Panasonic®

Programmable Controller

FP7 Positioning Unit

User's Manual

WUME-FP7POSP-10

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(MEMO)

Introduction

Thank you for purchasing a Panasonic product. Before you use the product, please carefully read through the user's manual, and understand it in detail to use the product properly.

Types of Manual

- There are different types of user's 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 from the Panasonic website:https://industry.panasonic.com/global/en/downloads/?tab=manual.

Unit name or purpose of use		Manual name	Manual code
FP7 Power Supply Unit		FP7 CPU Unit User's Manual (Hardware)	WUME-FP7CPUH
FP7 CPU Unit			
		FP7 CPU Unit Command Reference Manual	WUME-FP7CPUPGR
		FP7 CPU Unit User's Manual (Logging Trace Function)	WUME-FP7CPULOG
		FP7 CPU Unit User's Manual (Security Function)	WUME-FP7CPUSEC
	Instructions for Built-in LAN Port	FP7 CPU Unit User's Manual (LAN Port Communication)	WUME-FP7LAN
		FP7 CPU Unit User's Manual (Ethernet Expansion Function)	WUME-FP7CPUETEX
		FP7 CPU Unit User's Manual (EtherNet/IP Communication)	WUME-FP7CPUEIP
		Web Server Function Manual	WUME-FP7WEB
	Instructions for Built-in COM Port	FP7 Series User's Manual (SCU Communication)	WUME-FP7COM
	FP7 Extension Cassette (Communication) (RS-232C / RS485 type)		
	FP7 Extension Cassette (Communication) (Ethernet Type)	FP7 Series User's Manual (Communication Cassette Ethernet Type)	WUME-FP7CCET
	FP7 Extension (Function) Cassette Analog Cassette	FP7 Analog Cassette User's Manual	WUME-FP7FCA
FP7 Digital Input / Output Unit		FP7 Digital Input / Output Unit User's Manual	WUME-FP7DIO
FP7 Analog Input Unit		FP7 Analog Input Unit User's Manual	WUME-FP7AIH
FP7 Analog Output Unit		FP7 Analog Output Unit User's Manual	WUME-FP7AOH
FP7 Thermocouple Multi-analog Input Unit		FP7 Thermocouple Multi-analog Input Unit FP7 RTD Input Unit User's Manual	WUME-FP7TCRTD
FP7 RTD Input Unit			
FP7 Multi Input / Output Unit		FP7 Multi Input / Output Unit User's Manual	WUME-FP7MXY
FP7 High-speed counter unit		FP7 High-speed Counter Unit User's Manual	WUME-FP7HSC
FP7 Pulse Output Unit		FP7 Pulse Output Unit User's Manual	WUME-FP7PG

Unit name or purpose of use	Manual name	Manual code
FP7 Positioning Unit	FP7 Positioning Unit User’s Manual	WUME-FP7POSP
FP7 Serial Communication Unit	FP7 Series User’s Manual (SCU Communication)	WUME-FP7COM
FP7 Multi-wire Link Unit	FP7 Multi-wire Link Unit User’s Manual	WUME-FP7MW
FP7 Motion Control Unit	FP7 Motion Control Unit User’s Manual	WUME-FP7MCEC
PHLS System	PHLS System User’s Manual	WUME-PHLS
Programming Software FPWIN GR7	FPWIN GR7 Introduction Guidance	WUME-FPWINGR7

Safety Precautions

- In order to prevent injuries and accidents, always adhere to the following.
- Always read this manual thoroughly before performing installation, operation, maintenance, and inspection, and use the device correctly.
- Ensure you are familiar with all device knowledge, safety information, and other precautions before use.
- In this manual, safety precaution levels are classified into "warnings" and "cautions".

⚠ **WARNING**	Cases where dangerous situations are expected to arise whereby the user could die or suffer serious injury if handled incorrectly

- Implement safety measures externally from this product so that the entire system can operate safely even if a failure occurs due to a fault in this product or some external factor.
- Do not use in an atmosphere containing flammable gases.
  Doing so could cause explosions.
- Do not place this product in fire.
  This could cause splitting of batteries, electronic components, etc.

⚠ **CAUTION**	Cases where dangerous situations are expected to arise whereby the user could suffer injury or physical damage could occur if handled incorrectly

- In order to prevent the product from generating abnormal heat or emitting smoke, use the product with some margin to the guaranteed characteristics and performance values.
- Do not disassemble or modify the product.
  Doing so could cause abnormal heat generation or smoke.
- Do not touch electrical terminals while the power is on.
  There is a risk of electrical shock.
- Construct external emergency stop and interlock circuits.
- Securely connect wires and connectors.
  Poor connections can cause abnormal heat generation or smoke.
- Do not allow foreign materials such as liquids, combustibles, or metals, to enter inside the product.
  Doing so could cause abnormal heat generation or smoke.
- Do not perform work (connection, disconnection, etc.) while the power is on.
  There is a risk of electrical shock.
- If methods other than those specified by our company are used when operating this product, the protection functions of the unit may be lost.
- This product was developed and manufactured for use in industrial environments.

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Handling Precautions

■ In this manual, the following symbols are used to indicate safety information that must be observed.

Stop	Indicates an action that is prohibited or a matter that requires caution.
!	Indicates an action that must be taken.
Info.	Indicates supplemental information.

Note	Indicates details about the subject in question or information useful to remember.
1 2 Procedure	Indicates operation procedures.

Table of Contents

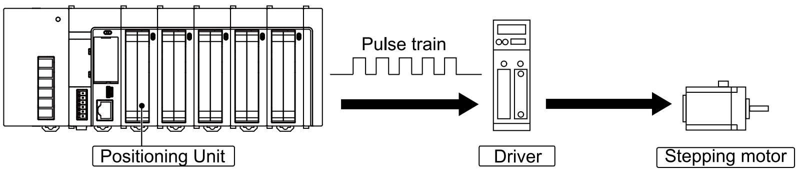
1 Functions of Unit and Restrictions on Combinations

1.1 Functions of Positioning Unit

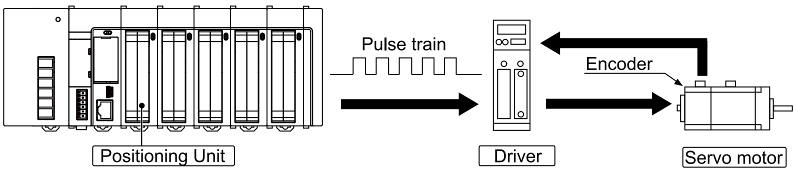
1.1.1 Functions of Unit

■ The positioning unit can perform positioning control when it is used in combination with a stepping motor or servomotor equipped with a driver of pulse string input type.

Positioning control with stepping motor



Positioning control with servomotor



■ Transistor output (open collector) type and line driver output type available

Two types are available—a line driver output type for high-speed control and a transistor output type for a motor equipped with a driver that connects only to open collector output (e.g., a stepping motor). If either type is applicable to your application, the use of the unit with line driver output is recommended.

■ Setting in configuration menu

The dedicated software "Configurator PM7" is available, which allows ease of creating a variety of parameters and positioning tables required for positioning control.

Note

- "Configurator PM7" is started from the **Option** menu of FPWIN GR7.

■ Interpolation control

2-axis linear interpolation, 2-axis circular interpolation, 3-axis linear interpolation, and 3-axis spiral interpolation control can be performed.

■ Synchronous control

The unit supports synchronous control using an electronic gear, electronic clutch, and electronic cam.

The unit can perform synchronous control with an actual or virtual axis as a master axis.

1.1.2 Unit Types

■ Product type

Type	Product number
2-axis transistor	AFP7PP02T
2-axis line driver	AFP7PP02L
4-axis transistor	AFP7PP04T
4-axis line driver	AFP7PP04L

1.2 Restrictions on Combinations of Units

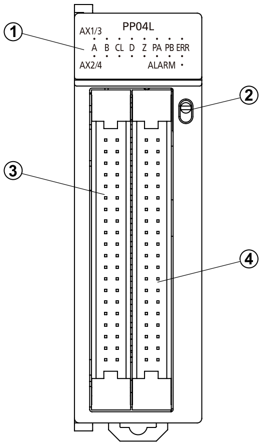
When the system is configured, take the other units being used into consideration and use a power supply unit with a sufficient capacity.

■ Current consumption

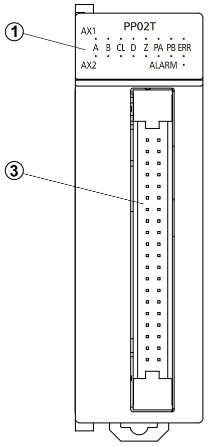
Type	Product number	Current consumption
2-axis transistor	AFP7PP02T	120mA
2-axis line driver	AFP7PP02L	120mA
4-axis transistor	AFP7PP04T	120mA
4-axis line driver	AFP7PP04L	120mA

2 Names and Functions of Components

2.1 Names and Functions of Components



4-axis type AFP7PP04T
AFP7PP04L



2-axis type AFP7PP02T
AFP7PP02L

(1) Operation monitor LEDs

Displays the operating status of two axes.

(2) Operating monitor switch (AFP7PP04T and AFP7PP04L only)

Toggles between the operating status display of 1st and 2nd axes and that of the 3rd and 4th axes.

(3) User I/F connector (1st axis and 2nd axis)

A connector for a motor driver and external interface.

(4) User I/F connector (3rd axis and 4th axis) (AFP7PP04T and AFP7PP04L only)

A connector for a motor driver and external interface.

2.2 Operating Status LEDs

The LEDs display the operating status of two axes at a time. If the unit is of 4-axis type, use the switch to toggle between the operating status display of the 1st and 2nd axes and that of the 3rd and 4-axes. The contents of the LED display are the same in each axis.

Operation Monitor LEDs

<table>
<tr><th>LED</th><th colspan="2">Description</th><th>Col or</th><th>LED ON</th><th>Light switch off</th><th>LED Flashing</th></tr>
<tr><td rowspan="2">A</td><td rowspan="2">Pulse output A-signal display (Note 1)</td><td>With pulse/sign output settings</td><td>Gre en</td><td>- (Note 4)</td><td>Not in operation</td><td>Pulse output</td></tr>
<tr><td>With CW/CCW output settings</td><td>Gre en</td><td>- (Note 4)</td><td>Not in operation (Forward)</td><td>In pulse output operation (forward rotation)</td></tr>
<tr><td rowspan="2">B</td><td rowspan="2">Pulse input B signal display (Note 1)</td><td>With pulse/sign output settings</td><td>Gre en</td><td>Reverse rotation instruction</td><td>Forward rotation instruction</td><td>-</td></tr>
<tr><td>With CW/CCW output settings</td><td>Gre en</td><td>-</td><td>Not in operation (Reverse)</td><td>In pulse output operation (reverse rotation)</td></tr>
<tr><td>CL</td><td colspan="2">Displays counter clear signal output</td><td>Gre en</td><td>Output ON</td><td>Output OFF</td><td>-</td></tr>
<tr><td>D</td><td colspan="2">Displays near home state (Note 2)</td><td>Gre en</td><td>ON</td><td>OFF</td><td>-</td></tr>
<tr><td>Z</td><td colspan="2">Displays home input state (Note 2)</td><td>Gre en</td><td>ON</td><td>OFF</td><td>-</td></tr>
<tr><td>PA</td><td colspan="2">Pulse input A-signal display (Note 3)</td><td>Gre en</td><td colspan="3">Displays the input status of pulse input A-signal</td></tr>
<tr><td>PB</td><td colspan="2">Pulse input B signal display (Note 3)</td><td>Gre en</td><td colspan="3">Displays the input status of pulse input B-signal</td></tr>
<tr><td>ERR</td><td colspan="2">Displays the occurrence of error or warning</td><td>Re d</td><td>If an error occurs</td><td>In normal operation</td><td>At the time of warning occurrence</td></tr>
<tr><td>ALARM</td><td colspan="2">Displays hardware error</td><td>Re d</td><td>If a hardware error occurs</td><td>In normal operation</td><td>-</td></tr>
</table>

(Note 1) The LED for the pulse output A- and B- signals flash at a cycle (speed) of the output frequency, thus looking as if continuously lit if the speed is high.

(Note 2) Near home input (D) and home input (Z) will be lit if the respective inputs are enabled.

(Note 3) The input status of pulse input signals (PA) and (PB) will be displayed.

(Note 4) The LEDs may be continuously lit with or without pulse output if the electronic clutch or electronic cam is in operation.

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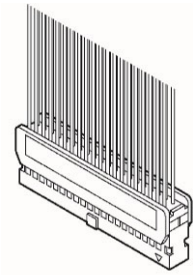
3 Wiring

3.1 Connection Using the Discrete-wire Connector

3.1.1 Specifications of Wire-pressed Terminal Cable

This is a connector allowing loose wires to be connected without removing the wire's insulation. A pressure connection tool is required to connect the loose wires.

Connector for wire-pressed terminal cable (40P)



■ Compatible wires (stranded wire)

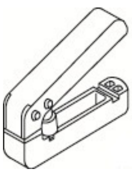
Size	Nominal cross-sectional area	Insulation thickness	Rated current
AWG22	0.3 mm^2	Φ1.5 to Φ1.1	3A
AWG24	0.2 mm^2		

■ Connector AFP2801 for wire-pressed terminal cable (provided with unit)

Composition of parts	Unit type and required quantity	
	2-axis type	4-axis type
Housing (40P)	1 × 1 set	1 × 2 set
Semi-cover (40P)	2 × 1 set	2 × 2 set
5-pin contact (for AWG22 and 24)	8 × 1 set	8 × 2 set

(Note 1) One set is provided for the 2-axis type and two sets are provided for the 4-axis type. If you need more connectors, purchase AFP2801 (2 sets/pack).

■ Pressure connection tool



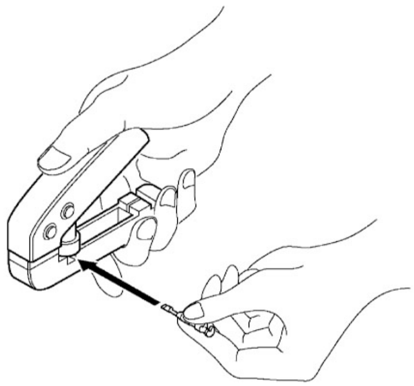
Product number	AXY52000FP

3.1.2 Wiring the Discrete-wire Connector

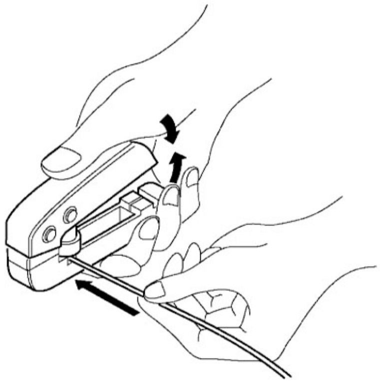
- When performing wiring work, refer to the instruction manual of the crimping tool in order to prevent faulty wiring.

Procedure

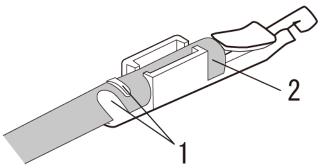
1. Bend and break the contact, and set it in the crimping tool.



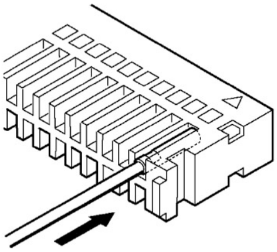
2. Insert the wire without removing its insulation until it stops, and lightly grip the crimping tool.



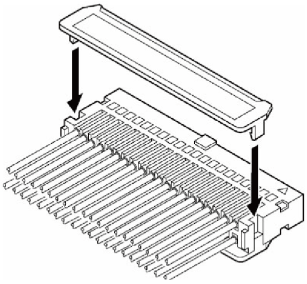
3. The contact appears as shown below after it is crimped. Confirm the following two points.
   1. The wire must be embraced inside the clamped part.
   2. The wire must be inserted to the end.

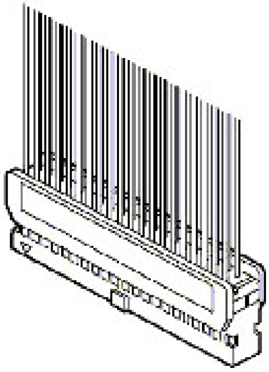


4. Insert the wire with the contact into the housing.



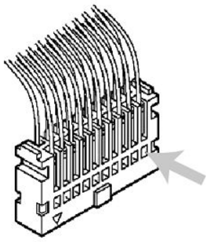
5. When all the wires have been inserted, fit the semi-cover into place.



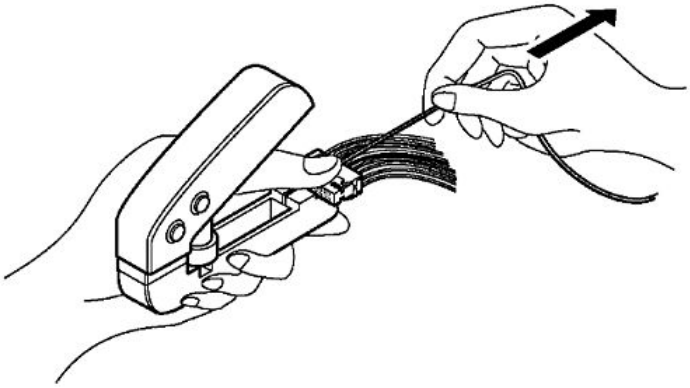


Info.

- If there is a wiring mistake or the wire is incorrectly press-fit, use the crimping tool to remove the contact.
  1. Set the pin of the crimping tool at the position indicated by an arrow.



  2. Hold the housing with fingers and pull the wire.



3.2 Connection Using the Push-In Connector

3.2.1 About Push-In Connector

40-pole push-in type connector manufactured by Ningbo Degson Electronic Co. Ltd. that can be used with the FP7 Series.

Product name	Model number	Remarks
Push-in connector set (40-pole)	AFP2808	2 pcs.

3.2.2 Compatible Parts and Dedicated Tools

Pole terminal with insulating sleeve

Use the following pole terminals.

Manufacturer	Model number	Size	Cross-sectional area
Phoenix Contact Co. Ltd	AI0, 34-8TQ	AWG#22	0.34 mm^2

Dedicated pressure-welding tool for pole terminals

Manufacturer	Model number
Phoenix Contact Co. Ltd	CRIMPFOX 10S

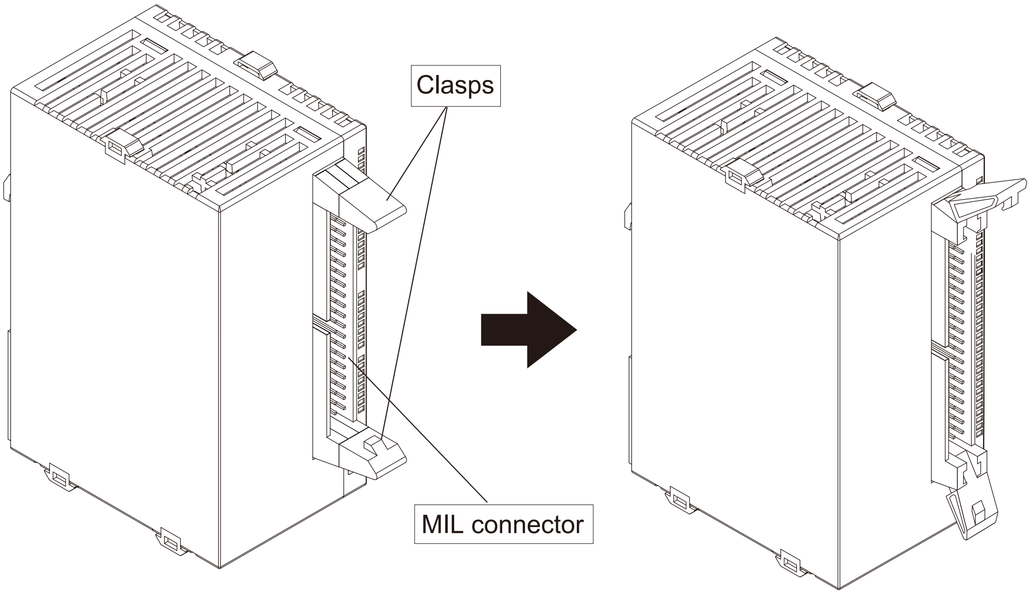
3.2.3 Wiring to Connector

Installing onto the Unit

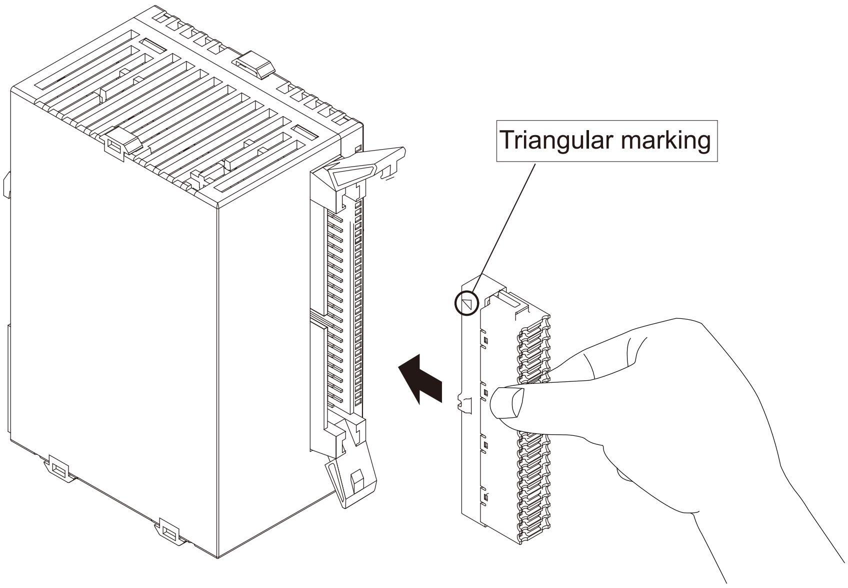
Follow the procedure below to install the product onto the unit.

1 2 Procedure

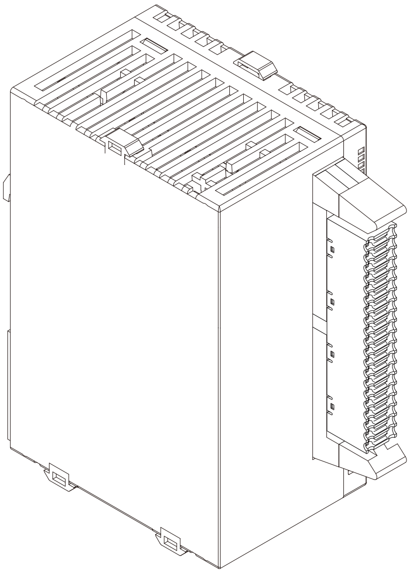
1. Open out the clasps of the MIL connector.



2. Insert the product into the MIL connector. When inserting the product, make sure that the triangular marking is at the top.



3. Insert the product until the clasps of the MIL connector close.



Wiring

Follow the procedure below when wiring.

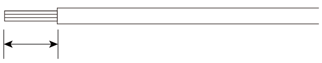
Note

Wiring precautions

- Do not damage the core when stripping off the covering material.
- Do not apply stress to the wires after wiring.
- Do not solder the core. Soldering the core may cause it to disconnect due to vibration.

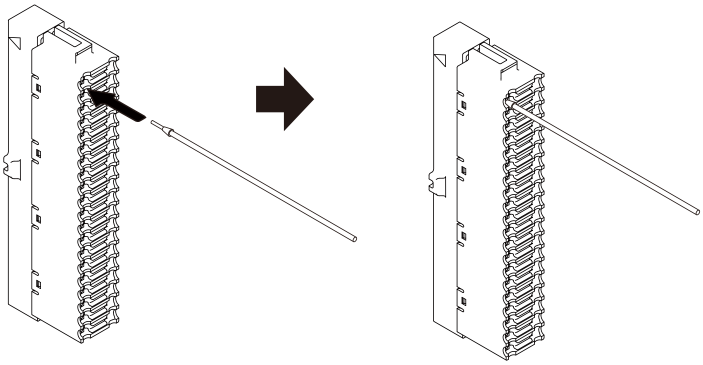
Procedure

1. Strip off the covering material from the wire



2. Attach the pole terminal to the core part. Do not twist the core when attaching.

3. After attaching the pole terminal, pressure-weld using the dedicated pole terminal pressure-welding tool.
4. After pressure-welding, insert the wire into the product.



Info.

After inserting the wire, ensure that the wire does not protrude.

Replacing Wires

Follow the procedure below when replacing wires.

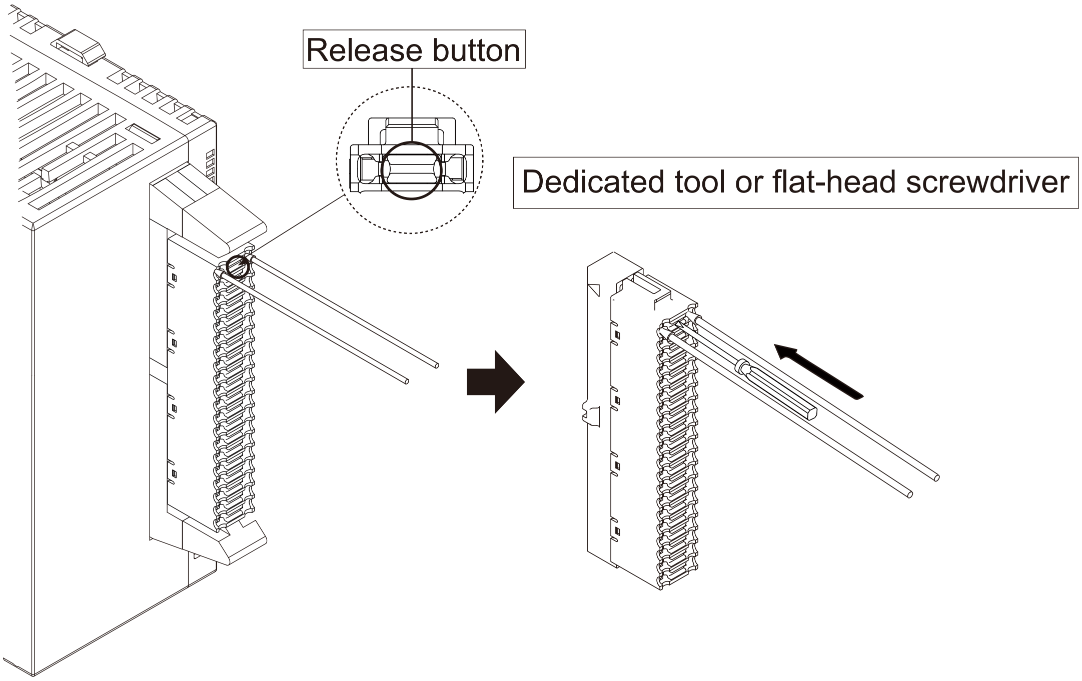
1 2 Procedure

Use the following dedicated tool or an equivalent flat-head screwdriver to remove the wire.

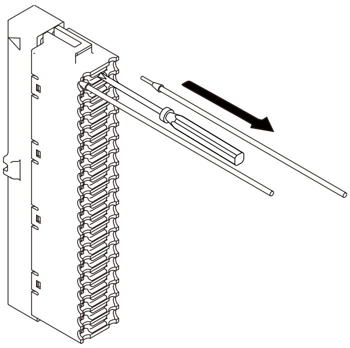
Dedicated tool

Manufacturer	Model number	Remarks
Phoenix Contact Co. Ltd	SZS 0, 4x2, 5	Blade width 0.4 × Blade thickness 2.5

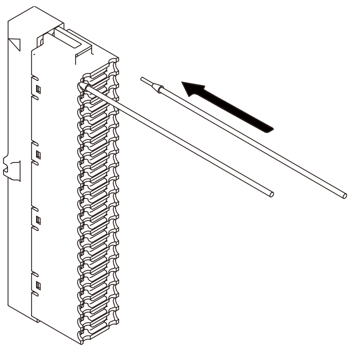
1. Push the dedicated tool or flat-head screwdriver into the release button on the product.



2. Remove the wire while pressing down the button.



3. Insert the new wire. For details on how to insert the wire, refer to "Wiring".



Info.

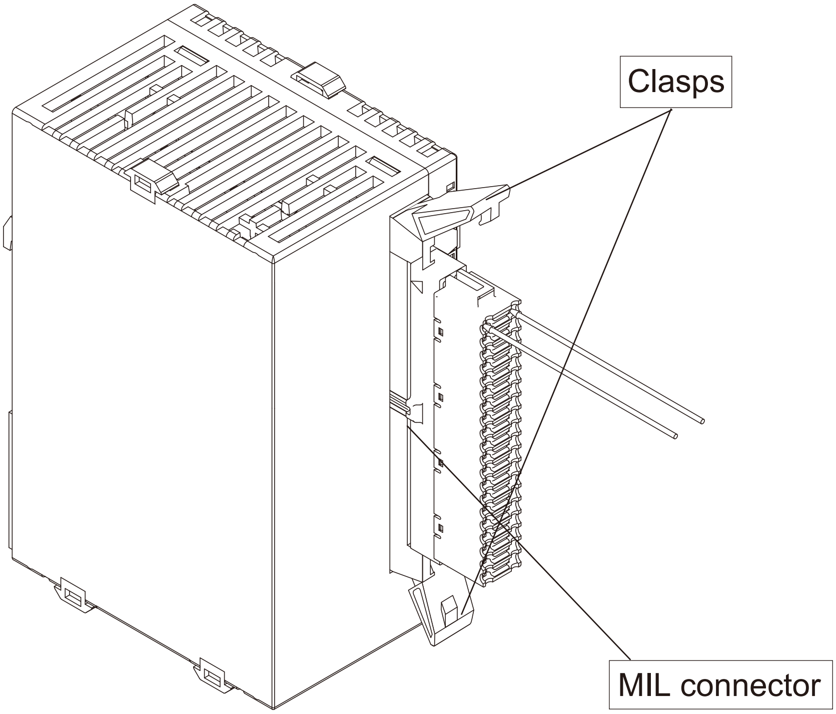
- Pressing the release button unlocks the wires on both sides of the button. After replacing the wires, ensure that the wires do not protrude.

Removing from the Unit

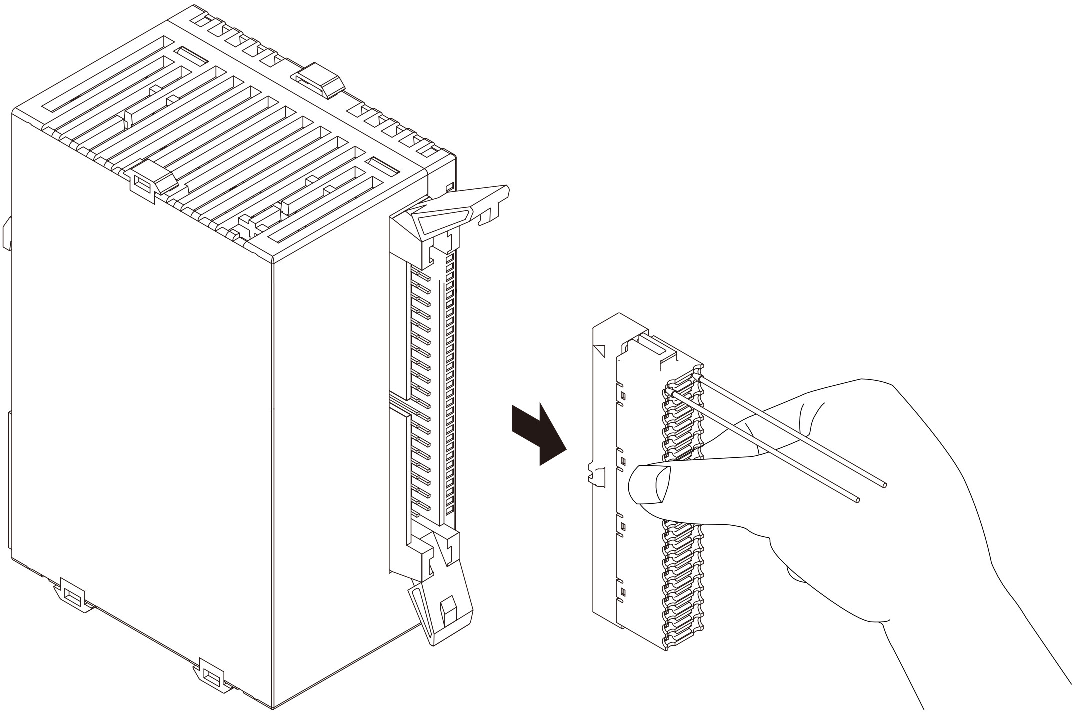
Follow the procedure below to remove the product from the unit.

1 2 Procedure

1. Open out the clasps of the MIL connector.

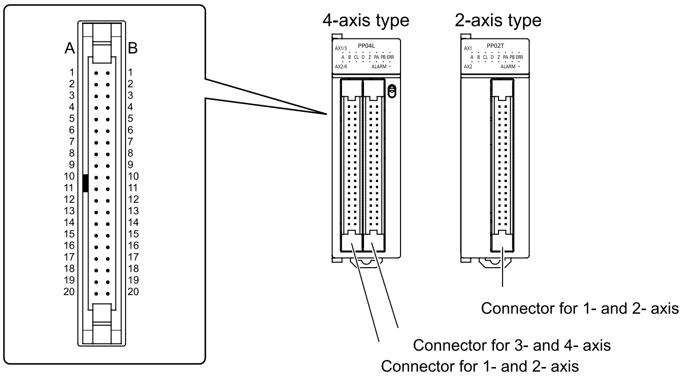


2. Remove the product from the unit.



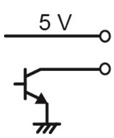
3.3 I/O Specifications and Terminal Wiring

3.3.1 Input/Output Specifications

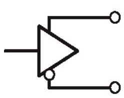


The 4-axis type and 2-axis type use two connectors and one connector, respectively. Signal pins for two axes are allocated to a single connector. There is no difference in pin arrangement between the AX1 and AX2 connector and the AX3 and AX4 connector if the unit is of the 4-axis type. Any pins with the same number have the same function. The transistor type and line driver type are the same in input terminal and power terminal specifications. Only the performance of the pulse output terminal of the transistor type and that of the line driver type are different from each other.

Output terminal (transistor output type)

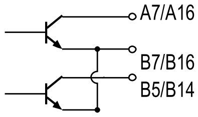
Pin No.		Circuit	Signal name	Output Specifications	
1st/ 3rd axis	2nd/ 4th axis			Item	Description
A1	A10	 5 V; A1/A10 A2/A11; B1/B10 B2/B11	Pulse output A: 5 V DC output	Output type	Open collector
B1	B10		Pulse output A: Open collector	Operating voltage range	4.75 to 26.4 V DC
A2	A11		Pulse output B: 5 V DC output	Max. load current	15mA
B2	B11		Pulse output B: Open collector	ON Max. voltage drop	0.6 V

Output terminal (line driver output type)

Pin No.		Circuit	Signal name	Output Specifications	
1st/ 3rd axis	2nd/ 4th axis			Item	Description
A1	A10	 A1/A10 A2/A11; B1/B10 B2/B11	Pulse output A: Line driver (+)	Output type	Line driver output AM26C31 or equivalent
B1	B10		Pulse output A: Line driver (-)		
A2	A11		Pulse output B: Line driver (+)		

Pin No.		Circuit	Signal name	Output Specifications	
1st/ 3rd axis	2nd/ 4th axis			Item	Description
B2	B11		Pulse output B: Line driver (-)		

Output terminal (common)

Pin No.		Circuit	Signal name	Output Specifications	
1st/ 3rd axis	2nd/ 4th axis			Item	Description
A7	A16		Deviation counter clear	Output type	Open collector
				Operating voltage range	4.75 to 26.4 V DC
B7	B16		COM	Max. load current	10mA
B5	B14		Servo ON	ON Max. voltage drop	1.0 V

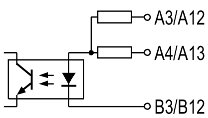
(Note 1) The deviation counter clear signal will be output for 1 ms on completion of home return control.

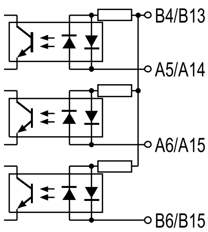
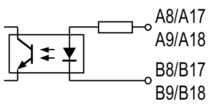
Power supply terminal (common)

Pin No.	Circuit	Signal name	Power supply specifications	
			Item	Description
A20		External power supply input: 24 V DC (+)	Supply power range	21.4 to 26.4 V DC
B20		External power supply input: 24 V DC (-)	Current consumption	4-axis type: 90 mA max. 2-axis type: 50 mA max.

(Note 1) In the case of the 4-axis type, the external power supply input terminals of the two connectors are connected internally.

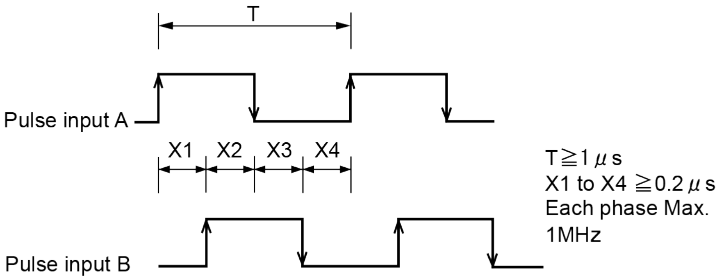
Input terminal (common)

Pin No.		Circuit	Signal name	Input specifications	
1st/ 3rd axis	2nd/ 4th axis			Item	Description
A3	A12		Home input 24 V DC (+) (Z24)	Operating voltage range	21.6 to 26.4 V DC
				Min. ON voltage/ current	19.2 V DC/5.5 mA
				Max. OFF voltage/ current	2 V DC/2 mA
				Input impedance	Approx. 3.9 kΩ
				Min. input pulse width	100 μs or over
A4	A13		Home input 5 V DC (+) (Z5)	Operating voltage range	3.5 to 5.25 V DC

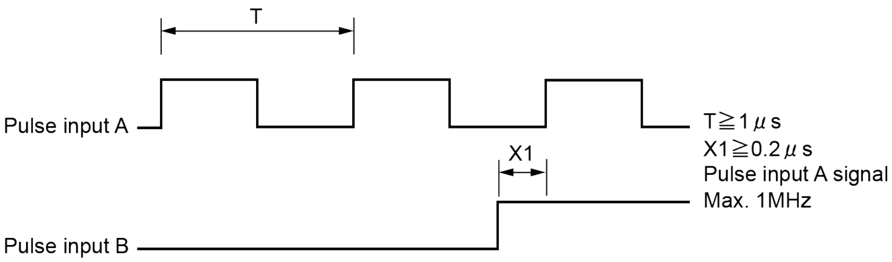
Pin No.		Circuit	Signal name	Input specifications	
1st/ 3rd axis	2nd/ 4th axis			Item	Description
					(5 V DC, line driver specifications)
				Min. ON voltage/ current	3 V DC/4 mA
				Max. OFF voltage/ current	1 V DC/0.5 mA
				Input impedance	Approx. 560 Ω
				Min. input pulse width	100 μs or over
B3	B12		Home input (-)	-	-
B4	B13		COM	-	-
A5	A14		Near home input (DOG)	Operating voltage range	21.6 to 26.4 V DC
				Min. ON voltage/ current	Near home input (DOG) 19.2 V DC/5.0 mA Limit (+) input (Limit +) Limit (-) input (Limit -) 19.2 V DC/2.6 mA
A6	A15		Limit (+) Input (Limit +)	Max. OFF voltage/ current	2 V DC/1.5 mA
B6	B15		Limit (-) Input (Limit -)	Input impedance	Near home input (DOG) Approx. 3.6 kΩ Limit (+) input (Limit +) Limit (-) input (Limit -) Approx. 6.8 kΩ
				Min. input pulse width	500 μs or over
A8	A17		Pulse input A (+)	Operating voltage range	3.5 to 5.25 V DC (5 V DC, line driver specifications)
B8	B17		Pulse input A (-)	Min. ON voltage/ current	3 V DC/3.2 mA
A9	A18		Pulse input B (+)	Max. OFF voltage/ current	1 V DC/0.5 mA
B9	B18		Pulse input B (-)	Input impedance	Approx. 560 Ω

- Use pulse input signals A and B within the following specifications.

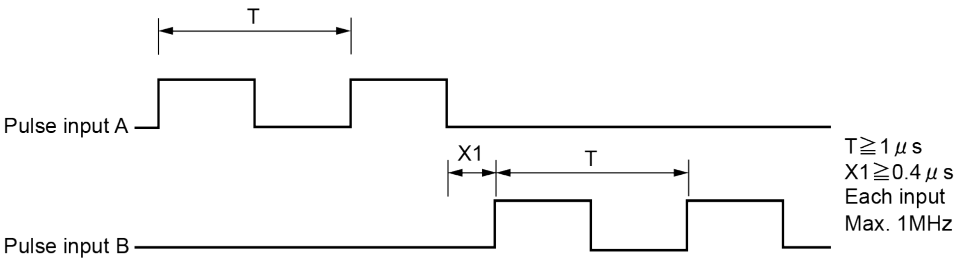
Using Pulse Input A and B for 2-phase Input.



Using pulse input A and B for direction discrimination input.

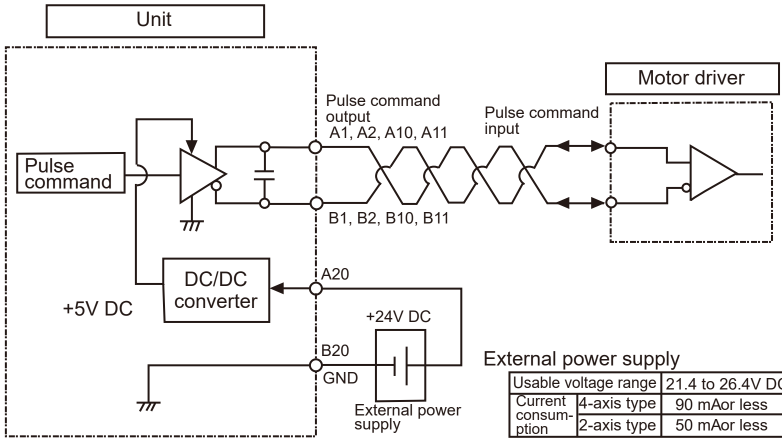


Using pulse input A and B for individual input.



3.4 Supply of Power to Drive Internal Circuit

3.4.1 Line Driver Output Type

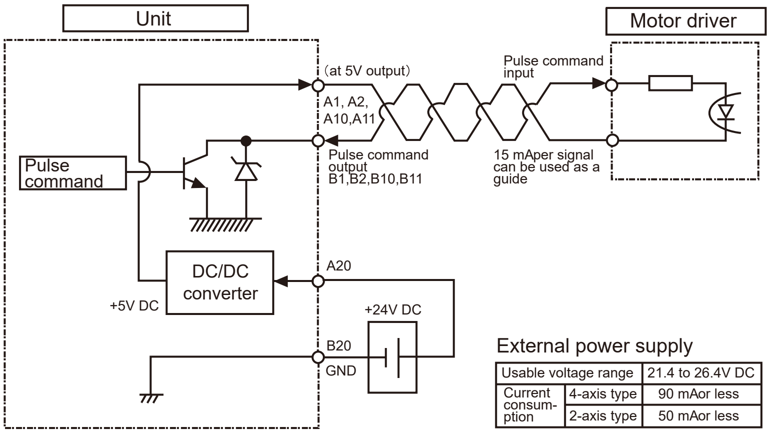


Usable voltage range		21.4 to 26.4V DC
Current consum-ption	4-axis type	90 mAor less
	2-axis type	50 mAor less

The illustration shows one signal component extracted from the overall configuration.

3.4.2 Transistor Output

It is possible to get power for the pulse instruction output circuit from the 5-V DC output terminal (pins A1, A2, A10, and A11).

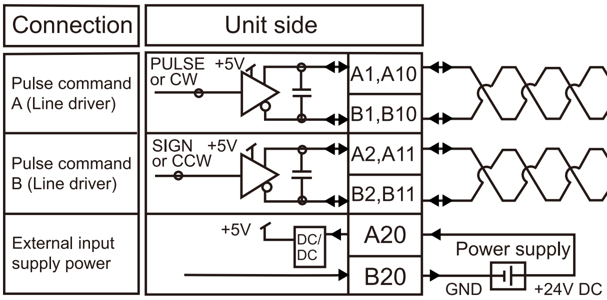


Usable voltage range		21.4 to 26.4V DC
Current consum-ption	4-axis type	90 mAor less
	2-axis type	50 mAor less

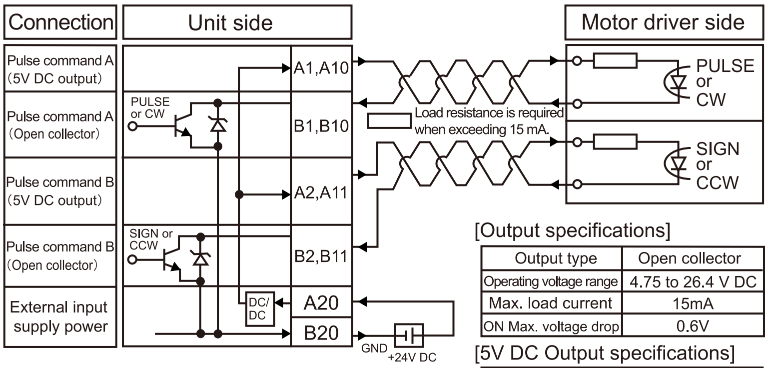
- Make sure that a current not in excess of 15 mA is provided for each signal in the case of using pulse transistor output (open collector output). Add appropriate resistance if the current exceeds 15 mA.

3.5 Connecting Pulse Instruction Signal Output

3.5.1 Line Driver Output Type



3.5.2 Transistor Output Type



[Output specifications]

Output type	Open collector
Operating voltage range	4.75 to 26.4 V DC
Max. load current	15mA
ON Max. voltage drop	0.6V

[5V DC Output specifications]

Output power supply range	4.75 to 5.25 V DC
Current consumption	5V DC 15mA/1signal

- Make sure that a current not in excess of 15 mA is provided for each signal. Add appropriate resistance if the current is in excess.

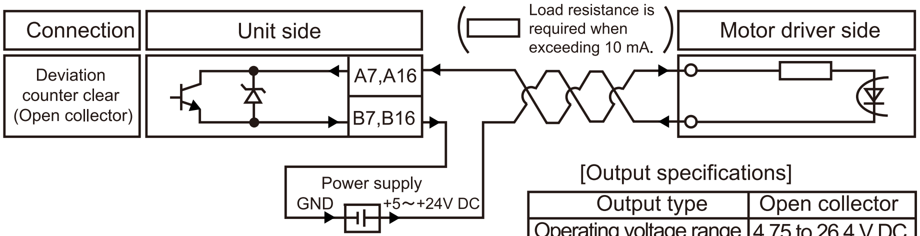
The symbol below indicates twisted-pair wiring.

Info.

- The use of a twisted-pair cable is recommended to connect the output of the positioning unit and the motor driver.

3.6 Connection of Deviation Counter Clear Output Signal

- This is an example showing the connection of the counter clear input to the servo amplifier.
- An external power supply (+5 V DC to +24 V DC) must be provided for the connection.



[Output specifications]

Output type	Open collector
Operating voltage range	4.75 to 26.4 V DC
Max. load current	10mA
ON Max. voltage drop	1V

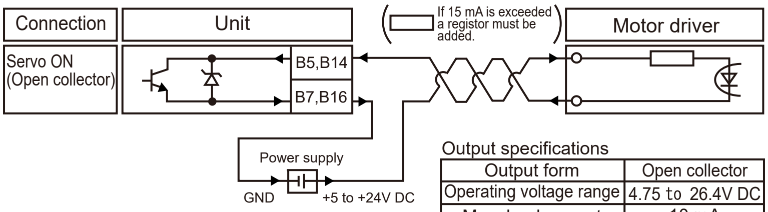
Note

- Always use twisted-pair cables for wiring.
- The current which can be conducted as the deviation counter clear output signal is 10 mA max. If this is exceeded, a resistance should be added.

3.7 Connecting Servo On Output Signal

The following diagram shows an example of connection to the servo on, of the server motor driver.

This connection requires an external power supply of 5 to 24 V DC.



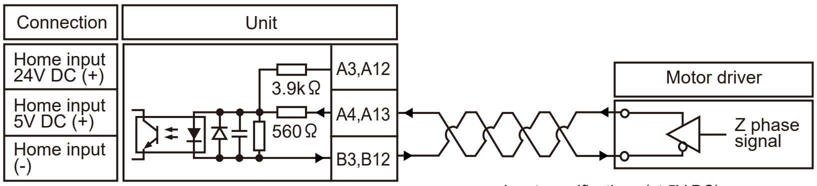
Output specifications

Output form	Open collector
Operating voltage range	4.75 to 26.4V DC
Max. load current	10 mA
ON Max. voltage drop	1V

- Be sure to use a twisted-pair cable.
- A maximum of 10 mA can flow as a servo ON output signal. Add appropriate resistance if the current is in excess.

3.8 Connecting Home Input/Near Home Input Signal

3.8.1 Connecting Home Input (Connecting Motor Driver Z-phase Output)



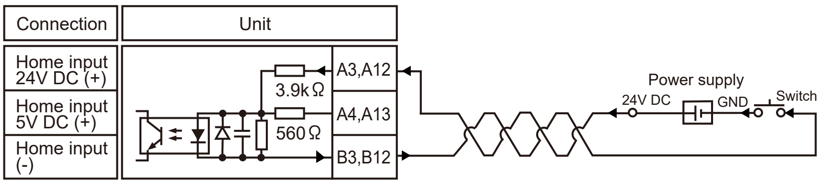
Input specifications (at 5V DC)

Input voltage range	3.5 to 5.25V DC
Min. ON voltage/current	3V DC/4mA
Max. OFF voltage/current	1V DC/0.5mA
Input impedance	560Ω
Min. input pulse width	100μs

Info.

- The use of a twisted-pair cable is recommended to connect the output of the positioning unit and the motor driver.

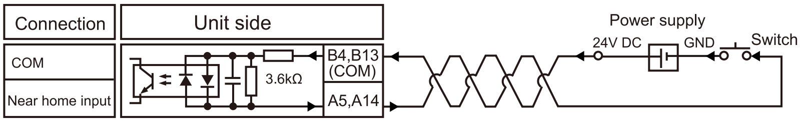
3.8.2 Connection of Home Input (When connecting to an external switch/ sensor)



Input specifications (at 24V DC)

Input voltage range	21.6 to 26.4V DC
Min. ON voltage/current	19.2V DC/5.5mA
Max. OFF voltage/current	2V DC/2mA
Input impedance	3.9kΩ
Min. input pulse width	100μs

3.8.3 Connecting Near Home Input Signal

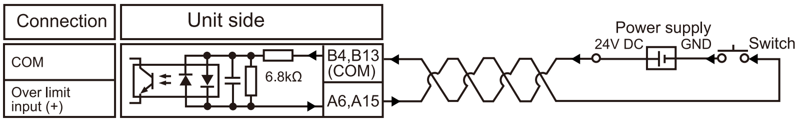


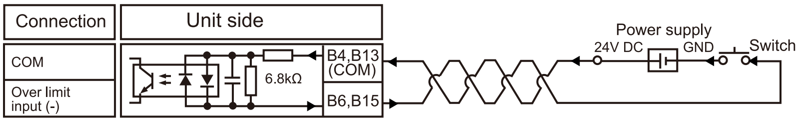
[Input specifications]

Input voltage range	21.6 to 26.4 V DC
Min. ON voltage/current	19.2V DC/5.0mA
Max. OFF voltage/current	2V DC/1.5mA
Input impedance	Approx. 3.6kΩ
Min. input pulse width	500μs

(Note 1) B4 and B13 are common to near home input, limit (+) input, and limit (-) input.

3.8.4 Connecting Limit Input Signal





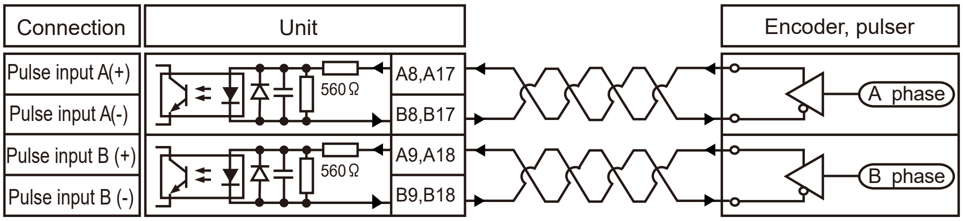
[Input specifications]

Input voltage range	21.6 to 26.4 V DC
Min. ON voltage/current	19.2V DC/2.6mA
Max. OFF voltage/current	2V DC/1.5mA
Input impedance	Approx. 6.8kΩ
Min. input pulse width	500μs

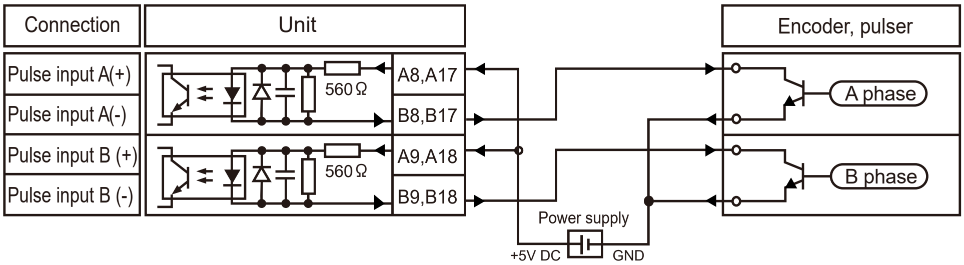
(Note 1) B4 and B13 are common to near home input, limit (+) input, and limit (-) input.

3.9 Connections of Pulse Input

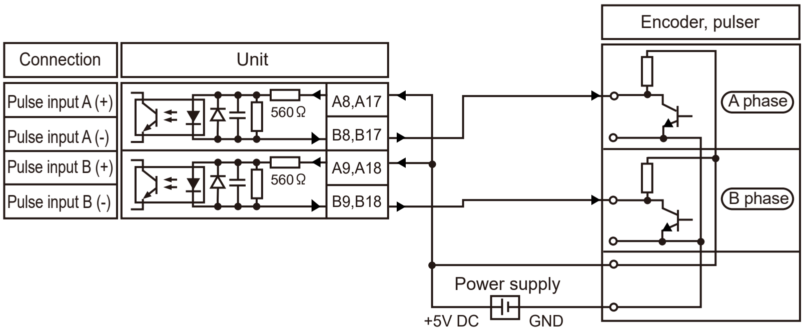
3.9.1 Line Driver Type



3.9.2 Transistor Open Collector Type



3.9.3 Transistor-resistor Pull-up Type



Info.

- As the same pulser input terminal is used for Pulser input operation and Feedback pulse count, either function of the two can only be used.
- The use of a twisted-pair cable is recommended.
- When counting the 2-phase input such as the input from the encoder, set the pulse input transfer multiple to "4 multiple setting" (× 4) or "2 multiple setting" (× 2) to prevent counting error. The pulse input transfer multiple is specified using the control code.

3.10 Wiring Cautions

Connect the transistor output type or line driver output type to the motor driver over twisted-pair cable within the following wiring distance.

■ **<Signals Supported>**

- Transistor output
- Line driver output
- Deviation counter clear output

Output type	Model number	Wiring distance
Transistor output type	AFP7PP02T	10 m
	AFP7PP04T	
Line driver output type	AFP7PP02L	
	AFP7PP04L	

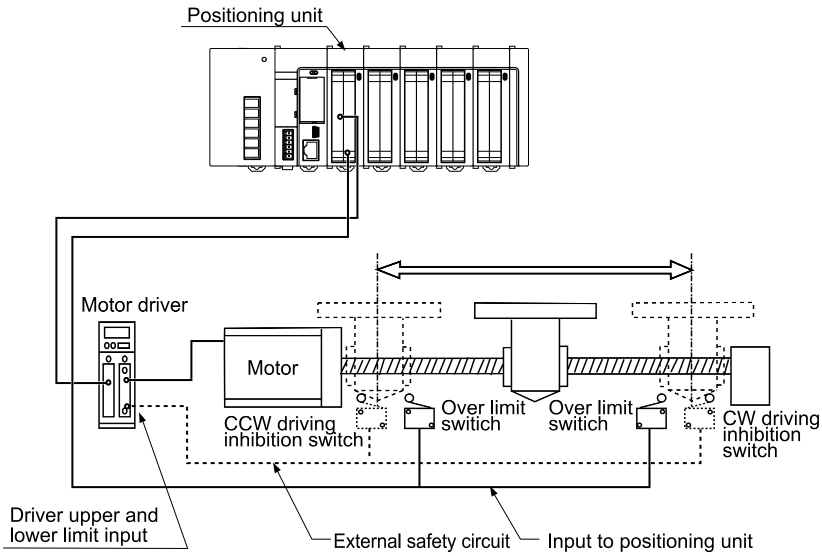
(MEMO)

4 Power On/Off and Check Items

4.1 Safety Circuit Design

Example of a safety circuit

Installation of over limit switches



Safety Circuit with Positioning Unit

Install over limit switches as shown in the figure above.

Connect the switch to the limit (+) input and limit (-) input of the positioning unit.

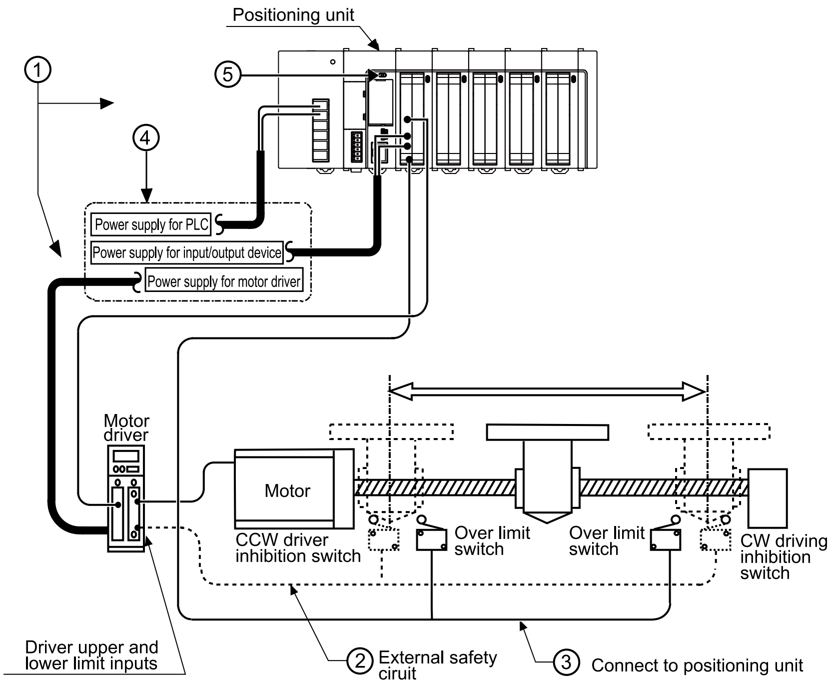
Safety circuit based on external circuit

Install the safety circuit recommended by the manufacturer of the motor being used.

4.2 Before Turning on the Power

■ Items to check before turning on the power

System configuration example



(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 installation of the external safety circuit

Check to make sure the safety circuit (wiring and installation of over limit switch) based on the external circuit has been installed properly.

(3) Checking the safety circuit with the positioning unit

Check the connections of the positioning unit and over limit switch.

Check the installation condition of the over limit switches.

(4) Checking the settings for the power-on sequence

Make sure settings have been entered so that power supplies will be turned on according to the procedure outlined in "4.3.1 Procedure for Turning On the Power".

(5) Checking the CPU mode selection switch

Set the CPU unit to PROG. Mode. Setting it in the RUN mode can cause inadvertent operation.

!	• The use of the positioning unit requires configuration menu settings. Check that each parameter is set properly.

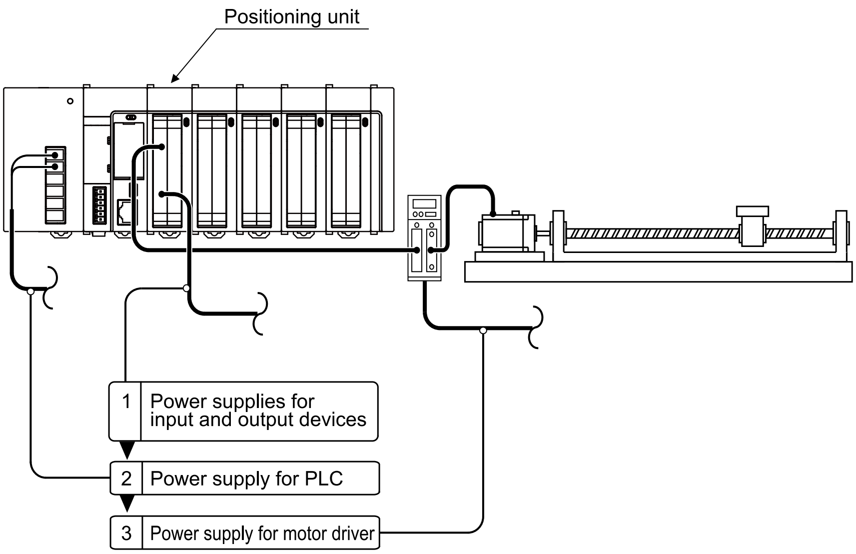
4.3 Procedure for Turning On the Power

4.3.1 Procedure for Turning On the Power

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

Procedure

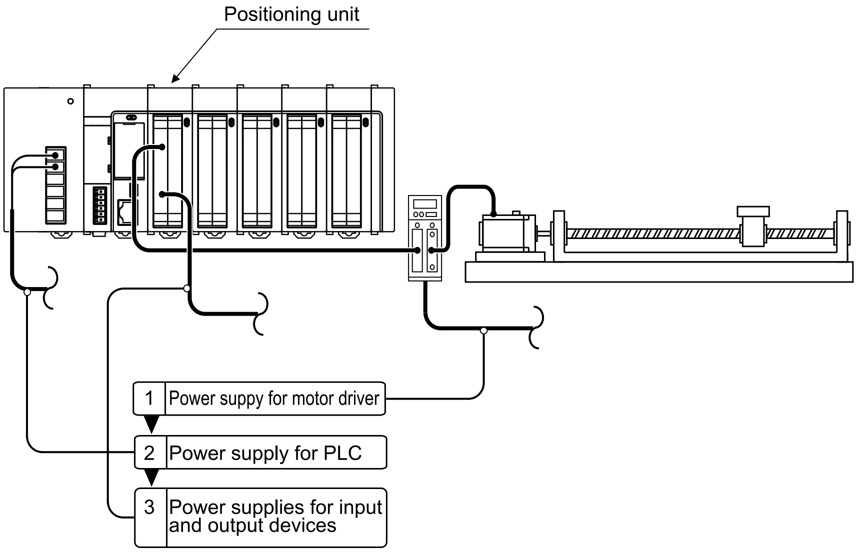
1. Turn ON the power supplies for the input and output devices connected to the PLC. (The power supplies include those for line driver output or open collector output.)
2. Turn ON the power supply for the PLC.
3. Turn on the power supply for the motor driver.



4.3.2 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 motor driver.
2. Turn OFF the power supply for the PLC.
3. Turn OFF the power supplies for the input and output devices connected to the PLC. (The power supplies include those for line driver output or open collector output.)


Positioning unit
1 Power suppy for motor driver
2 Power supply for PLC
3 Power supplies for input and output devices

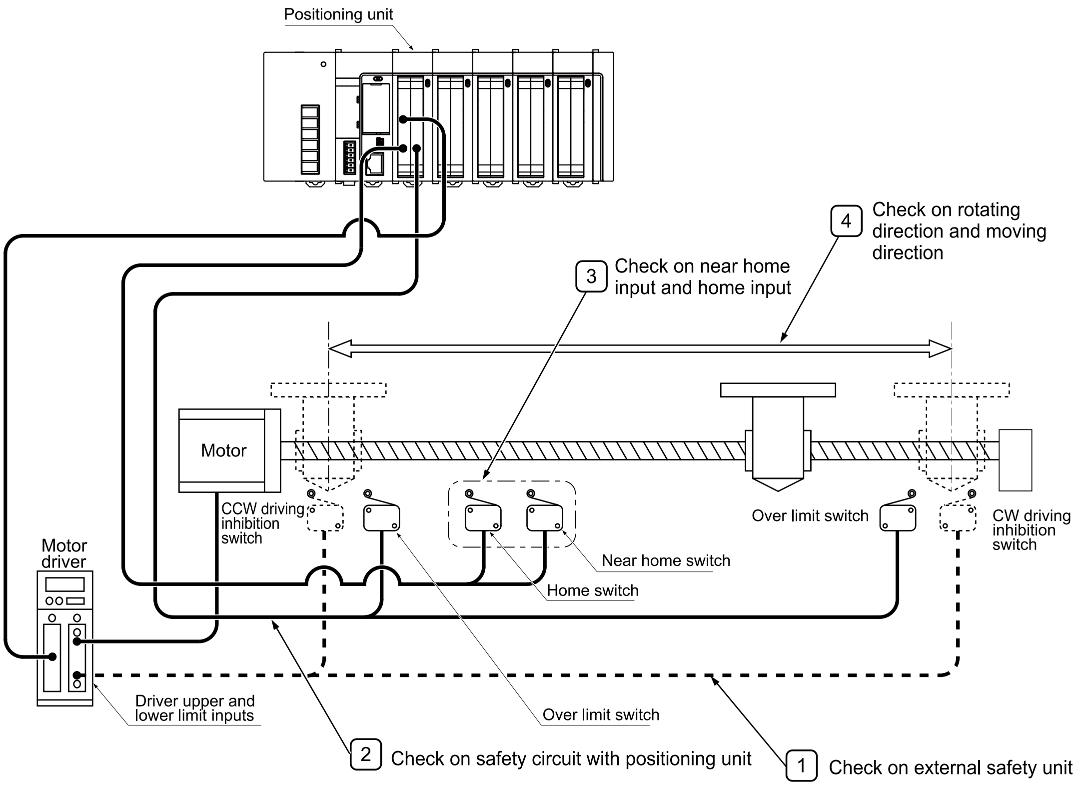
4.4 Checking While the Power is ON

4.4.1 Items to check after turning on the power

■ Items to check after turning on the power

System configuration example

Make checks in the following four major steps.



4.4.2 Checking the installation of the external safety circuit

Make a check on the safety circuit recommended by the motor manufacturer, which includes a check on the disconnection of the power supply to the motor driver with CW and CCW drive inhibition switch input from an external circuit.

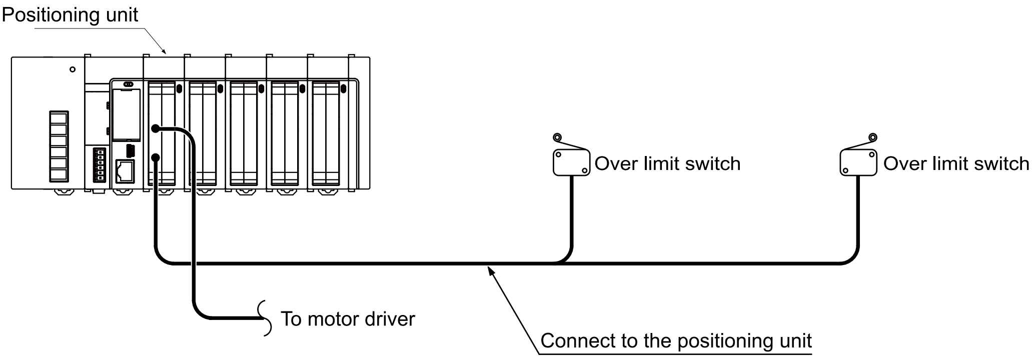
4.4.3 Check on Safety Circuit with Positioning Unit

1 2 Procedure

1. Forcibly operate the over limit switch for the positioning safety circuit and check that the positioning unit correctly receives limit input.
The state of limit input can be checked with the input contact. The valid logic of limit input can be changed in the parameter-setting menu of the "Configurator PM7".

2. Input a program, if necessary, to perform the JOG operation of the positioning unit.
Then forcibly operate limit input and check that the motor will come to a stop. You can use the tool operation of the "Configurator PM7" to make a check without using a program.

3. Perform the JOG operation of the positioning unit and check that the over limit switch will operate normally.



Behavior at limit input

Condition	Direction	Limit status	Operation
When JOG operation is started	Forward	Limit input (+): ON	Startup failure, error occurrence
		Limit input (-): ON	Executable
	Reverse	Limit input (+): ON	Executable
		Limit input (-): ON	Startup failure, error occurrence
During JOG operation	Forward	Limit input (+): ON	Deceleration stoppage, error occurrence
	Reverse	Limit input (-): ON	Deceleration stoppage, error occurrence

4.4.4 Operation Checks on Near Home Switch and Home Switch

1 2 Procedure

1. Forcibly operate home input and near home input and check that the operation indicator of the positioning unit will be lit. Monitor the input contact with the "FPWIN GR7" as well and make a similar check.

2. Input a home return program to make an actual home return and check that the positioning unit will perform deceleration with near home input.

   Point of confirmation

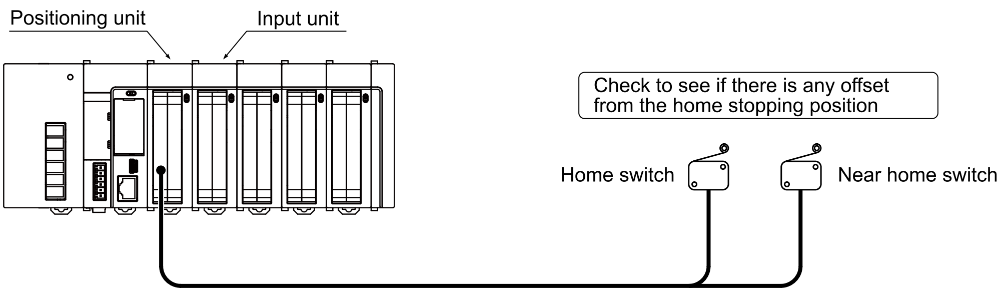
   Set the valid logic of home input and near home input in the parameter-setting menu of the "Configurator PM7".

3. Repeat the JOG and home return operation of the positioning unit and check that the home stop position will not shift.

   Point of confirmation

   A shift may result depending on the position of near home input or home input and the return speed.

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



4.4.5 Checking Rotating and Moving Directions and Moving Distance

1 2 Procedure

1. Perform JOG operations to check whether the rotation and movement directions of the motor are correct.

   Use the tool operation function of the "Configurator PM7" and perform the JOG operation of the positioning unit.

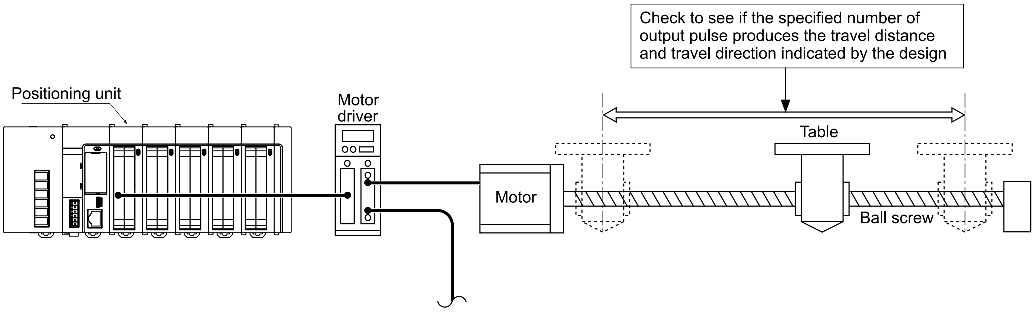
   Point of confirmation

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

2. Check whether the movement distance is as designed after position control is performed. Use the tool operation function of the "Configurator PM7" and perform the JOG or positioning operation of the positioning unit.

Point of confirmation

The movement distance is determined according to factors such as the pitch of the ball screw, deceleration gear ratio, and set movement amount of the positioning data.



(MEMO)

5 Unit Allocation and Parameter Settings

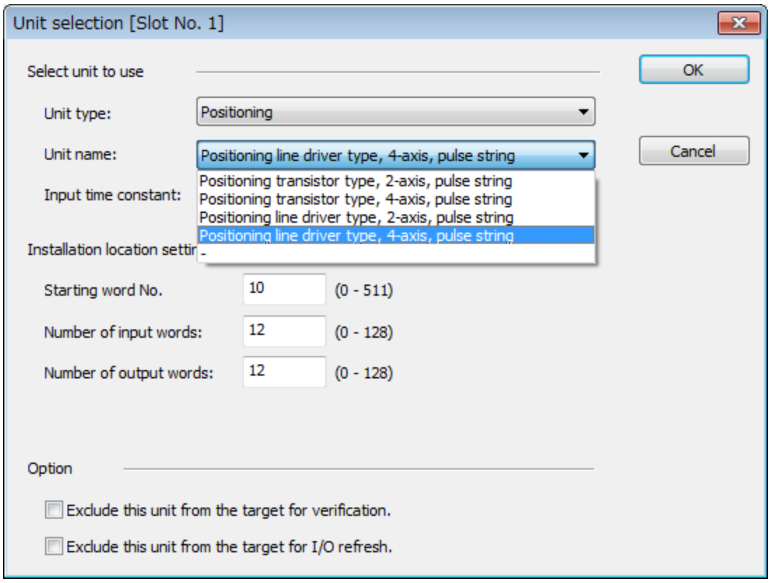
5.1 Unit Allocation

5.1.1 Registration in I/O Map

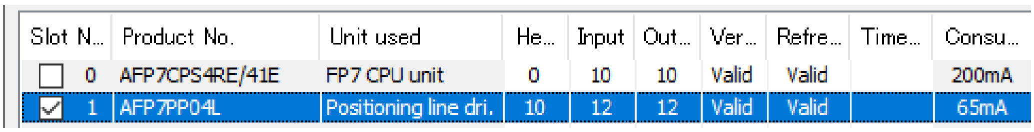
Before setting parameters, register the unit to be used in the I/O map.

1 2 Procedure

1. Select **Options**>**FP7 Configuration**>**I/O map** in the menu bar.
   The "I/O Map Setting" dialog box is displayed.
2. Double-click a desired slot.
   The "Unit Selection" dialog box is displayed.
3. Select Positioning from the unit type, select the name of the unit to be used, and press the [OK] button.



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



Slot N...	Product No.	Unit used	He...	Input	Out...	Ver...	Refre...	Time...	Consu...
0	AFP7CPS4RE/41E	FP7 CPU unit	0	10	10	Valid	Valid		200mA
1	AFP7PP04L	Positioning line dri.	10	12	12	Valid	Valid		65mA

5.1.2 Confirmation of I/O Allocation Information

- Each operation start signal, stop signal, home input signal, and positioning completion signal of the positioning unit is allocated to I/O signals.
- The I/O numbers actually used vary according to the starting word number.

■ I/O signal allocation (input)

Signal name	I/O number				
	1 axes	2 axes	3 axes	4 axes	Virtual axis
Ready positioning	X0				
Cam table reading completion annunciation	X2				
Cam table rewriting completion annunciation	X3				
Tool operation in progress	X4				
Axis group setting done	X5				
Recalculation completion	X7				
Servo lock	X10	X11	X12	X13	X17
BUSY	X18	X19	X1A	X1B	X1F
Operation completion	X20	X21	X22	X23	X27
Home return completion	X28	X29	X2A	X2B	X2F
Home input	X30	X31	X32	X33	-
Near home input	X38	X39	X3A	X3B	-
Auxiliary contact	X48	X49	X4A	X4B	X4F
Limit +	X50	X52	X54	X56	-
Limit -	X51	X53	X55	X57	-
Error notification	X60	X61	X62	X63	X67
Warning notification	X68	X69	X6A	X6B	X6F
Synchronization setting completion	X80	X81	X82	X83	-
Synchronization cancellation in-progress notification	X88	X89	X8A	X8B	-
Slave axis gear ratio change annunciation	X90	X91	X92	X93	-
Slave axis clutch change annunciation	X98	X99	X9A	X9B	-
Positioning speed change request reception annunciation	X110	X111	X112	X113	X117
Positioning movement amount change request reception annunciation	X118	X119	X11A	X11B	X11F

(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 starting word number.

Example) The home input of 1st axis is X130 for slot number 1 if the first word is number 10.

■ I/O signal allocation (output)

Signal name	I/O number				
	1 axes	2 axes	3 axes	4 axes	Virtual axis
System stop	Y0				
Cam table reading request	Y2				
Cam table rewriting request	Y3				

Signal name	I/O number				
	1 axes	2 axes	3 axes	4 axes	Virtual axis
Axis group setting change request	Y5				
Recalculation request	Y7				
Servo ON (The operation is the edge type.)	Y8	Y9	YA	YB	-
Positioning start (The operation is the edge type.)	Y10	Y11	Y12	Y13	Y17
Home return start (The operation is the edge type.)	Y18	Y19	Y1A	Y1B	Y1F
JOG forward rotation (The operation is the level type.)	Y20	Y22	Y24	Y26	Y2E
JOG reverse rotation (The operation is the level type.)	Y21	Y23	Y25	Y27	Y2F
Emergency stop (The operation is the level type.)	Y30	Y31	Y32	Y33	Y37
Deceleration stop (The operation is the level type.)	Y38	Y39	Y3A	Y3B	Y3F
Pulser operation permit (The operation is the level type.)	Y40	Y41	Y42	Y43	Y47
J-point speed change (The operation is the edge type.)	Y48	Y49	Y4A	Y4B	Y4F
Servo OFF request (The operation is the edge type.)	Y50	Y51	Y52	Y53	-
J-point positioning start	Y58	Y59	Y5A	Y5B	Y5F
Error clearing request	Y60	Y61	Y62	Y63	Y67
Warning clearing request	Y68	Y69	Y6A	Y6B	Y6F
Synchronization setting request	Y80	Y81	Y82	Y83	-
Synchronization cancellation request	Y88	Y89	Y8A	Y8B	-
Slave axis gear ratio change request (The operation is the edge type.)	Y90	Y91	Y92	Y93	-
Slave axis clutch ON request	Y98	Y99	Y9A	Y9B	-
Slave axis clutch OFF request	Y100	Y101	Y102	Y103	-
Positioning speed change request	Y110	Y111	Y112	Y113	Y117
Positioning movement amount change request	Y118	Y119	Y11A	Y11B	Y11F

(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 starting word number.

Example) The home input of 1st axis is Y110 for slot number 1 if the first word is number 10.

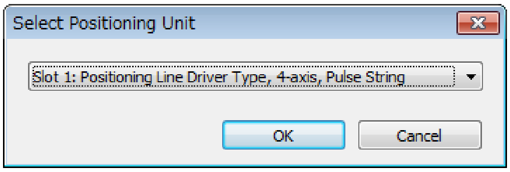
5.2 Allocation of Axes to Be Used

5.2.1 Settings in Configurator PM7

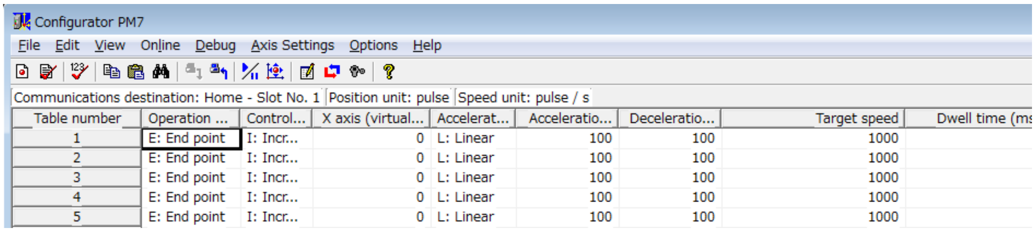
Use the Configurator PM7 to allocate axes for the use of the positioning unit along with the purposes of the axes. The following procedure is explained on the condition that the positioning unit has been already allocated in the I/O map.

1 2 Procedure

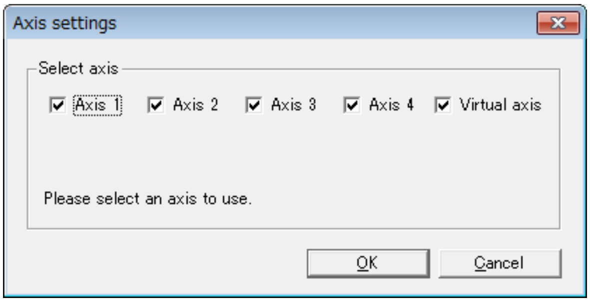
1. Select **Options**>**Positioning Table Settings** from the menu bar.
   The "Select Positioning Unit" dialog box is displayed.



