Servo System Controller

MELSEC iQ-R/iQ-F Series Motion Module Basics (Simple Motion Mode)

This training course is intended for those who will construct a motion control system using the Simple Motion mode of the MELSEC iQ-R/iQ-F Series Motion modules for the first time.

Click the Forward button at the upper right corner to proceed to the next page.

L(NA)00265ENG

Introduction Purpose of the Course

This course is designed for anyone new to the Simple Motion mode of the MELSEC iQ-R/iQ-F Series Motion modules to learn about system design, installation, wiring, setting, and programming.

This course requires the basic knowledge of the MELSEC iQ-R Series programmable controller or MELSEC iQ-F Series programmable controller in addition to AC servos and positioning control.

For beginners, we recommend the following courses.

- "MELSEC iQ-R Series Basic" Course or "MELSEC iQ-F Series Basics" Course
- "GX Works3 (Ladder)" Course
- "MELSERVO Basics (MR-J5)" Course
- "FA Equipment for Beginners (Positioning)" Course

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Introduction Course Structure

The contents of this course are as follows.
We recommend that you start from Chapter 1.

Chapter 1 Overview of Simple Motion Mode

This chapter describes the overview of Simple Motion mode and differences from the PLCopen® motion control FB mode.

Chapter 2 System of Simple Motion Mode

This chapter describes the hardware configuration of the servo system used in this course.

Chapter 3 Creating a Project

This chapter describes the procedure that begins with creating a project and extends through the setting of each parameter.

Chapter 4 Positioning Control and Interpolation Control Program

This chapter describes the initial setting (all axis servo ON), JOG operation, and program for operating the positioning data.

Chapter 5 Digital Oscilloscope

This chapter describes how to check the operation of the sample program by using a digital oscilloscope.

Final Test

5 sections in total (19 questions) Passing grade: 60% or higher

Introduction How to Use This e-Learning Tool

Go to the next page	>	Go to the next page.
Back to the previous page	<	Back to the previous page.
Move to the desired page	TOC	"Table of Contents" will be displayed, enabling you to navigate to the desired page.
Exit the learning	X	Exit the learning. Window such as "Contents" screen and the learning will be closed.

Introduction Precautions for Use

■Safety precautions

When you learn based on using actual products, please carefully read the safety precautions in the corresponding manuals and handle the product properly while taking all precautions for safety.

■Precautions in this course

The screen images shown in the course may differ from your actual software depending on the version.
The following software versions are used in the course.
For the latest version of each software, check the Mitsubishi Electric FA Website.

MELSOFT GX Works3	Ver.1.082L	Simple Motion Module Setting	Ver.1.172E
MELSOFT MR Configurator2	Ver.1.130L		

The content of this course involves restrictions on the firmware version of each module.

- The firmware version of the iQ-R PLC CPU must be 44 or later (12 or later for R00/01/02CPU).
- The firmware version of the RD78G Motion module must be 16 or later.
- The firmware version of the iQ-F PLC CPU must be 1.230 or later.
- The firmware version of the FX5-□SSC-G Motion module must be 1.001 or later.

For how to update the firmware version, refer to the Mitsubishi Electric FA Website or the module configuration manual.

The book icon indicates the reference manual.
The contents of the manuals described in this course are those of the following versions.
If the versions differ, the location of description and contents may be slightly different.
For the latest version of each manual, refer to the Mitsubishi Electric FA Website.

Manual name	Manual No.	Version
MELSEC iQ-R Motion Module User's Manual (Startup)	IB-0300406	F
MELSEC iQ-R Motion Module User's Manual (Network)	IB-0300426	F
MELSEC iQ-R Motion Module User's Manual (Application for Simple Motion Mode)	IB-0300572	D
MELSEC iQ-R Motion Module (Simple Motion Mode) Function Block Reference	BCN-B62005-1040	B
MELSEC iQ-F FX5 Motion Module/ Simple Motion Module User's Manual (Startup)	IB-0300251	H
MELSEC iQ-F FX5 Motion Module/ Simple Motion Module User's Manual (Application)	IB-0300253	J
MELSEC iQ-F FX5 Motion Module User's Manual (CC-Link IE TSN)	IB-0300568	C
MELSEC iQ-F FX5 Motion Module/ Simple Motion Module Function Block Reference	BCN-B62005-719	C

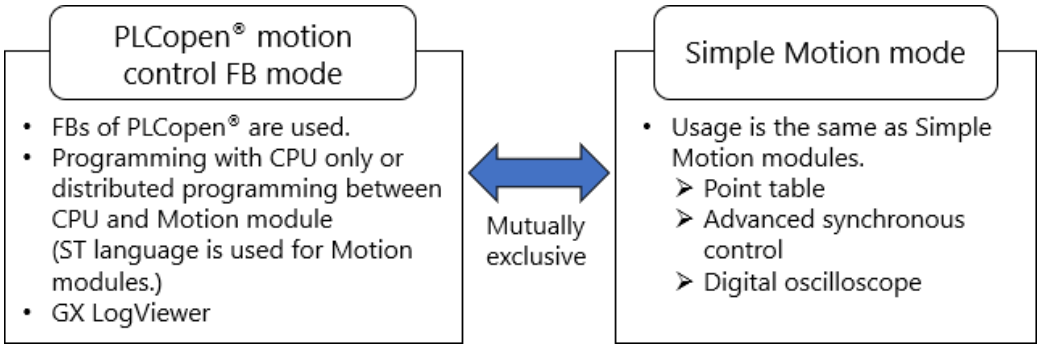
Chapter 1 Overview of Simple Motion Mode

The RD78G Motion module has two different modes: "PLCopen® motion control FB mode" and "Simple Motion mode". This chapter describes the overview of Simple Motion mode and differences from the PLCopen® motion control FB mode.

1.1 What is Simple Motion mode?

Simple Motion mode is an operation mode compatible with RD77MS/GF, QD77MS/GF, and FX5-□SSC-S Simple Motion modules.The programming method and parameter settings are almost the same as the Simple Motion modules.

It cannot be used with PLCopen® motion control FB mode.Therefore, they cannot be used in the same module.



1.2 Modules that can use Simple Motion mode

The following table lists the modules that can use Simple Motion mode.

PLC series	Both Simple Motion mode and PLCopen® motion control FB mode	PLCopen® motion control FB mode only	Simple Motion mode only
iQ-R series	RD78G4 RD78G8 RD78G16 (Note)	RD78G32 RD78G64 RD78GHV, RD78GHW	-
iQ-F series	-	-	FX5-40SSC-G FX5-80SSC-G

(Note) For RD78G4, 8, and 16, the firmware version 16 or later supports Simple Motion mode.

1.3 Differences from PLCopen® motion control FB mode

The following table lists the differences from PLCopen® motion control FB mode.

Item	Simple Motion mode	PLCopen® motion control FB mode
Programming method	Programming with PLC CPU	Programming with PLC CPU only or distributed programming between PLC CPU and Motion module
Positioning	Point table method	Executed by Motion control FB
Synchronous control	Configured with the synchronous control parameter to start synchronous control for each axis	Executed by Motion control FB
Engineering tool	GX Works3, Simple Motion Module Setting Function	GX Works3, Motion Control Setting Function
Logging	Digital oscilloscope	Logging setting function and GX LogViewer

1.4 Differences from Simple Motion modules

The following table lists differences from iQ-R/iQ-F series Simple Motion modules.

Item	Simple Motion mode of Motion modules	Simple Motion module	
Model	RD78G4/8/16 FX5-□SSC-G	RD77MS, QD77MS, LD77MS, FX5-□SSC-S	RD77GF, QD77GF
Supported network	CC-Link IE TSN	SSCNET III/H	CC-Link IE Field
Home position return setting	Configured with servo amplifier parameters (Note 1)	Configured with axis parameters	Configured with servo amplifier parameters (Note 1)
External signal (manual pulser) input	No (Note 2)	Yes	RD77GF: No (Note 2) QD77GF: Yes

(Note 1) Only the home position address as well as speed and acceleration/deceleration time for high-speed home position return should be configured with the axis parameters of the Simple Motion module.

(Note 2) When using a manual pulser with a module that has no external signal input, use the high-speed counter module, built- in counter function in CPU (only for iQ-F series), or the high-speed counter module of the network device (only for CC-Link IE Field) to connect it.

1.5 Summary of This Chapter

In this chapter, you have learned:

- What is Simple Motion mode?
- Modules that can use Simple Motion mode
- Differences from PLCopen® motion control FB mode
- Differences from Simple Motion modules

Point

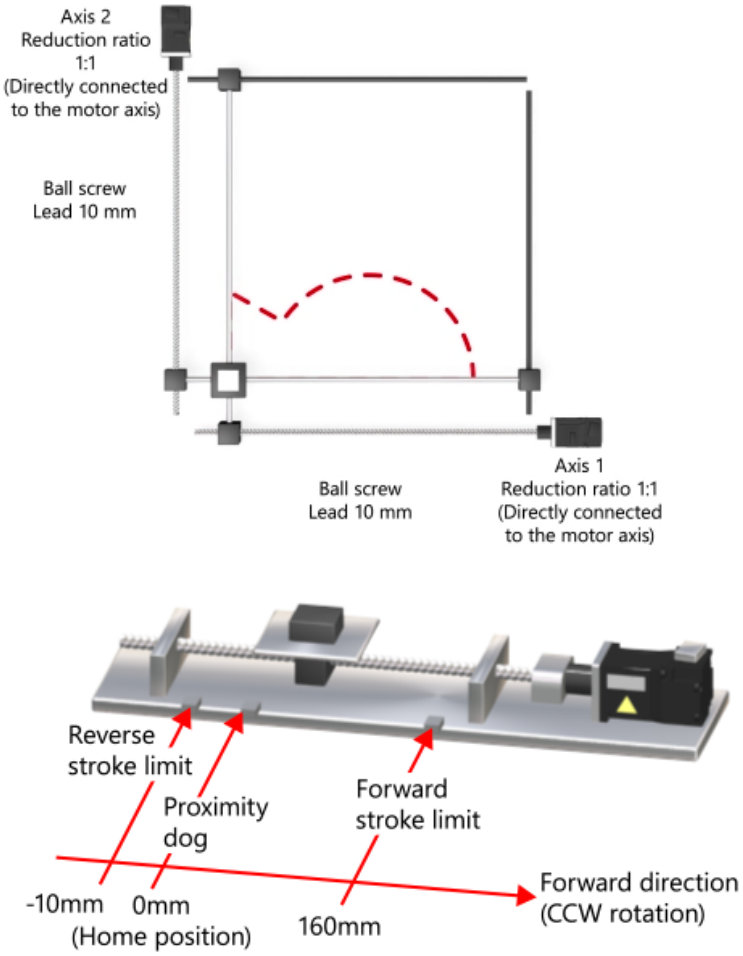
What is Simple Motion mode?	• Simple Motion mode of Motion modules is an operation mode compatible with Simple Motion modules. • It cannot be used with PLCopen® motion control FB mode.
Modules that can use Simple Motion mode	The following modules can use Simple Motion mode. • RD78G4/8/16 • FX5-□SSC-G
Differences from PLCopen® motion control FB mode	• In Simple Motion mode, only the PLC CPU side is programmed. • The point table method is used for positioning. • Synchronous control is performed by setting the synchronous control parameter and turning on the synchronous control start for each axis.
Differences from Simple Motion modules	• The type of supported network and whether the external input (manual pulser input) is provided differ from Simple Motion modules. • Unlike SSCNETIII/H compatible Simple motion modules, parameters related to home position return are set on the servo amplifier side.

Chapter 2 System of Simple Motion Mode

This chapter describes the hardware configuration of the servo system used in this course.

2.1 Machine configuration

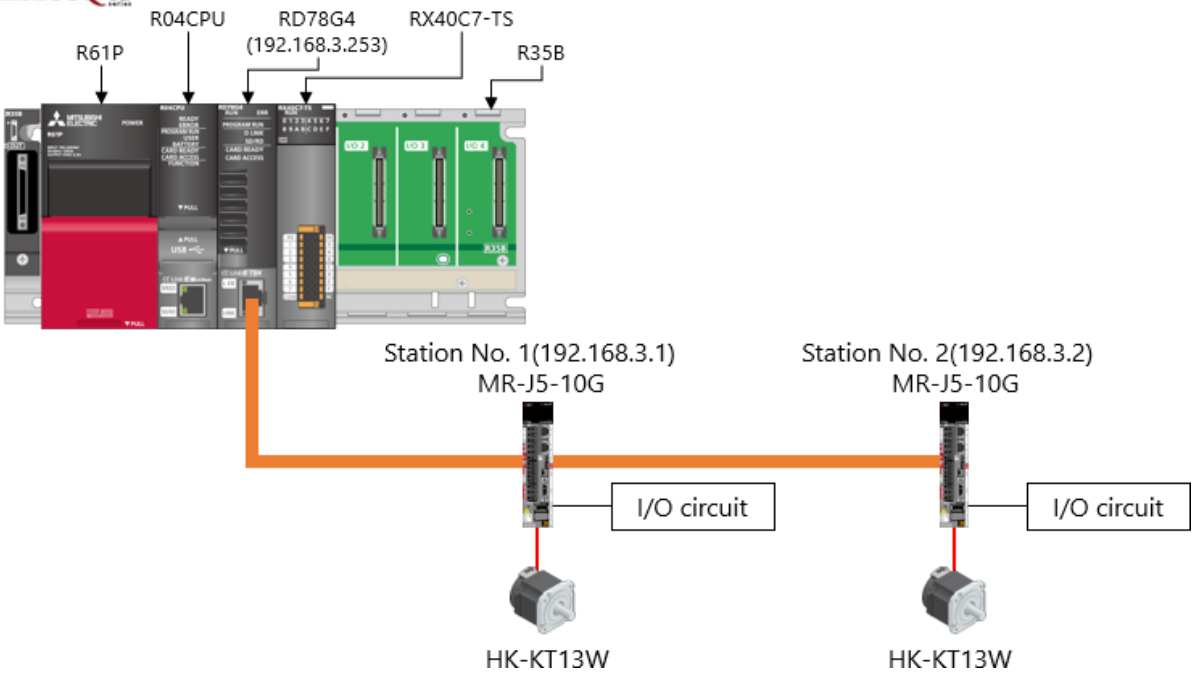
In this course, we use the machine configuration of the XY table shown below.
X-axis is represented as axis 1 and Y-axis is represented as axis 2. The location of the limit switch is assumed to be the same for X-axis and Y-axis.



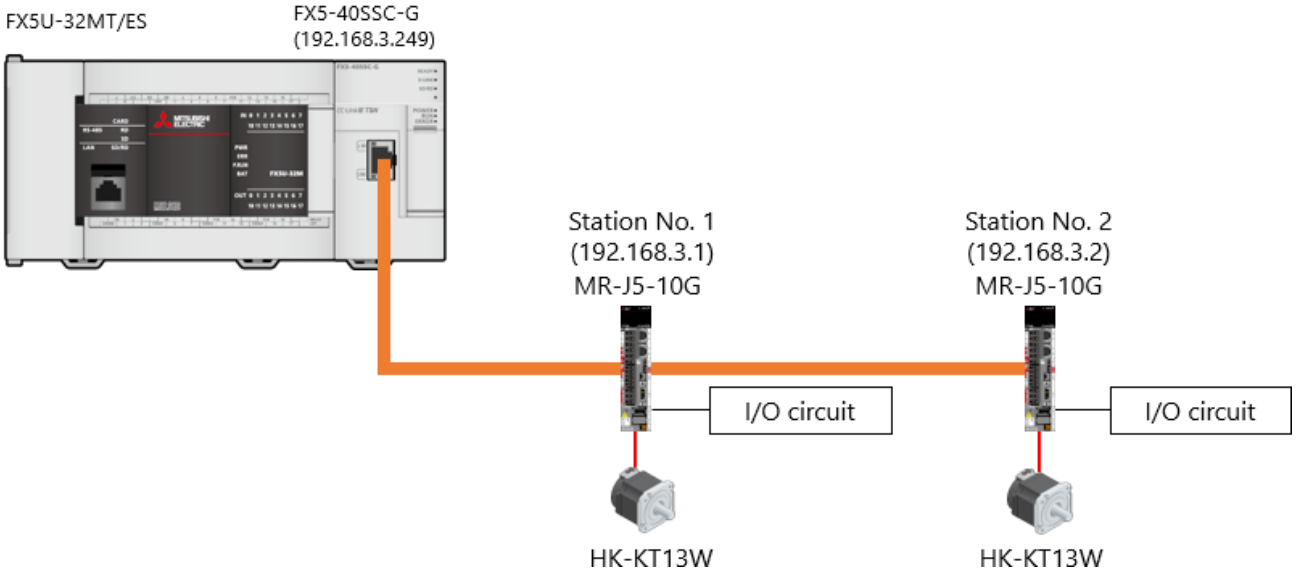
2.2 System configuration

In this course, we use the following system configuration.

