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Mitsubishi Electric Programmable Controller Training Manual MELSEC iQ-R/iQ-F Simple Motion (for GX Works3)

Introduction

This document is a training manual prepared to facilitate the understanding of single-axis control and multi-axis control by MELSEC iQ-R Series simple motion module.
It describes the features of the simple motion module, the procedures for setting the positioning data and creating the sequence programs using RD77MS4 simple motion module and GX Works3 as demonstration machine and the monitoring and testing operations.

The following related manuals are available.

(1) Simple motion module User's Manuals

MELSEC iQ-R Simple Motion Module User's Manual (Startup). . . . . IB(NA)-0300245ENG
MELSEC iQ-R Simple Motion Module User's Manual (Application). . . . . IB(NA)-0300247ENG
MELSEC iQ-R Simple Motion Module User's Manual (Advanced Synchronous Control)
. . . . IB(NA)-0300249ENG

(2) Programming manuals

MELSEC iQ-R Programming Manual (Program Design) . . . . SH(NA)-081265ENG
MELSEC iQ-R Programming Manual (Instructions, Standard Functions/Function Blocks)
. . . . SH(NA)-081226ENG

(3) Operating Manual

GX Works3 Operating Manual . . . . SH(NA)-081215ENG

(4) Documents relating to servo amplifier

MR-J4-_B_(-RJ) SERVO AMPLIFIER INSTRUCTION MANUAL . . . . SH(NA)-030106ENG
MELSERVO-J4 Servo amplifier INSTRUCTION MANUAL (TROUBLE SHOOTING)
. . . . SH(NA)-030109ENG

POINT

In this text, the buffer memories are classified with the following symbols, and the buffer memories for each axis are listed collectively.
- [Pr.**]: Positioning parameter and home position return parameter items
- [Da.**]: Positioning data and block start data items
- [Md.**]: Monitor data items
- [Cd.**]: Control data items

SSCNET is an abbreviation of Servo System Controller Network.

Contents

● Safety Precautions ●

(Always read before performing practical work.)

When designing systems, always read related manuals and give sufficient consideration to safety.
Pay due attention to the following points when performing practical work, and ensure correct handling of the product.

[Practical work precautions]

⚠ WARNING

- Do not touch terminals while the power is ON. Failure to observe this may result in electric shock.

- When removing the safety cover, either turn OFF the power, or ensure that sufficient attention is paid to safety.

⚠ CAUTION

- Carry out practical work in accordance with the instructions of your teacher.

- Do not remove the demonstration machine, or make changes to the wiring.
  Failure to observe this may result in a fault, malfunction, injury, or fire.

- Turn OFF the power before attaching or removing the module.
  Removing or attaching the module with the power ON may result in a module fault or electric shock.

- If the demonstration machine emits an abnormal odor or noise, press the [Power] button or [EMERGENCY STOP] button to stop the module.

- If an error occurs, notify your teacher immediately.

Revision History

* The text number is indicated in the lower left of the rear cover of this text.

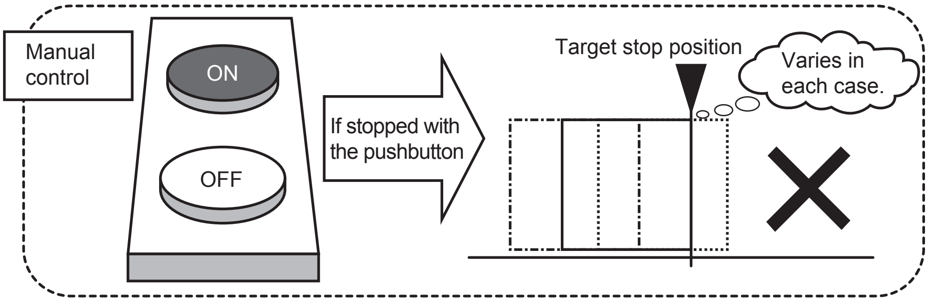
Print date	* Text No.	Revision details
December, 2017	SH-030278ENG-A	First print

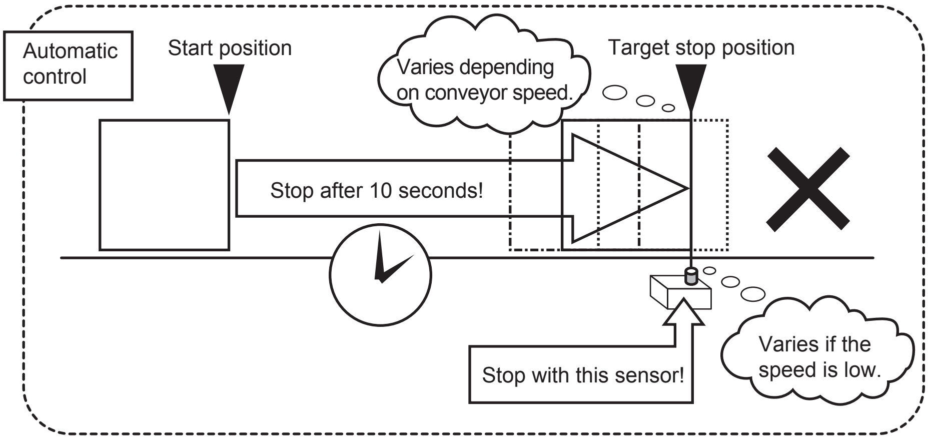
Chapter 1 Outline of Positioning Control

1.1 Outline of Positioning Control

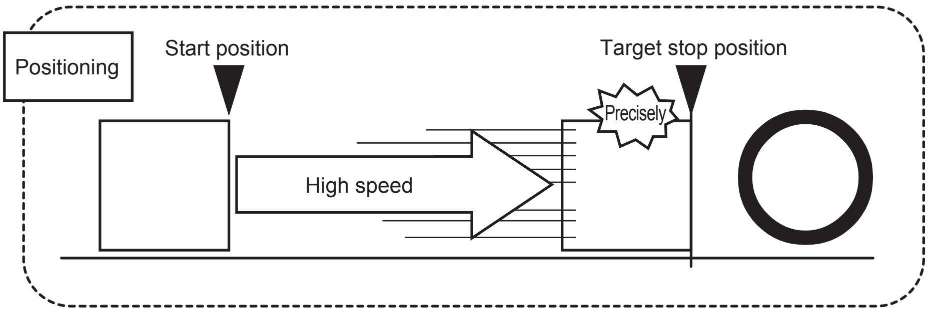
The term “positioning” refers to the process to move a body, such as a workpiece or a tool, (hereinafter, collectively referred to as a workpiece) at the specified speed and stop the body accurately at the target position.

The movement control of workpiece to the target position can be easily made by stopping the workpiece using a timer or installing a sensor at the stop position. However, various problems may arise if it is required to stop it accurately at the position or after moving at a high speed.





To solve these problems, the positioning procedures are described below, so that you can learn how to **transfer a workpiece to the target position at a high speed and stop the workpiece correctly**.



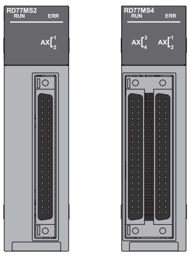
Simple transfer control can be achieved with programmable controllers using timers and limit switches where high accuracy is not required as shown in previous page.

For positioning control or transfer control where high accuracy is required, the positioning function of programmable controllers can be used to stop workpiece accurately at target position with **high repeatability and high reliability**.

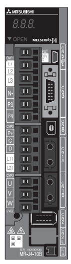
The stopping accuracy of the function can be controlled in the order of μm depending on the equipment mechanism.

- For positioning control using the positioning function of programmable controllers, devices appropriate to the control are required. The outline and functions of the devices are shown below.

  (1) Positioning controller (CPU module or positioning module)
  (2) Driving amplifier or driver for transmitting commands from programmable controllers to motor
  (3) Servo motor or stepping motor capable of precisely detecting rotation angle

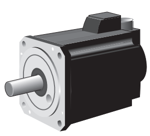


(1) Positioning controller
The CPU module or module serves as the positioning controller and gives necessary information for positioning to the servo amplifier or the stepping motor driver.



(2) Servo amplifier or the stepping motor driver
Based on the commands given by programmable controllers like the rotation direction, rotating speed, rotation amount are transmitted to the motor.

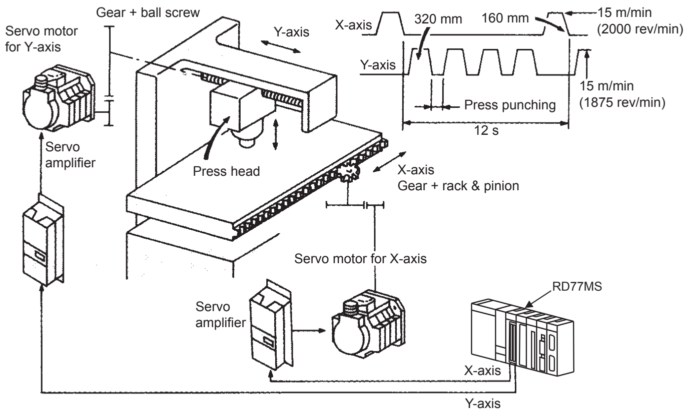
In which direction, forward or reverse	… Rotation direction command
At what speed	… Speed command
To where	… Position command



(3) Servo motor or stepping motor
The motor rotates in the specified direction at the specified speed and stops at the specified position according to the command given by the servo amplifier or stepping motor driver.

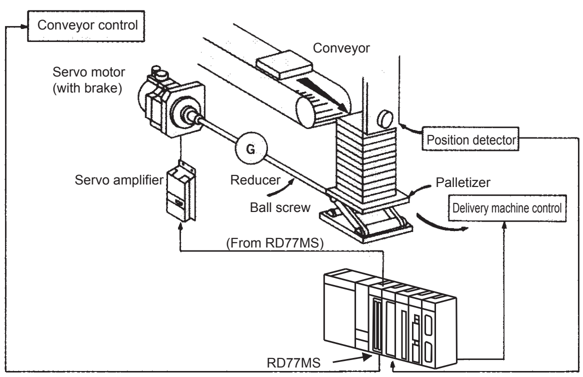
Positioning examples are as shown below:

■ Punch press (positioning for feeding in X- and Y-axis directions)



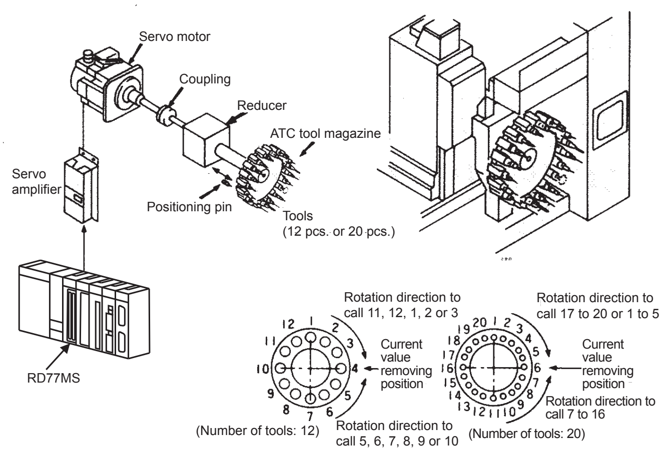
- To punch an insulating material or leather with a single die, positioning is performed using two servo motors. One servo motor is for feeding (X-axis) and second servo motor is for press head direction.
- After the table is positioned by the X-axis servo motor, the press head is positioned by the Y-axis servo motor, and the material is punched with the press.
- When the kind or shape of material is changed, the press head is replaced, and the positioning pattern is switched.

■ Palletizer



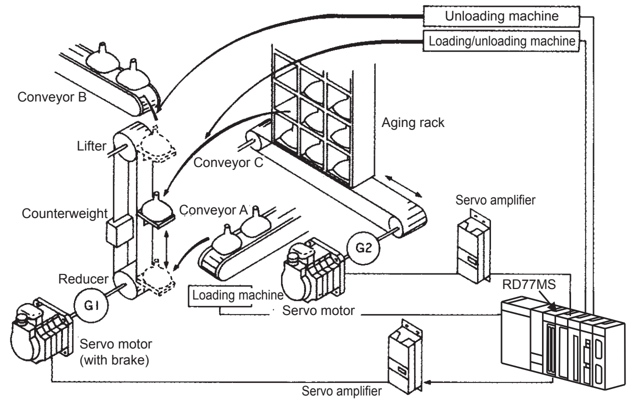
- The palletizer is positioned with a high degree of accuracy by using the 1-axis servo motor.
- The lowering distance of the palletizer corresponding to the material thickness is stored.

■ Small machining center (ATC magazine positioning)



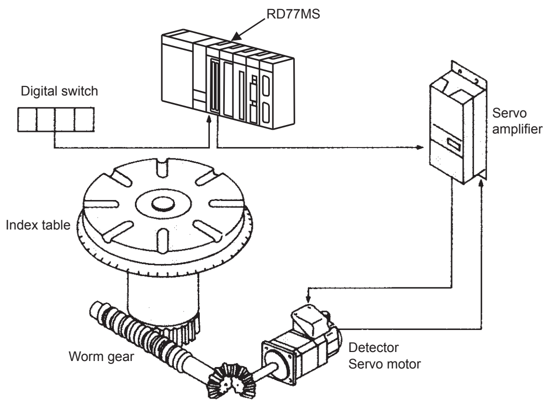
- The ATC tool magazine of small machining center is positioned.
- The relationship between the current value and target value of the magazine is calculated, and it is positioned in the forward or reverse direction in which the target tool can be accessed more quickly.

■ **Lifter (storing of CRTs in aging rack)**



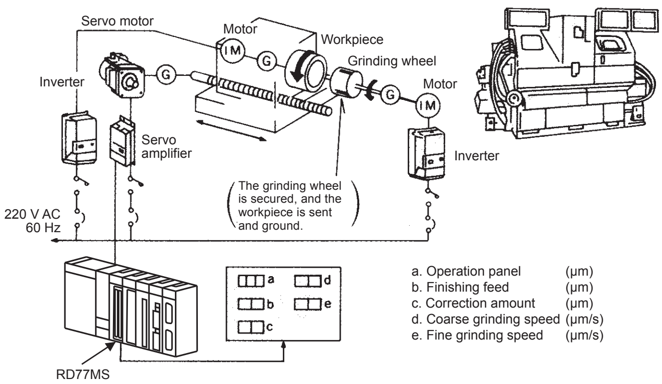
- CRTs are stored in the rack in the aging process by positioning with the aid of AC servo motor.
- The lifter is positioned in the vertical direction by using the one servo motor, and the aging rack is positioned in the horizontal direction by using second servo motor.

■ **Index table (high-precision angle indexing)**



- The index table is positioned with a high degree of accuracy by using the 1 servo motor.

■ **Internal grinding machine**



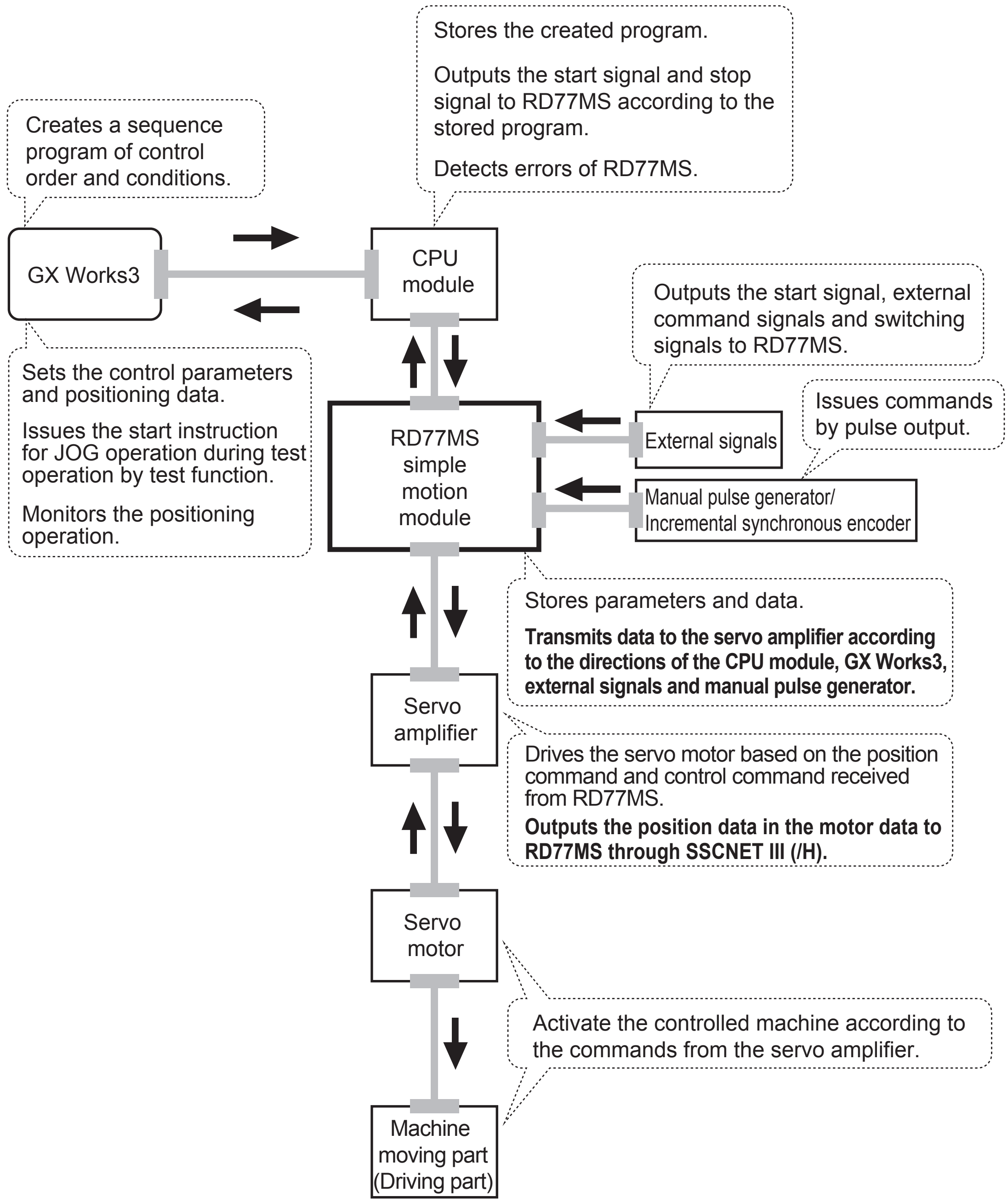
- Grinding of internal surface of workpiece is controlled by using the servo motor and inverters.
- One inverter controls the rotation of the workpiece, and the second inverter controls the rotation of the grinding wheel. The one servo motor feeds the workpiece to grind it.

1.2 Mechanism of Positioning Control

On the positioning system using RD77MS, various kinds of software and external devices are used for the functions shown in the following figure.

RD77MS captures various signals, parameters and positioning data, and the CPU module controls them to realize complicated positioning control.

Positioning control using RD77MS

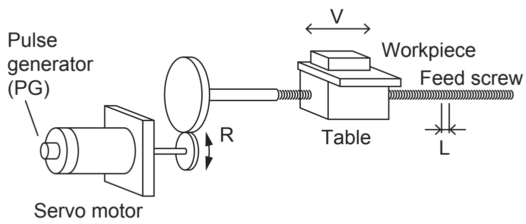


1.2.1 Schematic designs of positioning systems

The operations and schematic designs of positioning systems are shown below.

(1) System using ball screw

Travel and speed of system using ball screw



A : Position detection unit (mm/pulse)
Vs : Command pulse frequency (pulses/s)
n : Number of slits of pulse generator (pulse count) (pulses/rev)
L : Feed screw lead (mm/rev)
R : Reduction ratio
V : Moving part speed (mm/s)
N : Motor speed (r/min)
K : Position loop gain (1/s)
ε : Accumulated pulse count of deviation counter (pulses)

For the above system using ball screw, the position detection unit, command pulse frequency and accumulated pulse count of deviation counter are calculated by the following formulas.

[1] Position detection unit

The position detection unit is calculated from the feed screw lead, reduction ratio and number of slits of pulse generator.

$$A = \frac{L}{R \times n} \text{ [mm/pulse]}$$

[2] Command pulse frequency

The command pulse frequency is calculated from the moving part speed and position detection unit.

$$Vs = \frac{V}{A} \text{ [pulse/s]}$$

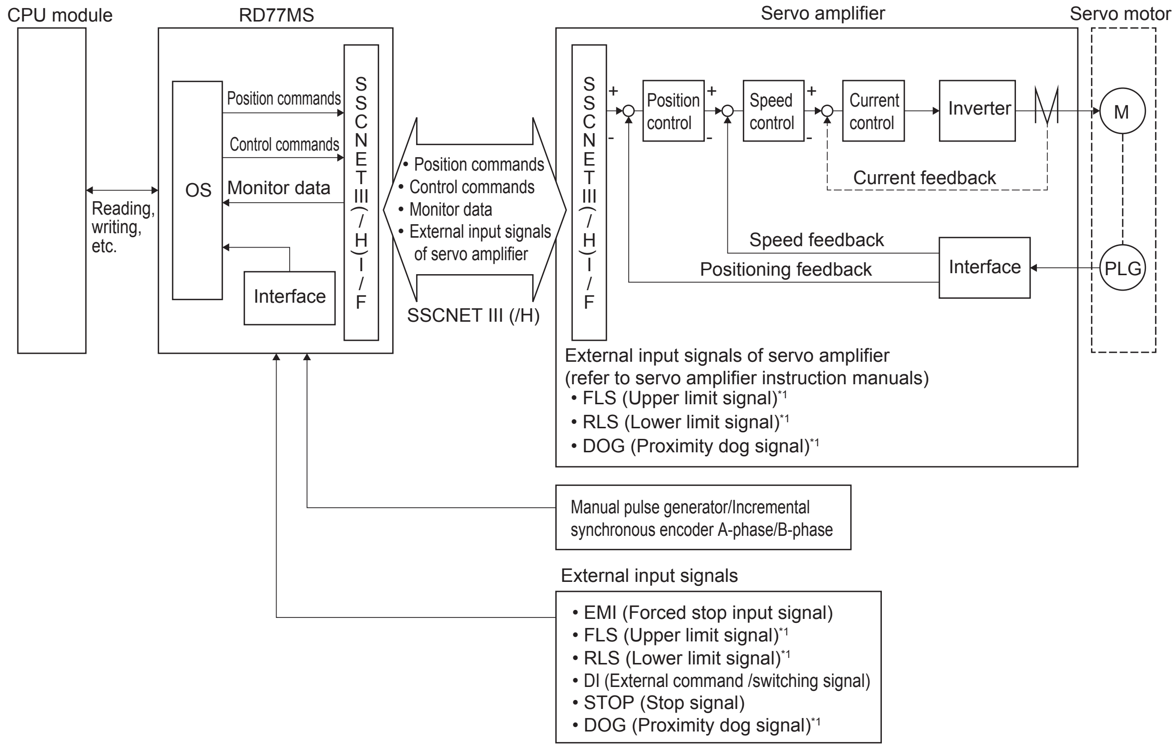
[3] Accumulated pulse count of deviation counter

The accumulated pulse count of deviation counter is calculated from the command pulse frequency and position loop gain.

$$\varepsilon = \frac{Vs}{K} \text{ [pulse]}$$

(2) Positioning system using RD77MS

Outline of operation of positioning system using RD77MS

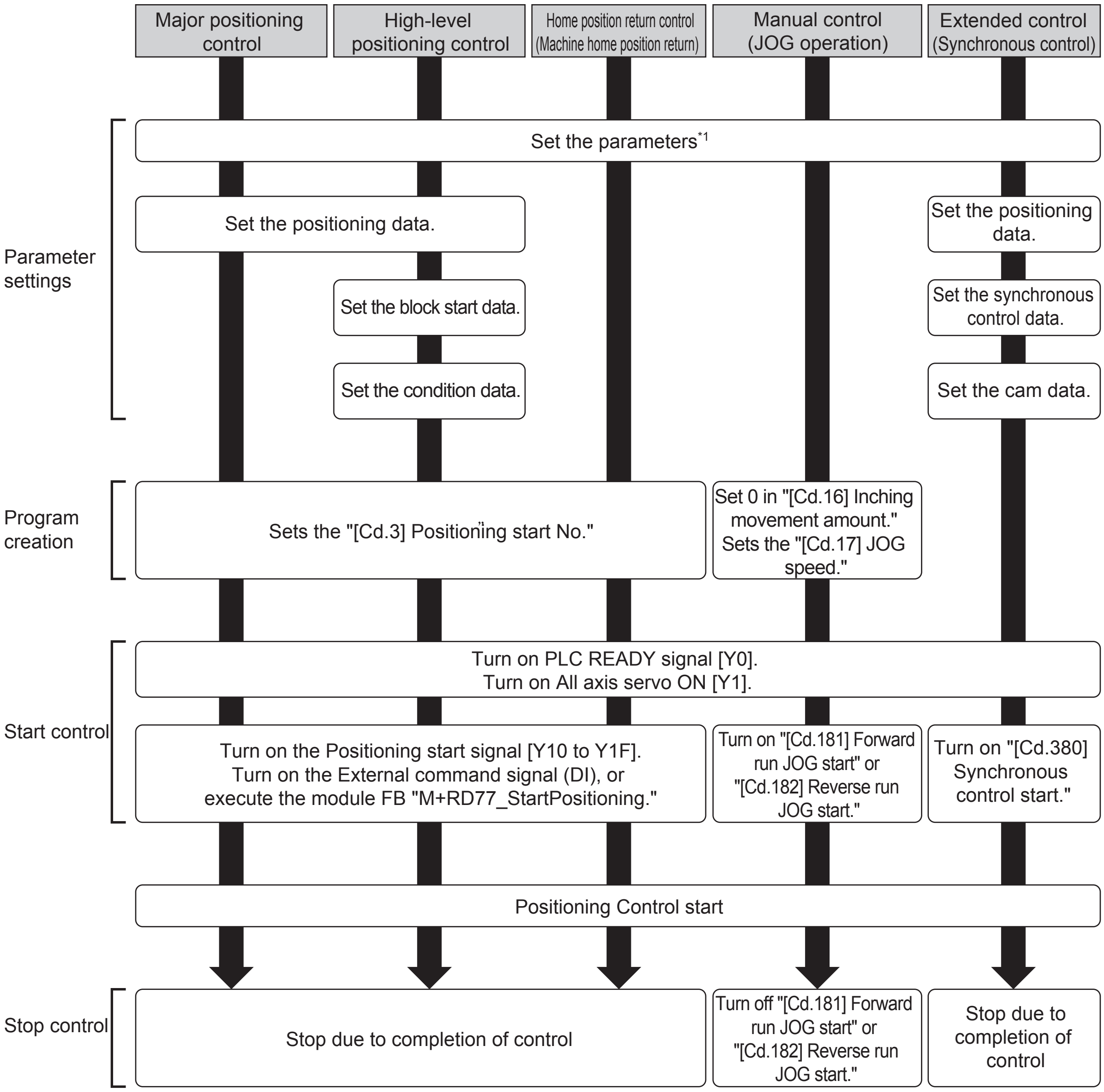


*1 Any of external input signal of RD77MS, external input signal of servo amplifier and external input signal through CPU (buffer memory of RD77MS) can be used depending on the parameter setting.

1.3 Positioning Control Procedures

1.3.1 Procedures for implementing positioning control

The positioning controls (used in this document) are implemented in accordance with the following procedures.



*1. The home position return parameters must be set only for the home position return control.

1.3.2 Outline of start

When the servo amplifier is started and the start trigger is activated for each control, RD77MS starts the positioning control.

Servo ON conditions

To start the servo amplifier, the following output signals must be successively turned on.

[1] PLC READY signal [Y0] ON

[2] All axis servo ON [Y1] ON

Start signals

The start signal for each control enabled after the servo amplifier is started is shown below.

<table>
<tr><th colspan="2">Control type</th><th>Start trigger</th></tr>
<tr><td colspan="2">Major positioning control</td><td rowspan="3">• The positioning start signal [Y10 to Y1F] is turned on.
• The external command signal (DI) is turned on.
• The module FB ”M+RD77_StartPositioning” is executed.</td></tr>
<tr><td colspan="2">High-level positioning control</td></tr>
<tr><td colspan="2">Home position return control</td></tr>
<tr><td rowspan="3">Manual control</td><td>JOG operation</td><td rowspan="2">“[Cd.181] Forward run JOG start signal” or “[Cd.182] Reverse run JOG start signal” is turned on.</td></tr>
<tr><td>Inching operation</td></tr>
<tr><td>Manual pulse generator</td><td>The manual pulse generator is operated.</td></tr>
</table>

1.3.3 Outline of stop

The axis stop signal or stop signal from external input signal is used to stop the control.
It is necessary to create a program for turning on the "[Cd.180] Axis stop signal" as the stopping program.
Each control is stopped in the following cases.

(a) When each control is completed normally

(b) When the servo amplifier power supply is turned off

(c) When a CPU module error occurs

(d) When the PLC READY signal is turned OFF

(e) When an error occurs in RD77MS

(f) When control is intentionally stopped
(Stop signal from CPU module turned ON, "Stop signal" of external input signal turned ON, etc.)

The stop process for the above cases is shown below.
(Except the normal termination in case (a))

Stop cause		Stop axis	M code ON signal after stop	Axis operation status after stopping ([Md.26])
Forced stop	"Forced stop input signal" OFF from an external device	All axes	No change	Servo OFF
Forced stop	Servo READY OFF Servo amplifier power supply OFF	Each axis	No change	Servo amplifier has not been connected
	Servo alarm			Error
	Forced stop input to servo amplifier			Servo OFF
Fatal stop (Stop group 1)	Hardware stroke limit upper/lower limit error occurrence	Each axis	No change	Error
Emergency stop (Stop group 2)	Error occurs in a CPU module	All axes	No change	Error
	PLC READY signal OFF		Turns OFF	
Relatively safe stop (Stop group 3)	Axis error detection (Error other than stop group 1 or 2)*1	Each axis	No change	Error
Intentional stop (Stop group 3)	"Axis stop signal" ON from a CPU module	Each axis	No change	Stopped (Standby)
	"Stop signal" of external input signal ON			

Stop cause		Stop process		
		Home position return control		Major positioning control
		Machine home position return control	Fast home position return control	
Forced stop	“Forced stop input signal“ OFF from an external device	Forced stop For the stop method of the servo amplifier, refer to each servo amplifier instruction manual.		
Forced stop	Servo READY OFF Servo amplifier power supply OFF			
	Servo alarm			
	Forced stop input to servo amplifier			
Fatal stop (Stop group 1)	Hardware stroke limit upper/lower limit error occurrence	Deceleration stop/rapid stop (Select with “Rapid stop group 1 rapid stop selection.”)		
Emergency stop (Stop group 2)	Error occurs in a CPU module	Deceleration stop/rapid stop (Select with “Rapid stop group 2 rapid stop selection.”)		
	PLC READY signal OFF			
Relatively safe stop (Stop group 3)	Axis error detection (Error other than stop group 1 or 2)*1	Deceleration stop/rapid stop (Select with “Rapid stop group 3 rapid stop selection.”)		
Intentional stop (Stop group 3)	“Axis stop signal” ON from a CPU module			
	“Stop signal” of external input signal ON			

Stop cause		Stop process		
		High-level positioning control	Manual control	
			JOG/Inching operation	Manual pulse generator operation
Forced stop	“Forced stop input signal“ OFF from an external device	Forced stop For the stop method of the servo amplifier, refer to each servo amplifier instruction manual.		-
Forced stop	Servo READY OFF Servo amplifier power supply OFF			
	Servo alarm			
	Forced stop input to servo amplifier			
Fatal stop (Stop group 1)	Hardware stroke limit upper/lower limit error occurrence	Deceleration stop/rapid stop (Select with “Rapid stop group 1 rapid stop selection.”)		Deceleration stop
Emergency stop (Stop group 2)	Error occurs in a CPU module	Deceleration stop/rapid stop (Select with “Rapid stop group 2 rapid stop selection.”)		Deceleration stop
	PLC READY signal OFF			
Relatively safe stop (Stop group 3)	Axis error detection (Error other than stop group 1 or 2)*1	Deceleration stop/rapid stop (Select with “Rapid stop group 3 rapid stop selection.”)		Deceleration stop
Intentional stop (Stop group 3)	“Axis stop signal” ON from a CPU module			
	“Stop signal” of external input signal ON			

*1. If an error occurs in a positioning data due to an invalid setting value, when the continuous positioning control uses multiple positioning data successively, it automatically decelerates at the previous positioning data. It does not stop rapidly even the setting value is rapid stop in stop group 3. If any of the following error occurs, the operation is performed up to the positioning data immediately before the positioning data where an error occurred, and then stops immediately.

· No command speed	(error code: 1A13H, 1A14H)
· Outside linear movement amount range	(error code: 1A15H, 1A16H)
· Large arc error deviation	(error code: 1A17H)
· Software stroke limit +	(error code: 1A18H, 1A19H)
· Software stroke limit -	(error code: 1A1AH, 1A1BH)
· Sub point setting error	(error code: 1A27H, 1A28H, 1A29H, 1A2AH, 1A37H)
· End point setting error	(error code: 1A2BH, 1A2CH)
· Center point setting error	(error code: 1A2DH, 1A2EH, 1A2FH)
· Outside radius range	(error code: 1A32H)
· Illegal setting of ABS direction in unit of degree	(error code: 19A4H, 19A5H)

Point

Provide the emergency stop circuits outside the servo system to prevent cases where danger may result from abnormal operation of the overall system in the event of an external power supply fault or servo system failure.

1.3.4 Outline of restart

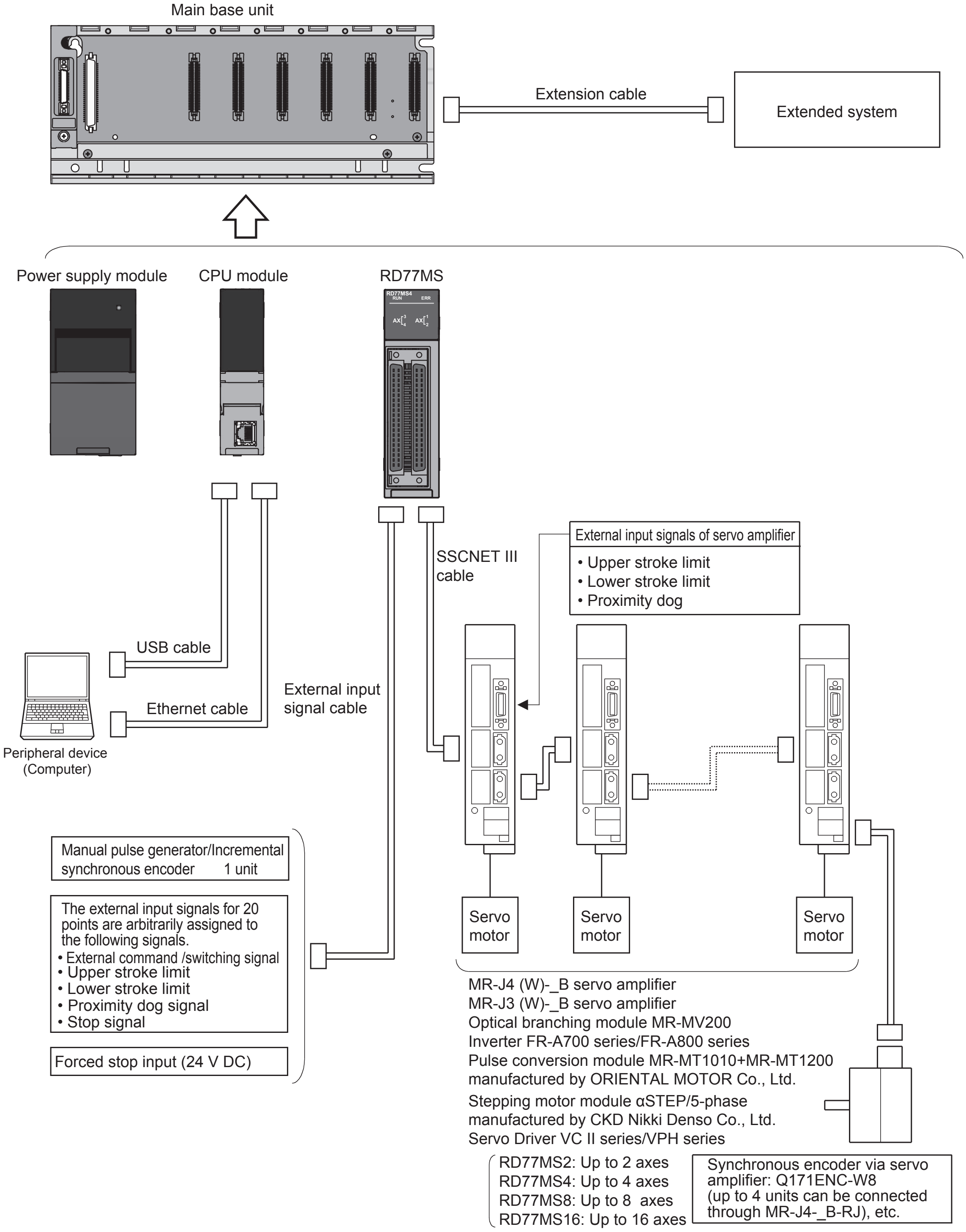
If the position control is stopped due to any cause, the positioning to the end point of position control can be restarted from the stop position by the "[Cd.6] Restart command."

If the control is stopped during continuous positioning or continuous path control, the positioning will be restarted from the stop position of the positioning data No. at which the control is stopped.

Chapter 2 System Configuration

2.1 System Configuration Devices

The general configuration including RD77MS and peripheral devices is shown below.



POINT

- The external input signal cannot be used depending on the connected device. Confirm the specification of the connected device.
- When using RD77MS2, the external input signals that can be assigned are for 10 points.

2.2 Configuration Device List

The positioning system using RD77MS consists of the following devices.

Name	Model	Remarks
Simple motion module	RD77MS2 RD77MS4 RD77MS8 RD77MS16	-
CPU module	RnCPU, RnENCPU, Safety CPU	-
Peripheral device (personal computer)*1	Personal computer running Windows®	-
GX Works3*1	SW1DND-GXW3-E	Software package for Windows® XP, Windows® Vista, Windows®7, Windows®8 or Windows®8.1
Ethernet cable*1 USB cable*1	-	Cable for connecting the CPU module and the personal computer running Windows®
Servo amplifier	-	-
Manual pulse generator/ Incremental synchronous encoder	-	Recommendation: MR-HDP01 (manufactured by Mitsubishi Electric Corporation)
SSCNET III cable*2	-	Cable for connecting RD77MS and servo amplifier or connecting servo amplifiers
External input signal cable*2	-	Cable for connecting RD77MS and external device (Fabricate referring to the manual for the connected device and Section 3.5.)

*1. Refer to GX Works3 Operating Manual for details.

*2. The following connectors for external input signals to be connected to SSCNET III cable and external input signal cable are available.

[SSCNET III cable]

Model		Cable length [m]	Details
MR-J3BUS☐M*3 (standard cord for inside of board)	MR-J3BUS015M	0.15	• For connection between RD77MS and MR-J4(W)-B/MR-J3(W)-B • For connection between MR-J4(W)-B/MR-J3(W)-B and MR-J4(W)-B/MR-J3(W)-B
	MR-J3BUS03M	0.3	
	MR-J3BUS05M	0.5	
	MR-J3BUS1M	1	
	MR-J3BUS3M	3	
MR-J3BUS☐M-A*3 (standard cable for outside of board)	MR-J3BUS5M-A	5	
	MR-J3BUS10M-A	10	
	MR-J3BUS20M-A	20	
MR-J3BUS☐M-B*3 (long-distance cable)	MR-J3BUS30M-B	30	
	MR-J3BUS40M-B	40	
	MR-J3BUS50M-B	50	

*3. ☐ indicates the cable length.
(015: 0.15 m, 03: 0.3 m, 05: 0.5 m, 1: 1 m, 3: 3 m, 5: 5 m, 10: 10 m, 20: 20 m, 30: 30 m, 40: 40 m, 50: 50 m)

[Connectors for external input signals]

Software name		Specifications
Applicable connectors		A6CON1, A6CON2 and A6CON4 (optional)
Applicable wire size	When A6CON1 or A6CON4 is used	0.088 to 0.3 mm^2 (AWG28 to 22) stranded wire
	When A6CON2 is used	0.088 to 0.24 mm^2 (AWG28 to 24) stranded wire

List of specifications for recommended pulse generator

Item	Specifications
Model	MR-HDP01
Operating ambient temperature	-10 to 60°C
Pulse resolution	25 pulses/rev (100 pulses/rev when multiplied by 4)
Output method	Voltage output, max. output current 20 mA
Supply voltage	4.5 to 13.2 V DC
Consumption current	60 mA
Output level	"H" level: Supply voltage[*4] -1 V or more (under no load) "L" level: 0.5 V or less (at max. output current)
Life	1,000,000 revolutions or more (at 200 r/min)
Allowable axial load	Radial load: Max. 19.6 N
	Thrust load: Max. 9.8 N
Weight	0.4 kg
Max. number of revolutions	Instantaneous max. 600 r/min Normal 200 r/min
Pulse signal form	Two signals, A-phase and B-phase, with phase difference of 90°
Starting friction torque	0.06 N•m (at 20°C)

*4. When a separate power supply is used, use a stabilized power supply with a supply voltage of 5 V DC ±0.25 V.

Chapter 3 Specifications and Functions

3.1 Performance Specifications

The performance specifications for RD77MS are shown below.

<table>
<tr><th colspan="2">Item</th><th>RD77MS2</th><th>RD77MS4</th><th>RD77MS8</th><th>RD77MS16</th></tr>
<tr><td colspan="2">Number of control axes</td><td>2 axes</td><td>4 axes</td><td>8 axes</td><td>16 axes</td></tr>
<tr><td colspan="2">Operation cycle</td><td colspan="4">0.444 ms/0.888 ms/1.777 ms/3.555 ms</td></tr>
<tr><td colspan="2">Interpolation functions</td><td>2-axis linear interpolation
2-axis circular interpolation</td><td colspan="3">2-, 3- or 4-axis linear interpolation
2-axis circular interpolation
3-axis helical interpolation</td></tr>
<tr><td colspan="2">Control modes</td><td colspan="4">PTP (Point To Point) control, path control (linear, arc and helical can be set), speed control, speed-position switching control, position-speed switching control, speed-torque control</td></tr>
<tr><td colspan="2">Control unit</td><td colspan="4">mm, inch, degree, pulse</td></tr>
<tr><td colspan="2">Positioning data</td><td colspan="4">600 pieces of data/axis</td></tr>
<tr><td colspan="2">Execution data backup function</td><td colspan="4">Parameters, positioning data, and block start data can be saved on flash ROM (battery-less).</td></tr>
<tr><td rowspan="6">Positioning</td><td>Positioning system</td><td colspan="4">PTP control: incremental system/absolute system
Speed-position switching control: incremental system/absolute system
Position-speed switching control: incremental system
Path control: incremental system/absolute system</td></tr>
<tr><td>Positioning range</td><td colspan="4">In absolute system
• -214748364.8 to 214748364.7 (μm)
• -21474.83648 to 21474.83647 (inch)
• 0 to 359.99999 (degree)
• -2147483648 to 2147483647 (pulse)
In incremental system
• -214748364.8 to 214748364.7 (μm)
• -21474.83648 to 21474.83647 (inch)
• -21474.83648 to 21474.83647 (degree)
• -2147483648 to 2147483647 (pulse)
In speed-position switching control (INC mode)/position-speed switching control
• 0 to 214748364.7 (μm)
• 0 to 21474.83647 (inch)
• 0 to 21474.83647 (degree)
• 0 to 2147483647 (pulse)
In speed-position switching control (ABS mode)*1
0 to 359.99999 (degree)</td></tr>
<tr><td>Speed command</td><td colspan="4">0.01 to 20000000.00 (mm/min)
0.001 to 2000000.000 (inch/min)
0.001 to 2000000.000 (degree/min)*2
1 to 1000000000 (pulse/s)</td></tr>
<tr><td>Acceleration/deceleration process</td><td colspan="4">Trapezoidal acceleration/deceleration, S-curve acceleration/deceleration</td></tr>
<tr><td>Acceleration/deceleration time</td><td colspan="4">1 to 8388608 (ms) 4 patterns can be set for each of acceleration time and deceleration time.</td></tr>
<tr><td>Rapid stop deceleration time</td><td colspan="4">1 to 8388608 (ms)</td></tr>
</table>

Item			RD77MS2	RD77MS4	RD77MS8	RD77MS16
Starting time*3	Operation cycle 0.444 ms	Maximum number of axes: 1-axis	0.7 ms			
		Maximum number of axes: 2-axes	0.7 ms			
		Maximum number of axes: 4-axes	0.74 ms			
	Operation cycle 0.888 ms	Maximum number of axes: 4-axes	1.1 ms			
		Maximum number of axes: 8-axes	1.32 ms			
		Maximum number of axes: 12-axes	1.46 ms			
	Operation cycle 1.777 ms	Maximum number of axes: 8-axes	1.1 ms			
		Maximum number of axes: 12-axes	1.46 ms			
		Maximum number of axes: 16-axes	1.59 ms			
	Operation cycle 3.555 ms	Maximum number of axes: 8-axes	0.92 ms			
		Maximum number of axes: 12-axes	1.12 ms			
		Maximum number of axes: 16-axes	1.52 ms			
External wiring connection system			40-pin connector			
Applicable wire size*4	When A6CON1 or A6CON4 is used		0.088 to 0.3 mm^2 (28 to 22 AWG) stranded wire			
	When A6CON2 is used		0.088 to 0.24 mm^2 (28 to 24 AWG) stranded wire			
External input wiring connector			A6CON1, A6CON2 and A6CON4 (optional)			
SSCNET III cable	MR-J3BUS□M*5		• For connection between RD77MS and MR-J4(W)-B/MR-J3(W)-B • For connection between MR-J4(W)-B/MR-J3(W)-B and MR-J4(W)-B/MR-J3(W)-B • Standard cord for inside of board: 0.15 m, 0.3 m, 0.5 m, 1 m, 3 m			
	MR-J3BUS□M-A*5		• For connection between RD77MS and MR-J4(W)-B/MR-J3(W)-B • For connection between MR-J4(W)-B/MR-J3(W)-B and MR-J4(W)-B/MR-J3(W)-B • Standard cable for outside of board: 5 m, 10 m, 20 m			
	MR-J3BUS□M-B*5 *6		• For connection between RD77MS and MR-J4(W)-B/MR-J3(W)-B • For connection between MR-J4(W)-B/MR-J3(W)-B and MR-J4(W)-B/MR-J3(W)-B • Long-distance cable: 30 m, 40 m, 50 m			
Manual pulse generator/ Incremental synchronous encoder input maximum frequency		Differential-output type	Up to 1M pulses/s			
		Open-collector type	Up to 200k pulses/s			
Manual pulse generator 1 pulse input magnification			1 to 10000 times			
Flash ROM write count			Max. 100,000 times			
Number of occupied I/O points			32 points (I/O assignment: Intelligent function module 32 points)			
Internal current consumption (5 V DC)			1.0 A			

Item		RD77MS2	RD77MS4	RD77MS8	RD77MS16
External dimensions	Height	106 mm			
	Width	27.8 mm			
	Depth	110 mm			
Mass		0.22 kg	0.23 kg		

*1. The speed-position switching control (ABS mode) can be used only when the control unit is "degree".
*2. When "Speed control 10 × multiplier setting for degree axis function" is valid, the setting range is 0.01 to 20000000.00 (degree/min).
*3. Time from accepting the positioning start signal until BUSY signal turns ON.
*4. Use cables with outside diameter of 1.3 mm (0.05 inch) or shorter to connect 40 cables to the connector. In addition, consider the amount of current to be used and select appropriate cables.
*5. □ indicates the cable length.
(015: 0.15 m, 03: 0.3 m, 05: 0.5 m, 1: 1m, 3: 3 m, 5: 5 m, 10: 10 m, 20: 20m, 30: 30m, 40: 40 m, 50: 50 m)
*6. For cables with a length of less than 30 m, contact us.

3.2 Main Features of RD77MS Simple Motion Module

(1) High-speed starting

The module can start positioning quickly within 0.444 to 3.555 ms (set value in “Operation cycle setting”)

(2) Various positioning control functions

The module has a lot of functions including the basic functions, such as home position return control, positioning control and manual control functions, necessary for positioning systems and sub functions for restricting and reinforcing these controls.

(a) Enhanced home position return control

[1] Enhanced home position return control
Five methods for returning to the machine home position are available; proximity dog method (1 Type), count method (2 Types), data set method (1 Type) and scale origin signal detection method (1 Type). You can select a method as per system requirement.

[2] Home position return retry function
The home position return retry function is available to understand home position return control from any position to the mechanical home position. You can start the home position return from any mechanical stop position when turning on the power supply to the system.

(b) Various control methods

There are various positioning control methods, i.e. position control, speed control, speed-position switching control and position-speed switching control.

[1] Positioning of each axis
Position control and speed control for each axis can be started at any timing.

[2] Interpolation control
Interpolation control can be performed using more than one axis.
(Linear interpolation control with 2 to 4 axes, circular interpolation control with 2 axes, speed control with 2 to 4 axes, etc.)

[3] Speed-torque control
Speed Control and Torque Control can be perform. It can not contain position loop.

(c) Large quantity of data

Up to 600 positioning data including control method, positioning address, command speed can be set for each axis.

(d) Continuous execution with multiple data

Multiple positioning data can be performed continuously by starting the positioning only once.
In addition, it is possible to integrate multiple positioning data into one point and execute several points continuously (block start).
This can reduce the number of execution times of positioning data and need for control of execution condition.

(e) Acceleration/deceleration process

Two acceleration/deceleration processing methods, trapezoidal and S-pattern acceleration/deceleration methods, are available. An acceleration/deceleration curve appropriate to the mechanical characteristics can be selected.

(3) Advance Synchronous Control

The module is applicable to synchronous control and electronic cam control.

(4) Mark detection function

The module can detect a mark to latch any data using an external command signal [DI1 to DI16].

(5) High maintainability

The maintainability of RD77MS has been improved by the following measures.

(a) Battery-less retention of data
Various data, such as positioning data and parameters, can be stored in the flash ROM in RD77MS. Therefore, the data can be retained without batteries.

(b) Event history function
Information on errors and events that have occurred in RD77MS is collected in the CPU module and saved in the SD memory card. Since the error information is retained in the CPU module, the error history can be checked from GX Works3 even after the power supply is turned off or reset.

(6) Simple motion module function blocks (module FBs) and module labels are available.

(a) Module FBs for positioning start and positioning teach are available.

(b) The devices in the module have been registered with signal names as module labels in GX Works3.

(c) Programs can be created only by dragging and dropping module FBs and module labels. This can reduce program development time.

(7) Setting, monitoring and testing with GX Works3

GX Works3 (Simple Motion Module setting) can be used to set the parameters and positioning data of RD77MS.
Before creating a sequence program for positioning control, you can check the wiring with the test function of GX Works3 (Simple Motion Module setting) and operate RD77MS with the set parameters and positioning data to check the Operation of Servo Motor .
The program can be efficiently debugged by monitoring the control condition.
By using GX Works3 in combination with MR Configurator2, you can easily set the servo parameters.
For the setting and testing with GX Works3, refer to Chapter 5.
For the monitoring, refer to Appendix 5.

(8) Forced stop function

All axes of the servo amplifiers can be immediately stopped by the external forced stop input signal.
The forced stop input signal can be enabled and disabled by setting the parameter.
For the forced stop function, refer to Section 4.3.

(9) Connection with servo amplifiers through high-speed synchronous network by SSCNETIII(/H)

The module can be connected directly with Mitsubishi MR-J4(W)-B/MR-J3(W)-B Series servo amplifiers through SSCNETIII(/H).

(a) RD77MS and each servo amplifiers are connected through the high-speed synchronous network SSCNETIII(/H), the wiring can be saved. Maximum distance between two stations using SSCNET III(/H) is 100 m. For 16 axis maximum distance can be (100 m × 16 Axis) is 1600 m.

(b) Since SSCNETIII(/H) cables (Optical Fiber based communication) are used, the communication is hardly affected by electromagnetic noises from the servo amplifiers.

(c) It is possible to read and write servo parameters from servo amplifiers using SSCNETIII(/H) communication on RD77MS module.

(d) Actual current values and errors controlled by the servo can be reviewed in the buffer memory (module's internal memory) of RD77MS.

(e) MR Configurator2 and servo amplifiers can communicate through the CPU module.

(10) Easy to use on absolute position system

(a) MR-J4(W)-B/MR-J3(W)-B Series servo amplifiers and servo motors are applicable on an absolute position system as standard, and they can be used as an absolute position system only by fitting the batteries for absolute position system to the servo amplifiers.

(b) Once the home position is determined, the home position return operation is not required when the system power is turned on.

(c) On the absolute position system, the home position can be determined by the data set method home position return, and the wiring for the proximity dog is not required.

(d) When the set unit is “degree,” an absolute position system for infinite feeding can be established.

3.3 Function List

RD77MS has some functions. This document explains the functions of RD77MS classifying them as shown below.

(1) Main functions

(1) Home position return control

The home position return control is a function to determine the position of origin for positioning control (machine home position return) and move a workpiece to the origin (fast home position return). Use this function to return a workpiece to the home position when the power supply is turned on or after the positioning is stopped.

(2) Major positioning controls

The positioning data stored in RD77MS is used for these controls. Basic controls, such as position control and speed control, are executed by setting the necessary items in the positioning data and start the positioning data.

(3) High-level positioning controls

The positioning data and block start data stored in RD77MS are used for these controls.

Applied positioning controls as shown below can be performed.

- A series of positioning data are handled as a block, and some blocks are executed in the specified order.
- Position control and speed control are executed with criteria for conditions.
- Positioning data of several axes are started simultaneously (commands are output simultaneously to some servo amplifiers).
- Specified positioning data is executed repeatedly.

(4) Manual control

Signals are externally input to RD77MS, and RD77MS performs the positioning operation. Use the manual control to move a workpiece to any position (JOG operation) and make fine adjustments to positioning (inching or manual pulse generator operation).

(5) Extended controls

In addition to the positioning control, the following controls can be performed.

- Speed control and torque control (speed/torque control) not containing a position loop in command to servo amplifiers
- Control by replacing hardware mechanism consisting of gears, shafts, transmissions and cams with software by using the synchronous control parameters to synchronize with the input axis (synchronous control)

(2) Sub function

When a main function is executed, correction or restriction to the control can be made, or various functions can be added.

(3) Common function

Controls for the parameter initialization function and execution data backup function common to the operations of RD77MS can be performed.

3.3.1 Main functions

The main functions for positioning controls by using RD77MS are outlined below.

Refer to the following user's manuals for details of each function.

- MELSEC iQ-R Simple Motion Module User's Manual (Application)
- MELSEC iQ-R Simple Motion Module User's Manual (Advanced Synchronous Control)

Main functions			Details
Home position return control	Machine home position return		Mechanically establishes the positioning start point using a proximity dog, etc. In the data setting method, no axis movement occurs since the current position is set as the home position. (Positioning start No. 9001)
	Fast home position return		Positions a target to the home position address ([Md.21] Machine feed value) stored in the RD77MS using machine home position return. (Positioning start No. 9002)
Major positioning control	Position control	Linear control (1-axis linear control) (2-axis linear interpolation control) (3-axis linear interpolation control) (4-axis linear interpolation control)	Positions a target using a linear path to the address set in the positioning data or to the position designated with the movement amount.
		Fixed-feed control (1-axis fixed-pitch feed control) (2-axis fixed-pitch feed control) (3-axis fixed-pitch feed control) (4-axis fixed-pitch feed control)	Positions a target by the movement amount designated with the amount set in the positioning data. (With fixed-feed control, the "[Md.20] Feed current value" is set to "0" when the control is started. With 2-, 3-, or 4-axis fixed-feed control, the fixed-feed is fed along a linear path obtained by interpolation.)
		2-axis circular interpolation control (Auxiliary point designation) (Center point designation)	Positions a target using an arc path to the address set in the positioning data, or to the position designated with the movement amount, sub point or center point.
		3-axis helical interpolation control (Auxiliary point designation) (Center point designation)	Positions a target using a helical path to a specified position. (Specify the position by specifying the end point address directly or by specifying the relative distance from the current position (movement amount).)
	Speed control	1-axis speed control 2-axis speed control 3-axis speed control 4-axis speed control	Continuously outputs the command corresponding to the command speed set in the positioning data.

Main functions			Details
Major positioning control	Speed, position switching control		First, carries out speed control, and then carries out position control (positioning with designated address or movement amount) by turning the "speed-position switching signal" ON.
	Position-speed switching control		First, carries out position control, and then carries out speed control (continuous output of the command corresponding to the designated command speed) by turning the "position-speed switching signal" ON.
	Other controls	Current Value Change	Changes the feed current value ([Md.20]) to the address set in the positioning data. The following two methods can be used. (The machine feed value ([Md.21]) cannot be changed.) • Current value changing using positioning data • Current value changing using current value changing start No. (No. 9003)
		NOP instruction	No execution control method. When NOP instruction is set, this instruction is not executed and the operation of the next data is started.
		JUMP instruction	Unconditionally or conditionally jumps to designated positioning data No.
		LOOP	Carries out loop control with repeated LOOP to LEND.
		LEND	Returns to the beginning of the loop control with repeated LOOP to LEND.
High-level positioning control	Block start (normal start)		With one start, executes the positioning data in a random block with the set order.
	Conditional start		Carries out condition judgment set in the "condition data" for the designated positioning data, and then executes the "block start data". When the condition is established, the "block start data" is executed. When not established, that "block start data" is ignored, and the next point's "block start data" is executed.
	Wait start		Carries out condition judgment set in the "condition data" for the designated positioning data, and then executes the "block start data". When the condition is established, the "block start data" is executed. When not established, stops the control until the condition is established. (Waits.)
	Simultaneous start		Simultaneously executes the designated positioning data of the axis designated with the "condition data". (Outputs commands at the same timing.)
	Repeated start (FOR loop)		Repeats the program from the block start data set with the "FOR loop" to the block start data set in "NEXT" for the designated number of times.
	Repeated start (FOR condition)		Repeats the program from the block start data set with the "FOR condition" to the block start data set in "NEXT" until the conditions set in the "condition data" are established.

Main functions		Details
Manual control	JOG operation	Outputs a command to servo amplifier while the JOG start signal is ON.
	Inching operation	Outputs commands corresponding to minute movement amount by manual operation to servo amplifier. (Performs fine adjustment with the JOG start signal.)
	Manual pulse generator operation	Outputs pulses commanded with the manual pulse generator to servo amplifier.
	Inter-module synchronization function	Synchronizes the control timings among multiple modules on the same base.
Extended control	Speed-torque control	Carries out the speed control or torque control that does not include the position loop for the command to servo amplifier by switching control mode.
	Synchronous control	Carries out the synchronous control that synchronizes with input axis by setting the system such as gear, shaft, change gear and cam to the "synchronous control parameter".

In "major positioning control" , "Operation pattern" can be set to designate whether to continue executing positioning data. Outlines of the "operation patterns" are given below.

Operation pattern	Details
Individual positioning control (Positioning complete)	When "independent positioning control" is set for the operation pattern of the started positioning data, only the designated positioning data will be executed, and then the positioning will end.
Continuous positioning control	When "continuous positioning control" is set for the operation pattern of the started positioning data, after the designated positioning data is executed, the program will stop once, and then the next following positioning data will be executed.
Continuous path control	When "continuous path control" is set for the operation pattern of the started positioning data, the designated positioning data will be executed, and then without decelerating, the next following positioning data will be executed.

3.3.2 Sub function

The sub functions for positioning controls using RD77MS are outlined below.
Refer to MELSEC iQ-R Simple Motion Module User’s Manual (Application) for details of each function.

Sub function		Details
Functions characteristic to machine home position return	Home position return retry function	This function retries the home position return with the upper/lower limit switches during the machine home position return. This allows machine home position return to be carried out even if the axis is not returned to before the proximity dog with JOG operation, etc.
	Home position shift function	After returning to the machine home position, this function compensates the position by the designated distance from the machine home position and sets that position as the home position address.
Functions that compensate control	Backlash compensation function	This function compensates the mechanical backlash amount. Feed commands equivalent to the set backlash amount are output each time the movement direction changes.
	Electronic gear function	By setting the movement amount per pulse, this function can freely change the machine movement amount per commanded pulse. When the movement amount per pulse is set, a flexible positioning system that matches the machine system can be structured.
	Near pass function*1	This function suppresses the machine vibration when the speed is changed during continuous path control in the interpolation control.
Functions that limit control	Speed limit function	If the command speed exceeds "[Pr.8] Speed limit value" during control, this function limits the commanded speed to within the "[Pr.8] Speed limit value" setting range.
	Torque limit function	If the torque generated by the servomotor exceeds "Torque limit setting value" during control, this function limits the generated torque to within the "Torque limit setting value" setting range.
	Software stroke limit function	If a command outside of the upper/lower limit stroke limit setting range, set in the parameters, is issued, this function will not execute positioning for that command.
	Hardware stroke limit function	This function carries out deceleration stop with the hardware stroke limit switch.
	Forced stop function	This function stops all axes of servo amplifiers by the forced stop input signal connected to the external input connection connector of RD77MS or input from the buffer memory.

Sub function		Details
Functions that change control details	Speed change function	This function changes the speed during positioning. Set the changed speed in the speed change buffer memory (New speed value), and change the speed with the speed change request (Speed change request).
	Override function	This function changes the speed within a percentage of 0 to 300 % during positioning. This is executed using "[Cd.13] Positioning operation speed override".
	Acceleration/deceleration time change function	This function changes the acceleration/deceleration time during speed change.
	Torque change function	This function changes the "torque limit value" during control.
	Target position change function	This function changes the target position during positioning. Position and speed can be changed simultaneously.
Functions related to positioning start	Pre-reading start function	This function shortens the virtual start time.
Absolute position system		This function restores the absolute position of designated axis.
Functions related to positioning stop	Stop command processing for deceleration stop function	This function selects a deceleration curve when a stop cause occurs during deceleration stop processing to speed 0.
	Continuous operation interrupt function	This function interrupts continuous operation. When this request is accepted, the operation stops when the execution of the current positioning data is completed.
	Step function	This function temporarily stops the operation to confirm the positioning operation during debugging, etc. The operation can be stopped at each "automatic deceleration" or "positioning data".

Sub function		Details
Other functions	Skip function	This function stops the positioning being executed (decelerates to a stop) when the skip signal is input, and carries out the next positioning.
	M code output function	This function issues a command for a sub work (clamp or drill stop, tool change, etc.) according to the M code No. (0 to 65535) that can be set for each positioning data. The M code output timing can be set for each positioning data.
	Teaching function	This function stores the address positioned with manual control into the "[Da.6] Positioning address/movement amount" having the designated positioning data No..
	Command in-position function	This function calculates the remaining distance for the RD77MS to reach the positioning stop position. When the value is less than the set value, the "command in-position flag" is set to "1". When using another auxiliary work before ending the control, use this function as a trigger for the sub work.
	Acceleration/deceleration processing function	This function adjusts the acceleration/deceleration.
	Deceleration start flag function	This function turns ON the flag when the constant speed status or acceleration status switches to the deceleration status during position control, whose operation pattern is "Positioning complete", to make the stop timing known.
	Follow up function	This function monitors the motor rotation amount with the servo turned OFF, and reflects it on the feed current value.
	Speed control 10 × multiplier setting for degree axis function	This function executes the positioning control by the 10 × speed of the command speed and the speed limit value when the setting unit is "degree".
	Operation setting for incompletion of home position return function	This function is provided to select whether positioning control is operated or not, when the home position return request flag is ON.

*1. The near pass function is featured as standard and is valid only for setting continuous path control for position control. It cannot be set to be invalid with parameters.

3.3.3 Common function

The functions to be executed as needed are outlined below.

Refer to MELSEC iQ-R Simple Motion Module User's Manual (Application) for details of each function.

Common function	Details
Parameter initialization function	This function returns the setting data stored in the buffer memory/internal memory and flash ROM/internal memory (nonvolatile) of RD77MS to the default values. The following two methods can be used. (1) Method using a program (2) Method using an GX Works3
Execution data backup function	This function writes the execution data being used in the control into the flash ROM/internal memory (nonvolatile). The following two methods can be used. (1) Method using a program (2) Method using an GX Works3
External input signal select function	This function sets the input type, input terminal, signal logic and input filter for each external input signal of each axis (upper/lower stroke limit signal (FLS/RLS), proximity dog signal (DOG), and stop signal (STOP)). The external input signals of the axes can be arbitrarily assigned to the 20 terminals of the external input connection connector of RD77MS.
History monitor function	This function monitors start history and current value history of all axes.
Amplifier-less operation function	This function executes the positioning control of RD77MS without connecting to the servo amplifiers. It is used to debug the program at the start-up of the device or simulate the positioning operation.
Virtual servo amplifier function	This function executes the operation as the axis (virtual servo amplifier axis) that operates only command (instruction) virtually without servo amplifiers.
Driver communication function	This function uses the "Master-slave operation function" of servo amplifier. The simple motion module controls the master axis and the slave axis is controlled by data communication between servo amplifiers (driver communication) without simple motion module.
Mark detection function	This function is used to latch any data at the input timing of the mark detection signal (DI).
Optional data monitor function	This function is used to store the data selected by user up to 4 data per axis to buffer memory and monitor them.
Event history function	This function collects errors and event information occurred in the RD77MS in the CPU module, and saves them to an SD memory card. This function enables to check the error history even after the power OFF or reset by holding the error contents in the CPU module.
Connect/disconnect function of SSCNET communication	Temporarily connect/disconnect of SSCNET communication is executed during system's power supply ON. This function is used to exchange the servo amplifiers or SSCNETIII cables.
Online module change	Allows to replace a module without stopping the system. For procedures for the online module change, refer to the following. • MELSEC iQ-R Online Module Change Manual
Test mode	This mode executes the test operation and adjustment of axes using an GX Works3.

3.4 Specifications of I/O Signals with CPU Modules

3.4.1 List of input/output signals with CPU modules

The RD77MS uses 32 input points and 32 output points for exchanging data with the CPU module.
The following table shows the input/output signals used when RD77MS is mounted in the slot No.0 in the base unit.

The devices X input signals from RD77MS to the CPU module, and the devices Y output signals from the CPU module to RD77MS.

<table>
<tr><th colspan="3">Signal direction: RD77MS → CPU module</th><th colspan="3">Signal direction: CPU module → RD77MS</th></tr>
<tr><th>Device No.</th><th colspan="2">Signal name</th><th>Device No.</th><th colspan="2">Signal name</th></tr>
<tr><td>X0</td><td>READY</td><td>ON: READY
OFF: Not READY/ Watch dog timer error</td><td>Y0</td><td>PLC READY</td><td>OFF: PLC READY OFF
ON: PLC READY ON</td></tr>
<tr><td>X1</td><td>Synchronization flag</td><td>OFF: Module access disabled
ON: Module access enabled</td><td>Y1</td><td>All axis servo ON</td><td>OFF: Servo OFF
ON: Servo ON</td></tr>
<tr><td>X2</td><td colspan="2" rowspan="14">Use prohibited</td><td>Y2</td><td colspan="2" rowspan="14">Use prohibited</td></tr>
<tr><td>X3</td><td>Y3</td></tr>
<tr><td>X4</td><td>Y4</td></tr>
<tr><td>X5</td><td>Y5</td></tr>
<tr><td>X6</td><td>Y6</td></tr>
<tr><td>X7</td><td>Y7</td></tr>
<tr><td>X8</td><td>Y8</td></tr>
<tr><td>X9</td><td>Y9</td></tr>
<tr><td>XA</td><td>YA</td></tr>
<tr><td>XB</td><td>YB</td></tr>
<tr><td>XC</td><td>YC</td></tr>
<tr><td>XD</td><td>YD</td></tr>
<tr><td>XE</td><td>YE</td></tr>
<tr><td>XF</td><td>YF</td></tr>
</table>

Signal direction: RD77MS → CPU module				Signal direction: CPU module → RD77MS			
Device No.	Signal name			Device No.	Signal name		
X10	Axis 1	BUSY[*1]	OFF: Not BUSY ON: BUSY	Y10	Axis 1	Positioning start[*1]	OFF: Positioning start not requested ON: Positioning start requested
X11	Axis 2			Y11	Axis 2		
X12	Axis 3			Y12	Axis 3		
X13	Axis 4			Y13	Axis 4		
X14	Axis 5			Y14	Axis 5		
X15	Axis 6			Y15	Axis 6		
X16	Axis 7			Y16	Axis 7		
X17	Axis 8			Y17	Axis 8		
X18	Axis 9			Y18	Axis 9		
X19	Axis 10			Y19	Axis 10		
X1A	Axis 11			Y1A	Axis 11		
X1B	Axis 12			Y1B	Axis 12		
X1C	Axis 13			Y1C	Axis 13		
X1D	Axis 14			Y1D	Axis 14		
X1E	Axis 15			Y1E	Axis 15		
X1F	Axis 16			Y1F	Axis 16		

*1. The BUSY signal and positioning start signal, whose axis Nos. exceed the number of controlled axes, cannot be used.

POINT

(1) The M code ON signal, error detection signal, start complete signal and positioning complete signal are assigned to the bit of "[Md.31] Status."

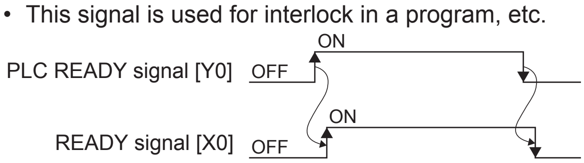
(2) The axis stop signal, forward run JOG start signal, reverse run JOG start signal, execution prohibition flag are assigned to the buffer memory [Cd.180] to [Cd.183].

IMPORTANT

The above prohibited signals are used by the system. The user cannot use them.
If any of the signals is used, we will not guarantee the operation of RD77MS.

3.4.2 Details of input signals

The ON/OFF timing and conditions of the input signals are shown below.

<table>
<tr><th>Device No.</th><th colspan="3">Signal name</th><th>Details</th></tr>
<tr><td>X0</td><td colspan="2">READY</td><td>ON: READY
OFF: Not READY/
Watch dog timer error</td><td>• When the PLC READY signal [Y0] turns from OFF to ON, the parameter setting range is checked. If no error is found, this signal turns ON.
• When the PLC READY signal [Y0] turns OFF, this signal turns OFF.
• When watch dog timer error occurs, this signal turns OFF.
• This signal is used for interlock in a program, etc.

</td></tr>
<tr><td>X1</td><td colspan="2">Synchronization flag</td><td>OFF: Module access disabled
ON: Module access enabled</td><td>• After the CPU module is turned ON or the CPU module is reset, this signal turns ON if the access from the CPU module to the simple motion module is possible.
• When "Asynchronous" is selected in the module synchronization setting of the CPU module, this signal can be used as interlock for the access from a program to the simple motion module.</td></tr>
<tr><td>X10</td><td>Axis 1</td><td rowspan="16">BUSY[*1]</td><td rowspan="16">OFF: Not BUSY
ON: BUSY</td><td rowspan="16">• This signal turns ON at the start of positioning, home position return or JOG operation. It turns OFF when the "[Da.9] Dwell time/JUMP destination positioning data No." has passed after positioning stops. (This signal remains ON during positioning.)
• This signal turns OFF when the positioning is stopped with step operation.
• During manual pulse generator operation, this signal turns ON while the "[Cd.21] Manual pulse generator enable flag" is ON.
• This signal turns OFF at error completion or positioning stop.</td></tr>
<tr><td>X11</td><td>Axis 2</td></tr>
<tr><td>X12</td><td>Axis 3</td></tr>
<tr><td>X13</td><td>Axis 4</td></tr>
<tr><td>X14</td><td>Axis 5</td></tr>
<tr><td>X15</td><td>Axis 6</td></tr>
<tr><td>X16</td><td>Axis 7</td></tr>
<tr><td>X17</td><td>Axis 8</td></tr>
<tr><td>X18</td><td>Axis 9</td></tr>
<tr><td>X19</td><td>Axis 10</td></tr>
<tr><td>X1A</td><td>Axis 11</td></tr>
<tr><td>X1B</td><td>Axis 12</td></tr>
<tr><td>X1C</td><td>Axis 13</td></tr>
<tr><td>X1D</td><td>Axis 14</td></tr>
<tr><td>X1E</td><td>Axis 15</td></tr>
<tr><td>X1F</td><td>Axis 16</td></tr>
</table>

*1. The BUSY signal, whose axis No. exceeds the number of controlled axes, cannot be used.

POINT

The BUSY signal turns ON even when position control of movement amount 0 is executed. However, since the ON time is short, the ON status may not to be detected in the program.

3.4.3 Details of output signals

The ON/OFF timing and conditions of the output signals are shown below.

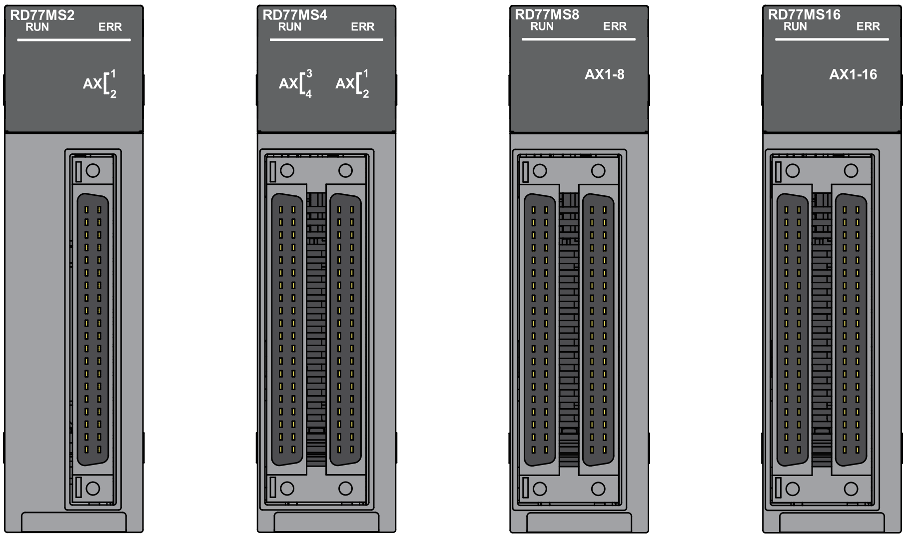
<table>
<tr><th>Device No.</th><th colspan="3">Signal name</th><th>Details</th></tr>
<tr><td>Y0</td><td colspan="2">PLC READY</td><td>OFF: PLC READY OFF
ON: PLC READY ON</td><td>(a) This signal notifies the simple motion module that the CPU module is normal.
• It is turned ON/OFF with the program.
(b) When the data (parameter, etc.) are changed, this signal is turned OFF depending on the parameter.
(c)The following processes are carried out when this signal turns from OFF to ON.
• The parameter setting range is checked.
• The READY signal [X0] turns ON.
(d) The following processes are carried out when this signal turns from ON to OFF. In these cases, the OFF time should be set to 100 ms or more.
• The READY signal [X0] turns OFF.
• The operating axis stops.
• The M code ON signal ([Md.31] Status: b12) for each axis turns OFF, and "0" is stored in "[Md.25] Valid M code".
(e) When parameters or positioning data (No.1 to 600) are written from the GX Works3 or CPU module to the flash ROM, this signal will turn OFF.</td></tr>
<tr><td>Y1</td><td colspan="2">All axis servo ON</td><td>OFF: Servo OFF
ON: Servo ON</td><td>• All the servo amplifiers connected to the simple motion module are turned ON or OFF.</td></tr>
<tr><td>Y10</td><td>Axis 1</td><td rowspan="16">Positioning start*1</td><td rowspan="16">OFF: Positioning start not requested
ON: Positioning start requested</td><td rowspan="16">• Home position return operation or positioning operation is started.
• The positioning start signal is valid at the rising edge, and the operation is started.
• When this signal turns ON during BUSY, the warning "Start during operation" (warning code: 0900H) will occur.</td></tr>
<tr><td>Y11</td><td>Axis 2</td></tr>
<tr><td>Y12</td><td>Axis 3</td></tr>
<tr><td>Y13</td><td>Axis 4</td></tr>
<tr><td>Y14</td><td>Axis 5</td></tr>
<tr><td>Y15</td><td>Axis 6</td></tr>
<tr><td>Y16</td><td>Axis 7</td></tr>
<tr><td>Y17</td><td>Axis 8</td></tr>
<tr><td>Y18</td><td>Axis 9</td></tr>
<tr><td>Y19</td><td>Axis 10</td></tr>
<tr><td>Y1A</td><td>Axis 11</td></tr>
<tr><td>Y1B</td><td>Axis 12</td></tr>
<tr><td>Y1C</td><td>Axis 13</td></tr>
<tr><td>Y1D</td><td>Axis 14</td></tr>
<tr><td>Y1E</td><td>Axis 15</td></tr>
<tr><td>Y1F</td><td>Axis 16</td></tr>
</table>

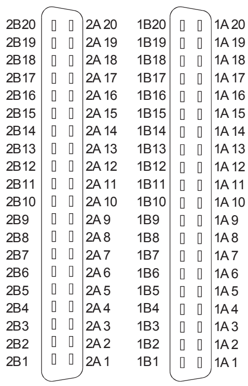
*1. The positioning signal, whose axis No. exceeds the number of controlled axes, cannot be used.

3.5 Input/output Interface with External Devices

(1) Signal assignment on external device connection connector of RD77MS

RD77MS2 RD77MS4 RD77MS8 RD77MS16



Pin layout (Front view of the module)*1	Pin No.	Signal name	Pin No.	Signal name	Pin No.	Signal name	Pin No.	Signal name
	2B20		2A20		1B20	HB*2*3*4	1A20	5V*8
	2B19		2A19		1B19	HA*2*3*4	1A19	5V*8
	2B18		2A18		1B18	HBL*2*3*5	1A18	HBH*2*3*5
	2B17		2A17		1B17	HAL*2*3*5	1A17	HAH*2*3*5
	2B16		2A16		1B16	No connect*6	1A16	No connect*6
	2B15		2A15		1B15	5V*9	1A15	5V*9
	2B14	No connect*6	2A14	No connect*6	1B14	SG*9	1A14	SG*9
	2B13		2A13		1B13		1A13	
	2B12		2A12		1B12		1A12	
	2B11		2A11		1B11	No connect*6	1A11	No connect*6
	2B10		2A10		1B10		1A10	
	2B9		2A9		1B9		1A9	
	2B8		2A8		1B8	EMI.COM	1A8	EMI
	2B7	COM	2A7	COM	1B7	COM	1A7	COM
	2B6	COM	2A6	COM	1B6	COM	1A6	COM
	2B5	SIN20*7	2A5	SIN15*7	1B5	SIN10*7	1A5	SIN5*7
	2B4	SIN19*7	2A4	SIN14*7	1B4	SIN9*7	1A4	SIN4*7
	2B3	SIN18*7	2A3	SIN13*7	1B3	SIN8*7	1A3	SIN3*7
	2B2	SIN17*7	2A2	SIN12*7	1B2	SIN7*7	1A2	SIN2*7
	2B1	SIN16*7	2A1	SIN11*7	1B1	SIN6*7	1A1	SIN1*7

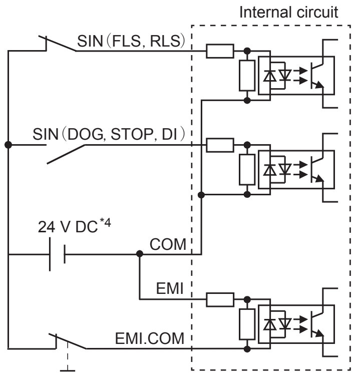
*1. RD77MS2 does not have the connectors 2A20 to 2A1 and 2B20 to 2B1.
*2. Set the signal input form in "[Pr.24] Manual pulse generator/Incremental synchronous encoder input selection".
*3. With the manual pulse generator/incremental synchronous encoder of voltage-output/open-collector type Connect the A-phase/PULSE signal to HA, and the B-phase/SIGN signal to HB.
*4. With the manual pulse generator/incremental synchronous encoder of differential-output type Connect the A-phase/PULSE signal to HAH, and the A-phase/PULSE inverse signal to HAL. Connect the B-phase/SIGN signal to HBH, and the B-phase/SIGN inverse signal to HBL.
*5. Do not connect to any terminals explained as "No connect".
*6. Set the external command signal [DI, FLS, RLS, DOG, STOP] in "[Pr.116] FLS signal selection", "[Pr.117] RLS signal selection", "[Pr.118] DOG signal selection", "[Pr.119] STOP signal selection" and "[Pr.95] External command signal selection".
*7. Do not connect wires other than the signal wires of the manual pulse generator to 1A20 and 1A19.
*8. Do not use 1A(B)15 and 1A(B)14 for other than the power supply of manual pulse generator.

3.5.1 Input/output interface signals

(1) Internal circuit of RD77MS interface

The schematic view of the internal circuit of the external device connection interface of RD77MS is shown below.

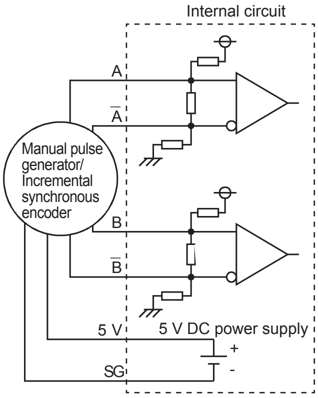
(a) Interface between external input signals/forced stop input signals

Input or Output	Signal name		Pin No.	Wiring example	Description
Input	External input signals[*1] (upper/lower limit signal[*2])	SIN (FLS, RLS)	_ _1 to 5[*3]		Upper limit signal Lower limit signal Proximity dog signal Stop signal External command signals Switching signal External forced stop input
	External input signal[*1] (proximity dog[*2], stop, external command/ switching signal)	SIN (DOG, STOP, DI)			
	Common	COM	_ _6[*3]		
			_ _7[*3]		
	Forced stop input	EMI	1A8		
		EMI. COM	1B8		

*1. When using external input signal of servo amplifier, set "1" with "[Pr.116] FLS signal selection", "[Pr.117] RLS signal selection", and "[Pr.118] DOG signal selection".
*2. Refer each servo amplifier instruction manual for wiring of the input/output signals of servo amplifier.
*3. "_ _" indicates "1A", "1B", 2A ", or "2B".
*4. As for the 24 V DC sign, both "+" and "-" are possible.

(b) Manual pulse generator/Incremental synchronous encoder input

[1] Interface between manual pulse generator/incremental synchronous encoder (Differential output type)

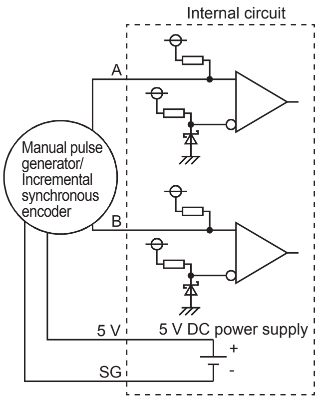
Input or Output	Signal name		Pin No.	Wiring example	Specifications	Description
Input*1*2	Manual pulse generator, phase A/ PULSE	HAH (A+)	1A17		• Rated input voltage: 5.5 V DC or less • HIGH level: 2.0 to 5.25 V DC • LOW level: 0.8 V DC or less • Equivalent to 26LS31	For connecting manual pulse generator/ Incremental synchronous encoder
		HAL (A-)	1B17			
	Manual pulse generator, phase B/ PULSE	HBH (B+)	1B17			
		HBL (B-)	1B18			
Power supply	5V*3		1A15 1B15			
	SG		1A14 1B14			

*1. Set "0: Differential-output type" in "[Pr.89] Manual pulse generator/Incremental synchronous encoder input type selection" if the manual pulse generator/incremental synchronous encoder of differential-output type is used.
The default value is "1: Voltage-output/open-collector type".

*2. Set the signal input form in "[Pr.24] Manual pulse generator/Incremental synchronous encoder input selection".

*3. The 5 V DC power supply from the RD77MS must not be used if a separate power supply is applied to the manual pulse generator/incremental synchronous encoder. If a separate power supply is used, use a stabilized power supply of voltage 5 V DC.
Anything else may cause a failure.

[2] Interface between manual pulse generator/incremental synchronous encoder (Voltage-output type/open-collector type)

Input or Output	Signal name		Pin No.	Wiring example	Specifications	Description
Input*1*2	Manual pulse generator, phase A/ PULSE	HA (A)	1B19		• Rated input voltage: 5.5 V DC or less • HIGH level: 3 to 5.25 V DC/2 mA or less • LOW level: 1 V DC or less/5 mA or more	For connecting manual pulse generator/ Incremental synchronous encoder
	Manual pulse generator, phase B/ PULSE	HB (B)	1B20			
Power supply	5V*3		1A15 1B15			
	SG		1A14 1B14			

*1. Set "1: Voltage-output/open-collector type" in "[Pr.89] Manual pulse generator/Incremental synchronous encoder input type selection" if the manual pulse generator/incremental synchronous encoder of voltage-output/open-collector type is used.
The default value is "1: Voltage-output/open-collector type".

*2. Set the signal input form in "[Pr.24] Manual pulse generator/Incremental synchronous encoder input selection".

*3. The 5 V DC power supply from the RD77MS must not be used if a separate power supply is applied to the manual pulse generator/incremental synchronous encoder. If a separate power supply is used, use a stabilized power supply of voltage 5 V DC.
Anything else may cause a failure.

3.6 Buffer Memory

RD77MS has a buffer memory. A higher level of controls can be realized by reading and writing with a sequence program.
Refer to the following user's manuals for the details of the buffer memory.

- MELSEC iQ-R Simple Motion Module User's Manual (Application)
- MELSEC iQ-R Simple Motion Module User's Manual (Advanced Synchronous Control)

3.6.1 Buffer memory area configuration

The entire configuration of the buffer memory is shown below.
The buffer memory of simple motion module is configured of the following types of areas.
n: Axis No. - 1
k: Mark detection setting No. - 1
p: Pointer No.-1
j: Synchronous encoder axis No. - 1

Buffer memory area configuration		Buffer memory address	Writing possibility
Parameter area	Servo network composition parameter area	58020+32n, 58021+32n, 58660, 58661	Possible
	Common parameter area	33, 35, 67, 105, 106, 58000 to 58008	
	Basic parameter area	0+150n to 15+150n	
	Detailed parameter area	17+150n to 69+150n, 116+150n to 123+150n	
	Home position return basic parameter area	70+150n to 78+150n	
	Home position return detailed parameter area	80+150n to 91+150n	
	Extended parameter area	100+150n to 103+150n	
	Mark detection setting parameter area	54000+20k to 54010+20k	
Monitor data area	System monitor area	4000 to 4288, 87000, 87010+10p to 87016+10p	Not possible
	Axis monitor area	2400+100n to 2499+100n, 59300+100n to 59303+100n	
	Servo network composition monitor area	58660, 58661	
	Mark detection monitor data area	54960+80k to 55025+80k	
Control data area	System control data area	5900 to 5945	Possible
	Axis control data area	4300+100n to 4395+100n 30100+10n to 30103+10n	
	Mark detection control data area	54640+10k to 54642+10k	

<table>
<tr><th colspan="3">Buffer memory area configuration</th><th>Buffer memory address</th><th>Writing possibility</th></tr>
<tr><td>Positioning data area (No.1 to 100)</td><td colspan="2" rowspan="2">Positioning data area</td><td>6000+1000n to 6009+1000n
71000+1000n, 71001+1000n</td><td rowspan="13">Possible</td></tr>
<tr><td>Positioning data area (No.101 to 600)</td><td>Set by GX Works3</td></tr>
<tr><td rowspan="3">Block start data area (No.7000)</td><td colspan="2" rowspan="2">Block start data area</td><td>22000+400n to 22049+400n</td></tr>
<tr><td>22050+400n to 22099+400n</td></tr>
<tr><td colspan="2">Condition data</td><td>22100+400n to 22199+400n</td></tr>
<tr><td rowspan="3">Block start data area (No.7001)</td><td colspan="2" rowspan="2">Block start data area</td><td>22200+400n to 22249+400n</td></tr>
<tr><td>22250+400n to 22299+400n</td></tr>
<tr><td colspan="2">Condition data area</td><td>22300+400n to 22399+400n</td></tr>
<tr><td rowspan="2">Block start data area (No.7002)</td><td colspan="2">Block start data area</td><td rowspan="6">Set by GX Works3</td></tr>
<tr><td colspan="2">Condition data area</td></tr>
<tr><td rowspan="2">Block start data area (No.7003)</td><td colspan="2">Block start data area</td></tr>
<tr><td colspan="2">Condition data area</td></tr>
<tr><td rowspan="2">Block start data area (No.7004)</td><td colspan="2">Block start data area</td></tr>
<tr><td colspan="2">Condition data area</td></tr>
<tr><td>PLC CPU memo area</td><td colspan="2">PLC CPU memo area</td><td>30000 to 30099</td><td>Possible</td></tr>
<tr><td rowspan="13">Servo parameter area</td><td rowspan="3">PA group</td><td>PA01 to PA18</td><td>28401+100n to 28418+100n</td><td rowspan="13">Possible</td></tr>
<tr><td>PA19</td><td>64464+70n</td></tr>
<tr><td>PA20 to PA32</td><td>64400+70n to 64412+70n</td></tr>
<tr><td colspan="2" rowspan="2">PB group</td><td>28419+100n to 28463+100n</td></tr>
<tr><td>64413+70n to 64431+70n</td></tr>
<tr><td colspan="2" rowspan="2">PC group</td><td>28464+100n to 28495+100n</td></tr>
<tr><td>64432+70n to 64463+70n</td></tr>
<tr><td colspan="2">PD group</td><td>65520+340n to 65567+340n</td></tr>
<tr><td colspan="2">PE group</td><td>65568+340n to 65631+340n</td></tr>
<tr><td colspan="2">PS group</td><td>65712+340n to 65743+340n</td></tr>
<tr><td colspan="2">PF group</td><td>65632+340n to 65679+340n</td></tr>
<tr><td colspan="2">Po group</td><td>65680+340n to 65711+340n</td></tr>
<tr><td colspan="2">PL group</td><td>65744+340n to 65791+340n</td></tr>
</table>

Buffer memory area configuration		Buffer memory address	Writing possibility
Synchronous control area	Servo input axis parameters	32800+10n to 32805+10n	Possible
	Servo input axis monitor data	33120+10n to 33127+10n	Not possible
	Synchronous encoder axis parameter	34720+20j to 34735+20j	Possible
	Synchronous encoder axis control data	35040+10j to 35047+10j	Possible
	Synchronous encoder axis monitor data	35200+20j to 35212+20j	Not possible
	Synchronous control system control data	36320, 36322	Possible
	Synchronous parameters	36400+200n to 36513+200n	Possible
	Synchronous control monitor data	42800+40n to 42835+40n	Not possible
	Control data for synchronous control	44080+20n to 44090+20n	Possible
	Cam operation control data	45000 to 53791	Possible
	Cam operation monitor data	53800 to 53801	Not possible

PRECAUTIONS

It is prohibited to use missing addresses not listed above. If used, the system may not operate correctly.

POINT

When the parameter of the servo amplifier side is changed by the following method, the RD77MS reads parameters automatically, and the data is transmitted to the servo parameter area in the buffer memory and internal memory (nonvolatile).

(a) When changing the servo parameters by the auto tuning.

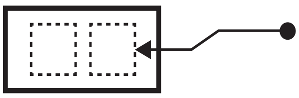
(b) When the servo parameter is changing after the MR Configurator2 is connected directly with the servo amplifier.

3.6.2 Explanation of buffer memories used in practical work

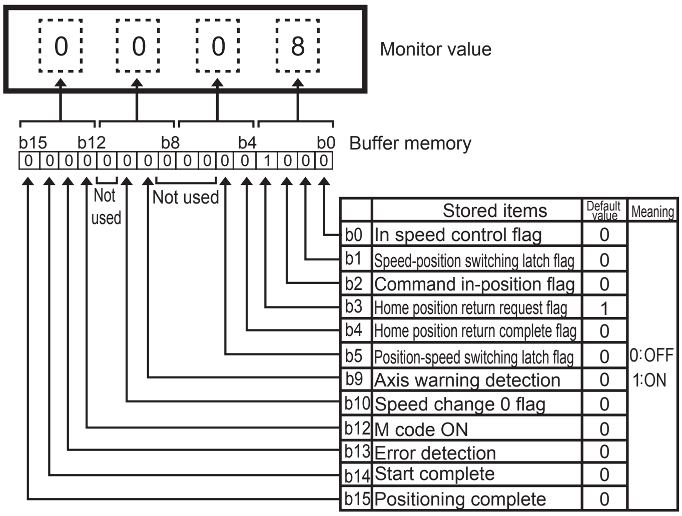
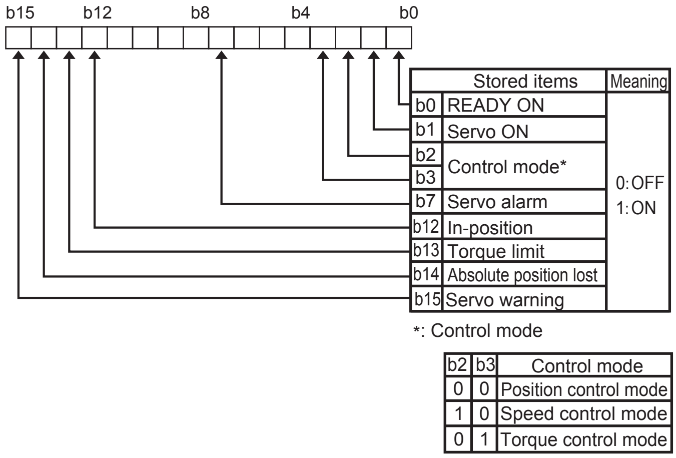
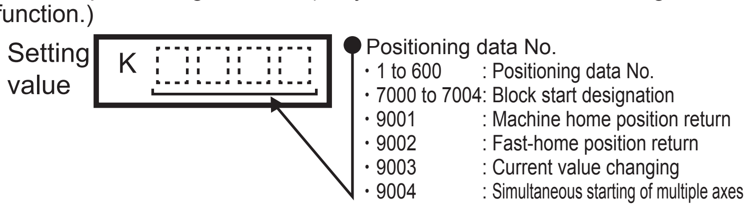
This section explains the buffer memories used in the programs in the training manual.

Refer to the following user's manuals for the details of each buffer memory.

- MELSEC iQ-R Simple Motion Module User's Manual (Application)
- MELSEC iQ-R Simple Motion Module User's Manual (Advanced Synchronous Control)

Buffer memory address	Item	Remarks/setting range	Default value
2400+100n 2401+100n	Feed current value	The currently commanded address is stored. (Different from the actual motor position during operation) The current position address is stored. If "degree" is selected as the unit, the addresses will have a ring structure for values between 0 and 359.99999°. • The home position address is stored when the machine home position return is completed. • When the current value is changed with the current value changing function, the changed value is stored.	0000H
2406+100n	Axis error No.	When an axis error is detected, the error code corresponding to the error details is stored. • The latest error code is always stored. (When a new axis error occurs, the error code is overwritten.) • When "[Cd.5] Axis error reset" (axis control data) turns ON, the axis error No. is cleared (set to 0).	0000H
2407+100n	Axis warning No.	Whenever an axis warning is reported, a related warning code is stored. • This area stores the latest warning code always. (Whenever an axis warning is reported, a new warning code replaces the stored warning code.) • When the "[Cd.5] Axis error reset" (axis control data) is set to ON, the axis warning No. is cleared to "0".	0000H
2409+100n	Axis operation status	This area stores the axis operation status. Monitor value  Axis operation status -2: Step standby -1: Error 0: Standby 1: Stopped 2: Interpolation 3: JOG operation 4: Manual pulse generator operation 5: Analyzing 6: Special start standby 7: Home position return 8: Position control 9: Speed control 10: Speed control in speed-position switching control 11: Position control in speed-position switching control 12: Speed control in position-speed switching control 13: Position control in position-speed switching control 15: Synchronous control 16: Test mode JOG operation 20: Servo amplifier has not been connected/ Servo amplifier power supply OFF 21: Servo OFF 30: Control mode switch 31: Speed control 32: Torque control 33: Continuous operation to torque control mode	0

n: Axis No. - 1

<table>
<tr><th>Buffer Memory Address</th><th>Item</th><th>Remarks/setting range</th><th>Default value</th></tr>
<tr><td>2417+100n</td><td>Status</td><td>This area stores the states (ON/OFF) of various flags.
</td><td>0008H</td></tr>
<tr><td>2477+100n</td><td>Servo status1</td><td>This area stores the servo status1.
</td><td>0000H</td></tr>
<tr><td>2478+100n</td><td>Regenerative load ratio/ Optional data monitor output 1</td><td>• The rate of regenerative power to the allowable regenerative power is indicated as a percentage.
• When the regenerative option is used, the rate to the allowable regenerative power of the option is indicated.
(Buffer memory) %
• This area stores the content set in "[Pr.91] Optional data monitor: Data type setting 1" at optional data monitor data type setting.</td><td>0</td></tr>
<tr><td>2488+100n</td><td>Servo alarm</td><td>• This area stores the servo alarm code and servo warning code displayed in LED of servo amplifier.
• When the "[Cd.5] Axis error reset" (axis control data) is set to ON after remove the error factor of servo amplifier side, the servo alarm is cleared (set to 0).
• For the error codes, refer to each Servo amplifier Technical Document Collection.</td><td>0000H</td></tr>
<tr><td>4300+100n</td><td>Positioning start No.</td><td>Sets the positioning start No. (Only 1 to 600 for the Pre-reading start function.)
</td><td>0</td></tr>
</table>

n: Axis No. - 1

<table>
<tr><th>Buffer Memory Address</th><th>Item</th><th>Remarks/setting range</th><th>Default value</th></tr>
<tr><td>4302+100n</td><td>Axis error reset</td><td>• Clears the axis error detection, axis error No., axis warning detection and axis warning No.
• When the axis operation state of simple motion module is "in error occurrence", the error is cleared and the simple motion module is returned to the "waiting" state.
• Clears the both of simple motion module errors and servo amplifier alarms by axis error reset.
• The error cannot be reset during a forced stop. Execute the axis error reset after the forced stop is released.
• The set values are shown below.
0: Axis error reset request accepted (set by RD77MS)
1: Error reset request (set by user)</td><td>0</td></tr>
<tr><td>4314+100n
4315+100n</td><td>New speed value</td><td>• When changing the speed, use this data item to specify a new speed.
• The operation halts if you specify "0".<table>
<tr><th>Unit</th><th>mm
($\times 10^{-2}$ mm/min)</th><th>inch
($\times 10^{-3}$ inch/min)</th><th>degree
($\times 10^{-3}$ degree/min)</th><th>pulse
(pulse/s)</th></tr>
<tr><td>Setting range</td><td>0 to 2000000000</td><td>0 to 2000000000</td><td>0 to 2000000000</td><td>0 to 1000000000</td></tr>
</table></td><td>0</td></tr>
<tr><td>4317+100n</td><td>Inching movement amount</td><td>• Use this data item to set the amount of movement by inching.
• The machine performs a JOG operation if "0" is set.<table>
<tr><th>Unit</th><th>mm
($\times 10^{-1}$ µm)</th><th>inch
($\times 10^{-3}$ inch)</th><th>degree
($\times 10^{-3}$ degree)</th><th>pulse
(pulse)</th></tr>
<tr><td>Setting range</td><td>0 to 65535</td><td>0 to 65535</td><td>0 to 65535</td><td>0 to 65535</td></tr>
</table></td><td>0</td></tr>
<tr><td>4318+100n
4319+100n</td><td>JOG speed</td><td>Use this data item to set the JOG speed.<table>
<tr><th>Unit</th><th>mm
($\times 10^{-2}$ mm/min)</th><th>inch
($\times 10^{-5}$ inch/min)</th><th>degree
($\times 10^{-5}$ degree/min)</th><th>pulse
(pulse/s)</th></tr>
<tr><td>Setting range</td><td>1 to 2000000000</td><td>1 to 2000000000</td><td>1 to 2000000000</td><td>1 to 1000000000</td></tr>
</table></td><td>0</td></tr>
<tr><td>4348+100n</td><td>Teaching data selection</td><td>• This data item specifies the teaching result write destination.
• Data are cleared to zero when the teaching ends.
• The set values are shown below.
0: Takes the feed current value as a positioning address.
1: Takes the feed current value as an arc data.</td><td>0</td></tr>
<tr><td>4349+100n</td><td>Teaching positioning data No.</td><td>• This data item specifies data to be produced by teaching.
• If a value between 1 and 600 is set, a teaching operation is done.
• The value is cleared to "0" when the RD77MS is initialized and the teaching operation completes, and when an illegal value (601 or higher) is entered.</td><td>0</td></tr>
<tr><td>4351+100n</td><td>Servo OFF command</td><td>• Executes servo OFF for each axis.
• The set values are shown below.
0: Servo ON
1: Servo OFF</td><td>0</td></tr>
<tr><td>5900</td><td>Flash ROM write request</td><td>• Writes not only "positioning data (No.1 to 600)" and "block start data (No.7000 to 7004)" stored in the buffer memory/internal memory area, but also "parameters" and "servo parameters" to the flash ROM/internal memory (nonvolatile).
• The set values are shown below.
0: Writing in flash ROM completed (set by RD77MS)
1: Flash ROM write request (set by user)</td><td>0</td></tr>
</table>

n: Axis No. - 1

Buffer Memory Address	Item	Remarks/setting range	Default value
6006+1000n 6007+1000n	Positioning address/ movement amount	Set the address as the target value for positioning control. (Refer to “[Da.6] Positioning address/movement amount” in 4.9 “Positioning data.”)	0
30100+10n	Axis stop	• When the axis stop signal turns ON, the home position return control, positioning control, JOG operation, inching operation, manual pulse generator operation, speed-torque control, etc. will stop. • By turning the axis stop signal ON during positioning operation, the positioning operation will be "stopped". • Whether to decelerate stop or rapidly stop can be selected with "[Pr.39] Stop group 3 rapid stop selection". • During interpolation control of the positioning operation, if the axis stop signal of any axis turns ON, all axes in the interpolation control will decelerate and stop. • The set values are shown below. 1: Axis stop requested Other than 1: Axis stop not requested	0
30101+10n	Forward run JOG start	• When the JOG start signal is ON, JOG operation will be carried out at the "[Cd.17] JOG speed". When the JOG start signal turns OFF, the operation will decelerate and stop. • When inching movement amount is set, the designated movement amount is output for one operation cycle and then the operation stops. • The set values are shown below. 1: JOG started Other than 1: JOG not started	0
30102+10n	Reverse run JOG start		0
36320	Synchronous control start	• Synchronous control begins if the target axis bit is turned ON. • Synchronous control ends if the bit is turned OFF during synchronous control. • Set the target axis in 16-bit. (bit 0: axis 1 to bit 15: axis 16) OFF: Synchronous control end ON: Synchronous control start	0
36472+200n 36473+200n	Cam axis length per cycle	• Sets the input amount required for 1 cam cycle. • The setting range is from 1 to 2147483647 [cam axis cycle unit].	4194304
36474+200n	Cam No.	• Set the cam No. • The set values are shown below. 0 : Linear cam (preset) 1 to 256: User created cams	0
42828+40n	Main shaft clutch ON/ OFF status	The ON/OFF status of the main shaft clutch is stored. 0: Clutch OFF status 1: Clutch ON status	0
42829+40n	Main shaft clutch smoothing status	The smoothing status of the main shaft clutch is stored. 0: No clutch smoothing 1: During clutch smoothing	0
44080+20n	Main shaft clutch command	• Set the clutch command ON/OFF status. • The set values are shown below. 0: Main shaft clutch command OFF 1: Main shaft clutch command ON	0
44081+20n	Main shaft clutch control invalid command	• The main shaft clutch control is disabled. • The set values are shown below. 0: Main shaft clutch control valid 1: Main shaft clutch control invalid	0
44082+20n	Main shaft clutch forced OFF command	• The clutch is forcibly turned off. • The set values are shown below. 0: Main shaft clutch normal control 1: Main shaft clutch forced OFF	0

n: Axis No. - 1

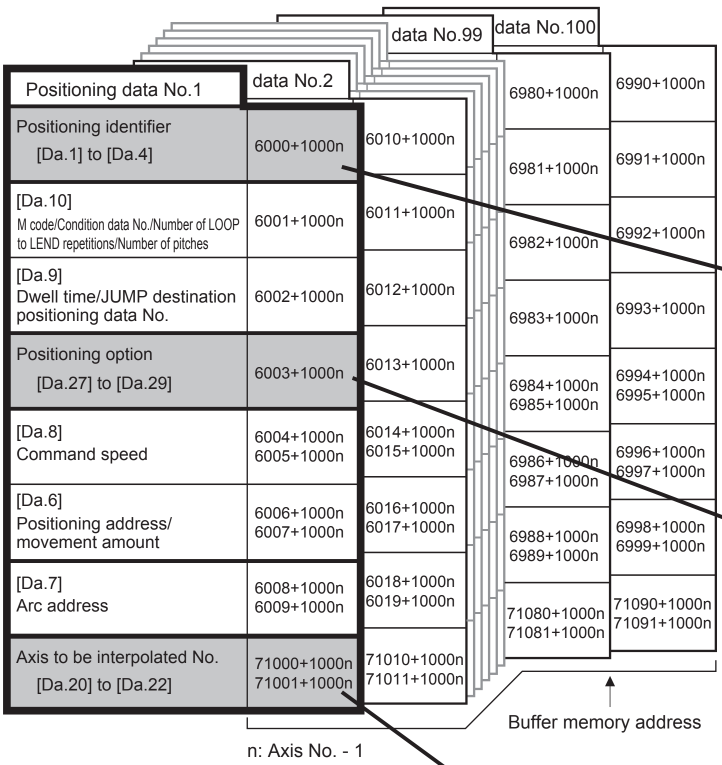
Buffer Memory Address	Item	Remarks/setting range	Default value
44083+20n	Auxiliary shaft clutch command	• Set the clutch command ON/OFF status. • The set values are shown below. 0: Auxiliary shaft clutch command OFF 1: Auxiliary shaft clutch command ON	0
45000	Cam data operation request	• Set the cam data operation command. • The set values are shown below. 0: Cam data operation completed (set by RD77MS) 1: Read (set by user) 2: Write (cam saving area) (set by user) 3: Write (cam extension area) (set by user)	0
45001	Operation cam No.	• Set the number of the cam to be operated. • The setting range is from 1 to 256.	0
45002	Cam data first position	Set the top position of the cam data to be operated. • Stroke ratio data format: 1 to cam resolution • Coordinate data format: 0 to (number of coordinates – 1)	0
45003	Number of cam data operation points	Set the number of points of cam data to be operated. • Stroke ratio data format: 1 to 4096 • Coordinate data format: 1 to 2048	0
45004	Cam data format	• Set the cam data format. When cam data is written: Set the cam data format. When cam data is read: The set cam data format is stored. • The set values are shown below. 1: Stroke ratio data format 2: Coordinate data format	0
45008 to 53199	Cam data value	• Cam data for the number of cam data operation points can be set and obtained in the following format. When cam data is written: Set the cam data corresponding to the cam data format. When cam data is read: The set cam data is stored. • The setting range of stroke ratio data format is shown below. -2147483648 to 2147483647[$\times 10^{-7}$ %] • The setting ranges of coordinate data format are shown below. Input value: 0 to 2147483647 [cam axis cycle unit] Output value: -2147483648 to 2147483647 [output axis position unit]	0
53200	Cam auto-generation request	• Set the cam automatic creation request. • The set values are shown below. 0: Cam automatic generation completed (set by RD77MS) 1: Cam automatic generation request (set by user)	0
53201	Cam auto-generation cam No.	• The number of automatically generated cam is set. • The setting range is from 1 to 256.	0
53202	Cam auto-generation type	• Set the type of cam automatic generation. • The set values are shown below. 1: Cam for rotary cutter	0
53204 to 53779	Cam auto-generation data	Set the parameter for each type of cam automatic generation.[*1]	0

n: Axis No. - 1

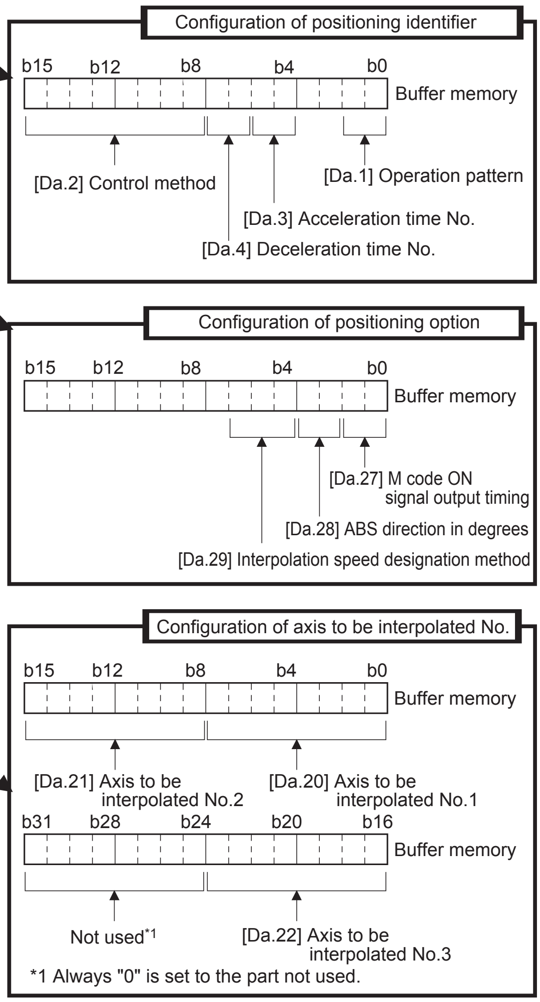
*1. The parameters for cam automatic generation for rotary cutter are shown below.

Buffer Memory Address	Item	Setting value	Details
53204	Cam resolution	256/512/1024/2048/4096/ 8192/16384/32768	Set the resolution of the cam to be created.
53206 53207	Sheet length	1 to 2147483647 [(Optional) Same unit (0.1 mm, etc.)]	Set the sheet length. Set this value as the cam axis length per cycle.
53208 53209	Sheet synchronous width	1 to 2147483647 [(Optional) Same unit (0.1 mm, etc.)]	Set the length of the synchronous zone of sheet.
53210 53211	Synchronous axis length	1 to 2147483647 [(Optional) Same unit (0.1 mm, etc.)]	Set the perimeter of rotary cutter shaft.
53212 53213	Synchronization starting position	0 to 2147483647 [(Optional) Same unit (0.1 mm, etc.)]	Set the length from the sheet head to the synchronization start zone.
53214	Synchronous section acceleration ratio	-5000 to 5000 [0.01 %]	Set this ratio to make a fine adjustment to the synchronization speed in the synchronization zone. Synchronization zone speed = synchronization speed × (100 % + acceleration rate)

<Configuration of positioning data area>



- Up to 100 positioning data items can be set (stored) for each axis in the buffer memory address shown on the left. No.101 to No.600 are not allocated to buffer memory. Set with the GX Works3. [RD77MS] Data is controlled as positioning data No.1 to 600 for each axis.
- One positioning data item is configured of the items shown in the bold box.



Chapter 4 Types of Data

With the positioning system using the RD77MS, the various parameters and data explained in this chapter are used for control. The parameters and data include parameters set according to the device configuration, such as the system configuration, and parameters and data set according to each control.

4.1 Parameters and Data Required for Control

The parameters and data required to carry out control with the RD77MS include the "setting data", "monitor data" and "control data" shown below.

4.1.1 Setting data

The data is set beforehand according to the machine and application. The data set for the buffer memory can also be saved in the flash ROM or internal memory (nonvolatile) in the RD77MS.

The setting data is classified as follows.

Setting data

- Parameters
  - Servo network composition parameters: Parameters for the network. Set the device to be used and the network according to the system configuration.
  - Common parameters: Parameters that are independent of axes and related to the overall system. Set according to the system configuration when the system is started up.
  - Positioning parameters
    - Basic parameters 1
    - Basic parameters 2

      Set according to the machine and applicable motor when the system is started up.

      * If the setting of the basic parameters 1 is incorrect, the rotation direction may be reversed, or no operation may take place.
    - Detailed parameters 1
    - Detailed parameters 2

      Set according to the system configuration when the system is started up.

      * Detailed parameters 2 are data items for using the functions of RD77MS to the fullest. Set as required.
  - Home position return parameters
    - Home position return basic parameters
    - Home position return detailed parameters

      Set the values required for carrying out home position return control.
  - Extended parameters: Set according to the system configuration when the system is started up.
  - Servo parameters
    - Servo amplifier parameters (PA, PB, PC, PD, PE, PS, PF, Po, PL): Set the data that is determined by the specification of the servo being used when the system is started up.
- Positioning data
  - Positioning data: Set the data for "major positioning control".
- Block start data
  - Block start data: Set the block start data for "high-level positioning control".
  - Condition data: Set the condition data for "high-level positioning control".
  - Memo data: Set the condition judgment values for the condition data used in "high-level positioning control".
- Synchronous control data: Set the data for synchronous control.

- The data can be set by using a program or GX Works3. In this document, GX Works3 is used.
- The basic parameters 1, detailed parameters 1, home position return parameters, "[Pr.83] Speed control 10 × multiplier setting for degree axis", "[Pr.89] Manual pulse generator/Incremental synchronous encoder input type selection", "[Pr.90] Operation setting for speed-torque control mode" and "[Pr.95] External command signal selection" become valid when the PLC READY signal [Y0] turns from OFF to ON.
- The basic parameters 2, detailed parameters 2 (excluding "[Pr.83] Speed control 10 × multiplier setting for degree axis", "[Pr.90] Operation setting for speed-torque control mode", "[Pr.95] External command signal selection", "[Pr.122] Manual pulse generator speed limit mode" and "[Pr.123] Manual pulse generator speed limit value") become valid immediately when they are written to the buffer memory, regardless of the state of the PLC READY signal [Y0].
- Even when the PLC READY signal [Y0] is ON, the values or contents of the following can be changed: basic parameters 2, detailed parameters 2, positioning data, and block start data.
- The servo parameter is transmitted from the RD77MS to the servo amplifier when the initialized communication carried out after the power supply is turned ON or the CPU module is reset.
  The power supply is turned ON or the CPU module is reset after writing servo parameter in flash ROM of RD77MS if the servo parameter is transmitted to the servo amplifier.
- The only valid data assigned to basic parameter 2, detailed parameter 2, positioning data or block start data are the data read at the moment when a positioning or JOG operation is started. Once the operation has started, any modification to the data is ignored.
  Exceptionally, however, modifications to the following are valid even when they are made during a positioning operation: acceleration time 0 to 3, deceleration time 0 to 3, and external command function.
  - Acceleration time 0 to 3, deceleration time 0 to 3:
    Positioning data are pre-read and pre-analyzed. Modifications to the data four or more steps after the current step are valid.
  - External command function selection:
    The value at the time of detection is valid.

POINT

(1) The "setting data" is created for each axis.
(2) The "setting data" parameters have determined default values, and are set to the default values before shipment from the factory. (Parameters related to axes that are not used are left at the default value.)
(3) The "setting data" can be initialized with the GX Works3 or the program.
(4) It is recommended to set the "setting data" with the GX Works3. The program for data setting is complicated and many devices must be used. This will increase the scan time.

4.1.2 Monitor data

The data indicates the control status. Since the data is stored in the buffer memory, it can be monitored as needed.

The monitor data is classified as follows.

Monitor data

- System monitor data — Monitors the specifications and the operation history of RD77MS.
- Axis monitor data — Monitors the data related to the operating axis, such as the current position and speed.
- Servo network composition monitor data — Monitors the data related to the current network state.
- Synchronous control monitor data — Monitors the data for synchronous control.

● The data can be monitored by using a program or GX Works3. In this document, GX Works3 is used.

4.1.3 Control data

The data is used by users to control the positioning system.

The control data is classified as follows.

Control data

- System control data — Writes/initializes the "positioning data" in the module. Sets the setting for operation of all axes.
- Axis control data — Makes settings related to the operation, and controls the speed change during operation, and stops/restarts the operation for each axis. Output signals (axis stop signal, JOG start signal and execution prohibition flag) from the CPU module to the RD77MS.
- Synchronous control data — Set the data for synchronous control.

● Control using the control data is carried out with the program.
"[Cd.41] Deceleration start flag valid" is valid for only the value at the time when the PLC READY signal [Y0] turns from OFF to ON.

4.2 Servo Network Composition Parameters

Used to select the SSCNET device to connect to the RD77MS. (The device cannot be changed while the programmable controllers is in the ready state.)

In this document, the following identification codes are used.

• 00001000: MR-J4-_B, MR-J4W-_B (2-, 3-axis type)

4.2.1 Connected device

Parameters	Item	Setting range	Default value
[Pr.100]	Connected device	Refer identification code list as mentioned in 4.2.2.	0

POINT

- Be sure to set up the connected device. Communication with the SSCNET device is not started by the initial value "0" in default value.
- When the setting value which is different from the connected device is set, the error "Connected device setting error" (error code: 193EH) occurs. When connecting with the connected device with the setting value other than above, the warning "Incompatible device" (warning code: 0C81H) occurs.

4.2.2 Identification code list

Mitsubishi electric (Vendor ID: 0000)

Identification code	Model	Network	Remarks
0100	MR-J3-_B, MR-J3W-_B (2-axis type)	SSCNET III	
0101	MR-J3-_B_-RJ006 (For fully closed loop control)	SSCNET III	
0102	MR-J3-_B_-RJ004 (For linear servo motor)	SSCNET III	
0107	MR-J3-_B-RJ080W (For direct drive motor)	SSCNET III	
0180	MR-J3W-0303BN6	SSCNET III	
0FFF	Virtual servo amplifier (MR-J3-B, standard)	SSCNET III	
1000	MR-J4-_B, MR-J4W-_B (2-, 3-axis type)	SSCNET III/H	
1FFF	Virtual servo amplifier (MR-J4-B)	SSCNET III/H	
2000	FR-A800-1[*1]	SSCNET III/H	Inverter
2001	FR-A800-2[*1]	SSCNET III/H	Inverter
4100	FR-A700 (Inverter)	SSCNET III	Inverter
4101	FR-A700-NA (Inverter)	SSCNET III	Inverter
4102	FR-A700-EC (Inverter)	SSCNET III	Inverter
4103	FR-A700-CHT (Inverter)	SSCNET III	Inverter
C000	MR-MT1010+MR-MT1200 (Pulse conversion module)	SSCNET III	Pulse conversion module

*1. Refer to the FR-A800 series instruction manual for details.

ORIENTAL MOTOR (Vendor ID: 0003)

Identification code	Model	Network	Remarks
2029	5-phase (ST)	SSCNET III/H	
202A	αSTEP (AZ)	SSCNET III/H	

Nikki Denso (Vendor ID: 0008)

Identification code	Model	Network	Remarks
0102	VC II (Manufactured by Nikki Denso Co., Ltd.) (For linear stage)	SSCNET III	
0107	VC II (Manufactured by Nikki Denso Co., Ltd.) (For direct drive motor)	SSCNET III	
0302	VPH (Manufactured by Nikki Denso Co., Ltd.) (For linear stage)	SSCNET III	
0307	VPH (Manufactured by Nikki Denso Co., Ltd.) (For direct drive motor)	SSCNET III	
1000	VC II (Manufactured by Nikki Denso Co., Ltd.)	SSCNET III/H	
1300	VPH (Manufactured by Nikki Denso Co., Ltd.)	SSCNET III/H	

4.3 Common Parameters

Parameters	Item	Setting value, setting range		Default value
[Pr.24]	Manual pulse generator/ Incremental synchronous encoder input selection	0: A-phase/B-phase multiplied by 4		0
		1: A-phase/B-phase multiplied by 2		
		2: A-phase/B-phase multiplied by 1		
		3: PULSE/SIGN		
[Pr.82]	Forced stop valid/invalid selection	0: Valid (External input signal)		0
		1: Invalid		
		2: Valid (Buffer memory)		
[Pr.89]	Manual pulse generator/ Incremental synchronous encoder input type selection	0: Differential output type		1
		1: Voltage output/open collector type		
[Pr.96]	Operation cycle setting	0000H: 0.888 ms		FFFFH
		0001H: 1.777 ms		
		0002H: 3.555 ms		
		0200H: 0.444 ms		
		FFFFH: Automatic setting		
[Pr.97]	SSCNET setting	0: SSCNET III		1
		1: SSCNET III/H		
[Pr.150]	Input terminal logic selection	b0: SIN1	0: ON at leading edge 1: ON at trailing edge	0
		to		
		b19: SIN20		
[Pr.151]	Manual pulse generator/ Incremental synchronous encoder input logic selection	0: Negative logic		0
		1: Positive logic		
[Pr.152]	Maximum number of control axes	0: No setting		0
		1 to 16: Maximum number of control axes		
[Pr.153]	External input signal digital filter setting	0H: 3.2 ms		6666H
		1H: 2.4 ms		
		2H: 1.6 ms		
		3H: 1.2 ms		
		4H: 0.8 ms		
		5H: 0.4 ms		
		6H: 0.2 ms		

[Pr.82] Forced stop valid/invalid selection

Set the forced stop valid/invalid.

All axes of the servo amplifier are made to batch forced stop when the forced stop input signal is turned on after the forced stop valid/invalid selection is set to "0: Valid (External input signal)" or "2: Valid (Buffer memory)". The error "Servo READY signal OFF during operation" (error code: 1902H) does not occur if the forced input signal is turned on during operation.

"0: Valid (External input signal)" (Forced stop from the external input signal is used.)
"1: Invalid" (Forced stop is not used.)
"2: Valid (Buffer memory)" (Forced stop from the buffer memory is used.)

PRECAUTIONS

- If the setting is other than 0 to 2, the error "Forced stop valid/invalid setting error" (error code: 1B71H) occurs.
- The "[Md.50] Forced stop input" is stored "1" by setting "Forced stop valid/invalid selection" to invalid.

4.4 Basic Parameters

The basic parameters are classified into basic parameters 1 and basic parameters 2.

4.4.1 Basic parameters 1

<table>
<tr><th rowspan="2">Parameters</th><th colspan="2">Unit used / Item</th><th colspan="4">Setting range</th><th rowspan="2">Default value</th></tr>
<tr><th colspan="2">Item</th><th>mm</th><th>inch</th><th>degree</th><th>pulse</th></tr>
<tr><td>[Pr.1]</td><td colspan="2">Unit setting</td><td>0: mm</td><td>1: inch</td><td>2: degree</td><td>3: pulse</td><td>3</td></tr>
<tr><td>[Pr.2]</td><td rowspan="3">Movement amount per pulse</td><td>Number of pulses per rotation (AP)</td><td colspan="4">1 to 200000000 pulse</td><td>20000</td></tr>
<tr><td>[Pr.3]</td><td>Movement amount per rotation (AL)</td><td>1 to 200000000 (×10^{-1} μm)</td><td>1 to 200000000 (×10^{-5} inch)</td><td>1 to 200000000 (×10^{-5} degree)</td><td>1 to 200000000 (pulse)</td><td>20000</td></tr>
<tr><td>[Pr.4]</td><td>Unit magnification (AM)</td><td colspan="4">1: 1 times
10: 10 times
100: 100 times
1000: 1000 times</td><td>1</td></tr>
<tr><td>[Pr.7]</td><td colspan="2">Bias speed at start</td><td>0 to 2000000000 (×10^{-2} mm/min)</td><td>0 to 2000000000 (×10^{-3} inch/min)</td><td>0 to 2000000000 (×10^{-3} degree/min)*1</td><td>0 to 1000000000 (pulse/s)</td><td>0</td></tr>
</table>

*1. Range of speed limit value when "Speed control 10 × multiplier setting for degree axis" is set to valid: 1 to 2000000000 (× 10^{-2} degree/min)

[Pr.1] Unit setting

Set the unit used for defining positioning operations. Choose from the following units depending on the type of the control target: mm, inch, degree, or pulse. Different units can be defined for different axes.

(Ex.) mm or inch: X-Y table, conveyor
(Select mm or inch depending on the machine specifications.)
degree: Rotating body (360 degrees/rotation)
pulse: X-Y table, conveyor

POINT
When you change the unit, note that the values of other parameters and data will not be changed automatically.

[Pr.2] to [Pr.4] Movement amount per pulse

Mechanical system value used when the RD77MS performs positioning control.
The movement amount per pulse (electronic gear) is expressed by the following equation.

$$\text{Movement amount per pulse} = \frac{\text{(1) Number of pulses per rotation (AP)}}{\text{(2) Movement amount per rotation (AL)} \times \text{(3) Unit magnification (AM)}}$$

Set the value in accordance with Steps (1) to (3).

(1) Number of pulses per rotation (AP)
Set the number of pulses required for a complete rotation of the motor shaft.
Number of pulses per rotation (AP) = Encoder resolution

(2) Movement amount per rotation (AL)
The movement amount of the workpiece per one motor rotation is determined by the mechanical structure.
If the worm gear lead (μm/rev) is PB and the deceleration rate is R, then
Movement amount per rotation (AL) = PB × R

(3) Unit magnification (AM)
For the movement amount per rotation (AL), the setting range has been determined. If the movement amount per rotation (AL) exceeds the setting range, the magnification can be adjusted with the unit magnification (AM).
Movement amount per rotation (AL) = PB × R = Movement amount per rotation (AL) × Unit magnification (AM)

Setting of movement amount per rotation (AL) and unit magnification (AM)

<Condition>
- The ball screw lead is 10 mm (10000 μm), and the gear ratio is $\frac{1}{1}$.

<Setting example>
- Since the setting range of movement amount per rotation (AL) is from 0.1 to 20000000.0 μm, set the AL to ”10000.0”.
- Set the unit magnification (AM) to ”1”.

<Calculation example>
Movement amount per rotation (AL) = ball screw lead × gear ratio (reduction ratio) × unit magnification (AM)
= 10000 μm × 1 × 1
= 10000 μm

<Error correction method>

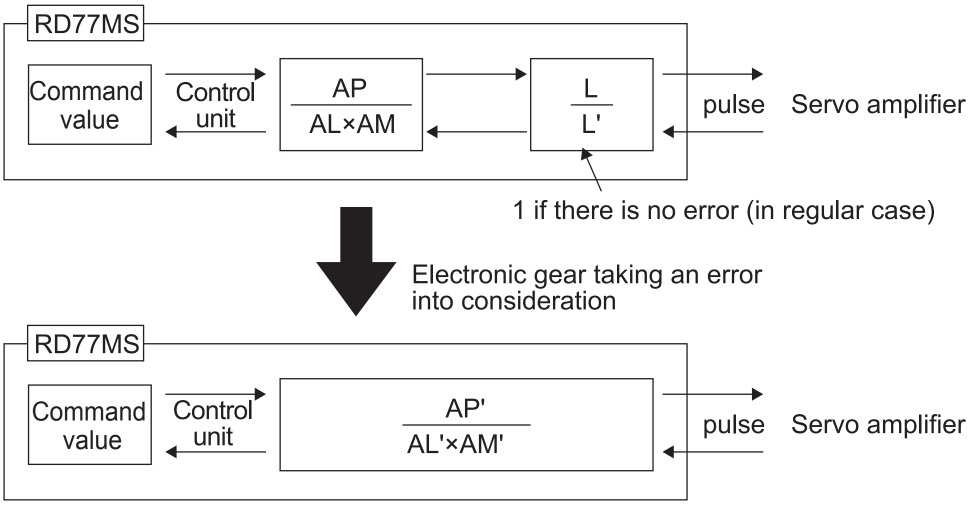
When position control is performed an error may occur between command movement amount (L) and actual movement amount (L’), with the electronic gear (movement amount per pulse) set in the parameter. RD77MS can correct the error by adjusting the electronic gear.

The “error correction amount” to be used for error correction is defined as shown below.

$$\text{Error compensation amount} = \frac{\text{Command movement amount (L)}}{\text{Actual movement amount (L')}}$$

The electronic gear to which the error correction amount is applied gives pulses as shown below.

$$\frac{AP}{AL \times AM} \times \frac{L}{L'} = \frac{AP'}{AL' \times AM'}$$



Calculation example

<Condition>

Number of pulses per rotation (AP): 4194304 [pulse]
Movement amount per rotation (AL): 5000.0 [μm]
Unit magnification (AM): 1

<Results of positioning>

Command movement amount (L): 100 [mm]
Actual movement amount (L’) = 101 [mm]

<Correction value>

$$\frac{AP}{AL \times AM} \times \frac{L}{L'} = \frac{4194304}{5000.0 \times 1} \times \frac{100}{101} = \frac{4194304\ (AP')}{5050\ (AL') \times 1\ AM'}$$

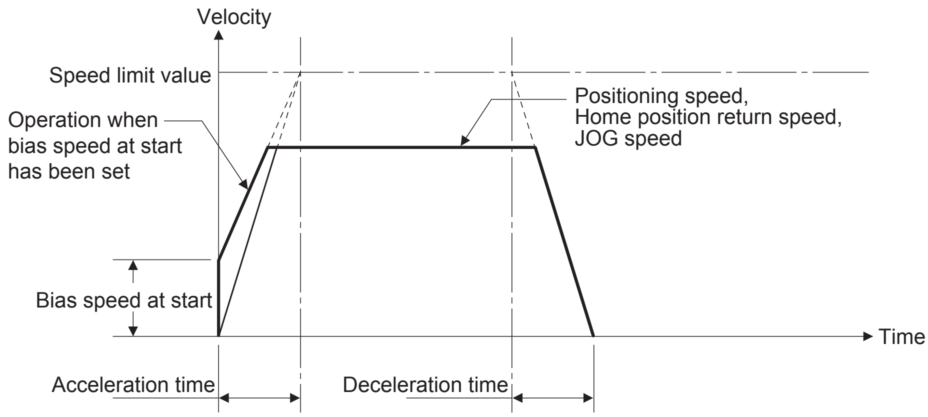
Number of pulses per rotation (AP'): 4194304 • • • [Pr.2]
Movement amount per rotation (AL): 5050.0 • • • [Pr.3]
Unit magnification (AM): 1 • • • [Pr.4]

Set the number of pulses per rotation (AP’), movement amount per rotation (AL’) and unit magnification (AM’) after correction in the parameters, and write the parameters in RD77MS. The settings will be enabled when the PLC READY signal [Y0] is turned on (OFF to ON).

[Pr.7] Bias speed at start

The bias speed at start is the lowest starting speed to be used for smooth motor rotation when a stepping motor is used.

This parameter is enabled when the home position return, position control or JOG operation is performed.



PRECAUTIONS
"Bias speed at start" is valid regardless of motor type. Set "0" when using the motor other than the stepping motor. Otherwise, it may cause vibration or impact even though an error does not occur.

4.4.2 Basic parameters 2

Parameters	Unit used / Item	Setting range: mm	Setting range: inch	Setting range: degree	Setting range: pulse	Default value
[Pr.8]	Speed limit value	1 to 2000000000 ($\times 10^{-2}$ mm/min)	1 to 2000000000 ($\times 10^{-3}$ inch/min)	1 to 2000000000 ($\times 10^{-3}$ degree/min)*1	1 to 1000000000 (pulse/s)	200000
[Pr.9]	Acceleration time 0	1 to 8388608 ms				1000
[Pr.10]	Deceleration time 0	1 to 8388608 ms				1000

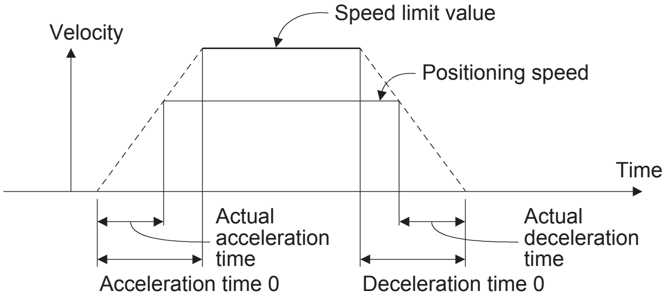
*1. Range of speed limit value when "Speed control 10 × multiplier setting for degree axis" is set to valid: 1 to 2000000000 (× 10^{-2} degree/min)

[Pr.8] Speed limit value

Set the maximum speed during positioning, home position return and speed-torque operations. If a speed exceeding the limit value, the speed will be limited to the speed limit value.

[Pr.9] Acceleration time 0/[Pr.10] Deceleration time 0

Acceleration time 0 specifies the time for the speed to increase from zero to the "[Pr.8] Speed limit value" ("[Pr.31] JOG speed limit value" at JOG operation control).
Deceleration time 0 specifies the time for the speed to decrease from the "[Pr.8] Speed limit value" ("[Pr.31] JOG speed limit value" at JOG operation control) to zero.



(1) If the positioning speed is set lower than the speed limit value, the actual acceleration/deceleration time will be relatively short.
Thus, set the maximum positioning speed equal to or only a little lower than the speed limit value.
(2) These settings are valid for home position return, positioning and JOG operations.
(3) When the positioning involves interpolation, the acceleration/deceleration time defined for the reference axis is valid.

4.5 Detailed Parameters

The detailed parameters are classified into detailed parameters 1 and detailed parameters 2.

4.5.1 Detailed parameters 1

Parameters	Unit used / Item		Setting range: mm	Setting range: inch	Setting range: degree	Setting range: pulse	Default value
[Pr.11]	Backlash compensation amount		0 to 65535 ($\times 10^{-1}$ µm)	0 to 65535 ($\times 10^{-5}$ inch)	0 to 65535 ($\times 10^{-5}$ degree)	0 to 65535 (pulse)	0
[Pr.12]	Software stroke limit upper limit value		-2147483648 to 2147483647 ($\times 10^{-1}$ µm)	-2147483648 to 2147483647 ($\times 10^{-5}$ inch)	0 to 35999999 ($\times 10^{-5}$ degree)	-2147483648 to 2147483647 (pulse)	2147483647
[Pr.13]	Software stroke limit lower limit value		-2147483648 to 2147483647 ($\times 10^{-1}$ µm)	-2147483648 to 2147483647 ($\times 10^{-5}$ inch)	0 to 35999999 ($\times 10^{-5}$ degree)	-2147483648 to 2147483647 (pulse)	-2147483648
[Pr.14]	Software stroke limit selection		0: Apply software stroke limit on feed current value 1: Apply software stroke limit on machine feed value				0
[Pr.15]	Software stroke limit valid/ invalid setting		0: Software stroke limit valid during JOG operation, inching operation and manual pulse generator operation 1: Software stroke limit invalid during JOG operation, inching operation and manual pulse generator operation				0
[Pr.16]	Command in-position width		1 to 2147483647 ($\times 10^{-1}$ µm)	1 to 214783647 ($\times 10^{-5}$ inch)	1 to 2147483647 ($\times 10^{-5}$ degree)	1 to 2147483647 (pulse)	100
[Pr.17]	Torque limit setting value		0.1 to 1000.0 %				300.0
[Pr.18]	M code ON signal output timing		0: WITH mode 1: AFTER mode				0
[Pr.19]	Speed switching mode		0: Standard speed switching mode 1: Front-loading speed switching mode				0
[Pr.20]	Interpolation speed designation method		0: Composite speed 1: Reference axis speed				0
[Pr.21]	Feed current value during speed control		0: Do not update feed current value 1: Update feed current value 2: Clear feed current value to zero				0
[Pr.22]	Input signal logic selection	Lower limit	0: Negative logic 1: Positive logic				0
		Upper limit					
		Stop signal					
		Proximity dog signal					
[Pr.81]	Speed-position function selection		0: Speed-position switching control (INC mode) 2: Speed-position switching control (ABS mode)				0
[Pr.116]	FLS signal selection	Input type	0H: Simple motion module 1H: Servo amplifier[*1] 2H: Buffer memory FH: Invalid				1H
		Input terminal	01H to 0AH (RD77MS2) 01H to 14H (RD77MS4/8/16)				00H

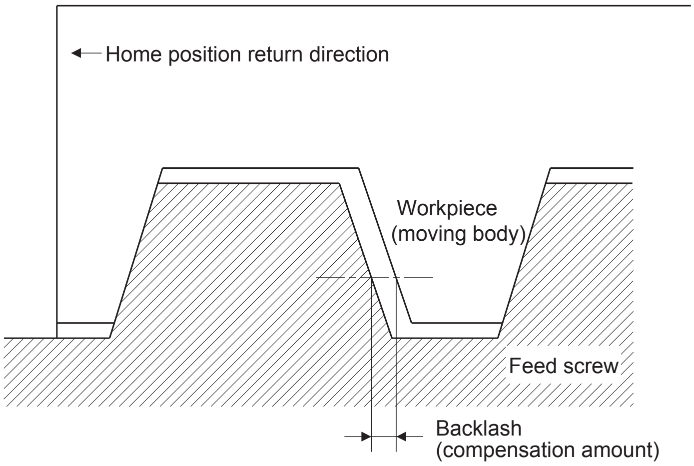
Parameters	Unit used / Item		Setting range: mm	inch	degree	pulse	Default value
[Pr.117]	RLS signal selection	Input type	0H: Simple motion module 1H: Servo amplifier*1 2H: Buffer memory FH: Invalid				1H
		Input terminal	01H to 0AH (RD77MS2) 01H to 14H (RD77MS4/8/16)				00H
[Pr.118]	DOG signal selection	Input type	0H: Simple motion module 1H: Servo amplifier*1 2H: Buffer memory FH: Invalid				1H
		Input terminal	01H to 0AH (RD77MS2) 01H to 14H (RD77MS4/8/16)				00H
[Pr.119]	STOP signal selection	Input type	0H: Simple motion module 1H: Servo amplifier*1 2H: Buffer memory FH: Invalid				2H
		Input terminal	01H to 0AH (RD77MS2) 01H to 14H (RD77MS4/8/16)				00H

*1. The setting is not available in STOP signal selection.

[Pr.11] Backlash compensation amount

The error that occurs due to backlash when moving the machine via gears can be compensated.

When the backlash compensation amount is set, commands equivalent to the compensation amount will be output each time the direction changes during positioning.



(1) The backlash compensation is valid after machine home position return. Thus, if the backlash compensation amount is set or changed, always carry out machine home position return once.

(2) The backlash compensation amount must meet the following formula.

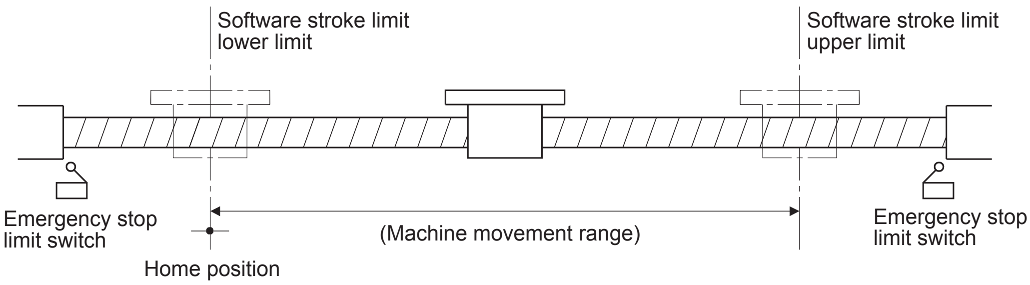
$$0 \le \text{Backlash compensation amount} \times \text{Movement amount per pulse}^{*1} \le 4194303 \text{ (pulse)}$$

*1. $\text{Movement amount per pulse} = \dfrac{\text{Number of pulses per rotation (AP)}}{\text{Movement amount per rotation (AL)} \times \text{Unit magnification (AM)}}$

"Backlash compensation amount error" (error code: 1AA0H) occurs when the setting is outside range of above calculations.

[Pr.12][Pr.13] Software stroke limit upper limit value/lower limit value

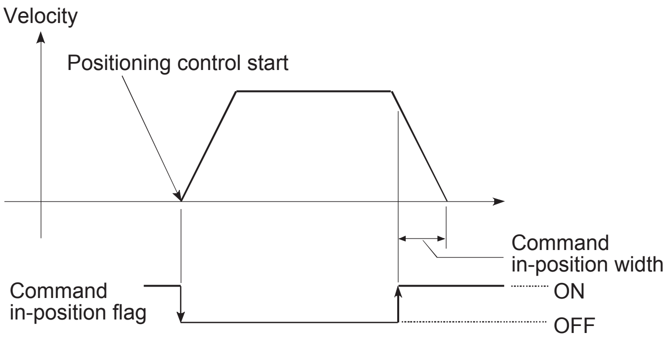
For the software stroke upper limit value, set the upper limit of the machine's movement range during positioning control.
For the software stroke lower limit value, set the lower limit of the machine's movement range during positioning control.



(1) Generally, the home position is set at the lower limit or upper limit of the stroke limit.
(2) By setting the upper limit value or lower limit value of the software stroke limit, overrun can be prevented in the software. However, an emergency stop limit switch must be installed nearby outside the range.
(3) To invalidate the software stroke limit, set the setting value to "upper limit value = lower limit value". (If it is within the setting range, the setting value can be anything.)
(4) When the unit is "degree", the software stroke limit check is invalid during speed control (including the speed control in speed-position and position-speed switching control) or during manual control.

[Pr.16] Command in-position width

Set the remaining distance that turns the command in-position ON. The command in-position signal is used as a front-loading signal of the positioning complete signal. When positioning control is started, the "Command in-position flag ([Md.31] Status: b2)" turns OFF, and the "command in-position flag" turns ON at the set position of the command in-position signal.



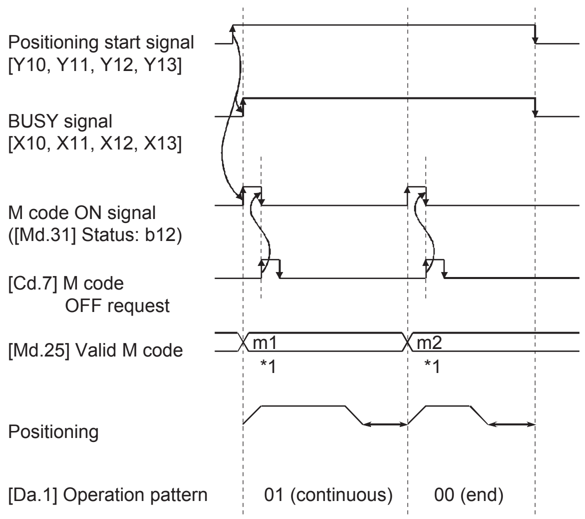
[Pr.17] Torque limit setting value

The torque limit function limits the torque generated by the servomotor within the set range. If the torque required for control exceeds the torque limit value, it is controlled with the set torque limit value.

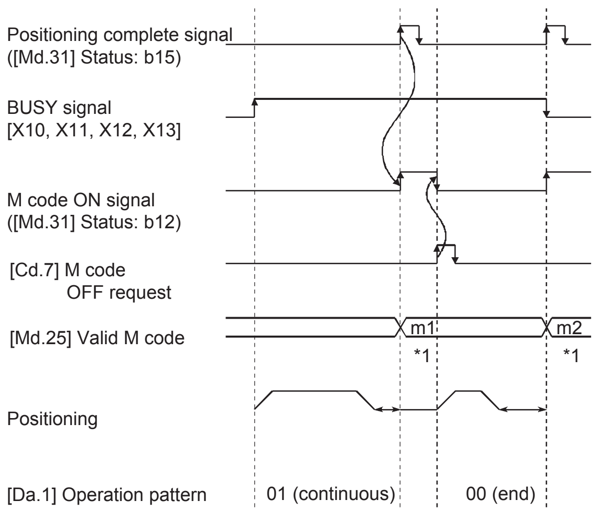
[Pr.18] M code ON signal output timing

This parameter sets the M code ON signal output timing.
Choose either WITH mode or AFTER mode as the M code ON signal output timing.

WITH mode: An M code is output and the M code ON signal is turned ON when a positioning operation starts.



AFTER mode: An M code is output and the M code ON signal is turned ON when a positioning operation completes.



*1. m1 and m2 indicate set M codes.

PRECAUTIONS

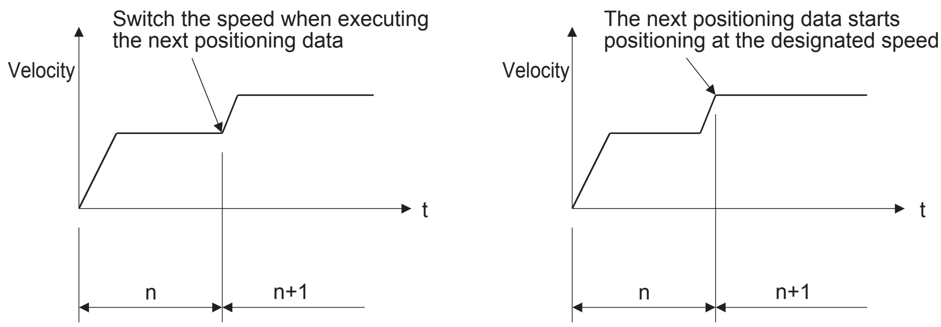
If AFTER mode is used with speed control, an M code will not be output and the M code ON signal will not be turned ON.

[Pr.19] Speed switching mode

Set whether to switch the speed switching mode with the standard switching or front-loading switching mode.

0: Standard switching • • • Switch the speed when executing the next positioning data.

1: Front-loading switching • • • The speed switches at the end of the positioning data currently being executed.



<For standard switching> <For front-loading switching>

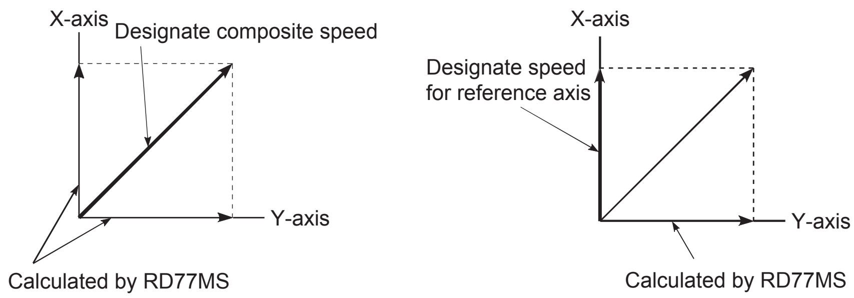
n: Positioning data No.

[Pr.20] Interpolation speed designation method

When carrying out linear interpolation/circular interpolation, set whether to designate the composite speed or reference axis speed.

0: Composite speed • • • The movement speed for the control target is designated, and the speed for each axis is calculated by the RD77MS.

1: Reference axis speed • • • The axis speed set for the reference axis is designated, and the speed for the other axis carrying out interpolation is calculated by the RD77MS.



<When composite speed is designated> <When reference axis speed is designated>

[Pr.21] Feed current value during speed control

Specify whether you wish to enable or disable the update of "[Md.20] Feed current value" while operations are performed under the speed control (including the speed control in speed-position and position-speed switching control).

0: The update of the feed current value is disabled • • • The feed current value will not change. (The value at the beginning of the speed control will be kept.)

1: The update of the feed current value is enabled • • • The feed current value will be updated. (The feed current value will change from the initial.)

2: The feed current value is cleared to zero • • • The feed current value will be set initially to zero and change from zero while the speed control is in effect.

PRECAUTIONS

- When the speed control is performed over two to four axes, the choice between enabling and disabling the update of "Feed current value" depends on how the reference axis is set.
- Set "1" to exercise speed-position switching control (ABS mode).

4.5.2 Detailed parameters 2

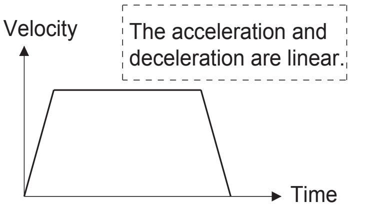
Parameters	Item (Unit used)	Setting range: mm	Setting range: inch	Setting range: degree	Setting range: pulse	Default value
[Pr.25 to Pr.27]	Acceleration time 1/2/3	1 to 8388608 ms				1000
[Pr.28 to Pr.30]	Deceleration time 1/2/3	1 to 8388608 ms				1000
[Pr.31]	JOG speed limit value	1 to 2000000000 ($\times 10^{-2}$ mm/min)	1 to 2000000000 ($\times 10^{-3}$ inch/min)	1 to 2000000000 ($\times 10^{-3}$ degree/min)	1 to 1000000000 (pulse/s)	20000
[Pr.32]	JOG operation acceleration time selection	0 to 3				0
[Pr.33]	JOG operation deceleration time selection	0 to 3				0
[Pr.34]	Acceleration/deceleration process selection	0: Trapezoid acceleration/deceleration process 1: S-curve acceleration/deceleration process				0
[Pr.35]	S-curve ratio	1 to 100 %				100
[Pr.36]	Rapid stop deceleration time	1 to 8388608 ms				1000
[Pr.37 to Pr.39]	Stop group 1/2/3 rapid stop selection	0: Normal deceleration stop 1: Rapid stop				0
[Pr.40]	Positioning complete signal output time	0 to 65535 ms				300
[Pr.41]	Allowable error range for circular interpolation	0 to 100000 ($\times 10^{-1}$ μm)	0 to 100000 ($\times 10^{-5}$ inch)	0 to 100000 ($\times 10^{-5}$ degree)	0 to 100000 (pulse)	100
[Pr.42]	External command function selection	0: External positioning start 1: External speed change request 2: Speed-position, position-speed switching request 3: Skip request 4: High-speed input request				0
[Pr.83]	Speed control 10 × multiplier setting for degree axis	0: Invalid 1: Valid				0
[Pr.84]	Restart allowable range when servo OFF to ON	0, 1 to 327680 [pulse] 0: restart not allowed				0
[Pr.90]	Operation setting for speed-torque control mode: Torque initial value selection	0: Command torque 1: Feedback torque				0
	Operation setting for speed-torque control mode: Speed initial value selection	0: Command speed 1: Feedback speed 2: Automatic selection				0
	Operation setting for speed-torque control mode: Condition selection at mode switching	0: Switching conditions valid (for switching control mode) 1: Zero speed ON condition invalid (for switching control mode)				0
[Pr.95]	External command signal selection	0: Not used 1 to 20: DI1 to DI20				0
[Pr.122]	Manual pulse generator speed limit mode	0: Do not hold speed limit 1: Do not output over value of speed limit 2: Output over value of speed limit later				0
[Pr.123]	Manual pulse generator speed limit value	1 to 2000000000 ($\times 10^{-2}$ mm/min)	1 to 2000000000 ($\times 10^{-3}$ inch/min)	1 to 2000000000 ($\times 10^{-3}$ degree/min)	1 to 1000000000 (pulse/s)	20000

[Pr.25] to [Pr.27] Acceleration time 1/2/3/[Pr.28] to [Pr.30] Deceleration time 1/2/3

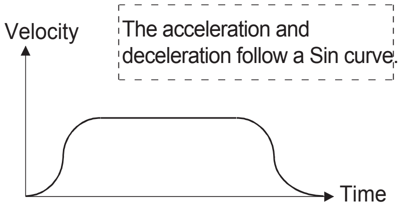
Acceleration time 1/2/3 specify the time for the speed to increase from zero to the "[Pr.8] Speed limit value" ("[Pr.31] JOG speed limit value" at JOG operation control).
Deceleration time 1/2/3 specify the time for the speed to decrease from the "[Pr.8] Speed limit value" ("[Pr.31] JOG speed limit value" at JOG operation control) to zero.
For details, refer to "[Pr.9] Acceleration time 0/[Pr.10] Deceleration time 0" in the basic parameters 2.