2. Select the slot number and unit of the positioning unit on which the setting is made.
   The configuration menu "Configurator PM7" for the positioning unit will start.

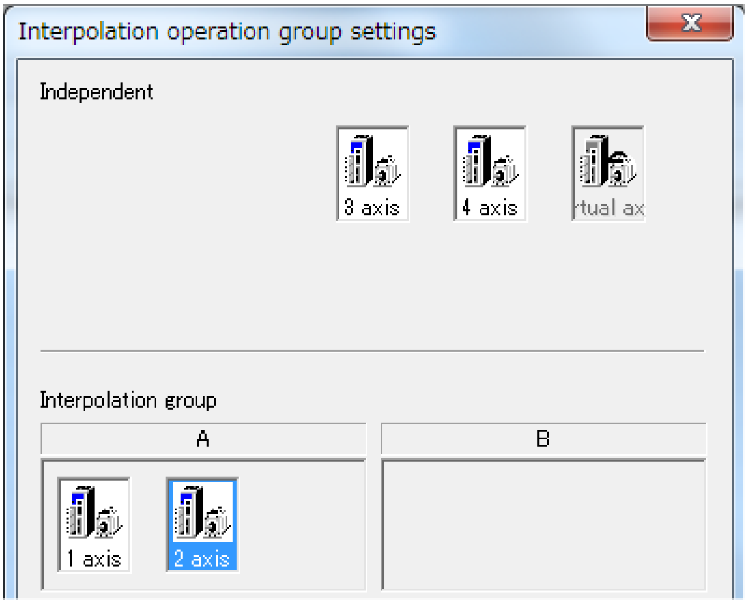


3. Select **Axis Settings**>**Change Axis** from the menu bar.
   The "Axis Settings" dialog box is displayed.



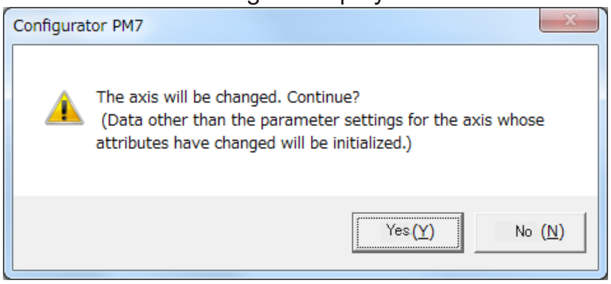
4. Select the axes to be used, and click the [OK] button.
   The "Interpolation Operation Group Settings" dialog box is displayed.

5. Drag the icon of each axis to be allocated for interpolation to the interpolation group field.
   The following screen shot shows the allocation of Axis 1 and Axis 2 to the interpolation group.



6. Click the [OK] button.

A confirmation message is displayed.



7. Confirm the changes and click the [Yes] button.

A data table tab each is created for the groups set.

Info.

- Setting items, such as the movement amount and interpolation operation of the X-, Y-, or Z-axis, will be added to the data table, and the group name [A] or [B] will be displayed on the tab if an interpolation group is set.
- The virtual axis and slave axes under synchronous control cannot be set to the interpolation groups.
- Closing the window by clicking the [X] mark during editing cancels and terminates the operation.

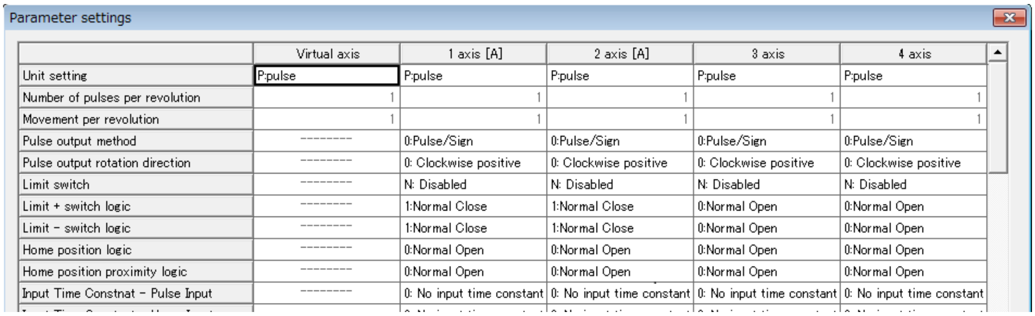
5.3 Parameter settings

5.3.1 Parameter Settings in Configurator PM7

Use the Configurator PM7 to allocate the most fundamental parameters for positioning control, such as the motor rotation direction, pulse output method (CW/CCW and Pulse/Sign), home input, limit input logic, and positioning control. The following procedure is explained assuming that Configurator PM7 has already been started.

1 2 Procedure

1. Select **Axis Settings**>**Parameter Settings** from the menu bar.
   The "Parameter Settings" dialog box is displayed.



Parameter settings

	Virtual axis	1 axis [A]	2 axis [A]	3 axis	4 axis
Unit setting	P:pulse	P:pulse	P:pulse	P:pulse	P:pulse
Number of pulses per revolution	1	1	1	1	1
Movement per revolution	1	1	1	1	1
Pulse output method	---------	0:Pulse/Sign	0:Pulse/Sign	0:Pulse/Sign	0:Pulse/Sign
Pulse output rotation direction	---------	0: Clockwise positive	0: Clockwise positive	0: Clockwise positive	0: Clockwise positive
Limit switch	---------	N: Disabled	N: Disabled	N: Disabled	N: Disabled
Limit + switch logic	---------	1:Normal Close	1:Normal Close	0:Normal Open	0:Normal Open
Limit - switch logic	---------	1:Normal Close	1:Normal Close	0:Normal Open	0:Normal Open
Home position logic	---------	0:Normal Open	0:Normal Open	0:Normal Open	0:Normal Open
Home position proximity logic	---------	0:Normal Open	0:Normal Open	0:Normal Open	0:Normal Open
Input Time Constnat - Pulse Input	---------	0: No input time constant	0: No input time constant	0: No input time constant	0: No input time constant

2. Make necessary parameter settings according to the application and press the [[OK]] button.

3. Select **File**>**Apply Settings** from the menu bar.

Info.

- Closing the window by clicking the [X] mark during editing cancels and terminates the operation.

5.3.2 Parameters

■ Setting item

Parameter name	Description	Related page
Unit setting	The unit to be used for setting each axis.	"4.4 Checking While the Power is ON"
Number of pulses per revolution	Number of pulses per motor revolution (Note 1)	
Movement amount per rotation	Movement amount per revolution for motors (Note 1)	
Pulse output method	Pulse output method: Pulse/Sign or CW/CCW	
Pulse output rotation direction	CW direction +: CW is the direction in which the elapsed value increases.	

Parameter name	Description	Related page
	CCW direction +: CCW is the direction in which the elapsed value increases.	
Limit switch	Enable/disable the limit switch.	
Limit + switch logic	Limit switch logic in the positive direction	
Limit - switch logic	Limit switch logic in the negative direction	
Home position logic	Home switch logic	"10.1 Pattern of Home Return"
Near home input logic	Near home switch logic	
Input time constant - Pulse input	Set the time constant of each pulse input signal. (Note 2)	-
Input time constant - Home input	Set the time constant of home input signal. (Note 2)	-
Pulse input application	Pulse input application	"13.6 Pulse Input"
Pulse input rotation direction	Rotating direction of pulse input (Forward/Reverse)	
Pulse input method	Input Methods for Pulse Input	
Pulse input multiplication	Multiplication of pulse input	
Software limit (positioning control)	Enables/disables the software limit for positioning control.	"13.2 Soft limits:"
Soft limit (Home return)	Enables/disables the software limit for home return control.	
Soft limit (JOG operation)	Enables/disables the software limit for JOG operation.	
Soft limits: Upper limit value	The upper limit value of the software limit.	
Soft limits: Lower limit value	The lower limit value of the software limit.	
Auxiliary output mode	Operating mode of the auxiliary output contact and auxiliary output code.	"13.3 Auxiliary Output Code and Auxiliary Output Contact"
Auxiliary output ON time (ms)	The period in which the auxiliary output contact is ON.	
Auxiliary output delay ratio (%)	Rate to perform output when using the delay mode for auxiliary output..	
Movement amount check	Post-check operation with the movement amount check function used	"13.6.6 Feedback Pulse Function"
Movement amount check value (Pulse)	Check threshold of the movement amount check function	
Numerator of movement amount check correction	The function of movement amount checking is executed based on the pulse input value multiplied by the following ratio. (Numerator of movement amount check correction)/ (Denominator of movement amount check correction)	
Denominator of movement amount check correction		
Movement amount check interval (ms)	Time interval to execute the movement amount check function.	
Startup Speed	Startup speed (initial speed) of all types of operation.	"13.7 Startup Speed"
Home return – Return setting code	The pattern of the home return.	"10.1 Pattern of Home Return"
Home return – Return direction	The operating direction of the home return.	

Parameter name	Description	Related page
Home return – Return acceleration time (ms)	The acceleration time of the home return.	
Home return – Return deceleration time (ms)	The deceleration time of the home return.	
Home return – Return target speed	The target speed of the home return.	
Home return – Return creep speed	The speed to search the home position after the proximity input.	
Home return - Home coordinates	Unit system conversion current value after the completion of the home return.	
Home return - Deviation counter clear time (ms)	Output time of deviation counter clear signal	
JOG operation - Acceleration/ Deceleration pattern settings	The acceleration/deceleration type of JOG operation.	"9.1 Settings and Operation of JOG Operation"
JOG operation – Jog acceleration time (ms)	The acceleration time of JOG operation.	
JOG operation – JOG deceleration time (ms)	The deceleration time of JOG operation.	
JOG operation – Target speed	The target rate of JOG operation.	
Emergency stop deceleration time (ms)	The deceleration time when the emergency stop is requested by the input contact.	"12.1 Types and Settings of Stop Function"
Limit stop deceleration time (ms)	The deceleration time of deceleration operation when the limit is input.	
Error stop deceleration time (ms)	The deceleration time of deceleration operation when an error occurs	
J-point - Operation setting code	The acceleration/deceleration pattern of the J point (speed point)	"7.1 Basic Operation"
J point – Acceleration time (ms)	The acceleration pattern of the J point (speed point)	
J point – Deceleration time (ms)	The deceleration pattern of the J point (speed point)	
J-point - Target speed	The target speed of the J point (speed point)	
Pulsar operation setting code	The pulser input (1 to 4) in the pulser operation.	"11.1 Settings and Operation of Pulser Operation""13.6 Pulse Input"
Pulser input method	Input type of pulse operation	
Pulser operation ratio numerator	The number of movement pulses is calculated from the number of input pulses of the pulser multiplied by the ratio below. (Numerator of ratio of pulser operation)/(Denominator of ratio of pulser operation)	
Pulser operation ratio denominator		
Pulser operation maximum speed	The maximum speed of pulse operation	

(Note 1) Set only if the set unit is μm, inches, or degrees. It should be cancelled down with the movement amount per rotation.

(Note 2) Available for the unit version Ver.1.3 or later.

Info.

- In the positioning 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 -.

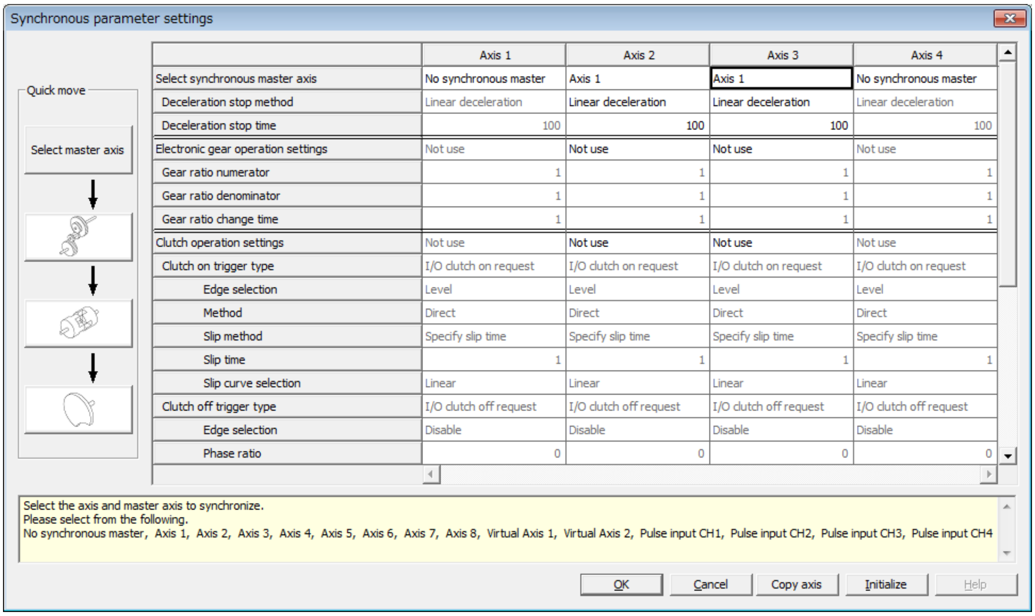
5.4 Synchronous Parameter/Cam Pattern Settings

5.4.1 Synchronous Parameter Settings

Use the Configurator PM7 to allocate parameters necessary for synchronous control. The following procedure is explained assuming that Configurator PM7 has already been started.

1 2 Procedure

1. Select **Axis Settings**>**Synchronization Parameter Settings** from the menu bar.
The "Synchronization Parameter Settings" dialog box is displayed.



	Axis 1	Axis 2	Axis 3	Axis 4
Select synchronous master axis	No synchronous master	Axis 1	Axis 1	No synchronous master
Deceleration stop method	Linear deceleration	Linear deceleration	Linear deceleration	Linear deceleration
Deceleration stop time	100	100	100	100
Electronic gear operation settings	Not use	Not use	Not use	Not use
Gear ratio numerator	1	1	1	1
Gear ratio denominator	1	1	1	1
Gear ratio change time	1	1	1	1
Clutch operation settings	Not use	Not use	Not use	Not use
Clutch on trigger type	I/O clutch on request	I/O clutch on request	I/O clutch on request	I/O clutch on request
Edge selection	Level	Level	Level	Level
Method	Direct	Direct	Direct	Direct
Slip method	Specify slip time	Specify slip time	Specify slip time	Specify slip time
Slip time	1	1	1	1
Slip curve selection	Linear	Linear	Linear	Linear
Clutch off trigger type	I/O clutch off request	I/O clutch off request	I/O clutch off request	I/O clutch off request
Edge selection	Disable	Disable	Disable	Disable
Phase ratio	0	0	0	0

2. Make necessary parameter settings according to the application and press the [[OK]] button.

Info.

- Closing the window by clicking the [X] mark during editing cancels and terminates the operation.

Info.

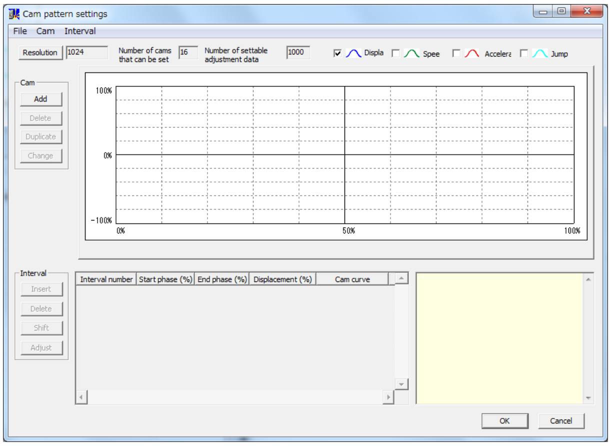
- Refer to Chapter "8 Automatic Operation (Synchronous Control)" for parameter settings related to synchronous control.

5.4.2 Cam pattern setting

Make electronic cam settings in the case of using an electronic cam. Use the Configurator PM7 to allocate necessary parameters. The following procedure is explained assuming that Configurator PM7 has already been started.

1 2 Procedure

1. Select **Axis Settings**>**Cam Pattern Settings** from the menu bar.
   The "Cam Pattern Settings" dialog box will be displayed.



2. Make necessary parameter settings according to the application and press the [[OK]] button.

3. Select **File**>**Apply Settings** from the menu bar.

Info.

- Parameter information saved can be read on the "Configurator PM7".
- In the case of synchronous control, basic parameters related to I/O operate according to "5.3 Parameter settings".

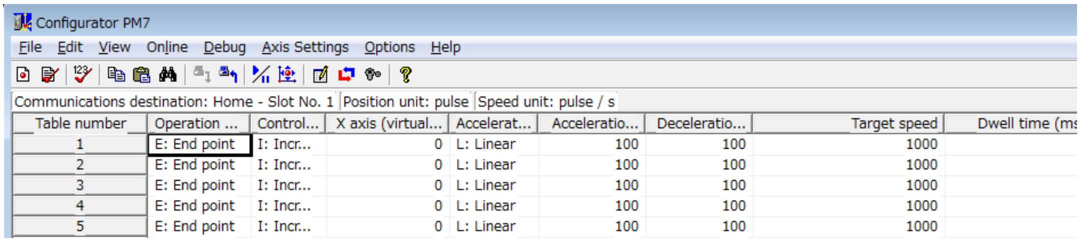
5.5 Creating Positioning Data Table

5.5.1 Construction of Positioning Data Table

Use Configurator PM7 to allocate positioning data tables. The following procedure is explained assuming that Configurator PM7 has already been started.

■ Initial display screen of Configurator PM7

- Sheets are divided for each axis, and 600 tables ranging No. 1 to No. 600 can be set.



■ Setting item

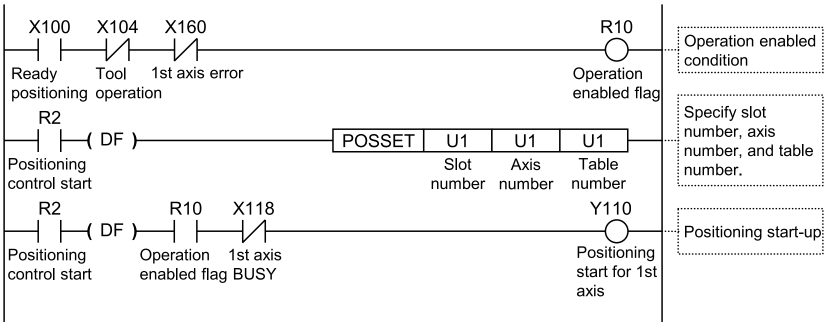
Parameter name	Description
Operation pattern	Select one from the following operation patterns. E point: Executes the trapezoidal control of only one table. C-point: Executes trapezoidal control continuously. Specify the end point (E-point) at the end of continuance point (C-point) control. P-point: Executes continuous speed change control. Specify the end point (E-point) at the end of pass point (P-point) control. J-point: Executes speed control. Specify the end point (E-point) at the end of speed control (J-point).
Control method	Select either incremental or absolute coordinates.
X-axis movement amount	Input the movement amount of the X-axis. The movement amount depends on the unit system specified in the parameter settings.
Acceleration/ deceleration method	Select the acceleration/deceleration method.
Acceleration time (ms)	Set the acceleration time. Setting unit: ms
Deceleration time (ms)	Set a deceleration time. Setting unit: ms
Target speed	Set the target speed. Setting unit: pps, m/s, inch/s, rev/s
Dwell Time (ms)	Set the time from when the positioning instruction in the end point control completes until the positioning done flag turns ON. For C-point control, dwell time is the waiting time between each table. For P-point control, dwell time is ignored.
Auxiliary Output	Set an auxiliary output code. When the auxiliary output is set to enable in the parameter settings, the auxiliary output code specified here is output.
Comment	Arbitrary comments can be input for each table.

(Note 1) The details for the settings in each parameter are indicated in the guidance bar.

(Note 2) In the case of selecting interpolation control, interpolation, Y-axis movement amount, X-axis auxiliary point, Y-axis auxiliary point, and interpolation speed items are displayed as well.

5.5.2 Table numbers and activation of positioning

- Execute the POSSET command in the user program to specify table numbers on the Configurator PM7.
- The positioning unit will start control under the conditions set in the table by executing the POSSET reference and turning the corresponding positioning start contact ON after specifying the desired slot number, axis number, and table number.



5.5.3 Operation Patterns and Tables

- Use a number of tables if the positioning patterns consist of pass point control, continuance point control, and JOG positioning control.
- In these types of control, the tables will be created continuously on the Configurator PM7, and select the "end point control" for the operation pattern for the last table.
- Specify the first data table number for each control in the program.

(Example) Pass point control

Create three positioning data tables, and select "E: End point" for the last table. Furthermore, start the first table number for each control in the user program.

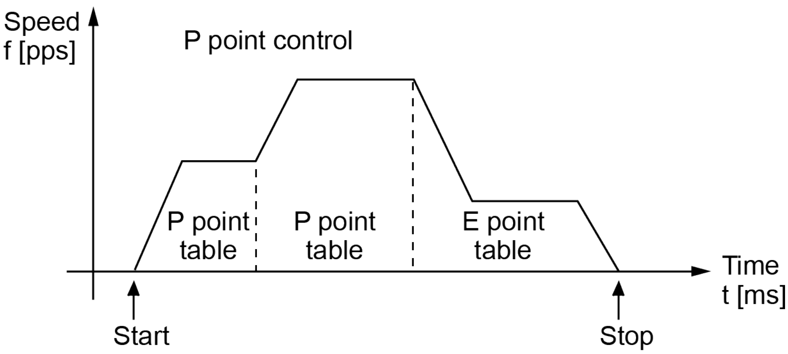


Table number	Operation pattern	Control method	X axis (virtual) movement	Acceleration/deceleration method
1	P: Pass point	I: Increment	50000	L: Linear
2	P: Pass point	I: Increment	100000	L: Linear
3	E: End point	I: Increment	30000	L: Linear

Info.

- For details of each control, refer to "7 Automatic Operation (Position Control)".

5.6 Saving Parameters

5.6.1 Saving and Loading of Configuration

Information on the basic parameters and positioning data tables that have been set for the Configurator PM7 are saved as configuration information along with information on I/O map allocations on a unit-by-unit basis. Save and load the configuration information as necessary.

- Specified basic parameters and positioning parameters can be saved or loaded on the Configurator PM7.
- Information on positioning parameters and positioning tables saved by using the save function can be reused between projects.

1 2 Procedure

1. Select **File**>**Save Setting** from the menu bar.
   The saving destination and file names are displayed.
2. Enter the saving destination and file name, and click the [Save] button.
   Information on the parameters and positioning data tables is saved in a file with a ".pm7" extension.

Info.

- When **Save Setting** is executed, information on the positioning data tables will be saved along with information set in the parameter setting menu.
- Closing the window by clicking the [X] mark during editing cancels and terminates the operation.
- The menu names of Configurator PM7 have been changed from FPWIN GR7 Ver.2.7.

Menu names of Configurator PM7		**Function**
FPWINGR7 Ver.2.6 or older	**FPWINGR7 Ver2.7 or later**	
New (N)	Initialize Setting (N)	Positioning parameters and positioning data table are newly created on Configurator PM7.
Load Configuration (J)	(None)	
Save Configuration (K)	Apply Setting (K)	Positioning parameters and positioning table data being edited on Configurator PM7 are saved as data being edited.
Import (O)	Read Setting (O)	Saved files (Extension: .pm7) are read.
Export (S)	Save Setting (S)	Data being edited offline on Configurator PM7 is saved as a file (Extension: .pm7).

6 Transfer to Unit and Commissioning

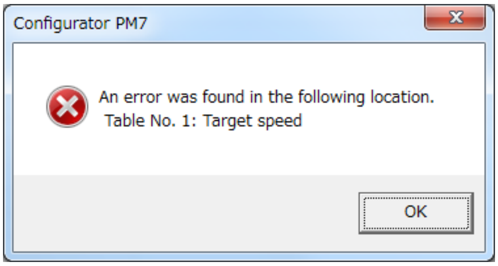
6.1 Check on Setting Contents

6.1.1 Check on Parameter Data

- The following procedure is explained assuming that Configurator PM7 has already been started.

1 2 Procedure

1. Select **Debug**>**Check Parameter and Data Values** from the menu bar.
   A message box is displayed indicating the check results. If there is an error in the settings for the positioning data tables, an error message will appear and the cursor will move to the corresponding error position.

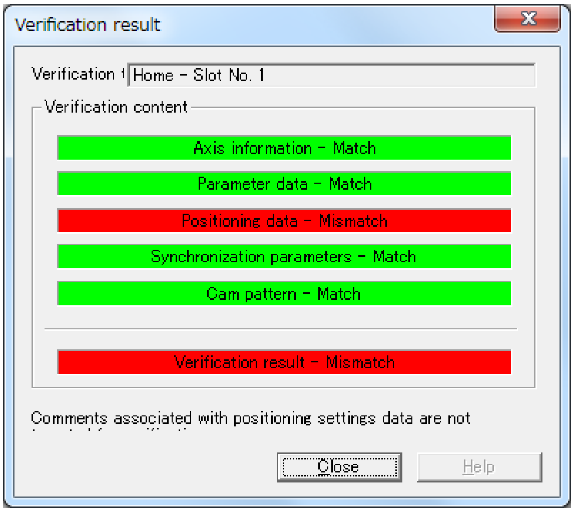


6.1.2 Comparison of Parameter Information

- It is possible to compare information on parameters being edited with information saved in the Configurator PM7. The following procedure is explained assuming that Configurator PM7 has already been started.

1 2 Procedure

1. Select **Debug**>**Verify**>**File** or "PLC" from the menu bar.
   When "File" is selected, the "Select a File to Verify" dialog box appears.
   When "PLC" is selected, information edited in the Configurator PM7 will be compared with configuration information saved in the unit memory (UM) of PLC, and the results of comparison will be displayed.
2. In the "Select a File to Verify" dialog box, select the target file and click the [OK] button.
   The comparison results will be displayed.



Info.

- Even if "Save Setting" is executed on Configurator PM7, data will not be saved in the unit memory (UM) of the PLC. When "PLC" is selected as the verification target, verification results may not coincide.
- The menu names of Configurator PM7 have been changed from FPWIN GR7 Ver.2.7.

Menu names of Configurator PM7		**Function**
FPWINGR7 Ver.2.6 or older	**FPWINGR7 Ver2.7 or later**	
File (F)	File (F)	Data being edited on Configurator PM7 is collated with saved files (Extension: .PM7).
Unit (U)	PLC (U)	Data is being edited on Configurator PM7 is collated with data stored in the unit memory (UM) of the PLC.
Config (C)	(None)	

6.2 Transfer of Parameters

6.2.1 Writing Parameters to CPU Unit

- Information on parameters that have been set is transferred as a part of project information to the CPU unit along with other configuration information.
- The following procedure is explained assuming that Configurator PM7 has already been started.

1 2 Procedure

1. Select **File**>**Exit** from the menu bar of the Configurator PM7.
   A confirmation message is displayed when any parameters or positioning tables have been changed.
2. "When the message "Setting data will be applied. Do you want to continue?" "appears, press [Yes (Y)].
   A confirmation message is displayed.
3. Click the [OK] button.
4. Select **Online**>**Download To PLC** from the FPWIN GR7 menu bar.
   Parameters for the positioning unit will be downloaded to the CPU unit along with the program and other configuration information.
5. Set the FP7 CPU unit to RUN mode.
   The configuration information will be transferred to the positioning unit so that the positioning unit will be read for commissioning with I/O signals or the Configurator PM7.
6. Select **Options**>**Positioning Table Settings** from the menu bar.
   The Configurator PM7 will be activated.
   Select **Online**>**Data monitor**, "Status display", "Tool operation" so that each menu item of the positioning unit will be available.

Info.

- The starting method of Configurator PM7 has been changed from FPWIN GR7 Ver. Select "Positioning Table Settings" from the **Options** menu.
- From FPWIN GR7 Ver.2.8, "Write PLC" and "Read PLC" can be executed from the **File** menu of Configurator PM7.

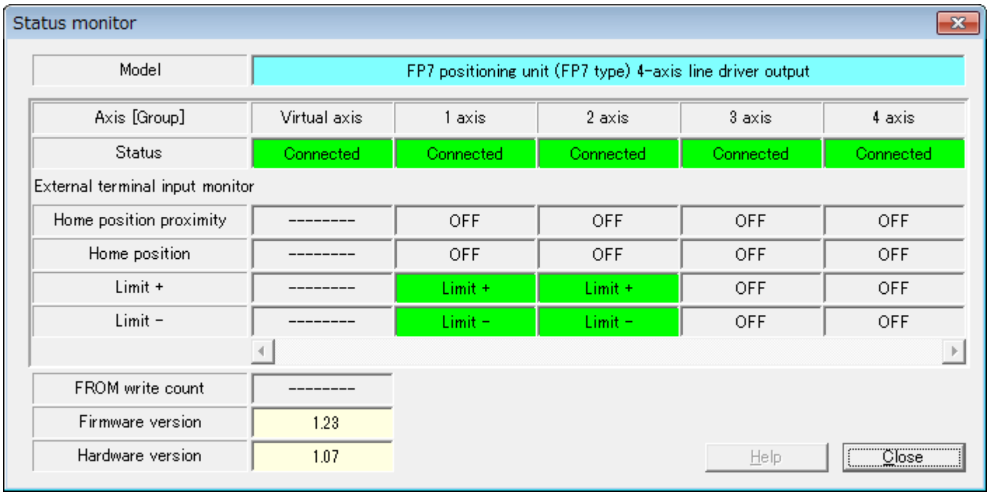
6.3 Monitoring on Configurator PM7

6.3.1 Status display

- The connection state of each axis and input state of external terminals can be monitored.
- The following procedure is explained assuming that Configurator PM7 has already been started.

Procedure

1. Select **Online**>**Status Display** from the menu bar.
   The "Status Monitor" dialog box is displayed.

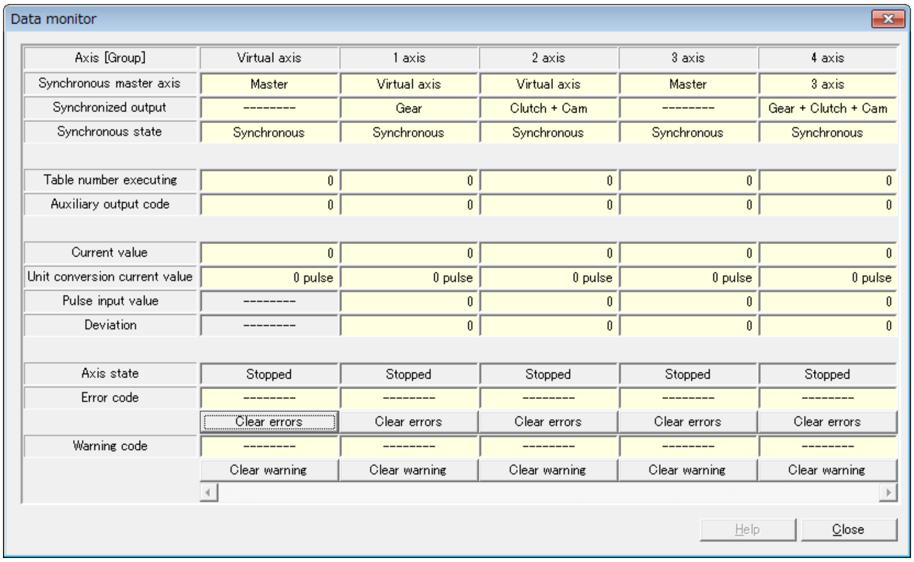


6.3.2 Data Monitor

- The connection state of each axis and input state of external terminals can be monitored.

Procedure

1. Select **Online**>**Data Monitor** from the menu bar.
   The "Data Monitor" dialog box is displayed.



Monitoring Items

Item	Description	Related page
synchronous master axis	Displays "Master" when an axis has been set as a master axis. When an axis has been set as a slave axis, the master axis on which this axis is based is displayed. Example: When Axis 2 has been set as a slave axis for the master axis that is Axis 1, "Axis 1" is displayed in the column of Axis 2. Displays "--------" for axes that are not used for synchronous control.	"8.1 Synchronous control"
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 Displays "--------" for the master axis and axes that are not used for synchronous control.	
Synchronous state	The states (synchronous/asynchronous) that have been set for each axis are displayed.	
Table number executing	The table number that the positioning data is being executed or has been executed.	"5.5 Creating Positioning Data Table"
Auxiliary output code	When the auxiliary output function is enabled, the output code is output in the range of 0 to 65,535.	"13.3 Auxiliary Output Code and Auxiliary Output Contact"
Current value	The current value of the positioning unit is displayed. The value becomes “0” upon completion of home return.	"13.4 Current value update" "13.5 Home Coordinates"
Unit conversion current value	The unit-converted current value of the positioning unit is displayed. The value becomes “0” upon completion of home return. If home position coordinates have been set, the value will be preset to the home position coordinates upon completion of home return.	

Item	Description	Related page
Pulse input value	When the pulse input function is enabled, input pulse values are displayed. In the case of virtual axes, "------" is displayed.	"13.6 Pulse Input"
Deviation	When the movement amount automatic check function is enabled, deviations are displayed. In the case of virtual axes, "------" is displayed.	
Axis state	"Running" or "Stopped" is displayed. When an error has occurred, "Error occurred" is displayed.	
Error code	Displays the last error code when an error has occurred. Clicking the [Clear errors] button clears errors.	"15.1 About Errors and Warnings"
Warning code	Displays the last warning code when a warning has occurred. Clicking the [Clear warning] button clears the warning.	

Note

- If a recoverable error occurs in the positioning unit, click the [Clear errors] button to clear the error.
- If a warning occurs in the positioning unit, click [Clear warning] to clear the warning.

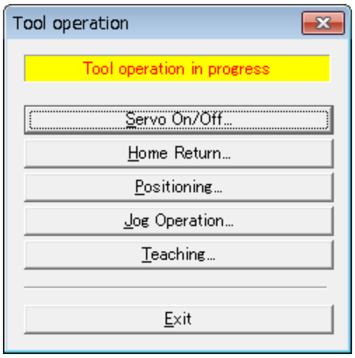
6.4 Tool operation

6.4.1 Tool Operation Function

- With Configurator PM7, you can perform commissioning using tool software before actually starting the user program.
- Be sure to save the settings and download the project to the CPU unit before starting the tool operation of the positioning unit.
- The following procedure is explained assuming that Configurator PM7 has already been started.

Procedure

1. Select **Online**>**Tool Operation** from the menu bar.
The "Tool Operation" dialog box is displayed.



Types of tool operation

Item	Description
Servo ON/OFF	Specifies servo ON/OFF for each axis.
Stop-on-contact torque value for 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 in the positioning table.
JOG operation	Moves the specified axis in 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.

Info.

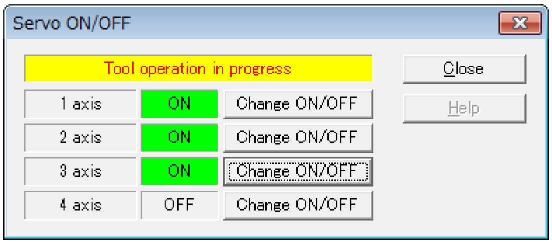
- The unit cannot be switched to tool operation mode while the unit is being operated by a user program.
- Operation requests based on I/O signals are disabled during tool operation.
- If any communication error occurs while the positioning unit is in tool operation, the positioning unit will detect the error and stop automatically. Also, If the previous tool operation does not finish properly due to a communication error, etc., the tool operation mode will be canceled forcibly when the next tool operation starts. Exit the operation once, and start the tool operation again.

6.4.2 Serve ON/OFF with Tool Operation Function

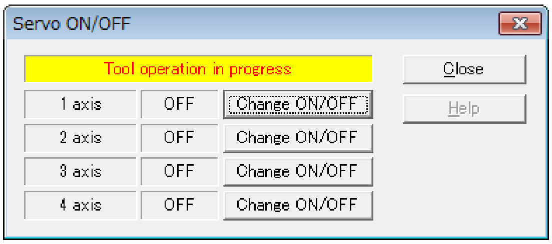
The following procedure is explained assuming that Configurator PM7 has already been started.

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. Click the [Change ON/OFF] button for the desired axis.
   The state is switched between servo lock (ON) and servo free (OFF).



4. Confirm the servo ON/OFF status of the desired axis, and click the [Close] button.
   The display returns to the "Tool Operation" dialog box.

Info.

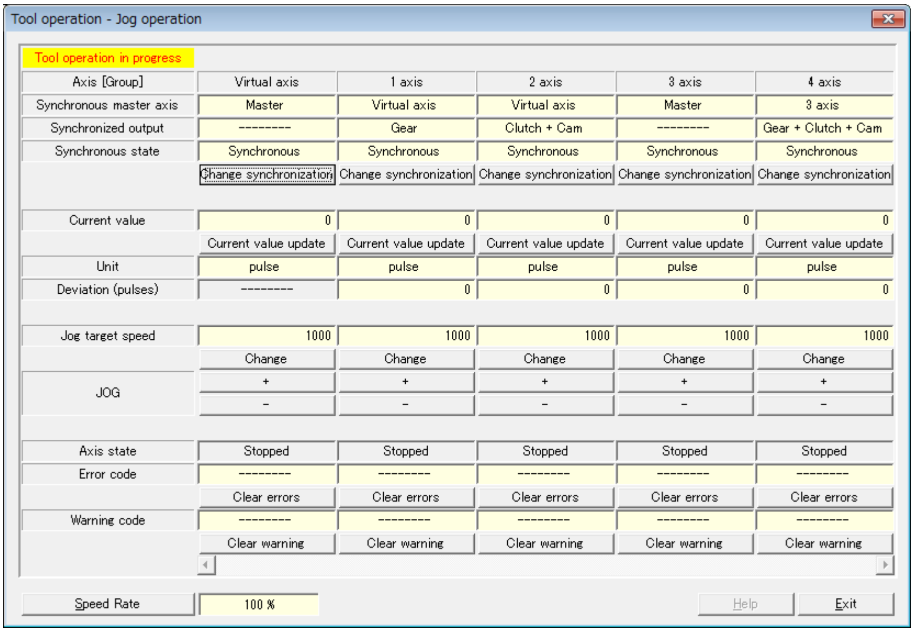
- If servo ON/OFF has been controlled using ladder programs, the servo-lock or servo-free state before the start of the tool operation is maintained and the operation shifts to tool operation mode.
- Even if the tool operation mode is terminated, the servo-lock or servo-free state prior to the termination will be maintained.

6.4.3 JOG Operation with Tool Operation Function

- With Configurator PM7, you can perform commissioning before actually starting the user program.
- The following procedure is explained assuming that Configurator PM7 has already been 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. Click the [+] or [-] button in the JOG field.
   The JOG operation will be executed.
4. Click the [Exit] button to terminate the JOG operation.

Info.

- If a recoverable error occurs in the positioning unit RTEX, click the [Error clear] button to clear the error.
- If a warning occurs in the positioning unit, click [Warning clear] to clear the warning.
- This dialog box cannot be closed during the operation.

Dialog box items

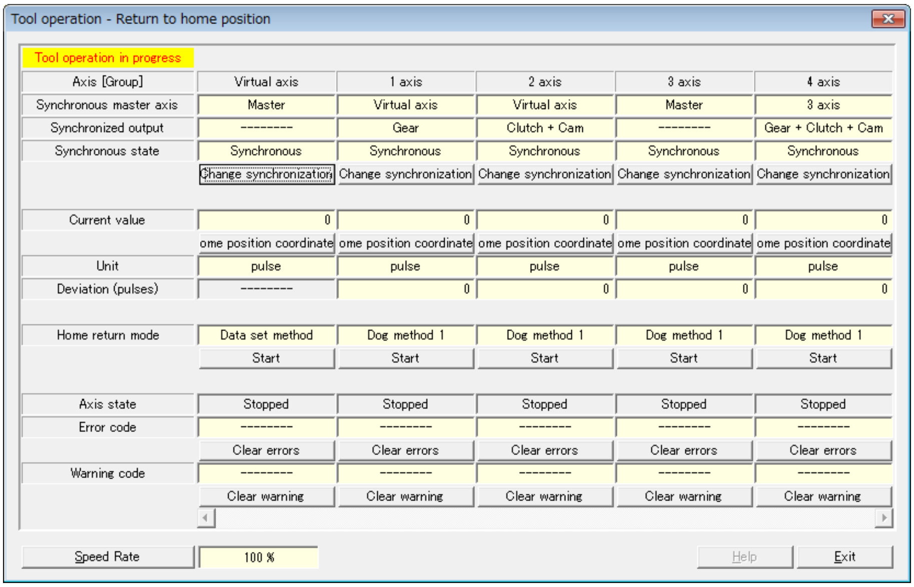
Item	Description	Related page
synchronous master axis	Displays "Master" when an axis has been set as a master axis. When an axis has been set as a slave axis, the master axis on which this axis is based is displayed. Example: When Axis 2 has been set as a slave axis for the master axis that is Axis 1, "Axis 1" is displayed in the column of Axis 2. Displays "--------" for axes that are not used for synchronous control.	"8.1 Synchronous control"
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 Displays "--------" for the master axis and axes that are not used for 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	Monitors the feedback values after the unit system conversion for each axis. Click [Current value update] to display the value input dialog box for changing the current value.	"13.4 Current value update"
Unit	The units of position for each axis specified in the parameter settings are displayed.	
Deviation (pulses)	When the movement amount automatic check function is enabled, deviations are displayed. In the case of virtual axes, "0" is displayed when the function is not used.	"13.6 Pulse Input"
JOG target speed	Monitors and displays the target speed for the JOG operation. Click [Change] to change the target speed for JOG operation.	"9.1 Settings and Operation of JOG Operation"
JOG [+]	Performs JOG forward rotation while [+] is being clicked.	
JOG [-]	Performs JOG reverse rotation while [-] is being clicked.	
Axis state	"Running" or "Stopped" is displayed. When an error has occurred, "Error occurred" is displayed.	
Error code	Displays the last error code when an error has occurred. Clicking the [Clear errors] button clears errors.	"15.1 About Errors and Warnings"
Warning code	Displays the last warning code when a warning has occurred. Clicking the [Clear warning] button clears the warning.	
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. Click the [Speed rate] button to display the value input dialog box.	

6.4.4 Home Return by Tool Operation Function

- When the power is turned on, the coordinates of the positioning unit do not coincide with those of the machine position. Execute home return before starting a positioning operation.
- With Configurator PM7, you can perform commissioning before actually starting the user program.
- The following procedure is explained assuming that Configurator PM7 has already been started.

1 2 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 the [Start] button for the axis for which home return is to be performed.
   Execute the home return operation.
4. Click the [Exit] button to terminate the home return operation.

Info.

- If a recoverable error occurs in the positioning unit, click the [Error Clear] button to clear the error.
- If a warning occurs in the positioning unit, click [Warning clear] to clear the warning.
- This dialog box cannot be closed during the operation.

Dialog box items

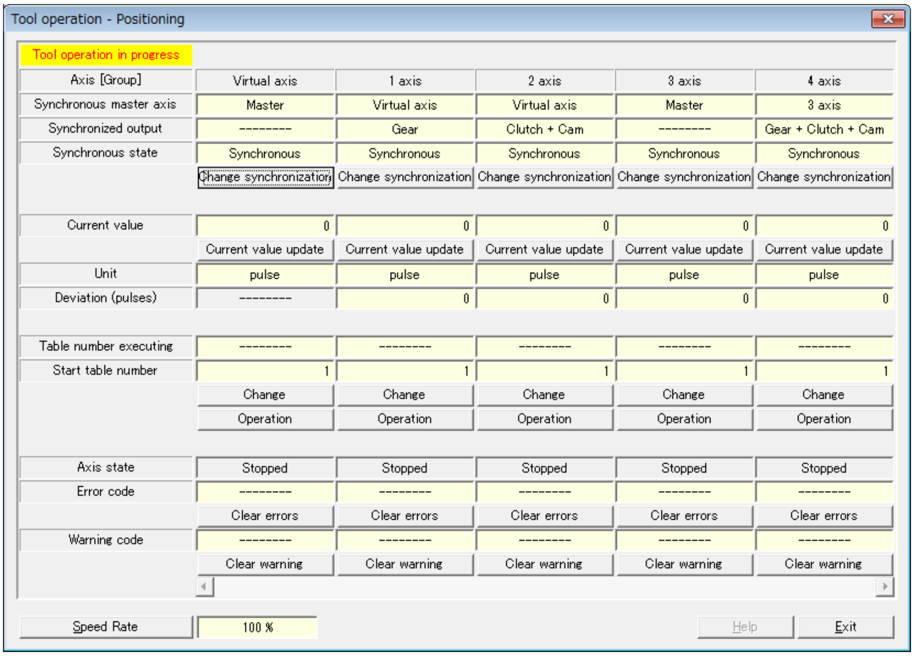
Item	Description	Related page
synchronous master axis	Displays "Master" when an axis has been set as a master axis. When an axis has been set as a slave axis, the master axis on which this axis is based is displayed. Example: When Axis 2 has been set as a slave axis for the master axis that is Axis 1, "Axis 1" is displayed in the column of Axis 2. Displays "--------" for axes that are not used for synchronous control.	"8.1 Synchronous control"
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 Displays "--------" for the master axis and axes that are not used for 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 feedback values after the unit system conversion for each axis. Click [Home coordinates] to display the value input dialog box for changing the value after home return.	"13.4 Current value update"
Unit	The units of position for each axis specified in the parameter settings are displayed.	
Deviation (pulse)	When the movement amount automatic check function is enabled, deviations are displayed. In the case of virtual axes, "0" is displayed when the function is not used.	"13.6 Pulse Input"
Home return mode	Displays the content of the home return setting code registered in the positioning setting data.	"10.1 Pattern of Home Return"
Start/Stop	Executes a home return start/stop operation. ● Click [Start] to execute a home return operation. The button name changes to [Stop]. ● Click [Stop] to execute a deceleration stop operation. The button name changes to [Start].	
Axis state	"Running" or "Stopped" is displayed. When an error has occurred, "Error occurred" is displayed.	
Error code	Displays the last error code when an error has occurred. Clicking the [Clear errors] button clears errors.	"15.1 About Errors and Warnings"
Warning code	Displays the last warning code when a warning has occurred. Clicking the [Clear warning] button clears the warning.	
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. Click the [Speed rate] button to display the value input dialog box.	

6.4.5 Positioning by Tool Operation Function

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

1 2 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. Click the [Change] button under the target start table number field.
   The "Start Table No. Setting" dialog box is displayed.
4. Enter a start table number.
5. Click the [Operation] button.
   The positioning operation will start from the specified start table number.
6. Click the [Exit] button to terminate the positioning operation.

Dialog box items

Item	Description	Related page
synchronous master axis	Displays "Master" when an axis has been set as a master axis. When an axis has been set as a slave axis, the master axis on which this axis is based is displayed.	"8.1 Synchronous control"

Item	Description	Related page
	Example: When Axis 2 has been set as a slave axis for the master axis that is Axis 1, "Axis 1" is displayed in the column of Axis 2. Displays "--------" for axes that are not used for synchronous control.	
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 Displays "--------" for the master axis and axes that are not used for 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	Monitors the feedback values after the unit system conversion for each axis. Click [Current value update] to display the value input dialog box for changing 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)	When the movement amount automatic check function is enabled, deviations are displayed. In the case of virtual axes, "0" is displayed when the function is not used.	"13.6 Pulse Input"
Table number executing	Displays the table number during the operation or when it completes.	"5.5 Creating Positioning Data Table"
Start table number	Position control start table number Click [Change] to change the start table number.	
Operation/Stop	Executes a positioning control operation or stop operation. ● Click [Operate] to execute a positioning control operation. The button name changes to [Stop]. ● Click [Stop] to execute a deceleration stop operation. The button name changes to [Operate].	
Axis state	"Running" or "Stopped" is displayed. When an error has occurred, "Error occurred" is displayed.	
Error code	Displays the last error code when an error has occurred. Clicking the [Clear errors] button clears errors.	"15.1 About Errors and Warnings"
Warning code	Displays the last warning code when a warning has occurred. Clicking the [Clear warning] button clears the warning.	
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. Click the [Speed rate] button to display the value input dialog box.	

Info.

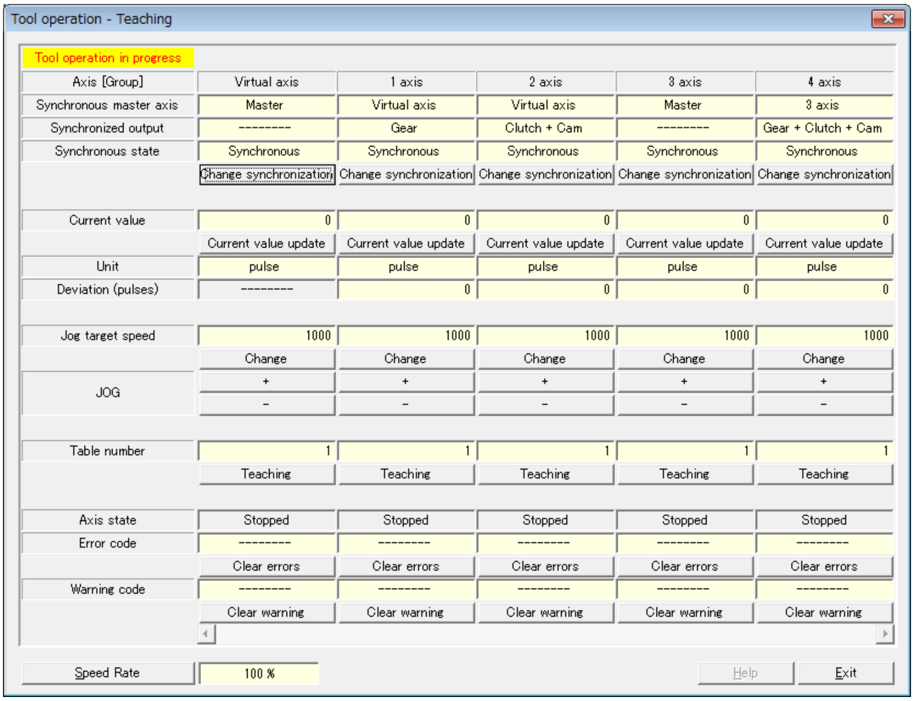
- For the positioning operation, the setting data should be downloaded to the positioning unit in advance. The operations after the start table number vary depending on the operation pattern.
- If a recoverable error occurs in the positioning unit RTEX, click the [Error clear] button to clear the error.
- If a warning occurs in the positioning unit, click [Warning clear] to clear the warning.
- The positioning operation of an interpolation group starts and stops the axis with the smallest number in the group within the program. For the tool operation function, a positioning operation is also started by clicking the [Operate] button for any axis; however, a warning message is displayed when the [Operate] button for any axis other than the smallest axis number is clicked.
- This dialog box cannot be closed during the operation.
- When conditions are changed during the tool operation, the unit memory will be updated temporarily and the operation will be performed, however, the changed conditions will not be reflected in the configuration data written in the CPU unit. Therefore, when the mode is changed to the RUN mode again, the unit will start based on the configuration data downloaded to the CPU unit.

6.4.6 Teaching by Tool Operation Function

Activate each axis manually by the tool operation, and register the positioning addresses where the axes come to a stop as the point data.

1 2 Procedure

1. Select **Online**>**Tool Operation** from the menu bar.
   The "Tool Operation" dialog box is displayed.
2. Select "Teaching" in the "Tool Operation" dialog box.
   The "Tool operation - Teaching" dialog box is displayed.



3. Have the JOG operation stop the axis at the positioning point.

4. Click the [Teaching] button.

5. Enter the table number where the desired positioning information is registered, and click the [OK] button.
The current value will be registered for the movement amount of the specified table number. Also, if the axis that has been taught is an interpolation axis, the current value is registered for the movement amount of the corresponding coordinates within the interpolation group.

6. Click the [Exit] button to terminate the teaching operation.

Dialog box items

Item	Description	Related page
synchronous master axis	Displays "Master" when an axis has been set as a master axis. When an axis has been set as a slave axis, the master axis on which this axis is based is displayed. Example: When Axis 2 has been set as a slave axis for the master axis that is Axis 1, "Axis 1" is displayed in the column of Axis 2. Displays "--------" for axes that are not used for synchronous control.	"8.1 Synchronous control"
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 Displays "--------" for the master axis and axes that are not used for synchronous control.	

Item	Description	Related page
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	Monitors the feedback values after the unit system conversion for each axis. 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 (pulse)	When the movement amount automatic check function is enabled, deviations are displayed. In the case of virtual axes, "0" is displayed when the function is not used.	"13.6 Pulse Input"
JOG target speed	Monitors and displays the target speed for the JOG operation. Click [Change] to change the target speed for JOG operation.	"9.1 Settings and Operation of JOG Operation"
JOG [+]	Performs JOG forward rotation while [+] is being clicked.	
JOG [-]	Performs JOG reverse rotation while [-] is being clicked.	
Table No.	Displays the table number for which teaching is performed. Click [Teaching] to change the table number for which teaching is performed and register the current value.	"5.5 Creating Positioning Data Table"
Axis state	"Running" or "Stopped" is displayed. When an error has occurred, "Error occurred" is displayed.	
Error code	Displays the last error code when an error has occurred. Clicking the [Clear errors] button clears errors.	"15.1 About Errors and Warnings"
Warning code	Displays the last warning code when a warning has occurred. Clicking the [Clear warning] button clears the warning.	
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. Click the [Speed rate] button to display the value input dialog box.	

Info.

- If a recoverable error occurs in the positioning unit RTEX, click the [Error clear] button to clear the error.
- If a warning occurs in the positioning unit, click [Warning clear] to clear the warning.
- If teaching is performed, the control method for the table number for which teaching is performed will be automatically changed to "Absolute".
- The result of the teaching becomes effective once the tool operation quits and the setting data is downloaded to the positioning unit.
- This dialog box cannot be closed during the operation.

7 Automatic Operation (Position Control)

7.1 Basic Operation

7.1.1 Patterns of Position Control

■ Types of operation

The automatic operation is an operation mode to perform positioning control. A single axis control and an interpolation control that starts and stops multiple axes simultaneously are available for positioning control.

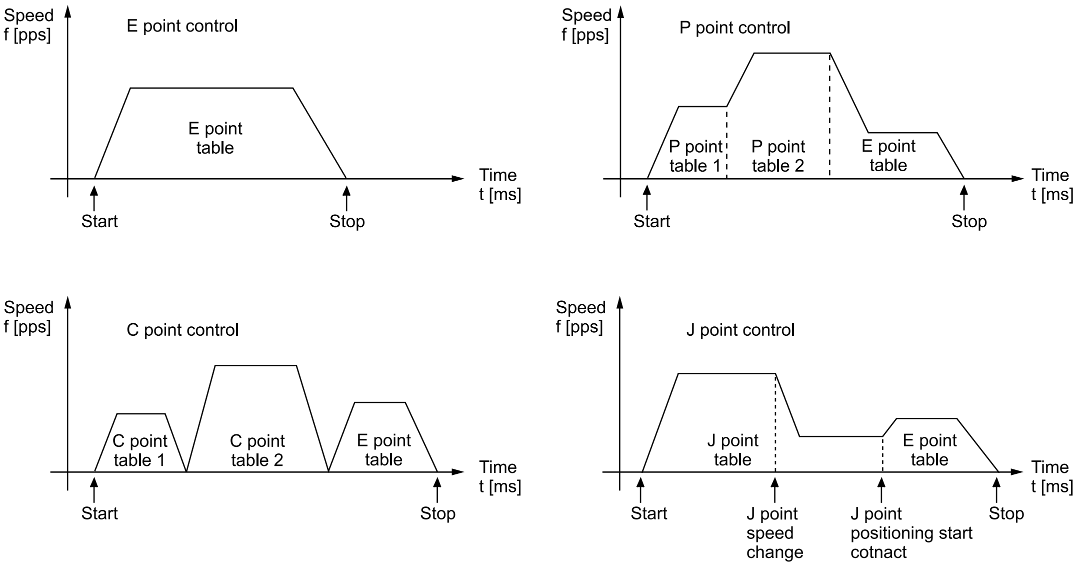
End point (E-point) control, which uses the positioning data of a single table, and pass point (P-point) control and continuous point (C-point) control, both of which use multiple tables, are available for single axis control and interpolation control. These types of control are described below, and acceleration time and deceleration time can be set individually. For P-point and C-point control, the last table must be set as an end point (E-point). In P-point control and C-point control, the operation done flag turns ON after the last table is executed.

JOG positioning (J-point) control (i.e., speed control) is available in addition to P-point control, C-point control, and E-point control.

J-point control operates until the start contact of J-point positioning turns ON after the operation of the positioning unit starts, and the next positioning control will start when the start contact of J-point positioning turns ON.

In J-point control, the operation done flag turns ON after the last table is executed.

J-point control can be used for a single axis only.



■ Operation Flow of Single Axis Control and Operation Flow of Interpolation Control

Single axis control

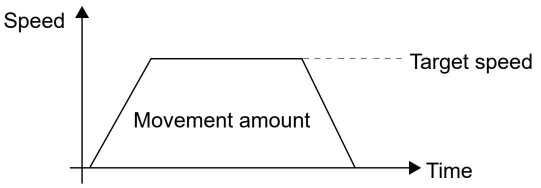
1. Use the Configuration menu and set the target axis as a single axis.
2. Use the Configuration menu and set the target positioning data.
3. Download the project to the CPU unit.
4. Set the POSSET command and set the target positioning control starting table.
5. Turn the corresponding positioning start contact ON.

Interpolation control

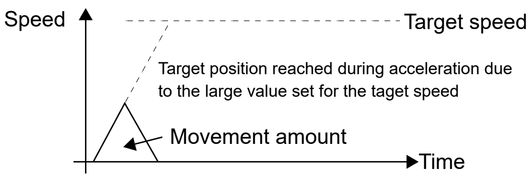
1. Use the Configuration menu and set the axes subject to interpolation as a group.
2. Use the Configuration menu and set the target positioning data. Set the center point and pass point as well in circular interpolation or spiral interpolation.
3. Download the project to the CPU unit.
4. Use the POSSET command for the axis with the smallest number in the group and set the target positioning control starting table.
5. Turn ON the corresponding positioning start contact of the axis with the smallest number in the group.

■ Trapezoidal Control and Triangular Control

In positioning operation, if the target speed is set to a high speed relative to the specified movement amount, trapezoidal control will not occur. Before reaching the target speed (during acceleration), it may decelerate and operate with triangular control.



Trapezoidal control



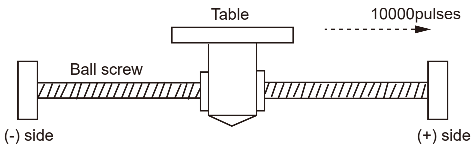
Triangular control

The acceleration/deceleration time should be set to 2 ms or more for triangular control.

To protect the motor and workpiece, and for accurate positioning operation, set the acceleration/deceleration time so that sudden movement does not occur.

7.1.2 Settings and Operation of E-Point Control

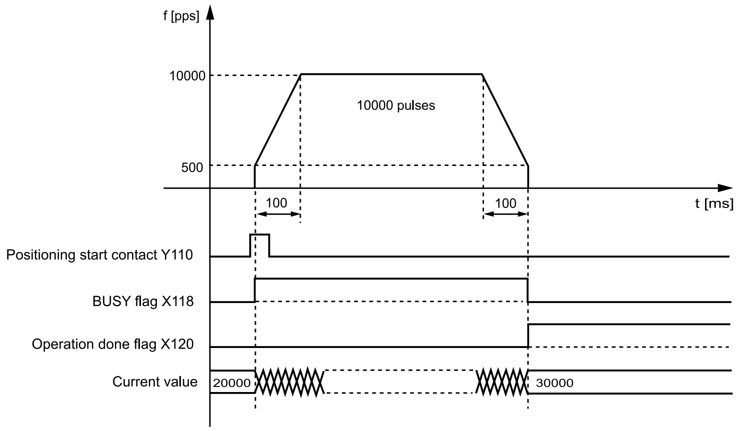
The example below is a case of single-axis control with the positioning unit installed in slot 1. The amount of movement is set using an incremental method and the unit is the number of pulses.



■ Settings

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

■ Behavior diagram

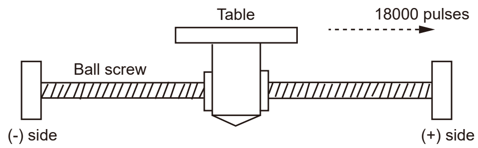


■ Behaviors of each contact

- The BUSY flag (X118), which indicates that the motor is running, turns ON when positioning control starts, and turns OFF when the operation is completed.
- The operation done flag (X120), which indicates the completion of operation, turns ON when the current operation is completed, and remains on hold until the next positioning control, JOG operation, home return, or pulser operation starts. The flag will turn ON after the positioning unit transmits a reference for the target position.

7.1.3 Settings and Operation of P-Point Control

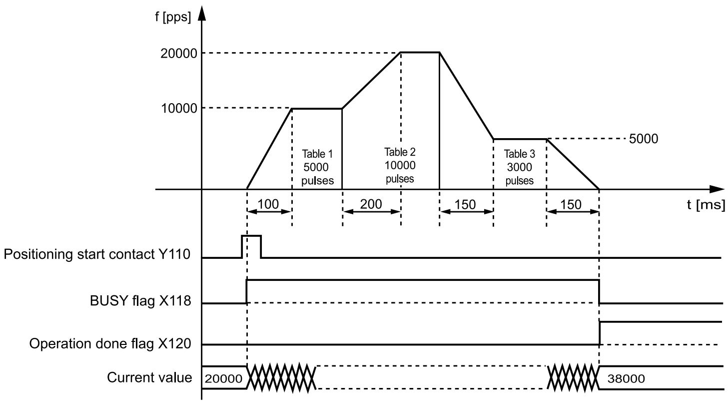
The example below is a case of single-axis control with the positioning unit installed in slot 1. The amount of movement is set using an incremental method and the unit is the number of pulses.



■ Settings

Item	Setting example		
	Table 1	**Table 2**	**Table 3**
Operation pattern	P: Pass point	P: Pass point	E: End point
Control method	I: Incremental	I: Incremental	I: Incremental
X-axis movement amount	5000 pulses	10000 pulses	3,000 pulses
Acceleration/deceleration method	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

■ Behavior diagram

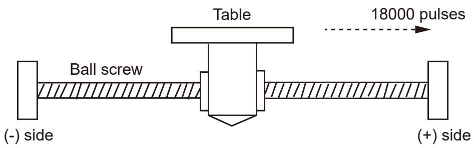


■ Behaviors of each contact

- The BUSY flag (X118), which indicates that the motor is running, turns ON when positioning control starts, and turns OFF when the operation is completed.
- The operation done flag (X120), which indicates the completion of operation, turns ON when the current operation is completed, and remains on hold until the next positioning control, JOG operation, home return, or pulser operation starts. The flag will turn ON after the positioning unit transmits a reference for the target position.

7.1.4 Settings and Operation of C-Point Control

The example below is a case of single-axis control with the positioning unit installed in slot 1. The amount of movement is set using an incremental method and the unit is the number of pulses.

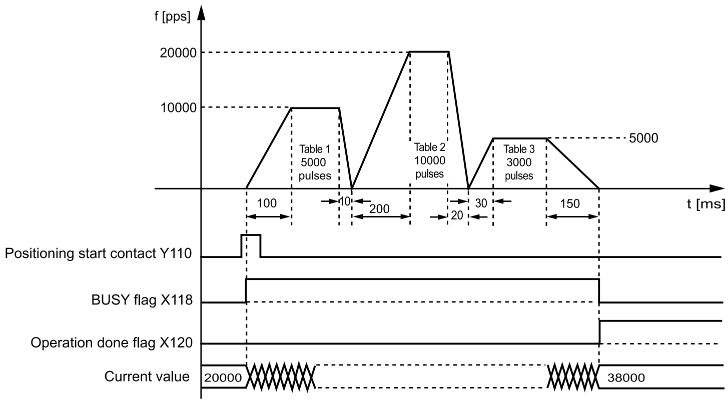


■ Settings

Use the tool software to make positioning data and parameter settings. The unit is set to pulses.

Item	Setting example		
	Table 1	Table 2	Table 3
Operation pattern	C: Continuance point	C: Continuance point	E: End point
Control method	I: Incremental	I: Incremental	I: Incremental
X-axis movement amount	5000 pulses	10000 pulses	3,000 pulses
Acceleration/deceleration method	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

■ Behavior diagram



■ Behaviors of each contact

- The BUSY flag (X118), which indicates that the motor is running, turns ON when positioning control starts, and turns OFF when the operation is completed.
- The operation done flag (X120), which indicates the completion of operation, turns ON when the current operation is completed, and remains on hold until the next positioning control, JOG operation, home return, or pulser operation starts. The flag will turn ON after the positioning unit transmits a reference for the target position.

7.1.5 Settings and Operation of J-Point Control

- When operations are started, J-point control (speed point control) performs the operations at the target speed until the J-point positioning start contact turns ON and then starts the next position control when the J-point positioning start contact turns ON.

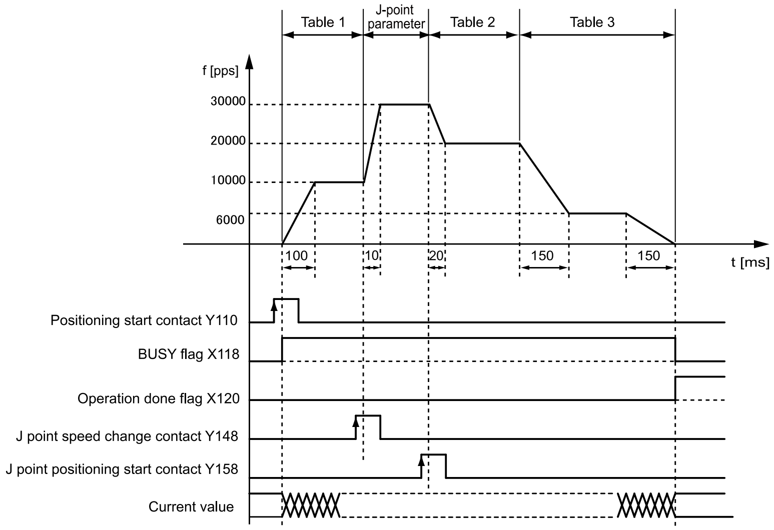
■ Settings

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: Incremental	-	I: Incremental	I: Incremental
X-axis movement amount	5000 pulses	-	10000 pulses	3,000 pulses
Acceleration/ deceleration method	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	-	-

Info.

- Specify parameters for the start of operation in the positioning data table. Specify parameters in the axis parameter-setting menu at the time of speed change.
- J-point control can be used for single-axis control only. It is not available for interpolation control.
- Use incremental mode as the position specification method for P-point control, C-point control, or E-point control executed after J-point control.
- Speed control is performed during J-point control, so be sure to enter the amount of movement for positioning that can secure a constant speed zone based on the target speed.

■ Behavior diagram

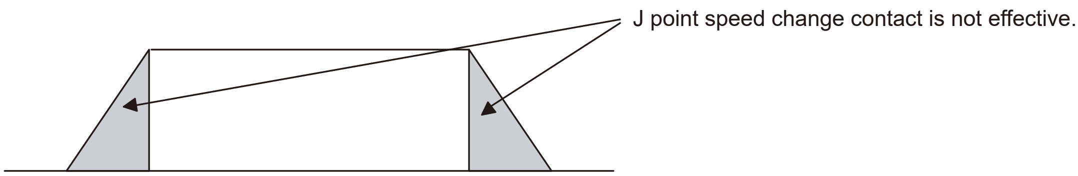


■ Behaviors of each contact

- The BUSY flag (X118) turns ON when the operation starts and turns OFF when the operation is completed.
- The operation done flag (X120) turns ON when the operation is completed, and remains ON until the next position control, JOG operation, home return, or pulser operation starts.
- The target speed will be changed when the J-point speed change contact (Y148) turns ON. The change will be enabled at the edge where the contact turns on.
- Positioning control starts when the J-point positioning start contact (Y158) turns ON.

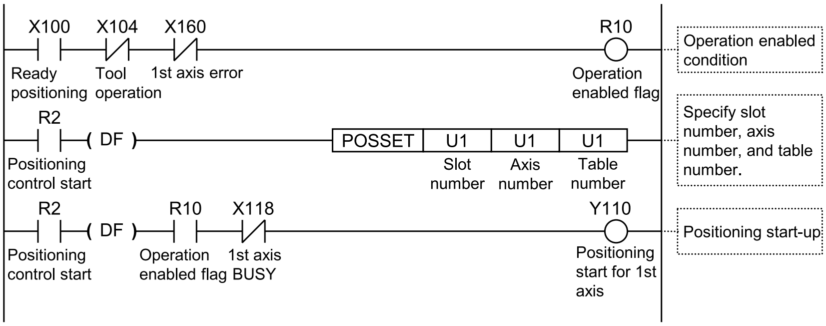
■ Operations when the speed change contact turns ON during acceleration or deceleration

- J-point control allows speed change during operation but does not allow speed change during acceleration or deceleration.
- If the speed change signal turns ON during acceleration or deceleration, the speed change will be executed after the unit enters a constant speed state.



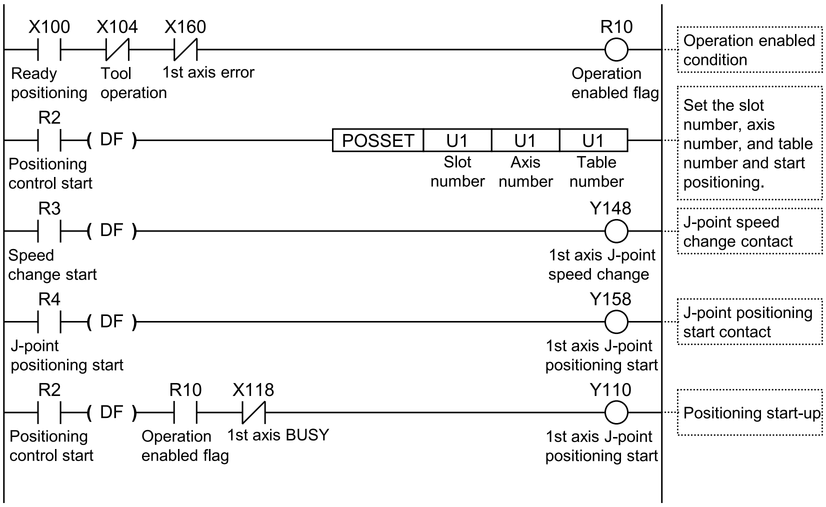
7.1.6 Sample Program (E-Point, P-Point, and C-Point Control)

■ Sample programs



7.1.7 Sample Programs (for J-point Control)

■ Sample programs



7.1.8 Notes on programming

■ Notes on programming

- The last table must be set as E: End point.
- 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 position control starts.
- The start contact and flag number varies depending on the number of axes and the installation position of the unit.

- The specified slot number varies depending on the installation position of the unit.

■ Behavior at limit input

Condition	Direction	Limit status	Operation
When each control starts	Forward	Limit input (+): ON	Startup failure, error occurrence
		Limit input (-): ON	Startup failure, error occurrence
	Reverse	Limit input (+): ON	Startup failure, error occurrence
		Limit input (-): ON	Startup failure, error occurrence
While each control is being performed	Forward	Limit input (+): ON	Deceleration stoppage, error occurrence
	Reverse	Limit input (-): ON	Deceleration stoppage, error occurrence

7.2 Interpolation control

7.2.1 Types of Interpolation Control

■ Types of operation

Interpolation control is classified into 2-axis linear interpolation control, 2-axis circular interpolation control, 3-axis linear interpolation control, and 3-axis spiral interpolation control. The methods for specifying the operation of each type of interpolation control are shown in the table below. Select an appropriate method according to the application. The axes in a relationship of interpolation are called X-axis and Y-axis for 2-axis interpolation and are called X-axis, Y-axis, and Z-axis for 3-axis interpolation. The X-, Y-, and Z-axes are automatically allocated in ascending order of axis signal level.

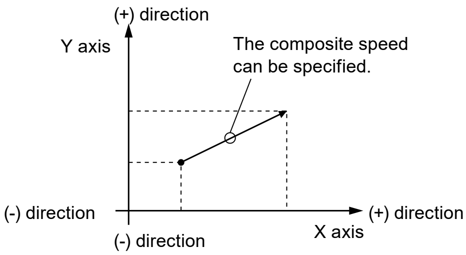
In each type of interpolation control, E-point control that uses one table of positioning data, and P-point control and C-point control that use multiple tables can be freely combined.

For example, using P-point control enables continuous interpolation control from 2-axis linear interpolation control to 2-axis circular interpolation control. The acceleration time and deceleration time can be specified individually. For P-point and C-point control, the last table must be set as an end point (E-point).

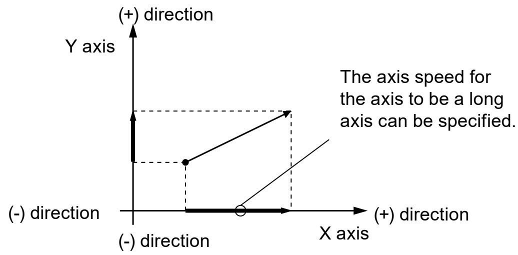
Type	Operation specification method	Necessary data
2-axis linear interpolation control	Composite speed specification	Composite speed of X-axis and Y-axis
	Long axis speed specification	Speed of long axis (axis whose movement distance is long)
2-axis circular interpolation control	Center point specification/CW direction	X-axis and Y-axis coordinates of center point
	Center point specification/CCW direction	X-axis and Y-axis coordinates of center point
	Pass point specification	X-axis and Y-axis coordinates of pass point on arc
3-axis linear interpolation control	Composite speed specification	Composite speed of X-axis, Y-axis, and Z-axis
	Long axis speed specification	Speed of long axis (axis whose movement distance is long)
3-axis spiral interpolation control	Center point specification/CW direction/X-axis feed	Y-axis and Z-axis coordinates of center point
	Center point specification/CCW direction/X-axis feed	Y-axis and Z-axis coordinates of center point
	Center point specification/CW direction/Y-axis feed	X-axis and Z-axis coordinates of center point
	Center point specification/CCW direction/Y-axis feed	X-axis and Z-axis coordinates of center point
	Center point specification/CW direction/Z-axis feed	X-axis and Y-axis coordinates of center point
	Center point specification/CCW direction/Z-axis feed	X-axis and Y-axis coordinates of center point
	Pass point specification/X-axis feed	Y-axis and Z-axis coordinates of pass point on arc

Type	Operation specification method	Necessary data
	Pass point specification/Y-axis feed	X-axis and Z-axis coordinates of pass point on arc
	Pass point specification/Z-axis feed	X-axis and Y-axis coordinates of pass point on arc

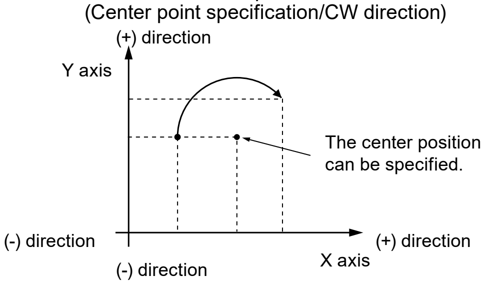
2-axis linear interpolation
(Composite speed specification)



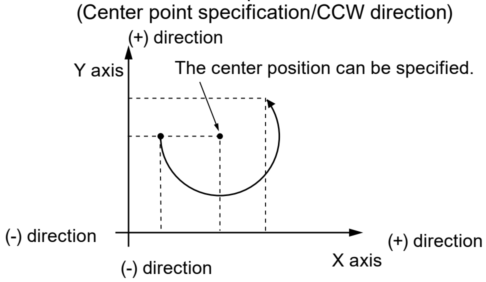
2-axis linear interpolation
(Long axis speed specification)



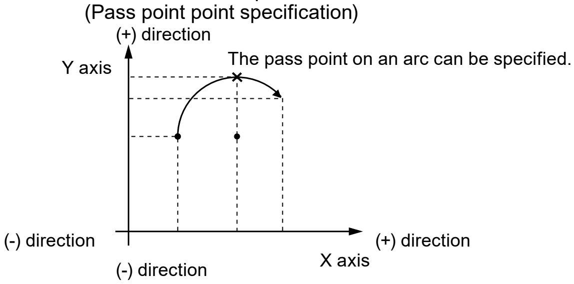
2-axis circular interpolation
(Center point specification/CW direction)



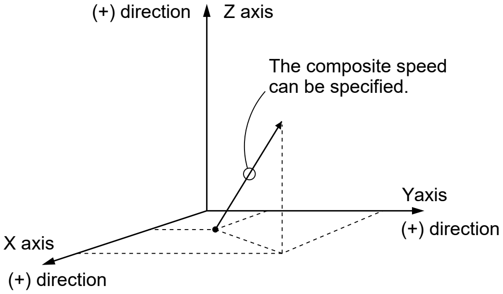
2-axis circular interpolation
(Center point specification/CCW direction)



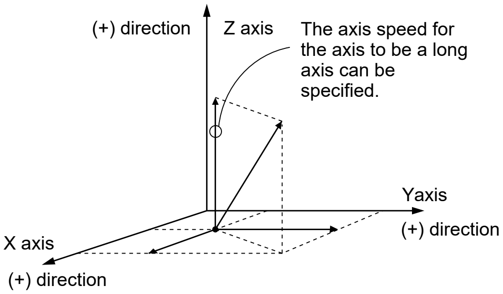
2-axis circular interpolation
(Pass point point specification)



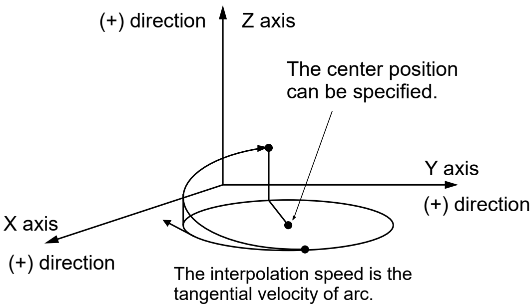
3-axis linear interpolation
(Composite speed specification)



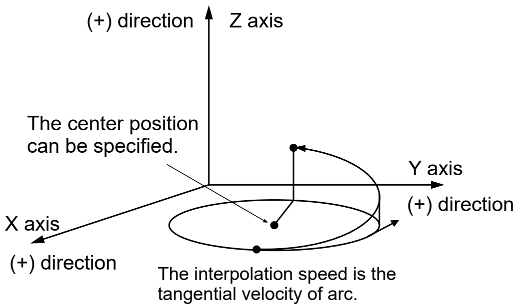
3-axis linear interpolation
(Composite speed specification)



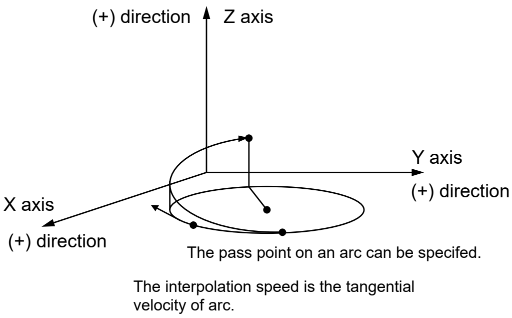
3-axis spiral interpolation (Center point
specification/CW direction/Z-axis movement)



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



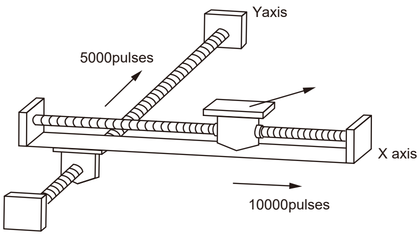
3-axis spiral interpolation (Pass point specification/
Z-axis movement)



(Note 1) If the X-axis and Y-axis are feed axes in 3-axis spiral interpolation, they behave as if each axis in the above diagram is replaced.

7.2.2 Settings and Operation of Two-Axis Linear Interpolation

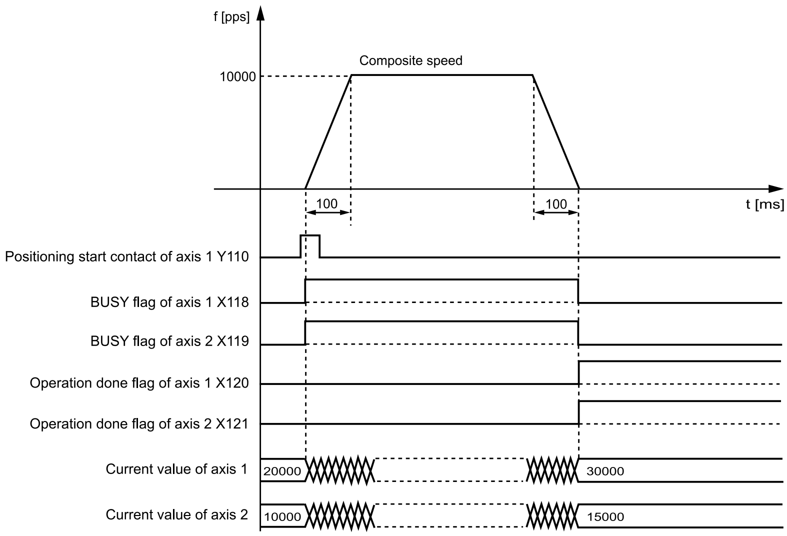
The example below is a case of E-point control with the positioning unit installed in slot 1. The X-axis is set as Axis 1and the Y-axis is set as Axis 2. The amount of movement is set using an incremental method and the unit is the number of pulses.