MELSEC iQ-R



MELSEC iQ-F

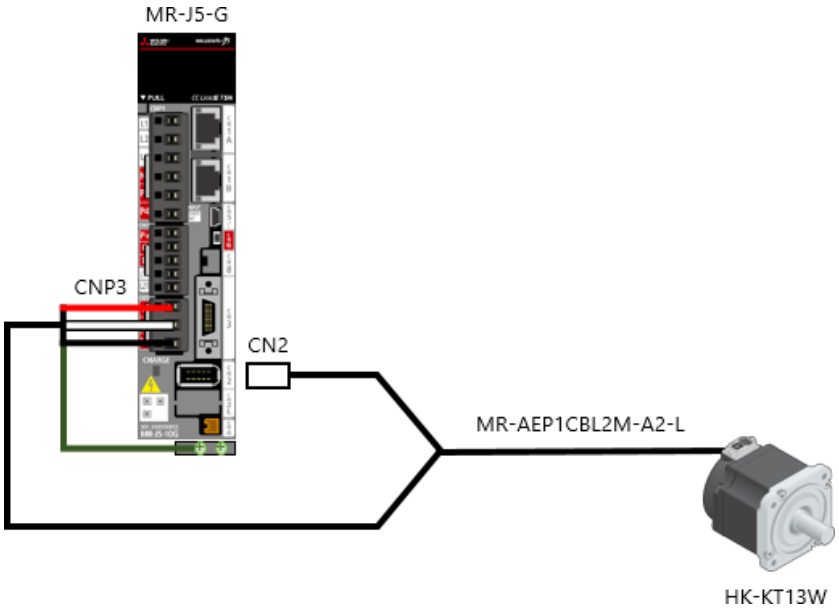


2.3 Wiring

This section describes external wiring such as wiring of the power supply for the programmable controller and servo amplifier, and the connection method of the servo motor.

2.3.1 Wiring of servo motor

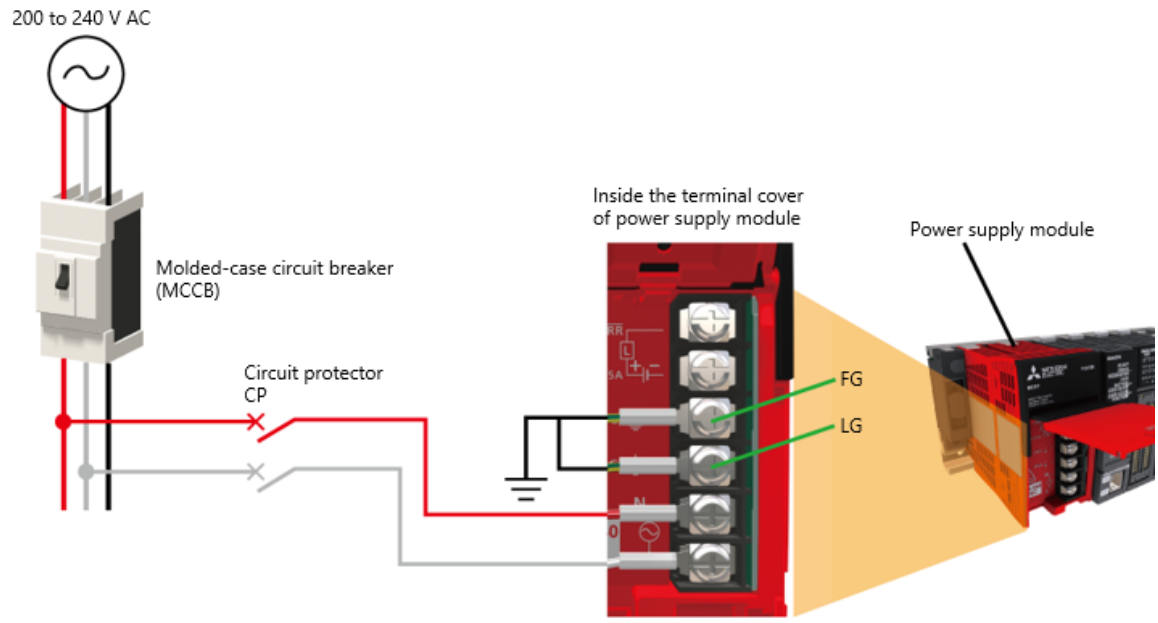
A single cable type option MR-AEP1CBL2M-A2-L is used for the power cable and encoder cable of the servo motor.



2.3.2 Wiring of power supply and network cables

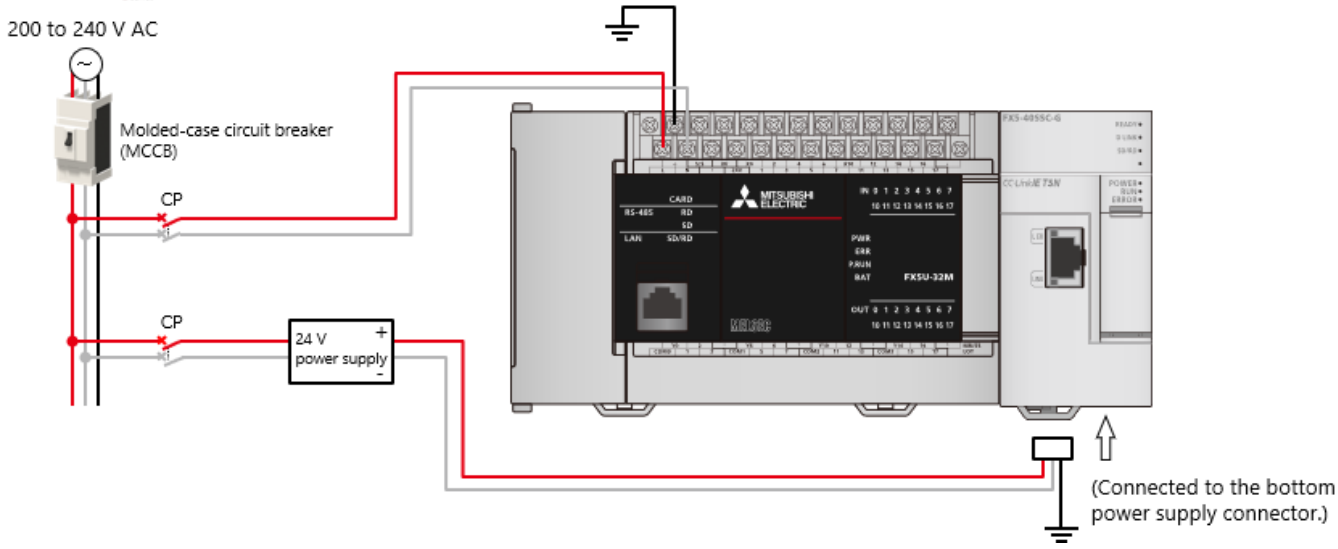
(1) Power supply wiring to the programmable controller
Wire the power supply to the programmable controller.
Connect the input AC power supply with the power input signal contacts (L and N).
The FG and LG contacts must be grounded with a ground resistance of 100 Ω or less.

MELSEC iQ-R



Item	Applicable cable size	Tightening torque
Power cable	18 to 14 AWG	1.02 to 1.38 N·m
Ground cable	18 to 14 AWG	1.02 to 1.38 N·m

MELSEC iQ-F



Item	Terminal block size	Tightening torque
Power cable	M3	0.5 to 0.8N·m
Ground cable	M3 (Use the cable with thickness of 14 AWG or higher.)	0.5 to 0.8N·m

2.3.2 Wiring of power supply and network cables

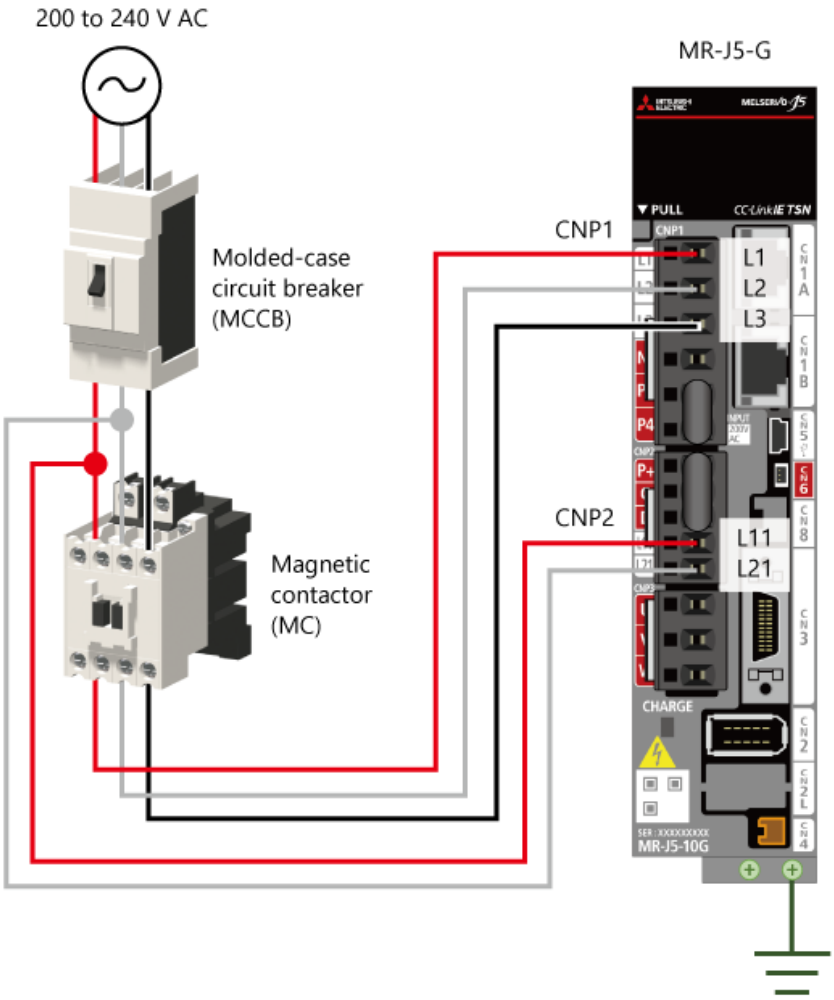
(2) Power supply wiring to the servo amplifier

Wire the power supply to the main circuit power supply (L1, L2, L3) and control circuit power supply (L11, L21) of the servo amplifier.

The following shows a schematic diagram.The actual wiring and applicable cable size differ depending on the capacity. For details, refer to the user's manual (hardware) of the servo amplifier.

Use a molded-case circuit breaker (MCCB) with the input cables of the main circuit power supply.

Always connect a magnetic contactor (MC) between the main circuit power supply and the L1/L2/L3 contacts of the servo amplifier.



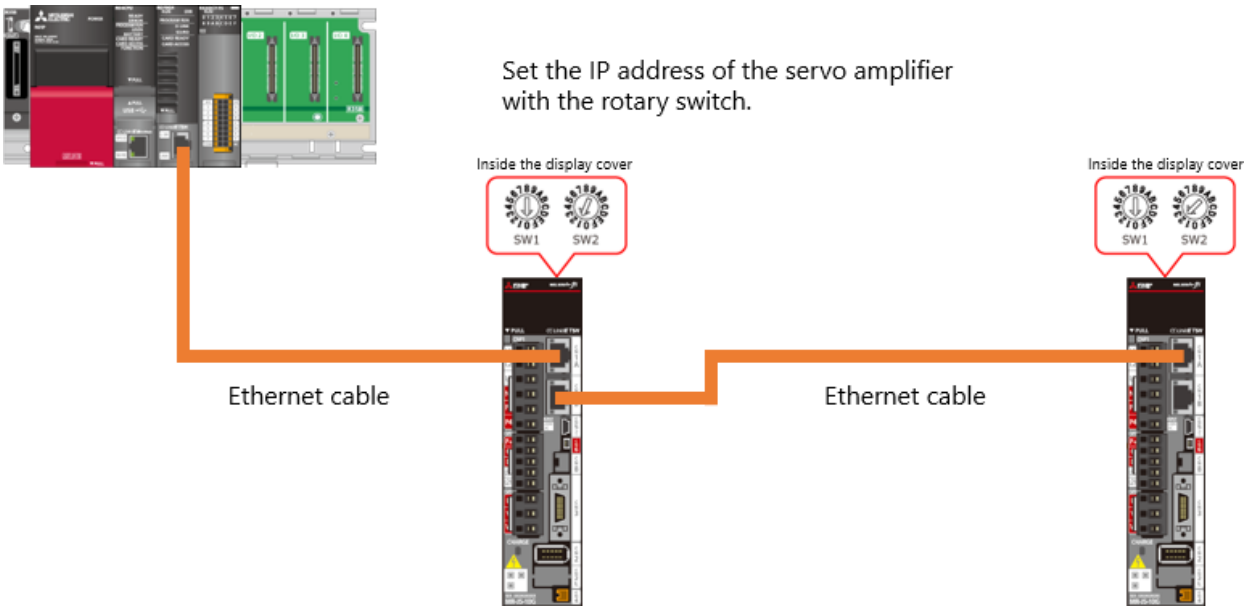
2.3.2 Wiring of power supply and network cables

(3) Wiring of network cables

Wire the network cables (Ethernet cables).

Use the Ethernet cables that meet the following standards.

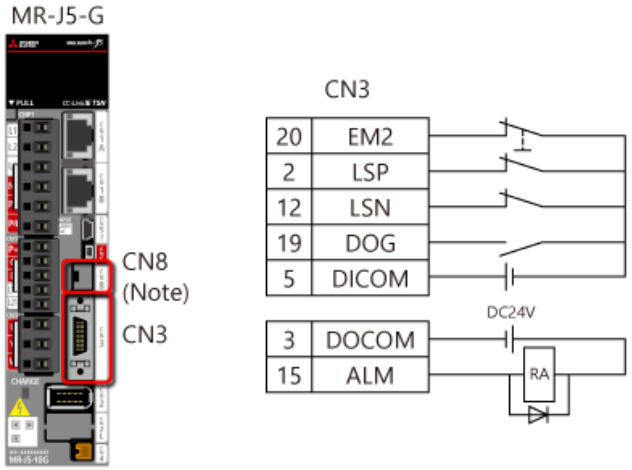
Communication speed	Ethernet cable	Connector	Standard
1Gbps	Category 5e or higher, (double shielded/STP) straight cable	RJ45 connector	Cable that meets the following standards. • IEEE802.3(1000BASE-T) • ANSI/TIA/EIA-568-B (Category5e)



2.3.3 Wiring of peripheral circuits

(1) I/O circuit of the amplifier

Wire the I/O circuit of the servo amplifier as shown below for both axis 1 and axis 2.
Wire the proximity dog, forward/reverse rotation limits, and forced stop.
In addition, configure the circuit so that the magnetic contactor is turned off by the ALM output.



(Note) Since the STO function is not used in this course, do not remove the CN8 short-circuit connector attached with the servo amplifier.

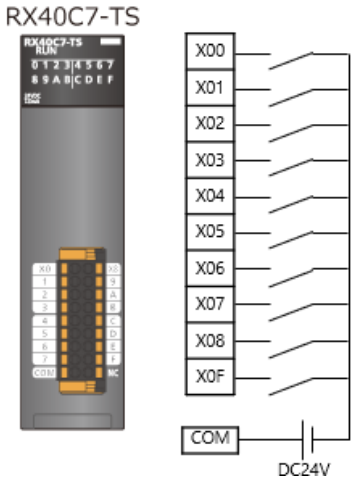
2.3.3 Wiring of peripheral circuits

(2) External circuit of the input module

The following shows the external circuit wiring of the input module.

Use momentary switches for all the switches.

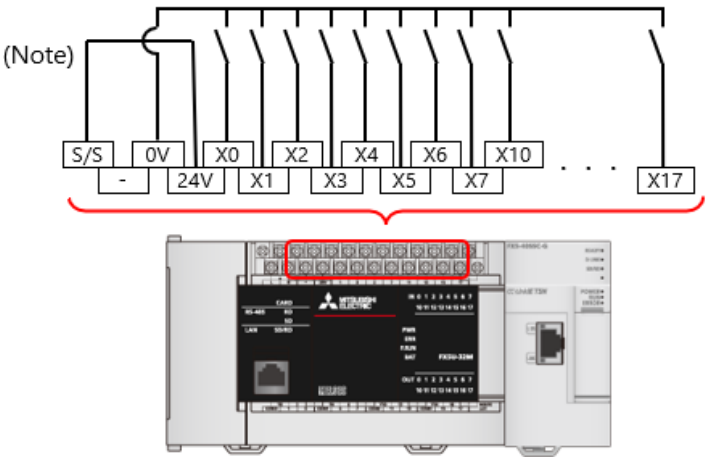
MELSEC iQ-R



(Note)
X00: Axis 1 forward run JOG
X01: Axis 1 reverse run JOG
X02: Axis 2 forward run JOG
X03: Axis 2 reverse run JOG
X04: Axis 1 home position return
X05: Axis 2 home position return
X06: Axis 1 single positioning
X07: Axis 2 single positioning
X08: Interpolation control start
X0F: Error reset

(Note) Since the I/O No. of RX40C7-TS is 0020H, X20 to X28 and X2F are used in the program.

MELSEC iQ-F



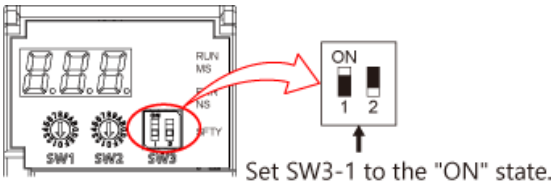
X0: Axis 1 forward run JOG
X1: Axis 1 reverse run JOG
X2: Axis 2 forward run JOG
X3: Axis 2 reverse run JOG
X4: Axis 1 home position return
X5: Axis 2 home position return
X6: Axis 1 single positioning
X7: Axis 2 single positioning
X10: Interpolation control start
X17: Error reset

(Note) The service 24 V DC power supply for the programmable controller is used for the external input circuit.