[Pr.34] Acceleration/deceleration process selection

Set whether to use trapezoid acceleration/deceleration or S-curve acceleration/deceleration for the acceleration/deceleration process.



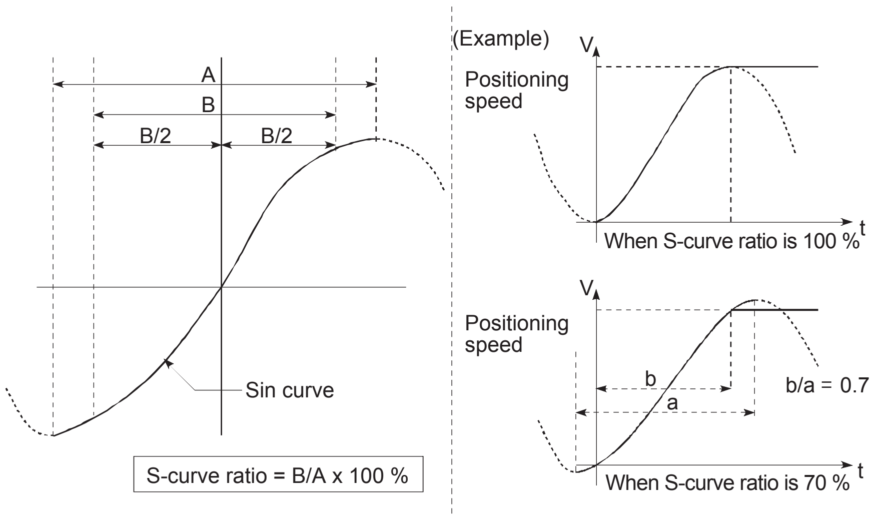
<Trapezoid acceleration/deceleration>



<S-curve acceleration/deceleration>

[Pr.35] S-curve ratio

Set the S-curve ratio (1 to 100 %) for carrying out the S-curve acceleration/deceleration process.
The S-curve ratio is designed to specify the portion to draw an acceleration/deceleration curve as a Sin curve as shown below.



[Pr.37] to [Pr.39] Rapid stop selection (Stop group 1/2/3)

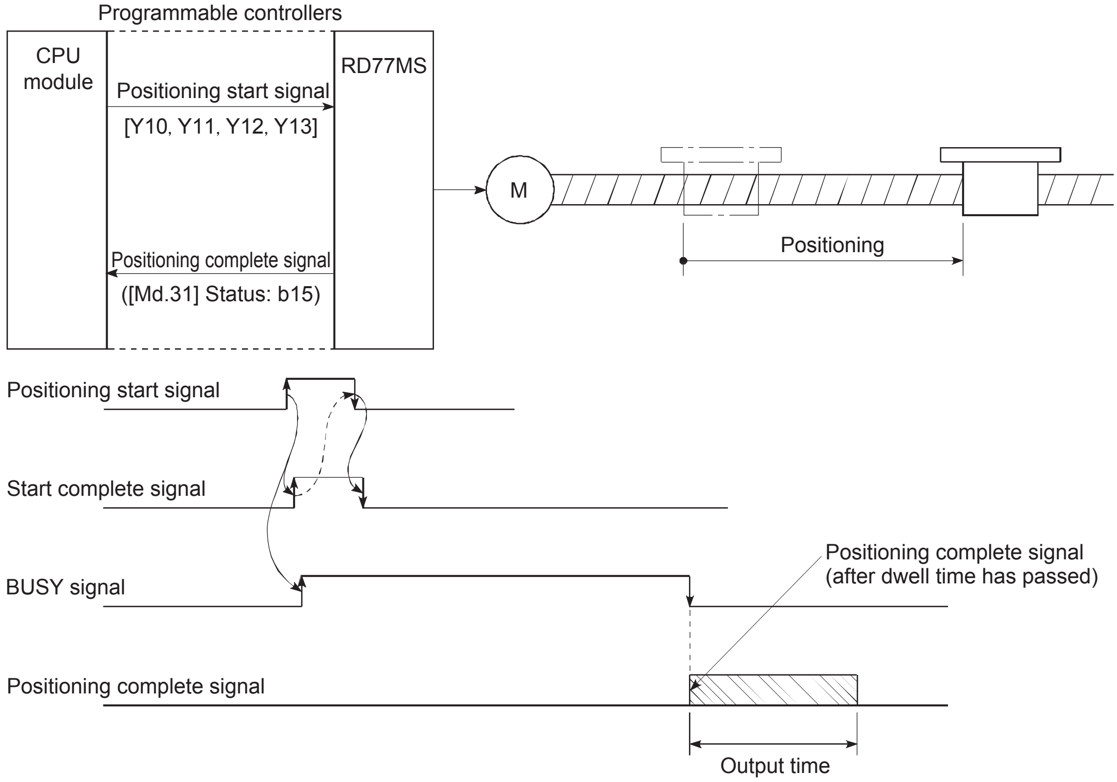
Set the method to stop when the stop causes in the following stop groups occur.

- Stop group 1 • • • Stop with hardware stroke limit
- Stop group 2 • • • Error occurrence of the CPU module, PLC READY signal [Y0] OFF
- Stop group 3 • • • Axis stop signal from the CPU module, Error occurrence (excludes errors in stop groups 1 and 2: includes only the software stroke limit errors during JOG operation, speed control, speed-position switching control, and position-speed switching control)

The methods of stopping include "0: Normal deceleration stop" and "1: Rapid stop".
If "1: Rapid stop" is selected, the axis will rapidly decelerate to a stop when the stop cause occurs.

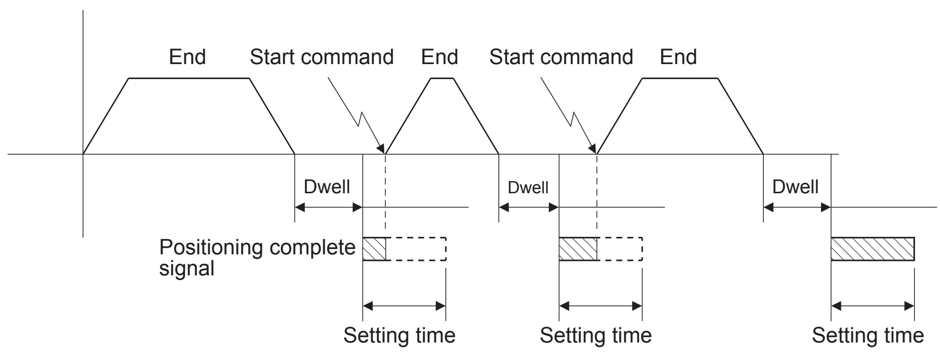
[Pr.40] Positioning complete signal output time

(a) Set the output time of the positioning complete signal "[Md.31] positioning complete signal (Status: b15)" output from the RD77MS. A positioning completes when the specified dwell time has passed after the RD77MS had terminated the command output. For the interpolation control, the positioning completed signal of interpolation axis is output only during the time set to the reference axis.

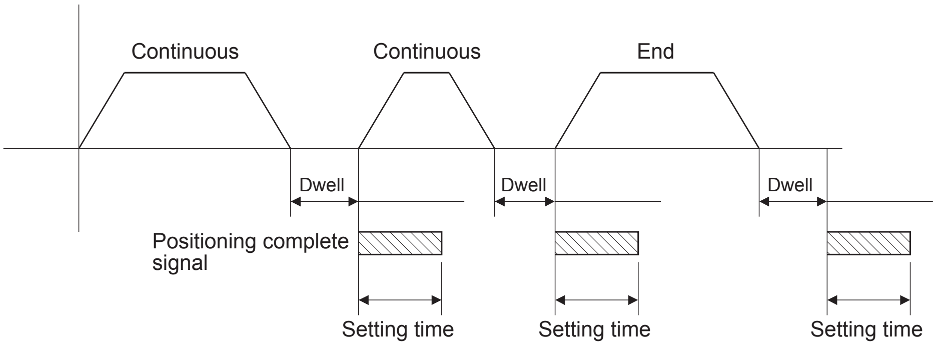


(b) Below is explained how the module operates when the next positioning is started while the positioning completion signal is on. (The details of the positioning patterns are explained in the "Positioning data" section.)

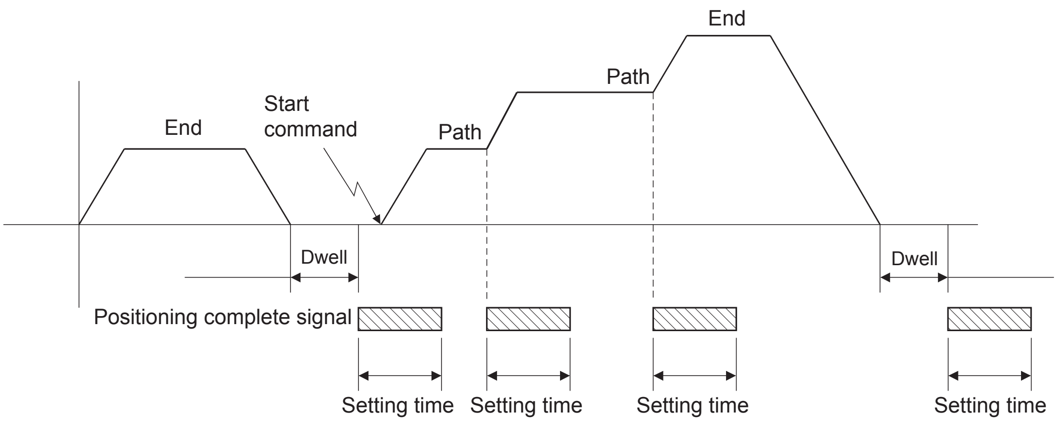
(1) When the positioning pattern is "end," the positioning completion signal will be turned off after the positioning by the next data No. is started.



(2) When the positioning pattern is “continuous positioning control” and the set time for the positioning completion signal is shorter than the time of the next positioning operation, the positioning completion signal will be turned on at the same time when the positioning by the next data No. is started after a lapse of the previous dwell time. It will be turned off after a lapse of the set time.



(3) When the positioning pattern is “continuous path control,” the positioning completion signal will be turned on at the speed change point, and the positioning by the next data No. will be started.



[Pr.41] Allowable circular interpolation error width

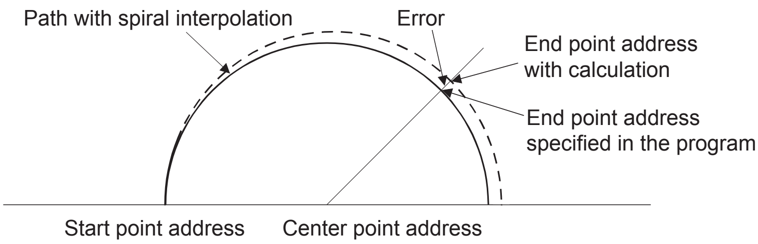
The allowable error range of the calculated arc path and end point address is set.*1

If the error of the calculated arc path and end point address is within the set range, circular interpolation will be carried out to the set end point address while compensating the error with spiral interpolation.

The allowable circular interpolation error width is set in the following axis buffer memory addresses.

(Ex.)

- If axis 1 is the reference axis, set in the axis 1 buffer memory addresses [60, 61].
- If axis 4 is the reference axis, set in the axis 4 buffer memory addresses [510, 511].



*1. In 2-axis circular interpolation control with center point designation, the arc path calculated with the start point address and center point address and the end point address may deviate.

[Pr.42] External command function selection

Set the function to be allocated to the external command signal.

0: External positioning start

• • • The external command signal input is used to start a positioning operation.

1: External speed change request

• • • The external command signal input is used to change the speed in the current positioning operation.
The new speed should be set in the "[Cd.14] New speed value".

2: Speed-position, position-speed switching request

• • • The external command signal input is used to switch from the speed control to the position control while in the speed-position switching control mode, or from the position control to the speed control while in the position-speed switching control mode.
To enable the speed-position switching control, set the "[Cd.24] Speed-position switching enable flag" to "1". To enable the position-speed switching control, set the "[Cd.26] Position-speed switching enable flag" to "1".

3: Skip request

• • • The external command signal input is used skip the current positioning operation.

4: High speed input request

• • • The external command signal input is used to execute the mark detection. And, also set to use the external command signal in the synchronous control.

POINT

To enable the external command signal, set the "[Cd.8] External command valid" to "1".

[Pr.83] Speed control 10 × multiplier setting for degree axis

Set the speed control 10 × multiplier setting for degree axis when you use command speed and speed limit value set by the positioning data and the parameter at "[Pr.1] Unit setting" setup degree by ten times at the speed.
Normally, the speed specification range is 1 to 2000000000 ($\times 10^{-3}$ degree/min), but it will be decupled and become 1 to 2000000000 ($\times 10^{-2}$ degree/min) by setting "Speed control 10 × multiplier setting for degree axis" to valid.
Refer to MELSEC iQ-R Simple Motion Module User's Manual (Application) for details on the speed control 10 × multiplier setting for degree axis.

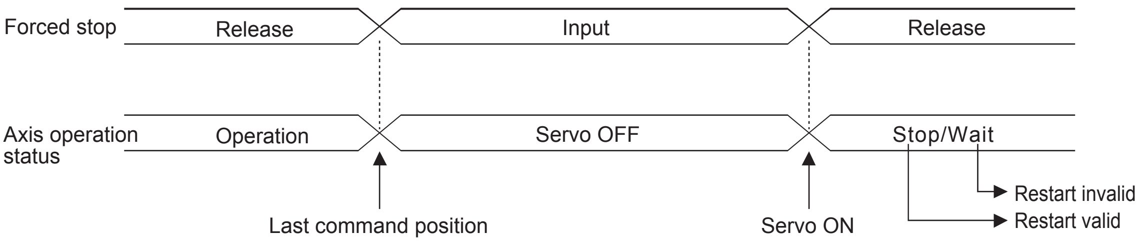
PRECAUTIONS

The "[Pr.83] Speed control 10 × multiplier setting for degree axis" is included in detailed parameters 2. However, it will be valid at the leading edge (OFF to ON) of the PLC READY signal [Y0].

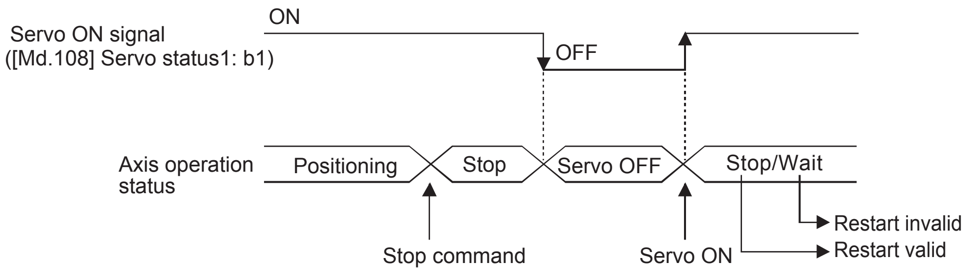
[Pr.84] Restart allowable range when servo OFF to ON

The restart function at switching servo OFF to ON performs continuous positioning operation (positioning start, restart) when switching servo OFF to ON while the RD77MS is stopped (including forced stop, servo forced stop).
Restart at switching servo OFF to ON can be performed when the difference between the last command position of RD77MS at stop and the current value at switching servo OFF to ON is equal to or less than the value set in the buffer memory for the restart allowable range setting.

(1) Servo emergency stop processing
   (a) After RD77MS is stopped by the servo emergency stop signal, it is kept stopped and can be restarted if the difference between the last command position of RD77MS at turning on of the servo stop signal and the current value at turning off of the servo stop signal is within the restart allowable range.
   (b) If the difference between the last command position of RD77MS at turning on of the servo stop signal and the current value at turning off of the servo stop signal exceeds the restart allowable range, it is kept in the standby state and cannot be restarted.



(2) Processing at switching the servo ON signal from OFF to ON
   (a) When the difference between the last command position of RD77MS at switching the servo ON signal from ON to OFF and the current value at switching the servo ON signal from OFF to ON is equal to or less than the value set in the buffer memory for the restart allowable range setting, the positioning operation is judged as stopped and can be restarted.
   (b) When the difference between the last command position of RD77MS at switching the servo ON signal from ON to OFF and the current value at switching the servo ON signal from OFF to ON is greater than the value set in the buffer memory for the restart allowable range setting, the positioning operation is judged as on-standby and cannot be restarted.



Refer to MELSEC iQ-R Simple Motion Module User's Manual (Application) for details.

[Pr.90] Operation setting for speed-torque control mode

Operation setting of the speed control mode, torque control mode or continuous operation to torque control mode at the speed-torque control is executed.

□□□0 H

- Torque initial value selection
- Speed initial value selection
- Condition selection at mode switching

(1) Torque initial value selection

Set the torque initial value at switching to torque control mode or to continuous operation to torque control mode.

(2) Speed initial value selection

Set the initial speed at switching from position control mode to speed control mode or the initial speed at switching from position control mode or from speed control mode to continuous operation to torque control mode.

(3) Condition selection at mode switching

Set the valid/invalid of switching conditions for switching control mode.

PRECAUTIONS

- The "[Pr.90] Operation setting for speed-torque control mode" is included in detailed parameters 2. However, it will be valid at the leading edge (OFF to ON) of the PLC READY signal [Y0].
- Normally it is set to 0, to switch to the torque control set to 1 just after the completion of positioning without waiting until the servo motor stops.

[Pr.95] External command signal selection

Set the external command signal.

Pin Nos. and input terminals corresponding to the external command signals (DI Nos.) are shown below. (For RD77MS2, the pins of up to DI10 can be used.)

- DI1 to DI5: 1A1 to 1A5, SIN1 to SIN5
- DI6 to DI10: 1B1 to 1A5, SIN6 to SIN10
- DI11 to DI15: 2A1 to 1A5, SIN11 to SIN15
- DI16 to DI20: 2B1 to 1A5, SIN16 to SIN20

POINT

Same external command signal can be used in the multiple axes.

[Pr.122] Manual pulse generator speed limit mode

Set how to output when the output by manual pulse generator operation exceeds "[Pr.123] Manual pulse generator speed limit value".

[Pr.123] Manual pulse generator speed limit value

Set the maximum speed during manual pulse generator operation. A manual pulse generator speed exceeding the limit value will be reduced to the speed limit value.

Set the "Manual pulse generator speed limit value" to a value less than "[Pr.8] Speed limit value". If the "[Pr.8] Speed limit value" is exceeded, the error "Manual pulse generator speed limit value error" (error code: 1ABAH) will occur.

4.6 Home Position Return Parameters

The home position return parameters are classified into basic parameters and detailed parameters.

4.6.1 Home position return basic parameters

(The device cannot be changed while the programmable controllers is in the ready state.)

Parameters	Unit used / Item	Setting range: mm	inch	degree	pulse	Default value
[Pr.43]	Home position return method	0: Proximity dog method 4: Count method 1 5: Count method 2 6: Data set method 7: Scale origin signal detection method 8: Driver home position return method				0
[Pr.44]	Home position return direction	0: Positive direction (address increment direction) 1: Negative direction (address decrement direction)				0
[Pr.45]	Home position address	-2147483648 to 2147483647 ($\times 10^{-1}$ μm)	-2147483648 to 2147483647 ($\times 10^{-5}$ inch)	0 to 35999999 ($\times 10^{-5}$ degree)	-2147483648 to 2147483647 (pulse)	0
[Pr.46]	Home position return speed	1 to 2000000000 ($\times 10^{-2}$ mm/min)	1 to 2000000000 ($\times 10^{-3}$ inch/min)	1 to 2000000000 ($\times 10^{-3}$ degree/min)*1	1 to 1000000000 (pulse/s)	1
[Pr.47]	Creep speed	1 to 2000000000 ($\times 10^{-2}$ mm/min)	1 to 2000000000 ($\times 10^{-3}$ inch/min)	1 to 2000000000 ($\times 10^{-3}$ degree/min)*1	1 to 1000000000 (pulse/s)	1
[Pr.48]	Home position return retry	0: Do not retry home position return with limit switch 1: Retry home position return with limit switch				0

*1. Range of home position return speed when "[Pr.83] Speed control 10 × multiplier setting for degree axis" is enabled: 1 to 2000000000 ($\times 10^{-2}$ degrees/min)

[Pr.43] Home position return method

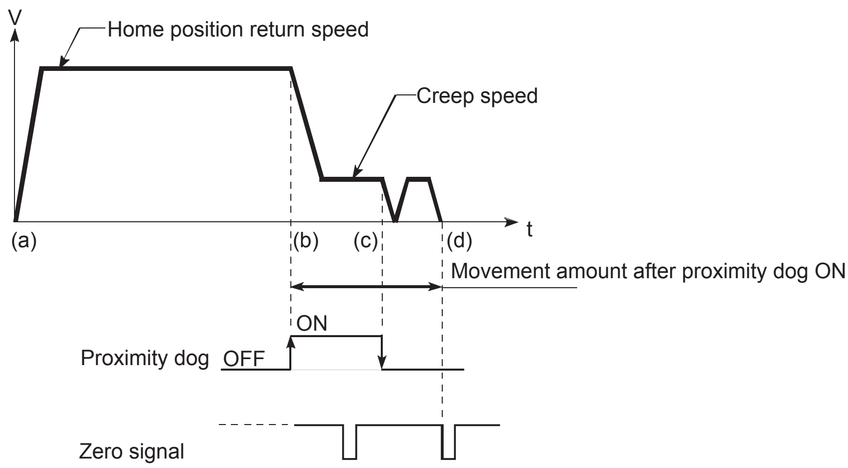
(1) Proximity dog method

(a) The machine home position return is started.
(The machine begins the acceleration designated in "[Pr.51] Home position return acceleration time selection", in the direction designated in "[Pr.44] Home position return direction". It then moves at the "[Pr.46] Home position return speed" when the acceleration is completed.)

(b) The machine begins decelerating when the proximity dog ON is detected.

(c) The machine decelerates to the "[Pr.47] Creep speed", and subsequently moves at that speed.
(At this time, the proximity dog must be ON. The workpiece will continue decelerating and stop if the proximity dog is OFF.)

(d) After the proximity dog turns OFF, the machine stops. It then restarts and stops at the first zero point.



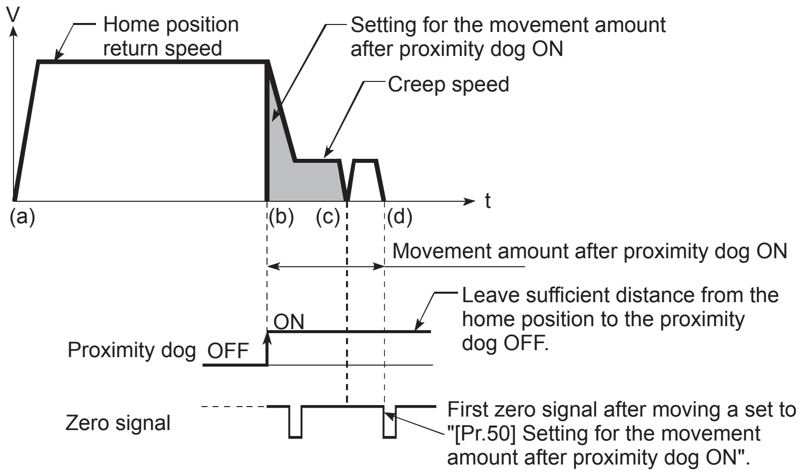
(2) Count method 1

(a) The machine home position return is started.
(The machine begins the acceleration designated in "[Pr.51] Home position return acceleration time selection", in the direction designated in "[Pr.44] Home position return direction". It then moves at the "[Pr.46] Home position return speed" when the acceleration is completed.)

(b) The machine begins decelerating when the proximity dog ON is detected.

(c) The machine decelerates to the "[Pr.47] Creep speed", and subsequently moves at that speed.

(d) The machine stops after the workpiece has been moved the amount set in the "[Pr.50] Setting for the movement amount after proximity dog ON" after the proximity dog turned ON. It then restarts and stops at the first zero point.



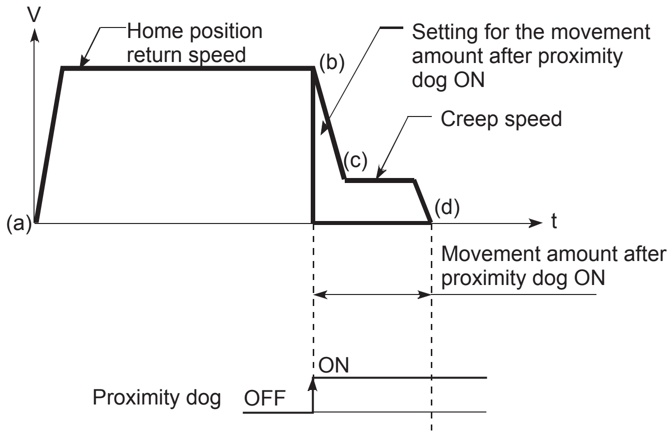
(3) Count method 2

(a) The machine home position return is started.
(The machine begins the acceleration designated in "[Pr.51] Home position return acceleration time selection", in the direction designated in "[Pr.44] Home position return direction". It then moves at the "[Pr.46] Home position return speed" when the acceleration is completed.)

(b) The machine begins decelerating when the proximity dog ON is detected.

(c) The machine decelerates to the "[Pr.47] Creep speed", and subsequently moves at that speed.

(d) The machine home position return will be completed when the machine moves the movement amount set in "[Pr.50] Setting for the movement amount after proximity dog ON" from the proximity dog ON position.



(4) Data set method

The current position of the machine after home position return completion is consider as a home position.
(Execute the home position return after rotating the servo motor at least 360 degrees by the JOG operation after turning on the power supply to the servo amplifier.
However, if selecting "1: Z-Phase must not pass" with "[PC17] Function selection C-4 home position return setting condition", it is possible to carry out the home position return without passing the zero point.)

(5) Scale origin signal detection method

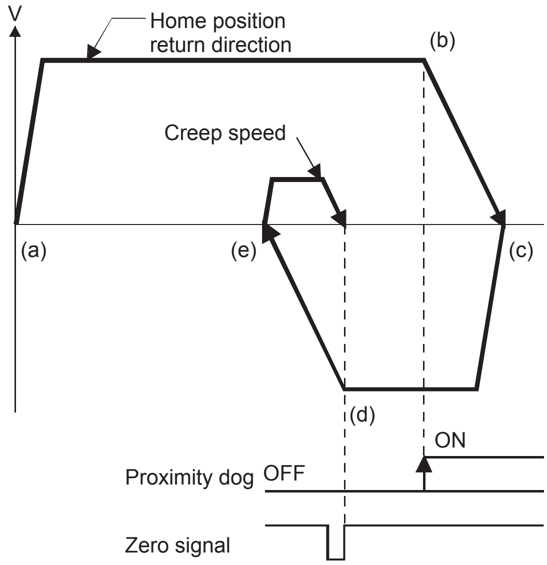
(a) The machine home position return is started.
(The machine begins the acceleration designated in "[Pr.51] Home position return acceleration time selection", in the direction designated in "[Pr.44] Home position return direction". It then moves at the "[Pr.46] Home position return speed" when the acceleration is completed.)

(b) The machine begins decelerating when the proximity dog ON is detected.

(c) After deceleration stop, the machine moves in the opposite direction against of home position return at the "[Pr.46] Home position return speed".

(d) During movement, the machine begins decelerating when the first zero signal is detected.

(e) After deceleration stop, the operation moves in direction of home position return at the "[Pr.47] Creep speed", and then the machine home position return will be completed at the detected nearest zero signal.



[Pr.44] Home position return direction

Set the direction to start movement when starting machine home position return.

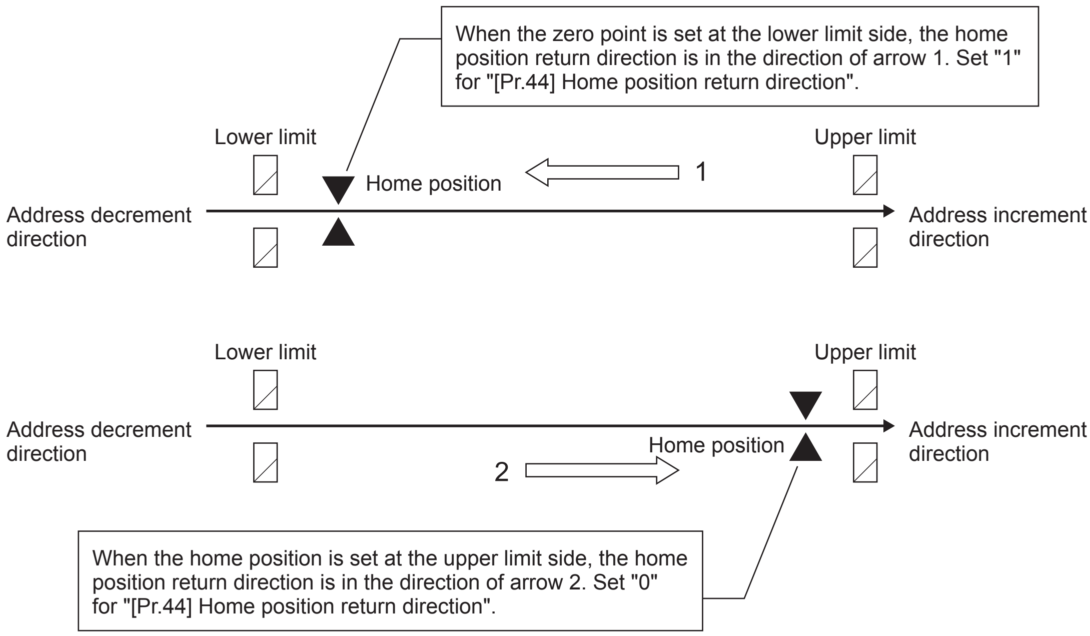
0: Positive direction (address increment direction)

• • • Moves in the direction that the address increments. (Arrow 2)

1: Negative direction (address decrement direction)

• • • Moves in the direction that the address decrements. (Arrow 1)

Normally, the home position is set near the lower limit or the upper limit, so "[Pr.44] Home position return direction" is set as shown below.



[Pr.45] Home position address

Set the address used as the reference point for positioning control (ABS system).
(When the machine home position return is completed, the stop position address is changed to the address set in "[Pr.45] Home position address". At the same time, the "[Pr.45] Home position address" is stored in "[Md.20] Feed current value" and "[Md.21] Machine feed value".)

[Pr.46] Home position return speed

Set the speed for home position return.

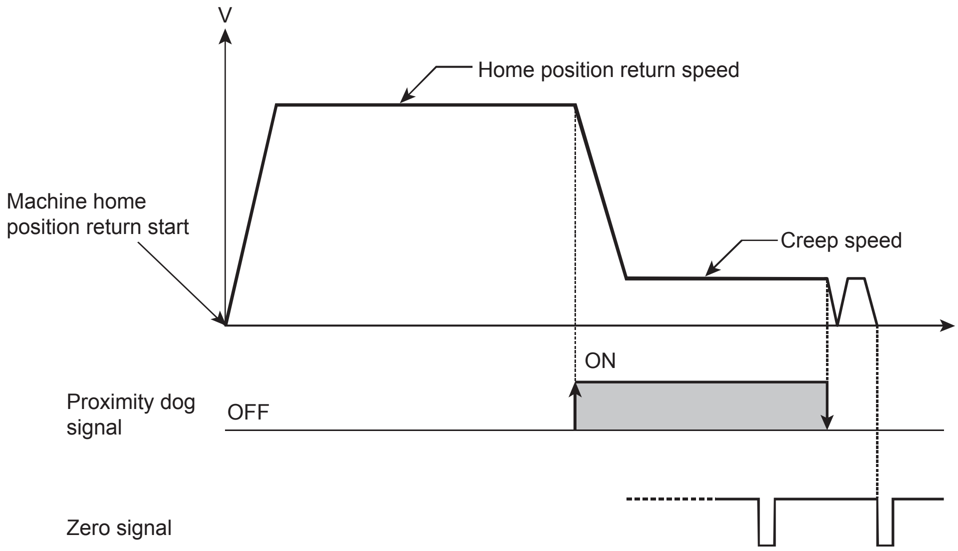
PRECAUTIONS

Set the "home position return speed" to less than "[Pr.8] Speed limit value". If the "speed limit value" is exceeded, the error "Outside speed limit value range" (error code: 1A69H) will occur, and home position return will not be executed.
The "home position return speed" should be equal to or faster than the "[Pr.7] Bias speed at start" and "[Pr.47] Creep speed".

[Pr.47] Creep speed

Set the creep speed after proximity dog ON (the low speed just before stopping after decelerating from the home position return speed).
The creep speed is set within the following range.

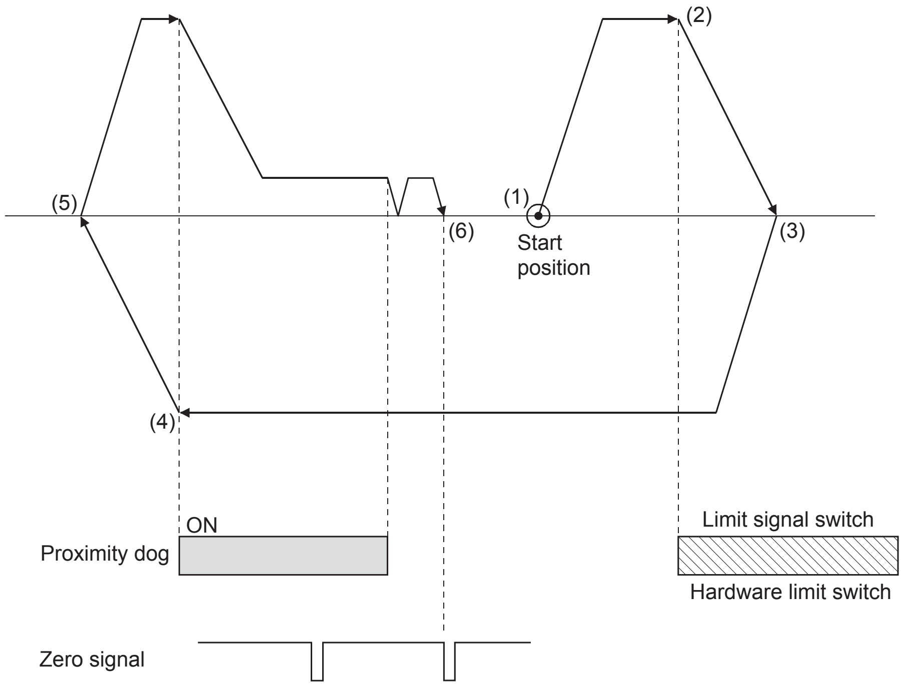
Home position return speed ≥ [Pr.47] Creep speed ≥ [Pr.7] Bias speed at start



[Pr.48] Home position return retry

Set whether to carry out home position return retry.

When home position return performed, workpiece started moving in home direction specified in home position return parameters. While returning to home position, it is searching for dog signal. If dog signal is not found and limit switch is come, movement for home position will stop without home position completion. In this type of system home position retry with limit switch can be performed.



[Operation of the home position return retry function]

(1) The movement starts in the "[Pr.44] Home position return direction" by a machine home position return start.

(2) The operation decelerates when the limit signal OFF is detected.

(3) After stopping due to the limit signal OFF detection, the operation moves at the "[Pr.46] Home position return speed" in the opposite direction of the "[Pr.44] Home position return direction".

(4) The operation decelerates and stops when the proximity dog turns OFF.

(5) After stopping due to the proximity dog OFF, a machine home position return is carried out in the "[Pr.44] Home position return direction".

(6) Machine home position return completion.

4.6.2 Home position return detailed parameters

(The device cannot be changed while the programmable controllers is in the ready state.)

Parameters	Unit / Item	Setting range: mm	Setting range: inch	Setting range: degree	Setting range: pulse	Default value
[Pr.50]	Setting for the movement amount after proximity dog ON	0 to 2147483647 ($\times10^{-1}$ μm)	0 to 2147483647 ($\times10^{-5}$ inch)	0 to 2147483647 ($\times10^{-5}$ degree)	0 to 2147483647 (pulse)	0
[Pr.51]	Home position return acceleration time selection	0: Acceleration time 0 1: Acceleration time 1 2: Acceleration time 2 3: Acceleration time 3 Select the Home position Return acceleration time from 0 to 3 from basic parameter 2.				0
[Pr.52]	Home position return deceleration time selection	0: Deceleration time 0 1: Deceleration time 1 2: Deceleration time 2 3: Deceleration time 3 Select the Home position Return deceleration time from 0 to 3 from basic parameter 2.				0
[Pr.53]	Home position shift amount	-2147483648 to 2147483647 ($\times10^{-1}$ μm)	-2147483648 to 2147483647 ($\times10^{-5}$ inch)	-2147483648 to 2147483647 ($\times10^{-5}$ degree)	-2147483648 to 2147483647 (pulse)	0
[Pr.54]	Home position return torque limit value	0.1 to 1000.0 (%)				300.0
[Pr.55]	Operation setting for incompletion of home position return	0: Positioning control is not executed. 1: Positioning control is executed.				0
[Pr.56]	Speed designation during home position shift	0: Home position return speed 1: Creep speed				0
[Pr.57]	Dwell time during home position return retry	0 to 65535 ms				0
[Pr.86]	Pulse conversion module home position return request setting*1	0: Home position return request is turned on when servo is turned off. 1: Home position return request is not turned on when servo is turned off.				0
[Pr.87]	Standby time after output of pulse conversion module clear signal *1	1 to 1000 ms				0

*1. Only when the pulse conversion module is used

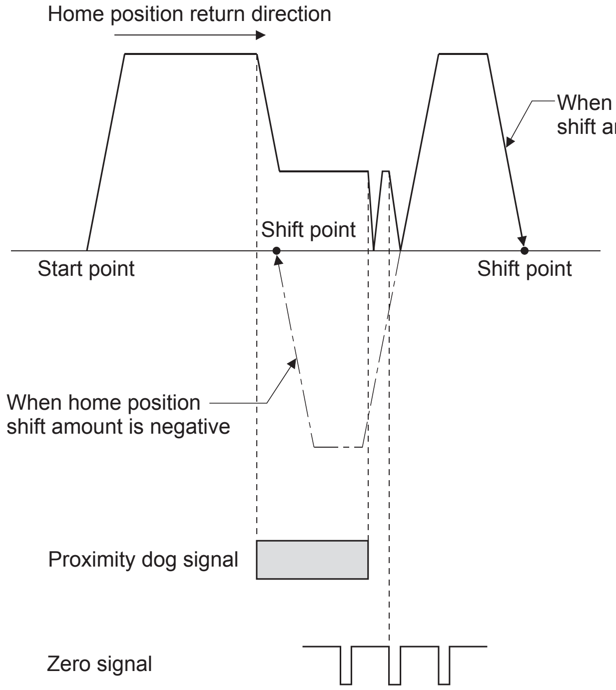
[Pr.50] Setting for the movement amount after proximity dog ON

When using the count method 1 or 2, set the movement amount to the home position after the proximity dog signal turns ON.

(The movement amount after proximity dog ON should be equal to or greater than the sum of the "distance covered by the deceleration from the home position return speed to the creep speed" and "distance of movement in 10 ms at the home position return speed".)

[Pr.53] Home position shift amount

Set the amount to shift (move) from the position stopped at with machine home position return.



POINT

The home position shift function is used to compensate the home position stopped at with machine home position return. If there is a physical limit to the home position, due to the relation of the proximity dog installation position, use this function to compensate the home position to an optimum position.

[Pr.55] Operation setting for incompletion of home position return

Set whether the positioning control is executed or not (When the home position return request flag is ON.).

(1) When the home position return request flag is ON, selecting "0: Positioning control is not executed" will result in the error "Start at home position return incomplete" (error code: 19A6H), and positioning control will not be performed. At this time, operation with the manual control (JOG operation, inching operation, manual pulse generator operation) is available.
The positioning control can be executed even if the home position return request flag is ON when selecting "1: Positioning control is executed".

(2) The following shows whether the positioning control is possible to start/restart or not when selecting "0: Positioning control is not executed".
   (a) Start possible
   Machine home position return, JOG operation, inching operation, manual pulse generator operation, and current value changing using current value changing start No. (No. 9003)

(b) Start/restart impossible control

When the following cases at block start, condition start, wait start, repeated start, multiple axes simultaneous start and pre-reading start

1-axis linear control, 2/3/4-axis linear interpolation control, 1/2/3/4-axis fixed-feed control, 2-axis circular interpolation control (with sub point designation/center point designation), 3-axis helical interpolation control (with sub point designation/center point designation), 1/2/3/4-axis speed control, speed-position switching control (INC mode/ ABS mode), position-speed switching control, and current value changing using current value changing (No.1 to 600)

(3) When the home position return request flag is ON, starting the fast home position return will result in the error "Home position return request ON" (error code: 1945H) despite the setting value of "Operation setting for incompletion of home position return", and the fast home position return will not be executed.

PRECAUTIONS

Do not execute the positioning control in home position return request signal ON for the axis which uses in the positioning control. Failure to observe this could lead to an accident such as a collision.

4.7 Extended Parameters

<table>
<tr><th>Parameters</th><th>Item</th><th>Setting range</th><th>Default value</th></tr>
<tr><td>[Pr.91]</td><td>Optional data monitor: Data type setting 1</td><td rowspan="4">0: No setting
1: Effective load ratio[*1]
2: Regenerative load ratio
3: Peak load ratio
4: Load inertia moment ratio[*1]
5: Model loop gain[*1]
6: Main circuit bus voltage[*1]
7: Servo motor speed[*1]
8: Encoder multiple revolution counter
9: Module power consumption
10: Instantaneous torque[*1]
12: Servo motor thermistor temperature
13: Disturbance torque[*1]
14: Overload alarm margin
15: Error excessive alarm margin
16: Settling time
17: Overshoot amount
20: Position feedback[*2]
21: Encoder position within one revolution[*2]
22: Selected droop pulse[*2]
23: Module integral power consumption[*2]
24: Load-side encoder information 1[*2]
25: Load-side encoder information 2[*2]
26: Z-phase counter[*2]
27: Servo motor side/load-side position deviation[*2]
28: Servo motor side/load-side speed deviation[*2]
29: External encoder count value
30: Module power consumption (2 words)[*2]</td><td>0</td></tr>
<tr><td>[Pr.92]</td><td>Optional data monitor: Data type setting 2</td><td>0</td></tr>
<tr><td>[Pr.93]</td><td>Optional data monitor: Data type setting 3</td><td>0</td></tr>
<tr><td>[Pr.94]</td><td>Optional data monitor: Data type setting 4</td><td>0</td></tr>
</table>

*1. The name differs depending on the connected device.
*2. Used point: 2 words

4.8 Servo Parameters

The servo parameters include servo amplifier series and basic setting, gain/filter setting, extension setting, input/output setting, extension setting 2 and extension setting 3.
This document shows the servo parameters of MELSERVO-J4 Series.

4.8.1 Basic setting

(The device cannot be changed while the programmable controllers is in the ready state.)

<table>
<tr><th>Parameters</th><th colspan="2">Item</th><th>Setting range</th><th>Default value</th></tr>
<tr><td rowspan="2">[PA01]</td><td rowspan="2">Operation mode*1</td><td>Operation mode selection</td><td>0: Standard control mode
1: Fully closed loop control mode
4: Linear servo motor control mode
6: DD motor control mode
Setting other than above will result in [AL. 37 Parameter error].</td><td>0</td></tr>
<tr><td>Compatibility mode selection</td><td>0: J3 compatibility mode
1: J4 mode</td><td>1</td></tr>
<tr><td>[PA02]</td><td colspan="2">Regenerative option*1</td><td>00H: Regenerative option is not used.
• For servo amplifier of 100 W, regenerative resistor is not used.
• For servo amplifier of 0.2 kW to 7 kW, built-in regenerative resistor is used.
01H: FR-RC-(H)/FR-CV-(H)/FR-BU2-(H)
When you use FR-RC-(H), FR-CV-(H) or FR-BU2-(H), "Mode 2 (_ _ _ 1)" of "Undervoltage alarm detection mode selection" in [Pr. PC20].
02H: MR-RB032
03H: MR-RB12
04H: MR-RB32
05H: MR-RB30
06H: MR-RB50 (Cooling fan is required.)
08H: MR-RB31
09H: MR-RB51 (Cooling fan is required.)
0BH: MR-RB3N
0CH: MR-RB5N (Cooling fan is required.)
80H: MR-RB1H-4
81H: MR-RB3M-4 (Cooling fan is required.)
82H: MR-RB3G-4 (Cooling fan is required.)
83H: MR-RB5G-4 (Cooling fan is required.)
84H: MR-RB34-4 (Cooling fan is required.)
85H: MR-RB54-4 (Cooling fan is required.)
91H: MR-RB3U-4 (Cooling fan is required.)
92H: MR-RB5U-4 (Cooling fan is required.)
FAH: When the supplied regenerative resistors or the regenerative option is cooled by the cooling fan to increase the ability with the servo amplifier of 11 kW to 22 kW.</td><td>0000H</td></tr>
<tr><td>[PA03]</td><td colspan="2">Absolute position detection system*2</td><td>0: Disabled (used in incremental system)
1: Enabled (used in absolute position detection system)</td><td>0</td></tr>
<tr><td rowspan="2">[PA04]</td><td rowspan="2">Function selection A-1*2</td><td>Servo forced stop selection</td><td>0: Enabled (The forced stop input EM2 or EM1 is used.)
1: Disabled (The forced stop input EM2 and EM1 are not used.)</td><td>0</td></tr>
<tr><td>Forced stop deceleration function selection</td><td>0: Forced stop deceleration function disabled (EM1)
2: Forced stop deceleration function enabled (EM2)</td><td>2</td></tr>
<tr><td>[PA08]</td><td colspan="2">Auto tuning mode</td><td>0: 2 gain adjustment mode 1 (interpolation mode)
1: Auto tuning mode 1
2: Auto tuning mode 2
3: Manual mode
4: 2 gain adjustment mode 2</td><td>1</td></tr>
</table>

<table>
<tr><th>Parameters</th><th>Item</th><th>Setting range</th><th>Default value</th></tr>
<tr><td>[PA09]</td><td>Auto tuning response</td><td>
<table>
<tr><th rowspan="2">Setting value</th><th colspan="2">Machine characteristic</th></tr>
<tr><th>Response</th><th>Guideline for machine resonance frequency [Hz]</th></tr>
<tr><td>1</td><td rowspan="2">Low response</td><td>2.7</td></tr>
<tr><td>2</td><td>3.6</td></tr>
<tr><td>3</td><td rowspan="17"></td><td>4.9</td></tr>
<tr><td>4</td><td>6.6</td></tr>
<tr><td>5</td><td>10.0</td></tr>
<tr><td>6</td><td>11.3</td></tr>
<tr><td>7</td><td>12.7</td></tr>
<tr><td>8</td><td>14.3</td></tr>
<tr><td>9</td><td>16.1</td></tr>
<tr><td>10</td><td>18.1</td></tr>
<tr><td>11</td><td>20.4</td></tr>
<tr><td>12</td><td>23.0</td></tr>
<tr><td>13</td><td>25.9</td></tr>
<tr><td>14</td><td>29.2</td></tr>
<tr><td>15</td><td>32.9</td></tr>
<tr><td>16</td><td>37.0</td></tr>
<tr><td>17</td><td>41.7</td></tr>
<tr><td>18</td><td>47.0</td></tr>
<tr><td>19</td><td>52.9</td></tr>
<tr><td>20</td><td rowspan="2">Middle response</td><td>59.6</td></tr>
<tr><td>21</td><td>67.1</td></tr>
<tr><td>22</td><td rowspan="17"></td><td>75.6</td></tr>
<tr><td>23</td><td>85.2</td></tr>
<tr><td>24</td><td>95.9</td></tr>
<tr><td>25</td><td>108.0</td></tr>
<tr><td>26</td><td>121.7</td></tr>
<tr><td>27</td><td>137.1</td></tr>
<tr><td>28</td><td>154.4</td></tr>
<tr><td>29</td><td>173.9</td></tr>
<tr><td>30</td><td>195.9</td></tr>
<tr><td>31</td><td>220.6</td></tr>
<tr><td>32</td><td>248.5</td></tr>
<tr><td>33</td><td>279.9</td></tr>
<tr><td>34</td><td>315.3</td></tr>
<tr><td>35</td><td>355.1</td></tr>
<tr><td>36</td><td>400.0</td></tr>
<tr><td>37</td><td>446.6</td></tr>
<tr><td>38</td><td>501.2</td></tr>
<tr><td>39</td><td rowspan="2">High response</td><td>571.5</td></tr>
<tr><td>40</td><td>642.7</td></tr>
</table>
</td><td>16</td></tr>
<tr><td>[PA10]</td><td>In-position range</td><td>0 to 65535 [pulse]</td><td>1600</td></tr>
<tr><td>[PA14]</td><td>Rotation direction selection/
travel direction selection*2</td><td>0: CCW direction when positioning address is incremented
1: CW direction when positioning address is incremented</td><td>0</td></tr>
</table>

<table>
<tr><th>Parameters</th><th>Item</th><th>Setting range</th><th>Default value</th></tr>
<tr><td>[PA15]</td><td>Encoder output pulses*2</td><td>1 to 65535 [pulse/rev]</td><td>4000</td></tr>
<tr><td>[PA16]</td><td>Encoder output pulses 2*2</td><td>1 to 65535</td><td>1</td></tr>
<tr><td>[PA17]</td><td>Servo motor series setting</td><td rowspan="2">
<table>
<tr><th rowspan="2">Linear servo motor series</th><th rowspan="2">Linear servo motor (primary side)</th><th colspan="2">Parameters</th></tr>
<tr><th>[Pr. PA17] setting</th><th>[Pr. PA18] setting</th></tr>
<tr><td rowspan="9">LM-H3</td><td>LM-H3P2A-07P-BSS0</td><td rowspan="9">00BBH</td><td>2101H</td></tr>
<tr><td>LM-H3P3A-12P-CSS0</td><td>3101H</td></tr>
<tr><td>LM-H3P3B-24P-CSS0</td><td>3201H</td></tr>
<tr><td>LM-H3P3C-36P-CSS0</td><td>3301H</td></tr>
<tr><td>LM-H3P3D-48P-CSS0</td><td>3401H</td></tr>
<tr><td>LM-H3P7A-24P-ASS0</td><td>7101H</td></tr>
<tr><td>LM-H3P7B-48P-ASS0</td><td>7201H</td></tr>
<tr><td>LM-H3P7C-72P-ASS0</td><td>7301H</td></tr>
<tr><td>LM-H3P7D-96P-ASS0</td><td>7401H</td></tr>
<tr><td rowspan="9">LM-U2</td><td>LM-U2PAB-05M-0SS0</td><td rowspan="9">00B4H</td><td>A201H</td></tr>
<tr><td>LM-U2PAD-10M-0SS0</td><td>A401H</td></tr>
<tr><td>LM-U2PAF-15M-0SS0</td><td>A601H</td></tr>
<tr><td>LM-U2PBB-07M-1SS0</td><td>B201H</td></tr>
<tr><td>LM-U2PBD-15M-1SS0</td><td>B401H</td></tr>
<tr><td>LM-U2PBF-22M-1SS0</td><td>2601H</td></tr>
<tr><td>LM-U2P2B-40M-2SS0</td><td>2201H</td></tr>
<tr><td>LM-U2P2C-60M-2SS0</td><td>2301H</td></tr>
<tr><td>LM-U2P2D-80M-2SS0</td><td>2401H</td></tr>
<tr><td rowspan="16">LM-F</td><td>LM-FP2B-06M-1SS0 (natural cooling)</td><td rowspan="16">00B2H</td><td>2201H</td></tr>
<tr><td>LM-FP2D-12M-1SS0 (natural cooling)</td><td>2401H</td></tr>
<tr><td>LM-FP2F-18M-1SS0 (natural cooling)</td><td>2601H</td></tr>
<tr><td>LM-FP4B-12M-1SS0 (natural cooling)</td><td>4201H</td></tr>
<tr><td>LM-FP4D-24M-1SS0 (natural cooling)</td><td>4401H</td></tr>
<tr><td>LM-FP4F-36M-1SS0 (natural cooling)</td><td>4601H</td></tr>
<tr><td>LM-FP4H-48M-1SS0 (natural cooling)</td><td>4801H</td></tr>
<tr><td>LM-FP5H-60M-1SS0 (natural cooling)</td><td>5801H</td></tr>
<tr><td>LM-FP2B-06M-1SS0 (liquid cooling)</td><td>2202H</td></tr>
<tr><td>LM-FP2D-12M-1SS0 (liquid cooling)</td><td>2402H</td></tr>
<tr><td>LM-FP2F-18M-1SS0 (liquid cooling)</td><td>2602H</td></tr>
<tr><td>LM-FP4B-12M-1SS0 (liquid cooling)</td><td>4202H</td></tr>
<tr><td>LM-FP4D-24M-1SS0 (liquid cooling)</td><td>4402H</td></tr>
<tr><td>LM-FP4F-36M-1SS0 (liquid cooling)</td><td>4602H</td></tr>
<tr><td>LM-FP4H-48M-1SS0 (liquid cooling)</td><td>4802H</td></tr>
<tr><td>LM-FP5H-60M-1SS0 (liquid cooling)</td><td>5802H</td></tr>
<tr><td rowspan="7">LM-K2</td><td>LM-K2P1A-01M-2SS1</td><td rowspan="7">00B8H</td><td>1101H</td></tr>
<tr><td>LM-K2P1C-03M-2SS1</td><td>1301H</td></tr>
<tr><td>LM-K2P2A-02M-1SS1</td><td>2101H</td></tr>
<tr><td>LM-K2P2C-07M-1SS1</td><td>2301H</td></tr>
<tr><td>LM-K2P2E-12M-1SS1</td><td>2501H</td></tr>
<tr><td>LM-K2P3C-14M-1SS1</td><td>3301H</td></tr>
<tr><td>LM-K2P3E-24M-1SS1</td><td>3501H</td></tr>
</table>
</td><td rowspan="2">0000H</td></tr>
<tr><td>[PA18]</td><td>Servo motor type setting</td></tr>
</table>

<table>
<tr><th>Parameters</th><th colspan="2">Item</th><th>Setting range</th><th>Default value</th></tr>
<tr><td>[PA19]</td><td colspan="2">Parameter writing inhibit*2</td><td>
<table>
<tr><th>PA19</th><th>Setting operation</th><th>PA</th><th>PB</th><th>PC</th><th>PD</th><th>PE</th><th>PF</th><th>PL</th></tr>
<tr><td rowspan="2">Other than below</td><td>Reading</td><td>○</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Writing</td><td>○</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td rowspan="2">000AH</td><td>Reading</td><td>Only 19</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Writing</td><td>Only 19</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td rowspan="2">000BH</td><td>Reading</td><td>○</td><td>○</td><td>○</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Writing</td><td>○</td><td>○</td><td>○</td><td></td><td></td><td></td><td></td></tr>
<tr><td rowspan="2">000CH</td><td>Reading</td><td>○</td><td>○</td><td>○</td><td>○</td><td></td><td></td><td></td></tr>
<tr><td>Writing</td><td>○</td><td>○</td><td>○</td><td>○</td><td></td><td></td><td></td></tr>
<tr><td rowspan="2">000FH</td><td>Reading</td><td>○</td><td>○</td><td>○</td><td>○</td><td>○</td><td></td><td>○</td></tr>
<tr><td>Writing</td><td>○</td><td>○</td><td>○</td><td>○</td><td>○</td><td></td><td>○</td></tr>
<tr><td rowspan="2">00AAH</td><td>Reading</td><td>○</td><td>○</td><td>○</td><td>○</td><td>○</td><td>○</td><td></td></tr>
<tr><td>Writing</td><td>○</td><td>○</td><td>○</td><td>○</td><td>○</td><td>○</td><td></td></tr>
<tr><td rowspan="2">00ABH (initial value)</td><td>Reading</td><td>○</td><td>○</td><td>○</td><td>○</td><td>○</td><td>○</td><td>○</td></tr>
<tr><td>Writing</td><td>○</td><td>○</td><td>○</td><td>○</td><td>○</td><td>○</td><td>○</td></tr>
<tr><td rowspan="2">100BH</td><td>Reading</td><td>○</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Writing</td><td>Only 19</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td rowspan="2">100CH</td><td>Reading</td><td>○</td><td>○</td><td>○</td><td>○</td><td></td><td></td><td></td></tr>
<tr><td>Writing</td><td>Only 19</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td rowspan="2">100FH</td><td>Reading</td><td>○</td><td>○</td><td>○</td><td>○</td><td>○</td><td></td><td>○</td></tr>
<tr><td>Writing</td><td>Only 19</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td rowspan="2">10AAH</td><td>Reading</td><td>○</td><td>○</td><td>○</td><td>○</td><td>○</td><td>○</td><td></td></tr>
<tr><td>Writing</td><td>Only 19</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td rowspan="2">10ABH</td><td>Reading</td><td>○</td><td>○</td><td>○</td><td>○</td><td>○</td><td>○</td><td>○</td></tr>
<tr><td>Writing</td><td>Only 19</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>
</td><td>00ABH</td></tr>
<tr><td rowspan="2">[PA20]</td><td rowspan="2">Tough drive setting*2</td><td>Vibration tough drive selection</td><td>0: Disable
1: Enable</td><td>0</td></tr>
<tr><td>SEMI-F47 function selection</td><td>0: Disable
1: Enable</td><td>0</td></tr>
<tr><td>[PA21]</td><td colspan="2">Function selection A-3*2</td><td>0: Disable
1: Enable</td><td>1</td></tr>
<tr><td rowspan="2">[PA22]</td><td rowspan="2">Position control composition selection*1</td><td>Super trace control selection</td><td>0: Disable
2: Enable</td><td>0</td></tr>
<tr><td>Scale measurement function selection</td><td>0: Disable
1: Used in absolute position detection system
2: Used in incremental system</td><td>0</td></tr>
<tr><td rowspan="2">[PA23]</td><td rowspan="2">Drive recorder arbitrary alarm trigger setting</td><td>Alarm detail No. setting</td><td>Set the digits when you execute the trigger with arbitrary alarm detail No. for the drive recorder function. When these digits are "00", only the arbitrary alarm No. setting will be enabled.</td><td>00</td></tr>
<tr><td>Alarm No. setting</td><td>Set the digits when you execute the trigger with arbitrary alarm No. for the drive recorder function. When "00" are set, arbitrary alarm trigger of the drive recorder will be disabled.</td><td>00</td></tr>
</table>

Parameters	Item	Setting range	Default value
[PA24]	Function selection A-4	0: Standard mode 1: 3 inertia mode 2: Low response mode	0
[PA25]	One-touch tuning - Overshoot permissible level	0 to 100 [%]	0
[PA26]	Function selection A-5*2	0: Disable 1: Enable	0

*1. The parameters will be enabled by once turning off the servo amplifier power supply and reapplying the power after changing the parameters (transmitting the parameters from RD77MS to the servo amplifier).

*2. The parameters will be enabled by once turning off the servo amplifier power supply and reapplying the power or resetting the controller after changing the parameters (transmitting the parameters from RD77MS to the servo amplifier).

[PA01] Operation mode

Select a operation mode.

□ 0 □ 0 H

Operation mode setting

Compatibility mode setting

[PA02] Regenerative option

Used to select the regenerative option.

0 0 □ □ H

Regenerative option selection

*. Input the set value in □ (hexadecimal).

[PA03] Absolute position detection system

Determine whether or not the absolute position detection system will be used.

[PA04] Function selection A-1

This is used to select the forced stop input and forced stop deceleration function.

□ □ 0 0 H

Servo forced stop selection

Forced stop deceleration function selection

[PA08] Auto tuning mode

Select the gain adjustment mode.

0 0 0 ▢ H

└── Gain adjustment mode selection

When “0: 2 gain adjustment mode 1 (interpolation mode)” is selected, the following parameters will be automatically set.
- "[PB06] Load to motor inertia ratio/load to motor mass ratio"
- "[PB08] Position loop gain"
- "[PB09] Speed loop gain"
- "[PB10] Speed integral compensation"

When “1: Auto tuning mode 1” is selected, the following parameters will be automatically set.
- "[PB06] Load to motor inertia ratio/load to motor mass ratio"
- "[PB07] Model loop gain"
- "[PB08] Position loop gain"
- "[PB09] Speed loop gain"
- "[PB10] Speed integral compensation"

When “2: Auto tuning mode 2” is selected, the following parameters will be automatically set.
- "[PB07] Model loop gain"
- "[PB08] Position loop gain"
- "[PB09] Speed loop gain"
- "[PB10] Speed integral compensation"

When “4: 2 gain adjustment mode 2” is selected, the following parameters will be automatically set.
- "[PB08] Position loop gain"
- "[PB09] Speed loop gain"
- "[PB10] Speed integral compensation"

[PA09] Auto tuning response

Set a response of the auto tuning.

[PA10] In-position range

Set an in-position range per command pulse.

[PA14] Rotation direction selection/travel direction selection

This is used to select a rotation direction or travel direction.

[PA15] Encoder output pulses

Set the encoder output pulses from the servo amplifier by using the number of output pulses per revolution, dividing ratio, or electronic gear ratio. (after multiplication by 4)
To set a numerator of the electronic gear, select "3: A-phase/B-phase pulse electronic gear setting" of “Encoder output pulse setting selection” in "[PC03] Encoder output pulse selection".

[PA16] Encoder output pulses 2

Set a denominator of the electronic gear for the A/B-phase pulse output. To set a denominator of the electronic gear, select "3: A-phase/B-phase pulse electronic gear setting" of “Encoder output pulse setting selection” in "[PC03] Encoder output pulse selection".

[PA17] and [PA18] Servo motor series setting/Servo motor type setting

When you use a linear servo motor, select its model. It is necessary to set the servo motor series and servo motor type at the same time.

[PA19] Parameter writing inhibit

Select a reference range and writing range of the parameter.

[PA20] Tough drive setting

Alarms may not be avoided with the tough drive depending on the situations of the power supply and load fluctuation.
You can assign MTTR (During tough drive) to pins CN3-11 to CN3-13, CN3-24 and CN3-25 with "[PD07] to [PD09] Output device selection 1 to 3".

0 □ □ 0 H

Vibration tough drive selection

SEMI-F47 function selection

[PA21] Function selection A-3

0 0 0 □ H

One-touch tuning function selection

When the digit is "0", the one-touch tuning with MR Configurator2 will be disabled.

[PA22] Position control composition selection

□ 0 □ 0 H

Super trace control selection*1

Scale measurement function selection

*1. The control is applicable to the software version B4 or later.

[PA23] Drive recorder arbitrary alarm trigger setting

□ □ □ □ H

Alarm detail No. selection

Alarm No. selection

[PA24] Function selection A-4

0 0 0 $\boxed{}$ H

Vibration suppression function selection

When two low resonance frequencies are generated, select "1: 3 inertia mode". When the load to motor inertia ratio exceeds the recommended load to motor inertia ratio, select "2: Low response mode".

[PA25] One-touch tuning - Overshoot permissible level

This is used to set a permissible value of overshoot amount with a percentage to in-position range.

[PA26] Function selection A-5

0 0 0 $\boxed{}$ H

Torque limit function selection at instantaneous power failure
(instantaneous power failure tough drive selection)

When an instantaneous power failure occurs during operation you can delay the time until [AL. 10.2 Voltage drop in the main circuit power] occurs with instantaneous power failure tough drive function.
To enable the torque limit function at instantaneous power failure, select "1: Enabled" of "SEMI-F47 function selection" in "[PA20] Tough drive setting".
This parameter setting is used with software version A6 or later.

4.8.2 Gain/filter setting

(The device cannot be changed while the programmable controllers is in the ready state.)

<table>
<tr><th>Parameters</th><th colspan="2">Item</th><th>Setting range</th><th>Default value</th></tr>
<tr><td>[PB01]</td><td colspan="2">Adaptive tuning mode (adaptive filter II)</td><td>0: Disable
1: Automatic setting
2: Manual setting</td><td>0</td></tr>
<tr><td rowspan="2">[PB02]</td><td rowspan="2">Vibration suppression control tuning mode (advanced vibration suppression control II)</td><td>Vibration suppression control 1 tuning mode selection</td><td>0: Disable
1: Automatic setting
2: Manual setting</td><td>0</td></tr>
<tr><td>Vibration suppression control 2 tuning mode selection</td><td>0: Disable
1: Automatic setting
2: Manual setting</td><td>0</td></tr>
<tr><td>[PB03]</td><td colspan="2">Torque feedback loop gain</td><td>0 to 18000 [rad/s]</td><td>18000</td></tr>
<tr><td>[PB04]</td><td colspan="2">Feed forward gain</td><td>0 to 100 [%]</td><td>0</td></tr>
<tr><td>[PB06]</td><td colspan="2">Load to motor inertia ratio/load to motor mass ratio</td><td>0.00 to 300.00 [Multiplier]</td><td>7.00</td></tr>
<tr><td>[PB07]</td><td colspan="2">Model loop gain</td><td>1.0 to 2000.0 [rad/s]</td><td>15.0</td></tr>
<tr><td>[PB08]</td><td colspan="2">Position loop gain</td><td>1.0 to 2000.0 [rad/s]</td><td>37.0</td></tr>
<tr><td>[PB09]</td><td colspan="2">Speed loop gain</td><td>20 to 65535 [rad/s]</td><td>823</td></tr>
<tr><td>[PB10]</td><td colspan="2">Speed integral compensation</td><td>0.1 to 1000.0 [ms]</td><td>33.7</td></tr>
<tr><td>[PB11]</td><td colspan="2">Speed differential compensation</td><td>0 to 1000</td><td>980</td></tr>
<tr><td>[PB12]</td><td colspan="2">Overshoot amount compensation</td><td>0 to 100 [%]</td><td>0</td></tr>
<tr><td>[PB13]</td><td colspan="2">Machine resonance suppression filter 1</td><td>10 to 4500 [Hz]</td><td>4500</td></tr>
<tr><td rowspan="2">[PB14]</td><td rowspan="2">Notch shape selection 1</td><td>Notch depth selection</td><td>0: -40 dB
1: -14 dB
2: -8 dB
3: -4 dB</td><td>0</td></tr>
<tr><td>Notch width selection</td><td>0: α = 2
1: α = 3
2: α = 4
3: α = 5</td><td>0</td></tr>
<tr><td>[PB15]</td><td colspan="2">Machine resonance suppression filter 2</td><td>10 to 4500 [Hz]</td><td>4500</td></tr>
<tr><td rowspan="3">[PB16]</td><td rowspan="3">Notch shape selection 2</td><td>Machine resonance suppression filter 2 selection</td><td>0: Disable
1: Enable</td><td>0</td></tr>
<tr><td>Notch depth selection</td><td>0: -40 dB
1: -14 dB
2: -8 dB
3: -4 dB</td><td>0</td></tr>
<tr><td>Notch width selection</td><td>0: α = 2
1: α = 3
2: α = 4
3: α = 5</td><td>0</td></tr>
<tr><td rowspan="2">[PB17]</td><td rowspan="2">Shaft resonance suppression filter</td><td>Shaft resonance suppression filter setting frequency selection</td><td>Setting of shaft resonance suppression filter</td><td>00</td></tr>
<tr><td>Notch depth selection</td><td>0: -40 dB
1: -14 dB
2: -8 dB
3: -4 dB</td><td>0</td></tr>
<tr><td>[PB18]</td><td colspan="2">Low-pass filter setting</td><td>100 to 18000 [rad/s]</td><td>3141</td></tr>
</table>

Parameters	Item		Setting range	Default value
[PB19]	Vibration suppression control 1 - Vibration frequency		0.1 to 300.0 [Hz]	100.0
[PB20]	Vibration suppression control 1 - Resonance frequency		0.1 to 300.0 [Hz]	100.0
[PB21]	Vibration suppression control 1 - Vibration frequency damping		0.00 to 0.30	0.00
[PB22]	Vibration suppression control 1 - Resonance frequency damping		0.00 to 0.30	0.00
[PB23]	Low-pass filter selection	Shaft resonance suppression filter selection	0: Automatic setting 1: Manual setting 2: Disable	0
		Low-pass filter selection	0: Automatic setting 1: Manual setting 2: Disable	0
[PB24]	Slight vibration suppression control[*1]	Slight vibration suppression control selection	0: Disable 1: Enable	0
		PI-PID switching control selection	0: PI control enabled 3: Continuous PID control enabled	0
[PB25]	Function selection B-1[*1]		0: Enabled (model adaptive control) 2: Disabled (PID control)	0
[PB26]	Gain switching function[*1]	Gain switching selection	0: Disable 1: Control command from controller is enabled 2: Command frequency 3: Droop pulses 4: Servo motor speed/linear servo motor speed	0
		Gain switching condition selection	0: Gain after switching is enabled with gain switching condition or more 1: Gain after switching is enabled with gain switching condition or less	0
		Gain switching time constant disabling condition selection	0: Switching time constant enabled 1: Switching time constant disabled 2: Return time constant disabled	0
[PB27]	Gain switching condition		0 to 65535 [kpulse/s, pulse, r/min]	10
[PB28]	Gain switching time constant		0 to 100 [ms]	1
[PB29]	Load to motor inertia ratio/load to motor mass ratio after gain switching		0.00 to 300.00 [Multiplier]	7.00
[PB30]	Position loop gain after gain switching		0.0 to 2000.0 [rad/s]	0.0
[PB31]	Speed loop gain after gain switching		0 to 65535 [rad/s]	0
[PB32]	Speed integral compensation after gain switching		0.0 to 5000.0 [ms]	0.0
[PB33]	Vibration suppression control 1 - Vibration frequency setting after gain switching		0.0 to 300.0 [Hz]	0.0
[PB34]	Vibration suppression control 1 - Resonance frequency setting after gain switching		0.0 to 300.0 [Hz]	0.0

Parameters	Item		Setting range	Default value
[PB35]	Vibration suppression control 1 - Vibration frequency damping after gain switching		0.00 to 0.30	0.00
[PB36]	Vibration suppression control 1 - Resonance frequency damping after gain switching		0.00 to 0.30	0.00
[PB45]	Command notch filter	Command notch filter setting frequency selection	00 to 5F	00H
		Notch depth selection	0 to F	0H
[PB46]	Machine resonance suppression filter 3		10 to 4500 [Hz]	4500
[PB47]	Notch shape selection 3	Machine resonance suppression filter 3 selection	0: Disable 1: Enable	0
		Notch depth selection	0: -40 dB 1: -14 dB 2: -8 dB 3: -4 dB	0
		Notch width selection	0: α = 2 1: α = 3 2: α = 4 3: α = 5	0
[PB48]	Machine resonance suppression filter 4		10 to 4500 [Hz]	4500
[PB49]	Notch shape selection 4	Machine resonance suppression filter 4 selection	0: Disable 1: Enable	0
		Notch depth selection	0: -40 dB 1: -14 dB 2: -8 dB 3: -4 dB	0
		Notch width selection	0: α = 2 1: α = 3 2: α = 4 3: α = 5	0
[PB50]	Machine resonance suppression filter 5		10 to 4500 [Hz]	4500
[PB51]	Notch shape selection 5	Machine resonance suppression filter 5 selection	0: Disable 1: Enable	0
		Notch depth selection	0: -40 dB 1: -14 dB 2: -8 dB 3: -4 dB	0
		Notch width selection	0: α = 2 1: α = 3 2: α = 4 3: α = 5	0
[PB52]	Vibration suppression control 2 - Vibration frequency		0.1 to 300.0 [Hz]	100.0
[PB53]	Vibration suppression control 2 - Resonance frequency		0.1 to 300.0 [Hz]	100.0
[PB54]	Vibration suppression control 2 - Vibration frequency damping		0.00 to 0.30	0.00
[PB55]	Vibration suppression control 2 - Resonance frequency damping		0.00 to 0.30	0.00

Parameters	Item	Setting range	Default value
[PB56]	Vibration suppression control 2 - Vibration frequency after gain switching	0.0 to 300.0 [Hz]	0.0
[PB57]	Vibration suppression control 2 - Resonance frequency after gain switching	0.0 to 300.0 [Hz]	0.0
[PB58]	Vibration suppression control 2 - Vibration frequency damping after gain switching	0.00 to 0.30	0.00
[PB59]	Vibration suppression control 2 - Resonance frequency damping after gain switching	0.00 to 0.30	0.00
[PB60]	Model loop gain after gain switching	0.0 to 2000.0 [rad/s]	0.0

*1. The parameters will be enabled by once turning off the servo amplifier power supply and reapplying the power or resetting the controller after changing the parameters (transmitting the parameters from RD77MS to the servo amplifier).

[PB01] Adaptive tuning mode (adaptive filter II)

Set the adaptive filter tuning.

When “1: Automatic setting” is selected, “[PB13] Machine resonance suppression filter 1” and “[PB14] Notch shape selection 1” will be automatically set.

[PB02] Vibration suppression control tuning mode (advanced vibration suppression control II)

This is used to set the vibration suppression control tuning mode.

0 0 ☐ ☐

Vibration suppression control 1 tuning mode selection

Vibration suppression control 2 tuning mode selection *1

*1. To enable the setting value, select "1: 3 inertia mode" of "Vibration suppression mode selection" in "[PA24] Function selection A-4."

When the vibration suppression control 1 tuning mode selection is set to “1: Automatic setting,” the following parameters will be automatically set.

- "[PB19] Vibration suppression control 1 - Vibration frequency"
- "[PB20] Vibration suppression control 1 - Resonance frequency"
- "[PB21] Vibration suppression control 1 - Vibration frequency damping"
- "[PB22] Vibration suppression control 1 - Resonance frequency damping"

When the vibration suppression control 2 tuning mode selection is set to “1: Automatic setting,” the following parameters will be automatically set.

- "[PB52] Vibration suppression control 2 - Vibration frequency setting"
- "[PB53] Vibration suppression control 2 - Resonance frequency setting"
- "[PB54] Vibration suppression control 2 - Vibration frequency damping setting"
- "[PB55] Vibration suppression control 2 - Resonance frequency damping setting"

[PB03] Torque feedback loop gain

This is used to set a torque feedback loop gain in the continuous operation to torque control.

[PB04] Feed forward gain

Set the feed forward gain.

[PB06] Load to motor inertia ratio/load to motor mass ratio

This is used to set the load to motor inertia ratio or load to motor mass ratio.

[PB07] Model loop gain

Set the response gain up to the target position.

[PB08] Position loop gain

This is used to set the gain of the position loop.

[PB09] Speed loop gain

This is used to set the gain of the speed loop.

[PB10] Speed integral compensation

This is used to set the integral time constant of the speed loop.

[PB11] Speed differential compensation

This is used to set the differential compensation.
To enable the parameter, select "3: Continuous PID control enabled" of "PI-PID switching control selection" in "[PB24] Slight vibration suppression control."

[PB12] Overshoot amount compensation

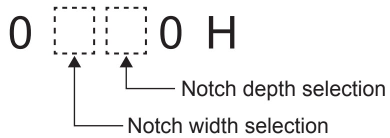
This is used to set a viscous friction torque or thrust to rated torque in percentage unit at servo motor rated speed or linear servo motor rated speed.

[PB13] Machine resonance suppression filter 1

Set the notch frequency of the machine resonance suppression filter 1.

[PB14] Notch shape selection 1

Set the shape of the machine resonance suppression filter 1.

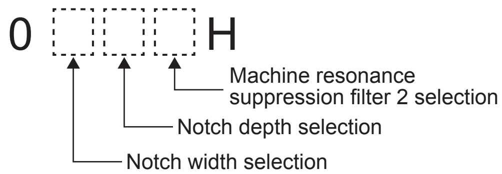


[PB15] Machine resonance suppression filter 2

Set the notch frequency of the machine resonance suppression filter 2.

[PB16] Notch shape selection 2

Set the shape of the machine resonance suppression filter 2.



[PB17] Shaft resonance suppression filter

This is used for setting the shaft resonance suppression filter.
This is used to suppress a high-frequency machine vibration.

0 □ □ □ H

Shaft resonance suppression filter setting frequency selection
(For the set values, refer to the following table.)

Notch depth selection

Shaft resonance suppression filter setting frequency selection

Setting value	Frequency [Hz]	Setting value	Frequency [Hz]
00	Disabled	10	562
01	Disabled	11	529
02	4500	12	500
03	3000	13	473
04	2250	14	450
05	1800	15	428
06	1500	16	409
07	1285	17	391
08	1125	18	375
09	1000	19	360
0A	900	1A	346
0B	818	1B	333
0C	750	1C	321
0D	692	1D	310
0E	642	1E	300
0F	600	1F	290

[PB18] Low-pass filter setting

Set the low-pass filter.

0 0 □ 0 H

Low-pass filter

[PB19, PB52] Vibration suppression control 1/2 - Vibration frequency

Set the vibration frequency for vibration suppression control to suppress low-frequency machine vibration.

[PB20, PB53] Vibration suppression control 1/2 - Resonance frequency

Set the resonance frequency for vibration suppression control to suppress low-frequency machine vibration.

[PB21, PB54] Vibration suppression control 1/2 - Vibration frequency damping

Set a damping of the vibration frequency for vibration suppression control to suppress low-frequency machine vibration.

[PB22, PB55] Vibration suppression control 1/2 - Resonance frequency damping

Set a damping of the resonance frequency for vibration suppression control to suppress low-frequency machine vibration.

[PB23] Low-pass filter selection

Select the shaft resonance suppression filter and low-pass filter.

0 0 □ □ H

Shaft resonance suppression filter selection

Low-pass filter selection

[PB24] Slight vibration suppression control

Select the slight vibration suppression control and PI-PID switching control.

0 0 □ □ H

Slight vibration suppression control selection

PI-PID switching control selection

[PB25] Function selection B-1

Select enabled/disabled of model adaptive control.

0 0 0 □ H

Model adaptive control selection

This parameter is supported with software version B4 or later.

[PB26] Gain switching function

Select the gain switching selection/condition.

0 □ □ □ H

Gain switching selection

Gain switching condition selection

Gain switching time constant disabling condition selection*1

*1. This parameter setting is used with software version B4 or later.

[PB27] Gain switching condition

This is used to set the value of gain switching condition (command frequency, droop pulses, and servo motor speed) set in "[PB26] Gain switching function."
The set value unit differs depending on the switching condition.

[PB28] Gain switching time constant

This is used to set the time constant when the gains switch in response to the conditions set in "[PB26] Gain switching function" and "[PB27] Gain switching condition".

[PB29] Load to motor inertia ratio/load to motor mass ratio after gain switching

This is used to set the load to motor inertia ratio/load to motor mass ratio for when gain switching is enabled.

[PB30] Position loop gain after gain switching

Set the position loop gain when the gain switching is enabled.

[PB31] Speed loop gain after gain switching

Set the speed loop gain when the gain switching is enabled.

[PB32] Speed integral compensation after gain switching

Set the speed integral compensation when the gain changing is enabled.

[PB33, PB56] Vibration suppression control 1/2 - Vibration frequency setting after gain switching

Set the vibration frequency of the vibration suppression control for when the gain switching is enabled.
This parameter will be enabled only when the following conditions are fulfilled.

- "Gain adjustment mode selection" in "[PA08] Position loop gain" is "3: Manual mode".
- "Vibration suppression control 1/2 tuning mode selection" in "[PB02] Vibration suppression control tuning mode (advanced vibration suppression control II)" is "2: Manual setting"
- "Gain switching selection" in "[PB26] Gain switching function" is "1: Control command from controller is enabled".

PRECAUTIONS

Switching during driving may cause a shock. Be sure to switch them after the servo motor or linear servo motor stops.

[PB34, PB57] Vibration suppression control 1/2 - Resonance frequency setting after gain switching

Set the resonance frequency for vibration suppression control when the gain switching is enabled.
This parameter will be enabled only when the following conditions are fulfilled.

- "Gain adjustment mode selection" in "[PA08] Position loop gain" is "3: Manual mode".
- "Vibration suppression control 1/2 tuning mode selection" in "[PB02] Vibration suppression control tuning mode (advanced vibration suppression control II)" is "2: Manual setting"
- "Gain switching selection" in "[PB26] Gain switching function" is "1: Control command from controller is enabled".

PRECAUTIONS

Switching during driving may cause a shock. Be sure to switch them after the servo motor or linear servo motor stops.

[PB35, PB58] Vibration suppression control 1/2 - Vibration frequency damping after gain switching

Set a damping of the vibration frequency for vibration suppression control when the gain switching is enabled.

This parameter will be enabled only when the following conditions are fulfilled.

- "Gain adjustment mode selection" in "[PA08] Position loop gain" is "3: Manual mode".
- "Vibration suppression control 1/2 tuning mode selection" in "[PB02] Vibration suppression control tuning mode (advanced vibration suppression control II)" is "2: Manual setting"
- "Gain switching selection" in "[PB26] Gain switching function" is "1: Control command from controller is enabled".

PRECAUTIONS

Switching during driving may cause a shock. Be sure to switch them after the servo motor or linear servo motor stops.

[PB36, PB59] Vibration suppression control 1/2 - Resonance frequency damping after gain switching

Set a damping of the resonance frequency for vibration suppression control when the gain switching is enabled.

This parameter will be enabled only when the following conditions are fulfilled.

- "Gain adjustment mode selection" in "[PA08] Position loop gain" is "3: Manual mode".
- "Vibration suppression control 1/2 tuning mode selection" in "[PB02] Vibration suppression control tuning mode (advanced vibration suppression control II)" is "2: Manual setting"
- "Gain switching selection" in "[PB26] Gain switching function" is "1: Control command from controller is enabled".

PRECAUTIONS

Switching during driving may cause a shock. Be sure to switch them after the servo motor or linear servo motor stops.

[PB45] Command notch filter

Set the command notch filter.

0 □ □ □ H

Command notch filter setting frequency selection
(For the set values, refer to the following table.)

Notch depth selection (For the set values, refer to the table on the next page.)

Command notch filter setting frequency selection

Setting	Frequency [Hz]	Setting	Frequency [Hz]	Setting	Frequency [Hz]
00	Disabled	20	70	40	17.6
01	2250	21	66	41	16.5
02	1125	22	62	42	15.6
03	750	23	59	43	14.8
04	562	24	56	44	14.1
05	450	25	53	45	13.4
06	375	26	51	46	12.8

Setting	Frequency [Hz]	Setting	Frequency [Hz]	Setting	Frequency [Hz]
07	321	27	48	47	12.2
08	281	28	46	48	11.7
09	250	29	45	49	11.3
0A	225	2A	43	4A	10.8
0B	204	2B	41	4B	10.4
0C	187	2C	40	4C	10
0D	173	2D	38	4D	9.7
0E	160	2E	37	4E	9.4
0F	150	2F	36	4F	9.1
10	140	30	35.2	50	8.8
11	132	31	33.1	51	8.3
12	125	32	31.3	52	7.8
13	118	33	29.6	53	7.4
14	112	34	28.1	54	7.0
15	107	35	26.8	55	6.7
16	102	36	25.6	56	6.4
17	97	37	24.5	57	6.1
18	93	38	23.4	58	5.9
19	90	39	22.5	59	5.6
1A	86	3A	21.6	5A	5.4
1B	83	3B	20.8	5B	5.2
1C	80	3C	20.1	5C	5.0
1D	77	3D	19.4	5D	4.9
1E	75	3E	18.8	5E	4.7
1F	72	3F	18.2	5F	4.5

Notch depth selection

Setting	Depth [dB]	Setting	Depth [dB]
0	-40.0	8	-6.0
1	-24.1	9	-5.0
2	-18.1	A	-4.1
3	-14.5	B	-3.3
4	-12.0	C	-2.5
5	-10.1	D	-1.8
6	-8.5	E	-1.2
7	-7.2	F	-0.6

[PB46] Machine resonance suppression filter 3

Set the notch frequency of the machine resonance suppression filter 3.

[PB47] Notch shape selection 3

Set the shape of the machine resonance suppression filter 3.

0 □□□ H

Machine resonance suppression filter 3 selection
Notch depth selection
Notch width selection

[PB48] Machine resonance suppression filter 4

Set the notch frequency of the machine resonance suppression filter 4.

[PB49] Notch shape selection 4

Set the shape of the machine resonance suppression filter 4.

0 □□□ H

Machine resonance suppression filter 4 selection
Notch depth selection
Notch width selection

[PB50] Machine resonance suppression filter 5

Set the notch frequency of the machine resonance suppression filter 5.

[PB51] Notch shape selection 5

Set the shape of the machine resonance suppression filter 5.
When you select "1: Enabled" of "Robust filter selection" in [PE41] Function selection E-3, the machine resonance suppression filter 5 is not available.

0 □□□ H

Machine resonance suppression filter 5 selection
Notch depth selection
Notch width selection

[PB60] Model loop gain after gain switching

Set the model loop gain when the gain switching is enabled.

4.8.3 Extension setting

(The device cannot be changed while the programmable controllers is in the ready state.)

Parameters	Item		Setting range	Default value
[PC01]	Error excessive alarm level		1 to 1000 [rev]/[mm]	0
[PC02]	Electromagnetic brake sequence output		0 to 1000 [ms]	0
[PC03]	Encoder output pulse selection[*1]	Encoder output pulse phase selection	0: Increasing A-phase 90° in CCW or positive direction 1: Increasing A-phase 90° in CW or negative direction	0
		Encoder output pulse setting selection	0: Output pulse setting 1: Division ratio setting 3: A-phase/B-phase pulse electronic gear setting 4: A/B-phase pulse through output setting	0
		Selection of the encoders for encoder output pulse	0: Servo motor encoder 1: Load-side encoder	0
[PC04]	Function selection C-1[*2]		0: Two-wire type 1: Four-wire type	0
[PC05]	Function selection C-2[*2]	Motor-less operation selection	0: Disable 1: Enable	0
		[AL. 9B Error excessive warning] selection	0: [AL. 9B Error excessive warning] disabled 1: [AL. 9B Error excessive warning] enabled	0
[PC06]	Function selection C-3[*2]		0: Per 1 rev or 1 mm 1: Per 0.1 rev or 0.1 mm 2: Per 0.01 rev or 0.01 mm 3: Per 0.001 rev or 0.001 mm	0
[PC07]	Zero speed		0 to 10000 [r/min]/[mm/s]	50
[PC08]	Overspeed alarm detection level		0 to 20000 [r/min]/[mm/s]	0

Parameters	Item	Setting range	Default value
[PC09]	Analog monitor 1 output	00H: (Linear) servo motor speed (±8 V/max. speed) 01H: Torque or thrust (±8 V/max. torque or max. thrust) 02H: (Linear) servo motor speed (+8 V/max. speed) 03H: Torque or thrust (+8 V/max. torque or max. thrust) 04H: Current command (±8 V/max. current command) 05H: Speed command (±8 V/max. speed) 06H: Servo motor-side droop pulses (±10 V/100 pulses) 07H: Servo motor-side droop pulses (±10 V/1000 pulses) 08H: Servo motor-side droop pulses (±10 V/10000 pulses) 09H: Servo motor-side droop pulses (±10 V/100000 pulses) 0AH: Feedback position (±10 V/1M pulses) 0BH: Feedback position (±10 V/10M pulses) 0CH: Feedback position (±10 V/100M pulses) 0DH: Bus voltage (200 V class and 100 V class: +8 V/400 V, 400 V class: +8 V/800 V) 0EH: Speed command 2 (±8 V/max. speed) 10H: Load-side droop pulses (±10 V/100 pulses) 11H: Load-side droop pulses (±10 V/1000 pulses) 12H: Load-side droop pulses (±10 V/10000 pulses) 13H: Load-side droop pulses (±10 V/100000 pulses) 14H: Load-side droop pulses (±10 V/1M pulses) 15H: Servo motor-side/load-side position deviation (±10 V/100000 pulses) 16H: Servo motor-side/load-side speed deviation (±8 V/max. speed) 17H: Internal temperature of encoder (±10 V/±128°C)	00H

Parameters	Item		Setting range	Default value
[PC10]	Analog monitor 2 output		00H: (Linear) servo motor speed (±8 V/max. speed) 01H: Torque or thrust (±8 V/max. torque or max. thrust) 02H: (Linear) servo motor speed (+8 V/max. speed) 03H: Torque or thrust (+8 V/max. torque or max. thrust) 04H: Current command (±8 V/max. current command) 05H: Speed command (±8 V/max. speed) 06H: Servo motor-side droop pulses (±10 V/100 pulses) 07H: Servo motor-side droop pulses (±10 V/1000 pulses) 08H: Servo motor-side droop pulses (±10 V/10000 pulses) 09H: Servo motor-side droop pulses (±10 V/100000 pulses) 0AH: Feedback position (±10 V/1M pulses) 0BH: Feedback position (±10 V/10M pulses) 0CH: Feedback position (±10 V/100M pulses) 0DH: Bus voltage (200 V class and 100 V class: +8 V/400 V, 400 V class: +8 V/800 V) 0EH: Speed command 2 (±8 V/max. speed) 10H: Load-side droop pulses (±10 V/100 pulses) 11H: Load-side droop pulses (±10 V/1000 pulses) 12H: Load-side droop pulses (±10 V/10000 pulses) 13H: Load-side droop pulses (±10 V/100000 pulses) 14H: Load-side droop pulses (±10 V/1M pulses) 15H: Servo motor-side/load-side position deviation (±10 V/100000 pulses) 16H: Servo motor-side/load-side speed deviation (±8 V/max. speed) 17H: Internal temperature of encoder (±10 V/±128°C)	01H
[PC11]	Analog monitor 1 offset		-999 to 999 [mV]	0
[PC12]	Analog monitor 2 offset		-999 to 999 [mV]	0
[PC13]	Analog monitor - Feedback position output standard data - Low		- 9999 to 9999 [pulses]	0
[PC14]	Analog monitor - Feedback position output standard data - High		-9999 to 9999 [10000 pulses]	0
[PC17]	Function selection C-4*2	Selection of home position setting condition	0: Need to pass servo motor Z-phase after power on 1: Not need to pass servo motor Z-phase after power on	0
		Linear encoder multipoint Z-phase input function selection	0: Disable 1: Enable	

Parameters	Item		Setting range	Default value
[PC18]	Function selection C-5[*1]		0: Detection with ready-on and servo-on command 1: Detection with servo-on command	0
[PC20]	Function selection C-7[*1]	[AL. 10 Undervoltage] detection method selection	0: [AL. 10] not occurrence 1: [AL. 10] occurrence	0
		Undervoltage alarm selection	0: [AL. 10] regardless of servo motor speed 1: [AL. E9] at servo motor speed 50 r/min (50 mm/s) or less, [AL. 10] at over 50 r/min (50 mm/s)	
[PC21]	Alarm history clear[*1]		0: Disable 1: Enable	0
[PC24]	Forced stop deceleration time constant		0 to 20000 [ms]	100
[PC26]	Function selection C-8[*2]		0: Two-wire type 1: Four-wire type	0
[PC27]	Function selection C-9[*2]	Encoder pulse count polarity selection	0: Encoder pulse increasing direction in the servo motor CCW or positive direction 1: Encoder pulse decreasing direction in the servo motor CCW or positive direction	0
		Selection of A/B/Z-phase input interface encoder Z-phase connection judgment function	0: Enable 1: Disable	0
[PC29]	Function selection C-B[*1]		0: Enable 1: Disable	0
[PC31]	Vertical axis freefall prevention compensation amount		-25000 to 25000 [0.0001rev]/[0.01mm]	0
[PC38]	Error excessive warning level		0 to 1000 [rev]/[mm]	0

*1. The parameters will be enabled by once turning off the servo amplifier power supply and reapplying the power or resetting the controller after changing the parameters (transmitting the parameters from RD77MS to the servo amplifier).
*2. The parameters will be enabled by once turning off the servo amplifier power supply and reapplying the power after changing the parameters (transmitting the parameters from RD77MS to the servo amplifier).

[PC01] Error excessive alarm level

Set the error excessive alarm level by the servo motor rotation amount.

[PC02] Electromagnetic brake sequence output

This is used to set the delay time between MBR (Electromagnetic brake interlock) and the base drive circuit is shut-off.

[PC03] Encoder output pulse selection

This is used to select the encoder pulse direction and encoder output pulse setting.

0 □ □ □ H

- Encoder output pulse phase selection
- Encoder output pulse setting selection
- Selection of the encoders for encoder output pulse

[PC04] Function selection C-1

Select the serial encoder cable to be used.

□ 0 0 0 H

- Encoder cable communication method selection

[PC05] Function selection C-2

Set the motor-less operation and "Error excessive warning." The motor-less operation cannot be used in the linear servo motor control mode, fully closed loop control mode, or DD motor control mode.

□ 0 0 □ H

- Motor-less operation selection
- [AL. 9B Error excessive warning] selection*1

*1. The setting of this digit is used by servo amplifier with software version B4 or later.

[PC06] Function selection C-3

Select units for error excessive alarm level setting with "[PC01] Error excessive alarm level" and for error excessive warning level setting with "[PC38] Error excessive warning level".
The parameter is not available in the speed control mode and torque control mode.

□ 0 0 0 H

- Error excessive alarm/error excessive warning level unit selection

[PC07] Zero speed

Used to set the output range of ZSP (Zero speed detection).
ZSP (Zero speed detection) has hysteresis of 20 r/min or 20 mm/s.

[PC08] Overspeed alarm detection level

This is used to set an overspeed alarm detection level.

[PC09, PC10] Analog monitor 1/2 output

Select a signal to output to MO1/2 (Analog monitor 1/2).

0 0 ☐ ☐ H

Analog monitor 1/2 output selection

PRECAUTIONS

When this parameter is set to Servo motor-side droop pulses or Load-side droop pulses, the encoder pulse unit will be used.

[PC11, PC12] Analog monitor 1/2 offset

This is used to set the offset voltage of MO1/2 (Analog monitor 1/2).

[PC13, PC14] Analog monitor - Feedback position output standard data - Low/High

Set a monitor output standard position (lower 4 digits/higher 4 digits) for the feedback position for when selecting "Feedback position" for MO1 (Analog monitor 1) and MO2 (Analog monitor 2).

[PC17] Function selection C-4

This is used to select a home position setting condition.

0 0 ☐ ☐ H

Selection of home position setting condition

Linear encoder multipoint Z-phase input function selection*1

*1. This parameter setting is used with software version A5 or later.

[PC18] Function selection C-5

This is used to select an occurring condition of [AL. E9 Main circuit off warning].

☐ 0 0 0 H

[AL. E9 Main circuit off warning] selection

[PC20] Function selection C-7

This is used to select a detection method of [AL. 10 Undervoltage].

0 ☐ 0 ☐ H

[AL. 10 Undervoltage] detection method selection

Undervoltage alarm selection

[PC21] Alarm history clear

Used to clear the alarm history.

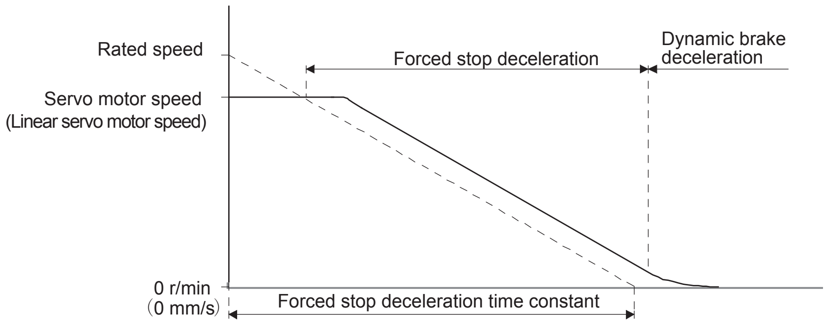
0 0 0 ☐ H

Alarm history clear selection

[PC24] Forced stop deceleration time constant

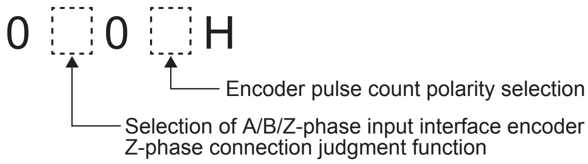
This is used to set deceleration time constant when you use the forced stop deceleration function.

Set the time per ms from the rated speed to 0 r/min or 0 mm/s.



[PC27] Function selection C-9

This is used to select a polarity of the linear encoder or load-side encoder.



[PC29] Function selection C-B

This is used to select the POL reflection at torque control.

[PC31] Vertical axis freefall prevention compensation amount

Set the compensation amount of the vertical axis freefall prevention function.

Set it per servo motor rotation amount or linear servo motor travel distance.

When a positive value is set, compensation is performed to the address increasing direction.

When a negative value is set, compensation is performed to the address decreasing direction.

The vertical axis freefall prevention function is performed when all of the following conditions are met.

1) Position control mode
2) The value of the parameter is other than "0".
3) The forced stop deceleration function is enabled.
4) Alarm occurs or EM2 turns off when the (linear) servo motor speed is zero speed or less.
5) MBR (Electromagnetic brake interlock) was enabled in [PD07] to [PD09] Output device selection 1 to 3, and the base circuit shut-off delay time was set in "[PC02] Electromagnetic brake sequence output."

[PC38] Error excessive warning level

Set an error excessive warning level.

This parameter setting is used with software version B4 or later.

4.8.4 I/O setting

(The device cannot be changed while the programmable controllers is in the ready state.)

<table>
<tr><th>Parameters</th><th colspan="2">Item</th><th>Setting range</th><th>Default value</th></tr>
<tr><td rowspan="2">[PD02]</td><td rowspan="2">Input signal automatic on selection 2[*1]</td><td>FLS (Upper stroke limit) selection</td><td>0: Disable
1: Enable</td><td rowspan="2">0H[*2]</td></tr>
<tr><td>RLS (Lower stroke limit) selection</td><td>0: Disable
1: Enable</td></tr>
<tr><td>[PD07]</td><td colspan="2">Output device selection 1[*1]</td><td>00H: Always off
02H: RD (Ready)
03H: ALM (Malfunction)
04H: INP (In-position)
05H: MBR (Electromagnetic brake interlock)
06H: DB (Dynamic brake interlock)
07H: TLC (Limiting torque)
08H: WNG (Warning)
09H: BWNG (Battery warning)
0AH: SA (Speed reached)
0CH: ZSP (Zero speed detection)
0FH: CDPS (Variable gain selection)
10H: CLDS (During fully closed loop control)
11H: ABSV (Absolute position undetermined)
17H: MTTR (During tough drive)</td><td>05H</td></tr>
<tr><td>[PD08]</td><td colspan="2">Output device selection 2[*1]</td><td>00H: Always off
02H: RD (Ready)
03H: ALM (Malfunction)
04H: INP (In-position)
05H: MBR (Electromagnetic brake interlock)
06H: DB (Dynamic brake interlock)
07H: TLC (Limiting torque)
08H: WNG (Warning)
09H: BWNG (Battery warning)
0AH: SA (Speed reached)
0CH: ZSP (Zero speed detection)
0FH: CDPS (Variable gain selection)
10H: CLDS (During fully closed loop control)
11H: ABSV (Absolute position undetermined)
17H: MTTR (During tough drive)</td><td>04H</td></tr>
<tr><td>[PD09]</td><td colspan="2">Output device selection 3[*1]</td><td>00H: Always off
02H: RD (Ready)
03H: ALM (Malfunction)
04H: INP (In-position)
05H: MBR (Electromagnetic brake interlock)
06H: DB (Dynamic brake interlock)
07H: TLC (Limiting torque)
08H: WNG (Warning)
09H: BWNG (Battery warning)
0AH: SA (Speed reached)
0CH: ZSP (Zero speed detection)
0FH: CDPS (Variable gain selection)
10H: CLDS (During fully closed loop control)
11H: ABSV (Absolute position undetermined)
17H: MTTR (During tough drive)</td><td>03H</td></tr>
</table>

Parameters	Item		Setting range	Default value
[PD11]	Input filter setting*1		0: None 1: 0.888 [ms] 2: 1.777 [ms] 3: 2.666 [ms] 4: 3.555 [ms]	4
[PD12]	Function selection D-1*1		0: Enable 1: Disable	0
[PD13]	Function selection D-2*1		0: Droop pulses are within the in-position range. 1: The command pulse frequency is 0, and droop pulses are within the in-position range.	0
[PD14]	Function selection D-3*1		0: Off 1: On	0
[PD15]	Driver communication setting*1	Master axis operation selection	0: Disabled (not using master-slave operation function) 1: Enabled (this servo amplifier: master axis)	0
		Slave axis operation selection	0: Disabled (not using master-slave operation function) 1: Enabled (this servo amplifier: slave axis)	0
[PD16]	Driver communication setting - Master - Transmit data selection 1*1		00H: Disabled 38H: Torque command	00H
[PD17]	Driver communication setting - Master - Transmit data selection 2*1		00H: Disabled 3AH: Speed limit command	00H
[PD20]	Driver communication setting - Slave - Master axis No. selection 1*1		0 to 32	0
[PD30]	Master-slave operation - Torque command coefficient on slave		0 to 500 [%]	0
[PD31]	Master-slave operation - Speed limit coefficient on slave		0 to 500 [%]	0
[PD32]	Master-slave operation - Speed limit adjusted value on slave		0 to 32767 [r/min]	0

*1. The parameters will be enabled by once turning off the servo amplifier power supply and reapplying the power or resetting the controller after changing the parameters (transmitting the parameters from RD77MS to the servo amplifier).

*2. The values shown in the Setting range column are binary values. Convert the set values to hexadecimal. HEX: 0 to 3 = BIN: 00□■ (■: FLS (upper stroke limit) selection, □: RLS (lower stroke limit) selection)

[PD02] Input signal automatic on selection 2

0 0 0 □ H

FLS (Upper stroke limit) selection, RLS (Lower stroke limit) selection

[PD07] to [PD09] Output signal device selection 1/2/3

You can assign any output device to the connector*1 of the servo amplifier.

*1. Output signal device selection 1: CN3-13 pin
Output signal device selection 2: CN3-9 pin
Output signal device selection 3: CN3-15 pin

0 0 ☐ ☐ H

Output signal device setting

[PD11] Input filter setting

Select the input filter.

0 0 0 ☐ H

Input signal filter selection

[PD12] Function selection D-1

☐ 0 0 0 H

Servo motor thermistor enabled/disabled selection

For servo motors without thermistor, the setting will be disabled.
This parameter setting is used with software version A5 or later.

[PD13] Function selection D-2

Select the INP (In-position) on condition.

0 ☐ 0 0 H

INP (In-position) on condition selection

This parameter is supported with software version B4 or later.

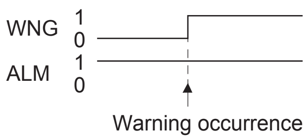
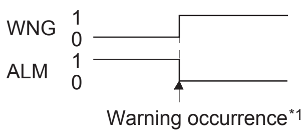
[PD14] Function selection D-3

Select WNG (Warning) and ALM (Malfunction) output status at warning occurrence.

0 0 ☐ 0 H

Selection of output device at warning occurrence

Servo amplifier output

Setting value	Device status
0	
1	

*1. Although ALM is turned off upon occurrence of the warning, the forced stop deceleration is performed.

[PD15] Driver communication setting

This parameter is used to select master/slave axis for the driver communication.

```
0 0 [ ][ ] H
     |  |
     |  └── Master axis operation selection
     └───── Slave axis operation selection
```

When Slave axis operation selection has been set to “1: Enabled,” the following parameters will be enabled.

- "[PD20] Driver communication setting - Slave - Master axis No. selection 1"
- "[PD30] Master-slave operation - Torque command coefficient on slave"
- "[PD31] Master-slave operation - Speed limit coefficient on slave"
- "[PD32] Master-slave operation - Speed limit adjusted value on slave"

This parameter setting is used with software version A8 or later.

[PD16] Driver communication setting - Master - Transmit data selection 1

This parameter is used to select transmit data from master axis to slave axis.

```
0 0 [ ][ ] H
     └┬─┘
      └──── Transmission data selection
```

This parameter setting is used with software version A8 or later.

[PD20] Driver communication setting - Slave - Master axis No. selection 1

Select the axis number of the servo amplifier that is the master of the slave axis.

This parameter setting is used with software version A8 or later.

[PD30] Master-slave operation - Torque command coefficient on slave

This parameter is used to set a internal torque command coefficient to torque command value received from master axis.

This parameter setting is used with software version A8 or later.

[PD31] Master-slave operation - Speed limit coefficient on slave

This parameter is used to set a internal speed limit value coefficient to speed limit command value received from master axis.

This parameter setting is used with software version A8 or later.

[PD32] Master-slave operation - Speed limit adjusted value on slave

This parameter is used to set a minimum value for internal speed limit value. This parameter ensures torque control range at low speed driving (avoid area likely to reach speed limit).

This parameter setting is used with software version A8 or later.

4.8.5 Extension setting 2

(The device cannot be changed while the programmable controllers is in the ready state.)

<table>
<tr><th>Parameters</th><th colspan="2">Item</th><th>Setting range</th><th>Default value</th></tr>
<tr><td>[PE01]</td><td colspan="2">Fully closed loop function selection 1*1</td><td>0: Always enabled
1: Switching with the control command of controller (switching semi./full.)</td><td>0</td></tr>
<tr><td rowspan="3">[PE03]</td><td rowspan="3">Fully closed loop function selection 2*2</td><td>Fully closed loop control error detection function selection</td><td>0: Disable
1: Speed deviation error detection
2: Position deviation error detection
3: Speed deviation error/position deviation error detection</td><td>3</td></tr>
<tr><td>Position deviation error detection system selection</td><td>0: Continuous detection system
1: Detection system at stop (detected with command set to "0")</td><td>0</td></tr>
<tr><td>Fully closed loop control error reset selection</td><td>0: Reset disabled (reset by powering off/on enabled)
1: Reset enabled</td><td>0</td></tr>
<tr><td>[PE04]</td><td colspan="2">Fully closed loop control - Feedback pulse electronic gear 1 - Numerator*1</td><td>1 to 65535</td><td>1</td></tr>
<tr><td>[PE05]</td><td colspan="2">Fully closed loop control - Feedback pulse electronic gear 1 - Denominator*1</td><td>1 to 65535</td><td>1</td></tr>
<tr><td>[PE06]</td><td colspan="2">Fully closed loop control - Speed deviation error detection level</td><td>1 to 50000 [r/min]</td><td>400</td></tr>
<tr><td>[PE07]</td><td colspan="2">Fully closed loop control - Position deviation error detection level</td><td>1 to 20000 [kpulse]</td><td>100</td></tr>
<tr><td>[PE08]</td><td colspan="2">Fully closed loop dual feedback filter</td><td>0 to 4500 [rad/s]</td><td>10</td></tr>
<tr><td rowspan="3">[PE10]</td><td rowspan="3">Fully closed loop function selection 3</td><td>Fully closed loop control - Position deviation error detection level - Unit selection</td><td>0: 1 kpulse unit
1: 1 pulse unit</td><td>0</td></tr>
<tr><td>Droop pulse monitor selection for controller display</td><td>0: Servo motor encoder
1: Load-side encoder
2: Deviation between the servo motor and load side</td><td>0</td></tr>
<tr><td>Cumulative feedback pulses monitor selection for controller display</td><td>0: Servo motor encoder
1: Load-side encoder</td><td>0</td></tr>
<tr><td>[PE34]</td><td colspan="2">Fully closed loop control - Feedback pulse electronic gear 2 - Numerator*1</td><td>1 to 65535</td><td>1</td></tr>
<tr><td>[PE35]</td><td colspan="2">Fully closed loop control - Feedback pulse electronic gear 2 - Denominator*1</td><td>1 to 65535</td><td>1</td></tr>
<tr><td>[PE41]</td><td colspan="2">Function selection E-3</td><td>0: Disable
1: Enable</td><td>0</td></tr>
<tr><td>[PE44]</td><td colspan="2">Lost motion compensation positive-side compensation value selection</td><td>0 to 30000 [0.01 %]</td><td>0</td></tr>
<tr><td>[PE45]</td><td colspan="2">Lost motion compensation negative-side compensation value selection</td><td>0 to 30000 [0.01 %]</td><td>0</td></tr>
<tr><td>[PE46]</td><td colspan="2">Lost motion filter setting</td><td>0 to 30000 [0.1 ms]</td><td>0</td></tr>
<tr><td>[PE47]</td><td colspan="2">Torque offset</td><td>-10000 to 10000 [0.01 %]</td><td>0</td></tr>
</table>

Parameters	Item		Setting range	Default value
[PE48]	Lost motion compensation function selection*2	Lost motion compensation selection	0: Lost motion compensation disabled 1: Lost motion compensation enabled	0
		Unit setting of lost motion compensation non-sensitive band	0: 1 pulse unit 1: 1 kpulse unit	0
[PE49]	Lost motion compensation timing		0 to 30000 [0.1 ms]	0
[PE50]	Lost motion compensation non-sensitive band		0 to 65535 [pulse]/[kpulse]	0

*1. The parameters will be enabled by once turning off the servo amplifier power supply and reapplying the power after changing the parameters (transmitting the parameters from RD77MS to the servo amplifier).

*2. The parameters will be enabled by once turning off the servo amplifier power supply and reapplying the power or resetting the controller after changing the parameters (transmitting the parameters from RD77MS to the servo amplifier).

[PE01] Fully closed loop function selection 1

0 0 0 □ H

Fully closed loop function selection

To enable the digit, select "1: Fully closed loop control mode" of "[PA01] Operation mode selection."

[PE03] Fully closed loop function selection 2

□ 0 □ □ H

Fully closed loop control error detection function selection

Position deviation error detection system selection

Fully closed loop control error reset selection

[PE04, PE34] Fully closed loop control - Feedback pulse electronic gear 1/2 - Numerator

This is used to set a numerator of electronic gear for the servo motor encoder pulse at the fully closed loop control.

Set the electronic gear so that the number of servo motor encoder pulses for one servo motor revolution is converted to the resolution of the load-side encoder.

[PE05, PE35] Fully closed loop control - Feedback pulse electronic gear 1/2 - Denominator

This is used to set a denominator of electronic gear for the servo motor encoder pulse at the fully closed loop control.

Set the electronic gear so that the number of servo motor encoder pulses for one servo motor revolution is converted to the resolution of the load-side encoder.

[PE06] Fully closed loop control - Speed deviation error detection level

This is used to set [AL. 42.9 Fully closed loop control error by speed deviation] of the fully closed loop control error detection.

[PE07] Fully closed loop control - Position deviation error detection level

This is used to set [AL. 42.8 Fully closed loop control error by position deviation] of the fully closed loop control error detection.

[PE08] Fully closed loop dual feedback filter

This is used to set a dual feedback filter band.

[PE10] Fully closed loop function selection 3

□ □ □ 0 H

Fully closed loop control - Position deviation error detection level - unit selection

Droop pulse monitor selection for controller display

Cumulative feedback pulses monitor selection for controller display

[PE41] Function selection E-3

0 0 0 □ H

Robust filter selection

[PE44] Lost motion compensation positive-side compensation value selection

Set the lost motion compensation for when reverse rotation (CW) switches to forward rotation (CCW) in increments of 0.01 % assuming the rated torque as 100 %.
This parameter is supported with software version B4 or later.

[PE45] Lost motion compensation negative-side compensation value selection

Set the lost motion compensation for when forward rotation (CCW) switches to reverse rotation (CW) in increments of 0.01 % assuming the rated torque as 100 %.
This parameter is supported with software version B4 or later.

[PE47] Torque offset

Set this when canceling unbalanced torque of vertical axis. Set this assuming the rated torque of the servo motor as 100 %.
This parameter is supported with software version B4 or later.

[PE48] Lost motion compensation function selection

Select the lost motion compensation function.

0 0 □ □ H

Lost motion compensation selection

Unit setting of lost motion compensation non-sensitive band

This parameter is supported with software version B4 or later.

[PE49] Lost motion compensation timing

Set the lost motion compensation timing in increments of 0.1 ms.

You can delay the timing to perform the lost motion compensation for the set time.

This parameter is supported with software version B4 or later.

[PE50] Lost motion compensation non-sensitive band

Set the lost motion compensation non-sensitive band. Set the parameter per encoder unit.

This parameter is supported with software version B4 or later.

4.8.6 Extension setting 3

(The device cannot be changed while the programmable controllers is in the ready state.)

Parameters	Item	Setting range	Default value
[PF06]	Function selection F-5*1	0: Automatic (enabled only for specified servo motors) 2: Disable	0
[PF12]	Electronic dynamic brake operating time	0 to 10000 [ms]	2000
[PF18]	STO diagnosis error detection time*2	0 to 60 [s]	0
[PF21]	Drive recorder switching time setting	-1 to 32767 [s]	0
[PF23]	Vibration tough drive - Oscillation detection level	0 to 100 [%]	50
[PF24]	Vibration tough drive function selection*1	0: [AL. 54 Oscillation detection] will occur at oscillation detection. 1: [AL. F3.1 Oscillation detection warning] will occur at oscillation detection. 2: Oscillation detection function disabled	0
[PF25]	SEMI-F47 function - Instantaneous power failure detection time	30 to 500 [ms]	200
[PF31]	Machine diagnosis function - Friction judgment speed	0 to permissible speed [r/min]/[mm/s]	0

*1. The parameters will be enabled by once turning off the servo amplifier power supply and reapplying the power or resetting the controller after changing the parameters (transmitting the parameters from RD77MS to the servo amplifier).

*2. The parameters will be enabled by once turning off the servo amplifier power supply and reapplying the power after changing the parameters (transmitting the parameters from RD77MS to the servo amplifier).

[PF06] Function selection F-5

0 0 0 ☐ H
Electronic dynamic brake selection

[PF12] Electronic dynamic brake operating time

Set an operating time for the electronic dynamic brake.

[PF18] STO diagnosis error detection time

Set the time from when an error occurs in the STO input signal or STO circuit until the detection of [AL. 68.1 Mismatched STO signal error].
This parameter is supported with software version C1 or later.

[PF21] Drive recorder switching time setting

This is used to set a drive recorder switching time.
When a USB communication is cut during using a graph function, the function will be changed to the drive recorder function after the setting time of this parameter.

[PF23] Vibration tough drive - Oscillation detection level

This is used to set a filter readjustment sensitivity of "[PB13] Machine resonance suppression filter 1" and "[PB15] Machine resonance suppression filter 2" while the vibration tough drive is enabled.

[PF24] Vibration tough drive function selection

Select alarm or warning when a oscillation continues at a filter readjustment sensitivity level of "[PF23] Vibration tough drive - Oscillation detection level".

0 0 0 ☐ H
Oscillation detection alarm selection

[PF25] SEMI-F47 function - Instantaneous power failure detection time

Set the time of the [AL. 10.1 Voltage drop in the control circuit power] occurrence.

[PF31] Machine diagnosis function - Friction judgment speed

Set a (linear) servo motor speed to divide a friction estimation area into high and low for the friction estimation process of the machine diagnosis.

4.9 Positioning Data

(The data can be changed while the programmable controllers is in the ready state.)

Para-meters		Unit / Item	Setting range: mm	inch	degree	pulse	Default value
[Da.1]	Positioning identifier	Operation pattern	0: Positioning complete 1: Continuous positioning control 3: Continuous path control				0
[Da.2]	Positioning identifier	Control method	01H: ABS Linear 1 [1-axis linear control (ABS)] 02H: INC Linear 1 [1-axis linear control (INC)] 03H: Fixed-feed 1 [1-axis fixed-feed control] 04H: FWD V1 [1-axis speed control (forward rotation)] 05H: RVS V1 [1-axis speed control (reverse rotation)] 06H: FWD V/P [Speed-position switching control (forward rotation)] 07H: RVS V/P [Speed-position switching control (reverse rotation)] 08H: FWD P/V [Position, speed switching control (forward rotation)] 09H: RVS P/V [Position, speed switching control (reverse rotation)] 0AH: ABS Linear 2 [2-axis linear interpolation control (ABS)] 0BH: INC Linear 2 [2-axis linear interpolation control (INC)] 0CH: Fixed-feed 2 [fixed-feed control by 2-axis linear interpolation] 0DH: ABS ArcMP [2-axis circular interpolation control with sub point designation (ABS)] 0EH: INC ArcMP [2-axis circular interpolation control with sub point designation (INC)] 0FH: ABS ArcRGT [2-axis circular interpolation control with center point designation (ABS, CW)] 10H: ABS ArcLFT [2-axis circular interpolation control with center point designation (ABS, CCW)] 11H: INC ArcRGT [2-axis circular interpolation control with center point designation (INC, CW)] 12H: INC ArcLFT [2-axis circular interpolation control with center point designation (INC, CCW)] 13H: FWD V2 [2-axis speed control (forward rotation)] 14H: RVS V2 [2-axis speed control (reverse rotation)] 15H: ABS Linear 3 [3-axis linear interpolation control (ABS)] 16H: INC Linear 3 [3-axis linear interpolation control (INC)] 17H: Fixed-feed 3 [fixed-feed control by 3-axis linear interpolation] 18H: FWD V3 [3-axis speed control (forward rotation)] 19H: RVS V3 [3-axis speed control (reverse rotation)] 1AH: ABS Linear 4 [4-axis linear interpolation control (ABS)] 1BH: INC Linear 4 [4-axis linear interpolation control (INC)] 1CH: Fixed-feed 4 [fixed-feed control by 4-axis linear interpolation] 1DH: FWD V4 [4-axis speed control (forward rotation)] 1EH: RVS V4 [4-axis speed control (reverse rotation)] 20H: Helical interpolation control with sub point specified (ABS) [3-axis helical interpolation control with sub point designation (ABS)] 21H: Helical interpolation control with sub point specified (INC) [3-axis helical interpolation control with sub point designation (INC)] 22H: Helical interpolation control with center point specified (ABS, CW) [3-axis helical interpolation control with center point designation (ABS, CW)] 23H: Helical interpolation control with center point specified (ABS, CCW) [3-axis helical interpolation control with center point designation (ABS, CCW)] 24H: Helical interpolation control with center point specified (INC, CW) [3-axis helical interpolation control with center point designation (INC, CW)] 25H: Helical interpolation control with center point specified (INC, CCW) [3-axis helical interpolation control with center point designation (INC, CCW)] 80H: NOP [NOP instruction] 81H: Address CHG [current value changing] 82H: JUMP [JUMP instruction] 83H: LOOP (number of times) [LOOP to head of LEND] 84H: LEND [LOOP to tail of LEND]				00H

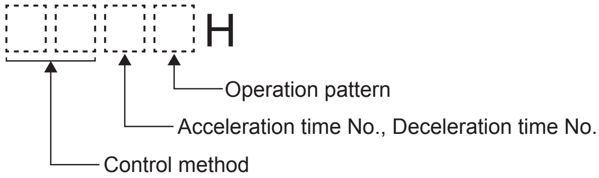
Para-meters	Unit / Item		Setting range: mm	Setting range: inch	Setting range: degree	Setting range: pulse	Default value
[Da.3]	Positioning identifier	Acceleration time No.	00: [Pr.9] Acceleration time 0 01: [Pr.25] Acceleration time 1 10: [Pr.26] Acceleration time 2 11: [Pr.27] Acceleration time 3				0H*1
[Da.4]	Positioning identifier	Deceleration time No.	00: [Pr.10] Deceleration time 0 01: [Pr.28] Deceleration time 1 10: [Pr.29] Deceleration time 2 11: [Pr.30] Deceleration time 3				0H*1
[Da.6]	Positioning address/ movement amount	Absolute (ABS) system, current value changing	-214748364.8 to 214748364.7 µm	-21474.83648 to 21474.83647 inch	0 to 359.99999 degree	-2147483648 to 2147483647 pulse	0
		Incremental (INC) system, fixed-feed 1, fixed-feed 2, fixed-feed 3, fixed-feed 4	-214748364.8 to 214748364.7 µm	-21474.83648 to 21474.83647 inch	-21474.83648 to 21474.83647 degree	-2147483648 to 2147483647 pulse	0
		For speed-position switching control or position-speed switching control	0 to 214748364.7 µm	0 to 21474.83647 inch	*2	0 to 2147483647 pulse	0
[Da.7]	Arc address		-214748364.8 to 214748364.7 µm	-21474.83648 to 21474.83647 inch	—	-2147483648 to 2147483647 pulse	0
[Da.8]	Command speed		0.01 to 20000000.00 mm/min	0.001 to 2000000.000 inch/min	0.001 to 2000000.000 degree/min	1 to 1000000 pulse/s	0
			-1: Current speed (Speed set for previous positioning data No.)				
[Da.9]	Dwell time/JUMP destination positioning data No.		JUMP instruction (82H): [Positioning data No.] 1 to 600 Other than JUMP instruction: [Dwell time] 0 to 65535 (ms)				0
[Da.10]	M code/Condition data No./ Number of LOOP to LEND repetitions/Number of pitches		JUMP instruction (82H): [Condition data No.] 0 to 10 Helical interpolation (20H to 25H): [Number of pitches] 0 to 999 LOOP (83H): [Number of repetitions] 1 to 65535 Other than above instructions: [M code] 1 to 65535				0
[Da.20]	Axis to be interpolated	Axis to be interpolated No.1	00H: Axis 1 selected 01H: Axis 2 selected 02H: Axis 3 selected 03H: Axis 4 selected 04H: Axis 5 selected 05H: Axis 6 selected 06H: Axis 7 selected 07H: Axis 8 selected 08H: Axis 9 selected 09H: Axis 10 selected 0AH: Axis 11 selected 0BH: Axis 12 selected 0CH: Axis 13 selected 0DH: Axis 14 selected 0EH: Axis 15 selected 0FH: Axis 16 selected				00H
[Da.21]	Axis to be interpolated	Axis to be interpolated No.2					
[Da.22]	Axis to be interpolated	Axis to be interpolated No.3					

*1. The values shown in the Setting range column are binary values. Convert the set values to hexadecimal.
HEX: 0 to F = BIN: □□■■ (■■: acceleration time No., □□: deceleration time No.)

*2. In ABS mode: 0 to 359.99999 degrees
In INC mode: 0 to 21474.83647 degrees

[Da.1 to Da.4] Positioning identifier

Set the operation pattern, control method, acceleration time No. and deceleration time number.



[Da.1] Operation pattern

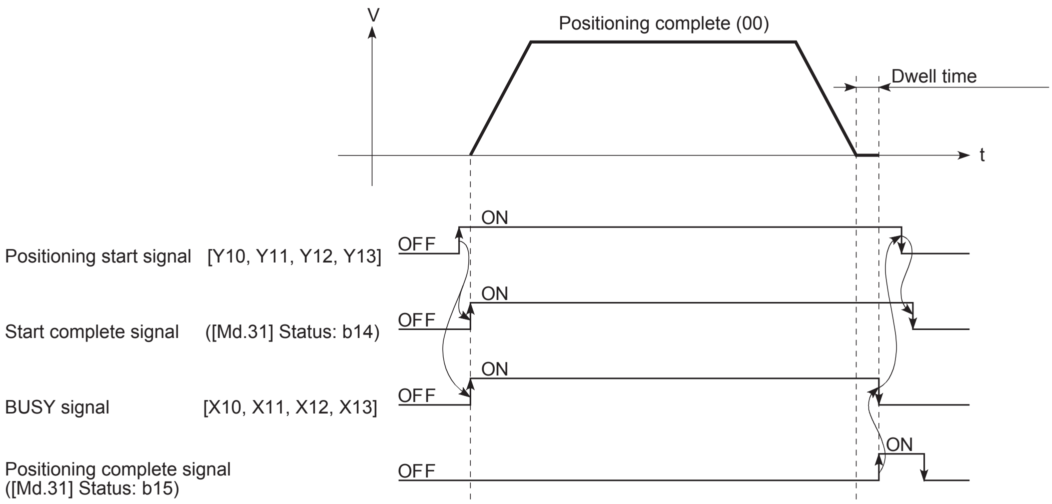
The operation pattern designates whether positioning of a certain data No. is to be ended with just that data, or whether the positioning is to be carried out in succession depending on the next data No. .

Operation pattern	Details
Positioning complete	Set to execute positioning to the designated address, and then complete positioning.
Continuous positioning control	Positioning is carried out successively in order of data Nos. with one start signal. The operation halts at each position indicated by a positioning data.
Continuous path control	Positioning is carried out successively in order of data Nos. with one start signal. The operation does not stop at each positioning data.

(1) Single positioning control (Positioning complete)

• • • This control is set when executing only one designated data item of positioning. If a dwell time is designated, the positioning completes after the designated time elapses.

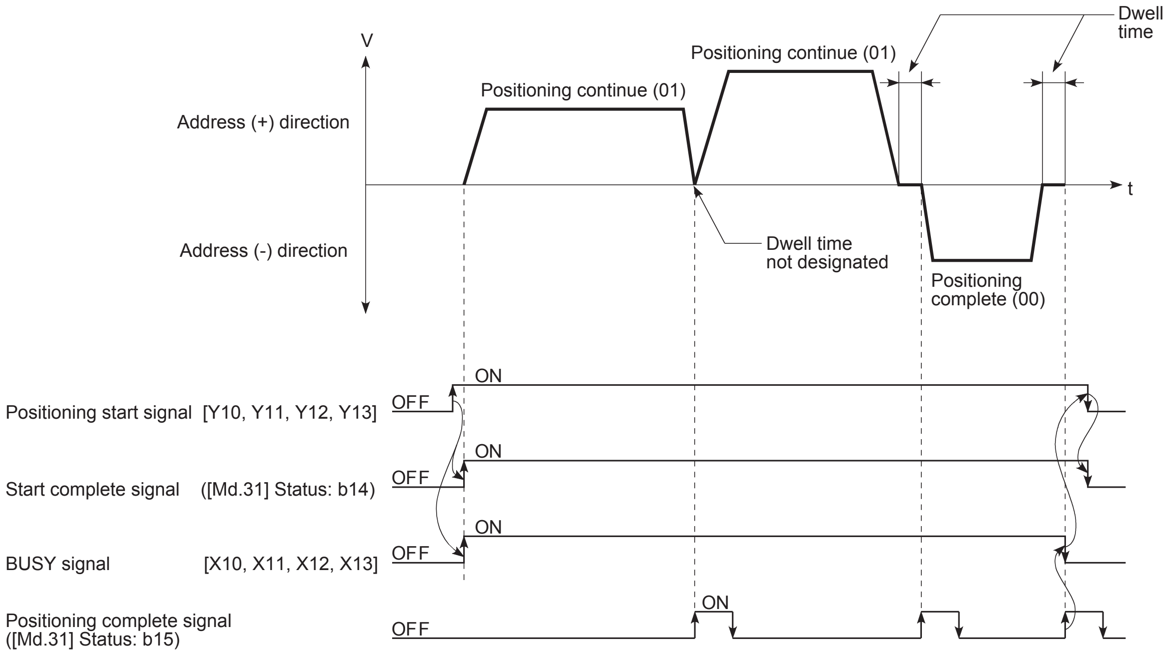
[4-axis module operation example]



(2) Continuous positioning control

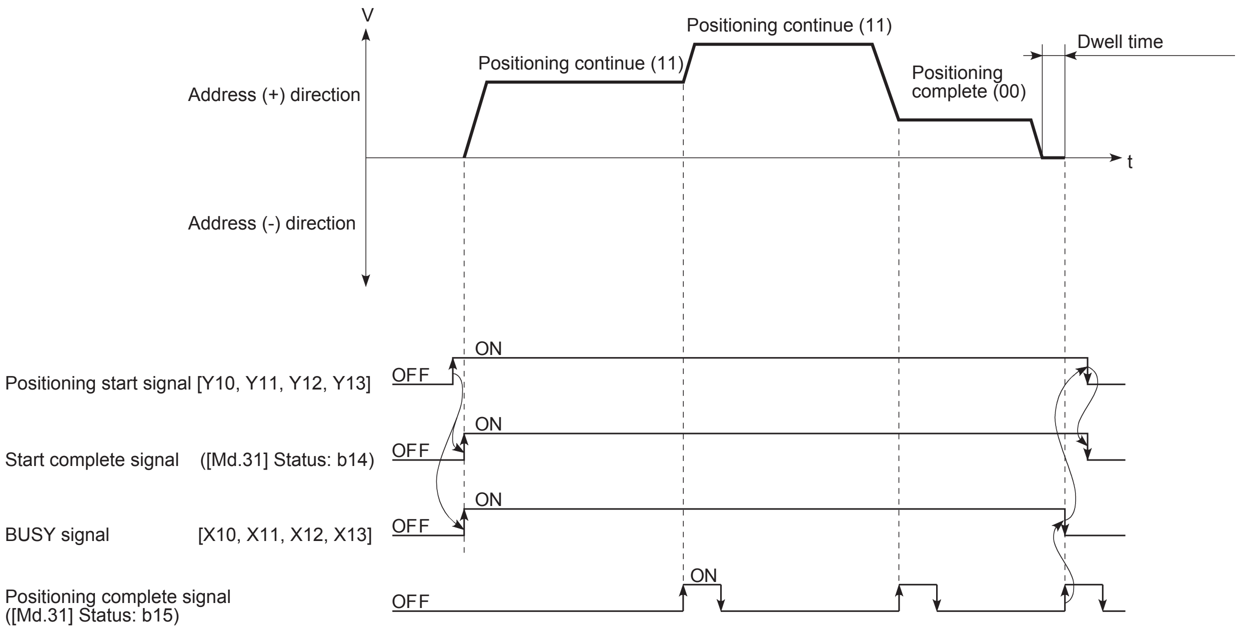
• • • The machine always automatically decelerates each time the positioning is completed. Acceleration is then carried out after the simple motion module command speed reaches 0 to carry out the next positioning data operation. If a dwell time is designated, the acceleration is carried out after the designated time elapses.

[4-axis module operation example]



(3) Continuous path control

• • • The speed is changed without deceleration stop between the command speed of the "positioning data No. currently being executed" and the speed of the "positioning data No. to carry out the next operation". The speed is not changed if the current speed and the next speed are equal. Dwell time is ignored, even if it is set.



[Da.2] Control method

Set the "control method" for carrying out positioning control.

(1) When "JUMP instruction" is set for the control method, the "[Da.9] Dwell time/JUMP destination positioning data No." and "[Da.10] M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches" setting details will differ.

(2) In case you selected "LOOP" as the control method, the "[Da.10] M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches" should be set differently from other cases.

(3) For the details of the control methods, refer to Section 4.10.

(4) If "2: degree" is set for "[Pr.1] Unit setting", 2-axis circular interpolation control and 3-axis helical interpolation control cannot be carried out. The error "Circular interpolation not possible" (error code: 199FH) will occur when executed.

[Da.3] Acceleration time No.

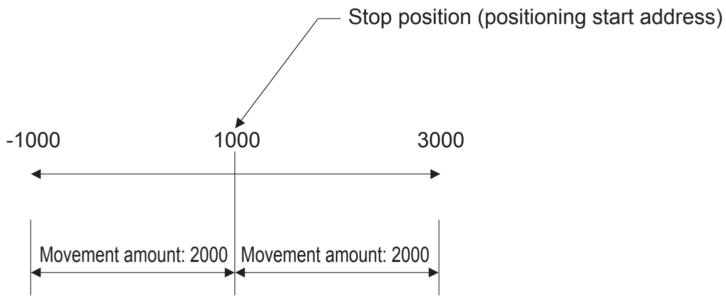
Set the acceleration time ("[Pr.9, Pr.25 to Pr.27] acceleration time 0 to 3") to use during positioning.

[Da.4] Deceleration time No.

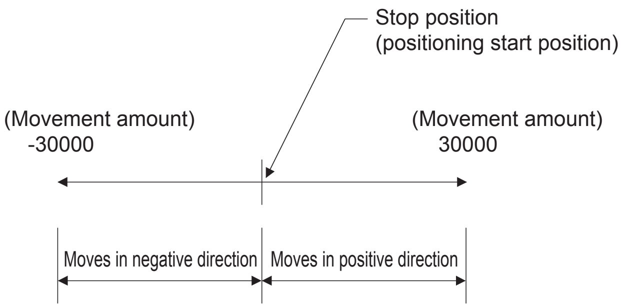
Set the deceleration time ("[Pr.10, Pr.28 to Pr.30] deceleration time 0 to 3") to use during positioning.

[Da.6] Positioning address/movement amount

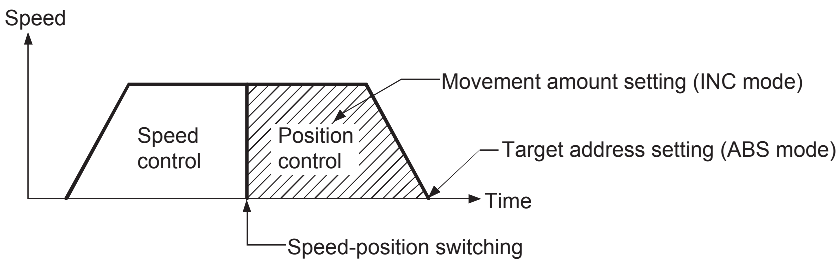
(a) Absolute (ABS) system, current value changing
The setting value (positioning address) for the ABS system and current value changing is set with an absolute address (address from home position).



(b) Incremental (INC) system, fixed-feed 1, fixed-feed 2, fixed-feed 3, fixed-feed 4
The setting value (movement amount) for the INC system is set as a movement amount with sign.
When movement amount is positive: Moves in the positive direction (address increment direction)
When movement amount is negative: Moves in the negative direction (address decrement direction)



(c) Speed-position switching control
- INC mode: Set the amount of movement after the switching from speed control to position control.
- ABS mode: Set the absolute address which will be the target value after speed control is switched to position control.
(The unit is "degree" only)

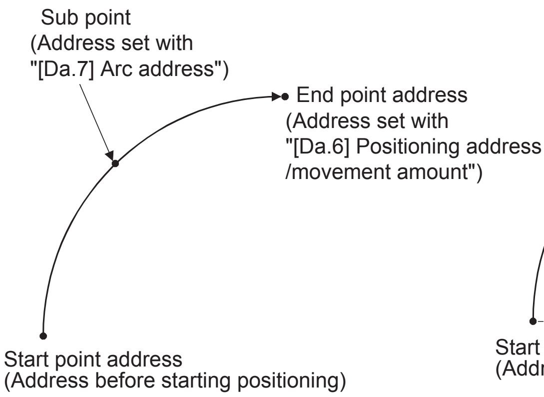


(d) Position-speed switching control
Set the amount of movement before the switching from position control to speed control.

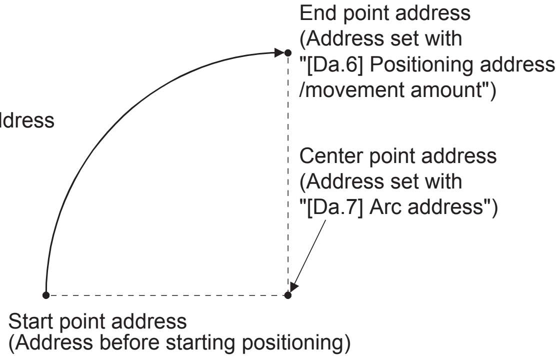
[Da.7] Arc address

The arc address is data required only when carrying out 2-axis circular interpolation control or 3-axis helical interpolation control.

- When carrying out circular interpolation with sub point designation, set the sub point (passing point) address as the arc address.
- When carrying out circular interpolation with center point designation, set the center point address of the arc as the arc address.



<Circular interpolation with sub point designation>



<Circular interpolation with center point designation>

[Da.8] Command speed

Set the command speed for positioning.

- If the set command speed exceeds "[Pr.8] Speed limit value", positioning will be carried out at the speed limit value.
- If "-1" is set for the command speed, the current speed (speed set for previous positioning data No.) will be used for positioning control. Use the current speed for uniform speed control, etc. If "-1" is set for continuing positioning data, and the speed is changed, the following speed will also change.
  Note that when starting positioning, if the "-1" speed is set for the positioning data that carries out positioning control first, the error "No command speed" (error code: 1A12H) will occur, and the positioning will not start.

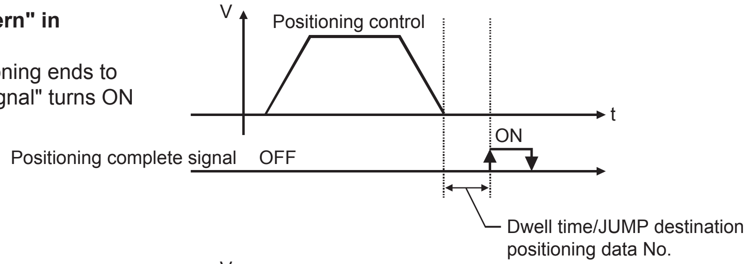
[Da.9] Dwell time/JUMP destination positioning data No.

Set the "dwell time" or "positioning data No." corresponding to the "[Da.2] Control method".

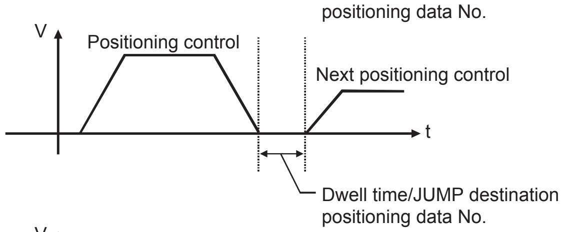
- When a method other than "JUMP instruction" is set for "[Da.2] Control method": Set the "dwell time".
- When "JUMP instruction" is set for "[Da.2] Control method": Set the "positioning data No." for the JUMP destination.

When the "dwell time" is set, the setting details of the "dwell time" will be as follows according to "[Da.1] Operation pattern".

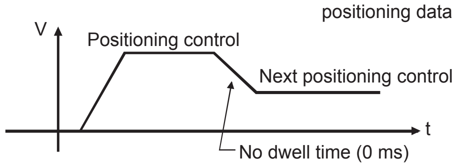
(1) When "[Da.1] Operation pattern" in "Positioning complete"
Set the time from when the positioning ends to when the "positioning complete signal" turns ON as the "dwell time".



(2) When "[Da.1] Operation pattern" is "Continuous positioning control"
Set the time from when positioning control ends to when the next positioning control starts as the "dwell time".



(3) When "[Da.1] Operation pattern" is "Continuous path control"
The setting value is irrelevant to the control.
(The "dwell time" is 0 ms.)



[Da.10] M code/Condition data No./No. of LOOP to LEND repetitions/No. of pitches

Set an "M code", a "condition data No.", the "Number of LOOP to LEND repetitions" or the "Number of pitches" depending on how the "[Da.2] Control method" is set.[*1]

*1. The condition data specifies the condition for the JUMP instruction to be executed. (A JUMP will take place when the condition is satisfied.)

(1) If a method other than "JUMP instruction", "LOOP", and "3-axis helical interpolation control" is selected as the "[Da.2] Control method"
Set an "M code".
If no "M code" needs to be output, set "0" (default value).

(2) If "JUMP instruction" or "LOOP" is selected as the "[Da.2] Control method"
Set the "condition data No." for JUMP.
- 0: Unconditional JUMP to the positioning data specified by "[Da.9] Dwell time/JUMP destination positioning data No.".
- 1 to 10: JUMP performed according to the condition data No. specified (a number between 1 and 10). Make sure that you specify the number of LOOP to LEND repetitions by a number other than "0". The error "Control method LOOP setting error" (error code: 1A33H) will occur if you specify "0".

(3) If "3-axis helical interpolation control" is selected as the "[Da.2] Control method"
Set the number of pitches for the linear interpolation axis. The rotation speed of the circular interpolation is set with the number of pitch.

4.10 Control Modes

This section explains the details of the positioning controls that can be selected by "[Da.2] Control method."
These methods correspond to the "major positioning control" functions.

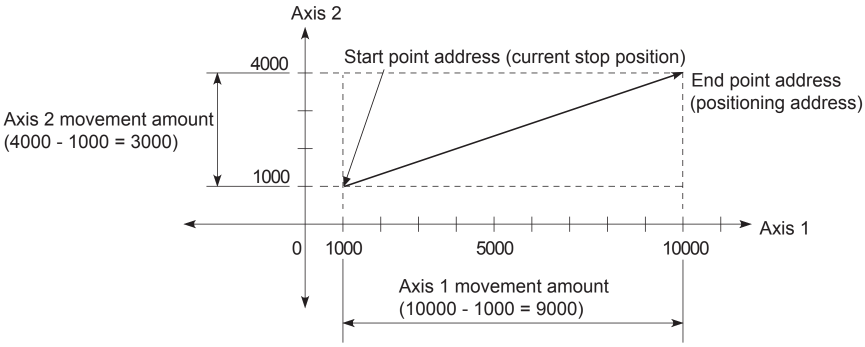
4.10.1 Linear control

ABS linear 1 to 4 (1-axis linear control and 2- to 4-axis linear interpolation controls)

The absolute 1-axis linear control and 2- to 4-axis linear interpolation controls are used for positioning from the current stop position (start point address) to the address (end point address) set in "[Da.6] Positioning address/movement amount."

Ex.) 2-axis linear interpolation control

When the start point address (current stop position) is (1000, 1000) and the end point address (positioning address) is (10000, 4000), positioning is carried out as follows.



When using the 1-axis linear control or one of the 2- to 4-axis linear interpolation controls (ABS linear 1 to 4), set the following parameters.

⊙: Always set, ○: Set as required, △: Setting restricted, -: Setting not required

Parameters	Setting item	Setting required/not required for the reference axis				Setting required/not required for the interpolation axis		
		ABS linear 1	ABS linear 2	ABS linear 3	ABS linear 4	ABS linear 2	ABS linear 3	ABS linear 4
[Da.1]	Operation pattern	⊙	⊙	⊙	⊙	-	-	-
[Da.2]	Control modes	ABS linear 1	ABS linear 2	ABS linear 3	ABS linear 4	-	-	-
[Da.3]	Acceleration time No.	○	○	○	○	-	-	-
[Da.4]	Deceleration time No.	○	○	○	○	-	-	-
[Da.6]	Positioning address/ movement amount	⊙	⊙	⊙	⊙	⊙	⊙	⊙
[Da.7]	Arc address	-	-	-	-	-	-	-
[Da.8]	Command speed	⊙	⊙	⊙	⊙	-	-	-
[Da.9]	Dwell time/JUMP destination positioning data No.	○	○	○	○	-	-	-
[Da.10]	M code/Condition data No./No. of LOOP to LEND repetitions/No. of pitches	○	○	○	○	-	-	-
[Da.20]	Axis to be interpolated No.1	-	⊙	⊙	⊙	-	-	-

Parameters	Setting item	Setting required/not required for the reference axis				Setting required/not required for the interpolation axis		
		ABS linear 1	ABS linear 2	ABS linear 3	ABS linear 4	ABS linear 2	ABS linear 3	ABS linear 4
[Da.21]	Axis to be interpolated No.2	-	-	⊙	⊙	-	-	-
[Da.22]	Axis to be interpolated No.3	-	-	-	⊙	-	-	-
[Da.27]	M code ON signal output timing	○	○	○	○	-	-	-
[Da.28]	ABS direction in degrees	○	○	○	○	-	-	-
[Da.29]	Interpolation speed designation method	△	△	△	△	-	-	-

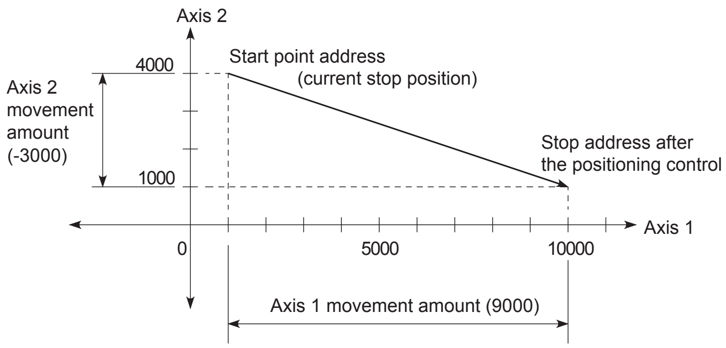
INC linear 1 to 4 (1-axis linear control, 2- to 4-axis linear interpolation controls)

The incremental 1-axis linear control and 2- to 4-axis linear interpolation controls are used for positioning from the current stop position (start point address) according to the movement amount set in "[Da.6] Positioning address/movement amount." The movement direction is determined by the sign of the movement amount.

- Positive movement amount: Positioning control to forward direction (Address increase direction)
- Negative movement amount: Positioning control to reverse direction (Address decrease direction)

Ex.) 2-axis linear interpolation control

When the axis 1 movement amount from the start point address is 9000 and the axis 2 movement amount from the start point address is -3000, positioning is as follows.



When using the 1-axis linear control or one of 2- to 4-axis linear interpolation controls (INC linear 1 to 4), set the following parameters.

⊙: Always set, ○: Set as required, △: Setting restricted, -: Setting not required

Parameters	Setting item	Setting required/not required for the reference axis				Setting required/not required for the interpolation axis		
		INC linear 1	INC linear 2	INC linear 3	INC linear 4	INC linear 2	INC linear 3	INC linear 4
[Da.1]	Operation pattern	⊙	⊙	⊙	⊙	-	-	-
[Da.2]	Control modes	INC linear 1	INC linear 2	INC linear 3	INC linear 4	-	-	-
[Da.3]	Acceleration time No.	○	○	○	○	-	-	-
[Da.4]	Deceleration time No.	○	○	○	○	-	-	-
[Da.6]	Positioning address/ movement amount	⊙	⊙	⊙	⊙	⊙	⊙	⊙
[Da.7]	Arc address	-	-	-	-	-	-	-
[Da.8]	Command speed	⊙	⊙	⊙	⊙	-	-	-
[Da.9]	Dwell time/JUMP destination positioning data No.	○	○	○	○	-	-	-
[Da.10]	M code/Condition data No./No. of LOOP to LEND repetitions/No. of pitches	○	○	○	○	-	-	-
[Da.20]	Axis to be interpolated No.1	-	⊙	⊙	⊙	-	-	-
[Da.21]	Axis to be interpolated No.2	-	-	⊙	⊙	-	-	-
[Da.22]	Axis to be interpolated No.3	-	-	-	⊙	-	-	-
[Da.27]	M code ON signal output timing	○	○	○	○	-	-	-
[Da.28]	ABS direction in degrees	○	○	○	○	-	-	-
[Da.29]	Interpolation speed designation method	△	△	△	△	-	-	-

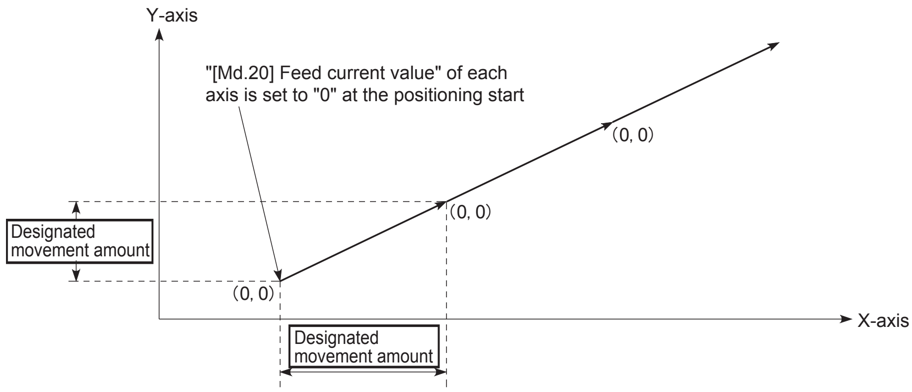
4.10.2 Fixed-feed control

Fixed-feed 1 to 4 (fixed-feed controls 1 to 4)

In fixed-feed control, the address ([Md.20] Feed current value) of the current stop position (start point address) is set to "0". Positioning is then carried out to a position at the end of the movement amount set in "[Da.6] Positioning address/movement amount". The movement direction is determined by the movement amount sign.

- Positive movement amount: Positioning control to forward direction (Address increase direction)
- Negative movement amount: Positioning control to reverse direction (Address decrease direction)

Ex.) 2-axis fixed-feed control



When using one of the fixed-feed controls 1 to 4 (fixed-feed 1 to 4), set the following parameters.

⊙: Always set, ○: Set as required, △: Setting restricted, -: Setting not required

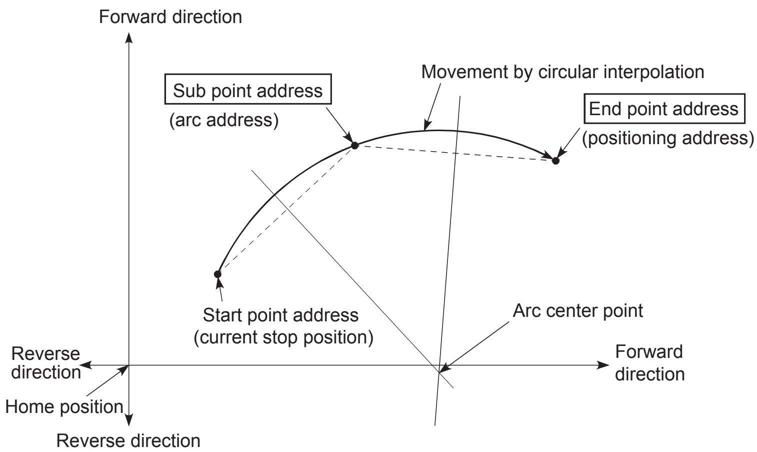
Parameters	Setting item	Setting required/not required for the reference axis				Setting required/not required for the interpolation axis		
		Fixed-feed 1	Fixed-feed 2	Fixed-feed 3	Fixed-feed 4	Fixed-feed 2	Fixed-feed 3	Fixed-feed 4
[Da.1]	Operation pattern	⊙	⊙	⊙	⊙	-	-	-
[Da.2]	Control modes	Fixed-feed 1	Fixed-feed 2	Fixed-feed 3	Fixed-feed 4	-	-	-
[Da.3]	Acceleration time No.	○	○	○	○	-	-	-
[Da.4]	Deceleration time No.	○	○	○	○	-	-	-
[Da.6]	Positioning address/ movement amount	⊙	⊙	⊙	⊙	⊙	⊙	⊙
[Da.7]	Arc address	-	-	-	-	-	-	-
[Da.8]	Command speed	⊙	⊙	⊙	⊙	-	-	-
[Da.9]	Dwell time/JUMP destination positioning data No.	○	○	○	○	-	-	-
[Da.10]	M code/Condition data No./No. of LOOP to LEND repetitions/No. of pitches	○	○	○	○	-	-	-
[Da.20]	Axis to be interpolated No.1	-	⊙	⊙	⊙	-	-	-

Parameters	Setting item	Setting required/not required for the reference axis				Setting required/not required for the interpolation axis		
		Fixed-feed 1	Fixed-feed 2	Fixed-feed 3	Fixed-feed 4	Fixed-feed 2	Fixed-feed 3	Fixed-feed 4
[Da.21]	Axis to be interpolated No.2	-	-	⊙	⊙	-	-	-
[Da.22]	Axis to be interpolated No.3	-	-	-	⊙	-	-	-
[Da.27]	M code ON signal output timing	○	○	○	○	-	-	-
[Da.28]	ABS direction in degrees	○	○	○	○	-	-	-
[Da.29]	Interpolation speed designation method	△	△	△	△	-	-	-

4.10.3 2-axis circular interpolation control with sub point designation

ABS circular sub (2-axis circular interpolation control with sub point designation)

In the absolute system, 2-axis circular interpolation control with sub point designation, positioning is carried out from the current stop position (start point address) to the address (end point address) set in "[Da.6] Positioning address/movement amount", in an arc path that passes through the sub point address set in "[Da.7] Arc address".
The resulting control path is an arc having as its center the intersection point of perpendicular bisectors of a straight line between the start point address (current stop position) and sub point address (arc address), and a straight line between the sub point address (arc address) and end point address (positioning address).