■ Settings

Item	Setting example
Operation pattern	E: End point
Interpolation operation	0: Linear (Composite speed)
Control method	I: Incremental
X-axis movement amount	10000 pulses
X-axis auxiliary point	0
Y-axis movement amount	5000 pulses
Y-axis auxiliary point	0
Acceleration/deceleration method	L: Linear
Acceleration time (ms)	100 ms
Deceleration time (ms)	100 ms
Interpolation speed	10000 pps

■ Behavior diagram



■ Behaviors of each contact

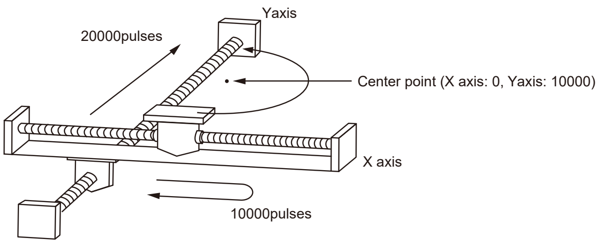
- The 1st axis and 2nd axis BUSY flags (X118 and X119) indicating the state that a motor is running will turn ON when the positioning control starts, and they will turn OFF when the operation completes.
- The 1st axis and 2nd axis operation done flags (X120 and X121) indicating the state that an operation completed will turn ON when the JOG operation is completed, and they will be held until the next positioning control, JOG operation, home return, or pulser operation starts.

■ Notes on programming

- To start interpolation control, turn ON the positioning start contact of the axis with the smallest number in the same group.
- The values of the X-axis auxiliary point and Y-axis auxiliary point are invalid for linear interpolation.
- For long axis speed specification, composite speed is faster than long axis speed.
- 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 position control starts.
- The start contact and flag number varies depending on the number of axes and the installation position of the unit.
- The specified slot number varies depending on the installation position of the unit.

7.2.3 Settings and Operation of Two-Axis Circular Interpolation

The example below is a case of E-point control with the positioning unit installed in slot 1. The X-axis is set as Axis 1and the Y-axis is set as Axis 2. The amount of movement is set using an incremental method and the unit is the number of pulses.



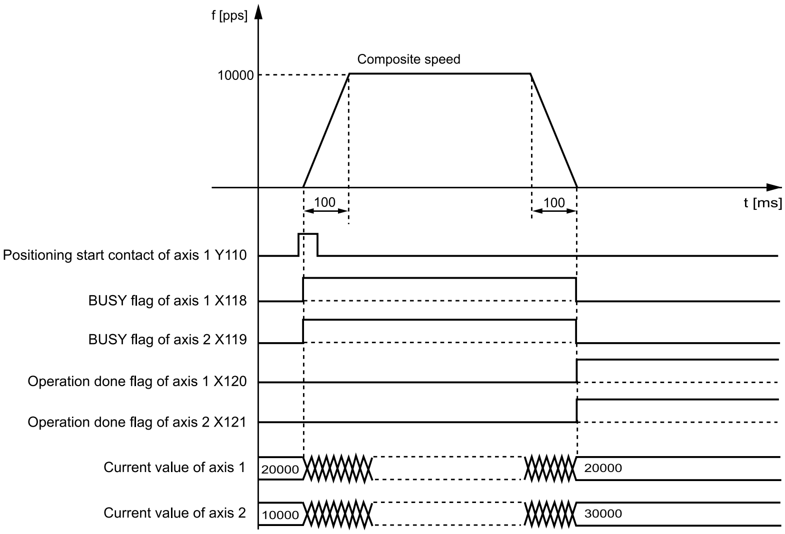
■ Settings

Use the tool software to make positioning data and parameter settings. The unit is set to pulses.

Item	Setting example
Operation pattern	E: End point
Interpolation operation	S: Circular (center point/CW direction)
Control method	I: Incremental
X-axis movement amount	0 pulses
X-axis auxiliary point	0 pulses
Y-axis movement amount	20000 pulses

Item	Setting example
Y-axis auxiliary point	10000 pulses
Acceleration/deceleration method	L: Linear
Acceleration time (ms)	100 ms
Deceleration time (ms)	100 ms
Interpolation speed	10000 pps

■ Behavior diagram



■ Behaviors of each contact

- The 1st axis and 2nd axis BUSY flags (X118 and X119) indicating the state that a motor is running will turn ON when the positioning control starts, and they will turn OFF when the operation completes.
- The 1st axis and 2nd axis operation done flags (X120 and X121) indicating the state that an operation completed will turn ON when the JOG operation is completed, and they will be held until the next positioning control, JOG operation, home return, or pulser operation starts.

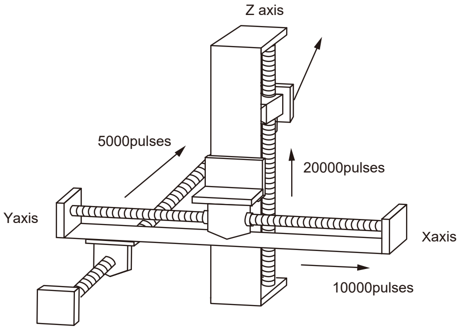
■ Notes on programming

- To start interpolation control, turn ON the positioning start contact of the axis with the smallest number in the same group.
- For center point specification, the X-axis auxiliary point is the center point of the X-axis, and the Y-axis auxiliary point is the center point of the Y-axis. Pass points must be set as the respective pass points of the X-axis and Y-axis.
- When the control method is the incremental method, both the center point and pass point are expressed as the incremental coordinates from the start point.
- If the start point and the operation completion point are the same, one circular operation is performed when the center point method is used, but an error occurs when the pass point method is used.
- For the pass point method, if the start point, the pass point, and the operation completion point exist on the same straight line, an arc will not be formed, resulting in an error.

- For long axis speed specification, composite speed is faster than long axis speed.
- 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 position control starts.
- The start contact and flag number varies depending on the number of axes and the installation position of the unit.
- The specified slot number varies depending on the installation position of the unit.

7.2.4 Settings and Operation of Three-Axis Linear Interpolation

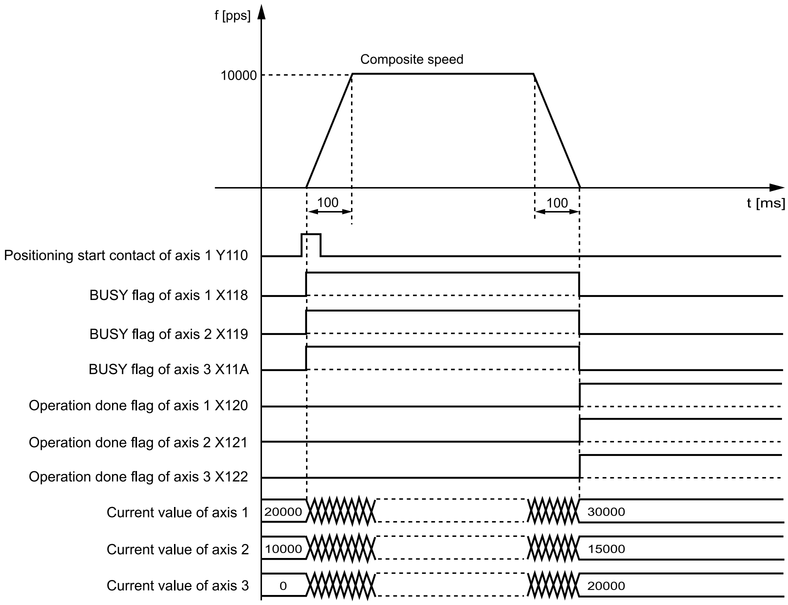
The example below is a case of E-point control with the positioning unit installed in slot 1. The X-axis is set as Axis 1, the Y-axis is set as Axis 2, and the Z-axis is set as Axis 3. The amount of movement is set using an incremental method and the unit is the number of pulses.



■ Settings

Item	Setting example
Operation pattern	E: End point
Interpolation operation	0: Linear (Composite speed)
Control method	I: Incremental
X-axis movement amount	10000 pulses
X-axis auxiliary point	0
Y-axis movement amount	5000 pulses
Y-axis auxiliary point	0
Z-axis movement amount	20000 pulses
Z-axis auxiliary point	0
Acceleration/deceleration method	L: Linear
Acceleration time (ms)	100 ms
Deceleration time (ms)	100 ms
Interpolation speed	10000 pps

■ Behavior diagram



■ Behaviors of each contact

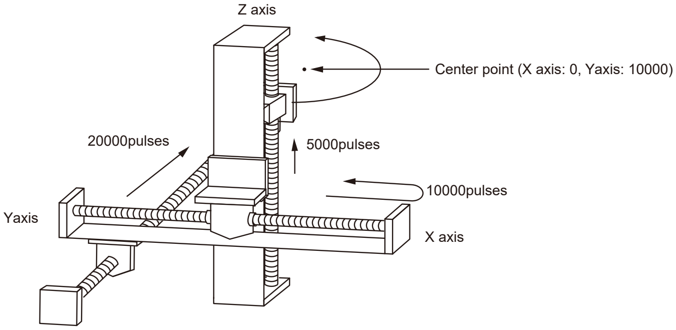
- The 1st axis, 2nd axis, and 3rd axis BUSY flags (X118, X119, and X11A) indicating the state that a motor is running will turn ON when the positioning control starts, and they will turn OFF when the operation completes.
- The 1st axis, 2nd axis, and 3rd axis operation done flags (X120, X121, and X122) indicating the state that an operation completed will turn ON when the JOG operation is completed, and they will be held until the next positioning control, JOG operation, home return, or pulser operation starts.

■ Notes on programming

- To start interpolation control, turn ON the positioning start contact of the axis with the smallest number in the same group.
- The values of the X-axis auxiliary point and Y-axis auxiliary point are invalid for linear interpolation.
- For long axis speed specification, composite speed is faster than long axis speed.
- 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 position control starts.
- The start contact and flag number varies depending on the number of axes and the installation position of the unit.
- The specified slot number varies depending on the installation position of the unit.

7.2.5 Settings and Operation of Three-Axis Spiral Interpolation

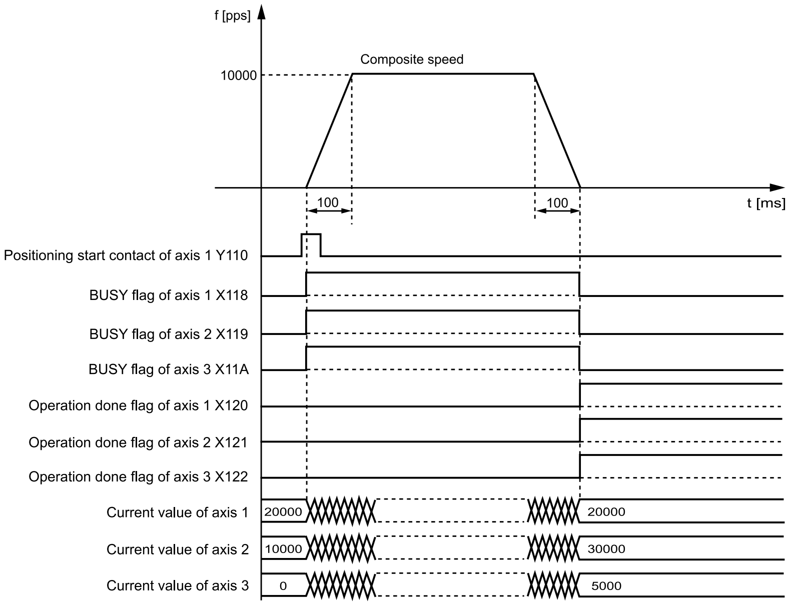
The example below is a case of E-point control with the positioning unit installed in slot 1. The X-axis is set as Axis 1, the Y-axis is set as Axis 2, and the Z-axis is set as Axis 3. The amount of movement is set using an incremental method and the unit is the number of pulses.



■ Settings

Item	Setting example
Operation pattern	E: End point
Interpolation operation	E: Spiral (Center/CW direction/Z-axis movement)
Control method	I: Incremental
X-axis movement amount	0 pulses
X-axis auxiliary point	0 pulses
Y-axis movement amount	20000 pulses
Y-axis auxiliary point	10000 pulses
Z-axis movement amount	5000 pulses
Z-axis auxiliary point	0
Acceleration/deceleration method	L: Linear
Acceleration time (ms)	100 ms
Deceleration time (ms)	100 ms
Interpolation speed	10000 pps

■ Behavior diagram



■ Behaviors of each contact

- The 1st axis, 2nd axis, and 3rd axis BUSY flags (X118, X119, and X11A) indicating the state that a motor is running will turn ON when the positioning control starts, and they will turn OFF when the operation completes.
- The 1st axis, 2nd axis, and 3rd axis operation done flags (X120, X121, and X122) indicating the state that an operation completed will turn ON when the JOG operation is completed, and they will be held until the next positioning control, JOG operation, home return, or pulser operation starts.

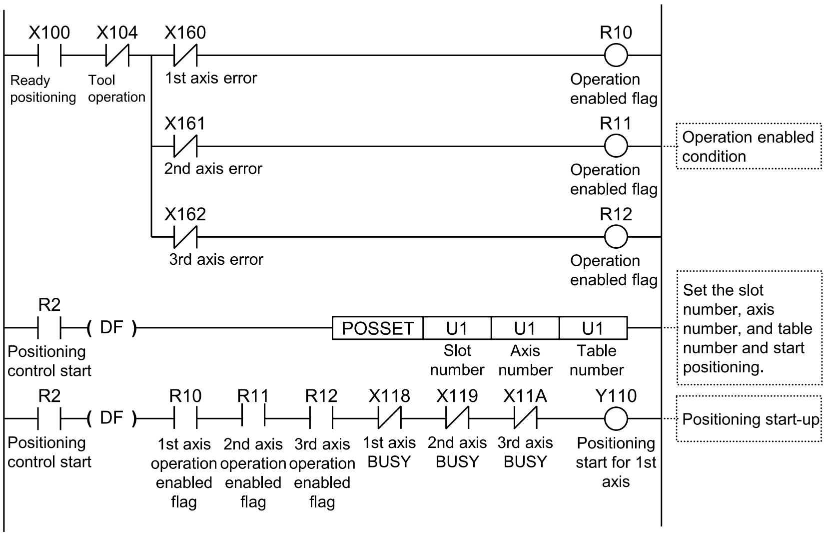
■ Notes on programming

- For center point specification, in the X-Y plane, the X-axis auxiliary point is the center point of the X-axis, and the Y-axis auxiliary point is the center point of the Y-axis. Pass points must be set as the respective pass points of the X-axis and Y-axis. The same applies to the Y-Z plane and X-Z plane.
- When the control method is the incremental method, both the center point and pass point are expressed as the incremental coordinates from the start point.
- If the start point and the operation completion point are the same, one circular operation is performed when the center point method is used, but an error occurs when the pass point method is used.
- For the pass point method, if the start point, the pass point, and the operation completion point exist on the same straight line, an arc will not be formed, resulting in an error.
- For long axis speed specification, composite speed is faster than long axis speed.
- 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 position control starts.
- The start contact and flag number varies depending on the number of axes and the installation position of the unit.
- The specified slot number varies depending on the installation position of the unit.

7.2.6 Sample Programs (for Interpolation Control)

An example of 3-axis interpolation control is shown below.

■ Sample programs



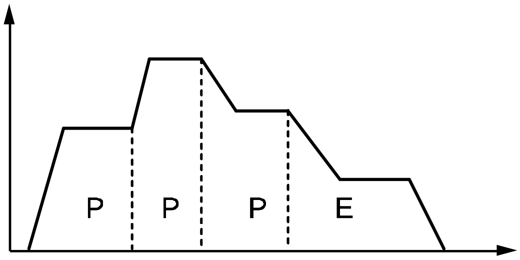
7.3 Setting and Operation of Positioning Repeat Function

The positioning repetition function executes continuous positioning control according to the specified number of repetitions.

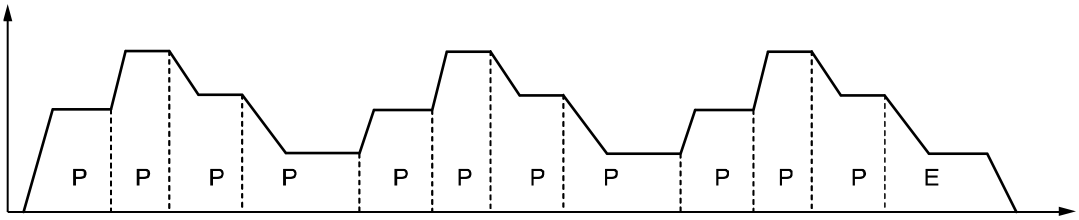
The number of repetitions is set in the area for specifying the number of positioning repetitions for each axis. The number of repetitions can be set within a range of 2 to 254. It is possible to specify a limitless number of repetitions by setting 255 for the area of the number of positioning repetitions.

■ Overview of positioning repeat function

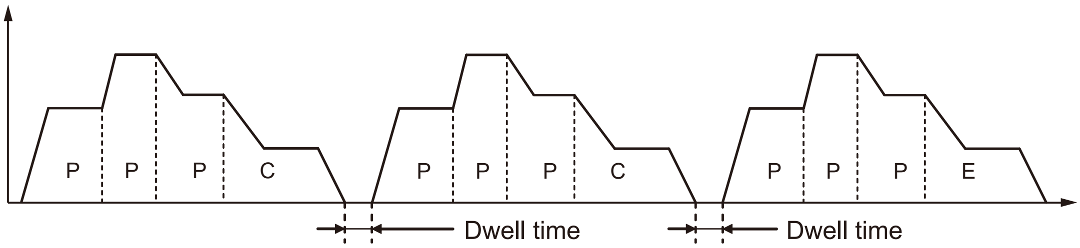
Positioning operations are performed as below when positioning control is repeated three times.



If a dwell time of 0 is set for E-point control, i.e., the end point of positioning control, the positioning unit will perform E-point control as P-point control, and complete positioning control after repeating 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 will perform E-point control as C-point control, and repeat positioning control with a pause specified by the dwell time (ms). The positioning unit finishes the operation after repeating the positioning control three times.



■ Setting area for positioning repeat function

This area is used to set the number of repetitions of positioning control to be started for each axis at the start of positioning control.

The positioning unit repeats positioning control for the number of repetitions set and finishes operating. The number of repetitions will be reset to the default value on completion of positioning control.

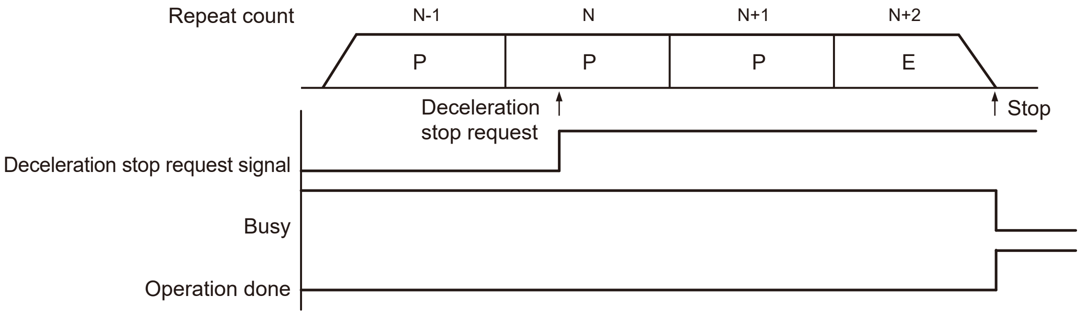
Unit memory No. (Hex)	Name	Description	Default	Setting range	Unit
UM 00108	Axis 1 positioning Repetition count	Stores the number of repetitions of the operation starting from the position control start table number of the 1st axis until the E point. If 255 is set, positioning control is repeated unlimitedly until the operation is stopped.	0	0 to 255	Number of times
UM 00109	Axis 2 positioning Repetition count	Stores the number of repetitions of the operation starting from the position control start table number of the 2nd axis until the E point. If 255 is set, positioning control is repeated unlimitedly until the operation is stopped.	0	0 to 255	Number of times
UM 0010A	Axis 3 positioning Repetition count	Stores the number of repetitions of the operation starting from the position control start table number of the 3rd axis until the E point. If 255 is set, positioning control is repeated unlimitedly until the operation is stopped.	0	0 to 255	Number of times
UM 0010B	Axis 4 positioning Repetition count	Stores the number of repetitions of the operation starting from the position control start table number of the 4th axis until the E point. If 255 is set, positioning control is repeated unlimitedly until the operation is stopped.	0	0 to 255	Number of times
UM 0010F	Virtual axis positioning Repetition count	Stores the number of repetitions starting from the starting table number of positioning control of the virtual axis until the E point. If 255 is set, positioning control is repeated unlimitedly until the operation is stopped.	0	0 to 255	Number of times

■ Stop processing for repetitive positioning operation

The following operations will occur only if a deceleration stop is performed during repetitive positioning.

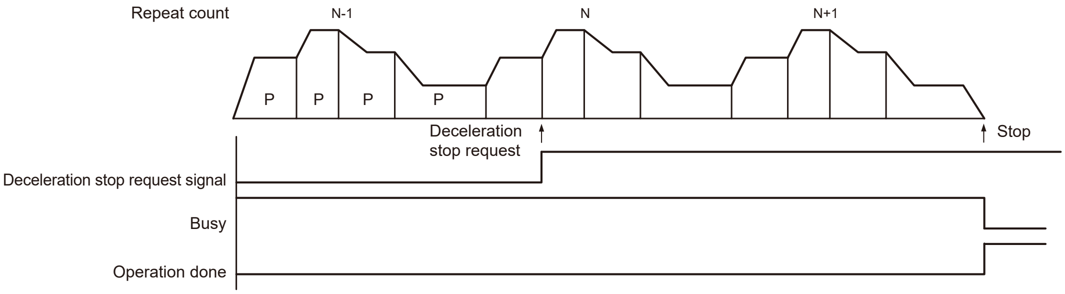
When repeating E-point control (dwell time: 0 ms)

When the positioning unit detects a deceleration stop, the positioning unit will come to a stop after repeating positioning control N+2 times.

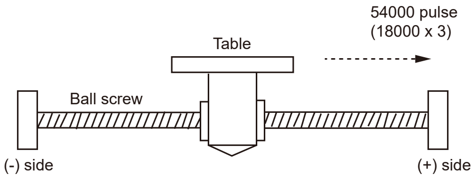


When executing multiple positioning tables continuously

When the positioning unit detects a deceleration stop, the positioning unit will come to a stop after repeating positioning control N+1 times.



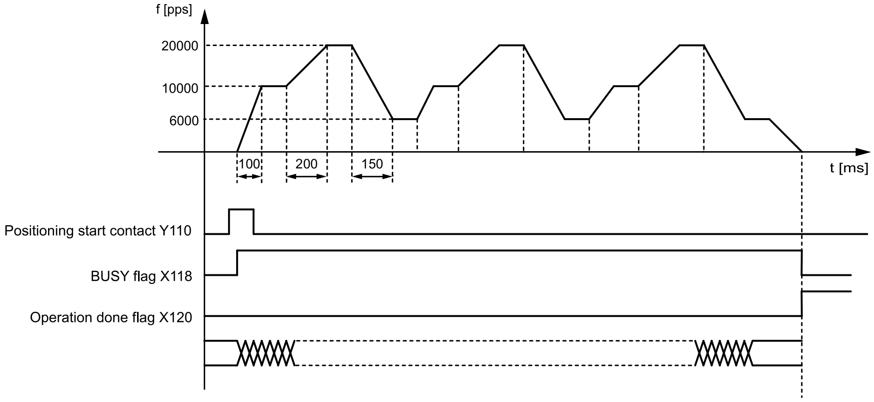
The example below is a case of single-axis control with the positioning unit installed in the slot 1. The amount of movement is set using an incremental method and the unit is the number of pulses.



■ Settings

Item	Setting example		
	Table 1	**Table 2**	**Table 3**
Operation pattern	P: Pass point	P: Pass point	E: End point
Control method	I: Incremental	I: Incremental	I: Incremental
X-axis movement amount	5000 pulses	10000 pulses	3,000 pulses
Acceleration/deceleration method	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 repetition count	3 (written to the setting area of the unit memory)		

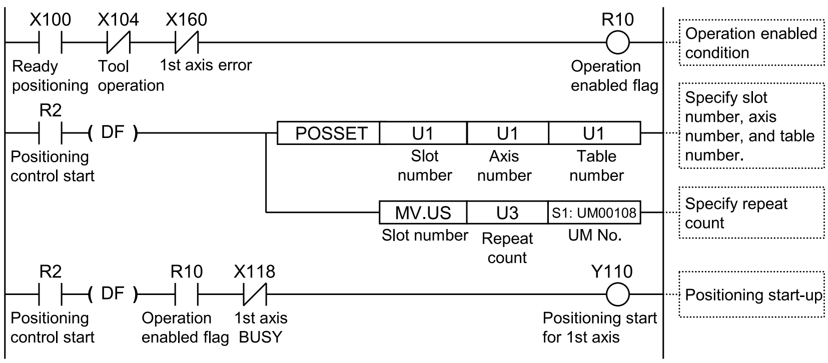
■ Behavior diagram



■ Behaviors of each contact

- The BUSY flag (X118), which indicates that the motor is running, turns ON when positioning control starts, and turns OFF when the operation is completed.
- The operation done flag (X120), which indicates the completion of operation, turns ON when the current operation is completed, and remains on hold until the next positioning control, JOG operation, home return, or pulser operation starts.

■ Sample programs



(MEMO)

8 Automatic Operation (Synchronous Control)

8.1 Synchronous control

8.1.1 Overview of Synchronous Control

■ What is synchronous control?

Synchronization control involves operating the master axis (the axis used as the operation reference) to operate the slave axis (the axis interlocked or synchronized with the master axis). The use of synchronous control provides the following advantages.

1. Ease of settings

   If the operations of multiple axes are related to each other, operations among multiple axes can be easily set up by, based on the master axis, designing the operations of other axes.

2. Ensuring operational safety

   If an axis comes to a stop for some reason while synchronous control is running, all the relevant axes under synchronous control will be stopped. Therefore, you can easily enhance the safety of the system.

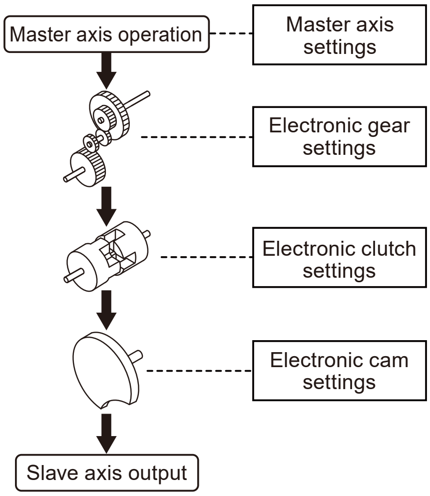
■ Functions of synchronous control

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 operations 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 operational phase of the master axis and outputs cam pulses according to the phase. The cam pattern is set with the configuration tool.

■ Execution order and setup procedure of synchronous control

The functions achieved by synchronous control and the procedures for setting up the functions are outlined below.



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

Select the use or non-use of the electronic gear. Various electronic 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 used.

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

8.2 Setting up the Master Axis and Slave Axes

8.2.1 Selecting and Setting up the Master Axis

The master axis serves as the operation reference for synchronous 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	Overview
Real axis	Axes (the 1st to 4th axes) available for the positioning unit. Use this type if the master axis also needs to be controlled. If an existing axis is used as the master axis, the rest of the existing axes (three axes) can be used as slave axes.
Virtual axis	A virtual axis exists in the positioning unit. The existing axes (1st to 4th axes) can be used effectively if the virtual axis is used. The virtual axis cannot output pulses externally. The virtual axis cannot receive any external input signals, either.
Pulse Input	The master axis operates according to pulse value input into the positioning unit. Use pulse input when an external device such as an external encoder is connected as the reference for synchronous control. If pulse input is used for the master axis, the slave axes will operate according to the pulse input. Therefore, be careful when starting or stopping the operation of the positioning unit.

■ Types and restrictions for master axis

		Master axis type		
		Real axis	**Virtual axis**	**Pulse Input**
Stop-on-contact torque value for home return		Yes	Available only for the data set method	No
JOG operation		Yes	Yes	No
positioning	Single axis	Yes	Yes	No
	Interpolation	Yes	No Available only for single axis	No
Stop Functions	System, emergency, deceleration stop	Yes	Yes	No
	Limit stop	Yes	Δ Stops only with software limit because of no limit signal input.	No
	Error stop	Yes	Yes	No
Other			Necessary to make settings to use the virtual axis on the Configuration screen.	Because of synchronization with external pulse input, the master axis cannot be controlled. To stop synchronous control, stop the slave axes.

Info.

- While the unit is under synchronous control, slave axes set to use the master axis operate only in synchronization with the master axis, so the slave axes cannot operate independently.
- Virtual axes can only be used as single axes. When using virtual axes, select the check box for virtual axes in the "Axis Settings" dialog box of "Configurator PM7".
- For home return of virtual axes, only the "data set method" can be used.
- If "pulse input" is set for the master axis, the master axis will synchronize with pulses input from external devices such as external encoders, so the master axis cannot be stopped freely.

8.2.2 Selecting and Setting Up the Slave Axis

■ Selecting the slave axis

The 1st to 4th axes are available as slave axes. Virtual axes can be used only as the master axis.

When "Synchronous master axis" is selected for the axis to be operated as a slave axis in the "Synchronization Parameter Settings" dialog box of Configurator PM7, the axis will operate as a slave axis for the master axis specified as "Synchronous master axis".

Up to four slave axes can be set for a single master axis.

Axes set as slave axes operate in synchronization with the master axis as long as synchronous control is enabled. No slave axes can perform positioning and other control independently from the master axis while synchronous control is enabled.

■ Settings for Slave Axes

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

- Unit setting
- Number of pulses per revolution
- Movement amount per rotation

8.3 Starting and Canceling Synchronous Control

8.3.1 Starting and Canceling Synchronous Control

■ Start and cancellation operations

- It is possible to cancel synchronous control temporarily by turning ON the synchronization cancellation request signal.
- It is possible to operate slave axes individually while synchronous control is canceled.
- The synchronous control can be started again with the sync cancel request signal turned OFF.
- The synchronous control can be cancelled while a master axis is activated. (This function is available from the unit of Ver.1.50 or later.)

■ Allocation of I/O signals

Signal name	1 axes	2 axes	3 axes	4 axes	Operation
Synchronization cancellation request	Y88	Y89	Y8A	Y8B	ON: Cancel synchronous control; OFF: Execute synchronous control
Synchronization cancellation in-progress notification	X88	X89	X8A	X8B	ON: Synchronous control canceled; OFF: Under synchronous control

(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.

■ Operation while synchronous control is being performed or is canceled

<table>
<tr><th colspan="2" rowspan="2">Operation requested axis</th><th colspan="2">Operation while synchronous control is being performed</th><th>Operation while synchronous control is canceled</th></tr>
<tr><th>Master axis</th><th>Slave axis</th><th>Master/slave axis</th></tr>
<tr><td colspan="2">Stop-on-contact torque value for home return</td><td>×
A home return operation is performed on the master axis.
A home return operation is not performed on slave axes. Synchronous operations are performed according to output from the master axis.
Before performing home return, cancel synchronous control.</td><td rowspan="4">×
The slave axes do not operate in response to operation requests.</td><td>Yes
Regardless of master or slave axes, a home return operation is performed only on the axes for which it has been requested.</td></tr>
<tr><td colspan="2">JOG operation</td><td rowspan="2">Yes
The slave axes operate in synchronization with the operation request for the master axis.</td><td rowspan="2">Yes
Regardless of master or slave axes, a JOG operation is performed only on the axes for which it has been requested.</td></tr>
<tr><td rowspan="2">positio ning</td><td>Single axis</td></tr>
<tr><td>Interpolation</td><td>Yes</td><td>Yes</td></tr>
</table>

Operation requested axis		Operation while synchronous control is being performed		Operation while synchronous control is canceled
		Master axis	**Slave axis**	**Master/slave axis**
		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.		Interpolation is executed upon request if the requested axis is the start axis of interpolation.
Stop Functions	System stop	All the axes come to a stop regardless of the synchronization settings.		
	Emergency stop	Yes The master axis comes to a stop upon request. The slave axes come to a stop in synchronization with the master axis.	Yes Only requested axes come to a stop. The master axis and other slave axes set for the same master axis continue operating.	Yes Only requested axes come to a stop. (All the target axes come to a stop during interpolation operations.)
	Deceleration stop			
	Limit stop	The master axis and all the slave axes come to a stop.		Only axes for which a limit error has occurred come to a stop.
	Error stop			Only axes for which an error has occurred come to a stop.

8.3.2 Notes on Canceling or Starting Synchronous Control

■ Notes on canceling synchronous control

- Synchronous control can be canceled during master operation; however, slave axes will stop immediately.
- We recommend that synchronous control be canceled after slave axes are stopped using the clutch function.
- When synchronous control is canceled, relays related to synchronous control (relays for synchronous slave gear ratio change state notification and synchronous slave clutch connection state notification) turn OFF.

■ Conditions for starting synchronous control

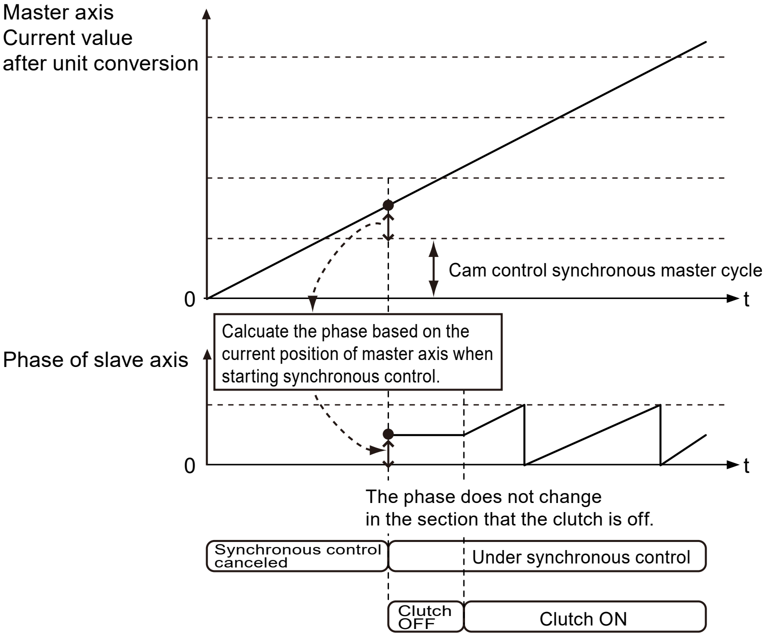
Only when the following conditions are met, the synchronous control can be started.

- Slave axes must be stopped.
- No stop request for slave axes must have been generated.
- No error must have occurred on slave axes.

If these conditions are not met, the unit will not enter a synchronous state and the synchronization cancellation in-progress notification will 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 at the start of synchronous control

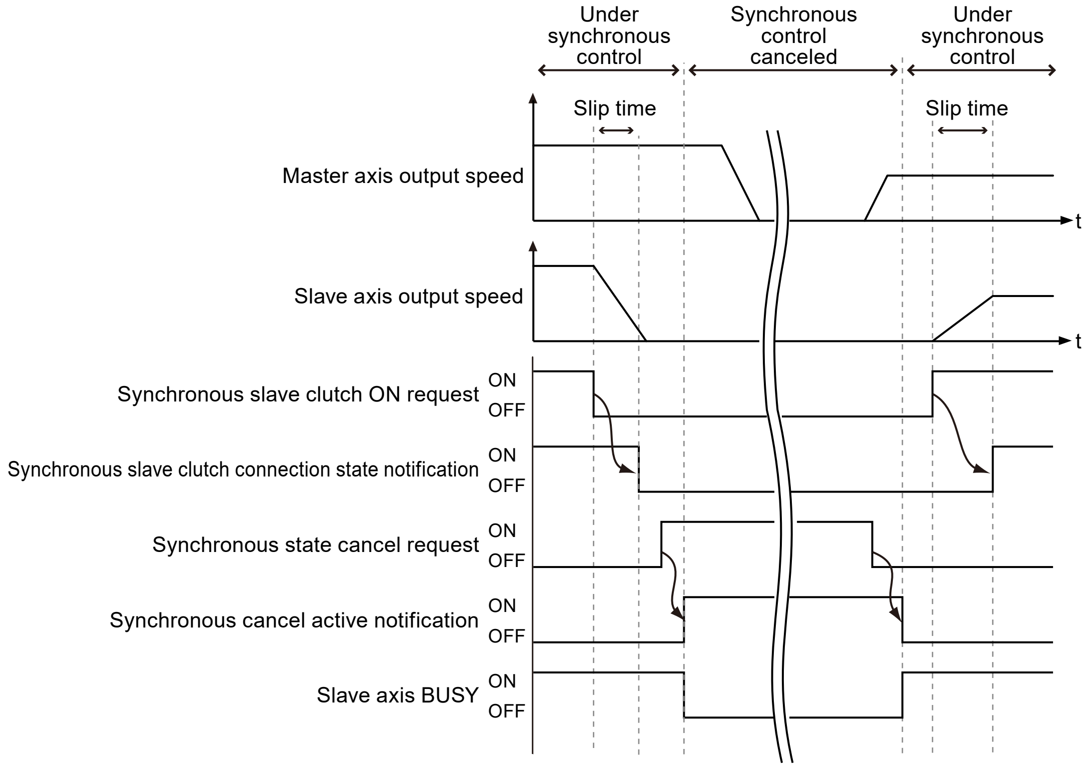
The phase is calculated from the "unit-converted current value" parameter for the master axis and the "cam control synchronous master axis cycle" synchronization parameter. The remainder obtained by dividing "unit-converted current value" by "cam control synchronous master axis cycle" is used as the phase.



■ Procedures for canceling and starting synchronous control

As an example, the following shows the procedures when "Level" is selected for the clutch trigger type.

Section	Proce dure	Operation by user program and operation by the unit
Synchronization cancellation	1	The user program turns OFF the synchronous slave clutch ON request.
	2	The unit turns OFF the synchronous slave clutch connection state notification.
	3	The user program turns ON the synchronous state cancellation request.
	4	The unit cancels synchronous control when the synchronization cancellation in-progress notification turns ON.
Synchronization start	5	The user program turns OFF the synchronization cancellation request.
	6	The unit turns OFF the synchronization cancellation in-progress notification.
	7	The user program turns ON the synchronous slave clutch ON request.
	8	The slave axis starts synchronous operation when the synchronous slave clutch connection state notification turns ON.



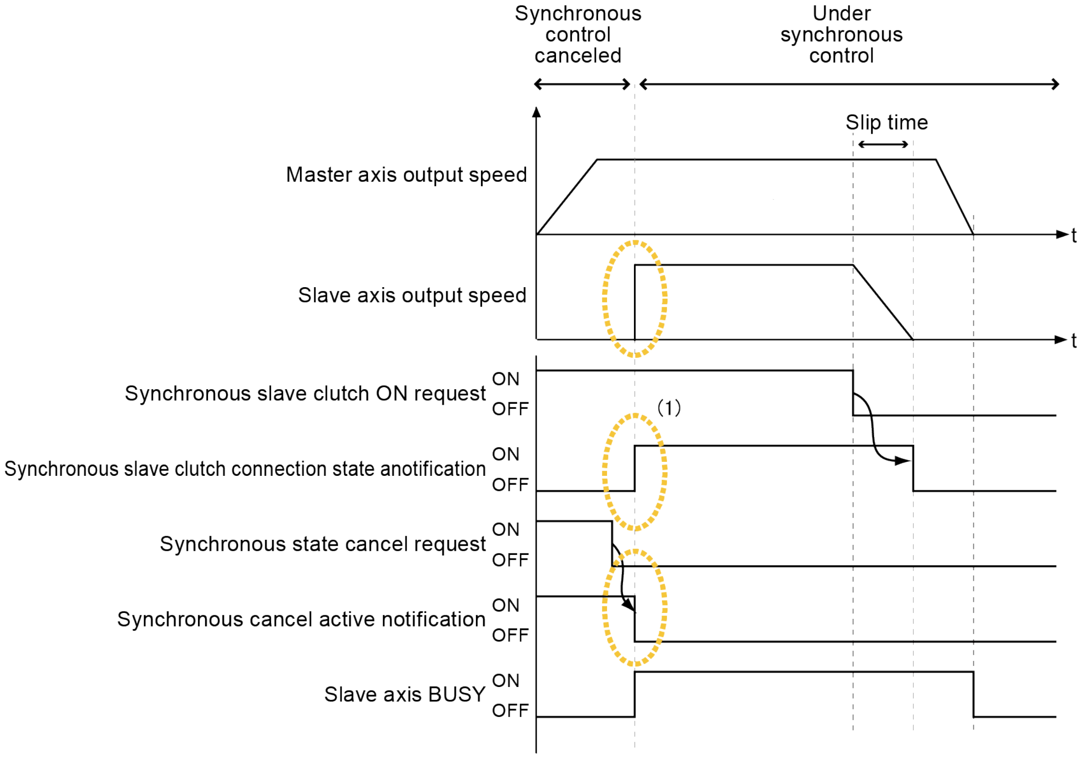
■ I/O allocations

Signal name	1 axes	2 axes	3 axes	4 axes
Synchronization cancellation request	Y88	Y89	Y8A	Y8B
Synchronization cancellation in-progress notification	X88	X89	X8A	X8B
Synchronous slave clutch ON request	Y98	Y99	Y9A	Y9B
Synchronous slave clutch ON request connection state annunciation	X98	X99	X9A	X9B
Slave axis BUSY	Y18	Y19	Y1A	Y1B

■ Operation when "Level" is selected for the clutch ON trigger type

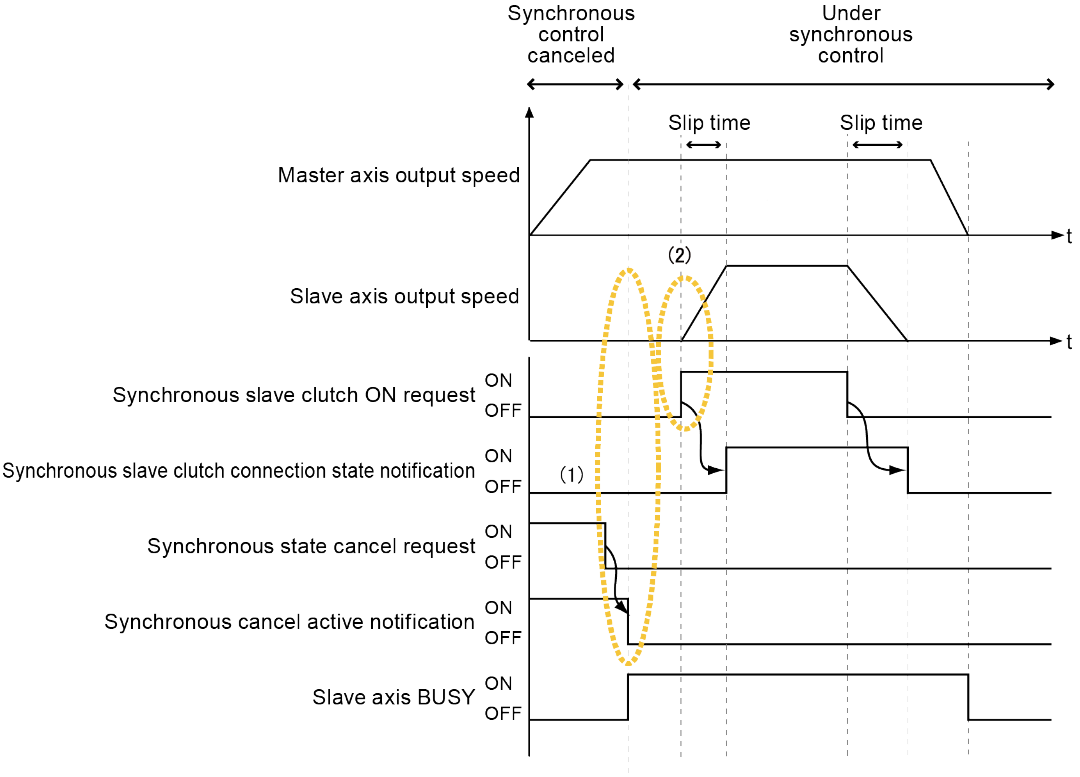
- If the "synchronous slave clutch ON request" is on when the synchronous control start processing is executed, the clutch is connected by the direct method regardless of the setting of "slip method".
- However, if the "synchronous slave clutch ON request" is off when the synchronous control start processing is executed, the clutch is connected according to the setting of "slip method".

When the synchronous slave clutch ON request is ON when synchronous control start processing is executed



(1)	The slave axes start operating immediately because the clutch is connected (synchronous slave clutch connection state notification: ON) when synchronous control starts (synchronization cancellation in-progress notification: OFF).

When the synchronous slave clutch ON request is OFF when synchronous control start processing is executed



(1)	The slave axes do not operate immediately because the clutch is not connected (synchronous slave clutch connection state notification: OFF) when synchronous control starts (synchronization cancellation in-progress notification: OFF).
(2)	Slave axes start operating according to the synchronous slave clutch ON request.

■ I/O allocations

Signal name	1 axes	2 axes	3 axes	4 axes
Synchronization cancellation request	Y88	Y89	Y8A	Y8B
Synchronization cancellation in-progress notification	X88	X89	X8A	X8B
Synchronous slave clutch ON request	Y98	Y99	Y9A	Y9B
Synchronous slave clutch ON request connection state annunciation	X98	X99	X9A	X9B
Slave axis BUSY	Y18	Y19	Y1A	Y1B

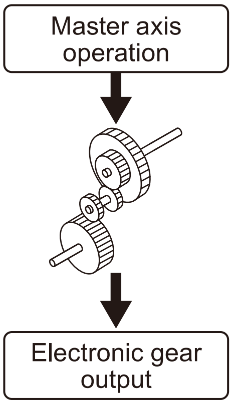
(Note 1) The I/O numbers in the above table show relative addresses based on the base word number. The I/O numbers actually used vary according to the slot number where the unit is installed and the starting word number.

8.4 Electronic gear function

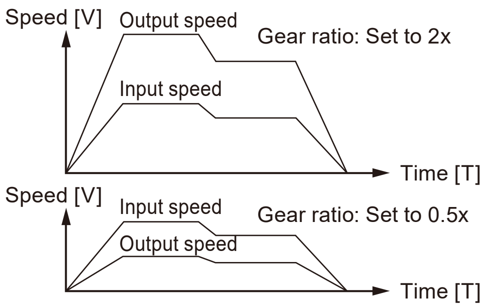
8.4.1 Overview of Electronic Gear Function

■ Electronic gear function

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



$$\underset{\text{(Speed after gear change)}}{\text{Output speed}} = \underset{\text{(Information on master axis speed)}}{\text{Input speed}} \times \frac{\text{Gear ratio numerator}}{\text{Gear ratio denominator}}$$



■ Noes on using the electronic gear function

The use of the electronic gear function makes it possible to set the slave axes to a desired speed relative to the master axis. The movement amount of the slave axes, however, is obtained from the following formula. Therefore, the movement amount of the master axis does not match that of the slave axes.

Movement amount of slave axes = Movement amount of master axis × (Gear ratio numerator/ Gear ratio denominator)

Note: When the gear ratio is constant during operation

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

> Stop
> - Keep in mind that the slave axes may come to a sudden stop if an emergency stop or deceleration stop is executed while the gear ratio is being changed.

8.4.2 Types and Contents of Positioning Parameters to Set

The following positioning parameters must be set up when electronic gears are used.

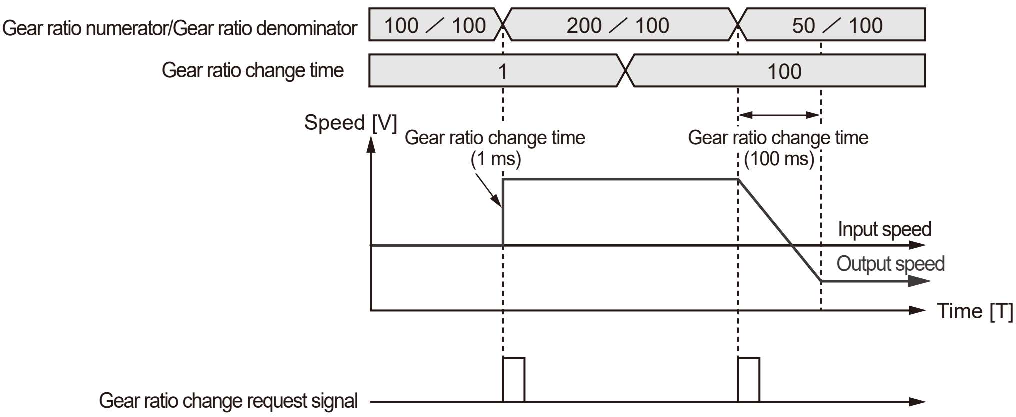
Name	Overview
Electronic gear operation setting	Specifies whether to use the electronic gear function. If the electronic gear is not used, the gear ratio of the electronic gear is fixed at 1:1 and the operation of the master axis is input directly into the electronic clutch function.

Name	Overview
Gear ratio numerator	Determines the gear ratio of the electronic gear. The gear ratios of electronic gears are 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	
Gear ratio change time	The time required to change the current gear ratio to a new gear ratio when the gear ratio of the electronic gear is changed during operation.

8.4.3 Changing the Gear Ratio during Operation

■ Notes on changing the gear ratio during operation

- If the gear ratio is changed during operation, the new gear ratio will take effect after the time specified for "Gear ratio change time" has elapsed.
- 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 gear ratio change is linear acceleration or deceleration. S-shaped acceleration or deceleration cannot be used.



■ Programming method

When changing the gear ratio during operation, use the following procedure to write a user program.

1. Changing the gear ratio
   - Change the "gear ratio numerator" and "gear ratio denominator" of the electronic gear in the electronic gear setting area.
   - The gear ratio at the time of starting the positioning 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.
2. 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 according to the "edge type" detection method. 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.

■ I/O allocations

Signal name	1 axes	2 axes	3 axes	4 axes
Slave axis gear ratio change request	Y90	Y91	Y92	Y93
Slave axis gear ratio change state notification	X90	X91	X92	X93

(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.

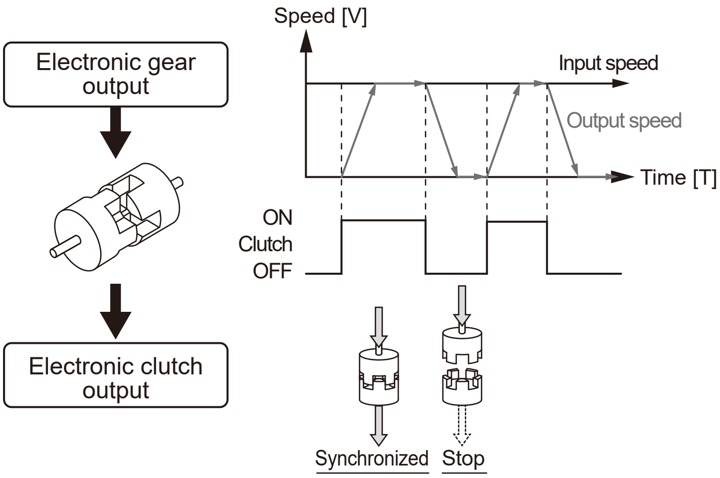
Info.

- For detailed information on the gear ratio setting area, refer to "17.7.1 Synchronous Control Setting Area".

8.5 Electronic Clutch Function

8.5.1 What Is the Electronic Clutch Function?

The electronic clutch function engages (turns ON) or disengages (turns OFF) the clutch in response to output from the electronic gear function. When the electronic clutch is disengaged (turned OFF), the master axis is disconnected from the slave axes and the slave axes are no longer interlocked with the master axis and come to a stop. When the electronic clutch is engaged (turned ON), the master axis and slave axes will operate in synchronization.



- Keep in mind that the slave axes may come to a sudden stop if the clutch is disengaged while the master axis is decelerating.

8.5.2 Types and Contents of Setting Parameters

The use of the electronic clutch requires the following parameter settings.

Parameter name		Overview
Electronic clutch use/non-use		Specify whether to use the electronic clutch function. When the electronic clutch function is used, the electronic clutch is disengaged (OFF) by default. When performing an operation, be sure to engage the electronic clutch according to the operation. If the electronic clutch function is not used, the electronic clutch will remain engaged, causing output data from the electronic gear to be input directly into the electronic cam. At that time, the master axis will always operate in synchronization with the slave axes.
Clutch ON	trigger type	Set "I/O clutch ON request" as the trigger to be detected.
	edge selection	Select from "Level", "Rise", or "Fall" for the method of detecting trigger signals.
	method	Select "Direct" or "Slip" for the clutch engagement method.
	slip time	If "Slip" is selected for the method, set the slip time.

Parameter name		Overview
Clutch OFF	trigger type	Set "I/O clutch OFF request" or "I/O + Phase after clutch (phase specification clutch OFF function)" as the trigger to be detected.
	edge selection	Select "Invalid", "Rise", or "Fall" as the method of detecting trigger signals.
	method	Select "Direct" or "Slip" for the clutch engagement method.
	slip time	If "Slip" is selected for the method, set the slip time.
	Phase ratio	Set if "I/O + Phase after clutch" is selected as the trigger type. After performing clutch OFF using the clutch request signal, continue operation until the slave axis phase reaches the set value.

(Note 1) "I/O+Phase after clutch" is available for the unit Ver.1.40 or later. For setting this, FPWIN GR7 Ver.2.8 or later is required.

Info.

- The mode (I/O + Phase after clutch) has been added to stop the motors of slave axes at an arbitrary phase after turning off the clutch. This function is available for the unit of Ver.1.40 or later. For details, refer to "8.5.5 Phase specification clutch OFF function".

8.5.3 Trigger Types for Electronic Clutch

The following methods are used to engage (turn ON) or disengage (turn OFF) the electronic clutch.

■ Clutch request signals (Y98 to Y9B, Y100 to Y103)

The electronic clutch is controlled by the I/O signal "clutch request signal" allocated to the unit.

■ I/O allocations

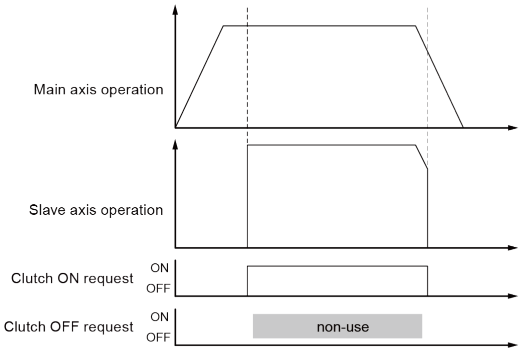
Signal type	1 axes	2 axes	3 axes	4 axes	Operation
Slave axis clutch ON request	Y98	Y99	Y9A	Y9B	
Slave axis clutch OFF request	Y100	Y101	Y102	Y103	
Slave axis clutch operation annunciation	X98	X99	X9A	X9B	ON: Engaged, OFF: Disengaged

■ edge selection

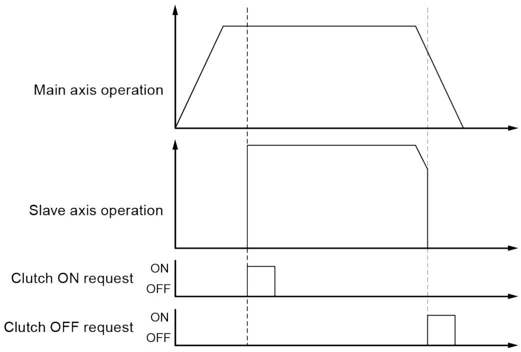
edge selection	Operation
Level	The clutch operation is switched by using only the slave axis clutch ON request (Y98 to Y9B). It can be used by setting the slave axis clutch ON trigger type to "Level". When “Level” is selected for the edge, the clutch OFF edge selection and the slave clutch OFF request (Y100 to Y103) is disabled.
Rising edge	The clutch turns ON by the leading edge of the slave clutch ON request (Y98 to Y9B). Also, the clutch turns OFF by the leading edge of the slave clutch OFF request (Y100 to Y103).
Falling edge	The clutch turns ON by the trailing edge of the slave clutch ON request (Y98 to Y9B). Also, the clutch turns OFF by the trailing edge of the slave clutch OFF request (Y100 to Y103).

■ Operation of each edge selection

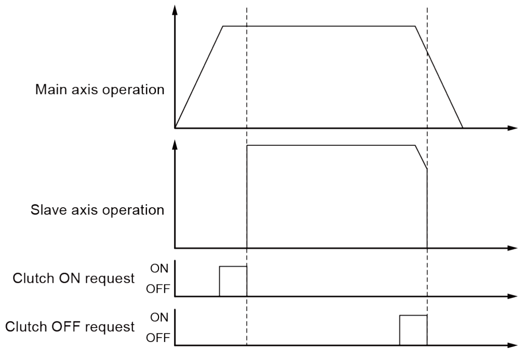
The operation of each edge selection is as follows. (The clutch is connected using the "direct method".)



Edge selection : Level



Edge selection : Rise



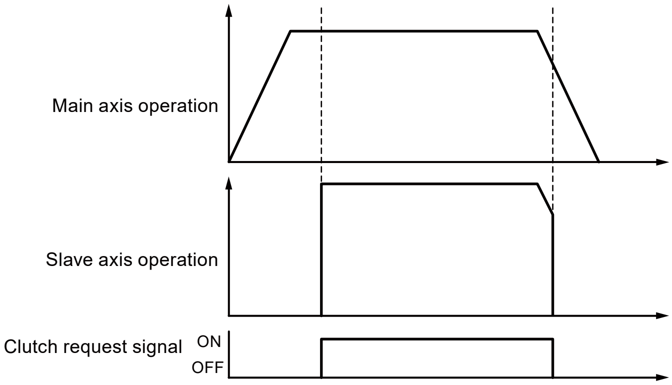
Edge selection : Fall

8.5.4 Electronic Clutch Engagement Method

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

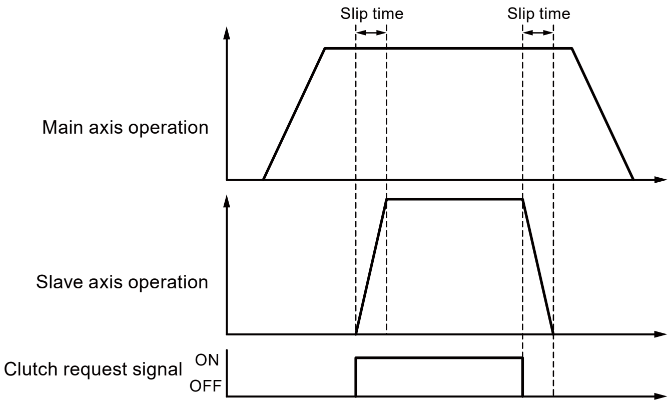
■ Direct method

This method detects the engagement (ON) or disengagement (OFF) of the clutch to adjust the operating speed of the master axis to match that of the slave axes. With the direct method, the speed of the slave axes with the clutch engaged (ON) or disengaged (OFF) matches the operating speed of the master axis with the acceleration/deceleration time set to 0.



■ slip method

This method detects the engagement (ON) or disengagement (OFF) of the clutch and sets the slip time to the acceleration time and deceleration time so that the operating speed of the slave axes can follow the operation speed of the master axis. The acceleration/deceleration method is linear acceleration/deceleration.



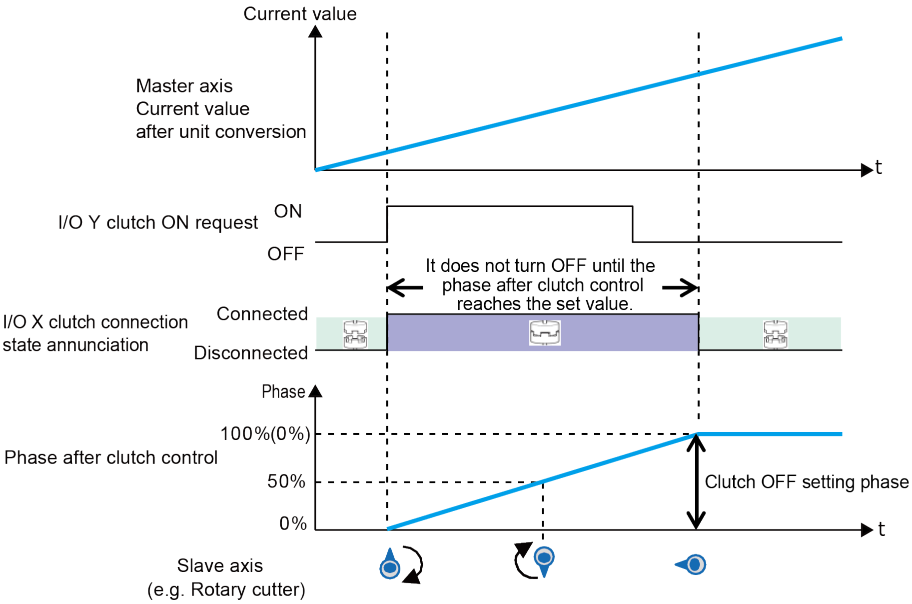
8.5.5 Phase specification clutch OFF function

The "phase specification clutch OFF function" turns OFF the electronic clutch at any specified phase. This function provides consistent control when operations are repeatedly started and stopped at the same phase, for example. This function is available for the unit of Ver.1.40 or later.

■ Phase specification clutch OFF function

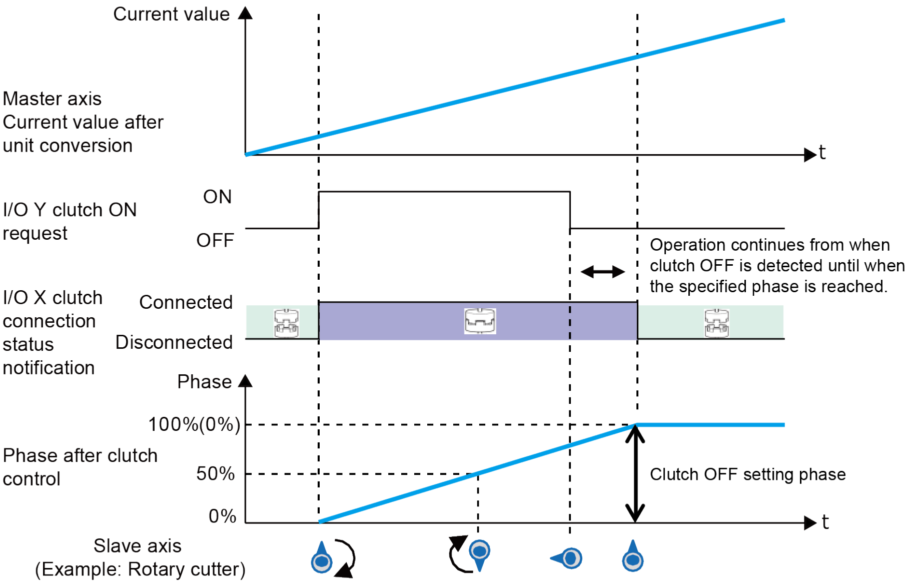
When an OFF request is issued as an I/O signal, a clutch OFF operation is executed regardless of the phase.

In the case of clutch OFF by I/O signal (in the case of edge selection: level)



Using the "phase specification clutch off function" disconnects a clutch when the phase reaches the set phase after the clutch off request by the I/O signal.

In the case of using the phase specification clutch OFF function

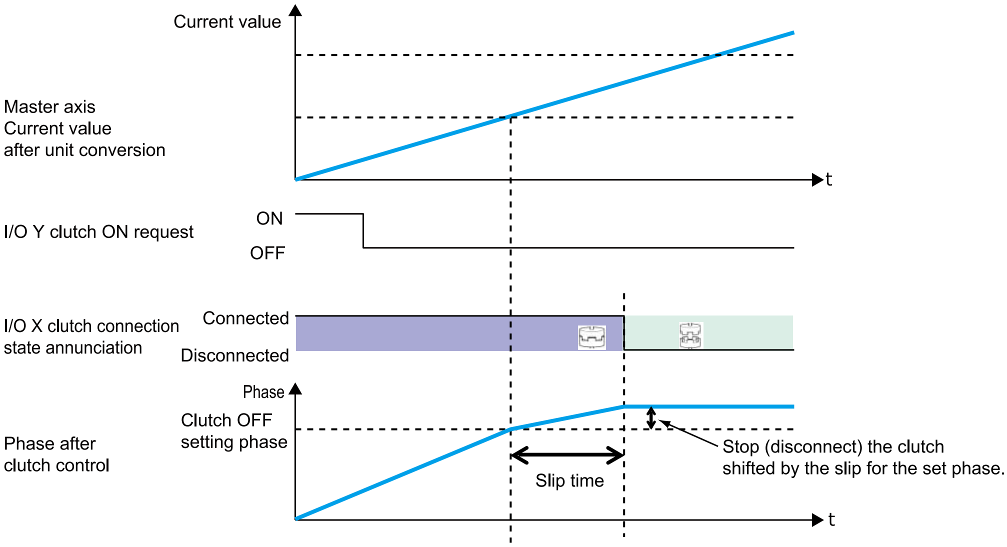


(Note 1) The above figure shows the case where both the clutch ON request and clutch OFF request are set to "Level". Also, either "Rise" or "Fall" can be selected.

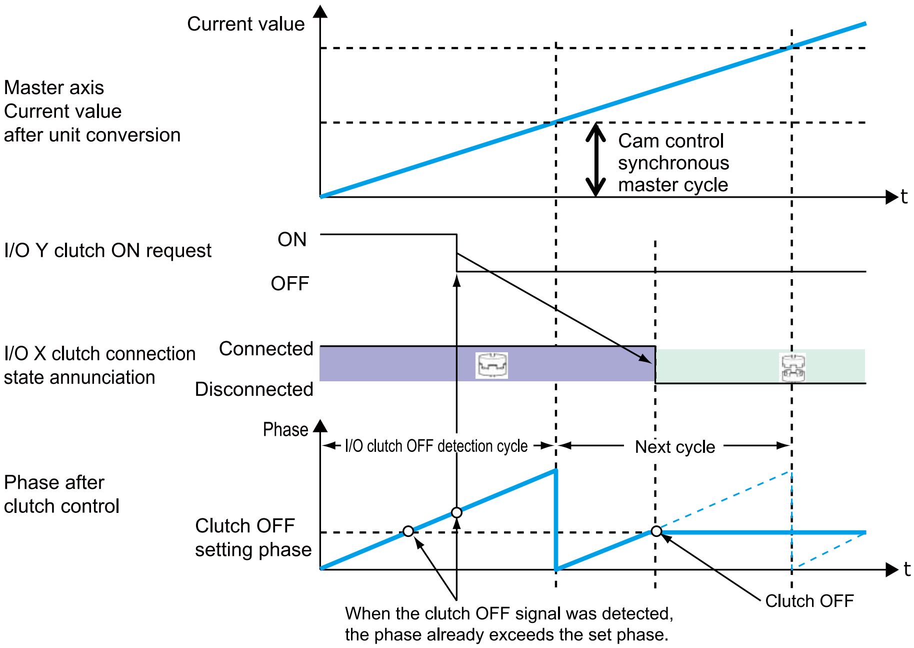
(Note 2) The above figure shows the case where the clutch OFF setting ratio is set to "0%". It can be set to 0 to 99%.

■ Notes on operational characteristics

- If "Slip" is set for the clutch OFF method, a deceleration stop will be performed when the specified slip time elapses after the phase reaches the clutch OFF setting ratio. To stop the motor at the phase matching the set ratio, set the clutch OFF method to "Direct" beforehand.



- When the clutch off trigger signal is detected at a phase larger than the set clutch off setting ratio (0 to 99%), the clutch will be off at the next time the signal reaches the set phase.

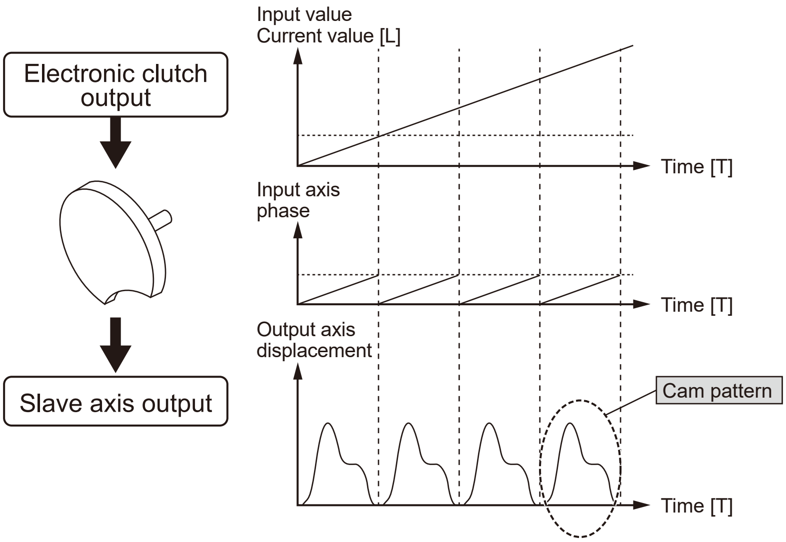


8.6 Electronic Cam Function

8.6.1 Overview of Electronic Cam Function

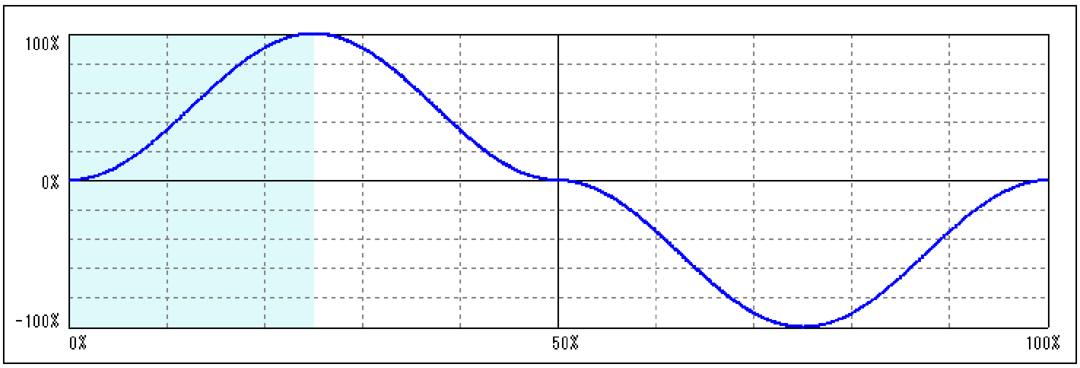
■ What is the electronic cam function?

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. 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 on the Configurator screen.



■ Cam pattern

Cam patterns use one rotation of the master axis as an operation reference, based on which the displacement of the slave axes in each phase (rotation angle) of the master axis is defined. Cam patterns are defined with the phase (rotation angle) of the master axis based on one rotation as a reference on the X-axis and the displacement on the Y-axis in percent. The cam pattern is set with the desired settings for the positioning unit selected from the Configurator PM7 Configuration screen.



■ Cam pattern specifications

Setting item	Specifications
Resolution	1024, 2048, 4096, 8192, 16384, 32768
No. of cam patterns	16 when the resolution is 1024, 2048, 4096, or 8192 8 when the resolution is 16384 4 when the resolution is 32768
Section setting	100 %/cycle, 20 sections max.
Displacement setting	100 % setting
Cam curve	Select one of the following methods: ● Constant velocity ● Constant acceleration ● Simple harmonic motion ● Cycloid ● Modified trapezoid ● Modified sine ● Modified constant velocity ● Trapecloid ● One-dwell cycloid m=1 ● One-dwell cycloid m=2/3 ● One-dwell modified trapezoid m=2/3 ● One-dwell modified trapezoid (Ferguson) ● One-dwell modified sine ● One-dwell trapecloid ● No-dwell modified trapezoid ● No-dwell modified constant velocity ● NC2 curve ● Asymmetric cycloid ● Asymmetric modified trapezoid
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 Desired display can be specified by check box.

Info.

- The advance angle correction function has been added, which corrects the response delay of cam output axis. This function is available for the unit of Ver.1.5 or later. For details, refer to "8.6.5 Advance Angle Correction Function".

8.6.2 Types and Contents of Setting Parameters

The use of the electronic cam requires the following parameter settings.

Parameter name	Overview
Electronic cam use/non-use	Select the use or non-use of the electronic cam function. If the electronic cam is not used, the electronic cam function will not work, and outputs from the electronic clutch will be output as pulses.
Cam pattern	The cam pattern is the most fundamental setting for using the electronic cam function. Cam patterns are set on the "Cam Pattern Settings" screen opened from the configuration screen. The positioning unit converts cam patterns into point data based on the preset cam curves and resolutions.

Parameter name	Overview
Cam control master axis cycle	Set the number of pulses corresponding to the total phase of the cam pattern used (one-rotation data on the master axis).
Used cam pattern number	Specify the cam pattern number to be used from multiple cam patterns created.
Cam stroke amount	Set the number of pulses equivalent to the total displacement (100%) of the cam pattern to be used.
Advance angle correction operation setting	Select the use or non-use of the advance angle correction function.
reference amount	The unit follows the unit system of the master axis. Setting range: -1073741823 to 1073741823 (The decimal point position is based on unit systems.)
reference speed	The unit follows the unit system of the master axis. Setting range: 1 to 32767000 (The decimal point position is based on unit systems.)
Parameter change time	Setting range: 1 to 10,000 (ms)

(Note 1) The advanced angle correction function is available for units of Ver.1.5 or later.

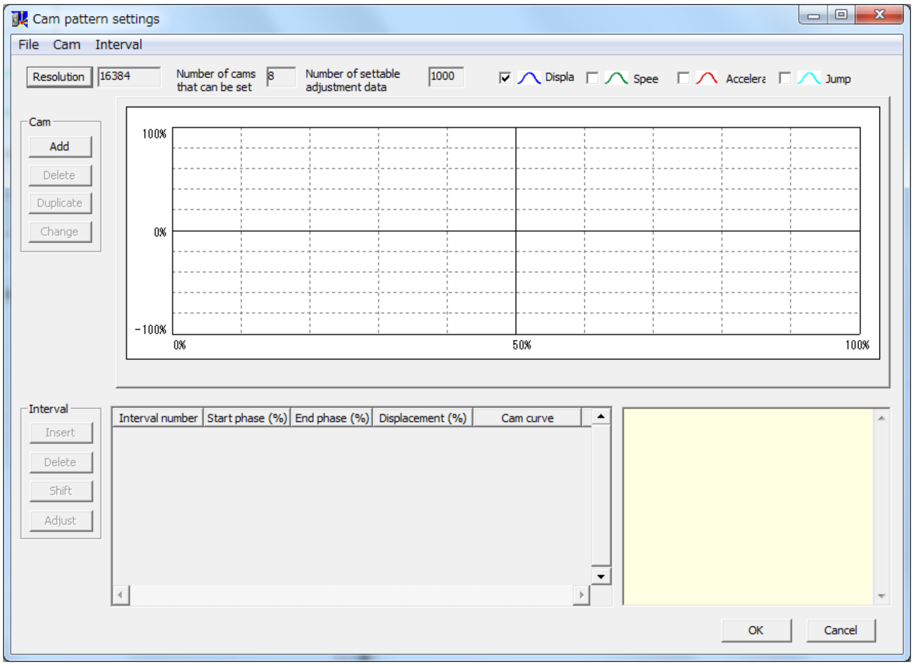
8.6.3 Cam Pattern Setting Method

■ Opening the Cam Pattern Settings screen

Open the "Configuration" screen on the FPWIN GR7 and select "Positioning settings" so that the setting tool for the positioning unit will start.

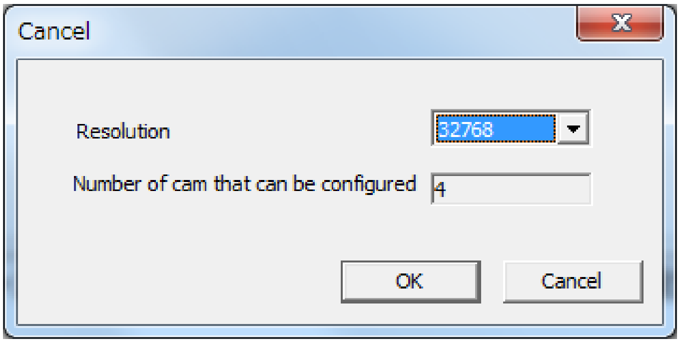
Select **Axis Settings**>**Cam Pattern Settings** from the menu bar of the unit setting tool or click the  icon on the toolbar. The "Cam Pattern Settings" screen will be displayed.

A blank screen is displayed for a new file, or the settings of cam pattern 1 are displayed when data already exists.



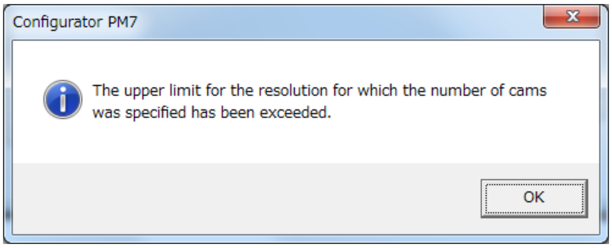
■ Resolution settings

Press the [Resolution] button on the Cam Pattern screen. The "Resolution Settings" screen is displayed. Select Resolution and click the [OK] button.



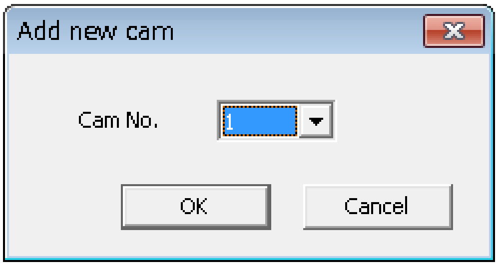
Info.

- The resolution is valid for all cam patterns. You cannot set a different resolution per cam pattern.
- The number of cam patterns that can be set varies depending on the resolution. The current resolution cannot be changed to a new resolution if the current number of cam patterns exceeds the number of cam patterns that can be used for the new resolution. In this case, delete cam patterns and then change the resolution again.

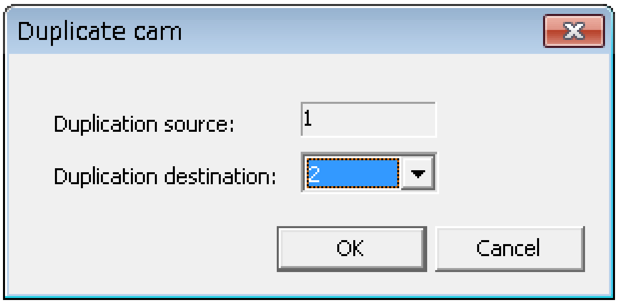


■ Creating or copying new cam patterns

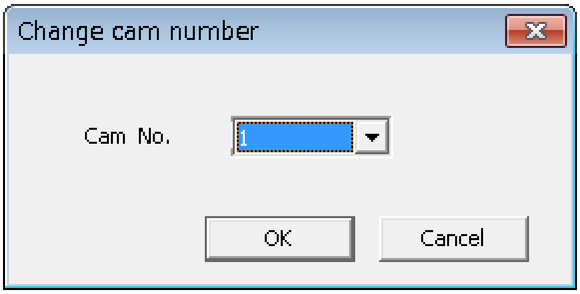
The cam number selection screen is displayed by clicking the [Add] button in the "Cam" field. Select the desired cam number and click the [OK] button.



Cam patterns can also be copied. Press the [Duplicate] button and select the copying destination and original cam pattern numbers.



When changing the cam number, click the [Change] button and select a new cam number.