2.4 Test operation

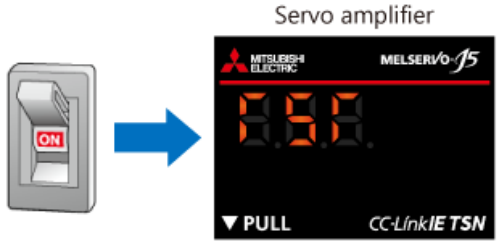
After wiring, perform test operation with the servo amplifier alone to check the motion such as rotation direction. Follow the steps below to perform test operation.

(1) Turn off the power of the servo amplifier and programmable controller.
(2) Turn on (up) the DIP switch (SW3-1) of the servo amplifier.

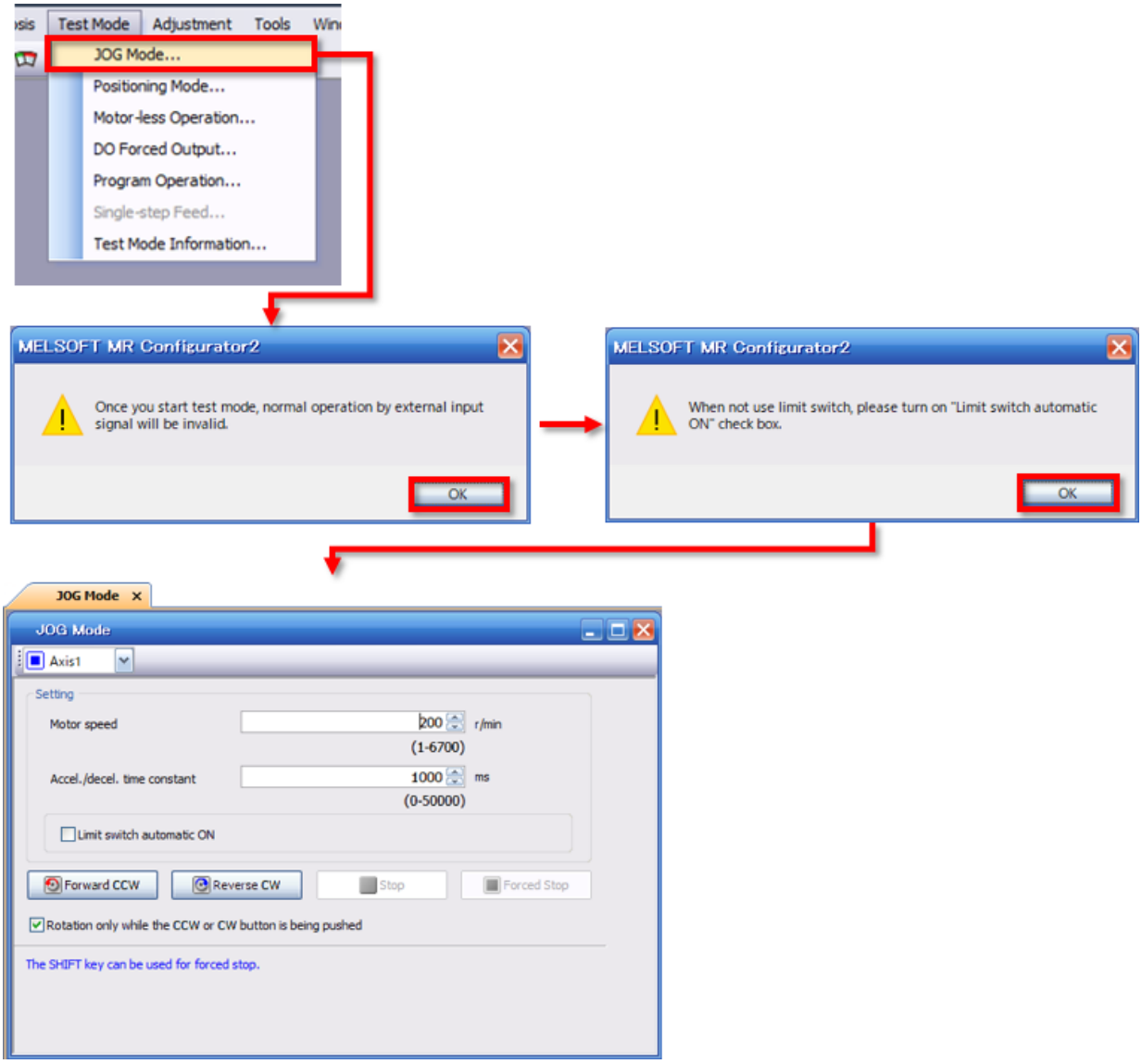


Set SW3-1 to the "ON" state.

(3) Connect the servo amplifier and personal computer with a USB cable or an Ethernet cable. (Note)
(4) Turn on the power supply of the servo amplifier. "TST" is displayed in the monitor.



(5) Start MR Configurator2 and perform test operation (JOG operation).



(6) Check the rotation direction and motion of the machine.

(7) When test operation is finished, turn off the power of the servo amplifier and turn off the DIP switch (SW3-1).

(Note) When using an Ethernet cable, change the MR Configurator2 project to a multi-axis project.

Tips When multiple servo amplifiers are used, Ethernet connection is convenient because there is no need to change cables. For details, refer to MR Configurator2 Help.

2.5 Summary of This Chapter

In this chapter, you have learned:

- Machine configuration
- System configuration
- Wiring
- Test operation

Point

Machine configuration	• The target system uses two ball screws to make an X-Y table.
System configuration	• For the iQ-R series, connect two MR-J5-G servo amplifiers to the Motion module RD78G4. • For the iQ-F series, connect two MR-J5-G servo amplifiers to the Motion module FX5-40SSC-G.
Wiring	• A servo motor uses single cable type option cables. • Set the fourth octet of the IP address with the rotary switch on the servo amplifier. • Connect the proximity dog signal, limit switch, and forced stop switch to the servo amplifier.
Test operation	• Change the DIP switch position on the servo amplifier and connect the personal computer. • Check the rotation direction of the servo motor with the test operation function of MR Configurator2.

Chapter 3 Creating a Project

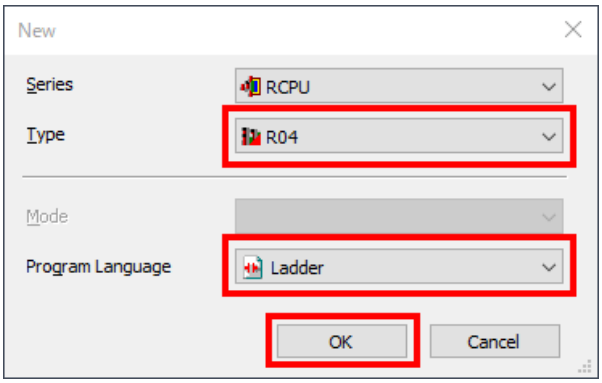
This chapter describes the procedure that begins with creating a project and extends through the setting of each parameter.
Note that screenshots of the iQ-R series are shown in the following pages.
When using the iQ-F series, please replace them accordingly.

The project files to be created in this course can be downloaded from the links below.

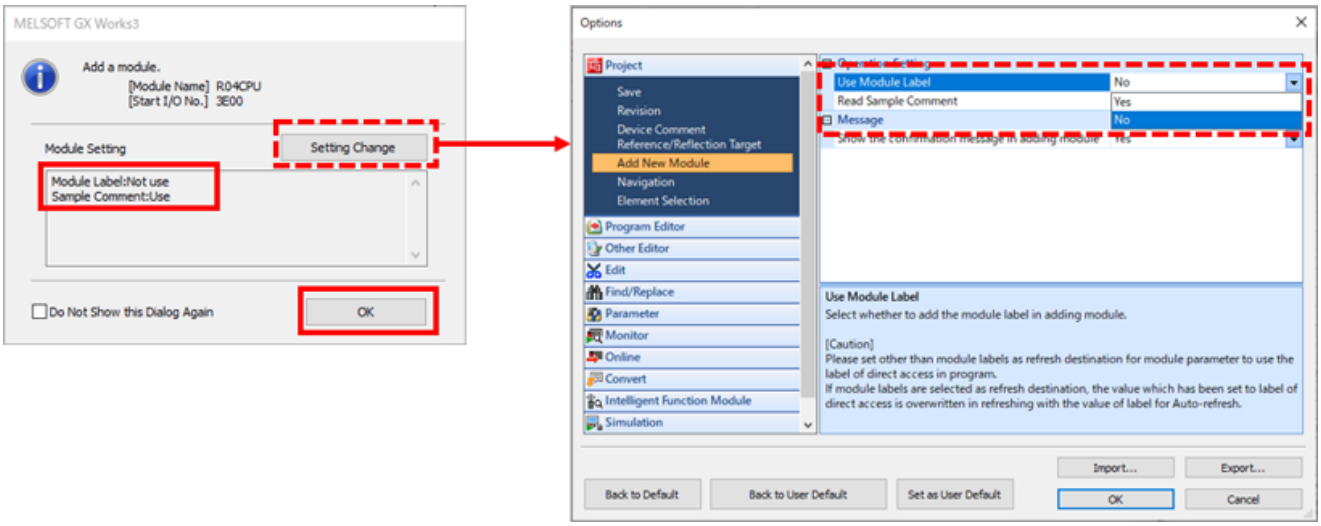
RD78G_SimpleMode_Basics_Sample.zip (1.90MB)
FX5-SSC-G_SimpleMode_Basics_Sample.zip (1.17MB)

3.1 Creating a new project

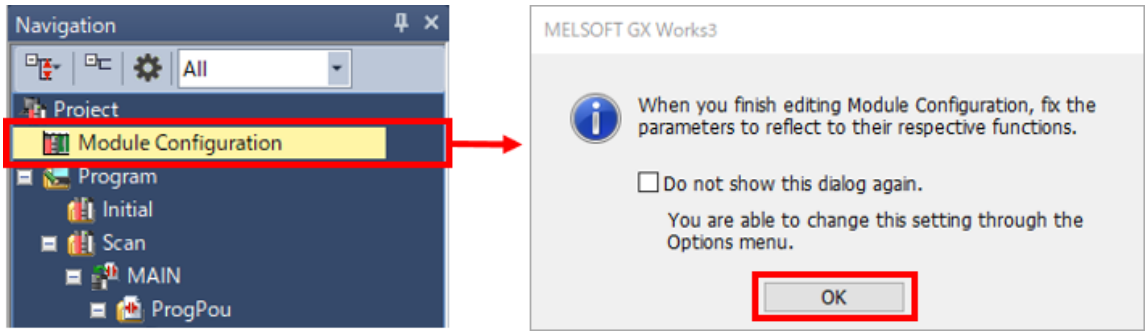
(1) Select [Project] → [New] in GX Works3.
In the following window, select the model of the PLC CPU to be used and the programming language to be used in the PLC CPU.
After selecting them, click the [OK] button.



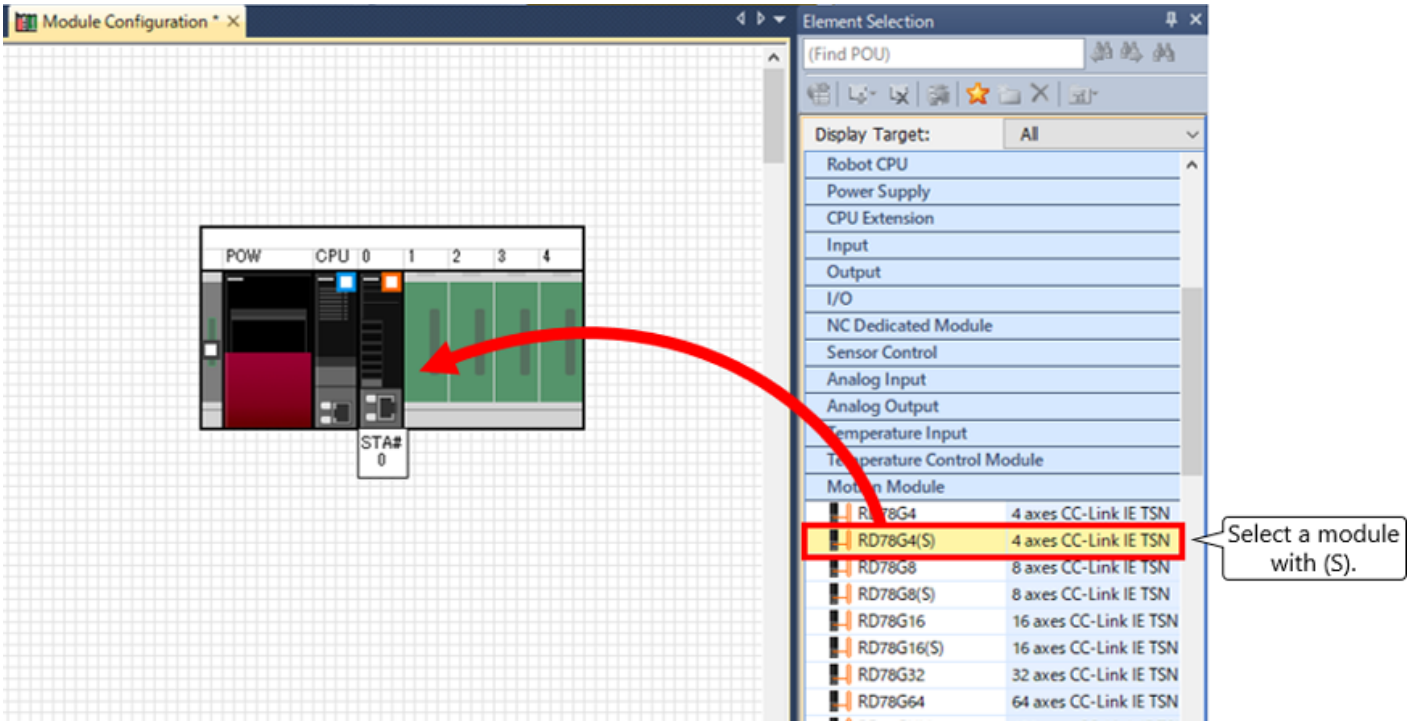
(2) When the following window appears, set whether to use the module label and sample comment.
In this course, set both items to "Use".
If either of them is set to "Not use", click the [Setting Change] button and change the setting.
Click the [OK] button to open the project.



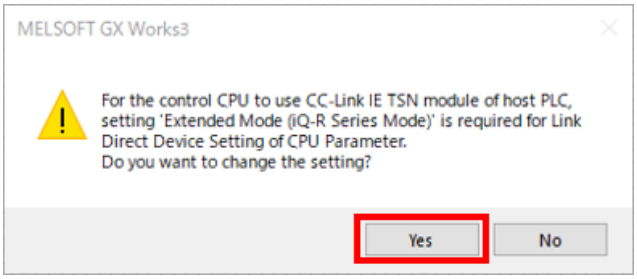
(3) Double-click [Module Configuration] in the project tree.
When the following dialog box appears, click the [OK] button.



When the module configuration diagram opens, drag and drop the module from the Element Selection window on the right side, and create a module configuration diagram in the same way as that for the system configuration diagram (Section 2.2).
For the Motion module, drag and drop a module with (S) at the end of the model.

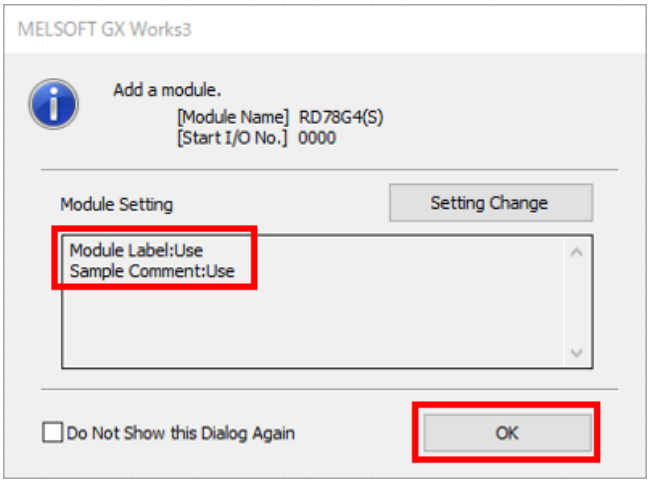


When the module configuration diagram is complete, right-click the display and select [Parameter] → [Fix].
For the iQ-R series, the following message appears. Click the [Yes] button.