When using 2-axis circular interpolation control with sub point designation (ABS circular sub), set the following parameters.

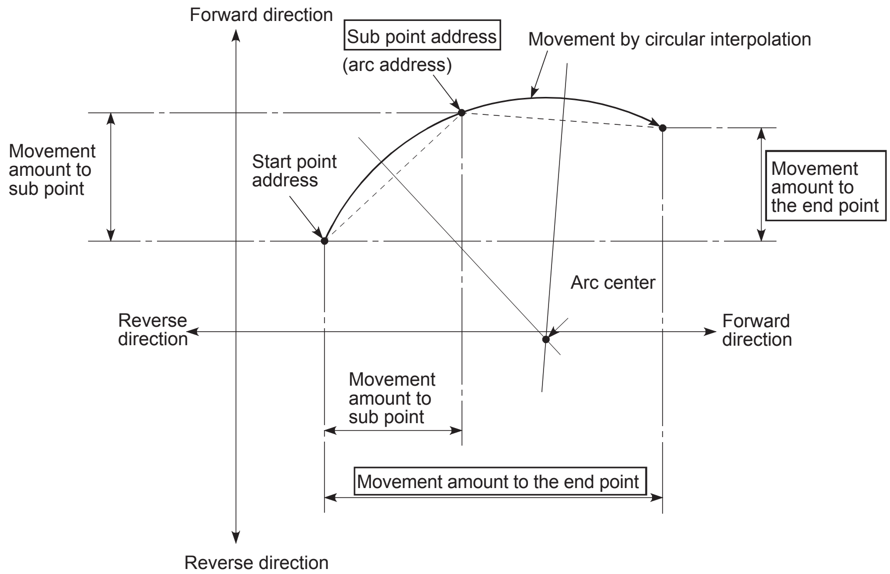
⊙: Always set, ○: Set as required, △: Setting restricted, -: Setting not required

Parameters	Setting item	Setting required/not required for the reference axis	Setting required/not required for the interpolation axis
[Da.1]	Operation pattern	⊙	-
[Da.2]	Control modes	ABS circular sub	-
[Da.3]	Acceleration time No.	○	-
[Da.4]	Deceleration time No.	○	-
[Da.6]	Positioning address/movement amount	⊙	⊙
[Da.7]	Arc address	⊙	⊙
[Da.8]	Command speed	⊙	-
[Da.9]	Dwell time/JUMP destination positioning data No.	○	-
[Da.10]	M code/Condition data No./No. of LOOP to LEND repetitions/No. of pitches	○	-
[Da.20]	Axis to be interpolated No.1	⊙	-
[Da.21]	Axis to be interpolated No.2	-	-
[Da.22]	Axis to be interpolated No.3	-	-
[Da.27]	M code ON signal output timing	○	-
[Da.28]	ABS direction in degrees	○	-
[Da.29]	Interpolation speed designation method	△	-

INC circular sub (2-axis circular interpolation control with sub point designation)

In the incremental system, 2-axis circular interpolation control with sub point designation, positioning is carried out from the current stop position (start point address) to a position at the end of the movement amount set in "[Da.6] Positioning address/movement amount" in an arc path that passes through the sub point address set in "[Da.7] Arc address". The movement direction depends on the sign (+ or -) of the movement amount.

The resulting control path is an arc having as its center the intersection point of perpendicular bisectors of the straight line between the start point address (current stop position) and sub point address (arc address) calculated from the movement amount to the sub point, and a straight line between the sub point address (arc address) and end point address (positioning address) calculated from the movement amount to the end point.



When using 2-axis circular interpolation control with sub point designation (INC circular sub), set the following parameters.

⊙: Always set, ○: Set as required, △: Setting restricted, -: Setting not required

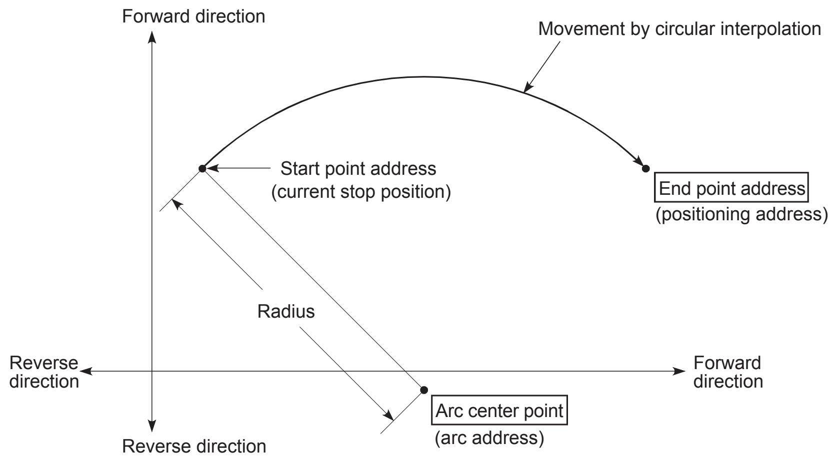
Parameters	Setting item	Setting required/not required for the reference axis	Setting required/not required for the interpolation axis
[Da.1]	Operation pattern	⊙	-
[Da.2]	Control modes	INC circular sub	-
[Da.3]	Acceleration time No.	○	-
[Da.4]	Deceleration time No.	○	-
[Da.6]	Positioning address/movement amount	⊙	⊙
[Da.7]	Arc address	⊙	⊙
[Da.8]	Command speed	⊙	-
[Da.9]	Dwell time/JUMP destination positioning data No.	○	-
[Da.10]	M code/Condition data No./No. of LOOP to LEND repetitions/No. of pitches	○	-
[Da.20]	Axis to be interpolated No.1	⊙	-
[Da.21]	Axis to be interpolated No.2	-	-

Parameters	Setting item	Setting required/not required for the reference axis	Setting required/not required for the interpolation axis
[Da.22]	Axis to be interpolated No.3	-	-
[Da.27]	M code ON signal output timing	○	-
[Da.28]	ABS direction in degrees	○	-
[Da.29]	Interpolation speed designation method	△	-

4.10.4 2-axis circular interpolation control with center point designation

ABS circular right/left (2-axis circular interpolation control with center point designation)

In the absolute system, 2-axis circular interpolation control with center point designation positioning is carried out from the current stop position (start point address) to the address (end point address) set in "[Da.6] Positioning address/movement amount", in an arc path having as its center the address (arc address) of the center point set in "[Da.7] Arc address".



When using 2-axis circular interpolation control with center point designation (ABS circular right, ABS circular left), set the following parameters.

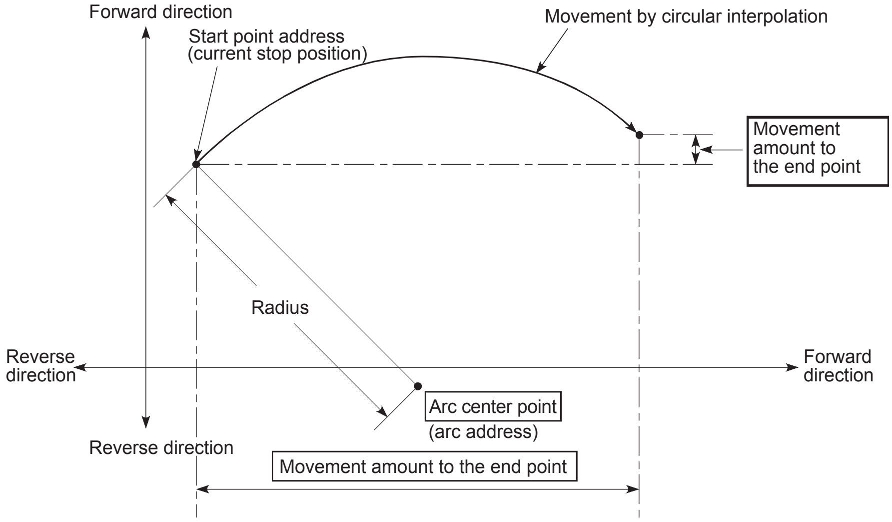
⊙: Always set, ○: Set as required, △: Setting restricted, -: Setting not required

Parameters	Setting item	Setting required/not required for the reference axis		Setting required/not required for the interpolation axis	
		ABS circular right	ABS circular left	ABS circular right	ABS circular left
[Da.1]	Operation pattern	⊙	⊙	-	-
[Da.2]	Control modes	ABS circular right	ABS circular left	-	-
[Da.3]	Acceleration time No.	○	○	-	-
[Da.4]	Deceleration time No.	○	○	-	-
[Da.6]	Positioning address/movement amount	⊙	⊙	⊙	⊙
[Da.7]	Arc address	⊙	⊙	⊙	⊙
[Da.8]	Command speed	⊙	⊙	-	-
[Da.9]	Dwell time/JUMP destination positioning data No.	○	○	-	-

Parameters	Setting item	Setting required/not required for the reference axis		Setting required/not required for the interpolation axis	
		ABS circular right	ABS circular left	ABS circular right	ABS circular left
[Da.10]	M code/Condition data No./No. of LOOP to LEND repetitions/No. of pitches	○	○	-	-
[Da.20]	Axis to be interpolated No.1	⊙	⊙	-	-
[Da.21]	Axis to be interpolated No.2	-	-	-	-
[Da.22]	Axis to be interpolated No.3	-	-	-	-
[Da.27]	M code ON signal output timing	○	○	-	-
[Da.28]	ABS direction in degrees	○	○	-	-
[Da.29]	Interpolation speed designation method	△	△	-	-

INC circular right/left (2-axis circular interpolation control with center point designation)

In the incremental system, 2-axis circular interpolation control with center point designation, positioning is carried out from the current stop position (start point address) to a position at the end of the movement amount set in "[Da.6] Positioning address/movement amount", in an arc path having as its center the address (arc address) of the center point set in "[Da.7] Arc address".



When using 2-axis circular interpolation control with center point designation (INC circular right, INC circular left), set the following parameters.

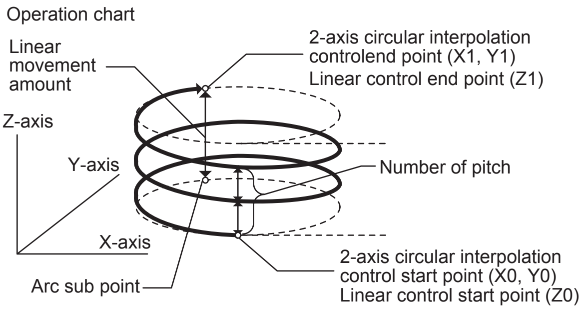
⊙: Always set, ○: Set as required, △: Setting restricted, -: Setting not required

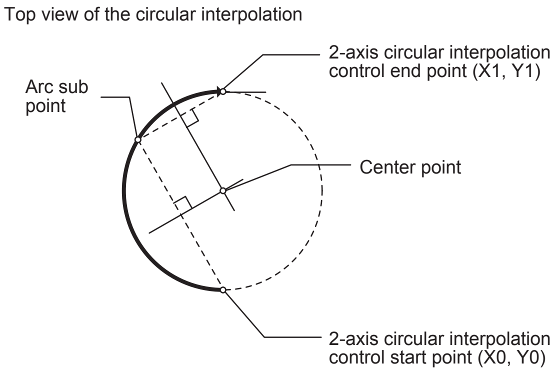
Parameters	Setting item	Setting required/not required for the reference axis		Setting required/not required for the interpolation axis	
		INC circular right	INC circular left	INC circular right	INC circular left
[Da.1]	Operation pattern	⊙	⊙	-	-
[Da.2]	Control modes	INC circular right	INC circular left	-	-
[Da.3]	Acceleration time No.	○	○	-	-
[Da.4]	Deceleration time No.	○	○	-	-
[Da.6]	Positioning address/movement amount	⊙	⊙	⊙	⊙
[Da.7]	Arc address	⊙	⊙	⊙	⊙
[Da.8]	Command speed	⊙	⊙	-	-
[Da.9]	Dwell time/JUMP destination positioning data No.	○	○	-	-
[Da.10]	M code/Condition data No./No. of LOOP to LEND repetitions/No. of pitches	○	○	-	-
[Da.20]	Axis to be interpolated No.1	⊙	⊙	-	-
[Da.21]	Axis to be interpolated No.2	-	-	-	-
[Da.22]	Axis to be interpolated No.3	-	-	-	-
[Da.27]	M code ON signal output timing	○	○	-	-
[Da.28]	ABS direction in degrees	○	○	-	-
[Da.29]	Interpolation speed designation method	△	△	-	-

4.10.5 3-axis helical interpolation control with sub point designation

Helical interpolation control with sub point designation (ABS) (3-axis helical interpolation control with sub point designation)

In the absolute system and 3-axis helical interpolation control with sub point designation, the positioning is performed from the current stop position (X0, Y0, Z0) to the position indicated with the arc end point address (X1 and Y1) and the linear interpolation axis end point address (Z1) set in "[Da.6] Positioning address/movement amount". As the positioning to the commanded position, the linear interpolation with the other linear interpolation axes is performed and the positioning target is rotated helically for the number of pitches set in "[Da.10] M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches" of the linear interpolation axis while the circular interpolation through the sub point address (sub point address) set in "[Da.7] Arc address" is performed.
The resulting path is an arc whose center is the intersection point of the perpendicular bisectors of a straight line between the start point address (current stop position) and sub point address (arc address) and a straight line between the sub point address (arc address) and end point address (positioning address).





When using 3-axis helical interpolation control with sub point designation (helical interpolation control with sub point designation (ABS)), set the following parameters.
⊙: Always set, ○: Set as required, △: Setting restricted, -: Setting not required

Parameters	Setting item	Setting requirement of reference axis	Setting requirement of circular interpolation axis*1	Setting requirement of linear interpolation axis*2
[Da.1]	Operation pattern	⊙	-	-
[Da.2]	Control modes	Helical interpolation control with sub point designation (ABS)	-	-
[Da.3]	Acceleration time No.	⊙	-	-
[Da.4]	Deceleration time No.	⊙	-	-
[Da.6]	Positioning address/movement amount	⊙	⊙	⊙
[Da.7]	Arc address	⊙	⊙	-
[Da.8]	Command speed	⊙	-	-
[Da.9]	Dwell time/JUMP destination positioning data No.	○	-	-
[Da.10]	M code/Condition data No./No. of LOOP to LEND repetitions/No. of pitches	○	-	⊙*3

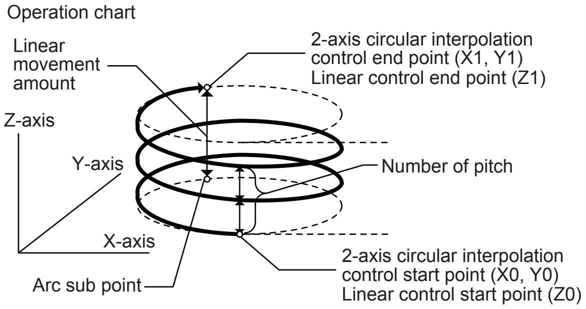
Parameters	Setting item	Setting requirement of reference axis	Setting requirement of circular interpolation axis*1	Setting requirement of linear interpolation axis*2
[Da.20]	Axis to be interpolated No.1	⊙	-	-
[Da.21]	Axis to be interpolated No.2	⊙	-	-
[Da.22]	Axis to be interpolated No.3	-	-	-
[Da.27]	M code ON signal output timing	○	-	-
[Da.28]	ABS direction in degrees	○	-	-
[Da.29]	Interpolation speed designation method	△	-	-

*1. Specified in "[Da.20] Axis to be interpolated No.1" of the reference axis.
*2. Specified in "[Da.21] Axis to be interpolated No.2" of the reference axis.
*3. Set the number of pitches for the linear interpolation axis.

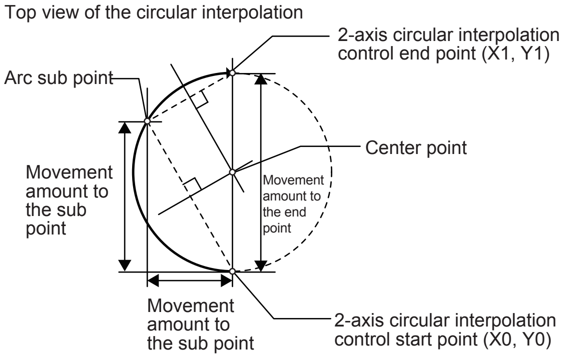
Helical interpolation control with sub point designation (INC) (3-axis helical interpolation control with sub point designation)

In the incremental system and 3-axis helical interpolation control with sub point designation, the positioning is performed from the current stop position (X0, Y0, Z0) to the position (X1, Y1, Z1) for the movement amount set in "[Da.6] Positioning address/movement amount". As the positioning to the commanded position, the linear interpolation with the other linear interpolation axes is performed and the positioning target is rotated helically for the number of pitches set in "[Da.10] M code/Condition data No./Number of LOOP to LEND repetitions/ Number of pitches" of the linear interpolation axis while the circular interpolation through the sub point address (sub point address) set in "[Da.7] Arc address" is performed. The movement direction is determined by the sign of the movement amount.
The resulting path is an arc whose center is the intersection point of the perpendicular bisectors of a straight line between the start point address (current stop position) and the sub point address (arc address) calculated from the movement amount to the sub point, and a straight line between the sub point address (arc address) and the end point address (positioning address) calculated from the movement amount to the end point.

Operation chart



Top view of the circular interpolation



When using 3-axis helical interpolation control with sub point designation (helical interpolation control with sub point designation (INC)), set the following parameters.
⊙: Always set, ○: Set as required, △: Setting restricted, -: Setting not required

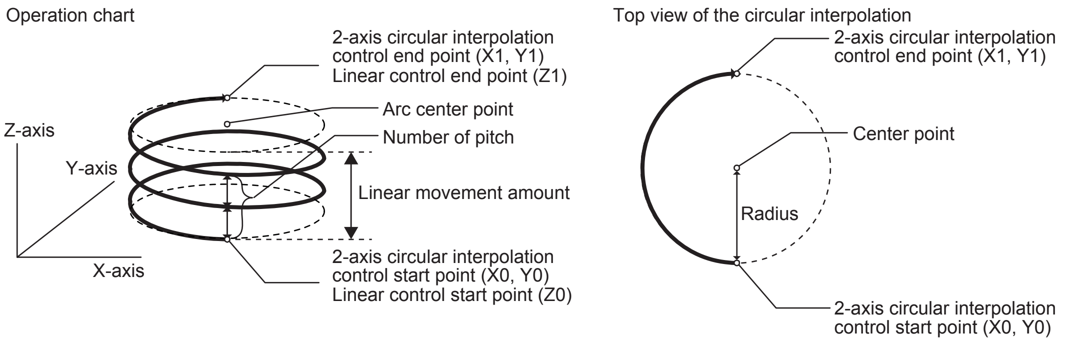
Parameters	Setting item	Setting requirement of reference axis	Setting requirement of circular interpolation axis*1	Setting requirement of linear interpolation axis*2
[Da.1]	Operation pattern	⊙	-	-
[Da.2]	Control modes	Helical interpolation control with sub point designation (INC)	-	-
[Da.3]	Acceleration time No.	⊙	-	-
[Da.4]	Deceleration time No.	⊙	-	-
[Da.6]	Positioning address/movement amount	⊙	⊙	⊙
[Da.7]	Arc address	⊙	⊙	-
[Da.8]	Command speed	⊙	-	-
[Da.9]	Dwell time/JUMP destination positioning data No.	○	-	-
[Da.10]	M code/Condition data No./No. of LOOP to LEND repetitions/No. of pitches	○	-	⊙*3
[Da.20]	Axis to be interpolated No.1	⊙	-	-
[Da.21]	Axis to be interpolated No.2	⊙	-	-
[Da.22]	Axis to be interpolated No.3	-	-	-
[Da.27]	M code ON signal output timing	○	-	-
[Da.28]	ABS direction in degrees	○	-	-
[Da.29]	Interpolation speed designation method	△	-	-

*1. Specified in "[Da.20] Axis to be interpolated No.1" of the reference axis.
*2. Specified in "[Da.21] Axis to be interpolated No.2" of the reference axis.
*3. Set the number of pitches for the linear interpolation axis.

4.10.6 3-axis helical interpolation control with center point designation

Helical interpolation control with center point designation (ABS, CW)/(ABS, CCW) (3-axis helical interpolation control with center point designation)

In the absolute system and 3-axis helical interpolation control with center point designation, the positioning is performed from the current stop position (X0, Y0, Z0) to the position indicated with the arc end point address (X1 and Y1) and the linear interpolation axis end point address (Z1) set in "[Da.6] Positioning address/movement amount". As the positioning to the commanded position, the linear interpolation with the other linear interpolation axes is performed and the positioning target is rotated helically for the number of pitches set in "[Da.10] M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches" of the linear interpolation axis while the circular interpolation of the circle whose center is the center point address (arc address) set in "[Da.7] Arc address" is performed.



When using the 3-axis helical interpolation control with center point designation (helical interpolation control with center point designation (ABS, CW), helical interpolation control with center point designation (ABS, CCW)), set the following parameters.

⊙: Always set, ○: Set as required, △: Setting restricted, -: Setting not required

Para-meters	Setting item	Setting required/not required for the reference axis		Setting requirement of circular interpolation axis*1		Setting requirement of linear interpolation axis*2	
		Helical interpolation control with center point designation (ABS, CW)	Helical interpolation control with center point designation (ABS, CCW)	Helical interpolation control with center point designation (ABS, CW)	Helical interpolation control with center point designation (ABS, CCW)	Helical interpolation control with center point designation (ABS, CW)	Helical interpolation control with center point designation (ABS, CCW)
[Da.1]	Operation pattern	⊙	⊙	-	-	-	-
[Da.2]	Control modes	Helical interpolation control with center point designation (ABS, CW)	Helical interpolation control with center point designation (ABS, CCW)	-	-	-	-
[Da.3]	Acceleration time No.	⊙	⊙	-	-	-	-
[Da.4]	Deceleration time No.	⊙	⊙	-	-	-	-
[Da.6]	Positioning address/ movement amount	⊙	⊙	⊙	⊙	⊙	⊙
[Da.7]	Arc address	⊙	⊙	⊙	⊙	-	-
[Da.8]	Command speed	⊙	⊙	-	-	-	-
[Da.9]	Dwell time/JUMP destination positioning data No.	○	○	-	-	-	-

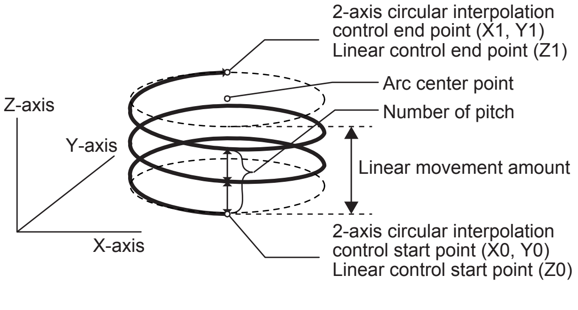
Para-meters	Setting item	Setting required/not required for the reference axis		Setting requirement of circular interpolation axis*1		Setting requirement of linear interpolation axis*2	
		Helical interpolation control with center point designation (ABS, CW)	Helical interpolation control with center point designation (ABS, CCW)	Helical interpolation control with center point designation (ABS, CW)	Helical interpolation control with center point designation (ABS, CCW)	Helical interpolation control with center point designation (ABS, CW)	Helical interpolation control with center point designation (ABS, CCW)
[Da.10]	M code/Condition data No./No. of LOOP to LEND repetitions/ No. of pitches	○	○	-	-	⊙*3	⊙*3
[Da.20]	Axis to be interpolated No.1	⊙	⊙	-	-	-	-
[Da.21]	Axis to be interpolated No.2	⊙	⊙	-	-	-	-
[Da.22]	Axis to be interpolated No.3	-	-	-	-	-	-
[Da.27]	M code ON signal output timing	○	○	-	-	-	-
[Da.28]	ABS direction in degrees	○	○	-	-	-	-
[Da.29]	Interpolation speed designation method	△	△	-	-	-	-

*1. Specified in "[Da.20] Axis to be interpolated No.1" of the reference axis.
*2. Specified in "[Da.21] Axis to be interpolated No.2" of the reference axis.
*3. Set the number of pitches for the linear interpolation axis.

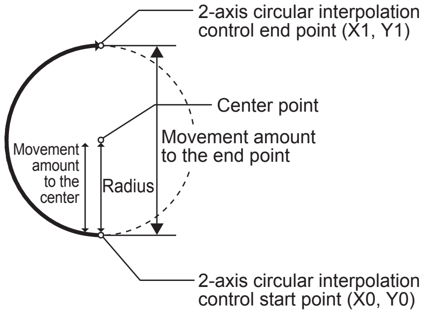
Helical interpolation control with center point designation (INC, CW)/(INC, CCW) (3-axis helical interpolation control with center point designation)

In the incremental system and 3-axis helical interpolation control with center point designation, the positioning is performed from the current stop position (X0, Y0, Z0) to the position (X1, Y1, Z1) for the movement amount set in "[Da.6] Positioning address/movement amount". As the positioning to the commanded position, the linear interpolation with the other linear interpolation axes is performed and the positioning target is rotated helically for the number of pitches set in "[Da.10] M code/Condition data No./Number of LOOP to LEND repetitions/Number of pitches" of the linear interpolation axis while the circular interpolation of the circle whose center is the center point address (arc address) set in "[Da.7] Arc address" is performed.

Operation chart



Top view of the circular interpolation



When using the 3-axis helical interpolation control with sub point designation (helical interpolation control with sub point designation (INC)), set the following parameters.
⊙: Always set, ○: Set as required, △: Setting restricted, -: Setting not required

Parameters	Setting item	Setting required/not required for the reference axis		Setting requirement of circular interpolation axis*1		Setting requirement of linear interpolation axis*2	
		Helical interpolation control with center point designation (INC, CW)	Helical interpolation control with center point designation (INC, CCW)	Helical interpolation control with center point designation (INC, CW)	Helical interpolation control with center point designation (INC, CCW)	Helical interpolation control with center point designation (INC, CW)	Helical interpolation control with center point designation (INC, CCW)
[Da.1]	Operation pattern	⊙	⊙	-	-	-	-
[Da.2]	Control modes	Helical interpolation control with center point designation (INC, CW)	Helical interpolation control with center point designation (INC, CCW)	-	-	-	-
[Da.3]	Acceleration time No.	⊙	⊙	-	-	-	-
[Da.4]	Deceleration time No.	⊙	⊙	-	-	-	-
[Da.6]	Positioning address/ movement amount	⊙	⊙	⊙	⊙	⊙	⊙
[Da.7]	Arc address	⊙	⊙	⊙	⊙	-	-
[Da.8]	Command speed	⊙	⊙	-	-	-	-
[Da.9]	Dwell time/JUMP destination positioning data No.	○	○	-	-	-	-
[Da.10]	M code/Condition data No./No. of LOOP to LEND repetitions/ No. of pitches	○	○	-	-	⊙*3	⊙*3
[Da.20]	Axis to be interpolated No.1	⊙	⊙	-	-	-	-
[Da.21]	Axis to be interpolated No.2	⊙	⊙	-	-	-	-
[Da.22]	Axis to be interpolated No.3	-	-	-	-	-	-
[Da.27]	M code ON signal output timing	○	○	-	-	-	-
[Da.28]	ABS direction in degrees	○	○	-	-	-	-
[Da.29]	Interpolation speed designation method	△	△	-	-	-	-

*1. Specified in "[Da.20] Axis to be interpolated No.1" of the reference axis.
*2. Specified in "[Da.21] Axis to be interpolated No.2" of the reference axis.
*3. Set the number of pitches for the linear interpolation axis.

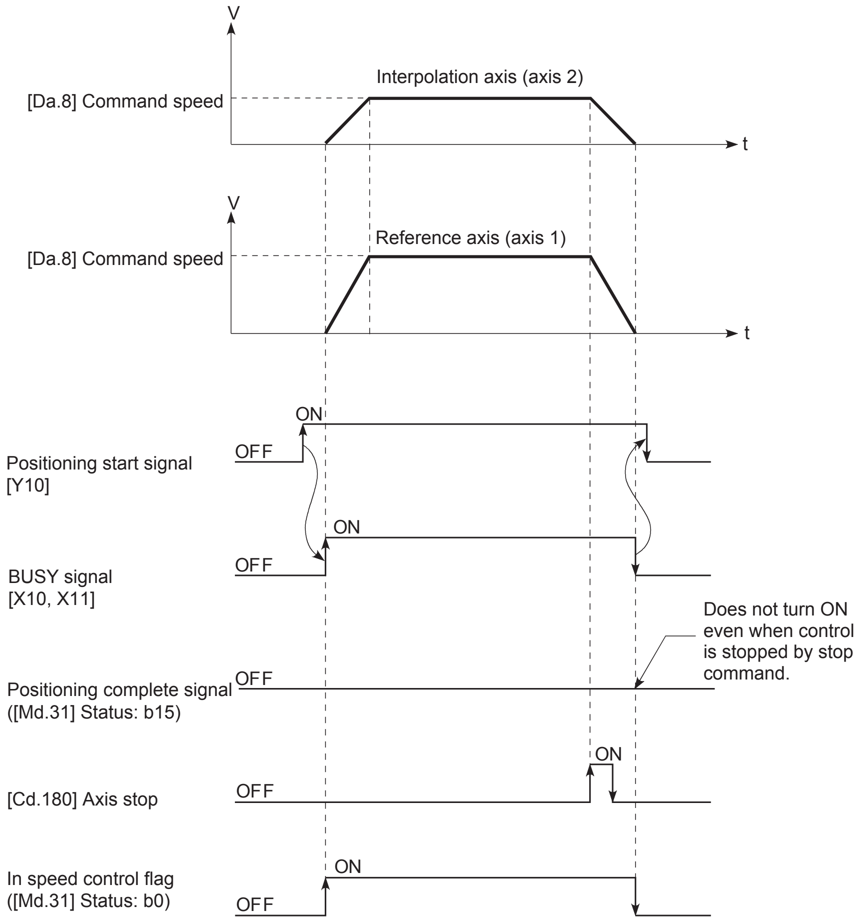
4.10.7 Speed control

Forward run/reverse run: speed 1 to 4 (speed control)

The control is carried out in the axis direction in which the positioning data has been set by continuously outputting pulses for the speed set in "[Da.8] Command speed" until the input of a stop command.

The eight types of speed control includes "Forward run: speed 1 to 4" in which the control starts in the forward run direction, and "Reverse run: speed 1 to 4" in which the control starts in the reverse run direction.

Ex.) 2-axis speed control



When using speed control (forward run: speed 1 to 4, reverse run: speed 1 to 4), set the following parameters.

⊙: Always set, ○: Set as required, △: Setting restricted, -: Setting not required

• Forward run speed

Parameters	Setting item	Setting required/not required for the reference axis				Setting required/not required for the interpolation axis		
		Forward run speed 1	Forward run speed 2	Forward run speed 3	Forward run speed 4	Forward run speed 2	Forward run speed 3	Forward run speed 4
[Da.1]	Operation pattern	⊙	⊙	⊙	⊙	-	-	-
[Da.2]	Control modes	Forward run speed 1	Forward run speed 2	Forward run speed 3	Forward run speed 4	-	-	-
[Da.3]	Acceleration time No.	○	○	○	○	-	-	-
[Da.4]	Deceleration time No.	○	○	○	○	-	-	-
[Da.6]	Positioning address/ movement amount	-	-	-	-	-	-	-
[Da.7]	Arc address	-	-	-	-	-	-	-
[Da.8]	Command speed	⊙	⊙	⊙	⊙	⊙	⊙	⊙
[Da.9]	Dwell time/JUMP destination positioning data No.	○	○	○	○	-	-	-
[Da.10]	M code/Condition data No./No. of LOOP to LEND repetitions/No. of pitches	○	○	○	○	-	-	-
[Da.20]	Axis to be interpolated No.1	-	⊙	⊙	⊙	-	-	-
[Da.21]	Axis to be interpolated No.2	-	-	⊙	⊙	-	-	-
[Da.22]	Axis to be interpolated No.3	-	-	-	⊙	-	-	-
[Da.27]	M code ON signal output timing	○	○	○	○	-	-	-
[Da.28]	ABS direction in degrees	○	○	○	○	-	-	-
[Da.29]	Interpolation speed designation method	△	△	△	△	-	-	-

• Reverse run speed

Parameters	Setting item	Setting required/not required for the reference axis				Setting required/not required for the interpolation axis		
		Reverse run speed 1	Reverse run speed 2	Reverse run speed 3	Reverse run speed 4	Reverse run speed 2	Reverse run speed 3	Reverse run speed 4
[Da.1]	Operation pattern	⊙	⊙	⊙	⊙	-	-	-
[Da.2]	Control modes	Reverse run speed 1	Reverse run speed 2	Reverse run speed 3	Reverse run speed 4	-	-	-
[Da.3]	Acceleration time No.	○	○	○	○	-	-	-
[Da.4]	Deceleration time No.	○	○	○	○	-	-	-
[Da.6]	Positioning address/ movement amount	-	-	-	-	-	-	-
[Da.7]	Arc address	-	-	-	-	-	-	-

Parameters	Setting item	Setting required/not required for the reference axis				Setting required/not required for the interpolation axis		
		Reverse run speed 1	Reverse run speed 2	Reverse run speed 3	Reverse run speed 4	Reverse run speed 2	Reverse run speed 3	Reverse run speed 4
[Da.8]	Command speed	⊙	⊙	⊙	⊙	⊙	⊙	⊙
[Da.9]	Dwell time/JUMP destination positioning data No.	○	○	○	○	-	-	-
[Da.10]	M code/Condition data No./No. of LOOP to LEND repetitions/No. of pitches	○	○	○	○	-	-	-
[Da.20]	Axis to be interpolated No.1	-	⊙	⊙	⊙	-	-	-
[Da.21]	Axis to be interpolated No.2	-	-	⊙	⊙	-	-	-
[Da.22]	Axis to be interpolated No.3	-	-	-	⊙	-	-	-
[Da.27]	M code ON signal output timing	○	○	○	○	-	-	-
[Da.28]	ABS direction in degrees	○	○	○	○	-	-	-
[Da.29]	Interpolation speed designation method	△	△	△	△	-	-	-

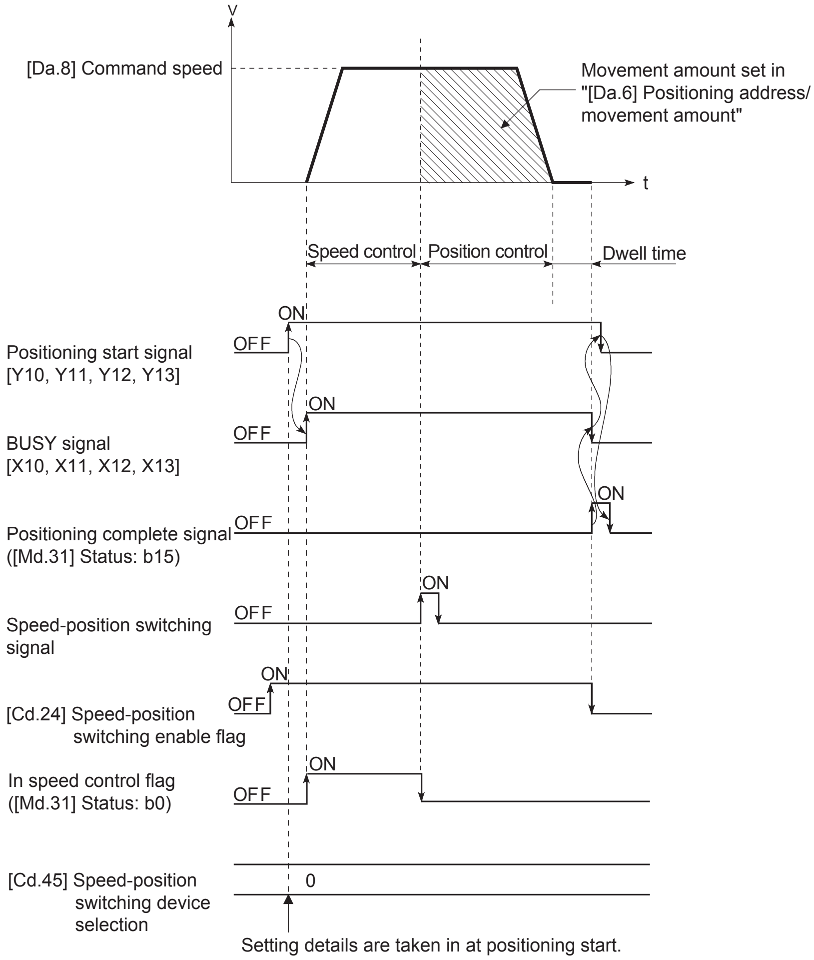
4.10.8 Speed-position switching control

The speed-position switching control in the INC or ABS mode is selected by "[Pr.81] Speed-position function selection."

Forward run: speed/position, Reverse run: speed/position (speed-position switching control (INC mode))

The pulses of the speed set in "[Da.8] Command speed" are kept output on the axial direction set to the positioning data. When the "speed-position switching signal" is input, position control of the movement amount set in "[Da.6] Positioning address/movement amount" is exercised.

Ex.) When an external command signal (DI) is used as the speed-position switching signal:



When using speed-position switching control (INC mode) (Forward run: speed/position, Reverse run: speed/position), set the following parameters.

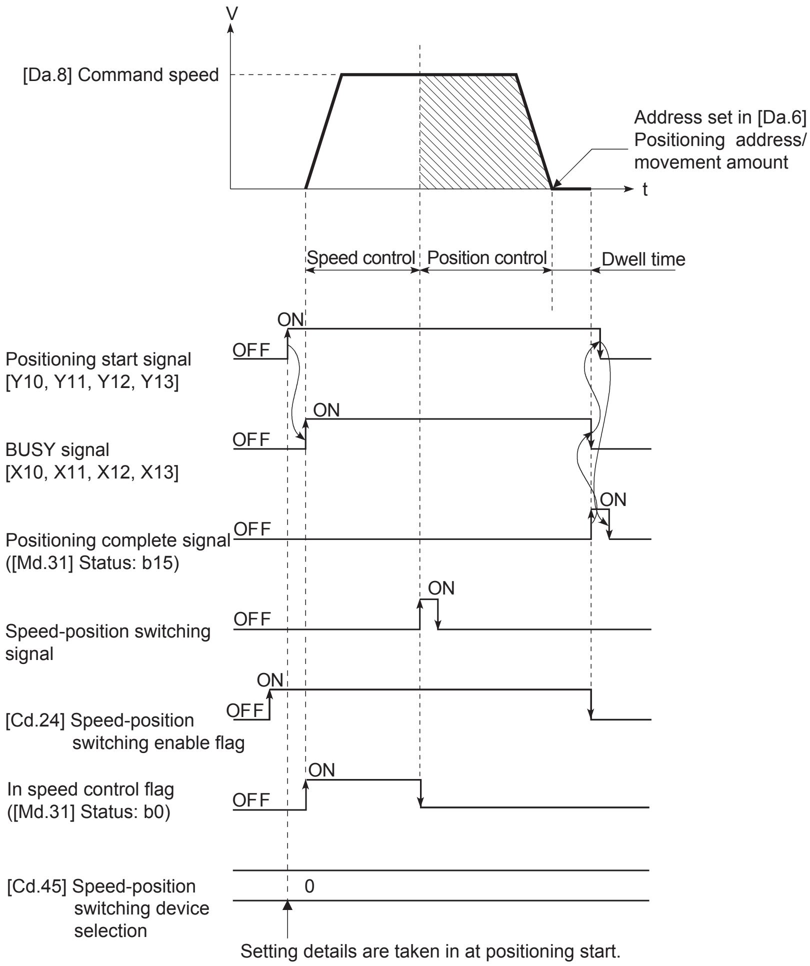
⊙: Always set, ○: Set as required, △: Setting restricted, -: Setting not required

Parameters	Setting item	Setting required/not required	
		Forward run: speed/position	**Reverse run: speed/position**
[Da.1]	Operation pattern	⊙	⊙
[Da.2]	Control modes	Forward run: speed/position	Reverse run: speed/position
[Da.3]	Acceleration time No.	○	○
[Da.4]	Deceleration time No.	○	○
[Da.6]	Positioning address/movement amount	⊙	⊙
[Da.7]	Arc address	-	-
[Da.8]	Command speed	⊙	⊙
[Da.9]	Dwell time/JUMP destination positioning data No.	○	○
[Da.10]	M code/Condition data No./No. of LOOP to LEND repetitions/No. of pitches	○	○
[Da.20]	Axis to be interpolated No.1	-	-
[Da.21]	Axis to be interpolated No.2	-	-
[Da.22]	Axis to be interpolated No.3	-	-
[Da.27]	M code ON signal output timing	○	○
[Da.28]	ABS direction in degrees	-	-
[Da.29]	Interpolation speed designation method	-	-

Forward run: speed/position, Reverse run: speed/position (Speed-position switching control (ABS mode))

The pulses of the speed set in "[Da.8] Command speed" are kept output in the axial direction set to the positioning data. When the "speed-position switching signal" is input, position control to the address set in "[Da.6] Positioning address/movement amount" is exercised. "Speed-position switching control (ABS mode)" is valid only when "[Pr.1] Unit setting" is "degree".

Ex.) When an external command signal (DI) is used as the speed-position switching signal:



When using speed-position switching control (ABS mode) (Forward run: speed/position, Reverse run: speed/position), set the following parameters.

⊙: Always set, ○: Set as required, △: Setting restricted, -: Setting not required

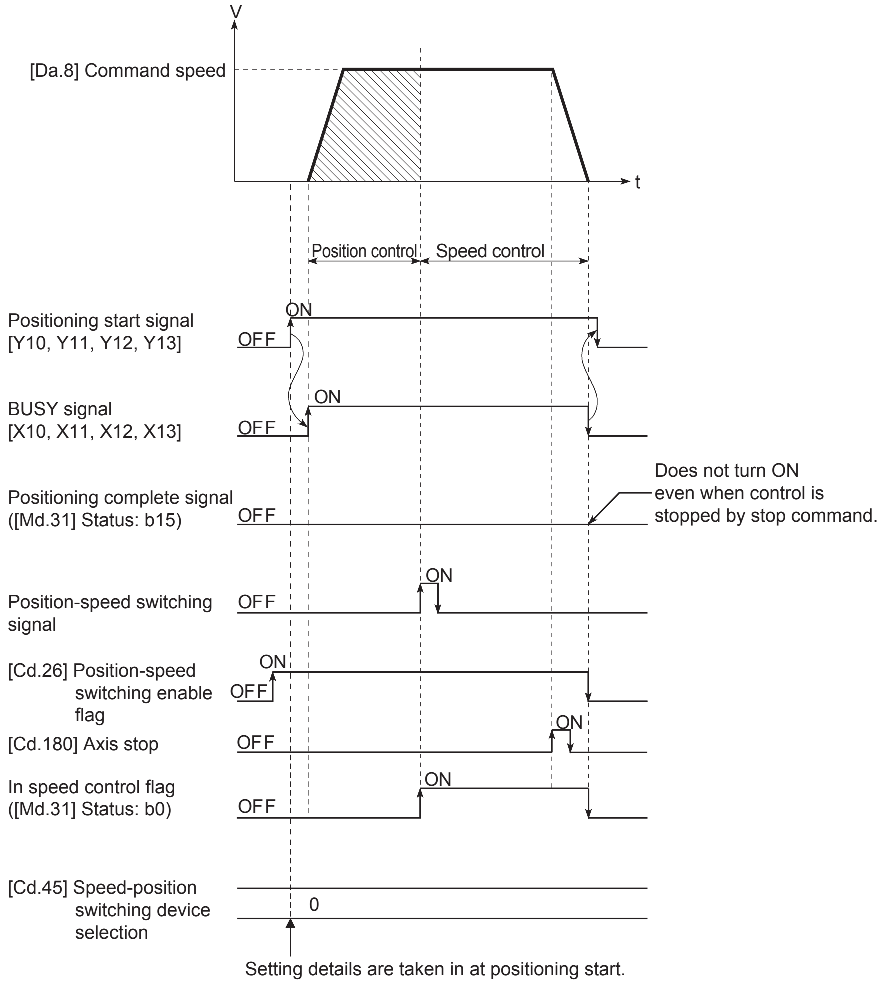
Parameters	Setting item	Setting required/not required	
		Forward run: speed/position	**Reverse run: speed/position**
[Da.1]	Operation pattern	⊙	⊙
[Da.2]	Control modes	Forward run: speed/position	Reverse run: speed/position
[Da.3]	Acceleration time No.	○	○
[Da.4]	Deceleration time No.	○	○
[Da.6]	Positioning address/movement amount	⊙	⊙
[Da.7]	Arc address	-	-
[Da.8]	Command speed	⊙	⊙
[Da.9]	Dwell time/JUMP destination positioning data No.	○	○
[Da.10]	M code/Condition data No./No. of LOOP to LEND repetitions/No. of pitches	○	○
[Da.20]	Axis to be interpolated No.1	-	-
[Da.21]	Axis to be interpolated No.2	-	-
[Da.22]	Axis to be interpolated No.3	-	-
[Da.27]	M code ON signal output timing	○	○
[Da.28]	ABS direction in degrees	-	-
[Da.29]	Interpolation speed designation method	-	-

4.10.9 Position-speed switching control

Forward run: position/speed, Reverse run: position/speed (position-speed switching control)

Before the position-speed switching signal is input, position control is carried out for the movement amount set in "[Da.6] Positioning address/movement amount" in the axis direction in which the positioning data has been set. When the position-speed switching signal is input, the position control is carried out by continuously outputting the pulses for the speed set in "[Da.8] Command speed" until the input of a stop command.

Ex.) When an external command signal (DI) is used as the position-speed switching signal:



When using position-speed switching control (forward run: position/speed, reverse run: position/speed), set the following parameters.

⊙: Always set, ○: Set as required, △: Setting restricted, -: Setting not required

Parameters	Setting item	Setting required/not required	
		Forward run: position/speed	**Reverse run: position/speed**
[Da.1]	Operation pattern	⊙	⊙
[Da.2]	Control modes	Forward run: position/speed	Reverse run: position/speed
[Da.3]	Acceleration time No.	○	○
[Da.4]	Deceleration time No.	○	○
[Da.6]	Positioning address/movement amount	○	○
[Da.7]	Arc address	-	-
[Da.8]	Command speed	⊙	⊙
[Da.9]	Dwell time/JUMP destination positioning data No.	○	○
[Da.10]	M code/Condition data No./No. of LOOP to LEND repetitions/No. of pitches	○	○
[Da.20]	Axis to be interpolated No.1	-	-
[Da.21]	Axis to be interpolated No.2	-	-
[Da.22]	Axis to be interpolated No.3	-	-
[Da.27]	M code ON signal output timing	○	○
[Da.28]	ABS direction in degrees	-	-
[Da.29]	Interpolation speed designation method	-	-

4.10.10 Current value change

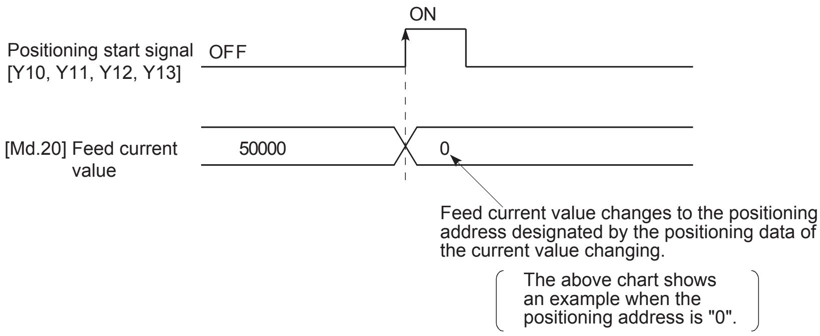
Current value change

The control is carried out in which the "[Md.20] Feed current value" of the stopped axis is changed to a random address set by the user. (The "[Md.21] Machine feed value" is not changed when the current value is changed.)

The two methods for changing the current value are shown below.

- Changing to a new current value using the positioning data
- Changing to a new current value using the start No. (No.9003) for a current value changing

Ex.) Changing to a new current value using positioning data



When using current value changing, set the following parameters.

⊙: Always set, ○: Set as required, △: Setting restricted, -: Setting not required

Parameters	Setting item	Setting required/not required
[Da.1]	Operation pattern	⊙
[Da.2]	Control modes	Current value change
[Da.3]	Acceleration time No.	-
[Da.4]	Deceleration time No.	-
[Da.6]	Positioning address/movement amount	⊙*1
[Da.7]	Arc address	-
[Da.8]	Command speed	-
[Da.9]	Dwell time/JUMP destination positioning data No.	-
[Da.10]	M code/Condition data No./No. of LOOP to LEND repetitions/No. of pitches	○
[Da.20]	Axis to be interpolated No.1	-
[Da.21]	Axis to be interpolated No.2	-
[Da.22]	Axis to be interpolated No.3	-
[Da.27]	M code ON signal output timing	○
[Da.28]	ABS direction in degrees	-
[Da.29]	Interpolation speed designation method	-

*1. Set the address to be changed.

4.10.11 NOP instruction

NOP (NOP instruction)

The NOP instruction is used for the nonexecutable control method.

The positioning data No. to which the NOP instruction is set transfers, without any processing, to the operation for the next positioning data No.

When using the NOP instruction, set the following positioning data.

⊙: Always set, ○: Set as required, △: Setting restricted, -: Setting not required

Parameters	Setting item	Setting required/not required
[Da.1]	Operation pattern	-
[Da.2]	Control modes	NOP instruction
[Da.3]	Acceleration time No.	-
[Da.4]	Deceleration time No.	-
[Da.6]	Positioning address/movement amount	-
[Da.7]	Arc address	-
[Da.8]	Command speed	-
[Da.9]	Dwell time/JUMP destination positioning data No.	-
[Da.10]	M code/Condition data No./No. of LOOP to LEND repetitions/No. of pitches	-
[Da.20]	Axis to be interpolated No.1	-
[Da.21]	Axis to be interpolated No.2	-
[Da.22]	Axis to be interpolated No.3	-
[Da.27]	M code ON signal output timing	-
[Da.28]	ABS direction in degrees	-
[Da.29]	Interpolation speed designation method	-

4.10.12 JUMP instruction

JUMP (JUMP instruction)

The JUMP instruction is used to control the operation so it jumps to a positioning data No. set in the positioning data during "continuous positioning control" or "continuous path control".

JUMP instruction includes the following two types of JUMP.

- Unconditional JUMP
  The JUMP instruction is unconditionally executed. The operation jumps to the positioning data No. set in "[Da.9] Dwell time/JUMP destination positioning data No.".
- Conditional JUMP
  When the execution conditions are met, the JUMP instruction will be executed, and the operation will jump to the set positioning No. (The conditions are set to the "condition data" used with "high-level positioning control".)

When using the JUMP (JUMP instruction), set the following parameters.

⊙: Always set, ○: Set as required, △: Setting restricted, -: Setting not required

Parameters	Setting item	Setting required/not required
[Da.1]	Operation pattern	-
[Da.2]	Control modes	JUMP instruction
[Da.3]	Acceleration time No.	-
[Da.4]	Deceleration time No.	-
[Da.6]	Positioning address/movement amount	-
[Da.7]	Arc address	-
[Da.8]	Command speed	-
[Da.9]	Dwell time/JUMP destination positioning data No.	⊙*1
[Da.10]	M code/Condition data No./No. of LOOP to LEND repetitions/No. of pitches	⊙*2
[Da.20]	Axis to be interpolated No.1	-
[Da.21]	Axis to be interpolated No.2	-
[Da.22]	Axis to be interpolated No.3	-
[Da.27]	M code ON signal output timing	-
[Da.28]	ABS direction in degrees	-
[Da.29]	Interpolation speed designation method	-

*1. Set the positioning data for the JUMP destination.

*2. Set the JUMP instruction execution conditions with the condition data No.
0: Unconditional JUMP
1 to 10: Condition data No. ("Simultaneous start" condition data cannot be set.)

4.10.13 Loop control

LOOP, LEND (loop control)

The LOOP is used for loop control by the repetition of LOOP to LEND.

- LOOP

  LOOP is the loop head, and LED is the loop tail.

- LEND

  When the number of repetitions specified in LOOP reaches 0, the loop will be terminated, and the processing for the next positioning data No. will be started.

Ex.) Executed in the order of the positioning data No.1→2→3→4→5→2→3→4→5→6.

Positioning data No.	Operation pattern	Control modes	Condition
1	Continuous positioning control	ABS2	
2	Positioning complete	LOOP	Number of loop cycles: 2
3	Continuous path control	ABS2	
4	Continuous positioning control	ABS2	
5	Positioning complete	LEND	
6	Positioning complete	ABS2	

A loop with positioning data Nos. 2 to 5 is executed twice.

During loop control, the positioning completion processing for the single positioning control ("00: Positioning complete" in "[Da.1] Operation pattern") will not be performed.

When using the Loop control (LOOP, LEND), set the following parameters.

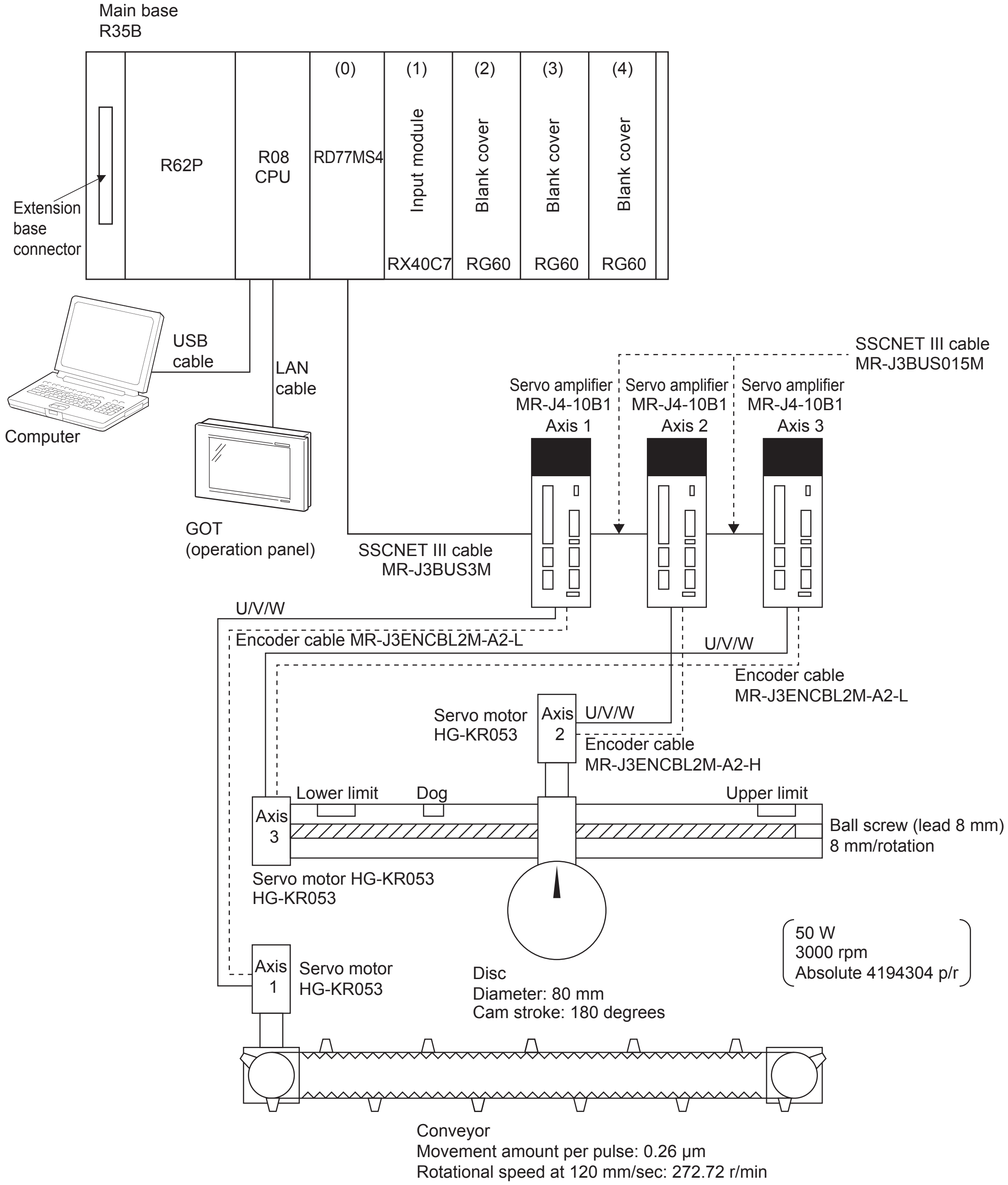
⊙: Always set, ○: Set as required, △: Setting restricted, -: Setting not required

Parameters	Setting item	Setting required/not required	
		LOOP	LEND
[Da.1]	Operation pattern	-	-
[Da.2]	Control modes	LOOP	LEND
[Da.3]	Acceleration time No.	-	-
[Da.4]	Deceleration time No.	-	-
[Da.6]	Positioning address/movement amount	-	-
[Da.7]	Arc address	-	-
[Da.8]	Command speed	-	-
[Da.9]	Dwell time/JUMP destination positioning data No.	-	-
[Da.10]	M code/Condition data No./No. of LOOP to LEND repetitions/No. of pitches	⊙[*1]	-
[Da.20]	Axis to be interpolated No.1	-	-
[Da.21]	Axis to be interpolated No.2	-	-
[Da.22]	Axis to be interpolated No.3	-	-
[Da.27]	M code ON signal output timing	-	-
[Da.28]	ABS direction in degrees	-	-
[Da.29]	Interpolation speed designation method	-	-

*1. Set the repeat cycles.

Chapter 5 Practice (1) Test Operation with GX Works3 (RD77MS4)

5.1 Demonstration Machine System Configuration



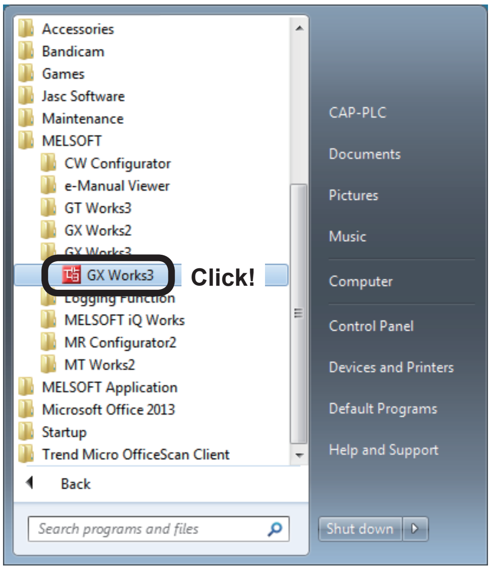
PRECAUTIONS

- Turn on the power switch of the demonstration machine after setting R08CPU to STOP.
- The equipment will be installed by your teacher. Do not connect or disconnect any cable or disassemble the equipment without your teacher's permission.
  Failure to observe this may result in a fault, malfunction, injury, or fire.

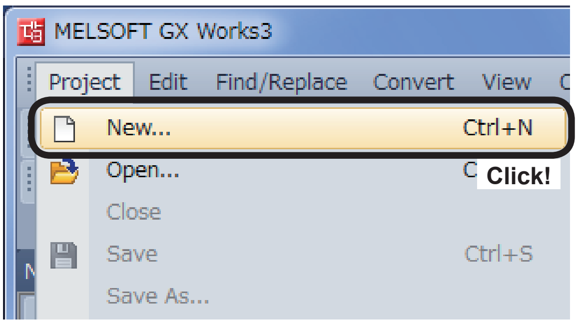
5.2 CPU Module Setting

Using the demonstration machine system configuration as an example, start up GX Works3, create a new project, and add extension modules.

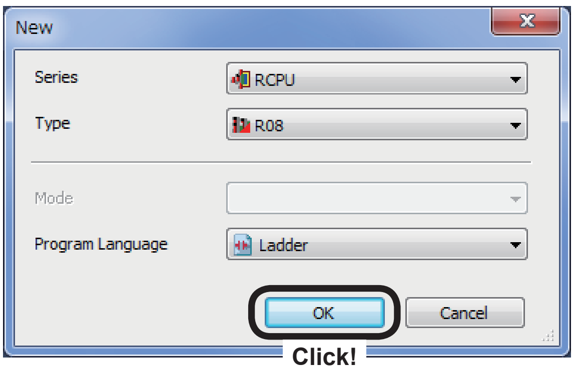
5.2.1 New project creation



(1) Click the Windows® [start] button, and then select [All Programs] → [MELSOFT] → [GX Works3] → [GX Works3].



(2) Click [New…] on the [Project] menu.

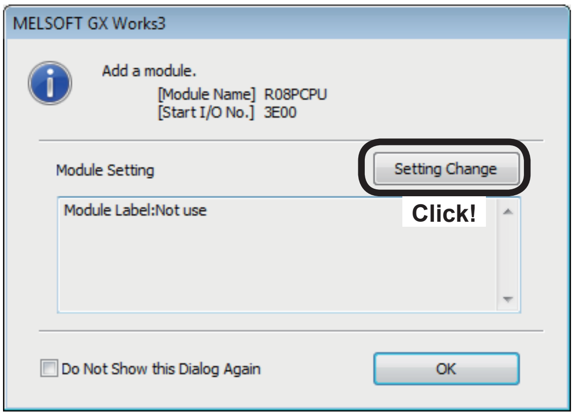


(3) Specify the following settings at the New Project dialog box that appears, and then click the OK button.

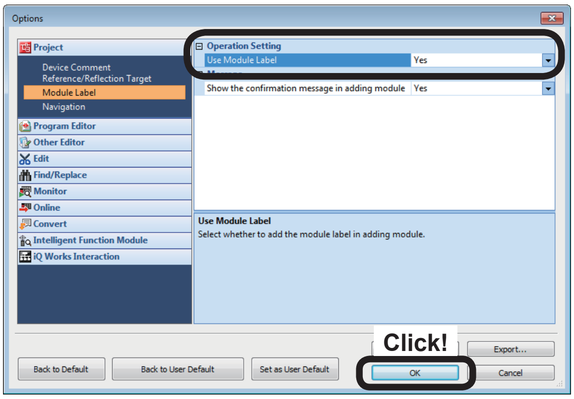
Series: RCPU
Type: R08
Program Language: Ladder

Go to next page

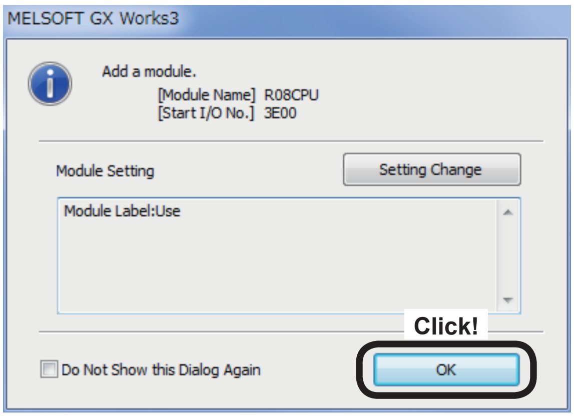
From previous page



(4) The dialog box shown on the left appears, press the Setting Change button.



(5) The Options dialog box appears. Change the setting for “Use Module Label” to “Yes,” and click the OK button.



(6) The display then returns to the dialog box shown on the left. Click the OK button.

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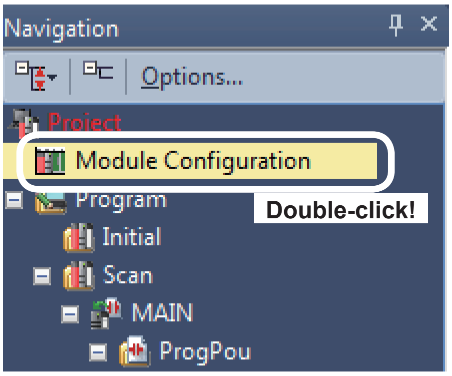
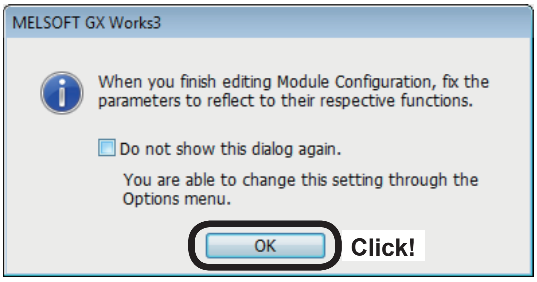
(7) If a dialog box relating to the label editor appears, click the OK button.

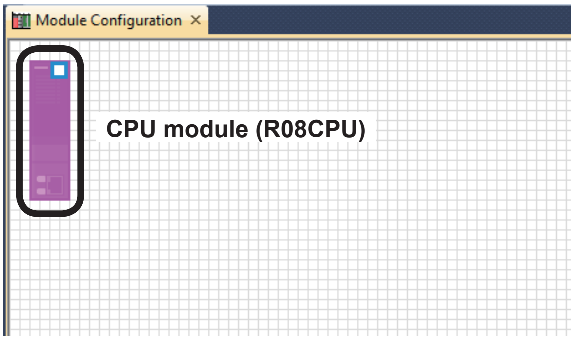
5.2.2 Adding extension modules



(1) Select [Project] in the [Navigation window], and then double-click [Module Configuration].

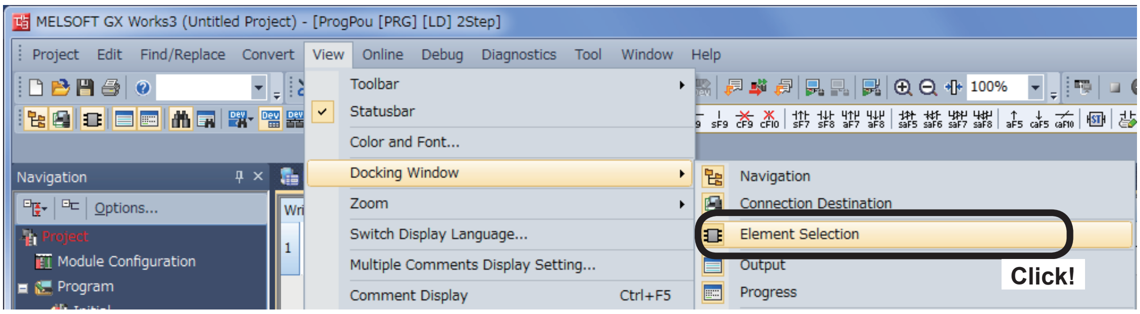


(2) If a dialog box relating to Module Configuration appears, click the OK button.

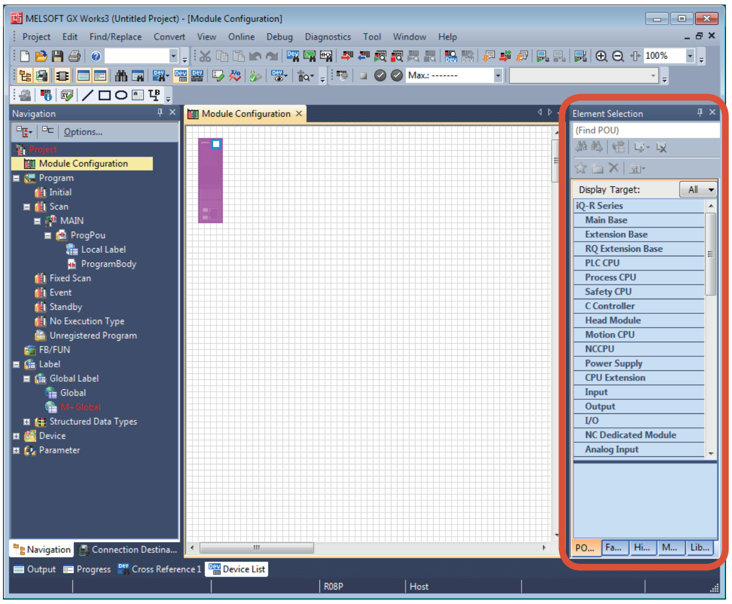


(3) A Module Configuration screen appears.

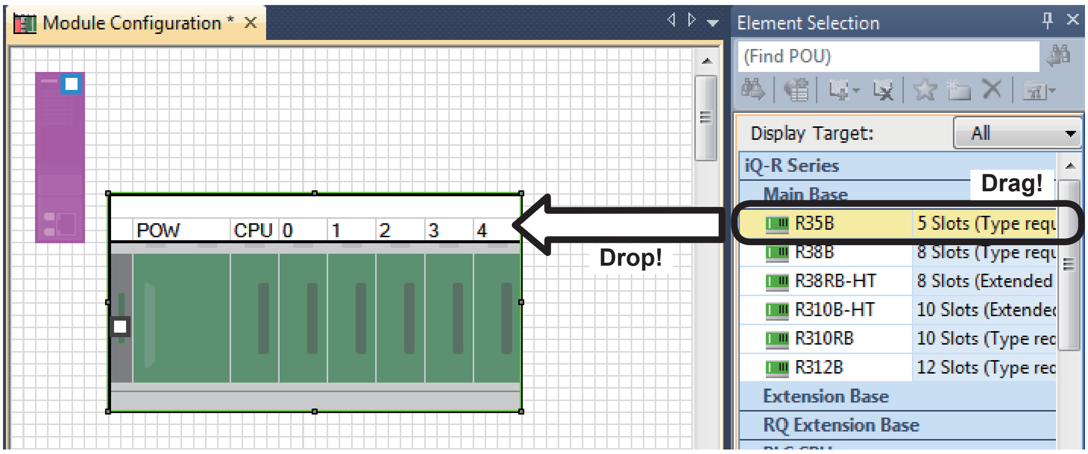
(4) Click [View] → [Docking window] → [Element Selection].

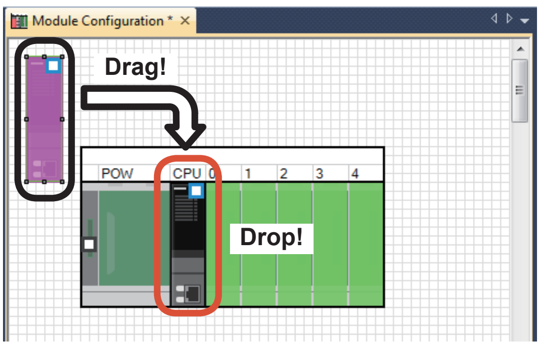


The Element Selection list is displayed.



(5) Drag iQ-R Series Main Base “R35B” from the Element Selection list, and drop it on the Module Configuration screen.





(6) Drag and drop the CPU module (R08CPU) in the CPU slot of R35B.

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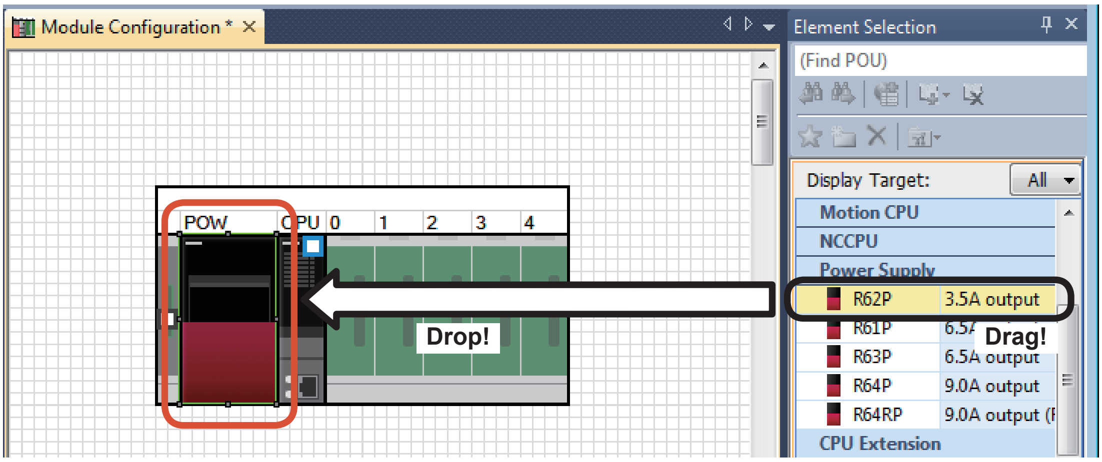
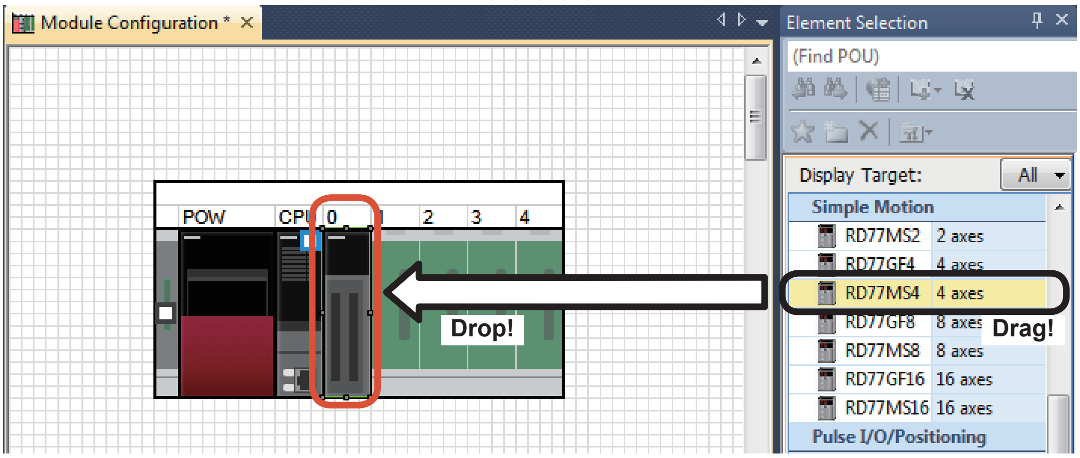
(7) Drag iQ-R Series Power Supply “R62P” from the Element Selection list, and drop it in the POW slot of R35B.



(8) Drag iQ-R Series Simple Motion “RD77MS4” from the Element Selection list, and drop it in the 0 slot of R35B.



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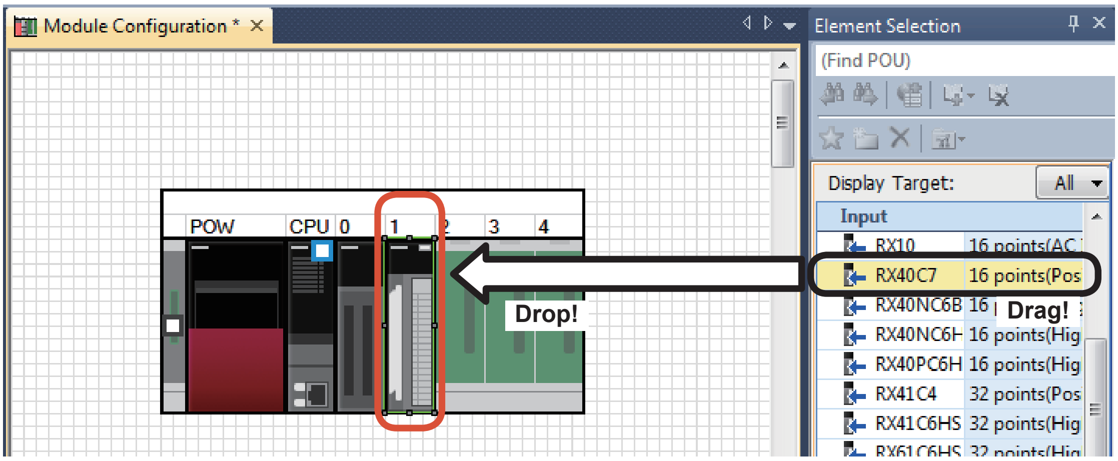
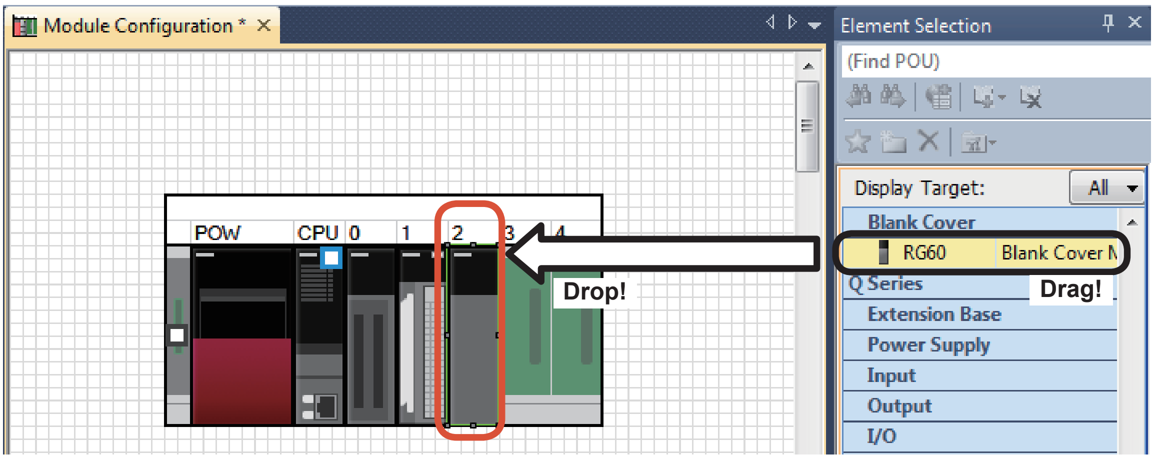
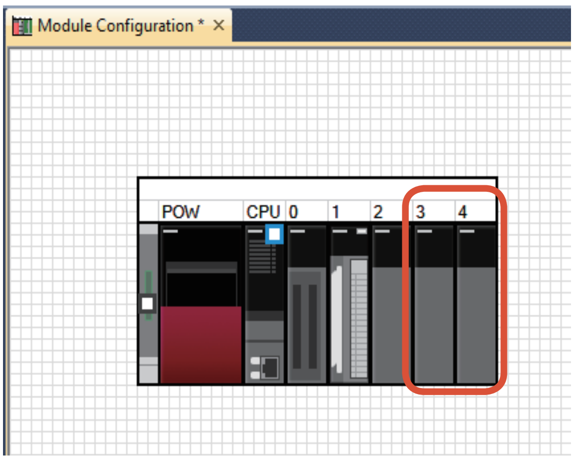
(9) Drag iQ-R Series input “RX40C7” from the Element Selection list, and drop it in the slot 1 of R35B.



(10) Drag iQ-R Series Blank Cover “RG60” from the Element Selection list, and drop it in the slot 2 of R35B.





Drag and drop “RG60” in the slots 3 and 4 in the same manner.

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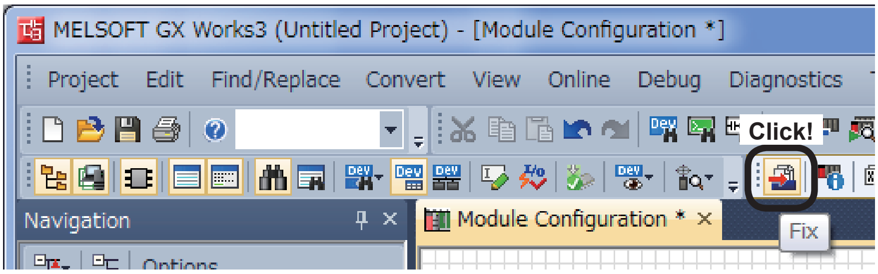
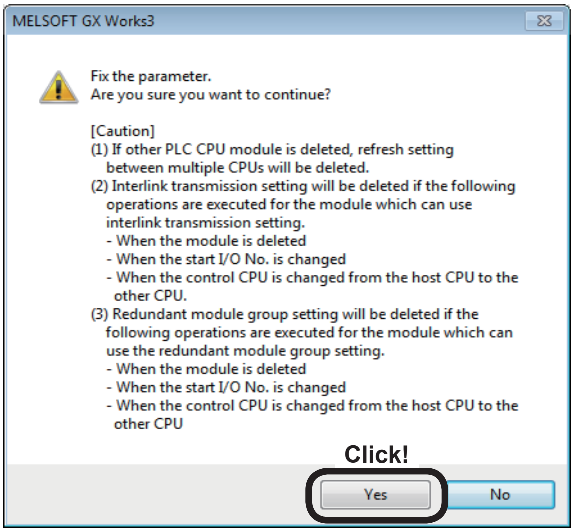
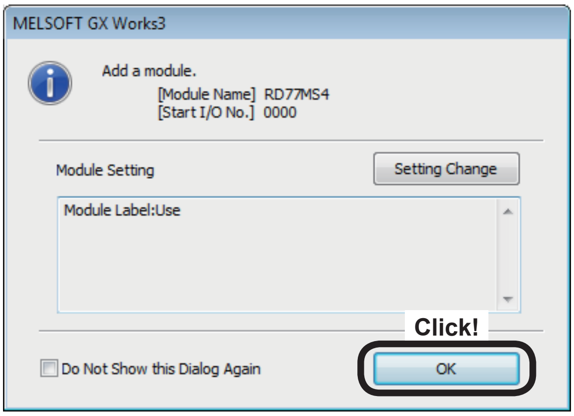
(11) Click the tool bar option [Fix].





The dialog box for entering the parameters appears. Click the Yes button.



(12) The dialog box shown on the left appears, press the OK button.

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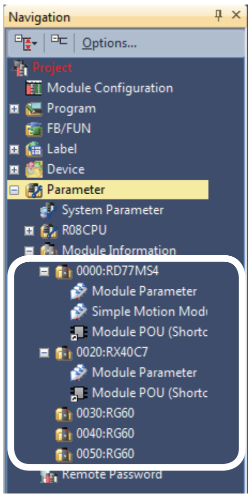
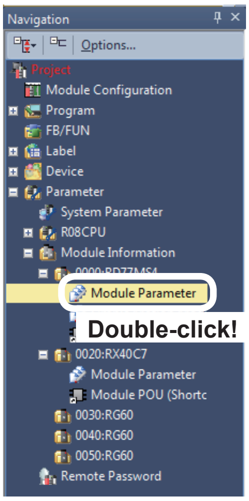
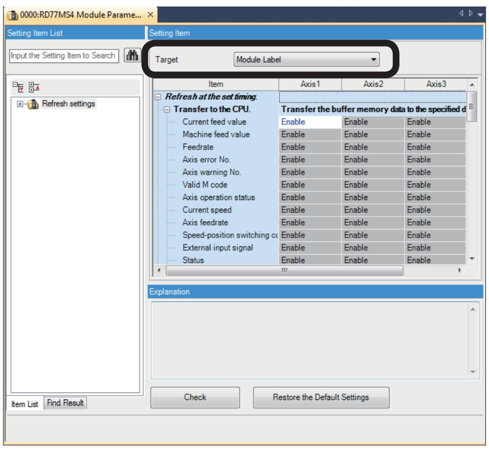


(13) The data on the extension modules added to the module configuration is reflected in the navigation window.



(14) Refresh the data on added RD77MS4.

In the [Navigation window], select [Parameter] → [Module Information] → [0000:RD77MS4], and double-click [Module Parameter].



(15) The module parameter screen for RD77MS4 appears.

Specify Module Label as the destination. The content of each buffer memory corresponding to the module label added in (12) is transmitted to the destination.

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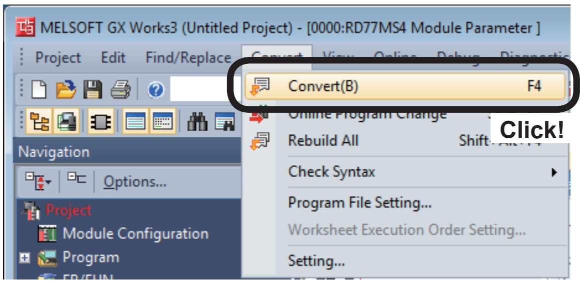


(16) Enable the CPU module setting.

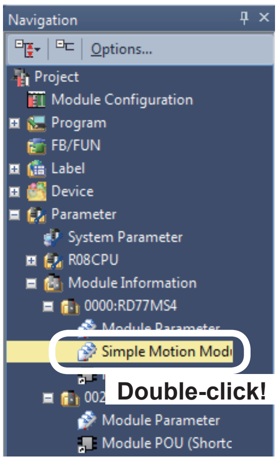
Click [Convert] → [Convert].

5.3 Simple Motion Module Setting

Set various parameters from the Simple Motion Module setting tool to use the positioning functions of RD77MS4.

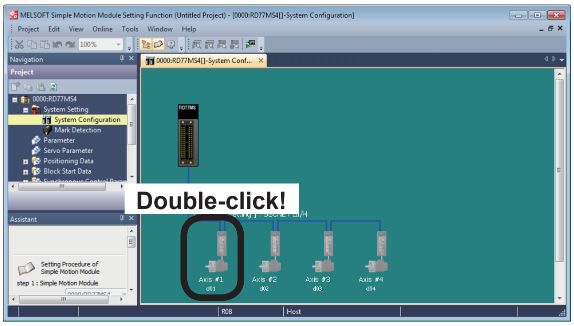
Part of the parameters can be set by using the assistant function. For the assistant function, refer to Appendix 3.

5.3.1 System configuration



(1) Start the Simple Motion Module setting tool.

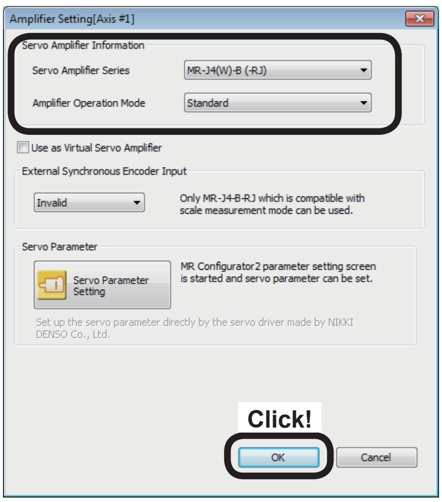
In the [Navigation window], select [Parameter] → [Module Information] → [0000:RD77MS4], and double-click [Simple Motion Module Setting].



(2) The Simple Motion Module setting tool will start.

The system configuration window appears. Set the system configuration.

Double-click an Axis #1 (d01).



(3) The Amplifier Setting [Axis #1] dialog box appears. Set the data as shown below, and click the OK button.

Servo Amplifier Series: MR-J4(W)-B (-RJ)
Amplifier Operation Mode: Standard

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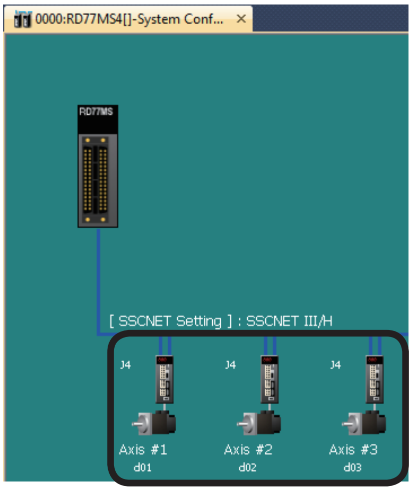
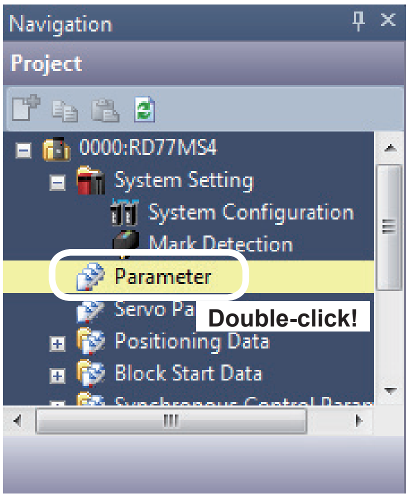


(4) Set Axis #2 (d02) and Axis #3 (d03) as shown below in accordance with the procedures in Steps (2) and (3).

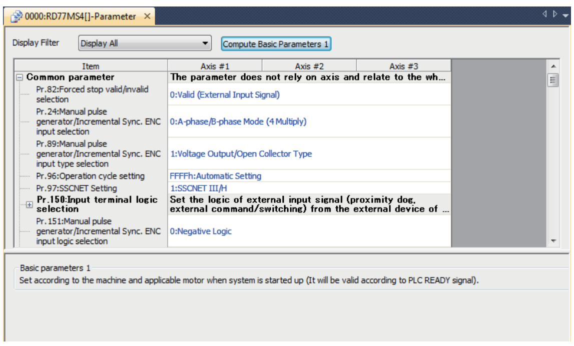
Servo Amplifier Series: MR-J4(W)-B (-RJ)
Amplifier Operation Mode: Standard

5.3.2 Parameters



(1) Set parameters of the RD77MS4.

In the [Navigation window], select [0000:RD77MS4], and double-click [Parameter].



(2) The RD77MS4 Parameter Setting screen appears.

Set the parameters of each axis.

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(3) Specify Common parameters as shown below.
Refer to Section 4.3 for details on Common Parameters.

Item	Axis #1	Axis #2	Axis #3
Common parameter	The parameter does not rely on axis and relate to the wh...		
Pr.82:Forced stop valid/invalid selection	1:Invalid		
Pr.24:Manual pulse generator/Incremental Sync. ENC input selection	0:A-phase/B-phase Mode (4 Multiply)		
Pr.89:Manual pulse generator/Incremental Sync. ENC input type selection	1:Voltage Output/Open Collector Type		
Pr.96:Operation cycle setting	FFFFh:Automatic Setting		
Pr.97:SSCNET Setting	1:SSCNET III/H		
Pr.150:Input terminal logic selection	Set the logic of external input signal (proximity dog, external command/switching) from the external device of ...		
Pr.151:Manual pulse generator/Incremental Sync. ENC input logic selection	0:Negative Logic		

(4) Specify Basic parameters 1 as shown below.
Refer to Section 4.4.1 for details on Basic parameters 1.

Item	Axis #1	Axis #2	Axis #3
Basic parameters 1	Set according to the machine and applicable motor when...		
Pr.1:Unit setting	0:mm	0:mm	0:mm
Pr.2:No. of pulses per rotation	4194304 pulse	4194304 pulse	4194304 pulse
Pr.3:Movement amount per rota...	2000.0 µm	2000.0 µm	8000.0 µm
Pr.4:Unit magnification	1:x1 Times	1:x1 Times	1:x1 Times
Pr.7:Bias speed at start	0.00 mm/min	0.00 mm/min	0.00 mm/min

(5) Specify Basic parameters 2 as shown below.
Refer to Section 4.4.2 for details on Basic parameters 2.

Item	Axis #1	Axis #2	Axis #3
Basic parameters 2	Set according to the machine and applicable motor when ...		
Pr.8:Speed limit value	10000.00 mm/min	10000.00 mm/min	10000.00 mm/min
Pr.9:Acceleration time 0	100 ms	100 ms	100 ms
Pr.10:Deceleration time 0	150 ms	150 ms	150 ms

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(6) Specify Detailed parameters 1 as shown below.
Refer to Section 4.5.1 for details on Detailed parameters 1.

Item	Axis #1	Axis #2	Axis #3
Detailed parameters 1	Set according to the system configuration when the syst...		
Pr.11:Backlash compensation a...	0.0 µm	0.0 µm	0.0 µm
Pr.12:Software stroke limit uppe...	214748364.7 µm	214748364.7 µm	149000.0 µm
Pr.13:Software stroke limit lowe...	-214748364.8 µm	-214748364.8 µm	-1000.0 µm
Pr.14:Software stroke limit selec...	0:Set Software Strok...	0:Set Software Strok...	0:Set Software Strok...
Pr.15:Software stroke limit valid...	0:Valid	0:Valid	0:Valid
Pr.16:Command in-position width	10.0 µm	10.0 µm	10.0 µm
Pr.17:Torque limit setting value	300.0 %	300.0 %	300.0 %
Pr.18:M-code ON signal output t...	0:WITH Mode	0:WITH Mode	0:WITH Mode
Pr.19:Speed switching mode	0:Standard Speed Sw...	0:Standard Speed Sw...	0:Standard Speed Sw...
Pr.20:Interpolation speed desig...	0:Vector Speed	0:Vector Speed	0:Vector Speed
Pr.21:Feed current value during...	0:Not Update of Fee...	0:Not Update of Fee...	0:Not Update of Fee...
Pr.22:Input signal logic selection...	0:Negative Logic	0:Negative Logic	0:Negative Logic
Pr.22:Input signal logic selection...	0:Negative Logic	0:Negative Logic	0:Negative Logic
Pr.22:Input signal logic selection...	0:Negative Logic	0:Negative Logic	0:Negative Logic
Pr.22:Input signal logic selection...	0:Negative Logic	0:Negative Logic	1:Positive Logic
Pr.81:Speed-position function s...	0:Speed-position Swit...	0:Speed-position Swit...	0:Speed-position Swit...
Pr.116:FLS signal selection : Inp...	15:Invalid	15:Invalid	1:Servo Amplifier
Pr.116:FLS signal selection : Inp...	00h:No Setting	00h:No Setting	00h:No Setting
Pr.117:RLS signal selection : Inp...	15:Invalid	15:Invalid	1:Servo Amplifier
Pr.117:RLS signal selection : Inp...	00h:No Setting	00h:No Setting	00h:No Setting
Pr.118:DOG signal selection : In...	15:Invalid	1:Servo Amplifier	1:Servo Amplifier
Pr.118:DOG signal selection : In...	00h:No Setting	00h:No Setting	00h:No Setting
Pr.119:STOP signal selection : I...	15:Invalid	15:Invalid	15:Invalid
Pr.119:STOP signal selection : I...	00h:No Setting	00h:No Setting	00h:No Setting

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(7) Specify Detailed parameters 2 as shown below.
Refer to Section 4.5.2 for details on Detailed parameters 2.

Item	Axis #1	Axis #2	Axis #3
Detailed parameters 2	Set according to the system configuration when the syst...		
Pr.25:Acceleration time 1	50 ms	1000 ms	1000 ms
Pr.26:Acceleration time 2	1000 ms	1000 ms	1000 ms
Pr.27:Acceleration time 3	1000 ms	1000 ms	1000 ms
Pr.28:Deceleration time 1	2000 ms	1000 ms	1000 ms
Pr.29:Deceleration time 2	1000 ms	1000 ms	1000 ms
Pr.30:Deceleration time 3	1000 ms	1000 ms	1000 ms
Pr.31:JOG speed limit value	6000.00 mm/min	6000.00 mm/min	5000.00 mm/min
Pr.32:JOG operation acceleratio...	0:100	0:100	0:100
Pr.33:JOG operation deceleratio...	0:150	0:150	0:150
Pr.34:Acceleration/deceleration ...	1:S-curve Acceleratio...	1:S-curve Acceleratio...	1:S-curve Acceleratio...
Pr.35:S-curve ratio	50 %	50 %	50 %
Pr.36:Rapid stop deceleration time	50 ms	50 ms	50 ms
Pr.37:Stop group 1 rapid stop s...	0:Normal Deceleratio...	0:Normal Deceleratio...	0:Normal Deceleratio...
Pr.38:Stop group 2 rapid stop s...	0:Normal Deceleratio...	0:Normal Deceleratio...	0:Normal Deceleratio...
Pr.39:Stop group 3 rapid stop s...	0:Normal Deceleratio...	0:Normal Deceleratio...	0:Normal Deceleratio...
Pr.40:Positioning complete signa...	300 ms	300 ms	300 ms
Pr.41:Allowable circular interpol...	10.0 µm	10.0 µm	10.0 µm
Pr.42:External command functio...	0:External Positioning...	0:External Positioning...	0:External Positioning...
Pr.83:Speed control 10x multipli...	0:Invalid	0:Invalid	0:Invalid
Pr.84:Restart permissible value ...	0 pulse	0 pulse	0 pulse
Pr.90:Operation setting for SPD...	0:Command Torque	0:Command Torque	0:Command Torque
Pr.90:Operation setting for SPD...	0:Command Speed	0:Command Speed	0:Command Speed
Pr.90:Operation setting for SPD...	0:Switching Condition...	0:Switching Condition...	0:Switching Condition...
Pr.127:Speed limit value input s...	0:Input Enable	0:Input Enable	0:Input Enable
Pr.95:External command signal s...	0:Not Used	0:Not Used	0:Not Used
Pr.122:Manual pulse generator ...	0:Do Not Execute Sp...	0:Do Not Execute Sp...	0:Do Not Execute Sp...
Pr.123:Manual pulse generator ...	200.00 mm/min	200.00 mm/min	200.00 mm/min

(8) Specify Home position return basic parameters as shown below.
Refer to Section 4.6.1 for details on Home position return basic parameters.

Item	Axis #1	Axis #2	Axis #3
HPR basic parameters	Set the values required for carrying out HPR control (Thi...		
Pr.43:HPR method	6:Data Set Method	0:Proximity Dog Method	0:Proximity Dog Method
Pr.44:HPR direction	1:Reverse Direction (...	1:Reverse Direction (...	1:Reverse Direction (...
Pr.45:HP address	-5000.0 µm	-5000.0 µm	0.0 µm
Pr.46:HPR speed	0.01 mm/min	100.00 mm/min	600.00 mm/min
Pr.47:Creep speed	0.01 mm/min	20.00 mm/min	250.00 mm/min
Pr.48:HPR retry	0:Do Not Retry HPR ...	1:Retry HPR with Limi...	1:Retry HPR with Limi...

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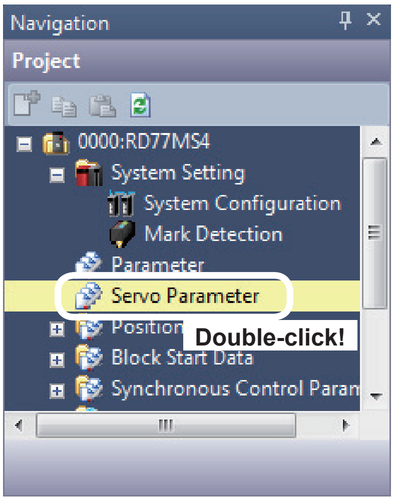
(9) Specify Home position return detailed parameters as shown below.
Refer to Section 4.6.2 for details on Home position return detailed parameters.

Item	Axis #1	Axis #2	Axis #3
HPR detailed parameters	Set the values required for carrying out HPR control (Thi...		
Pr.50:Setting for the movement ...	0.0 μm	0.0 μm	0.0 μm
Pr.51:HPR acceleration time sele...	0:100	0:100	0:100
Pr.52:HPR deceleration time sel...	0:150	0:150	0:150
Pr.53:HP shift amount	0.0 μm	-5000.0 μm	0.0 μm
Pr.54:HPR torque limit value	300.0 %	300.0 %	300.0 %
Pr.55:Operation setting for inco...	1:Positioning Control i...	1:Positioning Control i...	1:Positioning Control i...
Pr.56:Speed designation during ...	0:HPR Speed	0:HPR Speed	0:HPR Speed
Pr.57:Dwell time during HPR retry	0 ms	0 ms	0 ms
Pr.86:Pulse conversion unit : HP...	0:Turn HPR Request ...	0:Turn HPR Request ...	0:Turn HPR Request ...
Pr.87:Pulse conversion unit : W...	0 ms	0 ms	0 ms

5.3.3 Servo parameters



(1) Set parameters of the servo amplifier.
In the [Navigation window], select [0000:RD77MS4], and double-click [Servo Parameter].

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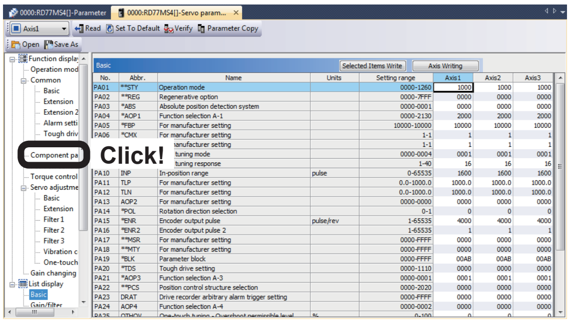
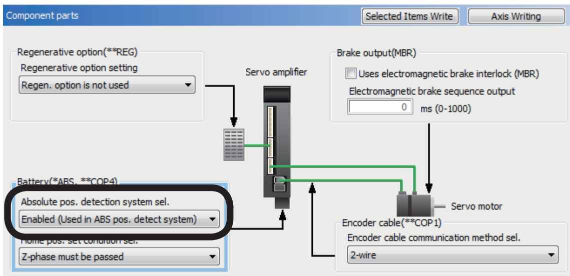
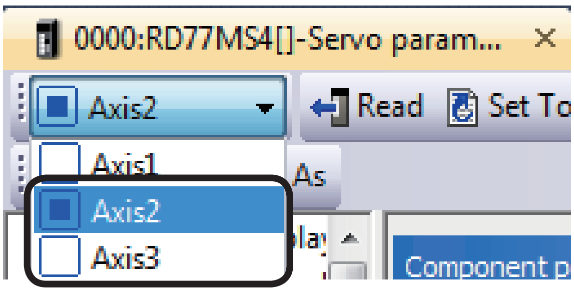


(2) A Servo Parameter Setting screen appears. Click [Function display] → [Component parts] in the Parameter Setting screen display selection tree, and then specify the following settings.

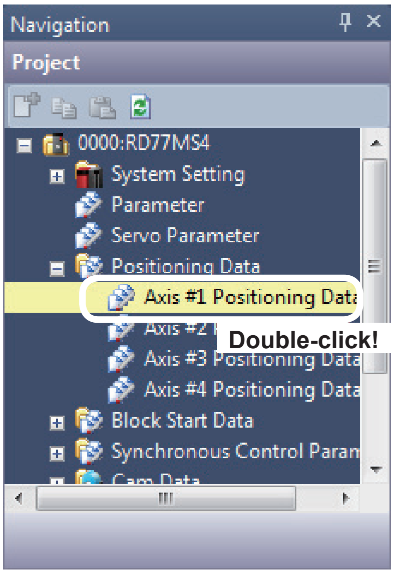


(3) Absolute pos. detection system selection.
: Enabled (Used in ABS pos. detect system)



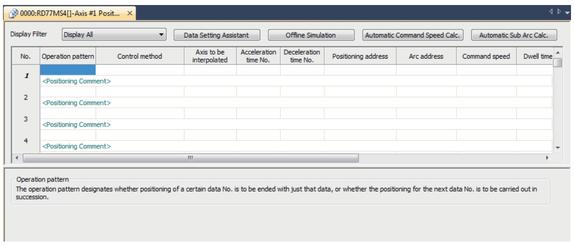
(4) Switch to Axis 2 and 3, and set the parameter settings in a manner similar to Axis 1.

5.3.4 Positioning data



(1) Set the positioning data.

Select [0000:RD77MS4] → [Positioning Data], and double-click [Axis #1 Positioning Data].



(2) Axis #1 Positioning Data Setting screen appears.

Specify positioning as shown below.

Refer to Section 4.9 for details on positioning data.

Axis 1 Positioning Data

No.	Operation pattern	Control method	Axis to be interpolated	Acceleration time No.	Deceleration time No.	Positioning address
1	0:END	01h:ABS Linear 1	-	0:100	0:150	35000.0 µm
	<Positioning Comment>					
2	0:END	01h:ABS Linear 1	-	0:100	0:150	70000.0 µm
	<Positioning Comment>					
3	0:END	01h:ABS Linear 1	-	0:100	0:150	10000.0 µm
	<Positioning Comment>					

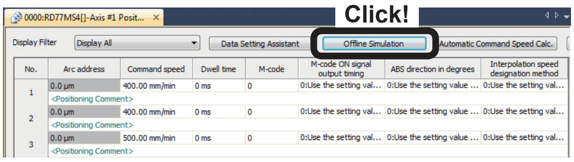
No.	Arc address	Command speed	Dwell time	M-code	M-code ON signal output timing	ABS direction in degrees	Interpolation speed designation method
1	0.0 µm	400.00 mm/min	0 ms	0	0:Use the setting val...	0:Use the setting value ...	0:Use the setting val...
	<Positioning Comment>						
2	0.0 µm	400.00 mm/min	0 ms	0	0:Use the setting val...	0:Use the setting value ...	0:Use the setting val...
	<Positioning Comment>						
3	0.0 µm	500.00 mm/min	0 ms	0	0:Use the setting val...	0:Use the setting value ...	0:Use the setting val...
	<Positioning Comment>						

Remarks

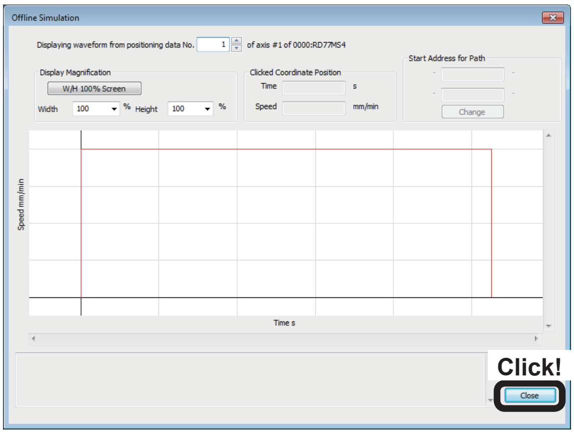
The positioning data can be edited by selecting the range by dragging the mouse and using the [Cut], [Copy] and [Paste] functions in the [Edit] mode.

5.3.5 Simulation

The simulation (virtual positioning) function is designed to confirm whether the set positioning data including the operation pattern, control method, addresses and command speed is appropriate.



(1) Click the Offline Simulation button on the Axis 1 Positioning Data Setting screen.



(2) Offline Simulation window appears.

(3) The results of simulation with positioning data No.1 are displayed.

(4) The positioning data of each axis can be simulated by changing the number in “0000:RD77MS4 Axis Positioning Start No.” to 2, 3, …

(5) To terminate the simulation, click the Close button to close the offline simulation window.

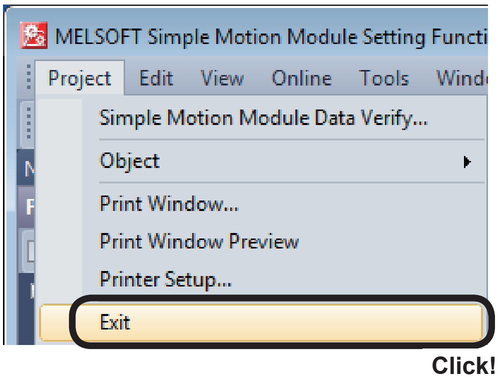
PRECAUTIONS

The results of simulation of positioning from the address 0 are displayed.

5.4 Writing to the RD77MS

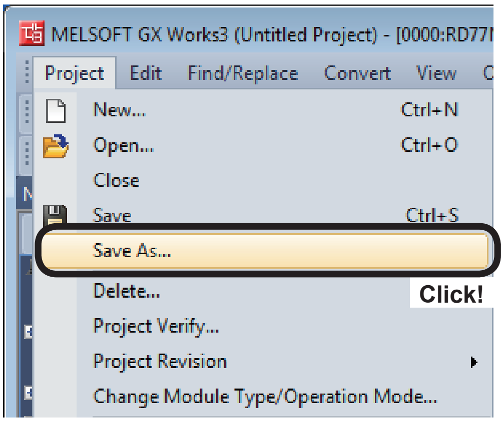
The set parameters are written to RD77MS.

5.4.1 Saving the project

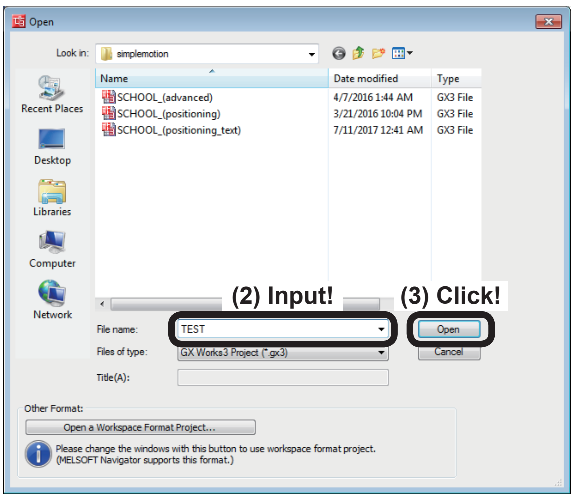


(1) Terminate the Simple Motion Module setting tool.

Click [Project] → [Exit] on the Simple Motion Module setting tool menu.



Click [Project] → [Save As...] on the GX Works3 menu.



(2) The Save As window appears. Input the file name.

(3) Click the Save button, and the project will be newly saved.

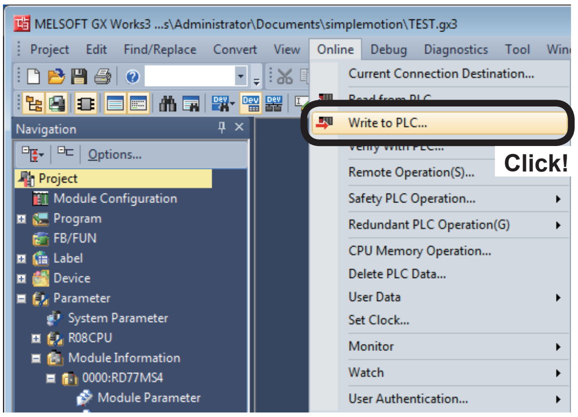
5.4.2 Writing to the PLC

Write settings data to the CPU module.

> **POINT**
>
> If the data cannot be written to the CPU module, delete the data in the CPU module, and write it again.
> For the method for deleting data, refer to Appendix 2.

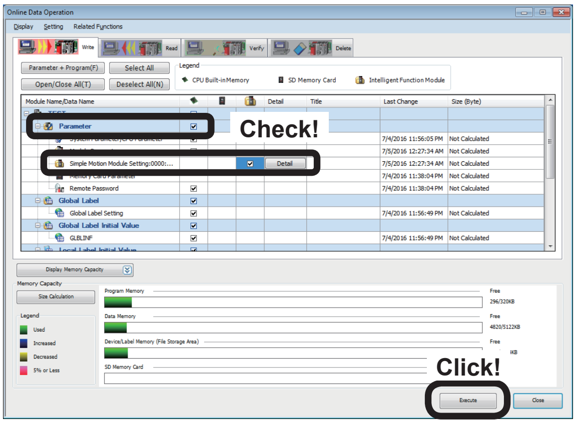
(1) Connect the personal computer and CPU module with the USB cable, and set the RUN/STOP/RESET switch of the CPU module to STOP.

⇩



(2) Click [Online] → [Write to PLC...].

⇩



(3) An Online Data Operation dialog box appears.
Check the "Parameter " and the "Simple Motion Module Setting:0000:RD77MS".

(4) Click the Execute button.

⇩

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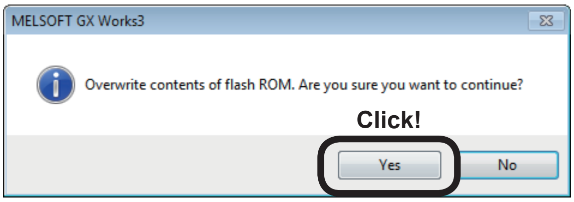
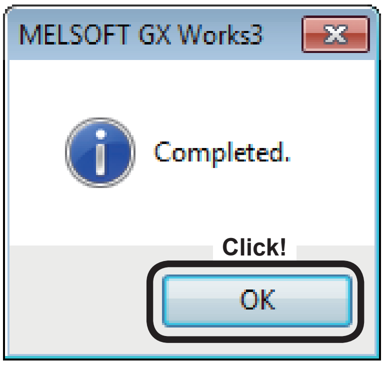
(5) The dialog box for writing to the PLC appears, and writing is started.

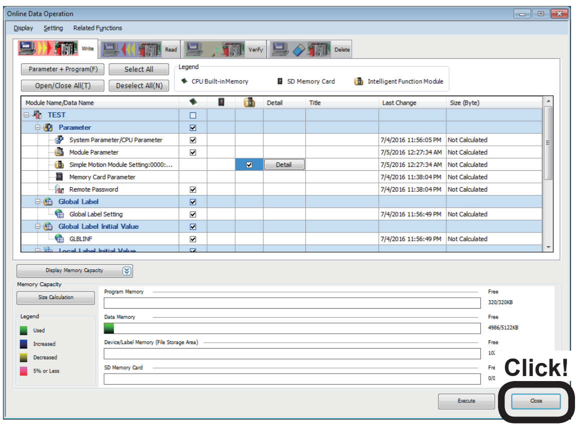
If the message shown left is displayed, click the [Yes to all] button.



The message shown left is displayed in the middle of writing. Click the [Yes] button.



(6) After the completion of writing, the message shown left is displayed. Click the [OK] button.



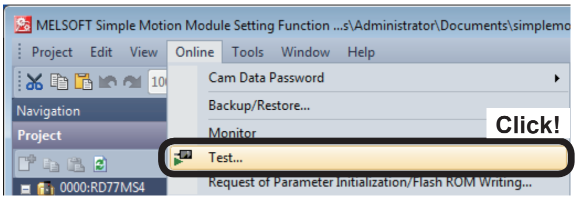
(7) Click the [Close] button in the Online Data Operation dialog box to close the dialog box.

(8) Reset the CPU module. (Hold the RUN/STOP/RESET switch on the RESET side.)

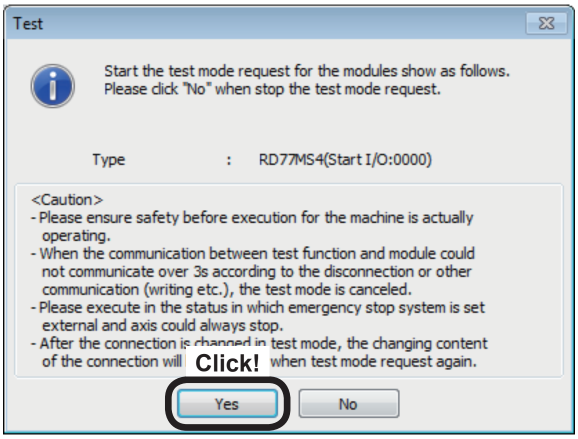
5.5 Test Operation

The home position return test and the test operation with written positioning data are performed to check the operation of RD77MS.

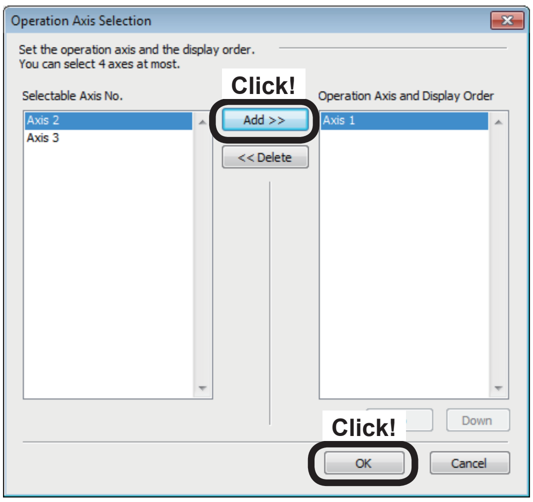
For the Simple Motion Monitor, refer to Appendix 5.



(1) Click [Online] → [Test] of the Simple Motion Module setting tool.



(2) The Test dialog box appears, press the Yes button.



(3) The Operation Axis Selection dialog box appears. The axis selected in [Selectable Axis No.] is moved to [Operation Axis and Display Order] by clicking the Add button. Move the axes 1 to 3 to [Operation Axis and Display Order], and click the OK button.

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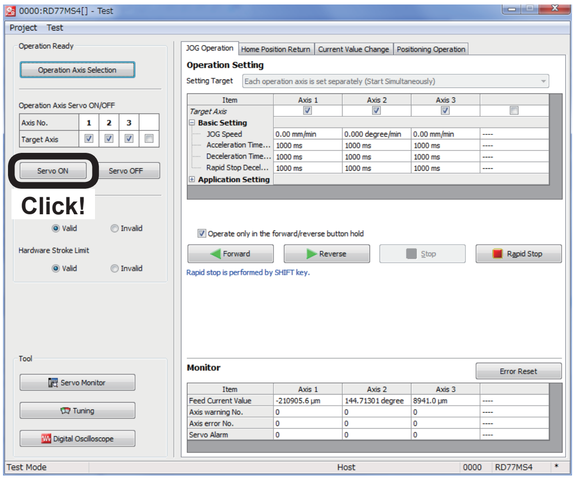
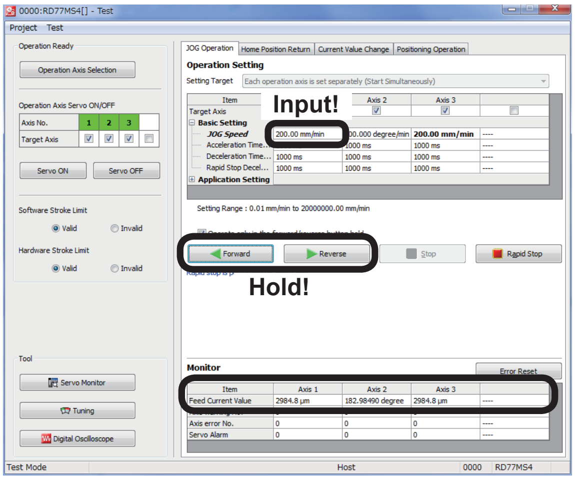


(4) The 0000:RD77MS[ ]- Test dialog box (JOG operation test display) appears.

Click the Servo ON button, and the servo amplifiers of axes 1 to 3 are turned on.



(5) Input 200.00 mm/min in [JOG Speed] of Axis 1 in the Basic Setting field, and click the Forward button. While the Forward button is held, the axes 1 to 3 are jogging in the forward direction. While the Reverse button is held, the axes 1 to 3 are jogging in the reverse direction.

The feed current value of each axis is displayed in the Monitor field under the dialog box. Make sure that the current value is incremented and decremented by the JOG operation.

POINT

1. The setting method in the Basic Setting field varies depending on the object of setting.
   - Setting of the same values for all operation axes (tandem operation)… The set values for the axis 1 are applied to the axes 2 and 3.
   - Individual setting of each operation axis (simultaneous start)… Perform the basic setting for each axis.
2. The JOG operation is performed only on the axes with a check in the Target Axis checkbox.
3. If the “Operate only in the forward/reverse button hold” checkbox is unchecked, the JOG operation will not be stopped until the Stop or Rapid Stop button is clicked after the operation is started.

PRECAUTIONS

The demonstration machine has upper limit and lower limit switches for axis 3. Pay attention to its current position. If any error occurs, click the Error Reset button in the Monitor field. The error will be reset.

If any error occurs on the axis 3 while some axes including the axis 3 are jogging, all axes will stop.

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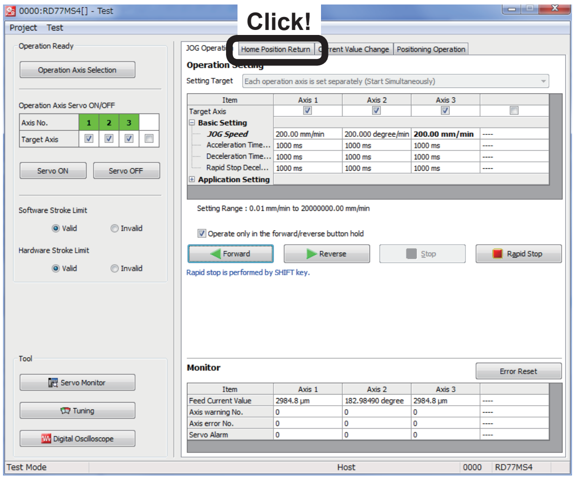
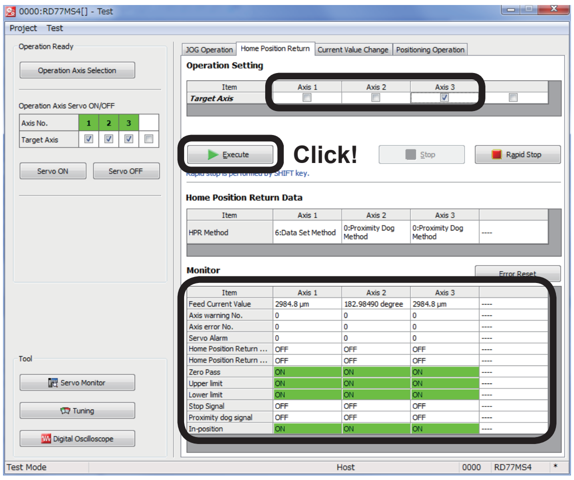


(6) Switch the display to Home Position Return test mode.

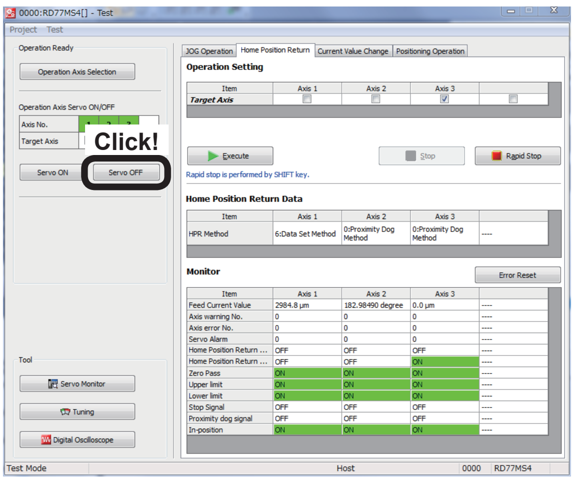
Click the [Home Position Return] tab.



(7) Uncheck the [Target Axis] checkboxes of the axes not to be returned to the home positions in the Operation Setting field.

Click Execute, and each axis will return to the home position by the home position return method specified in the home position return basic parameter (Section 4.6.1).

The feed current value of each axis is displayed in the Monitor field under the dialog box. After the completion of home position return, check that the axes are positioned in the home position addresses specified in the home position return basic parameters.



(8) Click Servo OFF to turn off the servo amplifiers of axes 1 to 3.

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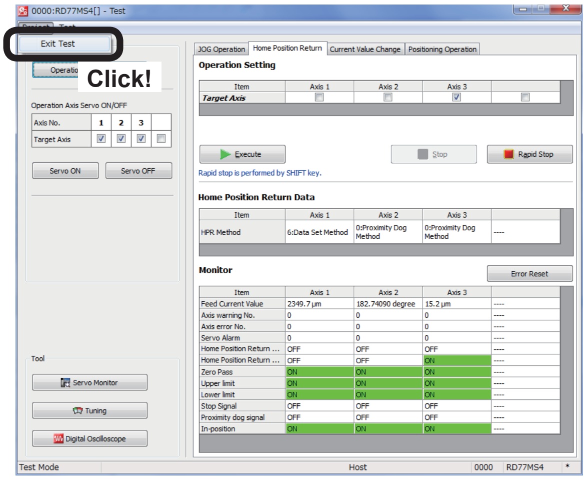
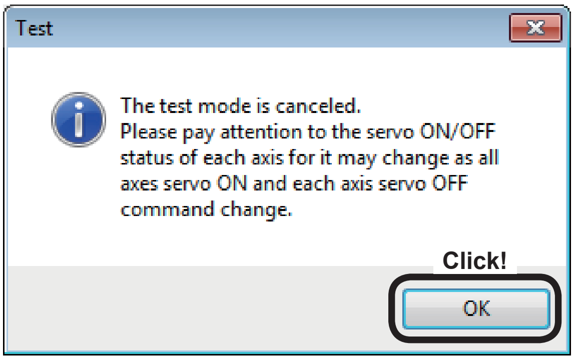


(9) Terminate the test mode.

Click [Project] → [Exit Test] in the dialog box.



The message shown on the left appears, press the OK button.

Chapter 6 Practice (2) Training in Positioning Control

6.1 Practice Content

In this chapter, we will learn the basic home position return operation and JOG operation using programs.

In addition, we will practice positioning to the standby point using major positioning control functions and positioning by specifying the point or address from the demonstration machine operation panel.

6.2 Device Assignment

Input (X)		Output (Y)	
X0	READY	Y0	PLC ready
X1	Synchronization flag	Y1	All axis servo ON
X10	Axis 1.BUSY	Y10	Axis 1.Positioning start
X11	Axis 2.BUSY	Y11	Axis 2.Positioning start
X12	Axis 3.BUSY	Y12	Axis 3.Positioning start

Internal relay (M)			
M0	[PB for GOT] Standby point	M4023	Axis 2 home position return FB operation NG flag
M1	[PB for GOT] Position selection	M4030	Axis 3 home position return FB start
M2	[PB for GOT] Indirect specification	M4031	Axis 3 home position return FB operating flag
M10	[Operating flag] Standby point	M4032	Axis 3 home position return FB operation OK flag
M11	[Operating flag] Position selection	M4033	Axis 3 home position return FB operation NG flag
M12	[Operating flag] Indirect specification	M4110	Axis 1 positioning FB start
M20	[PB for GOT] Speed change (2000)	M4111	Axis 1 positioning FB operating flag
M21	[PB for GOT] Speed change (1000)	M4112	Axis 1 positioning FB operation OK flag
M22	[PB for GOT] Speed change (500)	M4113	Axis 1 positioning FB operation NG flag
M23	[PB for GOT] Speed change (0)	M4210	Axis 1 speed change FB start
M1000	[PB for GOT] Servo ON	M4211	Axis 1 speed change FB operating flag
M1010	[PB for GOT] Axis 1 reverse rotation JOG	M4212	Axis 1 speed change FB operation OK flag
M1011	[PB for GOT] Axis 1 forward rotation JOG	M4213	Axis 1 speed change FB operation NG flag
M1012	[PB for GOT] Axis 2 reverse rotation JOG	M4800	FB start Standby point
M1013	[PB for GOT] Axis 2 forward rotation JOG	M4801	FB start Position selection
M1014	[PB for GOT] Axis 3 forward rotation JOG	M4802	FB start Indirect specification
M1015	[PB for GOT] Axis 3 reverse rotation JOG	M4910	FB start Axis 1 speed change (2000)
M1020	[PB for GOT] Home position return	M4911	FB start Axis 1 speed change (1000)
M1021	Home position return trigger	M4912	FB start Axis 1 speed change (500)
M1022	Axis 1 home position return start	M4913	FB start Axis 1 speed change (0)
M1023	Axis 2 home position return start	M6000	JOG•home position mode
M1024	Axis 3 home position return start	M6001	Positioning control 1
M4010	Axis 1 home position return FB start	M6010	Error detected
M4011	Axis 1 home position return FB operating flag	M6800	JOG•home position switch
M4012	Axis 1 home position return FB operation OK flag	M6801	Positioning control switch
M4013	Axis 1 home position return FB operation NG flag	M6802	Advanced synchronous control 1 switch

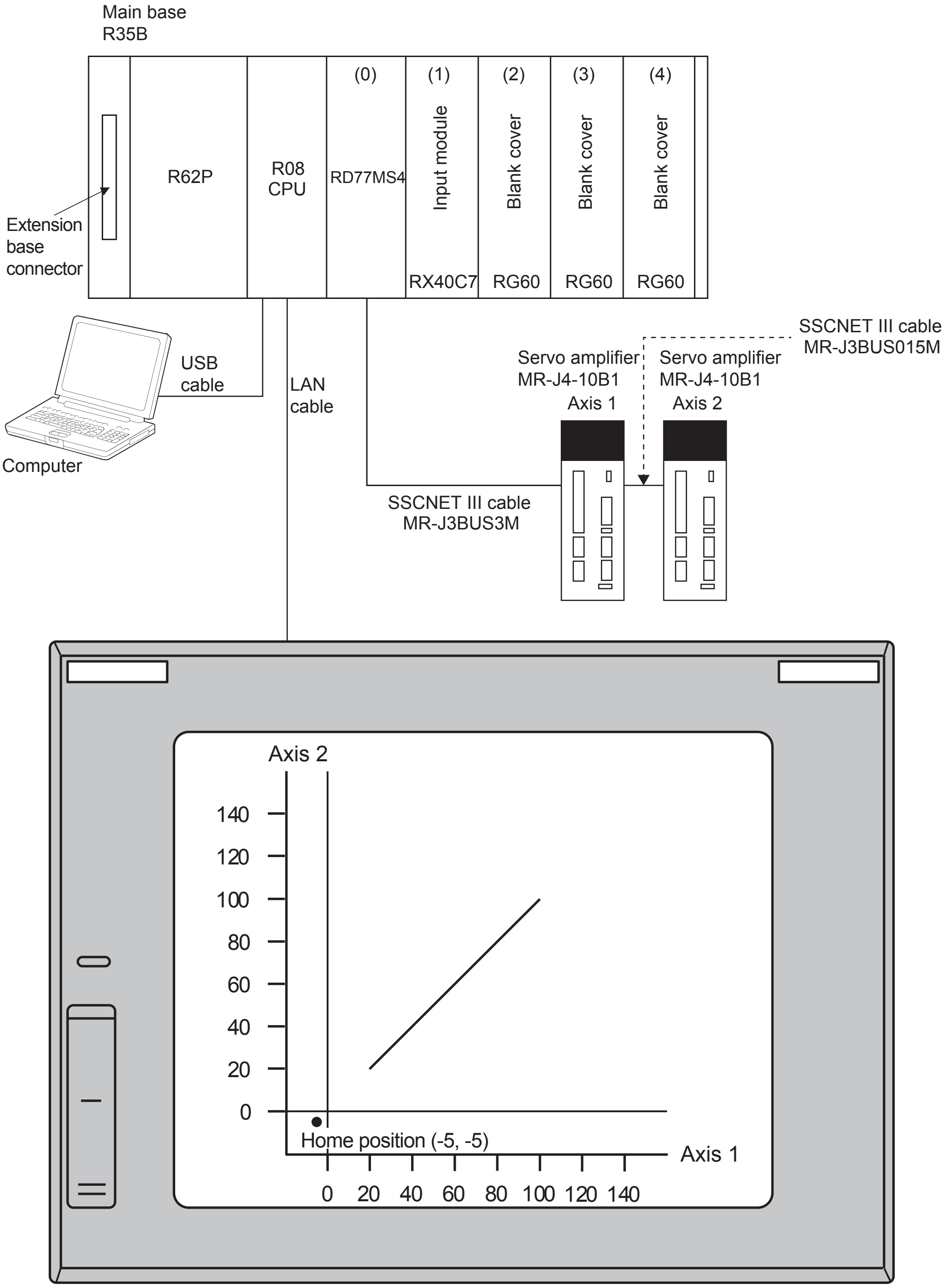
Internal relay (M)			
M4020	Axis 2 home position return FB start	M6803	Advanced synchronous control 2 switch
M4021	Axis 2 home position return FB operating flag	M6850	Positioning program startup
M4022	Axis 2 home position return FB operation OK flag		

Data register (D)			
D0	Axis 1 Feed current value	D2002	GOT value after calculation
D1		D2003	
D20	Axis 2 Feed current value	D2004	
D21		D2005	
D40	Axis 3 Feed current value	D3900	JOG•home position return screen change device
D41		D4019	Axis 1 home position return FB error No. storage
D640	Axis 1 JOG speed	D4029	Axis 2 home position return FB error No. storage
D641		D4039	Axis 3 home position return FB error No. storage
D642	Axis 2 JOG speed	D4118	Axis 1 positioning FB Positioning No. storage
D643		D4119	Axis 1 positioning FB error No. storage
D644	Axis 3 JOG speed	D4217	Axis 1 speed change FB speed storage
D645		D4218	
D2000	GOT value specification	D4219	Axis 1 speed change FB error No. storage
D2001			

6.3 RD77MS Demonstration Machine System Configuration

6.3.1 System configuration

In this training, the following system with two axes is used.

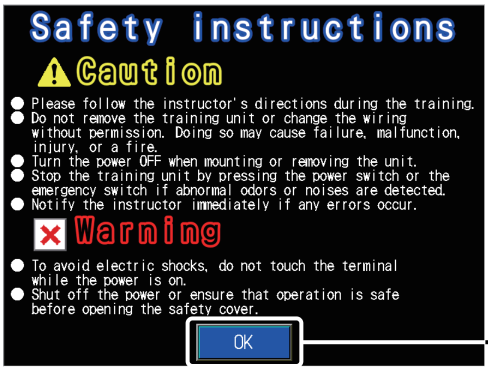


GOT
(Demonstration machine operation panel)

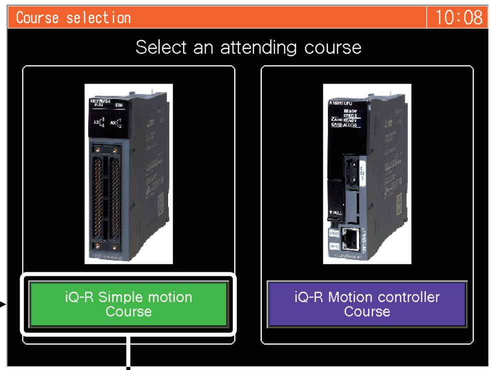
6.3.2 Demonstration machine operation panel

Demonstration machine operation panel is as follows.

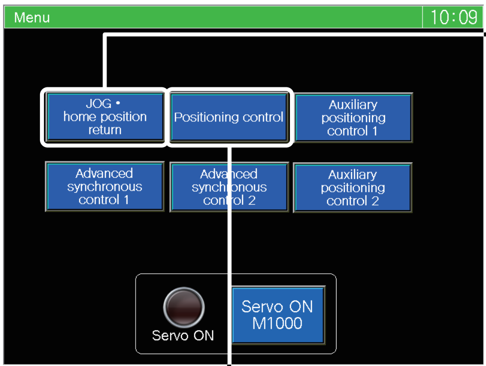
[Start screen]



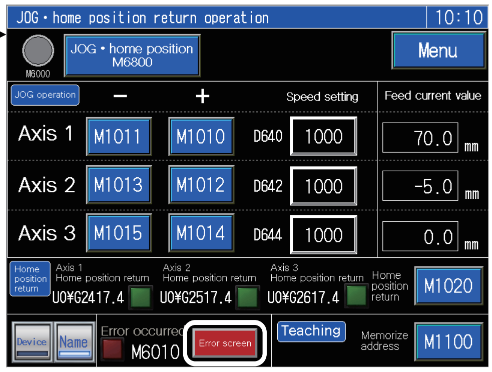
[Course selection screen]



[Screen switching menu]

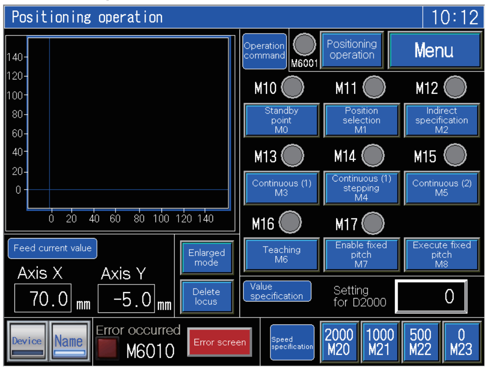


[JOG•home position return operation panel]



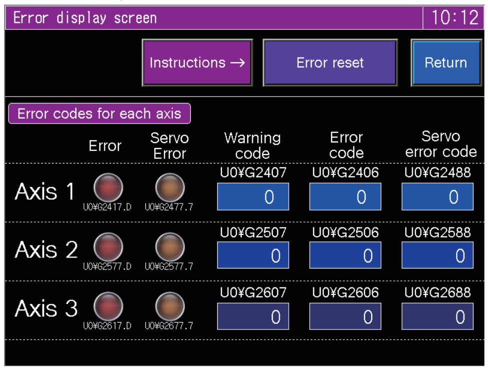
Related positioning controls
・JOG operation (Refer to Section 6.8.2)
・Home position return (Refer to Section 6.8.2)

[Positioning operation screen]



Related positioning controls
・Standby point positioning (Refer to Section 6.8.4)
・Point selection positioning (Refer to Section 6.8.5)
・Address indirect specification positioning (Refer to Section 6.8.6)
・Speed change (Refer to Section 6.8.7)
・Continuous positioning (1) (Refer to Appendix 2.3.2.)
・Continuous positioning (2) (Refer to Appendix 2.3.3.)
・Teaching, teaching playback (Refer to Appendix 2.3.4.)
・Fixed-feed, fixed-feed stepping (Refer to Appendix 2.3.5.)

[Error display screen]



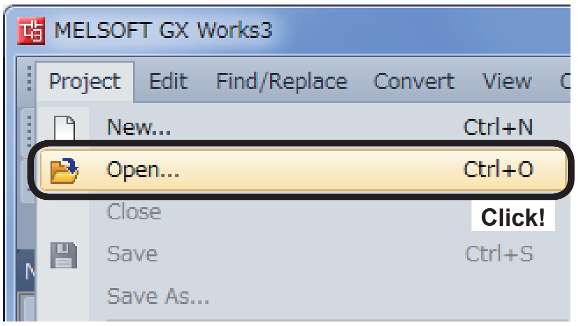
The error display screen is common to all screens.

This screen is displayed by touching Error screen on each screen.

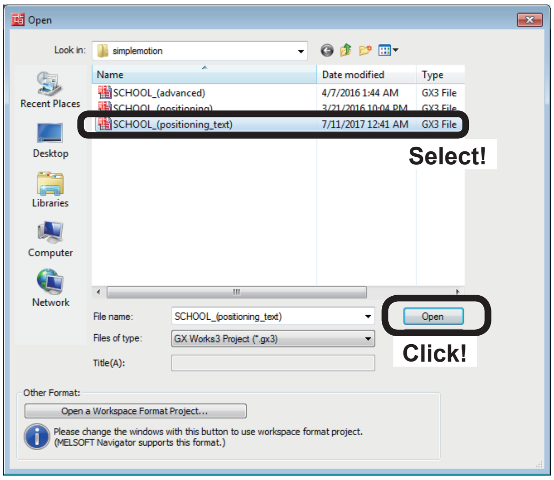
Current errors can be checked and reset.
(Refer to Section 6.8.8)

6.4 Opening the Project for RD77MS

Open the project data for practice.



(1) Click [Project] → [Open] on the GX Works3 menu.



(2) A dialog box for opening the project will open. Select "SCHOOL_(positioning_text), and click the [Open] button.

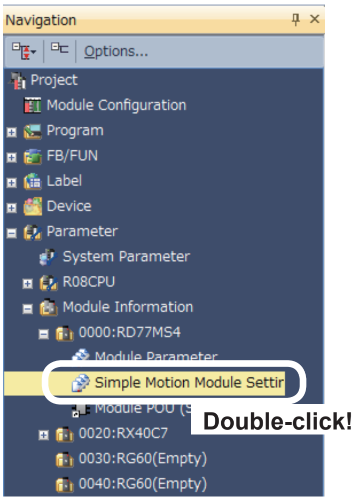
(3) If the message shown left is displayed, click the [OK] button.

For the procedure for creating new project data, refer to Chapter 5.
For the programs, refer to Sections 6.6 and 6.9.

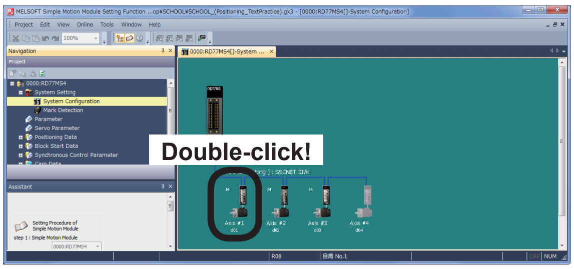
6.5 Simple Motion Module Setting

Set various parameters from the Simple Motion Module setting tool to use the positioning functions of RD77MS4.

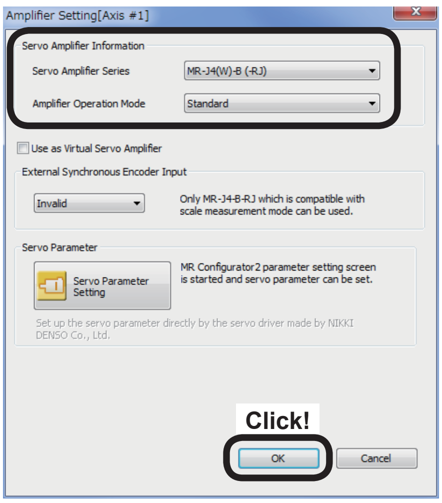
6.5.1 System configuration



(1) Start the Simple Motion Module setting tool.
In the [Navigation window], select [Parameter] → [Module Information] → [0000:RD77MS4], and double-click [Simple Motion Module Setting].



(2) The Simple Motion Module setting tool will start.
The system configuration window appears. Set the system configuration.
Double-click an Axis #1 (d01).



(3) The Amplifier Setting [Axis #1] dialog box appears. Set the data as shown below, and click the OK button.

Servo Amplifier Series: MR-J4(W)-B (-RJ)
Amplifier Operation Mode: Standard

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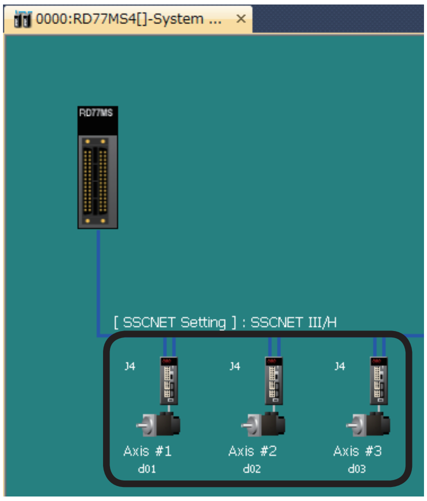
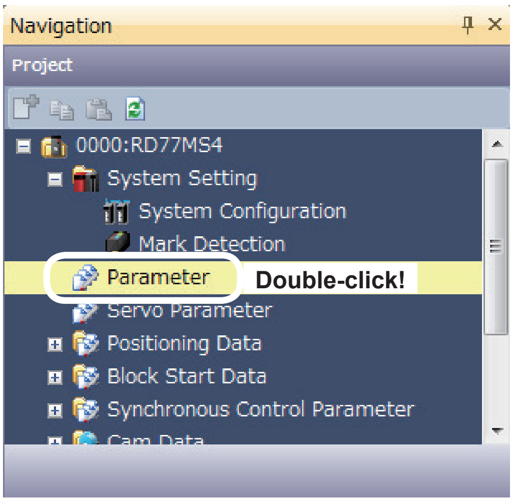


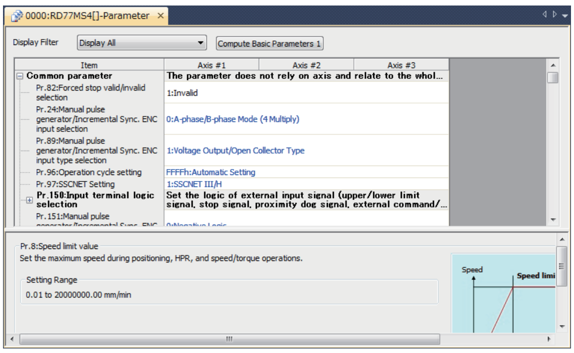
(4) Set Axis #2 (d02) and Axis #3 (d03) as shown below in accordance with the procedures in Steps (2) and (3).

Servo Amplifier Series: MR-J4(W)-B (-RJ)
Amplifier Operation Mode: Standard

6.5.2 Parameters



(1) Set parameters of the RD77MS4.
In the [Navigation window], select [0000:RD77MS4], and double-click [Parameter].



(2) The RD77MS4 Parameter Setting screen appears.
Set the parameters of each axis.

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(3) Specify Common parameters as shown below.

Item	Axis #1	Axis #2	Axis #3
Common parameter	The parameter does not rely on axis and relate to the whole system.		
Pr.82:Forced stop valid/invalid selection	1:Invalid		
Pr.24:Manual pulse generator/Incremental Sync. ENC input selection	0:A-phase/B-phase Mode (4 Multiply)		
Pr.89:Manual pulse generator/Incremental Sync. ENC input type selection	1:Voltage Output/Open Collector Type		
Pr.96:Operation cycle setting	FFFFh:Automatic Setting		
Pr.97:SSCNET Setting	1:SSCNET III/H		
Pr.150:Input terminal logic selection	Set the logic of external input signal (upper/lower limit signal, stop signal, proximity dog signal, external command/switching signal) from...		
Pr.151:Manual pulse generator/Incremental Sync. ENC	0:Negative Logic		

(4) Specify Basic parameters 1 as shown below.

Item	Axis #1	Axis #2	Axis #3
Basic parameters 1	Set according to the machine and applicable motor when system is st...		
Pr.1:Unit setting	0:mm	0:mm	0:mm
Pr.2:No. of pulses per rotation	4194304 pulse	4194304 pulse	4194304 pulse
Pr.3:Movement amount per rotation	2000.0 μm	2000.0 μm	8000.0 μm
Pr.4:Unit magnification	1:x1 Times	1:x1 Times	1:x1 Times
Pr.7:Bias speed at start	0.00 mm/min	0.00 mm/min	0.00 mm/min

(5) Specify Basic parameters 2 as shown below.

Item	Axis #1	Axis #2	Axis #3
Basic parameters 2	Set according to the machine and applicable motor when system is st...		
Pr.8:Speed limit value	10000.00 mm/min	10000.00 mm/min	10000.00 mm/min
Pr.9:Acceleration time 0	100 ms	100 ms	100 ms
Pr.10:Deceleration time 0	150 ms	150 ms	150 ms

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(6) Specify Detailed parameters 1 as shown below.

Item	Axis #1	Axis #2	Axis #3
Detailed parameters 1	Set according to the system configuration when the system is starte...		
Pr.11:Backlash compensation amount	0.0 µm	0.0 µm	0.0 µm
Pr.12:Software stroke limit upper limit value	214748364.7 µm	214748364.7 µm	149000.0 µm
Pr.13:Software stroke limit lower limit value	-214748364.8 µm	-214748364.8 µm	-1000.0 µm
Pr.14:Software stroke limit selection	0:Set Software Stroke Limit to Feed Current Value	0:Set Software Stroke Limit to Feed Current Value	0:Set Software Stroke Limit to Feed Current Value
Pr.15:Software stroke limit valid/invalid setting	0:Valid	0:Valid	0:Valid
Pr.16:Command in-position width	10.0 µm	10.0 µm	10.0 µm
Pr.17:Torque limit setting value	300.0 %	300.0 %	300.0 %
Pr.18:M-code ON signal output timing	0:WITH Mode	0:WITH Mode	0:WITH Mode
Pr.19:Speed switching mode	0:Standard Speed Switching Mode	0:Standard Speed Switching Mode	0:Standard Speed Switching Mode
Pr.20:Interpolation speed designation method	0:Vector Speed	0:Vector Speed	0:Vector Speed
Pr.21:Feed current value during speed control	0:Not Update of Feed Current Value	0:Not Update of Feed Current Value	0:Not Update of Feed Current Value
Pr.22:Input signal logic selection : Lower limit	0:Negative Logic	0:Negative Logic	0:Negative Logic
Pr.22:Input signal logic selection : Upper limit	0:Negative Logic	0:Negative Logic	0:Negative Logic
Pr.22:Input signal logic selection : Stop signal	0:Negative Logic	0:Negative Logic	0:Negative Logic
Pr.22:Input signal logic selection : Proximity dog signal	0:Negative Logic	0:Negative Logic	1:Positive Logic
Pr.81:Speed-position function selection	0:Speed-position Switching Control (INC Mode)	0:Speed-position Switching Control (INC Mode)	0:Speed-position Switching Control (INC Mode)
Pr.116:FLS signal selection : Input type	15:Invalid	15:Invalid	1:Servo Amplifier
Pr.116:FLS signal selection : Input terminal	00h:No Setting	00h:No Setting	00h:No Setting
Pr.117:RLS signal selection : Input type	15:Invalid	15:Invalid	1:Servo Amplifier
Pr.117:RLS signal selection : Input terminal	00h:No Setting	00h:No Setting	00h:No Setting
Pr.118:DOG signal selection : Input type	15:Invalid	1:Servo Amplifier	1:Servo Amplifier
Pr.118:DOG signal selection : Input terminal	00h:No Setting	00h:No Setting	00h:No Setting
Pr.119:STOP signal selection : Input type	15:Invalid	15:Invalid	15:Invalid
Pr.119:STOP signal selection : Input terminal	00h:No Setting	00h:No Setting	00h:No Setting

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(7) Specify Detailed parameters 2 as shown below.

Item	Axis #1	Axis #2	Axis #3
Detailed parameters 2	Set according to the system configuration when the system is starte...		
Pr.25:Acceleration time 1	50 ms	1000 ms	1000 ms
Pr.26:Acceleration time 2	1000 ms	1000 ms	1000 ms
Pr.27:Acceleration time 3	1000 ms	1000 ms	1000 ms
Pr.28:Deceleration time 1	2000 ms	1000 ms	1000 ms
Pr.29:Deceleration time 2	1000 ms	1000 ms	1000 ms
Pr.30:Deceleration time 3	1000 ms	1000 ms	1000 ms
Pr.31:JOG speed limit value	6000.00 mm/min	6000.00 mm/min	5000.00 mm/min
Pr.32:JOG operation acceleration time selection	0:100	0:100	0:100
Pr.33:JOG operation deceleration time selection	0:150	0:150	0:150
Pr.34:Acceleration/deceleration process selection	1:S-curve Acceleration/Deceleration Process	1:S-curve Acceleration/Deceleration Process	1:S-curve Acceleration/Deceleration Process
Pr.35:S-curve ratio	50 %	50 %	50 %
Pr.36:Rapid stop deceleration time	50 ms	50 ms	50 ms
Pr.37:Stop group 1 rapid stop selection	0:Normal Deceleration Stop	0:Normal Deceleration Stop	0:Normal Deceleration Stop
Pr.38:Stop group 2 rapid stop selection	0:Normal Deceleration Stop	0:Normal Deceleration Stop	0:Normal Deceleration Stop
Pr.39:Stop group 3 rapid stop selection	0:Normal Deceleration Stop	0:Normal Deceleration Stop	0:Normal Deceleration Stop
Pr.40:Positioning complete signal output time	300 ms	300 ms	300 ms
Pr.41:Allowable circular interpolation error width	10.0 µm	10.0 µm	10.0 µm
Pr.42:External command function selection	0:External Positioning Start	0:External Positioning Start	0:External Positioning Start
Pr.83:Speed control 10x multiplier setting for degree axis	0:Invalid	0:Invalid	0:Invalid
Pr.84:Restart permissible value range when servo OFF to ON	0 pulse	0 pulse	0 pulse
Pr.90:Operation setting for SPD-TRQ Cont. mode : Torque initial value selection	0:Command Torque	0:Command Torque	0:Command Torque
Pr.90:Operation setting for SPD-TRQ Cont. mode : Speed initial value selection	0:Command Speed	0:Command Speed	0:Command Speed
Pr.90:Operation setting for SPD-TRQ Cont. mode : Condition selection at mode switching	0:Switching Conditions Valid at Mode Switching	0:Switching Conditions Valid at Mode Switching	0:Switching Conditions Valid at Mode Switching
Pr.127:Speed limit value input selection at control mode switching	0:Input Enable	0:Input Enable	0:Input Enable
Pr.95:External command signal selection	0:Not Used	0:Not Used	0:Not Used
Pr.122:Manual pulse generator speed limit mode	0:Do Not Execute Speed Limit	0:Do Not Execute Speed Limit	0:Do Not Execute Speed Limit
Pr.123:Manual pulse generator speed limit value	200.00 mm/min	200.00 mm/min	200.00 mm/min

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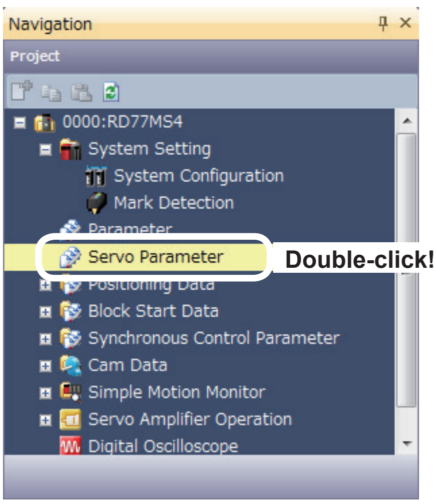
(8) Specify Home position return basic parameters as shown below.