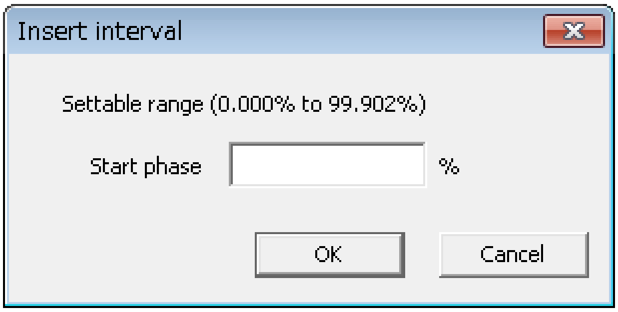


Note

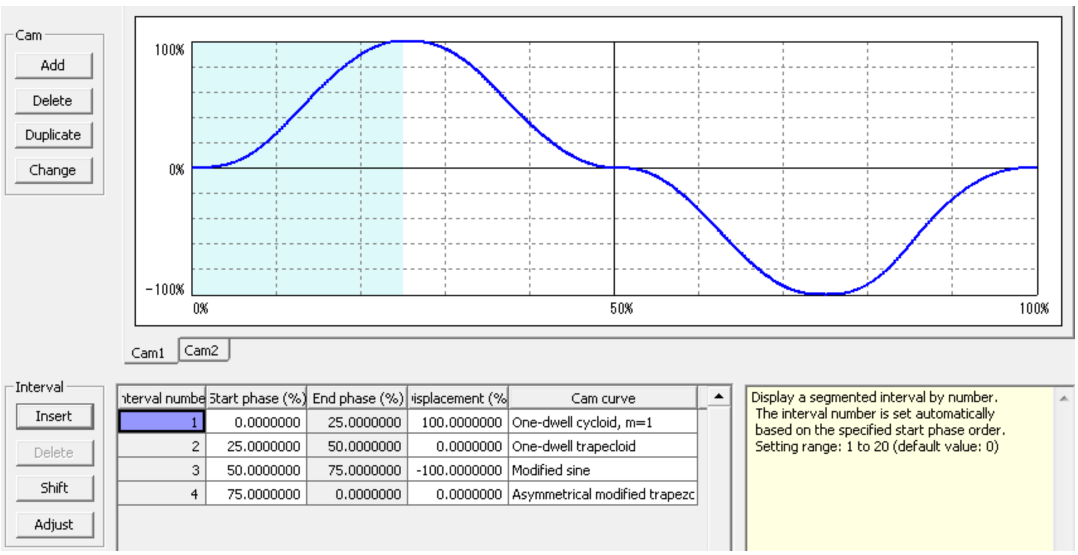
- Existing cam pattern numbers cannot be set.

■ Setting cam patterns

Click the [Insert] button in the "Section" field. Set the start phase, and click the [OK] button.
By default, only one section whose phase is 0% to 100% is set for the cam pattern.
By setting the start phase, the above section is divided into multiple sections.



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



Note

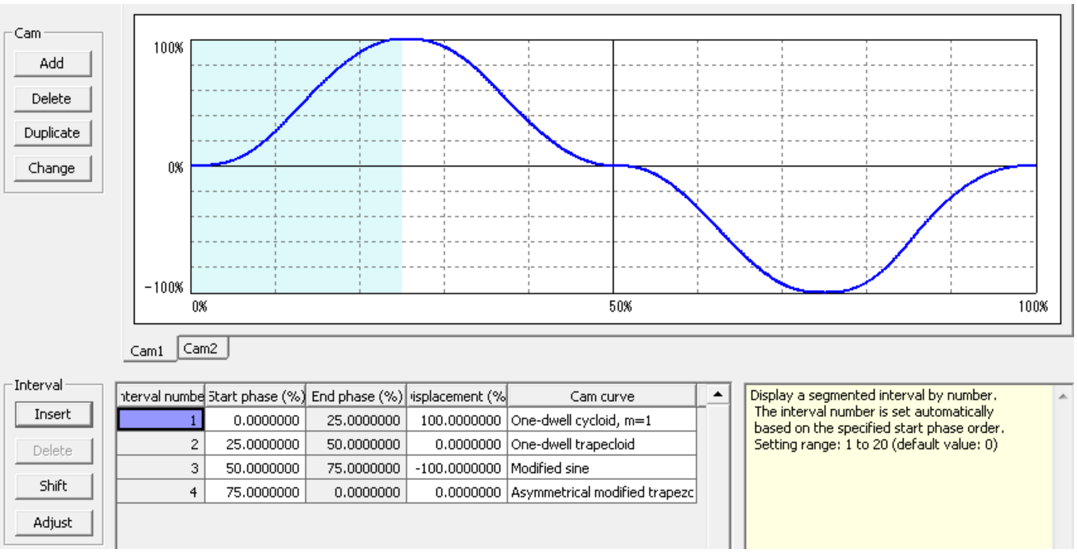
- The start phase may not become the specified phase value, depending on the resolution.

■ Editing the cam table

You can edit cam table data that has been created.
Set the following items for each section that has been set.

- Start phase (%)
- Displacement (%)
- Cam curve

The cam curve changes according to the settings.



Info.

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

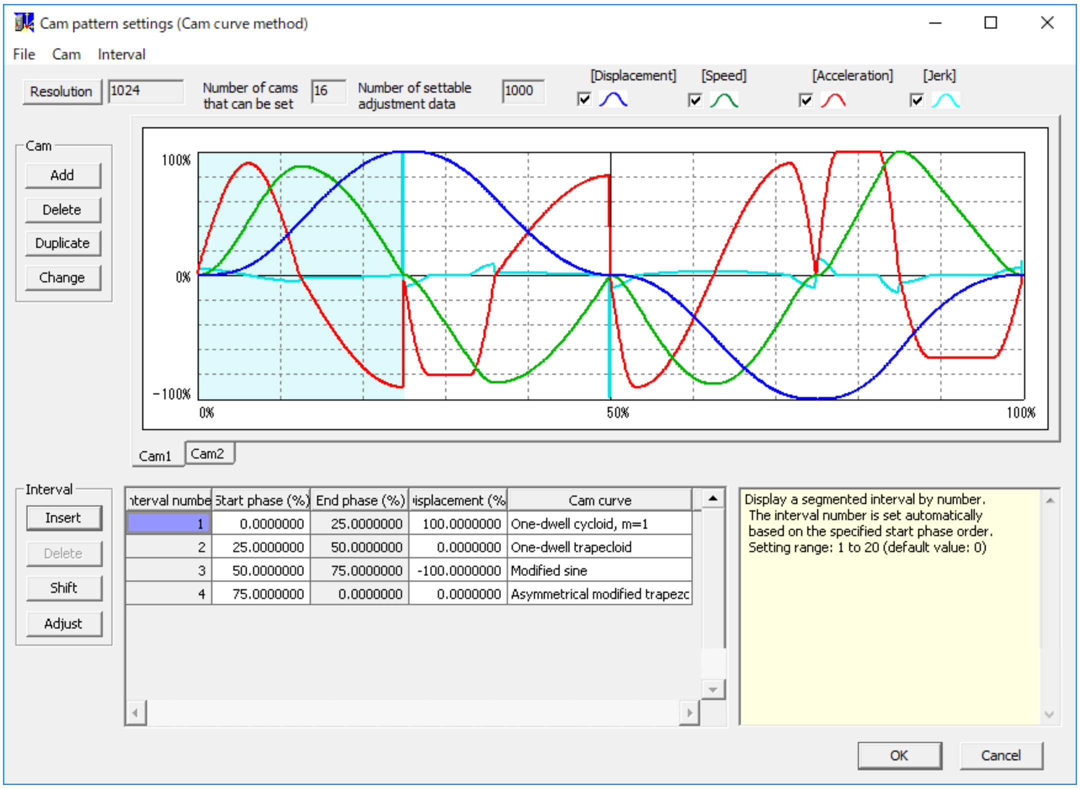
■ Checking the cam table

Check the set cam table (cam curve). In synchronous control, slave axes operate by following the cam curve. Therefore, the motor may not be able to follow the output if the change in the cam curve is rapid. For changes in the cam curve, information such as not only displacement but also acceleration is important. The Cam Table Settings screen can display information on the following items besides the displacement.

Displayed item	Overview
Displacement	This item is set in the cam table.
Speed	The operating speed of the cam table for the amount of displacement that has been set is displayed.

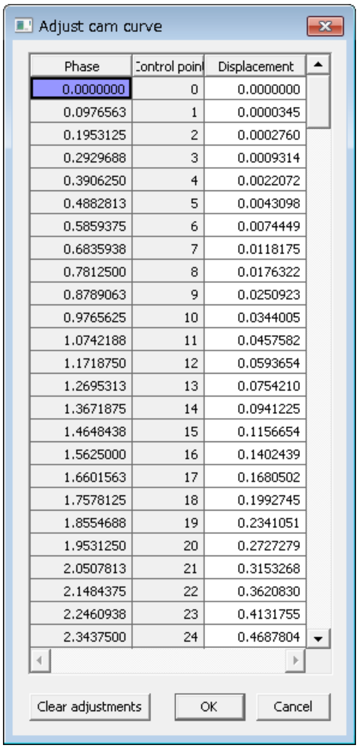
Displayed item	Overview
	Also, the speed is displayed as a relative value.
Acceleration	Accelerations in each phase are displayed. Care is required as a rapid speed change occurs in any section where acceleration significantly changes.
Jerk	Jerk refers to the change rate of acceleration. It is obtained by differentiating acceleration by time.

Each display item is set by checking the following boxes in the Cam Table Settings screen. Refer to each displayed item, and change the cam table settings.



■ Adjusting the cam table

The Cam Table settings screen is provided with a function to make the fine-tuning of set cam curve data. In order to mitigate radical changes, this adjustment function makes it possible to fine-tune cam data that has been set. To perform adjustment, select the section number to be adjusted and click the [Adjust] button. The adjustment screen is displayed. The adjustment screen shows the table of the portion corresponding to the specified section number among all the sections (0% to 100%) divided by the specified resolution.



Phase	Control point	Displacement
0.0000000	0	0.0000000
0.0976563	1	0.0000345
0.1953125	2	0.0002760
0.2929688	3	0.0009314
0.3906250	4	0.0022072
0.4882813	5	0.0043098
0.5859375	6	0.0074449
0.6835938	7	0.0118175
0.7812500	8	0.0176322
0.8789063	9	0.0250923
0.9765625	10	0.0344005
1.0742188	11	0.0457582
1.1718750	12	0.0593654
1.2695313	13	0.0754210
1.3671875	14	0.0941225
1.4648438	15	0.1156654
1.5625000	16	0.1402439
1.6601563	17	0.1680502
1.7578125	18	0.1992745
1.8554688	19	0.2341051
1.9531250	20	0.2727279
2.0507813	21	0.3153268
2.1484375	22	0.3620830
2.2460938	23	0.4131755
2.3437500	24	0.4687804

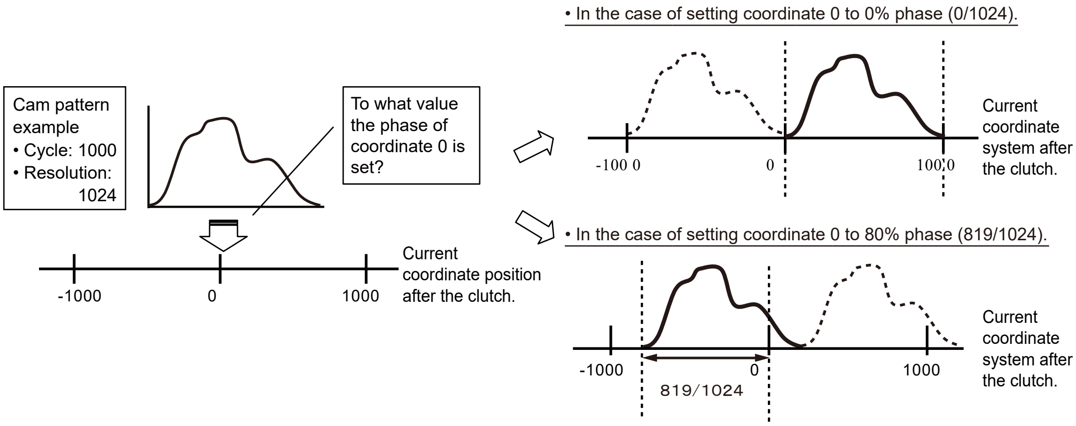
Select the data of the phase (control point) you want to adjust and change the displacement data. Select [OK] to reflect the adjustment. Select "Clear Adjustment" to clear the set adjustment data. The cam curve of the section number for which the adjustment was executed is displayed in red, indicating that adjustment has been performed.

nterval numbe	Start phase (%)	End phase (%)	isplacement (%	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	Modified sine
4	75.0000000	0.0000000	0.0000000	Asymmetrical modified trapezc

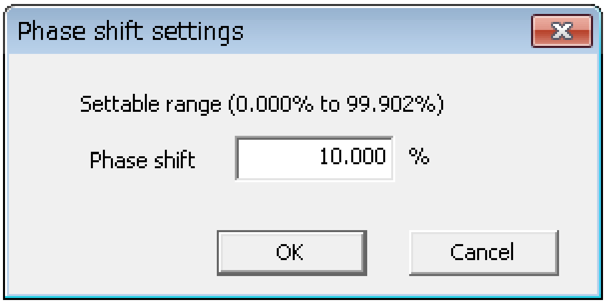
■ Shifting the cam table

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. Cam table shifting is a function that sets the percentage of the phase of a position in current value coordinate system 0 to the created cam pattern.

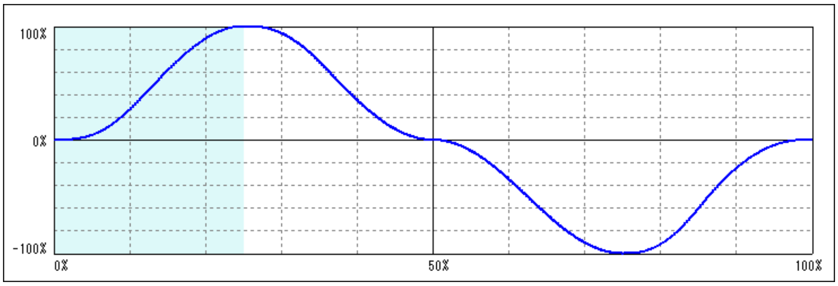
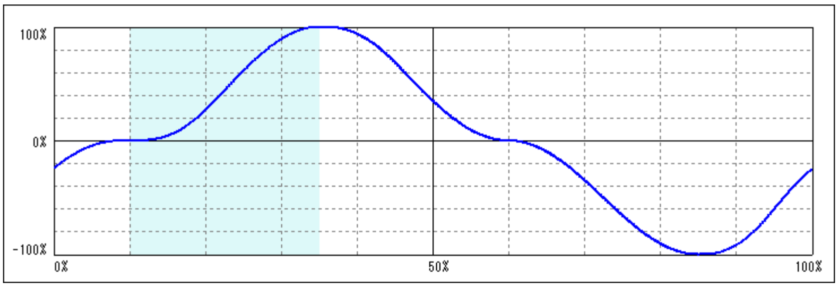
Illustration of electronic cam shifting



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



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

Before change	
After change	

■ Saving the cam table

Created cam tables can be automatically saved by clicking the [OK] button on the Cam Table Setting screen. Saved cam tables are managed by FPWIN GR7, and set by downloading to control units.

8.6.4 Editing Cam Patterns by User Programs

Cam patterns can also be edited by user programs. This function is available for the unit of Ver.1.50 or later.

■ Procedure for editing cam patterns

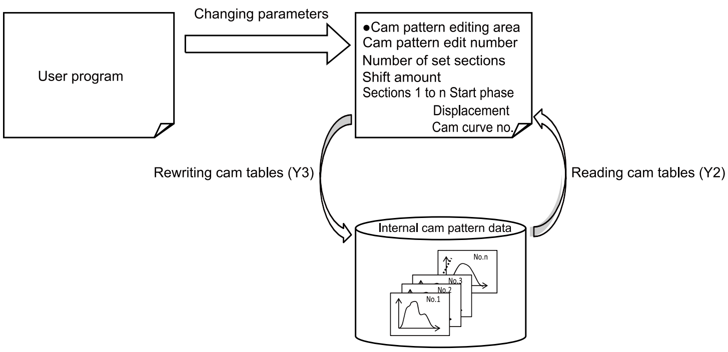
Editing cam patterns is executed by two operations: "Loading cam tables" and "Rewriting cam tables". These operations are performed using the "cam pattern editing area" (UM18000 to UM1805F) of unit memories, reading request contact (Y2) and rewriting request contact (Y3).

(1) Procedure for changing a cam pattern that has already been set

1. Read a cam table to the cam pattern editing area (UM) by the reading request contact (Y2).
2. Change the parameter of the cam table read to the cam pattern editing area (UM).
3. Execute rewriting the cam table by the rewriting request contact (Y3).

(2) Procedure for creating a new cam pattern

1. Write parameters of created cam pattern data to the cam pattern editing area (UM).
2. Execute rewriting the cam pattern data by the rewriting request contact (Y3).



■ Execution conditions for editing cam patterns

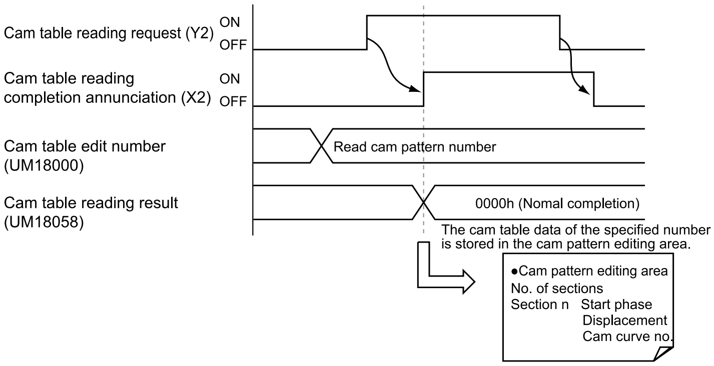
The editing of cam patterns by programs can be executed when the following three conditions are met.

- All axes are not in synchronous operation. (The synchronous control cancel annunciation flags of all axes are ON.)
- All axes are not activated. (The busy flags of all axes are ON.)
- Parameters are set correctly.

Also, when request for reading and rewriting are executed simultaneously, reading takes priority. In this case, the execution of the rewriting request results in the abnormal end, and the response code (FF21H) is stored in the unit memory (UM18059).

■ Procedure of reading cam pattern data

Procedure	Operation by user program and operation by the unit
1	Set a cam pattern number to be read out to the cam pattern editing area (UM18000).
2	Turn on the cam table reading request (Y2).
3	On the completion of reading, a response code is stored in the cam pattern editing area (UM18058), and the cam pattern reading completion annunciation flag (X2) turns on.
4	Once the cam table reading request (Y2) turns off, the cam pattern reading completion annunciation flag (X2) turns off..

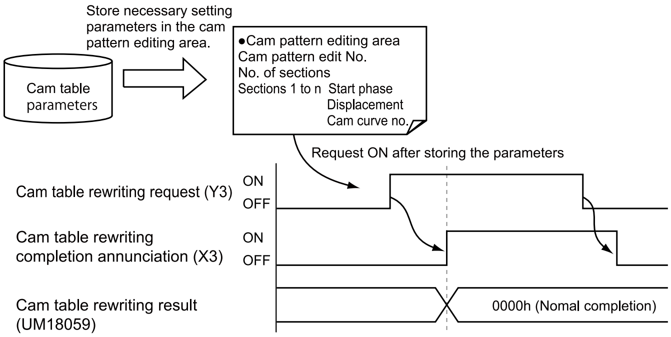


■ Related positioning parameter (Cam pattern editing area)

Unit memory No. (Hex)	Name	Default	Description
UM18058	Cam pattern reading result	H0	Stores the result of read processing (response code). [Range] (Hexadecimal) 0000H: Normal termination Other than 0000H: Abnormal termination

■ Procedure of rewriting cam pattern data

Procedure	Operation by user program and operation by the unit
1	Store necessary setting parameters in the cam pattern editing area (UM18000 to UM1805F). ● Rewriting cam pattern number ● No. of sections: following parameters in sections 1 to n (n is a specified number of sections.) ● Start phase ● Displacement ● Cam curve no.
2	Turn on the cam table rewriting request (Y3).
3	On the completion of rewriting, a response code is stored in the cam pattern editing area (UM18059), and the cam pattern rewriting completion annunciation flag (X3) turns on.
4	Once the cam table rewriting request (Y3) turns off, the cam pattern rewriting completion annunciation flag (X3) turns off.



■ Related positioning parameter (Cam pattern editing area)

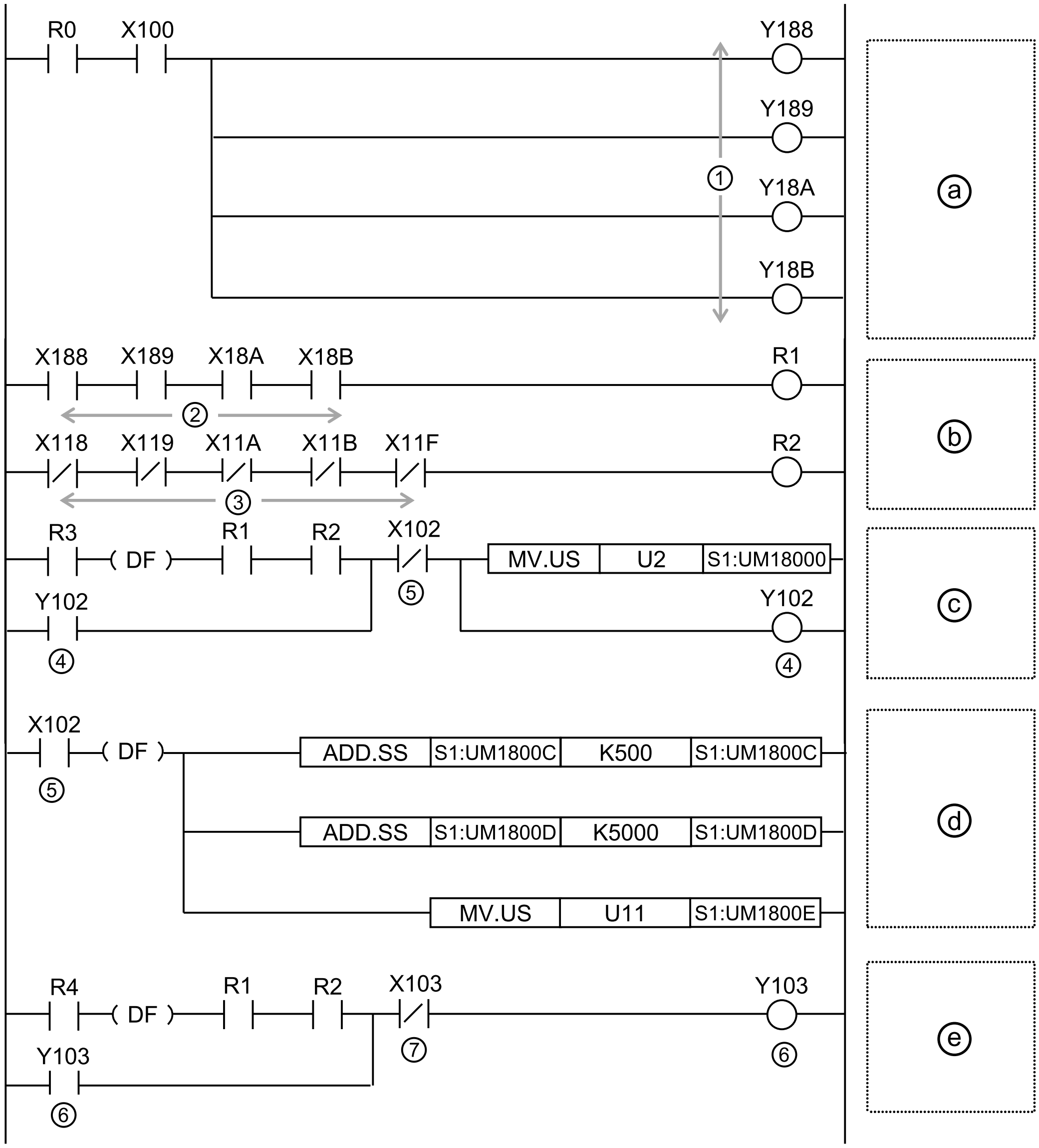
Unit memory No. (Hex)	Name	Default	Description
UM18059	Cam pattern rewriting result	H0	Stores the result of rewriting processing (response code). [Range] (Hexadecimal) 0000H: Normal termination Other than 0000H: Abnormal termination

Info.

- For details of related unit memories, refer to "17.9 Cam Pattern Editing Area".

■ Sample programs

- The following program shows the case that the phase, displacement, and the type of curve is changed in the section 2 of the cam table number 2.
- The program is executed through five steps of (a) to (e).
- In this sample program, the positioning unit is installed in the slot number 1, and the starting word number is 10.



Code	Items specified in the program	Description
(a)	Cancelling synchronous control for all axes	Performs the cancellation of synchronous control for all axes.
(b)	Confirming the conditions for execution permission	Confirms that all axes are not in the synchronous control and are stopped.
(c)	Starting the reading of cam tables.	Specifies a cam pattern number, and performs a reading request (Y102).
(d)	Changing parameters in the cam table editing area.	The cam table data in the section 3 is edited after the completion of reading the cam table. In this example, the following three items are set. ● Start phase: (Value before rewriting) + Addition of 5%

Code	Items specified in the program	Description
		● Displacement: (Value before rewriting) + Addition of 50% ● Cam curve: Constant acceleration
(e)	Starting to rewrite cam tables	Rewrites the specified cam pattern data.

Code	Items specified in the program	Values specified in the program				
		1 axes	2 axes	3 axes	4 axes	Virtual axis
(1)	Synchronization cancellation request	Y188	Y189	Y18A	Y18B	-
(2)	Synchronous control cancellation annunciation	X188	X189	X18A	X18B	-
(3)	BUSY	X118	X119	X11A	X11B	X11F
(4)	Cam table reading request	Y102				
(5)	Cam table reading completion	X102				
(6)	Cam table rewriting request	Y103				
(7)	Cam table rewriting completion	X103				

(Note 1) I/O numbers vary according to the value of the "Starting word number" allocated to the unit. The I/O numbers in the above table are considered as the starting word number is 10.

■ Precautions for editing cam patterns by program

- Even if cam pattern data is rewritten by this function, the cam pattern data stored as the configuration data in the CPU unit will not be updated.
- It will be rewritten to a cam pattern set on Configurator PM7 when the power turns on or configuration data is rewritten and the PROG mode changes to RUN mode. If necessary, rewrite the cam pattern again using a program.
- It is possible to confirm whether the cam pattern has been rewritten or not by the cam pattern update flag (UM1805A) in the unit memory using a program.
- When performing a reading request specifying an unregistered cam pattern number, all the read data will be "0".
- When performing a rewriting request while no cam pattern is registered (a resolution is undetermined), rewriting will be performed considering the resolution as 1024.
- Cam adjustment data set on Configurator PM7 cannot be used. Also, when executing the rewriting, the adjustment data before the execution of rewriting will be initialized.

Info.

- For details of "cam pattern update flag", refer to "17.9 Cam Pattern Editing Area".

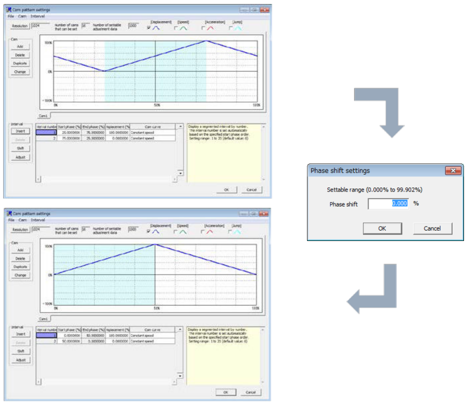
■ Notes on using phase shift amount

- Specify the values when the phase shift amount is 0(%) for the parameter values of cam pattern (starting phase, displacement and cam curve).
- The starting phase of the section number 1 is 0(%). If any values other than 0 (%) are set, an error will occur. For starting phases after section number 2, specify arbitrary starting phases. When settings are read or written , the phase that is the nearest to the resolution within the unit is automatically calculated.

- After setting the cam pattern when the phase shift amount is 0(%), set a phase shift amount. For phase shift amounts, when settings are read or written, the value that is the nearest to the resolution within the unit is also automatically calculated.

For rewriting the cam pattern set on the tool software Configurator PM7 to a user program, perform the following procedure.

1. Record the phase shift amount specified in Configurator PM7.
2. The start phase displayed in Configurator PM7 is the one to which the phase shift amount has been added. Set the phase shift amount to 0 (%) to check the values of cam pattern parameters (starting phase, displacement, and cam curve).
3. In the user program, use the parameter values obtained in 2. As for the starting phase, use values to two decimal places.
4. Set the phase shift amount recorded in 1. As is the case with the starting phase, use values to two decimal places.



8.6.5 Advance Angle Correction Function

The advance angle correction function is used to correct any delays in responses from the mechanical system connected to an electronic cam output or any delays in the PLC arithmetic processing time. This function is available for the unit of Ver.1.5 or later.

■ Specification of advance angle correction amount

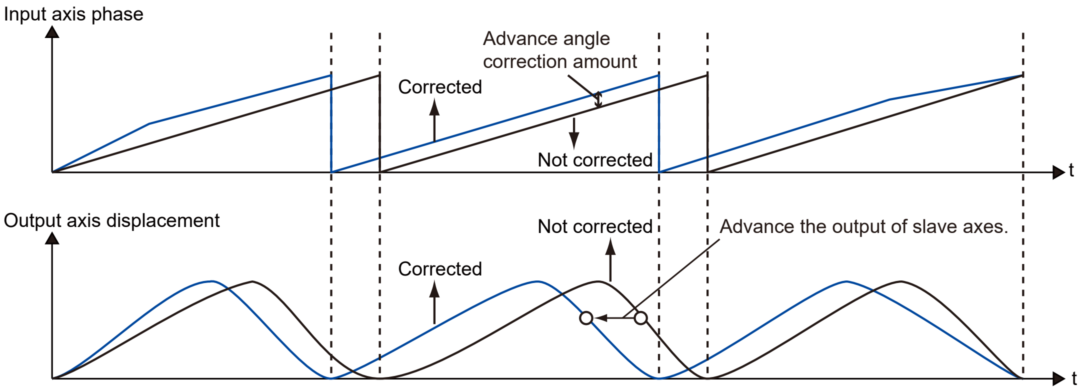
- Advance angle correction amounts are specified for each slave axis using a tool software or user program.
- By setting "advance angle correction reference speed" and "advance angle correction reference amount", correction amounts are automatically calculated using "master axis input speed" during operation. The advance angle correction amount is calculated using the following formula.

$$\text{Advance angle correction amount} = \text{Master axis input speed} \times \frac{\text{Advance angle correction reference amount}}{\text{Advance angle correction reference speed}}$$

(*) Master axis input speed : Speed after clutch control

■ Internal processing for advance angle correction

The phase of the master axis which will be a reference of slave axis correction is obtained as operation data for according to the set values of advance angle amount. The value is used as a reference when the correction amount for the slave axis is obtained.



■ Settings using tool software

Specify settings in the "Synchronous Control Setting" dialog box.

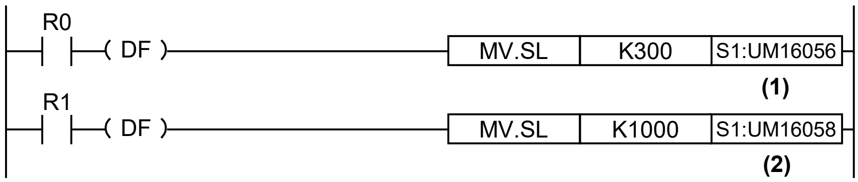
Electronic cam operation settings	Use
Cam control synchronization master period	1
Cam pattern number to use	1
Cam stroke	1
Advance angle correction operation setting	Use
Reference value	0
Reference speed	100
Parameter change time	100

Parameter name	Overview
Advance angle correction operation setting	Select the use or non-use of the advance angle correction function.
reference amount	The unit follows the unit system of the master axis. Setting range: -1073741823 to 1073741823 (The decimal point position is based on unit systems.)
reference speed	The unit follows the unit system of the master axis. Setting range: 1 to 32767000 (The decimal point position is based on unit systems.)
Parameter change time	Setting range: 1 to 10,000 (ms)

(Note 1) The advanced angle correction function is available for units of Ver.1.5 or later.

■ Setting with user programs

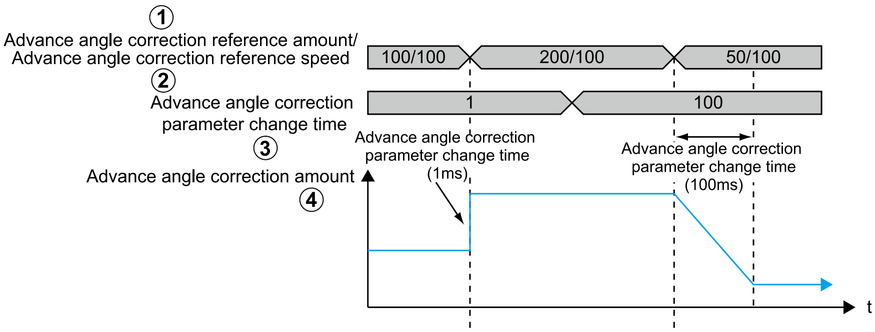
The following example shows the case that the advance angle correction reference value of 1st axis is changed to 50 and the advance angle correction reference speed to 3000.



Code	Items specified in the program	Values specified in the program			
		1 axes	2 axes	3 axes	4 axes
(1)	Advance angle correction reference amount setting area	UM16056	UM160C6	UM16136	UM161A6
(2)	Advance angle correction speed setting area	UM16058	UM160C8	UM16138	UM161A8

■ Changing the advance angle correction amount during operation

- The advance angle correction amount can be changed during operation.
- After the unit detects any change in "advance angle correction reference speed" or "advance angle correction reference amount", the advance angle correction amount is reflected after the specified "advance angle correction change time" has elapsed.

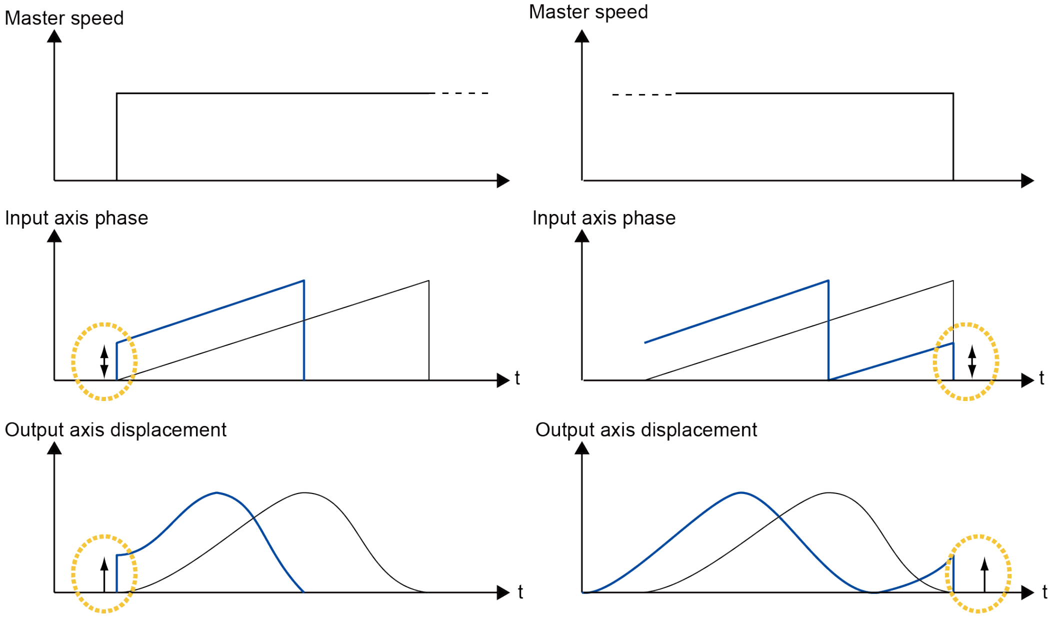


Code	Items specified in the program	Values specified in the program			
		1 axes	2 axes	3 axes	4 axes
(1)	Advance angle correction reference amount setting area	UM16056 UM16057	UM160C6 UM160C7	UM16136 UM16137	UM161A6 UM161A7
(2)	Advance angle correction speed setting area	UM16058 UM16059	UM160C8 UM160C9	UM16138 UM16139	UM161A8 UM161A9
(3)	Advance angle correction parameter change time	UM1605A	UM160CA	UM1613A	UM161AA
(4)	Advance angle correction amount	UM00424 UM00425	UM00464 UM00465	UM004A4 UM004A5	UM004E4 UM004E5

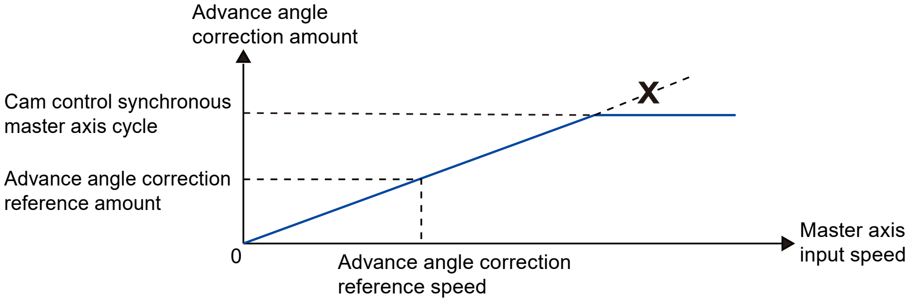
- "Advance angle correction reference speed" and "Advance angle correction reference amount" are signed 32-bit data. If they are changed by 16-bit (1-word) unit, they may be changed to uninteded values. Always rewrite them in 32-bit (2-word) units.
- If "advance angle correction reference speed" or "advance angle correction reference amount" are changed during operation, the timing of changed data acquisition by the unit may be delayed. Change either parameter of "advance angle correction reference speed" or "advance angle correction reference amount" to prevent the "advance angle correction amount" from being rapidly changed.

■ Notes on settings

- Overshoot or undershoot may occur depending on the settings when sufficient acceleration/deceleration time is not set for the start or stop of the master axis with the advance angle correction function used or when input speed is rapidly increased or decreased by directly engaging or disengaging the clutch when the master axis is operated.
- When using the advance angle correction function, set a sufficient acceleration/deceleration time for the master axis. When using the clutch function in combination, specify settings to prevent the occurrence of rapid acceleration or deceleration by the use of the slip function.



- Depending on the setting of "advance angle correction reference speed" or "advance angle correction reference amount", the calculated advance angle correction amount may exceed the "cam control synchronous master axis cycle". If the advance angle correction amount exceeds the "cam control synchronous master axis cycle", the "synchronous cam master axis cycle" will be the upper limit as below. Set the parameter of advance angle correction which meets an input speed.

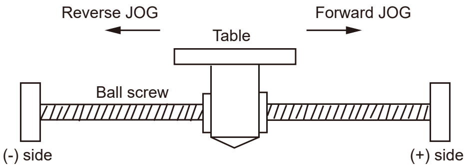


(MEMO)

9 Manual Operation (JOG Operation)

9.1 Settings and Operation of JOG Operation

The example below is a case of the positioning unit installed in the slot 1. The unit is the number of pulses.

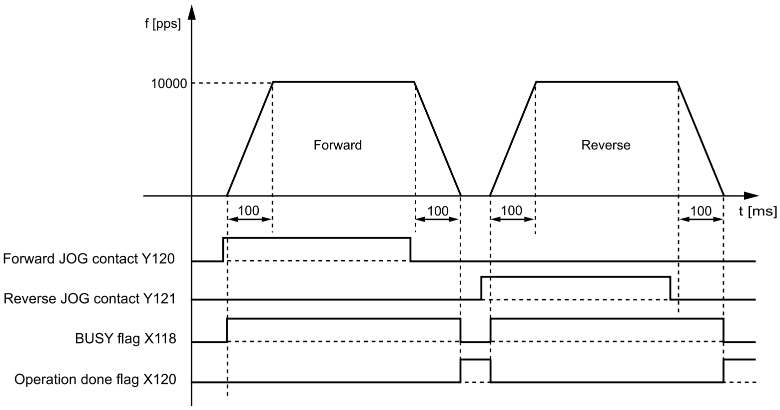


■ Settings

Parameters required for the JOG operation of the positioning unit is set in the positioning setting menu of the programming tool.

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

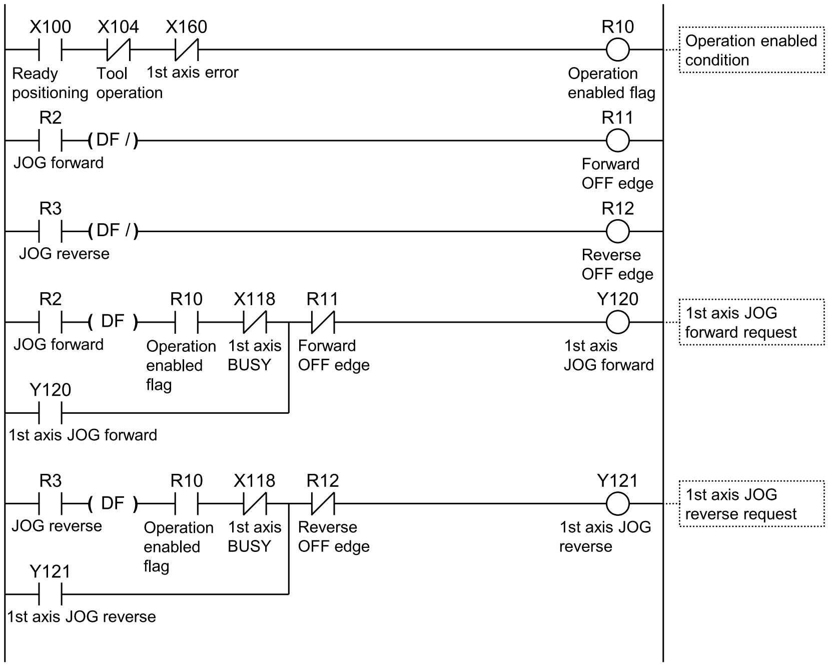
■ Behavior diagram



■ Behaviors of each contact

- The BUSY flag (X118), which indicates that the motor is running, turns ON when JOG operation starts, and turns OFF when the operation is completed.
- The operation done flag (X120), which indicates the completion of operation, turns ON when the current operation is completed, and remains on hold until the next positioning control, JOG operation, home return, or pulser operation starts.

■ Sample programs



■ Notes on programming

- The start contact and flag number varies depending on the number of axes and the installation position of the unit.
- The specified slot number varies depending on the installation position of the unit.

■ Behavior at limit input

Condition	Direction	Limit status	Operation
When JOG operation is started	Forward	Limit input (+): ON	Startup failure, error occurrence
		Limit input (-): ON	Executable
	Reverse	Limit input (+): ON	Executable
		Limit input (-): ON	Startup failure, error occurrence
During JOG operation	Forward	Limit input (+): ON	Deceleration stoppage, error occurrence
	Reverse	Limit input (-): ON	Deceleration stoppage, error occurrence

9.2 Changing the Speed During JOG Operation

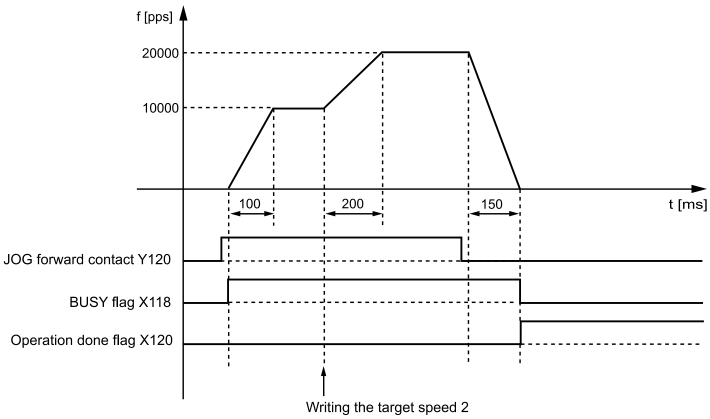
The target speed can be changed while the positioning unit is in JOG operation.

■ Settings

Parameters required for the JOG operation of the positioning unit is set in the positioning setting menu of the programming tool.

<table>
<tr><th>Item</th><th colspan="2">Setting example</th></tr>
<tr><td>Acceleration/deceleration pattern</td><td colspan="2">0: Linear acceleration/deceleration</td></tr>
<tr><td>Acceleration time 1 (ms)</td><td colspan="2">100 ms</td></tr>
<tr><td>Deceleration time 1 (ms)</td><td colspan="2">50 ms</td></tr>
<tr><td>Target speed 1</td><td colspan="2">10000 pps</td></tr>
<tr><td>Acceleration time 2 (ms)</td><td>200 ms</td><td rowspan="3">As for the acceleration time, deceleration time and target speed after the speed change, write the setting values in the unit memories using a program.</td></tr>
<tr><td>Deceleration time 2 (ms)</td><td>150 ms</td></tr>
<tr><td>Target speed 2</td><td>20000 pps</td></tr>
</table>

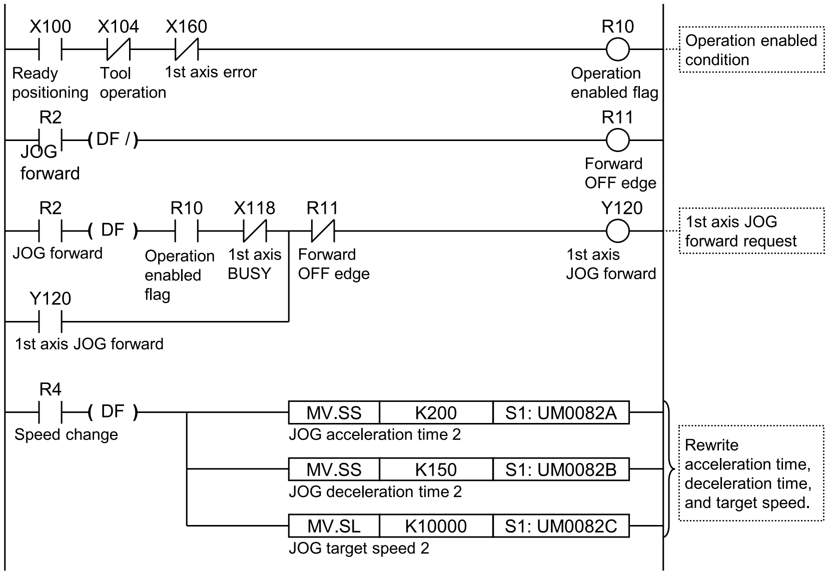
■ Behavior diagram



■ Behaviors of each contact

- The BUSY flag (X118), which indicates that the motor is running, turns ON when JOG operation starts, and turns OFF when the operation is completed.
- The target speed can be freely changed during JOG operation. Change the target speed in the program.
- The operation done flag (X120), which indicates the completion of operation, turns ON when the current operation is completed, and remains on hold until the next positioning control, JOG operation, home return, or pulser operation starts.

■ Sample programs



■ Notes on programming

- To change the JOG operation speed, use a user program and rewrite the unit memory (UM0082A to UM0082C).
- The start contact and flag number varies depending on the number of axes and the installation position of the unit.
- The specified slot number varies depending on the installation position of the unit.

(MEMO)

10 Manual Operation (Home Return)

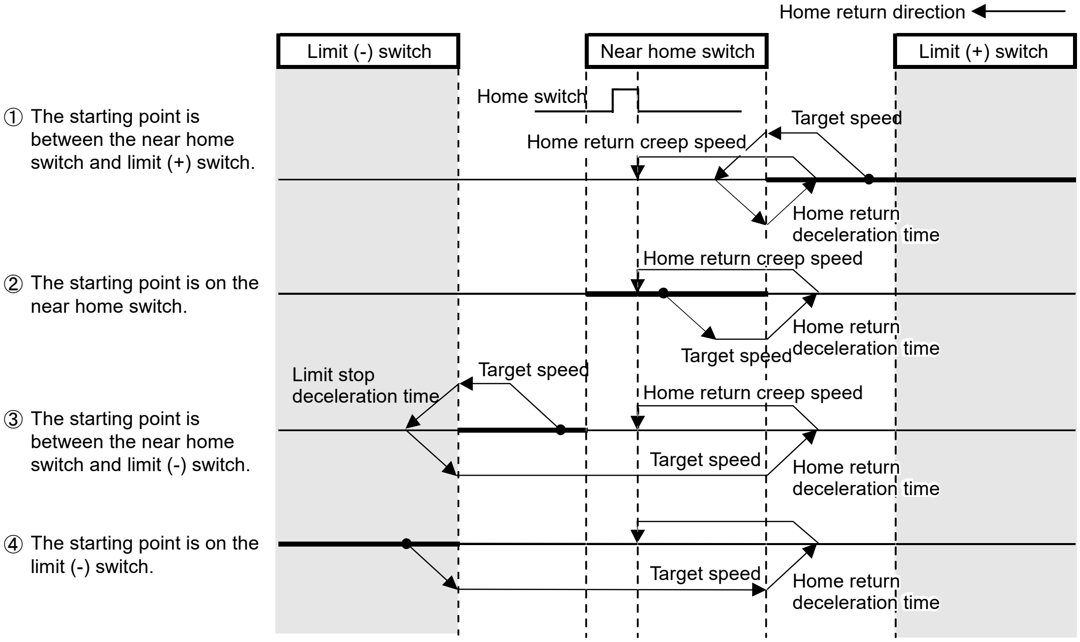
10.1 Pattern of Home Return

The home return is a function to move the current position to the reference origin and set the coordinates as 0.

The following home return methods are available for the positioning unit.

■ DOG Method 1 (Edge detection of near home switch + First rising edge of home position as reference)

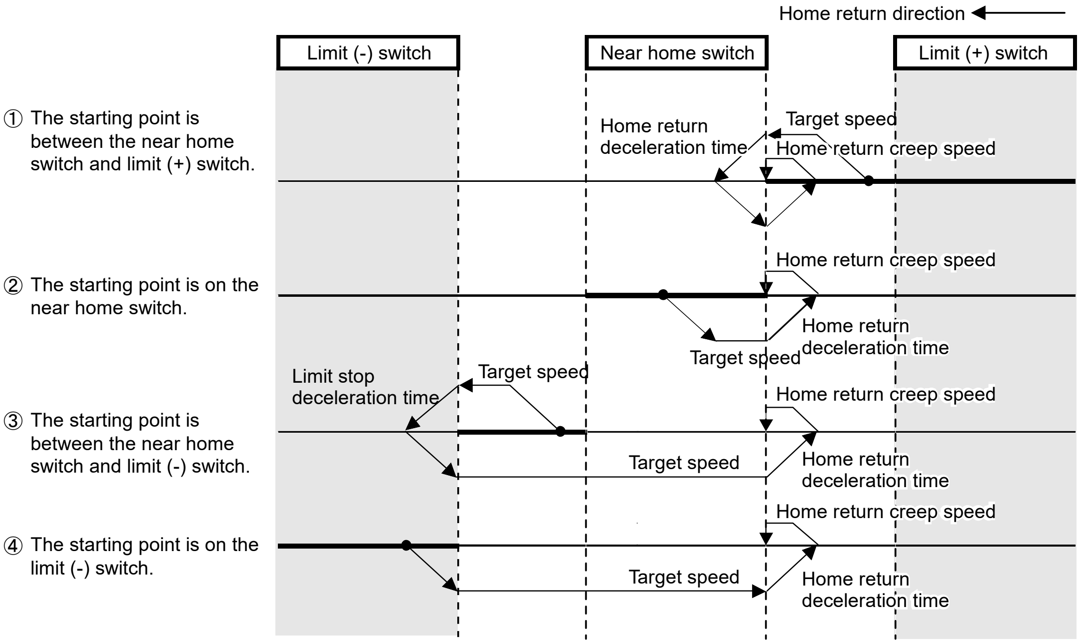
The leading edge of the first home switch is set as a home position after the detection of the leading edge of the near home switch.



(Note 1) When the home sensor is ON at startup, the operation is similar to (2).

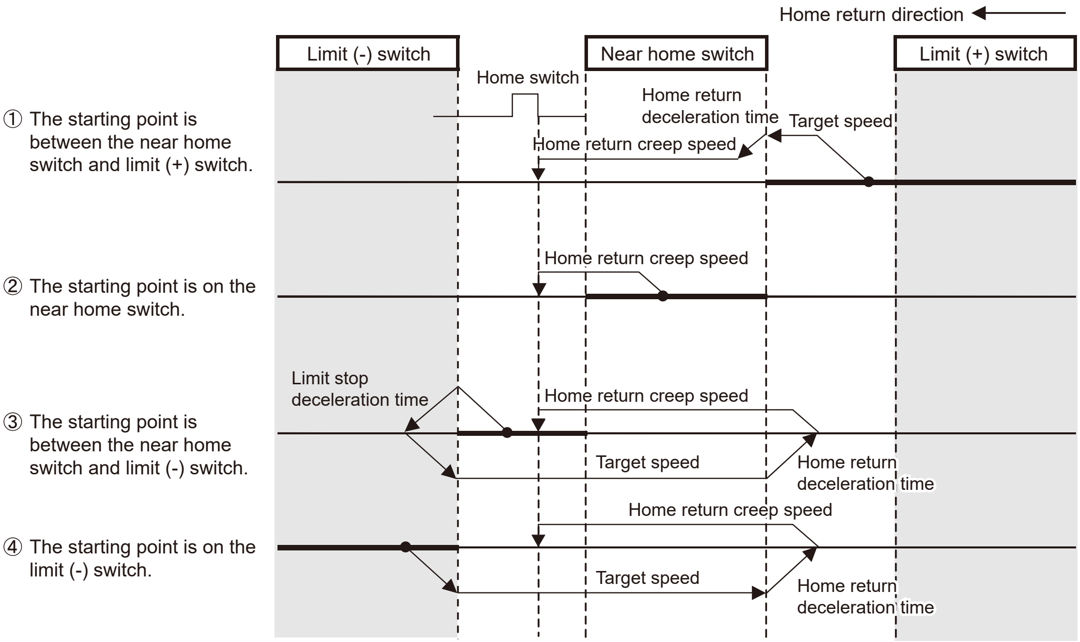
■ DOG Method 2 (Edge detection of near home switch)

The leading edge of the near home switch is detected and it is set as a home position.



■ DOG Method 3 (Edge detection of near home switch + Falling edge of home position as reference)

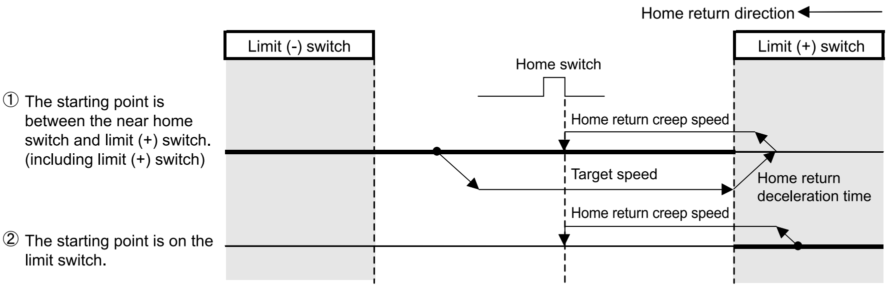
The leading edge of the first home switch in the home return direction is set as a home position after the detection of the trailing edge (back end) of the near home switch.



(Note 1) When the home sensor is ON at startup, the operation is similar to (3).

■ Limit Method 1 (Edge detection of limit switch + First rising edge of home position as reference)

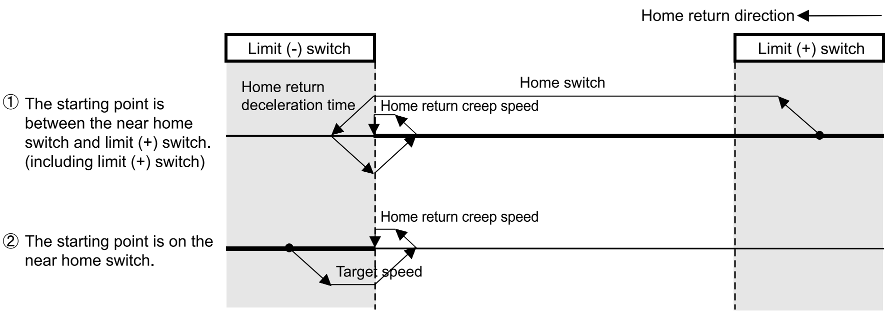
Reverses after detecting the rising edge of the limit switch on the opposite side of the home return direction. The first rising edge of the home switch is detected. It becomes the start point.



(Note 1) When the home sensor is ON at startup, the operation is similar to (1).

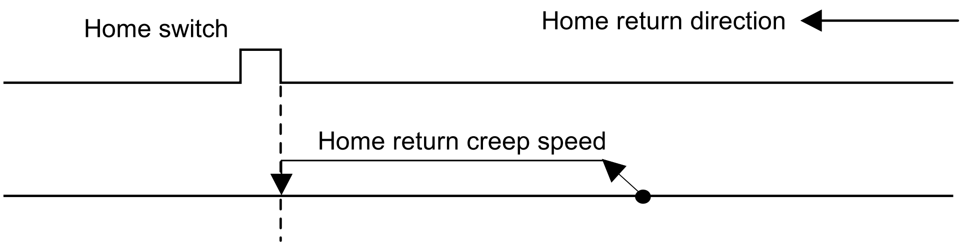
■ Limit Method 2 (Edge detection of limit switch)

Detects the rising edge of the limit switch in the home return direction and stops. That point becomes the start point.



■ Home Position Method (Edge detection of home switch)

Moves toward the home return direction from the current value and stops when the home position switch turns ON by detecting “level”. That point becomes the home position.



(Note 1) If the home position sensor is ON when the unit is started, home return is immediately completed and the position at the time of startup is regarded as the home position.

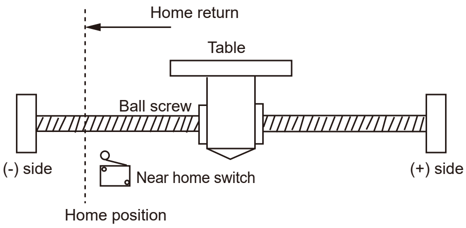
■ Data setting method

The current value is set as the home position.


Home position (= Current value)

10.2 Settings and Operation of Home Return

The example below is a case of the positioning unit installed in the slot 1. The unit is the number of pulses.

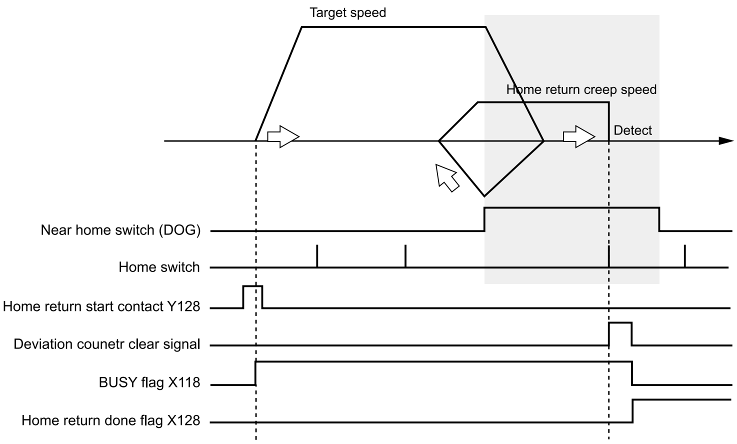


■ Settings

Parameters required for the home return operation of the positioning unit is set in the positioning setting menu of the programming tool.

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
Deviation counter clear signal ON time	1 ms

■ Behavior diagram

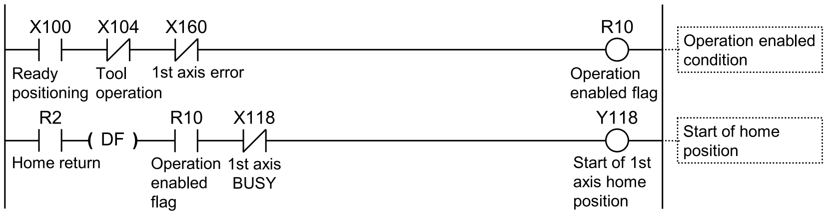


■ Behaviors of each contact

- The BUSY flag (X118), which indicates that the motor is running, turns ON when home return starts, and turns OFF when the operation is completed.
- The deviation counter clear signal will turn ON during the ON time of the deviation counter clear signal on completion of the home return.

- The home return done flag (X128), which indicates the completion of operation, turns ON when the home return operation is completed, and remains on hold until the next positioning control, JOG operation, home return, or pulser operation starts. The flag turns ON upon completion of the home return.

■ Sample programs



■ Notes on programming

- The start contact and flag number varies depending on the number of axes and the installation position of the unit.
- The specified slot number varies depending on the installation position of the unit.

■ Behavior at limit input

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

(MEMO)

11 Manual Operation (Pulser Operation)

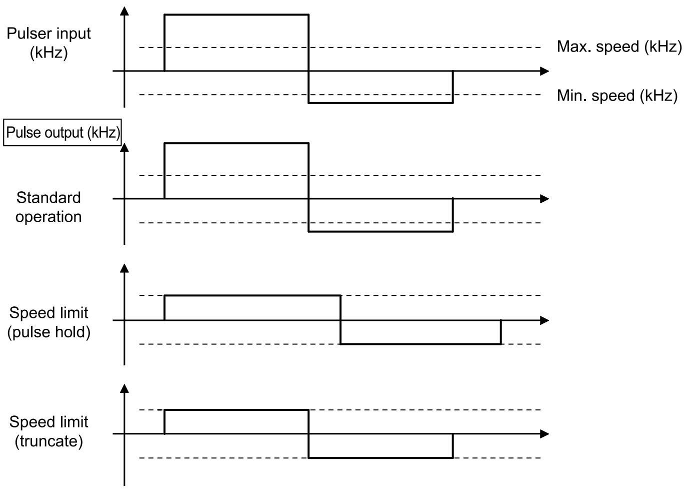
11.1 Settings and Operation of Pulser Operation

■ Types of Pulser Operation

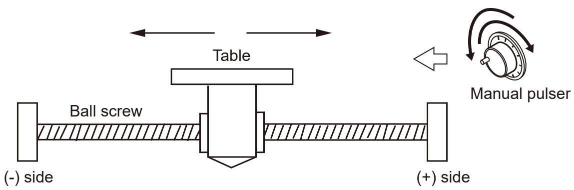
Pulser operation is a function that uses a pulser connected to the positioning unit to output pulses manually.

The following pulser operation methods are available.

Operation method	Operation
Standard operation	The number of pulses from a pulser is obtained every 1 ms to perform operations. The input contents of a pulser are reflected directly in actual operations.
Speed limit (pulses held)	When the pulser input speed exceeds the specified maximum speed, operations are performed by holding the maximum speed. Pulses input from a pulser are held. Because pulses that cannot be output are held, pulses may be output even if there is no input from the pulser. The unit of speed is "(Set unit × 1000)/s".
Speed limit (Truncate)	When the pulser input speed exceeds the specified maximum speed, operations are performed by holding the maximum speed. Pulses that cannot be output are discarded, and pulse output is interlocked with pulser operation. The unit of speed is "(Set unit × 1000)/s".



The example below is a case of the positioning unit installed in the slot 1. The unit is the number of pulses.

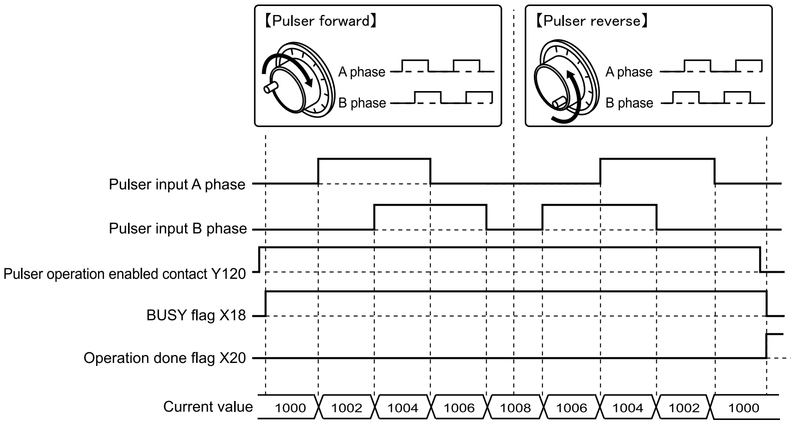


■ Settings

Parameters required for the pulser operation of the positioning unit is set in the positioning setting menu of the programming tool.

Item	Setting example	Settable range
Operation setting code	0: Pulser 1	0: Pulser 1 1: Pulser 2 2: Pulser 3 3: Pulser 4
Pulser operation ratio numerator	2	1 to 32767
Pulser operation ratio denominator	1	1 to 32767
Pulser operation method	2: Speed limits (truncated)	0: Standard operation. 1: Speed limits (pulse hold), 2: Speed limits (truncated)
Pulser operation maximum speed	500	Pulses: 0 to 32,767,000 pps

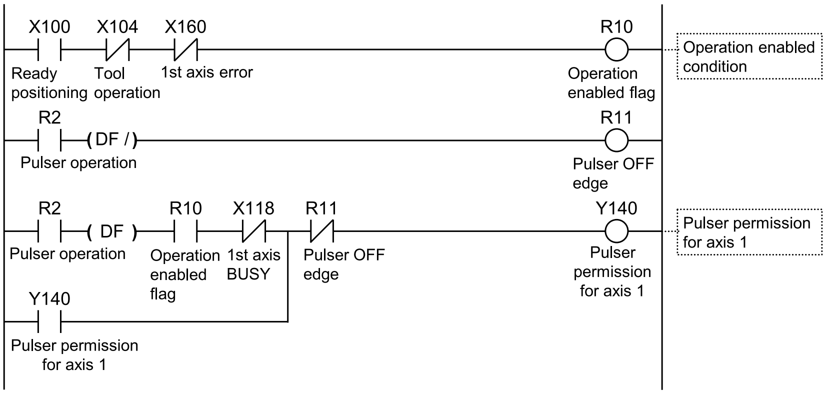
■ Behavior diagram



■ Behaviors of each contact

- The BUSY flag (X118) indicating the state that a motor is running will turn ON when the pulser operation permit contact turns ON and will turn OFF when the contact turns OFF.
- The operation done flag (X120) indicating the state of operation completion will turn ON when the pulser operation permit contact is turned OFF and the flag will be maintained until the next positioning control, JOG operation, home return, or pulser operation starts.

Sample programs



Notes on programming

- The movement amount per an 1-pulse signal from the pulser can be changed by setting the ratio numerator and ratio denominator for the input signal of the pulser.
- The start contact and flag number varies depending on the number of axes and the installation position of the unit.
- The specified slot number varies depending on the installation position of the unit.

Behavior at limit input

Condition	Direction	Limit status	Operation
When pulser operation is executed	Forward	Limit input (+): ON	Startup failure, error occurrence
		Limit input (-): ON	Executable
	Reverse	Limit input (+): ON	Executable
		Limit input (-): ON	Startup failure, error occurrence
During pulser operation	Forward	Limit input (+): ON	Deceleration stoppage, error occurrence
	Reverse	Limit input (-): ON	Deceleration stoppage, error occurrence

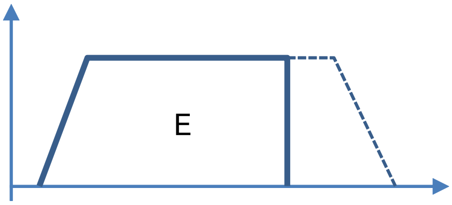
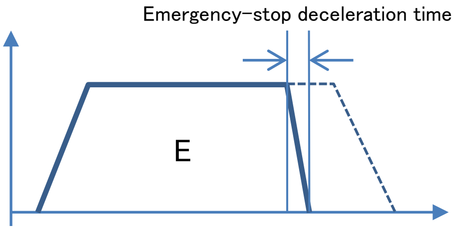
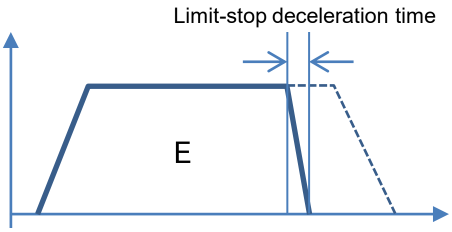
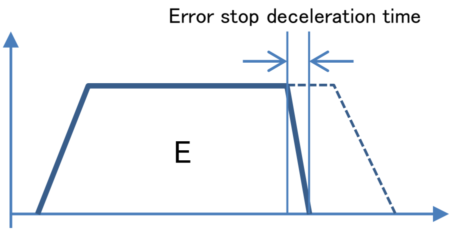
12 Stop Functions

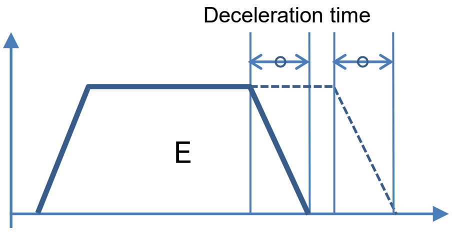
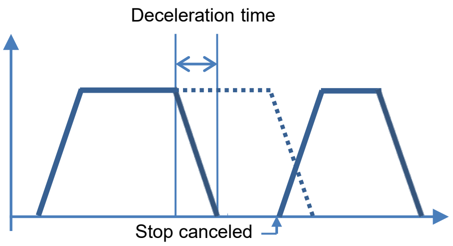
12.1 Types and Settings of Stop Function

12.1.1 Stop Operation Types

- The following seven stop operations are available.
- System stop, emergency stop, deceleration stop, and pause take effect when allocated output signals are turned ON by user programs.
- Limit stop, soft limit stop, and error stop take effect when the corresponding conditions are met.

■ Types of stop operation

Name	Timing chart	Occurrence condition and operation
System stop		• Once a system stop contact (Y0) turns ON, an active operation will stop and the pulse outputs of all axes will immediately stop. • Stops without deceleration time. • The similar operation is performed when the operation mode of the CPU unit is switched from RUN to PROG.
Emergency stop		• Once an emergency stop contact (Y30-Y37) turns ON, an active operation will stop and the pulse outputs of corresponding axes will stop. • Performs deceleration stop with the "emergency stop deceleration time" specified in the positioning parameter.
Limit stop		• Once a limit + input and limit - input (Y50-Y57) turns ON, an active operation will stop and the pulse outputs of corresponding axes will stop. • Performs deceleration stop with the "limit stop deceleration time" specified in the positioning parameter.
Soft limit stop		• When the software limit function is effective, an active operation will stop and the pulse outputs of corresponding axes will stop when it exceeds the range of the software limit. • Performs deceleration stop with the "limit stop deceleration time" specified in the positioning parameter.
Error stop		• When a unit error occurs, the pulse outputs of corresponding axes (all axes or each axis) will stop. (Note 1) • Performs deceleration stop with the "error stop deceleration time" specified in the positioning parameter.

Name	Timing chart	Occurrence condition and operation
Deceleration stop (Note 2)		• Once a deceleration stop contact (Y38-Y3F) turns ON, an active operation will stop and the pulse outputs of corresponding axes will stop. • Deceleration is performed in the deceleration time specified for active positioning operations.
Pause (Note 2)		• Once a deceleration stop contact (Y38-Y3F) turns ON, an active operation will stop and the pulse outputs of corresponding axes will stop. • Deceleration is performed in the deceleration time specified for active positioning operations. • When a deceleration stop signal turns OFF, the deceleration stop is canceled and the stopped control restarts.

(Note 1) When a self-diagnostic error which stops the operation of the CPU unit occurs, the mode will be switched to the PROG. mode and the system stop will be executed.

(Note 2) The operations of deceleration stop and pause are switched by setting the system operation setting area of unit memory by user programs.

■ Allocation of I/O Numbers

Signal name	I/O number				
	1 axes	2 axes	3 axes	4 axes	Virtual axis
System stop	Y0				
Emergency stop (Operation: Level type)	Y30	Y31	Y32	Y33	Y37
Deceleration stop (Operation: Level type)	Y38	Y39	Y3A	Y3B	Y3F

(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.

■ Stop operation during interpolation control

- For executing the emergency stop, deceleration stop, or pause, turn on a contact 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.

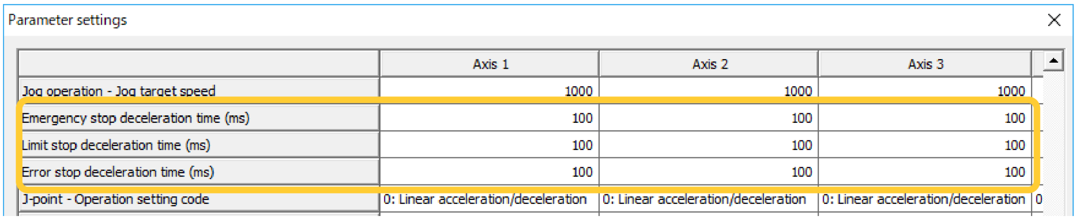
Info.

- For details of the stop operation during synchronous control, refer to "8.2 Setting up the Master Axis and Slave Axes" and "8.3 Starting and Canceling Synchronous Control".

12.1.2 Setting stop time

The stop time is specified for each axis using Configurator PM7.

■ Setting stop time



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

12.2 Processing during Stop

■ Operation during stop

- System stop, emergency stop, deceleration stop, and pause are performed by turning ON each request contact in the I/O area.
- The stopped state is held while each contact is ON and until each request signal turns OFF. Any operation cannot be performed during stop. The same applies to limit stop, soft limit stop, and error stop.

■ Priorities of each stop operation

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

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

■ Dwell time setting

- Dwell time settings are disabled for stop operations, regardless of the pattern.
- However, dwell time settings are enabled for positioning operation after pause.

■ Flag processing

- For system stop, the BUSY signal turns OFF and the operation completion signal turns ON.
- For emergency stop, limit stop, soft limit stop, error stop, and deceleration stop, the BUSY signal turns OFF and the operation completion signal turns ON upon completion of deceleration.

■ Current value coordinates

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

12.3 Pause Function

12.3.1 Pause Function

- The pause function temporarily stops the control during operation. The pause function is used by switching between the pause and deceleration stop functions.
- When the deceleration stop request contact turns ON, the pause function performs a deceleration stop in the deceleration time of the active control . Then, the stopped state is held while the deceleration stop request contact (Y38 to Y3F) is ON, and the stopped control is restarted when the deceleration stop request contact turns OFF.

Info.

- Deceleration stop cannot be executed while the pause function is being used. Use the emergency stop function to execute stop operation when using the pause function.
- The pause function is valid only when automatic operation (positioning control) is performed. During manual operation (JOG operation/home return/pulser operation), the behavior is the same as for deceleration stop.
- As is the case with other stop functions, the pause function holds the stopped state while a deceleration stop request signal is ON. If emergency stop or system stop is executed during stop, the pause function will be cancelled and the state will change to an emergency stop or system stop state.

12.3.2 Pause Settings

- The operations of deceleration stop and pause are switched by setting the system operation setting area (UM00389) of unit memory by user programs.

■ System operation setting area

Unit memory No. (Hex)	Name	Default	Description
UM 00389	Deceleration stop operation	0	Specify the operation of the positioning unit with the deceleration stop request signal activated (turned ON). 0: Deceleration stop During repetitive operation, the axis stops after operations are performed up to the E-point of the repetitive operation. 1: Pause ● Performs a deceleration stop, and restarts the positioning operation when the "deceleration stop request signal" is canceled (changed from ON to OFF). ● Also, the same operation as deceleration stop is performed during any operation other than a positioning operation. ● During repetitive operation, the axis stops after operations are performed up to the E-point of the repetitive operation and the positioning operation is restarted when the "deceleration stop request signal" is canceled (changed from ON to OFF). ● If a system stop or emergency stop is executed while the positioning unit is paused, the pause state will be canceled and the operation will not restart

Unit memory No. (Hex)	Name	Defaul t	Description
			even if the "deceleration stop request signal" is canceled (changed from ON to OFF).

(MEMO)

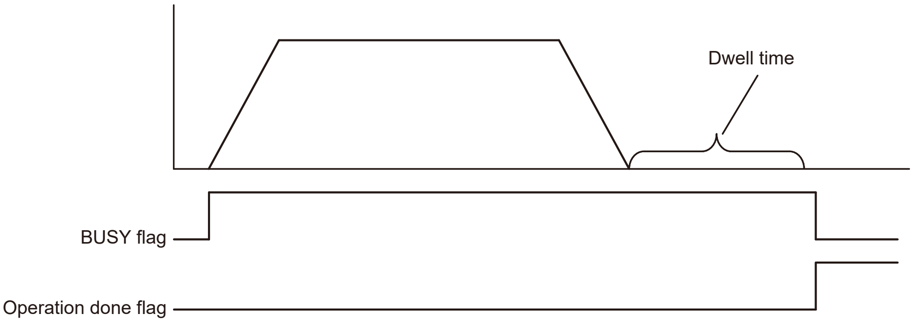
13 Auxiliary Functions

13.1 Dwell Time

Dwell time refers to the time from the completion of execution of a positioning table during automatic operation until transition to the next operation.

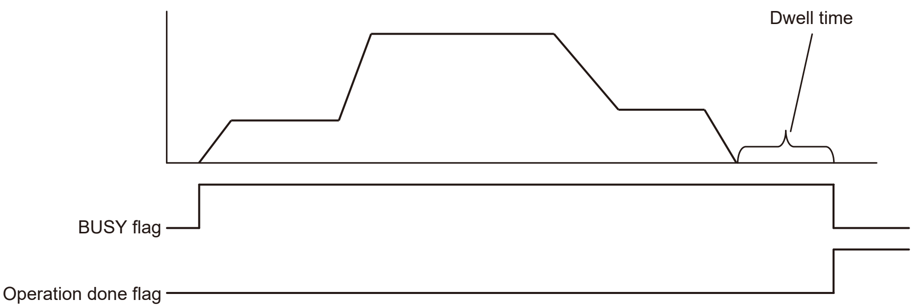
■ For E-point control

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



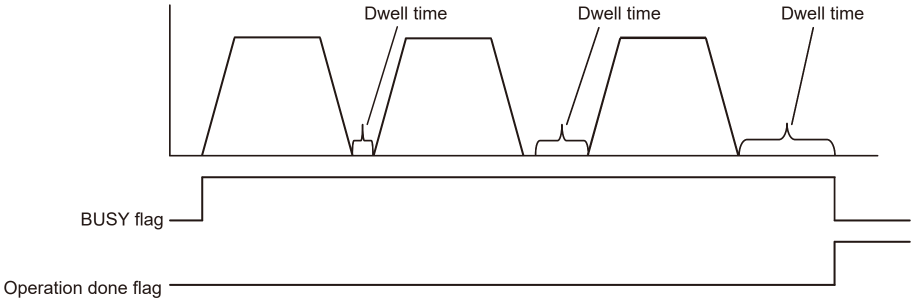
■ For P-point control

While the positioning unit is in P-point control, the positioning table will operate consecutively and the dwell time will be ignored. For the last table (E point), as is the case with E-point control, dwell time is the time from the completion of the position command until the operation done flag turns ON.



■ For C-point control

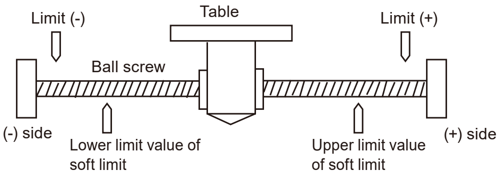
Dwell time is the waiting time required to execute the next table after completion of the positioning table (deceleration stop). For the last table (E point), as is the case with E-point control, dwell time is the time from the completion of the position command until the operation done flag turns ON.


Dwell time
Dwell time
Dwell time
BUSY flag
Operation done flag

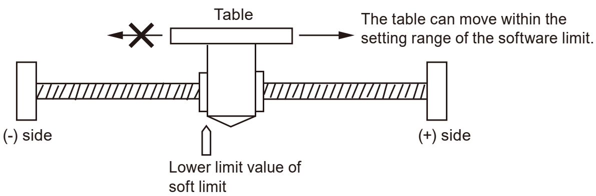
13.2 Soft limits:

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

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



When the setting range of soft limits (upper and lower limit values) is exceeded, an error occurs and 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.



The software limit enabled or disabled can be specified individually for the positioning control, JOG operation, and home return operation. For example, it is possible to disable the limit software only in home return operation.

13.3 Auxiliary Output Code and Auxiliary Output Contact

The auxiliary output contact is a function to announce externally which table is in operation when the automatic operation (E-point control, C-point control, P-point control, and J-point control) is executed.

The auxiliary output contact and auxiliary output code are available by setting "parameter auxiliary output" to With mode or Delay mode on an axis-by-axis basis.

■ Auxiliary output contact

The auxiliary output contact operates either in With mode or Delay mode.