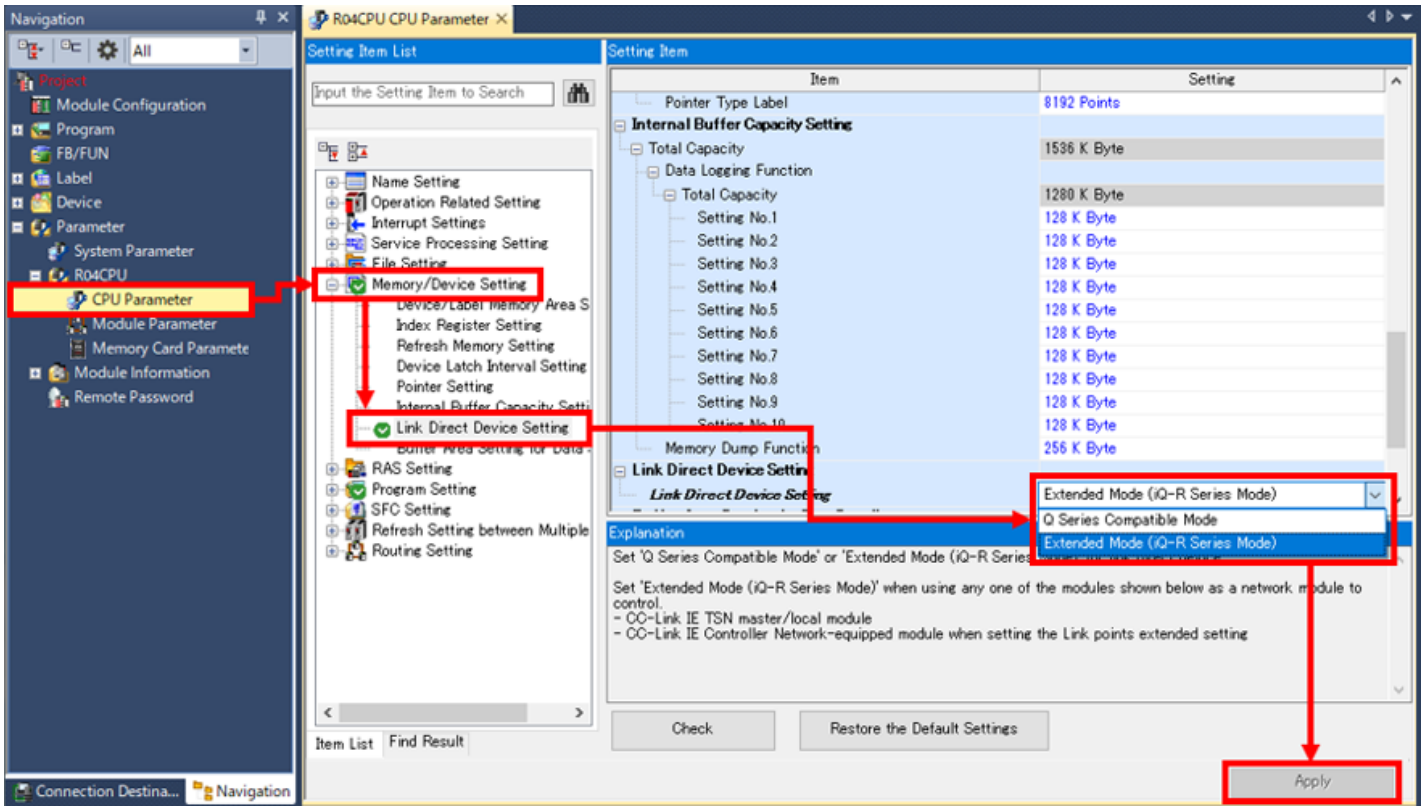
When the following dialog box appears, check that the sample comment and module label are set to "Use".
If either of them is set to "Not use", click the [Setting Change] button and change the setting.

Click the [OK] button to complete the setting.



3.2 PLC CPU setting

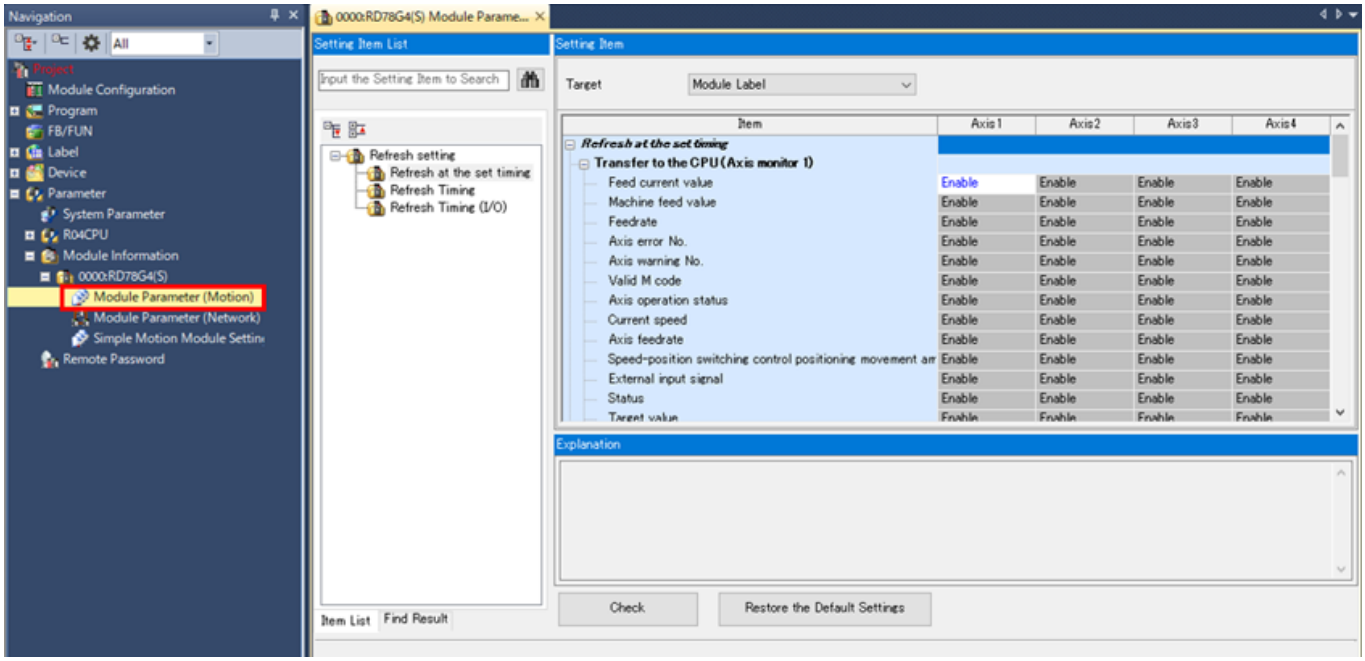
In the case of iQ-R series, select [Parameter] → [R04CPU] in the project tree and double-click [CPU Parameter].
Click [Link Direct Device Setting] from the setting item list.
Check that the link direct device setting is set to "Extended Mode (iQ-R Series Mode)".
If it is set to "Q Series Compatible Mode", change it to "Extended Mode (iQ-R Series Mode)".
When the setting is complete, click the [Apply] button in the lower right corner.



3.3 Motion module setting

3.3.1 Module parameter (motion)

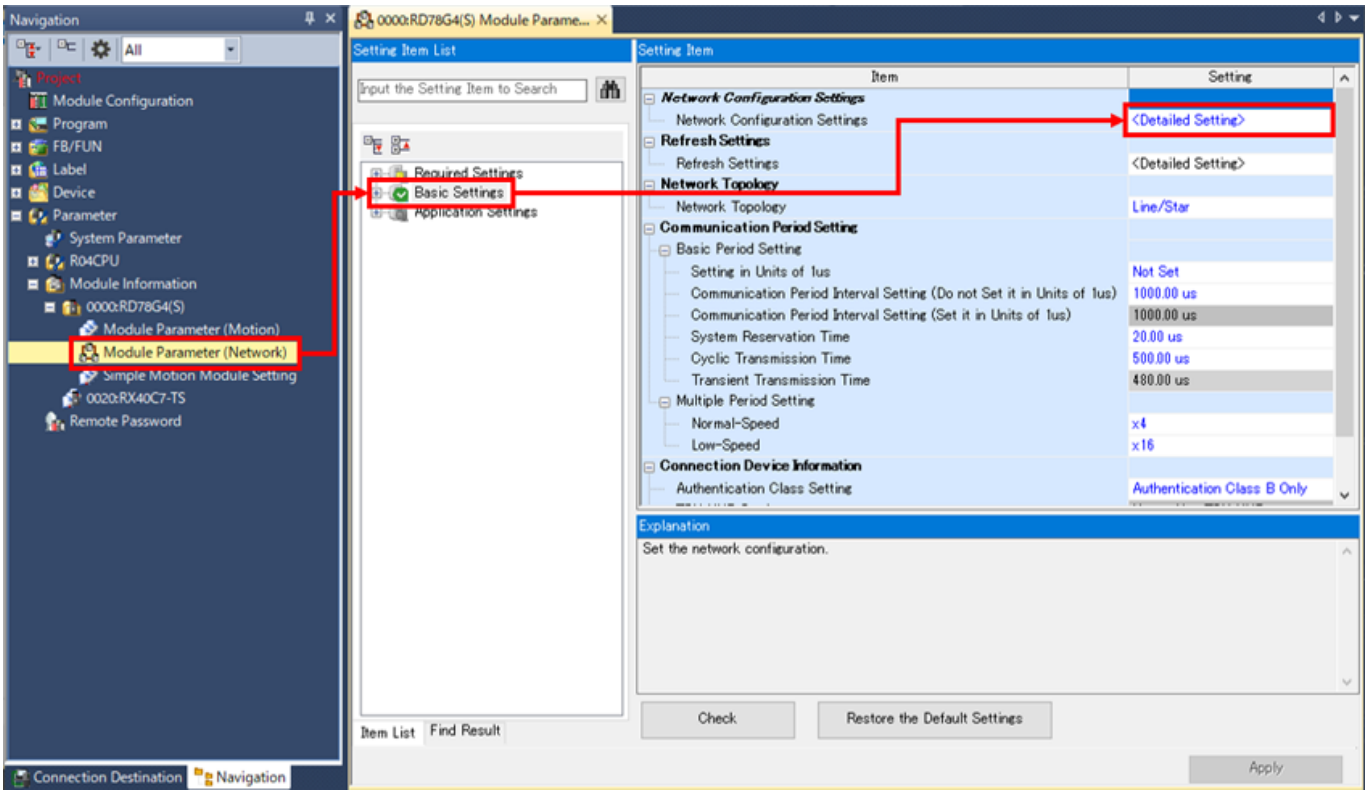
In the project tree, select [Parameter] → [Module Information] → [0000:RD78G4(S)] and double-click [Module Parameter (Motion)].
Configure the refresh setting to transfer the values in the buffer memory of the Motion module to devices or module labels in the CPU module.
Use the initial values in this course. (The values in the buffer memory will be transferred to the module labels.)



3.3.2 Module parameter (network)

In the project tree, select [Parameter] → [Module Information] → [0000:RD78G4(S)] and double-click [Module Parameter (Network)].
In this section, set the device to be connected to the network and configure the link refresh.

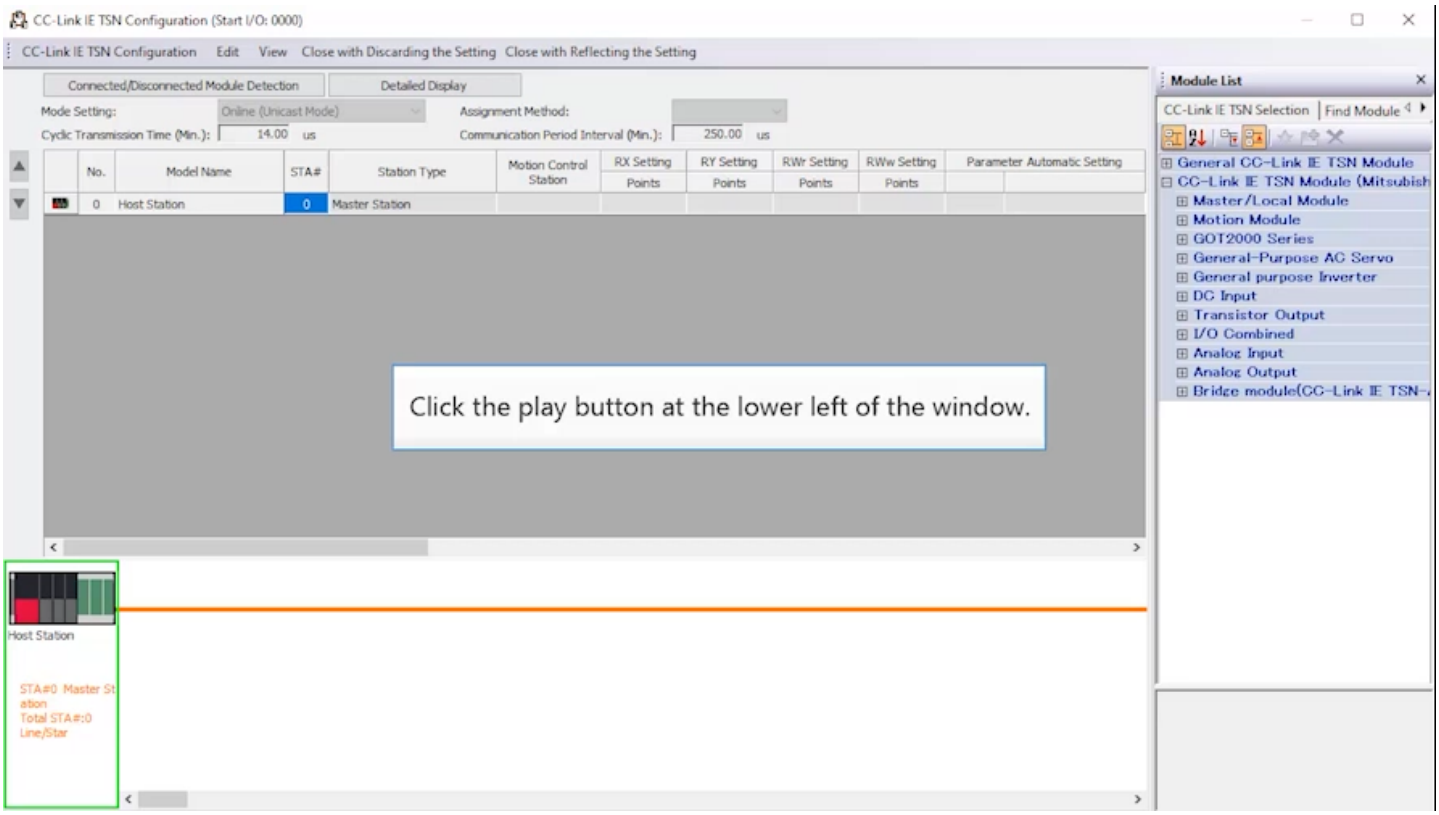
(1) Network configuration setting
Select [Basic Settings] from the setting item list and double-click <Detailed Setting> in the Network Configuration Settings item.



[Point]
In [Required Settings], configure the settings such as the station type, IP address, and network number of the controller.
Description of the settings is omitted here because the initial values are used in this course.

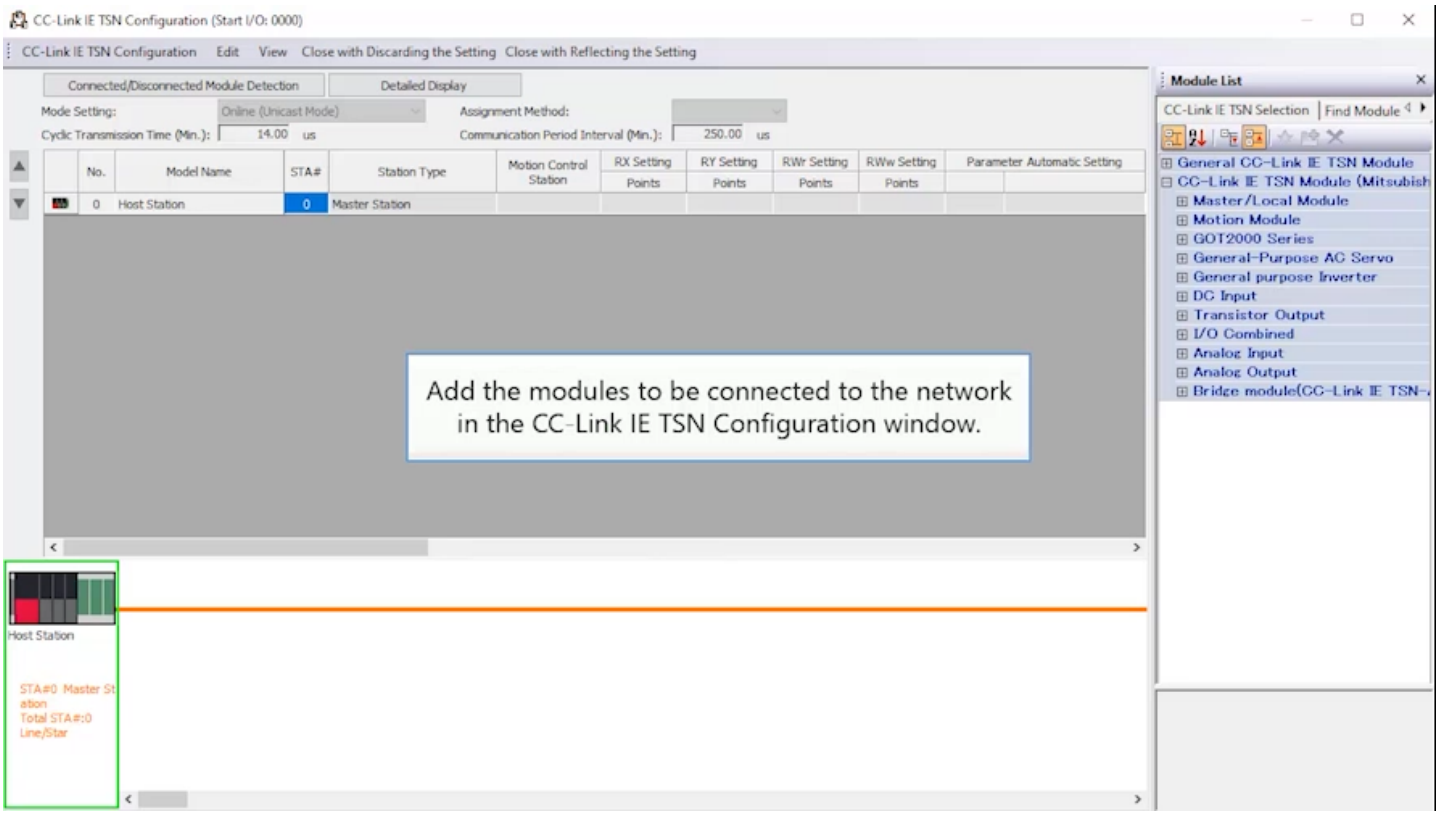
3.3.2 Module parameter (network)