Item	Axis #1	Axis #2	Axis #3
HPR basic parameters	Set the values required for carrying out HPR control (Valid when the PL...		
Pr.43:HPR method	6:Data Set Method	0:Proximity Dog Method	0:Proximity Dog Method
Pr.44:HPR direction	1:Reverse Direction (Address Decrease Direction)	1:Reverse Direction (Address Decrease Direction)	1:Reverse Direction (Address Decrease Direction)
Pr.45:HP address	-5000.0 μm	-5000.0 μm	0.0 μm
Pr.46:HPR speed	0.01 mm/min	100.00 mm/min	600.00 mm/min
Pr.47:Creep speed	0.01 mm/min	20.00 mm/min	250.00 mm/min
Pr.48:HPR retry	0:Do Not Retry HPR with Limit Switch	1:Retry HPR with Limit Switch	1:Retry HPR with Limit Switch

(9) Specify Home position return detailed parameters as shown below.

Item	Axis #1	Axis #2	Axis #3
HPR detailed parameters	Set the values required for carrying out HPR control (Valid when the PL...		
Pr.50:Setting for the movement amount after proximity dog ON	0.0 μm	0.0 μm	0.0 μm
Pr.51:HPR acceleration time selection	0:100	0:100	0:100
Pr.52:HPR deceleration time selection	0:150	0:150	0:150
Pr.53:HP shift amount	0.0 μm	-5000.0 μm	0.0 μm
Pr.54:HPR torque limit value	300.0 %	300.0 %	300.0 %
Pr.55:Operation setting for incompletion of HPR	1:Positioning Control is Executed	1:Positioning Control is Executed	1:Positioning Control is Executed
Pr.56:Speed designation during HP shift	0:HPR Speed	0:HPR Speed	0:HPR Speed
Pr.57:Dwell time during HPR retry	0 ms	0 ms	0 ms
Pr.86:Pulse conversion unit : HPR request setting	0:Turn HPR Request ON at Servo OFF	0:Turn HPR Request ON at Servo OFF	0:Turn HPR Request ON at Servo OFF
Pr.87:Pulse conversion unit : Waiting time after clear signal output	0 ms	0 ms	0 ms

6.5.3 Servo parameters



(1) Set parameters of the servo amplifier.

In the [Navigation window], select [0000:RD77MS4], and double-click [Servo Parameter].

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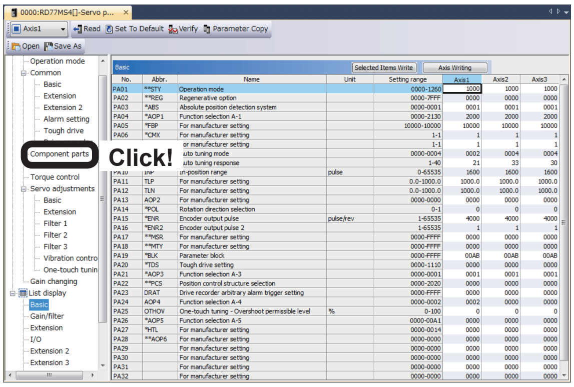
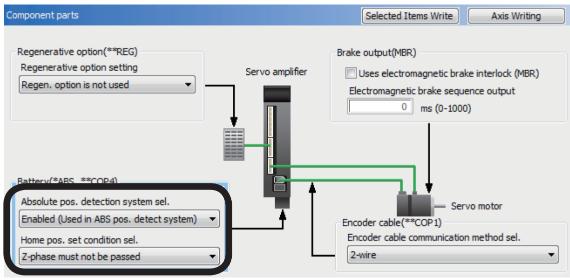
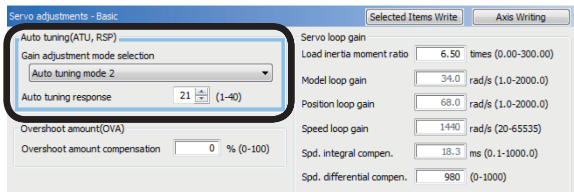


(2) A Servo Parameter Setting window appears. Click [Function display] → [Component parts] in the Parameter Setting screen display selection tree, and then specify the following settings.

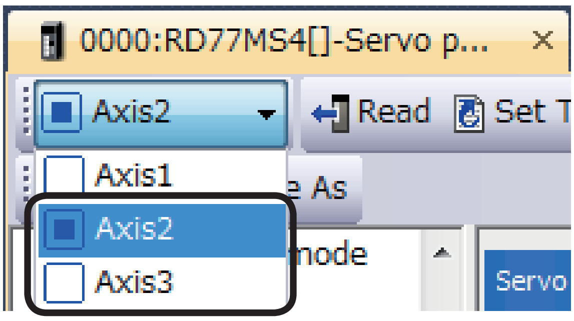


(3) Absolute pos. detect system selection.
: Enabled (Used in ABS pos. detect system)
Home pos, set condition sel.
: Z-phase must not be passed.



(4) Click [Function display] → [Servo adjustment] → [Basic setting] in the Parameter Setting screen display selection tree, and then specify the following settings.

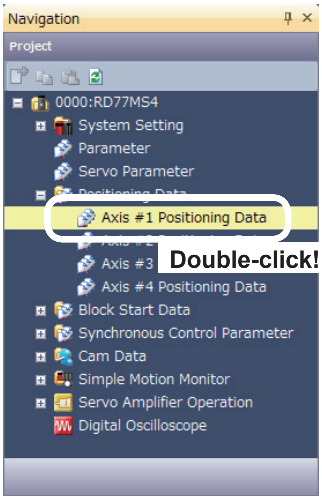
- Gain adjustment mode selection
  : Auto tuning mode 2
- Auto tuning response
  : 21



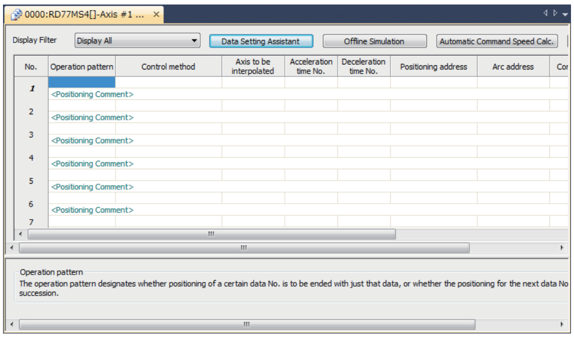
(5) Switch to Axis 2 and 3, and set the following parameter settings in a manner similar to Axis 1.

Item	Axis 2	Axis 3
Absolute pos. detection system sel.	Enabled (Used in ABS pos. detect system)	Enabled (Used in ABS pos. detect system)
Home pos, set condition sel.	Not need to pass servo motor Z-phase after power on	Need to pass servo motor Z-phase after power on
Gain Adjustment mode Selection	2 gain adjustment mode 2	2 gain adjustment mode 2
Auto tuning response	33	30

6.5.4 Positioning data



(1) Set the positioning data.
Select [0000:RD77MS4] → [Positioning Data], and double-click [Axis #1 Positioning Data].



(2) Axis 1 Positioning Data Setting screen appears.
Specify positioning as shown below.

Axis 1 Positioning data

No.	Operation pattern	Control method	Axis to be interpolated	Acceleration time No.	Deceleration time No.	Positioning address	Arc address
1	0:END	01h:ABS Linear 1	-	0:100	0:150	0.0 µm	0.0 µm
	<Positioning Comment>Standby point positioning						
2	0:END	01h:ABS Linear 1	-	0:100	0:150	40000.0 µm	0.0 µm
	<Positioning Comment>Pos. select positioning (No. 30)						
3	0:END	01h:ABS Linear 1	-	0:100	0:150	80000.0 µm	0.0 µm
	<Positioning Comment>Pos. select positioning (No. 31)						
4	0:END	01h:ABS Linear 1	-	0:100	0:150	120000.0 µm	0.0 µm
	<Positioning Comment>Pos. select positioning (No. 32)						
5	0:END	01h:ABS Linear 1	-	0:100	0:150	0.0 µm	0.0 µm
	<Positioning Comment>Indirect designation positioning						

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No.	Command speed	Dwell time	M-code	M-code ON signal output timing	ABS direction in degrees	Interpolation speed designation method
1	2000.00 mm/min	100 ms	0	0:Use the setting value of M-code ON signal output timing	0:Use the setting value of ABS direction at degree	0:Use the setting value of Interpolation speed designation method
2	5000.00 mm/min	0 ms	0	0:Use the setting value of M-code ON signal output timing	0:Use the setting value of ABS direction at degree	0:Use the setting value of Interpolation speed designation method
3	3000.00 mm/min	0 ms	0	0:Use the setting value of M-code ON signal output timing	0:Use the setting value of ABS direction at degree	0:Use the setting value of Interpolation speed designation method
4	1000.00 mm/min	0 ms	0	0:Use the setting value of M-code ON signal output timing	0:Use the setting value of ABS direction at degree	0:Use the setting value of Interpolation speed designation method
5	1000.00 mm/min	0 ms	0	0:Use the setting value of M-code ON signal output timing	0:Use the setting value of ABS direction at degree	0:Use the setting value of Interpolation speed designation method

6.6 Position Control Program

The positioning control practice programs include various programs, such as initial processing, JOG operation and home position return. Refer to the respective descriptions of each program in this manual for details.

The RD77MS programs for operation have been created with GX Works3.

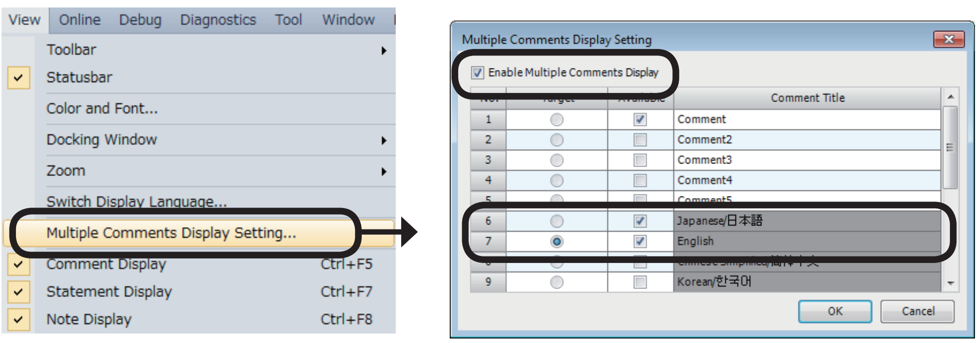
An explanatory drawing of the demonstration machine GOT operation panel is shown in Section 6.3.2.

POINT

Setting of display of multiple comments

When the setting of display of multiple comments is enabled, the comments in the sequence programs can be localized according to the displayed languages.

Click [View] → [Multiple Comments Display Setting] on the GX Works3 menu.



6.6.1 Initial processing

This program checks all parameters and starts all axes servo.
When the CPU module is set to the RUN status, the PLC READY signal will turn on. When the PLC READY signal turns on, the program will check the servo parameters and positioning data.
If the CPU module and RD77MS do not have any problems, the READY signal will turn on.
When the READY signal turns on, turn on the all axes servo ON command from the demonstration machine operation panel, and the CPU module will send the all axes servo ON command and start the servo amplifiers to complete the preparation for positioning.

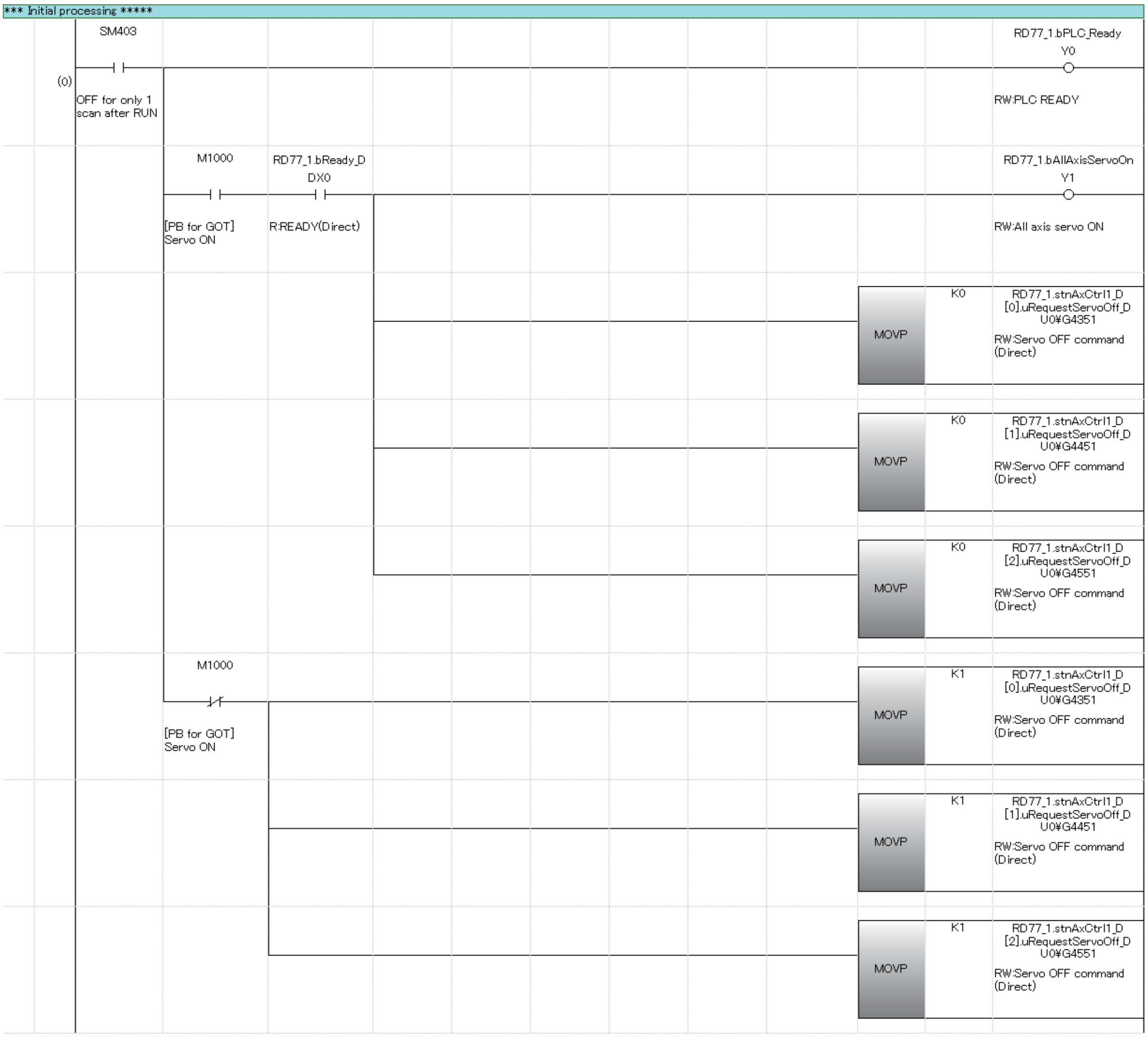
(1) Input and output signal

Item	Axis 1	Axis 2	Axis 3
PLC READY signal		Y0	
READY signal		X0	
All axes servo ON		Y1	

POINT

The BUSY signal turns ON even when position control of movement amount 0 is executed.
However, since the ON time is short, the ON status may not to be detected in the program.
Therefore, a direct device is used in this practice.

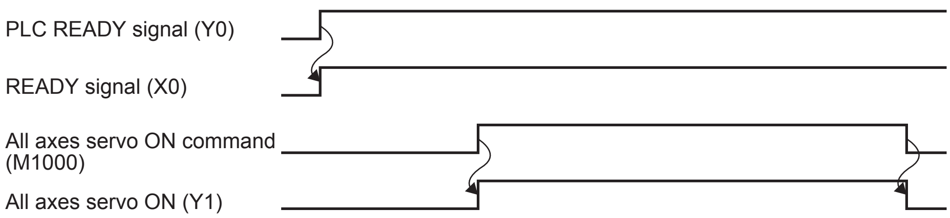
(2) Program example



(3) Demonstration machine operation panel

Servo ON M1000: All axes servo ON command

(4) Timing chart



6.6.2 JOG operation

This is a manual operation program to operate each axis only while the button is held down.

(1) Control data

Item	Buffer memory			Setting value
	Axis 1	Axis 2	Axis 3	
[Cd.16] Inching movement amount	4317	4417	4517	0 (When a value other than 0 is set, inching operation will be executed.)
[Cd.17] JOG speed	4318 4319	4418 4419	4518 4519	Axes 1 and 2: 1.00 to 6000.00 mm/min Axis 3: 1.00 to 5000.00 mm/min
[Cd.181] Forward run JOG start	30101	30111	30121	—
[Cd.182] Reverse run JOG start	30102	30112	30122	—

Remarks

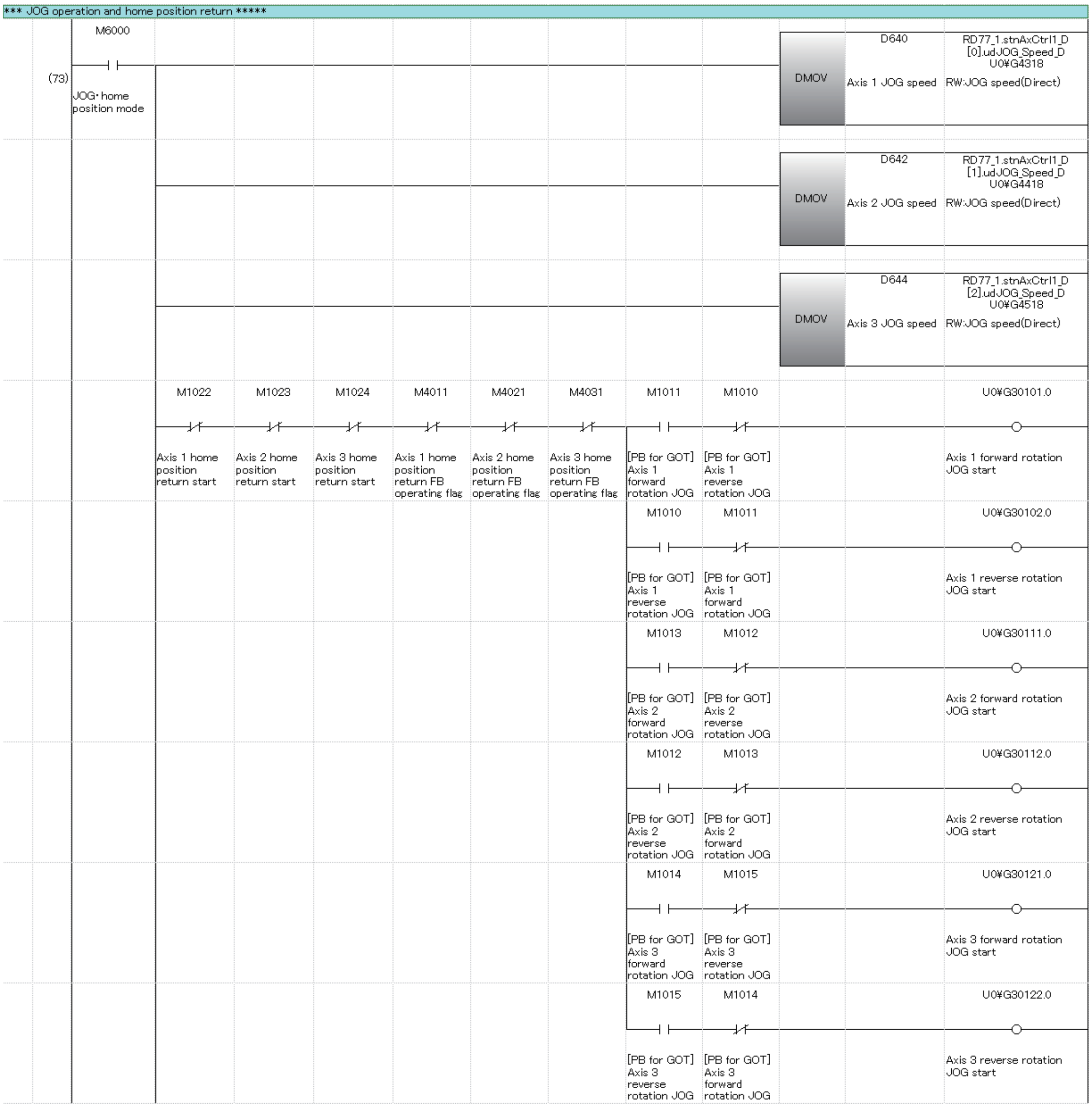
Since the default of "[Cd.16] Inching movement amount" is 0, the inching operation is not contained in this practice program.

(2) Program example

[1] JOG operating condition item

Axis No.	Axis 1	Axis 2	Axis 3
JOG operation command input	Forward rotation (M1011)	Forward rotation (M1013)	Forward rotation (M1014)
	Reverse rotation (M1010)	Reverse rotation (M1012)	Reverse rotation (M1015)

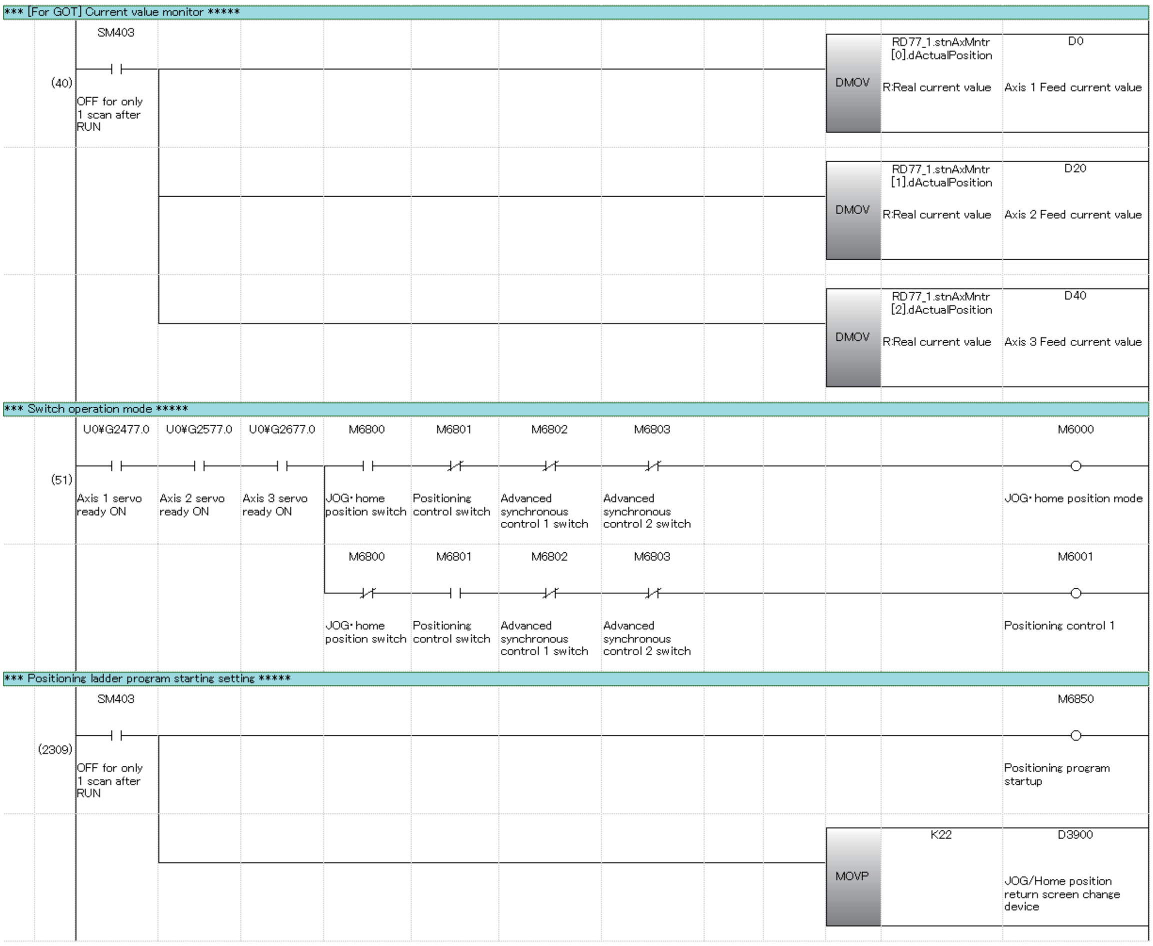
[2] Example of JOG operation program



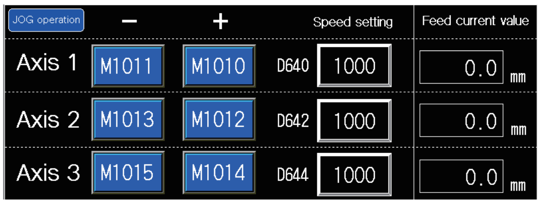

*** Error detection program *****
(2289)
U0¥G2417.D
Axis 1 error detection
M6010
Error detected
U0¥G2477.7
Axis 1 servo alarm occurring
U0¥G2517.D
Axis 2 error detection
U0¥G2577.7
Axis 2 servo alarm occurring
U0¥G2617.D
Axis 3 error detection
U0¥G2677.7
Axis 3 servo alarm occurring

Remarks

To run the programs for this practice, the GOT control programs are required.
The following GOT control programs are contained in the project data for this practice, “SCHOOL_(positioning)_text.”



(3) Demonstration machine operation panel [JOG•home position return operation panel]

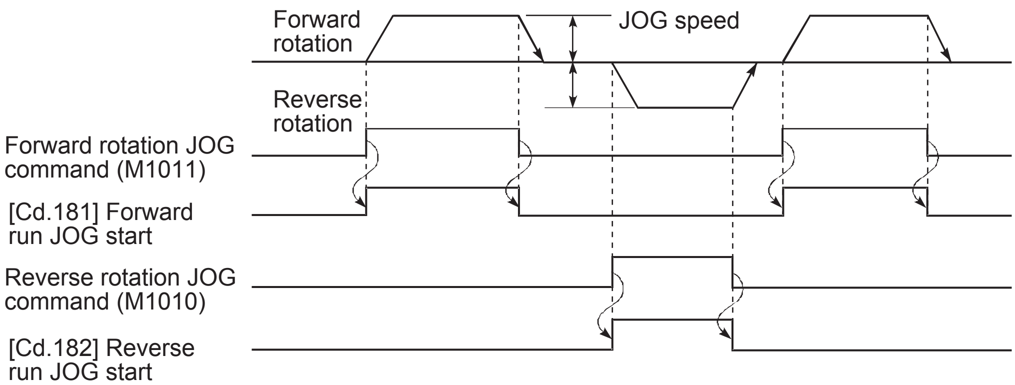


M1011: Axis 1 forward rotation JOG
M1010: Axis 1 reverse rotation JOG
M1013: Axis 2 forward rotation JOG
M1012: Axis 2 reverse rotation JOG
M1014: Axis 3 forward rotation JOG
M1015: Axis 3 reverse rotation JOG
D640 (U0¥G4319, U0¥G4318): Axis 1 JOG speed setting register
D642 (U0¥G4419, U0¥G4418): Axis 2 JOG speed setting register
D644 (U0¥G4519, U0¥G4518): Axis 3 JOG speed setting register
Feed current value (current position address):
[Md.20] Feed current value (Axis 1: U0¥G2401, U0¥G2400, Axis 2: U0¥G2501, U0¥G2500, Axis 3: U0¥G2601, U0¥G2600)

POINT

- Touch the set value of D640, D642 or D644, and the numeric input window will appear.
  Change the set value (unit: mm/min) in the numeric input window, and touch ENTER. Then, the JOG speed will be changed.
  The JOG speed input range is limited on the touch panel. (Axis 1: 0 to 1000, Axis 2: 0 to 5000, Axis 3: 0 to 3000)
- Also the address after home position return is reflected in the feed current value.

(4) Timing chart (for Axis 1)



6.6.3 Home position return

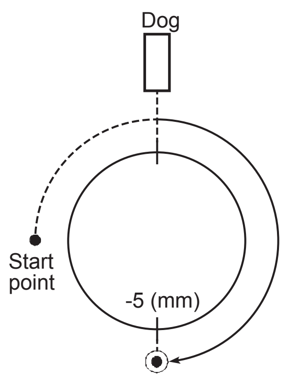
This program is designed for home position return.

The home position return operation for each axis is as follows.

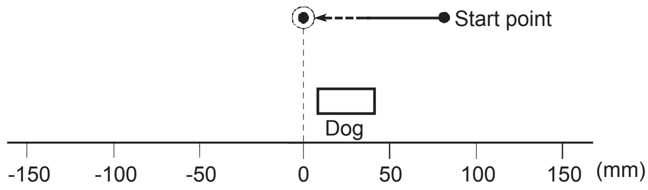
Axis 1: Data set method
The point where home position return is executed is consider as the home position (-5 mm).

Axes 2 and 3: Proximity dog method
After starting, the motor rotates in the home position return direction, and the rotation is complete when the home position dog changes from ON to OFF.

Axes 2: home position -5 mm



Axes 3: home position 0 mm



(1) Control data

Item	Buffer memory address			Setting value
	Axis 1	Axis 2	Axis 3	
[Cd.3] Positioning start No.	4300	4400	4500	9001 (Machine home position return)

POINT

When the home position return command input turns on, the module FB “M+RD77_ StartPositioning” writes the positioning start No.

(2) Output Signal

Item	Axis 1	Axis 2	Axis 3
Positioning start signal	Y10	Y11	Y12

POINT

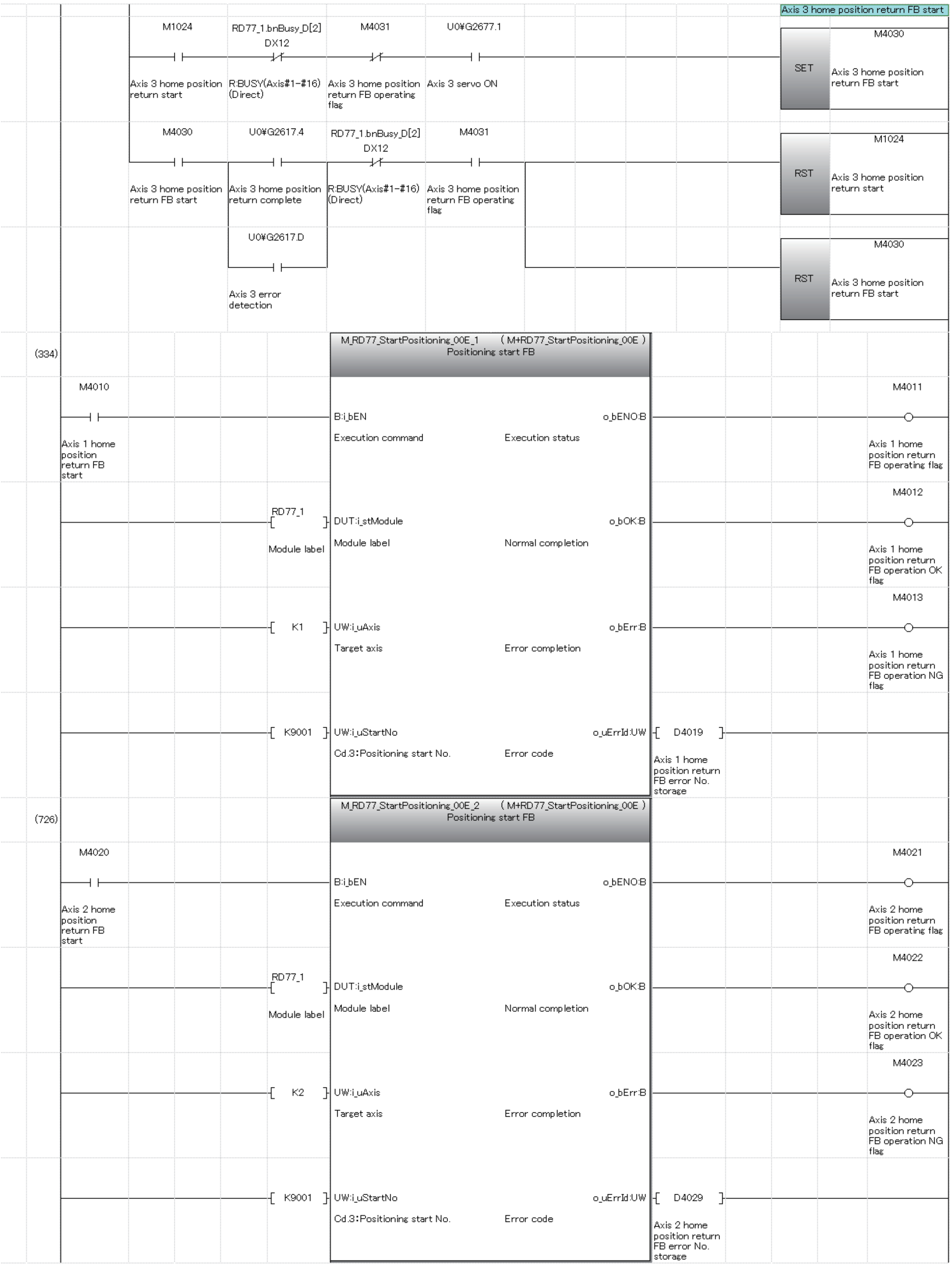
When the home position return command input turns on, the module FB “M+RD77_ StartPositioning” turns on the positioning start signal.

(3) Program example

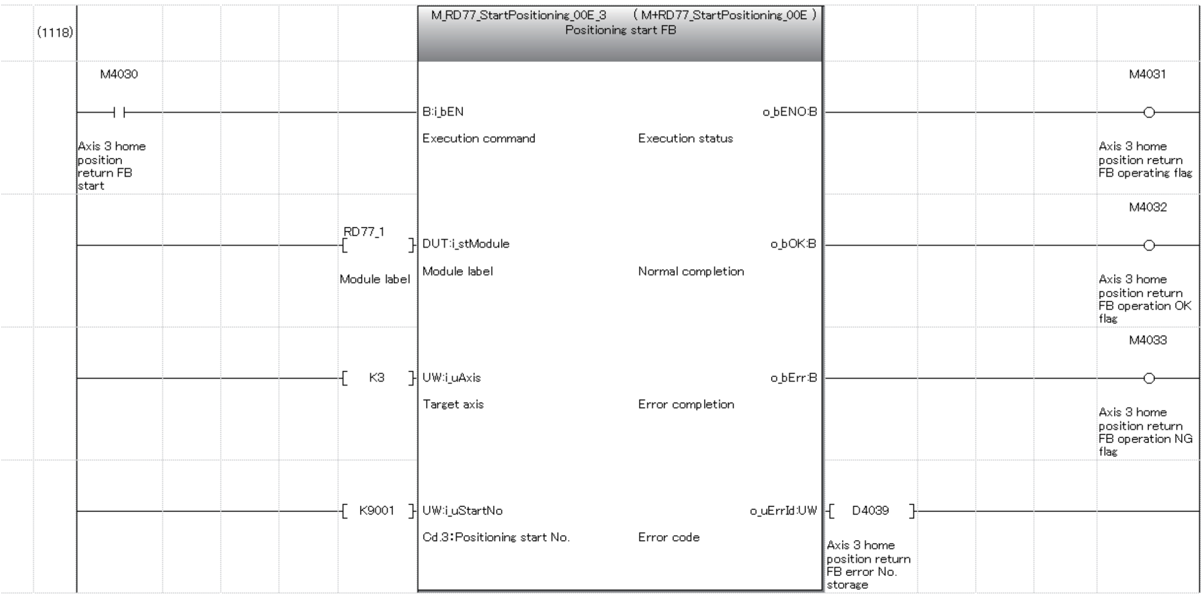
[1] Home position return condition item

Condition item	Axis 1	Axis 2	Axis 3
Home position return command input	M1020		

[2] Example of home position return program



For the procedure for inserting the FB, refer to Appendix 4.



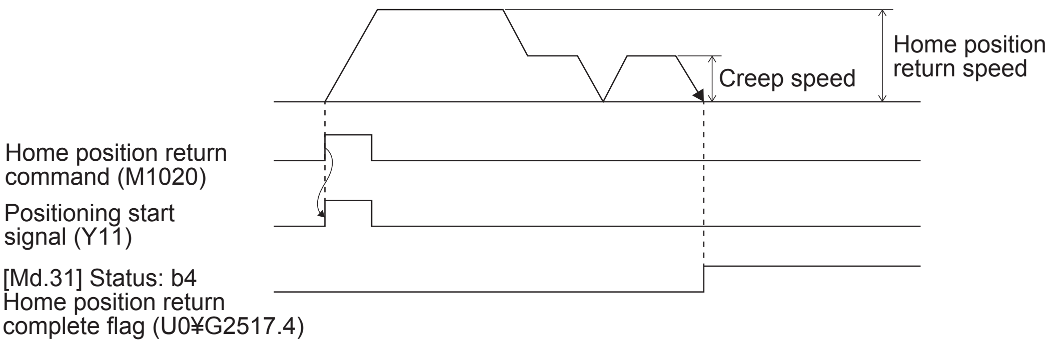
For the procedure for inserting the FB, refer to Appendix 4.

The following "Error detection program" is the same as that shown in p6-19.

(4) Demonstration machine operation panel [JOG•home position return operation panel]

M1020: Home position return command input for all axes
Axis 1 Home position return U0¥G2417.4: Home position return complete flag of Axis 1 ([Md.31] status: b4)
Axis 2 Home position return U0¥G2517.4: Home position return complete flag of Axis 2 ([Md.31] status: b4)
Axis 3 Home position return U0¥G2617.4: Home position return complete flag of Axis 3 ([Md.31] status: b4)

(5) Timing chart (for Axis 2)



6.6.4 Standby point positioning

This program is designed for positioning in the standby point (0) from any position on Axis 1. Standby point refers to a work standby position at other than the mechanical home position. (There may be times when the position is the same as the home position.)

(1) Control data

Item	Buffer memory address	Setting value
	Axis 1	
[Cd.3] Positioning start No.	4300	1 (Positioning data No. 1)

POINT

When the standby point positioning command input turns on, the module FB "M+RD77_StartPositioning" writes the positioning start No. in "[Cd.3] Positioning start No."

(2) Output signal

Item	Axis 1
Positioning start signal	Y10

POINT

When the standby point positioning command input turns on, the module FB "M+RD77_StartPositioning" turns on the positioning start signal.

(3) Program example

[1] Standby point positioning condition item

Condition item	Axis 1
Standby point positioning command input	M0

[2] Positioning data to be used (Positioning data No. 1)

1-axis linear control is performed on Axis 1.

Axis 1 Positioning Data

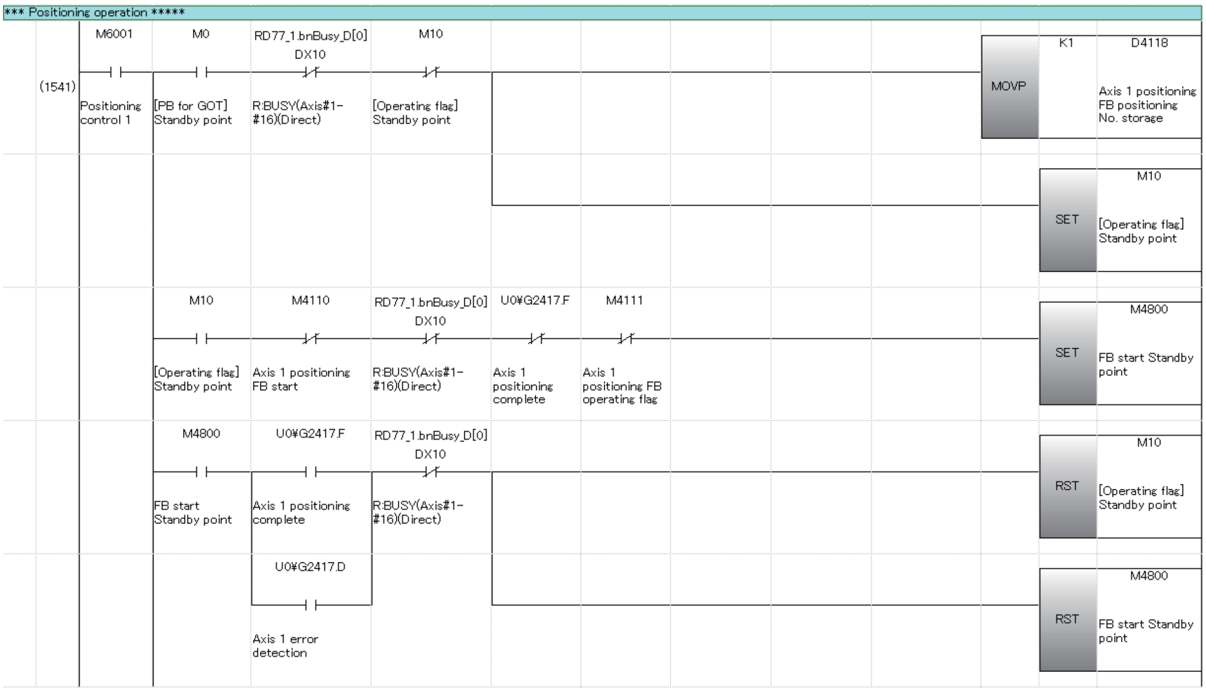
No.	Operation pattern	Control method	Axis to be interpolated	Acceleration time No.	Deceleration time No.	Positioning address	Arc address
1	0:END	01h:ABS Linear 1	-	0:100	0:150	0.0 µm	0.0 µm
	<Positioning Comment>Standby point positioning						

No.	Command speed	Dwell time	M-code	M-code ON signal output timing	ABS direction in degrees	Interpolation speed designation method
1	2000.00 mm/min	100 ms	0	0:Use the setting value of M-code ON signal output timing	0:Use the setting value of ABS direction at degree	0:Use the setting value of Interpolation speed designation method

[3] Example of standby point positioning program

To execute the following standby point positioning, the positioning execute program is required.

Refer to Section 6.6.8 on positioning execute program.

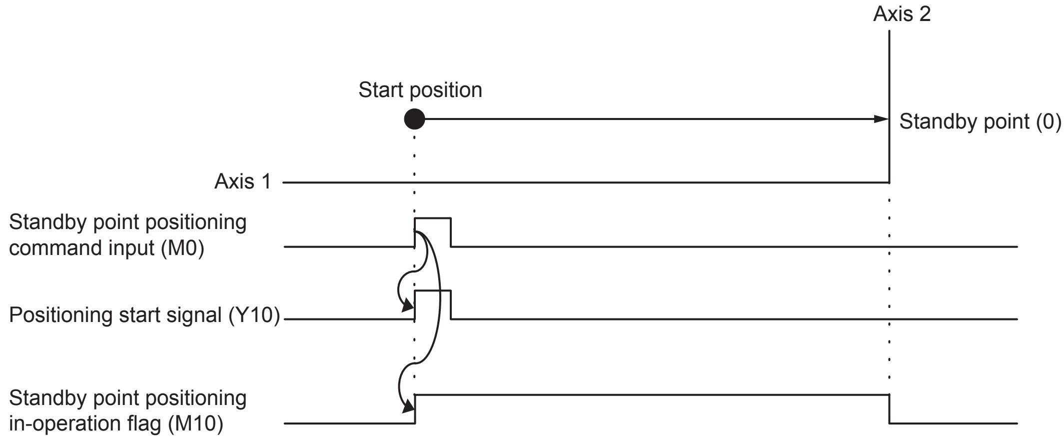


(4) Demonstration machine operation panel [Positioning operation screen]

M10: Standby point positioning in-operation flag

Standby point M0: Standby point positioning command input of Axis 1

(5) Timing chart



6.6.5 Point selection positioning

This program positions the Axis 1 in the point specified on the demonstration machine operation panel. The positioning address corresponds to the point No.

(1) Control data

Item	Buffer memory address	Setting value
	Axis 1	
[Cd.3] Positioning start No.	4300	2 to 4 (Positioning data No. 2 to 4)

POINT

When the point selection positioning command input turns on, the module FB "M+RD77_ StartPositioning" writes the positioning start No. in "[Cd.3] Positioning start No."

(2) Output signal

Item	Axis 1
Positioning start signal	Y10

POINT

When the point selection positioning command input turns on, the module FB "M+RD77_ StartPositioning" turns on the positioning start signal.

(3) Program example

[1] Point selection positioning condition item

Condition item	Axis 1
Point No. input	One of the values 30, 31 or 32 has been input in D2000.
Point selection positioning command input	M1

[2] Positioning data to be used (Positioning data Nos. 2 to 4)

1-axis linear control is performed on Axis 1.

The point No. is equal to the positioning data No. The positioning data No. to be used is switched according to the point No. input on the demonstration machine operation panel. (30 = Positioning data No. 2, 31 = Positioning data No. 3, 32 = Positioning data No. 4)

Axis 1 Positioning Data

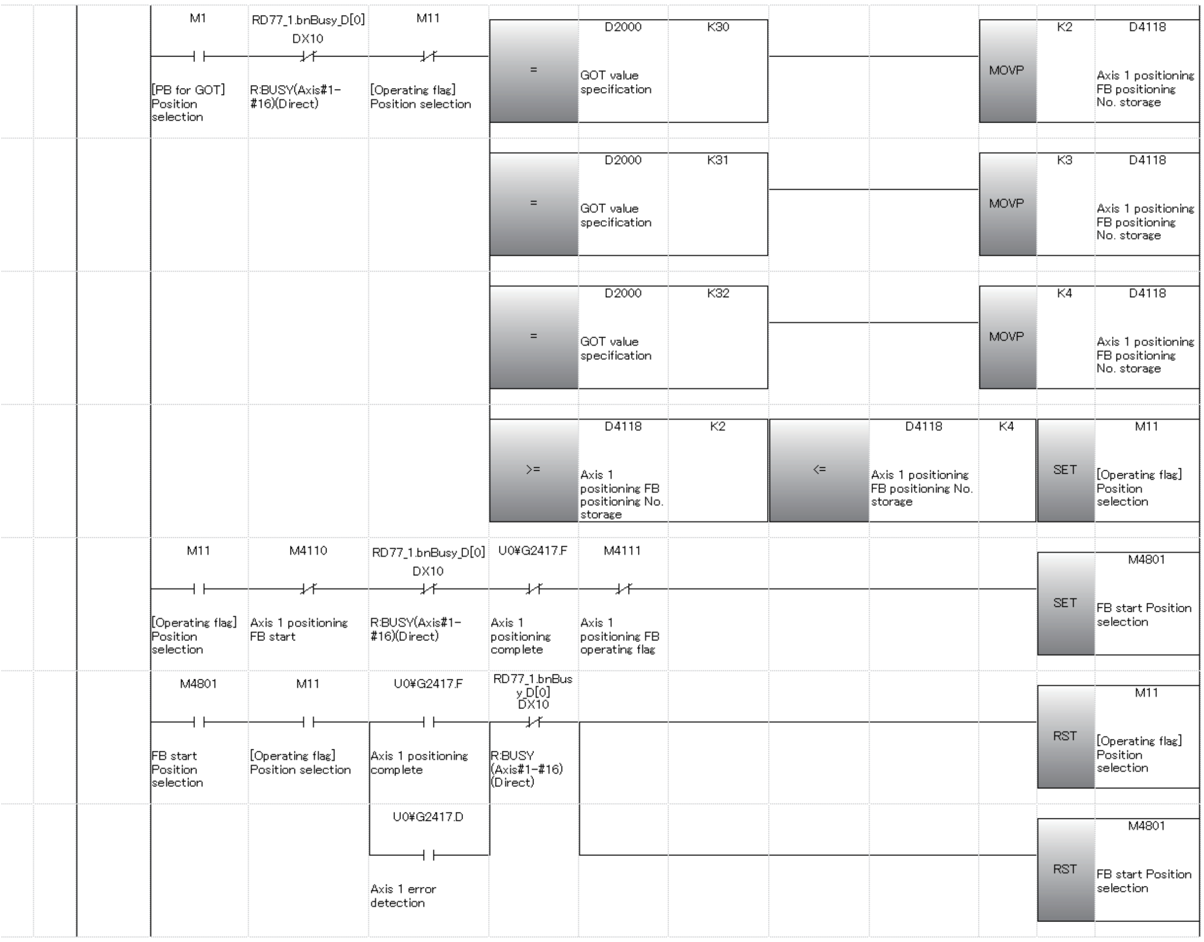
No.	Operation pattern	Control method	Axis to be interpolated	Acceleration time No.	Deceleration time No.	Positioning address	Arc address
2	0:END	01h:ABS Linear 1	-	0:100	0:150	40000.0 μm	0.0 μm
	<Positioning Comment>Pos. select positioning (No. 30)						
3	0:END	01h:ABS Linear 1	-	0:100	0:150	80000.0 μm	0.0 μm
	<Positioning Comment>Pos. select positioning (No. 31)						
4	0:END	01h:ABS Linear 1	-	0:100	0:150	120000.0 μm	0.0 μm
	<Positioning Comment>Pos. select positioning (No. 32)						

No.	Command speed	Dwell time	M-code	M-code ON signal output timing	ABS direction in degrees	Interpolation speed designation method
2	5000.00 mm/min	0 ms	0	0:Use the setting value of M-code ON signal output timing	0:Use the setting value of ABS direction at degree	0:Use the setting value of Interpolation speed designation method
3	3000.00 mm/min	0 ms	0	0:Use the setting value of M-code ON signal output timing	0:Use the setting value of ABS direction at degree	0:Use the setting value of Interpolation speed designation method
4	1000.00 mm/min	0 ms	0	0:Use the setting value of M-code ON signal output timing	0:Use the setting value of ABS direction at degree	0:Use the setting value of Interpolation speed designation method

[3] Example of point selection positioning program

To execute the following point selection positioning, the positioning execute program is required .

Refer to Section 6.6.8 on positioning execute program.

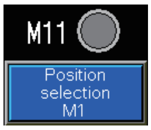


(4) Demonstration machine operation panel
[Positioning operation screen]

Value specification Setting for D2000: Point No. input

M11: Standby point positioning in-operation flag

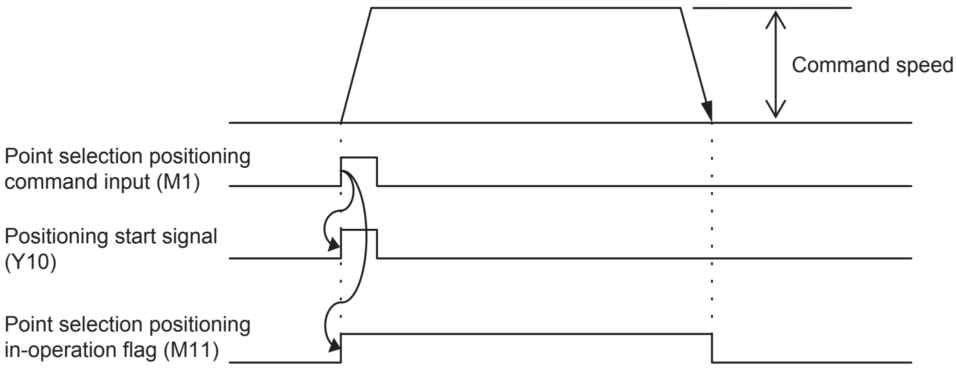
Position selection M1: Point selection positioning command input



POINT

Touch the set Value specification Setting for D2000, and the numeric input window will appear.
Input the point No. in the numerical input window, and touch the ENTER. Then, the point will be changed.
If a value other than 30, 31 and 32 has been set, the point selection positioning program will not operate even when the point selection positioning command input turns on.

(5) Timing chart



6.6.6 Address indirect specification positioning

This program is designed to position the Axis 1 in the address specified on the demonstration machine operation panel.

(1) Positioning data (Positioning data No. 5)

Item	Buffer memory address	Setting range
	Axis 1	
[Da.6] Positioning address/ movement amount	6046 6047	-214748364.8 to 214748364.7 µm*1

*1. When the address indirect specification positioning is executed, the value input on the demonstration machine operation panel (×10000) is set.

(2) Control data

Item	Buffer memory address	Setting value
	Axis 1	
[Cd.3] Positioning start No.	4300	5 (Positioning data No. 5)

POINT

When the address indirect specification positioning command input turns on, the module FB "M+RD77_StartPositioning" writes the positioning start No. in "[Cd.3] Positioning start No."

(3) Output signal

Item	Axis 1
Positioning start signal	Y10

POINT

When the address indirect specification positioning command input turns on, the module FB "M+RD77_StartPositioning" turns on the positioning start signal.

(4) Program example

[1] Address indirect specification positioning condition item

Condition item	Axis 1	Axis 2
Address input	D2000*1	
Address indirect specification positioning command input	M2	

*1. When 50 is input in D2000, the address is (Axis 1) = (50).

[2] Positioning data to be used (Positioning data No. 5)

1-axis linear control is performed on Axis 1.

The positioning address of each axis is changed to the current value set in "[Da.6] Positioning address/movement amount" of positioning data No. 5 when the address indirect specification positioning is executed.

Axis 1 Positioning Data

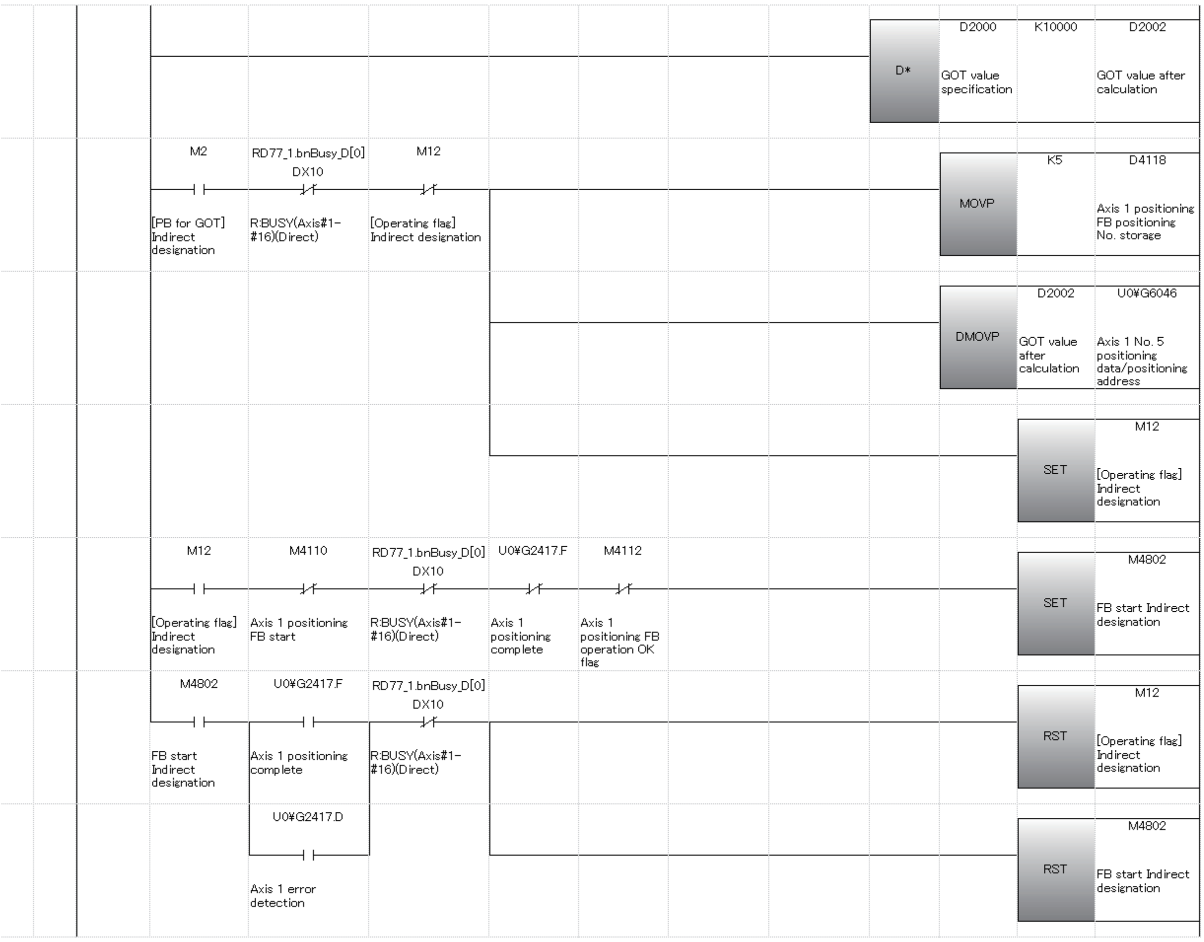
No.	Operation pattern	Control method	Axis to be interpolated	Acceleration time No.	Deceleration time No.	Positioning address	Arc address
5	0:END	01h:ABS Linear 1	-	0:100	0:150	0.0 μm	0.0 μm
	<Positioning Comment>Indirect designation positioning						

No.	Command speed	Dwell time	M-code	M-code ON signal output timing	ABS direction in degrees	Interpolation speed designation method
5	1000.00 mm/min	0 ms	0	0:Use the setting value of M-code ON signal output timing	0:Use the setting value of ABS direction at degree	0:Use the setting value of Interpolation speed designation method

[3] Example of address indirect specification positioning program

To execute the following address indirect specification positioning, the positioning execute program is required.

Refer to Section 6.6.8 on positioning execute program.



(4) Demonstration machine operation panel

[Positioning operation screen]

Value specification Setting for D2000: Positioning address input

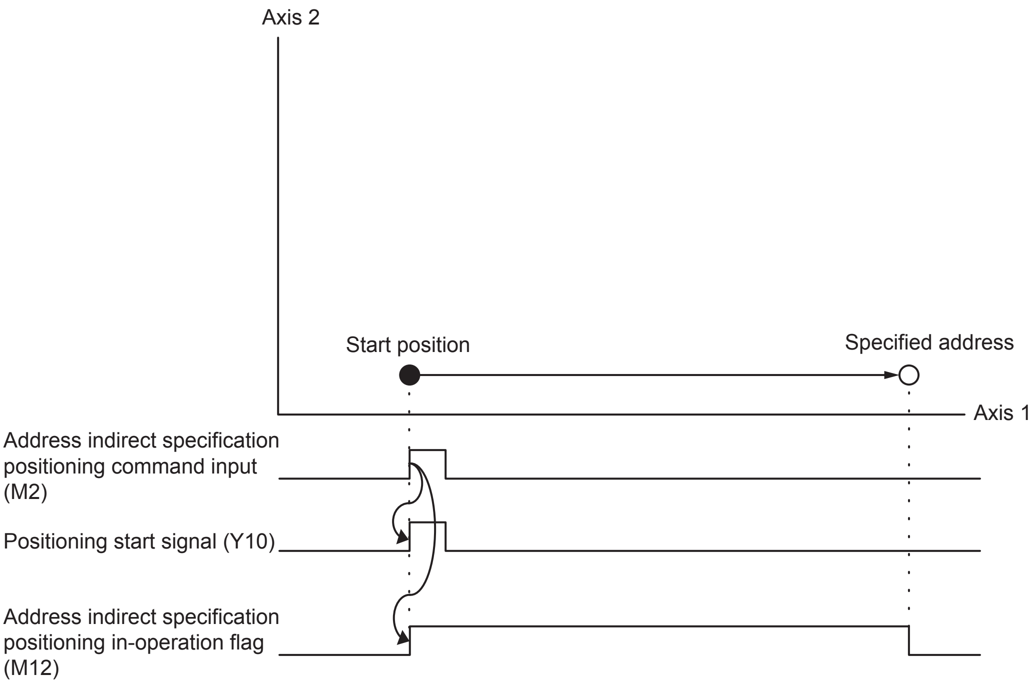
M12: Address indirect specification positioning in-operation flag

Indirect specification M2: Address indirect specification positioning command input

POINT

Touch the set value of D2000 setting, and the numeric input window will appear.
Input the positioning address (unit: mm) in the numeric input window, and touch ENTER. Then, the positioning address will be changed.
The allowable positioning address input range (0 to 140) is limited on the touch panel.

(5) Timing chart



6.6.7 Speed change

This program is designed to change the speed in three stages during positioning and temporarily stop the positioning operation.
The speed can be changed to the speed selected on the demonstration machine operation panel during standby point positioning, point selection positioning, address indirect specification positioning, continuous positioning (1), continuous positioning (2), teaching/teaching playback and fixed-feed/fixed-feed stepping operation.

(1) Control data

Item	Buffer memory address Axis 1	Setting range
[Cd.14] New speed value	4314 4315	0.00, 500.00, 1000.00, 2000.00 (mm/min)*1

*1. The speed is set to the speed selected on the demonstration machine operation panel.

POINT

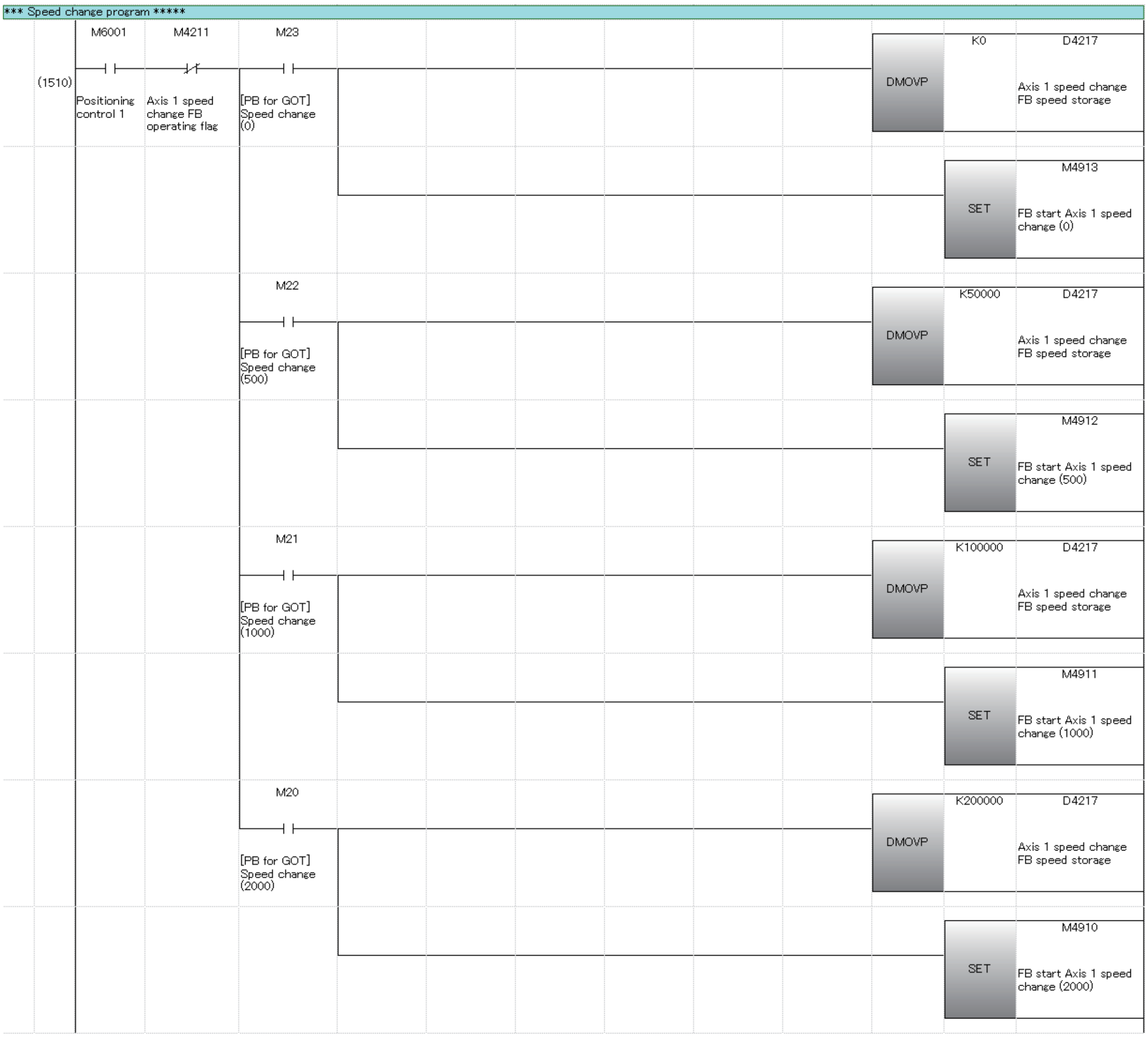
When the speed is changed, the module FB “M+RD77_ChangeSpeed” writes the value selected on the demonstration machine operation panel in "[Cd.14] New speed value."

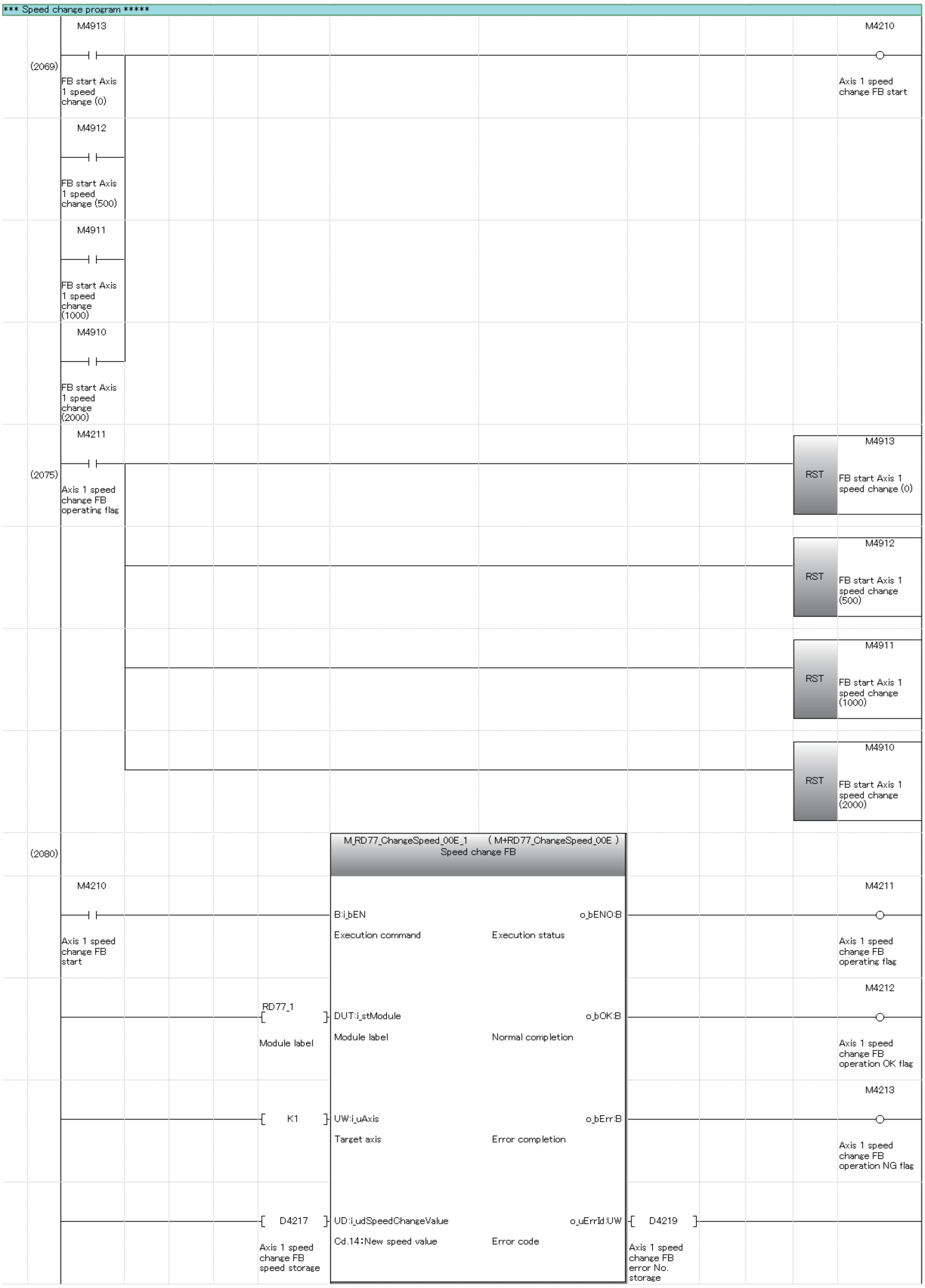
(2) Program example

[1] Speed change condition item

Condition item		Axis 1
Speed change command input	M20	Speed change (2000 mm/min)
	M21	Speed change (1000 mm/min)
	M22	Speed change (500 mm/min)
	M23	Temporary stop (0 mm/min)

[2] Example of speed change program

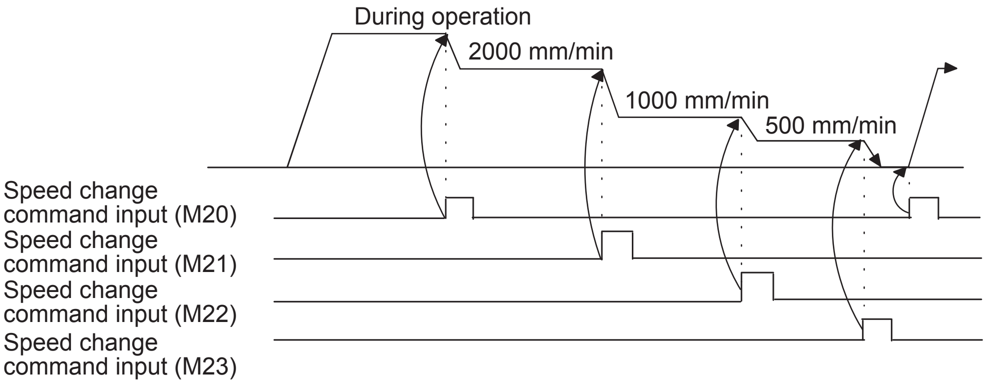



*** Speed change program *****
(2069)
M4913
FB start Axis 1 speed change (0)
M4210
Axis 1 speed change FB start
M4912
FB start Axis 1 speed change (500)
M4911
FB start Axis 1 speed change (1000)
M4910
FB start Axis 1 speed change (2000)
(2075)
M4211
Axis 1 speed change FB operating flag
RST
M4913
FB start Axis 1 speed change (0)
RST
M4912
FB start Axis 1 speed change (500)
RST
M4911
FB start Axis 1 speed change (1000)
RST
M4910
FB start Axis 1 speed change (2000)
(2080)
M_RD77_ChangeSpeed_00E_1 (M+RD77_ChangeSpeed_00E)
Speed change FB
M4210
Axis 1 speed change FB start
B:i_bEN
Execution command
o_bENO:B
Execution status
M4211
Axis 1 speed change FB operating flag
RD77_1
Module label
DUT:i_stModule
Module label
o_bOK:B
Normal completion
M4212
Axis 1 speed change FB operation OK flag
K1
UW:i_uAxis
Target axis
o_bErr:B
Error completion
M4213
Axis 1 speed change FB operation NG flag
D4217
Axis 1 speed change FB speed storage
UD:i_udSpeedChangeValue
Cd.14:New speed value
o_uErrId:UW
Error code
D4219
Axis 1 speed change FB error No. storage

(3) Demonstration machine operation panel

2000 M20: Speed change command (2000 mm/min)
1000 M21: Speed change command (1000 mm/min)
500 M22: Speed change command (500 mm/min)
0 M23: Temporary stop command (0 mm/min)

(4) Timing chart



POINT

- The speed can be changed only during standby point positioning, point selection positioning, address indirect specification positioning, continuous positioning (1), continuous positioning (2), teaching/teaching playback and fixed-feed/fixed-feed stepping operation.
- The command speed only for Axis 1 is changed. The interpolation speed for standby point positioning and address indirect specification positioning is the composite speed based on the command speed for Axis 1 after the speed is changed.
- The speed cannot be changed while decelerating.

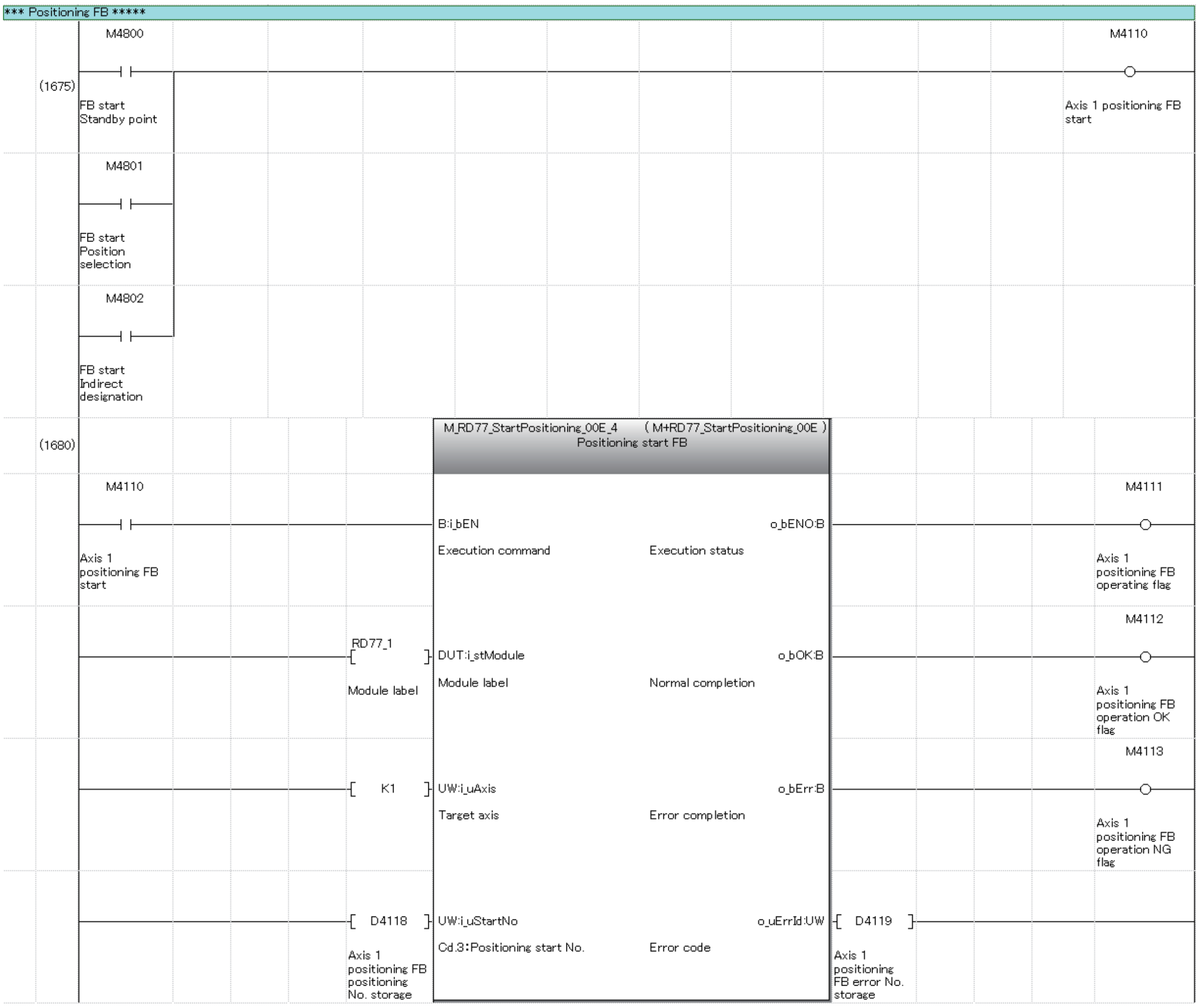
6.6.8 Positioning execute program

This program is used to execute the standby point positioning, point selection positioning and address indirect specification positioning.

When one of these positioning command inputs turns on, the module FB “M+RD77_ StartPositioning:”

- writes the start No. compatible with each positioning in “[Cd.3] Positioning start No.” and
- turns on the positioning start signal (Y10) to perform the positioning.

Example of each positioning program



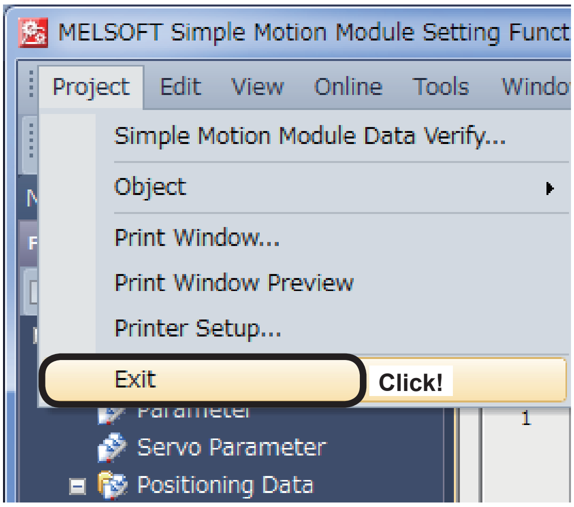
POINT

The module FB “M+RD77_StartPositioning” performs positioning differently depending on the start No. (positioning data) written in “[Cd.3] Positioning start No.”

6.7 Writing to the RD77MS

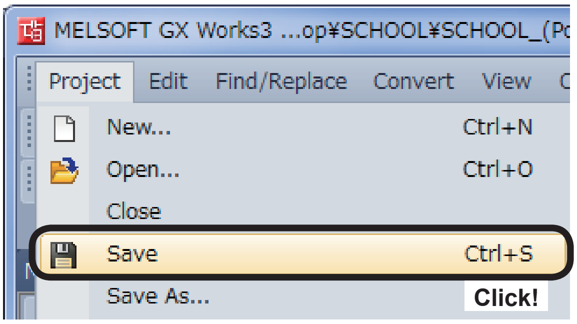
The set parameters are written to RD77MS.

6.7.1 Saving the project



(1) Terminate the Simple Motion Module setting tool.

Click [Project] → [Exit] on the Simple Motion Module setting tool menu.

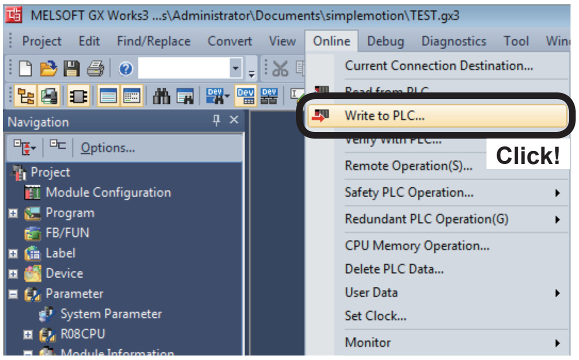


(2) Click [Project] → [Save] on the GX Works3 menu.

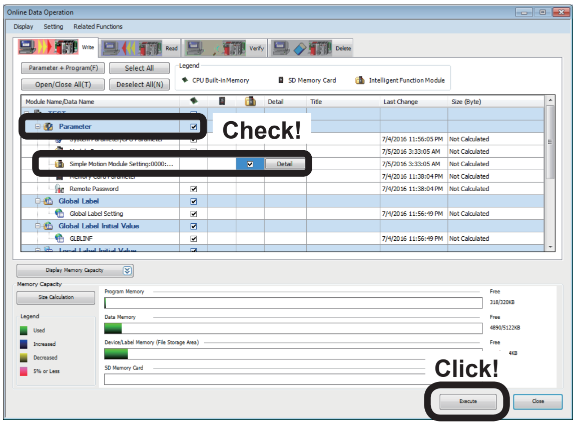
6.7.2 Writing to the PLC

Write settings data to the CPU module.

(1) Connect the personal computer and CPU module with the USB cable, and set the RUN/STOP/RESET switch of the CPU module to STOP.



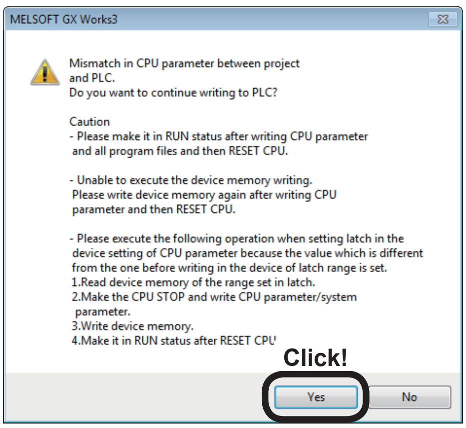
(2) Click [Online] → [Write to PLC...].



(3) An Online Data Operation dialog box appears.

Check the "Parameter " and the "Simple Motion Module Setting:0000:RD77MS".

(4) Click the Execute button.



(5) If the message shown left is displayed, click the Yes button.

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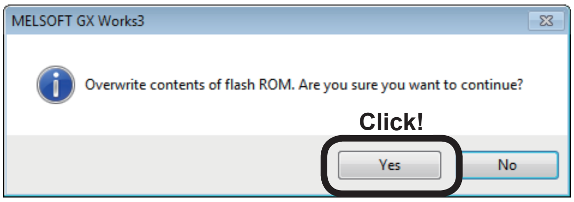
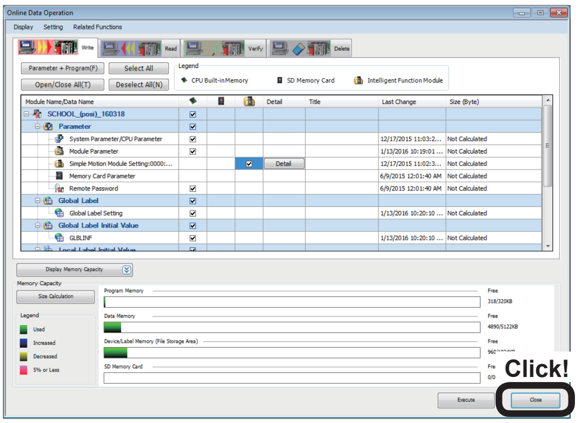
(6) The dialog box for writing to the PLC appears, and writing is started.
If the message shown left is displayed, click the Yes to all button.



The message shown left is displayed in the middle of writing. Click the Yes button.

(7) After the completion of writing, the message shown left is displayed. Click the OK button.



(8) Click the Close button in the Online Data Operation dialog box to close the dialog box.

(9) Reset the CPU module. (Hold the RUN/STOP/RESET switch on the RESET side.)

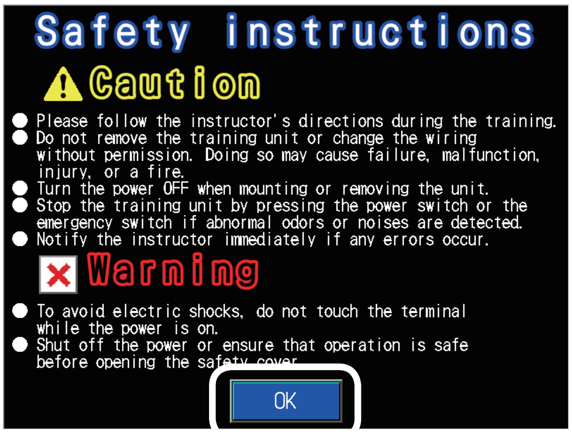
6.8 Demonstration Machine Operation

Execute the positioning operations in accordance with the programs stated in Section 6.6 operating the demonstration machine operation panel.

If any positioning operation cannot be performed, refer to the troubleshooting (Section 6.8.8).

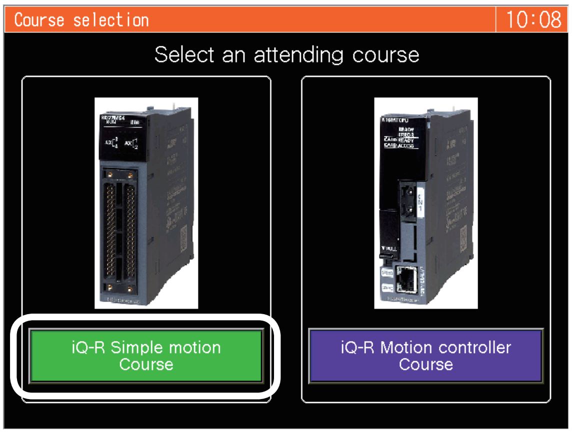
To confirm the current value of each parameter, use the Simple Motion Monitor. (refer to Appendix 5.)

6.8.1 Starting the servo amplifiers

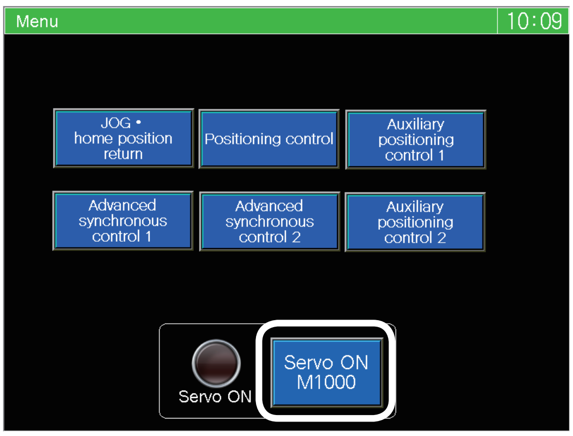


(1) Set the CPU module RUN/STOP/RESET switch to "RUN".

(2) The startup screen will appear. Touch [OK] to display the course selection screen.

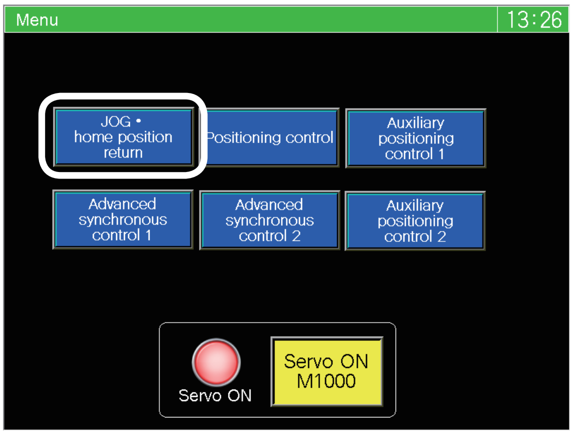


(3) Touch [iQ-R Simple motion Course] on the course selection screen to display the screen switching menu.



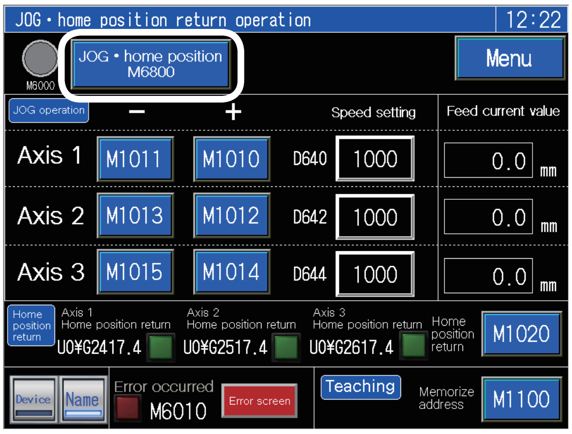
(4) Touch [Servo ON M1000] on the screen switching menu, and the servo amplifiers of Axis 1 to Axis 3 will start.

6.8.2 JOG operation



(1) Touch [JOG•home position return] on the screen switching menu.

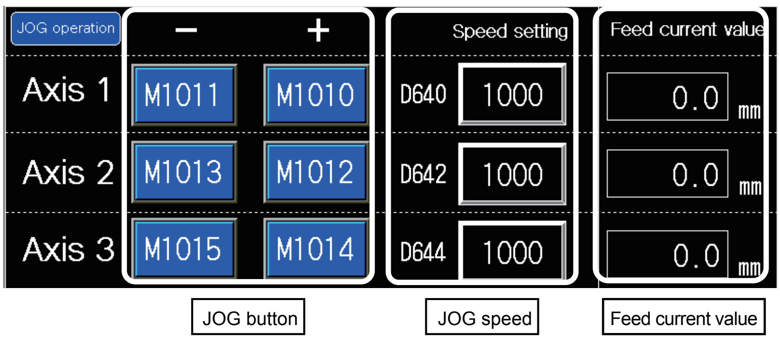
The JOG•home position return operation screen will appear.



(2) Touch the [JOG•home position M6800] on the JOG•home position return operation screen to turn on M6800, and the JOG•home position return operation screen will be operable.

(3) While the JOG button for each axis shown below is kept touched, the JOG operation is performed at the speed (mm/min) displayed in the speed setting field. The current address (mm) is displayed in the feed current value field.

Item		Axis 1	Axis 2	Axis 3
JOG operation command	Forward rotation	M1011	M1013	M1014
	Reverse rotation	M1010	M1012	M1015
Speed setting		D640	D642	D644



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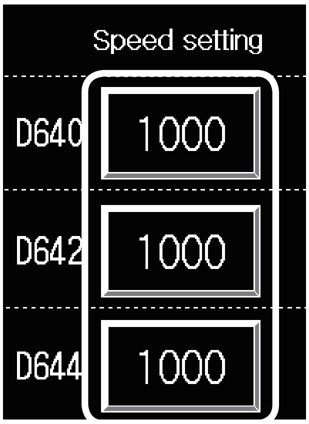


(4) Set the JOG speed arbitrarily. Touch the set value of the axis JOG speed to be changed. The numeric input window will appear.

(5) Input the JOG speed with the numeric keys. The input range is shown below.

Axis No.	JOG speed setting range (mm/min)
Axis 1	1 to 1000
Axis 2	1 to 5000
Axis 3	1 to 3000

Touch ENTER, and the input value will be reflected as the JOG speed.

(Then, the numeric input window will close.)

Perform the JOG operation as stated in (3), and make sure that the JOG speed has been changed.

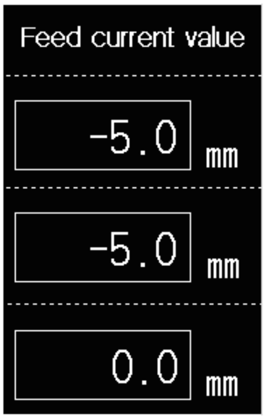
6.8.3 Home position return

Perform operation on the JOG•home position return operation screen in the same manner as in the case of the JOG operation.

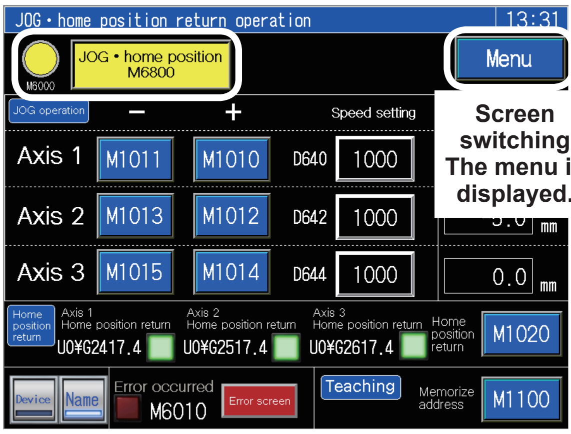
(2) **(1)**

(1) Touch Home position return M1020, and home position return will be started.

(2) After the operation is stopped, check Axis 1 home position return U0¥G2417.4, Axis 2 home position return U0¥G2517.4 and Axis 3 home position return U0¥G2617.4. If the axes have returned correctly to their home positions, the lamps of the axes are on.

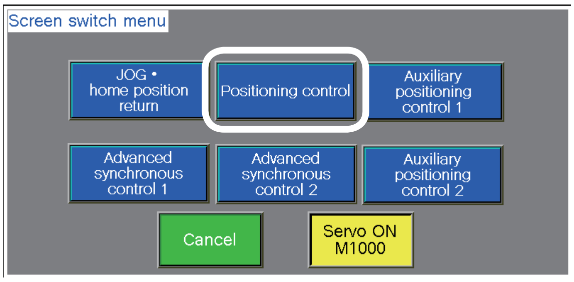


(3) When the home position return has been normally completed, check that the positioning addresses are the values shown left (home position addresses).



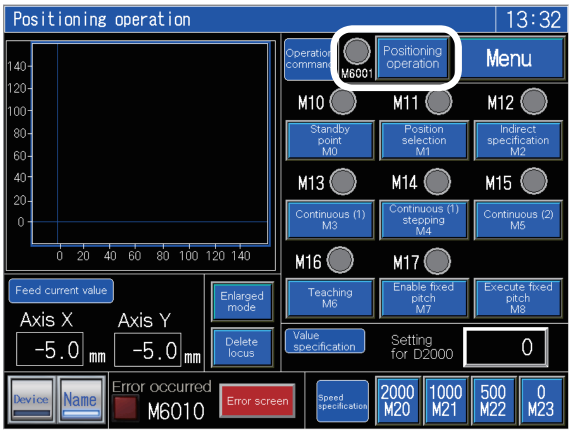
(4) After the completion of home position return, touch JOG•home position M6800 to turn off M6800.
Touch Menu to display the screen switching menu.

6.8.4 Standby point positioning

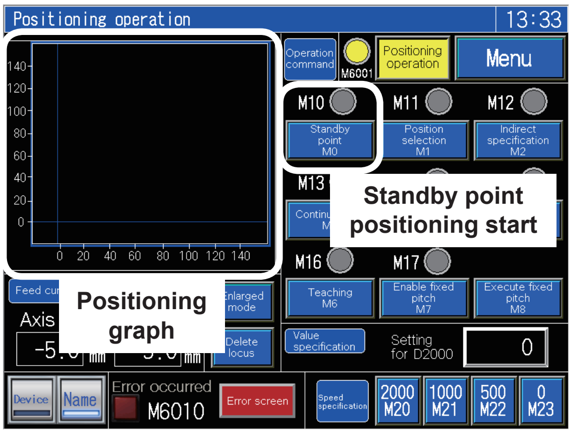


(1) Touch Positioning control on the screen switching menu.

Positioning operation screen appears.



(2) Touch Positioning operation on the positioning operation screen to turn on the positioning command M6001, and the positioning operation screen will be operable.



(3) Touch Standby point M0, and the Axis 1 will be moved from the current position to the standby point address (0).

M10 is on during standby point positioning operation.

The positioning trajectory obtained on the positioning operation screen is displayed in the positioning graph.

It is recommended to perform the standby point positioning after positioning by JOG operation.

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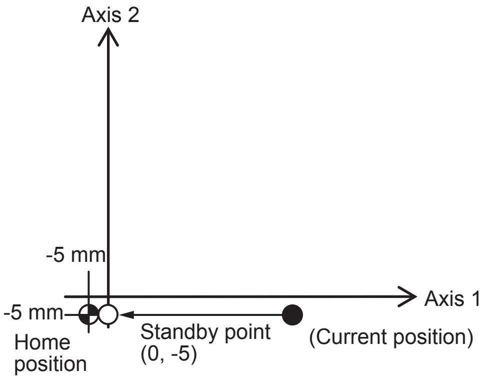
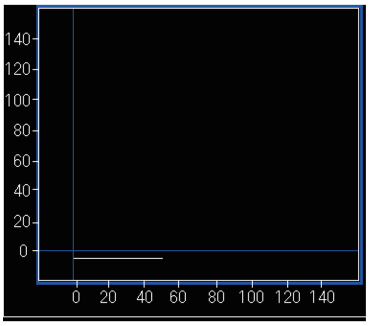
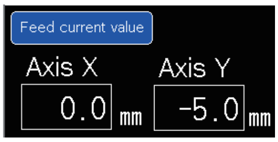
The standby point positioning trajectory is as shown below.



[Operation example]
Standby point positioning from (50, -5)





(4) Upon completion of standby point positioning, make sure that the feed current value of X-axis is 0.0 mm.

POINT

- The speed can be changed during positioning operation. For the speed change, refer to Section 6.8.7.
- The display mode of the positioning operation screen can be changed.

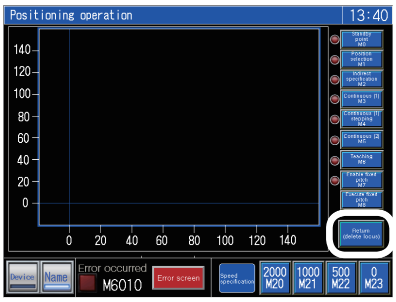
  (1) Touch Enlarged mode.

  ↓

  (2) The screen will be set to the zoom in mode, and the positioning graph will be zoomed in.
  While the positioning command M6001 is on, positioning can be started by the positioning start button on the right side of the screen.

  ↓

  (3) Touch Return (delete locus), and the screen will return to the normal mode.
  At this time, the positioning graph in the zoom in mode will be deleted. (The graph in the normal mode will not be deleted.)



- Touch Delete locus, and the positioning graph (in the normal mode) can be deleted.

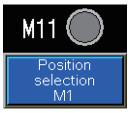
6.8.5 Point selection

Perform operation on the positioning operation screen in the same manner as in the case of the standby point positioning.

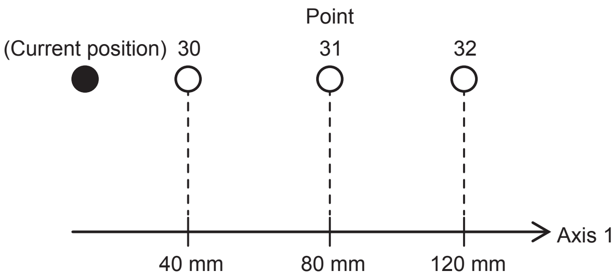
(1) Touch the set value of D2000 setting, and the numeric input window will appear.

(2) Input one of 30, 31 and 32, and touch ENTER to reflect the input value.
The positioning address for each point (input value) is shown below.

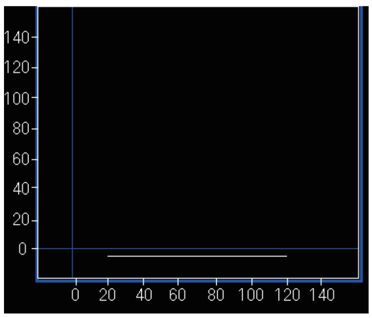
POINT	Positioning address (mm)
30	40.0
31	80.0
32	120.0

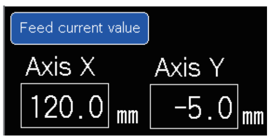


(3) Touch Position selection M1, and the Axis 1 will be positioned in the address corresponding to the point input in (2).
M11 is on during point selection positioning operation.
The point selection positioning trajectory is as shown below.



[Operation example]
Address indirect specification positioning from (20, -5) to point 32





(4) Upon completion of the address indirect specification positioning, check that the positioning address of X-axis in the feed current value field corresponds to the point set in (2).

POINT

The speed can be changed during positioning operation. For the speed change, refer to Section 6.8.7.

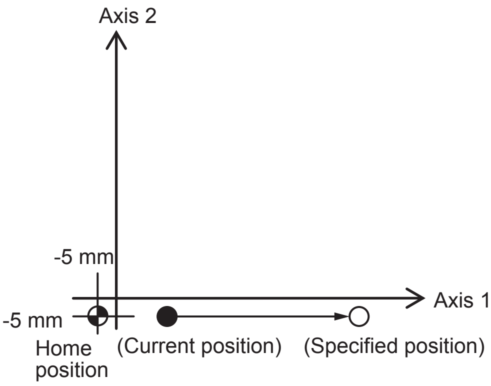
6.8.6 Address indirect specification positioning

Perform operation on the positioning operation screen in the same manner as in the case of the standby point positioning and point selection positioning.

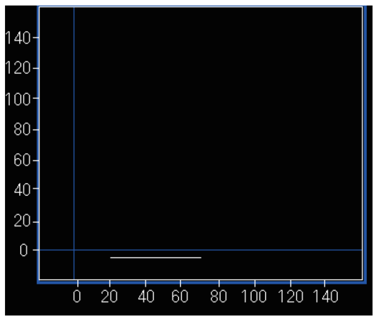
(1) Touch the set value of D2000 setting, and the numeric input window will appear.

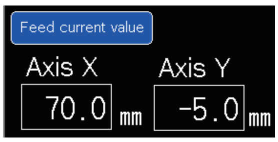
(2) Input the positioning address arbitrarily.
The input range is from 0 to 140 (mm).
Touch ENTER, and the input value will be reflected.
(Example) When the input value is 70: (Axis 1) = (70)

(3) Touch Indirect specification M2, and the Axis 1 will be positioned in the positioning address input in (2).
M12 is on during address indirect specification positioning operation.
The address indirect specification positioning trajectory is as shown below.



[Operation example]
Address indirect specification positioning from (20, -5) to (70, -5)





(4) Upon completion of point selection positioning, check that the positioning address of X-axis in the feed current value field is the value set in (2).

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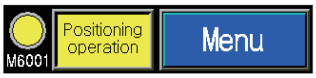


(5) To terminate the positioning, touch [Positioning operation] to turn off the positioning command M6001.
Touch [Menu] to display the screen switching menu.

(6) Touch [Servo ON M1000] to stop the servo amplifiers of Axes 1 to 3.

POINT

The speed can be changed during positioning operation. For the speed change, refer to Section 6.8.7.

6.8.7 Speed change

The speed can be changed by touching one of the following buttons on the positioning operation screen during standby point positioning, point selection positioning, address indirect specification positioning, continuous positioning (1), continuous positioning (2), teaching/teaching playback and fixed-feed/fixed-feed stepping operation.

- Touch [2000 M20], and the speed will be changed to 2000 mm/min.
- Touch [1000 M21], and the speed will be changed to 1000 mm/min.
- Touch [500 M22], and the speed will be changed to 500 mm/min.
- Touch [0 M23], and the positioning will be suspended (speed 0 mm/min).

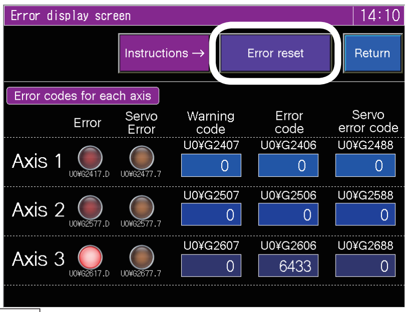
POINT

The speed can be changed any number of times during positioning operation.
However, do not perform operation during deceleration. A minor error will occur.

6.8.8 Troubleshooting

When the module does not work, check the following points.

On the GOT screen, the error codes are displayed in decimal notation.

<table>
<tr><th>Check item</th><th>Countermeasures</th></tr>
<tr><td>Check that the servo amplifiers have started (all axes servo ON).</td><td>If the servo amplifiers have not started, touch [Servo ON M1000] on the screen switching menu.</td></tr>
<tr><td>Check that the CPU module is running.</td><td>If it is not running, set the RUN/STOP/RESET switch to “RUN”.</td></tr>
<tr><td>Check that the module is not being tested by the Simple Motion setting tool.</td><td>If it is being tested, terminate the test. (Refer to Section 5.5.)</td></tr>
<tr><td>Check that all necessary parameters have been written to the programmable controllers.</td><td>Re-write the project data referring to Section 5.4.2.</td></tr>
<tr><td>Check that no errors have occurred.
(ERR.LED of RD77MS is on.)</td><td rowspan="2">If any error has occurred, cancel the error as stated below.
• Touch [Error screen] to display the error screen. Touch [Error reset], and the error will be reset.


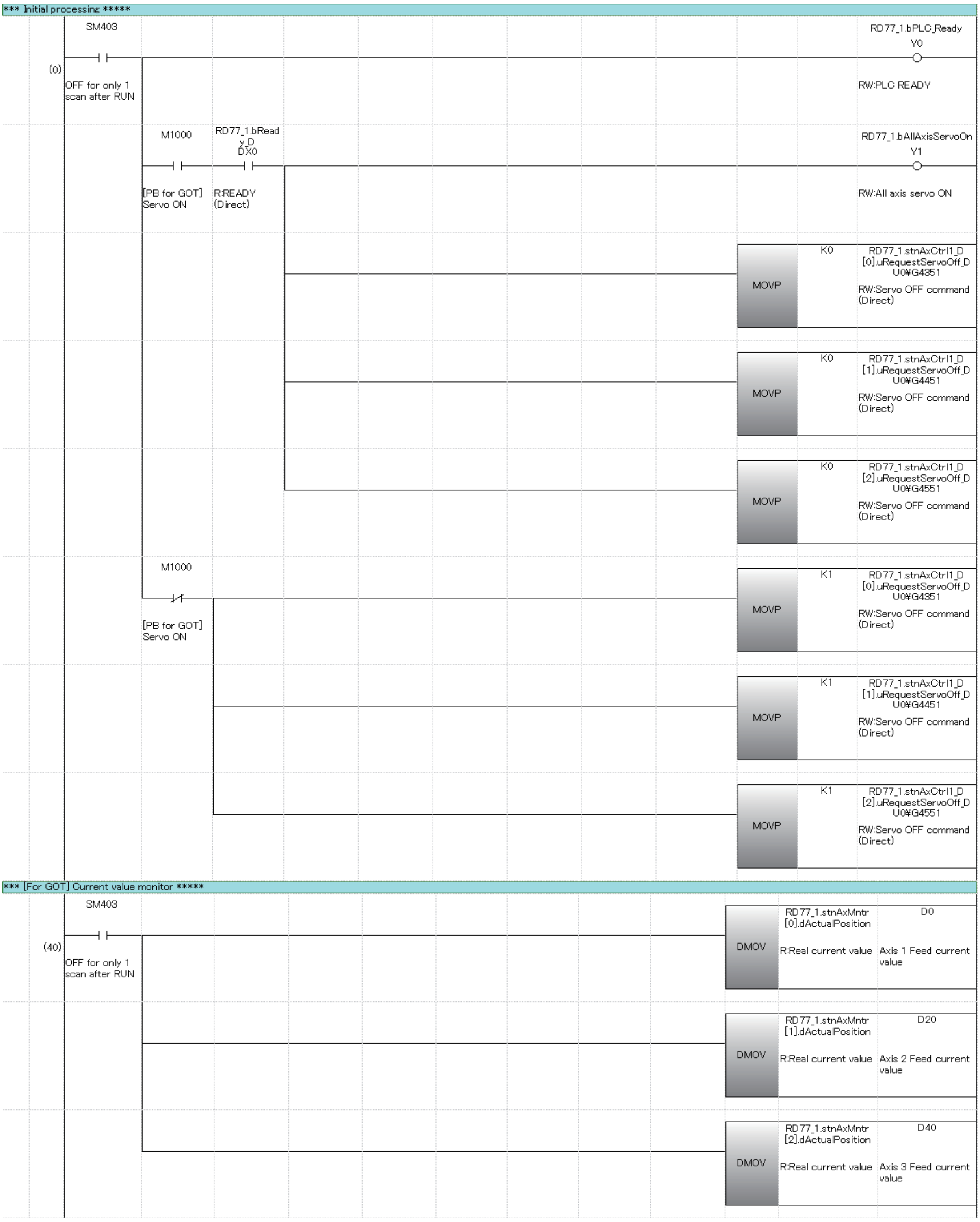
• Touch [Servo ON M1000] on the screen switching menu to turn off the all axes servo, and reset the CPU module. (Hold the RUN/STOP/RESET switch on the RESET side.)
After resetting the error, it is recommended to perform home position return (refer to Section 6.8.3).</td></tr>
<tr><td>Check that Error occurred M6010 is not on. </td></tr>
<tr><td>Check that the upper or lower limit of the positioning address of Axis 3 is not exceeded by JOG operation.</td><td>If any of the following error codes is displayed on the error screen, the upper or lower limit of the positioning address of Axis 3 is exceeded.
Touch [Error reset] to reset the error, and take appropriate measures.

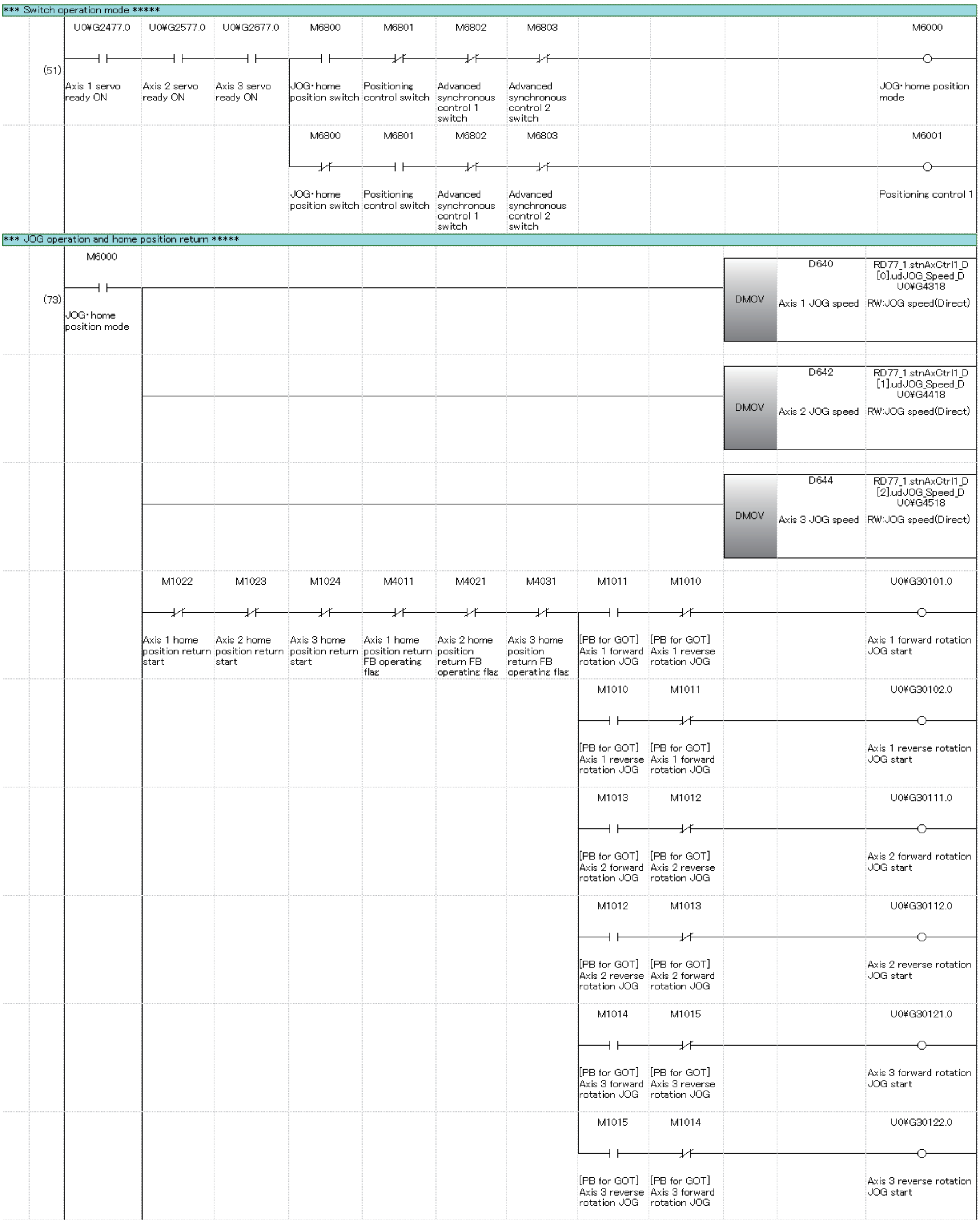
<table>
<tr><th>Error code</th><th>Operation error</th><th>Countermeasures</th></tr>
<tr><td>6404
6405</td><td>The upper limit of positioning address is exceeded.</td><td>• Perform reverse rotation JOG operation.
• Perform home position return.</td></tr>
<tr><td>6549</td><td>The lower limit of positioning address is exceeded.</td><td>• Perform forward rotation JOG operation.
• Perform home position return.</td></tr>
<tr><td>6433</td><td>Positioning is started after any of the above error occurs.</td><td>• Perform JOG operation in the direction in which the error does not occur.
• Perform home position return.</td></tr>
</table></td></tr>
</table>

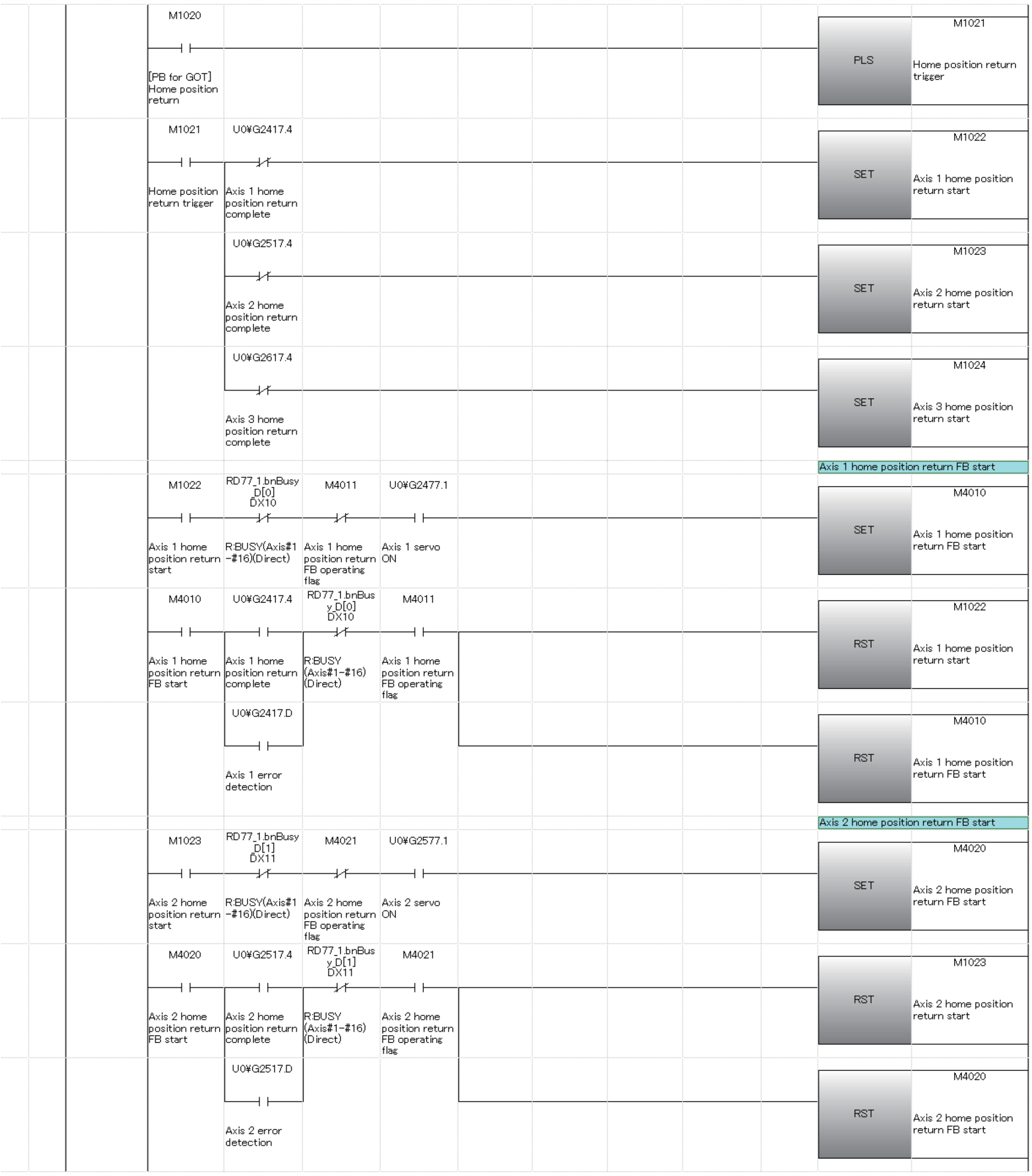
Check item	Countermeasures
Check whether home position return is not performed when the servo parameter “PC17 Function selection C-4” has been set to the default (0000H) and the JOG operation has not been performed. (6522 is stored as the error code.)	Perform home position return after JOG operation.
Check whether a point inapplicable to point selection positioning has not been set.	If a point other than 30, 31 and 32 has been set, point selection positioning cannot be performed. Set one of 30, 31 and 32.
The positioning operation time is short (the speed cannot be changed).	If the positioning operation time is short and the speed cannot be changed, start the positioning while touching the button of the desired speed.

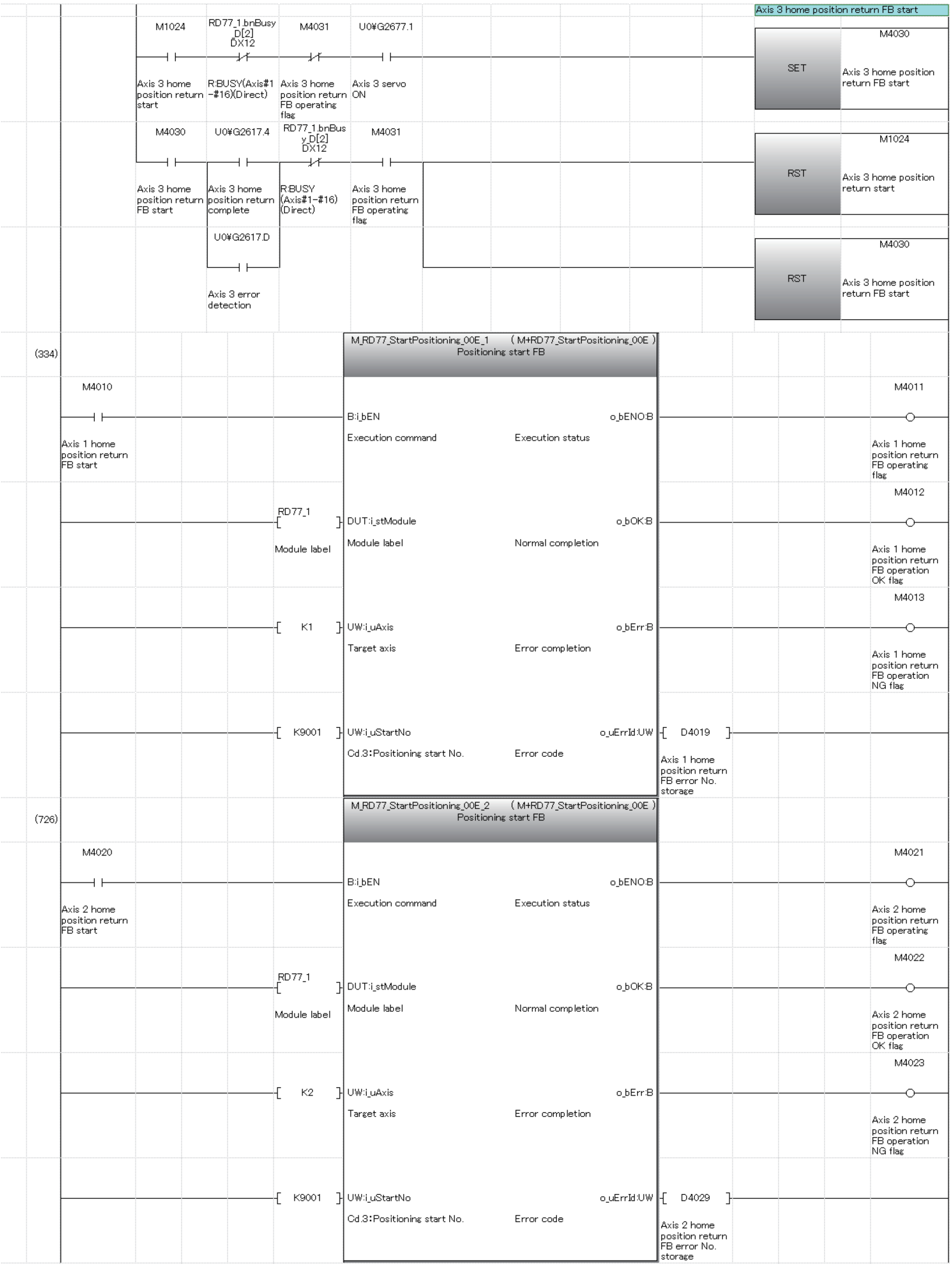
6.9 Sequence Program List

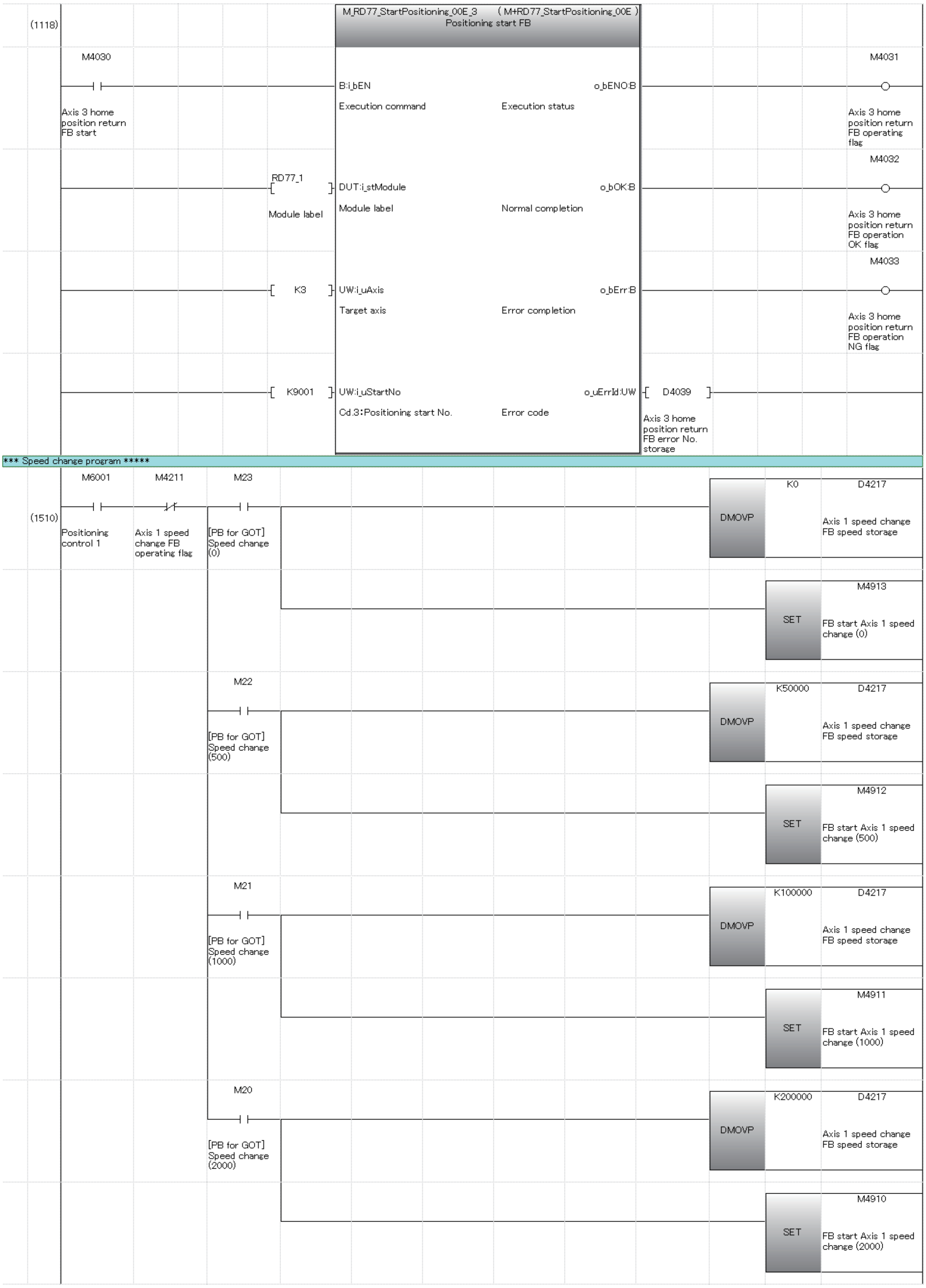
This shows a list of the sequence programs.

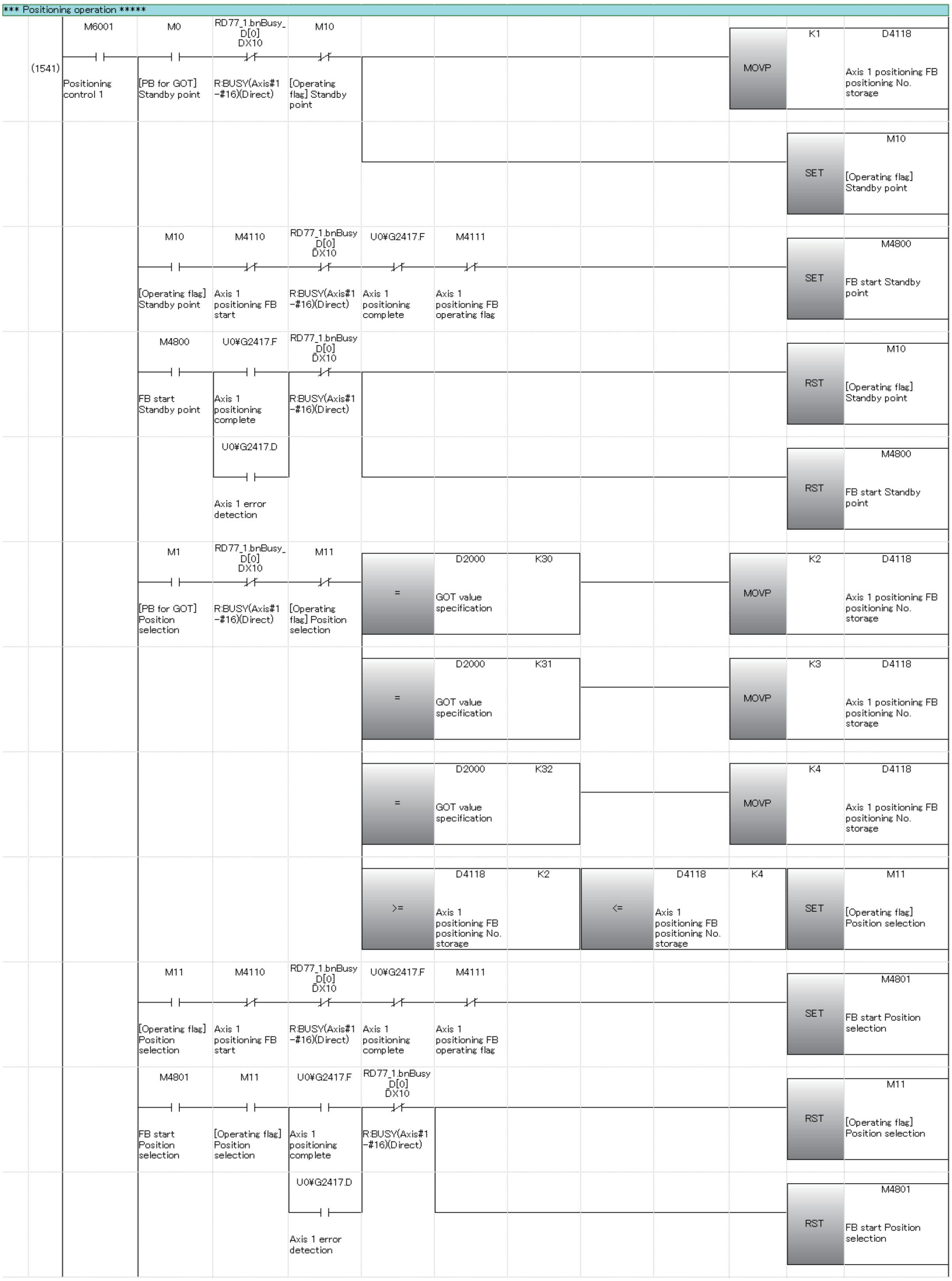


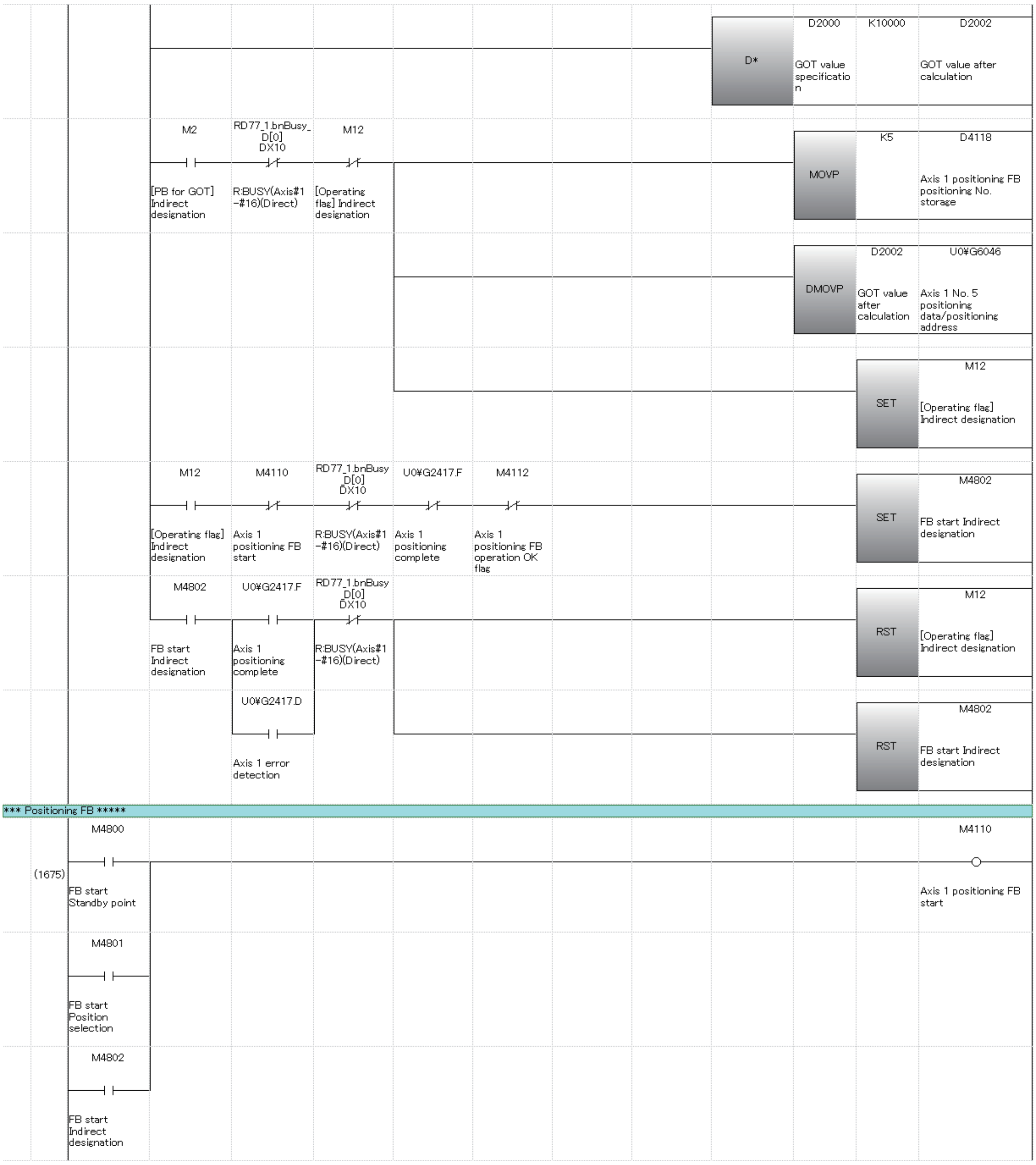

*** Switch operation mode *****
(51)
U0¥G2477.0
Axis 1 servo ready ON
U0¥G2577.0
Axis 2 servo ready ON
U0¥G2677.0
Axis 3 servo ready ON
M6800
JOG･home position switch
M6801
Positioning control switch
M6802
Advanced synchronous control 1 switch
M6803
Advanced synchronous control 2 switch
M6000
JOG･home position mode
M6800
JOG･home position switch
M6801
Positioning control switch
M6802
Advanced synchronous control 1 switch
M6803
Advanced synchronous control 2 switch
M6001
Positioning control 1
*** JOG operation and home position return *****
(73)
M6000
JOG･home position mode
DMOV
D640
Axis 1 JOG speed
RD77_1.stnAxCtrl1_D[0].udJOG_Speed_D
U0¥G4318
RW:JOG speed(Direct)
DMOV
D642
Axis 2 JOG speed
RD77_1.stnAxCtrl1_D[1].udJOG_Speed_D
U0¥G4418
RW:JOG speed(Direct)
DMOV
D644
Axis 3 JOG speed
RD77_1.stnAxCtrl1_D[2].udJOG_Speed_D
U0¥G4518
RW:JOG speed(Direct)
M1022
Axis 1 home position return start
M1023
Axis 2 home position return start
M1024
Axis 3 home position return start
M4011
Axis 1 home position return FB operating flag
M4021
Axis 2 home position return FB operating flag
M4031
Axis 3 home position return FB operating flag
M1011
[PB for GOT] Axis 1 forward rotation JOG
M1010
[PB for GOT] Axis 1 reverse rotation JOG
U0¥G30101.0
Axis 1 forward rotation JOG start
M1010
[PB for GOT] Axis 1 reverse rotation JOG
M1011
[PB for GOT] Axis 1 forward rotation JOG
U0¥G30102.0
Axis 1 reverse rotation JOG start
M1013
[PB for GOT] Axis 2 forward rotation JOG
M1012
[PB for GOT] Axis 2 reverse rotation JOG
U0¥G30111.0
Axis 2 forward rotation JOG start
M1012
[PB for GOT] Axis 2 reverse rotation JOG
M1013
[PB for GOT] Axis 2 forward rotation JOG
U0¥G30112.0
Axis 2 reverse rotation JOG start
M1014
[PB for GOT] Axis 3 forward rotation JOG
M1015
[PB for GOT] Axis 3 reverse rotation JOG
U0¥G30121.0
Axis 3 forward rotation JOG start
M1015
[PB for GOT] Axis 3 reverse rotation JOG
M1014
[PB for GOT] Axis 3 forward rotation JOG
U0¥G30122.0
Axis 3 reverse rotation JOG start

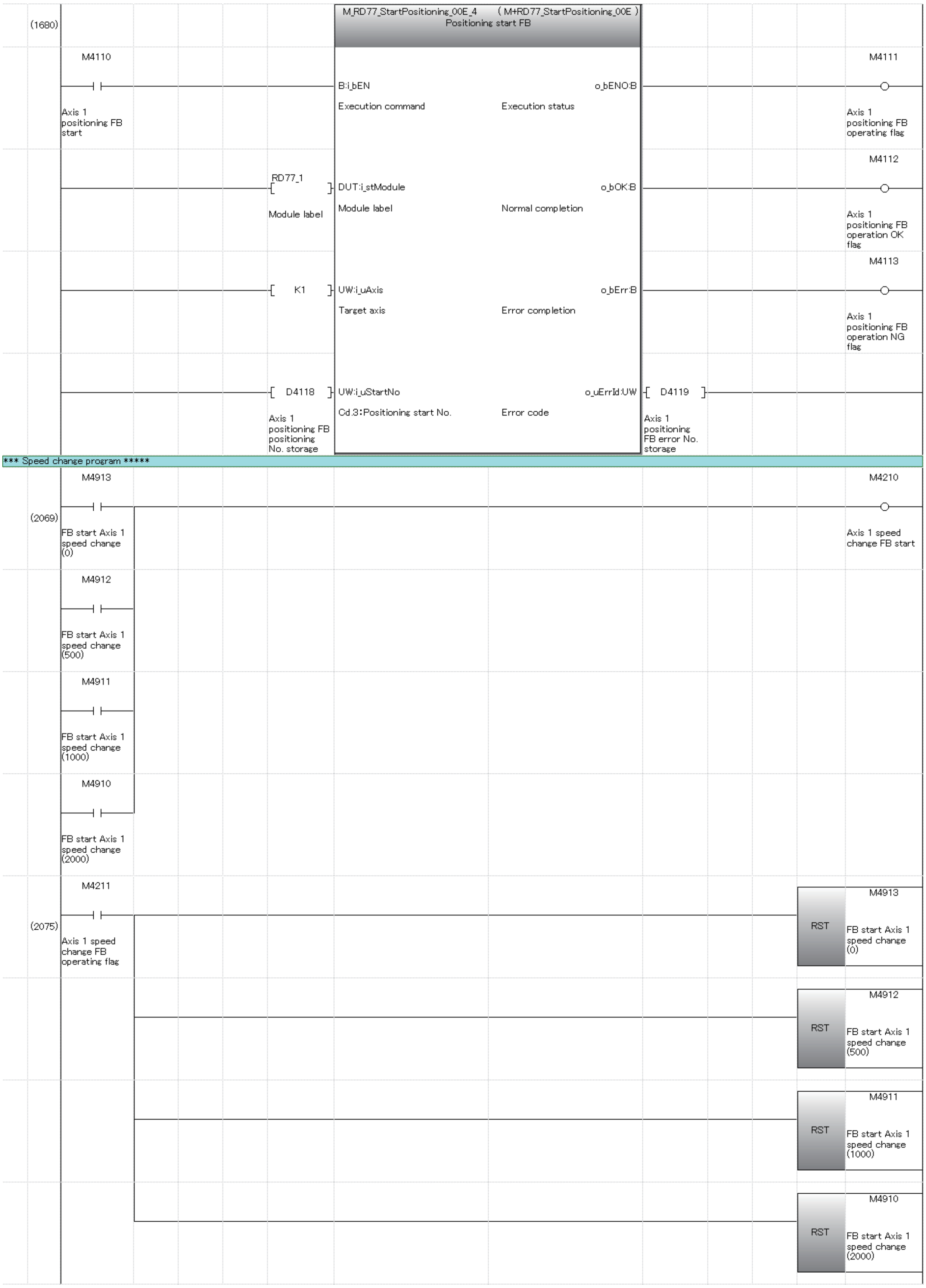

M1020
[PB for GOT] Home position return
PLS
M1021
Home position return trigger
M1021
Home position return trigger
U0¥G2417.4
Axis 1 home position return complete
SET
M1022
Axis 1 home position return start
U0¥G2517.4
Axis 2 home position return complete
SET
M1023
Axis 2 home position return start
U0¥G2617.4
Axis 3 home position return complete
SET
M1024
Axis 3 home position return start
Axis 1 home position return FB start
M1022
Axis 1 home position return start
RD77_1.bnBusy_D[0] DX10
R:BUSY(Axis#1-#16)(Direct)
M4011
Axis 1 home position return FB operating flag
U0¥G2477.1
Axis 1 servo ON
SET
M4010
Axis 1 home position return FB start
M4010
Axis 1 home position return FB start
U0¥G2417.4
Axis 1 home position return complete
RD77_1.bnBusy_D[0] DX10
R:BUSY (Axis#1-#16) (Direct)
M4011
Axis 1 home position return FB operating flag
RST
M1022
Axis 1 home position return start
U0¥G2417.D
Axis 1 error detection
RST
M4010
Axis 1 home position return FB start
Axis 2 home position return FB start
M1023
Axis 2 home position return start
RD77_1.bnBusy_D[1] DX11
R:BUSY(Axis#1-#16)(Direct)
M4021
Axis 2 home position return FB operating flag
U0¥G2577.1
Axis 2 servo ON
SET
M4020
Axis 2 home position return FB start
M4020
Axis 2 home position return FB start
U0¥G2517.4
Axis 2 home position return complete
RD77_1.bnBusy_D[1] DX11
R:BUSY (Axis#1-#16) (Direct)
M4021
Axis 2 home position return FB operating flag
RST
M1023
Axis 2 home position return start
U0¥G2517.D
Axis 2 error detection
RST
M4020
Axis 2 home position return FB start

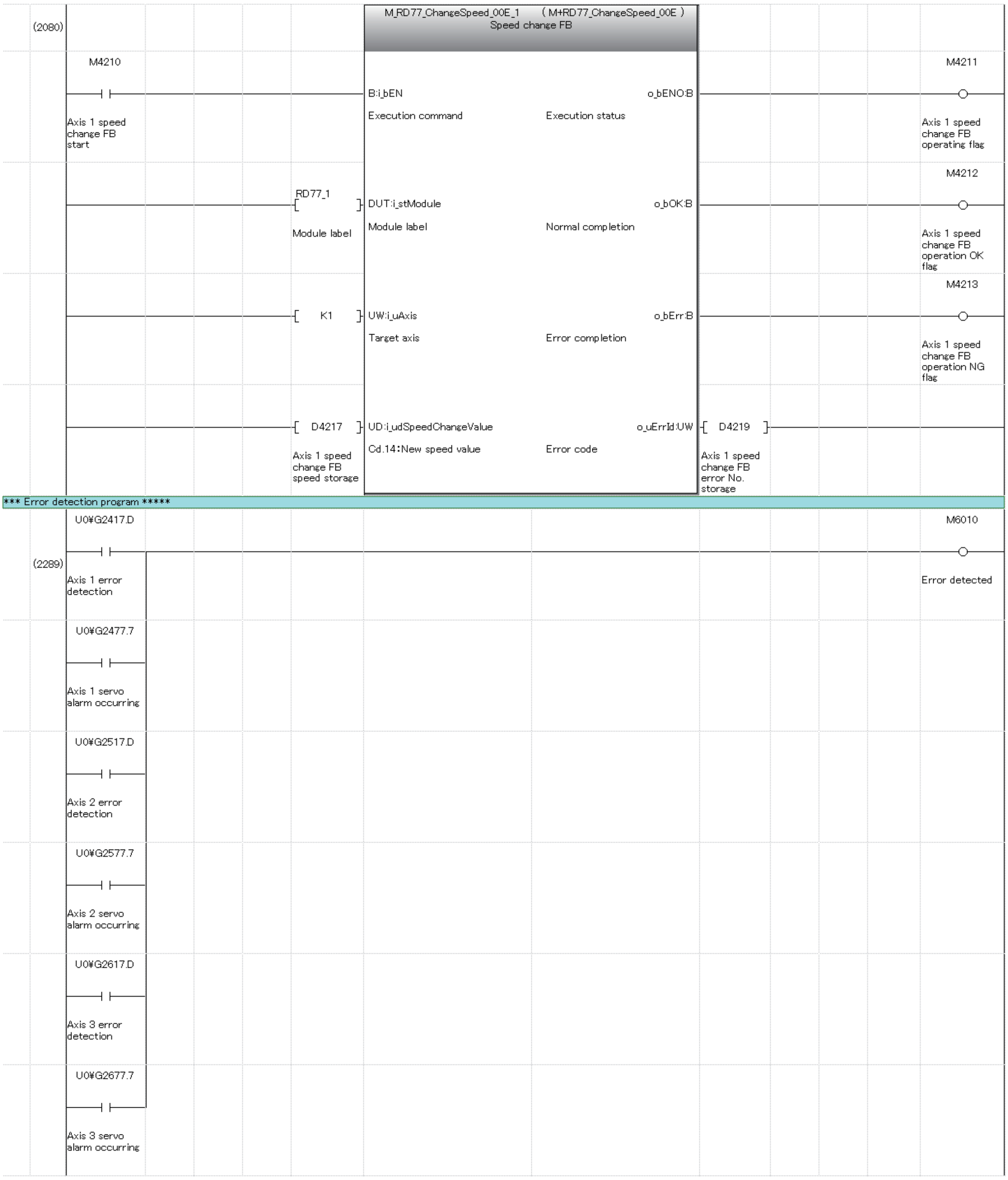

Axis 3 home position return FB start
M1024
RD77_1.bnBusy_D[2] DX12
M4031
U0¥G2677.1
Axis 3 home position return start
R:BUSY(Axis#1-#16)(Direct)
Axis 3 home position return FB operating flag
Axis 3 servo ON
SET
M4030
Axis 3 home position return FB start
M4030
U0¥G2617.4
RD77_1.bnBusy_D[2] DX12
M4031
Axis 3 home position return FB start
Axis 3 home position return complete
R:BUSY (Axis#1-#16) (Direct)
Axis 3 home position return FB operating flag
RST
M1024
Axis 3 home position return start
U0¥G2617.D
Axis 3 error detection
RST
M4030
Axis 3 home position return FB start
(334)
M_RD77_StartPositioning_00E_1 (M+RD77_StartPositioning_00E)
Positioning start FB
M4010
Axis 1 home position return FB start
B:i_bEN
Execution command
o_bENO:B
Execution status
M4011
Axis 1 home position return FB operating flag
RD77_1
Module label
DUT:i_stModule
Module label
o_bOK:B
Normal completion
M4012
Axis 1 home position return FB operation OK flag
K1
UW:i_uAxis
Target axis
o_bErr:B
Error completion
M4013
Axis 1 home position return FB operation NG flag
K9001
UW:i_uStartNo
Cd.3:Positioning start No.
o_uErrId:UW
Error code
D4019
Axis 1 home position return FB error No. storage
(726)
M_RD77_StartPositioning_00E_2 (M+RD77_StartPositioning_00E)
Positioning start FB
M4020
Axis 2 home position return FB start
B:i_bEN
Execution command
o_bENO:B
Execution status
M4021
Axis 2 home position return FB operating flag
RD77_1
Module label
DUT:i_stModule
Module label
o_bOK:B
Normal completion
M4022
Axis 2 home position return FB operation OK flag
K2
UW:i_uAxis
Target axis
o_bErr:B
Error completion
M4023
Axis 2 home position return FB operation NG flag
K9001
UW:i_uStartNo
Cd.3:Positioning start No.
o_uErrId:UW
Error code
D4029
Axis 2 home position return FB error No. storage

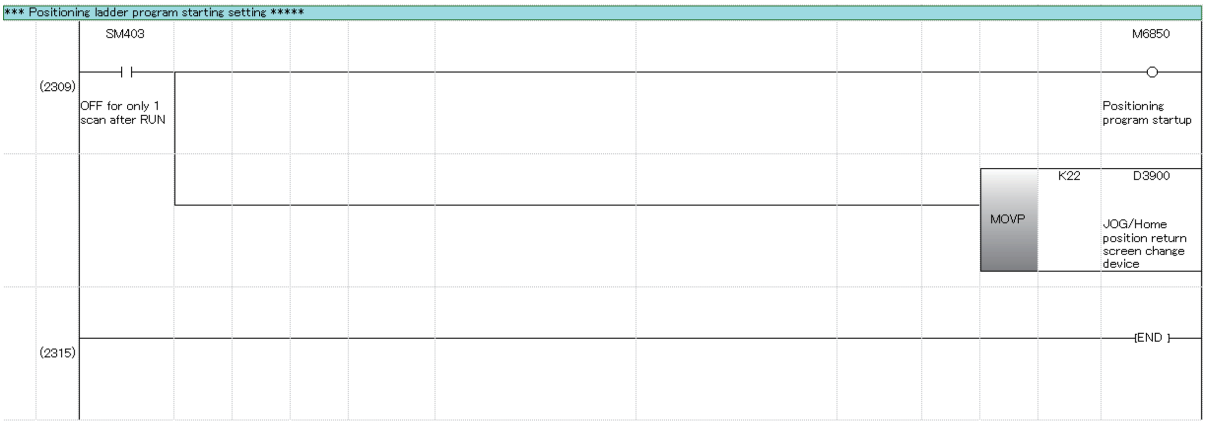

(1118)
M_RD77_StartPositioning_00E_3 (M+RD77_StartPositioning_00E)
Positioning start FB
M4030
Axis 3 home position return FB start
B:i_bEN
Execution command
o_bENO:B
Execution status
M4031
Axis 3 home position return FB operating flag
RD77_1
Module label
DUT:i_stModule
Module label
o_bOK:B
Normal completion
M4032
Axis 3 home position return FB operation OK flag
K3
UW:i_uAxis
Target axis
o_bErr:B
Error completion
M4033
Axis 3 home position return FB operation NG flag
K9001
UW:i_uStartNo
Cd.3:Positioning start No.
o_uErrId:UW
Error code
D4039
Axis 3 home position return FB error No. storage
*** Speed change program *****
(1510)
M6001
Positioning control 1
M4211
Axis 1 speed change FB operating flag
M23
[PB for GOT] Speed change (0)
DMOVP
K0
D4217
Axis 1 speed change FB speed storage
SET
M4913
FB start Axis 1 speed change (0)
M22
[PB for GOT] Speed change (500)
DMOVP
K50000
D4217
Axis 1 speed change FB speed storage
SET
M4912
FB start Axis 1 speed change (500)
M21
[PB for GOT] Speed change (1000)
DMOVP
K100000
D4217
Axis 1 speed change FB speed storage
SET
M4911
FB start Axis 1 speed change (1000)
M20
[PB for GOT] Speed change (2000)
DMOVP
K200000
D4217
Axis 1 speed change FB speed storage
SET
M4910
FB start Axis 1 speed change (2000)


*** Positioning operation *****
(1541)
M6001
Positioning control 1
M0
[PB for GOT] Standby point
RD77_1.bnBusy_D[0] DX10
R:BUSY(Axis#1-#16)(Direct)
M10
[Operating flag] Standby point
MOVP
K1
D4118
Axis 1 positioning FB positioning No. storage
SET
M10
[Operating flag] Standby point
M10
[Operating flag] Standby point
M4110
Axis 1 positioning FB start
RD77_1.bnBusy_D[0] DX10
R:BUSY(Axis#1-#16)(Direct)
U0¥G2417.F
Axis 1 positioning complete
M4111
Axis 1 positioning FB operating flag
SET
M4800
FB start Standby point
M4800
FB start Standby point
U0¥G2417.F
Axis 1 positioning complete
RD77_1.bnBusy_D[0] DX10
R:BUSY(Axis#1-#16)(Direct)
RST
M10
[Operating flag] Standby point
U0¥G2417.D
Axis 1 error detection
RST
M4800
FB start Standby point
M1
[PB for GOT] Position selection
RD77_1.bnBusy_D[0] DX10
R:BUSY(Axis#1-#16)(Direct)
M11
[Operating flag] Position selection
=
D2000
GOT value specification
K30
MOVP
K2
D4118
Axis 1 positioning FB positioning No. storage
=
D2000
GOT value specification
K31
MOVP
K3
D4118
Axis 1 positioning FB positioning No. storage
=
D2000
GOT value specification
K32
MOVP
K4
D4118
Axis 1 positioning FB positioning No. storage
>=
D4118
Axis 1 positioning FB positioning No. storage
K2
<=
D4118
Axis 1 positioning FB positioning No. storage
K4
SET
M11
[Operating flag] Position selection
M11
[Operating flag] Position selection
M4110
Axis 1 positioning FB start
RD77_1.bnBusy_D[0] DX10
R:BUSY(Axis#1-#16)(Direct)
U0¥G2417.F
Axis 1 positioning complete
M4111
Axis 1 positioning FB operating flag
SET
M4801
FB start Position selection
M4801
FB start Position selection
M11
[Operating flag] Position selection
U0¥G2417.F
Axis 1 positioning complete
RD77_1.bnBusy_D[0] DX10
R:BUSY(Axis#1-#16)(Direct)
RST
M11
[Operating flag] Position selection
U0¥G2417.D
Axis 1 error detection
RST
M4801
FB start Position selection


D2000
K10000
D2002
D*
GOT value specificatio n
GOT value after calculation
M2
RD77_1.bnBusy_D[0] DX10
M12
[PB for GOT] Indirect designation
R:BUSY(Axis#1-#16)(Direct)
[Operating flag] Indirect designation
K5
D4118
MOVP
Axis 1 positioning FB positioning No. storage
D2002
U0¥G6046
DMOVP
GOT value after calculation
Axis 1 No. 5 positioning data/positioning address
M12
SET
[Operating flag] Indirect designation
M12
M4110
RD77_1.bnBusy_D[0] DX10
U0¥G2417.F
M4112
[Operating flag] Indirect designation
Axis 1 positioning FB start
R:BUSY(Axis#1-#16)(Direct)
Axis 1 positioning complete
Axis 1 positioning FB operation OK flag
M4802
SET
FB start Indirect designation
M4802
U0¥G2417.F
RD77_1.bnBusy_D[0] DX10
FB start Indirect designation
Axis 1 positioning complete
R:BUSY(Axis#1-#16)(Direct)
M12
RST
[Operating flag] Indirect designation
U0¥G2417.D
Axis 1 error detection
M4802
RST
FB start Indirect designation
*** Positioning FB *****
M4800
(1675)
FB start Standby point
M4110
Axis 1 positioning FB start
M4801
FB start Position selection
M4802
FB start Indirect designation


(1680)
M_RD77_StartPositioning_00E_4 (M+RD77_StartPositioning_00E)
Positioning start FB
M4110
Axis 1 positioning FB start
B:i_bEN
Execution command
o_bENO:B
Execution status
M4111
Axis 1 positioning FB operating flag
RD77_1
Module label
DUT:i_stModule
Module label
o_bOK:B
Normal completion
M4112
Axis 1 positioning FB operation OK flag
K1
UW:i_uAxis
Target axis
o_bErr:B
Error completion
M4113
Axis 1 positioning FB operation NG flag
D4118
Axis 1 positioning FB positioning No. storage
UW:i_uStartNo
Cd.3:Positioning start No.
o_uErrId:UW
Error code
D4119
Axis 1 positioning FB error No. storage
*** Speed change program *****
(2069)
M4913
FB start Axis 1 speed change (0)
M4912
FB start Axis 1 speed change (500)
M4911
FB start Axis 1 speed change (1000)
M4910
FB start Axis 1 speed change (2000)
M4210
Axis 1 speed change FB start
(2075)
M4211
Axis 1 speed change FB operating flag
RST
M4913
FB start Axis 1 speed change (0)
RST
M4912
FB start Axis 1 speed change (500)
RST
M4911
FB start Axis 1 speed change (1000)
RST
M4910
FB start Axis 1 speed change (2000)


(2080)
M_RD77_ChangeSpeed_00E_1 (M+RD77_ChangeSpeed_00E)
Speed change FB
M4210
Axis 1 speed change FB start
B:i_bEN
Execution command
o_bENO:B
Execution status
M4211
Axis 1 speed change FB operating flag
RD77_1
Module label
DUT:i_stModule
Module label
o_bOK:B
Normal completion
M4212
Axis 1 speed change FB operation OK flag
K1
UW:i_uAxis
Target axis
o_bErr:B
Error completion
M4213
Axis 1 speed change FB operation NG flag
D4217
Axis 1 speed change FB speed storage
UD:i_udSpeedChangeValue
Cd.14:New speed value
o_uErrId:UW
Error code
D4219
Axis 1 speed change FB error No. storage
*** Error detection program *****
(2289)
U0¥G2417.D
Axis 1 error detection
M6010
Error detected
U0¥G2477.7
Axis 1 servo alarm occurring
U0¥G2517.D
Axis 2 error detection
U0¥G2577.7
Axis 2 servo alarm occurring
U0¥G2617.D
Axis 3 error detection
U0¥G2677.7
Axis 3 servo alarm occurring


*** Positioning ladder program starting setting *****
SM403
(2309)
OFF for only 1 scan after RUN
M6850
Positioning program startup
MOVP
K22
D3900
JOG/Home position return screen change device
(2315)
END

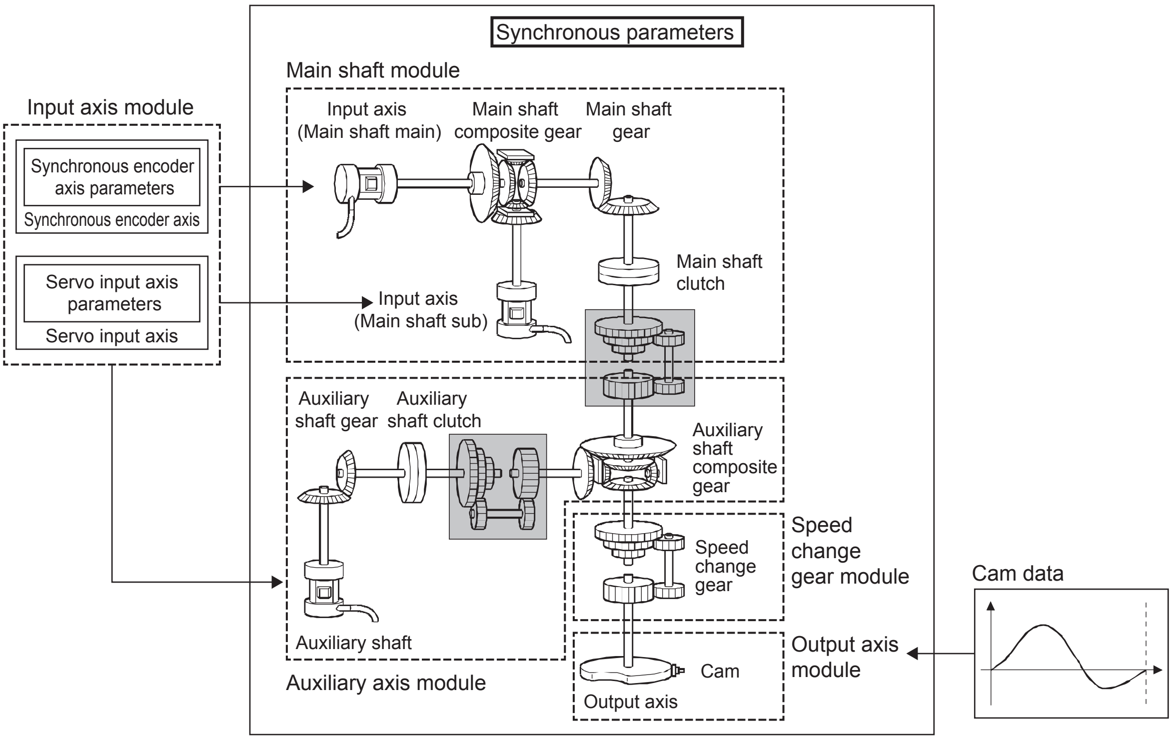
Chapter 7 Advanced Synchronous Control Practice

7.1 What is the Synchronous Control?

"Synchronous control" can be achieved using software instead of controlling mechanically with gear, shaft, speed change gear or cam, etc.
"Synchronous control" synchronizes movement with the input axis (servo input axis or synchronous encoder axis), by setting "parameters for synchronous control" and starting synchronous control on each output axis.