Auxiliary output mode	Operation
With mode	When the automatic operation starts, the auxiliary contact flag of the corresponding axis allocated to I/O will turn ON.
Delay mode	The auxiliary contact flags for corresponding axes allocated to the I/O area will turn ON according to the ratio of positioning movement (%) while the positioning unit is in automatic operation. The turn ON ratio while the positioning unit is in Delay mode is set in the Delay ratio area of auxiliary output in the unit memory. However, when the automatic operation is set to J-point control, the operation is the same as that in With mode.

The ON time of the auxiliary contact flag can be specified in ms increments.

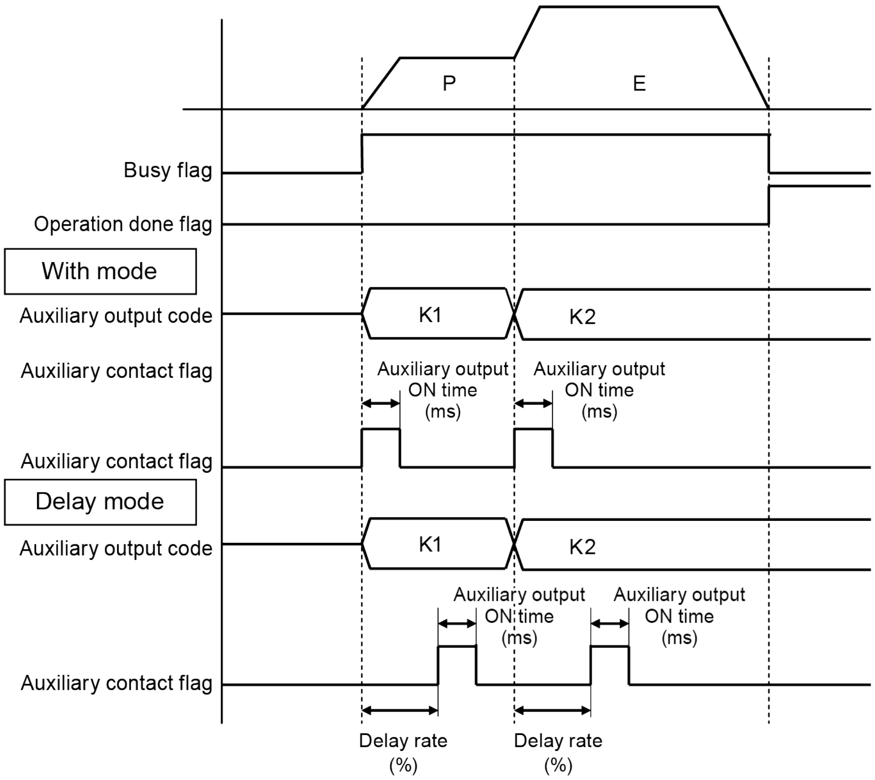
Note

- There will be no difference between the Delay mode and With mode in operation while the positioning unit is in J-point control.

■ 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 auxiliary output.

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



Note

- Auxiliary output data will maintain the value regardless of the type of auxiliary output mode (the with mode or delay mode) until the next positioning table is executed.

13.4 Current value update

The current value update function is a function to change the current value controlled by the positioning unit to a desired (preset) value. Refreshing the current value requires data writing to the unit memory.

■ Current Value Update Area (Unit Memory)

<table>
<tr><th>Unit memory No. (Hex)</th><th>Name</th><th>Description</th></tr>
<tr><td>UM 000C0</td><td>Current value update request flag</td><td>Only when the corresponding bit for each axis changes to 1 from 0, the current coordinate controlled by the positioning unit to the following current value.
After the change, the positioning unit will clear the corresponding bits to 0 automatically.
<table>
<tr><th>Bit</th><th>Name</th><th>Default</th><th>Description</th></tr>
<tr><td>0</td><td>Current value update request for Axis 1</td><td>0</td><td rowspan="8">0: No change
1: Update the current value of the target axis.
(After warning clearing is executed, the positioning control unit automatically resets the bit to 0.)</td></tr>
<tr><td>1</td><td>Current value update request for Axis 2</td><td>0</td></tr>
<tr><td>2</td><td>Current value update request for Axis 3</td><td>0</td></tr>
<tr><td>3</td><td>Current value update request for Axis 4</td><td>0</td></tr>
<tr><td>4</td><td>-</td><td>-</td></tr>
<tr><td>5</td><td>-</td><td>-</td></tr>
<tr><td>6</td><td>-</td><td>-</td></tr>
<tr><td>7</td><td>Current value update request for virtual axis</td><td>0</td></tr>
<tr><td>15 to 8</td><td>-</td><td>-</td><td>-</td></tr>
</table></td></tr>
<tr><td>UM 000C8</td><td rowspan="2">Current value update coordinates for Axis 1</td><td rowspan="2">Stores the coordinate to be preset as the current value of 1st axis.</td></tr>
<tr><td>UM 000C9</td></tr>
<tr><td>UM 000CA</td><td rowspan="2">Current value update coordinates for Axis 2</td><td rowspan="2">Stores the coordinate to be preset as the current value of 2nd axis.</td></tr>
<tr><td>UM 000CB</td></tr>
<tr><td>UM 000CC</td><td rowspan="2">Current value update coordinates for Axis 3</td><td rowspan="2">Stores the coordinate to be preset as the current value of 3rd axis.</td></tr>
<tr><td>UM 000CD</td></tr>
<tr><td>UM 000CE</td><td rowspan="2">Current value update coordinates for Axis 4</td><td rowspan="2">Stores the coordinate to be preset as the current value of 4th axis.</td></tr>
<tr><td>UM 000CF</td></tr>
<tr><td>UM 000D6</td><td rowspan="2">Current value update coordinate of virtual axis</td><td rowspan="2">Stores the coordinate to be preset as the current value of virtual axis..</td></tr>
<tr><td>UM 000D7</td></tr>
</table>

■ Current value update procedure

1. Write a coordinate to be preset in the current value update coordinate area of the axis to update the current value.
2. Preset the target axis bit to 1 in the current value update request flag area. As the current value update process is performed for the axis that is 1 in the current value request flag area, do not set any bit to 1 other than the target axis.
3. The current value after unit conversion in each axis information and monitor area is changed to the specified current value.

Note

- The value to be changed by updating the current value is the current value after unit conversion.

13.5 Home Coordinates

The positioning unit performs a home return to set the managing coordinate to 0.
“Home coordinates” is a function that enables the coordinates upon completion of home return processing to be set to arbitrary values.

■ Coordinate origin processing procedure

1. Write a coordinate to be the home in the home coordinate area of the target axis for which the coordinate is to be changed after a home return.
2. Execute the home return process. After the completion of the home return, the coordinate specified in the above 1 will become the home position.

Unit memory No. (Hex)	Name	Default	Setting range and description
UM 0084A UM 0084B	Coordinate origin of 1st axis	-	Stores the value of coordinate origin after the home return.
UM 0304A UM 0304B	Coordinate origin of 2nd axis		
UM 0584A UM 0584B	Coordinate origin of 3rd axis		
UM 0804A UM 0804B	Coordinate origin of 4th axis		
UM 1204A UM 1204B	Coordinate origin of virtual axis		

Note

- Set the coordinate origin in the specified unit.

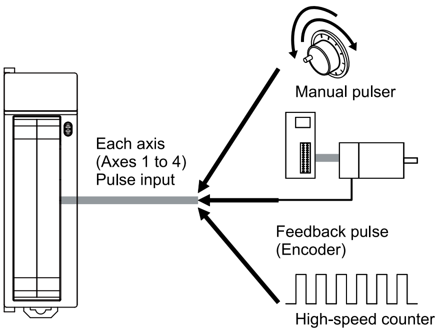
13.6 Pulse Input

13.6.1 Pulse Input Types

Each axis of the positioning unit has pulse input, thus connecting to a variety of input devices. Select the desired type of pulse input in the positioning setting menu of the tool software.

■ Applications of pulse input

Input target	Description
Pulser	● Set this type when using a manual pulser. ● The use of a pulser operation setting code allows specification of the target axis (ch) where the pulser will be used.
Feedback pulse	● Set feedback pulse input in the case of connecting an encoder in order to monitor the rotation of the motor. ● When feedback pulse input is selected, the positioning unit uses pulse input to perform the feedback pulse count of its own axis, thus detecting the difference between the instruction value and pulse input value. (Automatic check function of movement amount)
High-speed counter	● Set this type when using inputs for general-purpose counters. Various input methods (2-phase input, direction identification input, and individual input) are supported. ● The positioning unit stores the number of input pulses in the monitor area.



13.6.2 Restrictions on Combinations of Pulse Inputs

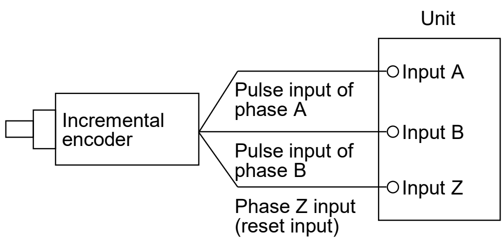
■ Restrictions on Combinations of Pulse Inputs

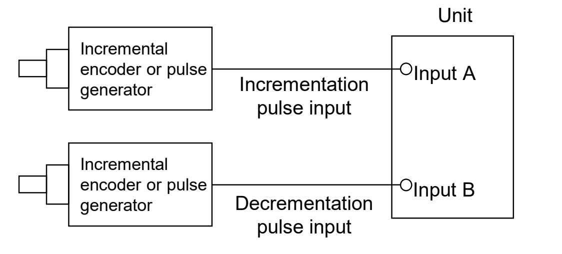
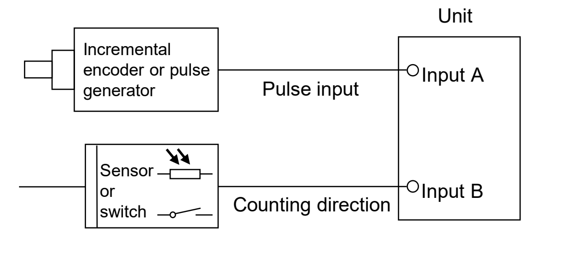
			Pulse input application		
			Pulser	**Feedback pulse**	**High-speed counter**
Pulse input mode parameter	Rotation direction	Forward	Available	Available	Available
		Reverse	Available	Available	Available
	Input mode	2-phase input	Available	Available	Available
		Direction identification input	Not available	Not available	Available
		Individual input	Not available	Not available	Available
	Multiplication	Multiply by 1	Not available	Available	Available
		Multiply by 2	Not available	Available	Available
		Multiply by 4	Available	Available	Available
	Pulse Input	Enabled	Available	Available	Available
		Disable	Not available	Not available	Available
	Pulse count value	Clear	Not available	Available	Not available
		Set	Not available	Available	Available

13.6.3 Input Methods of Pulse Input

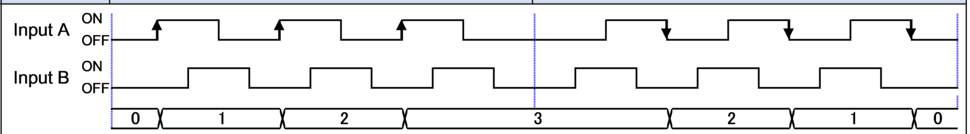
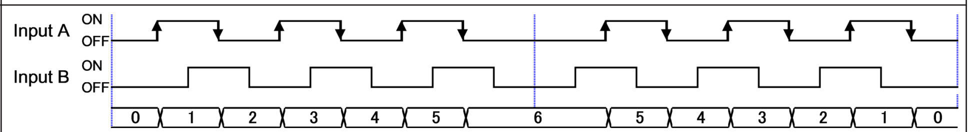
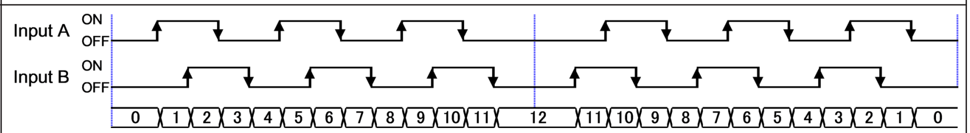
- Select from the following three types according to input devices to be connected.
- The count operation varies depending on the multiplication factor setting as shown below.

■ Input mode

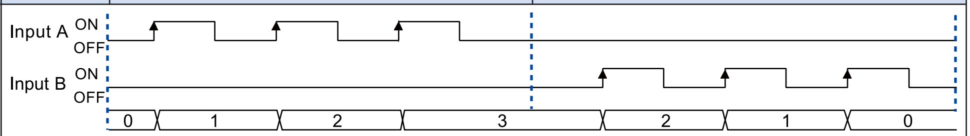
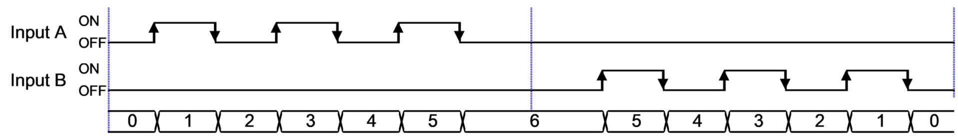
Method	Connection	Count
2-phase (phase differenc e)		For 2-phase input, the input A signal and input B signal of each counter are connected to phase A and phase B, respectively, in the encoder. The count direction depends on the phase difference between phases A and B. When phase A is ahead of phase B by 90 degrees in terms of the electrical angle, the count value is incremented. When phase A is behind phase B by 90 degrees in terms of the electrical angle, the count value is decremented.

Method	Connection	Count
Individual		For individual input, the counter is incremented when the level of the input A signal rises or falls, and decremented when the level of the input B signal rises or falls.
Direction identification		For direction identification input, the count signal is connected to the input A signal. The count direction is controlled by the direction signal level of the input B signal. When the input B signal is OFF, the counter is incremented when the level of the input A signal rises or falls. When the input B signal is ON, the counter is decremented.

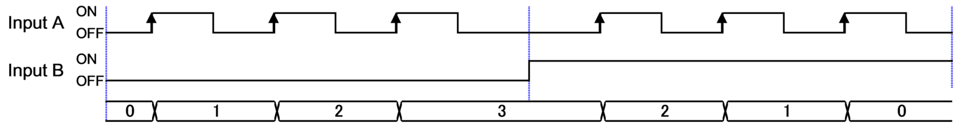
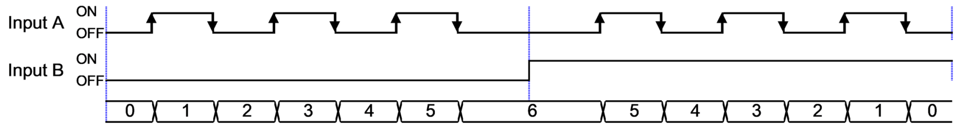
■ Count operation of 2-phase input

Multiplication	Timing chart	
	Incrementation	Decrementation
Multiply by 1		
Multiply by 2		
Multiply by 4		

■ Count operation of individual input

Multiplication	Timing chart	
	Incrementation	Decrementation
Multiply by 1		
Multiply by 2		

■ **Count operation of direction identification input**

Multiplication	Timing chart	
	Incrementation	Decrementation
Multiply by 1		
Multiply by 2		

13.6.4 Monitoring the Pulse Input Values

The positioning unit can monitor pulse input from programs.
Pulse input monitoring uses the following areas.

Unit memory No. (Hex)	Name	Description
UM 00436	Pulse input value of 1st axis	Pulse input values are stored according to the pulse input application (e.g., pulser, feedback pulse, or high-speed counter). (Unit: Pulse) Pulse input values are cumulatively stored, and cleared when the pulse input application is changed or when processing for clearing pulse input values is performed.
UM 00437		
UM 00476	Pulse input value of 2nd axis	
UM 00477		
UM 004B6	Pulse input value of 3rd axis	
UM 004B7		
UM 004F6	Pulse input value of 4th axis	
UM 004F7		

13.6.5 Pulser Input Function

By setting the positioning unit to "pulser" for the pulse input application, a manual pulser can be used.

Settings allow manual pulsers to connect to different axes. Therefore, a single pulser can operate a number of axes simultaneously. However, pay attention to settings for the axis connected to the pulser and the axes operated by the pulser.

Refer to the following table and make settings for the pulse input application.

Settings for pulse input application		Pulser operation	
Pulser connecting axis	Pulser operating axis	Operation	Overview
Feedback pulse High-speed counter	Feedback pulse High-speed counter Pulser	×	The positioning unit does not recognize pulse input as the manual pulser, thus not allowing the operation of the pulser.
Pulser	Feedback pulse	Yes	The pulser operates. The feedback pulse function is available while the pulser is in operation.
	High-speed counter	Yes	The pulser operates. The high-speed counter function is available while the pulser is in operation.
	Pulser	Yes	The pulser operates.

13.6.6 Feedback Pulse Function

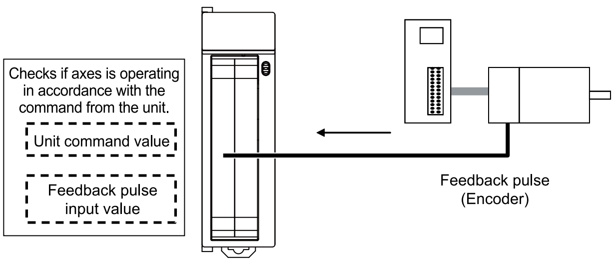
By setting the pulse input application to "feedback pulse", the positioning unit can use the function to utilize feedback pulses from the encoder.

■ Automatic check function of movement amount

The automatic check function of movement amount is used to check whether each axis in operation is operating according to the instruction value, and the function compares the difference between the current value (absolute) under the internal control of the unit and the feedback pulse input (deviation) with a threshold preset. The automatic check function of movement amount works for all types of operation.

The automatic check function of movement amount will work only if the pulse input application is set to "feedback pulse", and will not work if it is set to "pulser" or "high-speed counter".

The movement amount automatic check function can also be used during synchronous control. (This function is available from the unit of Ver.1.50 or later.) However, when the pulse input is used as the master axis, do not use the movement amount automatic check function for that axis.



The automatic check function of movement amount is set in the following areas.

1st axis

Unit memory No. (Hex)	Name	Description
UM 00808	Numerator of automatic movement amount check correction	Set a correction value of pulse input at the time of making an automatic movement amount check. The following formula is used to calculate a deviation feedback value (pulse input value with a correction) from pulse input and make an automatic movement amount check. Deviation feedback value = (Correction numerator/Correction denominator) x Pulse input
UM 00809	Denominator of automatic movement amount check correction	
UM 0080A	Automatic movement amount checking	Set an action when the difference between the instruction value and feedback value exceeds the movement check value at the time of automatic movement amount check. 0: Error occurred An error will occur and the operation of the positioning unit will come to a stop if the difference between the feedback value and reference movement exceeds the movement check value (threshold). The pulse input will be cleared when the error is cleared. 1: Warring occurred A warning will occur and the operation of the positioning unit will come to a stop if the difference between the feedback value and reference movement exceeds the movement check value (threshold). The pulse input will be cleared when the warning is cleared. 2: None No movement check is made.
UM 00818	Automatic movement amount check value	Set the threshold to use the automatic check function of movement amount.
UM 0081A	Automatic movement amount check interval	Set the interval of automatic movement amount checking. (Unit: ms)

2nd axis

Unit memory No. (Hex)	Name	Description
UM 03008	Numerator of automatic movement amount check correction	Refer to axis 1.
UM 03009	Denominator of automatic movement amount check correction	
UM 0300A	Automatic movement amount checking	
UM 03018	Automatic movement amount check value	
UM 0301A	Automatic movement amount check interval	

3rd axis

Unit memory No. (Hex)	Name	Description
UM 05808	Numerator of automatic movement amount check correction	Refer to axis 1.
UM 05809	Denominator of automatic movement amount check correction	
UM 0580A	Automatic movement amount checking	
UM 05818	Automatic movement amount check value	
UM 0181A	Automatic movement amount check interval	

4th axis

Unit memory No. (Hex)	Name	Description
UM 08008	Numerator of automatic movement amount check correction	Refer to axis 1.
UM 08009	Denominator of automatic movement amount check correction	
UM 0800A	Automatic movement amount checking	
UM 08018	Automatic movement amount check value	
UM 0801A	Automatic movement amount check interval	

■ Operation of Automatic Check Function of Movement Amount

The automatic check function of movement amount operates in the following procedure while the positioning unit is in operation.

1. The current position of the positioning unit will be saved in the unit the moment the positioning unit starts operating.
2. After the positioning unit starts operating, the automatic check function of movement amount will come to a stop until the "automatic movement check interval" elapses.
3. After the movement amount automatic interval elapses, the deviation feedback value calculated from the current pulse input value will be compared with the saved pulse input value, and the difference (deviation) will be checked whether it is in excess of the value set for the automatic movement check value.
4. The current position of the positioning unit will be saved in the unit.
5. Steps 2 to 4 above will be repeated.

Note

- Set the automatic movement check interval with consideration of the response time of the encoder in use.

■ Deviation monitoring

The value (deviation) calculated by the automatic check function of movement amount can be checked with the program.

The deviation monitor uses the following areas.

<table>
<tr><th>Unit memory No. (Hex)</th><th>Name</th><th>Description</th></tr>
<tr><td>UM 00434</td><td rowspan="2">Deviation of 1st axis</td><td rowspan="8">Stores the maximum value of the deviation (the difference between the pulse input value and instruction value).</td></tr>
<tr><td>UM 00435</td></tr>
<tr><td>UM 00474</td><td rowspan="2">Deviation of 2nd axis</td></tr>
<tr><td>UM 00475</td></tr>
<tr><td>UM 004B4</td><td rowspan="2">Deviation of 3rd axis</td></tr>
<tr><td>UM 004B5</td></tr>
<tr><td>UM 004F4</td><td rowspan="2">Deviation of 4th axis</td></tr>
<tr><td>UM 004F5</td></tr>
</table>

■ Clearing pulse input value

Pulses input as feedback pulses are integrated and stored as a pulse input value.

The pulse input value will be cleared at completion of home return when "feedback pulses" are used for the pulse input application.

■ Changing pulse input value

If the pulse input application is set to feedback pulse, the pulse input value can be changed to a desired value.

The following areas are used to change the pulse input value.

<table>
<tr><th>Unit memory No. (Hex)</th><th>Name</th><th>Description</th></tr>
<tr><td>UM 00241</td><td>Pulse count value change request flag</td><td>The pulse input value will be changed to the set pulse count when the corresponding bit for each axis is set to 1 from 0.
This flag is an edge trigger flag. When changing the pulse count value, always change this flag from 0 to 1.
After the change, the positioning unit will clear the corresponding bits to 0 automatically.
<table>
<tr><th>Bit</th><th>Name</th><th>Default</th><th>Description</th></tr>
<tr><td>0</td><td>Pulse count change of 1st axis</td><td>0</td><td rowspan="3">0: Do not change the pulse input value
0→1: Change the pulse input value</td></tr>
<tr><td>1</td><td>Pulse count change of 2nd axis</td><td>0</td></tr>
<tr><td>2</td><td>Pulse count change of 3rd axis</td><td>0</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><th>Unit memory No. (Hex)</th><th>Name</th><th>Description</th></tr>
<tr><td></td><td></td><td><table><tr><th>Bit</th><th>Name</th><th>Default</th><th>Description</th></tr><tr><td>3</td><td>Pulse count change of 4th axis</td><td>0</td><td></td></tr><tr><td>15 to 4</td><td>-</td><td>-</td><td>-</td></tr></table></td></tr>
<tr><td>UM 00248</td><td rowspan="2">Pulse input value change of 1st axis</td><td rowspan="2">Set the desired pulse input value for the 1st axis.</td></tr>
<tr><td>UM 00249</td></tr>
<tr><td>UM 0024A</td><td rowspan="2">Pulse input value change of 2nd axis</td><td rowspan="2">Set the desired pulse input value for the 2nd axis.</td></tr>
<tr><td>UM 0024B</td></tr>
<tr><td>UM 0024C</td><td rowspan="2">Pulse input value change of 3rd axis</td><td rowspan="2">Set the desired pulse input value for the 3rd axis.</td></tr>
<tr><td>UM 0024D</td></tr>
<tr><td>UM 0024E</td><td rowspan="2">Pulse input value change of 4th axis</td><td rowspan="2">Set the desired pulse input value for the 4th axis.</td></tr>
<tr><td>UM 0024F</td></tr>
</table>

13.6.7 High-speed Counter Function

By setting the positioning unit to "high-speed counter" for the pulse input application, pulse input can be used as an external counter.

■ Pulse input control

By setting the positioning unit to "high-speed counter" for the pulse input application, the pulse input count can be stopped as desired. When counting the pulse input value is stopped, the current pulse input value is held.

The pulse input count is enabled or disabled with settings in the following areas.

<table>
<tr><th>Unit memory No. (Hex)</th><th>Name</th><th>Description</th></tr>
<tr><td>UM 00240</td><td>Pulse count enable flag</td><td>The pulse input value will be changed to the set pulse count when the corresponding bit for each axis is set to 0 from 1.<table><tr><th>Bit</th><th>Name</th><th>Default</th><th>Description</th></tr><tr><td>0</td><td>1st axis pulse count enabled</td><td>0</td><td rowspan="4">0: Pulse count enabled
1: Pulse count disabled</td></tr><tr><td>1</td><td>2nd axis pulse count enabled</td><td>0</td></tr><tr><td>2</td><td>3rd axis pulse count enabled</td><td>0</td></tr><tr><td>3</td><td>4th axis pulse count enabled</td><td>0</td></tr><tr><td>15 to 4</td><td>-</td><td>-</td><td>-</td></tr></table></td></tr>
</table>

■ Changing pulse input value

If the pulse input application is set to high-speed counter, the pulse input value can be changed to a desired value.

The following areas are used to change the pulse input value.

<table>
<tr><th>Unit memory No. (Hex)</th><th>Name</th><th>Description</th></tr>
<tr><td>UM 00241</td><td>Pulse count value change request flag</td><td>The pulse input value will be changed to the set pulse count when the corresponding bit for each axis is set to 1 from 0.
This flag is an edge trigger flag. When changing the pulse count value, always change this flag from 0 to 1.
After the change, the positioning unit will clear the corresponding bits to 0 automatically.
<table>
<tr><th>Bit</th><th>Name</th><th>Default</th><th>Description</th></tr>
<tr><td>0</td><td>Pulse count change of 1st axis</td><td>0</td><td rowspan="4">0: Do not change the pulse input value
0→1: Change the pulse input value</td></tr>
<tr><td>1</td><td>Pulse count change of 2nd axis</td><td>0</td></tr>
<tr><td>2</td><td>Pulse count change of 3rd axis</td><td>0</td></tr>
<tr><td>3</td><td>Pulse count change of 4th axis</td><td>0</td></tr>
<tr><td>15 to 4</td><td>-</td><td>-</td><td>-</td></tr>
</table></td></tr>
<tr><td>UM 00248</td><td rowspan="2">Pulse input value change of 1st axis</td><td rowspan="2">Set the desired pulse input value for the 1st axis.</td></tr>
<tr><td>UM 00249</td></tr>
<tr><td>UM 0024A</td><td rowspan="2">Pulse input value change of 2nd axis</td><td rowspan="2">Set the desired pulse input value for the 2nd axis.</td></tr>
<tr><td>UM 0024B</td></tr>
<tr><td>UM 0024C</td><td rowspan="2">Pulse input value change of 3rd axis</td><td rowspan="2">Set the desired pulse input value for the 3rd axis.</td></tr>
<tr><td>UM 0024D</td></tr>
<tr><td>UM 0024E</td><td rowspan="2">Pulse input value change of 4th axis</td><td rowspan="2">Set the desired pulse input value for the 4th axis.</td></tr>
<tr><td>UM 0024F</td></tr>
</table>

13.7 Startup Speed

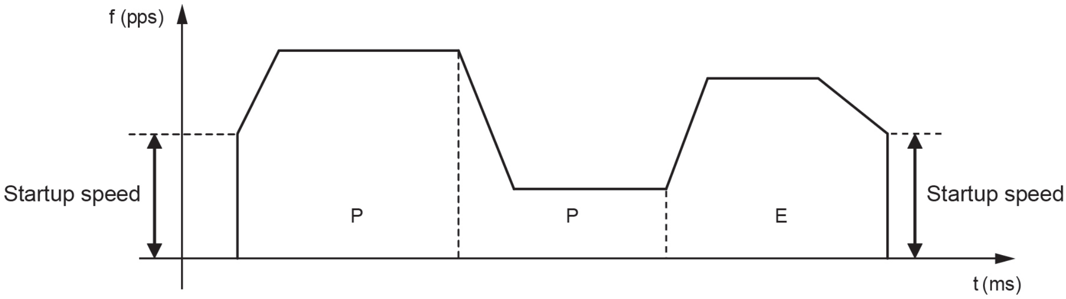
The positioning unit allows startup speed settings for the startup of each type of operation. The startup speed is available for positioning, JOG operation, and home return control.

■ Setting method of startup speed

Set the startup speed in the **parameter-setting menu for each axis** of the Configurator PM7.

■ Cautions for Startup Speed Settings

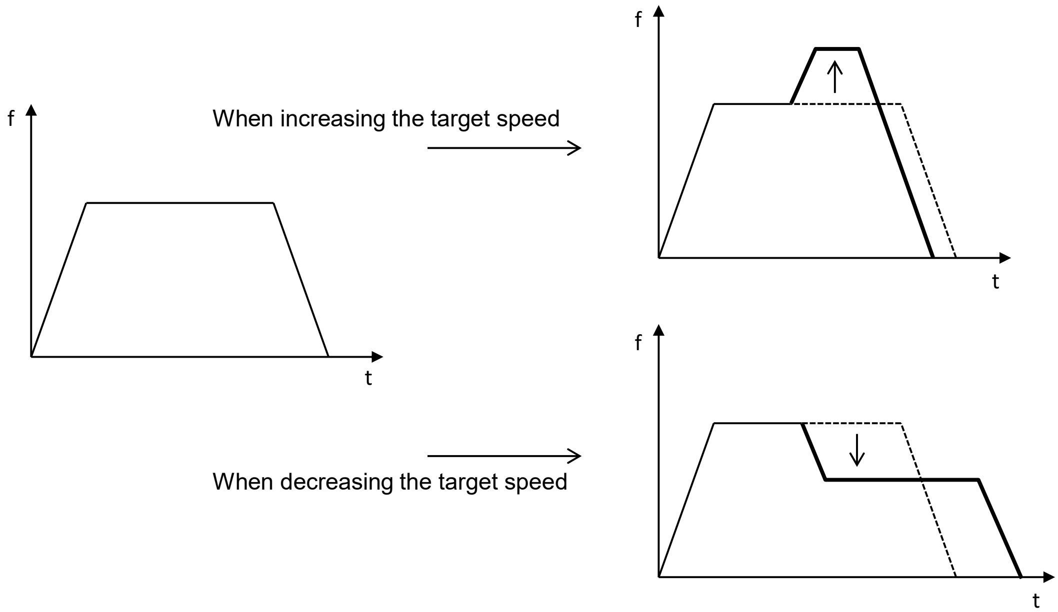
1. The startup speed will apply to the end of operation as well. The speed at the end of operation cannot be changed.
2. The home return creep speed at the time of a home return will not be influenced by t he start speed.
3. The target speed of each type of operation is not influenced by the startup speed. The positioning unit operates at the preset target speed regardless of the preset startup speed.



13.8 Target Speed Change Function (For unit version Ver.1.3 or later only)

13.8.1 Function Explanation

The target speed change function is used to change the target speed in an active positioning table to an arbitrary speed. Even if the speed is changed, the movement amount in the table does not change.



■ Conditions of use

The use conditions of the target speed change function are as follows.

Control method	Single axis control	○	• For synchronous control, the speed can be changed only for the master axis. (Slave axes operate according to the master axis.)
	Interpolation control	×	
	Synchronous control	○	
Operation pattern	E-point	○	• The speed can be changed more than once in one table. • The speed cannot be changed during deceleration accompanying a stop operation. • The speed cannot be changed during deceleration in C-point control. • The speed cannot be changed during the dwell time in C-point control. • For the J point control, use "J point speed change contact" to change the speed. • For JOG operation, change "JOG operation target speed" directly to change the speed.
	P-point	○	
	C-point	○	
	J-point	×	
	JOG operation	×	
	Repetitive control	○	

■ Speed change method

Direct speed specification	This is a method in which the desired speed is specified directly and requested by I/O. The valid range of the function can be selected from two patterns: "Active table only" and "Active table until operation is complete".
ratio specification (Override)	This is a function that changes the set speed by the specified percentage (%). No change request by I/O is required, and the change is reflected when the set value (ratio) is changed. The function is valid for all positioning operations after the setting is specified. The ratio specification remains in effect even if the speed is changed by direct speed specification.

13.8.2 Setting Procedure and Operations (Direct Speed Specification Method)

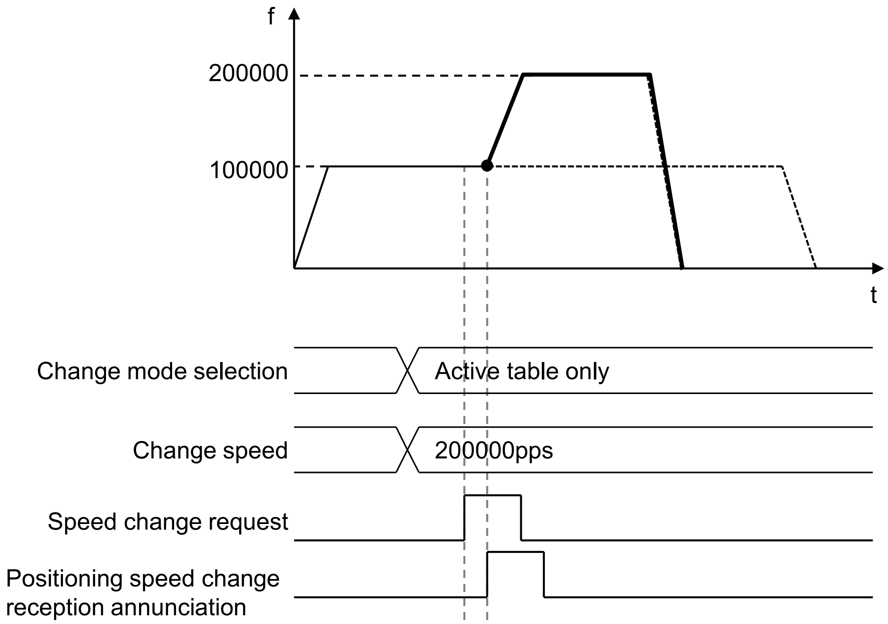
■ Setting procedure and operations of direct speed specification method

The target speed change function based on the direct speed specification method is activated during a positioning operation according to the following procedure.

1. Set "Change mode selection" and "Change speed" in the shared memory.
2. Turn on the "Speed change request" contact during a positioning operation.

* "Speed change reception annunciation" turns ON when the speed change is actually started.

* Once the "Speed change request" contact turns OFF, the "Speed change reception annunciation" also turns OFF.



(Note 1) The acceleration time to the changed speed and the deceleration time from the changed speed follow the set values in the active table.

(Note 2) The movement amount does not change even if the speed is changed.

■ Setting parameters of speed direct specification method

The following parameters are used in the target speed change function of the speed direction specification method.

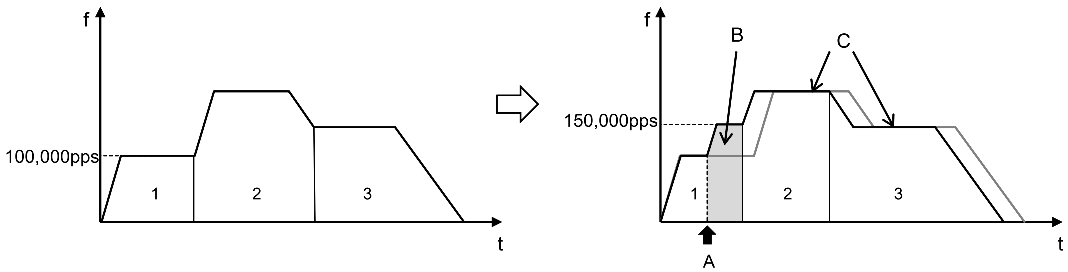
Positioning Operation Change Setting Area

Unit memory No. (Hex)	Name	Default	Description
UM17C01 UM17C11 UM17C21 UM17C31 UM17C71	Positioning speed change: mode selection	H0	Area for setting the range of change when the positioning speed is changed. 0000H: Active table only 0001H: Active table to E-point table (until operation is complete) In the case of other values, the unit operates assuming that 0000H (“Active table only”) is set.
UM17C02 to UM17C03 UM17C12 to UM17C13 UM17C22 to UM17C23 UM17C32 to UM17C33 UM17C72 to UM17C73	Positioning speed change: Changed speed	K100	Area for setting the changed speed when the positioning speed is changed. Unit-converted values are set. 1 to 32,767,000 (specified unit system)

(Note 1) The unit memory numbers in the above table are for the axis 1, axis 2, axis 3, axis 4 and virtual axis from the top.

■ Example of Operation (1): Direct speed specification, "Active table only"

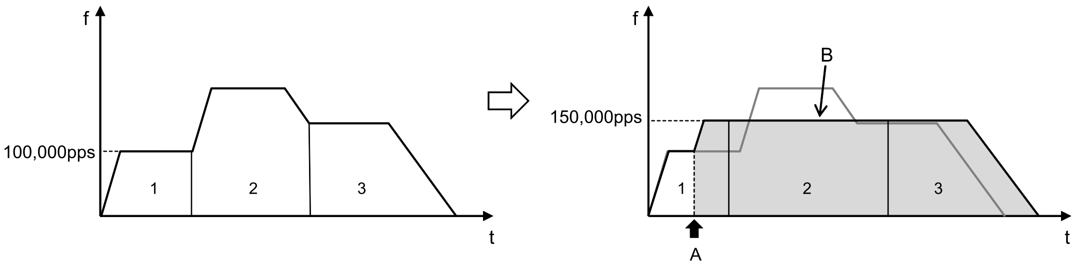
parameter	Set value
mode selection	0000H (Active table only)
Changed speed	150,000 (pps)



A	Speed change request contact turns ON.
B	Only the speed in Table 1 is changed to 150,000 pps.
C	The speeds in Tables 2 and 3 do not change.

■ Example of Operation (2): Direct speed specification, "Active table to E-point table (until operation is complete)"

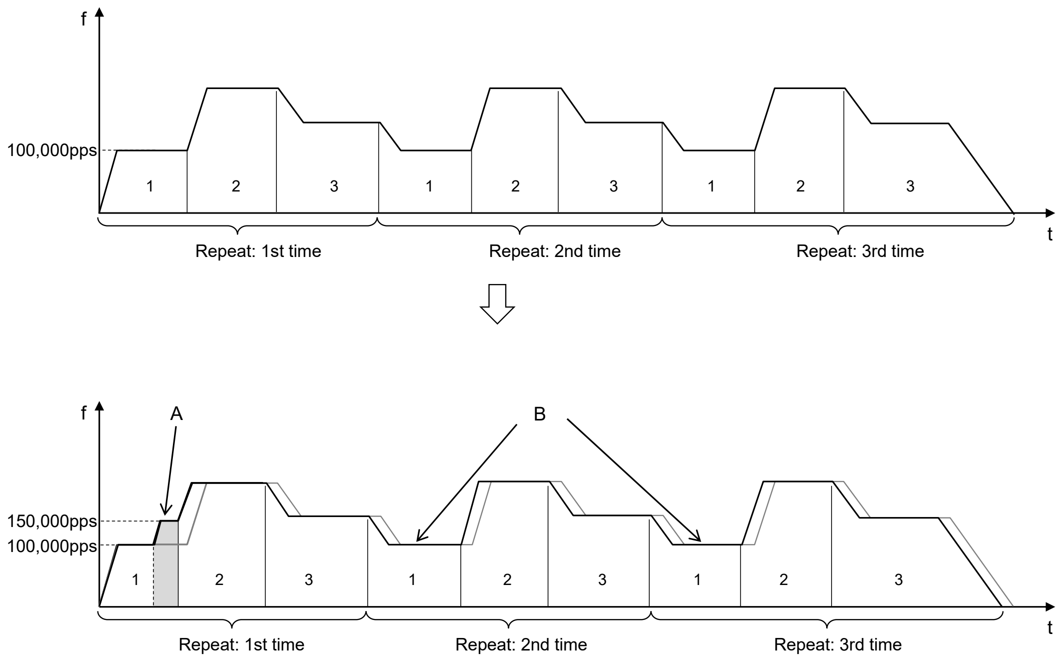
parameter	Set value
mode selection	0001H (Active table to E point table)
Changed speed	150,000 (pps)



A	Speed change request contact turns ON.
B	The speeds in all consecutive tables are changed to 150,000 pps.

■ Example of behavior (For repetitive operations)

When speed change (direct speed specification, “Active table only”) is performed during repetitive positioning operation, only the speed in the active table in the active repetition cycle is changed.

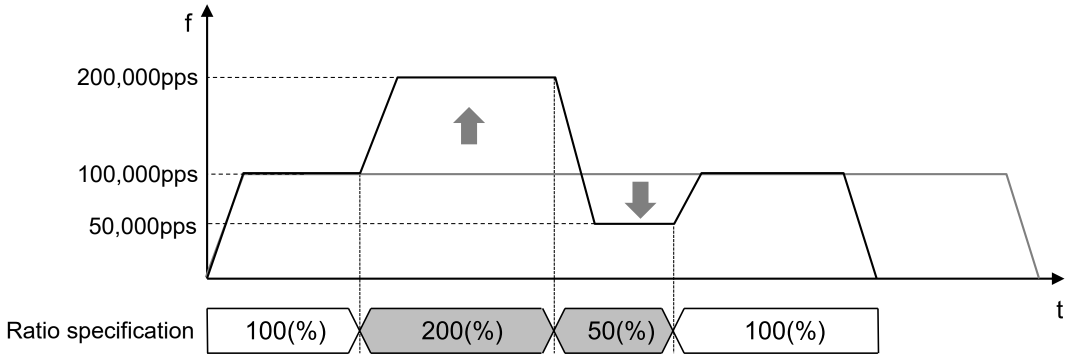


A	Only the speed in Table 1 in the first repetition cycle is changed to 150,000 pps.
B	The speeds in Table 1 in the second and third repetition cycles are not changed.

13.8.3 Setting Procedure and Behaviors (Ratio Specification Method)

■ Setting procedure and behaviors of ratio specification method (override)

When setting the ratio specification, the command speed is immediately reflected in the specified ratio once the "Ratio specification" in the shared memory is changed.



(Note 1) The acceleration time to the changed speed and the deceleration time from the changed speed follow the set values in the active table.

(Note 2) The movement amount does not change even if the speed is changed.

■ Setting parameters of ratio specification method

The following parameters are used in the target speed change function of the ratio specification method.

Positioning Operation Change Setting Area

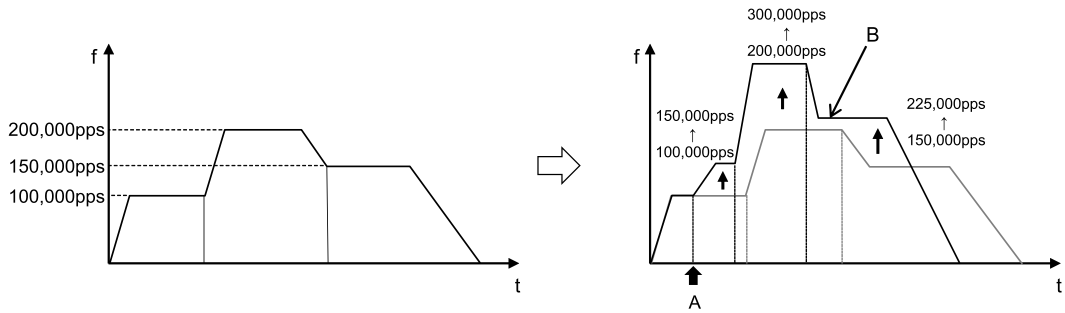
Unit memory No. (Hex)	Name	Default	Description
UM17C00	Positioning speed change: ratio specification (Override)	K100	Area for setting the ratio (override) of change relative to the commanded speed when the positioning speed is changed. No speed change request by I/O is required, and the change becomes valid when a value (ratio) is set. 1 to 300(%)
UM17C10			
UM17C20			
UM17C30			
UM17C70			

(Note 1) The unit memory numbers in the above table are for the axis 1, axis 2, axis 3, axis 4 and virtual axis from the top.

■ Example of behavior

When the ratio specification is changed from 100% to 150%

parameter	Set value
ratio specification	100(%) to 150(%)

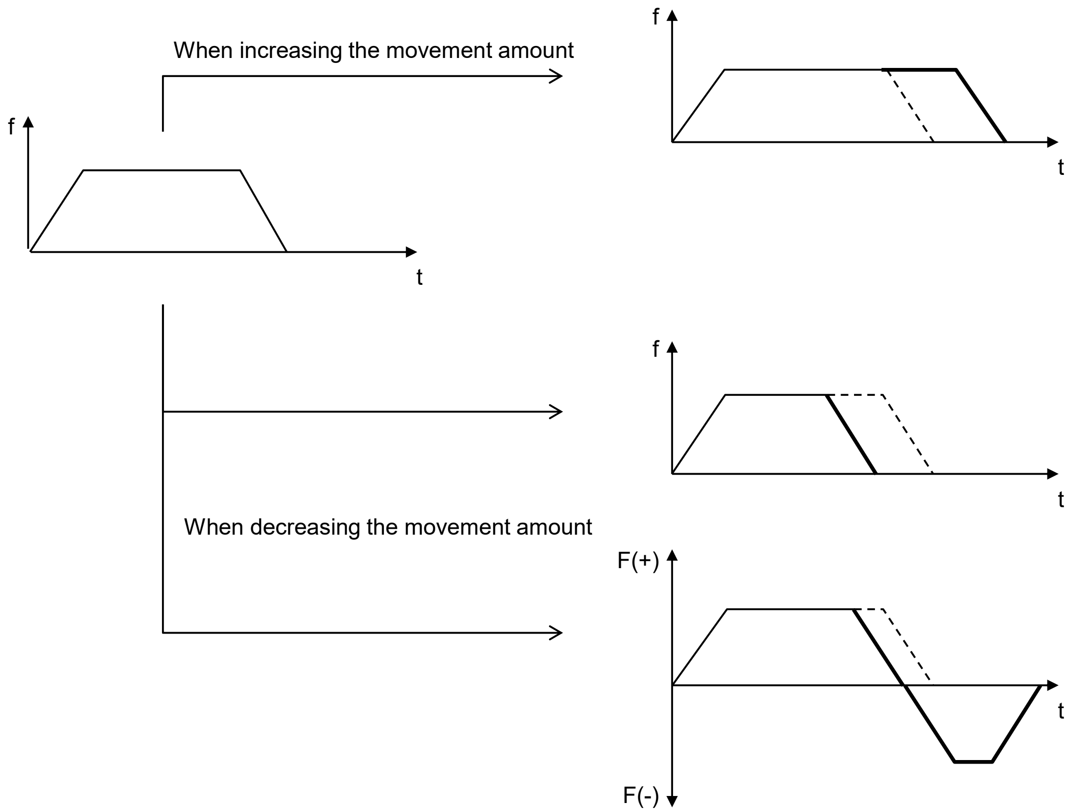


A	The ratio specification is changed from 100 to 150 (%).
B	All consecutive tables follow the set ratio.

13.9 Movement Amount Change Function (For unit version Ver.1.3 or later only)

13.9.1 Function Explanation

- The movement amount change function is used to change the movement amount in the active positioning table to an arbitrary amount.
- Even when the movement amount is changed, the target speed is the same.



■ Conditions of use

The use conditions of the movement amount change function are as follows.

Control method	Single axis control	○	• For synchronous control, the movement amount can be changed only for the master axis. (Slave axes operate according to the master axis.)
	Interpolation control	×	
	Synchronous control	○	
Operation pattern	E-point	○	• The movement amount can be changed more than once in one table.
	P-point	○	

	C-point	○	● The movement amount cannot be changed during deceleration accompanying a stop operation. ● The movement amount cannot be changed during deceleration in C-point control. ● The movement amount cannot be changed during the dwell time in C-point control.
	J-point	×	
	JOG operation	×	
	Repetitive control	○	

13.9.2 Setting Procedures and Operations

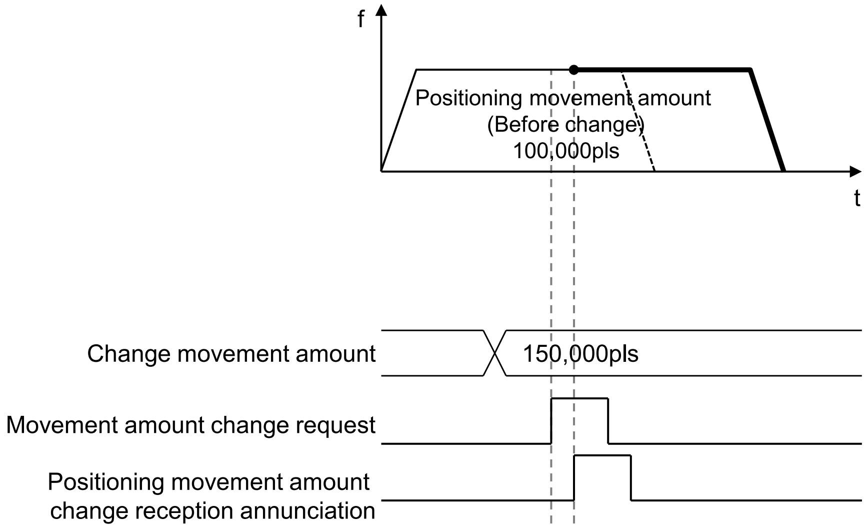
■ Setting procedure and behaviors of movement amount change function

The movement amount change function is activated during positioning operation according to the following procedure.

1. Set "Change movement amount" in the shared memory.
2. Turn on the "Movement amount change request" contact during a positioning operation.

* "Movement amount change reception annunciation" turns ON when the movement amount change is actually started.

* Once the "Speed change request" contact turns OFF, the "Speed change reception annunciation" also turns OFF.



■ Setting Parameters

The following parameters are used in the movement amount change function.

Positioning Operation Change Setting Area

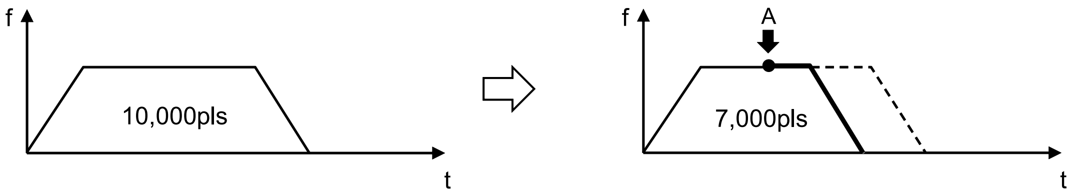
Unit memory No. (Hex)	Name	Default	Description
UM17C0A to UM17C0B	Positioning movement amount change: Changed movement amount	H0	Area for setting a changed movement amount when the positioning movement amount is changed. -1,073,741,823 to 1,073,741,823 (specified unit system)
UM17C1A to UM17C1B			

Unit memory No. (Hex)	Name	Default	Description
UM17C2A to UM17C2B			
UM17C3A to UM17C3B			
UM17C7A to UM17C7B			

(Note 1) The unit memory numbers in the above table are for the axis 1, axis 2, axis 3, axis 4 and virtual axis from the top.

■ Example of Operation (1): When reducing the movement amount (changed movement amount > current value)

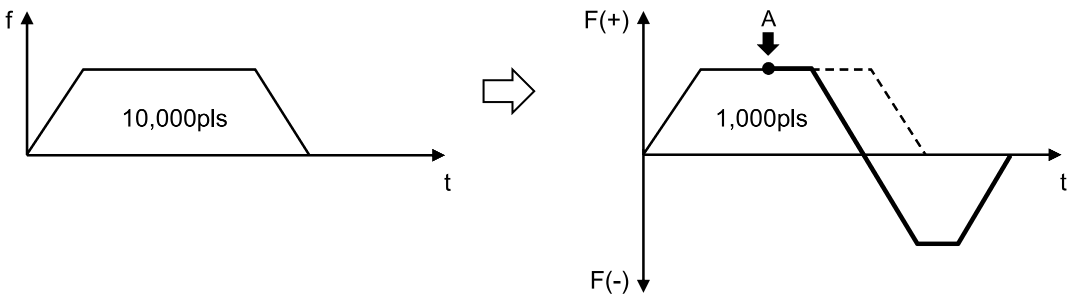
parameter	Set value
Control method	Incremental
Positioning movement amount (Before change)	10,000 (pls)
Positioning movement amount (After change)	7,000 (pls)



A	Movement amount change request contact ON

■ Example of Operation (2): When reducing the movement amount (changed movement amount < current value)

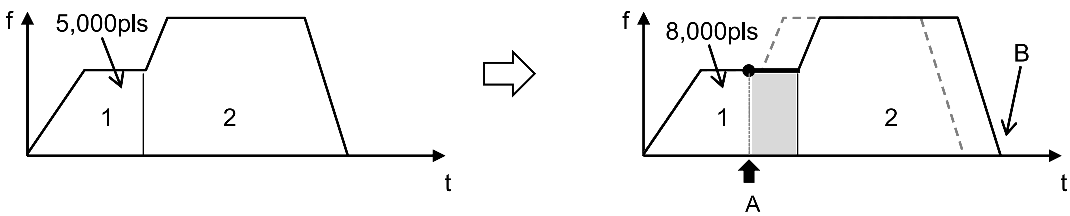
parameter	Set value
Control method	Incremental
Positioning movement amount (Before change)	10,000 (pls)
Positioning movement amount (After change)	1,000 (pls)



A	Movement amount change request contact ON

■ Example of Operation (3): When continuous table operation is performed (incremental)

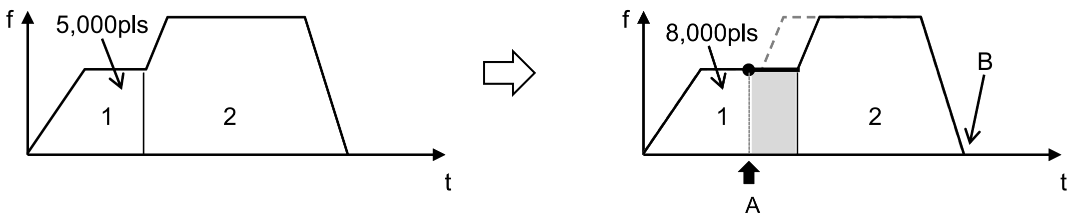
parameter	Set value
Control method	Incremental
First table positioning movement amount (Before change)	5,000 (pls)
First table positioning movement amount (After change)	8,000 (pls)



A	Movement amount change request contact ON
B	Because “Incremental” is set, the stopping position in Table 2 also changes.

■ Example of Operation (4): When continuous table operation is performed (absolute)

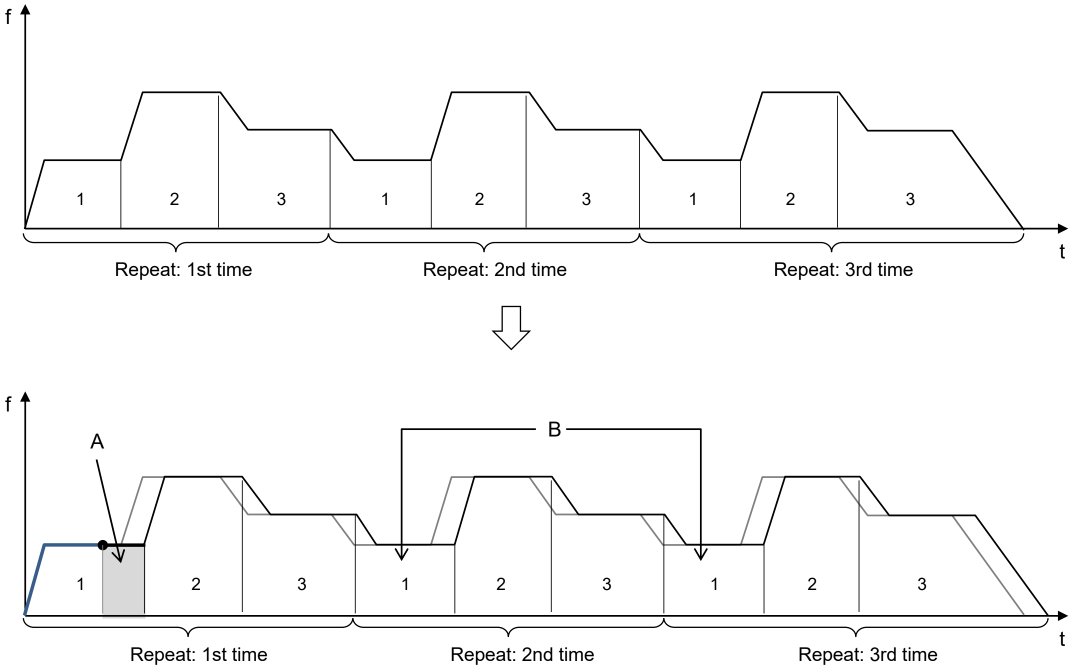
parameter	Set value
Control method	Absolute
First table positioning movement amount (Before change)	5,000 (pls)
First table positioning movement amount (After change)	8,000 (pls)



A	Movement amount change request contact ON
B	Because “Absolute” is set, the stopping position in Table 2 does not change.

■ Example of operation (For repetitive operations)

When the movement amount change function is executed during repetitive positioning operations, only the movement amount in the active table in the active repetition cycle is changed.



A	Only the movement amount in Table 1 in the first repetition cycle is changed to 8,000 pls.
B	The movement amounts in Table 1 in the second and third repetition cycles are not changed.

■ Auxiliary output when movement amounts are changed

When auxiliary output is set in Delay mode, even if the movement amount is changed, the auxiliary contact will turn ON at the position corresponding to the delay ratio relative to the pre-change movement amount. However, if the delay ratio is set to 100%, the auxiliary contact will turn ON upon completion of the operation.

(MEMO)

14 Precautions for programming

14.1 Precautions for programming

14.1.1 Turning Off Power Supply Clears Contents of Unit Memory

The unit memory data of the positioning unit will be cleared when the PLC is turned off.

14.1.2 Not Going to Other Operation from Current Operation

Automatic operation (positioning control) or manual operation (JOG operation, home return, or pulser operation) that has started with the start contact turned ON will continue even if the contact of other operation turns ON.

However, the stop operation (deceleration stop, emergency stop, system stop) can be executed during other types of operation.

14.1.3 Operation with the PLC Set to PROG. Mode from RUN Mode

Automatic operation (positioning control) or manual operation (JOG operation, home return, or pulser operation) that has started with the start contact turned ON will continue even if the PLC is switched to PROG. mode from RUN mode.

14.1.4 Types of Positioning Data Setting Areas

There are a standard area and an expansion area in the positioning data setting area, and they have the following characteristics. Use either of them according to the application.

■ Comparison of standard area and expansion area

Item	Standard area	Extended area
No. of positioning data tables	600 tables	25 tables +75 tables (Note 3)
Table No.	1 to 600	10001 to 10100 (Note 3)
Positioning parameter settings on Configurator PM7 (Note 1)	Available	Available
Positioning data settings on Configurator PM7 (Note 2)	Available Data that has been set is downloaded along with other project data including the program to the CPU unit. Positioning data will be calculated and each type of operation will be ready to start when the power is turned on or the CPU unit is set to RUN mode.	Not possible
Positioning data setting with user program (Note 2)	Available Each type of operation will be ready to start after the data is transferred to the	Available Each type of operation will be ready to start after the data is transferred to the

Item	Standard area	Extended area
	unit memory (UM) area with the user program and a recalculation request is made.	unit memory (UM) area with the user program. No recalculation request is required.
Characteristics	In the case of setting positioning data with the Configurator PM7, the start will be quicker than that with the extended area used.	In the case of setting positioning data with a user program, the start will be quicker than that with the standard area used.
application	Suitable to applications where the movement amount, target speed, and other positioning data are determined.	This is suitable for cases where positioning data fluctuates according to the operation results of the PLC.

(Note 1) Positioning parameters refer to operating conditions, such as the JOG operation and home return conditions along with the limit input logic, and deceleration stop time.

(Note 2) Positioning data refers to the individual positioning information such as the movement amount, target speed, acceleration and deceleration time, and operating pattern data, and other individual positioning information.

(Note 3) Table numbers 10026 to 10100 are available for the unit Ver.1.50 or later.

■ Calculation of reconstructing of standard area

The calculation of reconstruction (recalculation) will be required if the standard positioning data area is overwritten with a user program. If the data is not recalculated after rewriting the positioning table by the program, note that the operation will be executed with the previous positioning table. The recalculation procedure is as follows:

1. Change the positioning table in the unit memories.
2. Turn ON the recalculation request signal (Y7) in the I/O area.
3. Check that the recalculation completion signal (X7) in the I/O area turns ON, and start a desired type of operation.

Note

- The I/O numbers of the recalculation request signal (Y7) and the recalculation completion signal (X7) vary according to the value of the "Starting word number" allocated to the unit.

■ Unit memories of expansion areas

- In the expansion area, there are two areas, which are an expansion area 1 (for table numbers 10001 to 10025) and an expansion area 2 (for table numbers 10026 to 10100).
- The expansion area 2 (for table numbers 10026 to 10100) is available for the unit Ver.1.5 or later.

Expansion area 1

Table No.	1 axes	2 axes	3 axes	4 axes	Virtual axis
10001	UM 02E70	UM 05670	UM 07E70	UM 0A670	UM 14670
10002	UM 02E80	UM 05680	UM 07E80	UM 0A680	UM 14680
-	-	-	-	-	-
-	-	-	-	-	-
10024	UM 02FE0	UM 057E0	UM 07FE0	UM 0A7E0	UM 147E0
10025	UM 02FF0	UM 057F0	UM 07FF0	UM 0A7F0	UM 147F0

Expansion area 2

Table No.	1 axes	2 axes	3 axes	4 axes	Virtual axis
10026	UM 0A850	UM 0AD00	UM 0B1B0	UM 0B660	UM 0C920
10027	UM 0A860	UM 0AD10	UM 0B1C0	UM 0B670	UM 0C930
-	-	-	-	-	-
-	-	-	-	UM 0BAF0	-
10099	UM 0ACE0	UM 0B190	UM 0B640		UM 0CDB0
10100	UM 0ACF0	UM 0B1A0	UM 0B650	UM 0BB00	UM 0CDC0

Info.

- There are two extended areas for positioning tables. It is recommended to select an area with consecutive UM numbers according to the number of used tables.

Number of necessary tables	Area and table numbers to be used
1 to 25	Expansion area 1: Table numbers 10001 to 10025
26 to 75	Expansion area 2: Table numbers 10026 to 10100
76 to 100	Both the expansion areas 1 and 2 are used.

Info.

- For details of unit memory (UM) numbers in the expansion area, refer to "17.6.3 Positioning Data Setting Area".
- For details of the difference in program methods between the standard area and expansion area, refer to "18 Sample programs".

15 Errors and Warnings

15.1 About Errors and Warnings

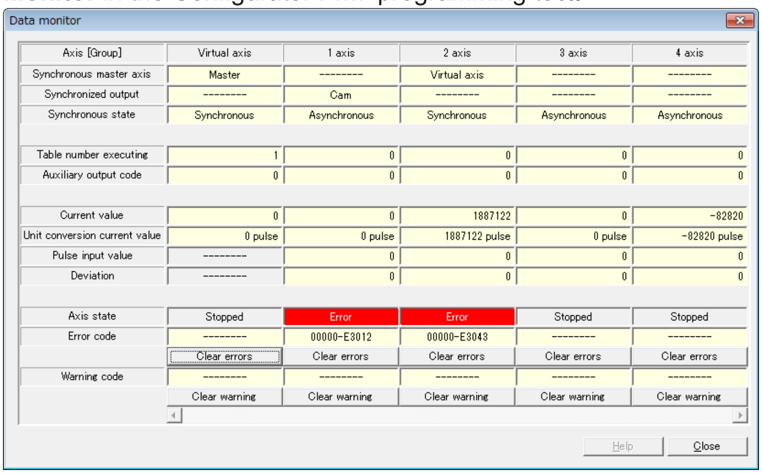
15.1.1 Errors and Warnings

If any operational unconformity occurs in the positioning unit, an error or warning will occur. When errors or warnings occur, the following operations are performed.

Error	An error occurs in any abnormal situation. When a motor is operating, the motor will stop operating if an error occurs. A motor that has stopped due to an error cannot be restarted until the error is cleared.
Warning	A warning occurs when there is an operational inconsistency rather than an abnormality. The operation can continue even after a warning occurs. When a motor is operating, it will continue operating even if a warning occurs.

15.1.2 Checking and Clearing Errors and Warnings on Configurator PM7

Errors and warnings can be checked and cleared for each axis by selecting **Online**>**Data Monitor** in the Configurator PM7 programming tool.


Data monitor

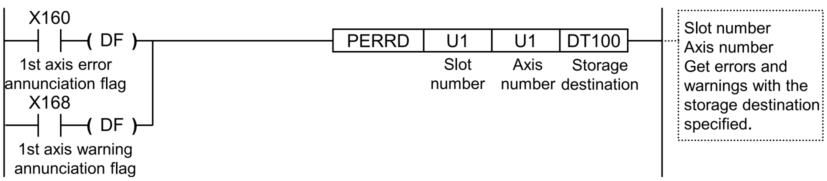
Axis [Group]	Virtual axis	1 axis	2 axis	3 axis	4 axis
Synchronous master axis	Master	--------	Virtual axis	--------	--------
Synchronized output	--------	Cam	--------	--------	--------
Synchronous state	Synchronous	Asynchronous	Synchronous	Asynchronous	Asynchronous
Table number executing	1	0	0	0	0
Auxiliary output code	0	0	0	0	0
Current value	0	0	1887122	0	-82820
Unit conversion current value	0 pulse	0 pulse	1887122 pulse	0 pulse	-82820 pulse
Pulse input value	--------	0	0	0	0
Deviation	--------	0	0	0	0
Axis state	Stopped	Error	Error	Stopped	Stopped
Error code	--------	00000-E3012	00000-E3043	--------	--------
	Clear errors	Clear errors	Clear errors	Clear errors	Clear errors
Warning code	--------	--------	--------	--------	--------
	Clear warning	Clear warning	Clear warning	Clear warning	Clear warning

Help Close

15.1.3 Check and Clearing with User Program

■ Check on error and warning information

- Use the dedicated command PERED (to get errors and warnings) and read information. Error codes and warning codes stored in buffer 1 will be read.

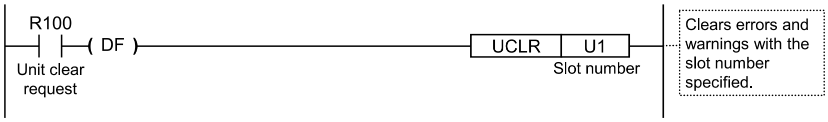


Error and warning codes are stored as shown below.

DT100	Error code
DT101	Warning code

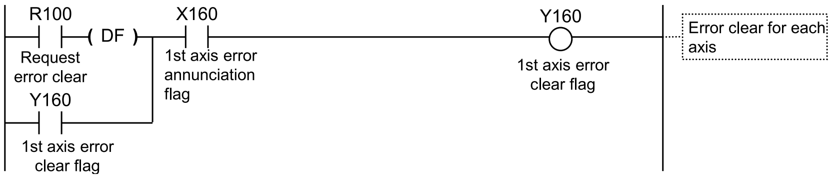
■ Clearing all axes with UCLR command

- When the dedicated UCLR command (to clear errors and warnings), the errors and warnings on all the axes of the positioning unit will be cleared.



■ Clearing each axis by I/O signals

- 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 I/O area. The following program is used for clearing errors.



■ Allocation of I/O signals

Signal name	1 axes	2 axes	3 axes	4 axes	Virtual axis
Error notification	X60	X61	X62	X63	X67
Warning notification	X68	X69	X6A	X6B	X6F
Error clearing request	Y60	Y61	Y62	Y63	Y67
Warning clearing request	Y68	Y69	Y6A	Y6B	Y6F

(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.

15.1.4 Error and Warning Logs

There are log areas to store the error/warning logs within the positioning unit.

Error log	Up to seven error codes can be stored for each axis.
Warning logs	Up to seven warning codes can be stored for each axis.

- When an error or warning occurs, the corresponding error or warning code is stored in the log area of the axis where the error or warning occurred.
- When an error/warning that is not related to axes occurs, such as an failure in the unit, the error/warning code will be stored in the log areas of all the axes.

- Only the latest error and warning codes for each axis can be checked from the positioning setting menu of the programming tool.
- When referring to the error and warning logs for each axis, read the following memory from the PLC.

Error log area (unit memory) Warning log area (unit memory)

UM 00128 ~ UM 00137	Error log area of axis 1
UM 00138 ~ UM 00147	Error log area of axis 2
UM 00148 ~ UM 00157	Error log area of axis 3
UM 00158 ~ UM 00167	Error log area of axis 4
UM 00198 ~ UM 001A7	Error log area of virtual axis

UM 00128	—
UM 00129	No. of occurrences of errors
UM 0012A UM 0012B	Error code annunciation buffer 1
UM 0012C UM 0012D	Error code annunciation buffer 2
UM 0012E UM 0012F	Error code annunciation buffer 3
UM 00130 UM 00131	Error code annunciation buffer 4
UM 00132 UM 00133	Error code annunciation buffer 5
UM 00134 UM 00135	Error code annunciation buffer 6
UM 00136 UM 00137	Error code annunciation buffer 7

UM 001C0 ~ UM 001CF	Warning log area of axis 1
UM 001D0 ~ UM 001DF	Warning log area of axis 2
UM 001E0 ~ UM 001EF	Warning log area of axis 3
UM 001F0 ~ UM 001FF	Warning log area of axis 4
UM 00230 ~ UM 0023F	Warning log area of virtual axis

UM 001C0	—
UM 001C1	No. of occurrences of warnings
UM 001C2 UM 001C3	Warning code annunciation buffer 1
UM 001C4 UM 001C5	Warning code annunciation buffer 2
UM 001C6 UM 001C7	Warning code annunciation buffer 3
UM 001C8 UM 001C9	Warning code annunciation buffer 4
UM 001CA UM 001CB	Warning code annunciation buffer 5
UM 001CC UM 001CD	Warning code annunciation buffer 6
UM 001CE UM 001CF	Warning code annunciation buffer 7

Number of error/warning occurrences	Stores the number of occurrences of errors and warnings.
Error/warning notification buffers	Stores error and warning codes. Errors and warnings are stored in chronological order beginning with buffer 1, followed by buffer 2, 3, etc.

15.2 Changes in Recovery from Errors

15.2.1 Overview

The method for recovering from errors differs according to the state at the time of error occurrence.

State at the time of error occurrence	Description	Error type
Recoverable status (Yes)	● After an error occurs, the operating axis stops. ● After an error occurs, the Positioning Unit can recover from the error at any timing.	All error types
Non-recoverable status (×)	● A critical error on the positioning unit system. ● When a non-recoverable error occurs, the power must be turned OFF and then ON.	System Error Axis operation error

15.3 Error Code Table

15.3.1 System Errors (From 1000H)

These are the errors that occur due to any failure within the positioning unit. System errors are defined as fatal errors for the system. Except for some errors, the power must be turned OFF and then ON to recover from the errors.

Error code	Error name	Description	Object	Recovered	Countermeasures
1000H	System out of control	The system is running out of control. If the error occurs, the ALARM LED on the positioning unit will be lit	All axes	×	Turn the power off and then on. If the error occurs repeatedly, please contact our sales office.
1001H	Hardware error	An error has occurred in a hardware test with the power supply turned on	All axes	×	
1002H	Unit error	Some sort of error occurred in internal processing.	All axes	×	
1003H	System processing error	An error occurred in system processing for some reason.	All axes	Yes	Check the settings. If the error occurs repeatedly when the set values are all correct, please contact our sales office.
1020H	Tool operation abnormal end	An error occurred in communication with the PC when tool operation was performed using the positioning setting menu of the programming tool.	All axes	Yes	Check the connection of the cable connecting the PC and PLC. Restart the PC.
1030H	CPU unit error	ALARM occurred in the CPU unit	All axes	×	Check the condition of the CPU unit. Turn the power off and then on.
1031H	CPU unit operation mode error	The system in operation has come to a stop because the CPU unit is switched to PROG. Mode.	All axes	Yes	Check the condition of the CPU unit. Set the CPU unit to RUN Mode.

15.3.2 Axis Operation Errors (From 3000H)

These errors occur while various operations are being executed.

Error code	Error name	Description	Object	Recovered	Countermeasures
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 performing an operation such as JOG operation. Check if the limit signals are normal.

Error code	Error name	Description	Object	Recovered	Countermeasures
3011H	Limit - signal detection	The input on the minus side of the limit turned ON.	Each axis	Yes	
3012H	Limit signal error	Inputs on both the plus and minus sides of the limit turned ON.	Each axis	Yes	Check the status of the limit signal.
3020H	Soft limits: (Plus side) detection	The movement amount of the motor exceeded the upper limit value of the soft limit.	Each axis	Yes	Move the motor into the range of the soft limit by performing an operation such as JOG operation. Check the set values of the soft limit.
3021H	Soft limits: (Minus side) detection	The movement amount of the motor exceeded the lower limit value of the soft limit.	Each axis	Yes	
3025H	Command speed calculation error 1	In the internal calculation process of the command speed, the calculation failed due to an overflow.	Each axis	Yes	Lower the set speed. Check the specified number of pulses per revolution and the specified movement amount per revolution.
3026H	Command speed calculation error 2		Each axis	Yes	
3027H	Command speed calculation error 3		Each axis	Yes	
3030H	Axis operation error	An error occurred in the operation processing of each axis.	Each axis	Yes	Check the set values and parameters of positioning data. If the error occurs repeatedly when the set values are all correct, please contact our sales office.
3031H	Operation abnormal termination	An error occurred in the operation processing of each axis.	Each axis All axes	Yes	If the error occurs repeatedly, please contact our sales office.
3032H	Axis group operation error	The settings of the axis group were changed during operation or while a stop request was being issued. The settings of the axis group are out of range.	Each axis	Yes	Change the axis group while the axes are stopped. Do not issue a stop request. Check the axis group settings.
3033H	Interpolation operation error	The operation stopped as an error occurred on another interpolation axis during interpolation operation.	Each axis	Yes	Check the set values of positioning data for interpolation operation. If the error occurs repeatedly when the set values are all correct, please contact our sales office.
3034H	Axis group not settable (In	The axis group settings were changed during pulser operation.	Each axis	Yes	Change the axis group when the pulser operation enabled signal is OFF.

Error code	Error name	Description	Object	Recovered	Countermeasures
	pulser operation)				
3035H	Positioning movement amount error	The positioning movement amount has exceeded the upper or lower limit value.	Each axis	Yes	Check the set values.
3043H	Synchronous operation error	The operation was stopped as an error occurred on another axis during synchronous operation.	Each axis	Yes	Check the unit settings of the stopped axis. If the error occurs repeatedly when the set values are all correct, please contact our sales office.
3046H	Automatic movement amount check error	The automatic movement amount check function has detected that the difference between the instruction value and feedback value is in excess of the preset automatic movement amount.	Each axis	Yes	Check the operation of the target axes. Check the parameters of the automatic check function of movement amount.

15.3.3 Set Value Errors (From 4000H)

The following errors occur to various set values made in the positioning setting menu of the programming tool and ladder programs.

Error code	Error name	Description	Object	Recovered	Countermeasures
4000H	Axis group setting error	The settings of axis groups are incorrect.	Each axis	Yes	Check the following items in the settings of the axis group and independent axis. ● The same axis number is registered in more than one group. ● Four or more axes are set in one group. ● The axis 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 following: pulse, μm, inch, degree
4004H	Pulse number error per rotation	The number of pulses is out of range.	Each axis	Yes	Check the set values. If the setting value is out of range, reduce the fraction with the following formula. (Pulse number per rotation) / (Movement amount per rotation)
4005H	Movement amount error per rotation	The movement amount is out of range.	Each axis	Yes	
4010H	Soft limit setting error	The upper or lower limit value of software limit is out of the range.	Each axis	Yes	Check the set values. If the error occurs repeatedly when the set values are all

Error code	Error name	Description	Object	Recovered	Countermeasures
4020H	Limit stop deceleration time error	The limit stop deceleration time is out of range.	Each axis	Yes	correct, please contact our sales office.
4021H	Error stop deceleration time error	The error stop deceleration time is out of range.	Each axis	Yes	
4022H	Emergency stop deceleration time error	The emergency stop deceleration time is out of range.	Each axis	Yes	
4028H	Auxiliary output setting error	The settings of auxiliary output are invalid. A mode other than With mode or Delay mode has been set for the auxiliary output mode. The auxiliary output delay ratio while the positioning unit is in Delay mode is not 0 to 100 (%).	Each axis	Yes	
4042H	Pulser setting error	The pulser input mode is incorrect. The pulser operation method is incorrect. The maximum pulser operation speed is incorrect.	Each axis	Yes	
4043H	Pulse operation disabled error	The pulse input application of the axis to which pulses are permitted to be input from the pulser is not set to Pulser.	Each axis	Yes	Check the pulse input application. When using a pulser, set the input application to "Pulser".
4044H	Speed rate error	The setting of the speed rate is out of range.	Each axis	Yes	Check the set values. If the error occurs repeatedly when the set values are all correct, please contact our sales office.
4050H	Startup speed error	The startup speed is out of the range.	Each axis	Yes	
4080H	JOG positioning Acceleration/ deceleration method error	The acceleration/deceleration method for JOG positioning operation is out of range.	Each axis	Yes	
4081H	JOG positioning Acceleration time error	The acceleration time of JOG positioning operation is out of range.	Each axis	Yes	
4082H	JOG positioning Deceleration time error	The deceleration time of JOG positioning operation is out of range.	Each axis	Yes	
4083H	JOG positioning Target speed error	The target speed of JOG positioning operation is out of range.	Each axis	Yes	
4102H	Stop-on-contact torque value for home return	The target speed of home return is out of range.	Each axis	Yes	

Error code	Error name	Description	Object	Recovered	Countermeasures
	Target speed error				
4105H	Stop-on-contact torque value for home return Acceleration time error	The acceleration time of home return is out of range.	Each axis	Yes	
4106H	Stop-on-contact torque value for home return Deceleration time error	The deceleration time of home return is out of range.	Each axis	Yes	
4107H	Stop-on-contact torque value for home return Setting code error	The home return setting code is invalid.	Each axis	Yes	
4110H	Home return creep speed error	The creep speed of home return is out of range.	Each axis	Yes	
4111H	Stop-on-contact torque value for home return return direction error	The moving direction of home return is invalid.	Each axis	Yes	
4112H	Home return limit error	The limit switch is disabled. (It occurs when the home return method is set to the limit method 1 or 2.)	Each axis	Yes	
4113H	Home return disable error by synchronous setting	The pulse input application for the target axis is set to feedback and the pulse input is set to synchronous master.	Each axis	Yes	
4120H	Home position coordinate error	The specified coordinates of the home position are out of range.	Each axis	Yes	
4201H	JOG operation target speed error	The target speed of JOG operation is out of range.	Each axis	Yes	
4203H	JOG operation acceleration/ deceleration type error	The acceleration/deceleration method for JOG operation is invalid.	Each axis	Yes	
4204H	JOG operation acceleration time error	The acceleration time of JOG operation is out of range.	Each axis	Yes	
4205H	JOG operation deceleration time error	The deceleration time of JOG operation is out of range.	Each axis	Yes	

Error code	Error name	Description	Object	Recovered	Countermeasures
4044H	Speed rate error	The setting of the speed rate is out of range.	Each axis	Yes	
4250H	Current value update error	The set value of current value updating is out of range.	Each axis	Yes	
4301H	Absolute/ incremental setting error	A value other than "Absolute" or "Incremental" is set for the control method.	Each axis	Yes	
4302H	Dwell time error	The set value of dwell time is out of range.	Each axis	Yes	
4303H	Positioning starting table No. error	The specified table number is 0 or greater than the maximum table number.	Each axis	Yes	
4304H	Table setting error	The last table of the positioning setting tables is not a table specifying E-point.	Each axis	Yes	
4400H	Positioning movement amount setting error	The movement amount of positioning operation is out of range.	Each axis	Yes	
4401H	Positioning acceleration/ deceleration type error	The acceleration/deceleration method of positioning operation is invalid.	Each axis	Yes	
4402H	Positioning acceleration time error	The acceleration time of positioning operation is out of range.	Each axis	Yes	
4403H	Positioning deceleration time error	The deceleration time of positioning operation is out of range.	Each axis	Yes	
4404H	Positioning target speed error	The target speed of positioning operation is out of range.	Each axis	Yes	
4500H	Interpolation type error	The specified interpolation type is invalid.	Each axis	Yes	
4504H	Circular interpolation not executable	Circular interpolation parameters (such as center point or pass point) are invalid.	Each axis	Yes	
4505H	Spiral interpolation not executable	As the set value is invalid, an error occurred during spiral interpolation execution.	Each axis	Yes	
4510H	Positioning speed change speed error	The positioning speed change speed is out of range.	Each axis	Yes	

Error code	Error name	Description	Object	Recovered	Countermeasures
4520H	Positioning movement amount change movement amount error	The positioning movement amount change movement amount is out of range.	Each axis	Yes	
4600H	Pulse input setting error	The specified pulse input mode is invalid.	Each axis	Yes	Check the set values. Check the combination of input mode, input multiplication, and input application.
4605H	Pulse count change value setting error	The specified new (post-change) pulse count value is out of range.	Each axis	Yes	Check the set values.
4609H	Automatic movement amount checking method setting error	The operation of the automatic check function of movement amount is incorrect	Each axis	Yes	
4610H	Numerator of automatic movement amount check correction setting error	The automatic movement amount correction numerator is out of the range.	Each axis	Yes	
4611H	Denominator of automatic movement amount check correction setting error	The automatic movement amount correction denominator is out of the range.	Each axis	Yes	
4613H	Automatic movement amount check interval setting error	The automatic movement amount check interval is out of the range.	Each axis	Yes	

15.3.4 Synchronization Parameter Setting Errors (From 5000H)

■ Synchronous parameter: Common error (from 5000H)

Error code	Error name	Description	Object	Recovered	Countermeasures
5000H	Synchronous master set value invalid	The settings for the synchronous master axis are invalid. ⇒ Setting error (Invalid values) ⇒ Own axis setting	Each axis	Yes	Check the set values. If the error occurs repeatedly when the set value is correct, please contact our sales office.