(1) Network configuration setting (continued)



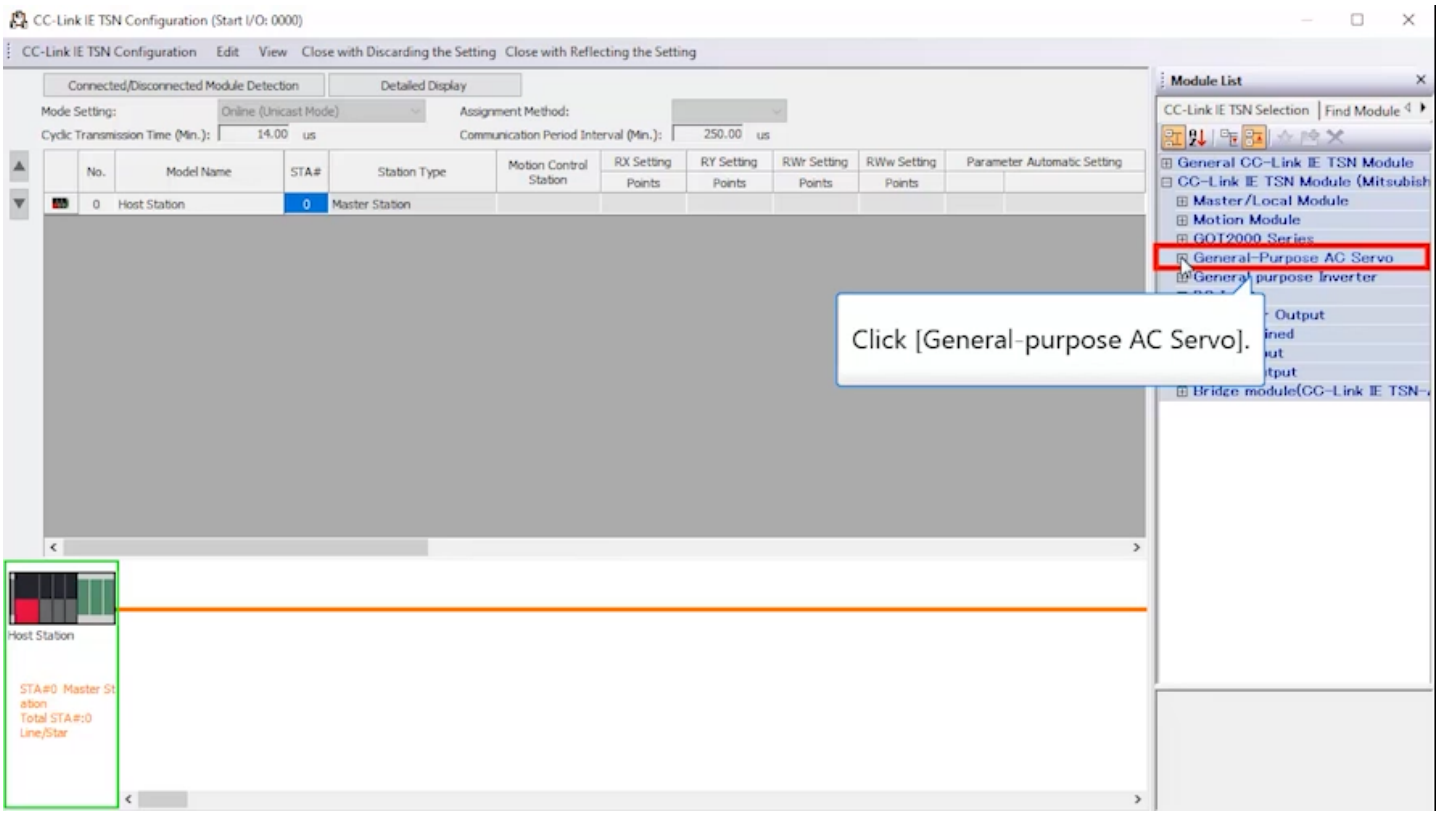
3.3.2 Module parameter (network)

(1) Network configuration setting (continued)



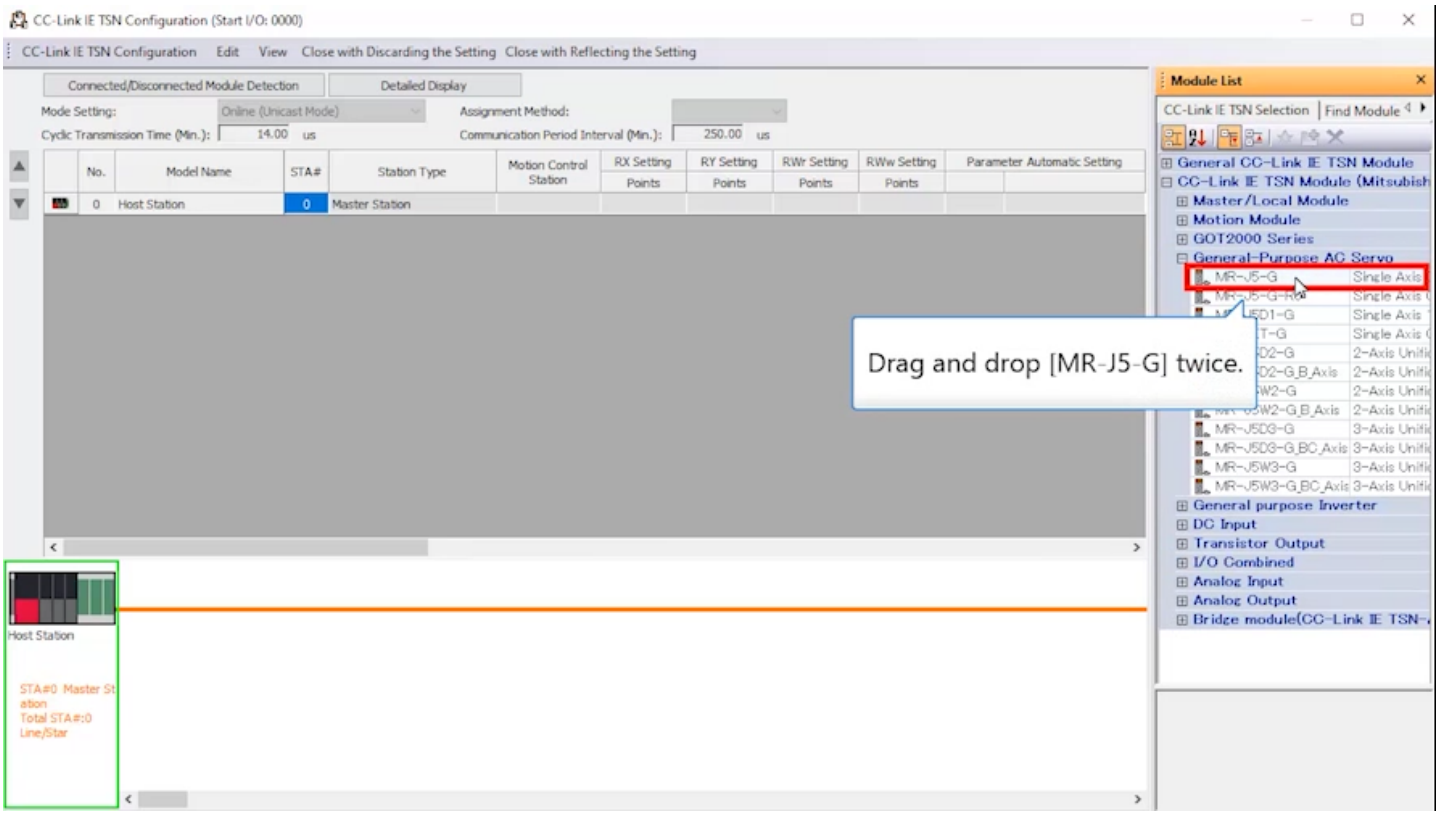
3.3.2 Module parameter (network)

(1) Network configuration setting (continued)



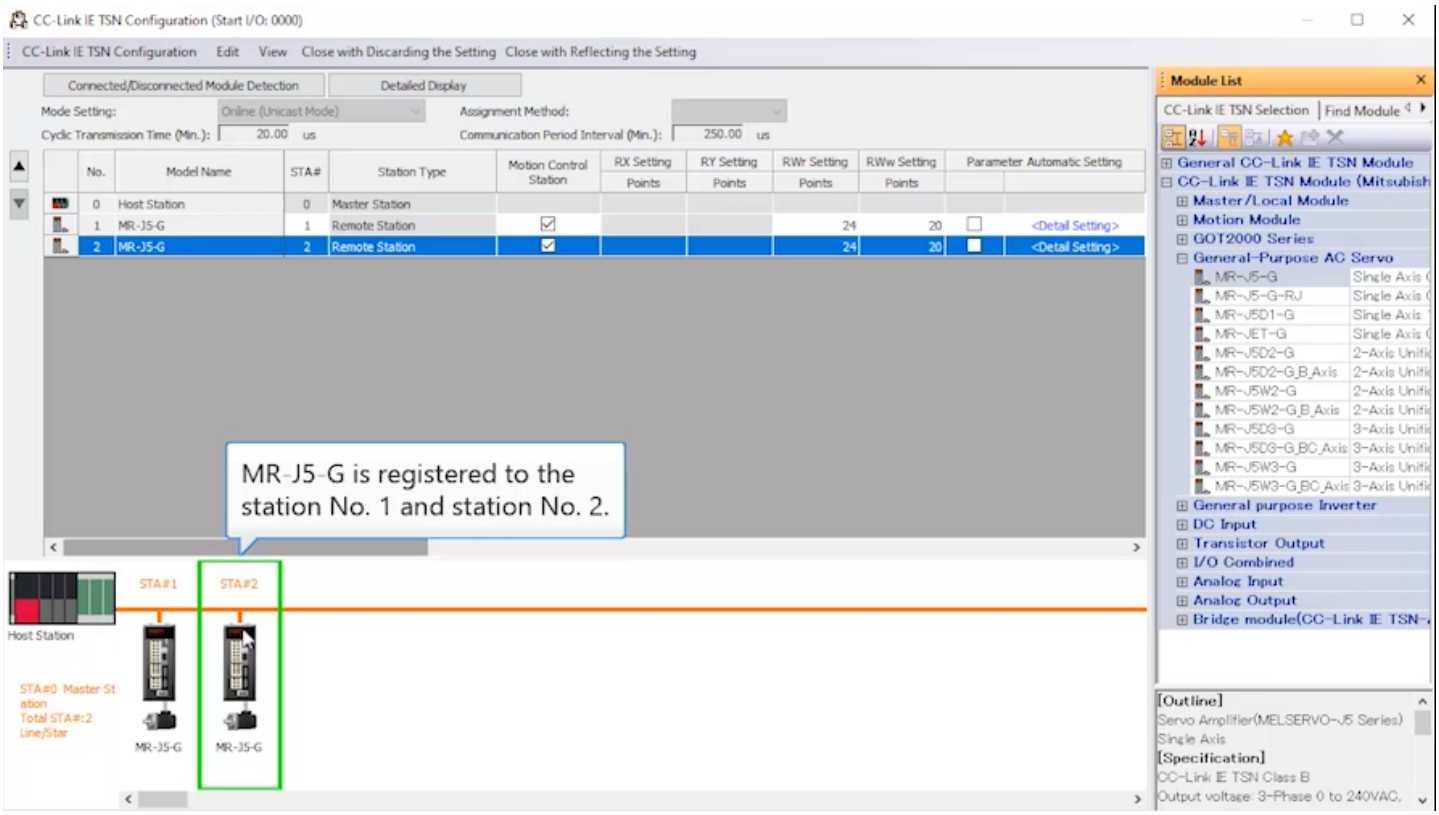
3.3.2 Module parameter (network)

(1) Network configuration setting (continued)



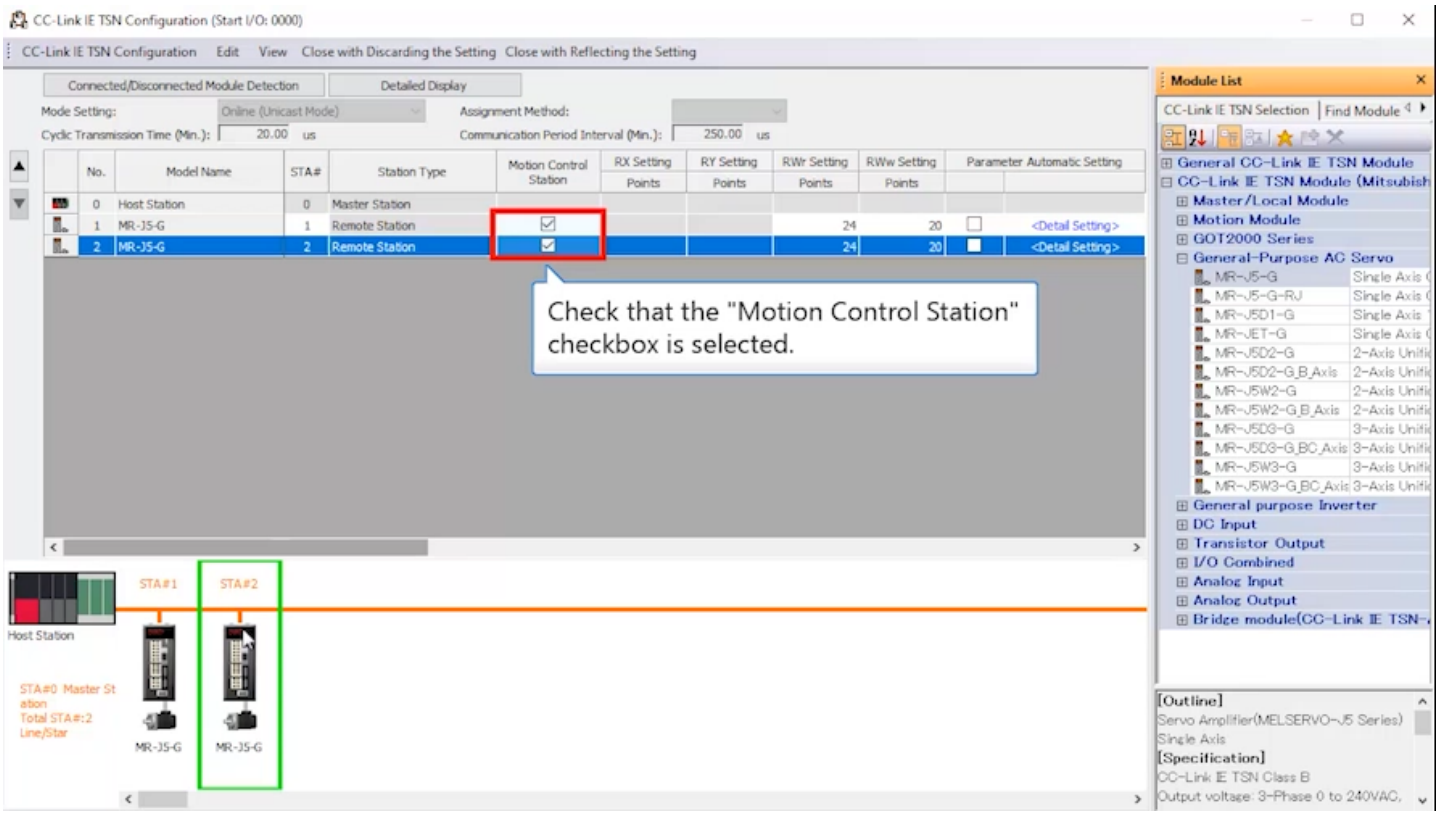
3.3.2 Module parameter (network)

(1) Network configuration setting (continued)