7.1.1 Synchronous control modules

The module is used in synchronous control as follows.

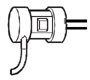
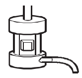
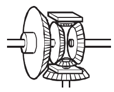
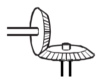
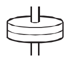
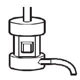
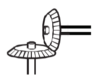
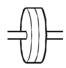
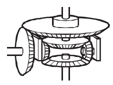
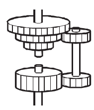
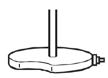


POINT

- Input axis module can be set to one of servo input axis or synchronous encoder axis.
- Speed change gear can be arranged on one of main shaft side, auxiliary shaft side or after composite auxiliary shaft gear.
- Set the travel value of input axis module so large as possible to prevent the speed fluctuation of output axis module in the synchronous control. If the travel value of input axis module is small, the speed fluctuation of output axis module may occur depending on the setting for synchronous parameter.
- The following items can be monitored using the simple motion module setting Function; each synchronous control monitor data and the rotation direction of main shaft main input axis, main shaft sub input axis, auxiliary shaft axis, and output axis (cam axis feed current value).

7.1.2 Synchronous control module list

The number of modules that can be used with synchronous control is shown below.
(Indicates the number of modules for RD77MS4.)

Classification	**Name**	**Parts**	**Maximum number of usable**	
			Number per module	**Number per axis**
Input axis module	Servo input axis	—	4	—
	Synchronous encoder axis	—	4	—
Main shaft module	Main shaft main input axis		4	1
	Main shaft sub input axis		4	1
	Composite main shaft gear		4	1
	Main shaft gear		4	1
	Main shaft clutch		4	1
Auxiliary axis module	Auxiliary shaft axis		4	1
	Auxiliary shaft gear		4	1
	Auxiliary shaft clutch		4	1
	Auxiliary shaft composite gear		4	1
Speed change gear module	Speed change gear		4	2
Output axis module	Output axis		4	1
Cam data	Cam data	—	Up to 256	—

7.1.3 Servo input axes

Servo input axes are used to drive input axes based on the position of servo motors controlled with the simple motion module.

Symbol	Setting item	Setting details	Setting value	Load cycle	Default	Buffer memory address
Pr.300	Servo input axis type	Sets the current value type from which the servo input axis input value is generated.	• Set in decimal. 0: Disable 1: Feed current value 2: Real current value 3: Servo command value 4: Feedback value	When power turned ON	0	32800+10n
Pr.301	Servo input axis smoothing time constant	Set if performing smoothing processing for input values.	• Set in decimal. 0 to 5000 [ms]		0	328001+10n
Pr.302	Servo input axis phase compensation advance time	Sets the time to advance or delay the phase.	• Set in decimal. -2147483648 to 2147483647 [μs]	Operation cycle	0	328002+10n 328003+10n
Pr.303	Servo input axis cam axis phase compensation time constant	Sets the time to reflect phase compensation.	• Set in decimal. 0 to 65535 [ms]*1	When power turned ON	10	328004+10n
Pr.304	Servo input axis rotation direction restriction	Set if restricting the input travel value to a single direction.	• Set in decimal. 0: No rotation direction restriction 1: Permit only when current value is increase direction 2: Permit only when current value is decrease direction		0	328005+10n

n: Axis No. - 1

*1. Set the value as follows in a program.
0 to 32767: Set as a decimal.
32768 to 65535: Convert into a hexadecimal and set.

7.1.4 Synchronous encoder axes

Use if driving input axes with input pulses from externally connected synchronous encoders.

Symbol	Setting item	Setting details	Setting value	Load cycle	Default	Buffer memory address
Pr.320	Synchronous encoder axis type	Sets the type of synchronous encoder axis used.	• Set in decimal. 0: Disable 1: Incremental synchronous encoder 101 to 116: Synchronous encoder via servo amplifier (Connectable servo amplifier: Axis 1 to axis 16) 201: Synchronous encoder via CPU	When power turned ON	0	34720+20j
Pr.321	Synchronous encoder axis unit setting	• Sets the synchronous encoder axis unit. • The position unit is set in the “×1 to 10^{-9} [control unit]” range. • The speed unit is set in the “×1 to 10^{-9} [control unit/s, or control unit/min]” range.	• Set in hexadecimal notation. H□□□□ **Control unit 0: mm, 1: inch, 2: degree, 3: PLS** **No. of position decimal point digits 0 to 9** **Speed time unit 0: second [s], 1: minute [min]** **No. of speed decimal point digits 0 to 9**		0003H	34721+20j
Pr.322	Synchronous encoder axis unit conversion numerator	Sets the numerator for converting synchronous encoder axis encoder pulses to synchronous encoder axis units.	• Set in decimal. -2147483648 to 2147483647 [Synchronous encoder axis position unit][*1]		1	34722+20j 34723+20j
Pr.323	Synchronous encoder axis unit conversion denominator	Sets the denominator for converting synchronous encoder axis encoder pulses to synchronous encoder axis units.	• Set in decimal. 1 to 2147483647 [pulse]		1	34724+20j 34725+20j
Pr.324	Synchronous encoder axis length per cycle	Sets the synchronous encoder axis length per cycle.	• Set in decimal. 1 to 2147483647 [Synchronous encoder axis position unit][*1]		4000	34726+20j 34727+20j
Pr.325	Synchronous encoder axis smoothing time constant	Set if performing smoothing processing for input values.	• Set in decimal. 0 to 5000 [ms]		0	34728+20j

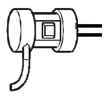
Symbol	Setting item	Setting details	Setting value	Load cycle	Default	Buffer memory address
Pr.326	Synchronous encoder axis phase compensation advance time	Sets the time to advance or delay the phase.	• Set in decimal. -2147483648 to 2147483647 [μs]	Operation cycle	0	34730+20j 34731+20j
Pr.327	Synchronous encoder axis phase compensation time constant	Sets the time to reflect phase compensation.	• Set in decimal. 0 to 65535 [ms]*2	When power turned ON	10	34732+20j
Pr.328	Synchronous encoder axis rotation direction restriction	Set if restricting the input travel value to a single direction.	• Set in decimal. 0: No rotation direction restriction 1: Permit only when current value is increase direction 2: Permit only when current value is decrease direction		0	34733+20j
Pr.329	Resolution of synchronous encoder via CPU	• Set the resolution of the synchronous encoder when the synchronous encoder axis type is set to synchronous encoder via CPU. • If 0 or less is set, the input value of synchronous encoder via CPU is processed as 32-bit counter.	• Set in decimal. -2147483648 to 2147483647 [pulse]		0	34734+20j 34735+20j

j: Synchronous encoder axis No. - 1

*1. Synchronous encoder axis position unit
*2. Set the value as follows in a program.
0 to 32767: Set as a decimal.
32768 to 65535: Convert into a hexadecimal and set.

7.1.5 Main shaft main input axis

This is the input axis at the main shaft module main side. This is the reference for the main shaft position.



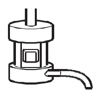
Symbol	Setting item	Setting details	Setting value	Load cycle	Default	Buffer memory address
Pr.400	Main input axis No.	Sets the input axis No. at the main shaft input main side.	• Set in decimal. 0: Disable 1 to 16: Servo input axis[*1] 801 to 804: Synchronous encoder axis	When starting synchronous control	0	36400+200n

n: Axis No. - 1

*1. The range from axis 1 to 2 is valid in the 2-axis module, from axis 1 to 4 is valid in the 4-axis module, from axis 1 to 8 is valid in the 8-axis module.

7.1.6 Main shaft sub input axis

This is the input axis at the main shaft module sub side. This is used if entering a compensation amount for the main shaft main input axis position.



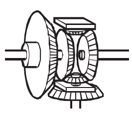
Symbol	Setting item	Setting details	Setting value	Load cycle	Default	Buffer memory address
Pr.401	Sub input axis No.	Sets the input axis No. at the main shaft input sub side.	• Set in decimal. 0: Disable 1 to 16: Servo input axis[*1] 801 to 804: Synchronous encoder axis	When starting synchronous control	0	36401+200n

n: Axis No. - 1

*1. The range from axis 1 to 2 is valid in the 2-axis module, from axis 1 to 4 is valid in the 4-axis module, from axis 1 to 8 is valid in the 8-axis module.

7.1.7 Composite main shaft gear

The main shaft main input axis and main shaft sub input axis travel values are compounded and transferred to the main shaft gear.

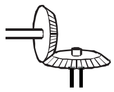


Symbol	Setting item	Setting details	Setting value	Load cycle	Default	Buffer memory address
Pr.402	Composite main shaft gear	Selects the input value composition method from main input axis and sub input axis.	• Set in hexadecimal notation. H□□□□ Main input method **0: No input** **1: Input +** **2: Input -** Sub input method **0: No input** **1: Input +** **2: Input -**	Operation cycle	0001H	36402+200n

n: Axis No. - 1

7.1.8 Main shaft gear

The gear ratio for which the travel value after the composite main shaft gear is set is converted and transferred.

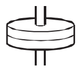


Symbol	Setting item	Setting details	Setting value	Load cycle	Default	Buffer memory address
Pr.403	Main shaft gear numerator	Sets the main shaft gear numerator.	• Set in decimal. -2147483648 to 2147483647	When starting synchronous control	1	36404+200n 36405+200n
Pr.404	Main shaft gear denominator	Sets the main shaft gear denominator.	• Set in decimal. 1 to 2147483647		1	36406+200n 36407+200n

n: Axis No. - 1

7.1.9 Main shaft clutch

The main shaft travel value is turned ON and OFF with the clutch and transferred.
This is used if conveying/isolating command pulses from main shaft input to the output axis module side, and controlling servo motor operation/stoppage.



Symbol	Setting item	Setting details	Setting value	Load cycle	Default	Buffer memory address
Pr.405	Main shaft clutch control setting	Sets the clutch control method.	• Set in hexadecimal notation. H□□ □ □ **ON control mode** **0: No clutch** **1: Clutch command ON/OFF** **2: Clutch command leading edge** **3: Clutch command trailing edge** **4: Address mode** **5: High-speed input request** **OFF control mode** **0: OFF control invalid** **1: One shot OFF** **2: Clutch command leading edge** **3: Clutch command trailing edge** **4: Address mode** **5: High-speed input request** **High-speed input request signal** **0 to F: High-speed input request signal from axis 1 to axis 16**[*1]	Operation cycle	0000H	36408+200n

Symbol	Setting item	Setting details	Setting value	Load cycle	Default	Buffer memory address
Pr.406	Main shaft clutch reference address setting	Sets the clutch reference address.	• Set in decimal. 0: Current value after composite main shaft gear 1: Current value per cycle after main shaft gear	When starting synchronous control	0	36409+200n
Pr.407	Main shaft clutch ON address	• Sets the address for turning ON the clutch when in address mode. (The setting is invalid when in other than address mode.) • If other than "0 to (cam axis length per cycle -1)", the clutch is controlled after converting to the "0 to (cam axis length per cycle -1)" range.	• Set in decimal. -2147483648 to 2147483647 [Main input axis position unit*2, or cam axis cycle unit*3]	Operation cycle	0	36410+200n 36411+200n
Pr.408	Travel value before main shaft clutch ON	• Sets the travel value until the clutch is actually turned ON after the clutch ON conditions are established. • Set a positive value for movements in the increase direction, and negative value for movements in the decrease direction.	• Set in decimal. -2147483648 to 2147483647 [Main input axis position unit*2, or cam axis cycle unit*3]	When clutch ON conditions established	0	36412+200n 36413+200n
Pr.409	Main shaft clutch OFF address	• Sets the address for turning OFF the clutch when in address mode. (The setting is invalid when in other than address mode.) • If other than "0 to (cam axis length per cycle -1)", the clutch is controlled after converting to the "0 to (cam axis length per cycle -1)" range.	• Set in decimal. -2147483648 to 2147483647 [Main input axis position unit*2, or cam axis cycle unit*3]	Operation cycle	0	36414+200n 36415+200n

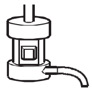
Symbol	Setting item	Setting details	Setting value	Load cycle	Default	Buffer memory address
Pr.410	Travel value before main shaft clutch OFF	• Sets the travel value until the clutch is actually turned OFF after the clutch OFF conditions are established. • Set a positive value for movements in the increase direction, and negative value for movements in the decrease direction.	• Set in decimal. -2147483648 to 2147483647 [Main input axis position unit*2, or cam axis cycle unit*3]	When clutch OFF conditions established	0	36416+200n 36417+200n
Pr.411	Main shaft clutch smoothing method	Sets the clutch smoothing method.	• Set in decimal. 0: Direct 1: Time constant method (index) 2: Time constant method (linear) 3: Slippage amount method (index) 4: Slippage amount method (linear) 5: Slippage amount method (Linear: following amount of input)	When starting synchronous control	0	36418+200n
Pr.412	Main shaft clutch smoothing time constant	Sets the smoothing time constant if time constant method smoothing.	• Set in decimal. 0 to 5000 [ms]		0	36419+200n
Pr.413	Slippage amount at main shaft clutch ON	Sets the slippage amount when the clutch is ON if slippage amount method smoothing.	• Set in decimal. 0 to 2147483647 [Main input axis position unit*2, or cam axis cycle unit*3]	When starting clutch ON	0	36420+200n 36421+200n
Pr.414	Slippage amount at main shaft clutch OFF	Sets the slippage amount when the clutch is OFF if slippage amount method smoothing.	• Set in decimal. 0 to 2147483647 [Main input axis position unit*2, or cam axis cycle unit*3]	When starting clutch OFF	0	36422+200n 36423+200n

n: Axis No. - 1

*1. The range from axis 1 to 2 is valid in the 2-axis module, from axis 1 to 4 is valid in the 4-axis module, from axis 1 to 8 is valid in the 8-axis module.
*2. Main input axis position unit
*3. Cam axis cycle unit

7.1.10 Auxiliary shafts

These are input axes for auxiliary shaft modules. For the auxiliary shaft module, the input values are generated from the auxiliary shafts. Furthermore, input values can be converted to values taking the mechanical reduction ratio and rotation direction into consideration with an auxiliary shaft gear.



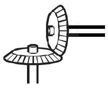
Symbol	Setting item	Setting details	Setting value	Load cycle	Default	Buffer memory address
Pr.418	Auxiliary shaft axis No.	Sets the auxiliary shaft input axis No.	• Set in decimal. 0: Disable 1 to 16: Servo input axis[*1] 801 to 804: Synchronous encoder axis	When starting synchronous control	0	36430+200n

n: Axis No. - 1

*1. The range from axis 1 to 2 is valid in the 2-axis module, from axis 1 to 4 is valid in the 4-axis module, from axis 1 to 8 is valid in the 8-axis module.

7.1.11 Auxiliary shaft gear

The auxiliary shaft travel value is converted with the set gear ratio and transferred.

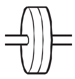


Symbol	Setting item	Setting details	Setting value	Load cycle	Default	Buffer memory address
Pr.420	Auxiliary shaft gear numerator	Sets the auxiliary shaft gear numerator.	• Set in decimal. -2147483648 to 2147483647	When starting synchronous control	1	36432+200n 36433+200n
Pr.421	Auxiliary shaft gear denominator	Sets the auxiliary shaft gear denominator.	• Set in decimal. 1 to 2147483647	When starting synchronous control	1	36434+200n 36435+200n

n: Axis No. - 1

7.1.12 Auxiliary shaft clutch

The auxiliary shaft travel value is turned ON and OFF with the clutch and transferred.
This is used if conveying/isolating command pulses from auxiliary shaft input to the output axis module side, and controlling servo motor operation/stoppage.



Symbol	Setting item	Setting details	Setting value	Load cycle	Default	Buffer memory address
Pr.422	Auxiliary shaft clutch control setting	Sets the clutch control method.	• Set in hexadecimal notation. H□□ □ □ ON control mode 0: No clutch 1: Clutch command ON/OFF 2: Clutch command leading edge 3: Clutch command trailing edge 4: Address mode 5: High-speed input request OFF control mode 0: OFF control invalid 1: One shot OFF 2: Clutch command leading edge 3: Clutch command trailing edge 4: Address mode 5: High-speed input request High-speed input request signal 0 to F:High-speed input request signal from axis 1 to axis 16[*1]	Operation cycle	0000H	36436+200n
Pr.423	Auxiliary shaft clutch reference address setting	Sets the clutch reference address.	• Set in decimal. 0: Auxiliary shaft current value 1: Current value per cycle after main shaft gear	When starting synchronous control	0	36437+200n
Pr.424	Auxiliary shaft clutch ON address	• Sets the address for turning ON the clutch when in address mode. (The setting is invalid when in other than address mode.) • If other than "0 to (cam axis length per cycle -1)", the clutch is controlled after converting to the "0 to (cam axis length per cycle -1)" range.	• Set in decimal. -2147483648 to 2147483647 [Auxiliary shaft position unit[*2], or cam axis cycle unit[*3]]	Operation cycle	0	36438+200n 36439+200n

Symbol	Setting item	Setting details	Setting value	Load cycle	Default	Buffer memory address
Pr.425	Travel value before auxiliary shaft clutch ON	• Sets the travel value until the clutch is actually turned ON after the clutch ON conditions are established. • Set a positive value for movements in the increase direction, and negative value for movements in the decrease direction.	• Set in decimal. -2147483648 to 2147483647 [Auxiliary shaft position unit[*2], or cam axis cycle unit[*3]]	When clutch ON conditions established	0	36440+200n 36441+200n
Pr.426	Auxiliary shaft clutch OFF address	• Sets the address for turning OFF the clutch when in address mode. (The setting is invalid when in other than address mode.) • If other than "0 to (cam axis length per cycle -1)", the clutch is controlled after converting to the "0 to (cam axis length per cycle -1)" range.	• Set in decimal. -2147483648 to 2147483647 [Auxiliary shaft position unit[*2], or cam axis cycle unit[*3]]	Operation cycle	0	36442+200n 36443+200n
Pr.427	Travel value before auxiliary shaft clutch OFF	• Sets the travel value until the clutch is actually turned OFF after the clutch OFF conditions are established. • Set a positive value for movements in the increase direction, and negative value for movements in the decrease direction.	• Set in decimal. -2147483648 to 2147483647 [Auxiliary shaft position unit[*2], or cam axis cycle unit[*3]]	When clutch OFF conditions established	0	36444+200n 36445+200n

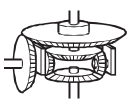
Symbol	Setting item	Setting details	Setting value	Load cycle	Default	Buffer memory address
Pr.428	Auxiliary shaft clutch smoothing method	Sets the clutch smoothing method.	• Set in decimal. 0: Direct 1: Time constant method (index) 2: Time constant method (linear) 3: Slippage amount method (index) 4: Slippage amount method (linear) 5: Slippage amount method (Linear: following amount of input)	When clutch OFF conditions established	0	36446+200n
Pr.429	Auxiliary shaft clutch smoothing time constant	Sets the smoothing time constant if time constant method smoothing.	• Set in decimal. 0 to 5000 [ms]		0	36447+200n
Pr.430	Slippage amount at auxiliary shaft clutch ON	Sets the slippage amount when the clutch is ON if slippage amount method smoothing.	• Set in decimal. 0 to 2147483647 [Auxiliary shaft position unit*2, or cam axis cycle unit*3]	When starting clutch ON	0	36448+200n 36449+200n
Pr.431	Slippage amount at auxiliary shaft clutch OFF	Sets the slippage amount when the clutch is OFF if slippage amount method smoothing.	• Set in decimal. 0 to 2147483647 [Auxiliary shaft position unit*2, or cam axis cycle unit*3]	When starting clutch OFF	0	36450+200n 36451+200n

n: Axis No. - 1

*1. The range from axis 1 to 2 is valid in the 2-axis module, from axis 1 to 4 is valid in the 4-axis module, from axis 1 to 8 is valid in the 8-axis module.
*2. Auxiliary shaft position unit
*3. Cam axis cycle unit

7.1.13 Auxiliary shaft composite gear

Main shaft and auxiliary shaft travel values are compounded and transferred.

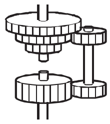


Symbol	Setting item	Setting details	Setting value	Load cycle	Default	Buffer memory address
Pr.419	Auxiliary shaft composite gear	Selects the input value composition method from the main shaft and auxiliary shaft.	• Set in hexadecimal notation. H□□□□ **Main shaft input method** **0: No input** **1: Input +** **2: Input -** **Auxiliary shaft input method** **0: No input** **1: Input +** **2: Input -**	Operation cycle	0001H	36431+200n

n: Axis No. - 1

7.1.14 Speed change gear

The speed change gear is used for changing the input speed from the main shaft, auxiliary shaft, or composite auxiliary shaft gear during operation. If not used, set "0: No speed change gear" for [Pr.434] speed change gear allocation.

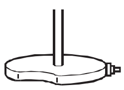


Symbol	Setting item	Setting details	Setting value	Load cycle	Default	Buffer memory address
Pr.434	Speed change gear allocation	Sets the speed change gear allocation.	• Set in decimal. 0: No speed change gear 1: Main shaft side 2: Auxiliary shaft side 3: After composite auxiliary shaft gear	When starting synchronous control	0	36460+200n
Pr.435	Speed change gear smoothing time constant	Sets the speed change gear smoothing time constant.	• Set in decimal. 0 to 5000 [ms]		0	36461+200n
Pr.436	Speed change ratio numerator	Sets the speed change ratio numerator.	• Set in decimal. -2147483648 to 2147483647	Operation cycle	1	36462+200n 36463+200n
Pr.437	Speed change ration denominator	Sets the speed change ratio denominator.	• Set in decimal. 1 to 2147483647		1	36464+200n 36465+200n

n: Axis No. - 1

7.1.15 Output axes

Output axes perform cam conversion processing based on the input travel value and set cam data, and outputs the feed current values that serve as commands to the servo amplifier.



Symbol	Setting item	Setting details	Setting value	Load cycle	Default	Buffer memory address
Pr.438	Cam axis cycle unit setting	• Sets the cam axis length per cycle unit. • This is a parameter for monitor display, and does not affect control.	• Set in hexadecimal notation. H□□□□ **Control unit** **0: mm** **1: inch** **2: degree** **3: pulse** **No. of decimal point digits** **0 to 9** **Unit setting selection** **0: Use main shaft main input axis unit.** **1: Use this setting unit.**	When starting synchronous control	0000H	36470+200n

Symbol	Setting item	Setting details	Setting value	Load cycle	Default	Buffer memory address
Pr.439	Cam axis cycle length	Sets the input amount required for 1 cam cycle.	• Set in decimal. 1 to 2147483647 [Cam axis cycle unit]*1	When starting synchronous control, when passing cam data 0 point	4194304	36472+200n 36473+200n
Pr.440	Cam No.	Sets the cam No.	• Set in decimal. 0 : Linear cam (preset) 1 to 256: User created cams		0	36474+200n
Pr.441	Cam stroke amount	• Sets the cam stroke amount relative to a stroke ratio of 100 % for stroke ratio data format cams. • Ignored for coordinate data format cams.	• Set in decimal. -2147483648 to 2147483647 [Output axis position unit]*2		4194304	36476+200n 36477+200n
Pr.442	Cam axis 1 cycle length change setting	Set if changing the [Pr.439] Cam axis length per cycle during synchronous control.	• Set in decimal. 0: Disable 1: Enable	When starting synchronous control	0	36471+200n
Pr.444	Cam axis phase compensation advance time	Sets the time to advance or delay the cam axis phase.	• Set in decimal. -2147483648 to 2147483647 [μs]	Operation cycle	0	36482+200n 36483+200n
Pr.445	Cam axis phase compensation time constant	Sets the time to reflect cam axis phase compensation.	• Set in decimal. 0 to 65535 [ms]*3	When starting synchronous control	10	36484+200n
Pr.446	Synchronous control deceleration time	Set the deceleration time for the synchronous control.	• Set in decimal. 0 to 65535 [ms]*3		0	36485+200n
Pr.447	Output axis smoothing time constant	Set if performing smoothing processing for output values.	• Set in decimal. 0 to 5000 [ms]		0	36486+200n

n: Axis No. - 1

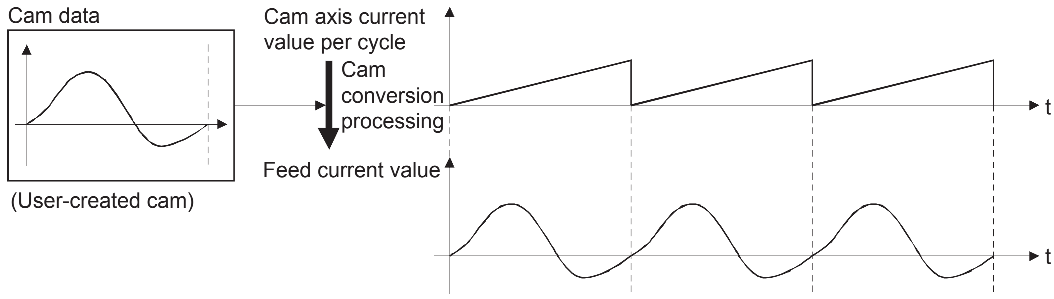
*1. Cam axis cycle unit
*2. Output axis position unit
*3. Set the value as follows in a program.
0 to 32767: Set as a decimal.
32768 to 65535: Convert into a hexadecimal and set.

[Cam data]

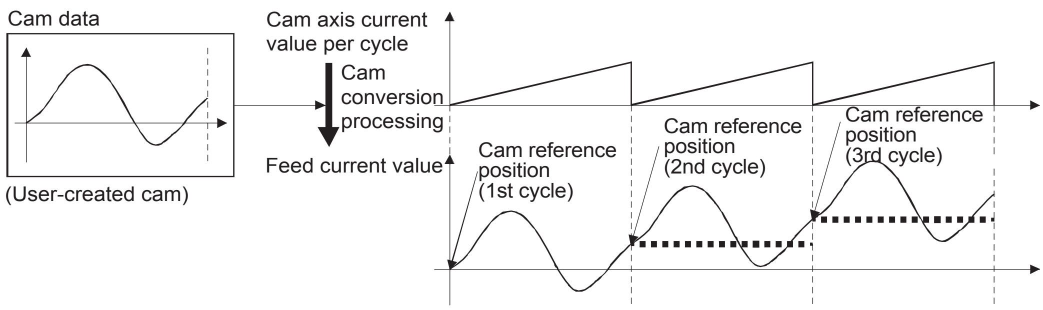
Synchronous control output axes are moved with cams. Output axis movement patterns (return movements, feed movements) relative to output axis module input travel values are registered in the cam data.

The movement patterns are as below:

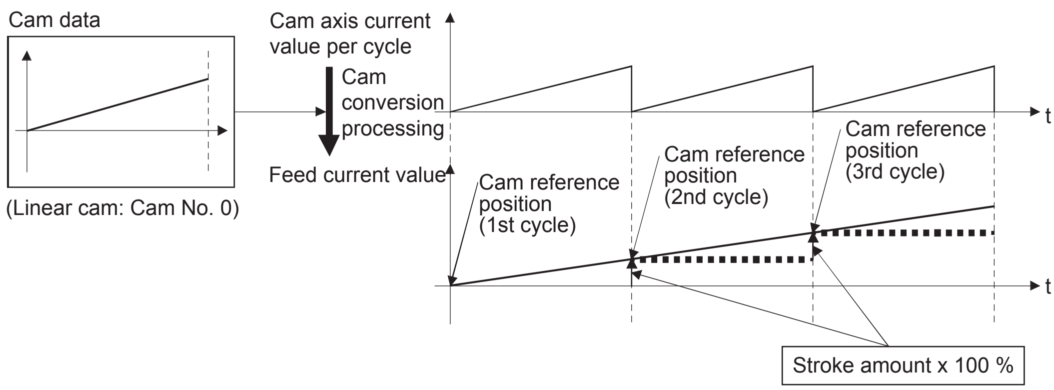
- Return movement: Return movement within fixed cam stroke range



- Feed movement: Movement that involves updating the cam reference position every 1 cycle

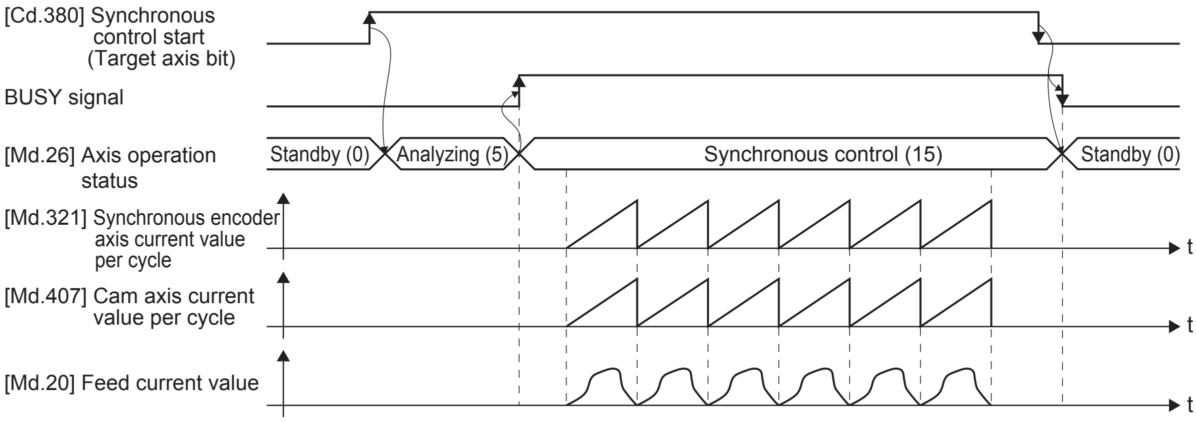


- Linear movement: Linear movement in which 1 cycle has a stroke ratio of 100 % (Cam No. 0)



7.1.16 Starting/ending for synchronous control

Set the parameters for synchronous control for each output axis to start synchronous control. The status changes to synchronous control after the parameters for synchronous control are analyzed at the start of synchronous control, and the output axes synchronize with input axis operations.



■ **Synchronous control system control data**

Symbol	Setting item	Setting details	Setting value	Load cycle	Default	Buffer memory address
Cd.380	Synchronous control start	• Synchronous control begins if the target axis bit is turned ON. • Synchronous control ends if the bit is turned OFF during synchronous control.	• Set the target axis in 16-bit. (bit0: axis 1 to bit15: axes 16*1) OFF: Synchronous control end ON: Synchronous control start	Operation cycle	0	36320

*1. The range from axis 1 to 2 is valid in the 2-axis module, from axis 1 to 4 is valid in the 4-axis module, from axis 1 to 8 is valid in the 8-axis module.

■ **Starting method for synchronous control**

Synchronous control can be started by turning the target axis bit from OFF to ON in "[Cd.380] Synchronous control start" after setting the parameters for synchronous control.
"5: Analyzing" is set in "[Md.26] Axis operation status" at the synchronous control start, and the parameters for synchronous control are analyzed. The BUSY signal turns ON after completion of analysis, and "15: Synchronous control" is set in "[Md.26] Axis operation status".
Start the input axis operation after confirming that "15: Synchronous control" is set in "[Md.26] Axis operation status".

■ **Ending method for synchronous control**

Synchronous control can be ended by turning the target axis bit from ON to OFF in "[Cd.380] Synchronous control start" after the input axis operation is stopped.
The BUSY signal turns OFF at the synchronous control end, and "0: Standby" is set in "[Md.26] Axis operation status" at the output axis stop.
Synchronous control can also be ended by turning the target axis bit from ON to OFF in "[Cd.380] Synchronous control start" during the input axis operation. However, it is recommended to end after stopping the input axis operation since the output axis stops immediately.

7.1.17 Stop operation of output axis

If the following causes occur in stopping the output axis during synchronous control, synchronous control is completed after stops processing for the output axis (BUSY signal is OFF, axis operation status is standby).

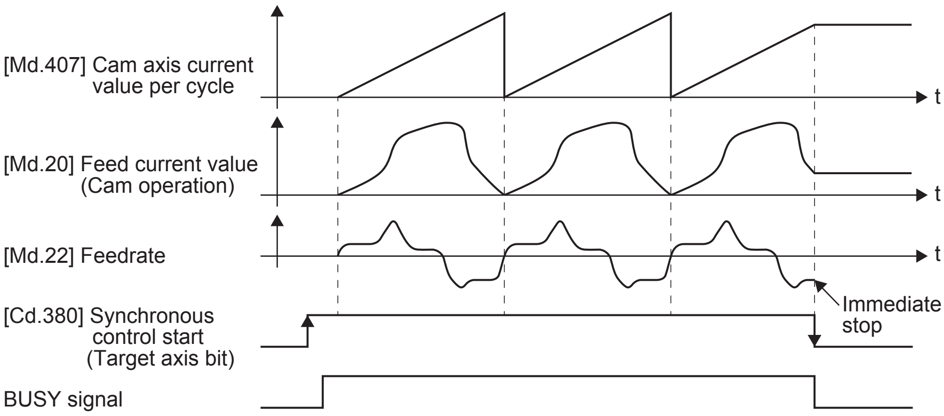
Synchronous alignment must be executed for the output axis to restart the synchronous control.

Stop cause	Stop process
The target axis bit of "[Cd.380] Synchronous control start" is turned from ON to OFF.	Immediate stop
Software stroke limit error occurrence	
Emergency stop	
Forced stop	
Stop group1 to 3[*1] (Stop with hardware stroke limit or stop command)	Deceleration stop

*1. Refer to "User's Manual (Application)" for your Simple Motion Module.

(1) Immediate stop

The operation stops without decelerate. The simple motion module immediately stops the command, but the operation will coast for the droop pulses accumulated in the deviation counter of the servo amplifier.



(2) Deceleration stop

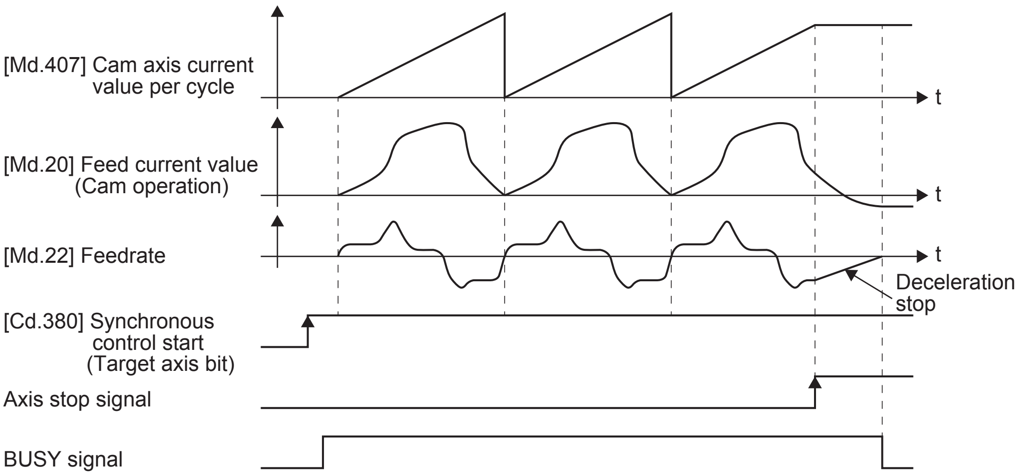
The output axis stops with deceleration according to the setting in **"[Pr.37] Stop group 1 rapid stop selection"** to **"[Pr.39] Stop group 3 rapid stop selection"**. The deceleration time is set in **"[Pr.446] Synchronous control deceleration time"** for deceleration stop, and in **"[Pr.36] Rapid stop deceleration time"** for rapid stop. The slope of deceleration is as follows.

Slope of deceleration =

[Pr.8] Speed limit value / Deceleration time (Rapid stop deceleration time)

The cam axis current value per cycle is not updated, and only the feed current value is updated, since the deceleration stop begins. Therefore, the path of the feed current value is drawn regardless the cam operation with deceleration stop.

The input axis must be stopped when the output axis is stop synchronizing with the input axis.



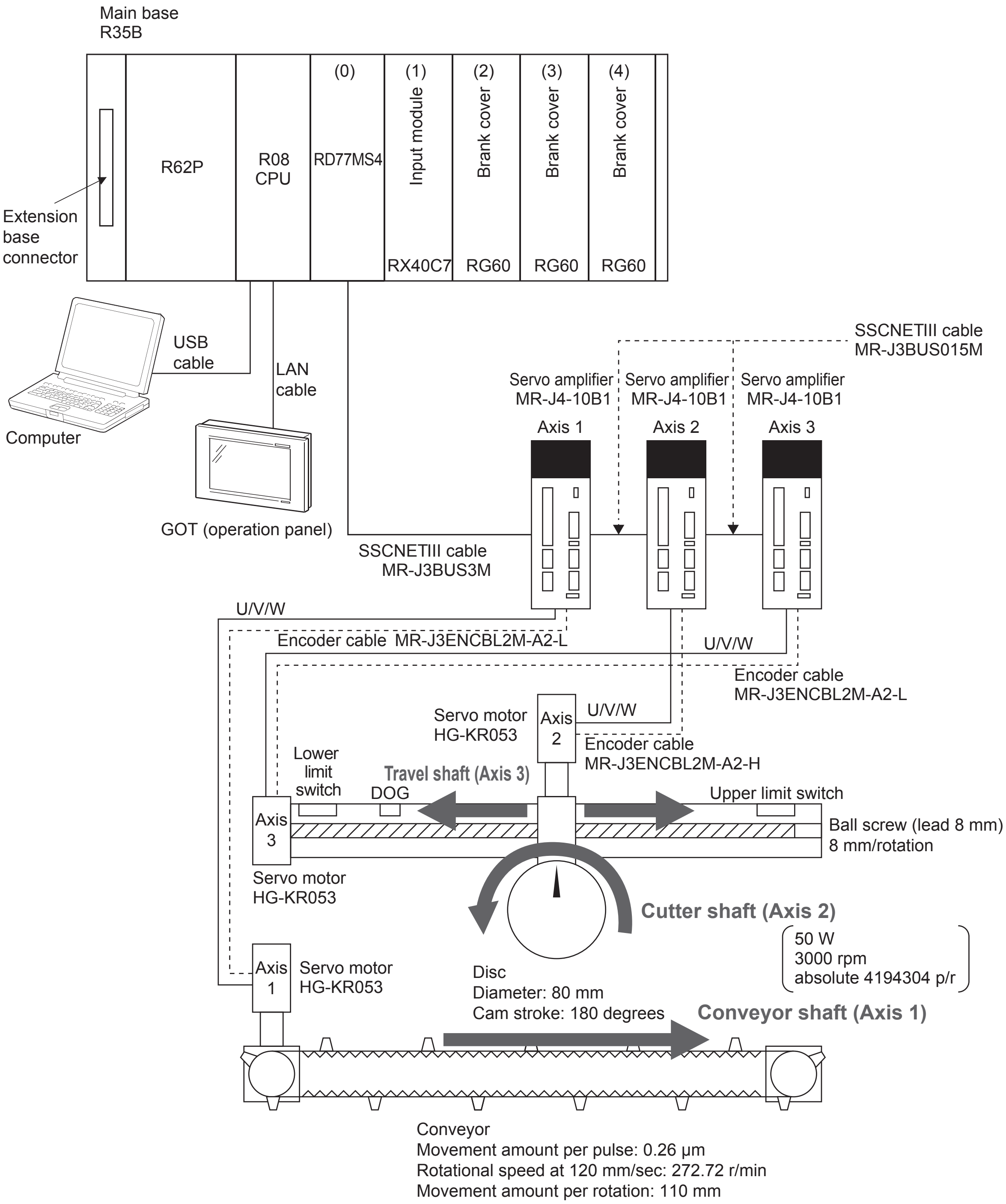
7.2 Practice Content

(1) Advanced synchronous control 1: Travel cutter

You will practice mainly the "Clutch function" that is used in the synchronous control. The travel cut takes place seamlessly by the travel of the disc axis and start of stop by the clutch function.

(2) Advanced synchronous control 2: Rotary cutter

You will practice mainly the "Cam automatic generation function" that is used in the synchronous control. The disc movements are controlled according to the automatically generated cam operation based on the parameters set up for the rotary cutter.



7.2.1 Advanced synchronous control 1: Travel cutter

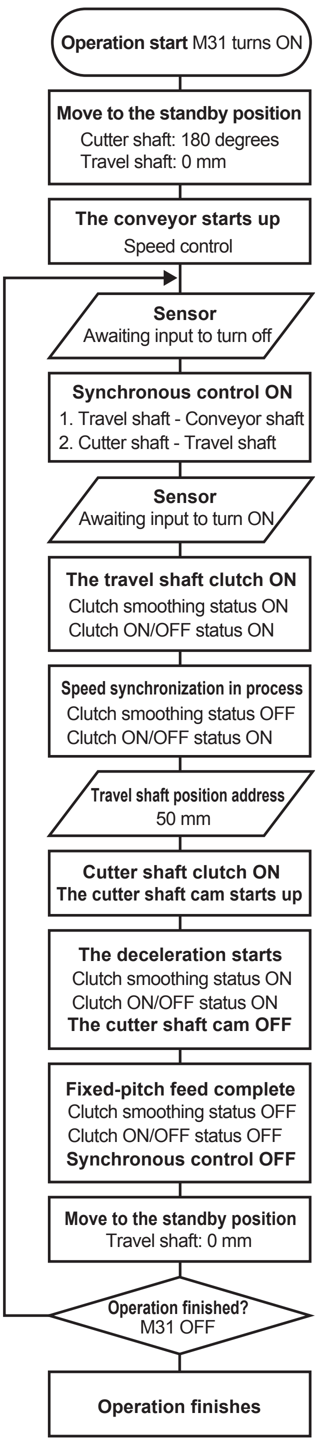
System

A sensor detects the workpiece on the conveyor that travels at a constant speed. With reference to the detected white mark as a start point, the cutter shaft starts travel movement in the direction of the conveyor move. After the cutter shaft has moved a certain distance, it starts the cutting movement.

POINT

As for the "Travel movement" by the travel shaft and the "Cutting movement" where the cutter shaft rotates for simulated cutting, both of them use and learn "Synchronous control", "Clutch function" and "Cam function".

<Control flow>



Synchronous control

- Travel movement where the disc moves to the right while synchronizing the conveyor motion
- Cutting movement where the cutter shaft rotates while synchronizing the travel shaft motion

Clutch function

- The travel shaft uses this function when it starts up and stops the travel movement.
- The cutter shaft uses the clutch function when it starts and stops the cutting movement.

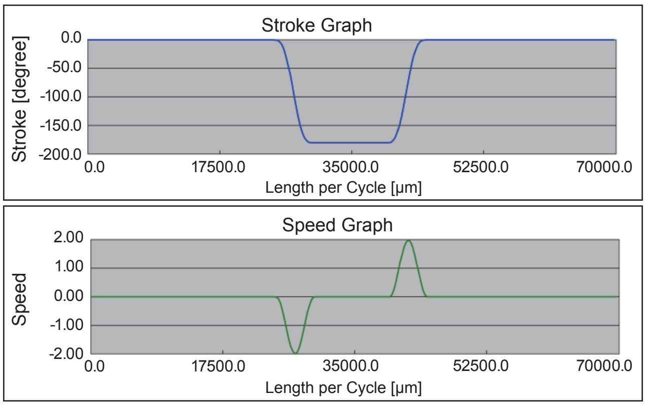
* Given the slippage amount at the time of clutch ON/OFF, the clutch function let the travel movement and cutting movement of the cutter shaft operates seamlessly smooth at the time such motions start.
This demonstration machine has the slippage amounts set to 50 mm at the start of the travel movement and 5 mm at its stop. You can observe the actual motions to see how they work.

Cam function

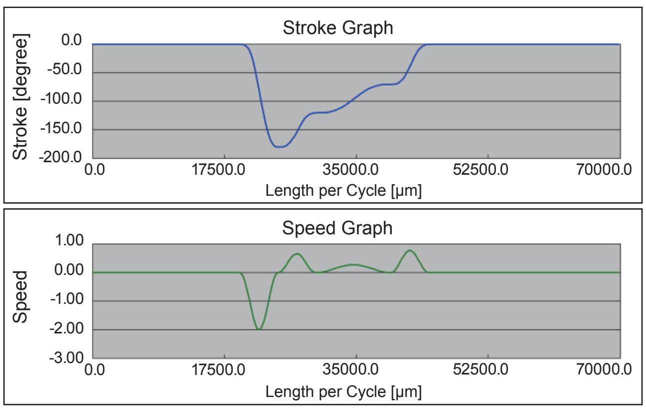
- The cutter shaft uses this function for the cutting movement.

* Here, with two sets of cam data set up in advance, you can select them on the demonstration machine operation panel to see how the cam moves.

Cam No. 1



Cam No. 2



7.2.2 Advanced synchronous control 2: Rotary cutter

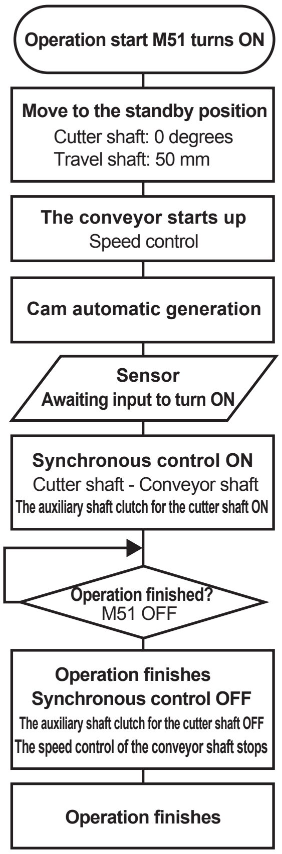
System

A sensor detects the workpiece once for the first time on the conveyor that travels at a constant speed. With reference to the detected white mark as a start point, the disc rotates to carry out the operation for the simulated cutting.

POINT

As for the "Cutting movement" where the disc rotates for simulated cutting, uses and learns "Synchronous control", "Clutch function" and "Cam automatic generation function".

<Control flow>



Synchronous control

● The cutting movement where the cutter shaft rotates.
The axis rotation follows the automatically generated cam operation.

Clutch function

● The cutter shaft uses this function when it starts the cutting movement.

* The synchronous control and the clutch function turn on at the same time as the sensor detects the workpiece for the first time. The ON status remains until the operation finishes.

Cam automatic generation function

● The cutter shaft uses this function for the cutting movement.

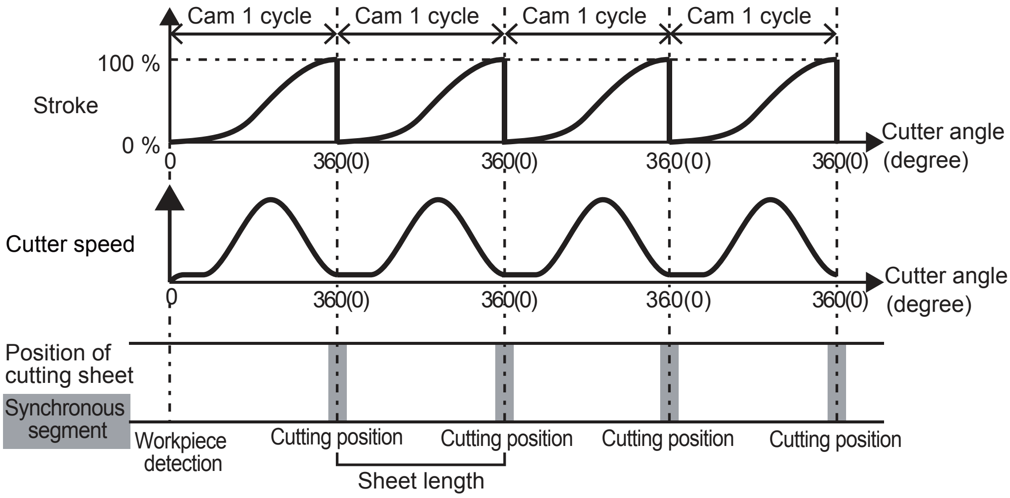
<About cam automatic generation function>

The initial parameter settings are as follows.

- Resolution: 512
- Cam automatic generation function: Cam for the rotary cutter.
- Acceleration rate over synchronous section: 100 % (Reaches the same speed as the conveyor speed at the rate of 100 %)
- Sheet length: 50.0 mm
- Sheet synchronous width: 10.0 mm
- Synchronous axis length: 251.3 mm (diameter)
- Synchronization start position: 45.0 mm

<About the rotary cutter movement>

The rotary cutter rotates according to the automatically generated cam operation as shown in the figure below.



7.3 Assignment of Devices Used for Practice

Input (X)		Output (Y)	
X0	READY	Y0	PLC ready
X1	Synchronization flag	Y1	All axis servo ON
X10	Axis 1.BUSY	Y10	Axis 1.Positioning start
X11	Axis 2.BUSY	Y11	Axis 2.Positioning start
X12	Axis 3.BUSY	Y12	Axis 3.Positioning start
X20	Sensor input (SEN1)		

Internal relay (M)			
M30	[PB for GOT] Home position return start (Advanced 1)	M4010	Home position return Axis 1 FB start
M31	[PB for GOT] Start up advanced 1	M4011	Home position return Axis 1 FB operating flag
M32	[PB for GOT] Clutch 1	M4012	Home position return Axis 1 FB operation OK flag
M33	[PB for GOT] Speed UP change	M4013	Home position return Axis 1 FB operation NG flag
M34	[PB for GOT] Speed DOWN change	M4020	Home position return Axis 2 FB start
M36	Command during Advanced 1 operation	M4021	Home position return Axis 2 FB operating flag
M50	[PB for GOT] Home position return start (Advanced 2)	M4022	Home position return Axis 2 FB operation OK flag
M51	[PB for GOT] Start up advanced 2	M4023	Home position return Axis 2 FB operation NG flag
M53	[PB for GOT] Speed UP change	M4030	Home position return Axis 3 FB start
M54	[PB for GOT] Speed DOWN change	M4031	Home position return Axis 3 FB operating flag
M55	[PB for GOT] Cam generation	M4032	Home position return Axis 3 FB operation OK flag
M56	Advanced 2 operation command	M4033	Home position return Axis 3 FB operation NG flag
M59	[PB for GOT] Cam data reference	M4310	Advanced 1 Axis 1 FB start
M202	[Operating completion flag] Axis 2 standby point traveling	M4311	Advanced 1 Axis 1 FB operating flag
M203	[Operating completion flag] Axis 3 standby point traveling	M4312	Advanced 1 Axis 1 FB operation OK flag
M211	[Operation completion flag] Home position return start	M4313	Advanced 1 Axis 1 FB operation NG flag
M252	[Operating completion flag] Axis 2 standby point traveling	M4320	Advanced 1 Axis 2 FB start
M253	[Operating completion flag] Axis 3 standby point traveling	M4321	Advanced 1 Axis 2 FB operating flag
M261	[Operation completion flag] Cam initial setting	M4322	Advanced 1 Axis 2 FB operation OK flag
M301	[Advanced 1 status] Home position return command when starting	M4323	Advanced 1 Axis 2 FB operation NG flag
M302	[Advanced 1 status] Start command	M4330	Advanced 1 Axis 3 FB start
M303	[Advanced 1 status] Standby point traveling command	M4331	Advanced 1 Axis 3 FB operating flag
M304	[Advanced 1 status] Conveyor start command	M4332	Advanced 1 Axis 3 FB operation OK flag
M305	[Advanced 1 status] Synchronous control start	M4333	Advanced 1 Axis 3 FB operation NG flag
M306	[Advanced 1 status] Sensor input wait	M4410	Advanced 1 Axis 1 speed change FB start
M307	[Advanced 1 status] Synchronous controlling	M4411	Advanced 1 Axis 1 speed change FB operating flag
M308	[Advanced 1 status] Synchronous control ending	M4412	Advanced 1 Axis 1 speed change FB operation OK flag
M309	[Advanced 1 status] Return operation start	M4413	Advanced 1 Axis 1 speed change FB operation NG flag
M310	[Advanced 1 status] Return operating	M4510	Advanced 2 Axis 1 FB start
M311	[Advanced 1 status] 1 cycle end	M4511	Advanced 2 Axis 1 FB operating flag

Internal relay (M)			
M312	[Advanced 1 status] End processing	M4512	Advanced 2 Axis 1 FB operation OK flag
M320	Advanced 1 1 cycle start command	M4513	Advanced 2 Axis 1 FB operation NG flag
M401	[Advanced 2 status] Home position return command when starting	M4520	Advanced 2 Axis 2 FB start
M402	[Advanced 2 status] Start command	M4521	Advanced 2 Axis 2 FB operating flag
M403	[Advanced 2 status] Standby point traveling command	M4522	Advanced 2 Axis 2 FB operation OK flag
M404	[Advanced 2 status] Conveyor start command	M4523	Advanced 2 Axis 2 FB operation NG flag
M405	[Advanced 2 status] Sensor input wait	M4530	Advanced 2 Axis 3 FB start
M406	[Advanced 2 status] Synchronous operating	M4531	Advanced 2 Axis 3 FB operating flag
M407	[Advanced 2 status] Synchronous ending	M4532	Advanced 2 Axis 3 FB operation OK flag
M408	[Advanced 2 status] Standby point traveling after end	M4533	Advanced 2 Axis 3 FB operation NG flag
M500	Advanced 2 Cam auto-generation command	M5012	FB start conveyor start (Axis 1)
M1000	[PB for GOT] Servo ON	M5021	FB start standby point traveling (Axis 2)
M1010	[PB for GOT] Axis 1 reverse rotation JOG	M5031	FB start standby point traveling (Axis 3)
M1011	[PB for GOT] Axis 1 forward rotation JOG	M5032	FB start standby point traveling after end (Axis 3)
M1012	[PB for GOT] Axis 2 reverse rotation JOG	M5040	FB start advanced speed change setting when starting
M1013	[PB for GOT] Axis 2 forward rotation JOG	M5041	FB start Advanced speed change acceleration
M1014	[PB for GOT] Axis 3 forward rotation JOG	M5042	FB start Advanced speed change deceleration
M1015	[PB for GOT] Axis 3 reverse rotation JOG	M5512	FB start conveyor start (Axis 1)
M1020	[PB for GOT] Home position return	M5521	FB start standby point traveling (Axis 2)
M1021	JOG screen Home position return trigger	M5522	FB start standby point traveling after end (Axis 2)
M1022	Axis 1 Home position return start	M5531	FB start standby point traveling (Axis 3)
M1023	Axis 2 Home position return start	M6000	JOG•home position mode
M1024	Axis 3 Home position return start	M6002	Advanced control 1
M1031	Home position return trigger for advanced	M6003	Advanced control 2
M2000	All ax servo ON	M6010	Error detection
M2001	Axis 1 BUSY signal	M6800	JOG•home position switch
M2002	Axis 2 BUSY signal	M6801	Positioning control switch
M2003	Axis 3 BUSY signal	M6802	Advanced synchronous control 1 switch
M2011	Axis 1 servo ready signal	M6803	Advanced synchronous control 2 switch
M2012	Axis 2 servo ready signal	M6840	Speed synchronizing
M2013	Axis 3 servo ready signal	M6841	Advanced synchronizing
		M6855	Advanced programs start

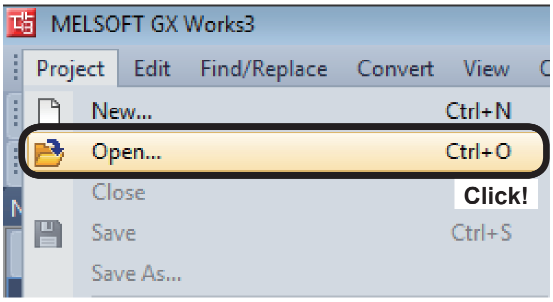
Data register			
D0	Axis 1 Feed current value	D5072	Sheet synchronous width 50% (D5062/2)
D1		D5073	
D20	Axis 2 Feed current value	D5074	
D21		D5075	
D40	Axis 3 Feed current value	D6050	[GOT setting] Automatic Cam generation acceleration rate over synchronous section
D41		D6051	

Data register (D)	
D640 D641	Axis 1 JOG speed
D642 D643	Axis 2 JOG speed
D644 D645	Axis 3 JOG speed
D3001	Advanced 1 Cam No. specification
D3900	Device to modify JOG/Home position return screen
D4019	Axis 1 home position return FB error No. storage
D4029	Axis 2 home position return FB error No. storage
D4039	Axis 3 home position return FB error No. storage
D4318	Axis 1 advanced 1 FB positioning No. storage
D4319	Axis 1 advanced 1 FB error No. storage
D4328	Axis 2 advanced 1 FB positioning No. storage
D4329	Axis 2 advanced 1 FB error No. storage
D4338	Axis 3 advanced 1 FB positioning No. storage
D4339	Axis 3 advanced 1 FB error No. storage
D4417 D4418	Advanced common Axis 1 speed change speed specification storage
D4419	Advanced common Axis 1 speed change FB error No. storing
D4518	Axis 1 advanced 2 FB positioning No. storage
D4519	Axis 1 advanced 2 FB error No. storage
D4528	Axis 2 advanced 2 FB positioning No. storage
D4529	Axis 2 advanced 2 FB error No. storage
D4538	Axis 3 advanced 2 FB positioning No. storage
D4539	Axis 3 advanced 2 FB error No. storage
D5050 D5051	Acceleration rate over synchronous section calculated value (change value)
D5062 D5063	Sheet length 50% calculated value (D6052/2)
D5064 D5065 D5066 D5067	Sheet synchronous width 50% (D6054/2)

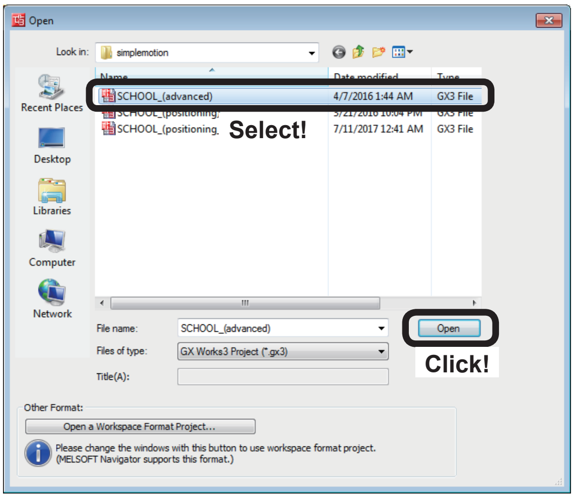
D6052 D6053	[GOT setting] Automatic Cam generation Sheet length
D6054 D6055	[GOT setting] Automatic Cam generation Sheet synchronous width
D6060 D6061 D6062 D6063	Length per cycle initial calculated value
D7000	Axis 1 motor rotation speed waveform data (Start point)
D7001 to D7298	Axis 1 motor rotation speed waveform data (Middle)
D7299	Axis 1 motor rotation speed waveform data (End point)
D7500	Axis 2 motor rotation speed waveform data (Start point)
D7501 to D7798	Axis 2 motor rotation speed waveform data (Middle)
D7799	Axis 2 motor rotation speed waveform data (End point)
D7950 D7951 D7952 D7953	For Axis 2 motor rotation speed waveform calculation
D8000	Axis 3 motor rotation speed waveform data (Start point)
D8001 to D8298	Axis 3 motor rotation speed waveform data (Middle)
D8299	Axis 3 motor rotation speed waveform data (End point)
D8450 D8451 D8452 D8453	For Axis 3 motor rotation speed waveform calculation
D8480	For trend display

7.4 Opening the Project for RD77MS

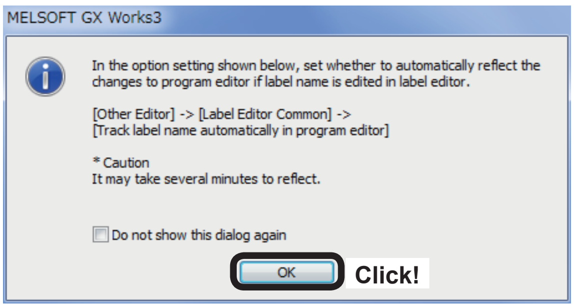
Open the project data for practice.



(1) Click [Project] → [Open] on the GX Works3 menu.



(2) A dialog box prompting the user to open a project appears. Select the "SCHOOL_(advanced)", and then click the Open button.



(3) The message shown on the left appears, press the OK button.

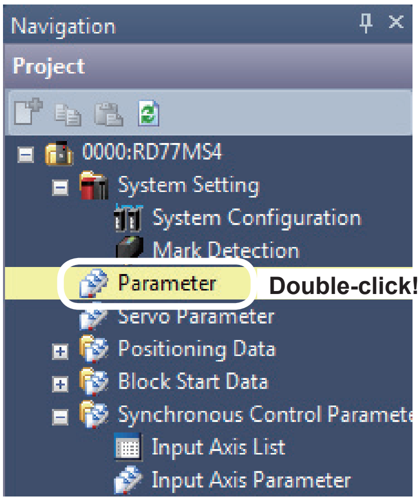
For the procedure for creating new project data, refer to Chapter 5.

Refer to Section 7.6 and 7.9 on program.

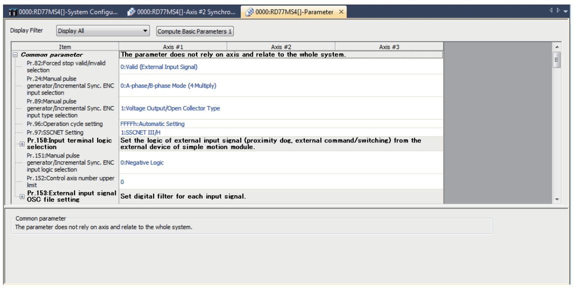
7.5 Simple Motion Module Setting

Set the parameters when performing practical work (traveling cutter and rotary cutter) with the Simple Motion Module setting tool.

7.5.1 Parameters



(1) Set parameters of the RD77MS4.
In the [Navigation window], select [0000:RD77MS4], and double-click [Parameter].



(2) The RD77MS4 Parameter Setting screen appears.

(3) Specify Common parameters as shown below.

Item	Axis #1	Axis #2	Axis #3
Common parameter	**The parameter does not rely on axis and relate to the whole system.**		
Pr.82:Forced stop valid/invalid selection	1:Invalid		
Pr.24:Manual pulse generator/Incremental Sync. ENC input selection	0:A-phase/B-phase Mode (4 Multiply)		
Pr.89:Manual pulse generator/Incremental Sync. ENC input type selection	1:Voltage Output/Open Collector Type		
Pr.96:Operation cycle setting	FFFFh:Automatic Setting		
Pr.97:SSCNET Setting	1:SSCNET III/H		
Pr.150:Input terminal logic selection	**Set the logic of external input signal (proximity dog, external command/switching) from the external device of simple motion module.**		
Pr.151:Manual pulse generator/Incremental Sync. ENC input logic selection	0:Negative Logic		
Pr.152:Control axis number upper limit	0		
Pr.153:External input signal OSC file setting	**Set digital filter for each input signal.**		

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(4) Specify Basic parameters 1 as shown below.

Item	Axis #1	Axis #2	Axis #3
Basic parameters 1	Set according to the machine and applicable motor when system is started up (It will be valid according to PLC REA...		
Pr.1:Unit setting	0:mm	2:degree	0:mm
Pr.2:No. of pulses per rotation	4194304 pulse	4194304 pulse	4194304 pulse
Pr.3:Movement amount per rotation	110000.0 µm	360.00000 degree	8000.0 µm
Pr.4:Unit magnification	1:x1 Times	1:x1 Times	1:x1 Times
Pr.7:Bias speed at start	0.00 mm/min	0.000 degree/min	0.00 mm/min

(5) Specify Basic parameters 2 as shown below.

Item	Axis #1	Axis #2	Axis #3
Basic parameters 2	Set according to the machine and applicable motor when system is started up		
Pr.8:Speed limit value	55000.00 mm/min	1080000.000 degree/min	24000.00 mm/min
Pr.9:Acceleration time 0	100 ms	100 ms	100 ms
Pr.10:Deceleration time 0	150 ms	100 ms	100 ms

(6) Specify Detailed parameters 1 as shown below.

Item	Axis #1	Axis #2	Axis #3
Detailed parameters 1	Set according to the system configuration when the system is started up.(It will be valid according to PLC READY s...		
Pr.11:Backlash compensation amount	0.0 µm	0.00000 degree	0.0 µm
Pr.12:Software stroke limit upper limit value	0.0 µm	0.00000 degree	149000.0 µm
Pr.13:Software stroke limit lower limit value	0.0 µm	0.00000 degree	-1000.0 µm
Pr.14:Software stroke limit selection	0:Set Software Stroke Limit to Feed Current Value	0:Set Software Stroke Limit to Feed Current Value	0:Set Software Stroke Limit to Feed Current Value
Pr.15:Software stroke limit valid/invalid setting	0:Valid	0:Valid	0:Valid
Pr.16:Command in-position width	10.0 µm	0.00100 degree	10.0 µm
Pr.17:Torque limit setting value	300.0 %	300.0 %	300.0 %
Pr.18:M-code ON signal output timing	0:WITH Mode	0:WITH Mode	0:WITH Mode
Pr.19:Speed switching mode	0:Standard Speed Switching Mode	0:Standard Speed Switching Mode	0:Standard Speed Switching Mode
Pr.20:Interpolation speed designation method	0:Vector Speed	0:Vector Speed	0:Vector Speed
Pr.21:Feed current value during speed control	1:Update of Feed Current Value	0:Not Update of Feed Current Value	0:Not Update of Feed Current Value
Pr.22:Input signal logic selection : Lower limit	0:Negative Logic	0:Negative Logic	0:Negative Logic
Pr.22:Input signal logic selection : Upper limit	0:Negative Logic	0:Negative Logic	0:Negative Logic
Pr.22:Input signal logic selection : Stop signal	0:Negative Logic	0:Negative Logic	0:Negative Logic
Pr.22:Input signal logic selection : Proximity dog signal	0:Negative Logic	0:Negative Logic	1:Positive Logic
Pr.81:Speed-position function selection	0:Speed-position Switching Control (INC Mode)	0:Speed-position Switching Control (INC Mode)	0:Speed-position Switching Control (INC Mode)
Pr.116:FLS signal selection : Input type	15:Invalid	15:Invalid	1:Servo Amplifier
Pr.116:FLS signal selection : Input terminal	00h:No Setting	00h:No Setting	00h:No Setting
Pr.117:RLS signal selection : Input type	15:Invalid	15:Invalid	1:Servo Amplifier
Pr.117:RLS signal selection : Input terminal	00h:No Setting	00h:No Setting	00h:No Setting
Pr.118:DOG signal selection : Input type	15:Invalid	1:Servo Amplifier	1:Servo Amplifier
Pr.118:DOG signal selection : Input terminal	00h:No Setting	00h:No Setting	00h:No Setting
Pr.119:STOP signal selection : Input type	15:Invalid	15:Invalid	15:Invalid
Pr.119:STOP signal selection : Input terminal	00h:No Setting	00h:No Setting	00h:No Setting

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(7) Specify Detailed parameters 2 as shown below.

Item	Axis #1	Axis #2	Axis #3
Detailed parameters 2	Set according to the system configuration when the system is started up(Set as required).		
Pr.25:Acceleration time 1	50 ms	1000 ms	1000 ms
Pr.26:Acceleration time 2	100 ms	1000 ms	1000 ms
Pr.27:Acceleration time 3	1000 ms	1000 ms	1000 ms
Pr.28:Deceleration time 1	2000 ms	1000 ms	1000 ms
Pr.29:Deceleration time 2	150 ms	1000 ms	1000 ms
Pr.30:Deceleration time 3	1000 ms	1000 ms	1000 ms
Pr.31:JOG speed limit value	11000.00 mm/min	36000.000 degree/min	8000.00 mm/min
Pr.32:JOG operation acceleration time selection	2:100	0:100	0:100
Pr.33:JOG operation deceleration time selection	2:150	0:100	0:100
Pr.34:Acceleration/deceleration process selection	0:Trapezoidal Acceleration/Deceleration Process	0:Trapezoidal Acceleration/Deceleration Process	0:Trapezoidal Acceleration/Deceleration Process
Pr.35:S-curve ratio	50 %	50 %	50 %
Pr.36:Rapid stop deceleration time	50 ms	50 ms	50 ms
Pr.37:Stop group 1 rapid stop selection	0:Normal Deceleration Stop	0:Normal Deceleration Stop	0:Normal Deceleration Stop
Pr.38:Stop group 2 rapid stop selection	0:Normal Deceleration Stop	0:Normal Deceleration Stop	0:Normal Deceleration Stop
Pr.39:Stop group 3 rapid stop selection	0:Normal Deceleration Stop	0:Normal Deceleration Stop	0:Normal Deceleration Stop
Pr.40:Positioning complete signal output time	300 ms	300 ms	300 ms
Pr.41:Allowable circular interpolation error width	10.0 μm	0.00100 degree	10.0 μm
Pr.42:External command function selection	0:External Positioning Start	0:External Positioning Start	0:External Positioning Start
Pr.83:Speed control 10x multiplier setting for degree axis	0:Invalid	0:Invalid	0:Invalid
Pr.84:Restart permissible value range when servo OFF to ON	0 pulse	0 pulse	0 pulse
Pr.90:Operation setting for SPD-TRQ Cont. mode : Torque initial value selection	0:Command Torque	0:Command Torque	0:Command Torque
Pr.90:Operation setting for SPD-TRQ Cont. mode : Speed initial value selection	0:Command Speed	0:Command Speed	0:Command Speed
Pr.90:Operation setting for SPD-TRQ Cont. mode : Condition selection at mode switching	0:Switching Conditions Valid at Mode Switching	0:Switching Conditions Valid at Mode Switching	0:Switching Conditions Valid at Mode Switching
Pr.127:Speed limit value input selection at control mode switch...	0:Input Enable	0:Input Enable	0:Input Enable
Pr.95:External command signal selection	0:Not Used	0:Not Used	0:Not Used
Pr.122:Manual pulse generator speed limit mode	0:Do Not Execute Speed Limit	0:Do Not Execute Speed Limit	0:Do Not Execute Speed Limit
Pr.123:Manual pulse generator speed limit value	200.00 mm/min	20.000 degree/min	200.00 mm/min

(8) Specify Home position return basic parameters as shown below.

Item	Axis #1	Axis #2	Axis #3
HPR basic parameters	Set the values required for carrying out HPR control (Valid when the PLC READY signals ON).		
Pr.43:HPR method	6:Data Set Method	0:Proximity Dog Method	0:Proximity Dog Method
Pr.44:HPR direction	1:Reverse Direction (Address Decrease Direction)	1:Reverse Direction (Address Decrease Direction)	1:Reverse Direction (Address Decrease Direction)
Pr.45:HP address	0.0 μm	180.00000 degree	0.0 μm
Pr.46:HPR speed	0.01 mm/min	18000.000 degree/min	600.00 mm/min
Pr.47:Creep speed	0.01 mm/min	3600.000 degree/min	250.00 mm/min
Pr.48:HPR retry	0:Do Not Retry HPR with Limit Switch	1:Retry HPR with Limit Switch	1:Retry HPR with Limit Switch

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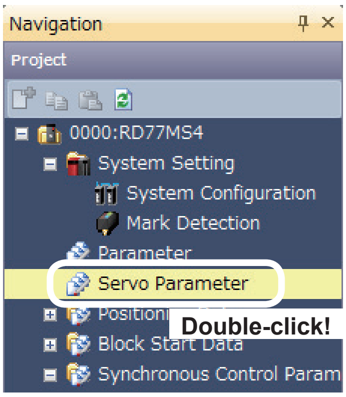
(9) Specify Home position return detailed parameters as shown below.

Item	Axis #1	Axis #2	Axis #3
HPR detailed parameters	Set the values required for carrying out HPR control (Valid when the PLC READY signals ON).		
Pr.50:Setting for the movement amount after proximity dog ON	0.0 μm	0.00000 degree	0.0 μm
Pr.51:HPR acceleration time selection	0:100	0:100	0:100
Pr.52:HPR deceleration time selection	0:150	0:100	0:100
Pr.53:HP shift amount	0.0 μm	-0.50000 degree	0.0 μm
Pr.54:HPR torque limit value	300.0 %	300.0 %	300.0 %
Pr.55:Operation setting for incompletion of HPR	1:Positioning Control is Executed	1:Positioning Control is Executed	1:Positioning Control is Executed
Pr.56:Speed designation during HP shift	0:HPR Speed	0:HPR Speed	0:HPR Speed
Pr.57:Dwell time during HPR retry	0 ms	0 ms	0 ms
Pr.86:Pulse conversion unit : HPR request setting	0:Turn HPR Request ON at Servo OFF	0:Turn HPR Request ON at Servo OFF	0:Turn HPR Request ON at Servo OFF
Pr.87:Pulse conversion unit : Waiting time after clear signal output	0 ms	0 ms	0 ms

(10) Specify Extended parameters as shown below.

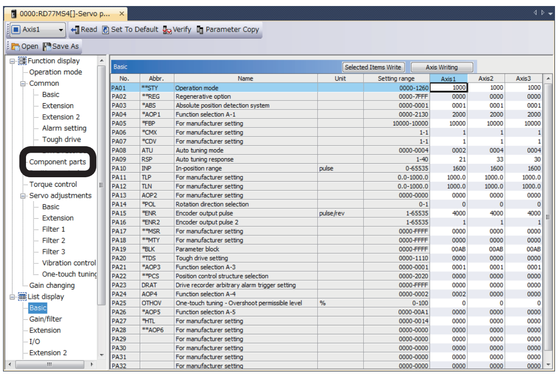
Item	Axis #1	Axis #2	Axis #3
Expansion parameters	Set according to the system configuration when the system is started up. (This parameter becomes valid after powe...		
Pr.91:Optional data monitor : Data type setting 1	7:Servo Motor Speed	0:No Setting	0:No Setting
Pr.92:Optional data monitor : Data type setting 2	0:No Setting	0:No Setting	0:No Setting
Pr.93:Optional data monitor : Data type setting 3	0:No Setting	0:No Setting	0:No Setting
Pr.94:Optional data monitor : Data type setting 4	0:No Setting	0:No Setting	0:No Setting

7.5.2 Servo parameters



(1) Set parameters of the servo amplifier.

In the [Navigation window], select [0000:RD77MS4], and double-click [Servo Parameter].



(2) A Servo Parameter Setting window appears. Click [Function display] → [Component parts] in the Parameter Setting screen display selection tree, and then specify the following settings.

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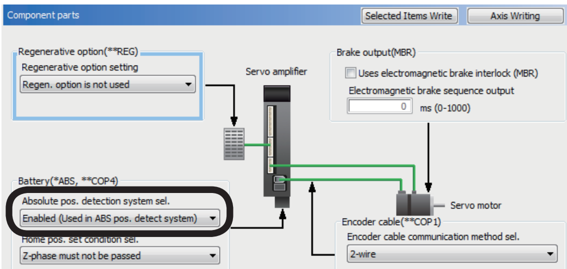
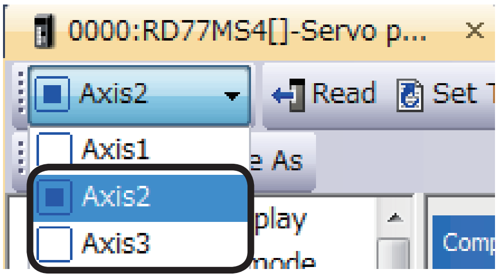
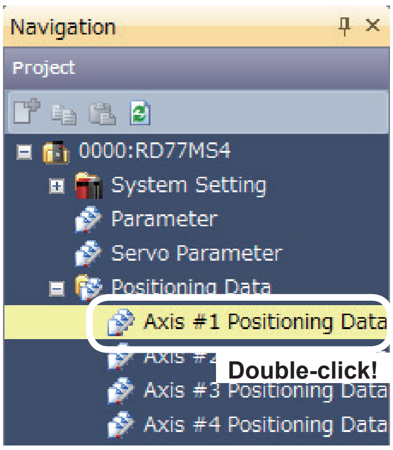


(3) Absolute pos. detect system selection
: Enabled (Used in ABS pos. detect system)



(4) Switch to Axis 2 and 3, and set the parameter settings in a manner similar to Axis 1.

7.5.3 Positioning data



(1) Set the positioning data.
Select [0000:RD77MS4] → [Positioning Data], and double-click [Axis #1 Positioning Data].

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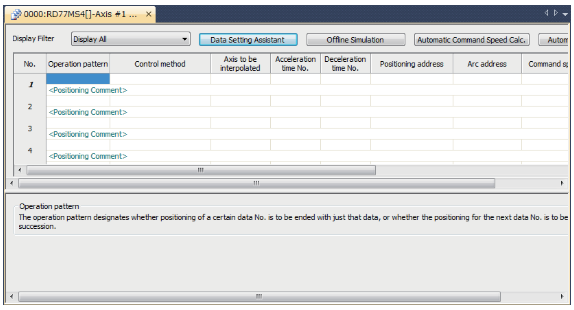


(2) Axis 1 Positioning Data Setting screen appears. Specify positioning parameters as shown below.

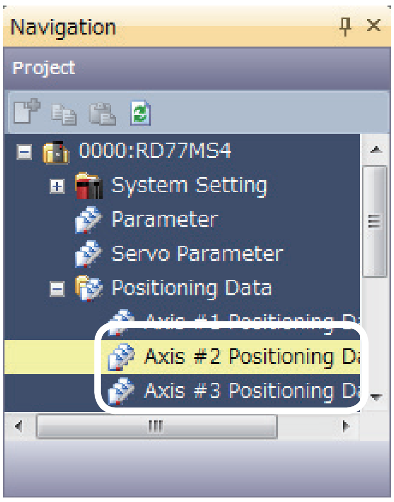
Axis 1 Positioning data

No.	Operation pattern	Control method	Axis to be interpolated	Acceleration time No.	Deceleration time No.	Positioning address	Arc address
5	0:END	05h:RVS V1	-	0:100	0:150	0.0 µm	0.0 µm
	<Positioning Comment>Ad.1,2 Conveyor start						

No.	Command speed	Dwell time	M-code	M-code ON signal output timing	ABS direction in degrees	Interpolation speed designation method
5	3000.00 mm/min	0 ms	0	0:Use the setting value of M-code ON signal output timing	0:Use the setting value of ABS direction at degree	0:Use the setting value of Interpolation speed designation method

Remarks

The positioning data can be edited by selecting the range by dragging the mouse and using the [Cut], [Copy] and [Paste] functions in the [Edit] mode.



(3) Switch to the Positioning Data of Axis 2 and 3, and set the parameter settings in a manner similar to Axis 1.

Axis 2 Positioning data

No.	Operation pattern	Control method	Axis to be interpolated	Acceleration time No.	Deceleration time No.	Positioning address	Arc address
1	0:END	01h:ABS Linear 1	-	0:100	0:100	180.00000 degree	0.00000 degree
	<Positioning Comment>Ad.1 Standby point traveling						
20	0:END	01h:ABS Linear 1	-	0:100	0:100	0.00000 degree	0.00000 degree
	<Positioning Comment>Ad.2 Standby point traveling						

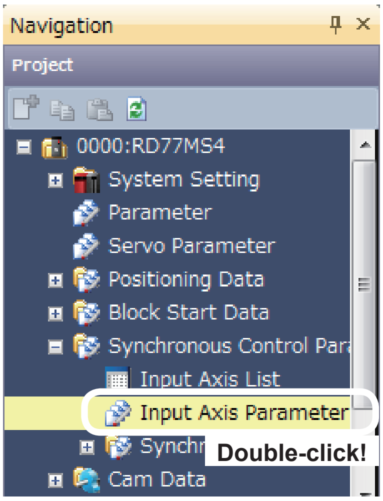
No.	Command speed	Dwell time	M-code	M-code ON signal output timing	ABS direction in degrees	Interpolation speed designation method
1	18000.000 degree/min	0 ms	0	0:Use the setting value of M-code ON signal output timing	0:Use the setting value of ABS direction at degree	0:Use the setting value of Interpolation speed designation method
20	18000.000 degree/min	0 ms	0	0:Use the setting value of M-code ON signal output timing	0:Use the setting value of ABS direction at degree	0:Use the setting value of Interpolation speed designation method

Axis 3 Positioning data

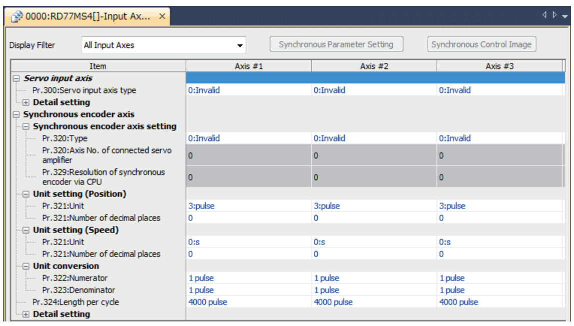
No.	Operation pattern	Control method	Axis to be interpolated	Acceleration time No.	Deceleration time No.	Positioning address	Arc address
1	0:END	01h:ABS Linear 1	-	0:100	0:100	0.0 μm	0.0 μm
	<Positioning Comment>Ad.1 Standby point traveling						
10	0:END	01h:ABS Linear 1	-	0:100	0:100	0.0 μm	0.0 μm
	<Positioning Comment>Ad.1 Return operation						
20	0:END	01h:ABS Linear 1	-	0:100	0:100	50000.0 μm	0.0 μm
	<Positioning Comment>Ad.2 Standby point traveling						

No.	Command speed	Dwell time	M-code	M-code ON signal output timing	ABS direction in degrees	Interpolation speed designation method
1	400.00 mm/min	0 ms	0	0:Use the setting value of M-code ON signal output timing	0:Use the setting value of ABS direction at degree	0:Use the setting value of Interpolation speed designation method
10	16000.00 mm/min	0 ms	0	0:Use the setting value of M-code ON signal output timing	0:Use the setting value of ABS direction at degree	0:Use the setting value of Interpolation speed designation method
20	24000.00 mm/min	0 ms	0	0:Use the setting value of M-code ON signal output timing	0:Use the setting value of ABS direction at degree	0:Use the setting value of Interpolation speed designation method

7.5.4 Synchronous control parameters

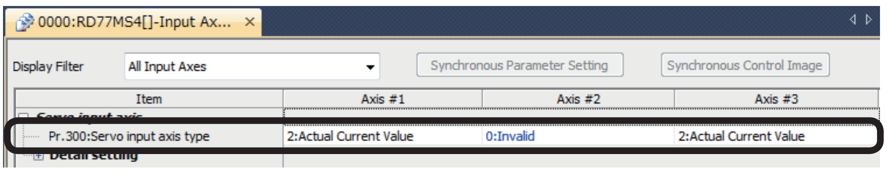


(1) Set the input axis parameters in the synchronous control parameters.
In the [Navigation window] of the Simple Motion setting tool, select [0000:RD77MS4] → [Synchronous Control Parameter], and double-click [Input Axis Parameter].



(2) The RD77MS4 Input Axis Parameter Setting screen appears.

(3) Specify servo input axis as shown below.



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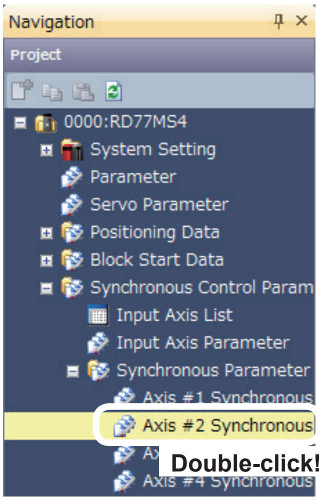
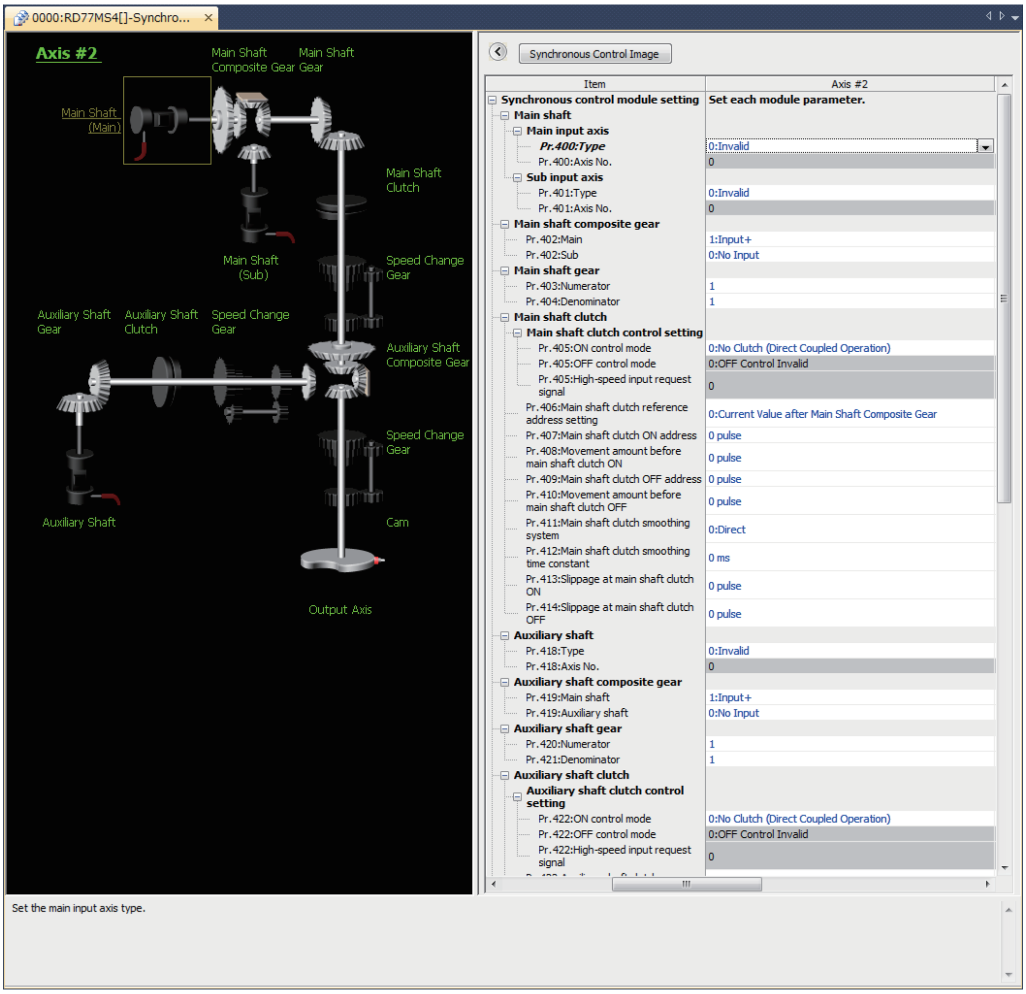


(4) Set synchronous parameters of the Axis 2.

In the [Navigation window] of the Simple Motion setting tool, select [0000:RD77MS4] → [Synchronous Control Parameter] → [Synchronous parameter], and double-click [Axis 2 synchronous parameter].

(5) The Axis 2 Synchronous Parameter Setting screen appears.



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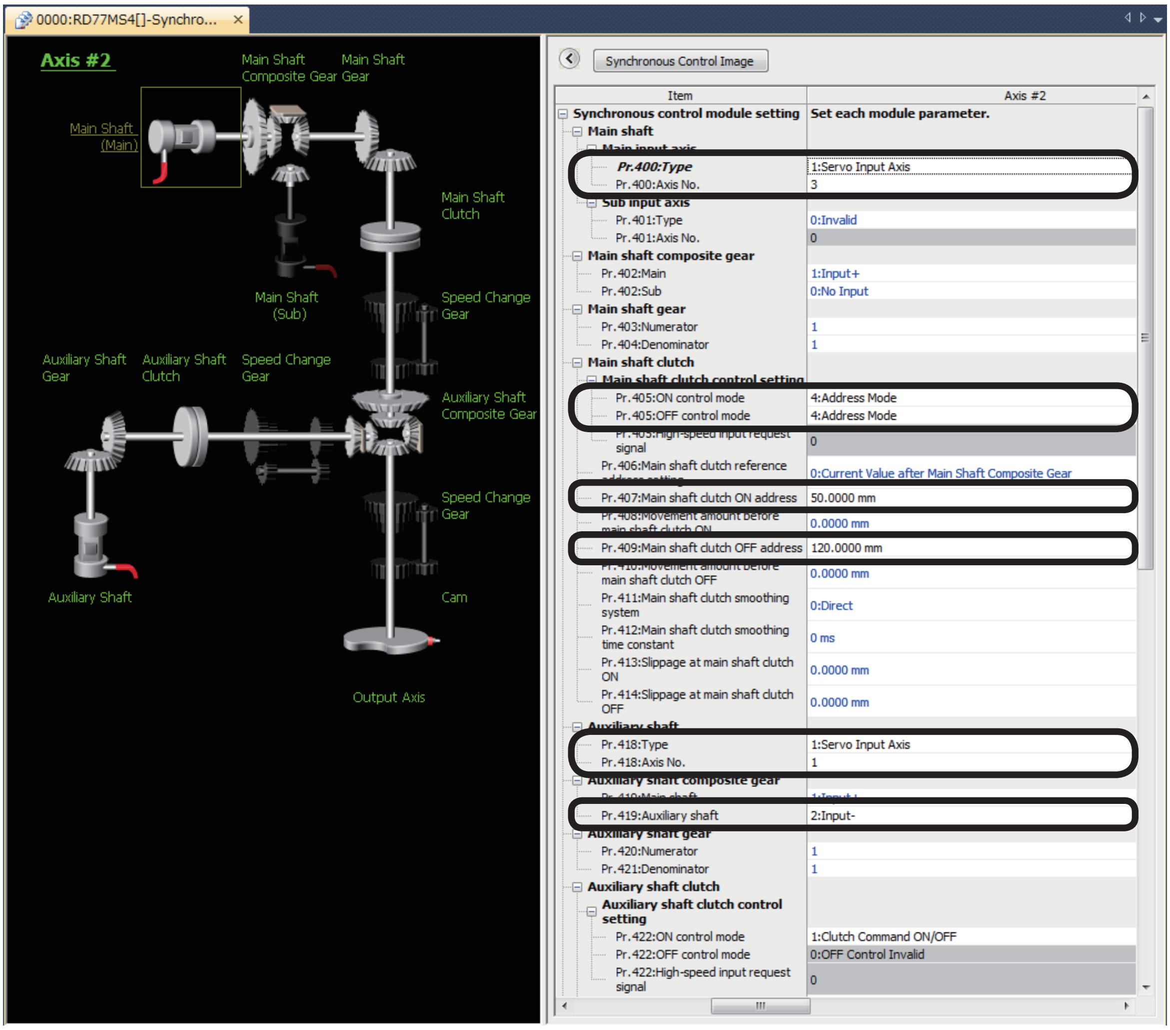
(6) Set the main shaft, the main shaft clutch, the auxiliary shaft and the auxiliary shaft composite gear as follows.



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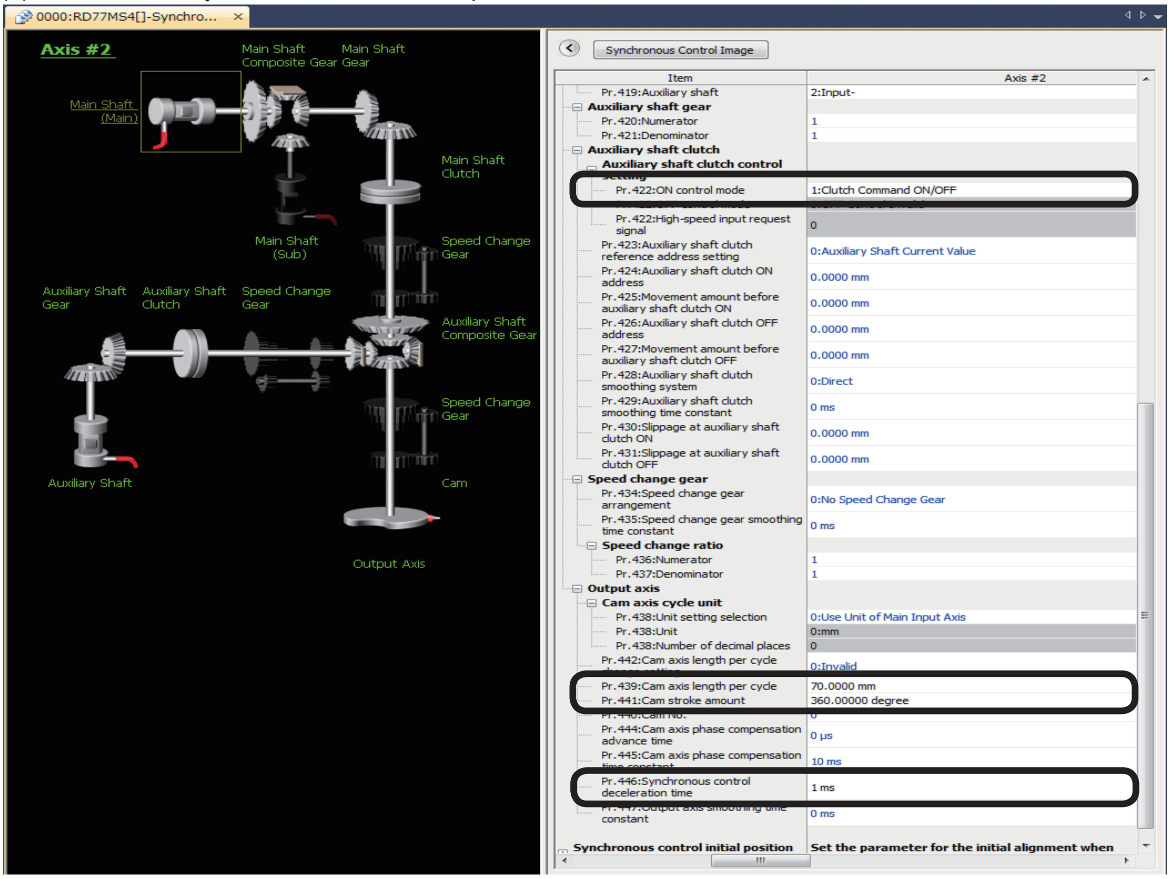
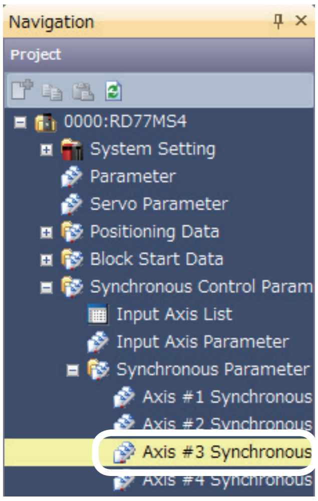
(7) Set the auxiliary shaft clutch and the output axis as follows.





(8) Next, switch to the Synchronous control parameter of Axis 3, and set the parameter settings in a manner similar to Axis 2.

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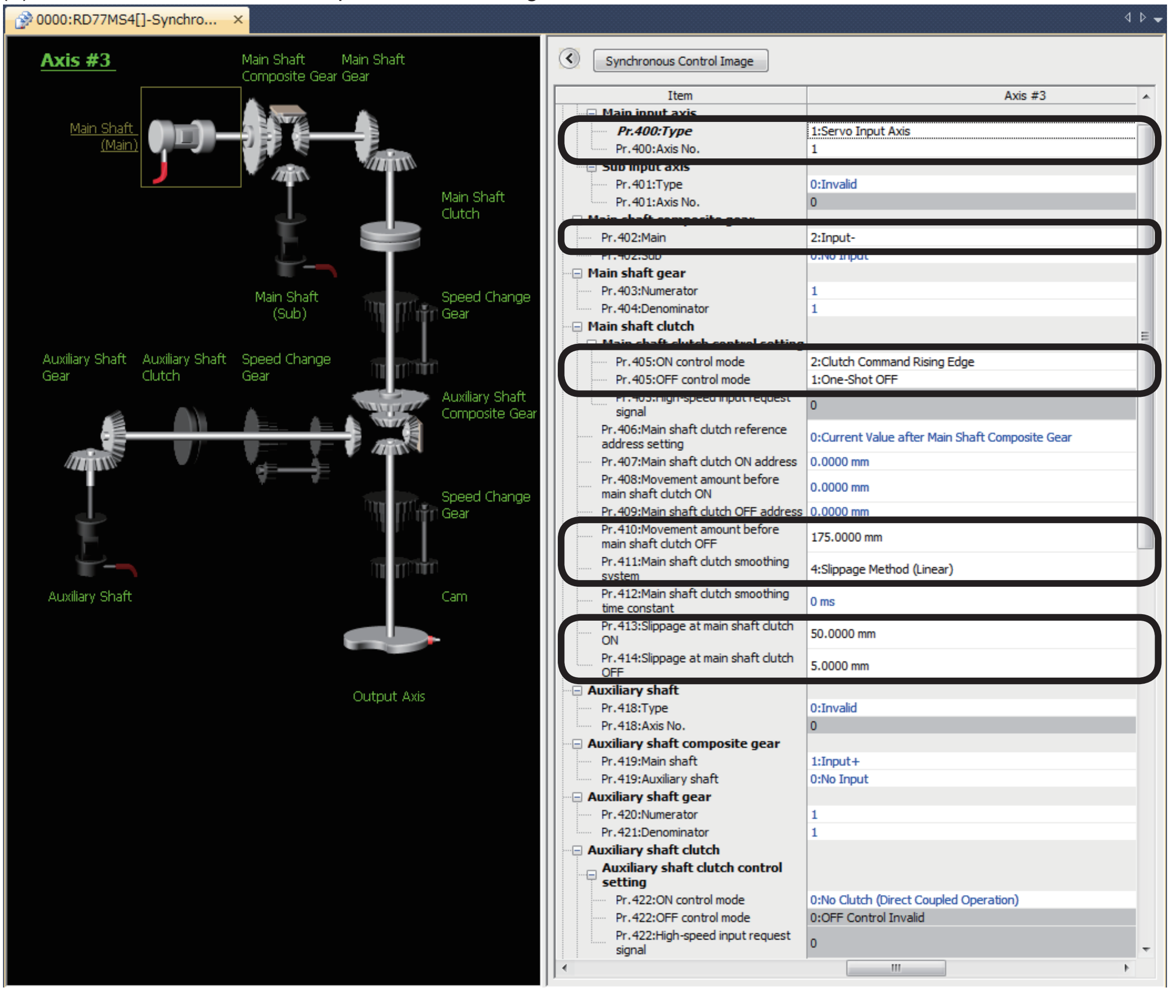
(9) Set the main shaft, the composite main shaft gear and the main shaft clutch as follows.



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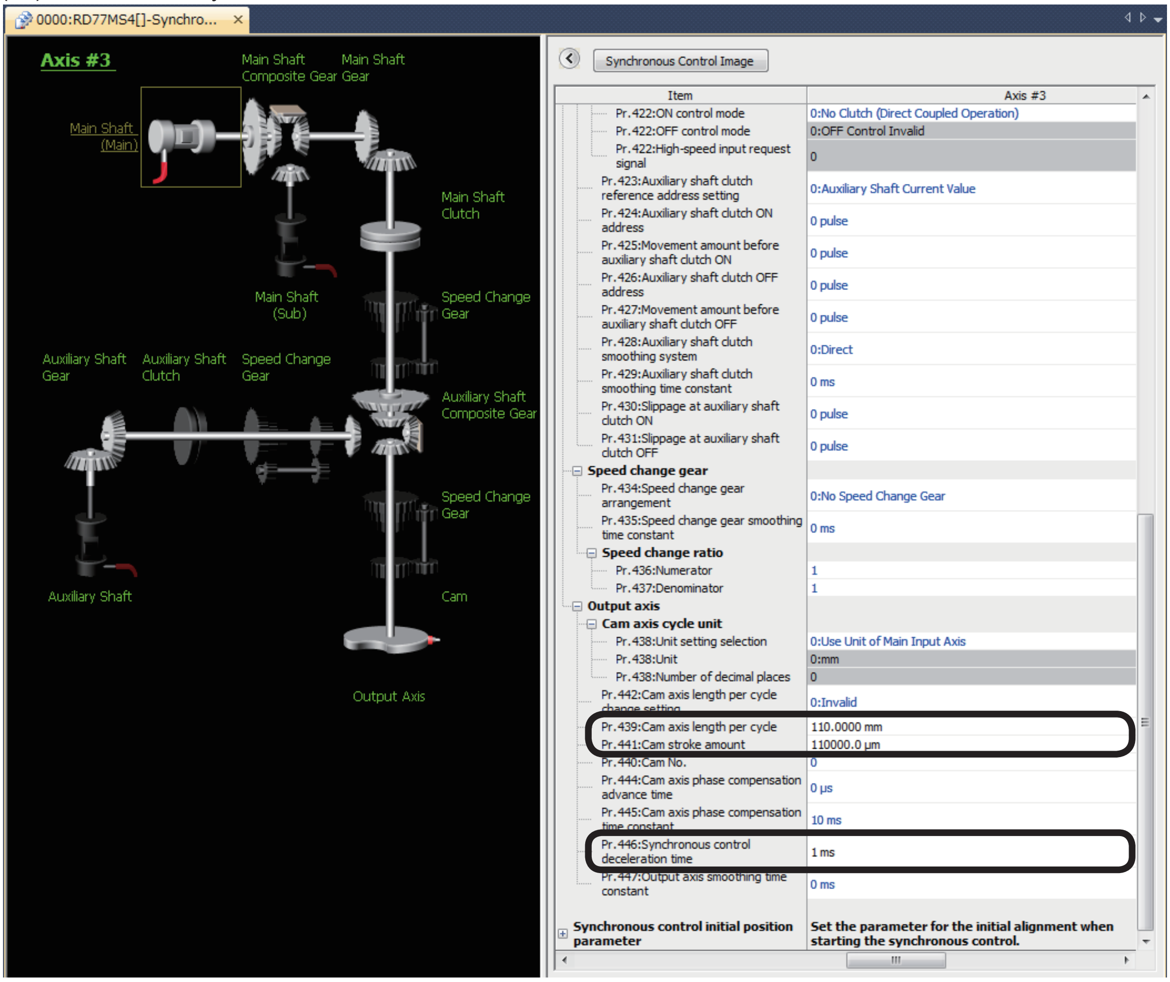
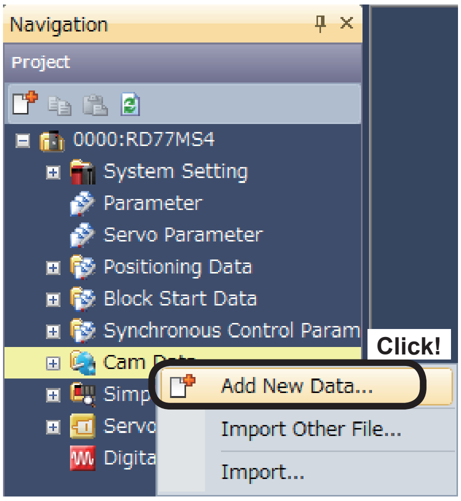
(10) Set the auxiliary shaft clutch as follows.

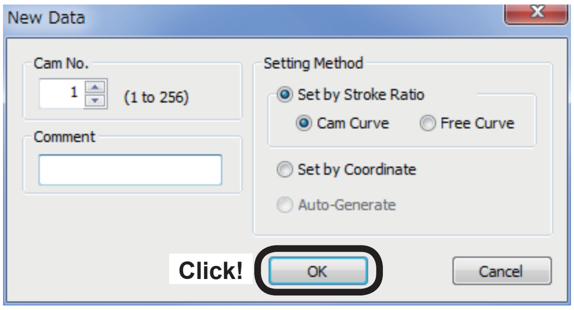


7.5.5 Cam data



(1) Create cam data for Axis 2.

In the [Navigation window] of the Simple Motion setting tool, right-click [Cam Data], and click [Add New Data].



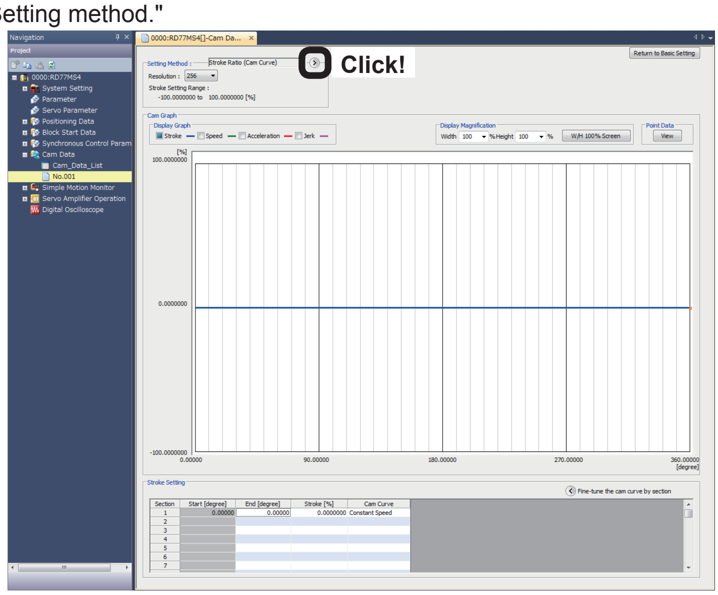
(2) Specify the following settings at the New Data dialog box that appears.

- Cam No.: 1
- Setting Method: Set by Stroke Ratio, and Cam Curve

Click the OK button after setting.

(3) Cam data is created. No. 0001 will be added to the navigation window, and the cam data No. 0001 screen will appear.

Click on ">" at "Setting method."



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(4) Display "Length per cycle setting" and "Stroke amount setting". Set them as shown on the right.

Len. per Cycle Setting Unit: mm Len. per Cycle: 70000.0 [μm]

Stroke Amount Setting Unit: degree Stroke Amount: 360.00000 [degree]

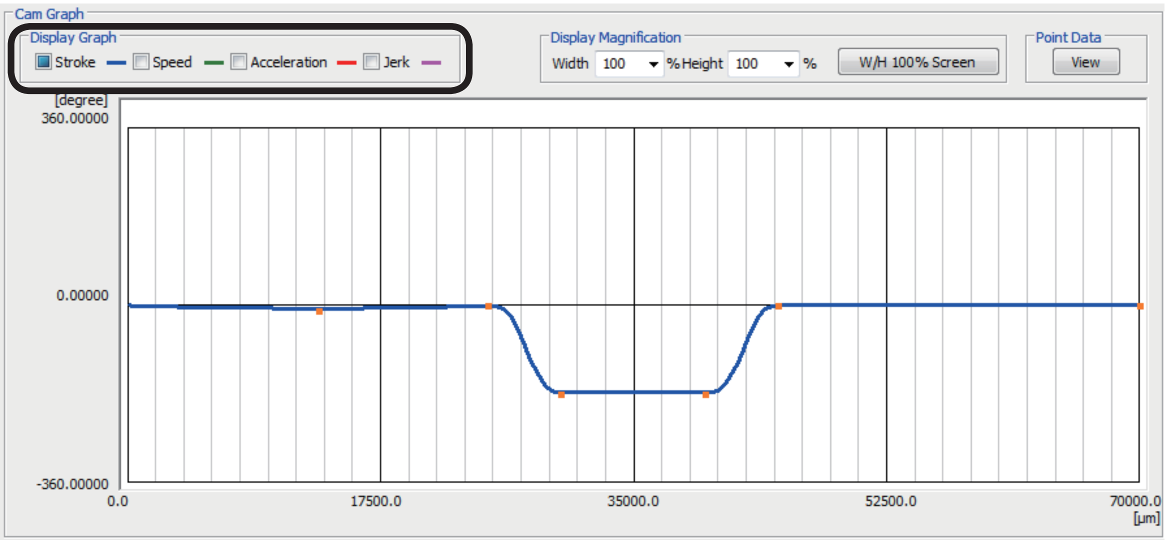
(5) Specify the setting screen stroke settings as follows.

Stroke Setting

Setting!

Section	Start [μm]	End [μm]	Stroke [degree]	Cam Curve
1	0.0	25000.0	0.00000	Constant Speed
2	25000.0	30000.0	-180.00000	Cycloid
3	30000.0	40000.0	-180.00000	Constant Speed
4	40000.0	45000.0	0.00000	Cycloid
5	45000.0	0.0	0.00000	Constant Speed

(6) The set stroke graph will be displayed in the cam graph field. Change the "Display Graph" check box selections to change the graph display in order to view the Stroke, Speed, Acceleration, and Jerk relative to the movement position in a chart.



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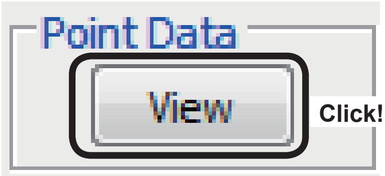
(7) To view the stroke ratio, speed, acceleration, and jerk relative to the movement position in numerical values, click the "Point Data" View button.



There are tables from No. 1 to 256.
Scroll to view all tables.

After checking, click the Close button.

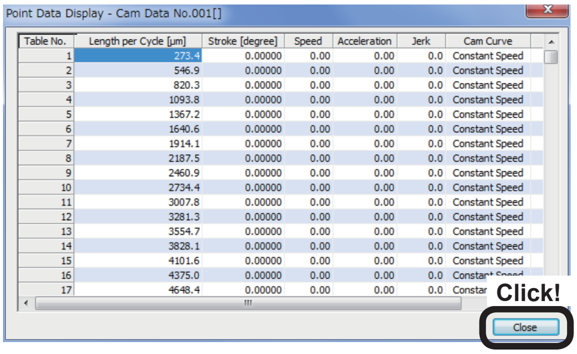
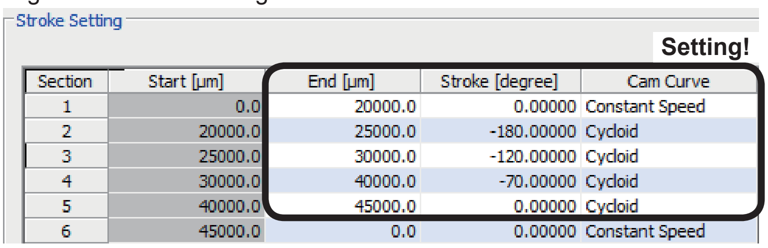


Table No.	Length per Cycle [µm]	Stroke [degree]	Speed	Acceleration	Jerk	Cam Curve
1	273.4	0.00000	0.00	0.00	0.0	Constant Speed
2	546.9	0.00000	0.00	0.00	0.0	Constant Speed
3	820.3	0.00000	0.00	0.00	0.0	Constant Speed
4	1093.8	0.00000	0.00	0.00	0.0	Constant Speed
5	1367.2	0.00000	0.00	0.00	0.0	Constant Speed
6	1640.6	0.00000	0.00	0.00	0.0	Constant Speed
7	1914.1	0.00000	0.00	0.00	0.0	Constant Speed
8	2187.5	0.00000	0.00	0.00	0.0	Constant Speed
9	2460.9	0.00000	0.00	0.00	0.0	Constant Speed
10	2734.4	0.00000	0.00	0.00	0.0	Constant Speed
11	3007.8	0.00000	0.00	0.00	0.0	Constant Speed
12	3281.3	0.00000	0.00	0.00	0.0	Constant Speed
13	3554.7	0.00000	0.00	0.00	0.0	Constant Speed
14	3828.1	0.00000	0.00	0.00	0.0	Constant Speed
15	4101.6	0.00000	0.00	0.00	0.0	Constant Speed
16	4375.0	0.00000	0.00	0.00	0.0	Constant Speed
17	4648.4	0.00000	0.00	0.00	0.0	Constan

(8) Create cam data for cam No. 0002 using the same procedure as that for cam No. 0001. Specify the setting screen stroke settings shown below.



Section	Start [µm]	End [µm]	Stroke [degree]	Cam Curve
1	0.0	20000.0	0.00000	Constant Speed
2	20000.0	25000.0	-180.00000	Cycloid
3	25000.0	30000.0	-120.00000	Cycloid
4	30000.0	40000.0	-70.00000	Cycloid
5	40000.0	45000.0	0.00000	Cycloid
6	45000.0	0.0	0.00000	Constant Speed

(9) Cam data creation is now complete.

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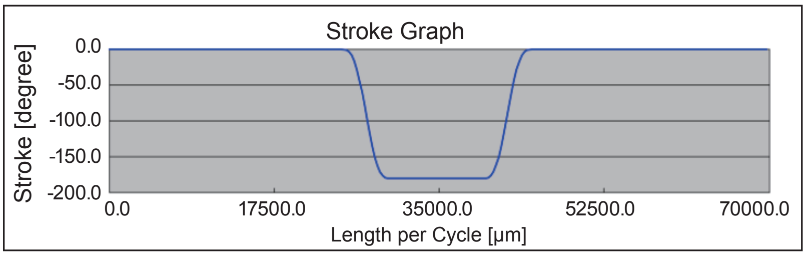
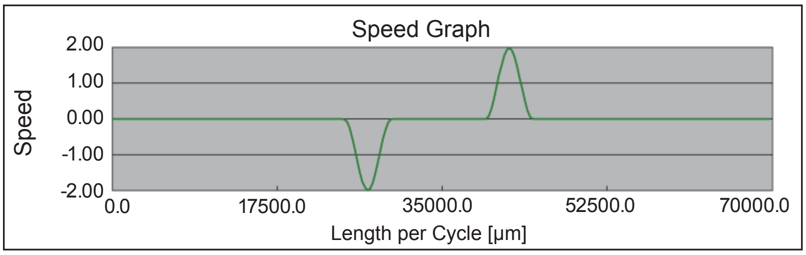
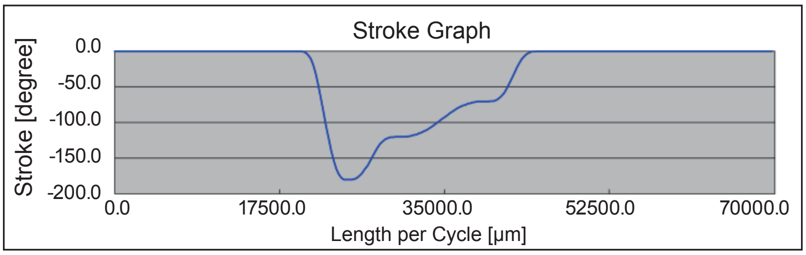
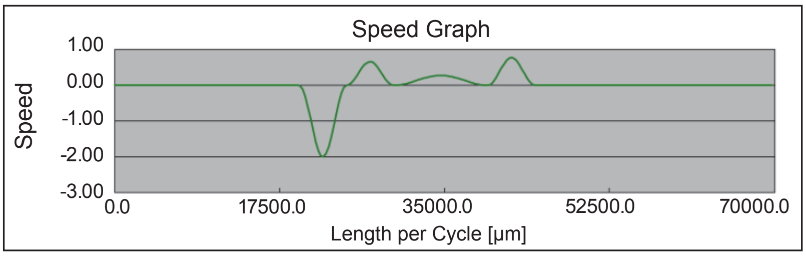
Cam No. 1





Cam No. 2

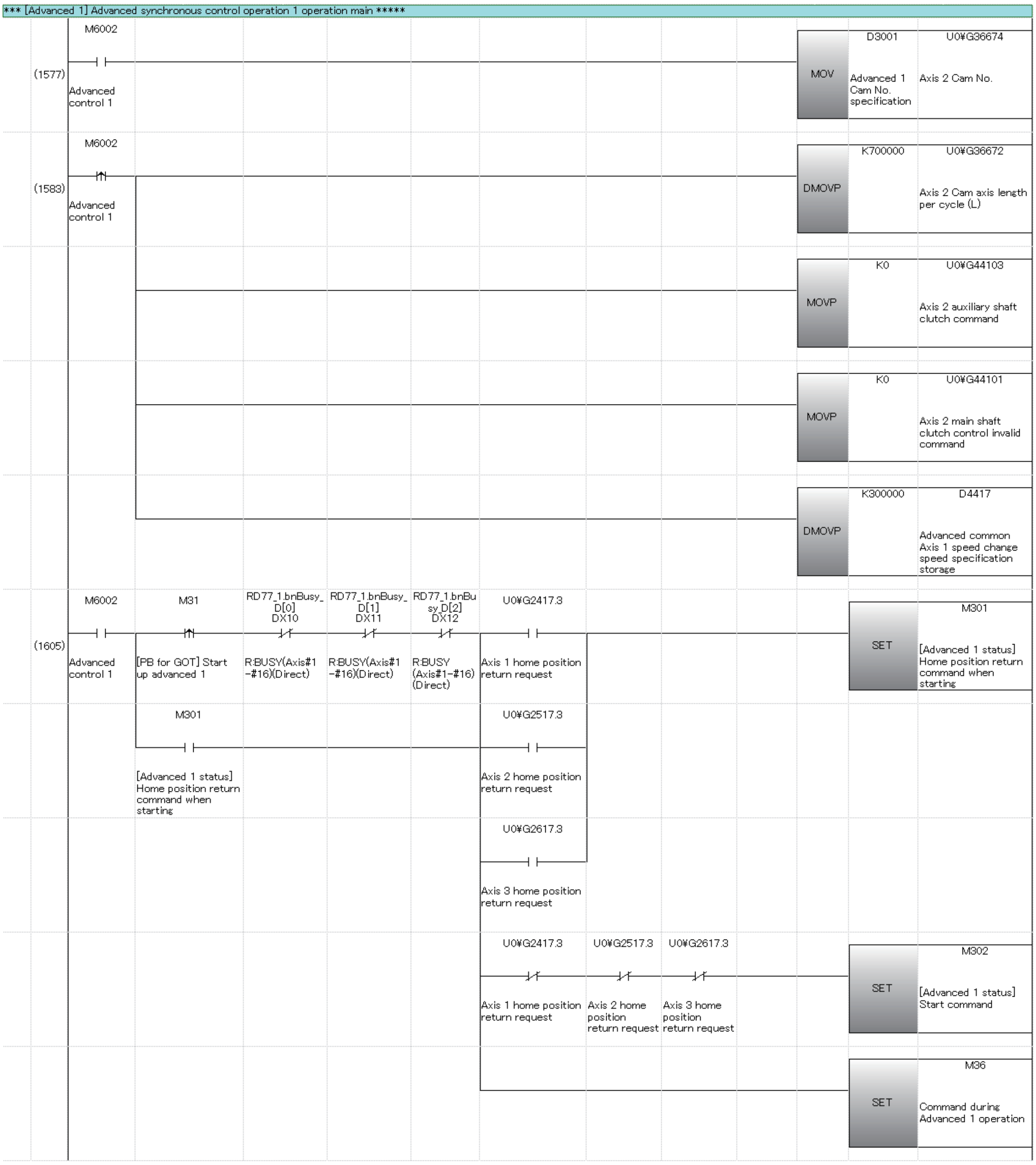


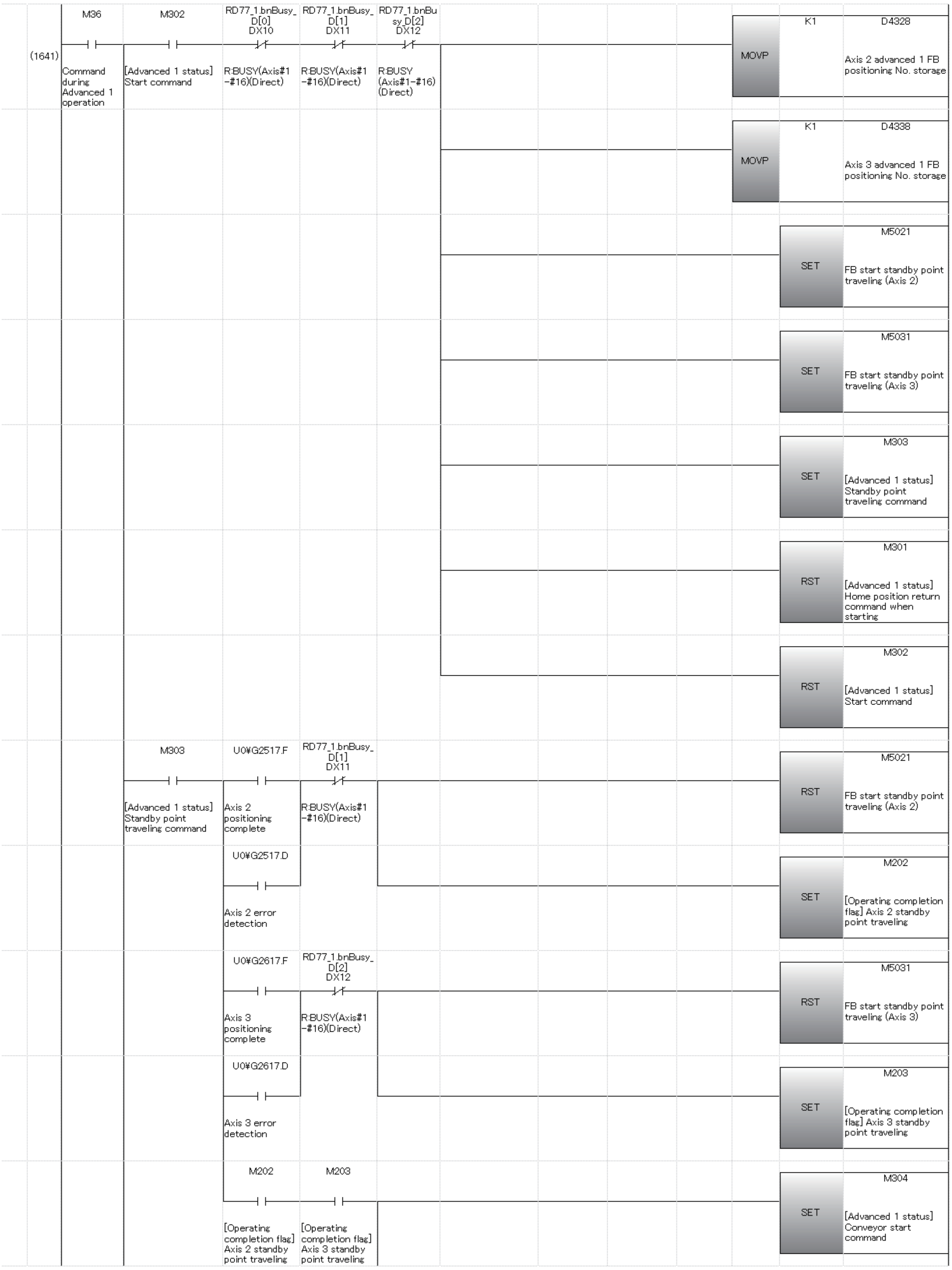


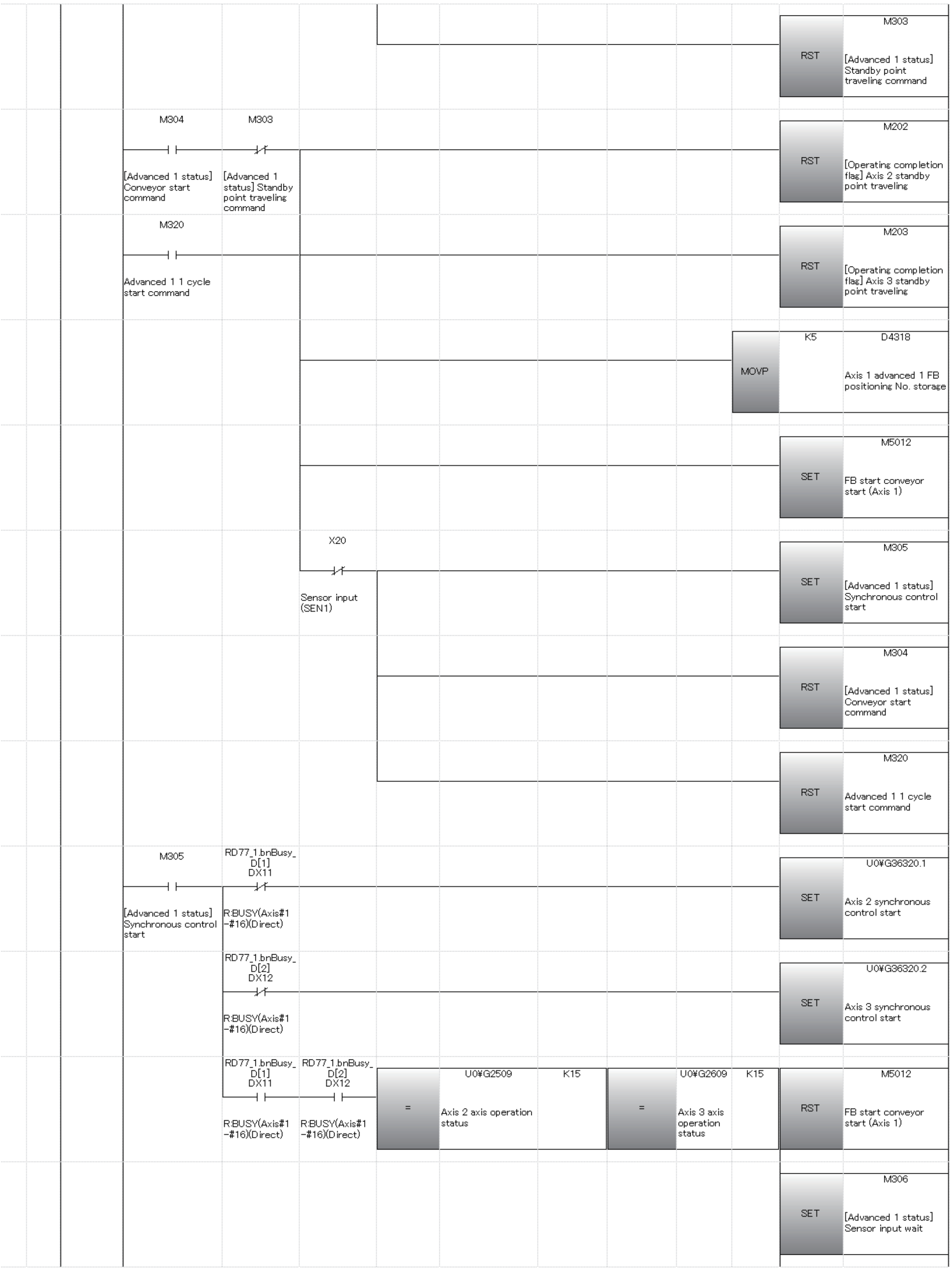
7.6 Advanced Synchronous Control Programs

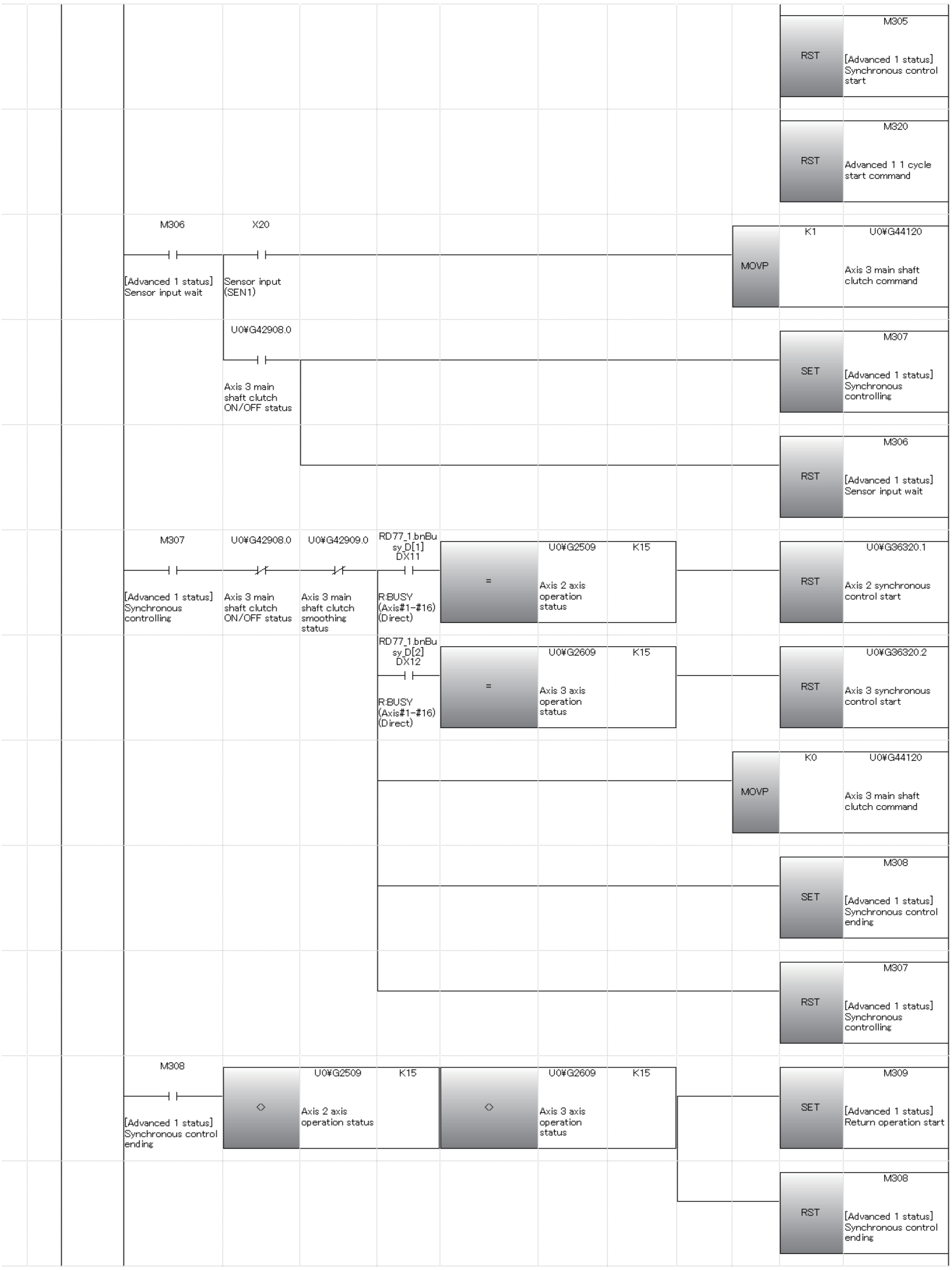
7.6.1 Advanced synchronous control 1: Travel cutter program

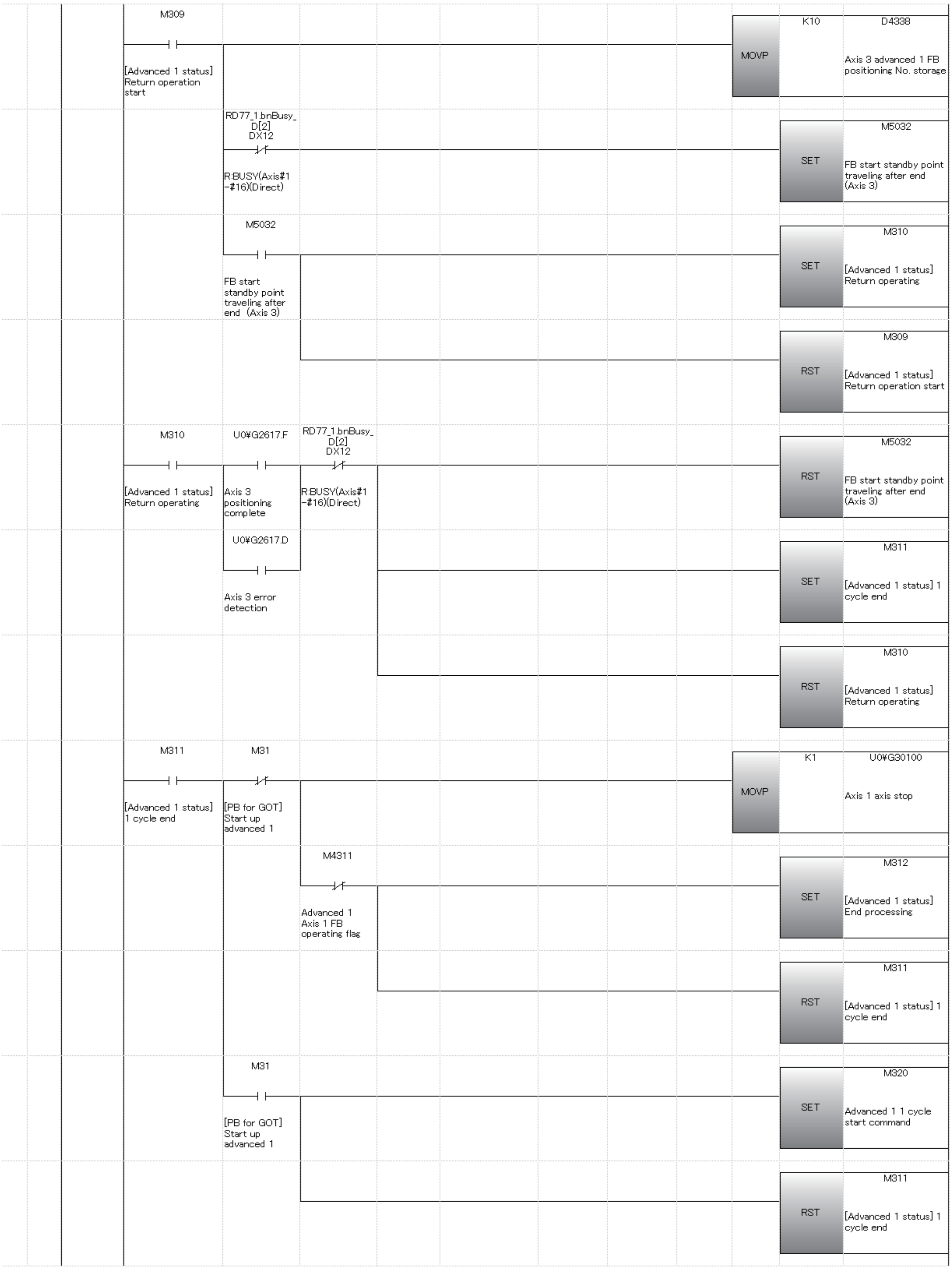
The sequence program used with advanced synchronous control 1 is shown in the following table.