Error code	Error name	Description	Object	Recovered	Countermeasures
5001H	Synchronous master Pulse input application error	The pulse input other than "High-speed counter" application was selected when setting the synchronous master axis to pulse input.	Each axis	Yes	
5002H	Synchronous setting disable error	A synchronization setting request was issued in the following axis states. ● The local axis (slave axis) is set as the master axis for another axis. ● The master axis is set as a slave axis for another axis. ● The local axis (slave axis) belongs to an interpolation group.	Each axis	Yes	
5006H	Synchronous slave single deceleration stop deceleration time	The setting for synchronous slave single deceleration stop time is invalid.	Each axis	Yes	Check the set values. If the error occurs repeatedly when the set value is correct, please contact our sales office.

■ Synchronous parameter: Electronic gear related error (from 5100H)

Error code	Error name	Description	Object	Recovered	Countermeasures
5100H	Electronic gear Gear ratio numerator setting error	Electronic gear The setting for the gear ratio numerator is invalid	Each axis	Yes	Check the set values. If the error occurs repeatedly when the set value is correct, please contact our sales office.
5101H	Electronic gear Gear ratio denominator setting error	Electronic gear The setting for the gear ratio denominator is invalid	Each axis	Yes	
5102H	Electronic gear Gear ratio change time setting error	Electronic gear The setting for the gear ratio change time is invalid	Each axis	Yes	

■ Synchronization Parameters: Electronic clutch related errors (from 5200H)

Error code	Error name	Description	Object	Recovered	Countermeasures
5200H	Electronic clutch	Electronic clutch The setting for the clutch ON trigger type is invalid	Each axis	Yes	Check the set values. If the error occurs repeatedly when the set value is correct, please contact our sales office.

Error code	Error name	Description	Object	Recovered	Countermeasures
	Clutch ON trigger type setting error				
5201H	Electronic clutch Clutch ON edge selection setting error	Electronic clutch The setting for the clutch ON edge selection is invalid	Each axis	Yes	
5203H	Electronic clutch Clutch OFF trigger type setting error	Electronic clutch The setting for the clutch OFF trigger type is invalid	Each axis	Yes	
5204H	Electronic clutch Clutch OFF edge selection setting error	Electronic clutch The setting for the clutch OFF edge selection is invalid	Each axis	Yes	
5207H	Electronic clutch Clutch ON method setting error	Electronic clutch The setting for the clutch ON method is invalid	Each axis	Yes	
5208H	Electronic clutch Clutch ON slip method setting error	Electronic clutch The setting for the clutch ON slip method is invalid	Each axis	Yes	
5209H	Electronic clutch Clutch ON slip time setting error	Electronic clutch The setting for the clutch ON slip time is invalid	Each axis	Yes	
5210H	Electronic clutch Clutch ON slip curve selection setting error	Electronic clutch The setting for the clutch ON slip curve selection is invalid	Each axis	Yes	
5211H	Electronic clutch Clutch OFF method setting error	Electronic clutch The setting for the clutch OFF method is invalid	Each axis	Yes	
5212H	Electronic clutch Clutch OFF slip method setting error	Electronic clutch The setting for the clutch OFF slip method is invalid	Each axis	Yes	

Error code	Error name	Description	Obj ect	Rec over ed	Countermeasures
5213H	Electronic clutch Clutch OFF slip time setting error	Electronic clutch The setting for the clutch OFF slip time is invalid	Eac h axis	Yes	
5214H	Electronic clutch Clutch OFF Slip curve selection setting error	Electronic clutch The setting for the clutch OFF slip curve selection is invalid	Eac h axis	Yes	

■ Synchronization Parameters: Electronic cam related errors (from 5300H)

Error code	Error name	Description	Obj ect	Rec over ed	Countermeasures
5300H	Electronic cam Cam control synchronous Master axis cycle setting error	Electronic cam The setting for the cam control synchronous master axis cycle is invalid	Eac h axis	Yes	Check the set values. If the error occurs repeatedly when the set value is correct, please contact our sales office.
5301H	Electronic cam Used cam pattern number setting error	Electronic cam The used cam pattern number used is out of range The cam pattern number to be used is unregistered.	Eac h axis	Yes	
5302H	Electronic cam Cam stroke amount setting error	Electronic cam The setting for the cam stroke amount is invalid	Eac h axis	Yes	

■ Cam pattern related errors (from 5400H)

Error code	Error name	Description	Obj ect	Rec over ed	Countermeasures
5400H	Cam pattern Resolution setting error	Electronic cam The setting for cam pattern resolution is out of range	Eac h axis	Yes	Check the set values. If the error occurs repeatedly when the set value is correct, please contact our sales office.
5401H	Cam pattern count setting error	Electronic cam The specified number of cam patterns is out of range	Eac h axis	Yes	
5402H	Cam pattern section function setting error	Electronic cam The setting for the cam pattern section function is out of range	Eac h axis	Yes	

Error code	Error name	Description	Object	Recovered	Countermeasures
5403H	Cam pattern control start position setting error	Electronic cam The setting for the cam pattern control start position (shift) is out of range	Each axis	Yes	
5404H	Cam pattern Start phase setting error	Electronic cam The start phase setting for each section of cam patterns is out of range	Each axis	Yes	
5405H	Cam pattern displacement setting error	Electronic cam The displacement for each section of cam patterns is out of range	Each axis	Yes	
5406H	Cam pattern Cam curve no. setting error	Electronic cam The curve number for each section of cam patterns is out of range	Each axis	Yes	
5410H	Adjustment data total count setting error	Electronic cam The total number of cam pattern adjustment data items is out of range	Each axis	Yes	
5411H	Adjustment data count setting error	Electronic cam The number of cam pattern adjustment data items is out of range (for each cam pattern)	Each axis	Yes	
5413H	Adjustment data control point setting error	Electronic cam The control point of cam pattern adjustment data is out of range	Each axis	Yes	
5414H	Adjustment data out-of-range setting error	Electronic cam The adjustment value of cam pattern adjustment data is out of range	Each axis	Yes	

15.4 Warning Code List

15.4.1 Unit Warnings (From B000H)

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

Error code	Error name	Description	Object	Recovered	Countermeasures
B010H	Duplicate startup	An attempt was made to start the operation of an axis when its previous operation had not finished.	Each axis	Yes	An operation request cannot be issued to any axis that is currently operating. However, the following requests can be issued even when the target axis is operating. ● Deceleration stop request flag (for each axis) ● Emergency stop request flag (for each axis) ● System stop request flag (for all axes)
B020H	Non-existent axis started	A positioning operation request was executed on a non-existent axis.	Each axis	Yes	● Check the axis settings. ● Check the positioning operation start.
B030H	J-point simultaneous startup warning	The "J-point speed change contact" and "J-point positioning start contact" turn ON simultaneously during the JOG positioning (J-point) operation. The J-point contacts are turned ON while the system is accelerating or decelerating	Each axis	Yes	When both contacts turn ON simultaneously, the "J-point positioning start contact" will have priority, and the "J-point speed change contact" will be ignored. Make settings so that the J-point speed change contact will be turned ON while the positioning unit is in operation at constant speed.
B031H	J-point speed change request warning	The J-point speed change contact turned ON when J-point operation is not active.	Each axis	Yes	Check the timing that the J-point speed change request contact turns ON.
B032H	J-point positioning start request warning	The J-point positioning start contact turned ON while J-point control was inactive.	Each axis	Yes	Check the timing that the J-point positioning start contact turns ON.
B045H	Synchronous axis difference check warning	The difference between the movement amounts of the target axes in synchronous operation has exceeded the specified difference threshold. This warning occurs when the synchronous operation mode and synchronous difference check function are set to "Warning".	Each axis	Yes	Check the operation of the target axes for the synchronous operation.
B046H	Automatic movement amount check warning	The difference between the command value and feedback value exceeded the specified movement amount automatic check value with the movement amount automatic check function.	Each axis	Yes	Check the operation of the target axes.

Error code	Error name	Description	Object	Recovered	Countermeasures
		This warning occurs when the operation of the automatic check function of movement amount is set to "Warning".			
B048H	Automatic movement amount check warning 2	The difference between the command value and feedback value exceeded the specified movement amount automatic check value with the movement amount automatic check function. This warning occurs under the following conditions. ● When the command value and feedback value (pulse input) exceeds the check value when the pulse count value has been changed. ● When the command value and feedback value exceeds the check value while home return is not performed.	Each axis	Yes	Check the operation of the target axes.
B050H	Out-of-range output speed over limit warning	The output exceeds the upper limit for each model by over 10%. Transistor type: 500 Kpps Line driver type: 4 Mpps	Each axis	Yes	Check the setting for the operation speed of the target axes.
B060H	Positioning speed change rejection warning (during other than positioning)	The positioning speed change request turned ON while a positioning operation was not being performed.	Each axis	Yes	Check the timing of the speed change request turning ON.
B062H	Positioning speed change rejection warning (during J-point operation)	The positioning speed change request turned ON during a J-point operation.	Each axis	Yes	
B063H	Positioning speed change rejection warning (for synchronous slave axes)	The positioning speed change request for synchronous slave axes turned ON.	Each axis	Yes	
B064H	Positioning speed change rejection warning (upon completion of positioning output)	The positioning speed change request turned ON after positioning output was completed.	Each axis	Yes	
B065H	Positioning speed change rejection warning (during	The positioning speed change request turned ON during the processing of a positioning stop.	Each axis	Yes	

Error code	Error name	Description	Object	Recovered	Countermeasures
	positioning stop processing)				
B066H	Positioning speed change rejection warning (during dwell time processing)	The positioning speed change request turned ON during positioning dwell time processing.	Each axis	Yes	
B070H	Positioning movement amount change rejection warning (during other than positioning)	The positioning movement amount change request turned ON while a positioning operation was not being performed.	Each axis	Yes	Check the timing of the movement amount change request turning ON.
B071H	Positioning movement amount change rejection warning (during interpolation operation)	The positioning movement amount change request turned ON during an interpolation operation.	Each axis	Yes	
B072H	Positioning movement amount change rejection warning (during J-point operation)	The positioning movement amount change request turned ON during a J-point operation.	Each axis	Yes	
B073H	Positioning movement amount change rejection warning (for synchronous slave axes)	The positioning movement amount change request for synchronous slave axes turned ON.	Each axis	Yes	
B074H	Positioning movement amount change rejection warning (upon completion of positioning output)	The positioning movement amount change request turned ON after positioning output was completed.	Each axis	Yes	
B075H	Positioning movement amount change rejection warning (during positioning stop processing)	The positioning movement amount change request turned ON during the processing of a positioning stop.	Each axis	Yes	
B076H	Positioning movement amount change rejection warning (during	The positioning movement amount change request turned ON during positioning dwell time processing.	Each axis	Yes	

Error code	Error name	Description	Obj ect	Rec over ed	Countermeasures
	dwell time processing)				
B100H	Synchronous setting change disable warning	The change of the synchronous setting was requested on an operating axis.	Eac h axis	Yes	Changing the synchronous setting should be performed when the busy signal for the axes to be synchronized is off.
B110H	Cam pattern table reading error warning	Processing in response to a cam pattern table read request terminated abnormally because the set values were invalid or the execution conditions were not satisfied.	All axes	Yes	● Confirm the setting values of the parameters required for reading cam patterns. ● Check whether there are any synchronized axes. If any, cancel the synchronous operation and read the cam pattern tables. * The details about the cause of the occurrence of this warning are stored in the "cam pattern reading result" area of unit memories.
B1111H	Cam pattern table rewriting error warning	Processing in response to a cam pattern table rewrite request terminated abnormally because the set values were invalid or the execution conditions were not satisfied.	All axes	Yes	● Check the set values of the parameters required for rewriting cam patterns. ● Check whether there are any synchronized axes. If so, cancel the synchronization before rewriting the cam pattern tables. * The details about the cause of the occurrence of this warning are stored in the "cam pattern rewriting result" area of unit memories.
B304H	Recalculation failure warning	An error occurred when recalculation processing was executed.	Eac h axis	Yes	Check the parameters and interpolation group settings for each axis.

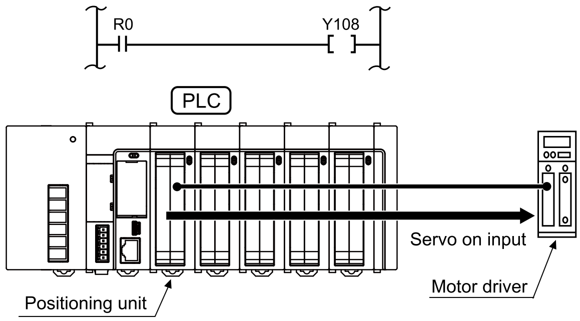
16 Troubleshooting

16.1 What to Do If an Error Occurs

16.1.1 Motor is not Rotating or Operating (Pulse Output A and B LEDs are Flashing or Lit)

■ Solution 1: Servo motor

Check that the servo input is ON.



■ Action 2

Check that the power to the driver is turned on.

■ Action 3

Check that the positioning unit and driver are wired correctly.

■ Action 4

Check that the pulse output coincides in setting (CW/CCW or Pulse/Sign setting) with the driver.

16.1.2 Motor is not Rotating or Operating (Pulse Output A and B LEDs are Off)

■ Solution

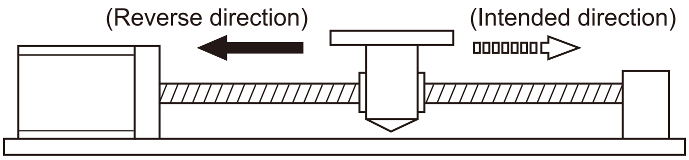
Review the program.

Points to check

1. Check whether the I/O numbers are correct.
2. Check whether the starting contact has been rewritten in the program.
3. Check the input logic of the over limit switch. (The error LED is lit if the logic is incorrect.)

16.1.3 Reversed Rotation or Movement Direction

[Example of reversed rotation or movement direction]



■ Action 1

Check that the positioning unit and driver are wired correctly.

Points to check

Check that the CW/CCW output or Pulse/Sign output is connected to the corresponding input of the driver.

■ Action 2

Change the pulse output rotation direction of each axis parameter to set the reversed rotating direction.

(MEMO)

17 Specifications

17.1 List of Specifications

17.1.1 General Specifications

Item	Specifications
Operating ambient temperature	0 to +55℃
Storage ambient temperature	-40 to +70℃
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)
Dielectric strength	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/s^2 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/s^2 min in X, Y, and Z directions three times each.
Noise resistance	1000 V [P-P], pulse width of 50 ns/1 μs (by noise simulator)
Atmosphere	Free from corrosive gases and excessive dust. and excessive dust
Overvoltage category	Category II
Pollution degree	Pollution degree 2
Internal current consumption	120mA or less
Weight	Approx. 145g

17.1.2 Performance Specifications

Item	Specifications			
	2-axis type		4-axis type	
Product number	**AFP7PP02T**	**AFP7PP02L**	**AFP7PP04T**	**AFP7PP04L**
Voltage output type	Transistor	Line driver	Transistor	Line driver
Number of axes controlled	2 axes		4 axes	
Interpolation control	2-axis linear interpolation 2-axis circular interpolation		2-axis linear interpolation, 3-axis linear interpolation 2-axis circular interpolation, 3-axis spiral interpolation	
No. of occupied I/O points	192 input points, 192 output points			

Item				Specifications			
				2-axis type		4-axis type	
Product number				**AFP7PP02T**	**AFP7PP02L**	**AFP7PP04T**	**AFP7PP04L**
Startup Speed				3 ms max. in standard area and 5 ms max. in expansion area			
Automatic operation	Position control	Position specification mode		Increment (specified relative position), Absolute (absolute positioning)			
		Position specification unit		Pulses 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)			
		Position command range		Pulse: -1,073,741,823 to +1,073,741,823 pulses µm (0.1 µm): -107,374,182.3 to +107,374,182.3 µm µm (1 µm): -1,073,741,823 to +1,073,741,823 µm inch (0.00001 inch): -10,737.41823 to +10,737.41823 inches inch (0.0001 inch): -107,374.1823 to +107,374.1823 inches degree (0.1 degree): -107,374,182.3 to +107,374,182.3 degrees degree (1 degree): -1,073,741,823 to +1,073,741,823 degrees			
		Speed command 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			
		Max. operation speed		500 kpps	4 Mpps	500 kpps	4 Mpps
		Acceleration/deceleration method		Linear acceleration/deceleration, S-shaped 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)			
		Number of positioning tables		For each axis: 600 tables in standard area and 100 tables in extended area (Note 1)			
		Control method	Single axis	PTP control (E- and C-point control), CP control (P-point control), JOG positioning control (J-point control)			
			2-axis interpolation	Linear interpolation: E-, P-, C-point control Composite speed or long axis speed specification			
				Circular interpolation: E-, P-, C-point control Center point or pass point specification			
			3-axis interpolation	Linear interpolation: E-, P-, C-point control Composite speed or long axis speed specification			
				Circular interpolation: E-, P-, C-point control Center point or pass point specification			
		Other functions		Dwell time: 0 to 32,767 ms (Settable by 1 ms), auxiliary output contact, auxiliary output code			

Item				Specifications			
				2-axis type		4-axis type	
Product number				**AFP7PP02T**	**AFP7PP02L**	**AFP7PP04T**	**AFP7PP04L**
	Synchronous operation	Master axis		Selectable from real axes, virtual axes and pulse inputs.			
		Slave axis		Max. of Axis-2 slave axis		Max. of Axis-2 slave axis	
		Electronic gear	Operation setting	Gear ratio setting			
			Operation method	Direct method, acceleration/deceleration method			
		Electronic clutch		Clutch ON trigger: Contact input			
				Direct 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	4 to 6 (according to resolution)			
Manual operation	JOG operation	Speed command 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 method		Linear acceleration/deceleration, S-shaped 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)			
	Stop-on-contact torque value for home return	Speed command 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 method		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)			
		Home return method		DOG methods (3 types), limit methods (2 types), data set method, and home position method			
	Pulser operation (Note 2)			Operation synchronized with inputs from pulser			
Stop Functions	Stop Operation Types			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 0. The deceleration time of emergency stop, limit stop, error stop, deceleration stop and pause is 0 to 10,000 ms. (Settable by 1 ms.)			

<table>
<tr><th colspan="3" rowspan="2">Item</th><th colspan="4">Specifications</th></tr>
<tr><th colspan="2">2-axis type</th><th colspan="2">4-axis type</th></tr>
<tr><th colspan="3">Product number</th><th>AFP7PP02T</th><th>AFP7PP02L</th><th>AFP7PP04T</th><th>AFP7PP04L</th></tr>
<tr><td rowspan="4">Other specifications</td><td rowspan="3">High-speed Counter Function (Note 2)</td><td>Countable range</td><td colspan="4">Counting range -2,147,483,648 to 2,147,483,648 pulses</td></tr>
<tr><td>Max. counting speed</td><td colspan="4">1 MHz</td></tr>
<tr><td>Input mode</td><td colspan="4">2-phase (phase difference) input, direction discrimination input, and individual input (with multiplier function for each mode)</td></tr>
<tr><td colspan="2"></td><td colspan="4">2-point limit inputs, home input, near home input, servo ON output, deviation counter output, software limit function</td></tr>
</table>

(Note 1) From the unit Ver.1.5 or later, the positioning table expansion area has been increased from 25 points to 100 points.

(Note 2) The pulser operation function and high-speed counter function use the same pulse input terminal. Therefore, both functions cannot be used simultaneously.

17.2 Allocation of I/O Numbers

The following I/O numbers indicate offset addresses. The I/O numbers actually allocated are based on the first word number allocated to the unit.

Example) If the first word number of the unit is "10", the positioning ready signal will be X100.

Contact allocation		Target axis	Name	Description
WX0	X0	All axes	Ready positioning	Indicates that the unit is ready to operate internally, and announces the start of the system.
	X1	-	-	-
	X2	All axes	Cam table reading completion annunciation	Reads cam tables when the cam table reading request contact (Y2) turns ON. This contact turns ON after the completion of the reading of cam tables.
	X3	All axes	Cam table rewriting completion annunciation	Rewrites cam tables when the cam table rewriting request contact (Y3) turns ON. This contact turns ON after the completion of the rewriting of cam tables.
	X4	All axes	Tool operation in progress	Contact to indicate that the positioning unit is in tool operation. The start from I/O is not available during the Tool operation. A warning will occur if you attempt to do so.
	X5	All axes	Axis group 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	-	-	-
	X7	All axes	Recalculation completion	If the recalculation request contact (Y7) turns ON, the positioning data of the unit memory (standard area) will be restructured. This contact will turn ON after restructuring completes. 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 ladder programs.
	X8-XF	-	-	-
WX1	X10	1 axes	Servo lock	Turns ON only if there is servo ON output with servo ON signals (Y8 to YB).
	X11	2 axes		
	X12	3 axes		
	X13	4 axes		
	X14-X17	-	-	-
	X18	1 axes	BUSY	Turns ON when the corresponding axis is operating.
	X19	2 axes		
	X1A	3 axes		
	X1B	4 axes		
	X1C-X1E	-	-	-

Contact allocation		Target axis	Name	Description
	X1F	Virtual axis	BUSY	Turns ON when the virtual axis is operating.
WX2	X20	1 axes	Operation completion	Turns on when an operation command for the corresponding axis is completed. Turns ON when execution of all tables is completed for P-point control and C-point control of automatic operation. After this contact turns ON, the ON state continues until the next control is started.
	X21	2 axes		
	X22	3 axes		
	X23	4 axes		
	X24-X26	-	-	-
	X27	Virtual axis	Operation completion	Turns ON when the operation instruction to the virtual axis is completed.
	X28	1 axes	Home return completion	Turns ON when the home return operation for the corresponding axis is completed. After this contact turns ON, the ON state continues until the next control is started.
	X29	2 axes		
	X2A	3 axes		
	X2B	4 axes		
	X2C-X2E	-	-	-
	X2F	Virtual axis	Home return completion	Turns ON when the home return operation for the virtual axis is completed.
WX3	X30	1 axes	Home input	A contact to monitor external home position input signal for the corresponding axis. The input logic can be changed in the parameter-setting menu of the Configurator PM7.
	X31	2 axes		
	X32	3 axes		
	X33	4 axes		
	X34-X37	-	-	-
	X38	1 axes	Near home input	A contact to monitor external near home position input signal for the corresponding axis. The input logic can be changed in the parameter-setting menu of the Configurator PM7.
	X39	2 axes		
	X3A	3 axes		
	X3B	4 axes		
	X3C-X3F	-	-	-
WX4	X40-X47	-	-	-
	X48	1 axes	Auxiliary contact	Turns ON when the corresponding positioning table of the corresponding axis is executed.
	X49	2 axes		
	X4A	3 axes		
	X4B	4 axes		
	X4C - X4E	-	-	-
	X4F	Virtual axis	Auxiliary contact	Turns ON when the corresponding positioning table of the virtual axis is executed.
WX5	X50	1 axes	Limit +	Monitor contact of the limit + and limit –. During positioning operation, JOG operation, or pulser operation, deceleration stop is performed when a limit input that is located further in the operating direction turns ON.
	X51		Limit -	
	X52	2 axes	Limit +	

Contact allocation		Target axis	Name	Description
	X53		Limit -	The deceleration stop time during the limit input can be changed in the unit memory. This is used as a contact that reverses the motor automatically when home return is performed. The input logic can be changed in the parameter-setting menu of the Configurator PM7.
	X54	3 axes	Limit +	
	X55		Limit -	
	X56	4 axes	Limit +	
	X57		Limit -	
	X58-X5F	-	-	-
WX6	X60	1 axes	Error notification	Turns ON when an error occurs on the corresponding axis. The contacts of all axes turn ON if all axes have errors. The details of the error can be confirmed in the error annunciation area of the unit memory.
	X61	2 axes		
	X62	3 axes		
	X63	4 axes		
	X64-X66	-	-	-
	X67	Virtual axis	Error notification	Turns ON when an error occurs on the virtual axis.
	X68	1 axes	Warning notification	Turns ON when a warning occurs on the corresponding axis. The contacts of all axes turn ON if a warning occurs on all axes. The details of the warning can be confirmed in the warning annunciation area of the unit memory.
	X69	2 axes		
	X6A	3 axes		
	X6B	4 axes		
	X6C-X6E	-	-	-
	X6F	Virtual axis	Warning notification	Turns ON when a warning occurs on the virtual axis.
WX7	X70-X7F	-	-	-
WX8	X80	1 axes	Synchronization setting completion	After the settings of synchronous control are changed with the program, synchronization settings in the unit are changed when the synchronization setting request contact (Y80 to Y83) is turned ON. The contact turns ON upon completion of the setting changes. This contact turns OFF when the synchronization setting request contact (Y80 to Y83) is turned OFF.
	X81	2 axes		
	X82	3 axes		
	X83	4 axes		
	X84-X87	-	-	-
	X88	1 axes	Synchronization cancellation in-progress notification	Turns ON when the synchronous operation of the positioning unit is canceled with the synchronous setting cancel request contact (Y88 to Y8B) turned ON. Synchronous operation cannot be executed on the axes for which this contact is turned ON.
	X89	2 axes		
	X8A	3 axes		
	X8B	4 axes		
	X8C-X8F	-	-	-
WX9	X90	1 axes	Slave axis Gear ratio change annunciation	Makes gear ratio changes with the slave axis gear ratio change request contact (Y90 to Y93) The contact for the corresponding axis will turn ON after the gear ratio is changed.
	X91	2 axes		
	X92	3 axes		
	X93	4 axes		
	X94-X97	-	-	-
	X98	1 axes	Slave axis	The clutch will start operating when the slave axis clutch ON re-request contact (Y98 to Y9B) or clutch OFF request contacts (Y100 to 103) turn ON.

Contact allocation		Target axis	Name	Description
	X99	2 axes	clutch operation notification	After the clutch operation is completed, the contact for the corresponding axis turns ON.
	X9A	3 axes		
	X9B	4 axes		
	X9C-X9F	-	-	-
WX10	X100-X10F	-	-	-
WX11	X110	1 axes	positioning speed change request reception annunciation	Starts the speed change operation when the positioning speed change request contact (Y110 to Y113) turns ON. Contacts for corresponding axes (X110 to X113) will turn ON when he request is accepted.
	X111	2 axes		
	X112	3 axes		
	X113	4 axes		
	X114-X116	-	-	-
	X117	Virtual axis	positioning speed change request reception annunciation	Starts the speed change operation when the positioning speed change request contact (Y117) turns ON. The contact for the corresponding axis (X117) will turn ON when he request is accepted.
	X118	1 axes	positioning movement amount change request reception annunciation	Starts the movement amount change operation when the positioning movement amount change request contact (Y118 to Y11B) turns ON. Contacts for corresponding axes (X118 to X11B) will turn ON when he request is accepted.
	X119	2 axes		
	X11A	3 axes		
	X11B	4 axes		
	X11C-X11E	-	-	-
	X11F	Virtual axis	positioning movement amount change request reception annunciation	Starts the movement amount change operation when the positioning movement amount change request contact (Y11F) turns ON. The contact for the corresponding axis (X11F) will turn ON when he request is accepted.
WY0	Y0	All axes	System stop	Contact for requesting system stoppage. When it turns ON, all axes stop at zero deceleration time.
	Y1	-	-	-
	Y2	All axes	Cam table reading request	Turn ON this signal for reading cam tables. The cam table of a specified cam pattern number will be read when this signal turns ON.
	Y3	All axes	Cam table rewriting request	Turn ON this signal for rewriting cam tables. The cam table of a specified cam pattern number will be rewritten when this signal turns ON.
	Y4	-	-	-
	Y5	All axes	Axis group setting change request	This contact will turn ON after the axis group settings are changed.

<table>
<tr><th colspan="2">Contact allocation</th><th>Target axis</th><th>Name</th><th>Description</th></tr>
<tr><td rowspan="7"></td><td>Y6</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Y7</td><td>All axes</td><td>Recalculation request</td><td>Turns ON this signal when each positioning data (standard area) in the unit memory was changed.
The positioning data after the table number starting the recalculation specified in the unit memory can be restructured and will be executable by turning ON this signal.
When re-creation of positioning data is complete, the recalculation completion contact (X7) turns ON.
Note) It is used only when the positioning data has been rewritten by ladder programs.</td></tr>
<tr><td>Y8</td><td>1 axes</td><td rowspan="4">Servo ON</td><td rowspan="4">The servo ON signal for the corresponding axis turns ON at the ON edge of this contact.
The servo ON signal will not turn OFF automatically while the positioning unit is in program mode.
To turn OFF the servo ON signal, turn ON the servo OFF request (Y50 to Y53).
(The operation is the edge type.)</td></tr>
<tr><td>Y9</td><td>2 axes</td></tr>
<tr><td>YA</td><td>3 axes</td></tr>
<tr><td>YB</td><td>4 axes</td></tr>
<tr><td>YC-YF</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td rowspan="13">WY1</td><td>Y10</td><td>1 axes</td><td rowspan="4">Positioning startup</td><td rowspan="4">Requests the positioning control of the corresponding axis.
The starting table is specified in the area for specifying the positioning control starting table number in the unit memory.
(The operation is the edge type.)
If this contact turns ON while the positioning unit is in tool operation, a warning will be output.</td></tr>
<tr><td>Y11</td><td>2 axes</td></tr>
<tr><td>Y12</td><td>3 axes</td></tr>
<tr><td>Y13</td><td>4 axes</td></tr>
<tr><td>Y14-Y16</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Y17</td><td>Virtual axis</td><td>Positioning startup</td><td>Requests the positioning control of the virtual axis.</td></tr>
<tr><td>Y18</td><td>1 axes</td><td rowspan="4">Home return startup</td><td rowspan="4">Requests the home return of the corresponding axis.
(The operation is the edge type.)
If this contact turns ON while the positioning unit is in tool operation, a warning will be output.</td></tr>
<tr><td>Y19</td><td>2 axes</td></tr>
<tr><td>Y1A</td><td>3 axes</td></tr>
<tr><td>Y1B</td><td>4 axes</td></tr>
<tr><td>Y1C-Y1E</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Y1F</td><td>Virtual axis</td><td>Home return startup</td><td>Requests the home return of the virtual axis. The home return of the virtual axis is possible only by "data setting".</td></tr>
<tr style="display:none"></tr>
<tr><td rowspan="9">WY2</td><td>Y20</td><td rowspan="2">1 axes</td><td>Forward JOG</td><td rowspan="8">Requests the JOG operation for the corresponding axis.
(The operation is the level type.)
If this contact turns ON while the positioning unit is in tool operation, a warning will be output.</td></tr>
<tr><td>Y21</td><td>Reverse JOG</td></tr>
<tr><td>Y22</td><td rowspan="2">2 axes</td><td>Forward JOG</td></tr>
<tr><td>Y23</td><td>Reverse JOG</td></tr>
<tr><td>Y24</td><td rowspan="2">3 axes</td><td>Forward JOG</td></tr>
<tr><td>Y25</td><td>Reverse JOG</td></tr>
<tr><td>Y26</td><td rowspan="2">4 axes</td><td>Forward JOG</td></tr>
<tr><td>Y27</td><td>Reverse JOG</td></tr>
<tr><td>Y28-Y2D</td><td>-</td><td>-</td><td>-</td></tr>
</table>

Contact allocation		Target axis	Name	Description
	Y2E	Virtual axis	Forward JOG	Requests the JOG operation of the virtual axis. (The operation is the level type.)
	Y2F		Reverse JOG	
WY3	Y30	1 axes	Emergency stop	Requests the emergency stop of the corresponding axis. (The operation is the level type.) Note) The deviation counter cannot be cleared.
	Y31	2 axes		
	Y32	3 axes		
	Y33	4 axes		
	Y34-Y36	-	-	-
	Y37	Virtual axis	Emergency stop	Requests the emergency stop of the virtual axis.
	Y38	1 axes	Deceleration stop	Requests the deceleration stop of the corresponding axis. (The operation is the level type.) Note) The deviation counter cannot be cleared.
	Y39	2 axes		
	Y3A	3 axes		
	Y3B	4 axes		
	Y3C-Y3E	-	-	-
	Y3F	Virtual axis	Deceleration stop	Requests the deceleration stop of the virtual axis.
WY4	Y40	1 axes	Pulser operation enabled	Requests the permission for the pulser operation of the corresponding axis. (The operation is the level type.)
	Y41	2 axes		
	Y42	3 axes		
	Y43	4 axes		
	Y44-Y46	-	-	-
	Y47	Virtual axis	Pulser operation enabled	Requests the permission for the pulser operation of the virtual axis.
	Y48	1 axes	J-point speed change	By turning ON this signal while the positioning unit is in J-point operation, the speed changes to the target speed in the specified acceleration/deceleration time and pattern. (The operation is the edge type.)
	Y49	2 axes		
	Y4A	3 axes		
	Y4B	4 axes		
	Y4C-Y4E	-	-	-
	Y4F	Virtual axis	J-point speed change	By turning ON this signal while the JOG positioning (J-point) operation is performed for the virtual axis, the speed changes to the target speed in the specified acceleration/deceleration time and pattern.
WY5	Y50	1 axes	Servo OFF request	Turns OFF the servo ON signal for the corresponding axis. The servo ON signal is turned OFF at the ON edge of this contact. (The operation is the edge type.)
	Y51	2 axes		
	Y52	3 axes		
	Y53	4 axes		
	Y54-Y57	-	-	-
	Y58	1 axes	J-point positioning start	The positioning unit will go to the next table processing when this signal turns ON during the JOG (J-point) positioning of the corresponding axis.
	Y59	2 axes		

Contact allocation		Target axis	Name	Description
	Y5A	3 axes		(The operation is the edge type.)
	Y5B	4 axes		
	Y5C-Y5E	-	-	-
	Y5F	Virtual axis	J-point positioning start	The positioning unit will go to the next table processing when this signal turns ON during the JOG (J-point) positioning of the virtual axis.
WY6	Y60	1 axes	Error clearing request	Requests the error clear of the corresponding axis. The processing to recover from errors is performed and the error logs are cleared by turning ON this signal. Note) Unrecoverable errors cannot be recovered even if this signal turns ON.
	Y61	2 axes		
	Y62	3 axes		
	Y63	4 axes		
	Y64-Y66	-	-	-
	Y67	Virtual axis	Error clearing request	Requests the error clear of the virtual axis.
	Y68	1 axes	Warning clearing request	Requests the warning clear of the corresponding axis. The warning logs are cleared by turning ON this signal.
	Y69	2 axes		
	Y6A	3 axes		
	Y6B	4 axes		
	Y6C-Y6E	-	-	-
	Y6F	Virtual axis	Warning clearing request	Requests the warning clear of the virtual axis.
WY7	Y70-Y7F	-	-	-
WY8	Y80	1 axes	Synchronization setting request	Turn ON this contact after changing the synchronous operation settings. Turn ON this contact for reflecting the setting changes in the synchronous control common area of the unit memory. This flag is an edge trigger flag.
	Y81	2 axes		
	Y82	3 axes		
	Y83	4 axes		
	Y84-Y87	-	-	-
	Y88	1 axes	Synchronization cancellation request	Turns ON the contact for the axis to cancel the synchronous operation. The unit does not perform synchronous operation on the axis for which this contact is turned ON. Turn ON this contact to cancel the synchronous state temporarily during synchronous control. To make the synchronous state, turn OFF this contact.
	Y89	2 axes		
	Y8A	3 axes		
	Y8B	4 axes		
	Y8C-Y8F	-	-	-
WY9	Y90	1 axes	Slave axis Gear ratio change request	A gear ratio change is made with the contact for the corresponding axis turned ON while the positioning unit is in synchronous operation. (The operation is the edge type.)
	Y91	2 axes		
	Y92	3 axes		
	Y93	4 axes		
	Y94-Y97	-	-	-

<table>
<tr><th colspan="2">Contact allocation</th><th>Target axis</th><th>Name</th><th>Description</th></tr>
<tr><td rowspan="5"></td><td>Y98</td><td>1 axes</td><td rowspan="4">Slave axis clutch ON request</td><td rowspan="4">Clutch ON operation is started by turning ON the contact for the corresponding axis during synchronous operation.
Only axes that use a clutch are started.
(Set the operation to level type, rising edge, or falling edge.)</td></tr>
<tr><td>Y99</td><td>2 axes</td></tr>
<tr><td>Y9A</td><td>3 axes</td></tr>
<tr><td>Y9B</td><td>4 axes</td></tr>
<tr><td>Y9C-Y9F</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td rowspan="5">WY10</td><td>Y100</td><td>1 axes</td><td rowspan="4">Slave axis clutch OFF request</td><td rowspan="4">Clutch OFF operation is started by turning ON the contact for the corresponding axis during synchronous operation.
Only axes that use a clutch are started.
(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.</td></tr>
<tr><td>Y101</td><td>2 axes</td></tr>
<tr><td>Y102</td><td>3 axes</td></tr>
<tr><td>Y103</td><td>4 axes</td></tr>
<tr><td>Y104-Y10F</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td rowspan="13">WY11</td><td>Y110</td><td>1 axes</td><td rowspan="4">positioning speed change request</td><td rowspan="4">Starts the speed change operation when the positioning speed change request contact (Y110 to Y113) turns ON.</td></tr>
<tr><td>Y111</td><td>2 axes</td></tr>
<tr><td>Y112</td><td>3 axes</td></tr>
<tr><td>Y113</td><td>4 axes</td></tr>
<tr><td>Y114-Y116</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Y117</td><td>Virtual axis</td><td>positioning speed change request</td><td>Starts the speed change operation when the positioning speed change request contact (Y117) turns ON.</td></tr>
<tr><td>Y118</td><td>1 axes</td><td rowspan="4">positioning movement amount change request</td><td rowspan="4">Starts the movement amount change operation when the positioning movement amount change request contact (Y118 to Y11B) turns ON.</td></tr>
<tr><td>Y119</td><td>2 axes</td></tr>
<tr><td>Y11A</td><td>3 axes</td></tr>
<tr><td>Y11B</td><td>4 axes</td></tr>
<tr><td>Y11C-Y11E</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Y11F</td><td>Virtual axis</td><td>positioning movement amount change request</td><td>Starts the movement amount change operation when the positioning movement amount change request contact (Y11F) turns ON.</td></tr>
</table>

17.3 Entire Configuration of Memory Unit Area

The unit memory is in control of parameter and positioning data set values for the positioning unit.

All set values are set using programming tool software or a user program.

<table>
<tr><th>Name of each area</th><th>Unit memory address</th><th colspan="2">Individual name of each area</th></tr>
<tr><td rowspan="11">Common area</td><td rowspan="11">UM 00000
to UM 003FF</td><td colspan="2">Setting Parameter Control Area</td></tr>
<tr><td colspan="2">Operating speed rate area</td></tr>
<tr><td colspan="2">Axis group setting area</td></tr>
<tr><td colspan="2">Current value update data area</td></tr>
<tr><td colspan="2">Positioning table setting area</td></tr>
<tr><td colspan="2">Positioning Control Area</td></tr>
<tr><td colspan="2">Error Notification & Clearing Area</td></tr>
<tr><td colspan="2">Warning Notification & Clearing Area</td></tr>
<tr><td colspan="2">Pulse count control area</td></tr>
<tr><td colspan="2">Synchronous control monitor area</td></tr>
<tr><td colspan="2">System operation setting area</td></tr>
<tr><td rowspan="5">Each axis information area</td><td rowspan="5">UM 00400
to UM 007FF</td><td>1 axes</td><td>Each Axis Information & Monitor Area</td></tr>
<tr><td>2 axes</td><td>Each Axis Information & Monitor Area</td></tr>
<tr><td>3 axes</td><td>Each Axis Information & Monitor Area</td></tr>
<tr><td>4 axes</td><td>Each Axis Information & Monitor Area</td></tr>
<tr><td>Virtual axis</td><td>Each Axis Information & Monitor Area</td></tr>
<tr><td rowspan="11">Each axis setting area</td><td rowspan="2">UM 00800
to UM 02FFF</td><td rowspan="2">1 axes</td><td>Parameter setting area</td></tr>
<tr><td>Positioning data setting area (600 standard points and 25 expansion points)</td></tr>
<tr><td rowspan="2">UM 03000
to UM 057FF</td><td rowspan="2">2 axes</td><td>Parameter setting area</td></tr>
<tr><td>Positioning data setting area (600 standard points and 25 expansion points)</td></tr>
<tr><td rowspan="2">UM 05800
to UM 07FFF</td><td rowspan="2">3 axes</td><td>Parameter setting area</td></tr>
<tr><td>Positioning data setting area (600 standard points and 25 expansion points)</td></tr>
<tr><td rowspan="2">UM 08000
to UM 0A7FF</td><td rowspan="2">4 axes</td><td>Parameter setting area</td></tr>
<tr><td>Positioning data setting area (600 standard points and 25 expansion points)</td></tr>
<tr><td>UM 0A850
to UM 0CFFF</td><td>Axes 1 to 4
Virtual axis</td><td>Positioning data setting area (75 expansion points)</td></tr>
<tr><td rowspan="2">UM 12000
to UM 147FF</td><td rowspan="2">Virtual axis</td><td>Parameter setting area</td></tr>
<tr><td>Positioning data setting area (600 standard points and 25 expansion points)</td></tr>
<tr><td rowspan="2">Synchronous Control Setting Area</td><td rowspan="2">UM 16000
to UM 1606F</td><td rowspan="2">1 axes</td><td>Synchronous control common setting area</td></tr>
<tr><td>Electronic gear setting area</td></tr>
</table>

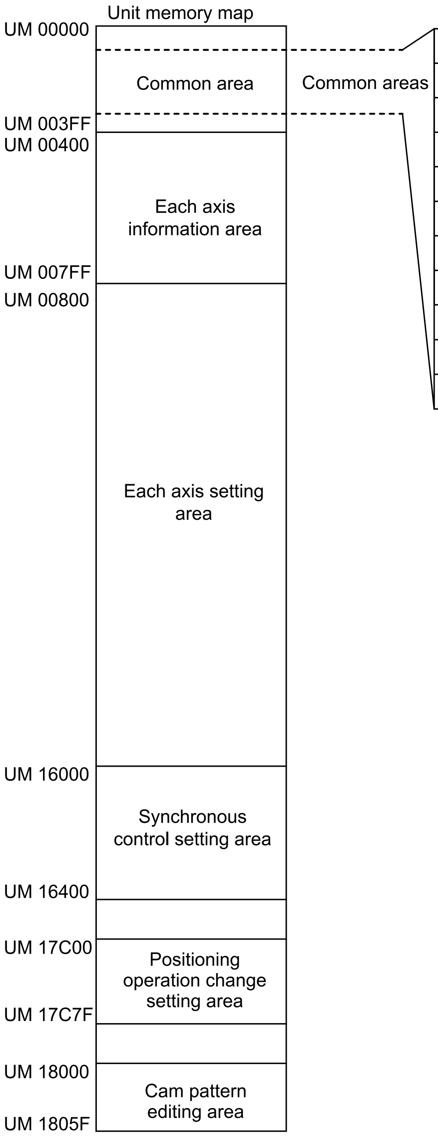
Name of each area	Unit memory address	Individual name of each area	
			Clutch setting area
			Electronic cam setting area
	UM 16070 to UM 160DF	2 axes	Synchronous control common setting area
			Electronic gear setting area
			Clutch setting area
			Electronic cam setting area
	UM 160E0 to UM 1614F	3 axes	Synchronous control common setting area
			Electronic gear setting area
			Clutch setting area
			Electronic cam setting area
	UM 16150 to UM 161BF	4 axes	Synchronous control common setting area
			Electronic gear setting area
			Clutch setting area
			Electronic cam setting area
Positioning Operation Change Setting Area	UM 17C00 to UM 17C0F	1 axes	Speed change setting area Movement amount change setting area
	UM 17C10 to UM 17C1F	2 axes	Speed change setting area Movement amount change setting area
	UM 17C20 to UM 17C2F	3 axes	Speed change setting area Movement amount change setting area
	UM 17C30 to UM 17C3F	4 axes	Speed change setting area Movement amount change setting area
	UM 17C70 to UM 17C7F	Virtual axis	Speed change setting area
Cam Pattern Editing Area	UM 18000 to UM 1805F	-	Cam Pattern Setting Area Cam pattern editing execution confirmation area

- Be sure not to execute writing in the reserved areas for the system.
- For reading each axis information area with the program, check if the ready positioning flag (X0) turns ON before reading it.

17.4 Details of Common Area in Unit Memory

17.4.1 Configuration of Common Area

The common area is allocated to the head of the unit memory to make common settings for each axis.



UM 00085	Setting parameter control area
UM 00088	Operation speed rate area
UM 000B0 - UM 000B4	Axis group setting area
UM 000C0 - UM 000D7	Current value update data area
UM 00100 - UM 00107	Positioning table setting area
UM 00108 - UM 0010F	Positioning control area
UM 00111 - UM 001A7	Error annunciation & clear area
UM 001A9 - UM 0023F	Warning annunciation & clear area
UM 00240 - UM 0024F	Pulse count control area
UM 002B0 - UM 002BF	Synchronous control monitor area
UM 00389	System operation setting area

17.4.2 Setting Parameter Control Area

Set a recalculation starting table number in order to recalculate the positioning data in the standard area.

Unit memory No. (Hex)	Name	Default	Description
UM 00085	Recalculation starting Table number	U1	If the ON state of the recalculation request signal (contact Y7) is detected, the positioning unit will recalculate positioning data on all axes beginning with this table number up to number 600. Setting range: 1 to 600

17.4.3 Operating speed rate area

This is an area that all operations related to axis operations are performed at a specified rate of operation speed.

Unit memory No. (Hex)	Name	Default	Description
UM 00088	Operating speed rate	U100	All operations relating to axes (positioning, JOG, home return) can be performed at the specified rate. Setting range: 1 to 100, Unit: %

17.4.4 Axis group setting area

The interpolation groups for each axis are set in this area.

<table>
<tr><th>Unit memory No. (Hex)</th><th>Name</th><th>Default</th><th>Description</th></tr>
<tr><td>UM 000B0</td><td>Group A
Axis setting</td><td>H0</td><td rowspan="4">Use this area to set either independent or interpolation operation for each axis. In the case of interpolation, each axis belongs to group A, B, C, or D. For example, if the 1st, 2nd, and 3rd axes belong to group A for three-axis interpolation, set the three corresponding bits for the interpolation settings for group A to 1. In the case of single independent settings, the axis will not belong to any group. Then turn ON the corresponding bit for the following independent axis settings. Maximum number of interpolation axis per group is 3. The same axis cannot be set in more than one group.
<table>
<tr><th>Bit</th><th>Name</th><th>Default</th><th>Description</th></tr>
<tr><td>0</td><td>Group attribute of Axis 1</td><td>0</td><td rowspan="4">0: Does not belong to any interpolation group
1: Belongs to an interpolation group
An error occurs if 4 or more bits are set to 1 in a group, or the same axis is set to 1 in another group.</td></tr>
<tr><td>1</td><td>Group attribute of Axis 2</td><td>0</td></tr>
<tr><td>2</td><td>Group attribute of Axis 3</td><td>0</td></tr>
<tr><td>3</td><td>Group attribute of Axis 4</td><td>0</td></tr>
<tr><td>15 to 4</td><td>-</td><td>-</td><td>-</td></tr>
</table>
</td></tr>
<tr><td>UM 000B1</td><td>Group B
Axis setting</td><td>H0</td></tr>
<tr><td>UM 000B2</td><td>Group C
Axis setting</td><td>H0</td></tr>
<tr><td>UM 000B3</td><td>Group D
Axis setting</td><td>H0</td></tr>
</table>

<table>
<tr><th>Unit memory No. (Hex)</th><th>Name</th><th>Default</th><th>Description</th></tr>
<tr><td>UM 000B4</td><td>Independent axis settings</td><td>H0</td><td>For axes that do not belong to any interpolation relationship, set the target bits in this area to 1.
<table>
<tr><th>Bit</th><th>Name</th><th>Default</th><th>Description</th></tr>
<tr><td>0</td><td>Group attribute of 1st axis</td><td>0</td><td rowspan="4">0: Belongs to an interpolation group. Alternately, not set on the used axis.
1: Independent axis (Does not belong to any interpolation group)
An error occurs when this overlaps with the setting of interpolation group.</td></tr>
<tr><td>1</td><td>Group attribute of 2nd axis</td><td>0</td></tr>
<tr><td>2</td><td>Group attribute of 3rd axis</td><td>0</td></tr>
<tr><td>3</td><td>Group attribute of 4th axis</td><td>0</td></tr>
<tr><td>15 to 4</td><td>-</td><td>-</td><td>-</td></tr>
</table></td></tr>
</table>

17.4.5 Current value update data area

To change the current value of each axis under the control of the positioning unit, store the changed coordinates in this area and turn ON the current value update request flag.

<table>
<tr><th>Unit memory No. (Hex)</th><th>Name</th><th>Default</th><th>Description</th></tr>
<tr><td>UM 000C0</td><td>Current value update
request flag</td><td>H0</td><td>Only when the corresponding bit for each axis changes to 1 from 0, the current coordinate controlled by the positioning unit to the following current value. After the change, the positioning unit will clear the corresponding bits to 0 automatically.
<table>
<tr><th>Bit</th><th>Name</th><th>Default</th><th>Description</th></tr>
<tr><td>0</td><td>Current value update request for Axis 1</td><td>0</td><td rowspan="6">0: No change
1: Update the current value of the target axis.
(After warning clearing is executed, the positioning control unit automatically resets the bit to 0.)</td></tr>
<tr><td>1</td><td>Current value update request for Axis 2</td><td>0</td></tr>
<tr><td>2</td><td>Current value update request for Axis 3</td><td>0</td></tr>
<tr><td>3</td><td>Current value update request for Axis 4</td><td>0</td></tr>
<tr><td>6 to 4</td><td>-</td><td>-</td></tr>
<tr><td>7</td><td>Current value update request for virtual axis</td><td>0</td></tr>
</table></td></tr>
</table>

Unit memory No. (Hex)	Name	Default	Description
			Bit: 15 to 8; Name: -; Default: -; Description: -
UM 000C8 -UM 000C9	Current value update coordinates for Axis 1	K0	Stores the coordinate value to be preset as the current value of each axis.
UM 000CA -UM 000CB	Current value update coordinates for Axis 2	K0	
UM 000CC -UM 000CD	Current value update coordinates for Axis 3	K0	
UM 000CE -UM 000CF	Current value update coordinates for Axis 4	K0	
UM 000D6 -UM 000D7	Virtual axis Current value update coordinate	K0	

17.4.6 Positioning control start table number setting area

Set the starting table number of positioning data on each axis at the time of staring positioning control. The setting ranges are 1 to 600 in the standard area, and 10001 to 10100 in the extended area.

Unit memory No. (Hex)	Name	Default	Description
UM 00100	Position control start table number for Axis 1	U1	Stores the table number of each axis starting the position control. Setting range: Standard area: 1 to 600, Expansion area: 10001 to 10100
UM 00101	Position control start table number for Axis 2	U1	
UM 00102	Position control start table number for Axis 3	U1	
UM 00103	Position control start	U1	

Unit memory No. (Hex)	Name	Default	Description
	table number for Axis 4		
UM 00107	Position control start table number for the virtual axis	U1	

(Note 1) Table numbers 10026 to 10100 are available for the unit Ver.1.50 or later.

17.4.7 Positioning Control Area

Set the number of repetitions of positioning control per axis. After positioning control is repeated by the specified number of times, it is completed . The number of repetitions will be reset to the default value on completion of positioning control.

Unit memory No. (Hex)	Name	Default	Description
UM 00108	Axis 1 positioning Repetition count	H0	Stores the number of times for repeating the operation starting from the position control starting table number until the E point. Setting range: 1 to 255 If 255 is set, positioning control is repeated unlimitedly until the operation is stopped.
UM 00109	Axis 2 positioning Repetition count	H0	
UM 0010A	Axis 3 positioning Repetition count	H0	
UM 0010B	Axis 4 positioning Repetition count	H0	
UM 0010F	Virtual axis positioning Repetition count	H0	

17.4.8 Error Notification & Clearing Area

This is an area in which the number of occurrences of errors and error codes are stored. For details of the operation, refer to Chapter "15 Errors and Warnings".

<table>
<tr><th>Unit memory No. (Hex)</th><th>Name</th><th>Description</th></tr>
<tr><td>UM 00111</td><td>Error clear settings on an axis-by-axis basis</td><td>Clears errors on an axis-by-axis basis.
<table>
<tr><th>Bit</th><th>Name</th><th>Default</th><th>Description</th></tr>
<tr><td>0</td><td>Error clearing for Axis 1</td><td>0</td><td rowspan="2">0: No error clearing
0→1: Execute error clearing
(After warning clearing is executed, the positioning</td></tr>
<tr><td>1</td><td>Error clearing for Axis 2</td><td>0</td></tr>
</table></td></tr>
</table>

<table>
<tr><th>Unit memory No. (Hex)</th><th>Name</th><th>Description</th></tr>
<tr><td></td><td></td><td>
<table>
<tr><th>Bit</th><th>Name</th><th>Default</th><th>Description</th></tr>
<tr><td>2</td><td>Error clearing for Axis 3</td><td>0</td><td rowspan="4">control unit automatically resets the bit to 0.)</td></tr>
<tr><td>3</td><td>Error clearing for Axis 4</td><td>0</td></tr>
<tr><td>6 to 4</td><td>-</td><td>-</td></tr>
<tr><td>7</td><td>Error clear for virtual axis</td><td>0</td></tr>
<tr><td>15 to 8</td><td>-</td><td>-</td><td>-</td></tr>
</table>
</td></tr>
<tr><td>UM 00129</td><td>Number of error occurrences on Axis 1</td><td>Annunciates the number of occurrences of errors on the 1st axis.</td></tr>
<tr><td>UM 0012A -UM 0012B</td><td>Error code notification buffer 1 for Axis 1</td><td rowspan="7">Stores the latest error codes in order from buffer 1.</td></tr>
<tr><td>UM 0012C -UM 0012D</td><td>Error code notification buffer 2 for Axis 1</td></tr>
<tr><td>UM 0012E -UM 0012F</td><td>Error code notification buffer 3 for Axis 1</td></tr>
<tr><td>UM 00130 -UM 00131</td><td>Error code notification buffer 4 for Axis 1</td></tr>
<tr><td>UM 00132 -UM 00133</td><td>Error code notification buffer 5 for Axis 1</td></tr>
<tr><td>UM 00134 -UM 00135</td><td>Error code notification buffer 6 for Axis 1</td></tr>
<tr><td>UM 00136 -UM 00137</td><td>Error code notification buffer 7 for Axis 1</td></tr>
<tr><td>UM 00139</td><td>Number of error occurrences on Axis 2</td><td>Annunciates the number of occurrences of errors on the 2nd axis.</td></tr>
<tr><td>UM 0013A -UM 0013B</td><td>Error code notification buffer 1 for Axis 2</td><td rowspan="3">Stores the latest error codes in order from buffer 1.</td></tr>
<tr><td>UM 0013C -UM 0013D</td><td>Error code notification buffer 2 for Axis 2</td></tr>
<tr><td>UM 0013E -UM 0013F</td><td>Error code notification buffer 3 for Axis 2</td></tr>
</table>

Unit memory No. (Hex)	Name	Description
UM 00140 -UM 00141	Error code notification buffer 4 for Axis 2	
UM 00142 -UM 00143	Error code notification buffer 5 for Axis 2	
UM 00144 -UM 00145	Error code notification buffer 6 for Axis 2	
UM 00146 -UM 00147	Error code notification buffer 7 for Axis 2	
UM 00149	Number of error occurrences on Axis 3	No. or occurrences of errors on the 3rd axis.
UM 0014A -UM 0014B	Error code notification buffer 1 for Axis 3	Stores the latest error codes in order from buffer 1.
UM 0014C -UM 0014D	Error code notification buffer 2 for Axis 3	
UM 0014E -UM 0014F	Error code notification buffer 3 for Axis 3	
UM 00150 -UM 00151	Error code notification buffer 4 for Axis 3	
UM 00152 -UM 00153	Error code notification buffer 5 for Axis 3	
UM 00154 -UM 00155	Error code notification buffer 6 for Axis 3	
UM 00156 -UM 00157	Error code notification buffer 7 for Axis 3	
UM 00159	Number of error occurrences on Axis 4	Annunciates the number of occurrences of errors on the 4th axis.
UM 0015A -UM 0015B	Error code notification buffer 1 for Axis 4	Stores the latest error codes in order from buffer 1.
UM 0015C -UM 0015D	Error code notification buffer 2 for Axis 4	
UM 0015E -UM 0015F	Error code notification buffer 3 for Axis 4	

Unit memory No. (Hex)	Name	Description
UM 00160 -UM 00161	Error code notification buffer 4 for Axis 4	
UM 00162 -UM 00163	Error code notification buffer 5 for Axis 4	
UM 00164 -UM 00165	Error code notification buffer 6 for Axis 4	
UM 00166 -UM 00167	Error code notification buffer 7 for Axis 4	
UM 00199	No. of occurrences of errors on virtual axis	Annunciates the number of occurrences of errors on the virtual axis.
UM 0019A UM 0019B	Virtual axis error code annunciation buffer 1	Stores the latest error codes in order from buffer 1.
UM 0019C UM 0019D	Virtual axis error code annunciation buffer 2	
UM 0019E UM 0019F	Virtual axis error code annunciation buffer 3	
UM 001A0 UM 001A1	Virtual axis error code annunciation buffer 4	
UM 001A2 UM 001A3	Virtual axis error code annunciation buffer 5	
UM 001A4 UM 001A5	Virtual axis error code annunciation buffer 6	
UM 001A6 UM 001A7	Virtual axis error code annunciation buffer 7	

17.4.9 Warning Notification & Clearing Area

This is an area in which the number of occurrences of warnings and warning codes are stored. For details of the operation, refer to Chapter "15 Errors and Warnings".

<table>
<tr><th>Unit memory No. (Hex)</th><th>Name</th><th>Description</th></tr>
<tr><td>UM 001A9</td><td>Warning clearing specification for each axis</td><td>Clears warnings on an axis-by-axis basis
<table>
<tr><th>Bit</th><th>Name</th><th>Default</th><th>Description</th></tr>
<tr><td>0</td><td>Warning clearing for Axis 1</td><td>0</td><td>0: No warning clearing</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><th>Unit memory No. (Hex)</th><th>Name</th><th>Description</th></tr>
<tr><td></td><td></td><td>
<table>
<tr><th>Bit</th><th>Name</th><th>Default</th><th>Description</th></tr>
<tr><td>1</td><td>Warning clearing for Axis 2</td><td>0</td><td rowspan="5">0→1: Execute warning clearing
(After warning clearing is executed, the positioning control unit automatically resets the bit to 0.)</td></tr>
<tr><td>2</td><td>Warning clearing for Axis 3</td><td>0</td></tr>
<tr><td>3</td><td>Warning clearing for Axis 4</td><td>0</td></tr>
<tr><td>6 to 4</td><td>-</td><td>-</td></tr>
<tr><td>7</td><td>Warning clear for virtual axis</td><td></td></tr>
<tr><td>15 to 8</td><td>-</td><td>-</td><td>-</td></tr>
</table>
</td></tr>
<tr><td>UM 001C1</td><td>Number of warning occurrences on Axis 1</td><td>Annunciates the number of occurrences of warnings on the 1st axis</td></tr>
<tr><td>UM 001C2
-UM 001C3</td><td>Warning code notification buffer 1 for Axis 1</td><td rowspan="7">The latest warning codes are stored in order from buffer number 1.</td></tr>
<tr><td>UM 001C4
-UM 001C5</td><td>Warning code notification buffer 2 for Axis 1</td></tr>
<tr><td>UM 001C6
-UM 001C7</td><td>Warning code notification buffer 3 for Axis 1</td></tr>
<tr><td>UM 001C8
-UM 001C9</td><td>Warning code notification buffer 4 for Axis 1</td></tr>
<tr><td>UM 001CA
-UM 001CB</td><td>Warning code notification buffer 5 for Axis 1</td></tr>
<tr><td>UM 001CC
-UM 001CD</td><td>Warning code notification buffer 6 for Axis 1</td></tr>
<tr><td>UM 001CE
-UM 001CF</td><td>Warning code notification buffer 7 for Axis 1</td></tr>
<tr><td>UM 001D1</td><td>Number of warning occurrences on Axis 2</td><td>Annunciates the number of occurrences of warnings on the 2nd axis.</td></tr>
<tr><td>UM 001D2
-UM 001D3</td><td>Warning code notification buffer 1 for Axis 2</td><td rowspan="5">The latest warning codes are stored in order from buffer number 1.</td></tr>
<tr><td>UM 001D4
-UM 001D5</td><td>Warning code notification buffer 2 for Axis 2</td></tr>
<tr><td>UM 001D6
-UM 001D7</td><td>Warning code notification buffer 3 for Axis 2</td></tr>
<tr><td>UM 001D8
UM 001D9</td><td>Warning code notification buffer 4 for Axis 2</td></tr>
<tr><td>UM 001DA
UM 001DB</td><td>Warning code notification buffer 5 for Axis 2</td></tr>
</table>

Unit memory No. (Hex)	Name	Description
UM 001DC UM 001DD	Warning code notification buffer 6 for Axis 2	
UM 001DE -UM 001DF	Warning code notification buffer 7 for Axis 2	Annunciates the code when a warning occurs.
UM 001E1	Number of warning occurrences on Axis 3	Annunciates the number of occurrences of warnings on the 3rd axis.
UM 001E2 -UM 001E3	Warning code notification buffer 1 for Axis 3	The latest warning codes are stored in order from buffer number 1.
UM 001E4 -UM 001E5	Warning code notification buffer 2 for Axis 3	
UM 001E6 -UM 001E7	Warning code notification buffer 3 for Axis 3	
UM 001E8 -UM 001E9	Warning code notification buffer 4 for Axis 3	
UM 001EA -UM 001EB	Warning code notification buffer 5 for Axis 3	
UM 001EC -UM 001ED	Warning code notification buffer 6 for Axis 3	
UM 001EE -UM 001EF	Warning code notification buffer 7 for Axis 3	
UM 001F1	Number of warning occurrences on Axis 4	Annunciates the number of occurrences of warnings on the 4th axis.
UM 001F2 -UM 001F3	Warning code notification buffer 1 for Axis 4	The latest warning codes are stored in order from buffer number 1.
UM 001F4 -UM 001F5	Warning code notification buffer 2 for Axis 4	
UM 001F6 -UM 001F7	Warning code notification buffer 3 for Axis 4	
UM 001F8 -UM 001F9	Warning code notification buffer 4 for Axis 4	
UM 001FA -UM 001FB	Warning code notification buffer 5 for Axis 4	
UM 001FC -UM 001FD	Warning code notification buffer 6 for Axis 4	
UM 001FE -UM 001FF	Warning code notification buffer 7 for Axis 4	
UM 00231	No. of occurrences of warnings on the virtual axis	Annunciates the number of occurrences of warnings on the virtual axis.
UM 00232 -UM 00233	Virtual axis warning code annunciation buffer 1	The latest warning codes are stored in order from buffer number 1.
UM 00234	Virtual axis warning code annunciation buffer 2	

Unit memory No. (Hex)	Name	Description
-UM 00235		
UM 00236 -UM 00237	Virtual axis warning code annunciation buffer 3	
UM 00238 -UM 00239	Virtual axis warning code annunciation buffer 4	
UM 0023A -UM 0023B	Virtual axis warning code annunciation buffer 5	
UM 0023C -UM 0023D	Virtual axis warning code annunciation buffer 6	
UM 0023E -UM 0023F	Virtual axis warning code annunciation buffer 7	

17.4.10 Pulse count control area

Performs the control of pulse input according to a selected pulse input application.

<table>
<tr><th>Unit memory No. (Hex)</th><th>Name</th><th>Default</th><th>Description</th></tr>
<tr><td>UM 00240</td><td>Pulse count enable flag</td><td>H0</td><td>This flag is valid when "High-speed counter" is selected for the pulse input application. When the corresponding bit to each axis is 0, the count of pulse input will start.
<table>
<tr><th>Bit</th><th>Name</th><th>Default</th><th>Description</th></tr>
<tr><td>0</td><td>1st axis pulse count enabled</td><td>0</td><td rowspan="5">0: Count pulse inputs
1: Pulse input count disabled</td></tr>
<tr><td>1</td><td>2nd axis pulse count enabled</td><td>0</td></tr>
<tr><td>2</td><td>3rd axis pulse count enabled</td><td>0</td></tr>
<tr><td>3</td><td>4th axis pulse count enabled</td><td>0</td></tr>
<tr><td>15 to 4</td><td>-</td><td>-</td></tr>
</table></td></tr>
<tr><td>UM 00241</td><td>Pulse count value change request flag</td><td>H0</td><td>This flag is valid when "Feedback pulse" or "High-speed counter" is selected for the pulse input application. This flag is an edge trigger flag.
When the corresponding bit to each axis changes to 1 from 0, the pulse input counter value of each axis will be changed to the value stored in "pulse input change value (UM00248 to UM0024F)".
<table>
<tr><th>Bit</th><th>Name</th><th>Default</th><th>Description</th></tr>
<tr><td>0</td><td>Pulse count change of 1st axis</td><td>0</td><td>0: Do not change pulse count value
0→1: Change pulse count value.</td></tr>
</table></td></tr>
</table>

<table>
<tr><th>Unit memory No. (Hex)</th><th>Name</th><th>Default</th><th>Description</th></tr>
<tr><td></td><td></td><td></td><td>
<table>
<tr><th>Bit</th><th>Name</th><th>Default</th><th>Description</th></tr>
<tr><td>1</td><td>Pulse count change of 2nd axis</td><td>0</td><td rowspan="4"></td></tr>
<tr><td>2</td><td>Pulse count change of 3rd axis</td><td>0</td></tr>
<tr><td>3</td><td>Pulse count change of 4th axis</td><td>0</td></tr>
<tr><td>15 to 4</td><td>-</td><td>-</td></tr>
</table>
</td></tr>
<tr><td>UM 00248
-UM 00249</td><td>Axis 1 pulse input changed value</td><td>K0</td><td rowspan="4">Set the desired pulse input value to replace the current value for each axis.</td></tr>
<tr><td>UM 0024A
-UM 0024B</td><td>Axis 2 pulse input changed value</td><td>K0</td></tr>
<tr><td>UM 0024C
-UM 0024D</td><td>Axis 3 pulse input changed value</td><td>K0</td></tr>
<tr><td>UM 0024E
-UM 0024F</td><td>Axis 4 pulse input changed value</td><td>K0</td></tr>
</table>

17.4.11 Synchronous control monitor area

This area is used to monitor the setting status of synchronous control.

<table>
<tr><th>Unit memory No. (Hex)</th><th>Name</th><th>Description</th></tr>
<tr><td>UM 002B0</td><td>Monitoring information of synchronous master axis for the 1st axis</td><td>Stores the setting status of the master axis under synchronous control.
<table>
<tr><th colspan="2">Stored value</th><th rowspan="2">Master axis</th></tr>
<tr><th>Under synchronous control</th><th>Synchronization cancellation in progress</th></tr>
<tr><td>HFFFF</td><td>H FFFF</td><td>No synchronous setting</td></tr>
<tr><td>H0000</td><td>H 8000</td><td>The target axis for monitoring is the master axis.</td></tr>
<tr><td>H 0001</td><td>H 8001</td><td>1 axes</td></tr>
<tr><td>H 0002</td><td>H 8002</td><td>2 axes</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><th>Unit memory No. (Hex)</th><th>Name</th><th>Description</th></tr>
<tr><td></td><td></td><td>
<table>
<tr><th colspan="2">Stored value</th><th rowspan="2">Master axis</th></tr>
<tr><th>Under synchronous control</th><th>Synchronization cancellation in progress</th></tr>
<tr><td>H 0003</td><td>H 8003</td><td>3 axes</td></tr>
<tr><td>H 0004</td><td>H 8004</td><td>4 axes</td></tr>
<tr><td>H 0010</td><td>H 8010</td><td>Virtual axis</td></tr>
<tr><td>H 0021</td><td>H 8021</td><td>Pulse input 1</td></tr>
<tr><td>H 0022</td><td>H 8022</td><td>Pulse input 2</td></tr>
<tr><td>H 0023</td><td>H 8023</td><td>Pulse input 3</td></tr>
<tr><td>H 0024</td><td>H 8024</td><td>Pulse input 4</td></tr>
</table>
</td></tr>
<tr><td>UM 002B1</td><td>Monitoring selection state of synchronous output function for 1st axis</td><td>Stores the status of the synchronous operation function set for the axis.
<table>
<tr><th>Bit</th><th>Function</th><th>Setting</th></tr>
<tr><td>0</td><td>Electronic gear operation setting</td><td rowspan="5">0: Not use
1: Use</td></tr>
<tr><td>1</td><td>Clutch operation setting</td></tr>
<tr><td>2</td><td>Electronic cam operation setting</td></tr>
<tr><td>3</td><td>Advance angle correction synchronization setting</td></tr>
<tr><td>15 to 4</td><td></td></tr>
</table>
</td></tr>
<tr><td>UM 002B2</td><td>Axis 2 synchronous master axis
Information monitor</td><td rowspan="6">Refer to the same item corresponding to Axis 1.</td></tr>
<tr><td>UM 002B3</td><td>Monitoring selection state of synchronous output function for 2nd axis</td></tr>
<tr><td>UM 002B4</td><td>Axis 3 synchronous master axis
Information monitor</td></tr>
<tr><td>UM 002B5</td><td>Monitoring selection state of synchronous output function for 3rd axis</td></tr>
<tr><td>UM 002B6</td><td>Axis 4 synchronous master axis
Information monitor</td></tr>
<tr><td>UM 002B7</td><td>Monitoring selection state of synchronous output function for 4th axis</td></tr>
<tr><td>UM 002BE</td><td>Monitoring information of synchronous master axis for the virtual axis</td><td>Refer to the same item corresponding to Axis 1.</td></tr>
</table>

Unit memory No. (Hex)	Name	Description
UM 002BF	Monitoring selection state of synchronous output function for virtual axis	H0000 (fixed)

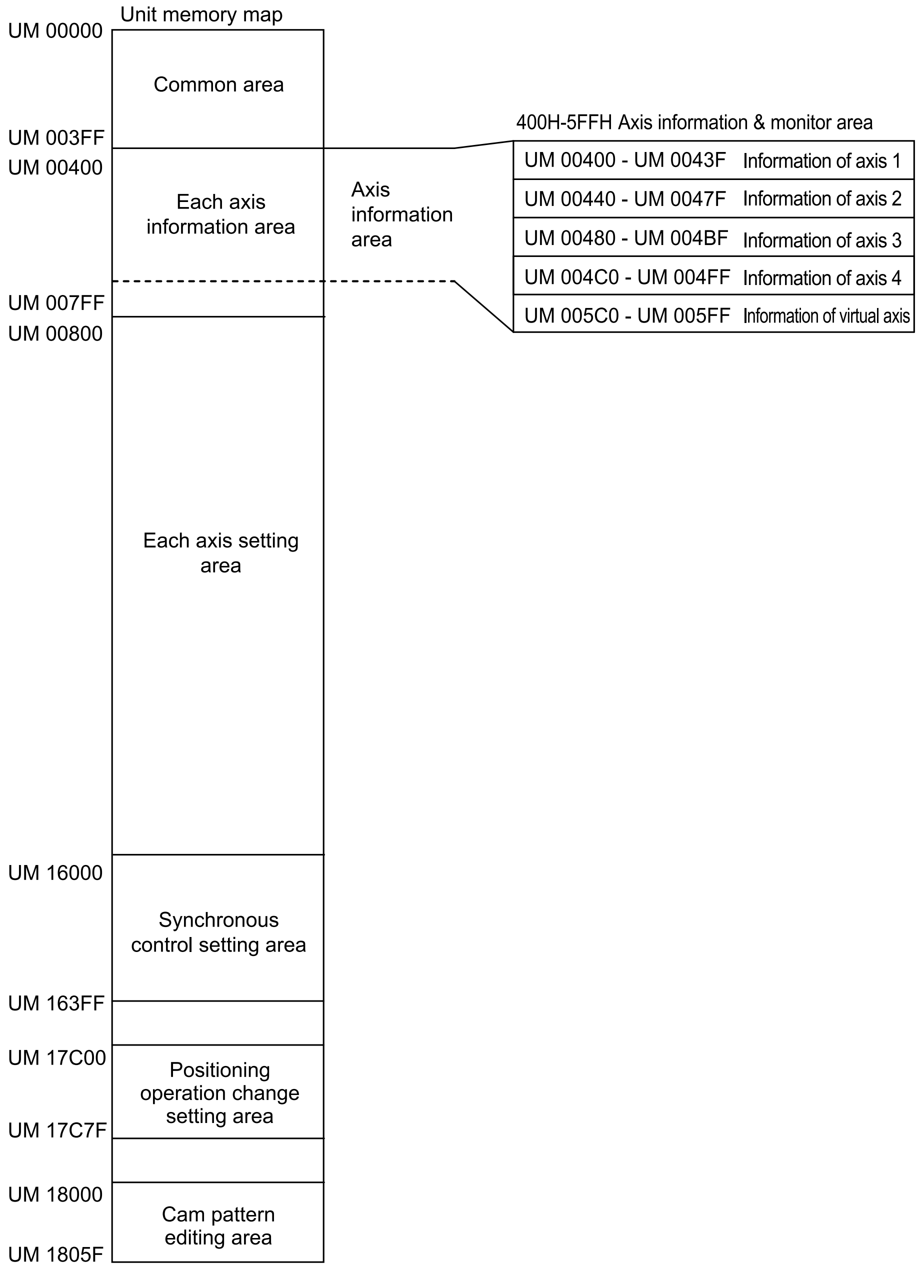
17.4.12 System operation setting area

This is an area for changing the operation of the positioning unit.

Unit memory No. (Hex)	Name	Default	Description
UM 00389	Deceleration stop operation	H0	Specify the operation of the positioning unit with the deceleration stop request signal activated (turned ON). **0: Deceleration stop** During repetitive operation, the axis stops after operations are performed up to the E-point of the repetitive operation. **1: Pause** ● Performs a deceleration stop, and restarts the positioning operation when the "deceleration stop request signal" is canceled (changed from ON to OFF). ● Also, the same operation as deceleration stop is performed during any operation other than a positioning operation. ● During repetitive operation, the axis stops after operations are performed up to the E-point of the repetitive operation and the positioning operation is restarted when the "deceleration stop request signal" is canceled (changed from ON to OFF). ● If a system stop or emergency stop is executed while the positioning unit is paused, the pause state will be canceled and the operation will not restart even if the "deceleration stop request signal" is canceled (changed from ON to OFF).

17.5 Details of Each Axis Information Area in Unit Memory

17.5.1 Configuration of Each Axis Information Area



Note

- Check that the positioning ready flag (X0) is turned ON in the case of reading each axis information area with a program.

17.5.2 Each Axis Information & Monitor Area

■ Information for Axis 1

<table>
<tr><th>Unit memory No. (Hex)</th><th>Name</th><th>Description</th></tr>
<tr><td>UM 00424
-UM 00425</td><td>Advance angle correction amount of 1st axis</td><td>Stores the advance angle correction amount. Stores values converted with the unit system (pulse, μm, inch, degree) selected for the master axis.</td></tr>
<tr><td>UM 00431</td><td>External terminal input monitor of 1st axis</td><td>Stores I/O information connected to each axis.
<table>
<tr><th>Bit</th><th>Name</th><th>Default</th><th>Description</th></tr>
<tr><td>0</td><td>Limit +</td><td>0</td><td rowspan="4">0: Inactive
1: Active</td></tr>
<tr><td>1</td><td>Limit -</td><td>0</td></tr>
<tr><td>2</td><td>Near home</td><td>0</td></tr>
<tr><td>3</td><td>Home position</td><td>0</td></tr>
<tr><td>15 to 4</td><td>-</td><td>-</td><td>-</td></tr>
</table></td></tr>
<tr><td>UM 00434
-UM 00435</td><td>Deviation of 1st axis</td><td>Stores the maximum value of the deviation (the difference between the pulse input value and instruction value).</td></tr>
<tr><td>UM 00436
-UM 00437</td><td>Pulse input value of 1st axis</td><td>Stores pulse input values according to the pulse input application (pulser, feedback pulse, or counter). Pulse input values will be integrated and stored until the pulse input application is changed or the pulse input is cleared.
Unit: Pulse</td></tr>
<tr><td>UM 00438</td><td>Active table or completed table for Axis 1</td><td>Stores the number of an active or completed positioning table.
Range: 1 to 600, 10001 to 10100</td></tr>
<tr><td>UM 00439</td><td>Auxiliary output code of 1st axis</td><td>Stores the auxiliary output code.</td></tr>
<tr><td>UM 0043A</td><td>Repeat count set value of 1st axis</td><td>Stores the specified number of positioning operations to be repeated. This area will be set to 1 if the positioning repeat is not implemented. Stores 255 if the number of positioning repeat times is unlimited.
Range: 0 to 255</td></tr>
<tr><td>UM 0043B</td><td>Repeat count current value of 1st axis</td><td>Stores the current number of repetitions during the operation. Stores 1 if the positioning repeat is not implemented. Returns to "0" when the repeat count exceeds the upper limit.
Range: 0 to 255</td></tr>
<tr><td>UM 0043C
-UM 0043D</td><td>Current value of 1st axis</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 is not updated when the current value update function is executed.
Unit: Pulse</td></tr>
</table>

Unit memory No. (Hex)	Name	Description
UM 0043E -UM 0043F	Unit system conversion current value of 1st axis	Stores the current value based on the electrical zero point (the value set in “Home coordinates”). Values converted with the unit system (pulse, m, inch, degree) selected in each axis setting area are stored. When home return is completed, the value set in “Home coordinates” is 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.

■ Information for Axis 2

Unit memory No. (Hex)	Name	Description
UM 00464 -UM 00465	Advance angle correction amount of 2nd axis	Refer to axis 1.
UM 00471	External terminal input monitor of 2nd axis	Refer to axis 1.
UM 00474	Deviation of 2nd axis	Refer to axis 1.
UM 00476 -UM 00477	Pulse input value of 2nd axis	Refer to axis 1.
UM 00478	Active table or completed table for Axis 2	Refer to axis 1.
UM 00479	Auxiliary output code of 2nd axis	Refer to axis 1.
UM 0047A	Repeat count set value of 2nd axis	Refer to axis 1.
UM 0047B	Repeat count current value of 2nd axis	Refer to axis 1.
UM 0047C -UM 0047D	Current value of 2nd axis	Refer to axis 1.
UM 0047E -UM 0047F	Unit system conversion current value of 2nd axis	Refer to axis 1.