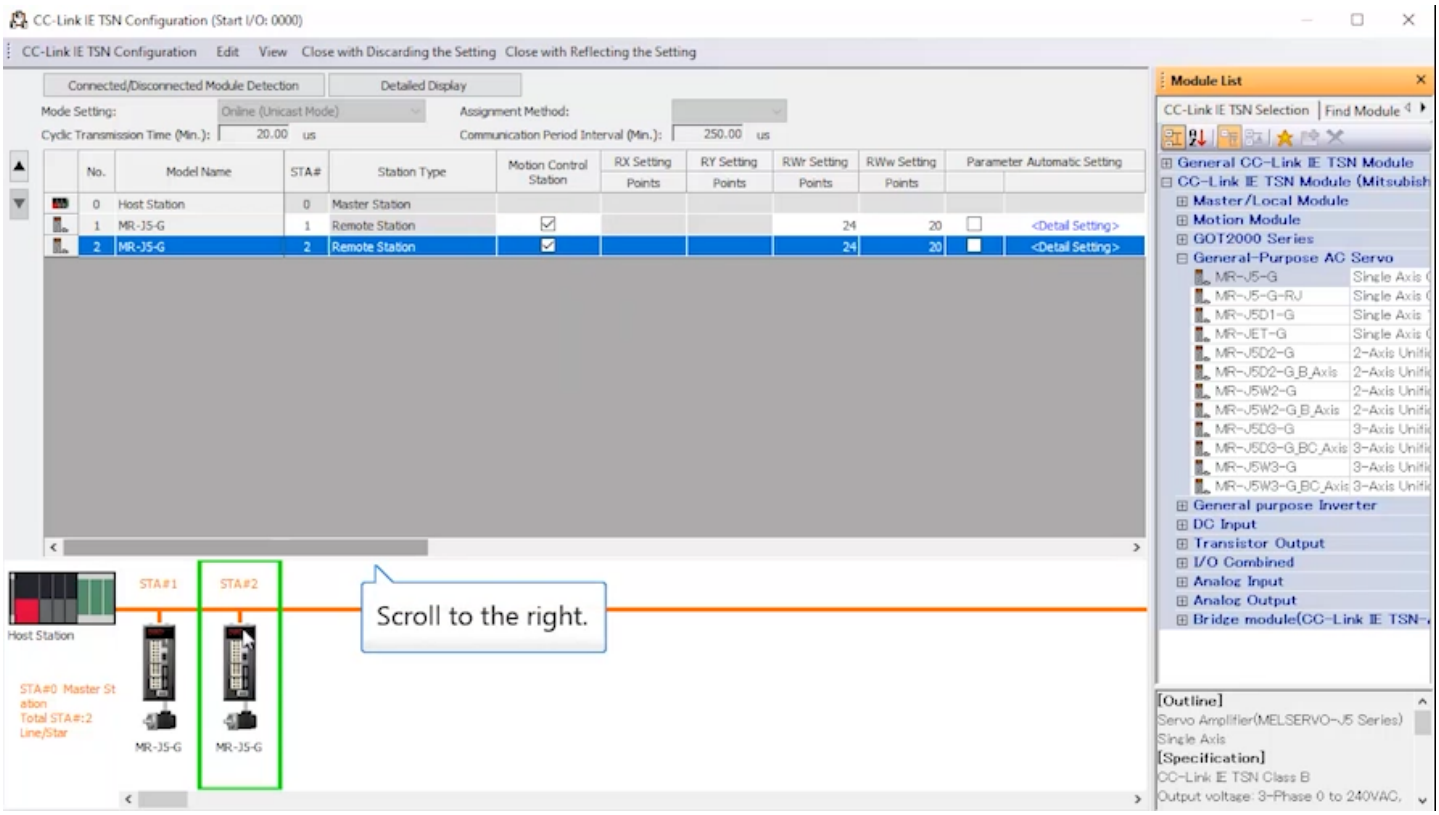
3.3.2 Module parameter (network)

(1) Network configuration setting (continued)



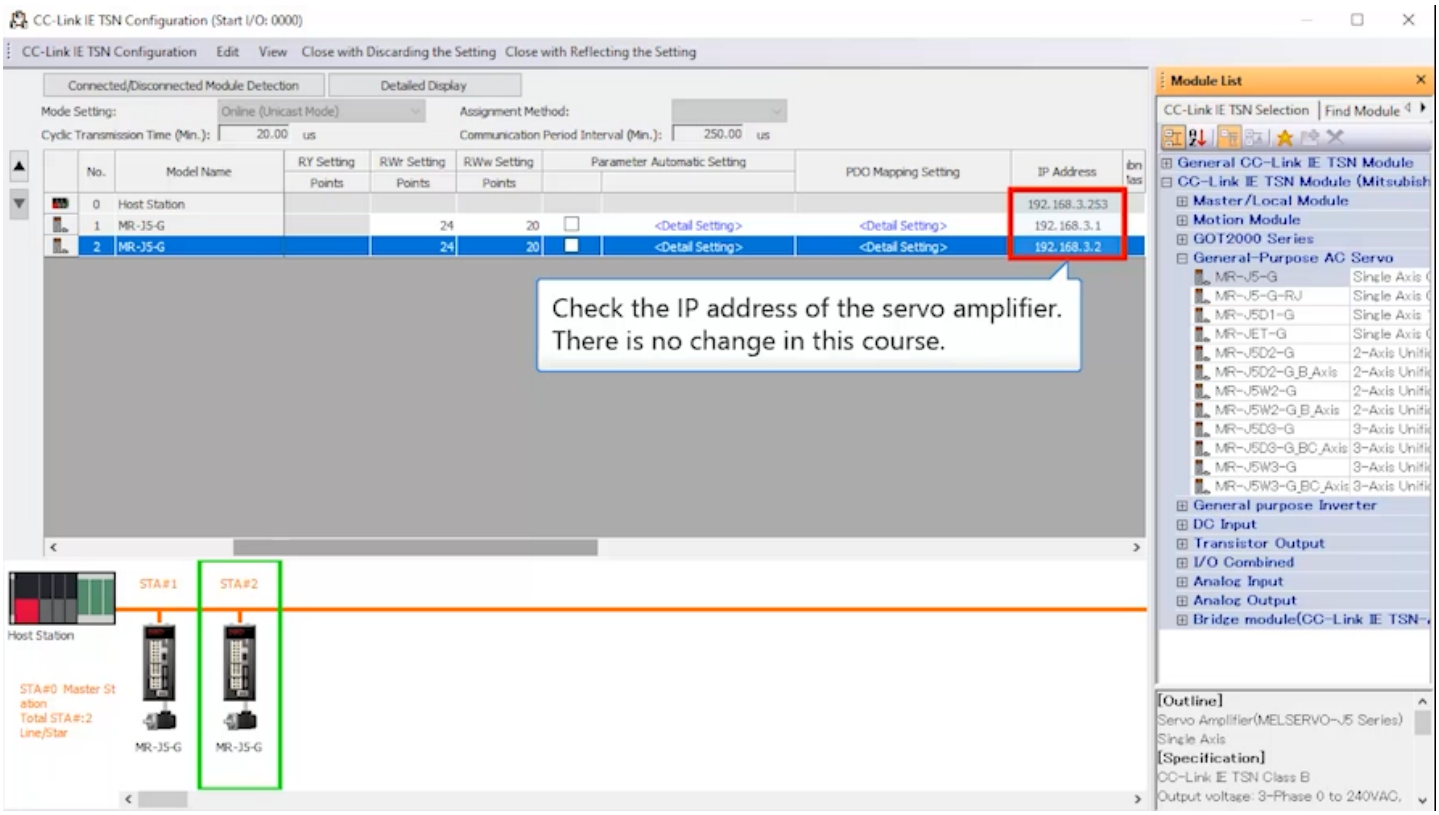
3.3.2 Module parameter (network)

(1) Network configuration setting (continued)



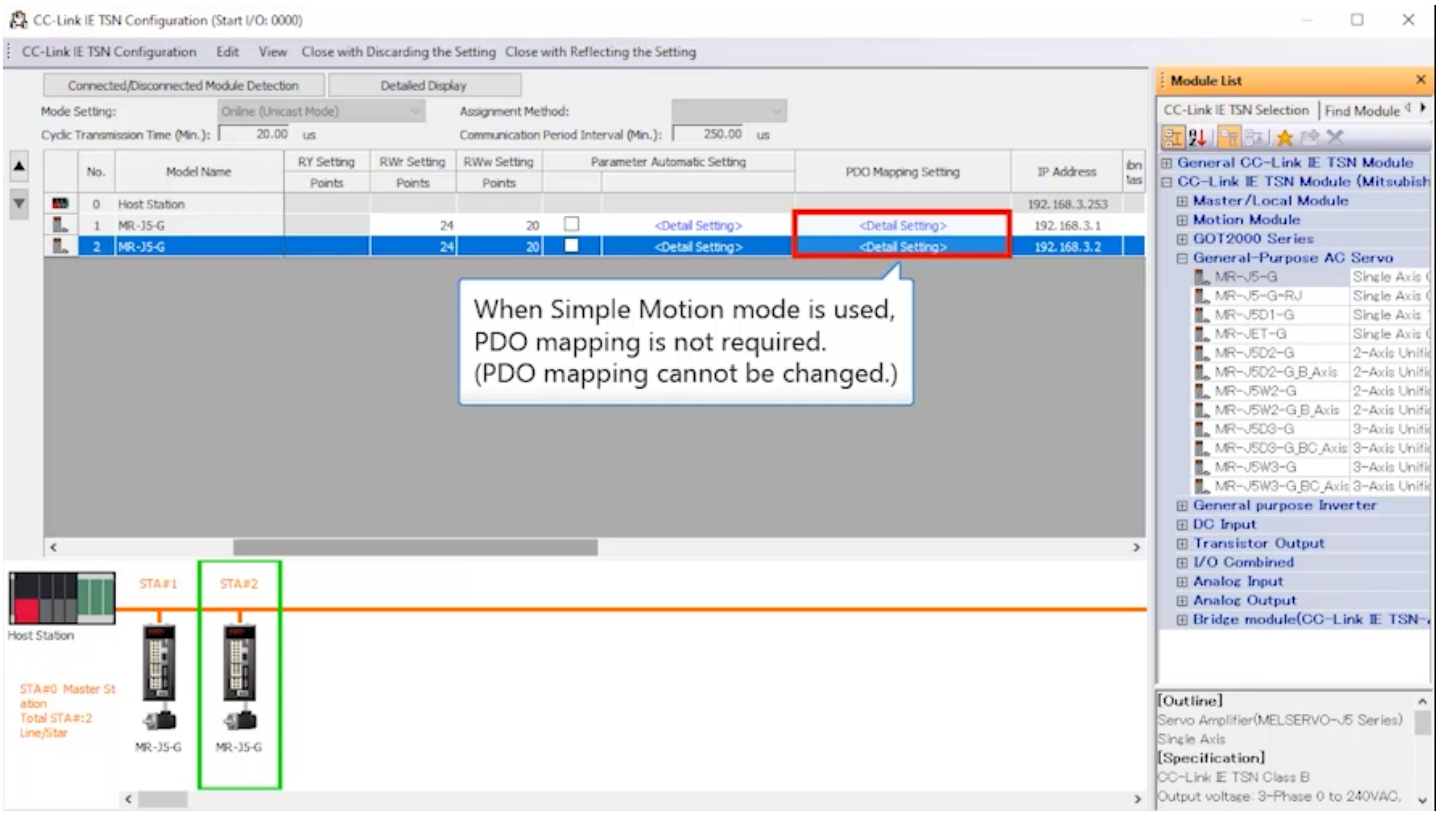
3.3.2 Module parameter (network)

(1) Network configuration setting (continued)



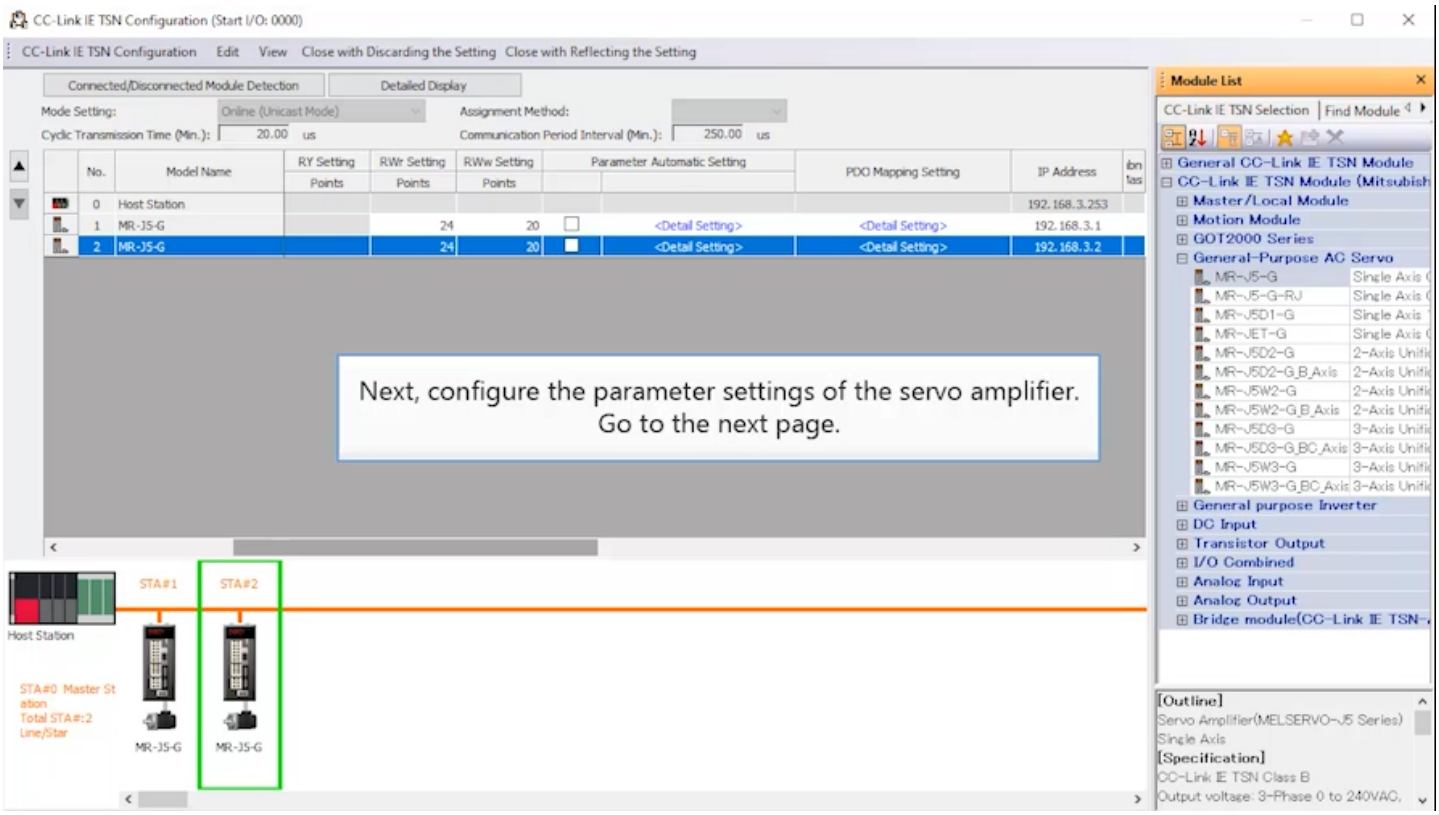
3.3.2 Module parameter (network)

(1) Network configuration setting (continued)



3.3.2 Module parameter (network)

(1) Network configuration setting (continued)



3.3.2 Module parameter (network)

(2) Parameter settings of the servo amplifier

When using Simple Motion mode, always set the parameters of the MR-J5-G servo amplifier as shown in the table below.
How to set the parameters of the servo amplifier is described on the next page.
Change the values shown in yellow from the initial values.
Writing values other than the setting values shown in the table below will cause "Servo parameter invalid".
In such a case, the servo parameters are automatically rewritten from the controller to the values in the table below when the power is turned on again.