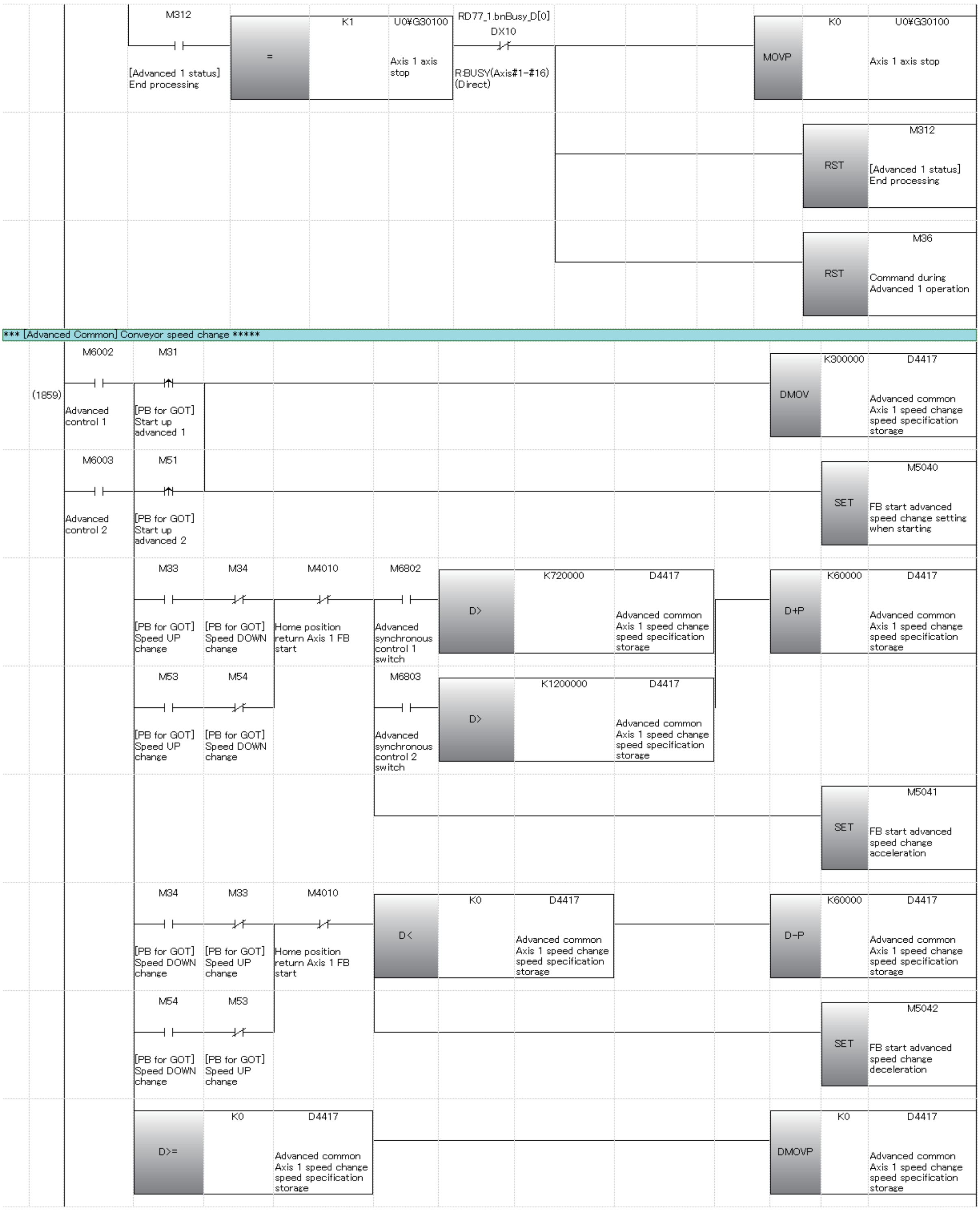


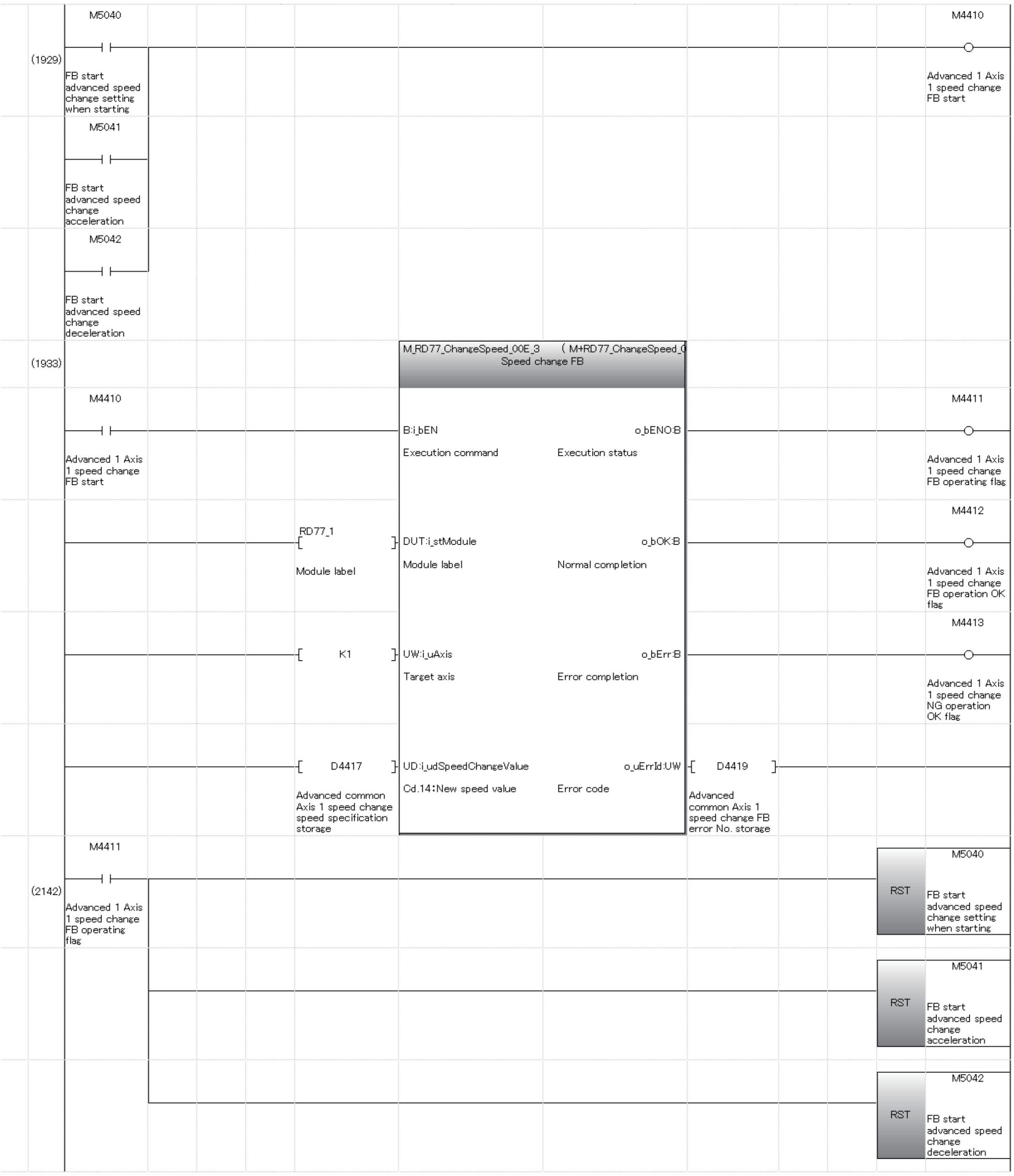

(1641)
M36
Command during Advanced 1 operation
M302
[Advanced 1 status] Start command
RD77_1.bnBusy_D[0] DX10
R:BUSY(Axis#1-#16)(Direct)
RD77_1.bnBusy_D[1] DX11
R:BUSY(Axis#1-#16)(Direct)
RD77_1.bnBusy_D[2] DX12
R:BUSY (Axis#1-#16) (Direct)
MOVP K1 D4328
Axis 2 advanced 1 FB positioning No. storage
MOVP K1 D4338
Axis 3 advanced 1 FB positioning No. storage
SET M5021
FB start standby point traveling (Axis 2)
SET M5031
FB start standby point traveling (Axis 3)
SET M303
[Advanced 1 status] Standby point traveling command
RST M301
[Advanced 1 status] Home position return command when starting
RST M302
[Advanced 1 status] Start command
M303
[Advanced 1 status] Standby point traveling command
U0¥G2517.F
Axis 2 positioning complete
RD77_1.bnBusy_D[1] DX11
R:BUSY(Axis#1-#16)(Direct)
RST M5021
FB start standby point traveling (Axis 2)
U0¥G2517.D
Axis 2 error detection
SET M202
[Operating completion flag] Axis 2 standby point traveling
U0¥G2617.F
Axis 3 positioning complete
RD77_1.bnBusy_D[2] DX12
R:BUSY(Axis#1-#16)(Direct)
RST M5031
FB start standby point traveling (Axis 3)
U0¥G2617.D
Axis 3 error detection
SET M203
[Operating completion flag] Axis 3 standby point traveling
M202
[Operating completion flag] Axis 2 standby point traveling
M203
[Operating completion flag] Axis 3 standby point traveling
SET M304
[Advanced 1 status] Conveyor start command

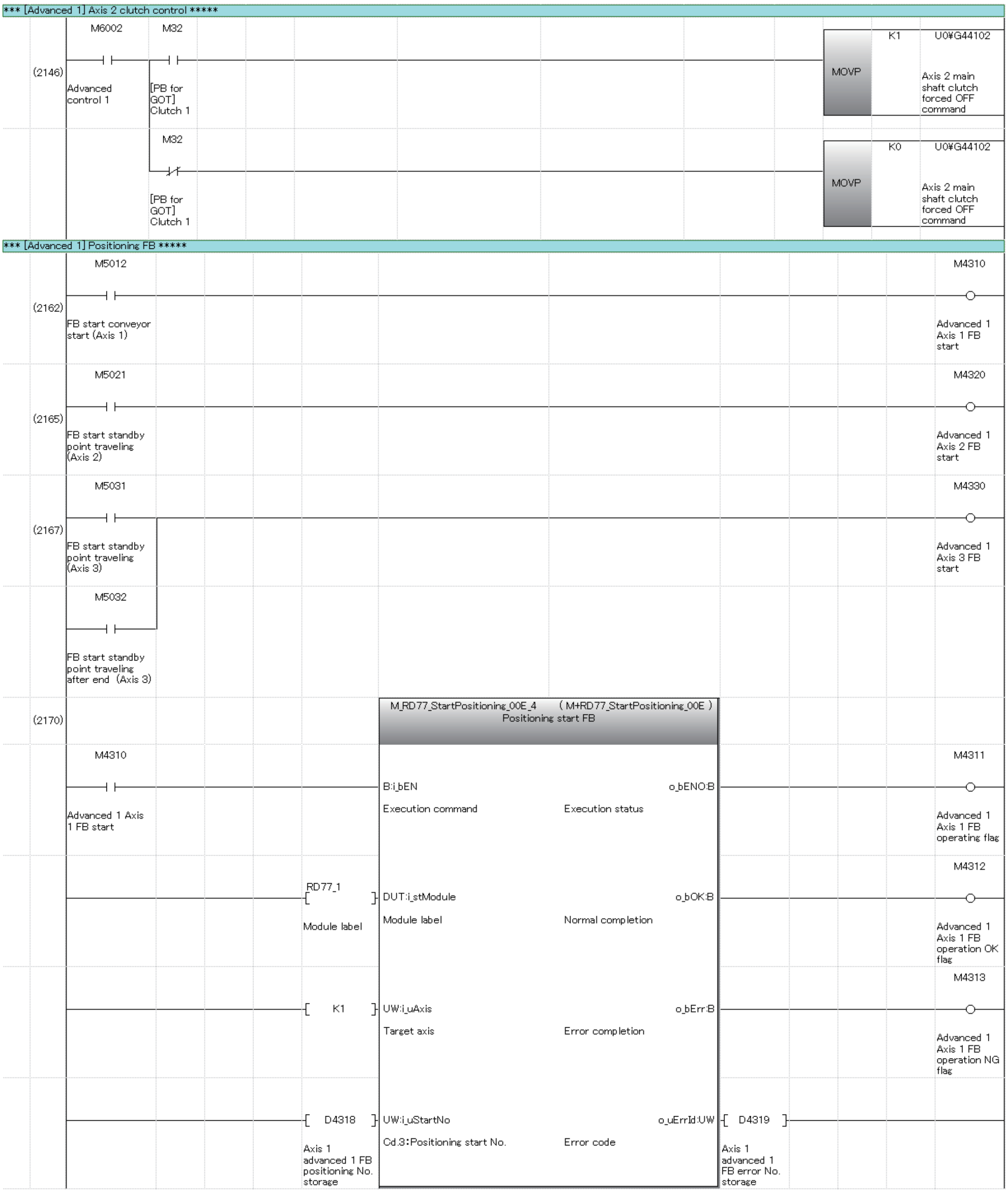

RST M303 [Advanced 1 status] Standby point traveling command
M304 [Advanced 1 status] Conveyor start command
M303 [Advanced 1 status] Standby point traveling command
RST M202 [Operating completion flag] Axis 2 standby point traveling
M320 Advanced 1 1 cycle start command
RST M203 [Operating completion flag] Axis 3 standby point traveling
MOVP K5 D4318 Axis 1 advanced 1 FB positioning No. storage
SET M5012 FB start conveyor start (Axis 1)
X20 Sensor input (SEN1)
SET M305 [Advanced 1 status] Synchronous control start
RST M304 [Advanced 1 status] Conveyor start command
RST M320 Advanced 1 1 cycle start command
M305 [Advanced 1 status] Synchronous control start
RD77_1.bnBusy_D[1] DX11 R:BUSY(Axis#1-#16)(Direct)
SET U0¥G36320.1 Axis 2 synchronous control start
RD77_1.bnBusy_D[2] DX12 R:BUSY(Axis#1-#16)(Direct)
SET U0¥G36320.2 Axis 3 synchronous control start
RD77_1.bnBusy_D[1] DX11 R:BUSY(Axis#1-#16)(Direct)
RD77_1.bnBusy_D[2] DX12 R:BUSY(Axis#1-#16)(Direct)
= U0¥G2509 K15 Axis 2 axis operation status
= U0¥G2609 K15 Axis 3 axis operation status
RST M5012 FB start conveyor start (Axis 1)
SET M306 [Advanced 1 status] Sensor input wait

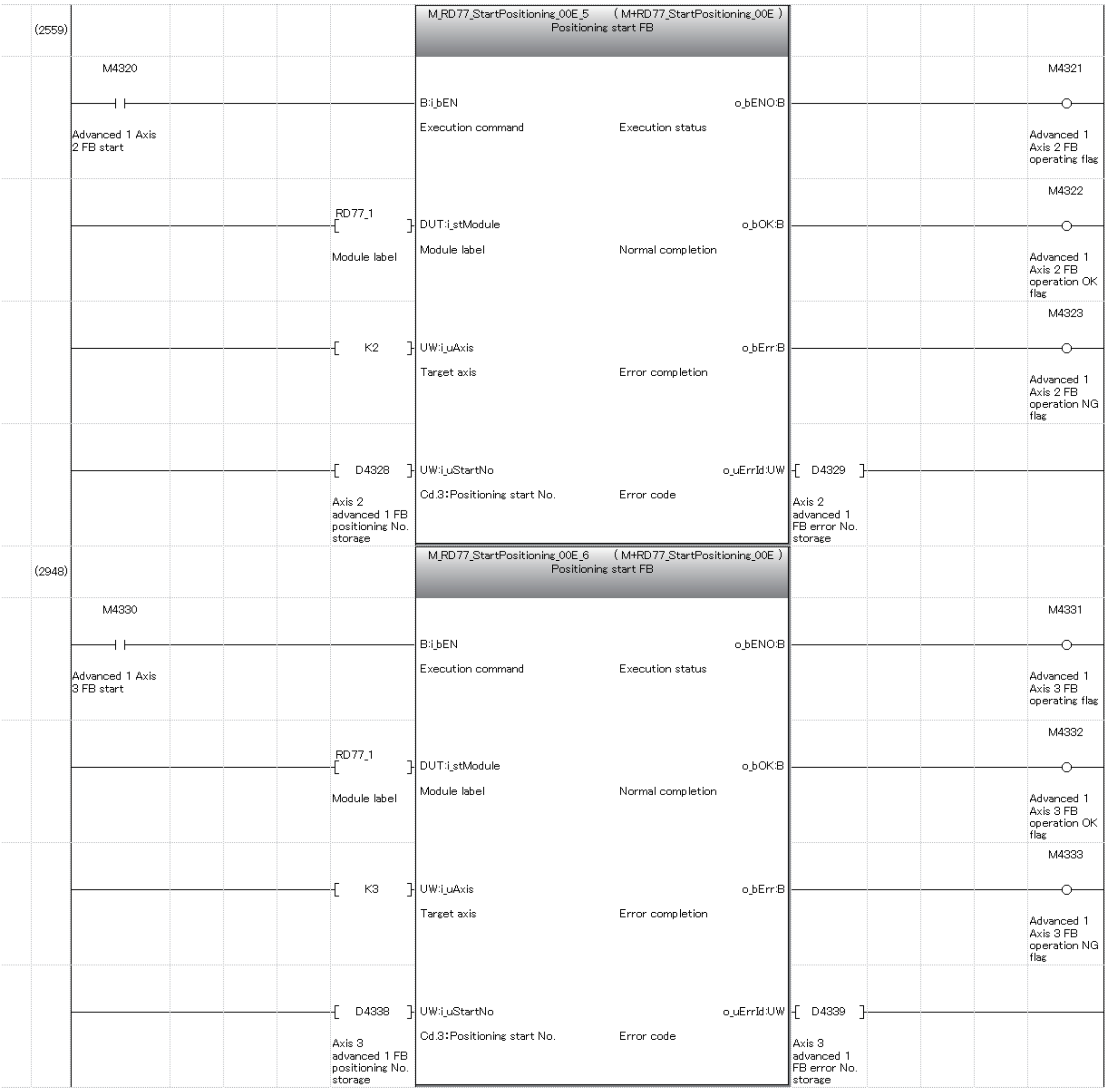

RST
M305
[Advanced 1 status] Synchronous control start
RST
M320
Advanced 1 1 cycle start command
M306
[Advanced 1 status] Sensor input wait
X20
Sensor input (SEN1)
MOVP
K1
U0¥G44120
Axis 3 main shaft clutch command
U0¥G42908.0
Axis 3 main shaft clutch ON/OFF status
SET
M307
[Advanced 1 status] Synchronous controlling
RST
M306
[Advanced 1 status] Sensor input wait
M307
[Advanced 1 status] Synchronous controlling
U0¥G42908.0
Axis 3 main shaft clutch ON/OFF status
U0¥G42909.0
Axis 3 main shaft clutch smoothing status
RD77_1.bnBusy_D[1]
DX11
R:BUSY (Axis#1-#16) (Direct)
=
U0¥G2509
K15
Axis 2 axis operation status
RST
U0¥G36320.1
Axis 2 synchronous control start
RD77_1.bnBusy_D[2]
DX12
R:BUSY (Axis#1-#16) (Direct)
=
U0¥G2609
K15
Axis 3 axis operation status
RST
U0¥G36320.2
Axis 3 synchronous control start
MOVP
K0
U0¥G44120
Axis 3 main shaft clutch command
SET
M308
[Advanced 1 status] Synchronous control ending
RST
M307
[Advanced 1 status] Synchronous controlling
M308
[Advanced 1 status] Synchronous control ending
◇
U0¥G2509
K15
Axis 2 axis operation status
◇
U0¥G2609
K15
Axis 3 axis operation status
SET
M309
[Advanced 1 status] Return operation start
RST
M308
[Advanced 1 status] Synchronous control ending

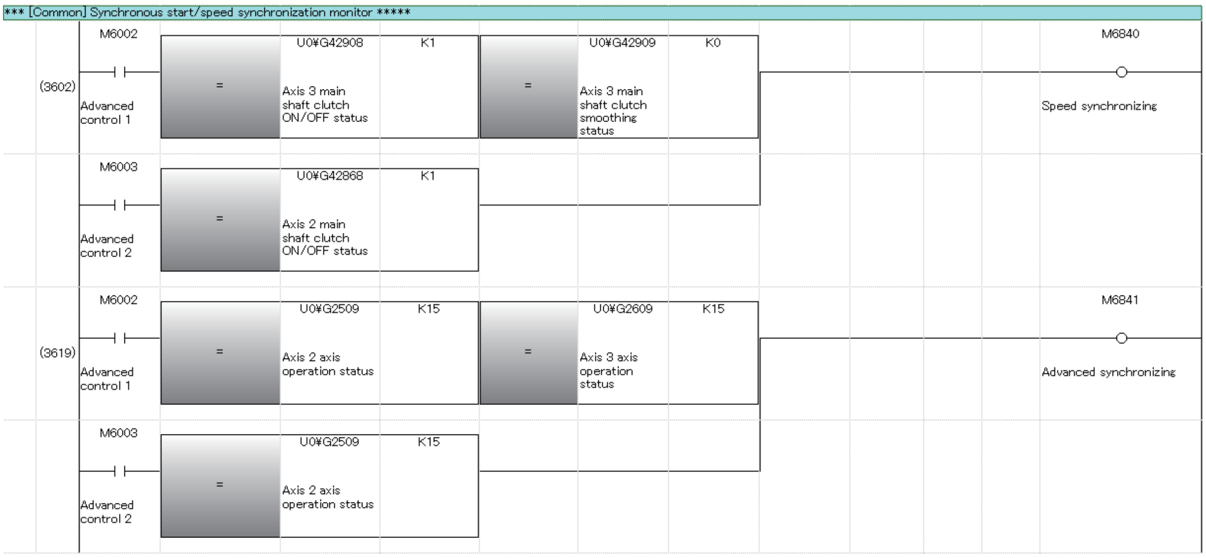

M309
[Advanced 1 status] Return operation start
MOVP
K10
D4338
Axis 3 advanced 1 FB positioning No. storage
RD77_1.bnBusy_D[2]
DX12
R:BUSY(Axis#1-#16)(Direct)
SET
M5032
FB start standby point traveling after end (Axis 3)
M5032
FB start standby point traveling after end (Axis 3)
SET
M310
[Advanced 1 status] Return operating
RST
M309
[Advanced 1 status] Return operation start
M310
[Advanced 1 status] Return operating
U0¥G2617.F
Axis 3 positioning complete
RD77_1.bnBusy_D[2]
DX12
R:BUSY(Axis#1-#16)(Direct)
RST
M5032
FB start standby point traveling after end (Axis 3)
U0¥G2617.D
Axis 3 error detection
SET
M311
[Advanced 1 status] 1 cycle end
RST
M310
[Advanced 1 status] Return operating
M311
[Advanced 1 status] 1 cycle end
M31
[PB for GOT] Start up advanced 1
MOVP
K1
U0¥G30100
Axis 1 axis stop
M4311
Advanced 1 Axis 1 FB operating flag
SET
M312
[Advanced 1 status] End processing
RST
M311
[Advanced 1 status] 1 cycle end
M31
[PB for GOT] Start up advanced 1
SET
M320
Advanced 1 1 cycle start command
RST
M311
[Advanced 1 status] 1 cycle end


M312
[Advanced 1 status] End processing
=
K1
U0¥G30100
Axis 1 axis stop
RD77_1.bnBusy_D[0]
DX10
R:BUSY(Axis#1-#16) (Direct)
MOVP
K0
U0¥G30100
Axis 1 axis stop
RST
M312
[Advanced 1 status] End processing
RST
M36
Command during Advanced 1 operation
*** [Advanced Common] Conveyor speed change *****
(1859)
M6002
Advanced control 1
M31
[PB for GOT] Start up advanced 1
DMOV
K300000
D4417
Advanced common Axis 1 speed change speed specification storage
M6003
Advanced control 2
M51
[PB for GOT] Start up advanced 2
SET
M5040
FB start advanced speed change setting when starting
M33
[PB for GOT] Speed UP change
M34
[PB for GOT] Speed DOWN change
M4010
Home position return Axis 1 FB start
M6802
Advanced synchronous control 1 switch
D>
K720000
D4417
Advanced common Axis 1 speed change speed specification storage
D+P
K60000
D4417
Advanced common Axis 1 speed change speed specification storage
M53
[PB for GOT] Speed UP change
M54
[PB for GOT] Speed DOWN change
M6803
Advanced synchronous control 2 switch
D>
K1200000
D4417
Advanced common Axis 1 speed change speed specification storage
SET
M5041
FB start advanced speed change acceleration
M34
[PB for GOT] Speed DOWN change
M33
[PB for GOT] Speed UP change
M4010
Home position return Axis 1 FB start
D<
K0
D4417
Advanced common Axis 1 speed change speed specification storage
D-P
K60000
D4417
Advanced common Axis 1 speed change speed specification storage
M54
[PB for GOT] Speed DOWN change
M53
[PB for GOT] Speed UP change
SET
M5042
FB start advanced speed change deceleration
D>=
K0
D4417
Advanced common Axis 1 speed change speed specification storage
DMOVP
K0
D4417
Advanced common Axis 1 speed change speed specification storage


(1929)
M5040
FB start advanced speed change setting when starting
M4410
Advanced 1 Axis 1 speed change FB start
M5041
FB start advanced speed change acceleration
M5042
FB start advanced speed change deceleration
(1933)
M_RD77_ChangeSpeed_00E_3 (M+RD77_ChangeSpeed_(
Speed change FB
M4410
Advanced 1 Axis 1 speed change FB start
B:i_bEN
Execution command
o_bENO:B
Execution status
M4411
Advanced 1 Axis 1 speed change FB operating flag
RD77_1
Module label
DUT:i_stModule
Module label
o_bOK:B
Normal completion
M4412
Advanced 1 Axis 1 speed change FB operation OK flag
K1
UW:i_uAxis
Target axis
o_bErr:B
Error completion
M4413
Advanced 1 Axis 1 speed change NG operation OK flag
D4417
Advanced common Axis 1 speed change speed specification storage
UD:i_udSpeedChangeValue
Cd.14:New speed value
o_uErrId:UW
Error code
D4419
Advanced common Axis 1 speed change FB error No. storage
(2142)
M4411
Advanced 1 Axis 1 speed change FB operating flag
RST
M5040
FB start advanced speed change setting when starting
RST
M5041
FB start advanced speed change acceleration
RST
M5042
FB start advanced speed change deceleration

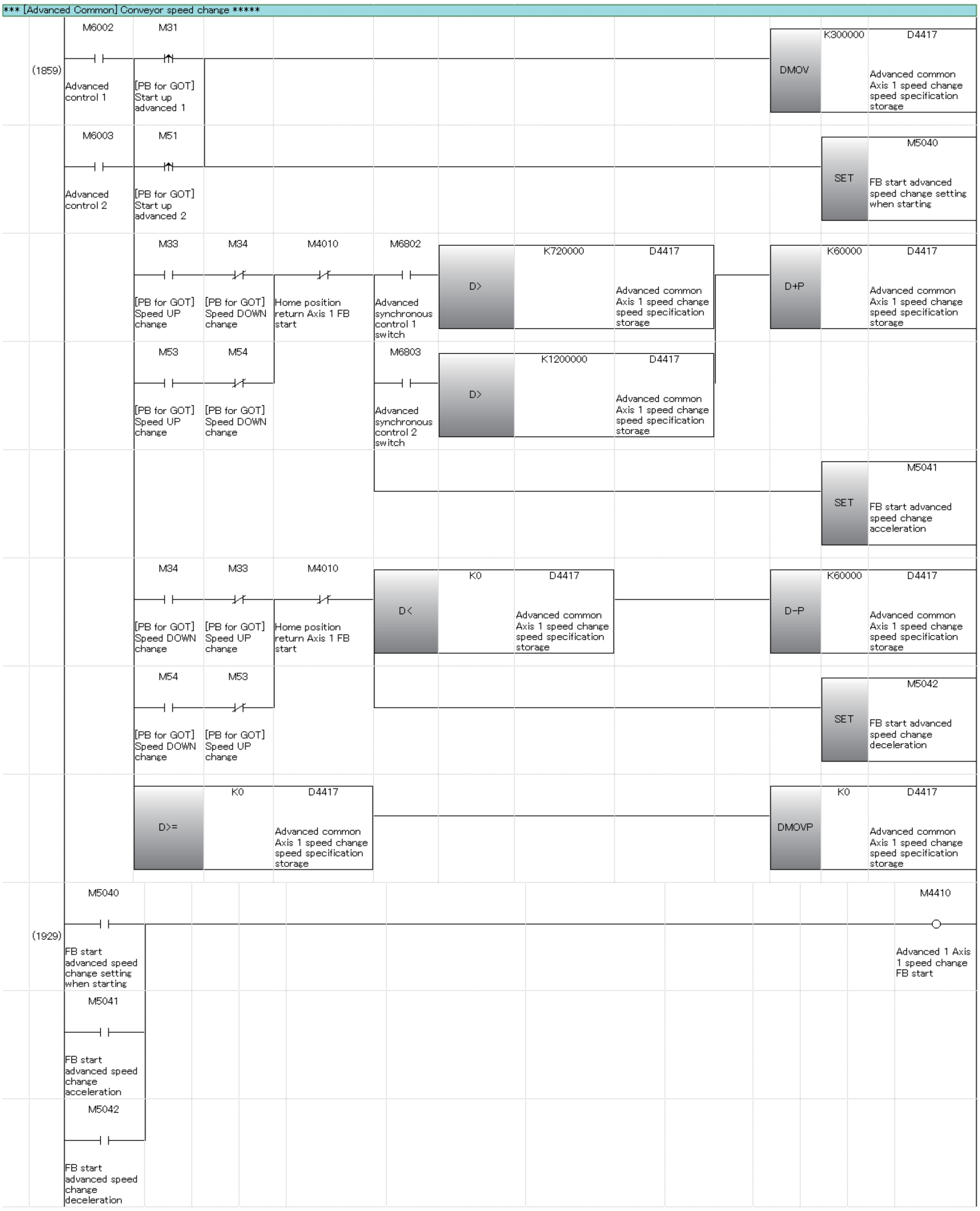

*** [Advanced 1] Axis 2 clutch control *****
(2146)
M6002
Advanced control 1
M32
[PB for GOT] Clutch 1
MOVP
K1
U0¥G44102
Axis 2 main shaft clutch forced OFF command
M32
[PB for GOT] Clutch 1
MOVP
K0
U0¥G44102
Axis 2 main shaft clutch forced OFF command
*** [Advanced 1] Positioning FB *****
(2162)
M5012
FB start conveyor start (Axis 1)
M4310
Advanced 1 Axis 1 FB start
(2165)
M5021
FB start standby point traveling (Axis 2)
M4320
Advanced 1 Axis 2 FB start
(2167)
M5031
FB start standby point traveling (Axis 3)
M4330
Advanced 1 Axis 3 FB start
M5032
FB start standby point traveling after end (Axis 3)
(2170)
M_RD77_StartPositioning_00E_4 (M+RD77_StartPositioning_00E)
Positioning start FB
M4310
Advanced 1 Axis 1 FB start
B:i_bEN
Execution command
o_bENO:B
Execution status
M4311
Advanced 1 Axis 1 FB operating flag
RD77_1
Module label
DUT:i_stModule
Module label
o_bOK:B
Normal completion
M4312
Advanced 1 Axis 1 FB operation OK flag
K1
UW:i_uAxis
Target axis
o_bErr:B
Error completion
M4313
Advanced 1 Axis 1 FB operation NG flag
D4318
Axis 1 advanced 1 FB positioning No. storage
UW:i_uStartNo
Cd.3:Positioning start No.
o_uErrId:UW
Error code
D4319
Axis 1 advanced 1 FB error No. storage

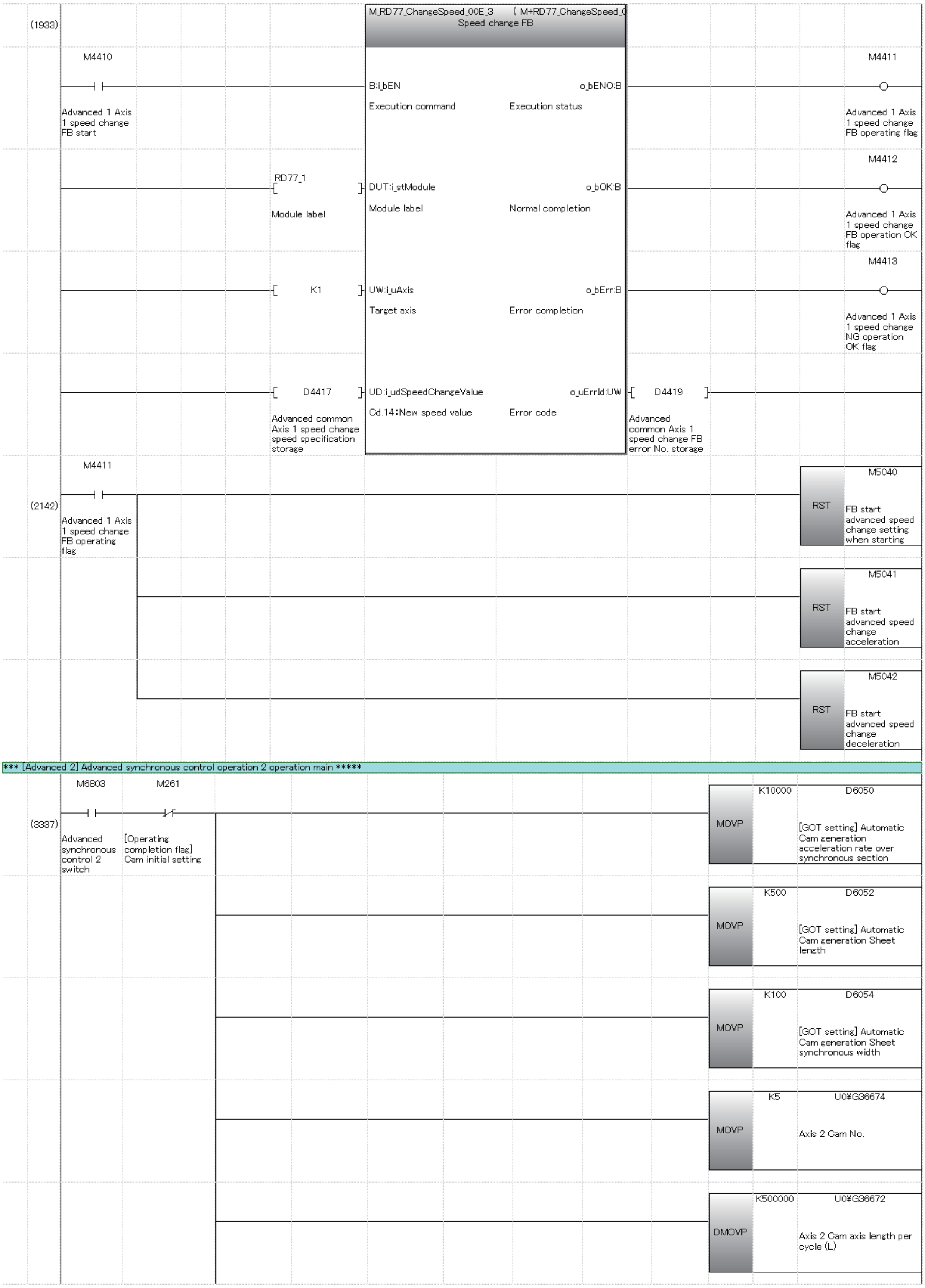

(2559)
M_RD77_StartPositioning_00E_5 (M+RD77_StartPositioning_00E)
Positioning start FB
M4320
Advanced 1 Axis 2 FB start
B:i_bEN
Execution command
o_bENO:B
Execution status
M4321
Advanced 1 Axis 2 FB operating flag
RD77_1
Module label
DUT:i_stModule
Module label
o_bOK:B
Normal completion
M4322
Advanced 1 Axis 2 FB operation OK flag
K2
UW:i_uAxis
Target axis
o_bErr:B
Error completion
M4323
Advanced 1 Axis 2 FB operation NG flag
D4328
Axis 2 advanced 1 FB positioning No. storage
UW:i_uStartNo
Cd.3:Positioning start No.
o_uErrId:UW
Error code
D4329
Axis 2 advanced 1 FB error No. storage
(2948)
M_RD77_StartPositioning_00E_6 (M+RD77_StartPositioning_00E)
Positioning start FB
M4330
Advanced 1 Axis 3 FB start
B:i_bEN
Execution command
o_bENO:B
Execution status
M4331
Advanced 1 Axis 3 FB operating flag
RD77_1
Module label
DUT:i_stModule
Module label
o_bOK:B
Normal completion
M4332
Advanced 1 Axis 3 FB operation OK flag
K3
UW:i_uAxis
Target axis
o_bErr:B
Error completion
M4333
Advanced 1 Axis 3 FB operation NG flag
D4338
Axis 3 advanced 1 FB positioning No. storage
UW:i_uStartNo
Cd.3:Positioning start No.
o_uErrId:UW
Error code
D4339
Axis 3 advanced 1 FB error No. storage


*** [Common] Synchronous start/speed synchronization monitor *****
(3602)
M6002
Advanced control 1
=
U0¥G42908
K1
Axis 3 main shaft clutch ON/OFF status
=
U0¥G42909
K0
Axis 3 main shaft clutch smoothing status
M6840
Speed synchronizing
M6003
Advanced control 2
=
U0¥G42868
K1
Axis 2 main shaft clutch ON/OFF status
(3619)
M6002
Advanced control 1
=
U0¥G2509
K15
Axis 2 axis operation status
=
U0¥G2609
K15
Axis 3 axis operation status
M6841
Advanced synchronizing
M6003
Advanced control 2
=
U0¥G2509
K15
Axis 2 axis operation status

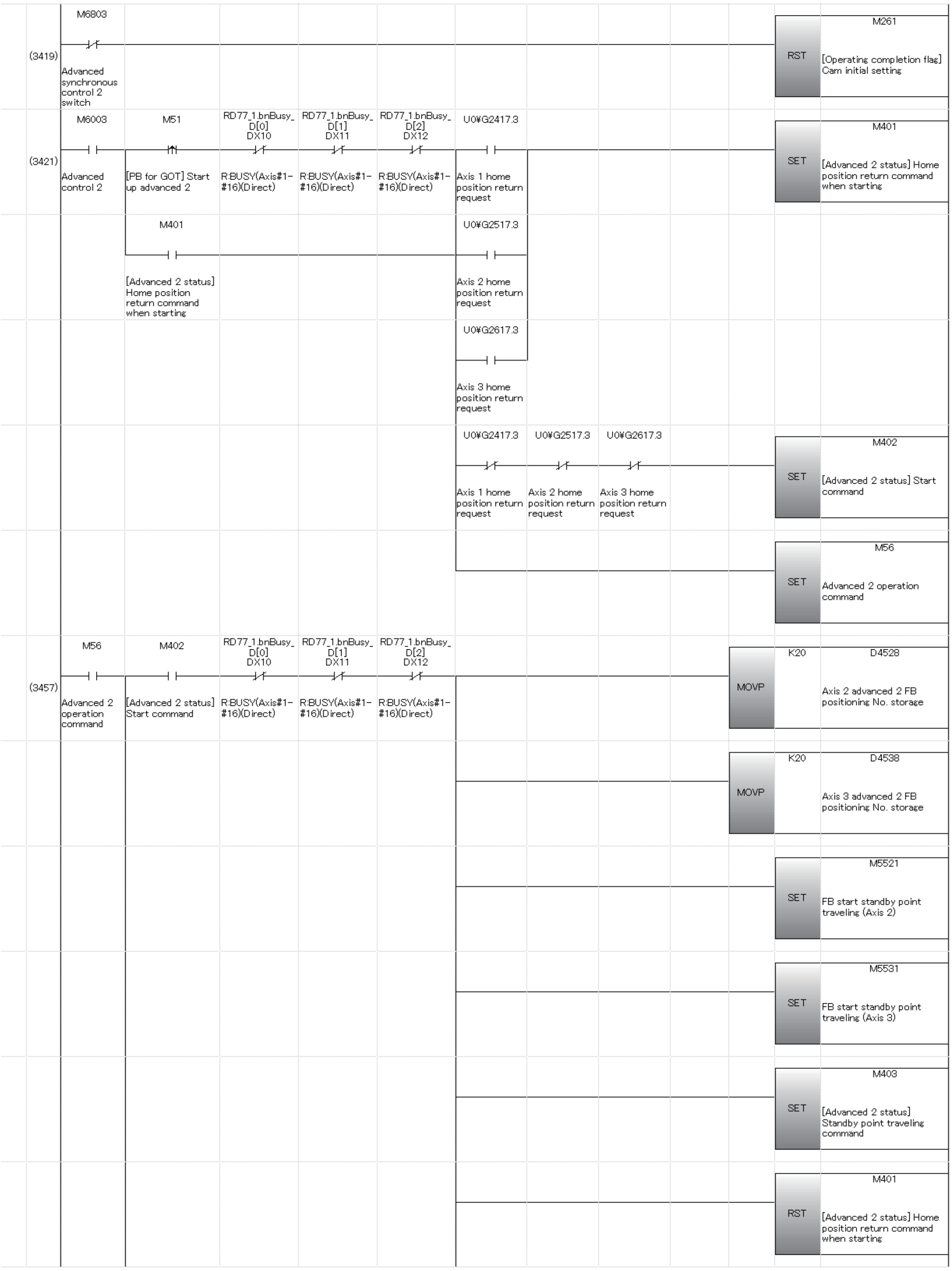
7.6.2 Advanced synchronous control 2: Rotary cutter program

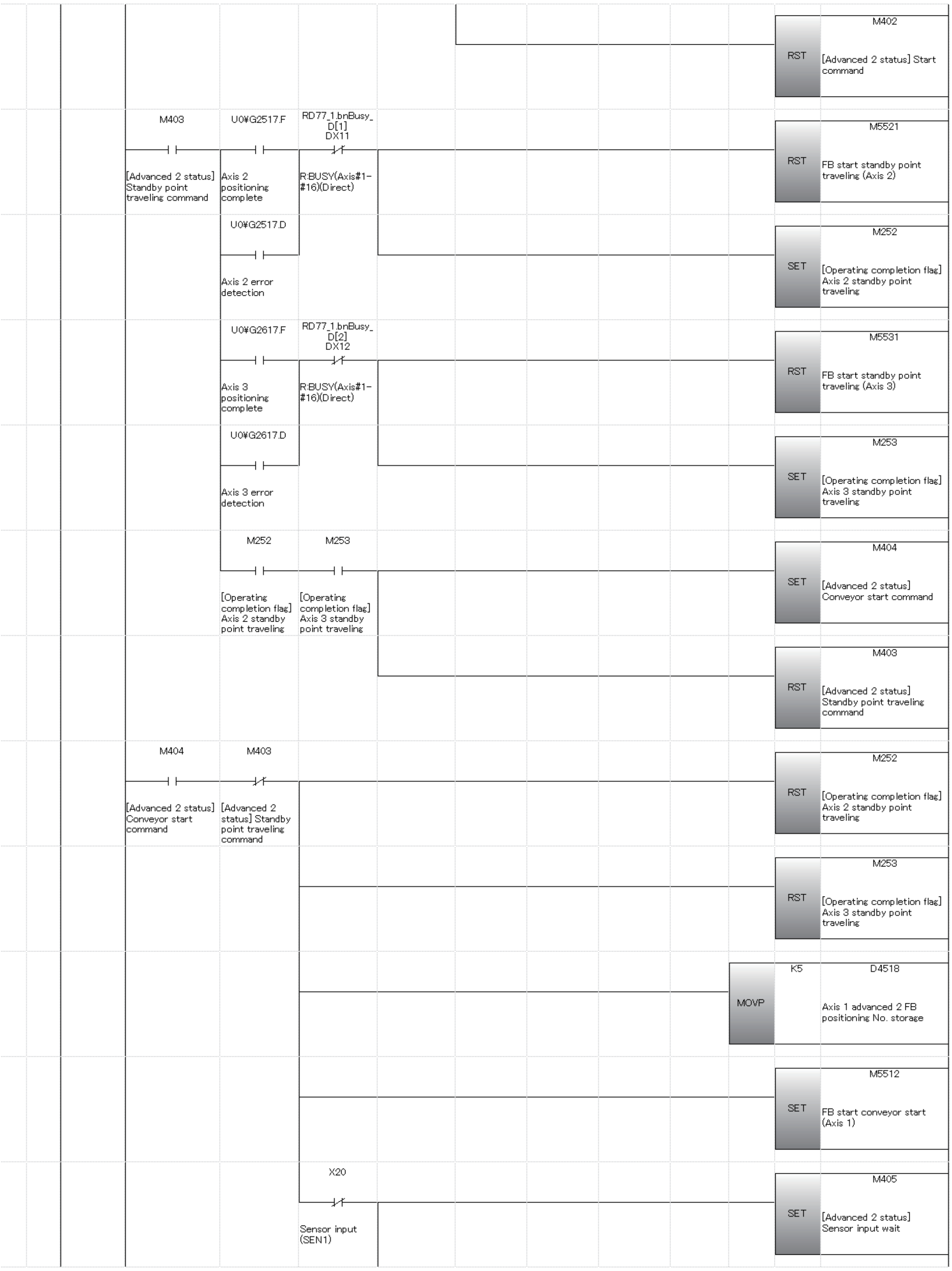
The sequence program used with advanced synchronous control 2 is shown in the following table.

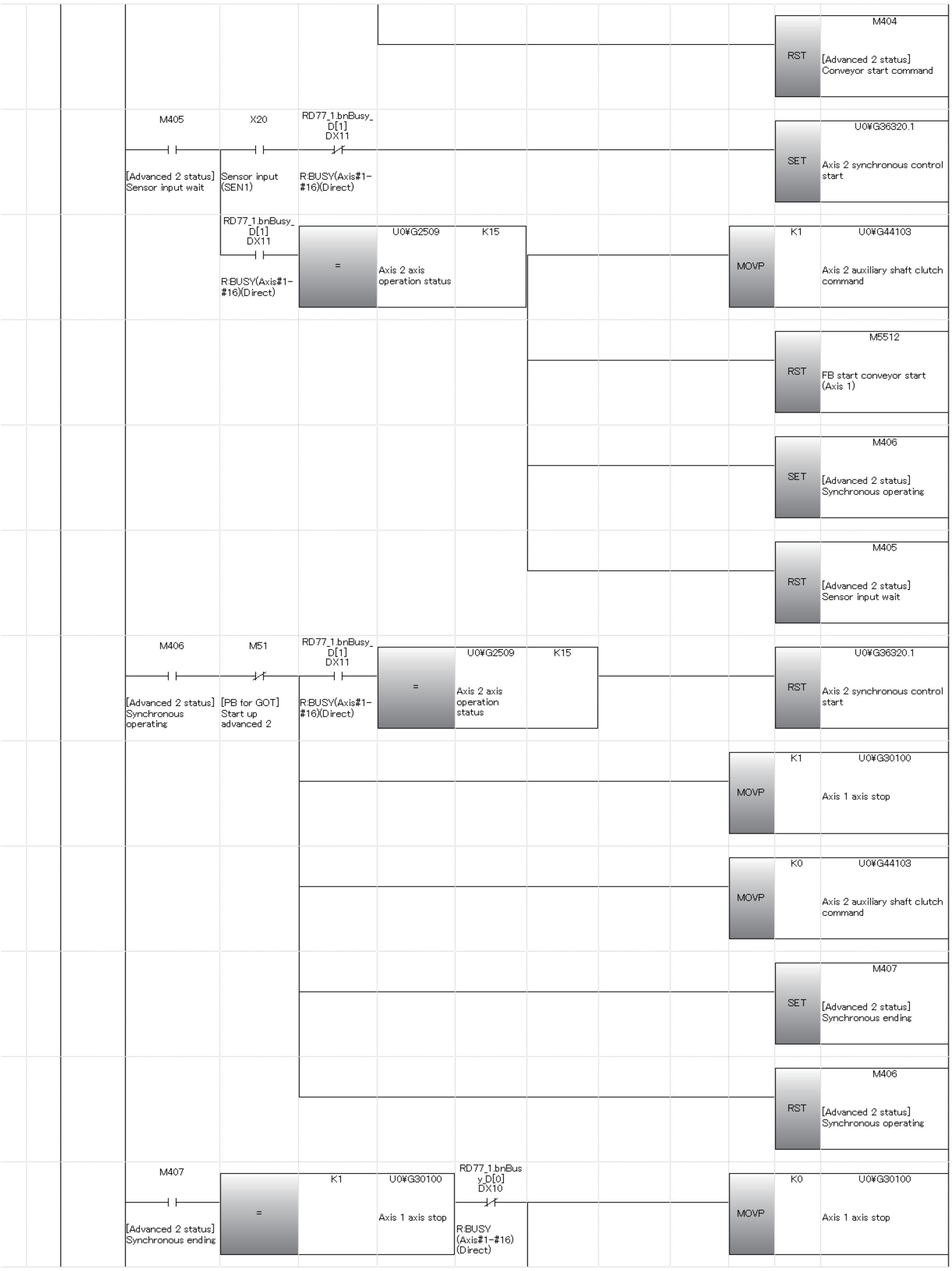



(1933)
M_RD77_ChangeSpeed_00E_3 (M+RD77_ChangeSpeed_(
Speed change FB
M4410
Advanced 1 Axis 1 speed change FB start
B:i_bEN
Execution command
o_bENO:B
Execution status
M4411
Advanced 1 Axis 1 speed change FB operating flag
RD77_1
Module label
DUT:i_stModule
Module label
o_bOK:B
Normal completion
M4412
Advanced 1 Axis 1 speed change FB operation OK flag
K1
UW:i_uAxis
Target axis
o_bErr:B
Error completion
M4413
Advanced 1 Axis 1 speed change NG operation OK flag
D4417
Advanced common Axis 1 speed change speed specification storage
UD:i_udSpeedChangeValue
Cd.14:New speed value
o_uErrId:UW
Error code
D4419
Advanced common Axis 1 speed change FB error No. storage
(2142)
M4411
Advanced 1 Axis 1 speed change FB operating flag
RST
M5040
FB start advanced speed change setting when starting
RST
M5041
FB start advanced speed change acceleration
RST
M5042
FB start advanced speed change deceleration
*** [Advanced 2] Advanced synchronous control operation 2 operation main *****
(3337)
M6803
Advanced synchronous control 2 switch
M261
[Operating completion flag] Cam initial setting
MOVP
K10000
D6050
[GOT setting] Automatic Cam generation acceleration rate over synchronous section
MOVP
K500
D6052
[GOT setting] Automatic Cam generation Sheet length
MOVP
K100
D6054
[GOT setting] Automatic Cam generation Sheet synchronous width
MOVP
K5
U0¥G36674
Axis 2 Cam No.
DMOVP
K500000
U0¥G36672
Axis 2 Cam axis length per cycle (L)

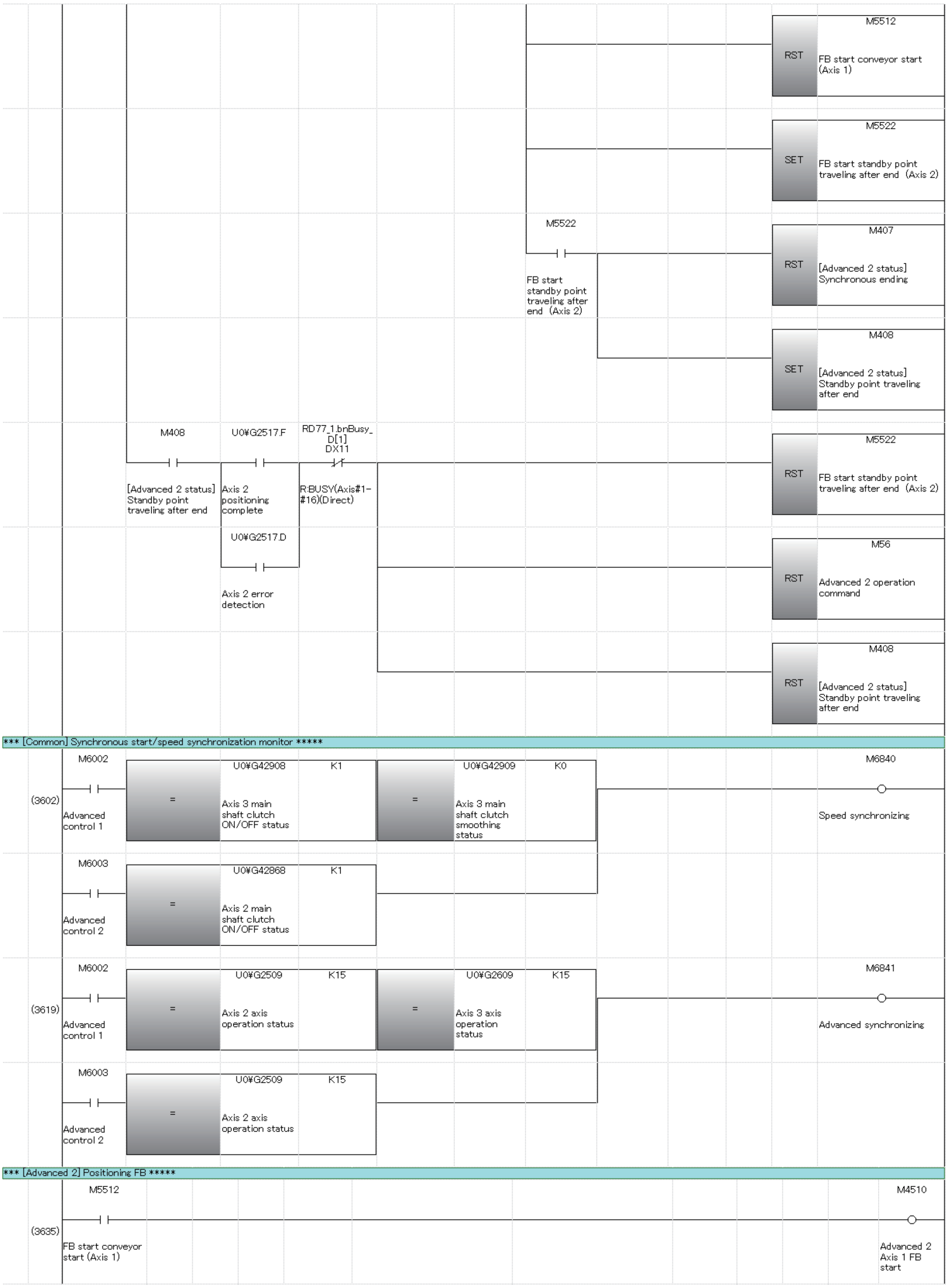
MOVP	K1	U0¥G44101	Axis 2 main shaft clutch control invalid command
DMOVP	K300000	D4417	Advanced common Axis 1 speed change speed specification storage
MOVP	K5	U0¥G53201	Auto-generation Cam No.
MOVP	K1	U0¥G53202	Cam auto-generation type
MOVP	K512	U0¥G53204	Auto-generation parameter value: Cam resolution
MOVP	K0	U0¥G53214	Auto-generation parameter value: Acceleration rate over synchronous section
DMOVP	K500	U0¥G53206	Auto-generation parameter value: Sheet length (L)
DMOVP	K100	U0¥G53208	Auto-generation parameter value: Sheet synchronous width (L)
DMOVP	K2513	U0¥G53210	Auto-generation parameter value: Synchronous axis length (L)
DMOVP	K450	U0¥G53212	Auto-generation parameter value: Synchronous start position (L)
MOVP	K1	U0¥G53200	Cam auto-generation request
SET		M261	[Operating completion flag] Cam initial setting

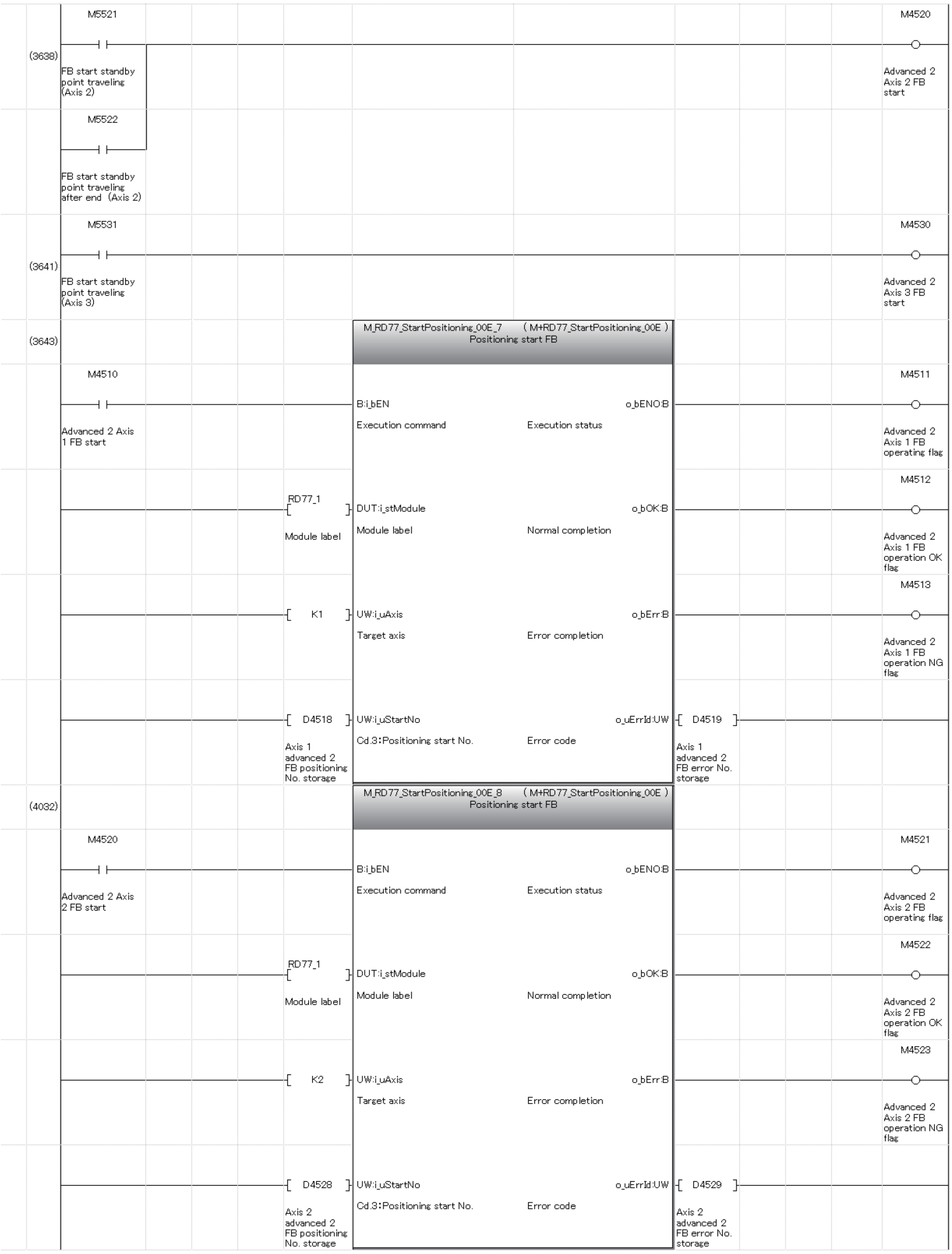

(3419)
M6803
Advanced synchronous control 2 switch
RST
M261
[Operating completion flag] Cam initial setting
(3421)
M6003
Advanced control 2
M51
[PB for GOT] Start up advanced 2
RD77_1.bnBusy_D[0] DX10
R:BUSY(Axis#1-#16)(Direct)
RD77_1.bnBusy_D[1] DX11
R:BUSY(Axis#1-#16)(Direct)
RD77_1.bnBusy_D[2] DX12
R:BUSY(Axis#1-#16)(Direct)
U0¥G2417.3
Axis 1 home position return request
SET
M401
[Advanced 2 status] Home position return command when starting
M401
[Advanced 2 status] Home position return command when starting
U0¥G2517.3
Axis 2 home position return request
U0¥G2617.3
Axis 3 home position return request
U0¥G2417.3
Axis 1 home position return request
U0¥G2517.3
Axis 2 home position return request
U0¥G2617.3
Axis 3 home position return request
SET
M402
[Advanced 2 status] Start command
SET
M56
Advanced 2 operation command
(3457)
M56
Advanced 2 operation command
M402
[Advanced 2 status] Start command
RD77_1.bnBusy_D[0] DX10
R:BUSY(Axis#1-#16)(Direct)
RD77_1.bnBusy_D[1] DX11
R:BUSY(Axis#1-#16)(Direct)
RD77_1.bnBusy_D[2] DX12
R:BUSY(Axis#1-#16)(Direct)
MOVP
K20
D4528
Axis 2 advanced 2 FB positioning No. storage
MOVP
K20
D4538
Axis 3 advanced 2 FB positioning No. storage
SET
M5521
FB start standby point traveling (Axis 2)
SET
M5531
FB start standby point traveling (Axis 3)
SET
M403
[Advanced 2 status] Standby point traveling command
RST
M401
[Advanced 2 status] Home position return command when starting


M402
RST
[Advanced 2 status] Start command
M403
[Advanced 2 status] Standby point traveling command
U0¥G2517.F
Axis 2 positioning complete
RD77_1.bnBusy_D[1]
DX11
R:BUSY(Axis#1-#16)(Direct)
M5521
RST
FB start standby point traveling (Axis 2)
U0¥G2517.D
Axis 2 error detection
M252
SET
[Operating completion flag] Axis 2 standby point traveling
U0¥G2617.F
Axis 3 positioning complete
RD77_1.bnBusy_D[2]
DX12
R:BUSY(Axis#1-#16)(Direct)
M5531
RST
FB start standby point traveling (Axis 3)
U0¥G2617.D
Axis 3 error detection
M253
SET
[Operating completion flag] Axis 3 standby point traveling
M252
[Operating completion flag] Axis 2 standby point traveling
M253
[Operating completion flag] Axis 3 standby point traveling
M404
SET
[Advanced 2 status] Conveyor start command
M403
RST
[Advanced 2 status] Standby point traveling command
M404
[Advanced 2 status] Conveyor start command
M403
[Advanced 2 status] Standby point traveling command
M252
RST
[Operating completion flag] Axis 2 standby point traveling
M253
RST
[Operating completion flag] Axis 3 standby point traveling
MOVP
K5
D4518
Axis 1 advanced 2 FB positioning No. storage
M5512
SET
FB start conveyor start (Axis 1)
X20
Sensor input (SEN1)
M405
SET
[Advanced 2 status] Sensor input wait

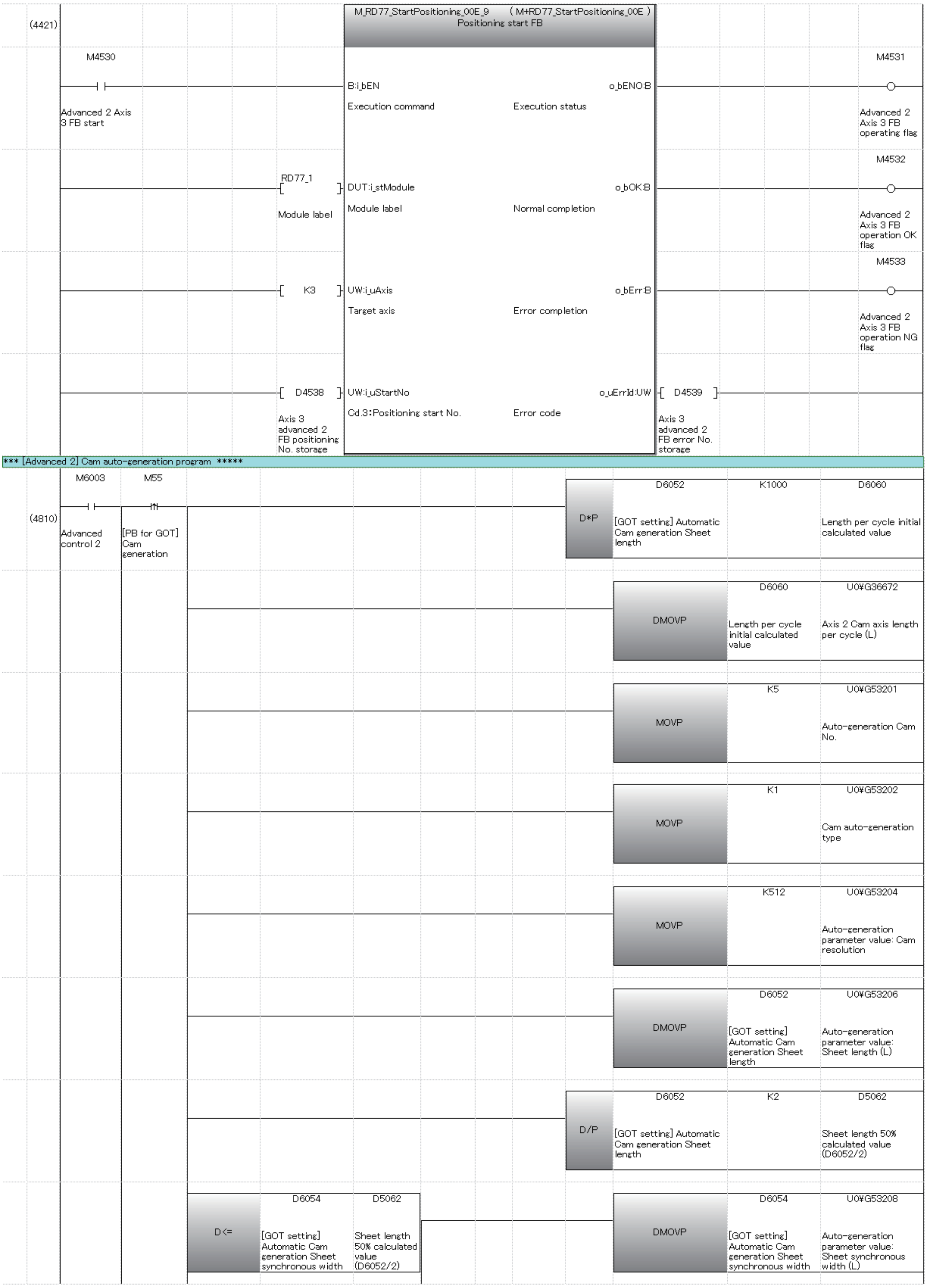


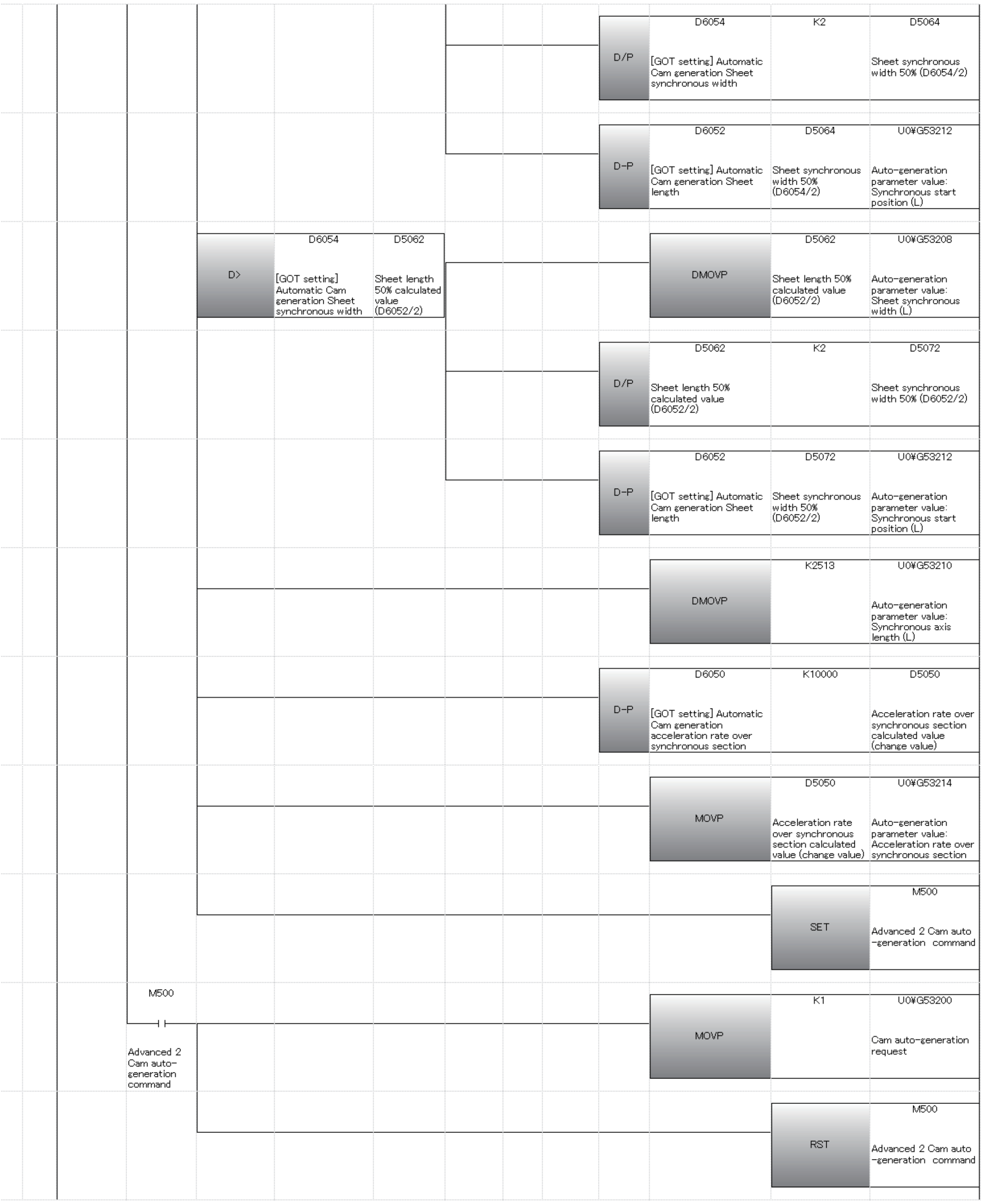
M404
RST
[Advanced 2 status] Conveyor start command
M405
[Advanced 2 status] Sensor input wait
X20
Sensor input (SEN1)
RD77_1.bnBusy_D[1] DX11
R:BUSY(Axis#1-#16)(Direct)
U0¥G36320.1
SET
Axis 2 synchronous control start
RD77_1.bnBusy_D[1] DX11
R:BUSY(Axis#1-#16)(Direct)
=
U0¥G2509
Axis 2 axis operation status
K15
MOVP
K1
U0¥G44103
Axis 2 auxiliary shaft clutch command
M5512
RST
FB start conveyor start (Axis 1)
M406
SET
[Advanced 2 status] Synchronous operating
M405
RST
[Advanced 2 status] Sensor input wait
M406
[Advanced 2 status] Synchronous operating
M51
[PB for GOT] Start up advanced 2
RD77_1.bnBusy_D[1] DX11
R:BUSY(Axis#1-#16)(Direct)
=
U0¥G2509
Axis 2 axis operation status
K15
U0¥G36320.1
RST
Axis 2 synchronous control start
MOVP
K1
U0¥G30100
Axis 1 axis stop
MOVP
K0
U0¥G44103
Axis 2 auxiliary shaft clutch command
M407
SET
[Advanced 2 status] Synchronous ending
M406
RST
[Advanced 2 status] Synchronous operating
M407
[Advanced 2 status] Synchronous ending
=
K1
U0¥G30100
Axis 1 axis stop
RD77_1.bnBusy_D[0] DX10
R:BUSY (Axis#1-#16) (Direct)
MOVP
K0
U0¥G30100
Axis 1 axis stop


M5512
RST
FB start conveyor start (Axis 1)
M5522
SET
FB start standby point traveling after end (Axis 2)
M5522
FB start standby point traveling after end (Axis 2)
M407
RST
[Advanced 2 status] Synchronous ending
M408
SET
[Advanced 2 status] Standby point traveling after end
M408
[Advanced 2 status] Standby point traveling after end
U0¥G2517.F
Axis 2 positioning complete
RD77_1.bnBusy_D[1]
DX11
R:BUSY(Axis#1-#16)(Direct)
M5522
RST
FB start standby point traveling after end (Axis 2)
U0¥G2517.D
Axis 2 error detection
M56
RST
Advanced 2 operation command
M408
RST
[Advanced 2 status] Standby point traveling after end
*** [Common] Synchronous start/speed synchronization monitor *****
(3602)
M6002
Advanced control 1
=
U0¥G42908
K1
Axis 3 main shaft clutch ON/OFF status
=
U0¥G42909
K0
Axis 3 main shaft clutch smoothing status
M6840
Speed synchronizing
M6003
Advanced control 2
=
U0¥G42868
K1
Axis 2 main shaft clutch ON/OFF status
(3619)
M6002
Advanced control 1
=
U0¥G2509
K15
Axis 2 axis operation status
=
U0¥G2609
K15
Axis 3 axis operation status
M6841
Advanced synchronizing
M6003
Advanced control 2
=
U0¥G2509
K15
Axis 2 axis operation status
*** [Advanced 2] Positioning FB *****
(3635)
M5512
FB start conveyor start (Axis 1)
M4510
Advanced 2 Axis 1 FB start



(3638)
M5521
FB start standby point traveling (Axis 2)
M5522
FB start standby point traveling after end (Axis 2)
M4520
Advanced 2 Axis 2 FB start
(3641)
M5531
FB start standby point traveling (Axis 3)
M4530
Advanced 2 Axis 3 FB start
(3643)
M_RD77_StartPositioning_00E_7 (M+RD77_StartPositioning_00E)
Positioning start FB
M4510
Advanced 2 Axis 1 FB start
B:i_bEN
Execution command
o_bENO:B
Execution status
M4511
Advanced 2 Axis 1 FB operating flag
RD77_1
Module label
DUT:i_stModule
Module label
o_bOK:B
Normal completion
M4512
Advanced 2 Axis 1 FB operation OK flag
K1
UW:i_uAxis
Target axis
o_bErr:B
Error completion
M4513
Advanced 2 Axis 1 FB operation NG flag
D4518
Axis 1 advanced 2 FB positioning No. storage
UW:i_uStartNo
Cd.3:Positioning start No.
o_uErrId:UW
Error code
D4519
Axis 1 advanced 2 FB error No. storage
(4032)
M_RD77_StartPositioning_00E_8 (M+RD77_StartPositioning_00E)
Positioning start FB
M4520
Advanced 2 Axis 2 FB start
B:i_bEN
Execution command
o_bENO:B
Execution status
M4521
Advanced 2 Axis 2 FB operating flag
RD77_1
Module label
DUT:i_stModule
Module label
o_bOK:B
Normal completion
M4522
Advanced 2 Axis 2 FB operation OK flag
K2
UW:i_uAxis
Target axis
o_bErr:B
Error completion
M4523
Advanced 2 Axis 2 FB operation NG flag
D4528
Axis 2 advanced 2 FB positioning No. storage
UW:i_uStartNo
Cd.3:Positioning start No.
o_uErrId:UW
Error code
D4529
Axis 2 advanced 2 FB error No. storage


(4421)
M_RD77_StartPositioning_00E_9 (M+RD77_StartPositioning_00E)
Positioning start FB
M4530
Advanced 2 Axis 3 FB start
B:i_bEN
Execution command
o_bENO:B
Execution status
M4531
Advanced 2 Axis 3 FB operating flag
RD77_1
Module label
DUT:i_stModule
Module label
o_bOK:B
Normal completion
M4532
Advanced 2 Axis 3 FB operation OK flag
K3
UW:i_uAxis
Target axis
o_bErr:B
Error completion
M4533
Advanced 2 Axis 3 FB operation NG flag
D4538
Axis 3 advanced 2 FB positioning No. storage
UW:i_uStartNo
Cd.3:Positioning start No.
o_uErrId:UW
Error code
D4539
Axis 3 advanced 2 FB error No. storage
*** [Advanced 2] Cam auto-generation program *****
(4810)
M6003
Advanced control 2
M55
[PB for GOT] Cam generation
D*P
D6052
[GOT setting] Automatic Cam generation Sheet length
K1000
D6060
Length per cycle initial calculated value
DMOVP
D6060
Length per cycle initial calculated value
U0¥G36672
Axis 2 Cam axis length per cycle (L)
MOVP
K5
U0¥G53201
Auto-generation Cam No.
MOVP
K1
U0¥G53202
Cam auto-generation type
MOVP
K512
U0¥G53204
Auto-generation parameter value: Cam resolution
DMOVP
D6052
[GOT setting] Automatic Cam generation Sheet length
U0¥G53206
Auto-generation parameter value: Sheet length (L)
D/P
D6052
[GOT setting] Automatic Cam generation Sheet length
K2
D5062
Sheet length 50% calculated value (D6052/2)
D<=
D6054
[GOT setting] Automatic Cam generation Sheet synchronous width
D5062
Sheet length 50% calculated value (D6052/2)
DMOVP
D6054
[GOT setting] Automatic Cam generation Sheet synchronous width
U0¥G53208
Auto-generation parameter value: Sheet synchronous width (L)



D/P
D6054
[GOT setting] Automatic Cam generation Sheet synchronous width
K2
D5064
Sheet synchronous width 50% (D6054/2)
D-P
D6052
[GOT setting] Automatic Cam generation Sheet length
D5064
Sheet synchronous width 50% (D6054/2)
U0¥G53212
Auto-generation parameter value: Synchronous start position (L)
D>
D6054
[GOT setting] Automatic Cam generation Sheet synchronous width
D5062
Sheet length 50% calculated value (D6052/2)
DMOVP
D5062
Sheet length 50% calculated value (D6052/2)
U0¥G53208
Auto-generation parameter value: Sheet synchronous width (L)
D/P
D5062
Sheet length 50% calculated value (D6052/2)
K2
D5072
Sheet synchronous width 50% (D6052/2)
D-P
D6052
[GOT setting] Automatic Cam generation Sheet length
D5072
Sheet synchronous width 50% (D6052/2)
U0¥G53212
Auto-generation parameter value: Synchronous start position (L)
DMOVP
K2513
U0¥G53210
Auto-generation parameter value: Synchronous axis length (L)
D-P
D6050
[GOT setting] Automatic Cam generation acceleration rate over synchronous section
K10000
D5050
Acceleration rate over synchronous section calculated value (change value)
MOVP
D5050
Acceleration rate over synchronous section calculated value (change value)
U0¥G53214
Auto-generation parameter value: Acceleration rate over synchronous section
SET
M500
Advanced 2 Cam auto -generation command
M500
Advanced 2 Cam auto-generation command
MOVP
K1
U0¥G53200
Cam auto-generation request
RST
M500
Advanced 2 Cam auto -generation command

*** [Advanced 2] Cam data reference program *****

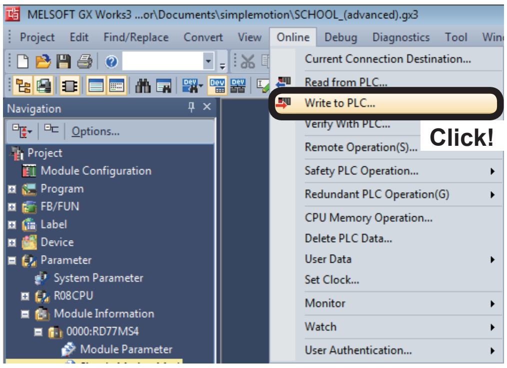
(4916) M59 [PB for GOT] Cam data reference

Step	Contact	Instruction	Source	Destination	Comment
(4916)	M59 [PB for GOT] Cam data reference	MOVP	K1	U0¥G45000	Cam data operation request
		MOVP	K5	U0¥G45001	Operation Cam No.
		MOVP	K1	U0¥G45002	Cam data start position
		MOVP	K512	U0¥G45003	Cam data operation points
		MOVP	K1	U0¥G45004	Cam data format

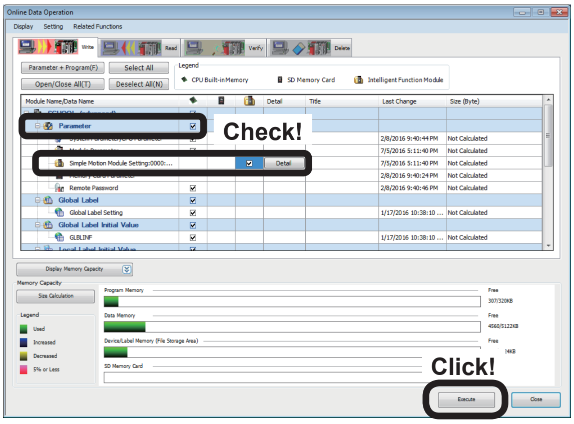
7.7 Writing to the PLC

Write settings data to the CPU module.

(1) Connect the personal computer and CPU module with the USB cable, and set the RUN/STOP/RESET switch of the CPU module to STOP.

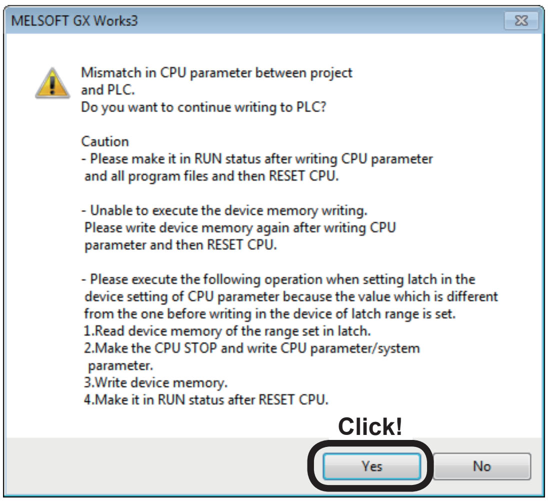


(2) Click [Online] → [Write to PLC…] of GX Works3.



(3) An Online Data Operation dialog box appears.
Check the "Parameter " and the "Simple Motion Module Setting:0000:RD77MS".

(4) Click the [Execute] button.

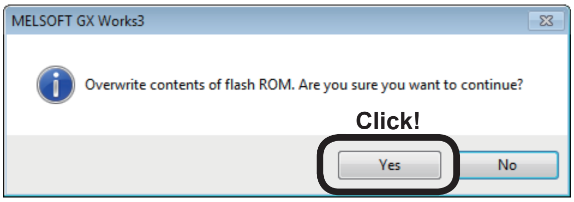


(5) The message shown on the left appears, press [Yes].

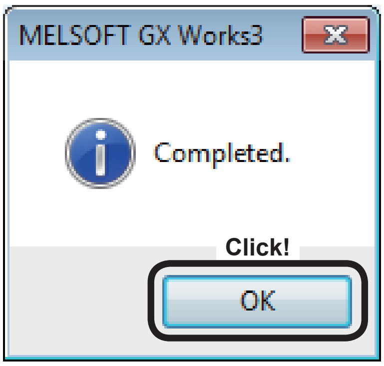
Go to next page

From previous page

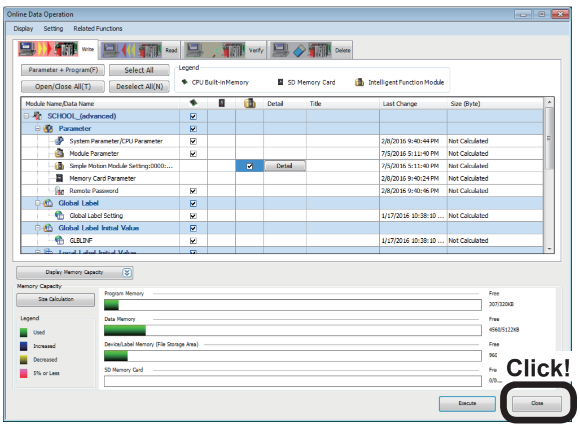
(6) The dialog box for writing to the PLC appears, and writing is started.
The message shown on the left appears, press the Yes to all button.



The message shown left is displayed in the middle of writing. Click the Yes button.



(7) After the completion of writing, the message shown left is displayed. Click the OK button.



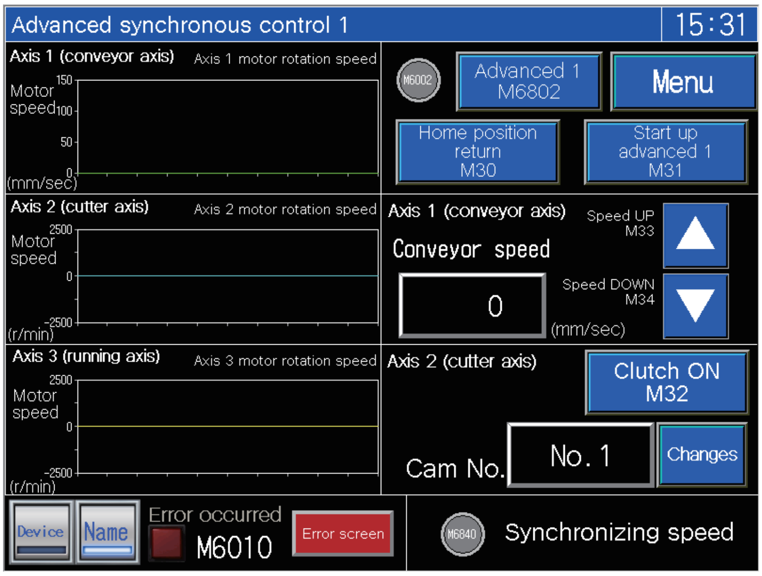
(8) Click the Close button in the Online Data Operation dialog box to close the dialog box.

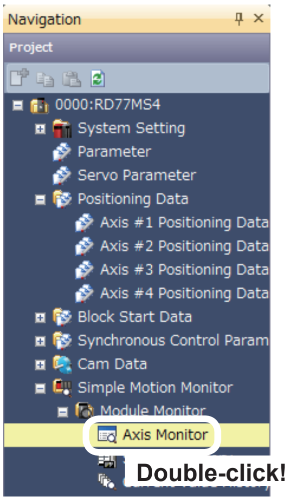
(9) Reset the CPU module. (Hold the RUN/STOP/RESET switch on the RESET side.)

7.8 Demonstration Machine Operation

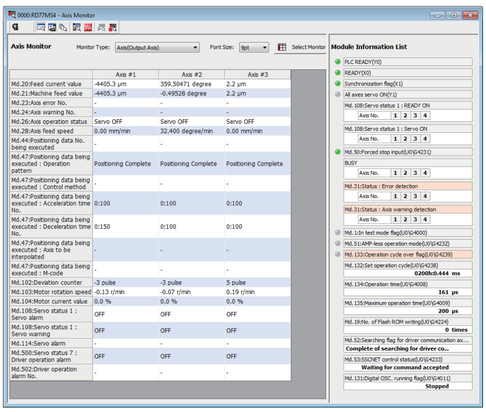
7.8.1 Advanced synchronous control 1: Travel cutter

Demonstration machine operation panel Advanced synchronous control 1 screen





(1) In the [Navigation window] of the Simple Motion setting tool, select [Module Monitor], and double-click [Axis Monitor].



(2) The monitor window axis monitor appears. Refer to Appendix 5 for details.

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From previous page

⇩

(3) Set the CPU module to "RUN".

⇩

[Servo ON]

(4) If the servo is not on, touch [Servo ON M1000] at the demonstration machine operation panel.
The servo status for axes 1 to 3 changes to ready.

Demonstration machine operation panel

Servo ON
M1000

⇩

(5) Touch [Advanced synchronous control 1].

⇩

[Switching to advanced synchronous control 1 and clutch operation]

(6) Touch [Advanced 1 M6802] on the Advanced synchronous control 1 screen. And the, touch [Home position return M30].

Next, touch [Start up advanced 1 M31] to start up the demonstration machine.

Touch [▲][▼] to ensure that conveyor speed change operation is possible.

Touch [Clutch ON M32], and ensure that clutch operation is possible.

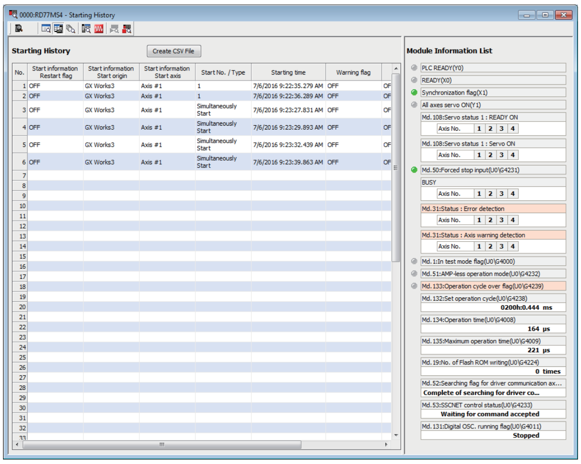
• Touch [Clutch ON M32] during operation with advanced synchronous control.
This turns off the clutch and the cutting movement (the rotation of the disc) stops.
Touching the switch for [Clutch OFF M32] again causes the disc to start the cutting movement again.
* The clutch can turn on and off the cutter shaft only. (It does not turn on and off the travel shaft.)

⇩

Error check operation

Simple Motion setting tool
[Navigation window]
⇓
[Module monitor]
⇓
[Starting history]

Starting history



⇩

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From previous page

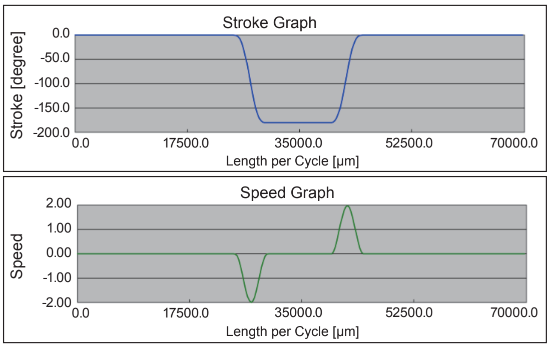
[Set cam No. to "2"]

(7) Press Changes of the "Cam No.". The numerical input screen appears. There, change "1" to "2".

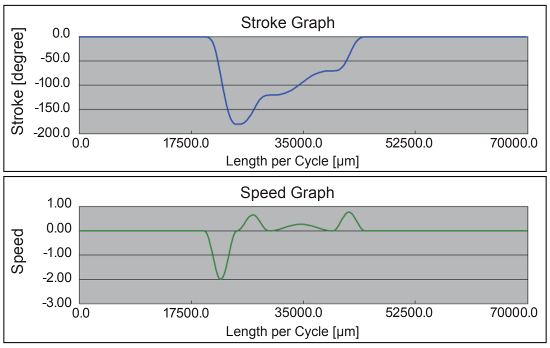
[Contents to be checked]

(8) Confirm that the disc moves differently from the cam No. 1.
Refer to the following cam data graphs.
(Note that the disc rotates in one step with the cam No. 1 while it rotates in two steps with the cam No. 2.)

Cam No. 1



Cam No. 2



[Finishing advanced synchronous control 1]

(9) Touch Start up advanced 1 M31 to end advanced 1 operation.

Touch Advanced 1 M6802 to end all operations.

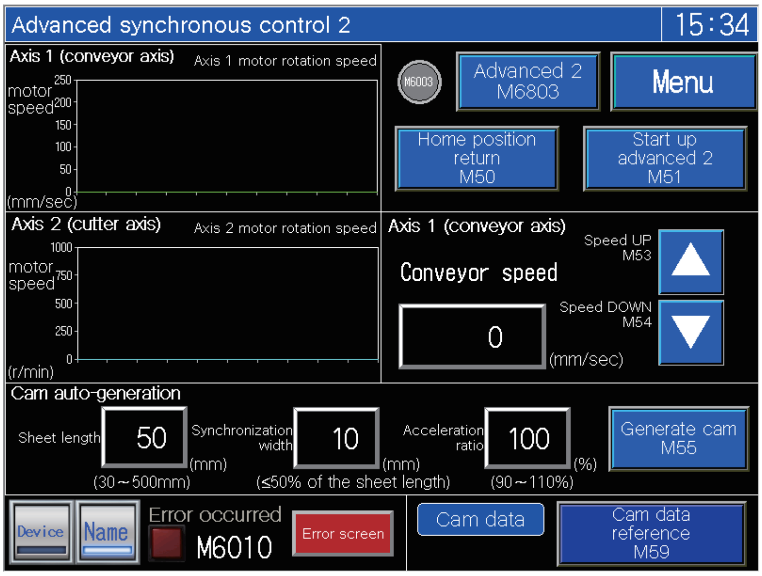
(10) Practice of the advanced control 1 is complete when all of these operations are finished.

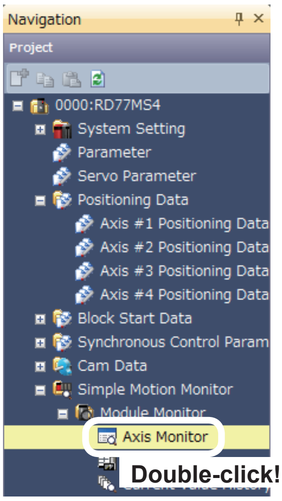
POINT

- Check that the clutch controls to turn ON/OFF the cutting movement.
- Change the conveyor speed to see that the travel shaft synchronizes with the conveyor shaft.
- Observe that the disc rotates according to the cam data "No. 1" and "No. 2" and it rotates differently between the two.

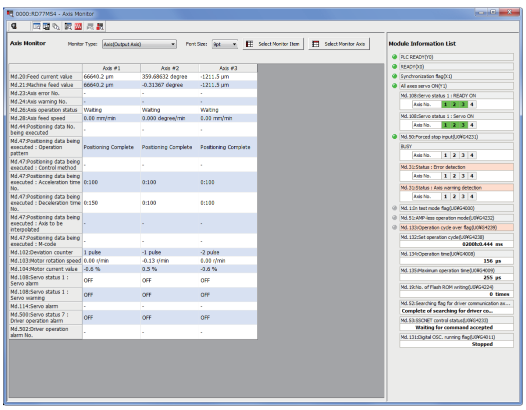
7.8.2 Advanced synchronous control 2: Rotary cutter

Demonstration machine operation panel   Advanced synchronous control 2 screen





(1) In the [Navigation window] of the Simple Motion setting tool, select [Module Monitor], and double-click [Axis Monitor].



(2) The monitor window axis monitor appears. Refer to Appendix 5 for details.

Go to next page

From previous page

(3) Set the CPU module to "RUN".

[Servo ON]

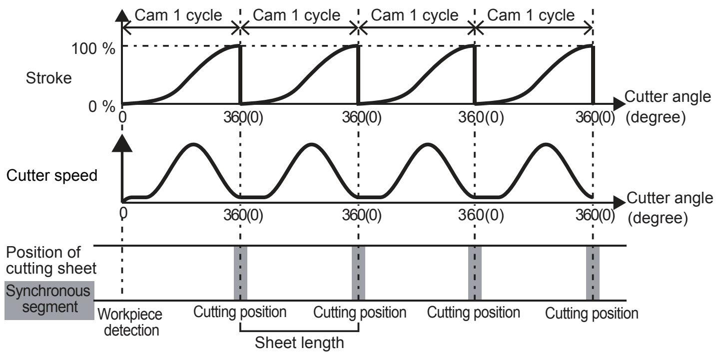
(4) If the servo is not on, touch [Servo ON M1000] at the demonstration machine operation panel.
The servo status for axes 1 to 3 changes to ready.

Demonstration machine operation panel [Servo ON M1000]

(5) Touch [Advanced synchronous control 2].

[Switching to advanced synchronous control 2]

(6) Touch [Advanced 2 M6803] on the Advanced synchronous control 2 screen. And then, touch [Home position return M50].
Next, touch [Start up advanced 2 M51] to start up the demonstration machine.
The initial setting of the cam automatic generation parameters is such that the demonstration machine carries out the cutting movement on workpieces that are laid out 50 mm apart from the others. Now, check this operation.



You may change the sheet length as you like. Note, however, that making it a multiple of 50 mm makes it easy for you to check the operation.

The initial settings of the cam automatic generation parameters on the demonstration machine motion are as follows.

- Type of cam automatic generation: Cam for rotary cutter
- Acceleration rate over synchronous section: 100 % (Reaches the same speed as the conveyor speed at the rate of 100 %)
- Sheet length: 50.0 mm
- Sheet synchronous width: 10.0 mm
- Synchronous axis length: 251.3 mm (circumference)
- Synchronization start position: 45.0 mm

Next, change the conveyor speed.

- Touch [▲][▼] to ensure that conveyor speed change operation is possible.
- Check that the synchronous cutting movement continues even if the conveyor speed changes.

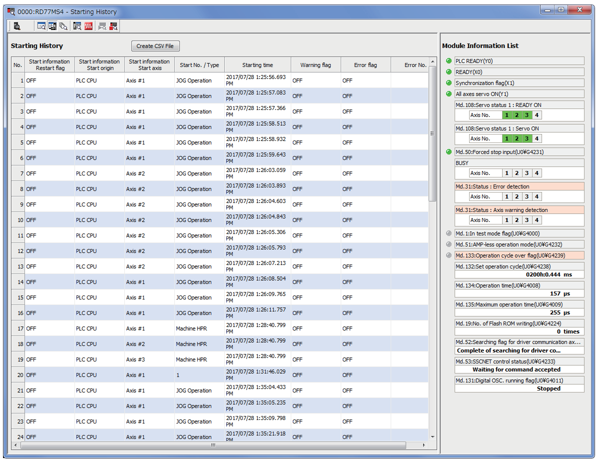
Go to next page

From previous page

Error check operation

Simple Motion setting tool
[Navigation window]
⇓
[Module monitor]
⇓
[Starting history]

Starting history



[Change cam automatic generation parameters]

(7) Change the three parameters as follows.
- Sheet length: (Length of sheet to be cut off)
- Sheet synchronous width: (The width of segment where the conveyor speed and the angular speed synchronize with the other when the cutter carries out the cutting movement)
- Acceleration rate over synchronous section: (The rate of increase in the angular speed of the disc with reference to the conveyor speed over the synchronous width. It reaches the same speed as the conveyor speed at the rate of 100 %.)

The initial parameter settings are 50.0 mm for the sheet length, 10.0 mm for the synchronous width and 100 % for the acceleration rate.

Touch [Start up advanced 2 M51] to stop the demonstration machine motion. Change the sheet length to 100.0 mm and synchronous width to 30.0 mm.
In each case, touch the numeric figure to call up the numerical input screen and change the parameters.
Touch [Generate cam M55] to generate the cam data. Next, touch [Start up advanced 2 M51] once again to start up the demonstration machine.

[Contents to be checked]

(8) Check that the demonstration machine carries out the cutting movement on every other workpiece which is aligned with an interval of 50 mm (skipping one every time).
Also, check that the synchronous section is extended.

[Finishing advanced synchronous control 2]

(9) Touch [Start up advanced 2 M51] to end advanced synchronous control 2 operation.

Touch [Advanced 2 M6803] to end all operations.

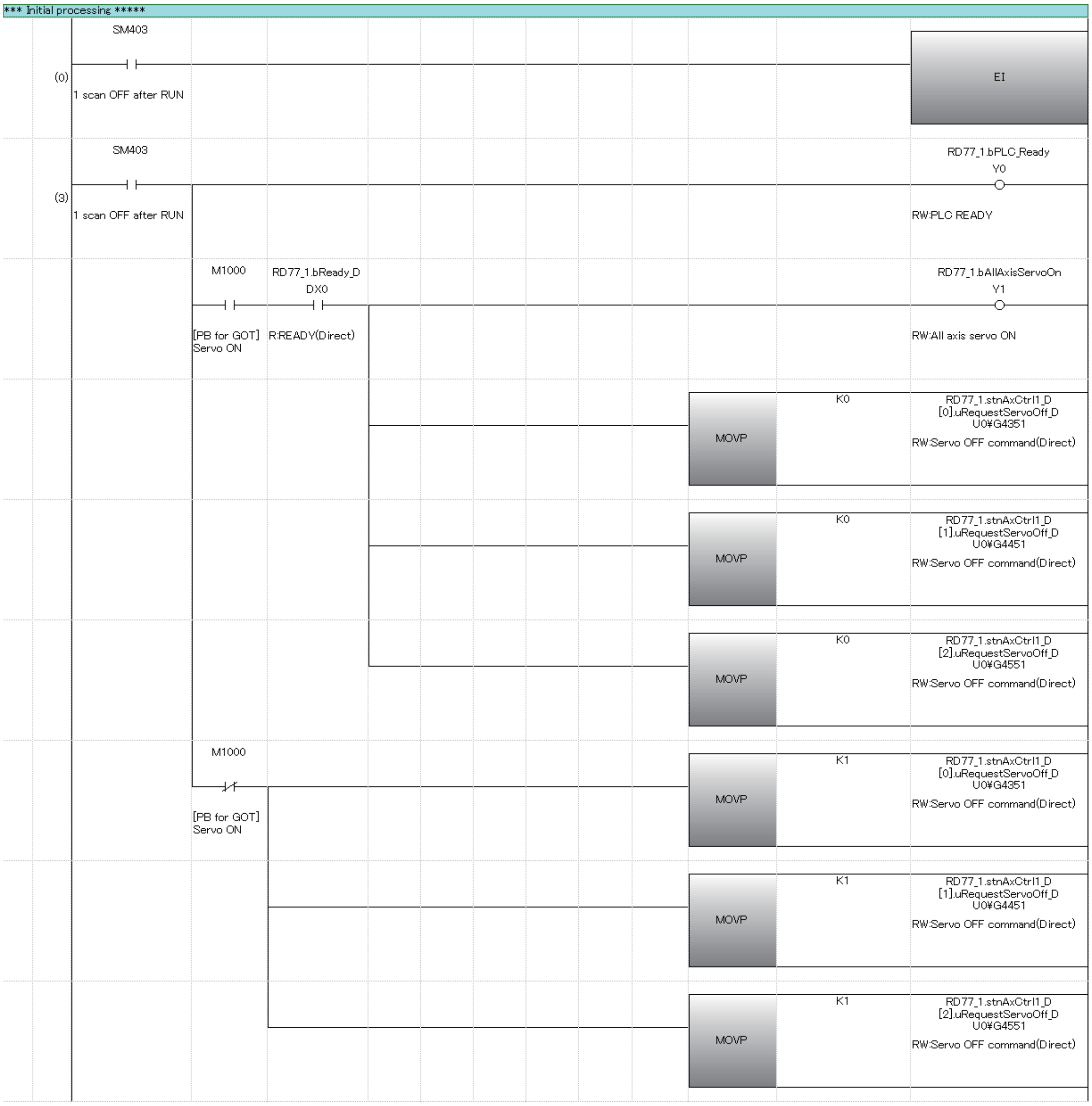
(10) Practice of the advanced control 2 is complete when all of these operations are finished.

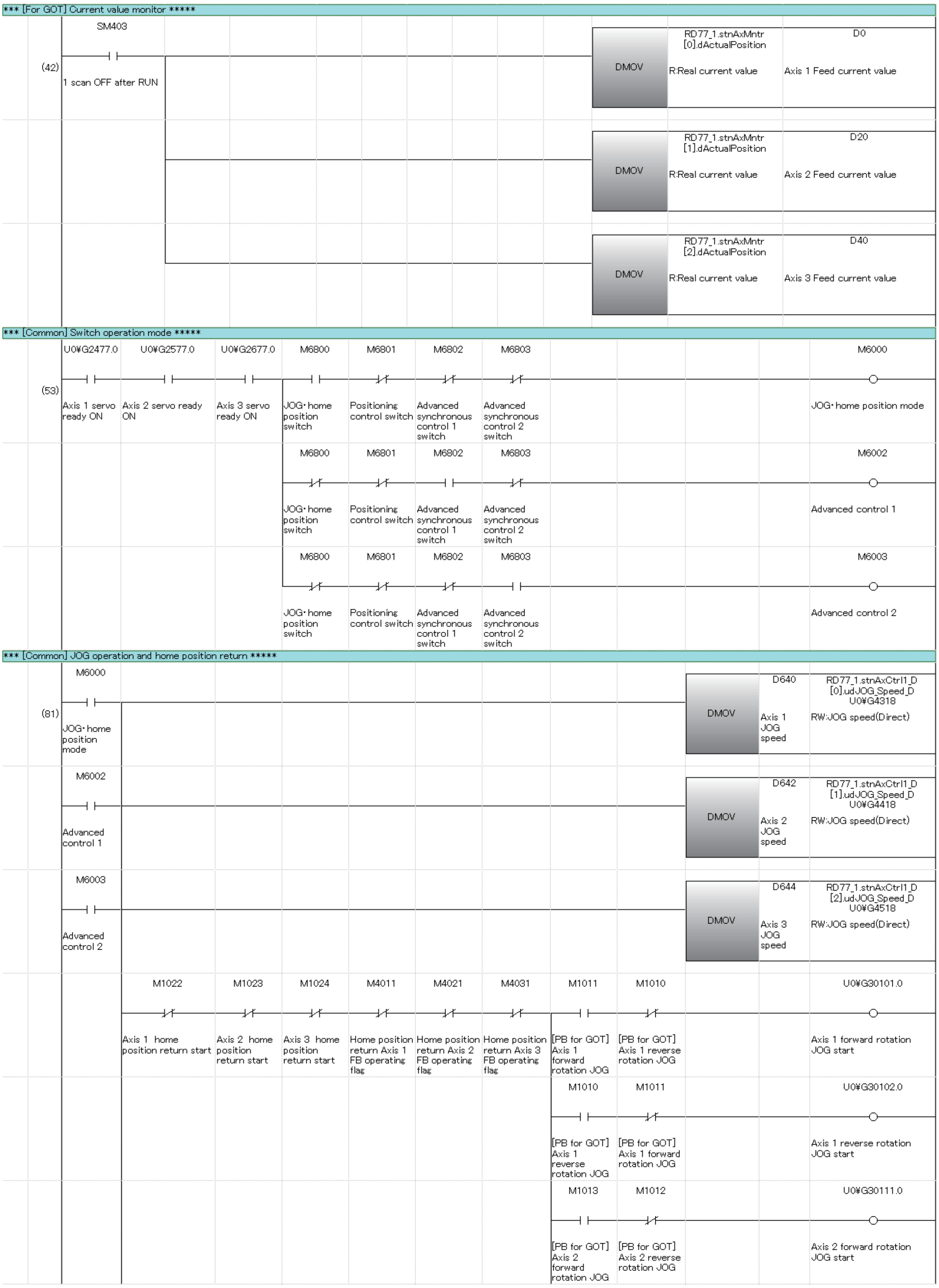
POINT

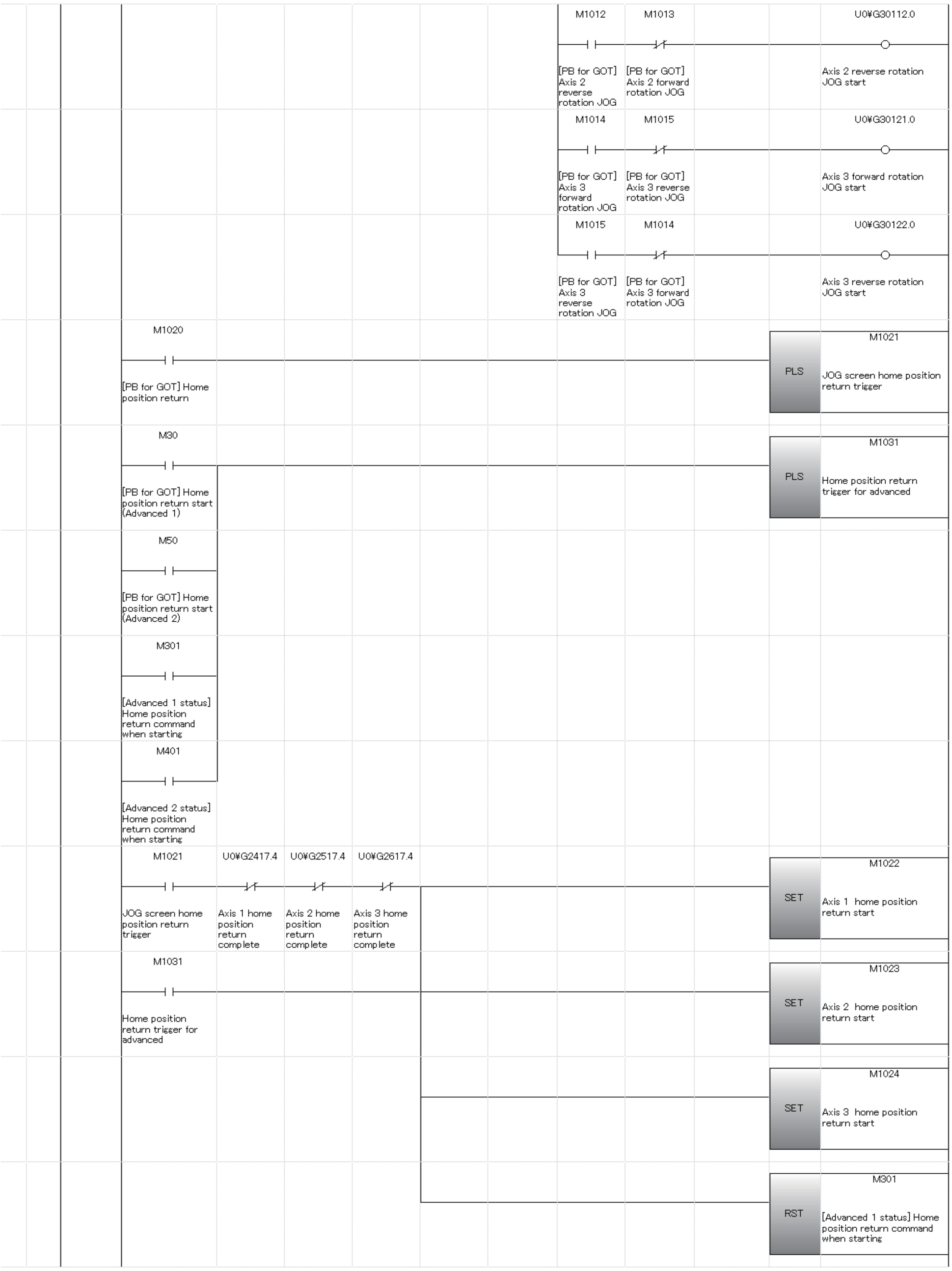
- Check that the disc follows the rotary cutter movement as motion diagram in (6).
- Change the conveyor speed to see that the cutter synchronizes with the conveyor.
- Change the cam automatic generation parameters to see that the motion of the cutter shaft changes accordingly.

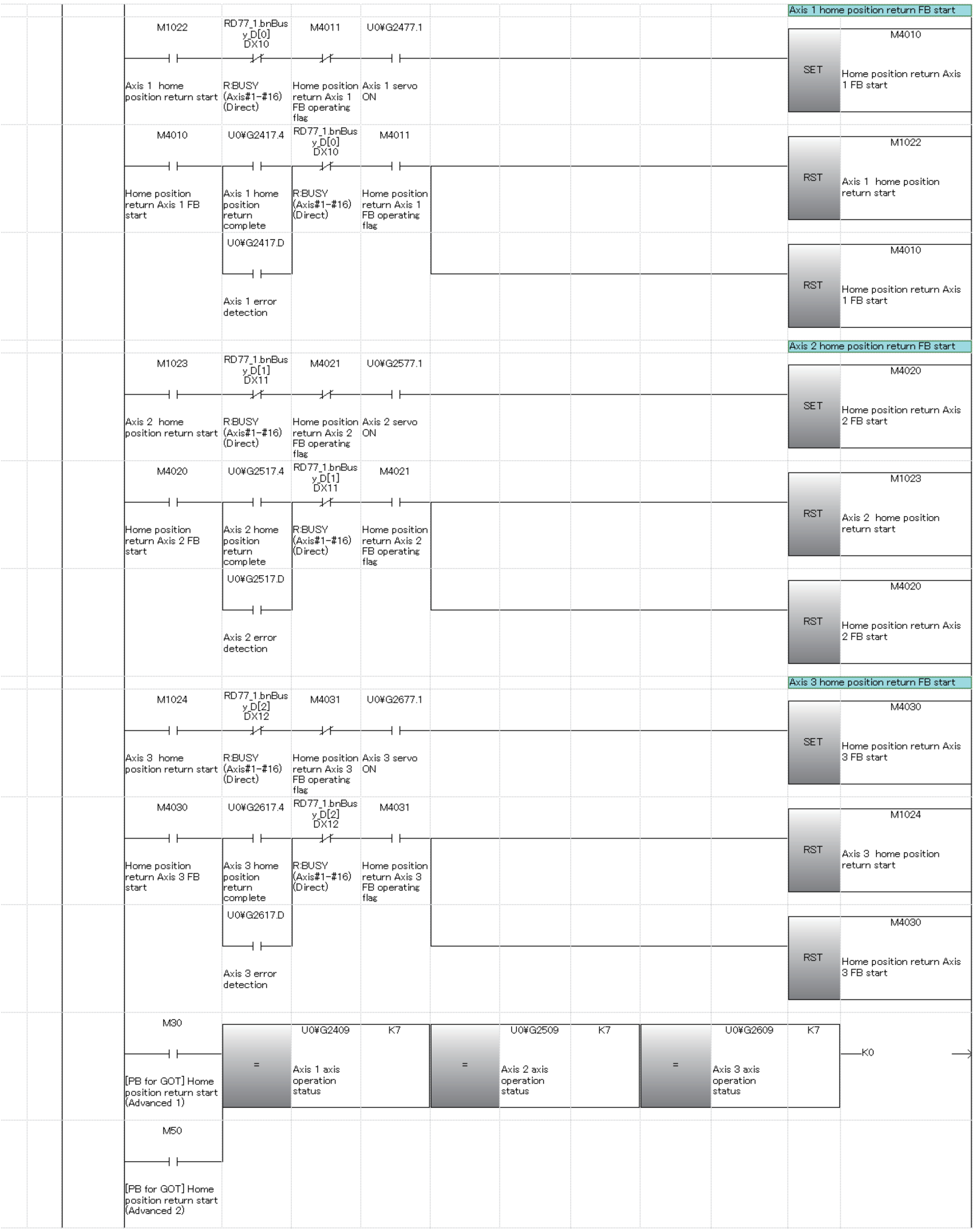
7.9 Sequence Program List

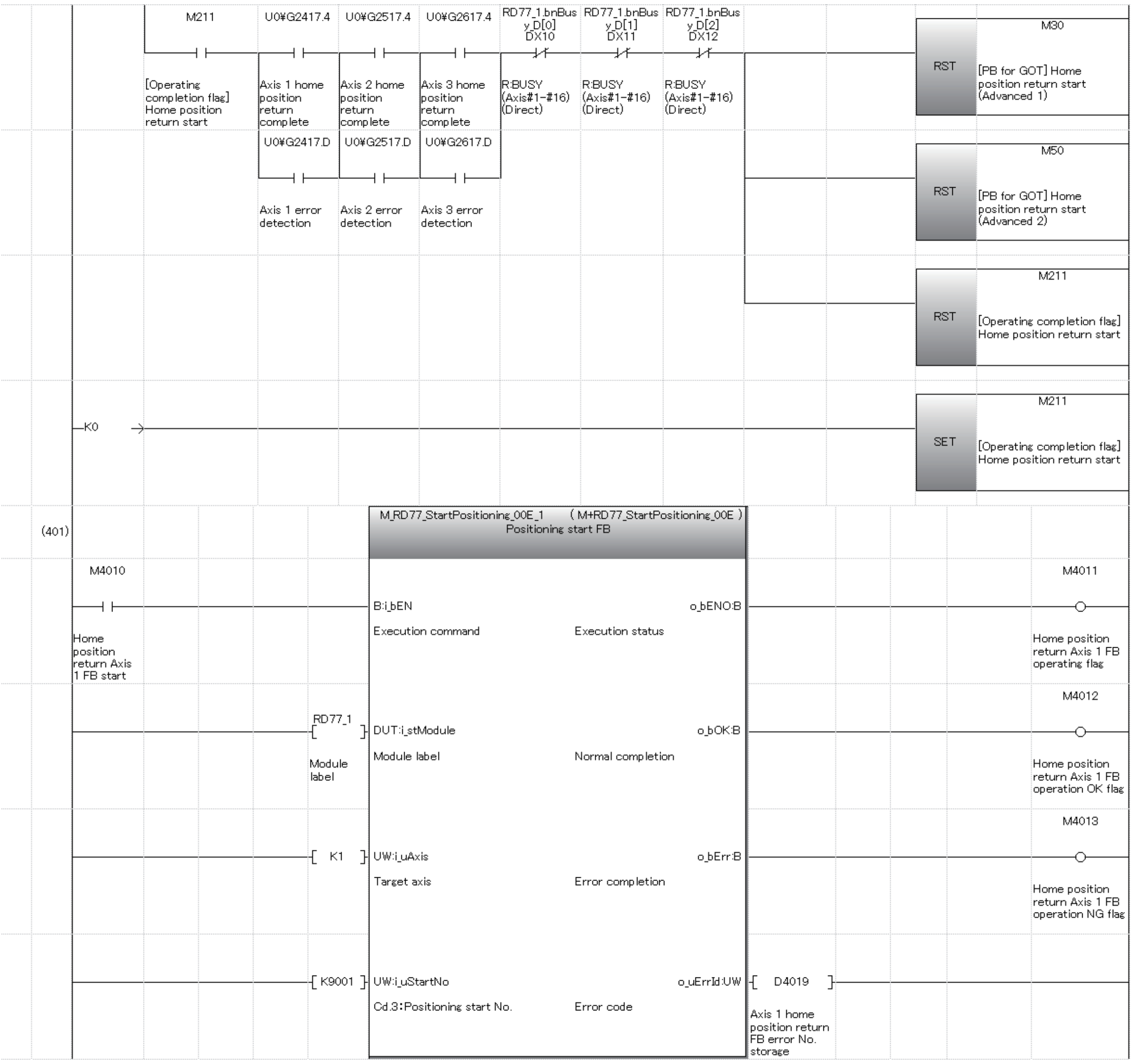
This shows a list of the sequence programs.

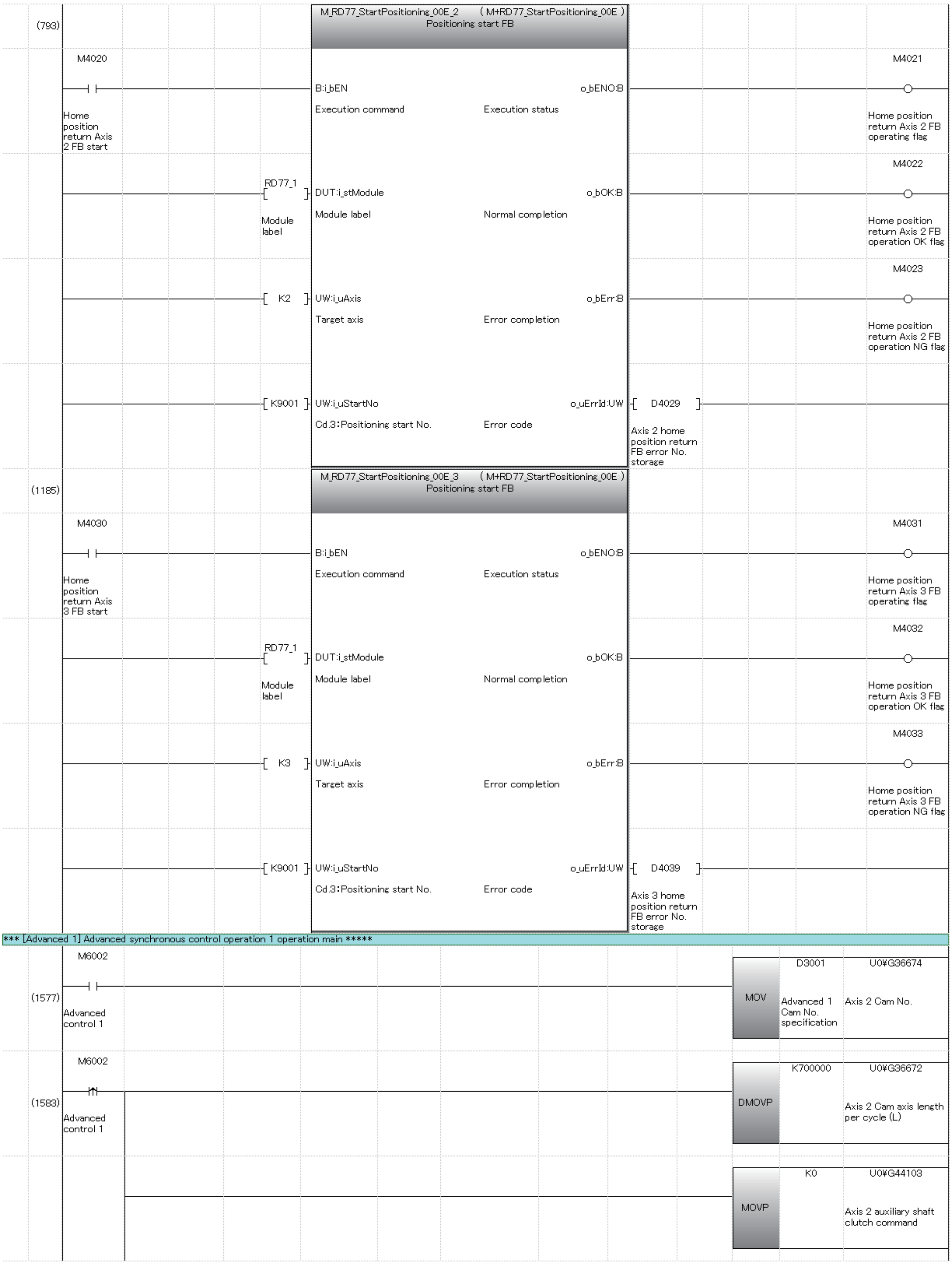


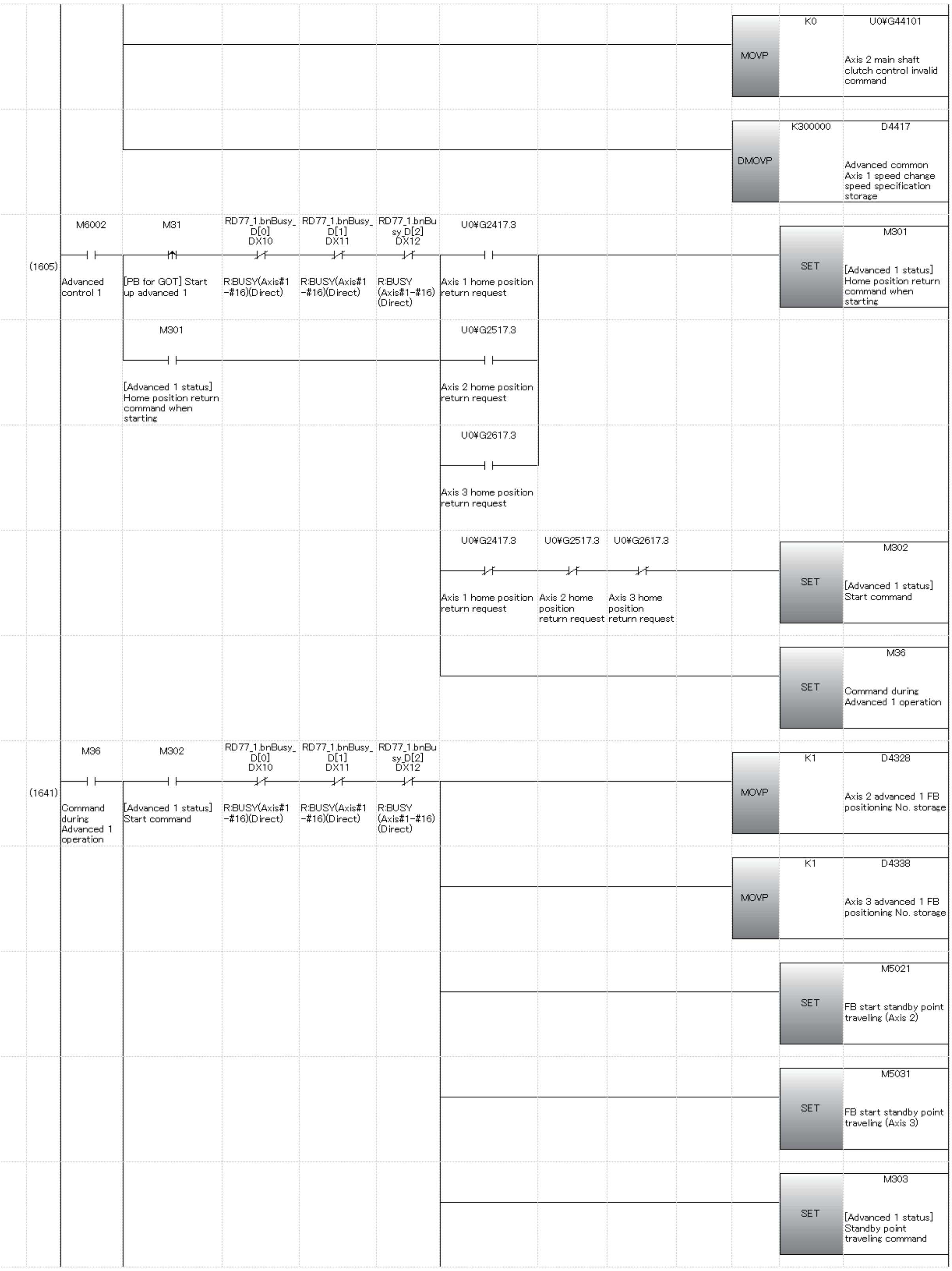

*** [For GOT] Current value monitor *****
(42)
SM403
1 scan OFF after RUN
DMOV
RD77_1.stnAxMntr [0].dActualPosition
R:Real current value
D0
Axis 1 Feed current value
DMOV
RD77_1.stnAxMntr [1].dActualPosition
R:Real current value
D20
Axis 2 Feed current value
DMOV
RD77_1.stnAxMntr [2].dActualPosition
R:Real current value
D40
Axis 3 Feed current value
*** [Common] Switch operation mode *****
(53)
U0¥G2477.0
Axis 1 servo ready ON
U0¥G2577.0
Axis 2 servo ready ON
U0¥G2677.0
Axis 3 servo ready ON
M6800
JOG･home position switch
M6801
Positioning control switch
M6802
Advanced synchronous control 1 switch
M6803
Advanced synchronous control 2 switch
M6000
JOG･home position mode
M6002
Advanced control 1
M6003
Advanced control 2
*** [Common] JOG operation and home position return *****
(81)
M6000
JOG･home position mode
DMOV
D640
Axis 1 JOG speed
RD77_1.stnAxCtrl1_D [0].udJOG_Speed_D
U0¥G4318
RW:JOG speed(Direct)
M6002
Advanced control 1
DMOV
D642
Axis 2 JOG speed
RD77_1.stnAxCtrl1_D [1].udJOG_Speed_D
U0¥G4418
RW:JOG speed(Direct)
M6003
Advanced control 2
DMOV
D644
Axis 3 JOG speed
RD77_1.stnAxCtrl1_D [2].udJOG_Speed_D
U0¥G4518
RW:JOG speed(Direct)
M1022
Axis 1 home position return start
M1023
Axis 2 home position return start
M1024
Axis 3 home position return start
M4011
Home position return Axis 1 FB operating flag
M4021
Home position return Axis 2 FB operating flag
M4031
Home position return Axis 3 FB operating flag
M1011
[PB for GOT] Axis 1 forward rotation JOG
M1010
[PB for GOT] Axis 1 reverse rotation JOG
U0¥G30101.0
Axis 1 forward rotation JOG start
M1010
[PB for GOT] Axis 1 reverse rotation JOG
M1011
[PB for GOT] Axis 1 forward rotation JOG
U0¥G30102.0
Axis 1 reverse rotation JOG start
M1013
[PB for GOT] Axis 2 forward rotation JOG
M1012
[PB for GOT] Axis 2 reverse rotation JOG
U0¥G30111.0
Axis 2 forward rotation JOG start

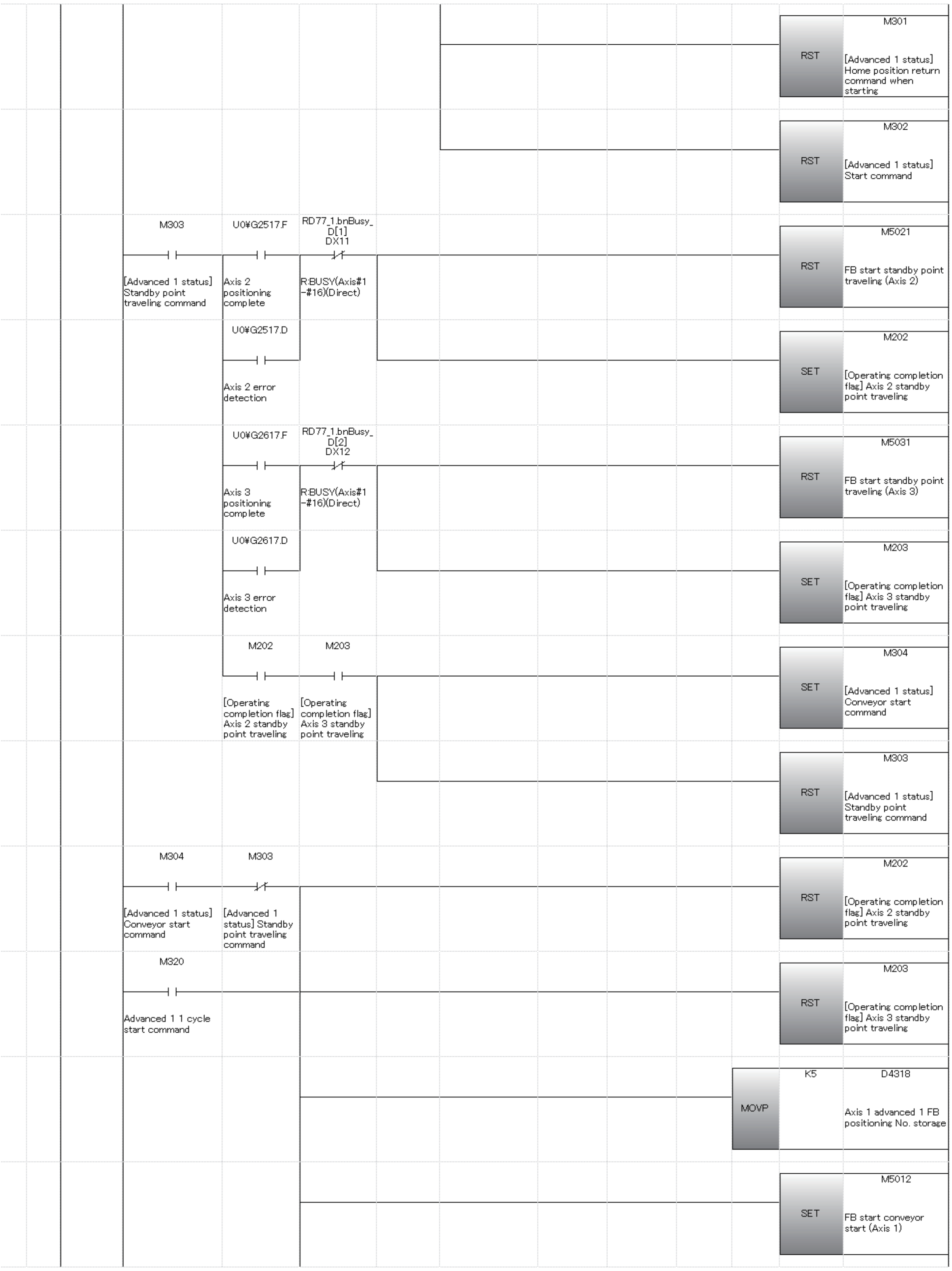

M1012
M1013
U0¥G30112.0
[PB for GOT] Axis 2 reverse rotation JOG
[PB for GOT] Axis 2 forward rotation JOG
Axis 2 reverse rotation JOG start
M1014
M1015
U0¥G30121.0
[PB for GOT] Axis 3 forward rotation JOG
[PB for GOT] Axis 3 reverse rotation JOG
Axis 3 forward rotation JOG start
M1015
M1014
U0¥G30122.0
[PB for GOT] Axis 3 reverse rotation JOG
[PB for GOT] Axis 3 forward rotation JOG
Axis 3 reverse rotation JOG start
M1020
[PB for GOT] Home position return
PLS
M1021
JOG screen home position return trigger
M30
[PB for GOT] Home position return start (Advanced 1)
PLS
M1031
Home position return trigger for advanced
M50
[PB for GOT] Home position return start (Advanced 2)
M301
[Advanced 1 status] Home position return command when starting
M401
[Advanced 2 status] Home position return command when starting
M1021
U0¥G2417.4
U0¥G2517.4
U0¥G2617.4
JOG screen home position return trigger
Axis 1 home position return complete
Axis 2 home position return complete
Axis 3 home position return complete
SET
M1022
Axis 1 home position return start
M1031
Home position return trigger for advanced
SET
M1023
Axis 2 home position return start
SET
M1024
Axis 3 home position return start
RST
M301
[Advanced 1 status] Home position return command when starting


Axis 1 home position return FB start
M1022
RD77_1.bnBusy_D[0] DX10
M4011
U0¥G2477.1
SET
M4010
Axis 1 home position return start
R:BUSY (Axis#1-#16) (Direct)
Home position return Axis 1 FB operating flag
Axis 1 servo ON
Home position return Axis 1 FB start
M4010
U0¥G2417.4
RD77_1.bnBusy_D[0] DX10
M4011
RST
M1022
Home position return Axis 1 FB start
Axis 1 home position return complete
R:BUSY (Axis#1-#16) (Direct)
Home position return Axis 1 FB operating flag
Axis 1 home position return start
U0¥G2417.D
RST
M4010
Axis 1 error detection
Home position return Axis 1 FB start
Axis 2 home position return FB start
M1023
RD77_1.bnBusy_D[1] DX11
M4021
U0¥G2577.1
SET
M4020
Axis 2 home position return start
R:BUSY (Axis#1-#16) (Direct)
Home position return Axis 2 FB operating flag
Axis 2 servo ON
Home position return Axis 2 FB start
M4020
U0¥G2517.4
RD77_1.bnBusy_D[1] DX11
M4021
RST
M1023
Home position return Axis 2 FB start
Axis 2 home position return complete
R:BUSY (Axis#1-#16) (Direct)
Home position return Axis 2 FB operating flag
Axis 2 home position return start
U0¥G2517.D
RST
M4020
Axis 2 error detection
Home position return Axis 2 FB start
Axis 3 home position return FB start
M1024
RD77_1.bnBusy_D[2] DX12
M4031
U0¥G2677.1
SET
M4030
Axis 3 home position return start
R:BUSY (Axis#1-#16) (Direct)
Home position return Axis 3 FB operating flag
Axis 3 servo ON
Home position return Axis 3 FB start
M4030
U0¥G2617.4
RD77_1.bnBusy_D[2] DX12
M4031
RST
M1024
Home position return Axis 3 FB start
Axis 3 home position return complete
R:BUSY (Axis#1-#16) (Direct)
Home position return Axis 3 FB operating flag
Axis 3 home position return start
U0¥G2617.D
RST
M4030
Axis 3 error detection
Home position return Axis 3 FB start
M30
=
U0¥G2409
K7
=
U0¥G2509
K7
=
U0¥G2609
K7
K0
[PB for GOT] Home position return start (Advanced 1)
Axis 1 axis operation status
Axis 2 axis operation status
Axis 3 axis operation status
M50
[PB for GOT] Home position return start (Advanced 2)

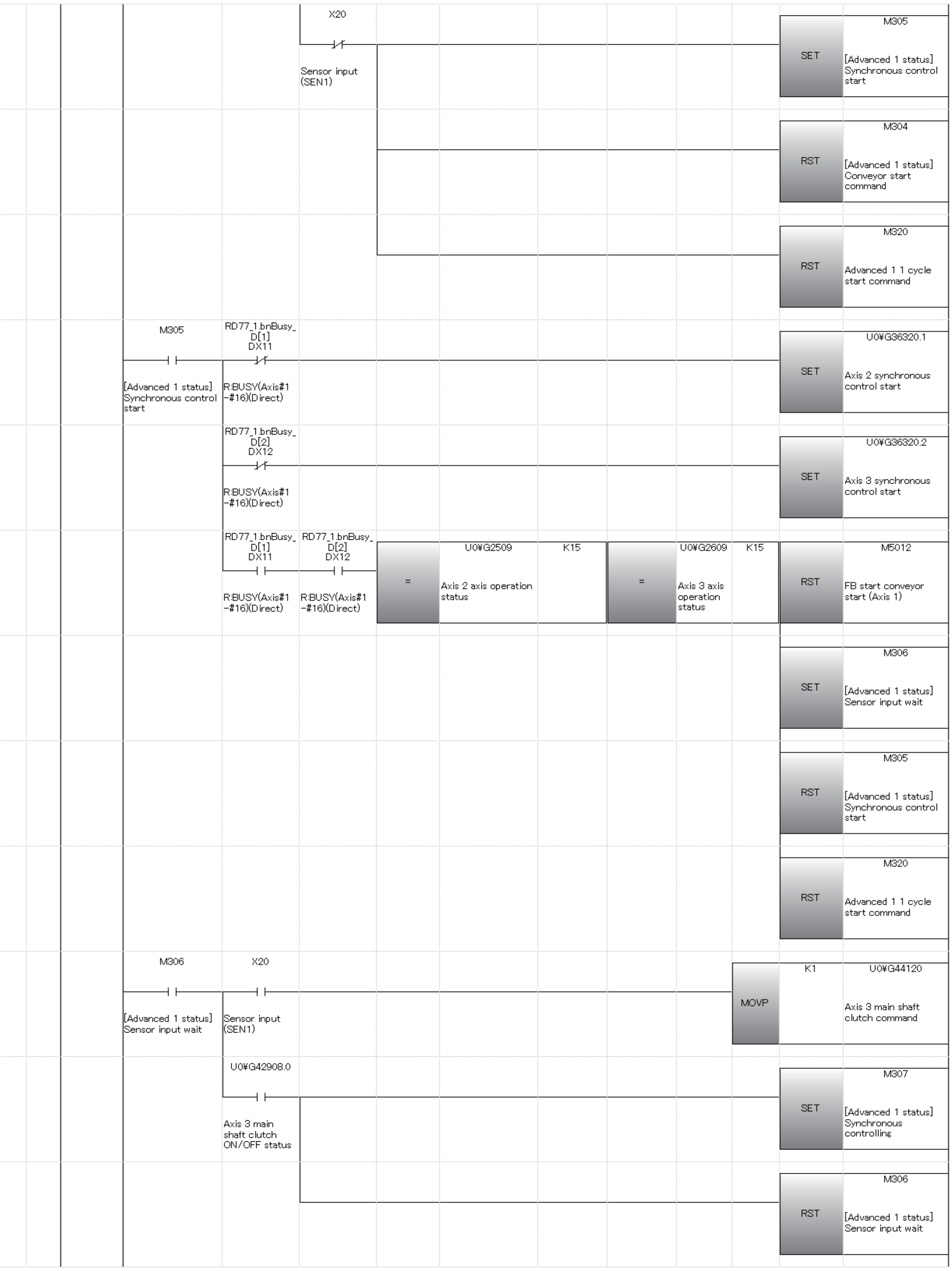

M211
U0¥G2417.4
U0¥G2517.4
U0¥G2617.4
RD77_1.bnBusy_D[0] DX10
RD77_1.bnBusy_D[1] DX11
RD77_1.bnBusy_D[2] DX12
[Operating completion flag] Home position return start
Axis 1 home position return complete
Axis 2 home position return complete
Axis 3 home position return complete
R:BUSY (Axis#1-#16) (Direct)
R:BUSY (Axis#1-#16) (Direct)
R:BUSY (Axis#1-#16) (Direct)
RST
M30
[PB for GOT] Home position return start (Advanced 1)
U0¥G2417.D
U0¥G2517.D
U0¥G2617.D
Axis 1 error detection
Axis 2 error detection
Axis 3 error detection
RST
M50
[PB for GOT] Home position return start (Advanced 2)
RST
M211
[Operating completion flag] Home position return start
K0
SET
M211
[Operating completion flag] Home position return start
(401)
M_RD77_StartPositioning_00E_1 (M+RD77_StartPositioning_00E)
Positioning start FB
M4010
Home position return Axis 1 FB start
B:i_bEN
Execution command
o_bENO:B
Execution status
M4011
Home position return Axis 1 FB operating flag
RD77_1
Module label
DUT:i_stModule
Module label
o_bOK:B
Normal completion
M4012
Home position return Axis 1 FB operation OK flag
K1
UW:i_uAxis
Target axis
o_bErr:B
Error completion
M4013
Home position return Axis 1 FB operation NG flag
K9001
UW:i_uStartNo
Cd.3:Positioning start No.
o_uErrId:UW
Error code
D4019
Axis 1 home position return FB error No. storage

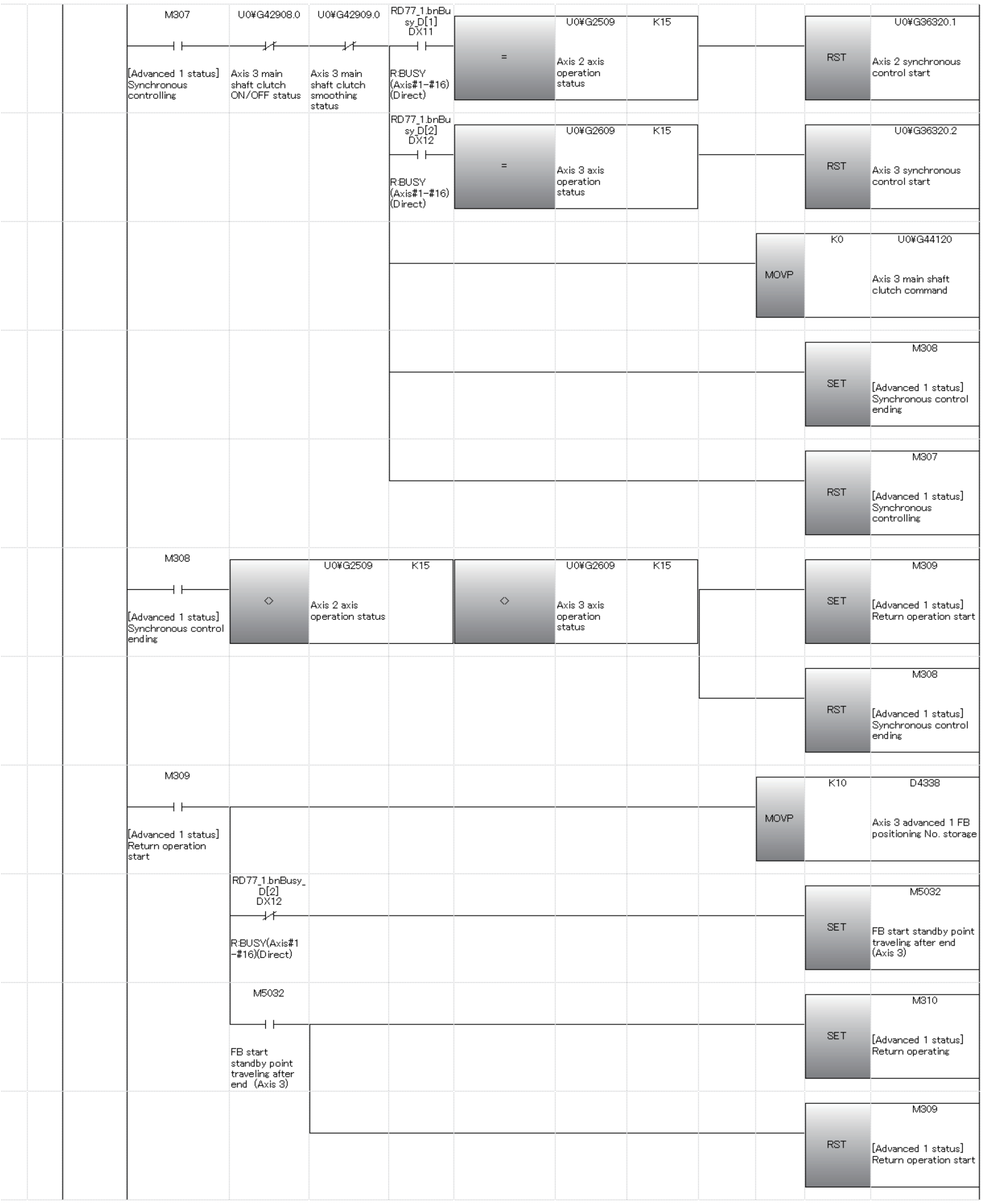

(793)
M_RD77_StartPositioning_00E_2 (M+RD77_StartPositioning_00E)
Positioning start FB
M4020
Home position return Axis 2 FB start
B:i_bEN
Execution command
o_bENO:B
Execution status
M4021
Home position return Axis 2 FB operating flag
RD77_1
Module label
DUT:i_stModule
Module label
o_bOK:B
Normal completion
M4022
Home position return Axis 2 FB operation OK flag
K2
UW:i_uAxis
Target axis
o_bErr:B
Error completion
M4023
Home position return Axis 2 FB operation NG flag
K9001
UW:i_uStartNo
Cd.3:Positioning start No.
o_uErrId:UW
Error code
D4029
Axis 2 home position return FB error No. storage
(1185)
M_RD77_StartPositioning_00E_3 (M+RD77_StartPositioning_00E)
Positioning start FB
M4030
Home position return Axis 3 FB start
B:i_bEN
Execution command
o_bENO:B
Execution status
M4031
Home position return Axis 3 FB operating flag
RD77_1
Module label
DUT:i_stModule
Module label
o_bOK:B
Normal completion
M4032
Home position return Axis 3 FB operation OK flag
K3
UW:i_uAxis
Target axis
o_bErr:B
Error completion
M4033
Home position return Axis 3 FB operation NG flag
K9001
UW:i_uStartNo
Cd.3:Positioning start No.
o_uErrId:UW
Error code
D4039
Axis 3 home position return FB error No. storage
*** [Advanced 1] Advanced synchronous control operation 1 operation main *****
(1577)
M6002
Advanced control 1
MOV
D3001
Advanced 1 Cam No. specification
U0¥G36674
Axis 2 Cam No.
(1583)
M6002
Advanced control 1
DMOVP
K700000
U0¥G36672
Axis 2 Cam axis length per cycle (L)
MOVP
K0
U0¥G44103
Axis 2 auxiliary shaft clutch command

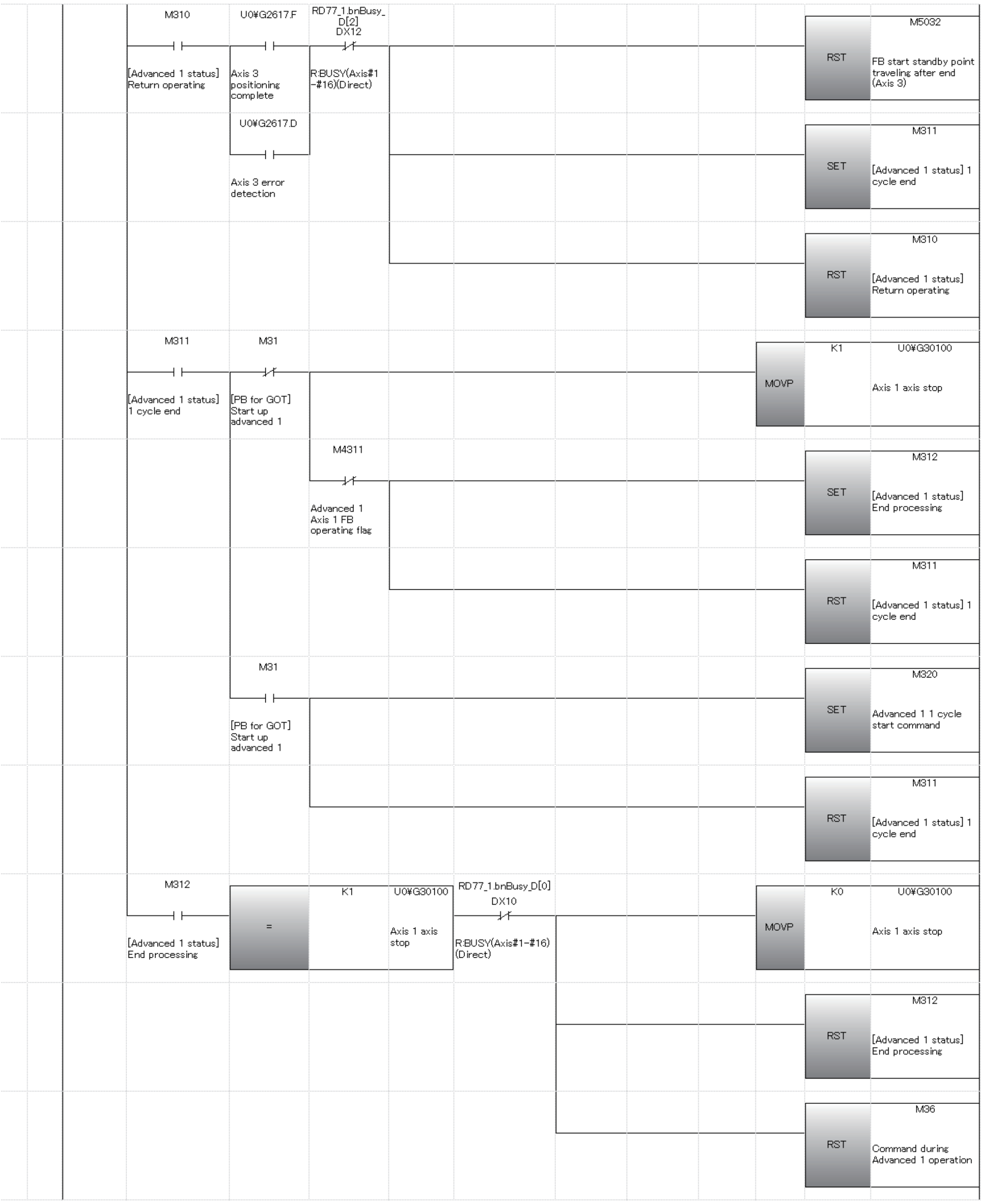

MOVP
K0
U0¥G44101
Axis 2 main shaft clutch control invalid command
DMOVP
K300000
D4417
Advanced common Axis 1 speed change speed specification storage
(1605)
M6002
Advanced control 1
M31
[PB for GOT] Start up advanced 1
RD77_1.bnBusy_D[0] DX10
R:BUSY(Axis#1-#16)(Direct)
RD77_1.bnBusy_D[1] DX11
R:BUSY(Axis#1-#16)(Direct)
RD77_1.bnBusy_D[2] DX12
R:BUSY (Axis#1-#16) (Direct)
U0¥G2417.3
Axis 1 home position return request
SET
M301
[Advanced 1 status] Home position return command when starting
M301
[Advanced 1 status] Home position return command when starting
U0¥G2517.3
Axis 2 home position return request
U0¥G2617.3
Axis 3 home position return request
U0¥G2417.3
U0¥G2517.3
U0¥G2617.3
Axis 1 home position return request
Axis 2 home position return request
Axis 3 home position return request
SET
M302
[Advanced 1 status] Start command
SET
M36
Command during Advanced 1 operation
(1641)
M36
Command during Advanced 1 operation
M302
[Advanced 1 status] Start command
RD77_1.bnBusy_D[0] DX10
R:BUSY(Axis#1-#16)(Direct)
RD77_1.bnBusy_D[1] DX11
R:BUSY(Axis#1-#16)(Direct)
RD77_1.bnBusy_D[2] DX12
R:BUSY (Axis#1-#16) (Direct)
MOVP
K1
D4328
Axis 2 advanced 1 FB positioning No. storage
MOVP
K1
D4338
Axis 3 advanced 1 FB positioning No. storage
SET
M5021
FB start standby point traveling (Axis 2)
SET
M5031
FB start standby point traveling (Axis 3)
SET
M303
[Advanced 1 status] Standby point traveling command

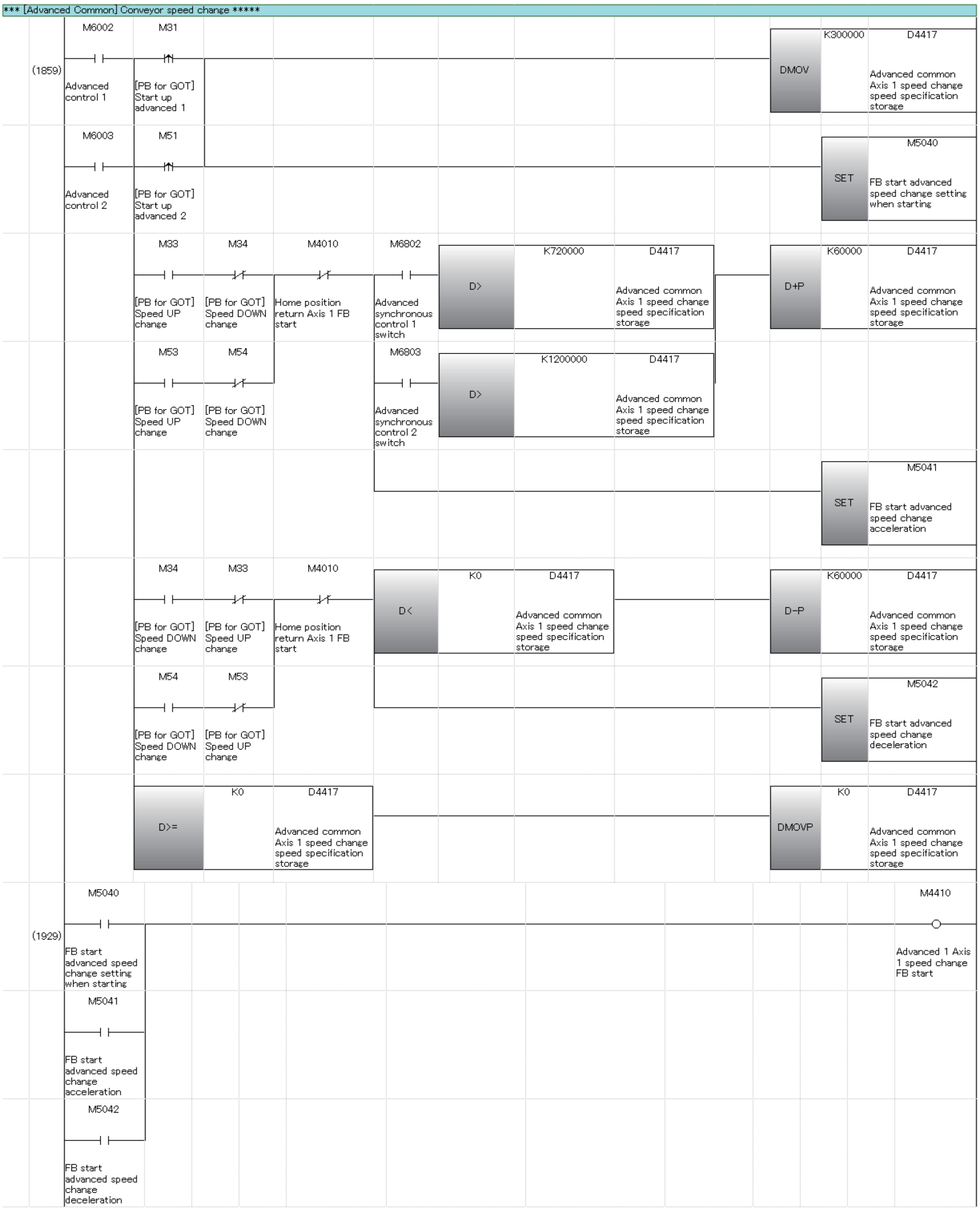


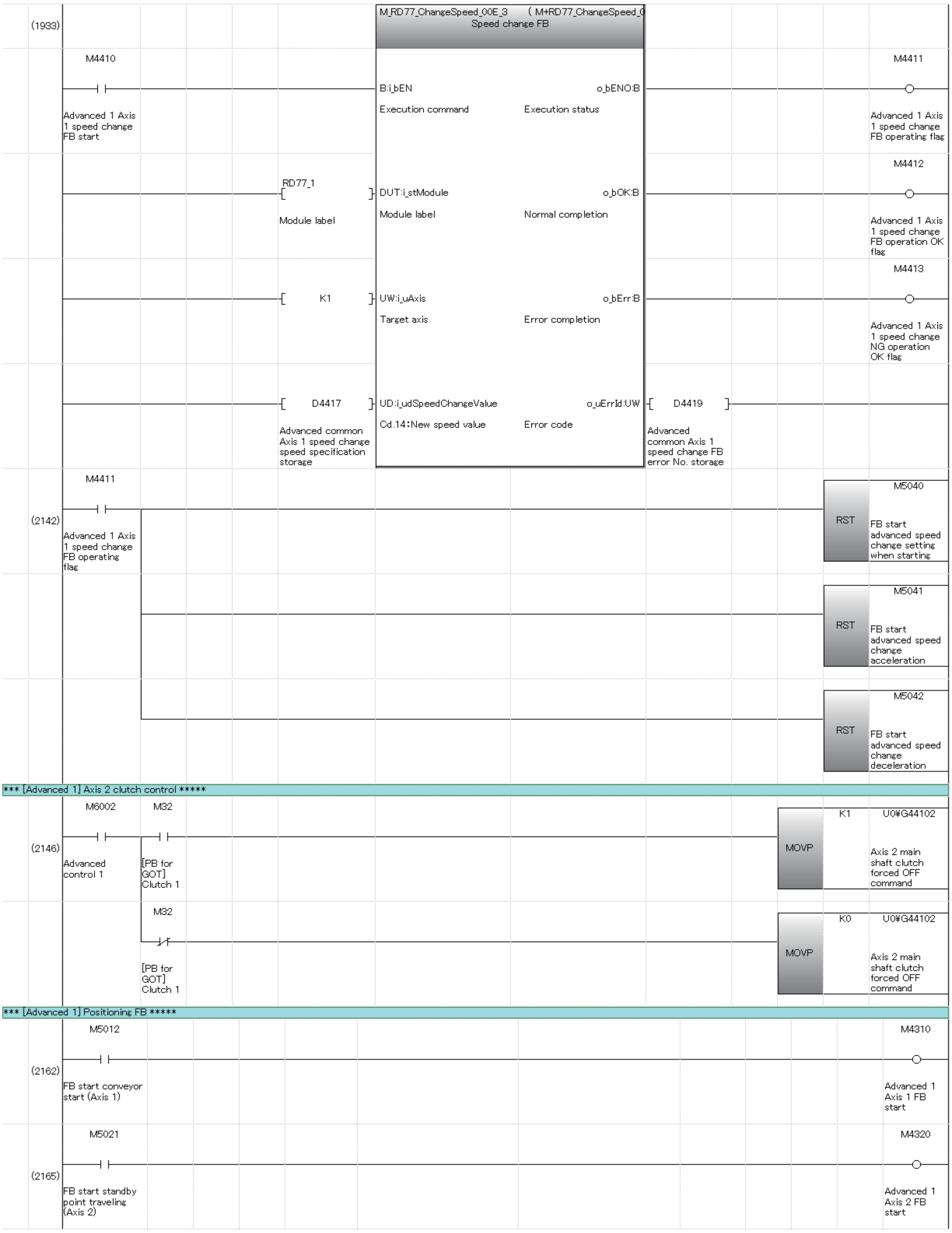
RST
M301
[Advanced 1 status] Home position return command when starting
RST
M302
[Advanced 1 status] Start command
M303
[Advanced 1 status] Standby point traveling command
U0¥G2517.F
Axis 2 positioning complete
RD77_1.bnBusy_D[1]
DX11
R:BUSY(Axis#1-#16)(Direct)
RST
M5021
FB start standby point traveling (Axis 2)
U0¥G2517.D
Axis 2 error detection
SET
M202
[Operating completion flag] Axis 2 standby point traveling
U0¥G2617.F
Axis 3 positioning complete
RD77_1.bnBusy_D[2]
DX12
R:BUSY(Axis#1-#16)(Direct)
RST
M5031
FB start standby point traveling (Axis 3)
U0¥G2617.D
Axis 3 error detection
SET
M203
[Operating completion flag] Axis 3 standby point traveling
M202
[Operating completion flag] Axis 2 standby point traveling
M203
[Operating completion flag] Axis 3 standby point traveling
SET
M304
[Advanced 1 status] Conveyor start command
RST
M303
[Advanced 1 status] Standby point traveling command
M304
[Advanced 1 status] Conveyor start command
M303
[Advanced 1 status] Standby point traveling command
RST
M202
[Operating completion flag] Axis 2 standby point traveling
M320
Advanced 1 1 cycle start command
RST
M203
[Operating completion flag] Axis 3 standby point traveling
MOVP
K5
D4318
Axis 1 advanced 1 FB positioning No. storage
SET
M5012
FB start conveyor start (Axis 1)