■ Information for Axis 3

Unit memory No. (Hex)	Name	Description
UM 004A4 -UM 004A5	Advance angle correction amount of 3rd axis	Refer to axis 1.
UM 004B1	External terminal input monitor of 3rd axis	Refer to axis 1.
UM 004B4	Deviation of 3rd axis	Refer to axis 1.
UM 004B6 -UM 004B7	Pulse input value of 3rd axis	Refer to axis 1.
UM 004B8	Active table or completed table for Axis 3	Refer to axis 1.

Unit memory No. (Hex)	Name	Description
UM 004B9	Auxiliary output code of 3rd axis	Refer to axis 1.
UM 004BA	Repeat count set value of 3rd axis	Refer to axis 1.
UM 004BB	Repeat count current value of 3rd axis	Refer to axis 1.
UM 004BC -UM 004BD	Current value of 3rd axis	Refer to axis 1.
UM 004BE -UM 004BF	Unit system conversion current value of 3rd axis	Refer to axis 1.

■ Information for Axis 4

Unit memory No. (Hex)	Name	Description
UM 004E4 -UM 004E5	Advance angle correction amount of 4th axis	Refer to axis 1.
UM 004F4	Deviation of 4th axis	Refer to axis 1.
UM 004F6 -UM 004F7	Pulse input value of 4th axis	Refer to axis 1.
UM 004F8	Active table or completed table for Axis 4	Refer to axis 1.
UM 004F9	Auxiliary output code of 4th axis	Refer to axis 1.
UM 004FA	Repeat count set value of 4th axis	Refer to axis 1.
UM 004FB	Repeat count current value of 4th axis	Refer to axis 1.
UM 004FC -UM 004FD	Current value of 4th axis	Refer to axis 1.
UM 004FE -UM 004FF	Unit system conversion current value of 4th axis	Refer to axis 1.

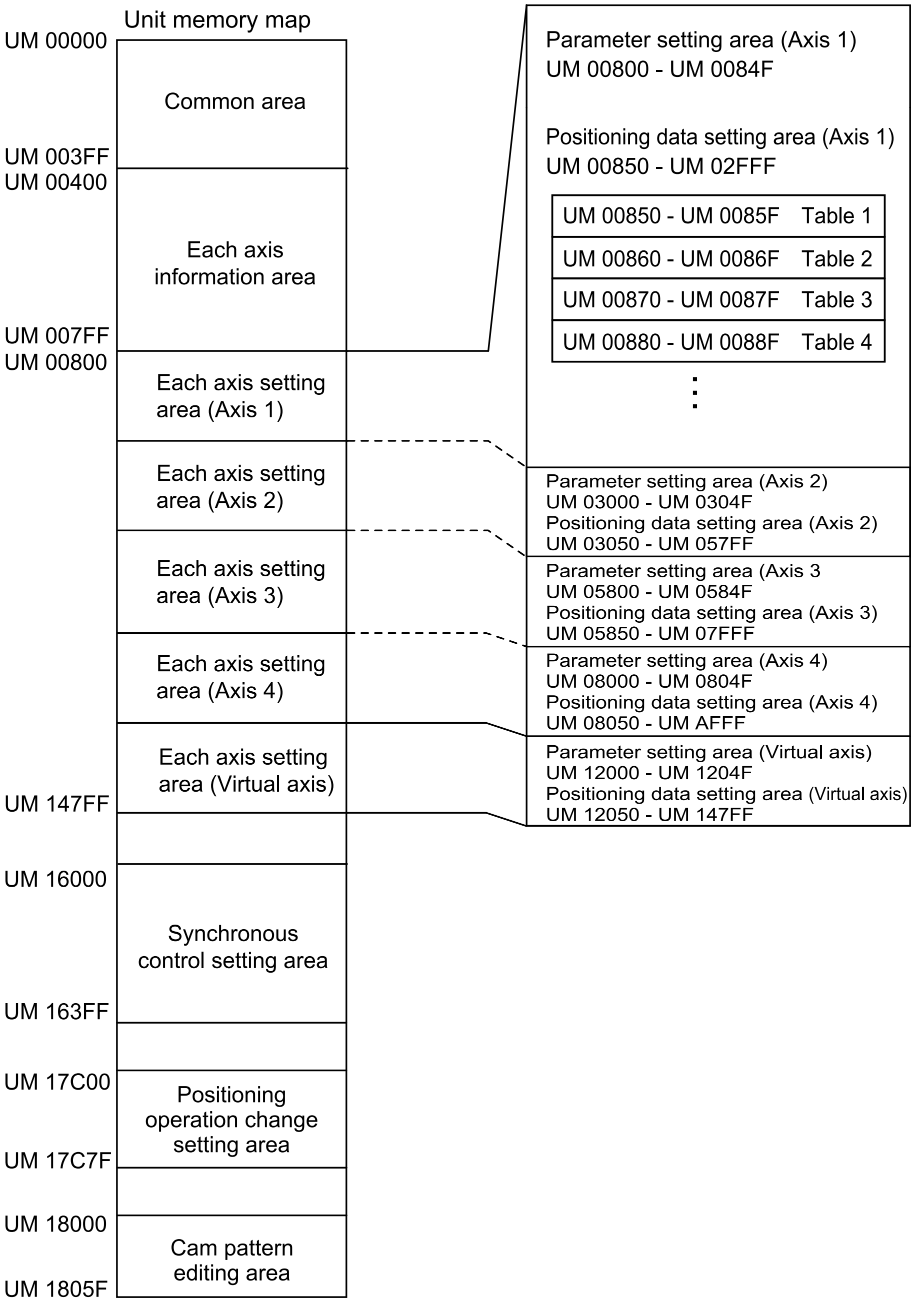
■ Virtual axis information

Unit memory No. (Hex)	Name	Description
UM 005F8	Implementation or implementation done table of virtual axis	Refer to axis 1.
UM 005F9	Auxiliary output code of virtual axis	Refer to axis 1.
UM 005FA	Repeat count set value of virtual axis	Refer to axis 1.
UM 005FB	Repeat count current value of virtual axis	Refer to axis 1.
UM 005FC -UM 005FD	Current value of virtual axis	Refer to axis 1.
UM 005FE -UM 005FF	Unit system conversion current value of virtual axis	Refer to axis 1.

17.6 Details of Each Axis Setting Area in Unit Memory

17.6.1 Configuration of Each Axis Setting Area

Each axis setting area stores the parameter setting area and positioning data. The positioning data setting area of each axis consists of a standard area with 600 tables and extended area with 100 tables.



17.6.2 Positioning parameter setting area

Unit memory addresses of positioning parameters are the addresses that the starting addresses allocated to each axis to which offset addresses are added.

■ Starting addresses of positioning parameters for each axis

Axis	1 axes	2 axes	3 axes	4 axes	Virtual axis
Unit memory address	UM 00800	UM03000	UM 05800	UM 08000	UM 12000

■ Positioning parameters for each axis

Data in the following format is stored in the memory starting from the starting address of the positioning parameters for each axis.

<table>
<tr><th>Offset address</th><th>Name</th><th>Default</th><th>Setting range and description</th></tr>
<tr><td>000H</td><td>Unit setting</td><td>H0</td><td>Set the movement unit system for the positioning control of each axis. Set the same unit system for all interpolation axes.
H0: Pulse
H100: μm (minimum position reference of 0.1 μm)
H101: μm (minimum position reference of 1 μm)
H200: inch (minimum position reference of 0.1 inch)
H201: inch (minimum position reference of 1 inch)
H300: degree (minimum position reference of 0.1 degree)
H301: degree (minimum position reference of 1 degree)
Any other settings will result in an error.</td></tr>
<tr><td>001H</td><td>System reserved</td><td>-</td><td>-</td></tr>
<tr><td>002H
-003H</td><td>Number of pulses per revolution</td><td>U1</td><td>Set the number of pulses per motor rotation. This is required to convert the number of pulses in terms of mm, inches, or degrees.
Setting range: 1 to 32,767
Any other settings will result in an error.</td></tr>
<tr><td>004H
-005H</td><td>Movement amount per rotation</td><td>U1</td><td>Set the movement amount per motor rotation. This is required to convert the number of pulses in terms of mm, inches, or degrees.
Setting range: 1 to 32,767
Any other settings will result in an error.
Interpretation changes according to the unit settings as below.
μm: 1 μm
inch: 1/10,000 inch
degree: 1 degree</td></tr>
<tr><td>006H</td><td>System reserved</td><td>-</td><td>-</td></tr>
<tr><td>007H</td><td>Pulse input method</td><td>H20</td><td>Sets up the pulse input signal.
Set up the signal according to the application of pulse input.
<table>
<tr><th>Bit</th><th>Name</th><th>Description</th></tr>
<tr><td>0</td><td>Rotation direction</td><td>Sets the rotation direction of pulse input.
0: Forward
1: Reverse</td></tr>
<tr><td>1</td><td>-</td><td>-</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><th>Offset address</th><th>Name</th><th>Default</th><th>Setting range and description</th></tr>
<tr><td></td><td></td><td></td><td>
<table>
<tr><th>Bit</th><th>Name</th><th>Description</th></tr>
<tr><td>3 to 2</td><td>Pulse input method</td><td>Sets the input method of pulse input.
bit3 bit2
0 0 : 2-phase input
0 1 : Direction identification input
1 0 : Individual input
1 1 : Reserve (set by default)</td></tr>
<tr><td>5 to 4</td><td>Input multiplication</td><td>Set the desired multiplication of the pulse input count if the pulse input mode (with bits 2 and 3) to 2-phase input.
bit5 bit4
0 0 : ×1 (Multiply by 1)
0 1 : ×2 (Multiply by 2)
1 0 : ×4 (Multiply by 4)
1 1 : Reserve (set by default)</td></tr>
<tr><td>7 to 6</td><td>Pulse input application</td><td>Specify the pulse input application of each axis.
● Pulser: Connects a manual pulser to the pulse input.
● Feedback pulse: Connects the feedback pulses of the encoder to pulse input.
● High-speed counter: It is used as a general-purpose counter input.
bit7 bit6
0 0 : Pulser
0 1 : Feedback pulse
1 0 : High-speed counter
1 1 : Reserve (set by default)</td></tr>
<tr><td>15 to 8</td><td>-</td><td>-</td></tr>
</table>
</td></tr>
<tr><td>008H</td><td>Numerator of automatic movement amount check correction</td><td>U1</td><td rowspan="2">Set a correction value of pulse input at the time of making an automatic movement amount check of machinery or equipment.
The following formula is used to calculate a deviation feedback value (pulse input value with a correction) from the pulse input terminal and make an automatic movement amount check.
Deviation feedback value = (Correction numerator/Correction denominator) x Pulse input
Range: 1 to 32767</td></tr>
<tr><td>009H</td><td>Denominator of automatic movement amount check correction</td><td>U1</td></tr>
<tr><td>00AH</td><td>Automatic movement amount checking</td><td>H0</td><td>Set an action when the difference between the instruction value and feedback value exceeds the movement check value at the time of automatic movement amount check.
0: Error occurred</td></tr>
</table>

<table>
<tr><th>Offset address</th><th>Name</th><th>Default</th><th>Setting range and description</th></tr>
<tr><td></td><td></td><td></td><td>An error will occur and the operation of the positioning unit will come to a stop if the difference between the feedback value and reference movement exceeds the movement check value (threshold).
1: Warring occurred
An error will occur and the operation of the positioning unit will come to a stop if the difference between the feedback value and reference movement exceeds the movement check value (threshold).
2: None
No movement amount check is made.</td></tr>
<tr><td>00BH</td><td>Soft limit enable/ disable setting</td><td>H0</td><td>Enables or disables the software limit on each control.
<table>
<tr><th>Bit</th><th>Name</th><th>Default</th><th>Description</th></tr>
<tr><td>0</td><td>Enables/ disables the software limit for positioning control</td><td>0</td><td>0: Disable soft limits during positioning control
1: Enable soft limits during positioning control</td></tr>
<tr><td>1</td><td>Enable/disable soft limits during home return
Soft limit enable/disable</td><td>0</td><td>0: Disable soft limits during home return
1: Enable soft limits during home return</td></tr>
<tr><td>2</td><td>Enable/disable soft limits during JOG operation
Soft limit enable/disable</td><td>0</td><td>0: Disable soft limits during JOG operation
1: Enable soft limits during JOG operation</td></tr>
<tr><td>15 to 3</td><td>-</td><td>-</td><td>-</td></tr>
</table></td></tr>
<tr><td>00CH
-00DH</td><td>Soft limits: Upper limit value</td><td>K10737 41823</td><td>Sets the upper limit value of soft limits for absolute coordinates.
Interpretation changes according to the unit settings as below.
Pulse: -1,073,741,823 to +1,073,741,823 pulses
μm (0.1 μm): -107,374,182.3 to +107,374,182.3 μm
μm (1 μm): -1,073,741,823 to +1,073,741,823 μm
inch (0.00001 inch): -10,737.41823 to +10,737.41823 inches
inch (0.0001 inch): -107,374.1823 to +107,374.1823 inches
degree (0.1 degree): -107,374,182.3 to +107,374,182.3 degrees
degree (1 degree): -1,073,741,823 to +1,073,741,823 degrees
Any other settings will result in an error.</td></tr>
<tr><td>00EH
-00FH</td><td>Soft limits: Lower limit value</td><td>K-1073 741823</td><td>Set the lower limit value of soft limits for absolute coordinates.
Interpretation changes according to the unit settings as below.
Pulse: -1,073,741,823 to +1,073,741,823 pulses
μm (0.1 μm): -107,374,182.3 to +107,374,182.3 μm
μm (1 μm): -1,073,741,823 to +1,073,741,823 μm
inch (0.00001 inch): -10,737.41823 to +10,737.41823 inches
inch (0.0001 inch): -107,374.1823 to +107,374.1823 inches
degree (0.1 degree): 0.0 to 359.9 degrees
degree (1 degree): 0 to 359 degrees</td></tr>
</table>

<table>
<tr><th>Offset address</th><th>Name</th><th>Default</th><th>Setting range and description</th></tr>
<tr><td></td><td></td><td></td><td>Any other settings will result in an error.</td></tr>
<tr><td>010H
-011H</td><td>System reserved</td><td>-</td><td>-</td></tr>
<tr><td>012H</td><td>Auxiliary output mode</td><td>HA00</td><td>Sets whether to use the auxiliary output function for auxiliary output contacts and auxiliary output codes. The ON time of the auxiliary output contact is determined by the auxiliary output ON time shown below.
<table>
<tr><th>Bit</th><th>Name</th><th>Default</th><th>Description</th></tr>
<tr><td>7 to 0</td><td>Auxiliary output mode</td><td>H00</td><td>0000H: Do not use the auxiliary output function (for auxiliary output contacts and codes)
0001H: Use With mode.
0002H: Use Delay mode</td></tr>
<tr><td>15 to 8</td><td>Auxiliary output ON time</td><td>HA
(10 ms)</td><td>Setting range: 00H (0 ms) to FFH (255 ms).</td></tr>
</table></td></tr>
<tr><td>013H</td><td>Auxiliary output Delay rate</td><td>H0</td><td>When using the delay mode for the auxiliary output, specify the ratio (%) to output. The setting range is 0(%) to 100(%). If the setting is 50%, the auxiliary output will be performed when the positioning movement amount exceeds 50%.</td></tr>
<tr><td>014H</td><td>Limit switch</td><td>H0</td><td>Set to enable or disable the limit input.
<table>
<tr><th>Bit</th><th>Name</th><th>Default</th><th>Description</th></tr>
<tr><td>0</td><td>Limit switch</td><td>1</td><td>0: Enables the input of limit signal
1: Disables the input of limit signal</td></tr>
<tr><td>15 to 1</td><td>-</td><td>-</td><td>-</td></tr>
</table></td></tr>
<tr><td>015H</td><td>Pulse output control code</td><td>H30</td><td>Make pulse output, home position, near home, and limit signal settings.
<table>
<tr><th>Bit</th><th>Name</th><th>Default</th><th>Description</th></tr>
<tr><td>0</td><td>Output method</td><td>0</td><td>0: Pulse/Sign
1: CW/CCW</td></tr>
<tr><td>1</td><td>Rotation direction</td><td>0</td><td>0: Elapsed value + direction is CW
1: Elapsed value + direction is CCW</td></tr>
<tr><td>2</td><td>Home position logic</td><td>0</td><td>0: Normal Open
1: Normal Close</td></tr>
<tr><td>3</td><td>Near home input logic</td><td>0</td><td>0: Normal Open
1: Normal Close</td></tr>
<tr><td>4</td><td>Limit + Logic</td><td>1</td><td>0: Normal Open
1: Normal Close</td></tr>
<tr><td>5</td><td>Limit - Logic</td><td>1</td><td>0: Normal Open
1: Normal Close</td></tr>
</table></td></tr>
</table>

<table>
<tr><th>Offset address</th><th>Name</th><th>Default</th><th>Setting range and description</th></tr>
<tr><td></td><td></td><td></td><td><table><tr><th>Bit</th><th>Name</th><th>Default</th><th>Description</th></tr><tr><td>15 to 6</td><td>-</td><td>0</td><td>-</td></tr></table></td></tr>
<tr><td>016H
-017H</td><td>Startup Speed</td><td>H0</td><td>Make startup speed settings for each type of operation. Make a startup speed change before starting each type of operation.
Range: 0 to 32,767,000
Any other settings will result in an error.
Interpretation changes according to the unit settings as below.
Pulses: 0 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>018H</td><td>Automatic movement amount check value</td><td>U10000</td><td>Set the threshold to use the automatic check function of movement amount.
Range: 0 to 65536
Default: 10000 (pulses)</td></tr>
<tr><td>019H</td><td>System reserved</td><td>-</td><td>-</td></tr>
<tr><td>01AH</td><td>Automatic movement amount check interval</td><td>H0</td><td>Set the interval of automatic movement amount checking in ms .
Setting range: 0 to 32767 (ms)
Default: 0 (ms)</td></tr>
<tr><td>01BH
-01FH</td><td>System reserved</td><td>-</td><td>-</td></tr>
<tr><td>020H</td><td>Home return setting code</td><td>H0</td><td>Sets a pattern of home return.
0: DOG method 1
1: DOG method 2
2: DOG method 3
3: Limit method 1
4: Limit method 2
5: Phase Z method
8：Data set
Any other settings will result in an error.</td></tr>
<tr><td>021H</td><td>Home return direction</td><td>H0</td><td>Sets the moving direction of home return.
0: Direction in which the elapsed value decreases (limit - direction)
1: Direction in which the elapsed value increase (limit + direction)
Any other settings will result in an error.</td></tr>
<tr><td>022H</td><td>Home return acceleration time</td><td rowspan="2">U100</td><td rowspan="2">Sets the acceleration/deceleration time while the positioning unit is in home return operation.
At the start of home return, acceleration is performed for the specified acceleration time, deceleration is performed for the specified deceleration time after near home input, and then the speed changes to the creep rate.
Setting range: 0 to 10,000 (ms)
Any other settings will result in an error.</td></tr>
<tr><td>023H</td><td>Home return deceleration time</td></tr>
<tr><td>024H
-025H</td><td>Home return target speed</td><td>U1000</td><td>Sets the target speed for home return control.
If there is no near home input after home return starts, acceleration is performed to shift to the target speed.
Setting range: 1 to 32,767,000</td></tr>
</table>

<table>
<tr><th>Offset address</th><th>Name</th><th>Default</th><th>Setting range and description</th></tr>
<tr><td></td><td></td><td></td><td>Any other settings will result in an error.
The setting range changes according to 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></tr>
<tr><td>026H
-027H</td><td>Home return creep speed</td><td>U100</td><td>Sets the speed of searching for the home position after near home input.
Set a value lower than the home return target speed.
Setting range: 1 to 32,767,000
Any other settings will result in an error.
The setting range changes according to 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></tr>
<tr><td>028H</td><td>Deviation counter clear signal ON time</td><td>U1</td><td>Set the ON time of the deviation counter clear signal after home return completion.
Setting range: 1 to 100 ms
The deviation counter clear signal is set to 100 ms even if a setting in excess of 100 ms is made.</td></tr>
<tr><td>029H</td><td>JOG operation setting code</td><td>H0</td><td>Sets the operation mode of the JOG operation.
<table>
<tr><th>Bit</th><th>Name</th><th>Default</th><th>Description</th></tr>
<tr><td>0</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>1</td><td>Acceleration/ deceleration pattern setting</td><td>0</td><td>0: Linear acceleration / deceleration
1: S-shaped acceleration/ deceleration</td></tr>
<tr><td>15 to 2</td><td>-</td><td>-</td><td>-</td></tr>
</table></td></tr>
<tr><td>02AH</td><td>JOG operation acceleration time</td><td rowspan="2">U100</td><td rowspan="2">Sets the acceleration/deceleration time for JOG operation.
After the start contact of JOG operation is ON, the positioning unit will go into deceleration operation in the preset time to come to a stop.
Setting range: 0 to 10,000 (ms)
Any other settings will result in an error.</td></tr>
<tr><td>02BH</td><td>JOG operation deceleration time</td></tr>
<tr><td>02CH
-02DH</td><td>JOG operation target speed</td><td>U1000</td><td>Sets the target speed for JOG operation.
After JOG operation is started, an acceleration operation is performed to shift to the target speed while the starting contact of the JOG operation is ON.
After the target speed is reached, operations are performed at the target speed.
Setting range: 1 to 32,767,000
Any other settings will result in an error.
Interpretation changes according to 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</td></tr>
</table>

Offset address	Name	Default	Setting range and description
			degree: 0.001 to 32,767.000 rev/s
02EH -02FH	System reserved	-	-
030H -032H	System reserved	-	-
033H	Emergency stop deceleration time	U100	This parameter takes effect when an emergency stop is requested by I/O, causing the deceleration operation to be completed in the specified deceleration time. Setting range: 0 to 10,000 (ms) Any other settings will result in an error.
034H	System reserved	-	-
035H	Limit stop deceleration time	U100	This parameter takes effect when the limit is input during operation, causing the deceleration operation to be completed in the specified deceleration time. Setting range: 0 to 10,000 (ms) Any other settings will result in an error.
036H	System reserved	-	-
037H	Error stop deceleration time	U100	This parameter takes effect when an error occurs, causing the deceleration operation to be completed in the specified deceleration time. Setting range: 0 to 10,000 (ms) Any other settings will result in an error.
038H	Pulsar operation setting code	H0	If a pulse operation request is made with I/O, select the desired pulser input from pulser inputs 1 to 4. 0: Pulser input 1 1: Pulser input 2 2: Pulser input 3 3: Pulser input 4 Any other settings will result in an error.
039H	Pulser operation ratio numerator	U1	Sets a multiplier for input pulse trains during pulser operation. The number of reference pulses is obtained from the pulse train input from the pulser multiplied by the numerator of the pulser operation ratio/denominator of pulser operation ratio. Setting range: 1 to 32,767 Any other settings will result in an error.
03AH	Pulser operation ratio denominator	U1	Set a divisor for the input pulse train for the operation of the pulser. The number of reference pulses is obtained from the pulse train input from the pulser multiplied by the numerator of the pulser operation ratio/denominator of pulser operation ratio. Setting range: 1 to 32,767 Any other settings will result in an error.
03BH	Pulser operation method	H0	This is the area for setting the pulser operation method. 0: Standard operation 1: Speed limit (pulse hold) 2: Speed limit (truncated) Any other settings will result in an error.
03CH	System reserved	-	-

<table>
<tr><th>Offset address</th><th>Name</th><th>Default</th><th>Setting range and description</th></tr>
<tr><td>-03FH</td><td></td><td></td><td></td></tr>
<tr><td>040H</td><td>System reserved</td><td>-</td><td>-</td></tr>
<tr><td>041H</td><td>J-point control code</td><td>H0</td><td>Sets the control code for J-point control.
<table><tr><th>Bit</th><th>Name</th><th>Default</th><th>Description</th></tr><tr><td>0</td><td>-</td><td>-</td><td>-</td></tr><tr><td>1</td><td>Acceleration/ deceleration pattern setting</td><td>0</td><td>0: Linear acceleration / deceleration
1: S-shaped acceleration/ deceleration</td></tr><tr><td>15 to 2</td><td>-</td><td>-</td><td>-</td></tr></table></td></tr>
<tr><td>042H</td><td>J-point acceleration time</td><td rowspan="2">U100</td><td rowspan="2">Sets the acceleration/deceleration time for J-point control.
Setting range: 0 to 10,000 (ms)
Any other settings will result in an error.</td></tr>
<tr><td>043H</td><td>J-point deceleration time</td></tr>
<tr><td>044H
-045H</td><td>J-point target speed</td><td>U1000</td><td>Sets the target speed for J-point control.
Setting range: 1 to 32,767,000
Any other settings will result in an error.
Interpretation changes according to 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></tr>
<tr><td>046H
-047H</td><td>System reserved</td><td>-</td><td>-</td></tr>
<tr><td>048H
-049H</td><td>Pulser operation maximum speed</td><td>H0</td><td>Sets the maximum speed when speed limit is selected for the pulser operation method.
The positioning unit will operate at maximum speed if the speed obtained from pulse input multiplied by the numerator of pulse operation/denominator of pulser operation is in excess of the specified maximum speed.
Unit: Set unit × 1000/s
Input range: 0 to 32767000 (pulse/s)
* If this area has been set to 0, it is the minimum speed in the set unit.</td></tr>
<tr><td>04AH
-04BH</td><td>Home coordinates</td><td>-</td><td>Stores the value of coordinate origin after the home return.</td></tr>
<tr><td>04CH</td><td>System reserved</td><td>-</td><td>-</td></tr>
<tr><td>04DH</td><td>Input time constant - Pulse input
(Note 1)</td><td>H0</td><td>Sets the time constant for each pulse input signal.
The pulse inputs A and B of the same axis are the same input time constant.
<table><tr><th>Bit</th><th>Default</th><th>Description</th></tr><tr><td>2 to 0</td><td>0H</td><td>0H: No input time constant
1H: -0.1 us
2H: -0.5 us
3H: -1.0 us</td></tr></table></td></tr>
</table>

Offset address	Name	Default	Setting range and description
			Bit: - / Default: - / Description: 4H: -2.0 us 5H: -10.0 us 6H: No input time constant 7H: No input time constant Bit: 15 to 3 / Default: - / Description: -
04EH	Input time constant - Home input (Note 1)	H0	Set the time constant of home input signal. Bit: 1 to 0 / Default: 0H / Description: 0H: No input time constant 1H: -10.0 us 2H: -100.0 us 3H: No input time constant Bit: 15 to 2 / Default: - / Description: -
04FH	System reserved	-	-

(Note 1) The input time constant is available for the unit of Ver.1.3 or later.

17.6.3 Positioning Data Setting Area

■ Positioning table

Data in the following format is stored from the first address of the positioning table for each axis. For details of the starting addresses of each positioning table, refer to the lists on page "P.17-46" and subsequent pages.

Offset address	Name	Default	Setting range and description
000H	Control code	H0	Area to set the position specification method and acceleration/ deceleration pattern of positioning. Bit: 0 / Name: Control method / Default: 0 / Description: 0: Increment mode 1: Absolute mode Bit: 1 / Name: Acceleration/ deceleration pattern / Default: 0 / Description: 0: Linear acceleration / deceleration 1: S-shaped acceleration/ deceleration Bit: 15 to 2 / Name: - / Default: - / Description: -
001H	Operation pattern	H0	Area to set the single and interpolation operation pattern of positioning. The relationship of interpolation is in conformity with the settings for the axis group setting area in the unit memory common area. For interpolation operations, the settings of the axis with the smallest number in an axis group take effect.

<table>
<tr><th>Offset address</th><th>Name</th><th>Default</th><th>Setting range and description</th></tr>
<tr><td></td><td></td><td></td><td>
<table>
<tr><th>Bit</th><th>Name</th><th>Default</th><th>Description</th></tr>
<tr><td>7 to 0</td><td>Control pattern</td><td>00H</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 result in an error.</td></tr>
<tr><td>15 to 8</td><td>Interpolation setting</td><td>00H</td><td>H 00: Linear interpolation (Composite speed)
H 01: Linear interpolation (Major axis speed)
H 10: Circular interpolation (Center point/CW direction)
H11: Circular interpolation (Center point/CCW direction)
H 20: Circular interpolation (Pass point):
H 50: Spiral interpolation (Center point/CW direction/X-axis movement)
H 51: Spiral interpolation (Center point/CCW direction/X-axis movement)
H 52: Spiral interpolation (Center point/CW direction/Y-axis movement)
H 53: Spiral interpolation (Center point/CCW direction/Y-axis movement)
H 54: Spiral interpolation (Center point/CW direction/Z-axis movement)
H 55: Spiral interpolation (Center point/CCW direction/Z-axis movement)
H 60: Spiral interpolation (Pass point/X-axis movement)
H 61: Spiral interpolation (Pass point/Y-axis movement)
H 62: Spiral interpolation (Pass point/Z-axis movement)
Any other settings will result in an error.</td></tr>
</table>
</td></tr>
<tr><td>002H
-003H</td><td>System reserved</td><td>-</td><td>-</td></tr>
<tr><td>004H</td><td>Positioning acceleration time</td><td rowspan="2">U100</td><td rowspan="2">Sets acceleration and deceleration times for positioning operations
Acceleration time and deceleration time can be set individually.
For interpolation operations, the settings of the axis with the smallest number in an axis group take effect.
Setting range: 0 to 10,000 (ms)
Any other settings will result in an error.</td></tr>
<tr><td>005H</td><td>Positioning deceleration time</td></tr>
<tr><td>006H
-007H</td><td>Positioning target speed
(Interpolation speed)</td><td>U1000</td><td>The target axis will operate at target speed in the case of single axis operation and operate at target interpolation speed in the case of interpolation operation.
For interpolation operations, the settings of the axis with the smallest number in an axis group take effect.
Setting range: 1 to 32,767,000
Any other settings will result in an error.</td></tr>
</table>

Offset address	Name	Defaul t	Setting range and description
			Interpretation changes according to 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	Sets the movement amount for positioning operations. The amount of increment movement or absolute coordinates will be set according to the control code settings. Setting range: -1,073,741,823 to +1,073,741,823 Any other settings will result in an error. Interpretation changes according to the unit settings as below. Pulse: -1,073,741,823 to +1,073,741,823 pulses μm (0.1 μm): -107,374,182.3 to +107,374,182.3 μm μm (1 μm): -1,073,741,823 to +1,073,741,823 μm inch (0.00001 inch): -10,737.41823 to +10,737.41823 inches inch (0.0001 inch): -107,374.1823 to +107,374.1823 inches degree (0.1 degree): -107,374,182.3 to +107,374,182.3 degrees degree (1 degree): -1,073,741,823 to +1,073,741,823 degrees
00AH -00BH	Auxiliary point	K0	Sets auxiliary points (center point and pass point coordinates) for circular interpolation or spiral interpolation control. Setting range: -1,073,741,823 to +1,073,741,823 Any other settings will result in an error. Interpretation changes according to the unit settings as below. Pulse: -1,073,741,823 to +1,073,741,823 pulses μm (0.1 μm): -107,374,182.3 to +107,374,182.3 μm μm (1 μm): -1,073,741,823 to +1,073,741,823 μm inch (0.00001 inch): -10,737.41823 to +10,737.41823 inches inch (0.0001 inch): -107,374.1823 to +107,374.1823 inches degree (0.1 degree): -107,374,182.3 to +107,374,182.3 degrees degree (1 degree): -1,073,741,823 to +1,073,741,823 degrees
00CH	Dwell Time	H0	On completion of the positioning of this table, the operation of the next table will start after stopping the motor for the dwell time in the case of the continuance point (C-point), the dwell time will be ignored in the case of the passing point (P-point), and the positioning done contact will turn ON after a pause of the dwell time in the case of end point (E-point) control. Setting range: 0 to 32,767 (ms) Any other settings will result in an error.
00DH	Auxiliary output code	K0	Sets the data to be output to the auxiliary output code in the each axis information & monitor area according to the setting of the auxiliary output mode in the parameter setting area. No setting ranges, in particular.
00EH -00FH	System reserved	-	-

Info.

- The unit memory address of each item on the positioning table is based on a separate address allocated to each axis and table added with the offset address.

■ First address of each positioning table (Standard area: 1 to 600)

Table No.	1 axes	2 axes	3 axes	4 axes	Virtual axis
1	UM 00850	UM 03050	UM 05850	UM 08050	UM 12050
2	UM 00860	UM 03060	UM 05860	UM 08060	UM 12060
3	UM 00870	UM 03070	UM 05870	UM 08070	UM 12070
4	UM 00880	UM 03080	UM 05880	UM 08080	UM 12080
5	UM 00890	UM 03090	UM 05890	UM 08090	UM 12090
6	UM 008A0	UM 030A0	UM 058A0	UM 080A0	UM 120A0
7	UM 008B0	UM 030B0	UM 058B0	UM 080B0	UM 120B0
8	UM 008C0	UM 030C0	UM 058C0	UM 080C0	UM 120C0
9	UM 008D0	UM 030D0	UM 058D0	UM 080D0	UM 120D0
10	UM 008E0	UM 030E0	UM 058E0	UM 080E0	UM 120E0
11	UM 008F0	UM 030F0	UM 058F0	UM 080F0	UM 120F0
12	UM 00900	UM 03100	UM 05900	UM 08100	UM 12100
13	UM 00910	UM 03110	UM 05910	UM 08110	UM 12110
14	UM 00920	UM 03120	UM 05920	UM 08120	UM 12120
15	UM 00930	UM 03130	UM 05930	UM 08130	UM 12130
16	UM 00940	UM 03140	UM 05940	UM 08140	UM 12140
17	UM 00950	UM 03150	UM 05950	UM 08150	UM 12150
18	UM 00960	UM 03160	UM 05960	UM 08160	UM 12160
19	UM 00970	UM 03170	UM 05970	UM 08170	UM 12170
20	UM 00980	UM 03180	UM 05980	UM 08180	UM 12180
21	UM 00990	UM 03190	UM 05990	UM 08190	UM 12190
22	UM 009A0	UM 031A0	UM 059A0	UM 081A0	UM 121A0
23	UM 009B0	UM 031B0	UM 059B0	UM 081B0	UM 121B0
24	UM 009C0	UM 031C0	UM 059C0	UM 081C0	UM 121C0
25	UM 009D0	UM 031D0	UM 059D0	UM 081D0	UM 121D0
26	UM 009E0	UM 031E0	UM 059E0	UM 081E0	UM 121E0
27	UM 009F0	UM 031F0	UM 059F0	UM 081F0	UM 121F0
28	UM 00A00	UM 03200	UM 05A00	UM 08200	UM 12200
29	UM 00A10	UM 03210	UM 05A10	UM 08210	UM 12210
30	UM 00A20	UM 03220	UM 05A20	UM 08220	UM 12220
31	UM 00A30	UM 03230	UM 05A30	UM 08230	UM 12230
32	UM 00A40	UM 03240	UM 05A40	UM 08240	UM 12240
33	UM 00A50	UM 03250	UM 05A50	UM 08250	UM 12250

Table No.	1 axes	2 axes	3 axes	4 axes	Virtual axis
34	UM 00A60	UM 03260	UM 05A60	UM 08260	UM 12260
35	UM 00A70	UM 03270	UM 05A70	UM 08270	UM 12270
36	UM 00A80	UM 03280	UM 05A80	UM 08280	UM 12280
37	UM 00A90	UM 03290	UM 05A90	UM 08290	UM 12290
38	UM 00AA0	UM 032A0	UM 05AA0	UM 082A0	UM 122A0
39	UM 00AB0	UM 032B0	UM 05AB0	UM 082B0	UM 122B0
40	UM 00AC0	UM 032C0	UM 05AC0	UM 082C0	UM 122C0
41	UM 00AD0	UM 032D0	UM 05AD0	UM 082D0	UM 122D0
42	UM 00AE0	UM 032E0	UM 05AE0	UM 082E0	UM 122E0
43	UM 00AF0	UM 032F0	UM 05AF0	UM 082F0	UM 122F0
44	UM 00B00	UM 03300	UM 05B00	UM 08300	UM 12300
45	UM 00B10	UM 03310	UM 05B10	UM 08310	UM 12310
46	UM 00B20	UM 03320	UM 05B20	UM 08320	UM 12320
47	UM 00B30	UM 03330	UM 05B30	UM 08330	UM 12330
48	UM 00B40	UM 03340	UM 05B40	UM 08340	UM 12340
49	UM 00B50	UM 03350	UM 05B50	UM 08350	UM 12350
50	UM 00B60	UM 03360	UM 05B60	UM 08360	UM 12360
51	UM 00B70	UM 03370	UM 05B70	UM 08370	UM 12370
52	UM 00B80	UM 03380	UM 05B80	UM 08380	UM 12380
53	UM 00B90	UM 03390	UM 05B90	UM 08390	UM 12390
54	UM 00BA0	UM 033A0	UM 05BA0	UM 083A0	UM 123A0
55	UM 00BB0	UM 033B0	UM 05BB0	UM 083B0	UM 123B0
56	UM 00BC0	UM 033C0	UM 05BC0	UM 083C0	UM 123C0
57	UM 00BD0	UM 033D0	UM 05BD0	UM 083D0	UM 123D0
58	UM 00BE0	UM 033E0	UM 05BE0	UM 083E0	UM 123E0
59	UM 00BF0	UM 033F0	UM 05BF0	UM 083F0	UM 123F0
60	UM 00C00	UM 03400	UM 05C00	UM 08400	UM 12400
61	UM 00C10	UM 03410	UM 05C10	UM 08410	UM 12410
62	UM 00C20	UM 03420	UM 05C20	UM 08420	UM 12420
63	UM 00C30	UM 03430	UM 05C30	UM 08430	UM 12430
64	UM 00C40	UM 03440	UM 05C40	UM 08440	UM 12440
65	UM 00C50	UM 03450	UM 05C50	UM 08450	UM 12450
66	UM 00C60	UM 03460	UM 05C60	UM 08460	UM 12460
67	UM 00C70	UM 03470	UM 05C70	UM 08470	UM 12470
68	UM 00C80	UM 03480	UM 05C80	UM 08480	UM 12480
69	UM 00C90	UM 03490	UM 05C90	UM 08490	UM 12490
70	UM 00CA0	UM 034A0	UM 05CA0	UM 084A0	UM 124A0

Table No.	1 axes	2 axes	3 axes	4 axes	Virtual axis
71	UM 00CB0	UM 034B0	UM 05CB0	UM 084B0	UM 124B0
72	UM 00CC0	UM 034C0	UM 05CC0	UM 084C0	UM 124C0
73	UM 00CD0	UM 034D0	UM 05CD0	UM 084D0	UM 124D0
74	UM 00CE0	UM 034E0	UM 05CE0	UM 084E0	UM 124E0
75	UM 00CF0	UM 034F0	UM 05CF0	UM 084F0	UM 124F0
76	UM 00D00	UM 03500	UM 05D00	UM 08500	UM 12500
77	UM 00D10	UM 03510	UM 05D10	UM 08510	UM 12510
78	UM 00D20	UM 03520	UM 05D20	UM 08520	UM 12520
79	UM 00D30	UM 03530	UM 05D30	UM 08530	UM 12530
80	UM 00D40	UM 03540	UM 05D40	UM 08540	UM 12540
81	UM 00D50	UM 03550	UM 05D50	UM 08550	UM 12550
82	UM 00D60	UM 03560	UM 05D60	UM 08560	UM 12560
83	UM 00D70	UM 03570	UM 05D70	UM 08570	UM 12570
84	UM 00D80	UM 03580	UM 05D80	UM 08580	UM 12580
85	UM 00D90	UM 03590	UM 05D90	UM 08590	UM 12590
86	UM 00DA0	UM 035A0	UM 05DA0	UM 085A0	UM 125A0
87	UM 00DB0	UM 035B0	UM 05DB0	UM 085B0	UM 125B0
88	UM 00DC0	UM 035C0	UM 05DC0	UM 085C0	UM 125C0
89	UM 00DD0	UM 035D0	UM 05DD0	UM 085D0	UM 125D0
90	UM 00DE0	UM 035E0	UM 05DE0	UM 085E0	UM 125E0
91	UM 00DF0	UM 035F0	UM 05DF0	UM 085F0	UM 125F0
92	UM 00E00	UM 03600	UM 05E00	UM 08600	UM 12600
93	UM 00E10	UM 03610	UM 05E10	UM 08610	UM 12610
94	UM 00E20	UM 03620	UM 05E20	UM 08620	UM 12620
95	UM 00E30	UM 03630	UM 05E30	UM 08630	UM 12630
96	UM 00E40	UM 03640	UM 05E40	UM 08640	UM 12640
97	UM 00E50	UM 03650	UM 05E50	UM 08650	UM 12650
98	UM 00E60	UM 03660	UM 05E60	UM 08660	UM 12660
99	UM 00E70	UM 03670	UM 05E70	UM 08670	UM 12670
100	UM 00E80	UM 03680	UM 05E80	UM 08680	UM 12680
101	UM 00E90	UM 03690	UM 05E90	UM 08690	UM 12690
102	UM 00EA0	UM 036A0	UM 05EA0	UM 086A0	UM 126A0
103	UM 00EB0	UM 036B0	UM 05EB0	UM 086B0	UM 126B0
104	UM 00EC0	UM 036C0	UM 05EC0	UM 086C0	UM 126C0
105	UM 00ED0	UM 036D0	UM 05ED0	UM 086D0	UM 126D0
106	UM 00EE0	UM 036E0	UM 05EE0	UM 086E0	UM 126E0
107	UM 00EF0	UM 036F0	UM 05EF0	UM 086F0	UM 126F0

Table No.	1 axes	2 axes	3 axes	4 axes	Virtual axis
108	UM 00F00	UM 03700	UM 05F00	UM 08700	UM 12700
109	UM 00F10	UM 03710	UM 05F10	UM 08710	UM 12710
110	UM 00F20	UM 03720	UM 05F20	UM 08720	UM 12720
111	UM 00F30	UM 03730	UM 05F30	UM 08730	UM 12730
112	UM 00F40	UM 03740	UM 05F40	UM 08740	UM 12740
113	UM 00F50	UM 03750	UM 05F50	UM 08750	UM 12750
114	UM 00F60	UM 03760	UM 05F60	UM 08760	UM 12760
115	UM 00F70	UM 03770	UM 05F70	UM 08770	UM 12770
116	UM 00F80	UM 03780	UM 05F80	UM 08780	UM 12780
117	UM 00F90	UM 03790	UM 05F90	UM 08790	UM 12790
118	UM 00FA0	UM 037A0	UM 05FA0	UM 087A0	UM 127A0
119	UM 00FB0	UM 037B0	UM 05FB0	UM 087B0	UM 127B0
120	UM 00FC0	UM 037C0	UM 05FC0	UM 087C0	UM 127C0
121	UM 00FD0	UM 037D0	UM 05FD0	UM 087D0	UM 127D0
122	UM 00FE0	UM 037E0	UM 05FE0	UM 087E0	UM 127E0
123	UM 00FF0	UM 037F0	UM 05FF0	UM 087F0	UM 127F0
124	UM 01000	UM 03800	UM 06000	UM 08800	UM 12800
125	UM 01010	UM 03810	UM 06010	UM 08810	UM 12810
126	UM 01020	UM 03820	UM 06020	UM 08820	UM 12820
127	UM 01030	UM 03830	UM 06030	UM 08830	UM 12830
128	UM 01040	UM 03840	UM 06040	UM 08840	UM 12840
129	UM 01050	UM 03850	UM 06050	UM 08850	UM 12850
130	UM 01060	UM 03860	UM 06060	UM 08860	UM 12860
131	UM 01070	UM 03870	UM 06070	UM 08870	UM 12870
132	UM 01080	UM 03880	UM 06080	UM 08880	UM 12880
133	UM 01090	UM 03890	UM 06090	UM 08890	UM 12890
134	UM 010A0	UM 038A0	UM 060A0	UM 088A0	UM 128A0
135	UM 010B0	UM 038B0	UM 060B0	UM 088B0	UM 128B0
136	UM 010C0	UM 038C0	UM 060C0	UM 088C0	UM 128C0
137	UM 010D0	UM 038D0	UM 060D0	UM 088D0	UM 128D0
138	UM 010E0	UM 038E0	UM 060E0	UM 088E0	UM 128E0
139	UM 010F0	UM 038F0	UM 060F0	UM 088F0	UM 128F0
140	UM 01100	UM 03900	UM 06100	UM 08900	UM 12900
141	UM 01110	UM 03910	UM 06110	UM 08910	UM 12910
142	UM 01120	UM 03920	UM 06120	UM 08920	UM 12920
143	UM 01130	UM 03930	UM 06130	UM 08930	UM 12930
144	UM 01140	UM 03940	UM 06140	UM 08940	UM 12940

Table No.	1 axes	2 axes	3 axes	4 axes	Virtual axis
145	UM 01150	UM 03950	UM 06150	UM 08950	UM 12950
146	UM 01160	UM 03960	UM 06160	UM 08960	UM 12960
147	UM 01170	UM 03970	UM 06170	UM 8970	UM 12970
148	UM 01180	UM 03980	UM 06180	UM 08980	UM 12980
149	UM 01190	UM 03990	UM 06190	UM 08990	UM 12990
150	UM 011A0	UM 039A0	UM 061A0	UM 089A0	UM 129A0
151	UM 011B0	UM 039B0	UM 061B0	UM 089B0	UM 129B0
152	UM 011C0	UM 039C0	UM 061C0	UM 089C0	UM 129C0
153	UM 011D0	UM 039D0	UM061D0	UM 089D0	UM 129D0
154	UM 011E0	UM 039E0	UM 061E0	UM 089E0	UM 129E0
155	UM 011F0	UM 039F0	UM 061F0	UM 089F0	UM 129F0
156	UM 01200	UM 03A00	UM 06200	UM 08A00	UM 12A00
157	UM 01210	UM 03A10	UM 06210	UM 08A10	UM 12A10
158	UM 01220	UM 03A20	UM 06220	UM 08A20	UM 12A20
159	UM 01230	UM 03A30	UM 06230	UM 08A30	UM 12A30
160	UM 01240	UM 03A40	UM 06240	UM 08A40	UM 12A40
161	UM 01250	UM 03A50	UM 06250	UM 08A50	UM 12A50
162	UM 01260	UM 03A60	UM 06260	UM 08A60	UM 12A60
163	UM 01270	UM 03A70	UM 06270	UM 08A70	UM 12A70
164	UM 01280	UM 03A80	UM 06280	UM 08A80	UM 12A80
165	UM 01290	UM 03A90	UM 06290	UM 08A90	UM 12A90
166	UM 012A0	UM 03AA0	UM 062A0	UM 08AA0	UM 12AA0
167	UM 012B0	UM 03AB0	UM 062B0	UM 08AB0	UM 12AB0
168	UM 012C0	UM 03AC0	UM 062C0	UM 08AC0	UM 12AC0
169	UM 012D0	UM 03AD0	UM 062D0	UM 08AD0	UM 12AD0
170	UM 012E0	UM 03AE0	UM 062E0	UM 08AE0	UM 12AE0
171	UM 012F0	UM 03AF0	UM 062F0	UM 08AF0	UM 12AF0
172	UM 01300	UM 03B00	UM 06300	UM 08B00	UM 12B00
173	UM 01310	UM 03B10	UM 06310	UM 08B10	UM 12B10
174	UM 01320	UM 03B20	UM 06320	UM 08B20	UM 12B20
175	UM 01330	UM 03B30	UM 06330	UM 08B30	UM 12B30
176	UM 01340	UM 03B40	UM 06340	UM 08B40	UM 12B40
177	UM 01350	UM 03B50	UM 06350	UM 08B50	UM 12B50
178	UM 01360	UM 03B60	UM 06360	UM 08B60	UM 12B60
179	UM 01370	UM 03B70	UM 06370	UM 08B70	UM 12B70
180	UM 01380	UM 03B80	UM 06380	UM 08B80	UM 12B80
181	UM 01390	UM 03B90	UM 06390	UM 08B90	UM 12B90

Table No.	1 axes	2 axes	3 axes	4 axes	Virtual axis
182	UM 013A0	UM 03BA0	UM 063A0	UM 08BA0	UM 12BA0
183	UM 013B0	UM 03BB0	UM 063B0	UM 08BB0	UM 12BB0
184	UM 013C0	UM 03BC0	UM 063C0	UM 08BC0	UM 12BC0
185	UM 013D0	UM 03BD0	UM 063D0	UM 08BD0	UM 12BD0
186	UM 013E0	UM 03BE0	UM 063E0	UM 08BE0	UM 12BE0
187	UM 013F0	UM 03BF0	UM 063F0	UM 08BF0	UM 12BF0
188	UM 01400	UM 03C00	UM 06400	UM 08C00	UM 12C00
189	UM 01410	UM 03C10	UM 06410	UM 08C10	UM 12C10
190	UM 01420	UM 03C20	UM 06420	UM 08C20	UM 12C20
191	UM 01430	UM 03C30	UM 06430	UM 08C30	UM 12C30
192	UM 01440	UM 03C40	UM 06440	UM 08C40	UM 12C40
193	UM 01450	UM 03C50	UM 06450	UM 08C50	UM 12C50
194	UM 01460	UM 03C60	UM 06460	UM 08C60	UM 12C60
195	UM 01470	UM 03C70	UM 06470	UM 08C70	UM 12C70
196	UM 01480	UM 03C80	UM 06480	UM 08C80	UM 12C80
197	UM 01490	UM 03C90	UM 06490	UM 08C90	UM 12C90
198	UM 014A0	UM 03CA0	UM 064A0	UM 08CA0	UM 12CA0
199	UM 014B0	UM 03CB0	UM 064B0	UM 08CB0	UM 12CB0
200	UM 014C0	UM 03CC0	UM 064C0	UM 08CC0	UM 12CC0
201	UM 014D0	UM 03CD0	UM 064D0	UM 08CD0	UM 12CD0
202	UM 014E0	UM 03CE0	UM 064E0	UM 08CE0	UM 12CE0
203	UM 014F0	UM 03CF0	UM 064F0	UM 08CF0	UM 12CF0
204	UM 01500	UM 03D00	UM 06500	UM 08D00	UM 12D00
205	UM 01510	UM 03D10	UM 06510	UM 08D10	UM 12D10
206	UM 01520	UM 03D20	UM 06520	UM 08D20	UM 12D20
207	UM 01530	UM 03D30	UM 06530	UM 08D30	UM 12D30
208	UM 01540	UM 03D40	UM 06540	UM 08D40	UM 12D40
209	UM 01550	UM 03D50	UM 06550	UM 08D50	UM 12D50
210	UM 01560	UM 03D60	UM 06560	UM 08D60	UM 12D60
211	UM 01570	UM 03D70	UM 06570	UM 08D70	UM 12D70
212	UM 01580	UM 03D80	UM 06580	UM 08D80	UM 12D80
213	UM 01590	UM 03D90	UM 06590	UM 08D90	UM 12D90
214	UM 015A0	UM 03DA0	UM 065A0	UM 08DA0	UM 12DA0
215	UM 015B0	UM 03DB0	UM 065B0	UM 08DB0	UM 12DB0
216	UM 015C0	UM 03DC0	UM 065C0	UM 08DC0	UM 12DC0
217	UM 015D0	UM 03DD0	UM 065D0	UM 08DD0	UM 12DD0
218	UM 015E0	UM 03DE0	UM 065E0	UM 08DE0	UM 12DE0

Table No.	1 axes	2 axes	3 axes	4 axes	Virtual axis
219	UM 015F0	UM 03DF0	UM 065F0	UM 08DF0	UM 12DF0
220	UM 01600	UM 03E00	UM 06600	UM 08E00	UM 12E00
221	UM 01610	UM 03E10	UM 06610	UM 08E10	UM 12E10
222	UM 01620	UM 03E20	UM 06620	UM 08E20	UM 12E20
223	UM 01630	UM 03E30	UM 06630	UM 08E30	UM 12E30
224	UM 01640	UM 03E40	UM 06640	UM 08E40	UM 12E40
225	UM 01650	UM 03E50	UM 06650	UM 08E50	UM 12E50
226	UM 01660	UM 03E60	UM 06660	UM 08E60	UM 12E60
227	UM 01670	UM 03E70	UM 06670	UM 08E70	UM 12E70
228	UM 01680	UM 03E80	UM 06680	UM 08E80	UM 12E80
229	UM 01690	UM 03E90	UM 06690	UM 08E90	UM 12E90
230	UM 016A0	UM 03EA0	UM 066A0	UM 08EA0	UM 12EA0
231	UM 016B0	UM 03EB0	UM 066B0	UM 08EB0	UM 12EB0
232	UM 016C0	UM 03EC0	UM 066C0	UM 08EC0	UM 12EC0
233	UM 016D0	UM 03ED0	UM 066D0	UM 08ED0	UM 12ED0
234	UM 016E0	UM 03EE0	UM 066E0	UM 08EE0	UM 12EE0
235	UM 016F0	UM 03EF0	UM 066F0	UM 08EF0	UM 12EF0
236	UM 01700	UM 03F00	UM 06700	UM 08F00	UM 12F00
237	UM 01710	UM 03F10	UM 06710	UM 08F10	UM 12F10
238	UM 01720	UM 03F20	UM 06720	UM 08F20	UM 12F20
239	UM 01730	UM 03F30	UM 06730	UM 08F30	UM 12F30
240	UM 01740	UM 03F40	UM 06740	UM 08F40	UM 12F40
241	UM 01750	UM 03F50	UM 06750	UM 08F50	UM 12F50
242	UM 01760	UM 03F60	UM 06760	UM 08F60	UM 12F60
243	UM 01770	UM 03F70	UM 06770	UM 08F70	UM 12F70
244	UM 01780	UM 03F80	UM 06780	UM 08F80	UM 12F80
245	UM 01790	UM 03F90	UM 06790	UM 08F90	UM 12F90
246	UM 017A0	UM 03FA0	UM 067A0	UM 08FA0	UM 12FA0
247	UM 017B0	UM 03FB0	UM 067B0	UM 08FB0	UM 12FB0
248	UM 017C0	UM 03FC0	UM 067C0	UM 08FC0	UM 12FC0
249	UM 017D0	UM 03FD0	UM 067D0	UM 08FD0	UM 12FD0
250	UM 017E0	UM 03FE0	UM 067E0	UM 08FE0	UM 12FE0
251	UM 017F0	UM 03FF0	UM 067F0	UM 08FF0	UM 12FF0
252	UM 01800	UM 04000	UM 06800	UM 09000	UM 13000
253	UM 01810	UM 04010	UM 06810	UM 09010	UM 13010
254	UM 01820	UM 04020	UM 06820	UM 09020	UM 13020
255	UM 01830	UM 04030	UM 06830	UM 09030	UM 13030

Table No.	1 axes	2 axes	3 axes	4 axes	Virtual axis
256	UM 01840	UM 04040	UM 06840	UM 09040	UM 13040
257	UM 01850	UM 04050	UM 06850	UM 09050	UM 13050
258	UM 01860	UM 04060	UM 06860	UM 09060	UM 13060
259	UM 01870	UM 04070	UM 06870	UM 09070	UM 13070
260	UM 01880	UM 04080	UM 06880	UM 09080	UM 13080
261	UM 01890	UM 04090	UM 06890	UM 09090	UM 13090
262	UM 018A0	UM 040A0	UM 068A0	UM 090A0	UM 130A0
263	UM 018B0	UM 040B0	UM 068B0	UM 090B0	UM 130B0
264	UM 018C0	UM 040C0	UM 068C0	UM 090C0	UM 130C0
265	UM 018D0	UM 040D0	UM 068D0	UM 090D0	UM 130D0
266	UM 018E0	UM 040E0	UM 068E0	UM 090E0	UM 130E0
267	UM 018F0	UM 040F0	UM 068F0	UM 090F0	UM 130F0
268	UM 01900	UM 04100	UM 06900	UM 09100	UM 13100
269	UM 01910	UM 04110	UM 06910	UM 09110	UM 13110
270	UM 01920	UM 04120	UM 06920	UM 09120	UM 13120
271	UM 01930	UM 04130	UM 06930	UM 09130	UM 13130
272	UM 01940	UM 04140	UM 06940	UM 09140	UM 13140
273	UM 01950	UM 04150	UM 06950	UM 09150	UM 13150
274	UM 01960	UM 04160	UM 06960	UM 09160	UM 13160
275	UM 01970	UM 04170	UM 06970	UM 09170	UM 13170
276	UM 01980	UM 04180	UM 06980	UM 09180	UM 13180
277	UM 01990	UM 04190	UM 06990	UM 09190	UM 13190
278	UM 019A0	UM 041A0	UM 069A0	UM 091A0	UM 131A0
279	UM 019B0	UM 041B0	UM 069B0	UM 091B0	UM 131B0
280	UM 019C0	UM 041C0	UM 069C0	UM 091C0	UM 131C0
281	UM 019D0	UM 041D0	UM 069D0	UM 091D0	UM 131D0
282	UM 019E0	UM 041E0	UM 069E0	UM 091E0	UM 131E0
283	UM 019F0	UM 041F0	UM 069F0	UM 091F0	UM 131F0
284	UM 01A00	UM 04200	UM 06A00	UM 09200	UM 13200
285	UM 01A10	UM 04210	UM 06A10	UM 09210	UM 13210
286	UM 01A20	UM 04220	UM 06A20	UM 09220	UM 13220
287	UM 01A30	UM 04230	UM 06A30	UM 09230	UM 13230
288	UM 01A40	UM 04240	UM 06A40	UM 09240	UM 13240
289	UM 01A50	UM 04250	UM 06A50	UM 09250	UM 13250
290	UM 01A60	UM 04260	UM 06A60	UM 09260	UM 13260
291	UM 01A70	UM 04270	UM 06A70	UM 09270	UM 13270
292	UM 01A80	UM 04280	UM 06A80	UM 09280	UM 13280

Table No.	1 axes	2 axes	3 axes	4 axes	Virtual axis
293	UM 01A90	UM 04290	UM 06A90	UM 09290	UM 13290
294	UM 01AA0	UM 042A0	UM 06AA0	UM 092A0	UM 132A0
295	UM 01AB0	UM 042B0	UM 06AB0	UM 092B0	UM 132B0
296	UM 01AC0	UM 042C0	UM 06AC0	UM 092C0	UM 132C0
297	UM 01AD0	UM 042D0	UM 06AD0	UM 092D0	UM 132D0
298	UM 01AE0	UM 042E0	UM 06AE0	UM 092E0	UM 132E0
299	UM 01AF0	UM 042F0	UM 06AF0	UM 092F0	UM 132F0
300	UM 01B00	UM 04300	UM 06B00	UM 09300	UM 13300
301	UM 01B10	UM 04310	UM 06B10	UM 09310	UM 13310
302	UM 01B20	UM 04320	UM 06B20	UM 09320	UM 13320
303	UM 01B30	UM 04330	UM 06B30	UM 09330	UM 13330
304	UM 01B40	UM 04340	UM 06B40	UM 09340	UM 13340
305	UM 01B50	UM 04350	UM 06B50	UM 09350	UM 13350
306	UM 01B60	UM 04360	UM 06B60	UM 09360	UM 13360
307	UM 01B70	UM 04370	UM 06B70	UM 09370	UM 13370
308	UM 01B80	UM 04380	UM 06B80	UM 09380	UM 13380
309	UM 01B90	UM 04390	UM 06B90	UM 09390	UM 13390
310	UM 01BA0	UM 043A0	UM 06BA0	UM 093A0	UM 133A0
311	UM 01BB0	UM 043B0	UM 06BB0	UM 093B0	UM 133B0
312	UM 01BC0	UM 043C0	UM 06BC0	UM 093C0	UM 133C0
313	UM 01BD0	UM 043D0	UM 06BD0	UM 093D0	UM 133D0
314	UM 01BE0	UM 043E0	UM 06BE0	UM 093E0	UM 133E0
315	UM 01BF0	UM 043F0	UM 06BF0	UM 093F0	UM 133F0
316	UM 01C00	UM 04400	UM 06C00	UM 09400	UM 13400
317	UM 01C10	UM 04410	UM 06C10	UM 09410	UM 13410
318	UM 01C20	UM 04420	UM 06C20	UM 09420	UM 13420
319	UM 01C30	UM 04430	UM 06C30	UM 09430	UM 13430
320	UM 01C40	UM 04440	UM 06C40	UM 09440	UM 13440
321	UM 01C50	UM 04450	UM 06C50	UM 09450	UM 13450
322	UM 01C60	UM 04460	UM 06C60	UM 09460	UM 13460
323	UM 01C70	UM 04470	UM 06C70	UM 09470	UM 13470
324	UM 01C80	UM 04480	UM 06C80	UM 09480	UM 13480
325	UM 01C90	UM 04490	UM 06C90	UM 09490	UM 13490
326	UM 01CA0	UM 044A0	UM 06CA0	UM 094A0	UM 134A0
327	UM 01CB0	UM 044B0	UM 06CB0	UM 094B0	UM 134B0
328	UM 01CC0	UM 044C0	UM 06CC0	UM 094C0	UM 134C0
329	UM 01CD0	UM 044D0	UM 06CD0	UM 094D0	UM 134D0

Table No.	1 axes	2 axes	3 axes	4 axes	Virtual axis
330	UM 01CE0	UM 044E0	UM 06CE0	UM 094E0	UM 134E0
331	UM 01CF0	UM 044F0	UM 06CF0	UM 094F0	UM 134F0
332	UM 01D00	UM 04500	UM 06D00	UM 09500	UM 13500
333	UM 01D10	UM 04510	UM 06D10	UM 09510	UM 13510
334	UM 01D20	UM 04520	UM 06D20	UM 09520	UM 13520
335	UM 01D30	UM 04530	UM 06D30	UM 09530	UM 13530
336	UM 01D40	UM 04540	UM 06D40	UM 09540	UM 13540
337	UM 01D50	UM 04550	UM 06D50	UM 09550	UM 13550
338	UM 01D60	UM 04560	UM 06D60	UM 09560	UM 13560
339	UM 01D70	UM 04570	UM 06D70	UM 09570	UM 13570
340	UM 01D80	UM 04580	UM 06D80	UM 09580	UM 13580
341	UM 01D90	UM 04590	UM 06D90	UM 09590	UM 13590
342	UM 01DA0	UM 045A0	UM 06DA0	UM 095A0	UM 135A0
343	UM 01DB0	UM 045B0	UM 06DB0	UM 095B0	UM 135B0
344	UM 01DC0	UM 045C0	UM 06DC0	UM 095C0	UM 135C0
345	UM 01DD0	UM 045D0	UM 06DD0	UM 095D0	UM 135D0
346	UM 01DE0	UM 045E0	UM 06DE0	UM 095E0	UM 135E0
347	UM 01DF0	UM 045F0	UM 06DF0	UM 095F0	UM 135F0
348	UM 01E00	UM 04600	UM 06E00	UM 09600	UM 13600
349	UM 01E10	UM 04610	UM 06E10	UM 09610	UM 13610
350	UM 01E20	UM 04620	UM 06E20	UM 09620	UM 13620
351	UM 01E30	UM 04630	UM 06E30	UM 09630	UM 13630
352	UM 01E40	UM 04640	UM 06E40	UM 09640	UM 13640
353	UM 01E50	UM 04650	UM 06E50	UM 09650	UM 13650
354	UM 01E60	UM 04660	UM 06E60	UM 09660	UM 13660
355	UM 01E70	UM 04670	UM 06E70	UM 09670	UM 13670
356	UM 01E80	UM 04680	UM 06E80	UM 09680	UM 13680
357	UM 01E90	UM 04690	UM 06E90	UM 09690	UM 13690
358	UM 01EA0	UM 046A0	UM 06EA0	UM 096A0	UM 136A0
359	UM 01EB0	UM 046B0	UM 06EB0	UM 096B0	UM 136B0
360	UM 01EC0	UM 046C0	UM 06EC0	UM 096C0	UM 136C0
361	UM 01ED0	UM 046D0	UM 06ED0	UM 096D0	UM 136D0
362	UM 01EE0	UM 046E0	UM 06EE0	UM 096E0	UM 136E0
363	UM 01EF0	UM 046F0	UM 06EF0	UM 096F0	UM 136F0
364	UM 01F00	UM 04700	UM 06F00	UM 09700	UM 13700
365	UM 01F10	UM 04710	UM 06F10	UM 09710	UM 13710
366	UM 01F20	UM 04720	UM 06F20	UM 09720	UM 13720

Table No.	1 axes	2 axes	3 axes	4 axes	Virtual axis
367	UM 01F30	UM 04730	UM 06F30	UM 09730	UM 13730
368	UM 01F40	UM 04740	UM 06F40	UM 09740	UM 13740
369	UM 01F50	UM 04750	UM 06F50	UM 09750	UM 13750
370	UM 01F60	UM 04760	UM 06F60	UM 09760	UM 13760
371	UM 01F70	UM 04770	UM 06F70	UM 09770	UM 13770
372	UM 01F80	UM 04780	UM 06F80	UM 09780	UM 13780
373	UM 01F90	UM 04790	UM 06F90	UM 09790	UM 13790
374	UM 01FA0	UM 047A0	UM 06FA0	UM 097A0	UM 137A0
375	UM 01FB0	UM 047B0	UM 06FB0	UM 097B0	UM 137B0
376	UM 01FC0	UM 047C0	UM 06FC0	UM 097C0	UM 137C0
377	UM 01FD0	UM 047D0	UM 06FD0	UM 097D0	UM 137D0
378	UM 01FE0	UM 047E0	UM 06FE0	UM 097E0	UM 137E0
379	UM 01FF0	UM 047F0	UM 06FF0	UM 097F0	UM 137F0
380	UM 02000	UM 04800	UM 07000	UM 09800	UM 13800
381	UM 02010	UM 04810	UM 07010	UM 09810	UM 13810
382	UM 02020	UM 04820	UM 07020	UM 09820	UM 13820
383	UM 02030	UM 04830	UM 07030	UM 09830	UM 13830
384	UM 02040	UM 04840	UM 07040	UM 09840	UM 13840
385	UM 02050	UM 04850	UM 07050	UM 09850	UM 13850
386	UM 02060	UM 04860	UM 07060	UM 09860	UM 13860
387	UM 02070	UM 04870	UM 07070	UM 09870	UM 13870
388	UM 02080	UM 04880	UM 07080	UM 09880	UM 13880
389	UM 02090	UM 04890	UM 07090	UM 09890	UM 13890
390	UM 020A0	UM 048A0	UM 070A0	UM 098A0	UM 138A0
391	UM 020B0	UM 048B0	UM 070B0	UM 098B0	UM 138B0
392	UM 020C0	UM 048C0	UM 070C0	UM 098C0	UM 138C0
393	UM 020D0	UM 048D0	UM 070D0	UM 098D0	UM 138D0
394	UM 020E0	UM 048E0	UM 070E0	UM 098E0	UM 138E0
395	UM 020F0	UM 048F0	UM 070F0	UM 098F0	UM 138F0
396	UM 02100	UM 04900	UM 07100	UM 09900	UM 13900
397	UM 02110	UM 04910	UM 07110	UM 09910	UM 13910
398	UM 02120	UM 04920	UM 07120	UM 09920	UM 13920
399	UM 02130	UM 04930	UM 07130	UM 09930	UM 13930
400	UM 02140	UM 04940	UM 07140	UM 09940	UM 13940
401	UM 02150	UM 04950	UM 07150	UM 09950	UM 13950
402	UM 02160	UM 04960	UM 07160	UM 09960	UM 13960
403	UM 02170	UM 04970	UM 07170	UM 09970	UM 13970

Table No.	1 axes	2 axes	3 axes	4 axes	Virtual axis
404	UM 02180	UM 04980	UM 07180	UM 09980	UM 13980
405	UM 02190	UM 04990	UM 07190	UM 09990	UM 13990
406	UM 021A0	UM 049A0	UM 071A0	UM 099A0	UM 139A0
407	UM 021B0	UM 049B0	UM 071B0	UM 099B0	UM 139B0
408	UM 021C0	UM 049C0	UM 071C0	UM 099C0	UM 139C0
409	UM 021D0	UM 049D0	UM 071D0	UM 099D0	UM 139D0
410	UM 021E0	UM 049E0	UM 071E0	UM 099E0	UM 139E0
411	UM 021F0	UM 049F0	UM 071F0	UM 099F0	UM 139F0
412	UM 02200	UM 04A00	UM 07200	UM 09A00	UM 13A00
413	UM 02210	UM 04A10	UM 07210	UM 09A10	UM 13A10
414	UM 02220	UM 04A20	UM 07220	UM 09A20	UM 13A20
415	UM 02230	UM 04A30	UM 07230	UM 09A30	UM 13A30
416	UM 02240	UM 04A40	UM 07240	UM 09A40	UM 13A40
417	UM 02250	UM 04A50	UM 07250	UM 09A50	UM 13A50
418	UM 02260	UM 04A60	UM 07260	UM 09A60	UM 13A60
419	UM 02270	UM 04A70	UM 07270	UM 09A70	UM 13A70
420	UM 02280	UM 04A80	UM 07280	UM 09A80	UM 13A80
421	UM 02290	UM 04A90	UM 07290	UM 09A90	UM 13A90
422	UM 022A0	UM 04AA0	UM 072A0	UM 09AA0	UM 13AA0
423	UM 022B0	UM 04AB0	UM 072B0	UM 09AB0	UM 13AB0
424	UM 022C0	UM 04AC0	UM 072C0	UM 09AC0	UM 13AC0
425	UM 022D0	UM 04AD0	UM 072D0	UM 09AD0	UM 13AD0
426	UM 022E0	UM 04AE0	UM 072E0	UM 09AE0	UM 13AE0
427	UM 022F0	UM 04AF0	UM 072F0	UM 09AF0	UM 13AF0
428	UM 02300	UM 04B00	UM 07300	UM 09B00	UM 13B00
429	UM 02310	UM 04B10	UM 07310	UM 09B10	UM 13B10
430	UM 02320	UM 04B20	UM 07320	UM 09B20	UM 13B20
431	UM 02330	UM 04B30	UM 07330	UM 09B30	UM 13B30
432	UM 02340	UM 04B40	UM 07340	UM 09B40	UM 13B40
433	UM 02350	UM 04B50	UM 07350	UM 09B50	UM 13B50
434	UM 02360	UM 04B60	UM 07360	UM 09B60	UM 13B60
435	UM 02370	UM 04B70	UM 07370	UM 09B70	UM 13B70
436	UM 02380	UM 04B80	UM 07380	UM 09B80	UM 13B80
437	UM 02390	UM 04B90	UM 07390	UM 09B90	UM 13B90
438	UM 023A0	UM 04BA0	UM 073A0	UM 09BA0	UM 13BA0
439	UM 023B0	UM 04BB0	UM 073B0	UM 09BB0	UM 13BB0
440	UM 023C0	UM 04BC0	UM 073C0	UM 09BC0	UM 13BC0

Table No.	1 axes	2 axes	3 axes	4 axes	Virtual axis
441	UM 023D0	UM 04BD0	UM 073D0	UM 09BD0	UM 13BD0
442	UM 023E0	UM 04BE0	UM 073E0	UM 09BE0	UM 13BE0
443	UM 023F0	UM 04BF0	UM 073F0	UM 09BF0	UM 13BF0
444	UM 02400	UM 04C00	UM 07400	UM 09C00	UM 13C00
445	UM 02410	UM 04C10	UM 07410	UM 09C10	UM 13C10
446	UM 02420	UM 04C20	UM 07420	UM 09C20	UM 13C20
447	UM 02430	UM 04C30	UM 07430	UM 09C30	UM 13C30
448	UM 02440	UM 04C40	UM 07440	UM 09C40	UM 13C40
449	UM 02450	UM 04C50	UM 07450	UM 09C50	UM 13C50
450	UM 02460	UM 04C60	UM 07460	UM 09C60	UM 13C60
451	UM 02470	UM 04C70	UM 07470	UM 09C70	UM 13C70
452	UM 02480	UM 04C80	UM 07480	UM 09C80	UM 13C80
453	UM 02490	UM 04C90	UM 07490	UM 09C90	UM 13C90
454	UM 024A0	UM 04CA0	UM 074A0	UM 09CA0	UM 13CA0
455	UM 024B0	UM 04CB0	UM 074B0	UM 09CB0	UM 13CB0
456	UM 024C0	UM 04CC0	UM 074C0	UM 09CC0	UM 13CC0
457	UM 024D0	UM 04CD0	UM 074D0	UM 09CD0	UM 13CD0
458	UM 024E0	UM 04CE0	UM 074E0	UM 09CE0	UM 13CE0
459	UM 024F0	UM 04CF0	UM 074F0	UM 09CF0	UM 13CF0
460	UM 02500	UM 04D00	UM 07500	UM 09D00	UM 13D00
461	UM 02510	UM 04D10	UM 07510	UM 09D10	UM 13D10
462	UM 02520	UM 04D20	UM 07520	UM 09D20	UM 13D20
463	UM 02530	UM 04D30	UM 07530	UM 09D30	UM 13D30
464	UM 02540	UM 04D40	UM 07540	UM 09D40	UM 13D40
465	UM 02550	UM 04D50	UM 07550	UM 09D50	UM 13D50
466	UM 02560	UM 04D60	UM 07560	UM 09D60	UM 13D60
467	UM 02570	UM 04D70	UM 07570	UM 09D70	UM 13D70
468	UM 02580	UM 04D80	UM 07580	UM 09D80	UM 13D80
469	UM 02590	UM 04D90	UM 07590	UM 09D90	UM 13D90
470	UM 025A0	UM 04DA0	UM 075A0	UM 09DA0	UM 13DA0
471	UM 025B0	UM 04DB0	UM 075B0	UM 09DB0	UM 13DB0
472	UM 025C0	UM 04DC0	UM 075C0	UM 09DC0	UM 13DC0
473	UM 025D0	UM 04DD0	UM 075D0	UM 09DD0	UM 13DD0
474	UM 025E0	UM 04DE0	UM 075E0	UM 09DE0	UM 13DE0
475	UM 025F0	UM 04DF0	UM 075F0	UM 09DF0	UM 13DF0
476	UM 02600	UM 04E00	UM 07600	UM 09E00	UM 13E00
477	UM 02610	UM 04E10	UM 07610	UM 09E10	UM 13E10

Table No.	1 axes	2 axes	3 axes	4 axes	Virtual axis
478	UM 02620	UM 04E20	UM 07620	UM 09E20	UM 13E20
479	UM 02630	UM 04E30	UM 07630	UM 09E30	UM 13E30
480	UM 02640	UM 04E40	UM 07640	UM 09E40	UM 13E40
481	UM 02650	UM 04E50	UM 07650	UM 09E50	UM 13E50
482	UM 02660	UM 04E60	UM 07660	UM 09E60	UM 13E60
483	UM 02670	UM 04E70	UM 07670	UM 09E70	UM 13E70
484	UM 02680	UM 04E80	UM 07680	UM 09E80	UM 13E80
485	UM 02690	UM 04E90	UM 07690	UM 09E90	UM 13E90
486	UM 026A0	UM 04EA0	UM 076A0	UM 09EA0	UM 13EA0
487	UM 026B0	UM 04EB0	UM 076B0	UM 09EB0	UM 13EB0
488	UM 026C0	UM 04EC0	UM 076C0	UM 09EC0	UM 13EC0
489	UM 026D0	UM 04ED0	UM 076D0	UM 09ED0	UM 13ED0
490	UM 026E0	UM 04EE0	UM 076E0	UM 09EE0	UM 13EE0
491	UM 026F0	UM 04EF0	UM 076F0	UM 09EF0	UM 13EF0
492	UM 02700	UM 04F00	UM 07700	UM 09F00	UM 13F00
493	UM 02710	UM 04F10	UM 07710	UM 09F10	UM 13F10
494	UM 02720	UM 04F20	UM 07720	UM 09F20	UM 13F20
495	UM 02730	UM 04F30	UM 07730	UM 09F30	UM 13F30
496	UM 02740	UM 04F40	UM 07740	UM 09F40	UM 13F40
497	UM 02750	UM 04F50	UM 07750	UM 09F50	UM 13F50
498	UM 02760	UM 04F60	UM 07760	UM 09F60	UM 13F60
499	UM 02770	UM 04F70	UM 07770	UM 09F70	UM 13F70
500	UM 02780	UM 04F80	UM 07780	UM 09F80	UM 13F80
501	UM 02790	UM 04F90	UM 07790	UM 09F90	UM 13F90
502	UM 027A0	UM 04FA0	UM 077A0	UM 09FA0	UM 13FA0
503	UM 027B0	UM 04FB0	UM 077B0	UM 09FB0	UM 13FB0
504	UM 027C0	UM 04FC0	UM 077C0	UM 09FC0	UM 13FC0
505	UM 027D0	UM 04FD0	UM 077D0	UM 09FD0	UM 13FD0
506	UM 027E0	UM 04FE0	UM 077E0	UM 09FE0	UM 13FE0
507	UM 027F0	UM 04FF0	UM 077F0	UM 09FF0	UM 13FF0
508	UM 02800	UM 05000	UM 07800	UM 0A000	UM 14000
509	UM 02810	UM 05010	UM 07810	UM 0A010	UM 14010
510	UM 02820	UM 05020	UM 07820	UM 0A020	UM 14020
511	UM 02830	UM 05030	UM 07830	UM 0A030	UM 14030
512	UM 02840	UM 05040	UM 07840	UM 0A040	UM 14040
513	UM 02850	UM 05050	UM 07850	UM 0A050	UM 14050
514	UM 02860	UM 05060	UM 07860	UM 0A060	UM 14060

Table No.	1 axes	2 axes	3 axes	4 axes	Virtual axis
515	UM 02870	UM 05070	UM 07870	UM 0A070	UM 14070
516	UM 02880	UM 05080	UM 07880	UM 0A080	UM 14080
517	UM 02890	UM 05090	UM 07890	UM 0A090	UM 14090
518	UM 028A0	UM 050A0	UM 078A0	UM 0A0A0	UM 140A0
519	UM 028B0	UM 050B0	UM 078B0	UM 0A0B0	UM 140B0
520	UM 028C0	UM 050C0	UM 078C0	UM 0A0C0	UM 140C0
521	UM 028D0	UM 050D0	UM 078D0	UM 0A0D0	UM 140D0
522	UM 028E0	UM 050E0	UM 078E0	UM 0A0E0	UM 140E0
523	UM 028F0	UM 050F0	UM 078F0	UM 0A0F0	UM 140F0
524	UM 02900	UM 05100	UM 07900	UM 0A100	UM 14100
525	UM 02910	UM 05110	UM 07910	UM 0A110	UM 14110
526	UM 02920	UM 05120	UM 07920	UM 0A120	UM 14120
527	UM 02930	UM 05130	UM 07930	UM 0A130	UM 14130
528	UM 02940	UM 05140	UM 07940	UM 0A140	UM 14140
529	UM 02950	UM 05150	UM 07950	UM 0A150	UM 14150
530	UM 02960	UM 05160	UM 07960	UM 0A160	UM 14160
531	UM 02970	UM 05170	UM 07970	UM 0A170	UM 14170
532	UM 02980	UM 05180	UM 07980	UM 0A180	UM 14180
533	UM 02990	UM 05190	UM 07990	UM 0A190	UM 14190
534	UM 029A0	UM 051A0	UM 079A0	UM 0A1A0	UM 141A0
535	UM 029B0	UM 051B0	UM 079B0	UM 0A1B0	UM 141B0
536	UM 029C0	UM 051C0	UM 079C0	UM 0A1C0	UM 141C0
537	UM 029D0	UM 051D0	UM 079D0	UM 0A1D0	UM 141D0
538	UM 029E0	UM 051E0	UM 079E0	UM 0A1E0	UM 141E0
539	UM 029F0	UM 051F0	UM 079F0	UM 0A1F0	UM 141F0
540	UM 02A00	UM 05200	UM 07A00	UM 0A200	UM 14200
541	UM 02A10	UM 05210	UM 07A10	UM 0A210	UM 14210
542	UM 02A20	UM 05220	UM 07A20	UM 0A220	UM 14220
543	UM 02A30	UM 05230	UM 07A30	UM 0A230	UM 14230
544	UM 02A40	UM 05240	UM 07A40	UM 0A240	UM 14240
545	UM 02A50	UM 05250	UM 07A50	UM 0A250	UM 14250
546	UM 02A60	UM 05260	UM 07A60	UM 0A260	UM 14260
547	UM 02A70	UM 05270	UM 07A70	UM 0A270	UM 14270
548	UM 02A80	UM 05280	UM 07A80	UM 0A280	UM 14280
549	UM 02A90	UM 05290	UM 07A90	UM 0A290	UM 14290
550	UM 02AA0	UM 052A0	UM 07AA0	UM 0A2A0	UM 142A0
551	UM 02AB0	UM 052B0	UM 07AB0	UM 0A2B0	UM 142B0

Table No.	1 axes	2 axes	3 axes	4 axes	Virtual axis
552	UM 02AC0	UM 052C0	UM 07AC0	UM 0A2C0	UM 142C0
553	UM 02AD0	UM 052D0	UM 07AD0	UM 0A2D0	UM 142D0
554	UM 02AE0	UM 052E0	UM 07AE0	UM 0A2E0	UM 142E0
555	UM 02AF0	UM 052F0	UM 07AF0	UM 0A2F0	UM 142F0
556	UM 02B00	UM 05300	UM 07B00	UM 0A300	UM 14300
557	UM 02B10	UM 05310	UM 07B10	UM 0A310	UM 14310
558	UM 02B20	UM 05320	UM 07B20	UM 0A320	UM 14320
559	UM 02B30	UM 05330	UM 07B30	UM 0A330	UM 14330
560	UM 02B40	UM 05340	UM 07B40	UM 0A340	UM 14340
561	UM 02B50	UM 05350	UM 07B50	UM 0A350	UM 14350
562	UM 02B60	UM 05360	UM 07B60	UM 0A360	UM 14360
563	UM 02B70	UM 05370	UM 07B70	UM 0A370	UM 14370
564	UM 02B80	UM 05380	UM 07B80	UM 0A380	UM 14380
565	UM 02B90	UM 05390	UM 07B90	UM 0A390	UM 14390
566	UM 02BA0	UM 053A0	UM 07BA0	UM 0A3A0	UM 143A0
567	UM 02BB0	UM 053B0	UM 07BB0	UM 0A3B0	UM 143B0
568	UM 02BC0	UM 053C0	UM 07BC0	UM 0A3C0	UM 143C0
569	UM 02BD0	UM 053D0	UM 07BD0	UM 0A3D0	UM 143D0
570	UM 02BE0	UM 053E0	UM 07BE0	UM 0A3E0	UM 143E0
571	UM 02BF0	UM 053F0	UM 07BF0	UM 0A3F0	UM 143F0
572	UM 02C00	UM 05400	UM 07C00	UM 0A400	UM 14400
573	UM 02C10	UM 05410	UM 07C10	UM 0A410	UM 14410
574	UM 02C20	UM 05420	UM 07C20	UM 0A420	UM 14420
575	UM 02C30	UM 05430	UM 07C30	UM 0A430	UM 14430
576	UM 02C40	UM 05440	UM 07C40	UM 0A440	UM 14440
577	UM 02C50	UM 05450	UM 07C50	UM 0A450	UM 14450
578	UM 02C60	UM 05460	UM 07C60	UM 0A460	UM 14460
579	UM 02C70	UM 05470	UM 07C70	UM 0A470	UM 14470
580	UM 02C80	UM 05480	UM 07C80	UM 0A480	UM 14480
581	UM 02C90	UM 05490	UM 07C90	UM 0A490	UM 14490
582	UM 02CA0	UM 054A0	UM 07CA0	UM 0A4A0	UM 144A0
583	UM 02CB0	UM 054B0	UM 07CB0	UM 0A4B0	UM 144B0
584	UM 02CC0	UM 054C0	UM 07CC0	UM 0A4C0	UM 144C0
585	UM 02CD0	UM 054D0	UM 07CD0	UM 0A4D0	UM 144D0
586	UM 02CE0	UM 054E0	UM 07CE0	UM 0A4E0	UM 144E0
587	UM 02CF0	UM 054F0	UM 07CF0	UM 0A4F0	UM 144F0
588	UM 02D00	UM 05500	UM 07D00	UM 0A500	UM 14500

Table No.	1 axes	2 axes	3 axes	4 axes	Virtual axis
589	UM 02D10	UM 05510	UM 07D10	UM 0A510	UM 14510
590	UM 02D20	UM 05520	UM 07D20	UM 0A520	UM 14520
591	UM 02D30	UM 05530	UM 07D30	UM 0A530	UM 14530
592	UM 02D40	UM 05540	UM 07D40	UM 0A540	UM 14540
593	UM 02D50	UM 05550	UM 07D50	UM 0A550	UM 14550
594	UM 02D60	UM 05560	UM 07D60	UM 0A560	UM 14560
595	UM 02D70	UM 05570	UM 07D70	UM 0A570	UM 14570
596	UM 02D80	UM 05580	UM 07D80	UM 0A580	UM 14580
597	UM 02D90	UM 05590	UM 07D90	UM 0A590	UM 14590
598	UM 02DA0	UM 055A0	UM 07DA0	UM 0A5A0	UM 145A0
599	UM 02DB0	UM 055B0	UM 07DB0	UM 0A5B0	UM 145B0
600	UM 02DC0	UM 055C0	UM 07DC0	UM 0A5C0	UM 145C0

■ First address of each positioning table (Expansion area: 10001 to 100025)

Table No.	1 axes	2 axes	3 axes	4 axes	Virtual axis
10001	UM 02E70	UM 05670	UM 07E70	UM 0A670	UM 14670
10002	UM 02E80	UM 05680	UM 07E80	UM 0A680	UM 14680
10003	UM 02E90	UM 05690	UM 07E90	UM 0A690	UM 14690
10004	UM 02EA0	UM 056A0	UM 07EA0	UM 0A6A0	UM 146A0
10005	UM 02EB0	UM 056B0	UM 07EB0	UM 0A6B0	UM 146B0
10006	UM 02EC0	UM 056C0	UM 07EC0	UM 0A6C0	UM 146C0
10007	UM 02ED0	UM 056D0	UM 07ED0	UM 0A6D0	UM 146D0
10008	UM 02EE0	UM 056E0	UM 07EE0	UM 0A6E0	UM 146E0
10009	UM 02EF0	UM 056F0	UM 07EF0	UM 0A6F0	UM 146F0
10010	UM 02F00	UM 05700	UM 07F00	UM 0A700	UM 14700
10011	UM 02F10	UM 05710	UM 07F10	UM 0A710	UM 14710
10012	UM 02F20	UM 05720	UM 07F20	UM 0A720	UM 14720
10013	UM 02F30	UM 05730	UM 07F30	UM 0A730	UM 14730
10014	UM 02F40	UM 05740	UM 07F40	UM 0A740	UM 14740
10015	UM 02F50	UM 05750	UM 07F50	UM 0A750	UM 14750
10016	UM 02F60	UM 05760	UM 07F60	UM 0A760	UM 14760
10017	UM 02F70	UM 05770	UM 07F70	UM 0A770	UM 14770
10018	UM 02F80	UM 05780	UM 07F80	UM 0A780	UM 14780
10019	UM 02F90	UM 05790	UM 07F90	UM 0A790	UM 14790
10020	UM 02FA0	UM 057A0	UM 07FA0	UM 0A7A0	UM 147A0
10021	UM 02FB0	UM 057B0	UM 07FB0	UM 0A7B0	UM 147B0
10022	UM 02FC0	UM 057C0	UM 07FC0	UM 0A7C0	UM 147C0

Table No.	1 axes	2 axes	3 axes	4 axes	Virtual axis
10023	UM 02FD0	UM 057D0	UM 07FD0	UM 0A7D0	UM 147D0
10024	UM 02FE0	UM 057E0	UM 07FE0	UM 0A7E0	UM 147E0
10025	UM 02FF0	UM 057F0	UM 07FF0	UM 0A7F0	UM 147F0

Info.