Parameter		Initial value	Setting value
Basic	PA06 (Electronic gear numerator) (Note 1)	1	• When the servo motor resolution is 26 bits: 16 (Rotary servo motor HK series, etc.) • When the servo motor resolution is not 26 bits: 1
	PA07 (Electronic gear denominator) (Note 1)	1	1
Extension	PC79.0 (DI status read selection) (Note 1)	0h	Eh bit1: Returns the on/off state of DI1 pin. bit2: Returns the on/off state of DI2 pin. bit3: Returns the on/off state of DI3 pin.
I/O	PD41.2 (Limit switch enabled status selection) (Note 1)	0h	1h : Enabled only for homing mode
	PD41.3 (Sensor input method selection) (Note 1)	0h	1h: Input from controller (FLS/RLS/DOG) (Note 3)
	PD60.0 (DI pin polarity selection) (Note 1)	0h	0h bit0: DI pin polarity selection 1 (turned on at 24 V input) bit1: DI pin polarity selection 2 (turned on at 24 V input) bit2: DI pin polarity selection 3 (turned on at 24 V input)
Positioning control	PT01.1 (Speed/acceleration/deceleration unit selection) (Note 2)	0h	0h
	PT08 (Homing position data) (Note 1)	0	0
	PT15 (Software position limit +)	0	0
	PT17 (Software position limit -)	0	0
	PT29.0 (Device input polarity 1) (Note 1)	0h	1h: Dog detection with on

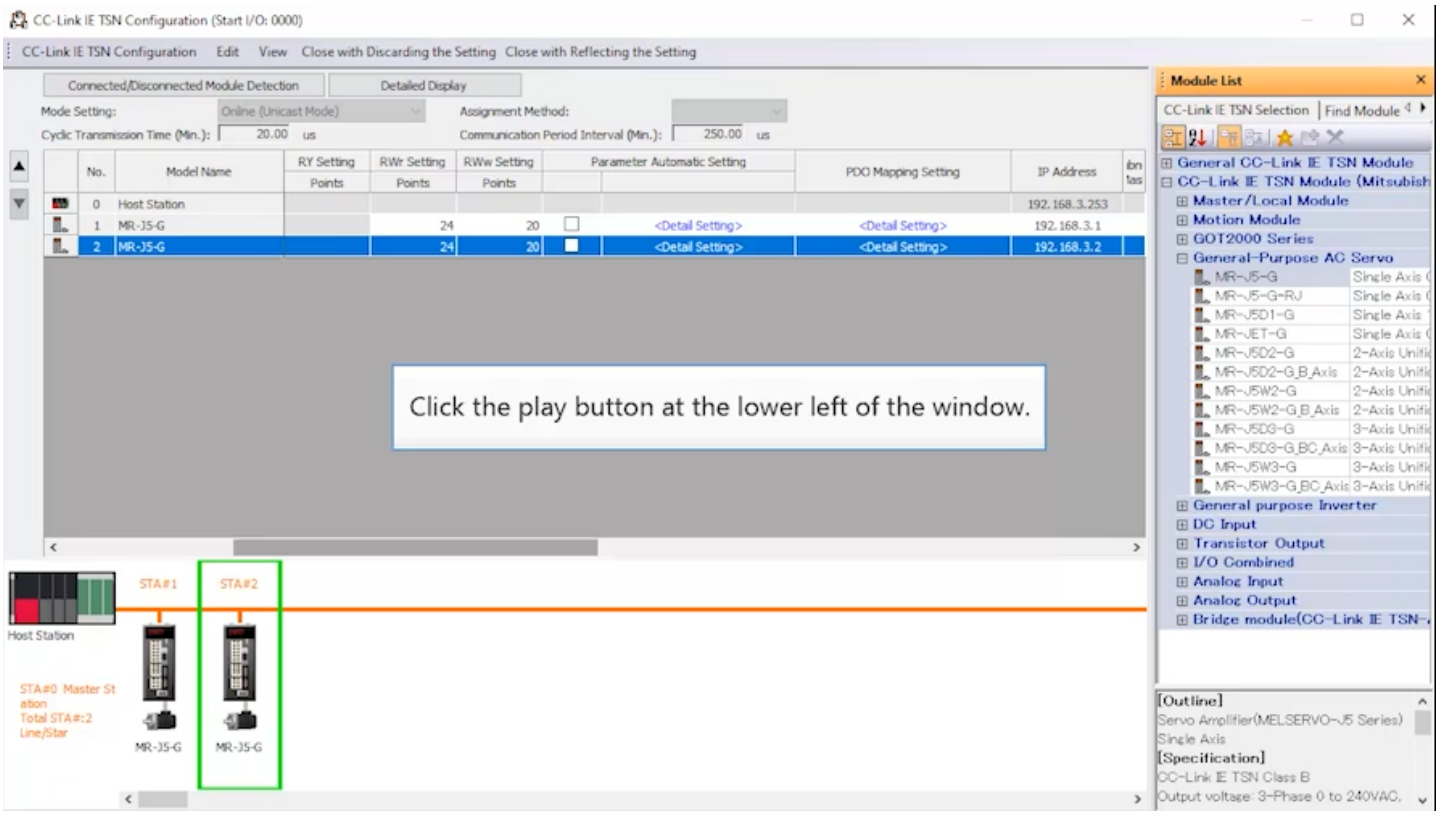
(Note)
1. The parameter is enabled after the Motion module or MR-J5-G is restarted.
2. The parameter is enabled after MR-J5-G is restarted.
3. Set "Input from controller" even when connecting the external signal to CN3 of the servo amplifier.

In addition, change the homing method from the initial value in this course.
Set the value as shown in the table below.

Parameter		Initial value	Setting value
Positioning control	PT45 (Homing method)	37 (method 37: Data set type)	-33 (Dog type rear end detection - CW direction with reference to Z-phase)

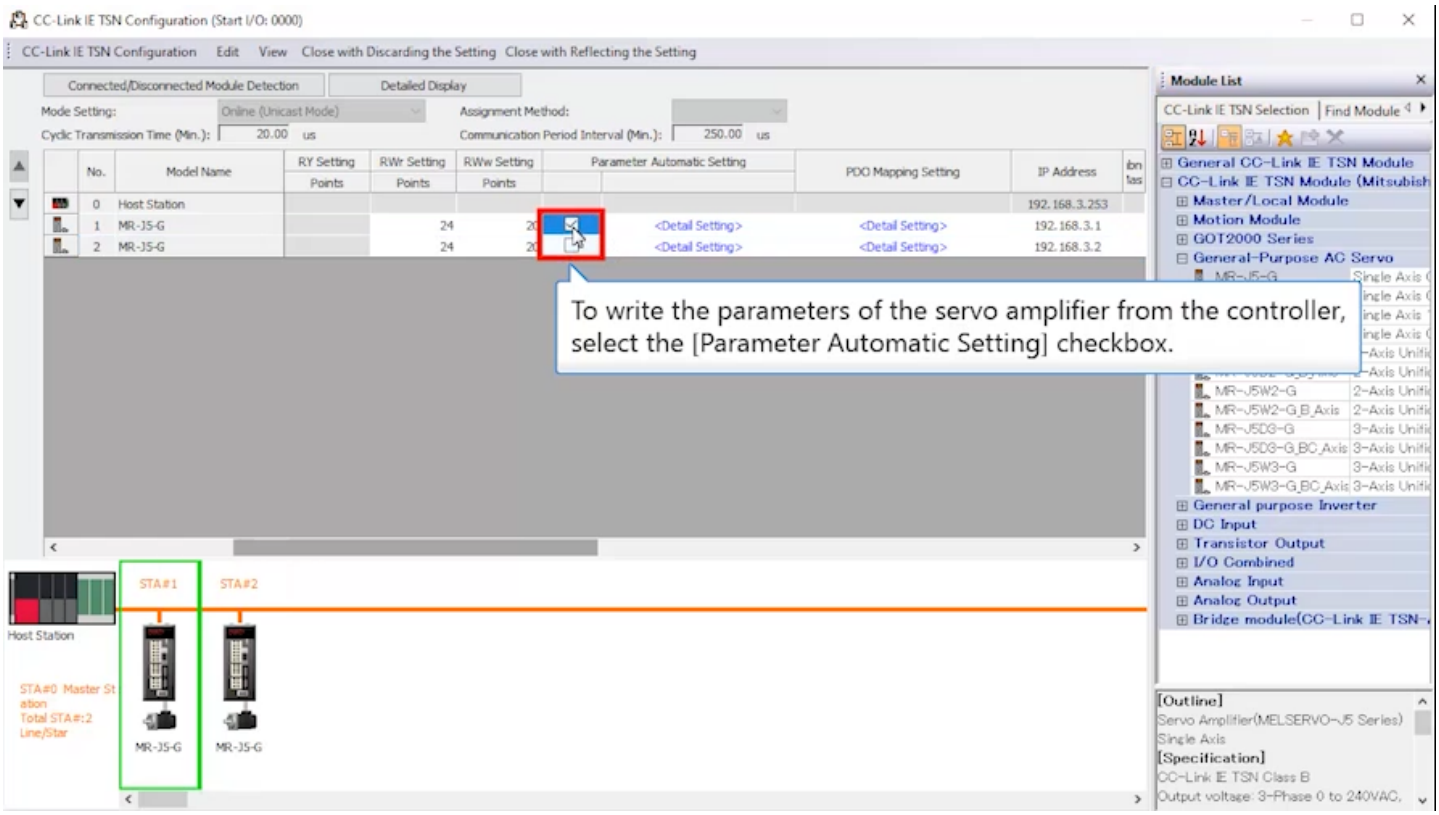
3.3.2 Module parameter (network)

(2) Parameter settings of the servo amplifier (continued)



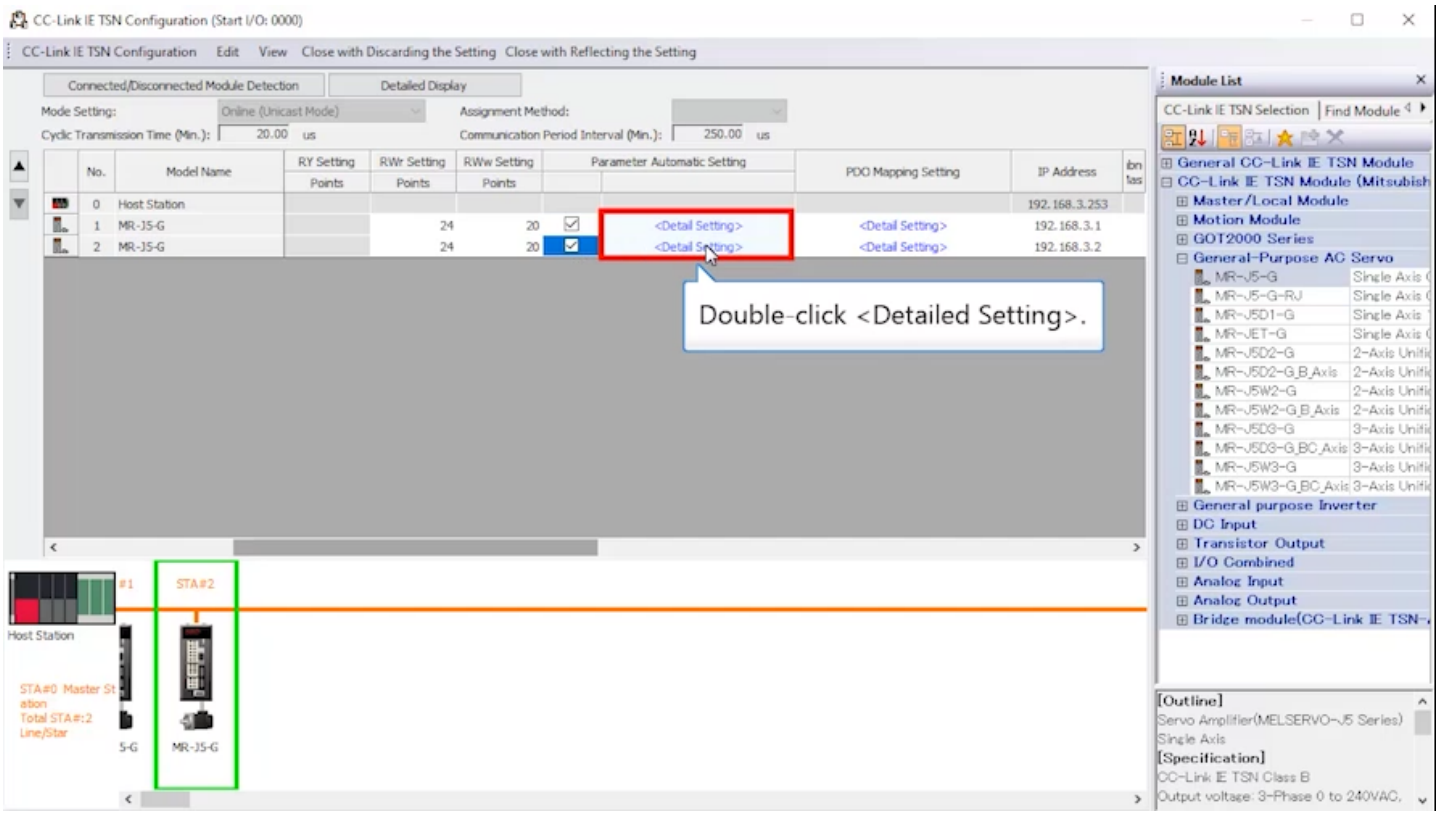
3.3.2 Module parameter (network)

(2) Parameter settings of the servo amplifier (continued)



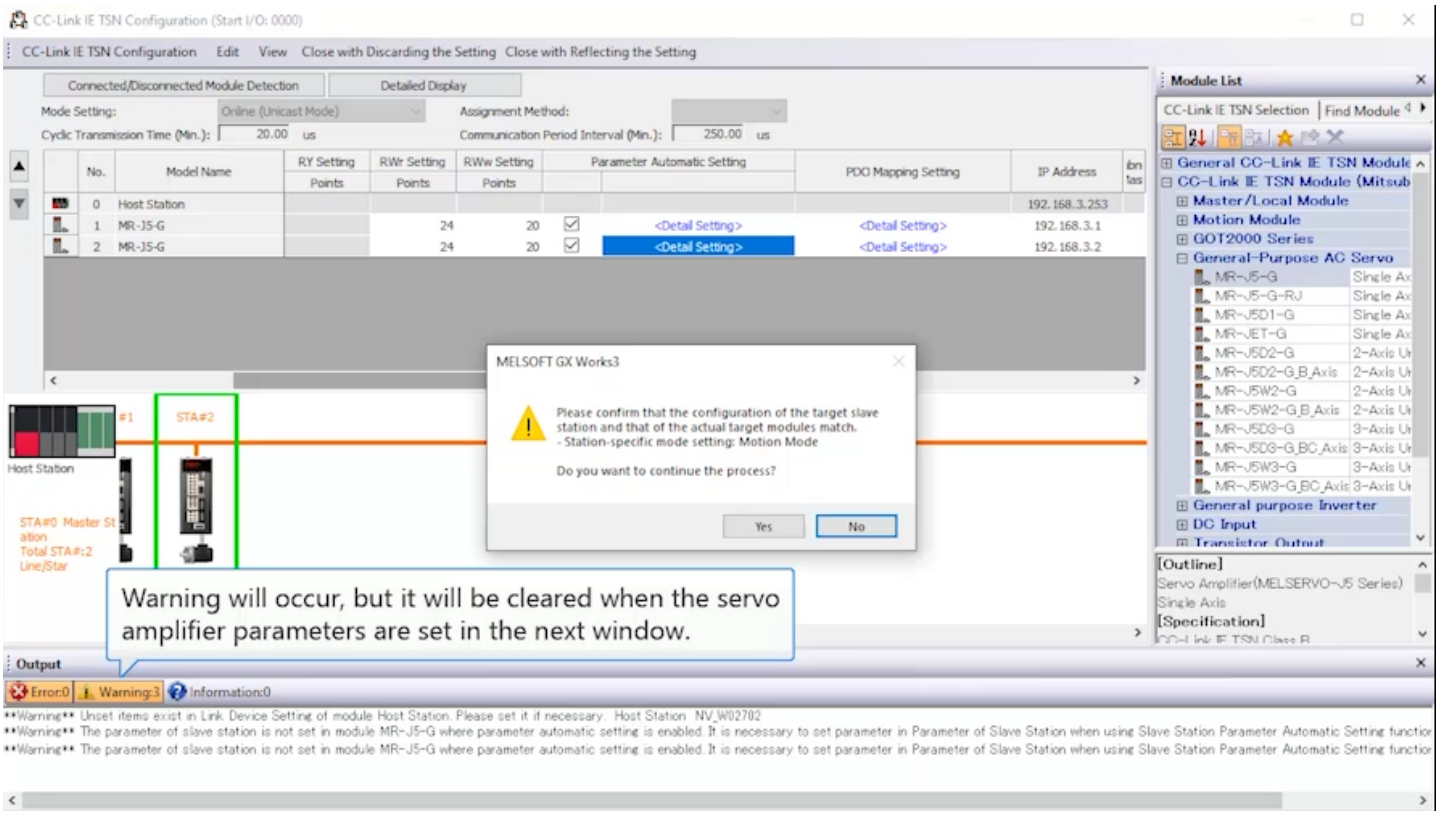
3.3.2 Module parameter (network)

(2) Parameter settings of the servo amplifier (continued)



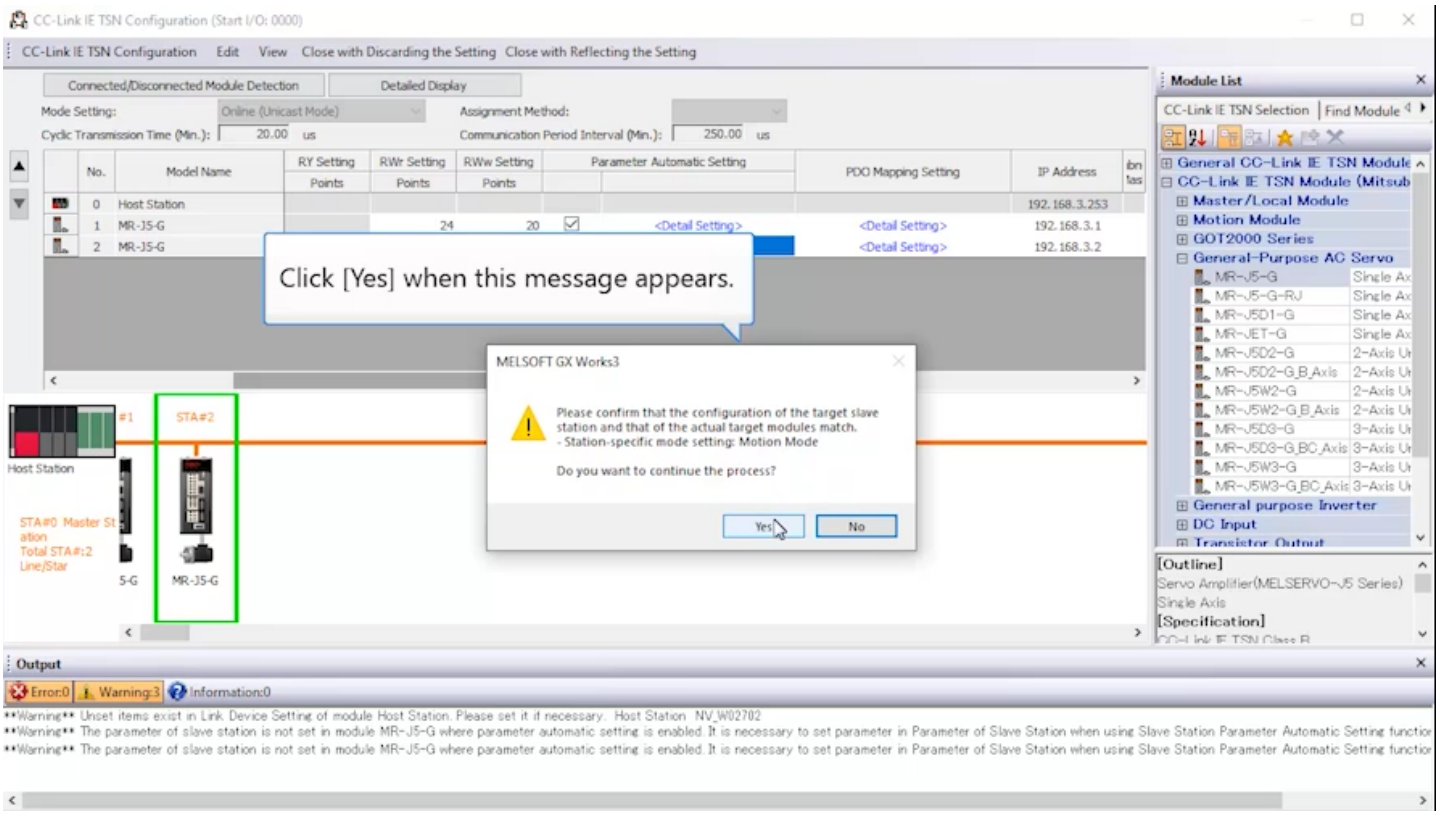
3.3.2 Module parameter (network)