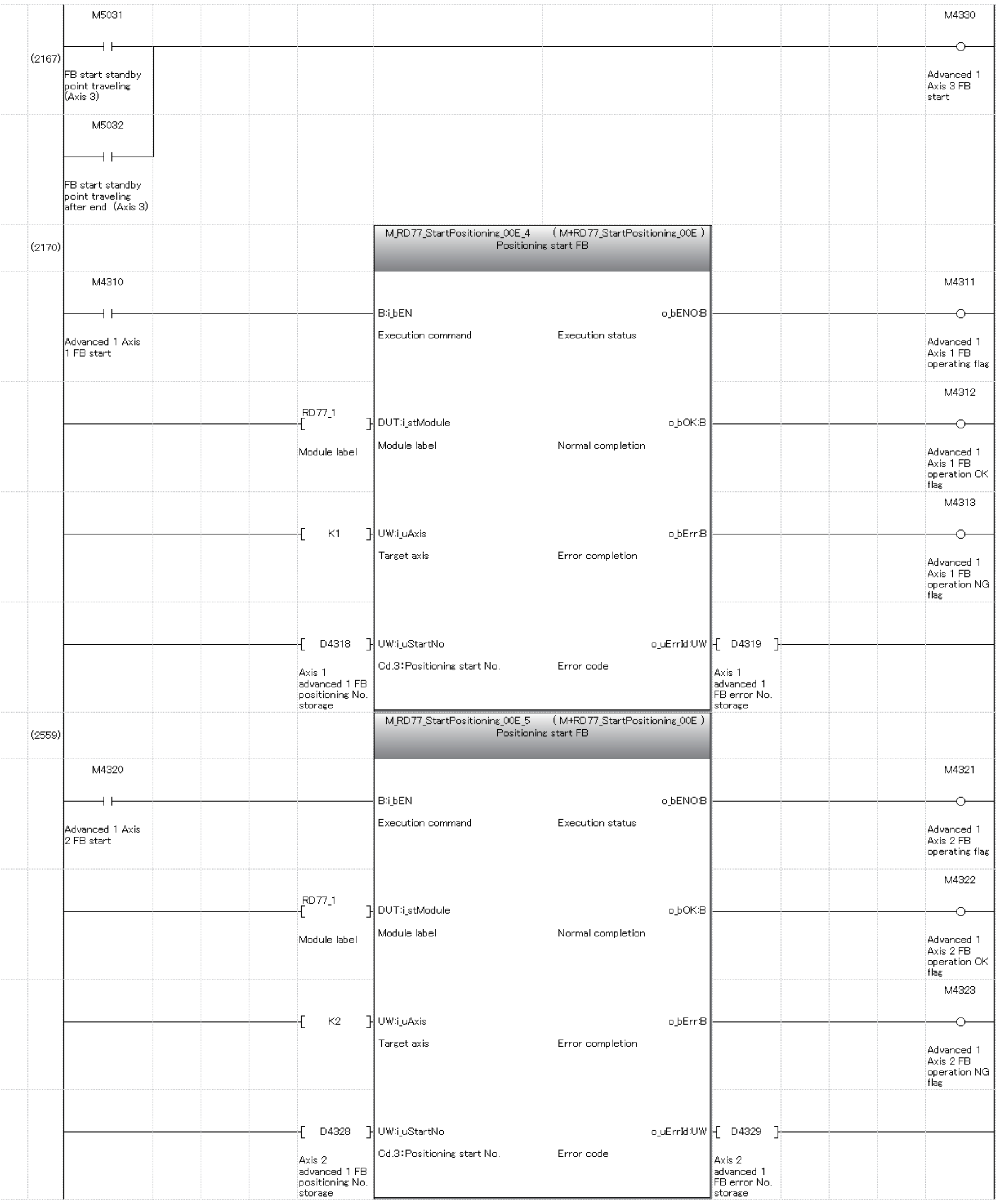

X20
Sensor input (SEN1)
SET M305 [Advanced 1 status] Synchronous control start
RST M304 [Advanced 1 status] Conveyor start command
RST M320 Advanced 1 1 cycle start command
M305 [Advanced 1 status] Synchronous control start
RD77_1.bnBusy_D[1] DX11 R:BUSY(Axis#1-#16)(Direct)
SET U0¥G36320.1 Axis 2 synchronous control start
RD77_1.bnBusy_D[2] DX12 R:BUSY(Axis#1-#16)(Direct)
SET U0¥G36320.2 Axis 3 synchronous control start
RD77_1.bnBusy_D[1] DX11 R:BUSY(Axis#1-#16)(Direct)
RD77_1.bnBusy_D[2] DX12 R:BUSY(Axis#1-#16)(Direct)
= U0¥G2509 K15 Axis 2 axis operation status
= U0¥G2609 K15 Axis 3 axis operation status
RST M5012 FB start conveyor start (Axis 1)
SET M306 [Advanced 1 status] Sensor input wait
RST M305 [Advanced 1 status] Synchronous control start
RST M320 Advanced 1 1 cycle start command
M306 [Advanced 1 status] Sensor input wait
X20 Sensor input (SEN1)
MOVP K1 U0¥G44120 Axis 3 main shaft clutch command
U0¥G42908.0 Axis 3 main shaft clutch ON/OFF status
SET M307 [Advanced 1 status] Synchronous controlling
RST M306 [Advanced 1 status] Sensor input wait

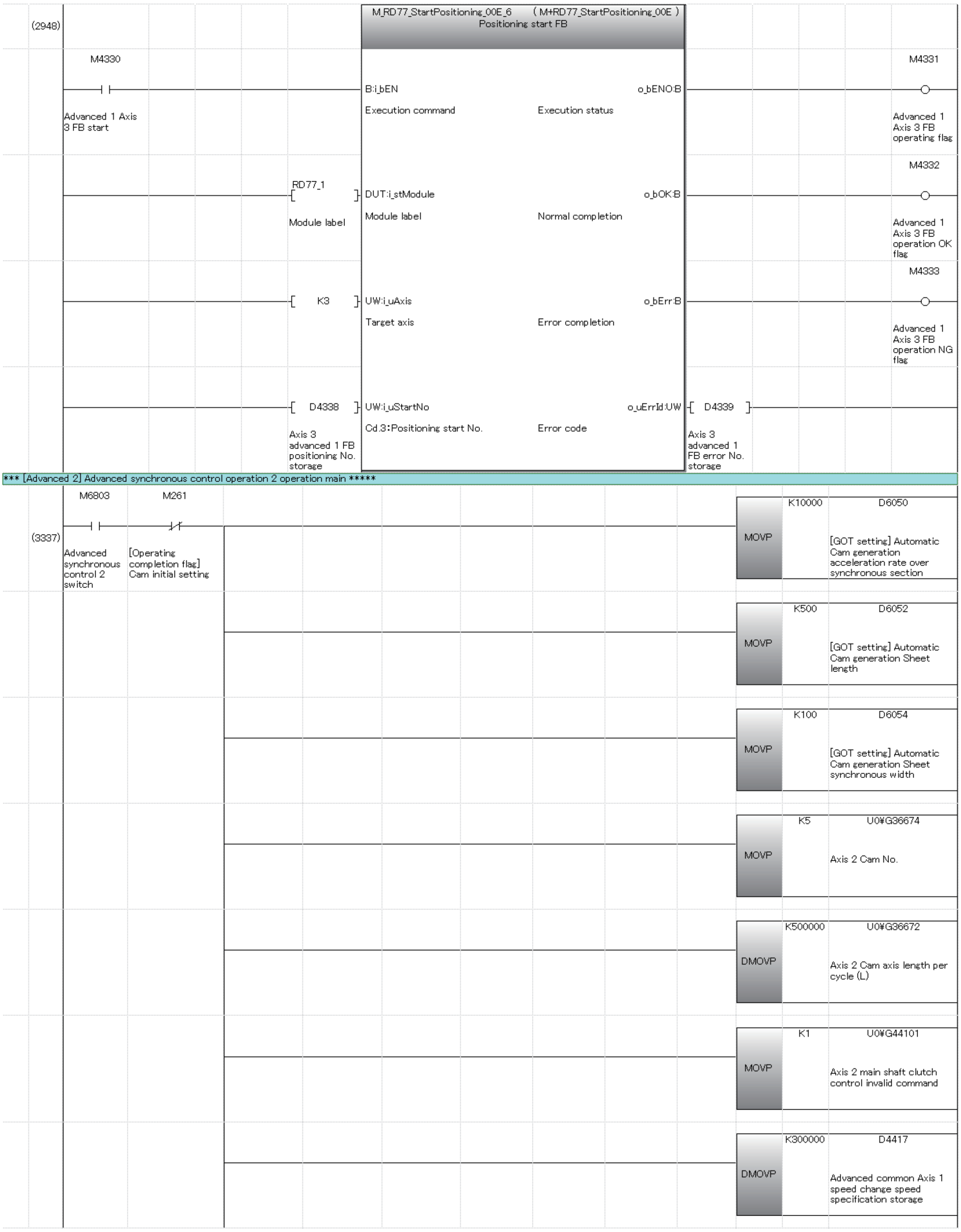

M307
[Advanced 1 status] Synchronous controlling
U0¥G42908.0
Axis 3 main shaft clutch ON/OFF status
U0¥G42909.0
Axis 3 main shaft clutch smoothing status
RD77_1.bnBusy_D[1] DX11
R:BUSY (Axis#1-#16) (Direct)
=
U0¥G2509
Axis 2 axis operation status
K15
RST
U0¥G36320.1
Axis 2 synchronous control start
RD77_1.bnBusy_D[2] DX12
R:BUSY (Axis#1-#16) (Direct)
=
U0¥G2609
Axis 3 axis operation status
K15
RST
U0¥G36320.2
Axis 3 synchronous control start
MOVP
K0
U0¥G44120
Axis 3 main shaft clutch command
SET
M308
[Advanced 1 status] Synchronous control ending
RST
M307
[Advanced 1 status] Synchronous controlling
M308
[Advanced 1 status] Synchronous control ending
<>
U0¥G2509
Axis 2 axis operation status
K15
<>
U0¥G2609
Axis 3 axis operation status
K15
SET
M309
[Advanced 1 status] Return operation start
RST
M308
[Advanced 1 status] Synchronous control ending
M309
[Advanced 1 status] Return operation start
MOVP
K10
D4338
Axis 3 advanced 1 FB positioning No. storage
RD77_1.bnBusy_D[2] DX12
R:BUSY(Axis#1-#16)(Direct)
SET
M5032
FB start standby point traveling after end (Axis 3)
M5032
FB start standby point traveling after end (Axis 3)
SET
M310
[Advanced 1 status] Return operating
RST
M309
[Advanced 1 status] Return operation start


M310
U0¥G2617.F
RD77_1.bnBusy_D[2]
DX12
[Advanced 1 status] Return operating
Axis 3 positioning complete
R:BUSY(Axis#1-#16)(Direct)
RST
M5032
FB start standby point traveling after end (Axis 3)
U0¥G2617.D
Axis 3 error detection
SET
M311
[Advanced 1 status] 1 cycle end
RST
M310
[Advanced 1 status] Return operating
M311
M31
[Advanced 1 status] 1 cycle end
[PB for GOT] Start up advanced 1
MOVP
K1
U0¥G30100
Axis 1 axis stop
M4311
Advanced 1 Axis 1 FB operating flag
SET
M312
[Advanced 1 status] End processing
RST
M311
[Advanced 1 status] 1 cycle end
M31
[PB for GOT] Start up advanced 1
SET
M320
Advanced 1 1 cycle start command
RST
M311
[Advanced 1 status] 1 cycle end
M312
[Advanced 1 status] End processing
=
K1
U0¥G30100
Axis 1 axis stop
RD77_1.bnBusy_D[0]
DX10
R:BUSY(Axis#1-#16)(Direct)
MOVP
K0
U0¥G30100
Axis 1 axis stop
RST
M312
[Advanced 1 status] End processing
RST
M36
Command during Advanced 1 operation

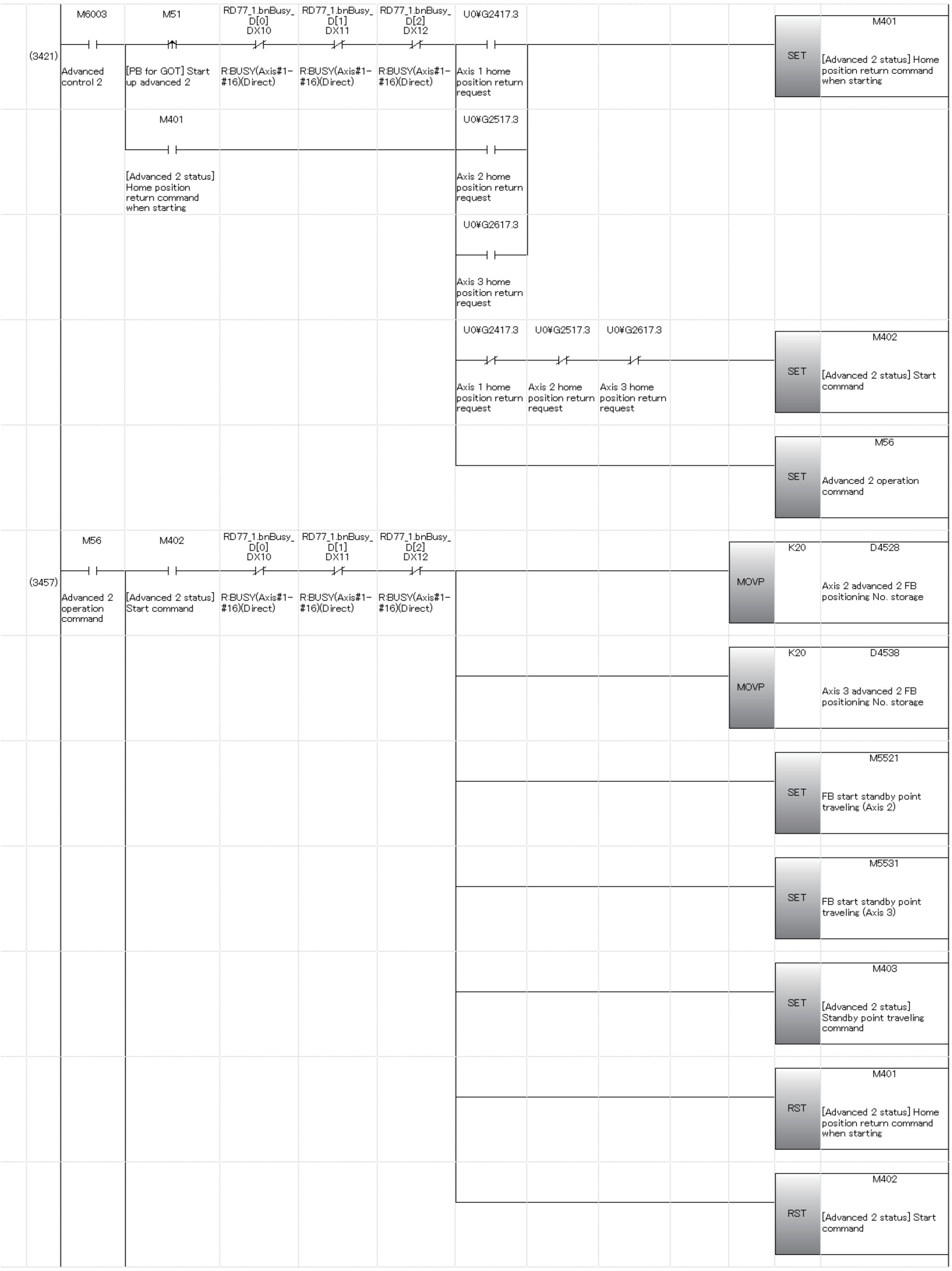

*** [Advanced Common] Conveyor speed change *****
(1859)
M6002
Advanced control 1
M31
[PB for GOT] Start up advanced 1
DMOV
K300000
D4417
Advanced common Axis 1 speed change speed specification storage
M6003
Advanced control 2
M51
[PB for GOT] Start up advanced 2
SET
M5040
FB start advanced speed change setting when starting
M33
[PB for GOT] Speed UP change
M34
[PB for GOT] Speed DOWN change
M4010
Home position return Axis 1 FB start
M6802
Advanced synchronous control 1 switch
D>
K720000
D4417
Advanced common Axis 1 speed change speed specification storage
D+P
K60000
D4417
Advanced common Axis 1 speed change speed specification storage
M53
[PB for GOT] Speed UP change
M54
[PB for GOT] Speed DOWN change
M6803
Advanced synchronous control 2 switch
D>
K1200000
D4417
Advanced common Axis 1 speed change speed specification storage
SET
M5041
FB start advanced speed change acceleration
M34
[PB for GOT] Speed DOWN change
M33
[PB for GOT] Speed UP change
M4010
Home position return Axis 1 FB start
D<
K0
D4417
Advanced common Axis 1 speed change speed specification storage
D-P
K60000
D4417
Advanced common Axis 1 speed change speed specification storage
M54
[PB for GOT] Speed DOWN change
M53
[PB for GOT] Speed UP change
SET
M5042
FB start advanced speed change deceleration
D>=
K0
D4417
Advanced common Axis 1 speed change speed specification storage
DMOVP
K0
D4417
Advanced common Axis 1 speed change speed specification storage
(1929)
M5040
FB start advanced speed change setting when starting
M4410
Advanced 1 Axis 1 speed change FB start
M5041
FB start advanced speed change acceleration
M5042
FB start advanced speed change deceleration

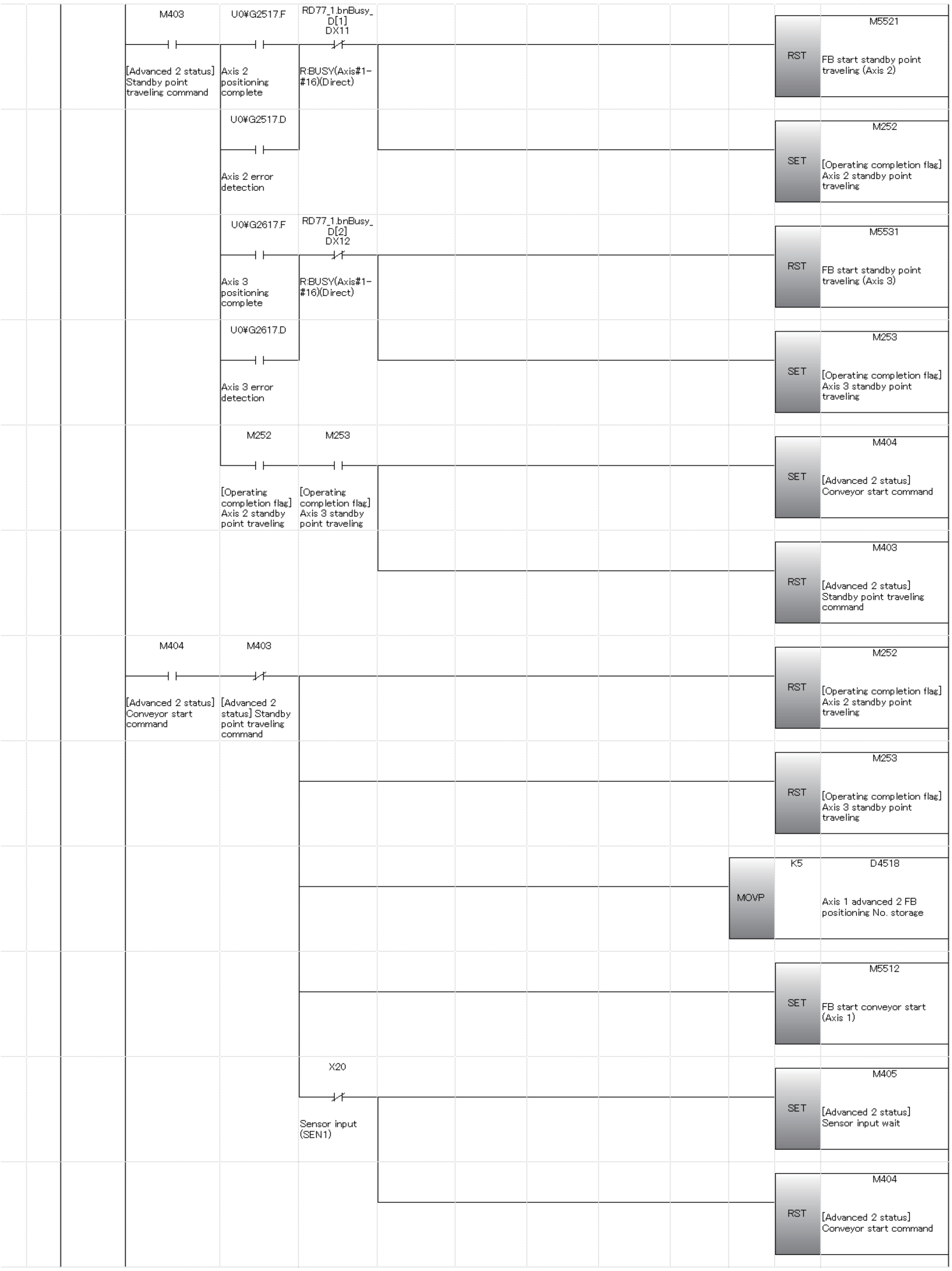

(1933)
M_RD77_ChangeSpeed_00E_3 (M+RD77_ChangeSpeed_(
Speed change FB
M4410
Advanced 1 Axis 1 speed change FB start
B:i_bEN
Execution command
o_bENO:B
Execution status
M4411
Advanced 1 Axis 1 speed change FB operating flag
RD77_1
Module label
DUT:i_stModule
Module label
o_bOK:B
Normal completion
M4412
Advanced 1 Axis 1 speed change FB operation OK flag
K1
UW:i_uAxis
Target axis
o_bErr:B
Error completion
M4413
Advanced 1 Axis 1 speed change NG operation OK flag
D4417
Advanced common Axis 1 speed change speed specification storage
UD:i_udSpeedChangeValue
Cd.14:New speed value
o_uErrId:UW
Error code
D4419
Advanced common Axis 1 speed change FB error No. storage
(2142)
M4411
Advanced 1 Axis 1 speed change FB operating flag
RST
M5040
FB start advanced speed change setting when starting
RST
M5041
FB start advanced speed change acceleration
RST
M5042
FB start advanced speed change deceleration
*** [Advanced 1] Axis 2 clutch control *****
(2146)
M6002
Advanced control 1
M32
[PB for GOT] Clutch 1
MOVP
K1
U0¥G44102
Axis 2 main shaft clutch forced OFF command
M32
[PB for GOT] Clutch 1
MOVP
K0
U0¥G44102
Axis 2 main shaft clutch forced OFF command
*** [Advanced 1] Positioning FB *****
(2162)
M5012
FB start conveyor start (Axis 1)
M4310
Advanced 1 Axis 1 FB start
(2165)
M5021
FB start standby point traveling (Axis 2)
M4320
Advanced 1 Axis 2 FB start

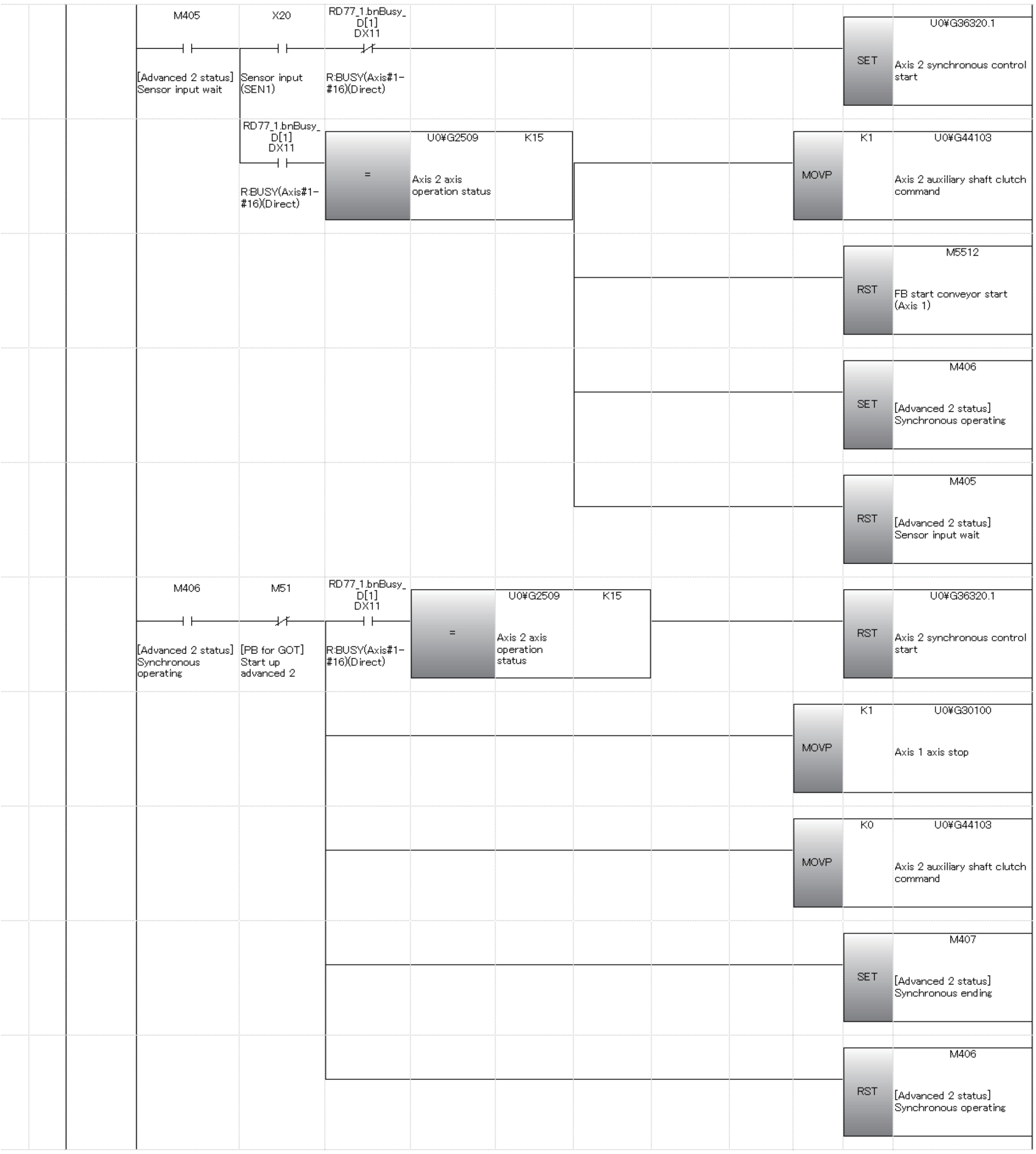

(2167)
M5031
FB start standby point traveling (Axis 3)
M5032
FB start standby point traveling after end (Axis 3)
M4330
Advanced 1 Axis 3 FB start
(2170)
M_RD77_StartPositioning_00E_4 (M+RD77_StartPositioning_00E)
Positioning start FB
M4310
Advanced 1 Axis 1 FB start
B:i_bEN
Execution command
o_bENO:B
Execution status
M4311
Advanced 1 Axis 1 FB operating flag
RD77_1
Module label
DUT:i_stModule
Module label
o_bOK:B
Normal completion
M4312
Advanced 1 Axis 1 FB operation OK flag
K1
UW:i_uAxis
Target axis
o_bErr:B
Error completion
M4313
Advanced 1 Axis 1 FB operation NG flag
D4318
Axis 1 advanced 1 FB positioning No. storage
UW:i_uStartNo
Cd.3:Positioning start No.
o_uErrId:UW
Error code
D4319
Axis 1 advanced 1 FB error No. storage
(2559)
M_RD77_StartPositioning_00E_5 (M+RD77_StartPositioning_00E)
Positioning start FB
M4320
Advanced 1 Axis 2 FB start
B:i_bEN
Execution command
o_bENO:B
Execution status
M4321
Advanced 1 Axis 2 FB operating flag
RD77_1
Module label
DUT:i_stModule
Module label
o_bOK:B
Normal completion
M4322
Advanced 1 Axis 2 FB operation OK flag
K2
UW:i_uAxis
Target axis
o_bErr:B
Error completion
M4323
Advanced 1 Axis 2 FB operation NG flag
D4328
Axis 2 advanced 1 FB positioning No. storage
UW:i_uStartNo
Cd.3:Positioning start No.
o_uErrId:UW
Error code
D4329
Axis 2 advanced 1 FB error No. storage

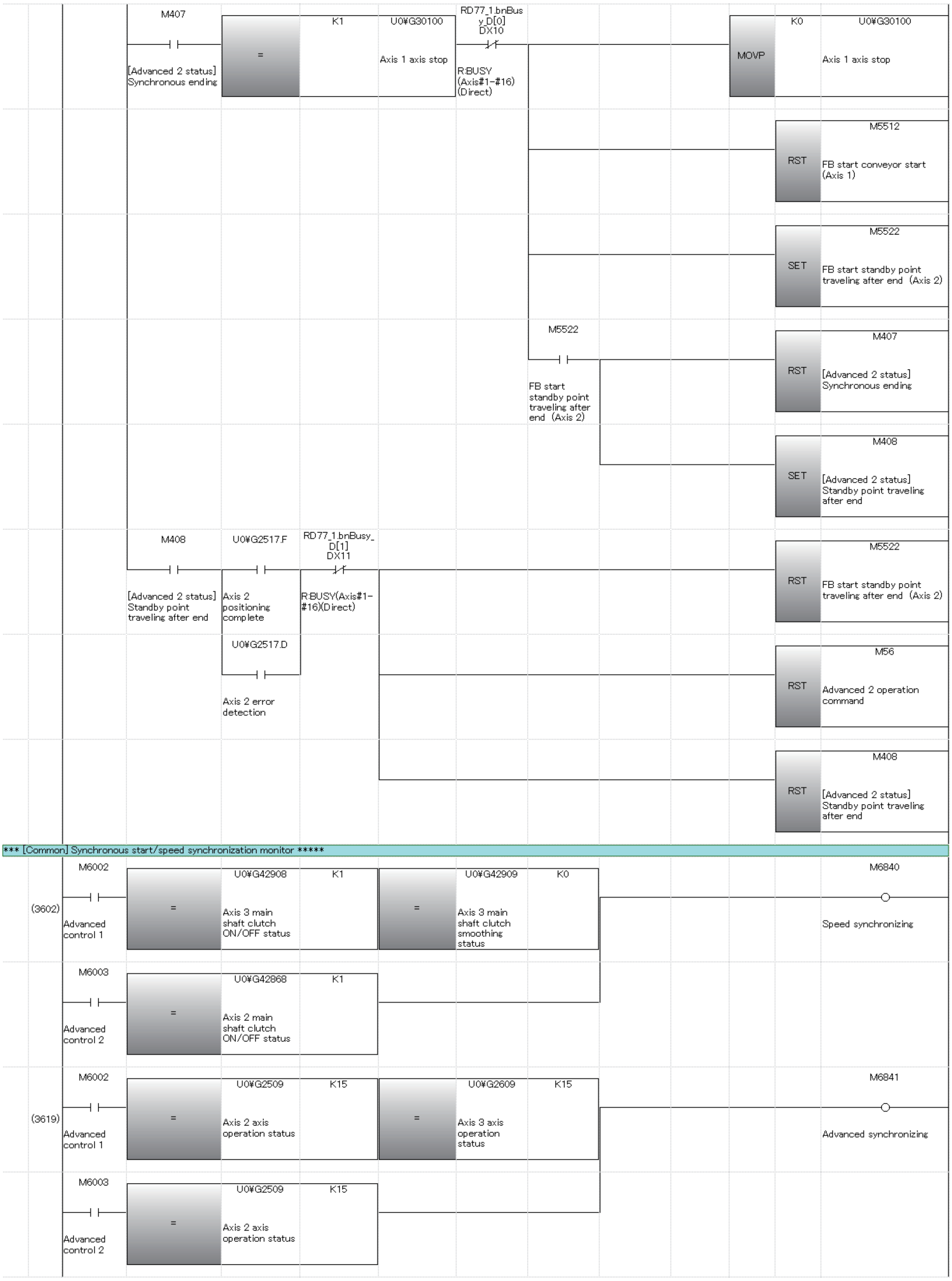

(2948)
M_RD77_StartPositioning_00E_6 (M+RD77_StartPositioning_00E)
Positioning start FB
M4330
Advanced 1 Axis 3 FB start
B:i_bEN
Execution command
o_bENO:B
Execution status
M4331
Advanced 1 Axis 3 FB operating flag
RD77_1
Module label
DUT:i_stModule
Module label
o_bOK:B
Normal completion
M4332
Advanced 1 Axis 3 FB operation OK flag
K3
UW:i_uAxis
Target axis
o_bErr:B
Error completion
M4333
Advanced 1 Axis 3 FB operation NG flag
D4338
Axis 3 advanced 1 FB positioning No. storage
UW:i_uStartNo
Cd.3:Positioning start No.
o_uErrId:UW
Error code
D4339
Axis 3 advanced 1 FB error No. storage
*** [Advanced 2] Advanced synchronous control operation 2 operation main *****
(3337)
M6803
Advanced synchronous control 2 switch
M261
[Operating completion flag] Cam initial setting
MOVP K10000 D6050
[GOT setting] Automatic Cam generation acceleration rate over synchronous section
MOVP K500 D6052
[GOT setting] Automatic Cam generation Sheet length
MOVP K100 D6054
[GOT setting] Automatic Cam generation Sheet synchronous width
MOVP K5 U0¥G36674
Axis 2 Cam No.
DMOVP K500000 U0¥G36672
Axis 2 Cam axis length per cycle (L)
MOVP K1 U0¥G44101
Axis 2 main shaft clutch control invalid command
DMOVP K300000 D4417
Advanced common Axis 1 speed change speed specification storage

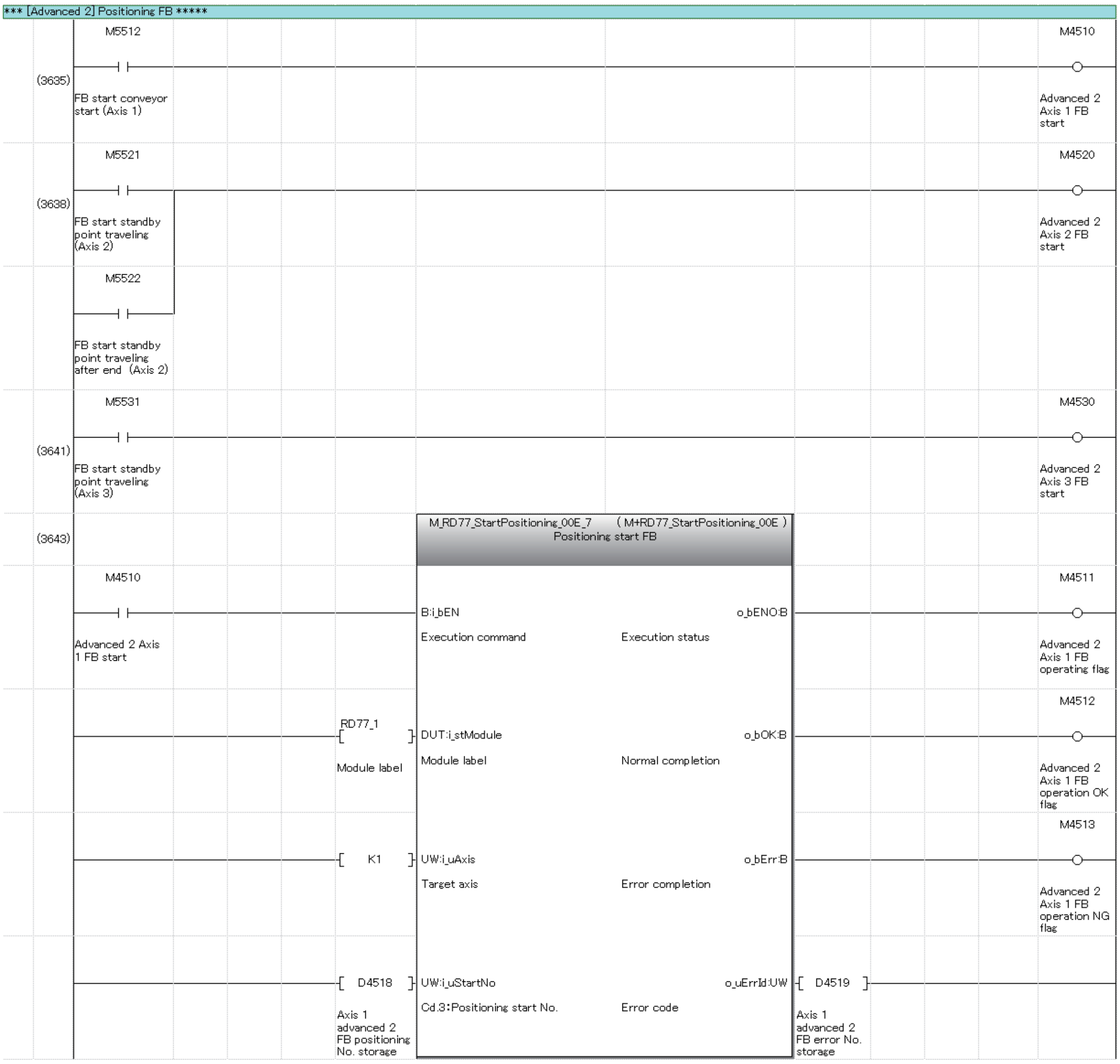
Step	Contact	Instruction	Source	Destination	Comment
		MOVP	K5	U0¥G53201	Auto-generation Cam No.
		MOVP	K1	U0¥G53202	Cam auto-generation type
		MOVP	K512	U0¥G53204	Auto-generation parameter value: Cam resolution
		MOVP	K0	U0¥G53214	Auto-generation parameter value: Acceleration rate over synchronous section
		DMOVP	K500	U0¥G53206	Auto-generation parameter value: Sheet length (L)
		DMOVP	K100	U0¥G53208	Auto-generation parameter value: Sheet synchronous width (L)
		DMOVP	K2513	U0¥G53210	Auto-generation parameter value: Synchronous axis length (L)
		DMOVP	K450	U0¥G53212	Auto-generation parameter value: Synchronous start position (L)
		MOVP	K1	U0¥G53200	Cam auto-generation request
		SET		M261	[Operating completion flag] Cam initial setting
(3419)	M6803 (-|/|-) Advanced synchronous control 2 switch	RST		M261	[Operating completion flag] Cam initial setting


(3421)
M6003
Advanced control 2
M51
[PB for GOT] Start up advanced 2
RD77_1.bnBusy_D[0] DX10
R:BUSY(Axis#1-#16)(Direct)
RD77_1.bnBusy_D[1] DX11
R:BUSY(Axis#1-#16)(Direct)
RD77_1.bnBusy_D[2] DX12
R:BUSY(Axis#1-#16)(Direct)
U0¥G2417.3
Axis 1 home position return request
SET
M401
[Advanced 2 status] Home position return command when starting
M401
[Advanced 2 status] Home position return command when starting
U0¥G2517.3
Axis 2 home position return request
U0¥G2617.3
Axis 3 home position return request
U0¥G2417.3
Axis 1 home position return request
U0¥G2517.3
Axis 2 home position return request
U0¥G2617.3
Axis 3 home position return request
SET
M402
[Advanced 2 status] Start command
SET
M56
Advanced 2 operation command
(3457)
M56
Advanced 2 operation command
M402
[Advanced 2 status] Start command
RD77_1.bnBusy_D[0] DX10
R:BUSY(Axis#1-#16)(Direct)
RD77_1.bnBusy_D[1] DX11
R:BUSY(Axis#1-#16)(Direct)
RD77_1.bnBusy_D[2] DX12
R:BUSY(Axis#1-#16)(Direct)
MOVP
K20
D4528
Axis 2 advanced 2 FB positioning No. storage
MOVP
K20
D4538
Axis 3 advanced 2 FB positioning No. storage
SET
M5521
FB start standby point traveling (Axis 2)
SET
M5531
FB start standby point traveling (Axis 3)
SET
M403
[Advanced 2 status] Standby point traveling command
RST
M401
[Advanced 2 status] Home position return command when starting
RST
M402
[Advanced 2 status] Start command


M403
[Advanced 2 status] Standby point traveling command
U0¥G2517.F
Axis 2 positioning complete
RD77_1.bnBusy_D[1]
DX11
R:BUSY(Axis#1-#16)(Direct)
RST
M5521
FB start standby point traveling (Axis 2)
U0¥G2517.D
Axis 2 error detection
SET
M252
[Operating completion flag] Axis 2 standby point traveling
U0¥G2617.F
Axis 3 positioning complete
RD77_1.bnBusy_D[2]
DX12
R:BUSY(Axis#1-#16)(Direct)
RST
M5531
FB start standby point traveling (Axis 3)
U0¥G2617.D
Axis 3 error detection
SET
M253
[Operating completion flag] Axis 3 standby point traveling
M252
[Operating completion flag] Axis 2 standby point traveling
M253
[Operating completion flag] Axis 3 standby point traveling
SET
M404
[Advanced 2 status] Conveyor start command
RST
M403
[Advanced 2 status] Standby point traveling command
M404
[Advanced 2 status] Conveyor start command
M403
[Advanced 2 status] Standby point traveling command
RST
M252
[Operating completion flag] Axis 2 standby point traveling
RST
M253
[Operating completion flag] Axis 3 standby point traveling
MOVP
K5
D4518
Axis 1 advanced 2 FB positioning No. storage
SET
M5512
FB start conveyor start (Axis 1)
X20
Sensor input (SEN1)
SET
M405
[Advanced 2 status] Sensor input wait
RST
M404
[Advanced 2 status] Conveyor start command


M405
[Advanced 2 status] Sensor input wait
X20
Sensor input (SEN1)
RD77_1.bnBusy_D[1] DX11
R:BUSY(Axis#1-#16)(Direct)
SET
U0¥G36320.1
Axis 2 synchronous control start
RD77_1.bnBusy_D[1] DX11
R:BUSY(Axis#1-#16)(Direct)
=
U0¥G2509
Axis 2 axis operation status
K15
MOVP
K1
U0¥G44103
Axis 2 auxiliary shaft clutch command
RST
M5512
FB start conveyor start (Axis 1)
SET
M406
[Advanced 2 status] Synchronous operating
RST
M405
[Advanced 2 status] Sensor input wait
M406
[Advanced 2 status] Synchronous operating
M51
[PB for GOT] Start up advanced 2
RD77_1.bnBusy_D[1] DX11
R:BUSY(Axis#1-#16)(Direct)
=
U0¥G2509
Axis 2 axis operation status
K15
RST
U0¥G36320.1
Axis 2 synchronous control start
MOVP
K1
U0¥G30100
Axis 1 axis stop
MOVP
K0
U0¥G44103
Axis 2 auxiliary shaft clutch command
SET
M407
[Advanced 2 status] Synchronous ending
RST
M406
[Advanced 2 status] Synchronous operating


M407
[Advanced 2 status] Synchronous ending
=
K1
U0¥G30100
Axis 1 axis stop
RD77_1.bnBusy_D[0]
DX10
R:BUSY (Axis#1–#16) (Direct)
MOVP
K0
U0¥G30100
Axis 1 axis stop
RST
M5512
FB start conveyor start (Axis 1)
SET
M5522
FB start standby point traveling after end (Axis 2)
M5522
FB start standby point traveling after end (Axis 2)
RST
M407
[Advanced 2 status] Synchronous ending
SET
M408
[Advanced 2 status] Standby point traveling after end
M408
[Advanced 2 status] Standby point traveling after end
U0¥G2517.F
Axis 2 positioning complete
RD77_1.bnBusy_D[1]
DX11
R:BUSY(Axis#1–#16)(Direct)
RST
M5522
FB start standby point traveling after end (Axis 2)
U0¥G2517.D
Axis 2 error detection
RST
M56
Advanced 2 operation command
RST
M408
[Advanced 2 status] Standby point traveling after end
*** [Common] Synchronous start/speed synchronization monitor *****
(3602)
M6002
Advanced control 1
=
U0¥G42908
K1
Axis 3 main shaft clutch ON/OFF status
=
U0¥G42909
K0
Axis 3 main shaft clutch smoothing status
M6840
Speed synchronizing
M6003
Advanced control 2
=
U0¥G42868
K1
Axis 2 main shaft clutch ON/OFF status
(3619)
M6002
Advanced control 1
=
U0¥G2509
K15
Axis 2 axis operation status
=
U0¥G2609
K15
Axis 3 axis operation status
M6841
Advanced synchronizing
M6003
Advanced control 2
=
U0¥G2509
K15
Axis 2 axis operation status


*** [Advanced 2] Positioning FB *****
(3635)
M5512
FB start conveyor start (Axis 1)
M4510
Advanced 2 Axis 1 FB start
(3638)
M5521
FB start standby point traveling (Axis 2)
M5522
FB start standby point traveling after end (Axis 2)
M4520
Advanced 2 Axis 2 FB start
(3641)
M5531
FB start standby point traveling (Axis 3)
M4530
Advanced 2 Axis 3 FB start
(3643)
M_RD77_StartPositioning_00E_7 (M+RD77_StartPositioning_00E)
Positioning start FB
M4510
Advanced 2 Axis 1 FB start
B:i_bEN
Execution command
o_bENO:B
Execution status
M4511
Advanced 2 Axis 1 FB operating flag
RD77_1
Module label
DUT:i_stModule
Module label
o_bOK:B
Normal completion
M4512
Advanced 2 Axis 1 FB operation OK flag
K1
UW:i_uAxis
Target axis
o_bErr:B
Error completion
M4513
Advanced 2 Axis 1 FB operation NG flag
D4518
Axis 1 advanced 2 FB positioning No. storage
UW:i_uStartNo
Cd.3:Positioning start No.
o_uErrId:UW
Error code
D4519
Axis 1 advanced 2 FB error No. storage

(4032)

M_RD77_StartPositioning_00E_8 (M+RD77_StartPositioning_00E)
Positioning start FB

Contact / Input	FB input	FB output	Output
M4520 Advanced 2 Axis 2 FB start	B:i_bEN Execution command	o_bENO:B Execution status	M4521 Advanced 2 Axis 2 FB operating flag
RD77_1 Module label	DUT:i_stModule Module label	o_bOK:B Normal completion	M4522 Advanced 2 Axis 2 FB operation OK flag
K2	UW:i_uAxis Target axis	o_bErr:B Error completion	M4523 Advanced 2 Axis 2 FB operation NG flag
D4528 Axis 2 advanced 2 FB positioning No. storage	UW:i_uStartNo Cd.3:Positioning start No.	o_uErrId:UW Error code	D4529 Axis 2 advanced 2 FB error No. storage

(4421)

M_RD77_StartPositioning_00E_9 (M+RD77_StartPositioning_00E)
Positioning start FB

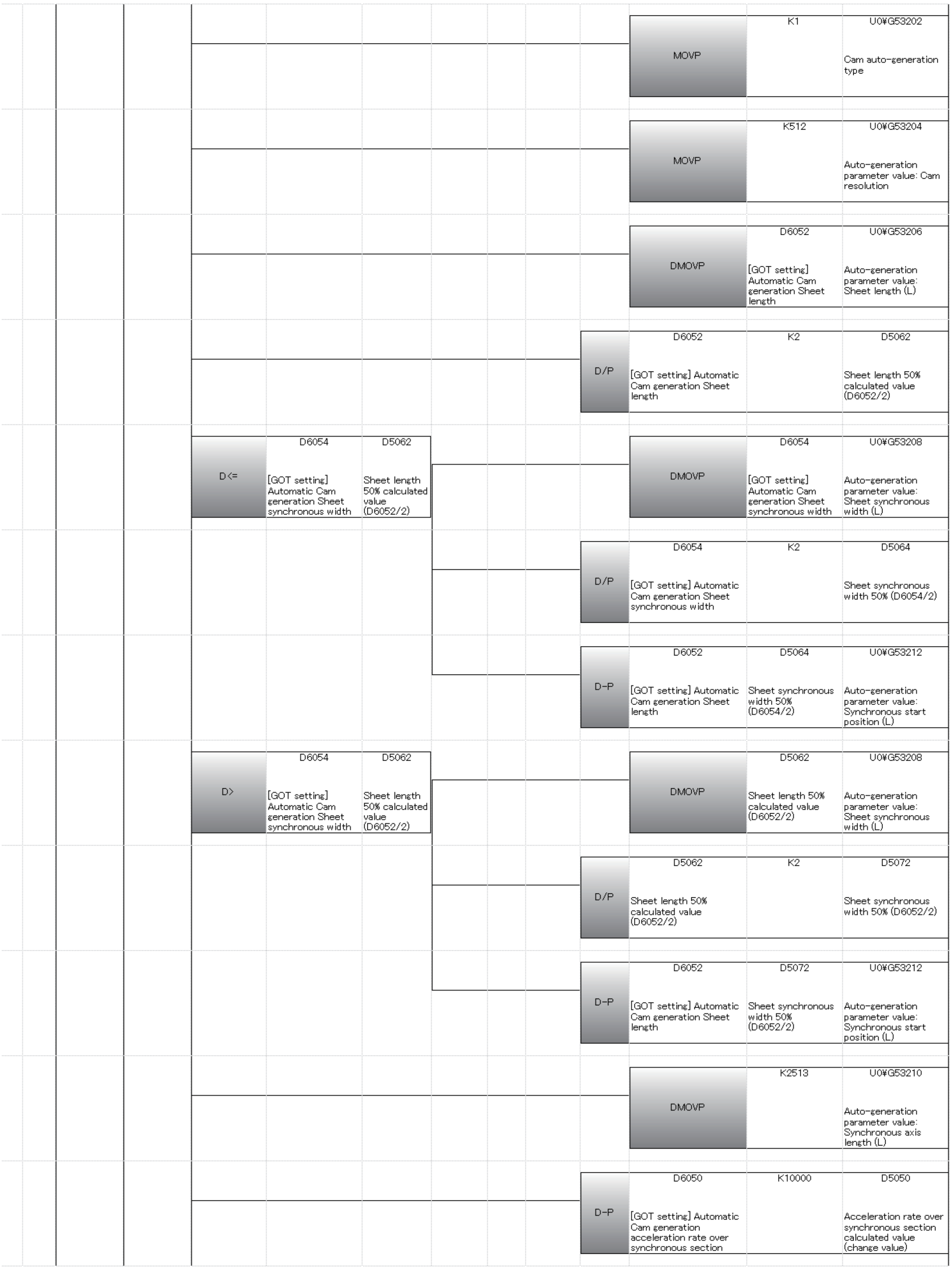
Contact / Input	FB input	FB output	Output
M4530 Advanced 2 Axis 3 FB start	B:i_bEN Execution command	o_bENO:B Execution status	M4531 Advanced 2 Axis 3 FB operating flag
RD77_1 Module label	DUT:i_stModule Module label	o_bOK:B Normal completion	M4532 Advanced 2 Axis 3 FB operation OK flag
K3	UW:i_uAxis Target axis	o_bErr:B Error completion	M4533 Advanced 2 Axis 3 FB operation NG flag
D4538 Axis 3 advanced 2 FB positioning No. storage	UW:i_uStartNo Cd.3:Positioning start No.	o_uErrId:UW Error code	D4539 Axis 3 advanced 2 FB error No. storage

*** [Advanced 2] Cam auto-generation program *****

(4810)

M6003 Advanced control 2 — M55 [PB for GOT] Cam generation

Instruction	Operand 1	Operand 2	Operand 3
D*P	D6052 [GOT setting] Automatic Cam generation Sheet length	K1000	D6060 Length per cycle initial calculated value
DMOVP	D6060 Length per cycle initial calculated value	U0¥G36672 Axis 2 Cam axis length per cycle (L)	
MOVP	K5	U0¥G53201 Auto-generation Cam No.	


MOVP
K1
U0¥G53202
Cam auto-generation type
MOVP
K512
U0¥G53204
Auto-generation parameter value: Cam resolution
DMOVP
D6052
[GOT setting] Automatic Cam generation Sheet length
U0¥G53206
Auto-generation parameter value: Sheet length (L)
D/P
D6052
[GOT setting] Automatic Cam generation Sheet length
K2
D5062
Sheet length 50% calculated value (D6052/2)
D<=
D6054
[GOT setting] Automatic Cam generation Sheet synchronous width
D5062
Sheet length 50% calculated value (D6052/2)
DMOVP
D6054
[GOT setting] Automatic Cam generation Sheet synchronous width
U0¥G53208
Auto-generation parameter value: Sheet synchronous width (L)
D/P
D6054
[GOT setting] Automatic Cam generation Sheet synchronous width
K2
D5064
Sheet synchronous width 50% (D6054/2)
D-P
D6052
[GOT setting] Automatic Cam generation Sheet length
D5064
Sheet synchronous width 50% (D6054/2)
U0¥G53212
Auto-generation parameter value: Synchronous start position (L)
D>
D6054
[GOT setting] Automatic Cam generation Sheet synchronous width
D5062
Sheet length 50% calculated value (D6052/2)
DMOVP
D5062
Sheet length 50% calculated value (D6052/2)
U0¥G53208
Auto-generation parameter value: Sheet synchronous width (L)
D/P
D5062
Sheet length 50% calculated value (D6052/2)
K2
D5072
Sheet synchronous width 50% (D6052/2)
D-P
D6052
[GOT setting] Automatic Cam generation Sheet length
D5072
Sheet synchronous width 50% (D6052/2)
U0¥G53212
Auto-generation parameter value: Synchronous start position (L)
DMOVP
K2513
U0¥G53210
Auto-generation parameter value: Synchronous axis length (L)
D-P
D6050
[GOT setting] Automatic Cam generation acceleration rate over synchronous section
K10000
D5050
Acceleration rate over synchronous section calculated value (change value)

MOVP D5050 U0¥G53214
Acceleration rate over synchronous section calculated value (change value)
Auto-generation parameter value: Acceleration rate over synchronous section

SET M500
Advanced 2 Cam auto -generation command

M500
Advanced 2 Cam auto-generation command

MOVP K1 U0¥G53200
Cam auto-generation request

RST M500
Advanced 2 Cam auto -generation command

*** [Advanced 2] Cam data reference program *****

(4916)
M59
[PB for GOT] Cam data reference

MOVP K1 U0¥G45000
Cam data operation request

MOVP K5 U0¥G45001
Operation Cam No.

MOVP K1 U0¥G45002
Cam data start position

MOVP K512 U0¥G45003
Cam data operation points

MOVP K1 U0¥G45004
Cam data format

*** [Common] Error detection program *****

(4944)
U0¥G2417.D
Axis 1 error detection

M6010
Error detected

U0¥G2477.7
Axis 1 servo alarm occurring

U0¥G2517.D
Axis 2 error detection

U0¥G2577.7
Axis 2 servo alarm occurring

U0¥G2617.D
Axis 3 error detection

U0¥G2677.7
Axis 3 servo alarm occurring

*** [For GOT] For GOT interlock *****

(4964)
U0¥G2477.1
Axis 1 servo ON
M2000
All axis servo ON

U0¥G2577.1
Axis 2 servo ON

U0¥G2677.1
Axis 3 servo ON

(4975)
RD77_1.bnBusy_D[0]
DX10
R:BUSY (Axis#1-#16) (Direct)
M2001
Axis 1 BUSY signal

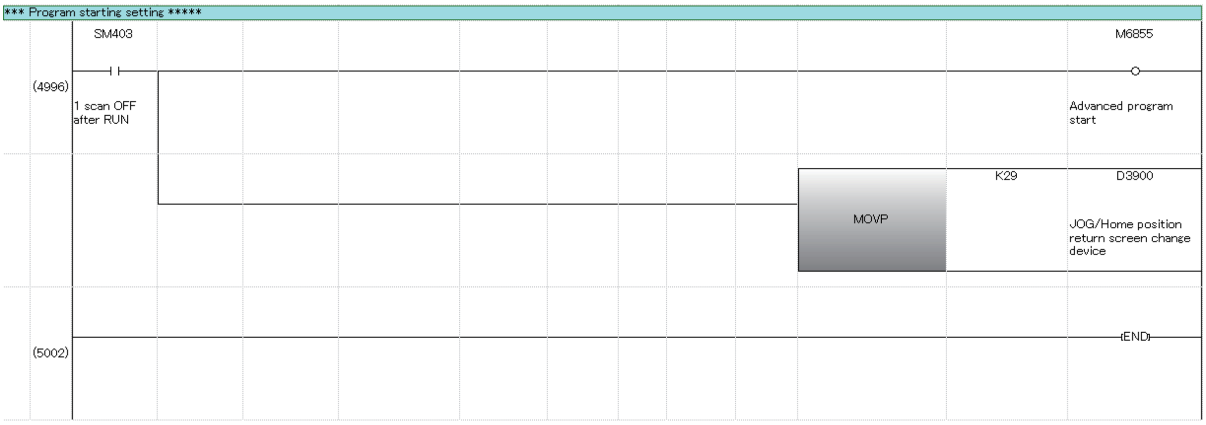
(4978)
RD77_1.bnBusy_D[1]
DX11
R:BUSY (Axis#1-#16) (Direct)
M2002
Axis 2 BUSY signal

(4981)
RD77_1.bnBusy_D[2]
DX12
R:BUSY (Axis#1-#16) (Direct)
M2003
Axis 3 BUSY signal

(4984)
U0¥G2477.0
Axis 1 servo ready ON
M2011
Axis 1 servo ready signal

(4988)
U0¥G2577.0
Axis 2 servo ready ON
M2012
Axis 2 servo ready signal

(4992)
U0¥G2677.0
Axis 3 servo ready ON
M2013
Axis 3 servo ready signal


*** Program starting setting *****
SM403
M6855
(4996)
1 scan OFF after RUN
Advanced program start
MOVP
K29
D3900
JOG/Home position return screen change device
(5002)
END

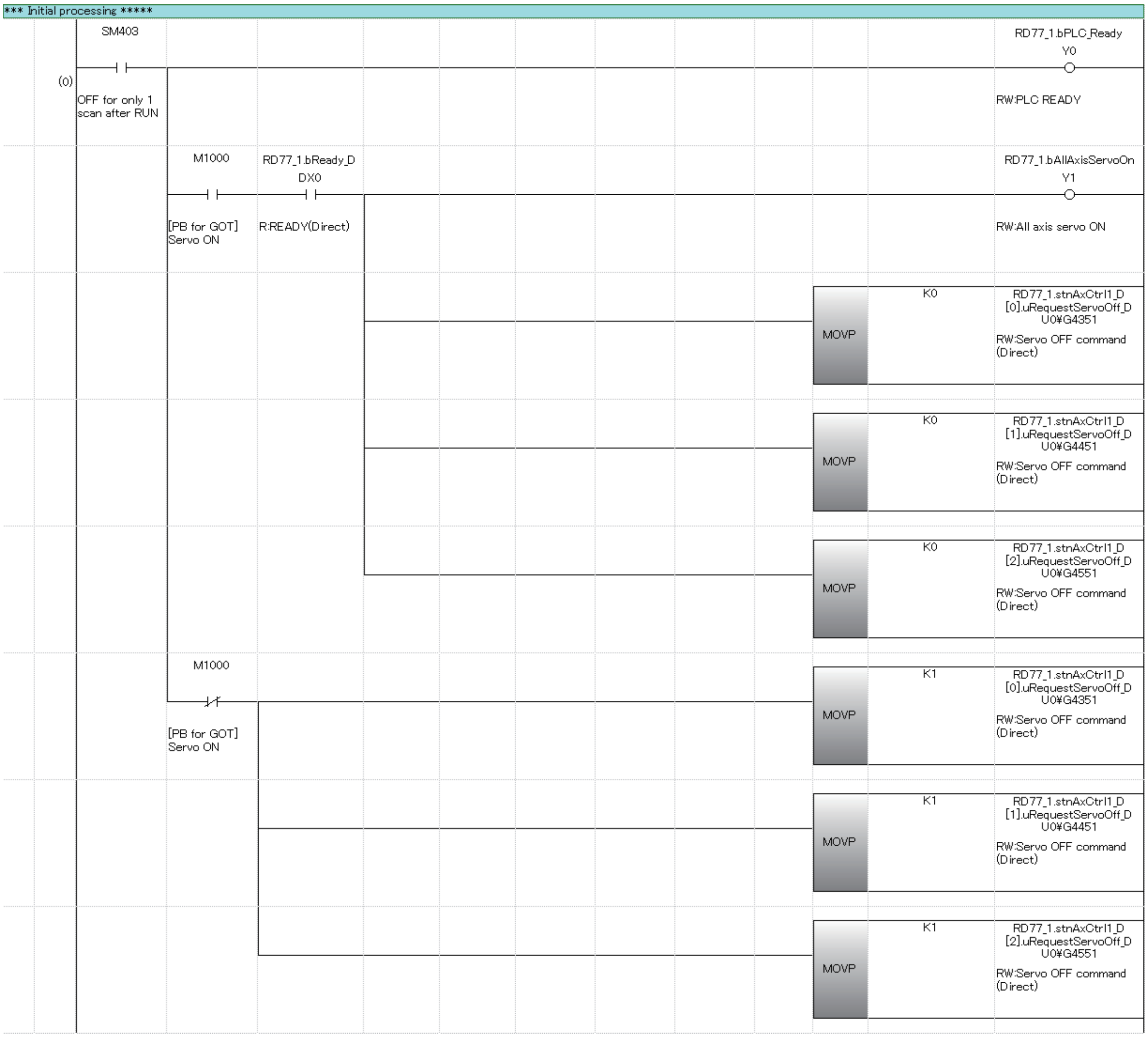
**** [Advanced Common] Display rotation count graph *****

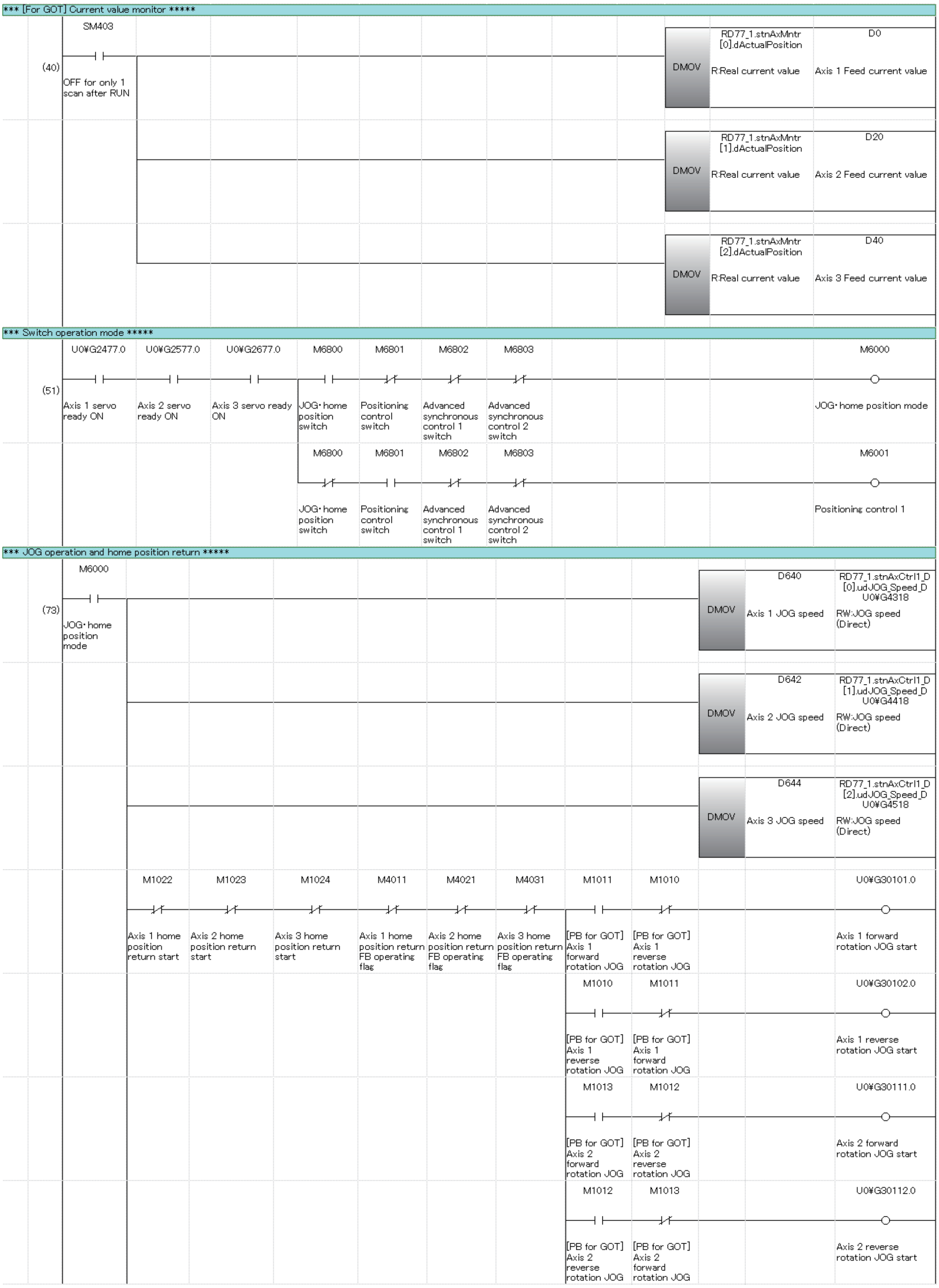
(0)	= K0 D8480 (For trend display)	BMOV	D7000 Axis 1 motor rotation speed waveform data (Start point)	D7001 Axis 1 motor rotation speed waveform data (Middle)	K299
		MOV	U0¥G2478 Axis 1 regenerative load rate/optional data monitor output 1	D7000 Axis 1 motor rotation speed waveform data (Start point)	
		BMOV	D7500 Axis 2 motor rotation speed waveform data (Start point)	D7501 Axis 2 motor rotation speed waveform data (Middle)	K299
		D/	RD77_1.stnAxMntr[1].dMotorRotationSpeed R:Motor rotation speed	K100	D7950 For Axis 2 motor rotation speed waveform calculation
		DINT2INT	D7950 For Axis 2 motor rotation speed waveform calculation	D7500 Axis 2 motor rotation speed waveform data (Start point)	
		BMOV	D8000 Axis 3 motor rotation speed waveform data (Start point)	D8001 Axis 3 motor rotation speed waveform data (Middle)	K299
		D/	RD77_1.stnAxMntr[2].dMotorRotationSpeed R:Motor rotation speed	K100	D8450 For Axis 3 motor rotation speed waveform calculation
		DINT2INT	D8450 For Axis 3 motor rotation speed waveform calculation	D8000 Axis 3 motor rotation speed waveform data (Start point)	
		+P	K1	D8480 For trend display	
(38)	= K1 D8480 (For trend display)	+P	K2	D8480 For trend display	
(45)	<= K2 D8480 (For trend display)	MOVP	K0	D8480 For trend display	
(51)		END			

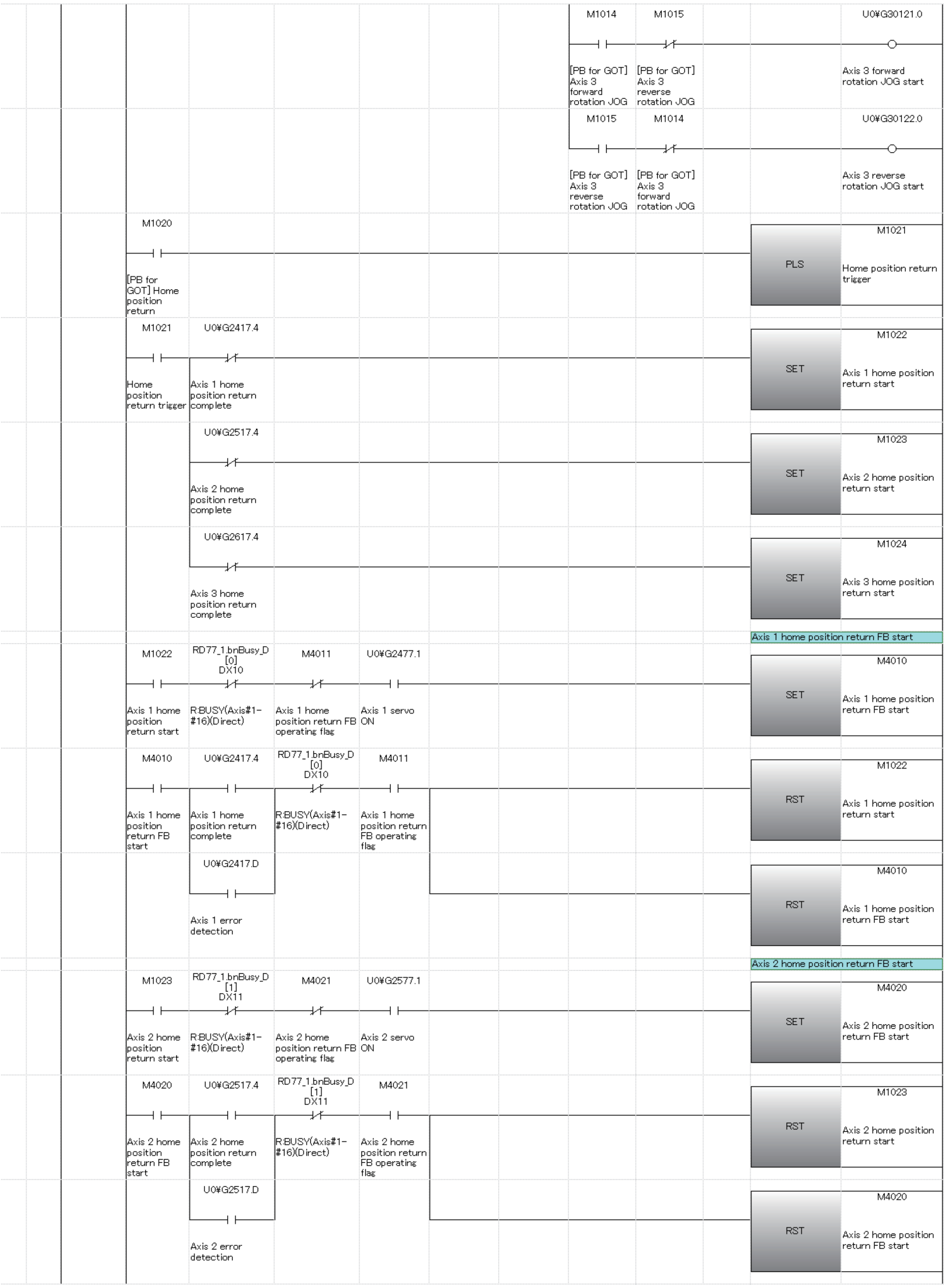
Appendices

Appendix 1 Sequence Program List

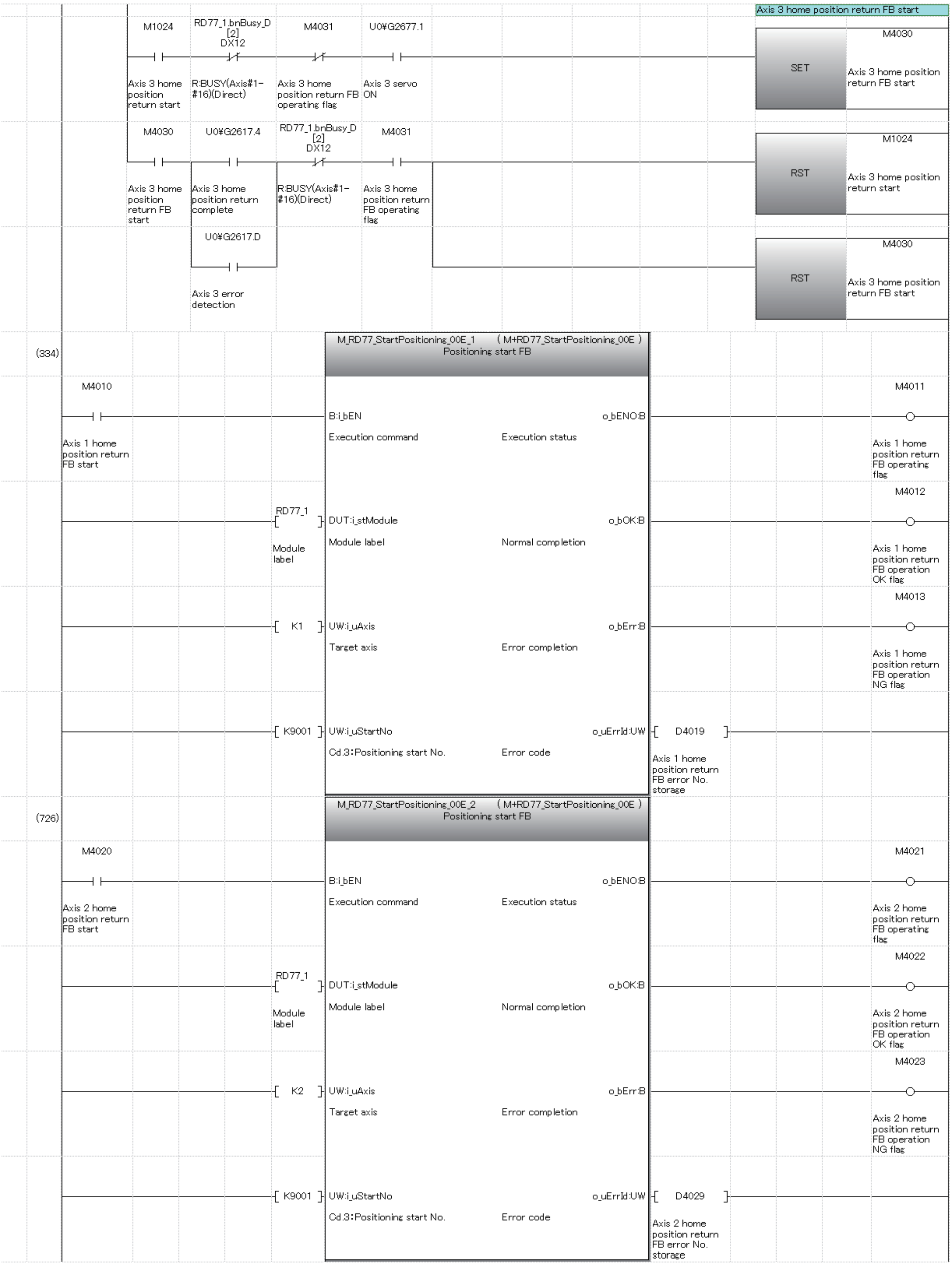
A list of sequence programs for project “SCHOOL_(positioning)” is shown below.

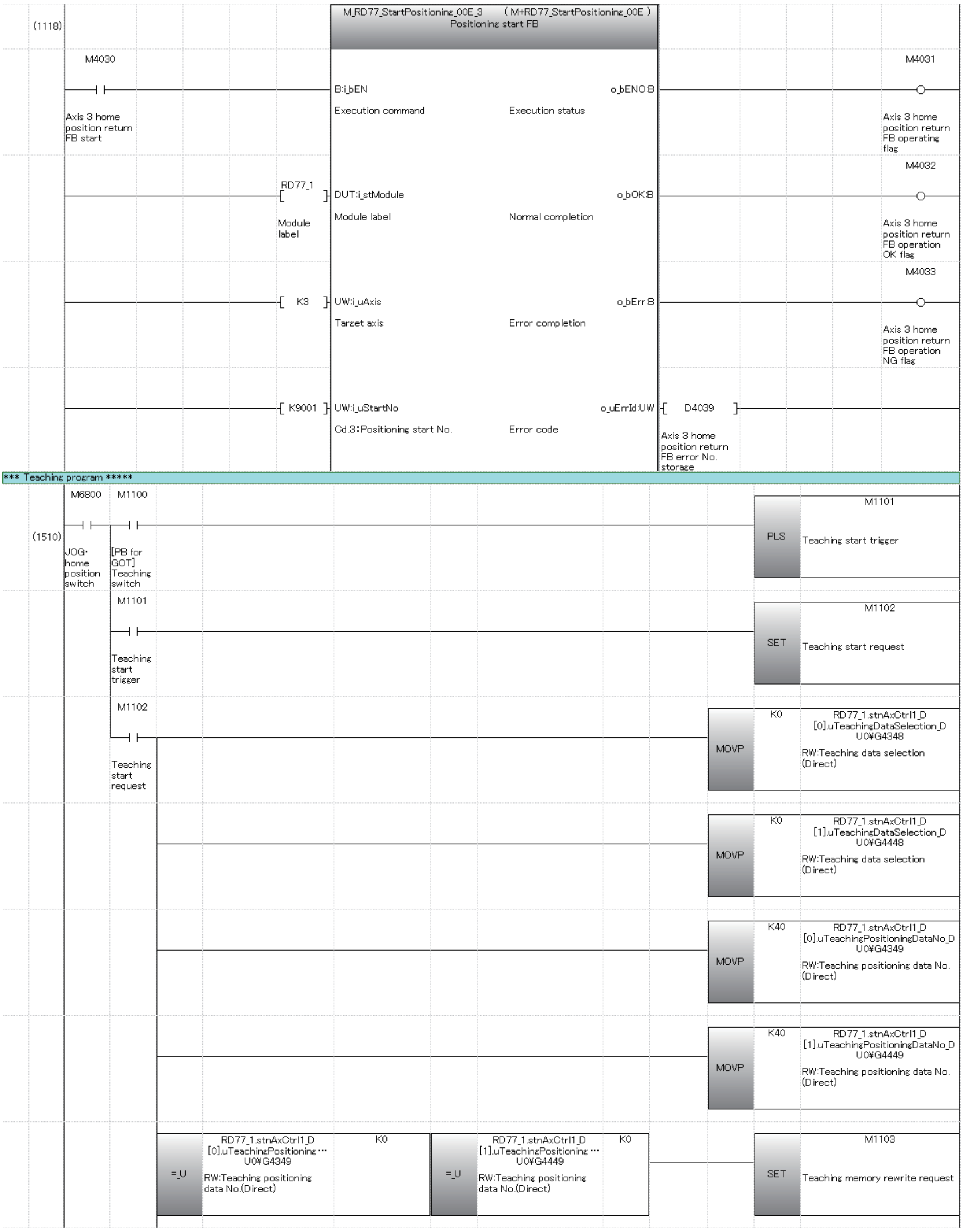


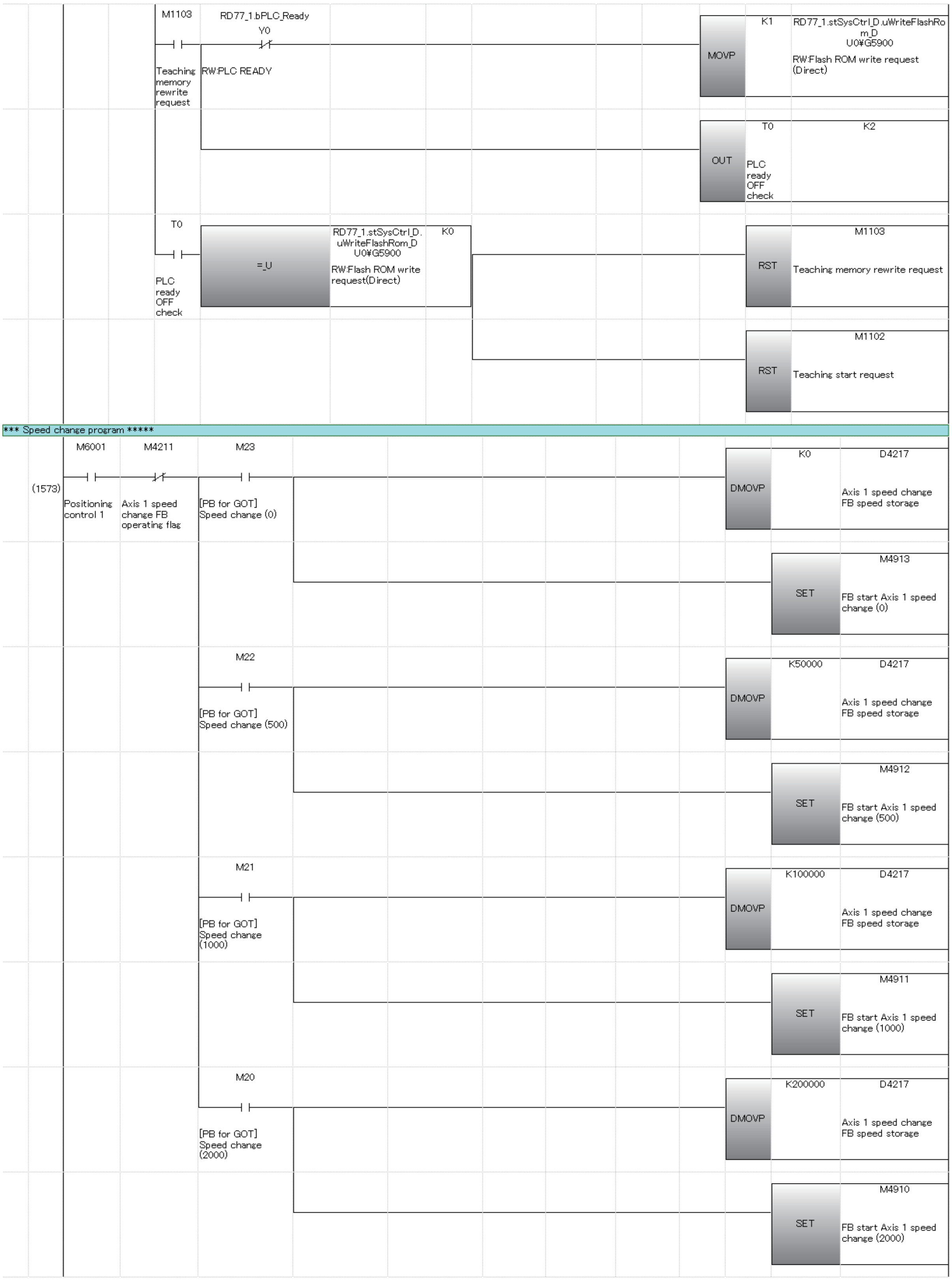

*** [For GOT] Current value monitor *****
SM403
(40)
OFF for only 1 scan after RUN
DMOV
RD77_1.stnAxMntr[0].dActualPosition
R:Real current value
D0
Axis 1 Feed current value
DMOV
RD77_1.stnAxMntr[1].dActualPosition
R:Real current value
D20
Axis 2 Feed current value
DMOV
RD77_1.stnAxMntr[2].dActualPosition
R:Real current value
D40
Axis 3 Feed current value
*** Switch operation mode *****
(51)
U0¥G2477.0
Axis 1 servo ready ON
U0¥G2577.0
Axis 2 servo ready ON
U0¥G2677.0
Axis 3 servo ready ON
M6800
JOG・home position switch
M6801
Positioning control switch
M6802
Advanced synchronous control 1 switch
M6803
Advanced synchronous control 2 switch
M6000
JOG・home position mode
M6001
Positioning control 1
*** JOG operation and home position return *****
M6000
(73)
JOG・home position mode
DMOV
D640
Axis 1 JOG speed
RD77_1.stnAxCtrl1_D[0].udJOG_Speed_D U0¥G4318
RW:JOG speed (Direct)
DMOV
D642
Axis 2 JOG speed
RD77_1.stnAxCtrl1_D[1].udJOG_Speed_D U0¥G4418
RW:JOG speed (Direct)
DMOV
D644
Axis 3 JOG speed
RD77_1.stnAxCtrl1_D[2].udJOG_Speed_D U0¥G4518
RW:JOG speed (Direct)
M1022
Axis 1 home position return start
M1023
Axis 2 home position return start
M1024
Axis 3 home position return start
M4011
Axis 1 home position return FB operating flag
M4021
Axis 2 home position return FB operating flag
M4031
Axis 3 home position return FB operating flag
M1011
[PB for GOT] Axis 1 forward rotation JOG
M1010
[PB for GOT] Axis 1 reverse rotation JOG
U0¥G30101.0
Axis 1 forward rotation JOG start
M1010
[PB for GOT] Axis 1 reverse rotation JOG
M1011
[PB for GOT] Axis 1 forward rotation JOG
U0¥G30102.0
Axis 1 reverse rotation JOG start
M1013
[PB for GOT] Axis 2 forward rotation JOG
M1012
[PB for GOT] Axis 2 reverse rotation JOG
U0¥G30111.0
Axis 2 forward rotation JOG start
M1012
[PB for GOT] Axis 2 reverse rotation JOG
M1013
[PB for GOT] Axis 2 forward rotation JOG
U0¥G30112.0
Axis 2 reverse rotation JOG start

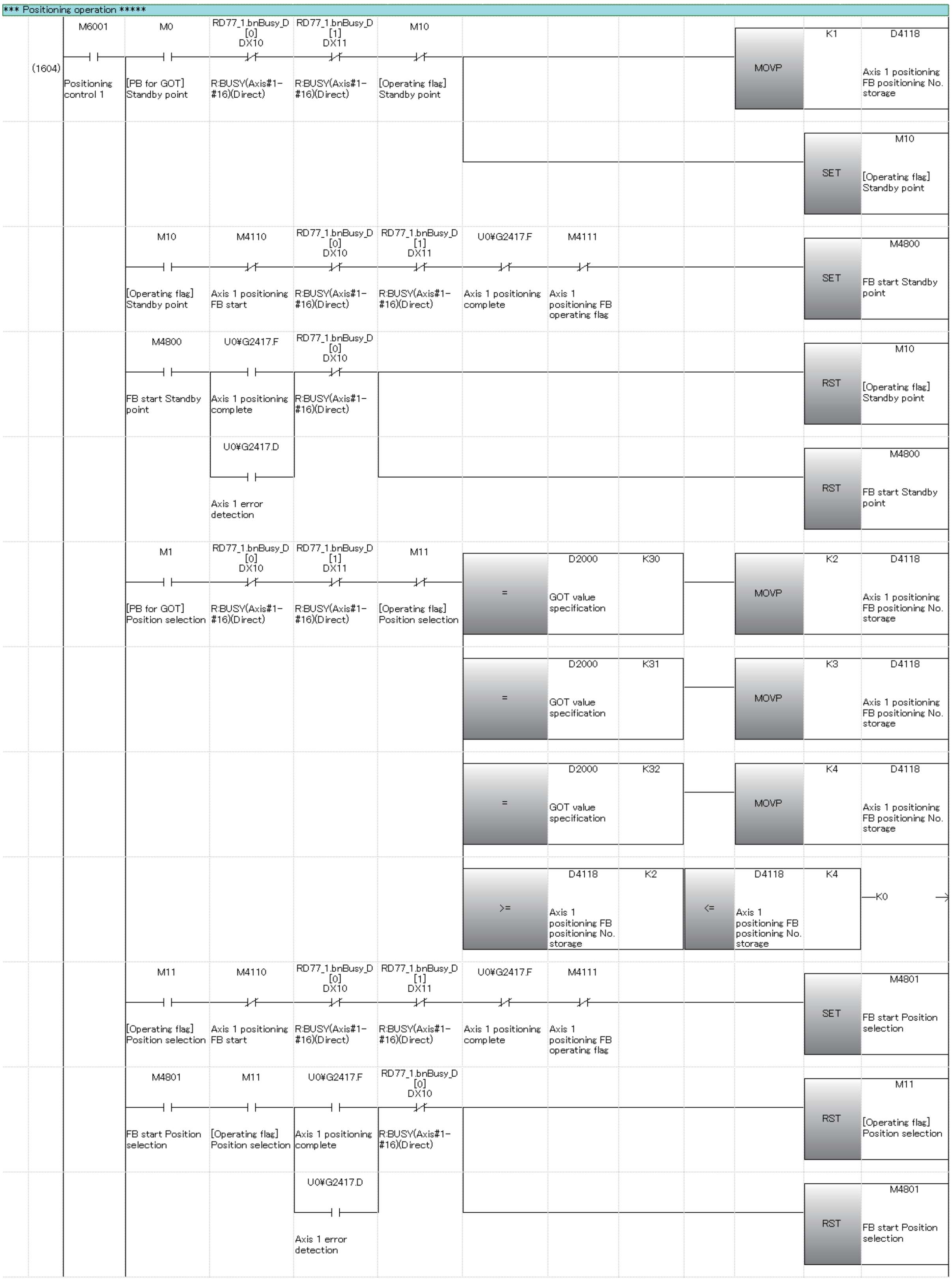


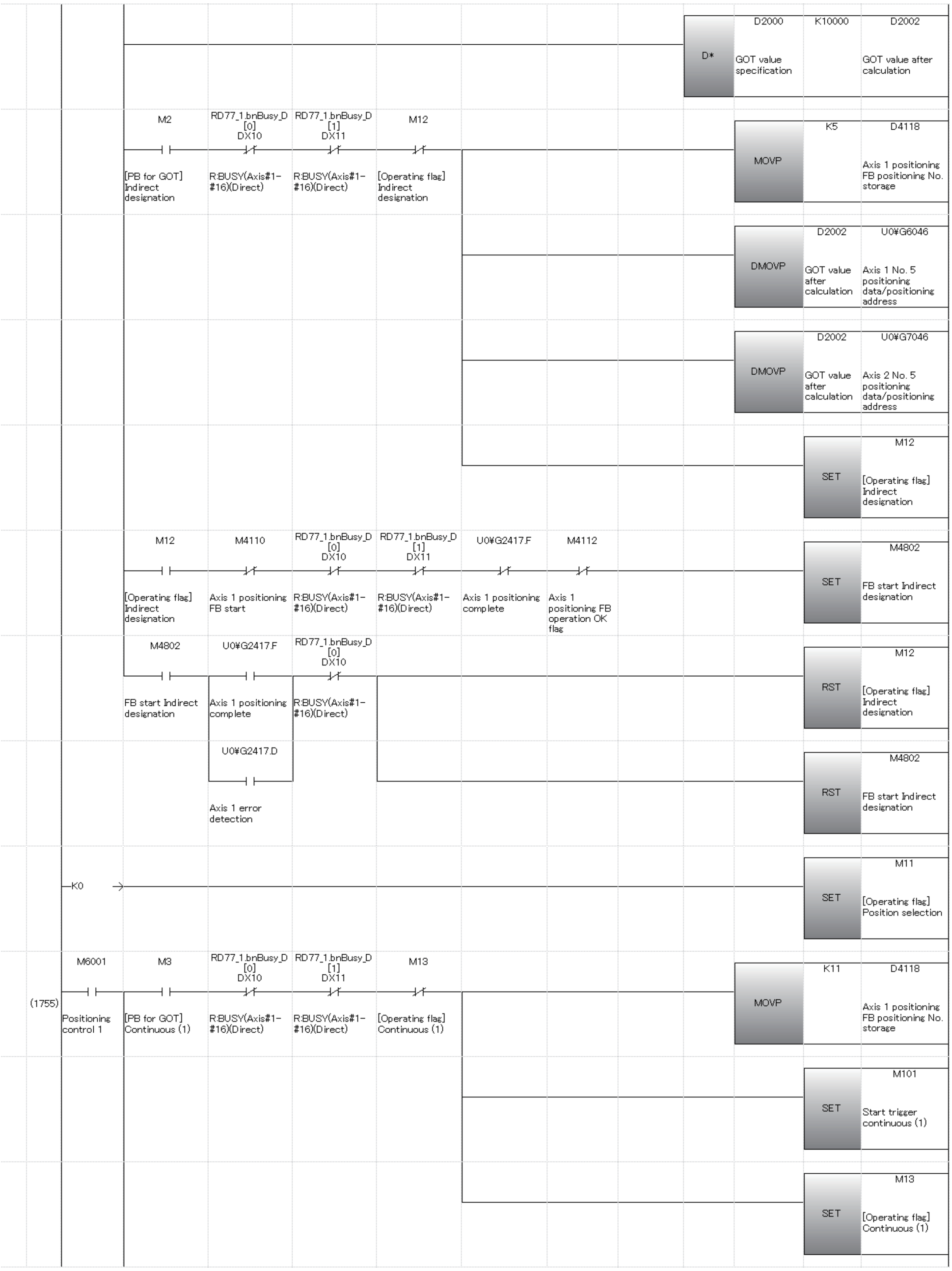
M1014
M1015
U0¥G30121.0
[PB for GOT] Axis 3 forward rotation JOG
[PB for GOT] Axis 3 reverse rotation JOG
Axis 3 forward rotation JOG start
M1015
M1014
U0¥G30122.0
[PB for GOT] Axis 3 reverse rotation JOG
[PB for GOT] Axis 3 forward rotation JOG
Axis 3 reverse rotation JOG start
M1020
[PB for GOT] Home position return
PLS
M1021
Home position return trigger
M1021
U0¥G2417.4
Home position return trigger
Axis 1 home position return complete
SET
M1022
Axis 1 home position return start
U0¥G2517.4
Axis 2 home position return complete
SET
M1023
Axis 2 home position return start
U0¥G2617.4
Axis 3 home position return complete
SET
M1024
Axis 3 home position return start
Axis 1 home position return FB start
M1022
RD77_1.bnBusy_D [0] DX10
M4011
U0¥G2477.1
Axis 1 home position return start
R:BUSY(Axis#1-#16)(Direct)
Axis 1 home position return FB operating flag
Axis 1 servo ON
SET
M4010
Axis 1 home position return FB start
M4010
U0¥G2417.4
RD77_1.bnBusy_D [0] DX10
M4011
Axis 1 home position return FB start
Axis 1 home position return complete
R:BUSY(Axis#1-#16)(Direct)
Axis 1 home position return FB operating flag
RST
M1022
Axis 1 home position return start
U0¥G2417.D
Axis 1 error detection
RST
M4010
Axis 1 home position return FB start
Axis 2 home position return FB start
M1023
RD77_1.bnBusy_D [1] DX11
M4021
U0¥G2577.1
Axis 2 home position return start
R:BUSY(Axis#1-#16)(Direct)
Axis 2 home position return FB operating flag
Axis 2 servo ON
SET
M4020
Axis 2 home position return FB start
M4020
U0¥G2517.4
RD77_1.bnBusy_D [1] DX11
M4021
Axis 2 home position return FB start
Axis 2 home position return complete
R:BUSY(Axis#1-#16)(Direct)
Axis 2 home position return FB operating flag
RST
M1023
Axis 2 home position return start
U0¥G2517.D
Axis 2 error detection
RST
M4020
Axis 2 home position return FB start

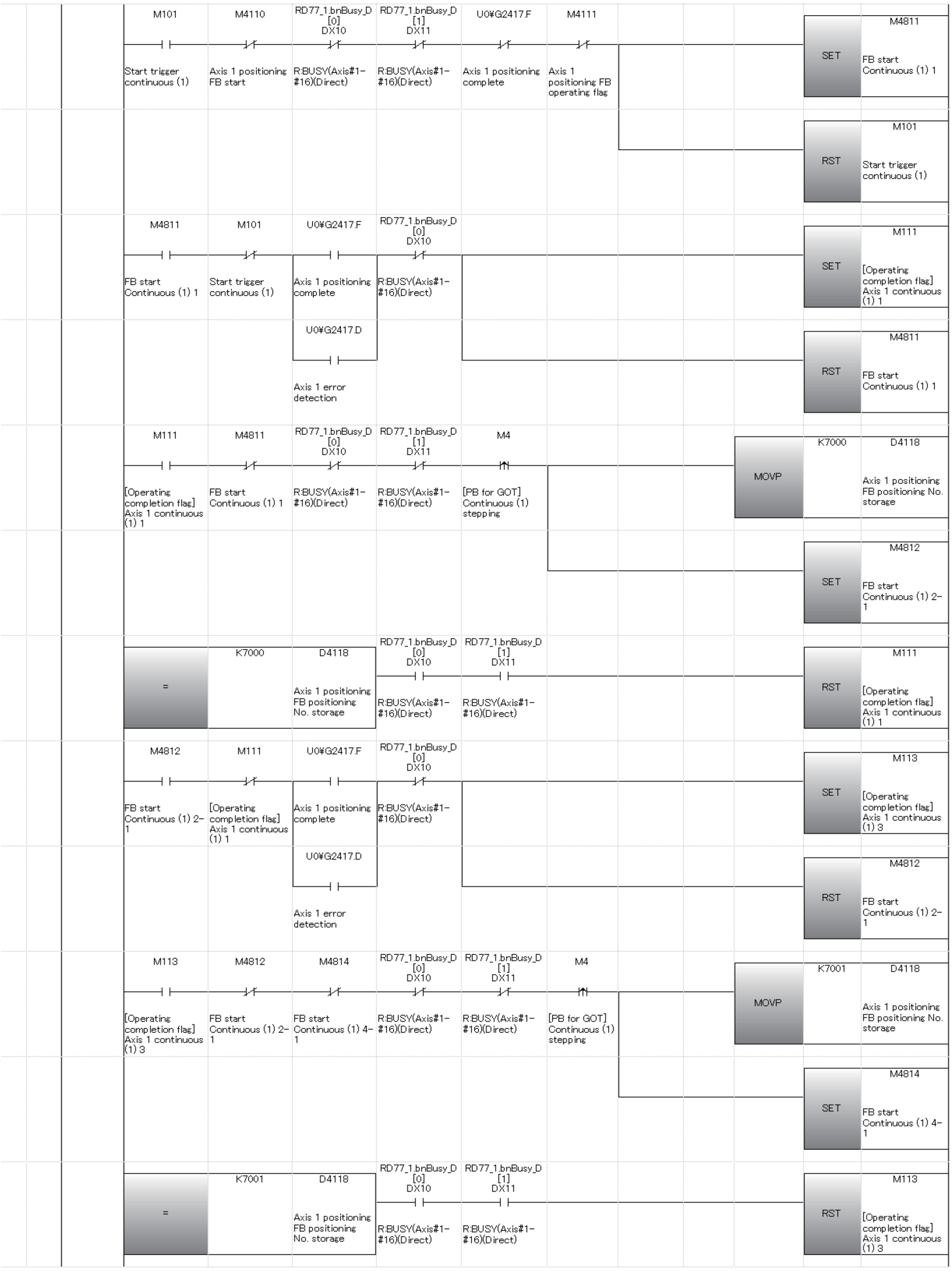

Axis 3 home position return FB start
M1024
RD77_1.bnBusy_D [2] DX12
M4031
U0¥G2677.1
Axis 3 home position return start
R:BUSY(Axis#1-#16)(Direct)
Axis 3 home position return FB operating flag
Axis 3 servo ON
SET
M4030
Axis 3 home position return FB start
M4030
U0¥G2617.4
RD77_1.bnBusy_D [2] DX12
M4031
Axis 3 home position return FB start
Axis 3 home position return complete
R:BUSY(Axis#1-#16)(Direct)
Axis 3 home position return FB operating flag
RST
M1024
Axis 3 home position return start
U0¥G2617.D
Axis 3 error detection
RST
M4030
Axis 3 home position return FB start
(334)
M_RD77_StartPositioning_00E_1 (M+RD77_StartPositioning_00E)
Positioning start FB
M4010
Axis 1 home position return FB start
B:i_bEN
Execution command
o_bENO:B
Execution status
M4011
Axis 1 home position return FB operating flag
RD77_1
Module label
DUT:i_stModule
Module label
o_bOK:B
Normal completion
M4012
Axis 1 home position return FB operation OK flag
K1
UW:i_uAxis
Target axis
o_bErr:B
Error completion
M4013
Axis 1 home position return FB operation NG flag
K9001
UW:i_uStartNo
Cd.3:Positioning start No.
o_uErrId:UW
Error code
D4019
Axis 1 home position return FB error No. storage
(726)
M_RD77_StartPositioning_00E_2 (M+RD77_StartPositioning_00E)
Positioning start FB
M4020
Axis 2 home position return FB start
B:i_bEN
Execution command
o_bENO:B
Execution status
M4021
Axis 2 home position return FB operating flag
RD77_1
Module label
DUT:i_stModule
Module label
o_bOK:B
Normal completion
M4022
Axis 2 home position return FB operation OK flag
K2
UW:i_uAxis
Target axis
o_bErr:B
Error completion
M4023
Axis 2 home position return FB operation NG flag
K9001
UW:i_uStartNo
Cd.3:Positioning start No.
o_uErrId:UW
Error code
D4029
Axis 2 home position return FB error No. storage

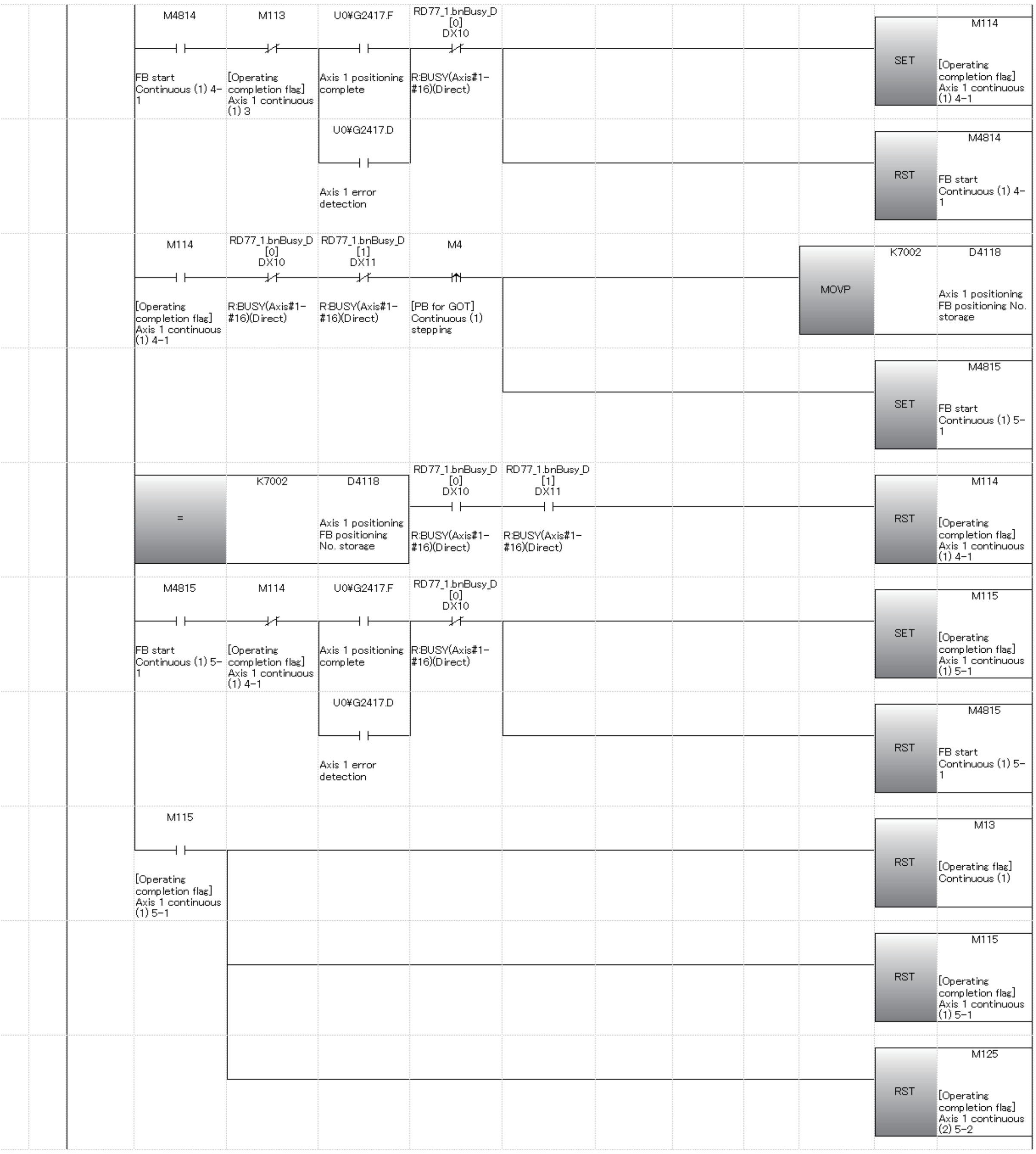

(1118)
M_RD77_StartPositioning_00E_3 (M+RD77_StartPositioning_00E)
Positioning start FB
M4030
Axis 3 home position return FB start
B:i_bEN
Execution command
o_bENO:B
Execution status
M4031
Axis 3 home position return FB operating flag
RD77_1
Module label
DUT:i_stModule
Module label
o_bOK:B
Normal completion
M4032
Axis 3 home position return FB operation OK flag
K3
UW:i_uAxis
Target axis
o_bErr:B
Error completion
M4033
Axis 3 home position return FB operation NG flag
K9001
UW:i_uStartNo
Cd.3:Positioning start No.
o_uErrId:UW
Error code
D4039
Axis 3 home position return FB error No. storage
*** Teaching program *****
(1510)
M6800
JOG・home position switch
M1100
[PB for GOT] Teaching switch
PLS
M1101
Teaching start trigger
M1101
Teaching start trigger
SET
M1102
Teaching start request
M1102
Teaching start request
MOVP
K0
RD77_1.stnAxCtrl1_D [0].uTeachingDataSelection_D
U0¥G4348
RW:Teaching data selection (Direct)
MOVP
K0
RD77_1.stnAxCtrl1_D [1].uTeachingDataSelection_D
U0¥G4448
RW:Teaching data selection (Direct)
MOVP
K40
RD77_1.stnAxCtrl1_D [0].uTeachingPositioningDataNo_D
U0¥G4349
RW:Teaching positioning data No. (Direct)
MOVP
K40
RD77_1.stnAxCtrl1_D [1].uTeachingPositioningDataNo_D
U0¥G4449
RW:Teaching positioning data No. (Direct)
=_U
RD77_1.stnAxCtrl1_D [0].uTeachingPositioning…
U0¥G4349
RW:Teaching positioning data No.(Direct)
K0
=_U
RD77_1.stnAxCtrl1_D [1].uTeachingPositioning…
U0¥G4449
RW:Teaching positioning data No.(Direct)
K0
SET
M1103
Teaching memory rewrite request

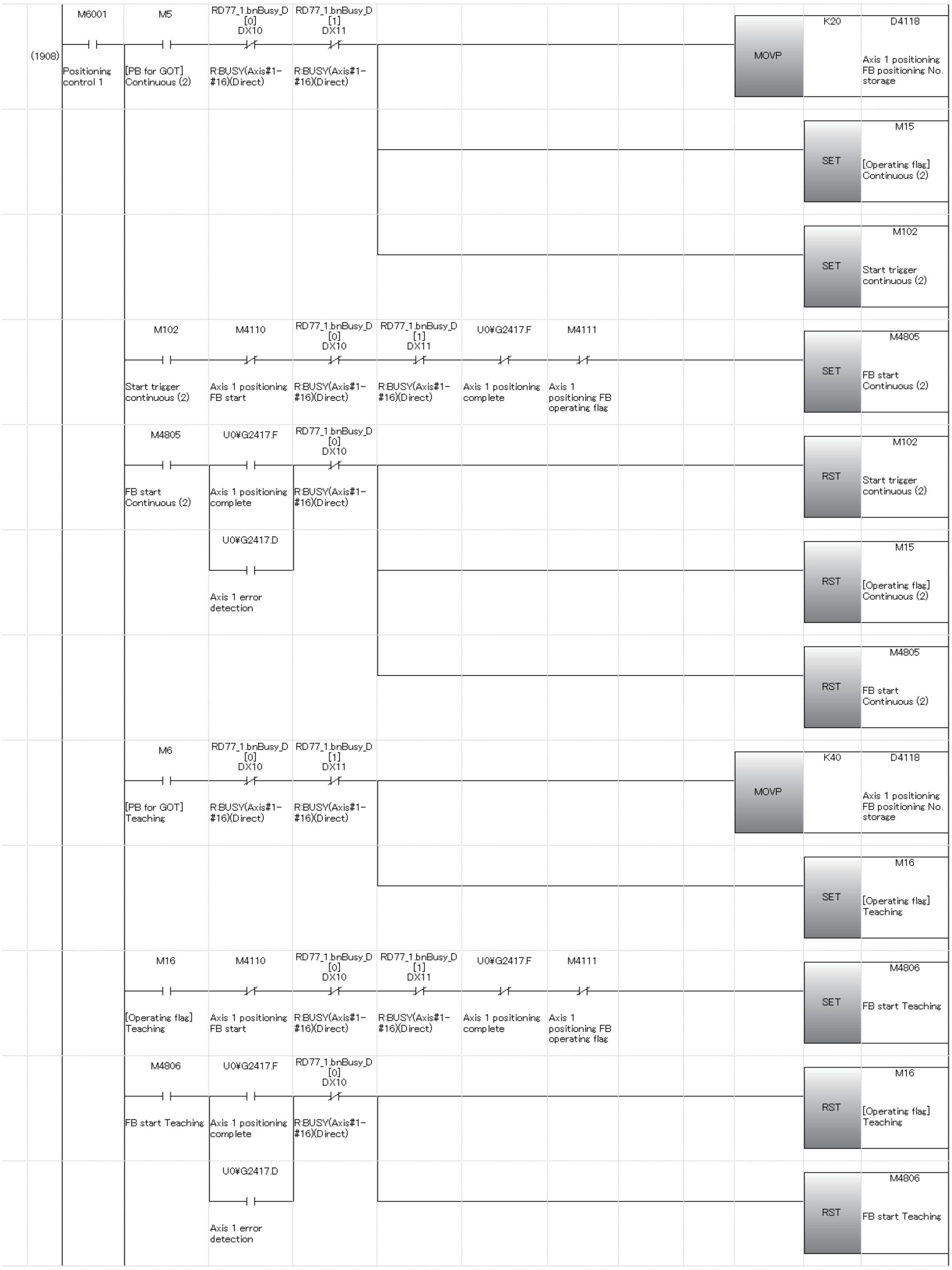

M1103
RD77_1.bPLC_Ready
Y0
Teaching memory rewrite request
RW:PLC READY
MOVP
K1
RD77_1.stSysCtrl_D.uWriteFlashRom_D
U0¥G5900
RW:Flash ROM write request (Direct)
OUT
T0
K2
PLC ready OFF check
T0
=_U
RD77_1.stSysCtrl_D.uWriteFlashRom_D
U0¥G5900
RW:Flash ROM write request(Direct)
K0
PLC ready OFF check
RST
M1103
Teaching memory rewrite request
RST
M1102
Teaching start request
*** Speed change program *****
(1573)
M6001
Positioning control 1
M4211
Axis 1 speed change FB operating flag
M23
[PB for GOT] Speed change (0)
DMOVP
K0
D4217
Axis 1 speed change FB speed storage
SET
M4913
FB start Axis 1 speed change (0)
M22
[PB for GOT] Speed change (500)
DMOVP
K50000
D4217
Axis 1 speed change FB speed storage
SET
M4912
FB start Axis 1 speed change (500)
M21
[PB for GOT] Speed change (1000)
DMOVP
K100000
D4217
Axis 1 speed change FB speed storage
SET
M4911
FB start Axis 1 speed change (1000)
M20
[PB for GOT] Speed change (2000)
DMOVP
K200000
D4217
Axis 1 speed change FB speed storage
SET
M4910
FB start Axis 1 speed change (2000)

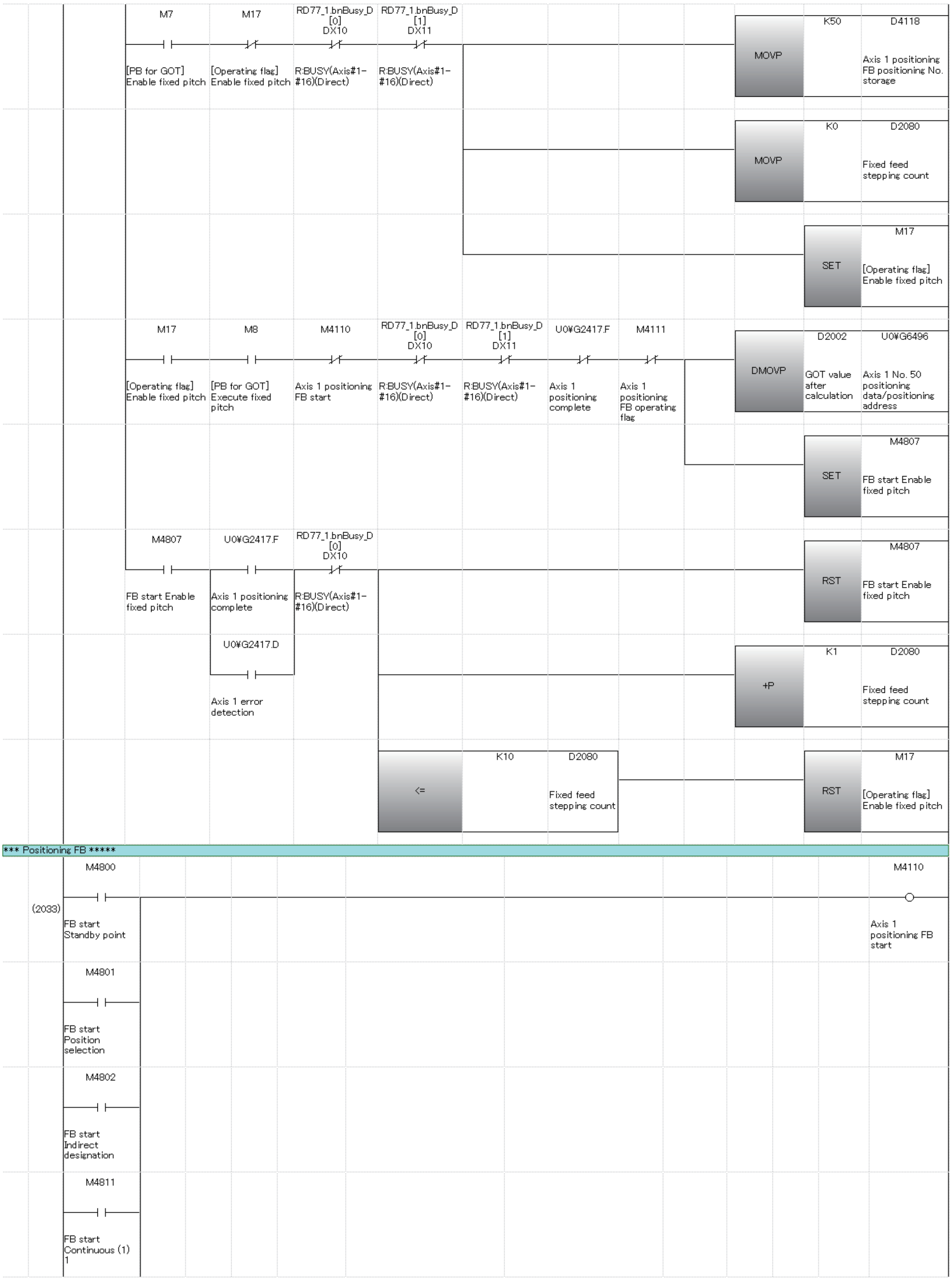

*** Positioning operation *****
(1604)
M6001
Positioning control 1
M0
[PB for GOT] Standby point
RD77_1.bnBusy_D [0] DX10
R:BUSY(Axis#1-#16)(Direct)
RD77_1.bnBusy_D [1] DX11
R:BUSY(Axis#1-#16)(Direct)
M10
[Operating flag] Standby point
MOVP K1 D4118
Axis 1 positioning FB positioning No. storage
SET M10
[Operating flag] Standby point
M10
[Operating flag] Standby point
M4110
Axis 1 positioning FB start
RD77_1.bnBusy_D [0] DX10
R:BUSY(Axis#1-#16)(Direct)
RD77_1.bnBusy_D [1] DX11
R:BUSY(Axis#1-#16)(Direct)
U0¥G2417.F
Axis 1 positioning complete
M4111
Axis 1 positioning FB operating flag
SET M4800
FB start Standby point
M4800
FB start Standby point
U0¥G2417.F
Axis 1 positioning complete
RD77_1.bnBusy_D [0] DX10
R:BUSY(Axis#1-#16)(Direct)
RST M10
[Operating flag] Standby point
U0¥G2417.D
Axis 1 error detection
RST M4800
FB start Standby point
M1
[PB for GOT] Position selection
RD77_1.bnBusy_D [0] DX10
R:BUSY(Axis#1-#16)(Direct)
RD77_1.bnBusy_D [1] DX11
R:BUSY(Axis#1-#16)(Direct)
M11
[Operating flag] Position selection
= D2000 K30
GOT value specification
MOVP K2 D4118
Axis 1 positioning FB positioning No. storage
= D2000 K31
GOT value specification
MOVP K3 D4118
Axis 1 positioning FB positioning No. storage
= D2000 K32
GOT value specification
MOVP K4 D4118
Axis 1 positioning FB positioning No. storage
>= D4118 K2
Axis 1 positioning FB positioning No. storage
<= D4118 K4
Axis 1 positioning FB positioning No. storage
K0
M11
[Operating flag] Position selection
M4110
Axis 1 positioning FB start
RD77_1.bnBusy_D [0] DX10
R:BUSY(Axis#1-#16)(Direct)
RD77_1.bnBusy_D [1] DX11
R:BUSY(Axis#1-#16)(Direct)
U0¥G2417.F
Axis 1 positioning complete
M4111
Axis 1 positioning FB operating flag
SET M4801
FB start Position selection
M4801
FB start Position selection
M11
[Operating flag] Position selection
U0¥G2417.F
Axis 1 positioning complete
RD77_1.bnBusy_D [0] DX10
R:BUSY(Axis#1-#16)(Direct)
RST M11
[Operating flag] Position selection
U0¥G2417.D
Axis 1 error detection
RST M4801
FB start Position selection

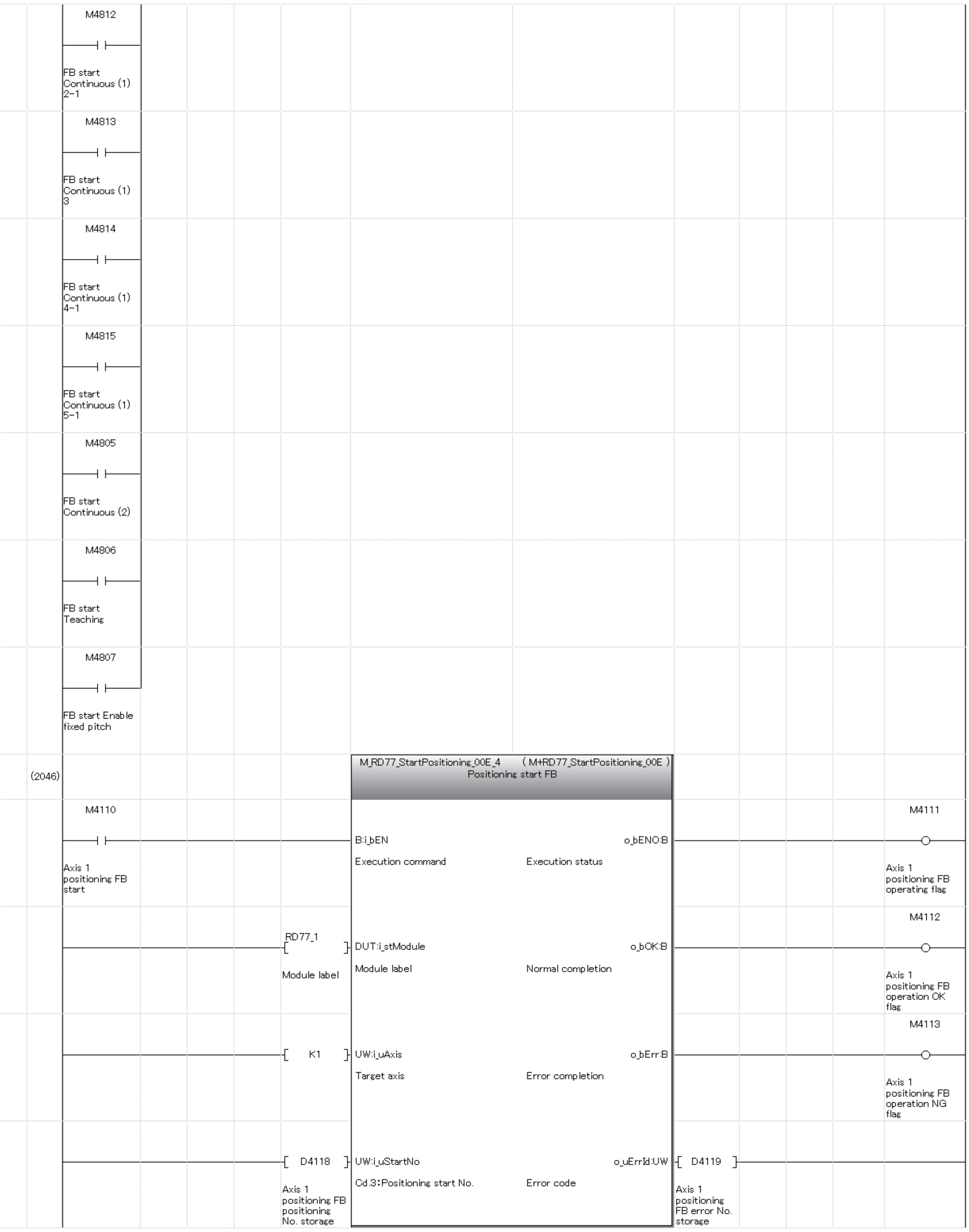

D*
D2000
GOT value specification
K10000
D2002
GOT value after calculation
M2
[PB for GOT] Indirect designation
RD77_1.bnBusy_D [0] DX10
R:BUSY(Axis#1-#16)(Direct)
RD77_1.bnBusy_D [1] DX11
R:BUSY(Axis#1-#16)(Direct)
M12
[Operating flag] Indirect designation
MOVP
K5
D4118
Axis 1 positioning FB positioning No. storage
DMOVP
D2002
GOT value after calculation
U0¥G6046
Axis 1 No. 5 positioning data/positioning address
DMOVP
D2002
GOT value after calculation
U0¥G7046
Axis 2 No. 5 positioning data/positioning address
SET
M12
[Operating flag] Indirect designation
M12
[Operating flag] Indirect designation
M4110
Axis 1 positioning FB start
RD77_1.bnBusy_D [0] DX10
R:BUSY(Axis#1-#16)(Direct)
RD77_1.bnBusy_D [1] DX11
R:BUSY(Axis#1-#16)(Direct)
U0¥G2417.F
Axis 1 positioning complete
M4112
Axis 1 positioning FB operation OK flag
SET
M4802
FB start Indirect designation
M4802
FB start Indirect designation
U0¥G2417.F
Axis 1 positioning complete
RD77_1.bnBusy_D [0] DX10
R:BUSY(Axis#1-#16)(Direct)
RST
M12
[Operating flag] Indirect designation
U0¥G2417.D
Axis 1 error detection
RST
M4802
FB start Indirect designation
K0
SET
M11
[Operating flag] Position selection
(1755)
M6001
Positioning control 1
M3
[PB for GOT] Continuous (1)
RD77_1.bnBusy_D [0] DX10
R:BUSY(Axis#1-#16)(Direct)
RD77_1.bnBusy_D [1] DX11
R:BUSY(Axis#1-#16)(Direct)
M13
[Operating flag] Continuous (1)
MOVP
K11
D4118
Axis 1 positioning FB positioning No. storage
SET
M101
Start trigger continuous (1)
SET
M13
[Operating flag] Continuous (1)

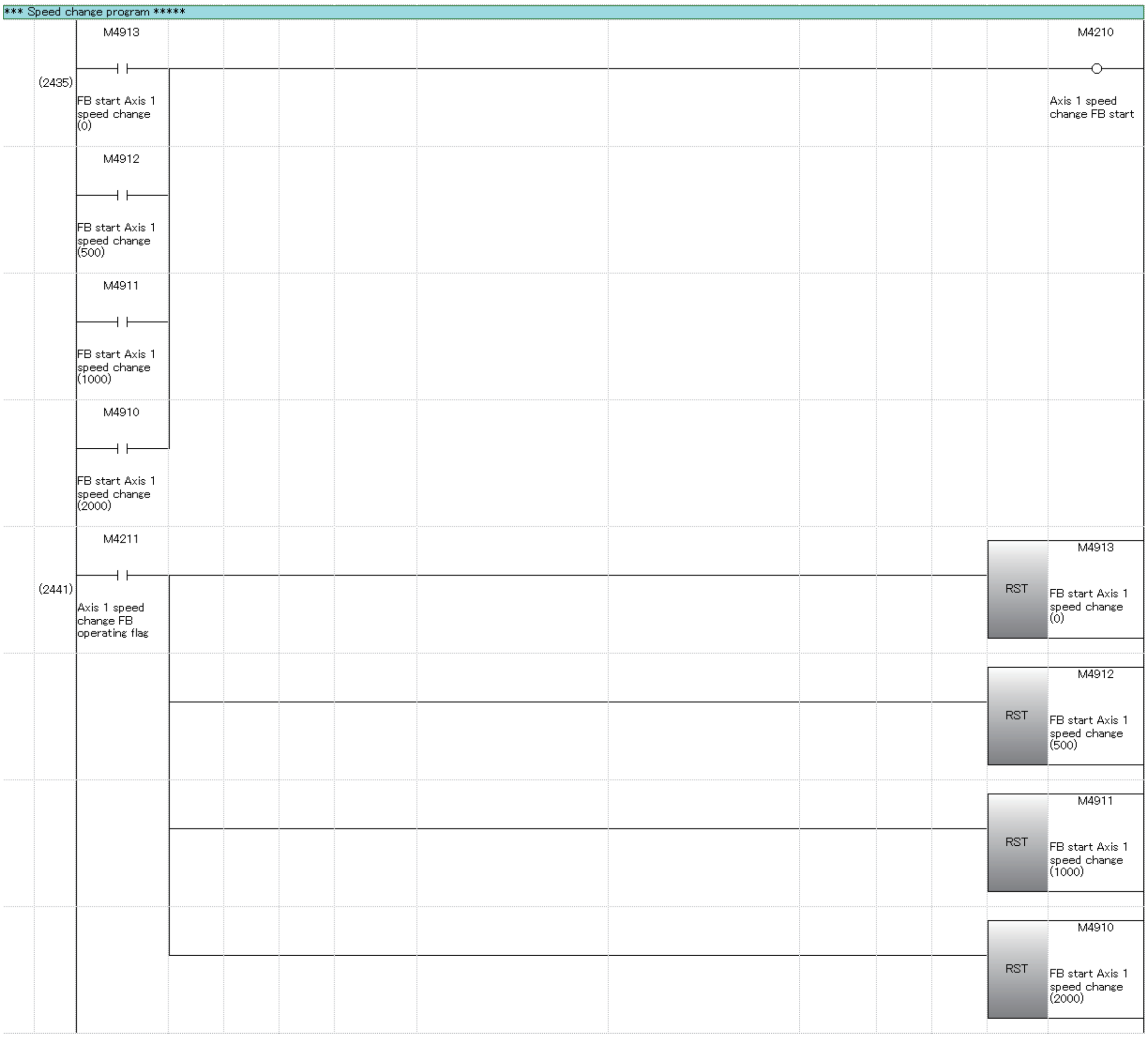

M101
M4110
RD77_1.bnBusy_D [0] DX10
RD77_1.bnBusy_D [1] DX11
U0¥G2417.F
M4111
SET
M4811
Start trigger continuous (1)
Axis 1 positioning FB start
R:BUSY(Axis#1-#16)(Direct)
R:BUSY(Axis#1-#16)(Direct)
Axis 1 positioning complete
Axis 1 positioning FB operating flag
FB start Continuous (1) 1
RST
M101
Start trigger continuous (1)
M4811
M101
U0¥G2417.F
RD77_1.bnBusy_D [0] DX10
SET
M111
FB start Continuous (1) 1
Start trigger continuous (1)
Axis 1 positioning complete
R:BUSY(Axis#1-#16)(Direct)
[Operating completion flag] Axis 1 continuous (1) 1
U0¥G2417.D
RST
M4811
Axis 1 error detection
FB start Continuous (1) 1
M111
M4811
RD77_1.bnBusy_D [0] DX10
RD77_1.bnBusy_D [1] DX11
M4
MOVP
K7000
D4118
[Operating completion flag] Axis 1 continuous (1) 1
FB start Continuous (1) 1
R:BUSY(Axis#1-#16)(Direct)
R:BUSY(Axis#1-#16)(Direct)
[PB for GOT] Continuous (1) stepping
Axis 1 positioning FB positioning No. storage
SET
M4812
FB start Continuous (1) 2-1
=
K7000
D4118
RD77_1.bnBusy_D [0] DX10
RD77_1.bnBusy_D [1] DX11
RST
M111
Axis 1 positioning FB positioning No. storage
R:BUSY(Axis#1-#16)(Direct)
R:BUSY(Axis#1-#16)(Direct)
[Operating completion flag] Axis 1 continuous (1) 1
M4812
M111
U0¥G2417.F
RD77_1.bnBusy_D [0] DX10
SET
M113
FB start Continuous (1) 2-1
[Operating completion flag] Axis 1 continuous (1) 1
Axis 1 positioning complete
R:BUSY(Axis#1-#16)(Direct)
[Operating completion flag] Axis 1 continuous (1) 3
U0¥G2417.D
RST
M4812
Axis 1 error detection
FB start Continuous (1) 2-1
M113
M4812
M4814
RD77_1.bnBusy_D [0] DX10
RD77_1.bnBusy_D [1] DX11
M4
MOVP
K7001
D4118
[Operating completion flag] Axis 1 continuous (1) 3
FB start Continuous (1) 2-1
FB start Continuous (1) 4-1
R:BUSY(Axis#1-#16)(Direct)
R:BUSY(Axis#1-#16)(Direct)
[PB for GOT] Continuous (1) stepping
Axis 1 positioning FB positioning No. storage
SET
M4814
FB start Continuous (1) 4-1
=
K7001
D4118
RD77_1.bnBusy_D [0] DX10
RD77_1.bnBusy_D [1] DX11
RST
M113
Axis 1 positioning FB positioning No. storage
R:BUSY(Axis#1-#16)(Direct)
R:BUSY(Axis#1-#16)(Direct)
[Operating completion flag] Axis 1 continuous (1) 3

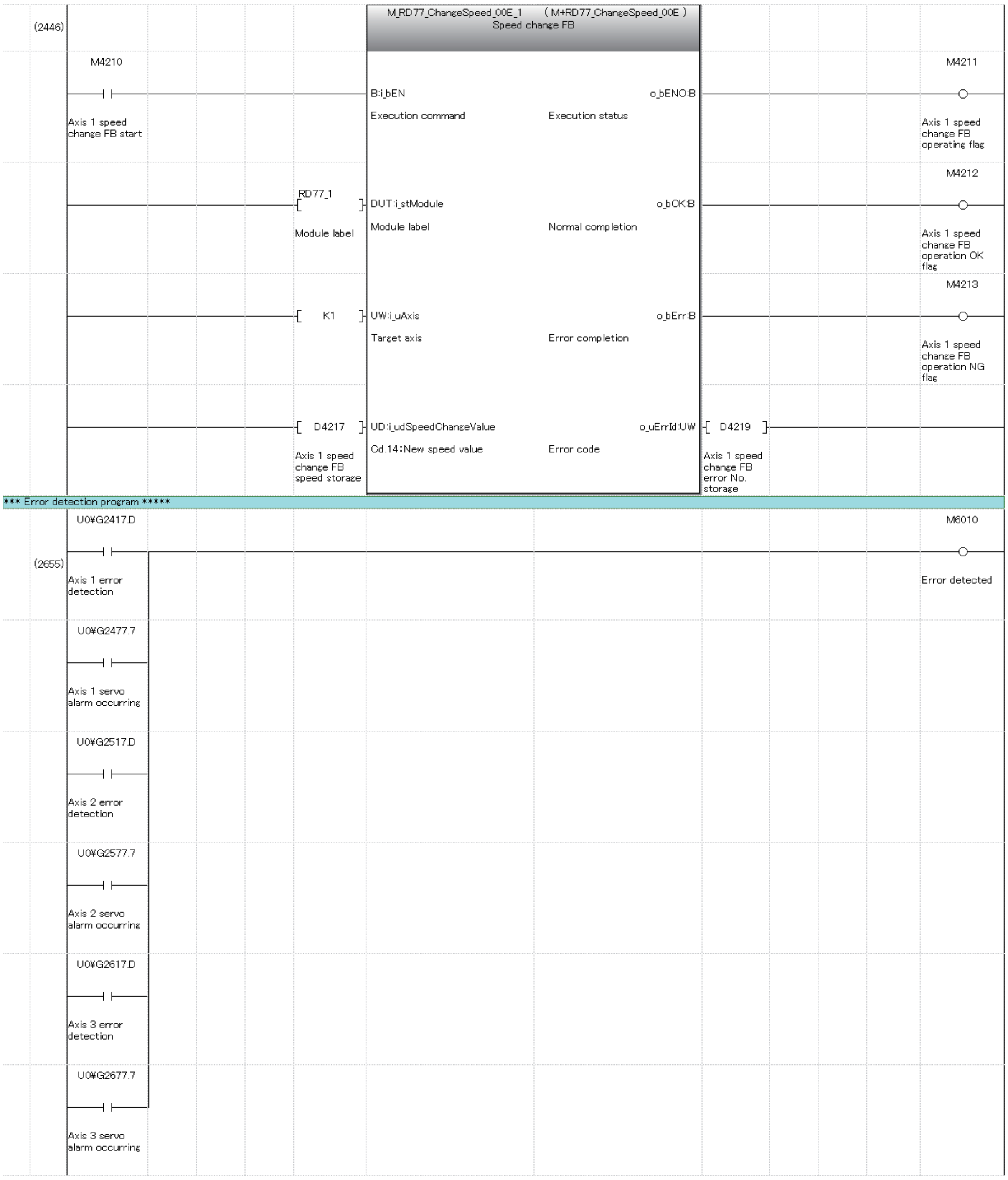

M4814
M113
U0¥G2417.F
RD77_1.bnBusy_D [0] DX10
SET
M114
FB start Continuous (1) 4-1
[Operating completion flag] Axis 1 continuous (1) 3
Axis 1 positioning complete
R:BUSY(Axis#1-#16)(Direct)
[Operating completion flag] Axis 1 continuous (1) 4-1
U0¥G2417.D
Axis 1 error detection
RST
M4814
FB start Continuous (1) 4-1
M114
RD77_1.bnBusy_D [0] DX10
RD77_1.bnBusy_D [1] DX11
M4
MOVP
K7002
D4118
[Operating completion flag] Axis 1 continuous (1) 4-1
R:BUSY(Axis#1-#16)(Direct)
R:BUSY(Axis#1-#16)(Direct)
[PB for GOT] Continuous (1) stepping
Axis 1 positioning FB positioning No. storage
SET
M4815
FB start Continuous (1) 5-1
=
K7002
D4118
RD77_1.bnBusy_D [0] DX10
RD77_1.bnBusy_D [1] DX11
RST
M114
Axis 1 positioning FB positioning No. storage
R:BUSY(Axis#1-#16)(Direct)
R:BUSY(Axis#1-#16)(Direct)
[Operating completion flag] Axis 1 continuous (1) 4-1
M4815
M114
U0¥G2417.F
RD77_1.bnBusy_D [0] DX10
SET
M115
FB start Continuous (1) 5-1
[Operating completion flag] Axis 1 continuous (1) 4-1
Axis 1 positioning complete
R:BUSY(Axis#1-#16)(Direct)
[Operating completion flag] Axis 1 continuous (1) 5-1
U0¥G2417.D
Axis 1 error detection
RST
M4815
FB start Continuous (1) 5-1
M115
RST
M13
[Operating completion flag] Axis 1 continuous (1) 5-1
[Operating flag] Continuous (1)
RST
M115
[Operating completion flag] Axis 1 continuous (1) 5-1
RST
M125
[Operating completion flag] Axis 1 continuous (2) 5-2

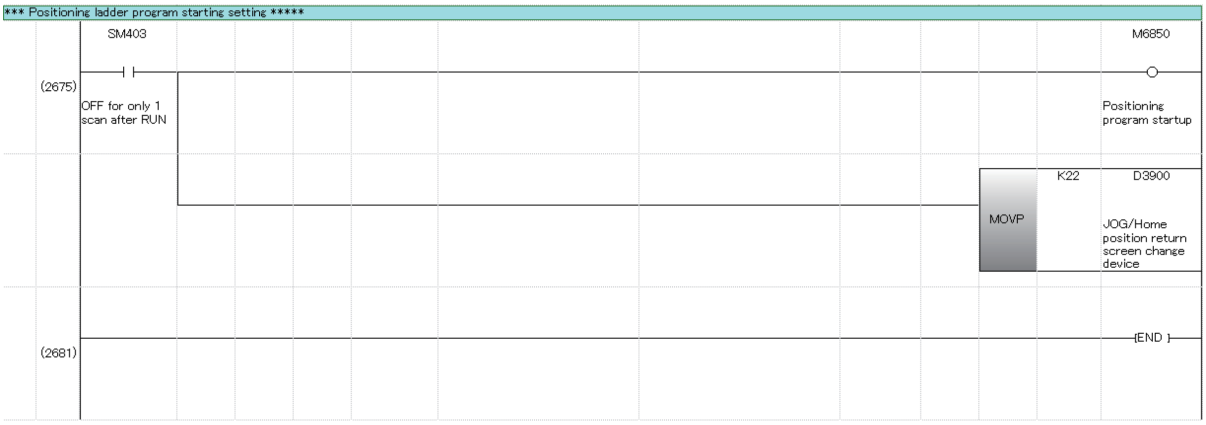

(1908)
M6001
Positioning control 1
M5
[PB for GOT] Continuous (2)
RD77_1.bnBusy_D [0] DX10
R:BUSY(Axis#1-#16)(Direct)
RD77_1.bnBusy_D [1] DX11
R:BUSY(Axis#1-#16)(Direct)
MOVP
K20
D4118
Axis 1 positioning FB positioning No. storage
SET
M15
[Operating flag] Continuous (2)
SET
M102
Start trigger continuous (2)
M102
Start trigger continuous (2)
M4110
Axis 1 positioning FB start
RD77_1.bnBusy_D [0] DX10
R:BUSY(Axis#1-#16)(Direct)
RD77_1.bnBusy_D [1] DX11
R:BUSY(Axis#1-#16)(Direct)
U0¥G2417.F
Axis 1 positioning complete
M4111
Axis 1 positioning FB operating flag
SET
M4805
FB start Continuous (2)
M4805
FB start Continuous (2)
U0¥G2417.F
Axis 1 positioning complete
RD77_1.bnBusy_D [0] DX10
R:BUSY(Axis#1-#16)(Direct)
U0¥G2417.D
Axis 1 error detection
RST
M102
Start trigger continuous (2)
RST
M15
[Operating flag] Continuous (2)
RST
M4805
FB start Continuous (2)
M6
[PB for GOT] Teaching
RD77_1.bnBusy_D [0] DX10
R:BUSY(Axis#1-#16)(Direct)
RD77_1.bnBusy_D [1] DX11
R:BUSY(Axis#1-#16)(Direct)
MOVP
K40
D4118
Axis 1 positioning FB positioning No. storage
SET
M16
[Operating flag] Teaching
M16
[Operating flag] Teaching
M4110
Axis 1 positioning FB start
RD77_1.bnBusy_D [0] DX10
R:BUSY(Axis#1-#16)(Direct)
RD77_1.bnBusy_D [1] DX11
R:BUSY(Axis#1-#16)(Direct)
U0¥G2417.F
Axis 1 positioning complete
M4111
Axis 1 positioning FB operating flag
SET
M4806
FB start Teaching
M4806
FB start Teaching
U0¥G2417.F
Axis 1 positioning complete
RD77_1.bnBusy_D [0] DX10
R:BUSY(Axis#1-#16)(Direct)
U0¥G2417.D
Axis 1 error detection
RST
M16
[Operating flag] Teaching
RST
M4806
FB start Teaching


M7
M17
RD77_1.bnBusy_D [0] DX10
RD77_1.bnBusy_D [1] DX11
[PB for GOT] Enable fixed pitch
[Operating flag] Enable fixed pitch
R:BUSY(Axis#1-#16)(Direct)
R:BUSY(Axis#1-#16)(Direct)
MOVP
K50
D4118
Axis 1 positioning FB positioning No. storage
MOVP
K0
D2080
Fixed feed stepping count
SET
M17
[Operating flag] Enable fixed pitch
M17
M8
M4110
RD77_1.bnBusy_D [0] DX10
RD77_1.bnBusy_D [1] DX11
U0¥G2417.F
M4111
[Operating flag] Enable fixed pitch
[PB for GOT] Execute fixed pitch
Axis 1 positioning FB start
R:BUSY(Axis#1-#16)(Direct)
R:BUSY(Axis#1-#16)(Direct)
Axis 1 positioning complete
Axis 1 positioning FB operating flag
DMOVP
D2002
U0¥G6496
GOT value after calculation
Axis 1 No. 50 positioning data/positioning address
SET
M4807
FB start Enable fixed pitch
M4807
U0¥G2417.F
RD77_1.bnBusy_D [0] DX10
FB start Enable fixed pitch
Axis 1 positioning complete
R:BUSY(Axis#1-#16)(Direct)
RST
M4807
FB start Enable fixed pitch
U0¥G2417.D
Axis 1 error detection
+P
K1
D2080
Fixed feed stepping count
<=
K10
D2080
Fixed feed stepping count
RST
M17
[Operating flag] Enable fixed pitch
*** Positioning FB *****
(2033)
M4800
FB start Standby point
M4110
Axis 1 positioning FB start
M4801
FB start Position selection
M4802
FB start Indirect designation
M4811
FB start Continuous (1) 1


M4812
FB start Continuous (1) 2-1
M4813
FB start Continuous (1) 3
M4814
FB start Continuous (1) 4-1
M4815
FB start Continuous (1) 5-1
M4805
FB start Continuous (2)
M4806
FB start Teaching
M4807
FB start Enable fixed pitch
(2046)
M_RD77_StartPositioning_00E_4 (M+RD77_StartPositioning_00E)
Positioning start FB
M4110
Axis 1 positioning FB start
B:i_bEN
Execution command
o_bENO:B
Execution status
M4111
Axis 1 positioning FB operating flag
RD77_1
Module label
DUT:i_stModule
Module label
o_bOK:B
Normal completion
M4112
Axis 1 positioning FB operation OK flag
K1
UW:i_uAxis
Target axis
o_bErr:B
Error completion
M4113
Axis 1 positioning FB operation NG flag
D4118
Axis 1 positioning FB positioning No. storage
UW:i_uStartNo
Cd.3:Positioning start No.
o_uErrId:UW
Error code
D4119
Axis 1 positioning FB error No. storage


*** Speed change program *****
(2435)
M4913
FB start Axis 1 speed change (0)
M4912
FB start Axis 1 speed change (500)
M4911
FB start Axis 1 speed change (1000)
M4910
FB start Axis 1 speed change (2000)
M4210
Axis 1 speed change FB start
(2441)
M4211
Axis 1 speed change FB operating flag
RST
M4913
FB start Axis 1 speed change (0)
RST
M4912
FB start Axis 1 speed change (500)
RST
M4911
FB start Axis 1 speed change (1000)
RST
M4910
FB start Axis 1 speed change (2000)


(2446)
M_RD77_ChangeSpeed_00E_1 (M+RD77_ChangeSpeed_00E)
Speed change FB
M4210
Axis 1 speed change FB start
B:i_bEN
Execution command
o_bENO:B
Execution status
M4211
Axis 1 speed change FB operating flag
RD77_1
Module label
DUT:i_stModule
Module label
o_bOK:B
Normal completion
M4212
Axis 1 speed change FB operation OK flag
K1
UW:i_uAxis
Target axis
o_bErr:B
Error completion
M4213
Axis 1 speed change FB operation NG flag
D4217
Axis 1 speed change FB speed storage
UD:i_udSpeedChangeValue
Cd.14:New speed value
o_uErrId:UW
Error code
D4219
Axis 1 speed change FB error No. storage
*** Error detection program *****
(2655)
U0¥G2417.D
Axis 1 error detection
M6010
Error detected
U0¥G2477.7
Axis 1 servo alarm occurring
U0¥G2517.D
Axis 2 error detection
U0¥G2577.7
Axis 2 servo alarm occurring
U0¥G2617.D
Axis 3 error detection
U0¥G2677.7
Axis 3 servo alarm occurring

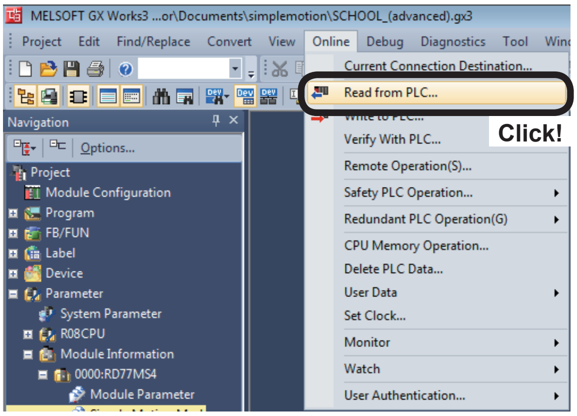

*** Positioning ladder program starting setting *****
SM403
M6850
(2675)
OFF for only 1 scan after RUN
Positioning program startup
MOVP
K22
D3900
JOG/Home position return screen change device
(2681)
END

Appendix 2 Application Practice

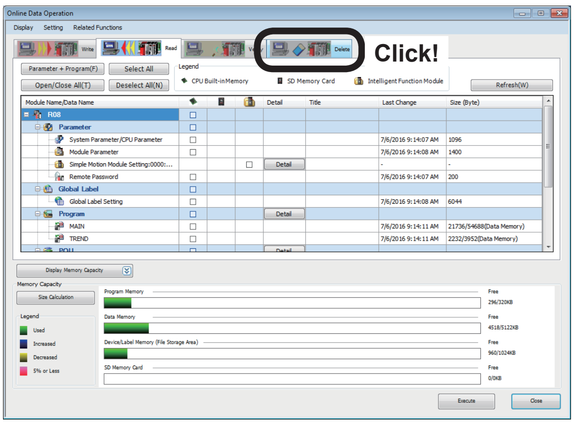
Here, we practice the continuous positioning, teaching/teaching playback and fixed-feed/fixed-feed stepping.

Start the practice after writing the project “SCHOOL_(positioning)” to the PLC. For the steps to the practical training, refer to Chapter 6 “Practice (2) Training in Positioning Control.”

If this training is performed after practice in advanced synchronous control (refer to Chapter 7), perform the home position return (refer to Section 6.8.3), and delete the project “SCHOOL_(advanced)” in accordance with the following procedure.



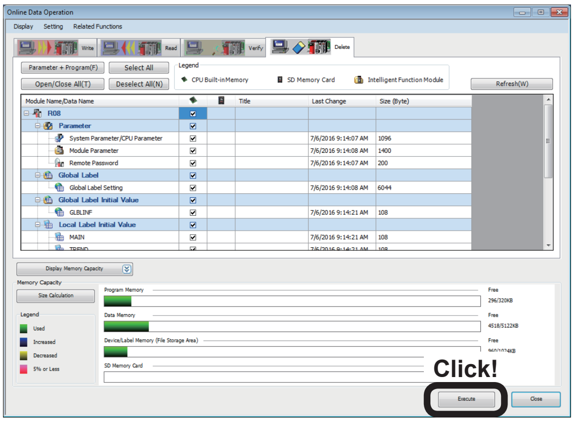
(1) Click [Online] → [Read from PLC] on GX Works3 menu.



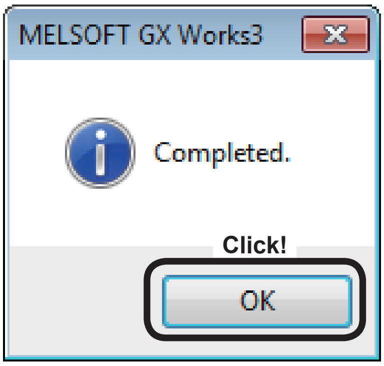
(2) An Online Data Operation dialog box appears. Click the [Delete] tab.

Go to next page

From previous page



(3) Check [R08], and click the Execute button.



(4) After the parameters are deleted, the message shown left will be displayed. Click the OK button.

Appendix 2.1 Practice Content

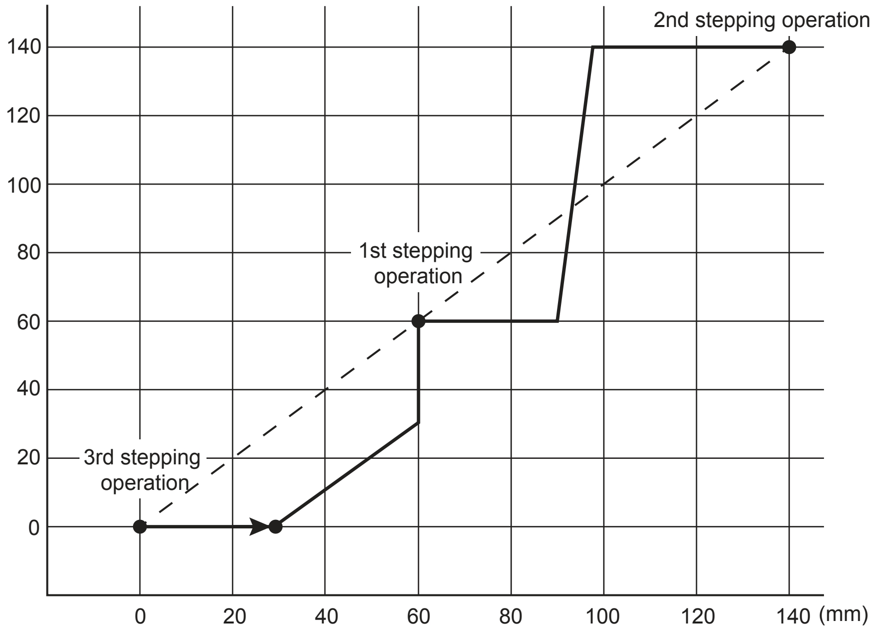
In this training, we practice not individual positioning operations stated in Chapter 6 “Practice (2) Training in Positioning Control,” but a series of positioning operations.

- Continuous positioning (1): To perform stepping operation
- Continuous positioning (2): To continuously perform positioning operations (Continuous path control)
- Teaching, Teaching playback: To register any position and position the machine in the registered position
- Fixed-feed, Fixed-feed stepping: To perform fixed-feed operation in the stepping mode

Appendix 2.2 Practice Program

Appendix 2.2.1 Continuous positioning (1)

This program is designed for stepping operation using the block start data.



The outline of the program operation is shown below.

Continuous positioning (1) start	Continuous positioning (1) command input ON
Movement to Standby Point	Positioning start No.: 11 (Positioning data No. 11) Positioning start signal ON Axis 1: Stop after positioning at 30 mm
Continuous positioning (1) stepping command input ON	
Execution of stepping operation (1)	Positioning start No.: 7000 (Block start data No. 0) Positioning start signal ON Axis 1 and Axis 2: Stop after positioning at 60 mm
Continuous positioning (1) stepping command input ON	
Execution of stepping operation (2)	Positioning start No.: 7001 (Block start data No. 1) Positioning start signal ON Axis 1: Stop after positioning at 90 mm Axis 1 and Axis 2: Stop after positioning at 140 mm
Continuous positioning (1) stepping command input ON	
Execution of stepping operation (3)	Positioning start No.: 7002 (Block start data No. 2) Positioning start signal ON Axis 1 and Axis 2: Stop after positioning at 0 mm
Continuous positioning (1) End	

(1) Control data

Item	Buffer memory address		Setting value
	Axis 1	Axis 2	
[Cd.3] Positioning start No.	4300	-	11 (Positioning data No. 11) 7000 (Block start data No. 0) 7001 (Block start data No. 1) 7002 (Block start data No. 2)

POINT

When the continuous positioning (1) command input turns on, the module FB "M+RD77_StartPositioning" writes the positioning start No. in "[Cd.3] Positioning start No." The positioning start No. is not written to the Axis 2 that will start according to the block start data.

(2) Output signal

Item	Axis 1	Axis 2
Positioning start signal	Y10	-

POINT

When the continuous positioning (1) command input turns on, the module FB "M+RD77_StartPositioning" turns on the positioning start signal. The positioning start signal for the Axis 2 that will start according to the block start data is not turned on.

(3) Program example

[1] Continuous positioning (1) condition items

Condition item	Axis 1	Axis 2
Continuous positioning (1) command input	M3	-
Continuous positioning (1) stepping command input	M4	

[2] Positioning data to be used (Positioning data Nos. 11 to 15)

Each of the Axes 1 and 2 is subject to 1-axis linear interpolation control (absolute method).