- There are two extended areas for positioning tables. It is recommended to select an area with consecutive UM numbers according to the number of used tables.

Number of necessary tables	Area and table numbers to be used
1 to 25	Expansion area 1: Table numbers 10001 to 10025
26 to 75	Expansion area 2: Table numbers 10026 to 10100
76 to 100	Both the expansion areas 1 and 2 are used.

- For details of the expansion area, refer to "14.1.4 Types of Positioning Data Setting Areas".

■ First address of each positioning table (Expansion area 2: 10026 to 100100)

Table No.	1 axes	2 axes	3 axes	4 axes	Virtual axis
10026	UM 0A850	UM 0AD00	UM 0B1B0	UM 0B660	UM 0C920
10027	UM 0A860	UM 0AD10	UM 0B1C0	UM 0B670	UM 0C930
10028	UM 0A870	UM 0AD20	UM 0B1D0	UM 0B680	UM 0C940
10029	UM 0A880	UM 0AD30	UM 0B1E0	UM 0B690	UM 0C950
10030	UM 0A890	UM 0AD40	UM 0B1F0	UM 0B6A0	UM 0C960
10031	UM 0A8A0	UM 0AD50	UM 0B200	UM 0B6B0	UM 0C970
10032	UM 0A8B0	UM 0AD60	UM 0B210	UM 0B6C0	UM 0C980
10033	UM 0A8C0	UM 0AD70	UM 0B220	UM 0B6D0	UM 0C990
10034	UM 0A8D0	UM 0AD80	UM 0B230	UM 0B6E0	UM 0C9A0
10035	UM 0A8E0	UM 0AD90	UM 0B240	UM 0B6F0	UM 0C9B0
10036	UM 0A8F0	UM 0ADA0	UM 0B250	UM 0B700	UM 0C9C0
10037	UM 0A900	UM 0ADB0	UM 0B260	UM 0B710	UM 0C9D0
10038	UM 0A910	UM 0ADC0	UM 0B270	UM 0B720	UM 0C9E0
10039	UM 0A920	UM 0ADD0	UM 0B280	UM 0B730	UM 0C9F0
10040	UM 0A930	UM 0ADE0	UM 0B290	UM 0B740	UM 0CA00
10041	UM 0A940	UM 0ADF0	UM 0B2A0	UM 0B750	UM 0CA10
10042	UM 0A950	UM 0AE00	UM 0B2B0	UM 0B760	UM 0CA20
10043	UM 0A960	UM 0AE10	UM 0B2C0	UM 0B770	UM 0CA30
10044	UM 0A970	UM 0AE20	UM 0B2D0	UM 0B780	UM 0CA40
10045	UM 0A980	UM 0AE30	UM 0B2E0	UM 0B790	UM 0CA50
10046	UM 0A990	UM 0AE40	UM 0B2F0	UM 0B7A0	UM 0CA60
10047	UM 0A9A0	UM 0AE50	UM 0B300	UM 0B7B0	UM 0CA70

Table No.	1 axes	2 axes	3 axes	4 axes	Virtual axis
10048	UM 0A9B0	UM 0AE60	UM 0B310	UM 0B7C0	UM 0CA80
10049	UM 0A9C0	UM 0AE70	UM 0B320	UM 0B7D0	UM 0CA90
10050	UM 0A9D0	UM 0AE80	UM 0B330	UM 0B7E0	UM 0CAA0
10051	UM 0A9E0	UM 0AE90	UM 0B340	UM 0B7F0	UM 0CAB0
10052	UM 0A9F0	UM 0AEA0	UM 0B350	UM 0B800	UM 0CAC0
10053	UM 0AA00	UM 0AEB0	UM 0B360	UM 0B810	UM 0CAD0
10054	UM 0AA10	UM 0AEC0	UM 0B370	UM 0B820	UM 0CAE0
10055	UM 0AA20	UM 0AED0	UM 0B380	UM 0B830	UM 0CAF0
10056	UM 0AA30	UM 0AEE0	UM 0B390	UM 0B840	UM 0CB00
10057	UM 0AA40	UM 0AEF0	UM 0B3A0	UM 0B850	UM 0CB10
10058	UM 0AA50	UM 0AF00	UM 0B3B0	UM 0B860	UM 0CB20
10059	UM 0AA60	UM 0AF10	UM 0B3C0	UM 0B870	UM 0CB30
10060	UM 0AA70	UM 0AF20	UM 0B3D0	UM 0B880	UM 0CB40
10061	UM 0AA80	UM 0AF30	UM 0B3E0	UM 0B890	UM 0CB50
10062	UM 0AA90	UM 0AF40	UM 0B3F0	UM 0B8A0	UM 0CB60
10063	UM 0AAA0	UM 0AF50	UM 0B400	UM 0B8B0	UM 0CB70
10064	UM 0AAB0	UM 0AF60	UM 0B410	UM 0B8C0	UM 0CB80
10065	UM 0AAC0	UM 0AF70	UM 0B420	UM 0B8D0	UM 0CB90
10066	UM 0AAD0	UM 0AF80	UM 0B430	UM 0B8E0	UM 0CBA0
10067	UM 0AAE0	UM 0AF90	UM 0B440	UM 0B8F0	UM 0CBB0
10068	UM 0AAF0	UM 0AFA0	UM 0B450	UM 0B900	UM 0CBC0
10069	UM 0AB00	UM 0AFB0	UM 0B460	UM 0B910	UM 0CBD0
10070	UM 0AB10	UM 0AFC0	UM 0B470	UM 0B920	UM 0CBE0
10071	UM 0AB20	UM 0AFD0	UM 0B480	UM 0B930	UM 0CBF0
10072	UM 0AB30	UM 0AFE0	UM 0B490	UM 0B940	UM 0CC00
10073	UM 0AB40	UM 0AFF0	UM 0B4A0	UM 0B950	UM 0CC10
10074	UM 0AB50	UM 0B000	UM 0B4B0	UM 0B960	UM 0CC20
10075	UM 0AB60	UM 0B010	UM 0B4C0	UM 0B970	UM 0CC30
10076	UM 0AB70	UM 0B020	UM 0B4D0	UM 0B980	UM 0CC40
10077	UM 0AB80	UM 0B030	UM 0B4E0	UM 0B990	UM 0CC50
10078	UM 0AB90	UM 0B040	UM 0B4F0	UM 0B9A0	UM 0CC60
10079	UM 0ABA0	UM 0B050	UM 0B500	UM 0B9B0	UM 0CC70
10080	UM 0ABB0	UM 0B060	UM 0B510	UM 0B9C0	UM 0CC80
10081	UM 0ABC0	UM 0B070	UM 0B520	UM 0B9D0	UM 0CC90
10082	UM 0ABD0	UM 0B080	UM 0B530	UM 0B9E0	UM 0CCA0
10083	UM 0ABE0	UM 0B090	UM 0B540	UM 0B9F0	UM 0CCB0
10084	UM 0ABF0	UM 0B0A0	UM 0B550	UM 0BA00	UM 0CCC0

Table No.	1 axes	2 axes	3 axes	4 axes	Virtual axis
10085	UM 0AC00	UM 0B0B0	UM 0B560	UM 0BA10	UM 0CCD0
10086	UM 0AC10	UM 0B0C0	UM 0B570	UM 0BA20	UM 0CCE0
10087	UM 0AC20	UM 0B0D0	UM 0B580	UM 0BA30	UM 0CCF0
10088	UM 0AC30	UM 0B0E0	UM 0B590	UM 0BA40	UM 0CD00
10089	UM 0AC40	UM 0B0F0	UM 0B5A0	UM 0BA50	UM 0CD10
10090	UM 0AC50	UM 0B100	UM 0B5B0	UM 0BA60	UM 0CD20
10091	UM 0AC60	UM 0B110	UM 0B5C0	UM 0BA70	UM 0CD30
10092	UM 0AC70	UM 0B120	UM 0B5D0	UM 0BA80	UM 0CD40
10093	UM 0AC80	UM 0B130	UM 0B5E0	UM 0BA90	UM 0CD50
10094	UM 0AC90	UM 0B140	UM 0B5F0	UM 0BAA0	UM 0CD60
10095	UM 0ACA0	UM 0B150	UM 0B600	UM 0BAB0	UM 0CD70
10096	UM 0ACB0	UM 0B160	UM 0B610	UM 0BAC0	UM 0CD80
10097	UM 0ACC0	UM 0B170	UM 0B620	UM 0BAD0	UM 0CD90
10098	UM 0ACD0	UM 0B180	UM 0B630	UM 0BAE0	UM 0CDA0
10099	UM 0ACE0	UM 0B190	UM 0B640	UM 0BAF0	UM 0CDB0
10100	UM 0ACF0	UM 0B1A0	UM 0B650	UM 0BB00	UM 0CDC0

17.7 Unit Memory Synchronous Control Setting Area

17.7.1 Synchronous Control Setting Area

This area is used to set up synchronous control. When making the setting using the configuration menu, these values are automatically stored. It is not necessary to set them.

Unit memory no. (Hex)	Description	
UM 16000 - UM1600F	Synchronous setting area of 1st axis	Synchronous control common setting area
UM 16010 - UM1601F		Electronic gear setting area
UM 16020 - UM1604F		Clutch setting area
UM 16050 - UM1606F		Electronic cam setting area
UM 16070 - UM1607F	Synchronous setting area of 2nd axis	Synchronous control common setting area
UM 16080 - UM1608F		Electronic gear setting area
UM 16090 - UM160BF		Clutch setting area
UM 160C0 - UM160DF		Electronic cam setting area
UM 160E0 - UM160EF	Synchronous setting area of 3rd axis	Synchronous control common setting area
UM 160F0 - UM160FF		Electronic gear setting area
UM 16100 - UM1612F		Clutch setting area
UM 16130 - UM1614F		Electronic cam setting area
UM 16150 - UM1615F	Synchronous setting area of 4th axis	Synchronous control common setting area
UM 16160 - UM1616F		Electronic gear setting area
UM 16170 - UM1619F		Clutch setting area
UM 161A0 - UM161BF		Electronic cam setting area
UM 161C0 - UM163FF	System reserved	

17.7.2 Details of Synchronous Control Setting Area

■ Synchronous control common setting area of 1st axis

<table>
<tr><th>Unit memory No. (Hex)</th><th>Name</th><th>Default</th><th>Description</th></tr>
<tr><td>UM16000</td><td>Synchronous master axis selection of 1st axis</td><td>H0</td><td>Sets the master axis for each axis.
<table>
<tr><th>Set value</th><th>Master axis</th><th>Set value</th><th>Master axis</th></tr>
<tr><td>H0</td><td>No synchronous master axis is used or the target axis is used as a master axis.</td><td>H10</td><td>Virtual axis</td></tr>
<tr><td>H1</td><td>1 axes</td><td>H21</td><td>Pulse input 1</td></tr>
<tr><td>H2</td><td>2 axes</td><td>H22</td><td>Pulse input 2</td></tr>
</table></td></tr>
</table>

<table>
<tr><th>Unit memory No. (Hex)</th><th>Name</th><th>Default</th><th>Description</th></tr>
<tr><td></td><td></td><td></td><td>
<table>
<tr><th>Set value</th><th>Master axis</th><th>Set value</th><th>Master axis</th></tr>
<tr><td>H3</td><td>3 axes</td><td>H23</td><td>Pulse input 3</td></tr>
<tr><td>H4</td><td>4 axes</td><td>H24</td><td>Pulse input 4</td></tr>
</table>
</td></tr>
<tr><td>UM16001</td><td>Synchronous output function selection of 1st axis</td><td>H0</td><td>Stores the status of the synchronous operation function set for the axis.
<table>
<tr><th>Bit</th><th>Function</th><th>Setting</th></tr>
<tr><td>0</td><td>Electronic gear operation setting</td><td rowspan="5">0: Not use
1: Use</td></tr>
<tr><td>1</td><td>Clutch operation setting</td></tr>
<tr><td>2</td><td>Electronic cam operation setting</td></tr>
<tr><td>3</td><td>Advance angle correction synchronization setting</td></tr>
<tr><td>15-4</td><td>Area reserved for system</td></tr>
</table>
</td></tr>
<tr><td>UM16002</td><td>1st axis synchronous slave
single deceleration stop
Deceleration method</td><td>H0</td><td>Set the deceleration method when performing the deceleration stop during the synchronous operation.
<table>
<tr><th>Bit</th><th>Function</th><th>Setting</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: S shape</td></tr>
<tr><td>15-2</td><td>Area reserved for system</td><td></td></tr>
</table>
</td></tr>
<tr><td>UM16003</td><td>1st axis synchronous slave
single deceleration stop
deceleration time</td><td>H0</td><td>Set the deceleration time when performing the deceleration stop during the synchronous operation.
Setting range: 0 to 10,000 (ms)
Any other settings will be errors.</td></tr>
<tr><td>UM16004
- 16000F</td><td>System reserved</td><td>-</td><td>-</td></tr>
</table>

(Note 1) The advanced angle correction function is available for units of Ver.1.5 or later.

■ Electronic gear setting area of 1st axis

<table>
<tr><th>Unit memory No. (Hex)</th><th>Name</th><th>Default</th><th>Description</th></tr>
<tr><td>UM16010
-UM16011</td><td>Each axis gear ratio numerator</td><td>U1</td><td rowspan="2">Sets the numerator and denominator separately for the gear ratios of electronic gears.
Setting range: U1 to U2,147,483,647
The gear ratios of electronic gears are determined by the following formula:</td></tr>
<tr><td>UM16012
-UM16013</td><td>Each axis gear ratio denominator</td><td>U1</td></tr>
</table>

Unit memory No. (Hex)	Name	Default	Description
			Output speed of electronic gear = Operating speed of master axis × (Gear ratio numerator / Gear ratio denominator)
UM16014	Each axis gear change time	U1	Sets the time required to change the current gear ratio to a new gear ratio when the gear ratio of the electronic gear is changed during operation. U1 to U 10000 [ms]
UM16015 -UM16001F	System reserved	-	-

■ Clutch setting area of 1st axis

Unit memory No. (Hex)	Name	Default	Description
UM16020	Clutch ON trigger types	H0	H0: I/O clutch ON request
UM16021	Clutch ON edge selection	H0	Sets the valid condition of trigger signals. H0: Level H1: Rising edge H2: Falling edge
UM16022 -UM16027	System reserved	-	-
UM16028	Clutch OFF trigger types	H0	H0: I/O clutch OFF request H11: I/O + Phase after clutch control clutch OFF
UM16029	Clutch OFF edge selection	H0	Sets the valid condition of trigger signals. H0: Invalid H1: Rising edge H2: Falling edge
UM1602A	Clutch OFF phase ratio	H0	Sets the ratio for the phase at which the clutch turns OFF when "I/O + Phase after clutch control" is selected for the clutch OFF trigger type. Setting range: 0 to 99 (%)
UM1602B -UM1602F	System reserved	-	-
UM16030	Clutch ON method	H0	H0: Direct H1: Slip
UM16031	System reserved	-	-
UM16032	Clutch ON slip method	H0	H0: Slip time setting
UM16033	Clutch ON slip time	U1	1 to 10000 ms
UM16034 -UM16035	System reserved	-	-
UM16036	Clutch ON slip curve selection	H0	H0: Linear
UM16037 -UM1603F	System reserved	-	-
UM16040	Clutch OFF method	H0	H0: Direct

Unit memory No. (Hex)	Name	Default	Description
			H1: Slip
UM16041	System reserved	-	-
UM16042	Clutch OFF slip method	H0	H0: Slip time setting
UM16043	Clutch OFF slip time	U1	1 to 10000 ms
UM16044 -UM16045	System reserved	-	-
UM16046	Clutch OFF slip curve selection	H0	H0: Linear
UM16047 -UM1604F	System reserved	-	-

■ Electronic cam setting area of 1st axis

Unit memory No. (Hex)	Name	Default	Description
UM16050 - UM16051	Cam control synchronous master axis cycle	U1	Set the cam control synchronous master cycle. U1 to U2147483647
UM16052	System reserved	-	-
UM16053	Used cam pattern number	U1	Sets the registered cam pattern number to be used. 1 to (16)
UM16054 - UM16055	Cam stroke amount	U1	Displacement amount upper limit setting for cam control U1 to U2147483647
UM16056 - UM16057	Advance angle correction reference amount	K0	Sets the correction reference amount required for the unit to calculate the advance angle correction amount when the advance angle correction function is used. Setting range: K-1,073,741,823 to K1,073,741,823 The unit follows the unit system of the master axis. Pulse: -1,073,741,823 to +1,073,741,823 pulses μm (0.1 μm): -107,374,182.3 to +107,374,182.3 μm μm (1 μm): -1,073,741,823 to +1,073,741,823 μm inch (0.00001 inch): -10,737.41823 to +10,737.41823 inches inch (0.0001 inch): -107,374.1823 to +107,374.1823 inches degree (0.1 degree): -107,374,182.3 to +107,374,182.3 degrees degree (1 degree): -1,073,741,823 to +1,073,741,823 degrees
UM16058 - UM16059	Advance angle correction speed	U100	Sets the reference speed required for the unit to calculate the advance angle correction amount when the advance angle correction function is used. Setting range: U1 to U32,767,000 (Specified unit system) The unit follows the unit system of the master axis. Pulse: 1 to 32,767,000 pps μm: 1 to 32,767,000 μm/s inch: 0.001 to 32,767.000 inch/s

Unit memory No. (Hex)	Name	Default	Description
			degree: 0.001 to 32,767.000 rev/s
UM1605A	Advance angle correction parameter change time	U100	Set the time required until a changed value is reflected when the parameter related to advance angle correction (advance angle correction reference speed or advance angle correction reference amount) is changed during the electronic cam operation. Setting range: U1 to U10000ms
UM1605B - UM1606F	System reserved	-	-

(Note 1) The advanced angle correction function is available for units of Ver.1.5 or later.

■ Synchronous control common setting area of 2nd axis

Unit memory No. (Hex)	Name	Default	Description
UM16070	Synchronous master axis selection of each axis	H0	Refer to axis 1.
UM16071	Synchronous output function selection of each axis	H0	Refer to axis 1.
UM16072 -UM1607F	System reserved	-	-

(Note 1) The advanced angle correction function is available for units of Ver.1.5 or later.

■ Electronic gear setting area of 2nd axis

Unit memory No. (Hex)	Name	Default	Description
UM16080 -UM16081	Each axis gear ratio numerator	U1	Refer to axis 1.
UM16082 -UM16083	Each axis gear ratio denominator	U1	Refer to axis 1.
UM16084	Each axis gear change time	U1	Refer to axis 1.
UM16085 -UM1608F	System reserved	-	-

■ Clutch setting area of 2nd axis

Unit memory No. (Hex)	Name	Default	Description
UM16090	Clutch ON trigger types	H0	Refer to axis 1.
UM16091	Clutch ON edge selection	H0	Refer to axis 1.
UM16092 -UM16097	System reserved	-	-
UM16098	Clutch OFF trigger types	H0	Refer to axis 1.

Unit memory No. (Hex)	Name	Default	Description
UM16099	Clutch OFF edge selection	H0	Refer to axis 1.
UM1609A	Clutch OFF phase ratio	H0	Refer to axis 1.
UM1609B -UM1609F	System reserved	-	Refer to axis 1.
UM160A0	Clutch ON method	H0	Refer to axis 1.
UM160A1	System reserved	-	-
UM160A2	Clutch ON slip method	H0	Refer to axis 1.
UM160A3	Clutch ON slip time	U1	Refer to axis 1.
UM160A4 -UM160A5	System reserved	-	-
UM160A6	Clutch ON slip curve selection	H0	Refer to axis 1.
UM160A7 -UM160AF	System reserved	-	-
UM160B0	Clutch OFF method	H0	Refer to axis 1.
UM160B1	System reserved	-	-
UM160B2	Clutch OFF slip method	H0	Refer to axis 1.
UM160B3	Clutch OFF slip time	U1	Refer to axis 1.
UM160B4 -UM1600B5	System reserved	-	-
UM160B6	Clutch OFF slip curve selection	H0	Refer to axis 1.
UM160B7 -UM160BF	System reserved	-	-

■ Electronic cam setting area of 2nd axis

Unit memory No. (Hex)	Name	Default	Description
UM160C0 -UM160C1	Cam control synchronous master axis cycle	U1	Refer to axis 1.
UM160C2	System reserved	-	-
UM160C3	Used cam pattern number	U1	Refer to axis 1.
UM160C4 -UM160C5	Cam stroke amount	U1	Refer to axis 1.
UM160C6 -UM160C7	Advance angle correction reference amount	K0	Refer to axis 1.
UM160C8 -UM160C9	Advance angle correction speed	U100	Refer to axis 1.

Unit memory No. (Hex)	Name	Default	Description
UM160CA	Advance angle correction parameter change time	U100	Refer to axis 1.
UM160CB -UM160DF	System reserved	-	-

(Note 1) The advanced angle correction function is available for units of Ver.1.5 or later.

■ Synchronous control common setting area of 3rd axis

Unit memory No. (Hex)	Name	Default	Description
UM160E0	Synchronous master axis selection of each axis	H0	Refer to axis 1.
UM160E1	Synchronous output function selection of each axis	H0	Refer to axis 1.
UM160E2 -UM160EF	System reserved	-	-

(Note 1) The advanced angle correction function is available for units of Ver.1.5 or later.

■ Electronic gear setting area of 3rd axis

Unit memory No. (Hex)	Name	Default	Description
UM160F0 -UM160F1	Each axis gear ratio numerator	U1	Refer to axis 1.
UM160F2 -UM160F3	Each axis gear ratio denominator	U1	Refer to axis 1.
UM160F4	Each axis gear change time	U1	Refer to axis 1.
UM161F5 -UM161FF	System reserved	-	-

■ Clutch setting area of 3rd axis

Unit memory No. (Hex)	Name	Default	Description
UM16100	Clutch ON trigger types	H0	Refer to axis 1.
UM16101	Clutch ON edge selection	H0	Refer to axis 1.
UM16102 -UM16107	System reserved	-	-
UM16108	Clutch OFF trigger types	H0	Refer to axis 1.

Unit memory No. (Hex)	Name	Default	Description
UM16109	Clutch OFF edge selection	H0	Refer to axis 1.
UM1610A	Clutch OFF phase ratio	H0	Refer to axis 1.
UM1610B -UM1610F	System reserved	-	Refer to axis 1.
UM16110	Clutch ON method	H0	Refer to axis 1.
UM16111	System reserved	-	-
UM16112	Clutch ON slip method	H0	Refer to axis 1.
UM16113	Clutch ON slip time	U1	Refer to axis 1.
UM16114 -UM16115	System reserved	-	-
UM16116	Clutch ON slip curve selection	H0	Refer to axis 1.
UM16117 -UM16119	System reserved	-	-
UM16110	Clutch OFF method	H0	Refer to axis 1.
UM16111	System reserved	-	-
UM16112	Clutch OFF slip method	H0	Refer to axis 1.
UM16113	Clutch OFF slip time	U1	Refer to axis 1.
UM16114 -UM16115	System reserved	-	-
UM16116	Clutch OFF slip curve selection	H0	Refer to axis 1.
UM16117 -UM1611F	System reserved	-	-

■ Electronic cam setting area of 3rd axis

Unit memory No. (Hex)	Name	Default	Description
UM16130 -UM16131	Cam control synchronous master axis cycle	U1	Refer to axis 1.
UM16132	System reserved	-	-
UM16133	Used cam pattern number	U1	Refer to axis 1.
UM16134 -UM16135	Cam stroke amount	U1	Refer to axis 1.
UM16136 -UM16137	Advance angle correction reference amount	K0	Refer to axis 1.

Unit memory No. (Hex)	Name	Default	Description
UM16138 -UM16139	Advance angle correction speed	U100	Refer to axis 1.
UM1613A	Advance angle correction parameter change time	U100	Refer to axis 1.
UM1613B -UM1614F	System reserved	-	-

(Note 1) The advanced angle correction function is available for units of Ver.1.5 or later.

■ Synchronous control common setting area of 4th axis

Unit memory No. (Hex)	Name	Default	Description
UM16150	Synchronous master axis selection of each axis	H0	Refer to axis 1.
UM16151	Synchronous output function selection of each axis	H0	Refer to axis 1.
UM16152 -UM1615F	System reserved	-	-

(Note 1) The advanced angle correction function is available for units of Ver.1.5 or later.

■ Electronic gear setting area of 4th axis

Unit memory No. (Hex)	Name	Default	Description
UM16160 -UM16161	Each axis gear ratio numerator	U1	Refer to axis 1.
UM16162 -UM16163	Each axis gear ratio denominator	U1	Refer to axis 1.
UM16164	Each axis gear change time	U1	Refer to axis 1.
UM16165 -UM1616F	System reserved	-	-

■ Clutch setting area of 4th axis

Unit memory No. (Hex)	Name	Default	Description
UM16170	Clutch ON trigger types	H0	Refer to axis 1.
UM16171	Clutch ON edge selection	H0	Refer to axis 1.
UM16172 -UM16177	System reserved	-	-
UM16178	Clutch OFF trigger types	H0	Refer to axis 1.

Unit memory No. (Hex)	Name	Default	Description
UM16179	Clutch OFF edge selection	H0	Refer to axis 1.
UM1617A	Clutch OFF phase ratio	H0	Refer to axis 1.
UM1617B -UM1617F	System reserved	-	Refer to axis 1.
UM16180	Clutch ON method	H0	Refer to axis 1.
UM16181	System reserved	-	-
UM16182	Clutch ON slip method	H0	Refer to axis 1.
UM16183	Clutch ON slip time	U1	Refer to axis 1.
UM16184 -UM16185	System reserved	-	-
UM16186	Clutch ON slip curve selection	H0	Refer to axis 1.
UM16187 -UM16189	System reserved	-	-
UM16190	Clutch OFF method	H0	Refer to axis 1.
UM16191	System reserved	-	-
UM16192	Clutch OFF slip method	H0	Refer to axis 1.
UM16193	Clutch OFF slip time	U1	Refer to axis 1.
UM16194 -UM16195	System reserved	-	-
UM16196	Clutch OFF slip curve selection	H0	Refer to axis 1.
UM16197 -UM1619F	System reserved	-	-

■ Electronic cam setting area of 4th axis

Unit memory No. (Hex)	Name	Default	Description
UM161A0 -UM161A1	Cam control synchronous master axis cycle	U1	Refer to axis 1.
UM161A2	System reserved	-	-
UM161A3	Used cam pattern number	U1	Refer to axis 1.
UM161A4 -UM161A5	Cam stroke amount	U1	Refer to axis 1.
UM161A6 -UM161A7	Advance angle correction reference amount	K0	Refer to axis 1.
UM161A8 -UM161A9	Advance angle correction speed	U100	Refer to axis 1.

Unit memory No. (Hex)	Name	Default	Description
UM161AA	Advance angle correction parameter change time	U100	Refer to axis 1.
UM161AB -UM161BF	System reserved	-	-

(Note 1) The advanced angle correction function is available for units of Ver.1.5 or later.

17.8 Positioning Operation Change Setting Area

17.8.1 Positioning Speed/Movement Amount Change Parameter

■ 1 axes

Unit memory No. (Hex)	Name	Default	Description
UM 17C00	1 axes Positioning speed change: ratio specification (Override)	U100	Area for setting the change rate (%) to the ratio specification (override) command speed of the positioning speed change. The speed change request by I/O is not necessary, and the change becomes valid when the set value (ratio) is set. U1 to U300 (%)
UM 17C01	1 axes Positioning speed change: mode selection	H0	Area for setting the range of change when the positioning speed is changed. H0: Active table only H1: Active table to E-point (until the completion of the operation) In the case of other values, the unit operates as the setting of H0 (Active table only).
UM17C02 -UM17C03	1 axes Positioning speed change: Changed speed	U100	Area for setting the changed speed when the positioning speed is changed. [Speed specification method: Speed direct specification] U1 to U32,767,000 (Specified unit system)
UM17C04 -UM17C09	System reserved	-	-
UM17C0A -UM17C0B	1 axes Positioning movement amount change: Changed movement amount	K0	Area for setting a changed movement amount when the positioning movement amount is changed. K-1,073,741,823 to K1,073,741,823 (Specified unit system)
UM17C0C -UM17C0F	System reserved	-	-

(Note 1) The positioning operation change setting area is available for the unit of Ver.1.3 or later.

■ 2 axes

Unit memory No. (Hex)	Name	Description
UM 17C10	2 axes Positioning speed change: ratio specification (Override)	Refer to axis 1.
UM 17C11	2 axes Positioning speed change: mode selection	Refer to axis 1.

Unit memory No. (Hex)	Name	Description
UM 17C12 -UM 17C13	2 axes Positioning speed change: Changed speed	Refer to axis 1.
UM 17C14 -UM 17C19	System reserved	-
UM 17C1A -UM17C1B	2 axes Positioning movement amount change: Changed movement amount	Refer to axis 1.
UM 17C1C -UM 17C1F	System reserved	-

(Note 1) The positioning operation change setting area is available for the unit of Ver.1.3 or later.

■ 3 axes

Unit memory No. (Hex)	Name	Description
UM 17C20	3 axes Positioning speed change: ratio specification (Override)	Refer to axis 1.
UM 17C21	3 axes Positioning speed change: mode selection	Refer to axis 1.
UM 17C22 -UM 17C23	3 axes Positioning speed change: Changed speed	Refer to axis 1.
UM 17C24 -UM 17C29	System reserved	-
UM 17C2A -UM17C2B	3 axes Positioning movement amount change: Changed movement amount	Refer to axis 1.
UM 17C2C -UM 17C2F	System reserved	-

(Note 1) The positioning operation change setting area is available for the unit of Ver.1.3 or later.

■ 4 axes

Unit memory No. (Hex)	Name	Description
UM 17C30	4 axes Positioning speed change: ratio specification (Override)	Refer to axis 1.
UM 17C31	4 axes Positioning speed change: mode selection	Refer to axis 1.
UM 17C32 -UM 17C33	4 axes Positioning speed change: Changed speed	Refer to axis 1.
UM 17C34 -UM 17C39	System reserved	-
UM 17C3A -UM17C3B	4 axes Positioning movement amount change: Changed movement amount	Refer to axis 1.
UM 17C3C -UM 17C3F	System reserved	-

(Note 1) The positioning operation change setting area is available for the unit of Ver.1.3 or later.

■ Virtual axis

Unit memory No. (Hex)	Name	Description
UM 17C70	Virtual axis Positioning speed change: ratio specification (Override)	Refer to axis 1.
UM 17C71	Virtual axis Positioning speed change: mode selection	Refer to axis 1.
UM 17C72 -UM 17C73	Virtual axis Positioning speed change: Changed speed	Refer to axis 1.
UM 17C74 -UM 17C79	System reserved	-
UM 17C7A	Virtual axis	Refer to axis 1.

Unit memory No. (Hex)	Name	Description
-UM17C7B	Positioning movement amount change: Changed movement amount	
UM 17C7C -UM 17C7F	System reserved	-

(Note 1) The positioning operation change setting area is available for the unit of Ver.1.3 or later.

17.9 Cam Pattern Editing Area

17.9.1 Cam Pattern Setting Area

<table>
<tr><th>Unit memory No. (Hex)</th><th>Name</th><th>Default</th><th>Description</th></tr>
<tr><td>UM18000</td><td>Cam pattern number</td><td>H0</td><td>When reading: Set a cam pattern number to be read out.
When rewriting: Set a cam pattern number to be rewritten.
The setting range varies depending on resolutions.
<table>
<tr><th>Pattern resolution</th><th>Settable range</th></tr>
<tr><td>1024, 2048, 4096, 8192</td><td>U1 to U16</td></tr>
<tr><td>16384</td><td>U1 to U8</td></tr>
<tr><td>32768</td><td>U1 to U4</td></tr>
</table></td></tr>
<tr><td>UM18001</td><td>System reserved</td><td>-</td><td>-</td></tr>
<tr><td>UM18002</td><td>No. of cam pattern setting sections</td><td>H0</td><td>When reading, the number of setting sections of the read cam pattern table is stored. When rewriting, sets the number of setting sections of the rewritten cam pattern table.
Setting range: U1 to U20</td></tr>
<tr><td>UM18003</td><td>Shift amount</td><td>H0</td><td>When reading, stores the shift amount of the read cam pattern table. When rewriting, sets the shift amount of the rewritten cam pattern table.
Setting range: U0 to U10000 × (0.01%)</td></tr>
<tr><td>UM18004</td><td>Start phase of Section 1</td><td>H0</td><td>● When reading, stores the start phase in the section 1 of the read cam pattern table. The read value is always 0.
● When rewriting, sets the start phase in the section 1 of the rewritten cam pattern table. When any value other than 0 is set in the section 1, it cannot be rewritten correctly.
Setting range: (Decimal) U0 to U10000 (×0.01%)
When reading, the numbers beyond the third decimal point are truncated and the result is stored. When writing, regsiters it after calculating the numbers beyond the third decimal point by the unit.</td></tr>
<tr><td>UM18005</td><td>Displacement of Section 1</td><td>K0</td><td>● When reading, stores the displacement in the section 1 of the read cam pattern table.
● When rewriting, sets the displacement in the section 1 of the rewritten cam pattern table.
Setting range: (Decimal) K-10000 to K10000 (×0.01%)
When reading, stores it truncating the numbers beyond the thrid decimal point. When rewriting, stores it filling the numbers beyond the third decimal point with 0.</td></tr>
<tr><td>UM18006</td><td>Cam curve of Section 1</td><td>H0</td><td>When reading, stores the cam curve number of the read cam pattern table. When rewriting, sets the cam curve number of the rewritten cam pattern table.
<table>
<tr><th>Set value</th><th>Cam curve name</th><th>Set value</th><th>Cam curve name</th></tr>
<tr><td>U10</td><td>Constant velocity</td><td>U43</td><td>One-dwell cycloid m=1</td></tr>
<tr><td>U11</td><td>Constant acceleration</td><td>U44</td><td>One-dwell cycloid m=2/3</td></tr>
</table></td></tr>
</table>

<table>
<tr><th>Unit memory No. (Hex)</th><th>Name</th><th>Default</th><th>Description</th></tr>
<tr><td></td><td></td><td></td><td>
<table>
<tr><th>Set value</th><th>Cam curve name</th><th>Set value</th><th>Cam curve name</th></tr>
<tr><td>U12</td><td>Simple harmonic motion</td><td>U45</td><td>One-dwell modified trapezoid m=1</td></tr>
<tr><td>U22</td><td>Cycloid</td><td>U46</td><td>One-dwell modified trapezoid (Ferguson)</td></tr>
<tr><td>U25</td><td>Modified trapezoid</td><td>U47</td><td>One-dwell modified trapezoid m=2/3</td></tr>
<tr><td>U26</td><td>Modified sine</td><td>U48</td><td>One-dwell modified sine</td></tr>
<tr><td>U27</td><td>Modified constant velocity</td><td>U49</td><td>One-dwell trapecloid</td></tr>
<tr><td>U33</td><td>Asymmetric cycloid</td><td>U51</td><td>No-dwell modified trapezoid</td></tr>
<tr><td>U34</td><td>Asymmetric modified trapezoid</td><td>U52</td><td>No-dwell modified constant velocity</td></tr>
<tr><td>U35</td><td>Trapecloid</td><td>U92</td><td>NC2 curve</td></tr>
</table>
</td></tr>
<tr><td>UM18007</td><td>System reserved</td><td>-</td><td>-</td></tr>
<tr><td>UM18008
-UM1800B</td><td>Area for Section 2</td><td>-</td><td rowspan="12">Just like the area for the section 1, one word each is allocated to the start phase, displacement, cam curve and the reserved area for system.
<table>
<tr><th></th><th>Start phase in section</th><th>Displace ment in section</th><th>Cam curve in section</th><th>System reserved</th></tr>
<tr><td rowspan="4">Offset address last number</td><td>UMx0</td><td>UMx1</td><td>UMx2</td><td>UMx3</td></tr>
<tr><td>UMx4</td><td>UMx5</td><td>UMx6</td><td>UMx7</td></tr>
<tr><td>UMx8</td><td>UMx9</td><td>UMxA</td><td>UMxB</td></tr>
<tr><td>UMxC</td><td>UMxD</td><td>UMxE</td><td>UMxF</td></tr>
</table>
</td></tr>
<tr><td>UM1800C
-UM1800F</td><td>Area for Section 3</td><td>-</td></tr>
<tr><td>UM18010
-UM18013</td><td>Area for Section 4</td><td>-</td></tr>
<tr><td>UM18014
-UM18017</td><td>Area for Section 5</td><td>-</td></tr>
<tr><td>UM18018
-UM1801B</td><td>Area for Section 6</td><td>-</td></tr>
<tr><td>UM1801C
-UM1801F</td><td>Area for Section 7</td><td>-</td></tr>
<tr><td>UM18020
-UM18023</td><td>Area for Section 8</td><td>-</td></tr>
<tr><td>UM18024
-UM18027</td><td>Area for Section 9</td><td>-</td></tr>
<tr><td>UM18028
-UM1802B</td><td>Area for Section 10</td><td>-</td></tr>
<tr><td>UM1802C
-UM1802F</td><td>Area for Section 11</td><td>-</td></tr>
<tr><td>UM18030
-UM18033</td><td>Area for Section 12</td><td>-</td></tr>
<tr><td>UM18034
-UM18037</td><td>Area for Section 13</td><td>-</td></tr>
</table>

Unit memory No. (Hex)	Name	Default	Description
UM18038 -UM1803B	Area for Section 14	-	
UM1803C -UM1803F	Area for Section 15	-	
UM18040 -UM18043	Area for Section 16	-	
UM18044 -UM18047	Area for Section 17	-	
UM18048 -UM1804B	Area for Section 18	-	
UM1804C -UM1804F	Area for Section 19	-	
UM18050 -UM18053	Area for Section 20	-	
UM18054 -UM18057	System reserved	-	

(Note 1) The cam pattern editing area is available for the unit of Ver.1.5 or later.

17.9.2 Cam pattern editing execution confirmation area

<table>
<tr><th>Unit memory No. (Hex)</th><th>Name</th><th>Default</th><th>Description</th></tr>
<tr><td>UM18058</td><td>Cam pattern reading result</td><td>H0</td><td>Stores the result of read processing (response code).
H0: Normal termination
Other than H0: Abnormal termination</td></tr>
<tr><td>UM18059</td><td>Cam pattern rewriting result</td><td>H0</td><td>Stores the result of rewriting processing (response code).
H0: Normal termination
Other than H0: Abnormal termination</td></tr>
<tr><td>UM1805A</td><td>Cam pattern update flag</td><td>HFFFF</td><td>Notifies the valid cam pattern table data.
Bits are allocated to the cam pattern numbers 1 to 15.
All the bits of bit0 to bit15 turn to "1" when the mode of the CPU unit changes to the RUN mode and the configuration data set by the tool software becomes valid. When a cam pattern is rewritten by a user program, the bit of a corresponding cam pattern number turns to "0".
Note) Never rewrite this area. If the area is rewritten, the status cannot be notified normally.
<table>
<tr><th>Bit No.</th><th>Name</th><th>Default</th><th>Description</th></tr>
<tr><td>0</td><td>Cam pattern No.1 validity condition</td><td>1</td><td>0: Cam pattern table after rewriting by user</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><th>Unit memory No. (Hex)</th><th>Name</th><th>Default</th><th>Description</th></tr>
<tr><td></td><td></td><td></td><td>
<table>
<tr><th>Bit No.</th><th>Name</th><th>Default</th><th>Description</th></tr>
<tr><td>1</td><td>Cam pattern No.2 validity condition</td><td>1</td><td rowspan="15">program is valid.
1: Configuration data from tool software is enabled.</td></tr>
<tr><td>2</td><td>Cam pattern No.3 validity condition</td><td>1</td></tr>
<tr><td>3</td><td>Cam pattern No.4 validity condition</td><td>1</td></tr>
<tr><td>4</td><td>Cam pattern No.5 validity condition</td><td>1</td></tr>
<tr><td>5</td><td>Cam pattern No.6 validity condition</td><td>1</td></tr>
<tr><td>6</td><td>Cam pattern No.7 validity condition</td><td>1</td></tr>
<tr><td>7</td><td>Cam pattern No.8 validity condition</td><td>1</td></tr>
<tr><td>8</td><td>Cam pattern No.9 validity condition</td><td>1</td></tr>
<tr><td>9</td><td>Cam pattern No.10 validity condition</td><td>1</td></tr>
<tr><td>10</td><td>Cam pattern No.11 validity condition</td><td>1</td></tr>
<tr><td>11</td><td>Cam pattern No.12 validity condition</td><td>1</td></tr>
<tr><td>12</td><td>Cam pattern No.13 validity condition</td><td>1</td></tr>
<tr><td>13</td><td>Cam pattern No.14 validity condition</td><td>1</td></tr>
<tr><td>14</td><td>Cam pattern No.15 validity condition</td><td>1</td></tr>
<tr><td>15</td><td>Cam pattern No.16 validity condition</td><td>1</td></tr>
</table>
</td></tr>
</table>

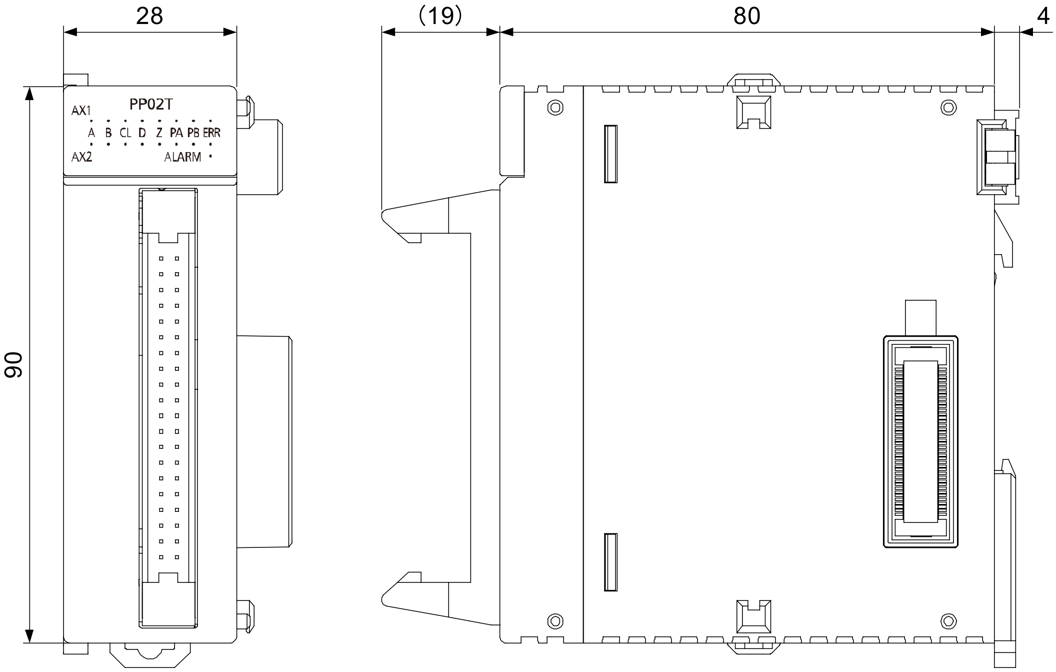
(Note 1) In the case of abnormal termination, the codes in the following table are stored.

Code	Name	Description	Processing		Countermeasures
			Read	Write	
H FF01	Cam pattern number setting error	Cam pattern number set displacement is out of range	Yes	Yes	Check the set cam pattern number.
H FF02	Invalid number of set cam pattern sections	The set number of cam pattern sections is out of range.	-	Yes	Check the set number of sections.
H FF03	Shift amount setting error	The set shift amount is out of range.	-	Yes	Check the set shift amount.

Code	Name	Description	Processing		Countermeasures
			Read	Write	
H FF05	Start phase setting error 1	The set start phase is out of range.	-	Yes	Check the set start phase of each section.
H FF06	Start phase setting error 2	The set start phase is equal to or smaller than the start phase of the previous section.	-	Yes	Check if the relation between the start phases of each section is (Start phase of section n-1) < (Start phase of section n).
H FF07	Start phase setting error 3	The set start phase of Section 1 is not 0.	-	Yes	Always set the start phase of Section 1 to 0.
H FF0A	Displacement setting error	The set displacement is out of range.	-	Yes	Check the set phase of each section.
H FF0B	Cam curve number setting error	The set cam curve number is out of range.	-	Yes	Check the set cam curve number of each section.
H FF10	Cam pattern reading non-executable error 1	There are axes under synchronous control.	Yes	-	Cancel the synchronous operation and execute the reading.
H FF11	Cam pattern reading non-executable error 2	An operating axis exists.	Yes	-	Make sure that there are no operating axes before reading the cam pattern.
H FF20	Cam pattern rewriting non-executable error 1	There are axes under synchronous control. -	-	Yes	Cancel the synchronous operation and execute the rewriting.
H FF21	Cam pattern rewriting non-executable error 2	An operating axis exists.	-	Yes	Execute the rewriting when no operating axis exists.
H FF22	Cam pattern rewriting non-executable error 3	The reading request and rewriting request turned on simultaneously.	-	Yes	Check if the reading request and rewriting request do not turn on simultaneously. When the reading request and rewriting request turn on simultaneously, the reading request takes priority.

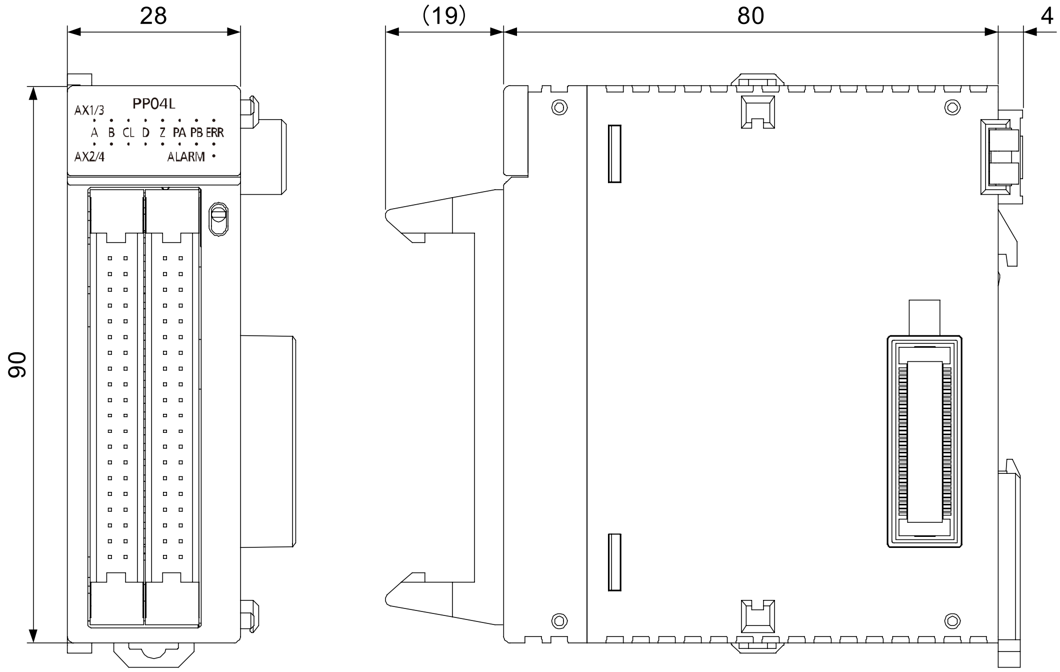
17.10 Dimensions

■ **2-axis type**



(Unit: mm)

■ 4-axis type



(Unit: mm)

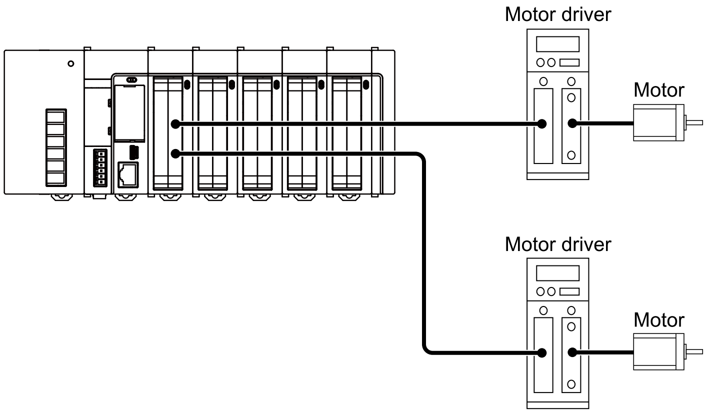
(MEMO)

18 Sample programs

18.1 Basic Configuration and Contact Allocations of Sample Programs

In the sample programs, the internal relays are used for the start contacts of each operation. Connect them to the input contacts such as switches as needed.

■ Basic Configuration



The positioning unit is installed in slot 1. The 1st axis and 2nd axis of the positioning unit connect to a stepping motor each, with the linear interpolation of the 2nd axis sampled. This example is shown on the condition that parameter settings for each axis are made in the **positioning setting** menu of the programming tool and saved in the positioning unit.

■ Used contacts and data registers

Number	Description
R2	Request home return
R3	Request positioning start
R4	1st axis JOG forward request
R5	1st axis JOG reverse request
R6	2nd axis JOG forward request
R7	2nd axis JOG reverse request
R10	Error clear
R11	Request set value change
R100	Operation enabled flag for 1st axis
R101	1st axis JOG forward OFF edge
R102	1st axis JOG reverse OFF edge
R200	Operation enabled flag for 2nd axis
R201	2nd axis JOG forward OFF edge
R202	2nd axis JOG reverse OFF edge

Number	Description
X100	Ready positioning flag
X104	Tool operation for all axes

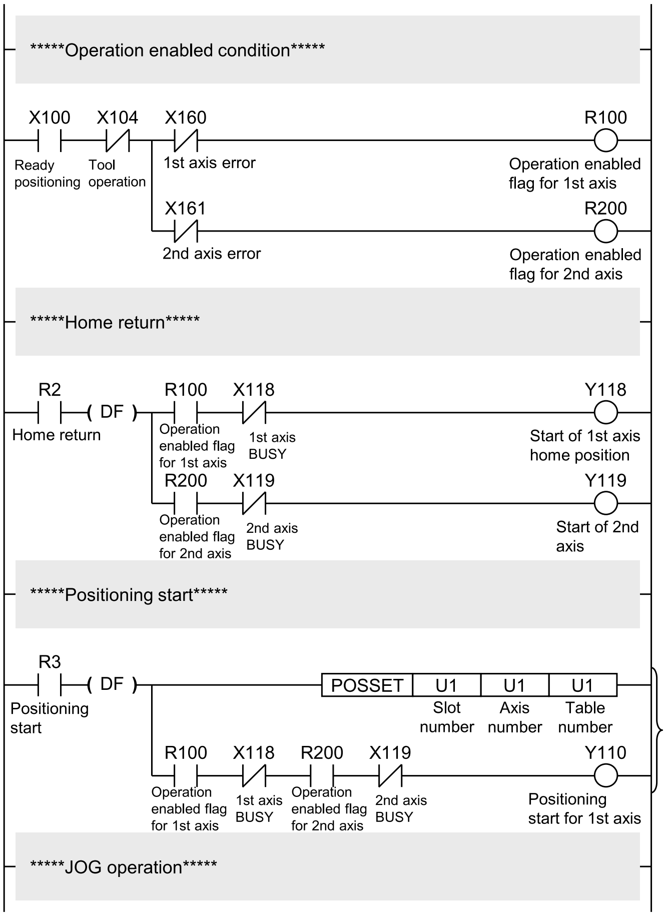
Number	Description
X107	Recalculation done flag
X118	1st axis BUSY flag
X119	2nd axis BUSY flag
X160	Error occurrence annunciation for 1st axis
X161	Error occurrence annunciation for 2nd axis
Y107	Recalculation request
Y110	Positioning start for Axis 1
Y118	Home return of 1st axis
Y119	Home return of 2nd axis
Y120	Axis 1 forward JOG
Y121	Axis 1 reverse JOG
Y122	Axis 2 forward JOG
Y123	Axis 2 reverse JOG
Y160	Error clearing for Axis 1
Y161	Error clearing for Axis 2

Number	Description
DT0	Starting table number
DT101	Number of errors of 1st axis
DT102 to DT115	Error contents of 1st axis
DT121	Number of errors of 2nd axis
DT122 to DT135	Error contents of 2nd axis
DT10 to DT25	Positioning data (of 1 table) of 1st axis
DT30 to DT45	Positioning data (of 1 table) of 2nd axis

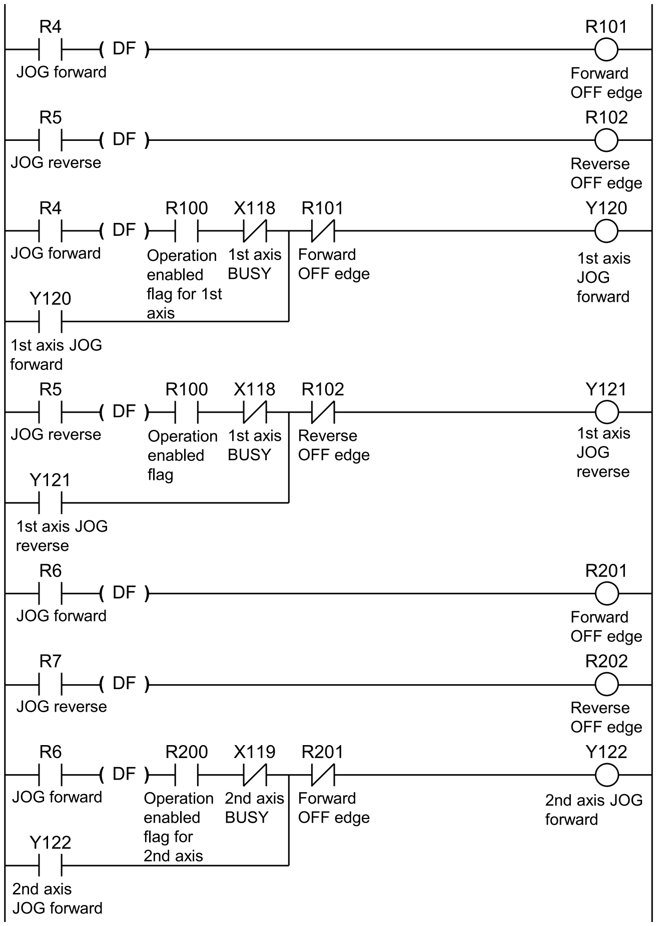
18.2 Sample programs

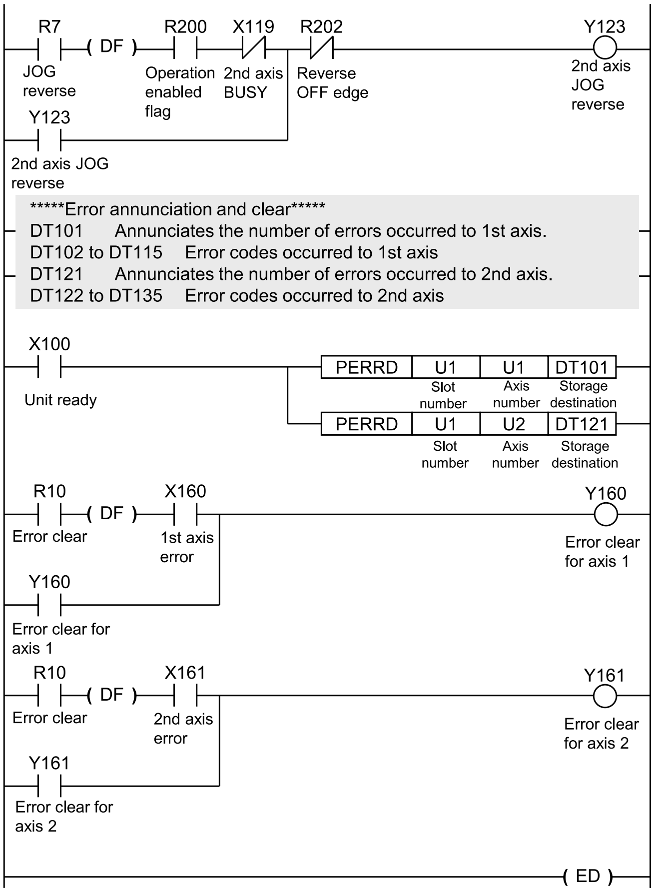
18.2.1 When Settings Done in Standard Area with Programming Tool

■ Sample programs



Positioning start
This part of the program varies with the setting method. This example shows a program already set with the Configurator PM. Replace this part for two other settings.

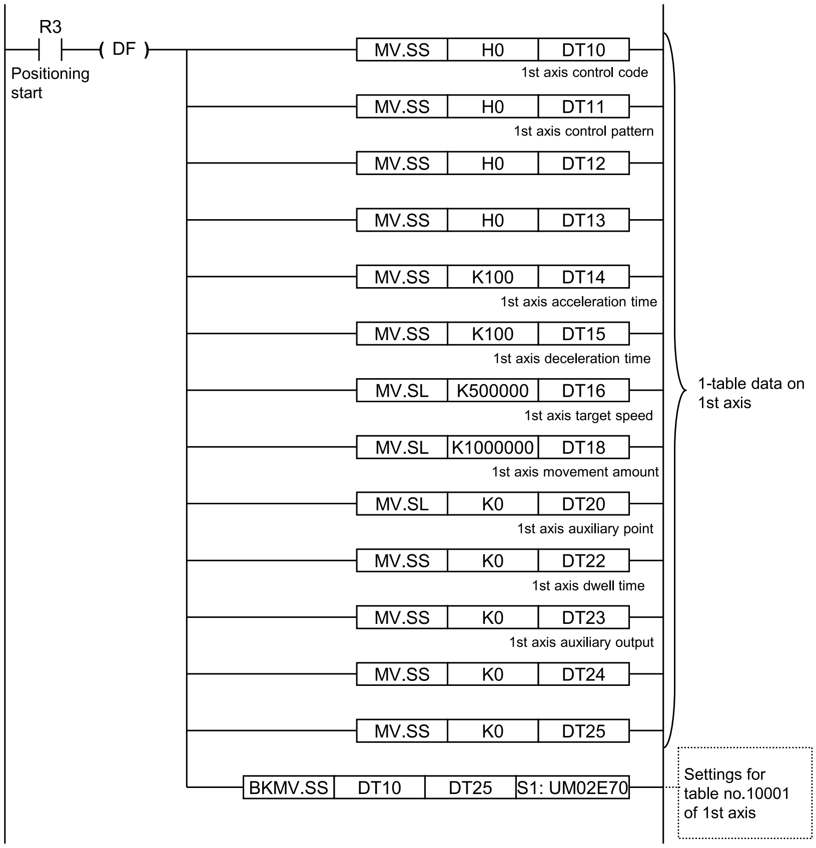

R4
DF
JOG forward
R101
Forward OFF edge
R5
DF
JOG reverse
R102
Reverse OFF edge
R4
DF
R100
X118
R101
Y120
JOG forward
Operation enabled flag for 1st axis
1st axis BUSY
Forward OFF edge
1st axis JOG forward
Y120
1st axis JOG forward
R5
DF
R100
X118
R102
Y121
JOG reverse
Operation enabled flag
1st axis BUSY
Reverse OFF edge
1st axis JOG reverse
Y121
1st axis JOG reverse
R6
DF
JOG forward
R201
Forward OFF edge
R7
DF
JOG reverse
R202
Reverse OFF edge
R6
DF
R200
X119
R201
Y122
JOG forward
Operation enabled flag for 2nd axis
2nd axis BUSY
Forward OFF edge
2nd axis JOG forward
Y122
2nd axis JOG forward

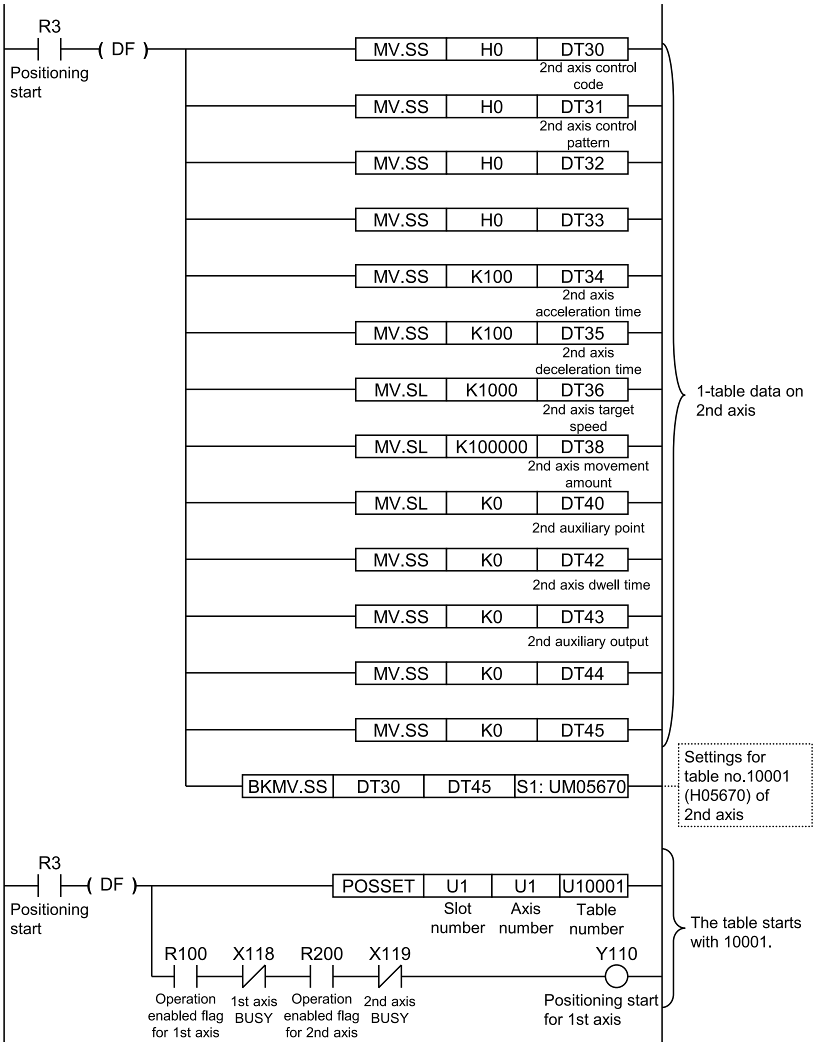

R7
JOG reverse
DF
R200
Operation enabled flag
X119
2nd axis BUSY
R202
Reverse OFF edge
Y123
2nd axis JOG reverse
Y123
2nd axis JOG reverse
*****Error annunciation and clear*****
DT101 Annunciates the number of errors occurred to 1st axis.
DT102 to DT115 Error codes occurred to 1st axis
DT121 Annunciates the number of errors occurred to 2nd axis.
DT122 to DT135 Error codes occurred to 2nd axis
X100
Unit ready
PERRD U1 U1 DT101
Slot number
Axis number
Storage destination
PERRD U1 U2 DT121
Slot number
Axis number
Storage destination
R10
Error clear
DF
X160
1st axis error
Y160
Error clear for axis 1
Y160
Error clear for axis 1
R10
Error clear
DF
X161
2nd axis error
Y161
Error clear for axis 2
Y161
Error clear for axis 2
ED

18.2.2 When Setting Positioning Data in Extended Area by Programming

Write positioning data in the extended area by programming.
Recalculating the positioning data is not necessary as the extended area is used.
Replace the part of the positioning start program in the sample program

■ Positioning start program

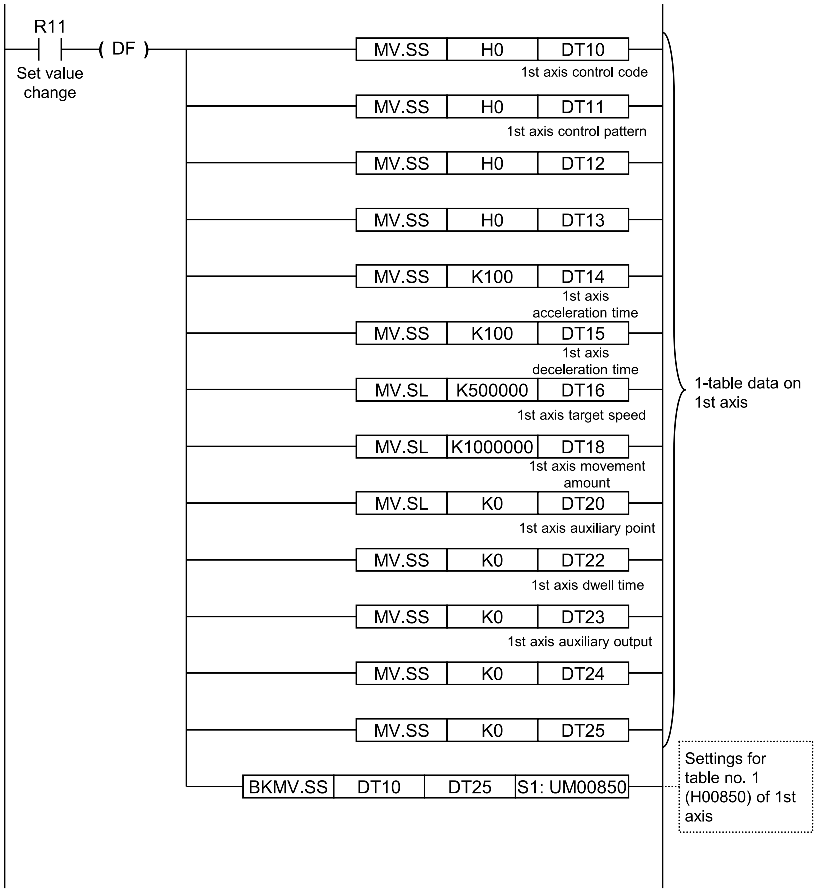


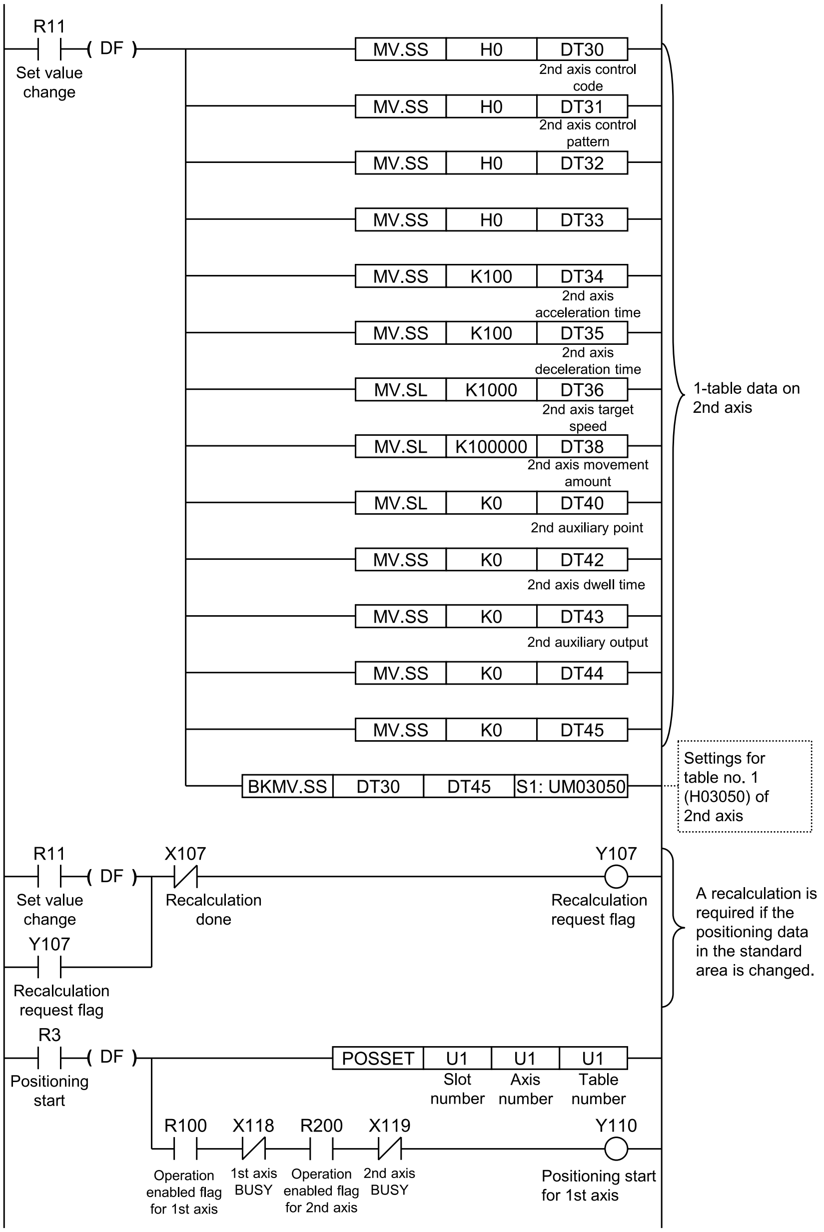

R3
DF
Positioning start
MV.SS H0 DT30
2nd axis control code
MV.SS H0 DT31
2nd axis control pattern
MV.SS H0 DT32
MV.SS H0 DT33
MV.SS K100 DT34
2nd axis acceleration time
MV.SS K100 DT35
2nd axis deceleration time
MV.SL K1000 DT36
2nd axis target speed
MV.SL K100000 DT38
2nd axis movement amount
MV.SL K0 DT40
2nd auxiliary point
MV.SS K0 DT42
2nd axis dwell time
MV.SS K0 DT43
2nd auxiliary output
MV.SS K0 DT44
MV.SS K0 DT45
1-table data on 2nd axis
BKMV.SS DT30 DT45 S1: UM05670
Settings for table no.10001 (H05670) of 2nd axis
R3
DF
Positioning start
POSSET U1 U1 U10001
Slot number
Axis number
Table number
The table starts with 10001.
R100
Operation enabled flag for 1st axis
X118
1st axis BUSY
R200
Operation enabled flag for 2nd axis
X119
2nd axis BUSY
Y110
Positioning start for 1st axis

18.2.3 When Setting Positioning Data in Standard Area by Programming

Write positioning data in the standard area by programming.
Recalculating the positioning data is necessary after setting the positioning data.
Replace the part of the positioning start program in the sample program

■ Positioning start program




R11
DF
Set value change
MV.SS H0 DT30
2nd axis control code
MV.SS H0 DT31
2nd axis control pattern
MV.SS H0 DT32
MV.SS H0 DT33
MV.SS K100 DT34
2nd axis acceleration time
MV.SS K100 DT35
2nd axis deceleration time
MV.SL K1000 DT36
2nd axis target speed
MV.SL K100000 DT38
2nd axis movement amount
MV.SL K0 DT40
2nd auxiliary point
MV.SS K0 DT42
2nd axis dwell time
MV.SS K0 DT43
2nd auxiliary output
MV.SS K0 DT44
MV.SS K0 DT45
1-table data on 2nd axis
BKMV.SS DT30 DT45 S1: UM03050
Settings for table no. 1 (H03050) of 2nd axis
R11
DF
Set value change
X107
Recalculation done
Y107
Recalculation request flag
Y107
Recalculation request flag
A recalculation is required if the positioning data in the standard area is changed.
R3
DF
Positioning start
POSSET U1 U1 U1
Slot number
Axis number
Table number
R100
Operation enabled flag for 1st axis
X118
1st axis BUSY
R200
Operation enabled flag for 2nd axis
X119
2nd axis BUSY
Y110
Positioning start for 1st axis

Record of Changes

The manual number is specified at the bottom of the cover page.

Issue date	Manual number	Description of changes
Dec. 2012	-	-
Feb. 2013	-	- • Corrected I/O allocation table (Sections 5.1, 8.3, 8.4, 12.1, 17.2) • Other, corrected errors.
Mar. 2013	WUME-FP7POSP-01	1st Edition • Corrected sample programs (Sections 18.2.2, 18.2.3) • Other, corrected errors.
Jun. 2015	WUME-FP7POSP-02	2nd Edition Added model (unit version Ver1.3 or later) • Positioning speed change function, positioning movement amount change function (Sections 13.8, 13.9, 17.8) • Input time constant change function (Sections 5.3.2, 17.6.2) • Changes relating to FPWINGR7 GUI (Sections 5.6, 6.1) • Other, corrected errors.
Mar. 2016	WUME-FP7POSP-03	3rd Edition • Added functions related to synchronous control (Section 12) Phase specification clutch OFF function, advance angle correction function, synchronous control cancellation during operation, rewriting cam patterns with a program • Increased the number of tables in the positioning table (expansion area) (25 tables to 100 tables) • Corrected errors.
Jan. 2021	WUME-FP7POSP-04	4th Edition • Error code addition, deletion • Corrected electronic clutch functions (Sections 8.5.2, 8.5.3, 8.5.5) • Warning code addition, deletion • Corrected errors.
Aug. 2021	WUME-FP7POSP-05	5th Edition • Added trapezoidal control and triangular control (Section 7.1.1) • Other, corrected errors.
Jul. 2022	WUME-FP7POSP-08	8th Edition • Changed manual format

Issue date	Manual number	Description of changes
May 2023	WUME-FP7POSP-09	9th Edition Add Push-In Connector "3.2.1 About Push-In Connector"
Apr. 2024	WUME-FP7POSP-10	10th Edition ● Change in Corporate name

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v) nuclear control system
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vii) burning appliances
viii) military devices
ix) medical devices (except for general controls)
x) machinery and systems which especially require the high level of reliability and safety

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(3) When the failure or defect was caused by a phenomenon that could not be predicted by the technology at purchasing or contracted time.
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(6) When the failure or defect was caused by a natural disaster or other force majeure.
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April, 2024

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