Axis 1 Positioning data

No.	Operation pattern	Control method	Axis to be interpolated	Acceleration time No.	Deceleration time No.	Positioning address	Arc address
11	0:END	01h:ABS Linear 1	-	0:100	0:150	30000.0 µm	0.0 µm
	<Positioning Comment>Continuous (1) (1)						
12	0:END	01h:ABS Linear 1	-	0:100	0:150	60000.0 µm	0.0 µm
	<Positioning Comment>Continuous (1) (2-1)						
13	0:END	01h:ABS Linear 1	-	1:50	1:2000	90000.0 µm	0.0 µm
	<Positioning Comment>Continuous (1) (3)						
14	0:END	01h:ABS Linear 1	-	0:100	0:150	140000.0 µm	0.0 µm
	<Positioning Comment>Continuous (1) (4-1)						
15	0:END	01h:ABS Linear 1	-	0:100	0:150	0.0 µm	0.0 µm
	<Positioning Comment>Continuous (1) (5-1)						

No.	Command speed	Dwell time	M-code	M-code ON signal output timing	ABS direction in degrees	Interpolation speed designation method
11	1000.00 mm/min	0 ms	0	0:Use the setting value of M-code ON signal output timing	0:Use the setting value of ABS direction at degree	0:Use the setting value of Interpolation speed designation method
12	2000.00 mm/min	0 ms	0	0:Use the setting value of M-code ON signal output timing	0:Use the setting value of ABS direction at degree	0:Use the setting value of Interpolation speed designation method
13	3000.00 mm/min	0 ms	0	0:Use the setting value of M-code ON signal output timing	0:Use the setting value of ABS direction at degree	0:Use the setting value of Interpolation speed designation method
14	500.00 mm/min	0 ms	0	0:Use the setting value of M-code ON signal output timing	0:Use the setting value of ABS direction at degree	0:Use the setting value of Interpolation speed designation method
15	2000.00 mm/min	0 ms	0	0:Use the setting value of M-code ON signal output timing	0:Use the setting value of ABS direction at degree	0:Use the setting value of Interpolation speed designation method

Axis 2 Positioning data

No.	Operation pattern	Control method	Axis to be interpolated	Acceleration time No.	Deceleration time No.	Positioning address	Arc address
12	0:END	01h:ABS Linear 1	-	0:100	0:150	60000.0 µm	0.0 µm
	<Positioning Comment>Continuous (1) (2-2)						
14	0:END	01h:ABS Linear 1	-	0:100	0:150	140000.0 µm	0.0 µm
	<Positioning Comment>Continuous (1) (4-2)						
15	0:END	01h:ABS Linear 1	-	0:100	0:150	0.0 µm	0.0 µm
	<Positioning Comment>Continuous (1) (5-2)						

No.	Command speed	Dwell time	M-code	M-code ON signal output timing	ABS direction in degrees	Interpolation speed designation method
12	2000.00 mm/min	0 ms	0	0:Use the setting value of M-code ON signal output timing	0:Use the setting value of ABS direction at degree	0:Use the setting value of Interpolation speed designation method
14	5000.00 mm/min	0 ms	0	0:Use the setting value of M-code ON signal output timing	0:Use the setting value of ABS direction at degree	0:Use the setting value of Interpolation speed designation method
15	2000.00 mm/min	0 ms	0	0:Use the setting value of M-code ON signal output timing	0:Use the setting value of ABS direction at degree	0:Use the setting value of Interpolation speed designation method

[3] Block start data to be used (block start data Nos. 0 to 2)

Block start data	Details of operation
Block No. 0 (Stepping operation (1))	The Axes 1 and 2 are simultaneously positioned according to the data No. 12 to complete the positioning.
Block No. 1 (Stepping operation (2))	The Axis 1 is positioned according to the data No. 13. Continuously the Axes 1 and 2 are simultaneously positioned according to the data No. 14 to complete the positioning.
Block No. 2 (Stepping operation (3))	The Axes 1 and 2 are simultaneously positioned according to the data No. 15 to complete the positioning.

Axis 1 Block start data

Block No. 0

Display Filter: Block No.0

Point No.	Shape	Start data No.	Special start instruction	Parameter	Condition data
1	0:END	12	03h:Simultaneously Start	1	Axis#2(No.12)

Block No. 1

Display Filter: Block No.1

Point No.	Shape	Start data No.	Special start instruction	Parameter	Condition data
1	1:Continue	13	00h:Normal Start	1	
2	0:END	14	03h:Simultaneously Start	1	Axis#2(No.14)

Block No. 2

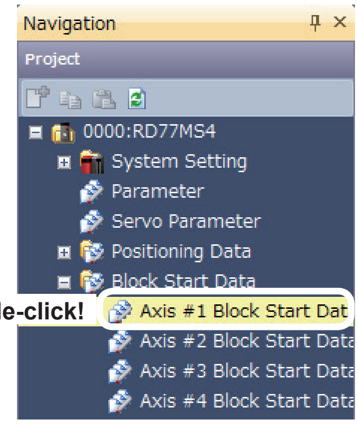
Display Filter: Block No.2

Point No.	Shape	Start data No.	Special start instruction	Parameter	Condition data
1	0:END	15	03h:Simultaneously Start	3	Axis#2(No.15)

Remarks

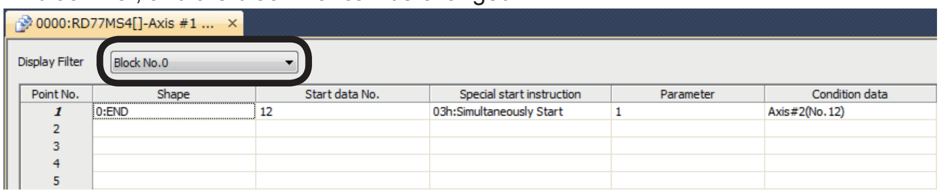
The settings in the block start data can be displayed in accordance with the following procedure.

(1) Select [0000:RD77MS4] → [Axis #1 block start data] in the [Navigation Window] of the Simple Motion setting tool, and double-click [Block start data].



Double-click!

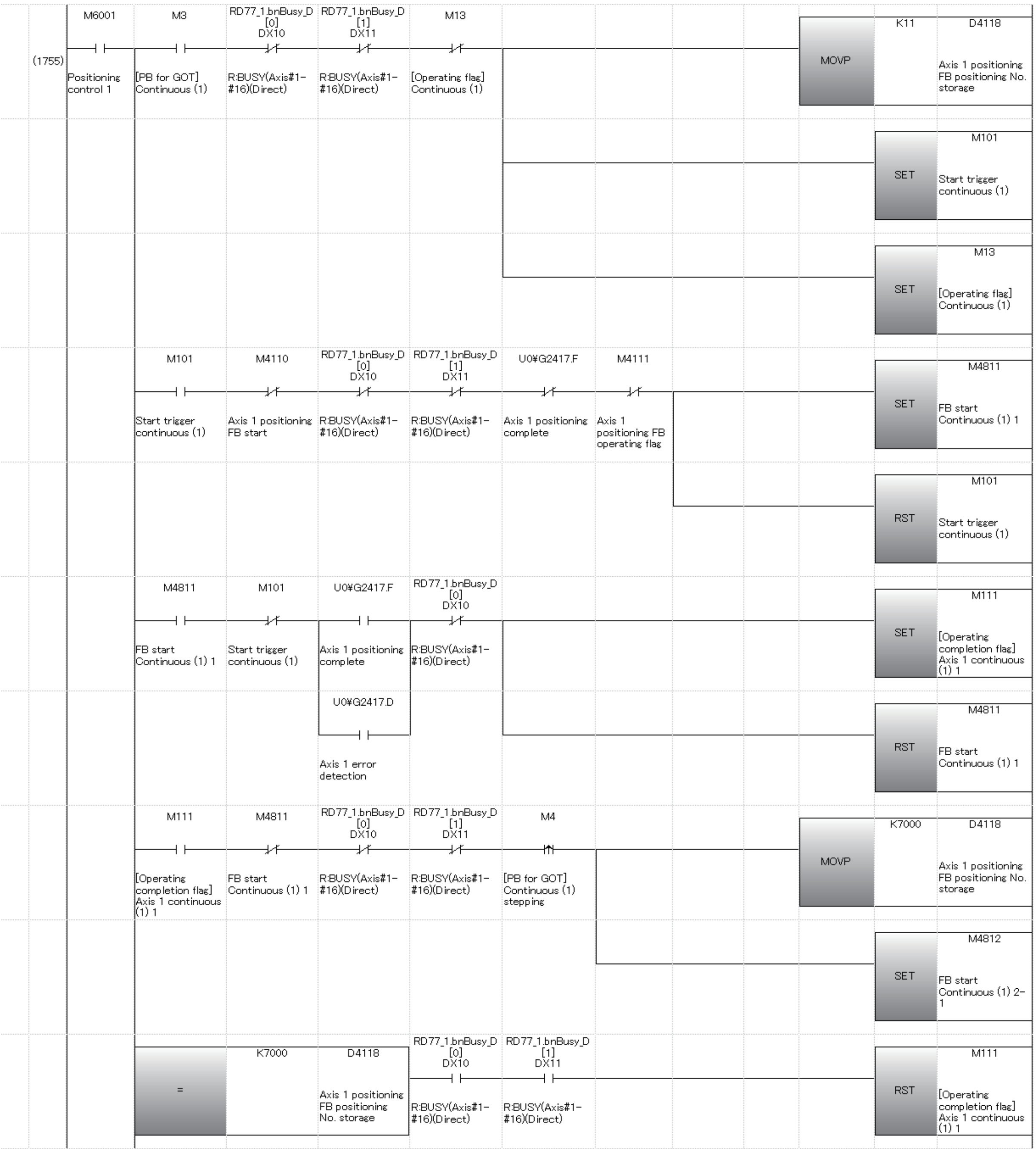
(2) The 0000:RD77MS4[ ]-Axis #1 Block Start Data setting screen appears. Click the display filter block No., and the block No. can be changed.

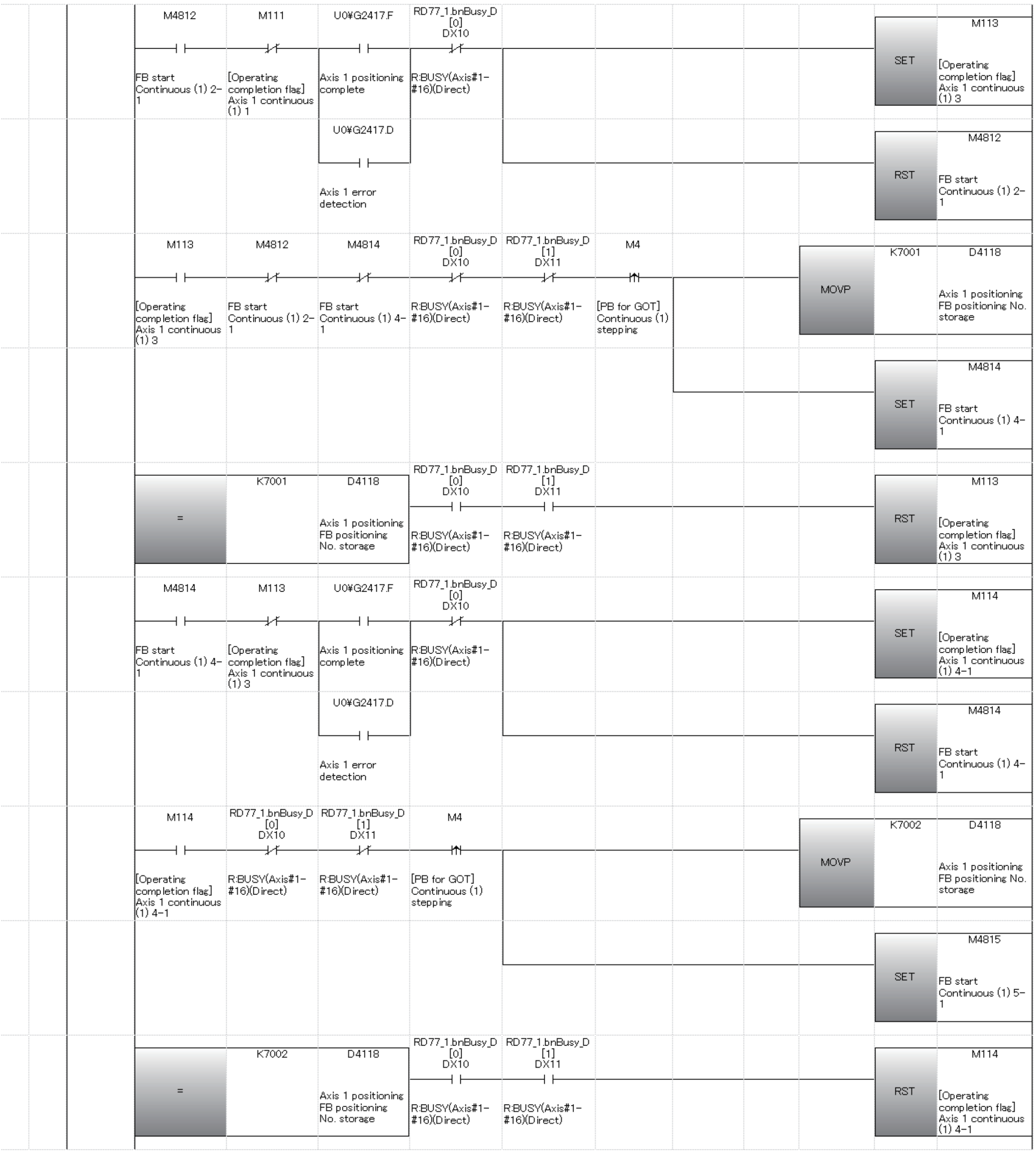


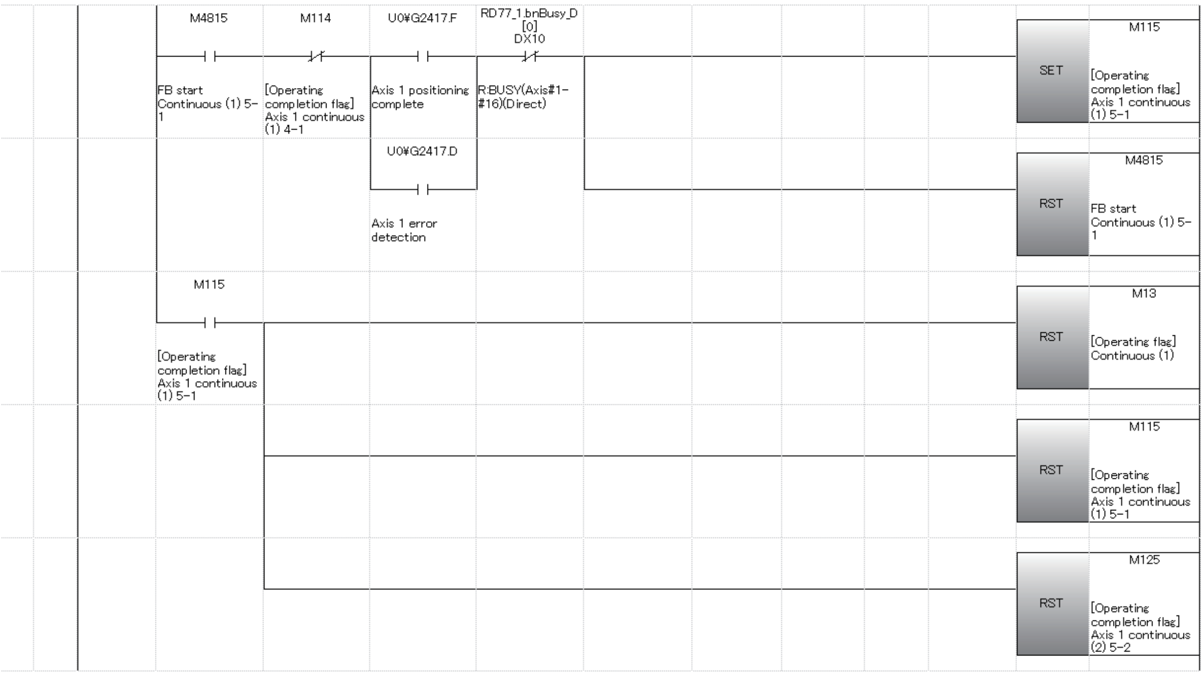
[4] Example of continuous positioning (1) program

To execute the following continuous positioning (1), the positioning execute program is required.

Refer to Section 6.6.8 on positioning execute program.




M4812
M111
U0¥G2417.F
RD77_1.bnBusy_D [0] DX10
FB start Continuous (1) 2-1
[Operating completion flag] Axis 1 continuous (1) 1
Axis 1 positioning complete
R:BUSY(Axis#1-#16)(Direct)
SET
M113
[Operating completion flag] Axis 1 continuous (1) 3
U0¥G2417.D
Axis 1 error detection
RST
M4812
FB start Continuous (1) 2-1
M113
M4812
M4814
RD77_1.bnBusy_D [0] DX10
RD77_1.bnBusy_D [1] DX11
M4
[Operating completion flag] Axis 1 continuous (1) 3
FB start Continuous (1) 2-1
FB start Continuous (1) 4-1
R:BUSY(Axis#1-#16)(Direct)
R:BUSY(Axis#1-#16)(Direct)
[PB for GOT] Continuous (1) stepping
MOVP
K7001
D4118
Axis 1 positioning FB positioning No. storage
SET
M4814
FB start Continuous (1) 4-1
=
K7001
D4118
Axis 1 positioning FB positioning No. storage
RD77_1.bnBusy_D [0] DX10
RD77_1.bnBusy_D [1] DX11
R:BUSY(Axis#1-#16)(Direct)
R:BUSY(Axis#1-#16)(Direct)
RST
M113
[Operating completion flag] Axis 1 continuous (1) 3
M4814
M113
U0¥G2417.F
RD77_1.bnBusy_D [0] DX10
FB start Continuous (1) 4-1
[Operating completion flag] Axis 1 continuous (1) 3
Axis 1 positioning complete
R:BUSY(Axis#1-#16)(Direct)
SET
M114
[Operating completion flag] Axis 1 continuous (1) 4-1
U0¥G2417.D
Axis 1 error detection
RST
M4814
FB start Continuous (1) 4-1
M114
RD77_1.bnBusy_D [0] DX10
RD77_1.bnBusy_D [1] DX11
M4
[Operating completion flag] Axis 1 continuous (1) 4-1
R:BUSY(Axis#1-#16)(Direct)
R:BUSY(Axis#1-#16)(Direct)
[PB for GOT] Continuous (1) stepping
MOVP
K7002
D4118
Axis 1 positioning FB positioning No. storage
SET
M4815
FB start Continuous (1) 5-1
=
K7002
D4118
Axis 1 positioning FB positioning No. storage
RD77_1.bnBusy_D [0] DX10
RD77_1.bnBusy_D [1] DX11
R:BUSY(Axis#1-#16)(Direct)
R:BUSY(Axis#1-#16)(Direct)
RST
M114
[Operating completion flag] Axis 1 continuous (1) 4-1



(4) Demonstration machine operation panel [Positioning operation screen]

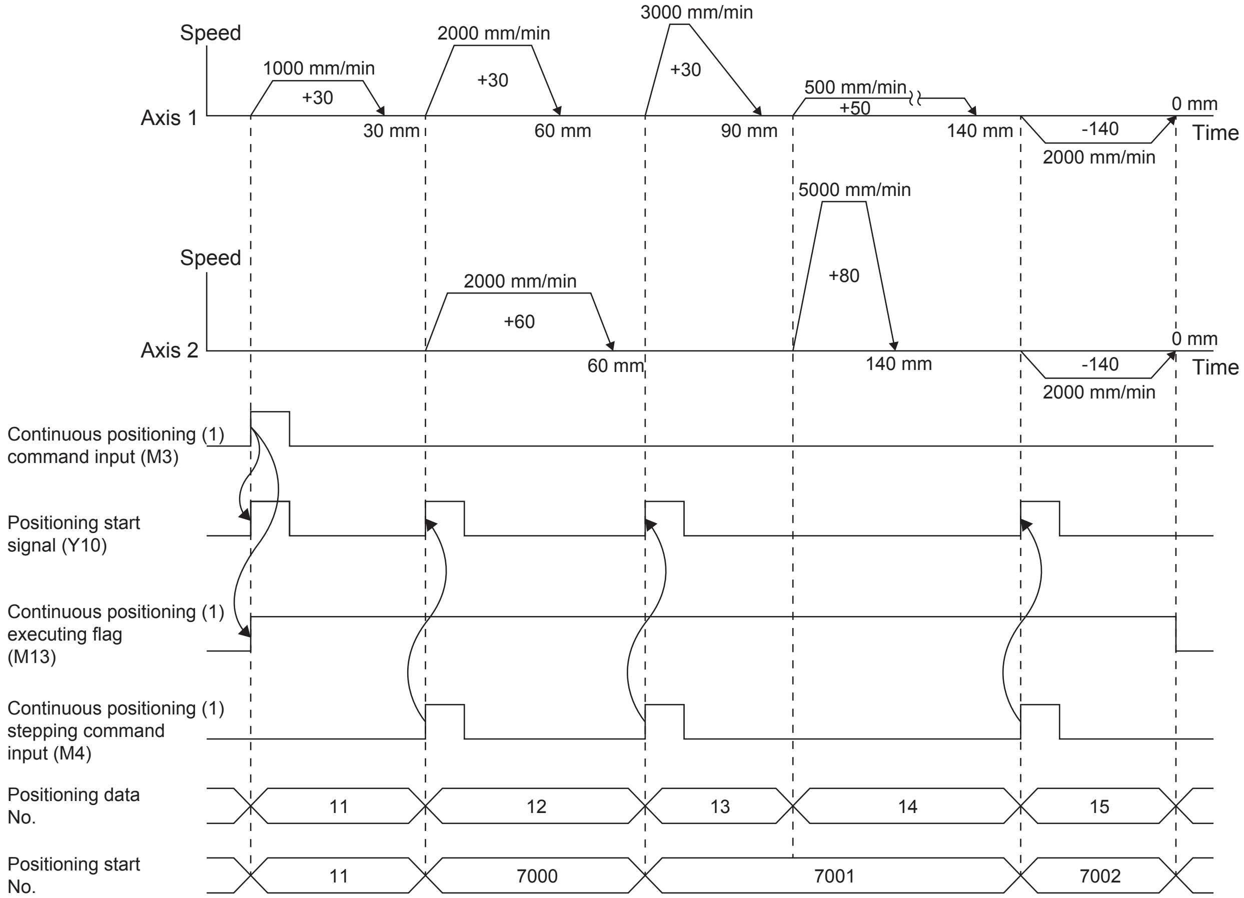
M13: Continuous positioning (1) executing flag

Continuous (1) M3: Continuous positioning (1) command input

M14: Continuous positioning (1) stepping executing flag

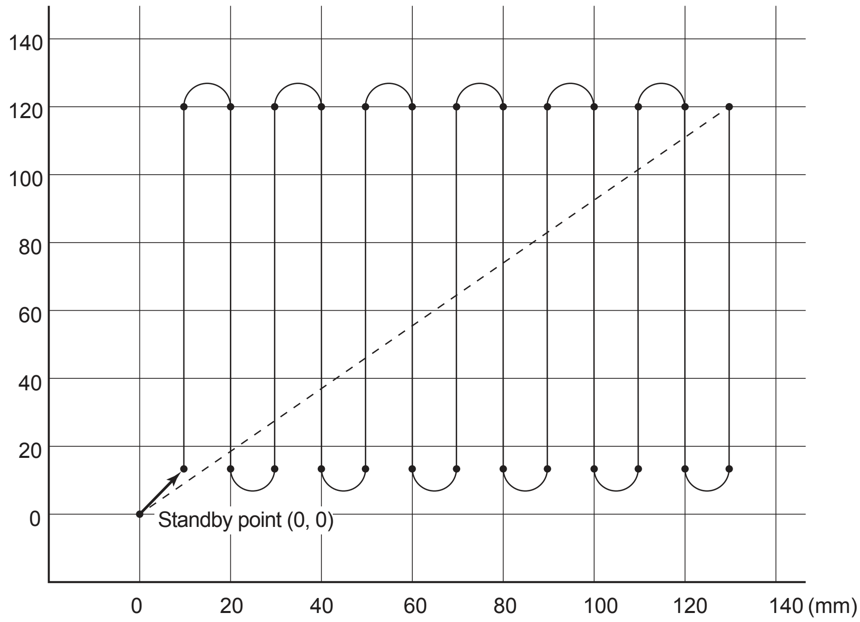
Continuous (1) stepping M4: Continuous positioning (1) stepping command input

(5) Timing chart



Appendix 2.2.2 Continuous positioning (2)

This program is used to continuously execute positioning operations using continuous path control.



(1) Control data

Item	Buffer memory address		Setting value
	Axis 1	Axis 2	
[Cd.3] Positioning start No.	4300	-	20 (Positioning data No. 20)

POINT

When the continuous positioning (2) command input turns on, the module FB “M+RD77_ StartPositioning” writes the positioning start No. in “[Cd.3] Positioning start No.” The positioning start No. is not written to the axis (Axis 2) to be interpolated.

(2) Output signal

Item	Axis 1	Axis 2
Positioning start signal	Y10	-

POINT

When the continuous positioning (2) command input turns on, the module FB “M+RD77_ StartPositioning” turns on the positioning start signal. The positioning start signal for the axis (Axis 2) to be interpolated is not turned on.

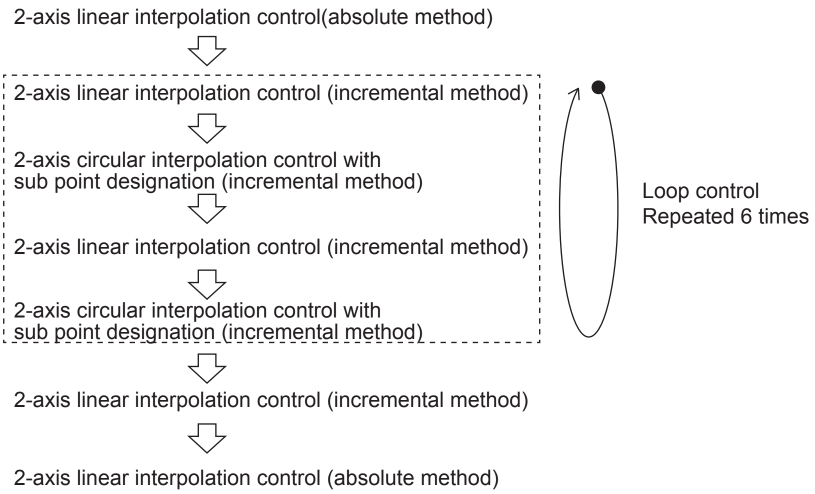
(3) Program example

[1] Continuous positioning (2) condition item

Condition item	Axis 1	Axis 2
Continuous positioning (2) command input	M5	

[2] Positioning data to be used (Positioning data Nos. 20 to 28)

The continuous path control of Axes 1 and 2 is performed in the following order.
The interpolation speed is the composite speed calculated by RD77MS based on the command speed of Axis 1.



Axis 1 Positioning data

No.	Operation pattern	Control method	Axis to be interpolated	Acceleration time No.	Deceleration time No.	Positioning address	Arc address
20	3:LOCATION	0Ah:ABS Linear 2	#2	0:100	0:150	10000.0 μm	0.0 μm
	<Positioning Comment>Continuous (2) (Initial pos.)						
21	3:LOCATION	83h:LOOP	-	0:100	0:150	0.0 μm	0.0 μm
	<Positioning Comment>Continuous (2) (LOOP start)						
22	3:LOCATION	0Bh:INC Linear 2	#2	0:100	0:150	0.0 μm	0.0 μm
	<Positioning Comment>						
23	3:LOCATION	0Eh:INC ArcMP	#2	0:100	0:150	10000.0 μm	5000.0 μm
	<Positioning Comment>						
24	3:LOCATION	0Bh:INC Linear 2	#2	0:100	0:150	0.0 μm	0.0 μm
	<Positioning Comment>						
25	3:LOCATION	0Eh:INC ArcMP	#2	0:100	0:150	10000.0 μm	5000.0 μm
	<Positioning Comment>						
26	3:LOCATION	84h:LEND	-	0:100	0:150	0.0 μm	0.0 μm
	<Positioning Comment>Continuous (2) (LOOP end)						
27	3:LOCATION	0Bh:INC Linear 2	#2	0:100	0:150	0.0 μm	0.0 μm
	<Positioning Comment>Continuous (2) (End point)						
28	0:END	0Ah:ABS Linear 2	#2	0:100	0:150	0.0 μm	0.0 μm
	<Positioning Comment>Continuous (2) (Initial pos.)						

No.	Command speed	Dwell time	M-code	M-code ON signal output timing	ABS direction in degrees	Interpolation speed designation method
20	2000.00 mm/min	0 ms	0	0:Use the setting value of M-code ON signal output timing	0:Use the setting value of ABS direction at degree	0:Use the setting value of Interpolation speed designation method
21	0.00 mm/min	0 ms	6	0:Use the setting value of M-code ON signal output timing	0:Use the setting value of ABS direction at degree	0:Use the setting value of Interpolation speed designation method
22	Current Speed	0 ms	0	0:Use the setting value of M-code ON signal output timing	0:Use the setting value of ABS direction at degree	0:Use the setting value of Interpolation speed designation method
23	Current Speed	0 ms	0	0:Use the setting value of M-code ON signal output timing	0:Use the setting value of ABS direction at degree	0:Use the setting value of Interpolation speed designation method
24	Current Speed	0 ms	0	0:Use the setting value of M-code ON signal output timing	0:Use the setting value of ABS direction at degree	0:Use the setting value of Interpolation speed designation method
25	Current Speed	0 ms	0	0:Use the setting value of M-code ON signal output timing	0:Use the setting value of ABS direction at degree	0:Use the setting value of Interpolation speed designation method
26	0.00 mm/min	0 ms	0	0:Use the setting value of M-code ON signal output timing	0:Use the setting value of ABS direction at degree	0:Use the setting value of Interpolation speed designation method
27	Current Speed	0 ms	0	0:Use the setting value of M-code ON signal output timing	0:Use the setting value of ABS direction at degree	0:Use the setting value of Interpolation speed designation method
28	Current Speed	0 ms	0	0:Use the setting value of M-code ON signal output timing	0:Use the setting value of ABS direction at degree	0:Use the setting value of Interpolation speed designation method

Axis 2 Positioning data

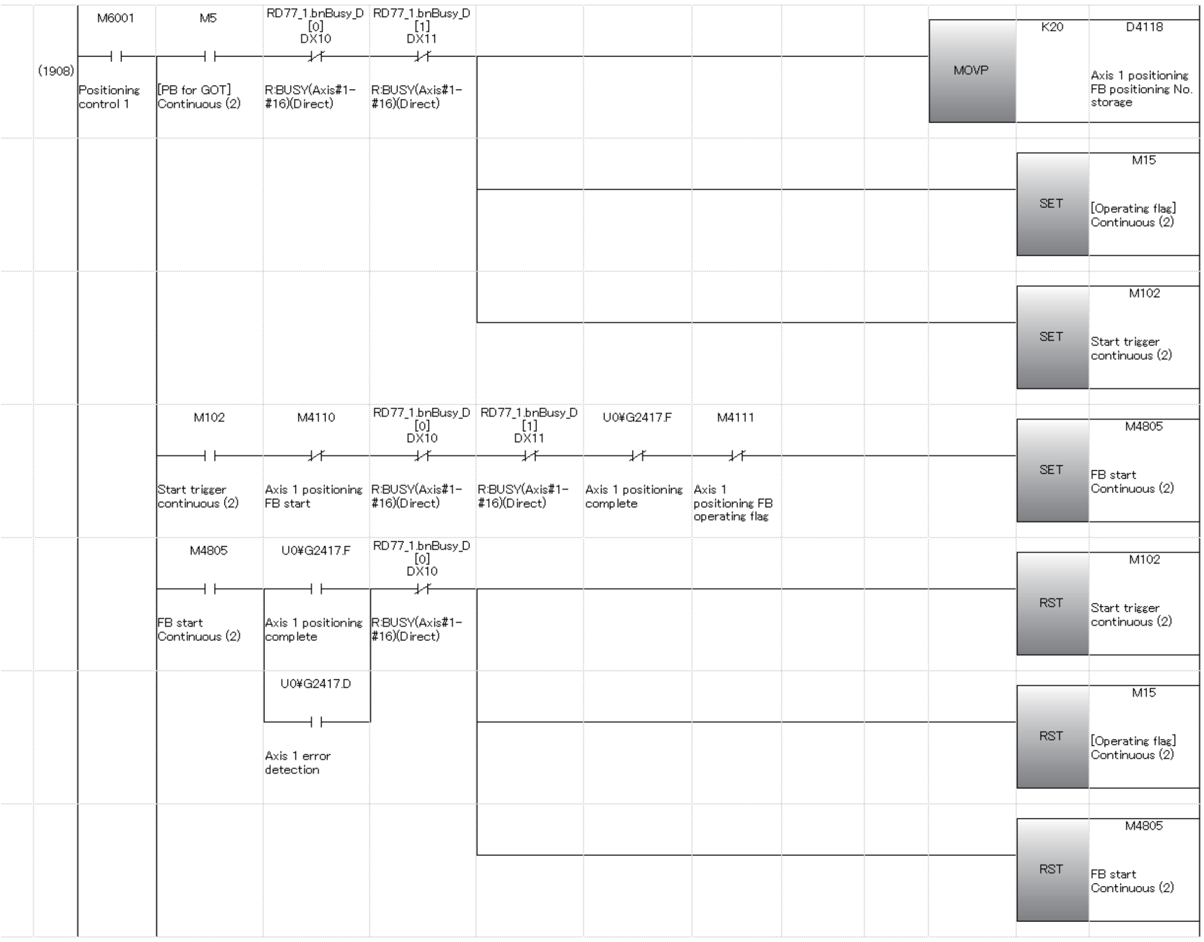
No.	Operation pattern	Control method	Axis to be interpolated	Acceleration time No.	Deceleration time No.	Positioning address	Arc address
20						20000.0 µm	0.0 µm
	<Positioning Comment>Continuous (2) (Initial pos.)						
22						100000.0 µm	0.0 µm
	<Positioning Comment>						
23						0.0 µm	5000.0 µm
	<Positioning Comment>						
24						-100000.0 µm	0.0 µm
	<Positioning Comment>						
25						0.0 µm	-5000.0 µm
	<Positioning Comment>						
27						100000.0 µm	0.0 µm
	<Positioning Comment>Continuous (2) (End point)						
28						0.0 µm	0.0 µm
	<Positioning Comment>Continuous (2) (Initial pos.)						

No.	Command speed	Dwell time	M-code	M-code ON signal output timing	ABS direction in degrees	Interpolation speed designation method
20	0.00 mm/min		0			
22	0.00 mm/min		0			
23	0.00 mm/min		0			
24	0.00 mm/min		0			
25	0.00 mm/min		0			
27	0.00 mm/min		0			
28	0.00 mm/min		0			

[3] Example of continuous positioning (2) program

To execute the following continuous positioning (2), the positioning execute program is required.

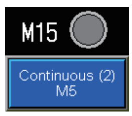
Refer to Section 6.6.8 on positioning execute program.



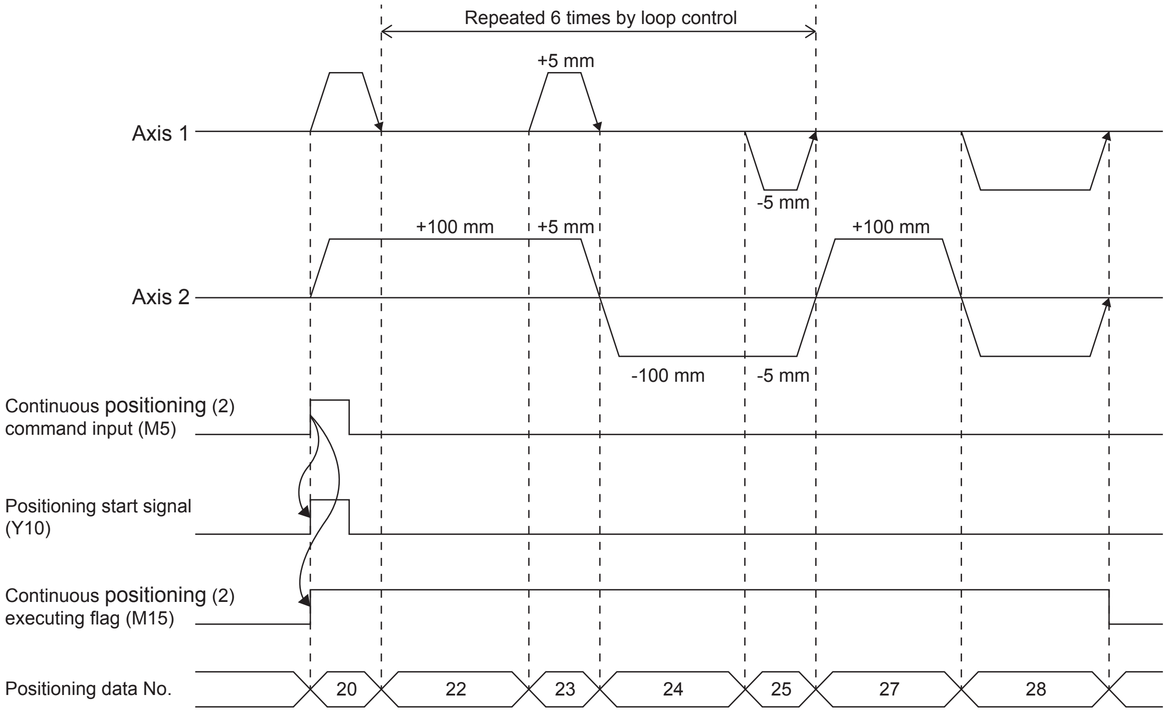
(4) Demonstration machine operation panel [Positioning operation screen]

M15: Continuous positioning (2) executing flag

Continuous (2) M5: Continuous positioning (2) command input



(5) Timing chart



Appendix 2.2.3 Teaching, teaching playback

This program is designed to register the positioning addresses for the Axes 1 and 2 (teaching) using the teaching function and position the axes in the registered addresses (teaching playback).

(1) Control data

Item	Buffer memory address		Setting value
	Axis 1	Axis 2	
[Cd.1] Flash ROM write request	5900		1 (Flash ROM write)
[Cd.3] Positioning start No.	4300	-	40 (Positioning data No. 40)
[Cd.38] Teaching data selection	4348	4448	0 (written in “[Da.6] Positioning address/movement amount”)
[Cd.39] Teaching positioning data No.	4349	4449	40 (Positioning data No. 40)

POINT

When the teaching command input turns on, the module FB “M+RD77_StartPositioning” writes the positioning start No. in “[Cd.3] Positioning start No.” The positioning start No. is not written to the axis (Axis 2) to be interpolated.

(2) Output signal

Item	Axis 1	Axis 2
Positioning start signal	Y10	-

POINT

When the teaching command input turns on, the module FB “M+RD77_StartPositioning” turns on the positioning start signal. The positioning start signal for the axis (Axis 2) to be interpolated is not turned on.

(3) Program example

[1] Teaching, teaching playback condition items

Condition item	Axis 1	Axis 2
Teaching command input	M1100	
Teaching playback command input	M6	

[2] Positioning data to be used (Positioning data No. 40)

The Axes 1 and 2 are subject to 2-axis linear interpolation control (absolute method).

The interpolation speed is the composite speed calculated by RD77MS based on the command speed of Axis 1.

Axis 1 Positioning data

No.	Operation pattern	Control method	Axis to be interpolated	Acceleration time No.	Deceleration time No.	Positioning address	Arc address
40	0:END	0Ah:ABS Linear 2	#2	0:100	0:150	0.0 µm	0.0 µm
	<Positioning Comment>Teaching positioning						

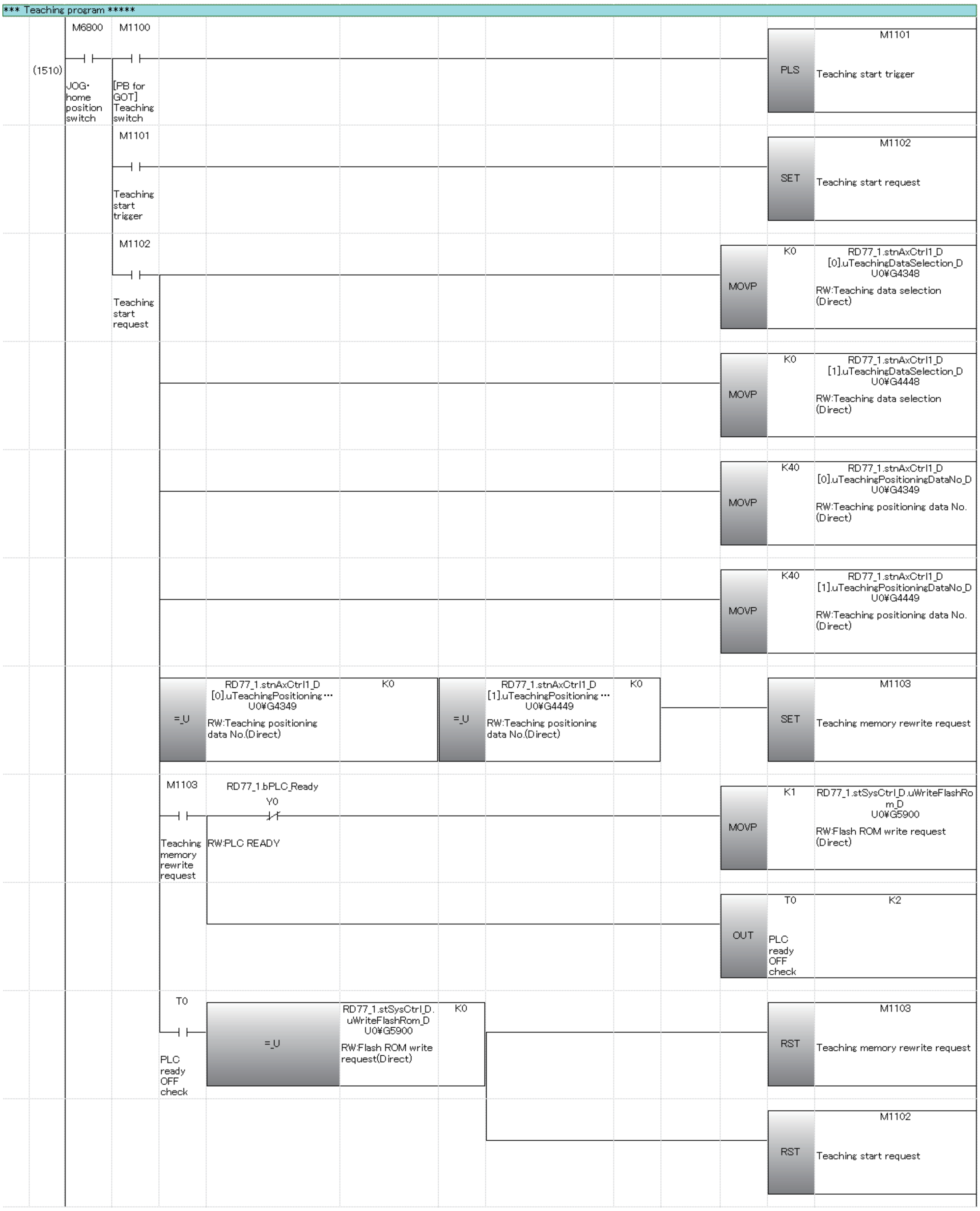
No.	Command speed	Dwell time	M-code	M-code ON signal output timing	ABS direction in degrees	Interpolation speed designation method
40	2000.00 mm/min	0 ms	0	0:Use the setting value of M-code ON signal output timing	0:Use the setting value of ABS direction at degree	0:Use the setting value of Interpolation speed designation method

Axis 2 Positioning data

No.	Operation pattern	Control method	Axis to be interpolated	Acceleration time No.	Deceleration time No.	Positioning address	Arc address
40						0.0 µm	0.0 µm
	<Positioning Comment>Teaching positioning						

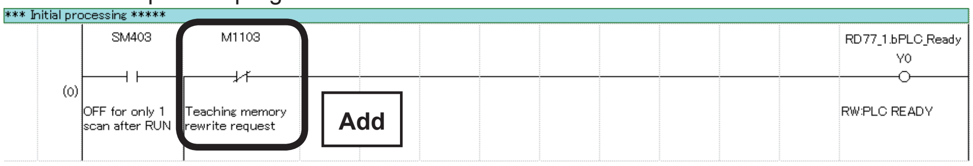
No.	Command speed	Dwell time	M-code	M-code ON signal output timing	ABS direction in degrees	Interpolation speed designation method
40	0.00 mm/min		0			

[3] Example of teaching program



POINT

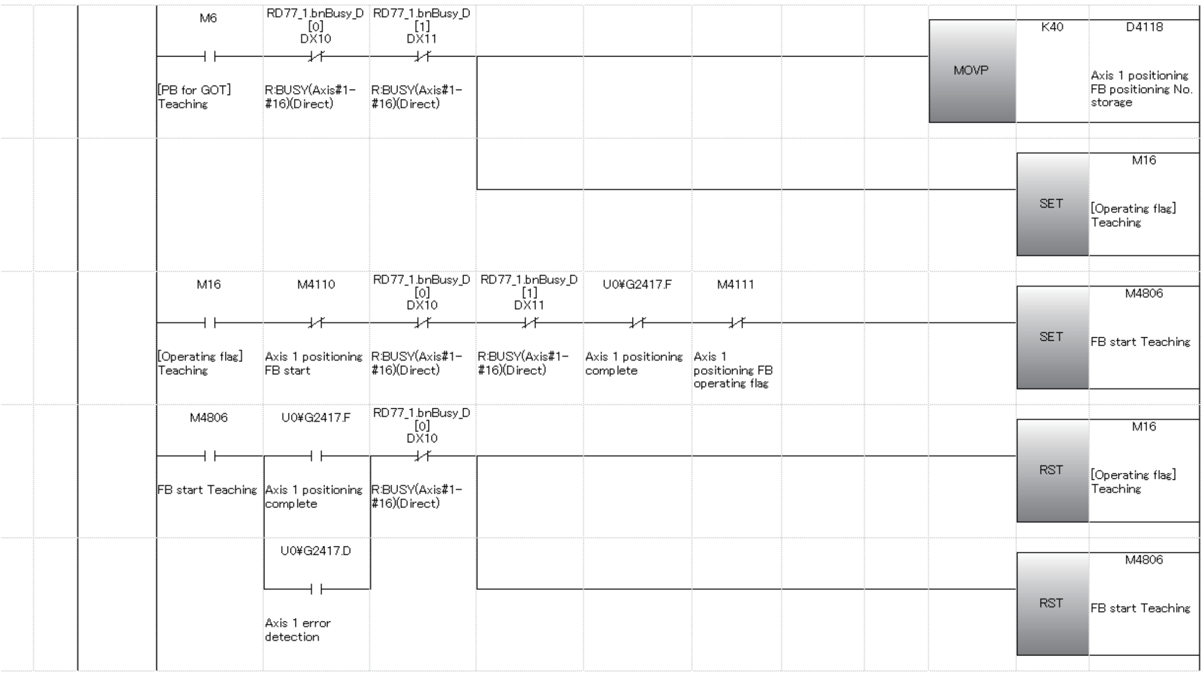
To write the position data in the flash ROM while teaching, the flash ROM write request must be executed while the PLC READY signal [Y0] is off.
To write the data in the flash ROM by this practice program, it is necessary to add the following circuit near the top of the program.



[4] Example of teaching playback program

To execute the following teaching playback, the positioning execute program is required.

Refer to Section 6.6.8 on positioning execute program.



(4) Demonstration machine operation panel

[1] JOG•home position return operation panel

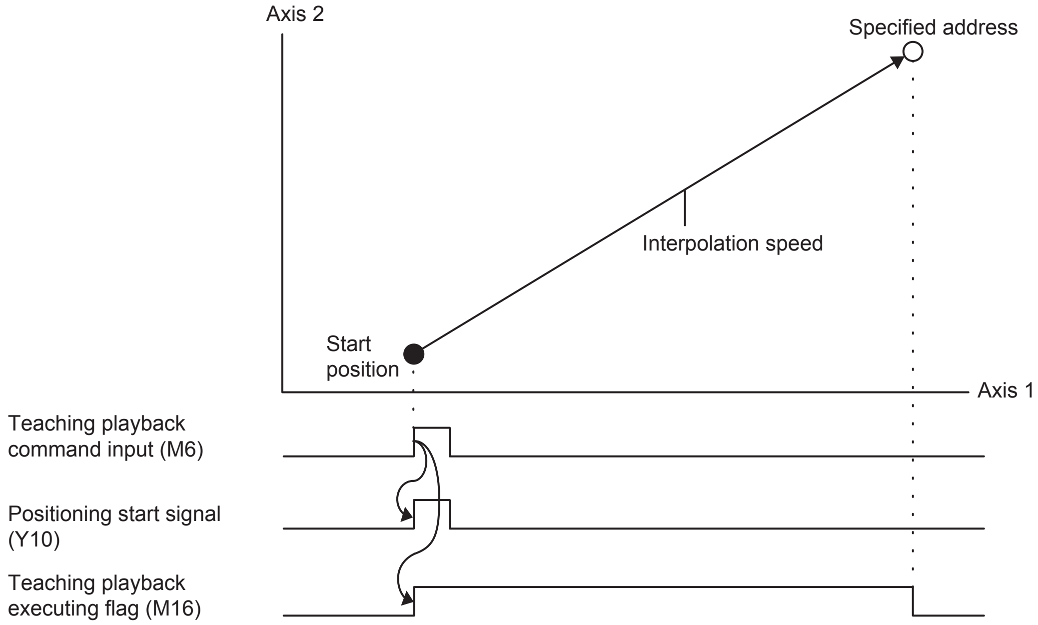
Teaching Memorize address M1100: Teaching command input

[2] Positioning operation screen

M16: Teaching playback executing flag

Teaching M6: Teaching playback command input

(5) Timing chart (Teaching play back)



Appendix 2.2.4 Fixed-feed, fixed-feed stepping

This program is used for fixed-feed of Axis 1 in the stepping operation.

(1) Positioning data (Positioning data No. 50)

Item	Buffer memory address	Setting value
	Axis 1	
[Da.6] Positioning address/ movement amount	6496 6497	-214748364.8 to 214748364.7 μm*1

*1. When the fixed-feed/fixed-feed stepping is executed, the value input on the demonstration machine operation panel (×10000) is set.

(2) Control data

Item	Buffer memory address	Setting value
	Axis 1	
[Cd.3] Positioning start No.	4300	50 (Positioning data No. 50)

POINT

When the fixed-feed stepping command input turns on, the module FB “M+RD77_StartPositioning” writes the positioning start No. in “[Cd.3] Positioning start No.”

(3) Output signal

Item	Axis 1
Positioning start signal	Y10

POINT

When the fixed-feed stepping command input turns on, the module FB “M+RD77_StartPositioning” turns on the positioning start signal.

(4) Program example

[1] Fixed-feed, fixed-feed stepping condition items

Condition item	Axis 1
Fixed-feed enable command input	M7
Fixed-feed stepping command input	M8

[2] Positioning data to be used (Positioning data No. 50)

1-axis fixed-feed control of the Axis 1 is performed based on the following settings. The positioning address is changed to the current value of “[Da.6] Positioning address/movement amount” of positioning data No. 50 when the fixed-feed/fixed-feed stepping is executed.

Axis 1 Positioning data

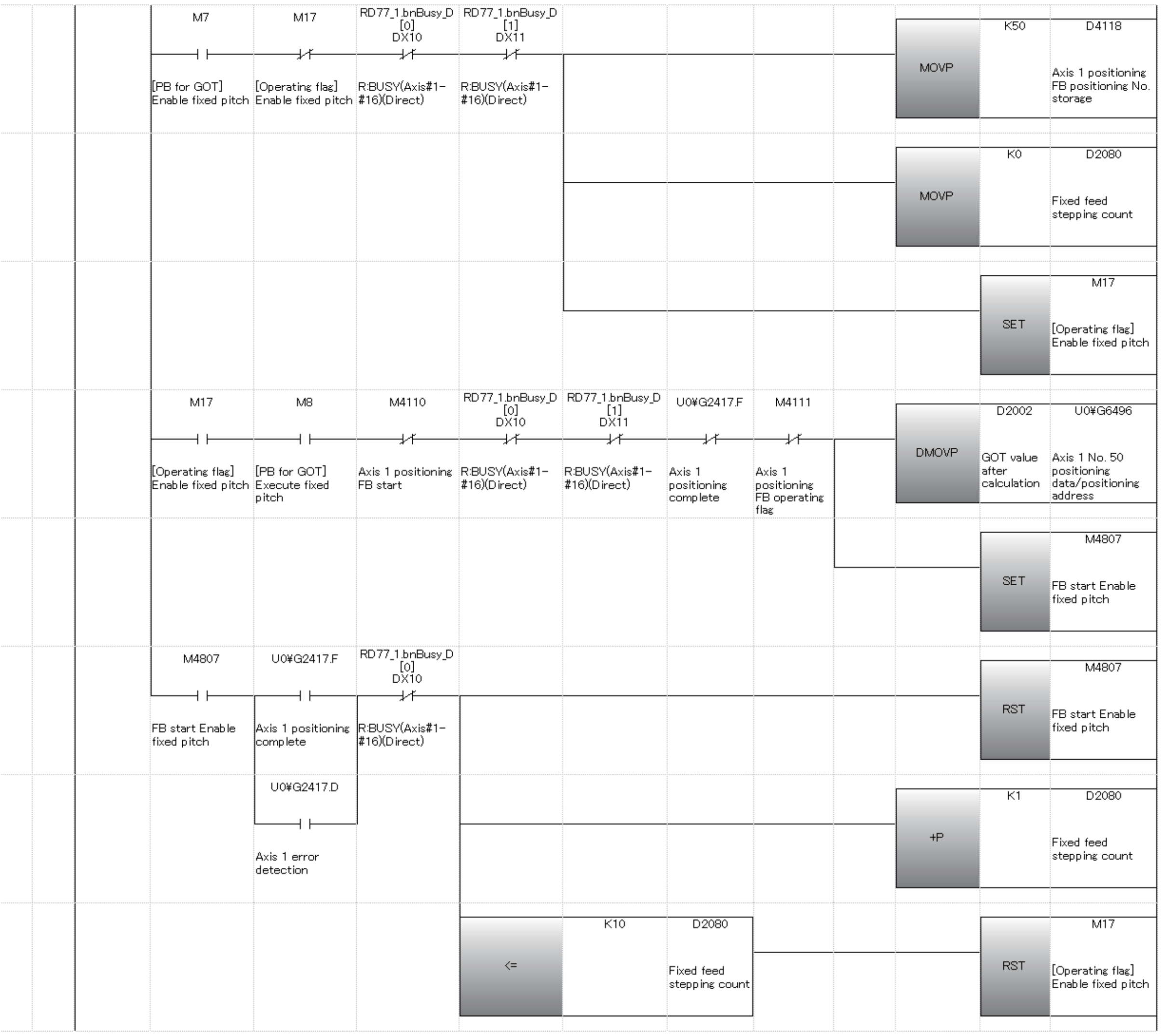
No.	Operation pattern	Control method	Axis to be interpolated	Acceleration time No.	Deceleration time No.	Positioning address	Arc address
50	0:END	03h:Feed 1	-	0:100	0:150	0.0 μm	0.0 μm
	<Positioning Comment>Fixed feed						

No.	Command speed	Dwell time	M-code	M-code ON signal output timing	ABS direction in degrees	Interpolation speed designation method
50	2000.00 mm/min	0 ms	0	0:Use the setting value of M-code ON signal output timing	0:Use the setting value of ABS direction at degree	0:Use the setting value of Interpolation speed designation method

[3] Example of fixed-feed/fixed-feed stepping program

To execute the following fixed-feed/fixed-feed stepping, the positioning execute program is required.

Refer to Section 6.6.8 on positioning execute program.



POINT

After the fixed-feed/fixed-feed stepping is started, fixed-feed stepping can be performed 10 times.

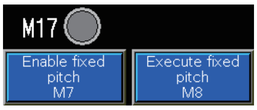
(4) Demonstration machine operation panel [Positioning operation screen]

Value specification Setting for D2000: movement amount input

M17: Fixed-feed enable flag

Enable fixed pitch M7: Fixed-feed enable command input

Execute fixed pitch M8: Fixed-feed stepping command input

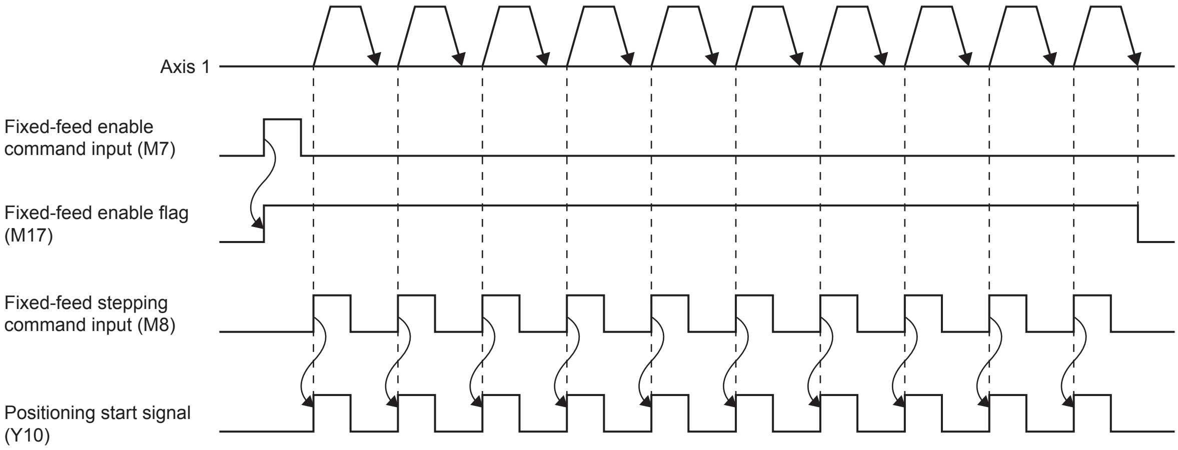


POINT

Touch the Value specification Setting for D2000, and the numeric input window will appear.

Input the movement amount (unit: mm) in the numeric input window, and touch ENTER. The movement amount will be changed.
The allowable input range of movement amount (0 to 140) is limited on the touch panel.

(5) Timing chart



Appendix 2.3 Demonstration Machine Operation

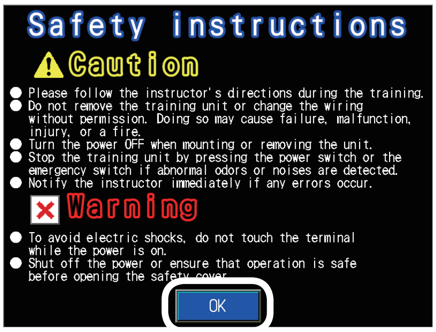
Execute the positioning operations in accordance with the programs stated in Appendix 1.2 operating the demonstration machine operation panel.

This practice is performed on the condition that (Axis 1, Axis 2) = (0, 0) after execution of the standby point positioning (refer to Section 6.8.4).

If any positioning operation cannot be performed, refer to the troubleshooting (Appendix 1.3.6).

To confirm the current value of each parameter, use the Simple Motion Monitor. (Refer to Appendix 4.)

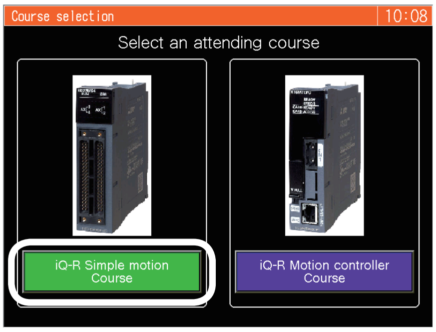
Appendix 2.3.1 Preparation for positioning execution



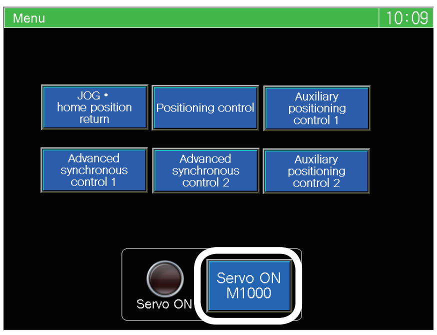
(1) Set the CPU module RUN/STOP/RESET switch to "RUN".

(2) The startup screen will appear. Touch [OK] to display the course selection screen.

If the screen switching menu has appeared, this step is unnecessary.

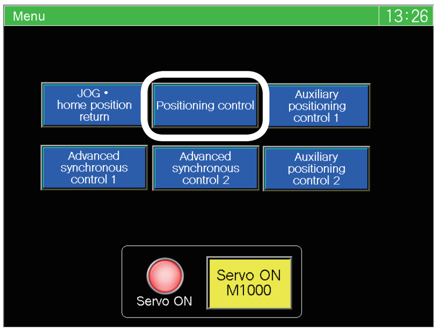


(3) Touch [iQ-R Simple motion Course] on the course selection screen to display the screen switching menu.



(4) Touch [Servo ON M1000] on the screen switching menu, and the servo amplifiers of Axis 1 to Axis 3 will start.

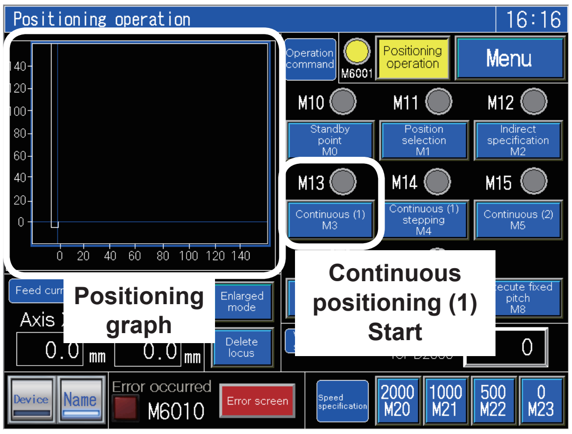
Appendix 2.3.2 Continuous positioning (1)



(1) Touch [Positioning control] on the screen switching menu.

Positioning operation screen appears.

(2) Touch [Positioning operation] on the positioning operation screen to enable the buttons on the positioning operation screen.



(3) Touch [Continuous (1) M3], and the Axis 1 will be moved from the current position to the standby position (30 mm) and stop.

M13 is on during Continuous positioning (1) operation.

The positioning trajectory obtained on the positioning operation screen is displayed in the positioning graph.

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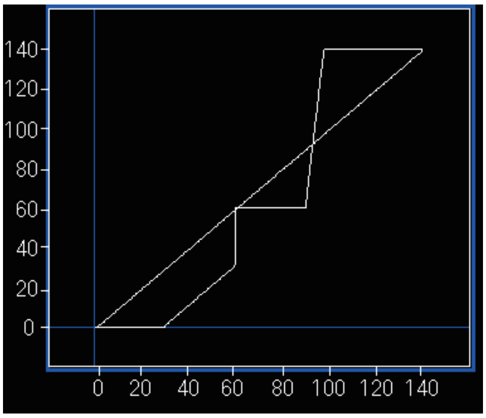
From previous page

(4) Touch [Continuous (1) stepping M4], and the Axes 1 and 2 will perform stepping operation.

After three times of stepping operation, the axes will be positioned at (Axis 1, Axis 2) = (0, 0), and Continuous positioning (1) will end.

The trajectory of Continuous positioning (1) is as shown below.

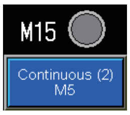


POINT

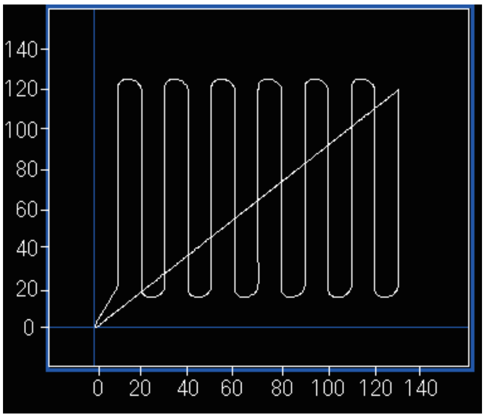
- The speed can be changed during positioning operation. For the speed change, refer to Section 6.8.7.
- While M13 is on, it is impossible to perform any operation other than the stepping operation of Continuous positioning (1) except the speed change operation. To perform any other operation, perform the stepping operation three times to complete Continuous positioning (1).
- If the speed is changed during Continuous positioning (1), the command speed only of Axis 1 is changed.
- Even if the speed is changed, the change will be ineffective when the next stepping operation is performed. (The speed will be overwritten with the speed that has been set in the positioning data to be executed.)

Appendix 2.3.3 Continuous positioning (2)

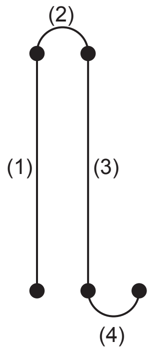
Perform operation on the positioning operation screen.



Touch [Continuous (2) M5], and Continuous positioning (2) will be started.
M15 is on during Continuous positioning (2) operation.
The trajectory of Continuous positioning (2) is as shown below.



After positioning at the start point ((Axis 1, Axis 2) = (10, 20)), the following operation will be repeated 6 times.



(1) Axis 2 linearly moves +100 mm.

(2) Axis 1 and Axis 2 circularly move at radius of +5 mm.

(3) Axis 2 linearly moves -100 mm.

(4) Axis 1 and Axis 2 circularly move at radius of -5 mm.

The Axis 2 moves +100 mm linearly, and the positioning ends after positioning at ((Axis 1, Axis 2) = (0, 0)).

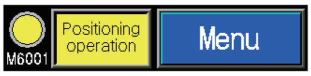
POINT

The speed can be changed during positioning operation. For the speed change, refer to Section 6.8.7.

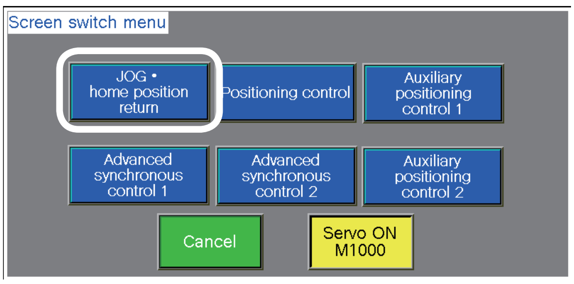
Appendix 2.3.4 Teaching, teaching playback

Teach (register) the current position on the JOG•home position return operation screen, and perform the teaching playback operation on the positioning operation screen.

(1) Perform positioning in any positioning address by Address indirect specification positioning (refer to Section 6.8.6).



(2) Touch [Positioning operation] to turn off M6001, and touch [Menu] to display the screen switching menu.



(3) Touch [JOG•home position return] to display the JOG•home position return operation screen.

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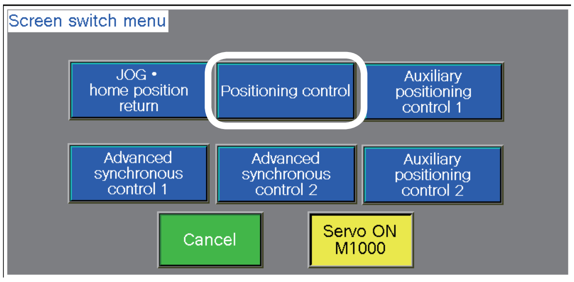
(4) Touch JOG•home position M6800 to turn on M6000 and enable the buttons on the JOG•home position return operation screen.

It is allowed to perform the positioning in (1) by JOG operation (refer to Section 6.8.2) from the JOG•home position return operation screen.

(5) Touch M1100, and the current positioning address will be taught (registered).

(6) Touch JOG•home position M6800 to turn off M6000, and touch Menu to display the screen switching menu.



(7) Touch Positioning control to display the positioning operation screen.

(8) Touch Positioning operation on the positioning operation screen to enable the buttons on the positioning operation screen.

(9) Touch Standby point M0, and perform standby point positioning.

(10) Touch Teaching M6, and teaching playback (positioning) in the positioning address registered in Step (5) will start.

M16 is on during teaching playback.

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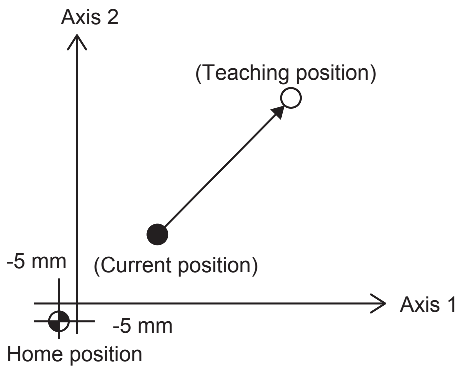
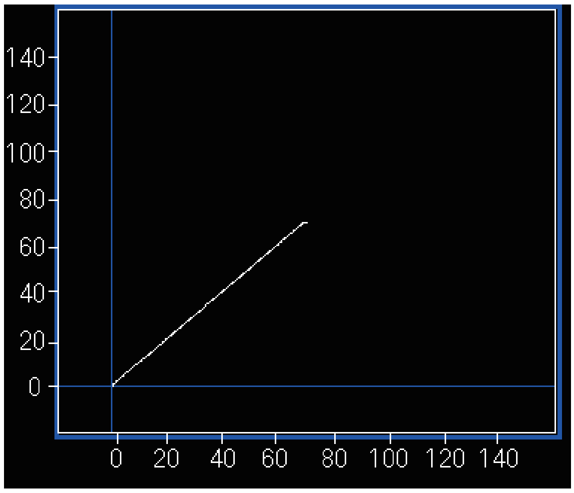
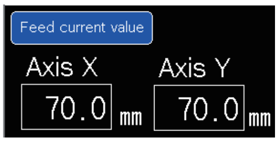
The trajectory of teaching playback is as shown below.



[Operation example]
Teaching playback from (0, 0) to (70, 70)





(11) After the completion of teaching playback, check that the positioning address of X-axis and Y-axis in the feed current value field is identical with the address registered in Step (5).

POINT

The speed can be changed during positioning operation. For the speed change, refer to Section 6.8.7.

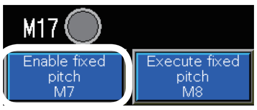
Appendix 2.3.5 Fixed-feed, fixed-feed stepping

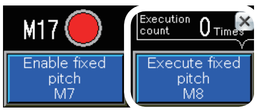
Perform operation on the positioning operation screen.

(1) Touch the Value specification Setting for D2000, and the numeric input window will appear.

(2) Input any movement amount for fixed-feed. The input range is from 0 to 140 (mm).

Touch [ENTER], and the input value will be reflected.





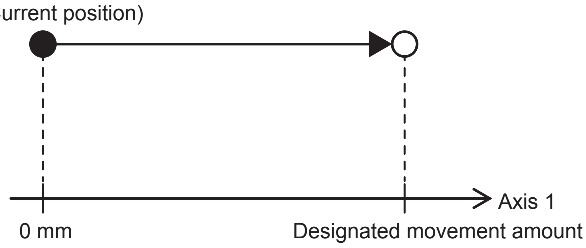
(3) Touch [Enable fixed pitch M7], and M17 will be turned on, and fixed-feed stepping can be performed.

Touch [Execute fixed pitch M8], and fixed-feed stepping will be performed.

Fixed-feed stepping can be performed 10 times. The number of times of execution is displayed above [Execute fixed pitch M8].

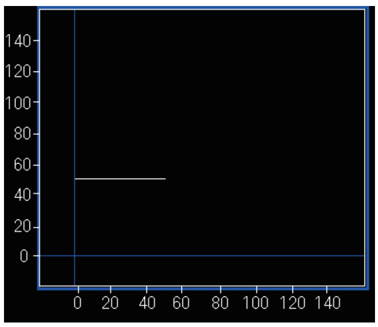
The trajectory of fixed-feed/fixed-feed stepping is as shown below.

(Current position)



Axis 1 is fed by the movement amount specified in (2) from 0 mm in the fixed-feed mode. (When the start point is (50, 50), the fixed-feed starts from (0, 50).)

[Operation example]
Fixed-feed/fixed-feed stepping from (0, 50) to (50, 50)



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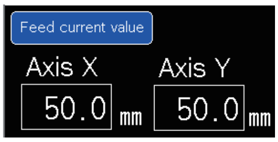
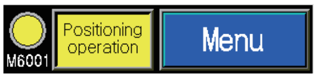


(4) During fixed-feed stepping, check that the positioning address of X-axis in the feed current value field is identical with the value specified in Step (2).



(5) After the completion of fixed-feed/fixed-feed stepping, touch [Positioning operation] and [Menu] to display the screen switching menu.

(6) Touch [Servo ON M1000] to stop the servo amplifiers of Axes 1 to 3.

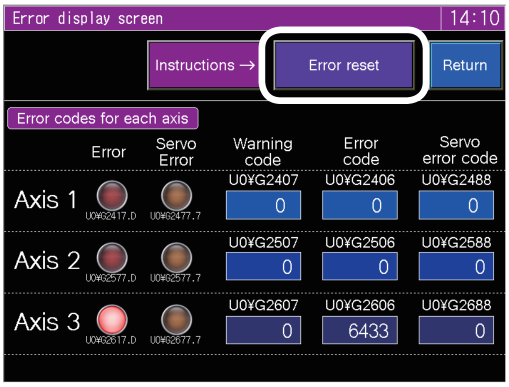
POINT

- The speed can be changed during positioning operation. For the speed change, refer to Section 6.8.7.
- Even if the speed is changed, the change will be ineffective when the next stepping operation is performed.
- While M17 is on, it is impossible to perform any operation other than the fixed-feed/fixed-feed stepping operation except the speed change operation. To perform any other operation, perform the stepping operation 10 times to complete the fixed-feed/fixed-feed stepping.
- Even if the fixed-feed of Axis 1 is started from a positioning address other than 0 mm, the fixed-feed will be started on condition that the current position is 0 mm.
- When the movement amount is changed, the change will be reflected at the start of the next stepping operation. (The stepping operation can be performed, for example, with a movement amount of 50 mm for the first to fifth stepping operations and 100 mm for the sixth to tenth operations.)
- The number of times of stepping operation can be hidden by touching [x].
  To redisplay it, touch [Enable fixed pitch M7].

Appendix 2.3.6 Troubleshooting

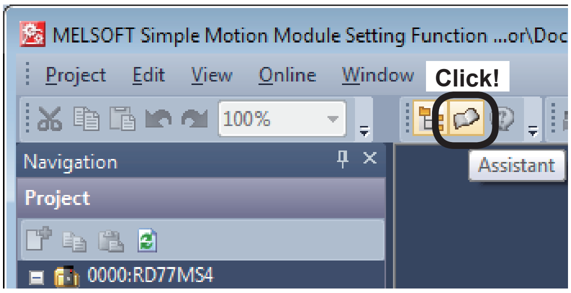
When the module does not work, check the following points.

On the GOT screen, the error codes are displayed in decimal notation.

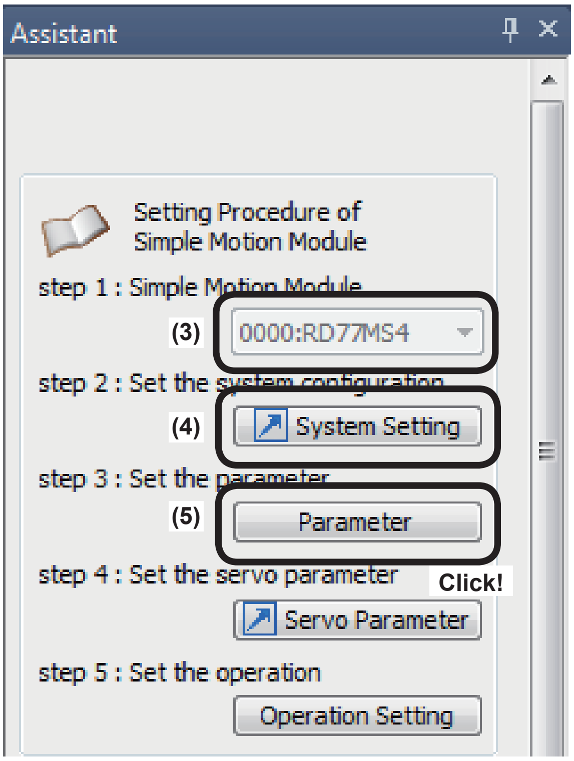
Check item	Countermeasures
Check that the servo amplifiers have started (all axes servo ON).	If the servo amplifiers have not started, touch [Servo ON M1000] on the screen switching menu.
Check that the CPU module is running.	If it is not running, set the RUN/STOP/RESET switch to "RUN".
Check that the module is not being tested by the Simple Motion setting tool.	If it is being tested, terminate the test. (Refer to Section 5.5.)
Check that no errors have occurred. (ERR.LED of RD77MS is on.)	If any error has occurred, cancel the error as stated below. • Touch [Error screen] to display the error screen. Touch [Error reset], and the error will be reset.  • Touch [Servo ON M1000] on the screen switching menu to turn off the all axes servo, and reset the CPU module. (Hold the RUN/STOP/RESET switch on the RESET side.) After resetting the error, it is recommended to perform home position return (Refer to Section 6.8.3).
Check that Error occurred M6010 is not on. 	
Check that all necessary parameters have been written to the programmable controllers.	Re-write the project data referring to Section 5.4.2.
Check that the positioning address of Axis 2 is within the range of positioning graph.	If positioning is performed when the positioning address of Axis 2 is not within the range from 0 to 140 mm, the operation can be performed normally, but the trajectory may not be displayed correctly on the graph. Perform positioning from an address within the range from 0 to 140 mm.
Check that M13 or M17 is not on.	While M13 is on, Continuous positioning (1) cannot be performed. While M17 is on, it is impossible to perform any operation other than the fixed-feed/fixed-feed stepping operation. Perform the stepping operation the specified number of times, and complete each positioning. If the movement amount for fixed-feed/fixed-feed stepping is set to 0, the number of times of stepping operation can be counted up without movement.

Appendix 3 Assistant Function

For supporting the simple motion module setting, an assistant function is available.
Examples of use of the function are shown below.



(1) Click the tool bar option [Assistant] on the Simple Motion Module setting tool.



(2) The assistant window will appear just under the navigation window.

(3) No setting is required in step 1: Simple Motion Module.

(4) Click the [System Setting] button in step 2: Set the system configuration, and the system configuration screen will appear. Set the system configuration. (Refer to Section 5.3.1.)

(5) Click the [Parameters] button in step 3: Set the parameter.

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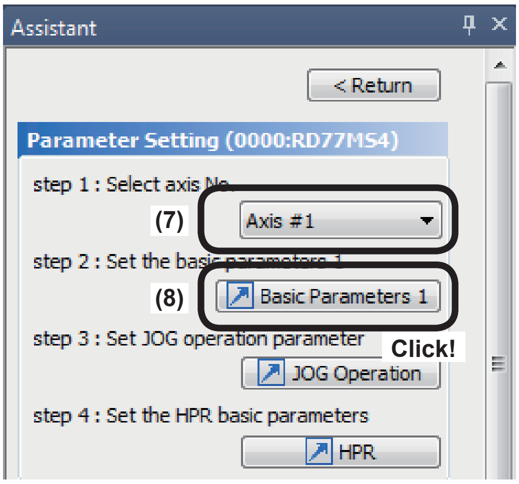
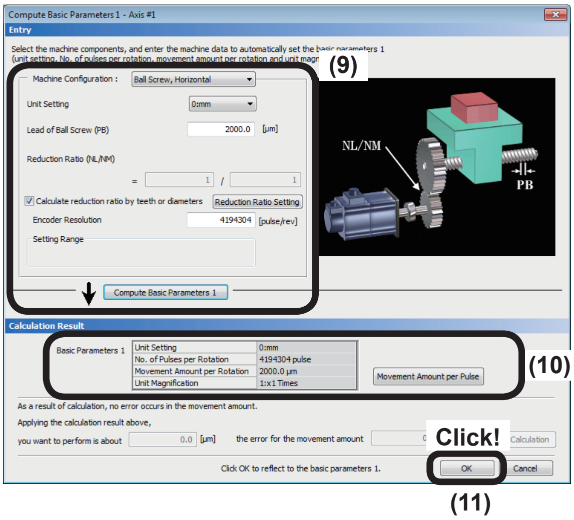


(6) The screen will change to the Parameter Setting screen. For the details of setting, refer to Section 5.3.2.

(7) Select the axis No. to set the parameters in step 1: Select axis No.

(8) Click the Basic Parameters 1 button in step 2: Set the basic parameters 1.

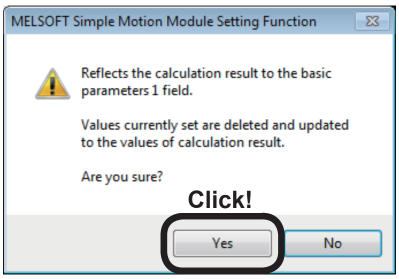


(9) The compute dialog box for the basic parameters 1 appears. After inputting the following values (default values), click the Compute Basic Parameters 1 button to Compute the basic parameters 1.

Machine Configuration	Ball screw, Horizontal
Unit Setting	0: mm
Lead of Ball Screw	2000.0 μm
Encoder Resolution	4194304 pulse/rev

(10) The results of calculation of the basic parameters 1 will be displayed. Click the Movement Amount per Pulse button, and a dialog box appears, and the Movement Amount per Pulse can be checked.

(11) Click the OK button.



(12) The dialog box shown on the left appears. Press the Yes button, and the calculation results will be reflected in the basic parameters 1.

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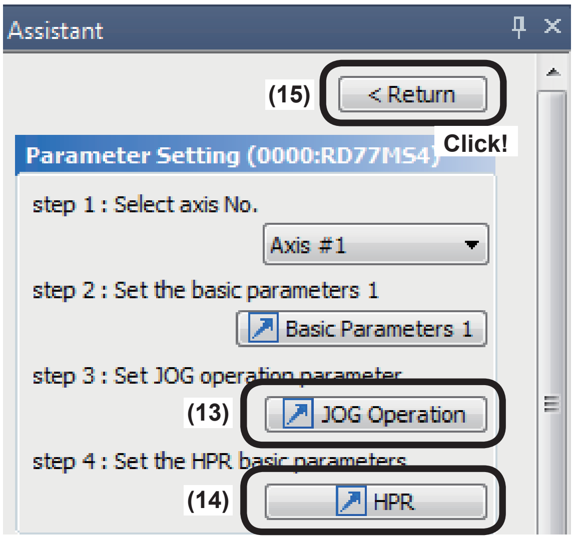
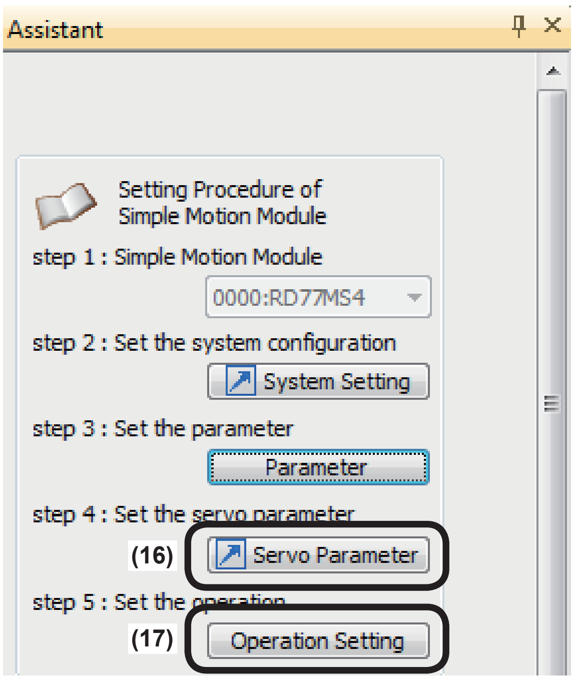


(13) Click the JOG Operation button in step 3: Set the JOG operation parameter. Set the detailed parameters 2.

(14) Click the HPR button in step 4: Set the HPR basic parameters. Set the home position return basic parameters.

(15) Click the Return button.



(16) The window will return to the initial assistant window.
Click Servo Parameter button in step 4: Set the servo parameter, and the servo parameter setting screen will appear. Set the servo parameters.

(17) Click the Operation Setting button in step 5: Set the operation.

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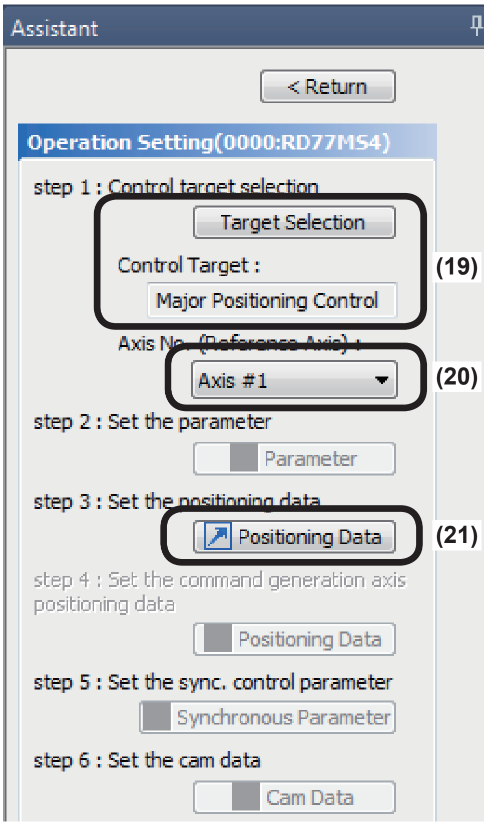
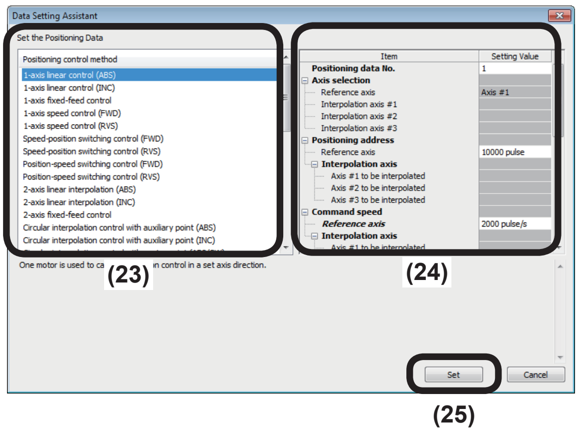


(18) The screen will change to the Operation Setting screen. For the details of setting, refer to Section 5.3.4.
This example of use is designed for “Control Target: Major Positioning Control.”

(19) Click Target Selection button in step 1: Control target selection. The screen will change to the control target selection screen. Select “Major Positioning Control.”

(20) Select the axis No. to set the positioning data in Axis No. (Reference Axis).

(21) Click the Positioning Data button in step 3: Set the positioning data.



(22) The Data Setting Assistant dialog box appears.

(23) Select "1-axis linear control (ABS)" in the Positioning control method field.

(24) Set the values as shown below.

Positioning data No.	1
Positioning address Reference axis	10000 pulse
Command speed Reference axis	2000 pulse/s

(25) Click the Set button. The Axis 1 positioning data setting screen appears, and the set values will be reflected in No. 1.

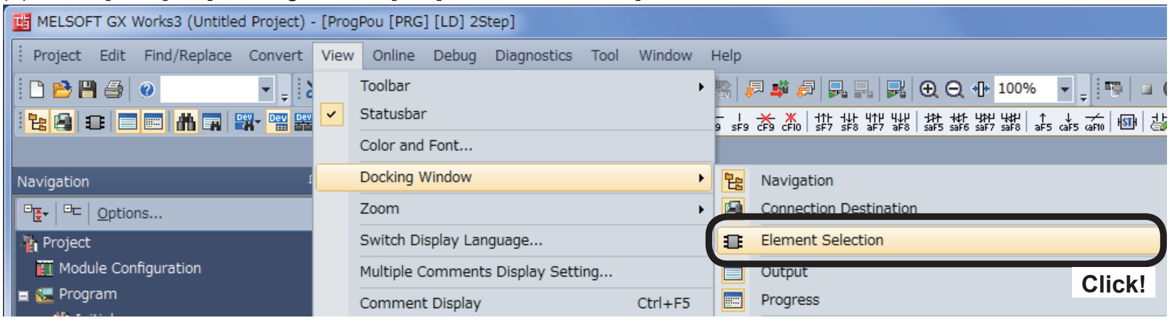
POINT

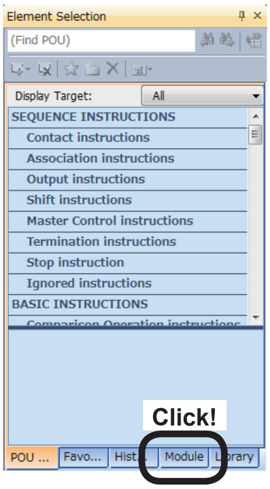
The axis monitor can be started by clicking the Monitor in Simple Motion Module Monitor in the assistant window. (Refer to Appendix 4.)

Appendix 4 FB (function block) Insertion Procedure

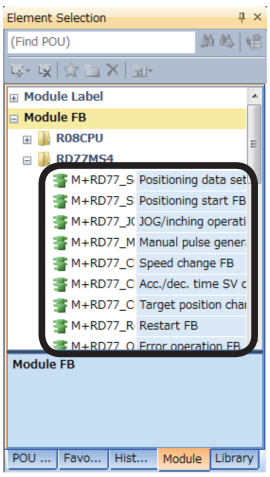
The procedure for inserting FB is shown below.

(1) Click [View] → [Docking Window] → [Element Selection].





(2) The Element Selection window will appear.
Click the Module tab.



(3) Expand RD77MS4 of the displayed module FB, and the FB list will be displayed.

PRECAUTIONS

If RD77MS4 is not displayed by expanding Module FB, add RD77MS4 to the module configuration. (Refer to Section 5.2.2.)
If the ladder editor is not displayed, it is impossible to use any data in the list.

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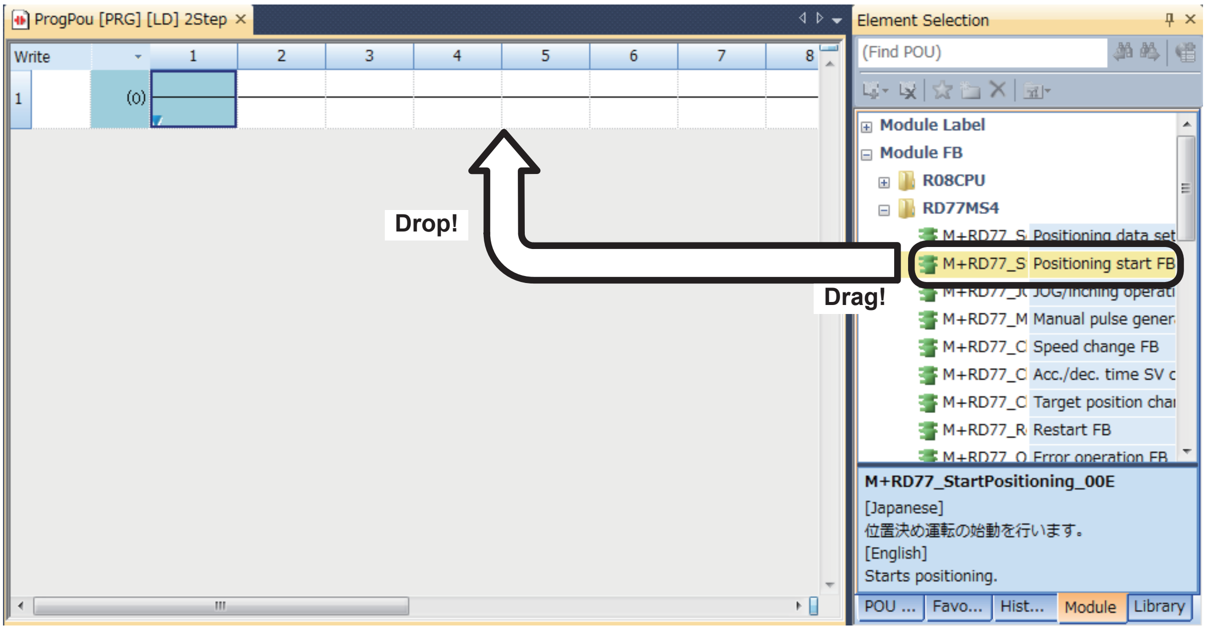
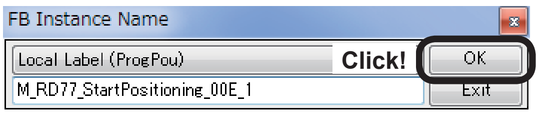
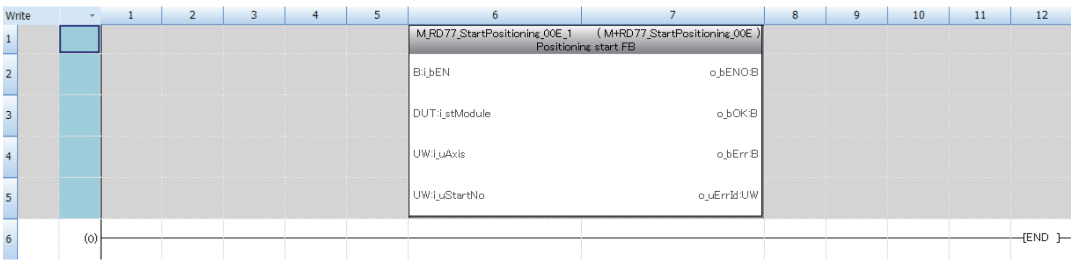
(4) Drag “M+RD77_StartPositioning_00E,” and drop it in the ladder editor.





(5) The FB instance name input dialog box appears. Select the local label for the instance, input the instance name, and click the OK button.

(6) The FB will be inserted into the ladder editor.



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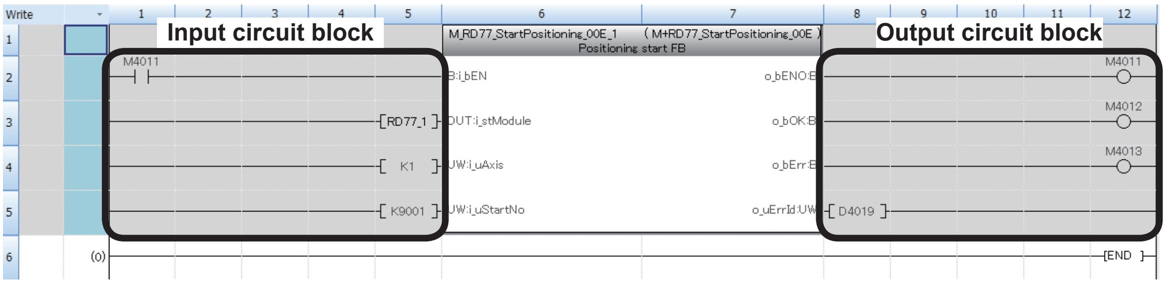
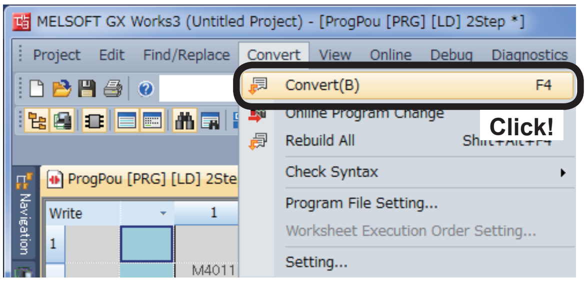
Create the input circuit and output circuit blocks of the FB instance as shown below.



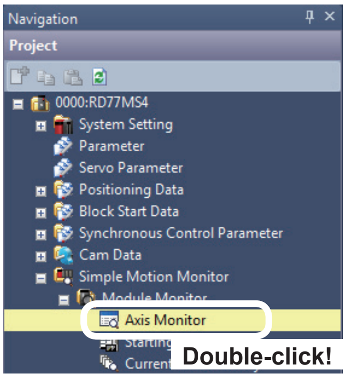


(7) Click [Convert] → [Convert].

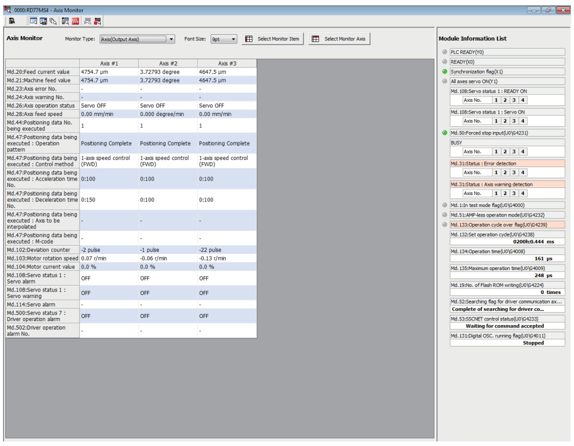
Appendix 5 Simple Motion Monitor

The parameters and error codes relating to all operation axes can be collectively monitored from the Simple Motion setting tool. You can check the parameters and errors of each axis during system operation.

Appendix 5.1 Starting the Monitor (in the case of Axis Monitor)

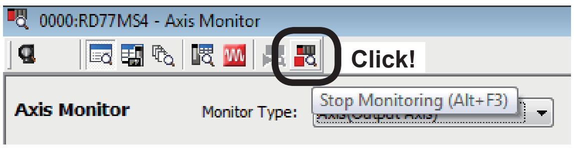


(1) In the [Navigation window] of the Simple Motion setting tool, select [Module Monitor], and double-click [Axis Monitor].

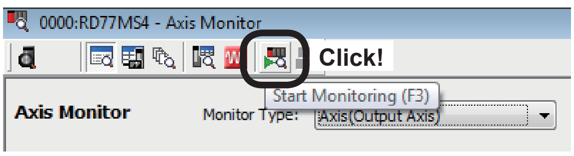


(2) The monitor starts up.

Appendix 5.2 Stopping/starting the Monitor



(1) To stop the monitor, click the "Stop Monitoring" button on the Monitor screen toolbar.



(2) To start the monitor again, click the "Start Monitoring" button on the Monitor screen toolbar.

Appendix 5.3 Switching the Monitor

The monitor screen can be switched by clicking a button on the monitor screen tool bar.

 : Axis Monitor

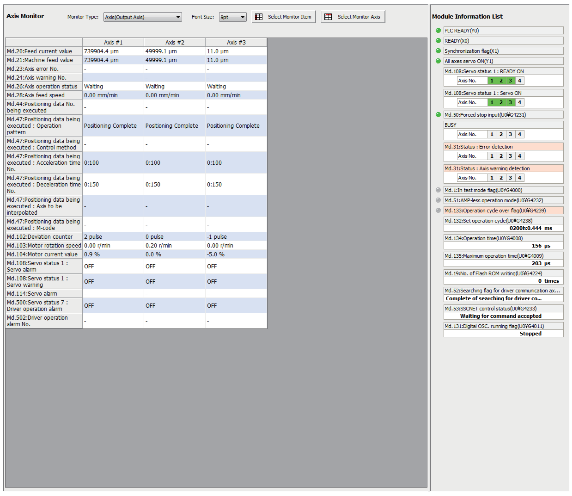
 : Starting History

 : Current Value History

Appendix 5.4 Types of Monitors

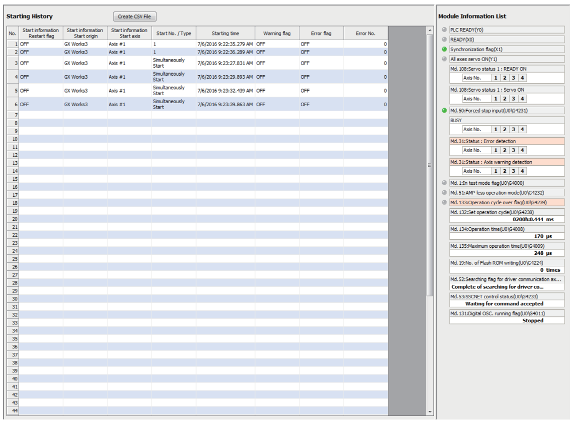
(1) Axis Monitor

The current values of positioning parameters (monitor data and control data) are displayed.
Refer to MELSEC iQ-R Simple Motion Module User's Manual (Application) for details of monitor data and control data.



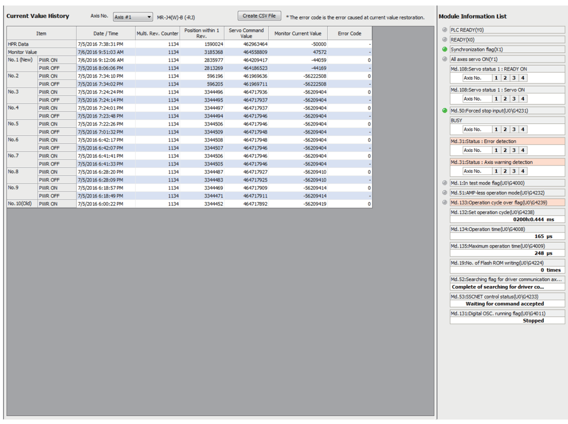
(2) Starting History

The flag, error and warning history information is displayed.
The operations caused by errors and warnings can be checked.



(3) Current Value History

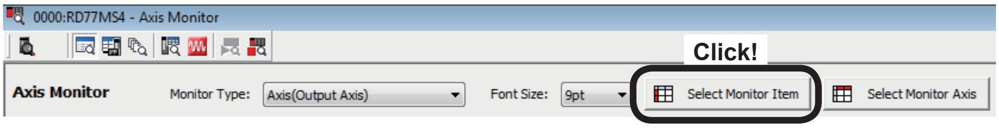
This screen shows the history of values monitored during home position return and when the power supply is turned on/off.

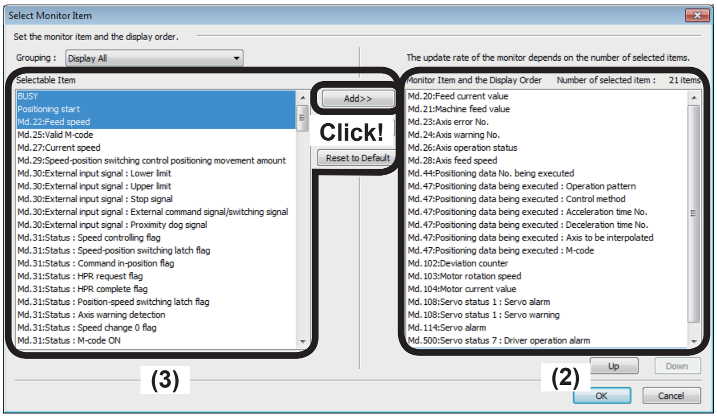


Appendix 5.5 Adding/deleting Monitor Items

On the axis monitor, items to be monitored can be added and deleted.

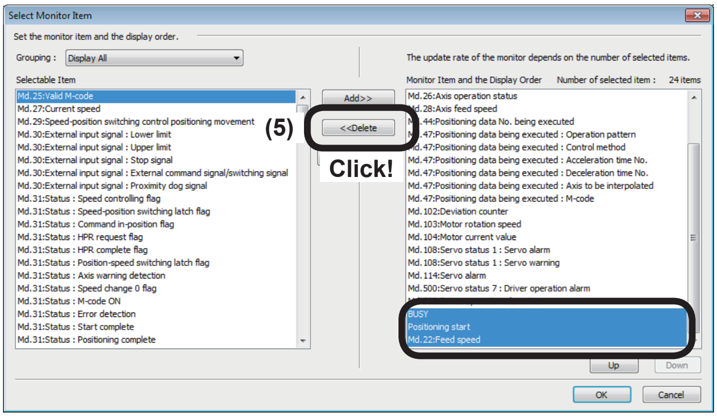
(1) Click the [Select Monitor Item] button on the axis monitor.





(2) Select Monitor item window appears. The items monitored on the axis monitor are displayed in the Monitor Item and the Display Order field.

(3) Select the items to be added from the Selectable Item field, and click the [Add] button.



(4) The items selected in (3) are added to the Monitor Item and the Display Order field. Click the [OK] button to return to the axis monitor, and the added items will be monitored.

(5) Select the items to be deleted from the Monitor Item and the Display Order field, and click the [Delete] button to delete the selected monitor items. The deleted items will be added to the Selectable Item field.

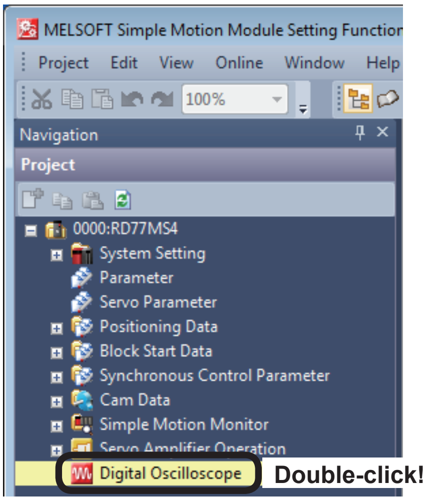
Appendix 6 Digital Oscilloscope

Position commands, position droop, motor speed, motor current and speed commands and so on can be sampled by the digital oscilloscope of the Simple Motion Module setting tool (GX Works3).

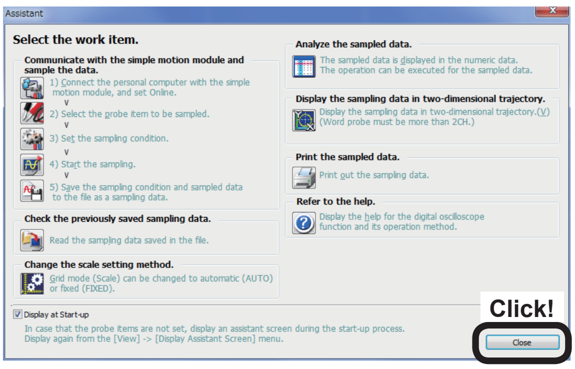
For the performance and specifications, refer to the Help (digital oscilloscope) for the Simple Motion Module setting tool.

This appendix gives an example of measurement for address indirect specification positioning of Axis 1 (refer to Section 6.8.6).

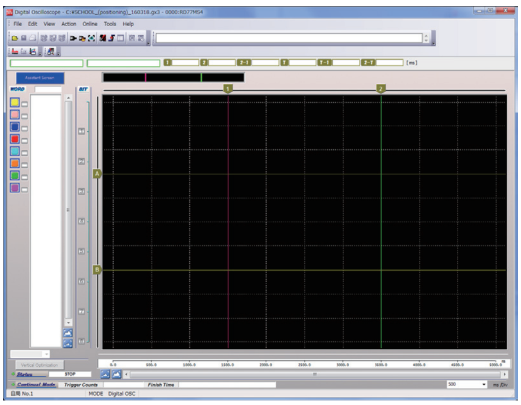
(1) Starting the digital oscilloscope



(1) In the [Navigation window] of the Simple Motion Module setting tool, double-click [Digital Oscilloscope].



(2) The assistant dialog box will appear. Click Close.

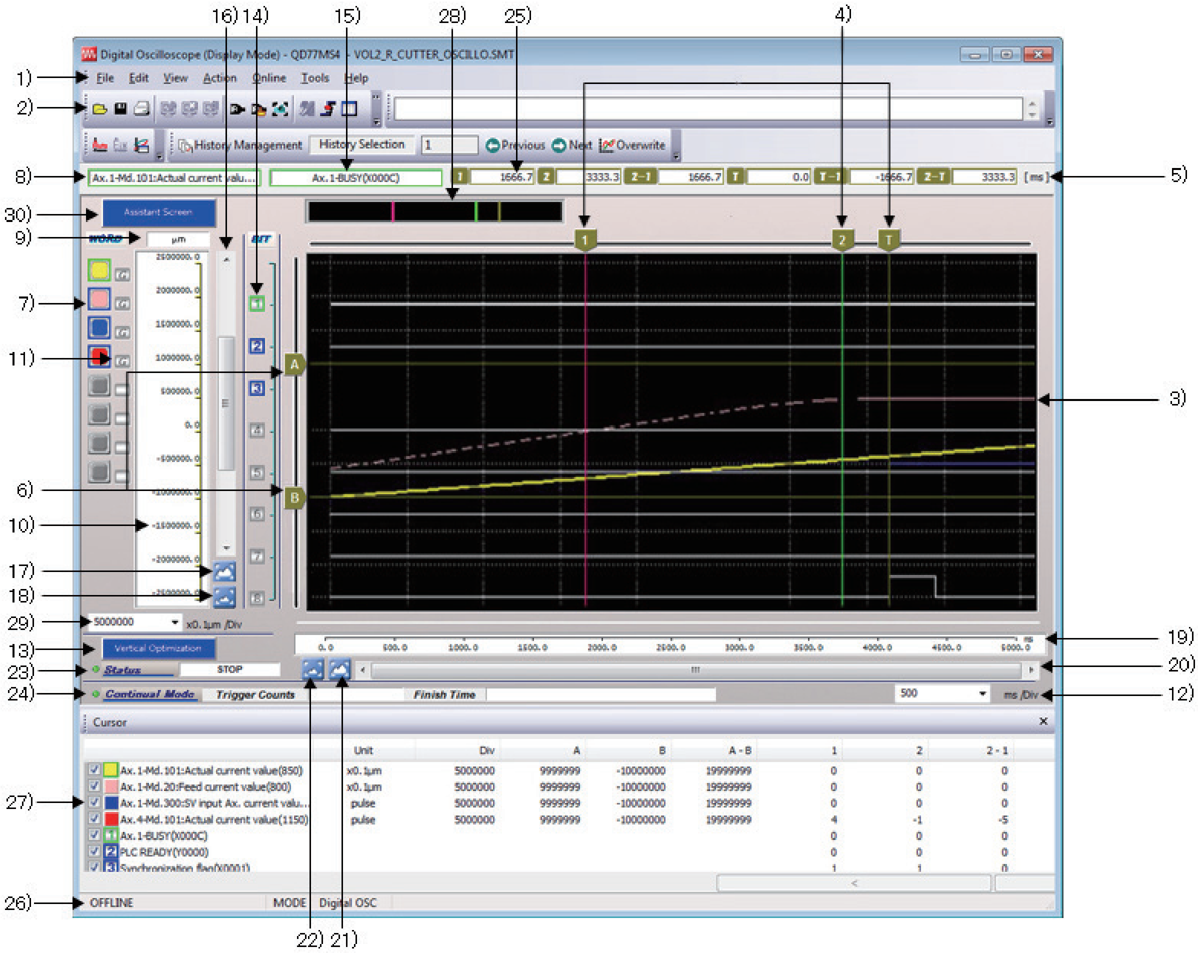


(3) A Digital Oscilloscope window appears.

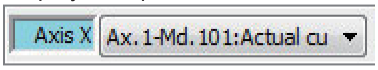
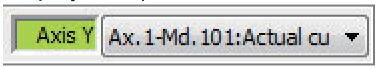
(2) Digital Oscilloscope window

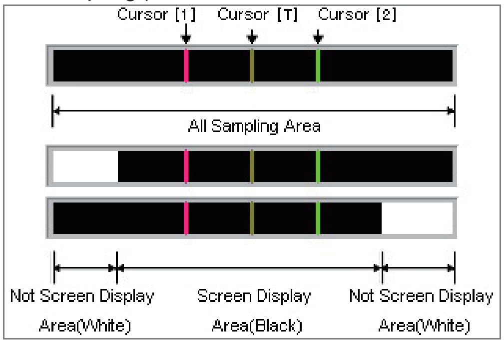
The digital oscilloscope window screen is configured as shown below.

The screen in the time axis indication mode (FIXED grid mode) is shown below.

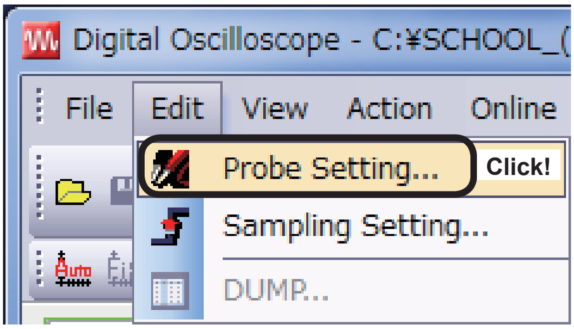


No.	Item	Details
1)	Menu bar	This menu is used to perform each function.
2)	Toolbar	Displays tool buttons used to perform each function.
3)	Waveform display area (time axis indication)	Displays word data and bit data waveforms.
	Waveform display area (Two dimensional locus display)	Two dimensional locus of X-axis and Y-axis appear. If the mouse cursor is in the display area, the coordinate tool hint appears at the cursor point.
4)	X-axis cursors [1], [2], [T] (Time axis indication)	Displays X-axis cursors [1] and [2], and trigger cursor[T].
	X-axis cursors [1], [2] (Two dimensional locus display)	Displays X-axis cursors [1] and [2].
5)	X-axis cursor position (Time axis indication)	Displays X-axis cursors [1] and [2] and trigger cursor[T] position (time), and the time between cursors. (Unit: ms)
	Cursor position (Two dimensional locus display)	Displays X-axis and Y-axis cursors [1], [2], [A], and [B] position, and the difference between the cursors.
6)	Y-axis cursors [A], [B]	Displays Y-axis cursors [A] and [B].
7)	Word waveform selection button	Selects the word waveform subject to operation.

No.	Item	Details
8)	Word waveform item name (Time axis indication)	Displays the probe name for the word waveform selected with the word waveform selection button.
	X-axis probe setting (Two dimensional locus display)	Displays the probe name selected for the X-axis. 
	Y-axis probe setting (Two dimensional locus display)	Displays the probe name selected for the Y-axis. 
9)	Word waveform item unit	Displays the data unit for the word waveform selected with the word waveform selection button.
10)	Word waveform selection item scale (Time axis indication)	Displays the data scale value for the word waveform selected with the word waveform selection button.
	Y-axis scale (Two dimensional locus display)	Displays the scale (unit) of the probe specified for the Y-axis.
11)	GND level button	Displays the GND(0) existence, and changes between the word waveform and GND level display.
12)	X-axis 1 division setting field (Displays only in FIXED grid mode.)	Changes the X-axis 1 Division setting.
13)	Y-axis scale optimization button (Displays only in FIXED grid mode.)	Automatically adjusts Y-axis divisions so that the selected word waveform can be displayed inside a single screen.
14)	Bit waveform selection button (Time axis indication only)	Selects the bit waveform subject to operation
15)	Bit waveform selection item (Time axis indication only)	Displays the probe name for the bit waveform selected with the word waveform selection button.
16)	Y-axis waveform scrollbar	Scrolls the word waveform selected with the word waveform selection button in the Y-axis direction.
17)	Vertical waveform enlarge button ()	Enlarges the scale of the word waveform selected with the word waveform selection button.
18)	Vertical waveform reduce button ()	Reduces the scale of the word waveform selected with the word waveform selection button.
19)	X-axis (time) scale (Time axis indication)	Displays the X-axis (time axis) scale.
	X-axis scale (Two dimensional locus display)	Displays the scale of the X-axis probe.
20)	X-axis waveform scrollbar	Scrolls through the entire waveform in the X-axis direction.
21)	Horizontal waveform enlarge button ()	Enlarges the entire waveform in the horizontal direction.
22)	Horizontal waveform reduce button ()	Reduces the entire waveform in the horizontal direction.
23)	Status	Displays the status when sampling.
24)	Continual mode status	Displays the status during execution in trigger type Continual mode.
25)	File comment	Displays a comment for the currently displayed file.
26)	Status bar	Displays digital oscilloscope status information.
27)	Docking window (Cursor window)	Displays cursor position data and the difference between cursors as the X-axis and Y-axis cursors move.

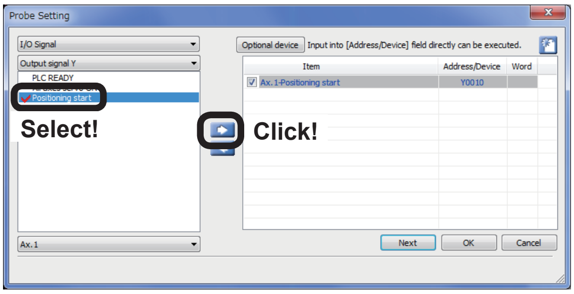
No.	Item	Details
28)	MAP window (Time axis indication)	Displays which area of the 100 % sampling data is the data area (X-axis range) displayed in the graph display field with a black band. The display area is only the X-axis scale range. The Y-axis scale display area is not applicable. By left-clicking any position in the MAP window, a graph displays with the clicked X-axis position as the center (vicinity). (Enabled while sampling.) 
	Two dimensional locus display reproduction function (Two dimensional locus display)	This item reproduces the locus when a sampling result is present.
29)	Word waveform scale mode display/change field (Time axis indication) (Displays only in AUTO grid mode.)  	Displays/changes the data scale mode for the word waveform selected with the word waveform selection button. • Manual scale [FIX] button: If the word waveform scale mode is changed to MANUAL, enlarge/reduce (range adjustment) the Y-axis scale, scroll the Y-axis (display area), and adjust the GND (0) position, and then press the FIX button to set the scale.
	Y-axis 1 Division setting (Time axis indication) (Displays only in FIXED grid mode.)	Changes the Y-axis 1 division setting for the selected word waveform.
	Waveform scale mode display (Two dimensional locus display)	Displays only AUTO grid mode. (Indication is AUTO.)
30)	Assistant screen display button	Displays the Assistant screen.

(3) Probe Setting and Sampling Setting

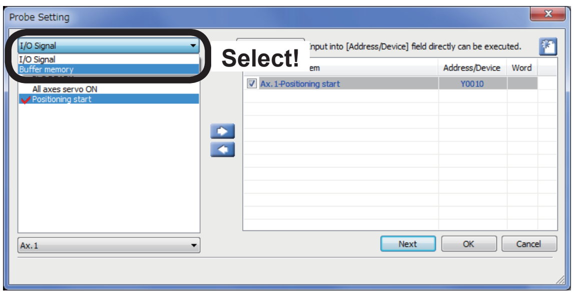


(1) Select the item to be probed.
Click [Probe Setting...] on the [Edit] menu at the Digital Oscilloscope window.

(2) The Probe Setting screen will appear. Select "Output signal Y" from the "Input signal X" dropdown list.



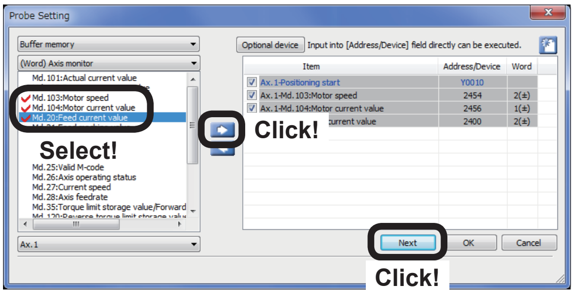
(3) Select "Positioning start" and click to register it in the Item column.



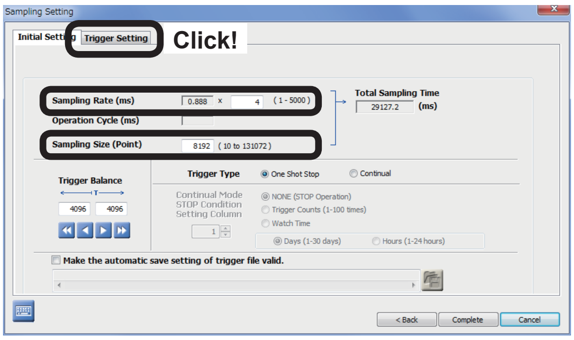
(4) Select "Buffer memory" from the "I/O Signal" dropdown list.

Go to next page

From previous page

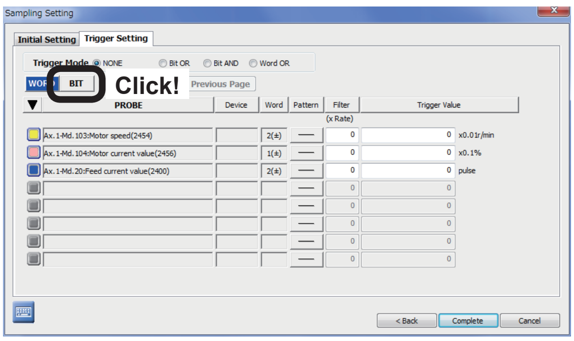


(5) Click “Md.103: Motor speed”, “Md.104: Motor current value” and “Md.20: Feed current value,” and click to register them in the Item column.
After registering, click the Next button.

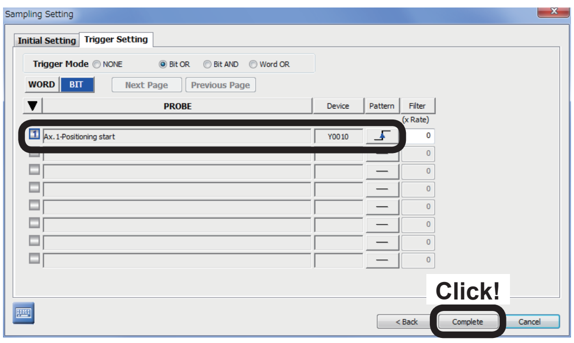


(6) Sampling Setting screen appears.
Specify the default settings as follows.
- Sampling Rate (ms): 0.888 × 4
- Sampling Size (Point): 8192

Click the “Trigger Setting” tab.



(7) The trigger setting items will be displayed. Click the BIT button.

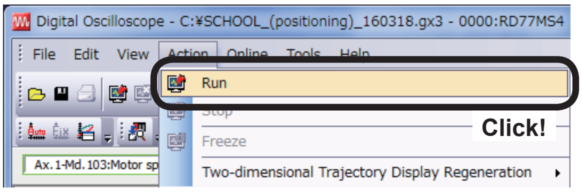


(8) Set the BIT trigger conditions as shown below.
- Trigger Mode: Bit OR
- Ax. 1-Positioning start Pattern:
  (OFF to ON (startup))

Click the Complete button.

(4) Waveform measurement

(1) Execute the standby point positioning to set the positioning address to (0, 0). (Refer to Section 6.8.4)



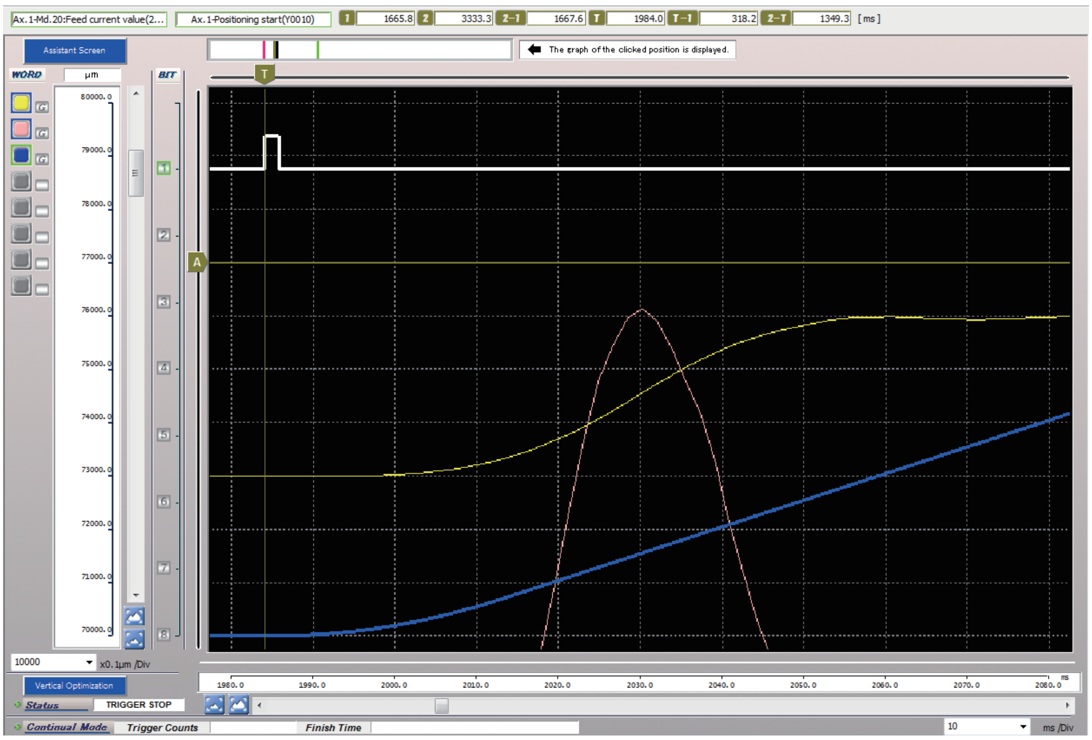
(2) Select [Action] in the Digital oscilloscope window, and click [Run].
Sampling is started.

(3) Execute the address indirect specification positioning (refer to Section 6.8.6).

Set any positioning address, and touch [Position selection M1] to execute the positioning.

A trigger is generated at the same time when [Position selection M1] is touched, and data for sample size is obtained.

(4) After the data is obtained, sampling will be automatically stopped, and the sampling data will be read. After the completion of reading, the waveforms of sampled word data and bit data will be displayed in the waveform display area.
The waveforms of address indirect designation positioning are shown after the trigger cursor [T].



Appendix 7 MELSEC iQ-F Series Simple Motion Module

Appendix 7.1 Major Features of MELSEC iQ-F Series Simple Motion Module

(1) Modules for 4 axes and 8 axes are available.

iQ-F Simple Motion Modules for 4 axes and 8 axes are available.

- FX5-40SSC-S (for 4 axes)
- FX5-80SSC-S (for 8 axes)

(2) Basic positioning control

Positioning control can be realized by starting the point table type positioning data from the sequence program.
The modules with various types of positioning control, e.g. linear interpolation, 2-axis circular interpolation, fixed-feed and continuous path, are applicable to many uses.

(3) Synchronous/cam control

(a) Advanced synchronous control
This control uses software in place of mechanisms, such as gears, shafts, clutches, transmissions and cams.
The synchronous control can be realized only by setting the parameters on GX Works3.
Synchronous control output axes are moved with cams.

(b) Cam automatic generation
Cam data for rotary cutter is automatically generated.
Optimum cam data can be generated only by inputting the sheet length, synchronous width and cam resolution to the device specified on the GOT screen.

(4) Mark detection function

The actual current position of servo motor can be obtained when the register mark on wrapping paper moving at a high speed is input to the sensor. Wrapping paper can be cut in the predetermined position by correcting the cutter shaft position when the register mark is input.

(5) Compatible with servo high-speed synchronous network SSCNETIII/H

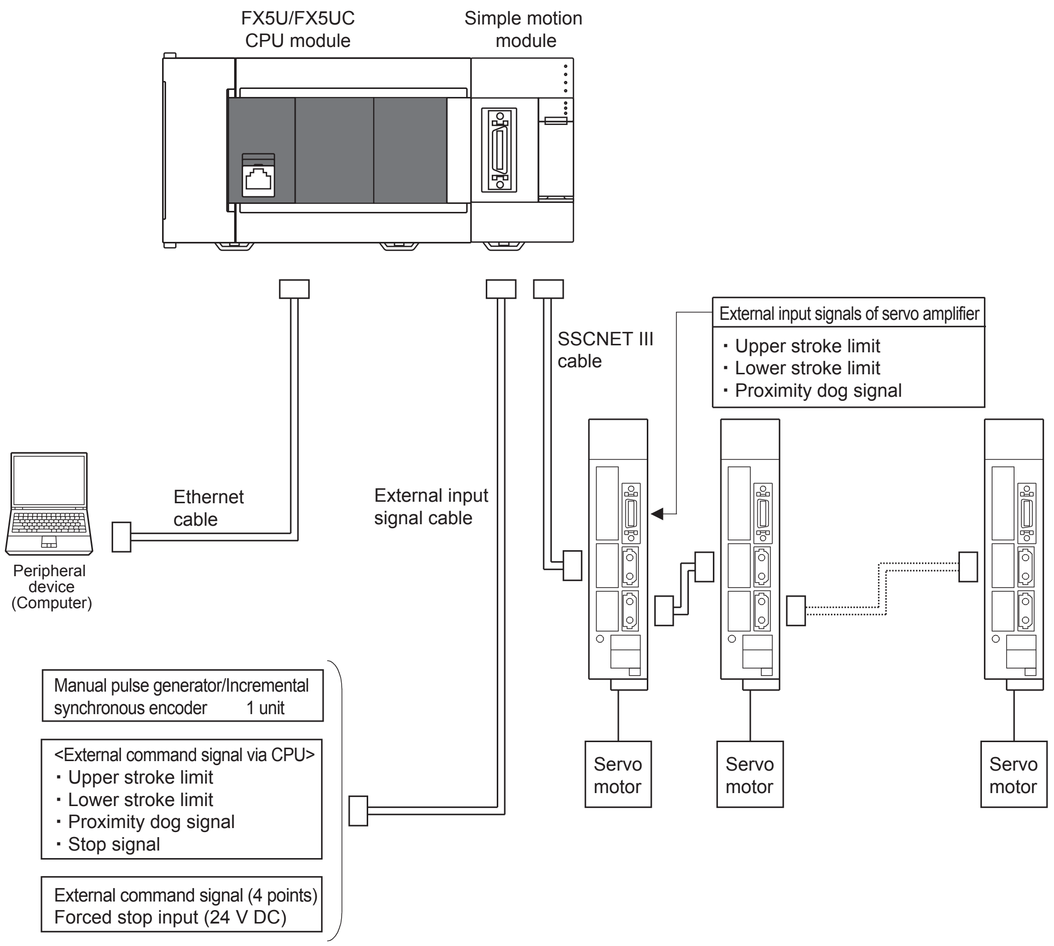
(a) Communication speed is 3 times faster.
The module can transmit data 3 times faster (bidirectional 150 Mbps (equivalent to unidirectional 300 Mbps)) compared to the conventional modules. It realizes improved system responsibility, increased number of axes and wiring saving and contributes toward improvement of equipment performance.

(b) Equipment performance improvement by synchronous communication
SSCNETIII/H enables completely synchronous communication. It realizes improvement of performance of printers, food machinery, processing machinery, etc. that require high precision synchronization.

(c) Connection of various drive units
The module can be connected not only to rotary servo motors, but also to linear servo motors, direct drive motors, FR-A800 Series inverters and devices produced by partner manufacturers.

Appendix 7.2 System Configuration

(1) System Configuration



(2) Compatible modules

Model name	Compatible versions
FX5U CPU module	• FX5-40SSC-S: Ver. 1.000 or later • FX5-80SSC-S: Ver. 1.014 or later
FX5UC CPU module*1	• FX5-40SSC-S: Ver. 1.000 or later • FX5-80SSC-S: Ver. 1.014 or later

*1. To connect with FX5UC CPU module, FX5-CNV-IF or FX5-C1PS-5V is required.

Appendix 7.3 Major Differences from MELSEC iQ-R Series Simple Motion Module

The major difference between iQ-R simple motion module and iQ-F simple motion module are shown below.

For the details of iQ-F Simple Motion Module, refer to the following manuals.

- MELSEC iQ-F FX5 Simple Motion Module User's Manual (Startup)
- MELSEC iQ-F FX5 Simple Motion Module User's Manual (Application)
- MELSEC iQ-F FX5 Simple Motion Module User's Manual (Advanced Synchronous Control)

(1) Input/Output Signals with CPU Modules

- The iQ-R simple motion module uses 32 input points and 32 output points for exchanging data with the CPU module.
- The iQ-F simple motion module uses buffer memory (10 input points and 10 output points) for exchanging data with the CPU module.

The correspondence between the CPU modules and input/output signals is shown in the following table.

iQ-R simple motion module → CPU module			⇔	iQ-F simple motion module → CPU module		
Device No.	Signal name			Buffer memory address	Signal name	
X0	READY			31500.b0	READY	
X1	Synchronization flag			31500.b1	Synchronization flag	
X2 to XF	Use prohibited			31500.b2 to b15	Use prohibited	
X10	Axis 1	BUSY*1		31501.b0	Axis 1	BUSY*1
X11	Axis 2			31501.b1	Axis 2	
X12	Axis 3			31501.b2	Axis 3	
X13	Axis 4			31501.b3	Axis 4	
X14	Axis 5			31501.b4	Axis 5	
X15	Axis 6			31501.b5	Axis 6	
X16	Axis 7			31501.b6	Axis 7	
X17	Axis 8			31501.b7	Axis 8	
X18	Axis 9			—	—	
X19	Axis 10					
X1A	Axis 11					
X1B	Axis 12					
X1C	Axis 13					
X1D	Axis 14					
X1E	Axis 15					
X1F	Axis 16					

*1. The BUSY signals and positioning start signals for the axis numbers larger than the number of controlled axes cannot be used.

CPU module → iQ-R simple motion module		
Device No.	Signal name	
Y0	PLC READY	
Y1	All ax servo ON	
Y2 to YF	Use prohibited	
Y10	Axis 1	Positioning start*1
Y11	Axis 2	
Y12	Axis 3	
Y13	Axis 4	
Y14	Axis 5	
Y15	Axis 6	
Y16	Axis 7	
Y17	Axis 8	
Y18	Axis 9	
Y19	Axis 10	
Y1A	Axis 11	
Y1B	Axis 12	
Y1C	Axis 13	
Y1D	Axis 14	
Y1E	Axis 15	
Y1F	Axis 16	

⇔

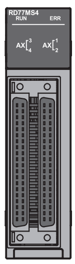
CPU module → iQ-F simple motion module		
Buffer memory address	Signal name	
5950	PLC READY	
5951	All ax servo ON	
—	—	
30104	Axis 1	Positioning start*1
30114	Axis 2	
30124	Axis 3	
30134	Axis 4	
30144	Axis 5	
30154	Axis 6	
30164	Axis 7	
30174	Axis 8	
—	—	

*1. The BUSY signals and positioning start signals for the axis numbers larger than the number of controlled axes cannot be used.

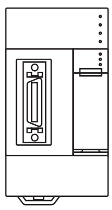
(2) Connector for external input connection

- iQ-R simple motion module has a 40-pin connector.
- iQ-F simple motion module has a 26-pin connector.

iQ-R simple motion module
(Example: RD77MS4)



iQ-F simple motion module
(Example: FX5-40SSC-S)

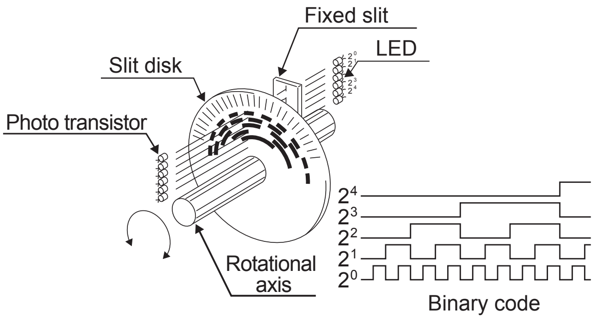


Appendix 8 Glossary

A

Absolute encoder

This is a detector that allows angular data contained in a single motor rotation to be output externally, and standard encoders allow 360 degrees to be extracted in 18 to 22 bits.
With incremental encoders, the axis position when a power outage occurs is lost, however, with absolute encoders, the axis position is retained, even in the event of a power outage.
Absolute encoders of various output types, such as binary code and BCD code types, are available. They are more expensive and have higher accuracy than incremental encoders.

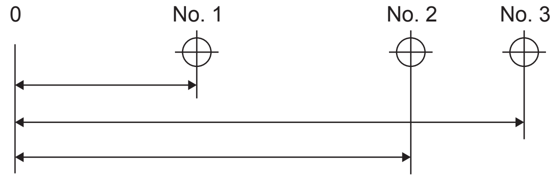


Absolute position detection system

If the machine is once returned to the home position when it is started up during positioning, the machine position is stored in the positioning module, and its current position is maintained even if the power supply is turned off. Machine displacements are compensated. Consequently, there is no need to perform home position return after restoring the power. This system configuration requires a motor with absolute position detector, a servo amplifier compatible with the absolute positioning system and a positioning module.

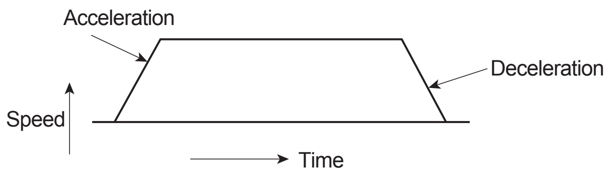
Absolute system

This is a method used to express the positioning address.
This is an absolute address method.
This method expresses the distance from the reference 0.
The positioning direction is determined automatically without being specified. There is also an incremental mode.



Automatic trapezoidal acceleration/ deceleration

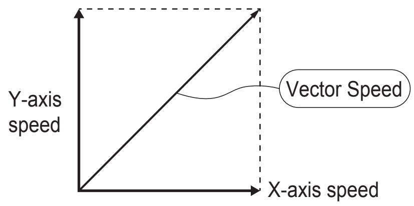
This is a movement in which the time and speed graph forms a trapezium.



C

Composite speed

Moving speed of control object during interpolation operation. It is computed by vector calculation of X-axis and Y-axis speed.



Creep speed

Speed of slow movement

It is difficult to stop the machine suddenly at a precise point when traveling at a high speed, and therefore the speed is once switched to the creep speed.

Current feed value

The current feed value is representing the current position of motor. The current feed value is getting updated, when motor is in running condition.

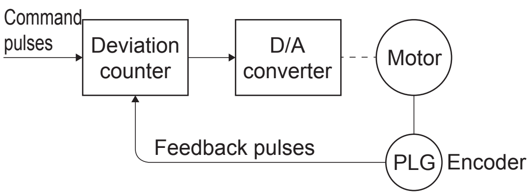
D

Deviation counter

This counter has two functions.

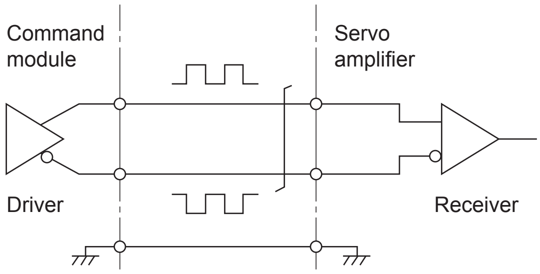
It counts the command pulses from the simple motion module and sends the count value to the D/A converter.

The feedback pulses are subtracted from the command pulses, the motor is operated with the deviation (droop pulses) between command pulses and feedback pulses until the number of command pulses reaches 0.



Differential output type

When one signal is output, another signal with reversed polarity is simultaneously output. This type is characterized by transmission at high frequency and high noise resistance and used for high-speed transmission of signals, such as pulse train input/output. Generally, the source and destination are called driver and receiver, respectively. A special IC is used.



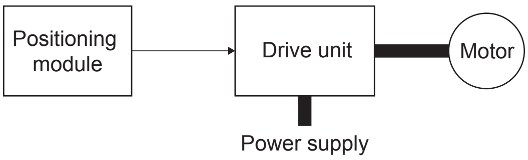
Drive unit

Commands (pulses, etc.) issued by the positioning module are of low voltage and current, resulting in insufficient energy to drive motors.

This module amplifies these commands to drive motors.

It may be attached to servo motors and stepping motors.

It is called also a servo amplifier.



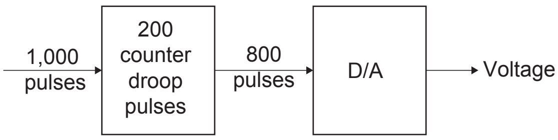
Drive unit ready

This signal indicates that the motor drive unit is ready.

The drive unit remains OFF if the power is OFF or if an accident occurs.

Droop pulse

As the machine has inertia (GD<244>2</244>), if positioning module speed commands are issued as is, the machine becomes delayed and is therefore unable to keep up.
In the case of servo motors, speed command pulses are accumulated in the deviation counter to delay them.
Droop pulses are these accumulated pulses.
When the machine stops, the deviation counter discharges all pulses to leave the count at 0.



Dynamic brake

When the protective circuits are triggered by a power outage or emergency stop condition (EMG signal), the dynamic brake is used to short the circuit via a resistor between servo motor terminals, consume rotation energy as heat, and stop axes suddenly without coasting the motor.
Braking power is generated only while motors capable of obtaining brake torque greater than that of electromagnetic brakes are rotating, and as there is no holding power when motors are stopped, mechanical brakes are also used to prevent vertical axes from falling.

E

Electronic gear

With this function, the command pulses from the pulse command module can be electrically decreased and increased (1/10 to 4000 times) in the servo amplifier.
Therefore, the positioning speed and movement amount can be controlled by the electronic gear ratio.

F

Feed back pulse

A command is issued during automatic control, and the pulse train is returned to confirm whether the machine has operated in accordance with the command. If not, a correction command is issued. If a command with 10,000 pulses is issued, and 10,000 feedback pulses are returned, the balance should be 0. These are also referred to as return pulses.

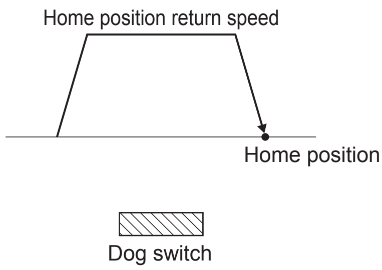
Flash ROM

Parameters and positioning data are stored in the flash ROM and can be backed up without batteries.
Since it does not use batteries, it is unnecessary to maintain the batteries.

H

High speed zeroing

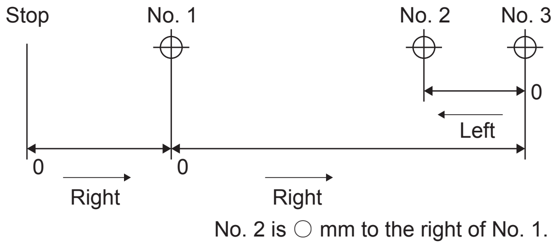
Return to machine home position at home position return speed without detection by dog switch.
(This function is enabled after home position return using the dog switch is performed at least once.)



I

Increment system

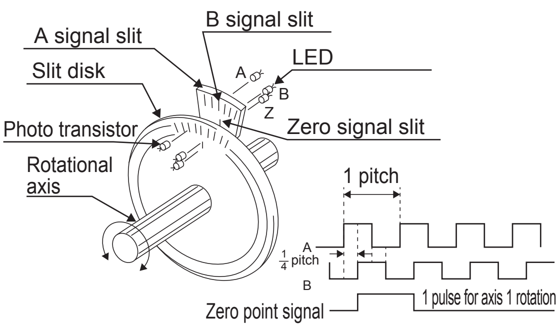
This mode is used for indicating a position based on the specified direction and travel distance from the current value regarded as 0. This is a relative address method. This mode is used for fixed feeding, etc. There is also an absolute mode.



Incremental encoder

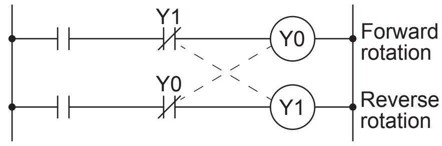
This is a device used simply to emit ON/OFF pulses as an axis rotates. Single-phase encoders emit only A pulses, and the axis rotation direction is unknown. Two phase encoders emit both A and B pulses, allowing the system to judge that the motor is rotating in the forward direction if B turns ON while A is ON, and in the reverse direction if A turns ON while B is ON.

There are also encoders with zero point signals. Incremental encoders emit between 100 and 10,000 pulses per axis rotation, and are the most commonly used encoders.



Interlock

Condition to block to prevent start of the next action until the current action is completed. The interlock is used to prevent equipment damage or runaway.



M

Machine feed value

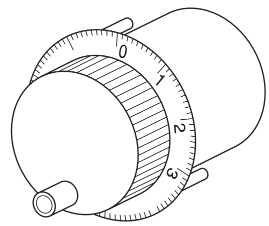
The home position address is stored when the home position return is completed.

The current position of the machine coordinates determined for each machine based on the home position address is stored.

The value is not changed even if the current value is changed.

Manual pulse generator

This is a device used to generate pulses by manually rotating a handle. It is used to manually perform precise positioning.



Made by Mitsubishi Electric Corporation (Model MR-HDP01)

Master axis

This is the side at which positioning data is prioritized when performing interpolation. For example, in the case of positioning on the X and Y-axes, the axis with larger travel distance is regarded as the master axis, and the speed on the axis is used. The speed on the slave axis is ignored.

O

Override function

Function to change the speed (current speed) during positioning in the range from 1 to 300 %.
During continuous positioning at different specified speeds, the speeds are changed at the same change rate.

P

Programmable controller ready

Signal indicating that the PLC CPU is ready. Positioning cannot be performed if it is not in this state.

Position control

The position controls, such as fixed-feed, positioning and movement amount control, are performed based on position and movement amount.
They are controlled constantly by feed pulses.

Positioning

This refers to traveling from a certain point to the predetermined next point.
For positioning, the distance, direction and speed are specified.
Positioning is used in, for example, sheet cutting, plate drilling, mounting of components on printed boards and welding.
Also robots perform positioning.

Positioning data

The data is used by the user to control the positioning system. The data for the number of positioning points (addresses) is specified based on the parameters. Up to 600 points can be specified. It is possible to write (alter) the data through a program during positioning.

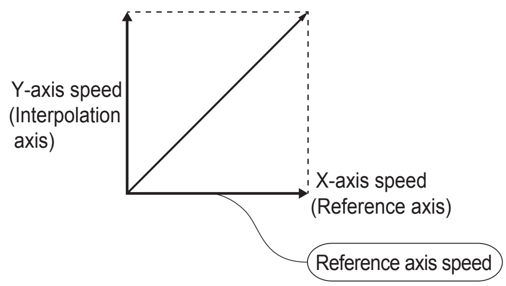
Positioning parameter

The positioning parameters are the basic data used for positioning control and include the control unit, movement amount per rotation, speed limit value, upper and lower stroke limits, acceleration/deceleration time and positioning method. The parameters have the default values. Change the values according to the control conditions.

R

Reference axis speed

Axis speed used as the reference when performing interpolation.

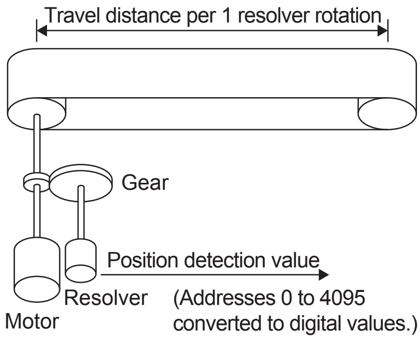


Regenerative brake option

This is an optional part, and is used to perform high-frequency acceleration and deceleration.

Resolver

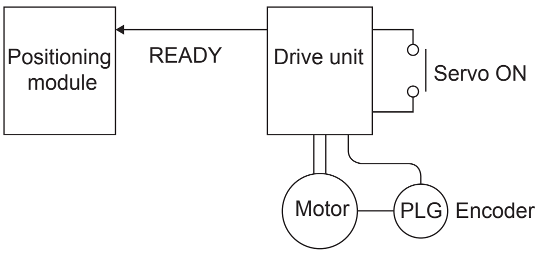
This is a device used to resolve angle detection into two analog voltages.
Also referred to as a two-phase synchro, as opposed to single phase voltage input, the resolver converts an axis rotation angle to a perpendicular two-phase voltage (analog voltage), and then outputs it.



S

Servo on

Servo Control is performed only when drive is normal and servo on signal is in “ON” state.



Skip function

This function stops the positioning being executed (decelerates to a stop) when the skip signal is input, and automatically carries out the next positioning.

Speed control

Control mainly of moving speed by servo motor. This control is used to control grinding stone rotation, welding speed, feed speed, etc. Unlike the position control, it does not control the current value (address).

Speed integral compensation

Frequency responses are issued when performing positioning control at item 1 in the positioning data servo parameters, and transient characteristics are improved.
It is helpful to increase this value when the overshoot when accelerating or decelerating does not get any smaller even by adjusting the speed loop gain.
The unit is ms.

Speed limit value

This is the maximum positioning speed.
When this value has been set in the parameter, even if a higher speed is accidentally set in other data, the speed will be set to the speed limit value. Note that acceleration time and deceleration time are the speed limit value times.

Speed loop gain

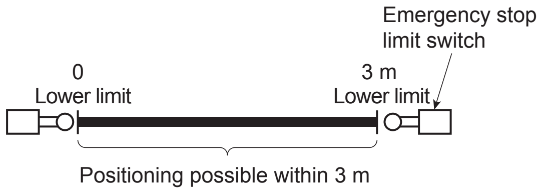
Expresses the control response speed when performing speed control at item 1 in the positioning data servo parameters.
If the control system responsiveness drops and operation becomes unstable as the load inertia moment ratio increases, stability can be improved by increasing this setting.
If increased too much, the overshoot increases when accelerating, and motor vibration noises are emitted during operation or stoppages.

Step function

When some positioning data numbers have been specified for continuous operation, this function performs a test run with each data number.

Stroke limit

This is the range in which positioning can be performed, or the movement range beyond which the machine will be damaged. (In the JOG mode, the machine can be moved to the outside of this range.) When a feed screw is used, the limit is determined by the screw length, and in the case of fixed-feed, the limit is the maximum cut size. The upper and lower limits are set by parameters. Separately from them, limit switches are provided to form an electrical emergency stop circuit on the outside of the programmable controllers.



T

Teaching

This function is used to teach the positioning addresses determined by the operator when the addresses are unknown or must be set appropriately to the actual workpiece.
For example, addresses on a complicated form like a graphic can be taught by tracing the model, and the positioning can be reproduced.

Torque control

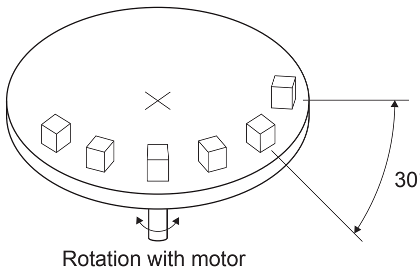
This function places a limit to the resistance torque applied to the positioning motor and turns off the power supply when a torque larger than the limit is applied to the motor.
If an excessive torque is applied to the motor, the current may suddenly increase, and the motor may be burnt out, or its life may be reduced due to the stress caused by the current.
The increase in torque during home position return is used as a motor stop command.

Tracking function

Travel values are entered from an external controller, and by adding these travel values to servo command values, positioning is performed at a relative speed with respect to the applicable object during travel.

Turntable

The turntable is rotating plate. Rotation is controlled by motor at specific angle as per requirement.
The positioning control unit is "degree".



U

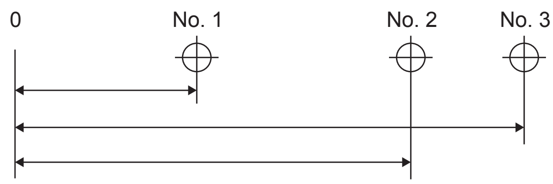
Unit setting

This refers to changing to the actual address or travel value unit for which positioning is to be performed.
The units, mm, inch, degree and pulse, are used appropriately. The default for the fixed parameters is pulse.

X

XY table

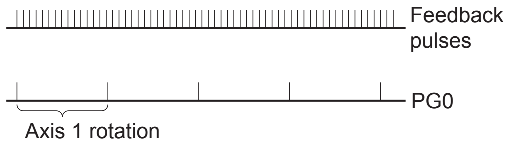
This is a table moved in the X (lateral) and Y (longitudinal) directions so that positioning can be performed easily.



Z

Zero phase signal

One (or two) pulse(s) generated per rotation of pulse generator shaft.
This signal is used for home position return for positioning. It is expressed also as a Z signal or PG0.

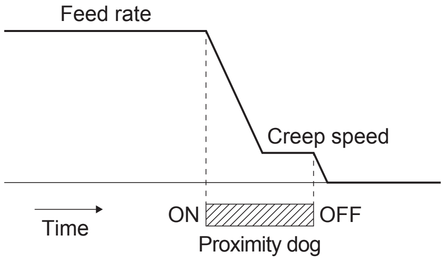


Zero shift function

After execution of home position return, the home position can be shifted in the positive or negative direction by determining the shift amount to the position where the home position return is completed.
A position other than the zero point or out of the dog switch detection range can be defined as the home position.

Zeroing dog

Limit switch installed before the home position. When the proximity dog is turned on, the feed speed is switched to the creep speed. Therefore, the proximity dog signal must be kept for the time during which the speed is decelerated from the feed speed to the creep speed.



MEMO

Mitsubishi Electric Programmable Controller Training Manual
MELSEC iQ-R/iQ-F Simple Motion (for GX Works3)

MODEL	
MODEL CODE	
SH(NA)-030278ENG-A(1712)MEE	

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