(2) Parameter settings of the servo amplifier (continued)



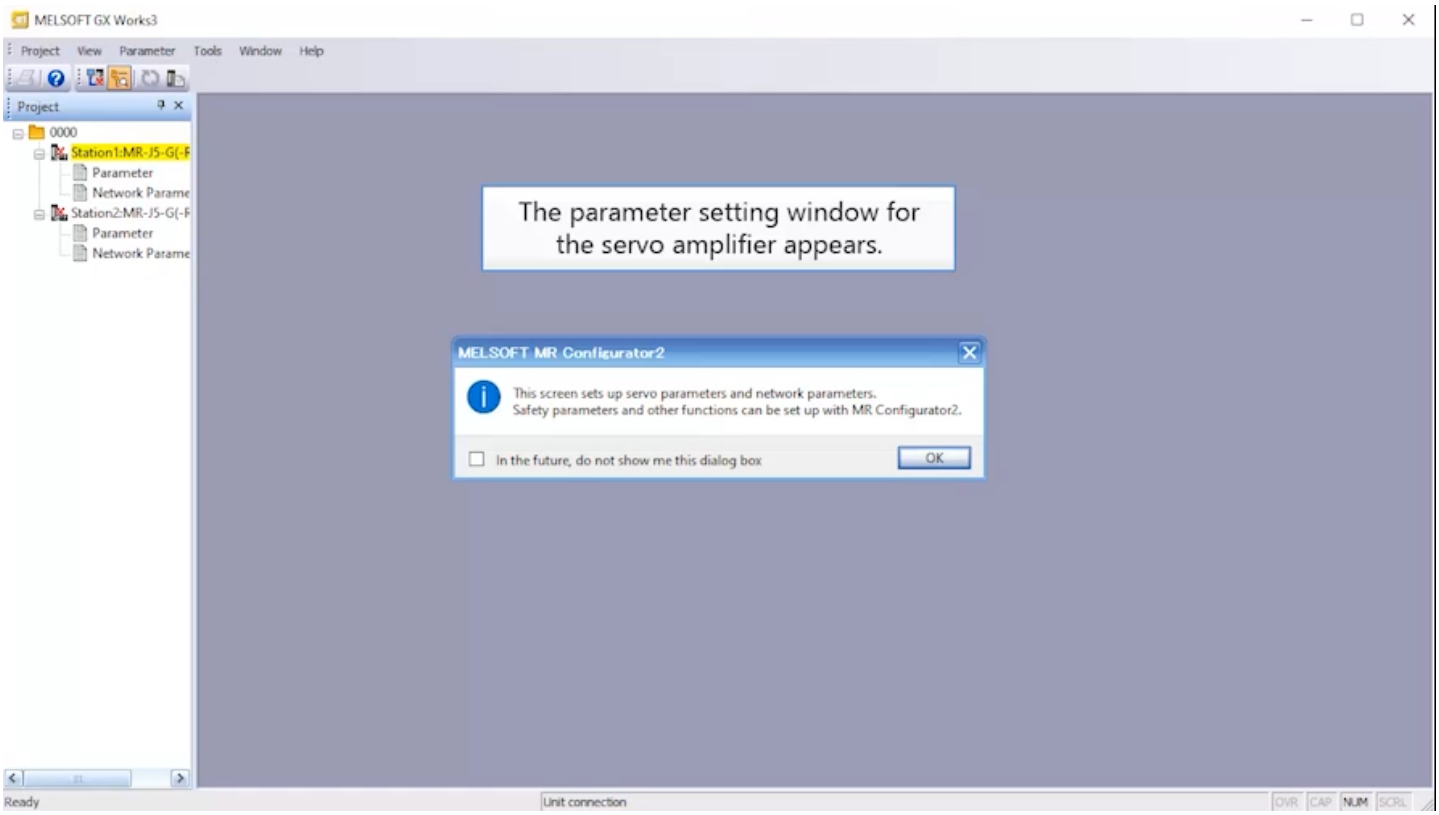
3.3.2 Module parameter (network)

(2) Parameter settings of the servo amplifier (continued)

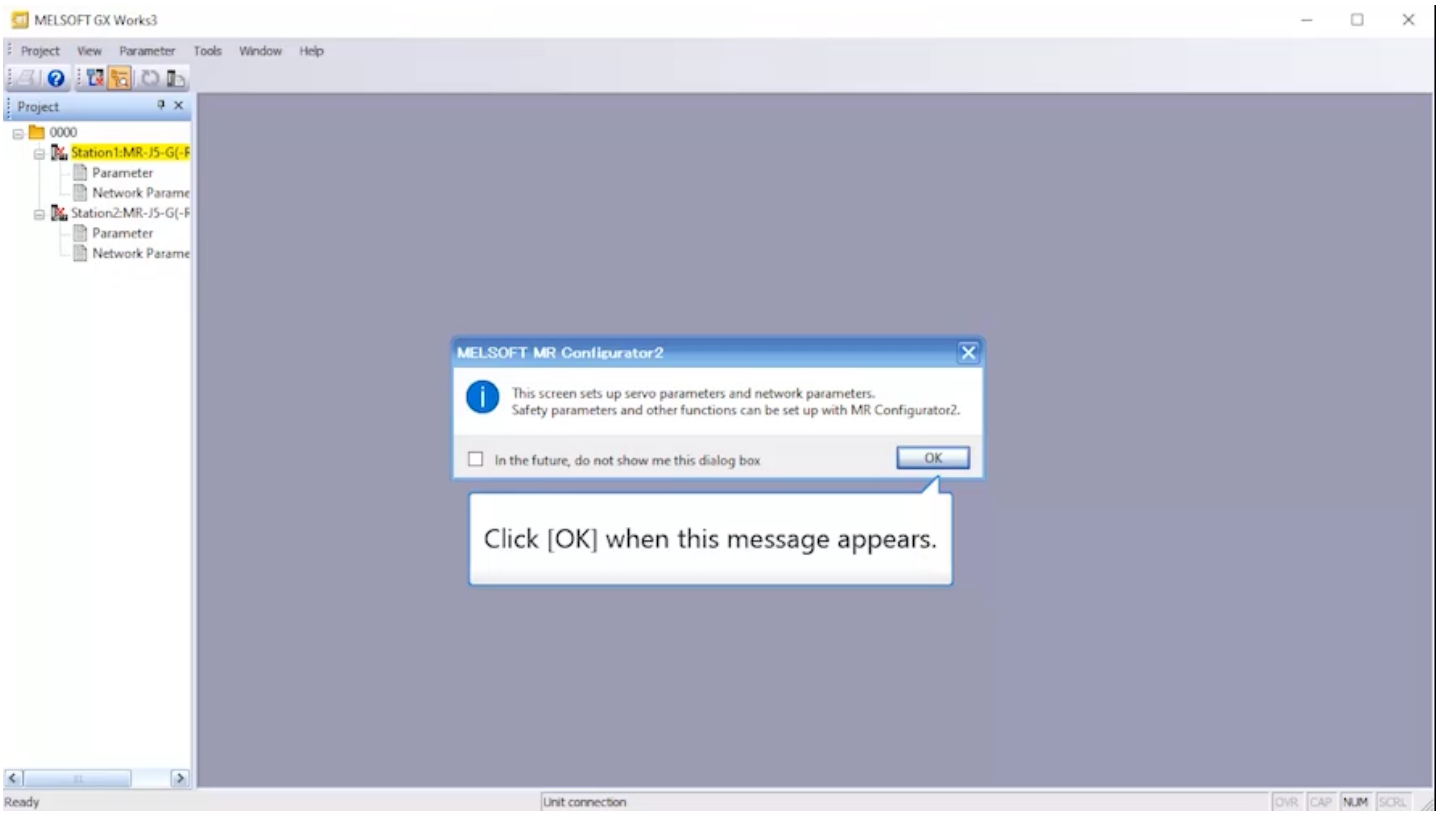


3.3.2 Module parameter (network)

(2) Parameter settings of the servo amplifier (continued)

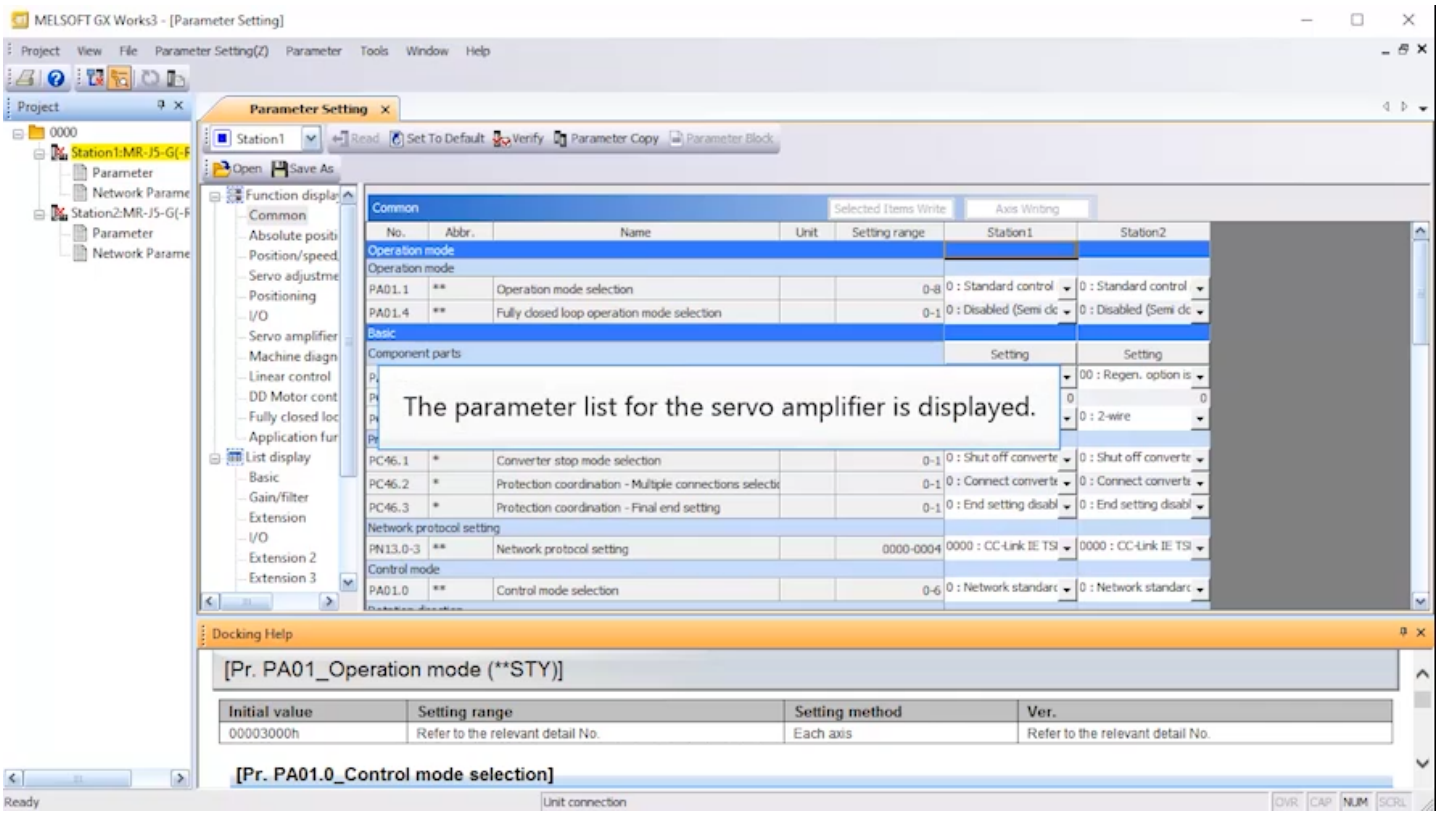


(2) Parameter settings of the servo amplifier (continued)

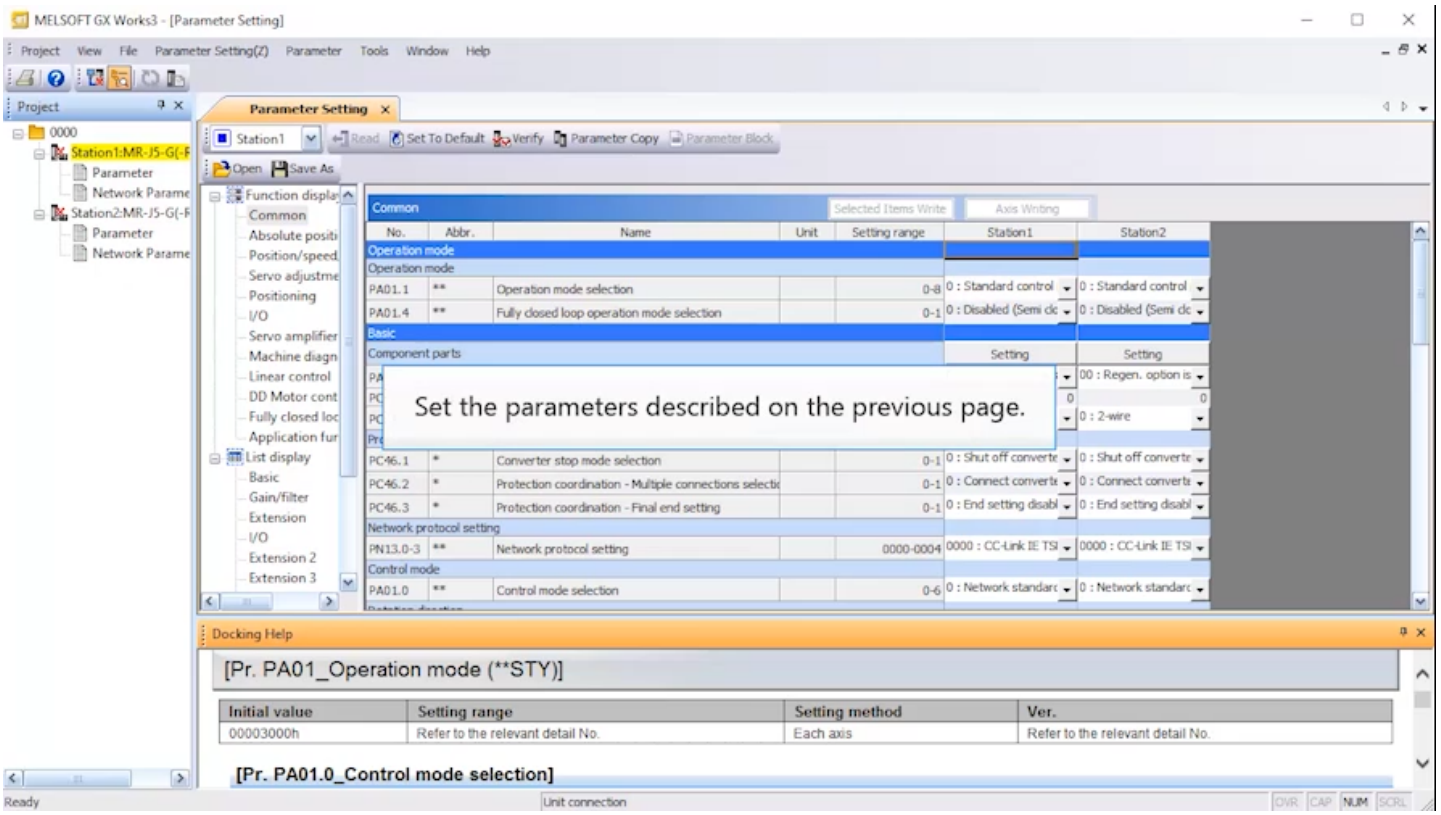


3.3.2 Module parameter (network)

(2) Parameter settings of the servo amplifier (continued)

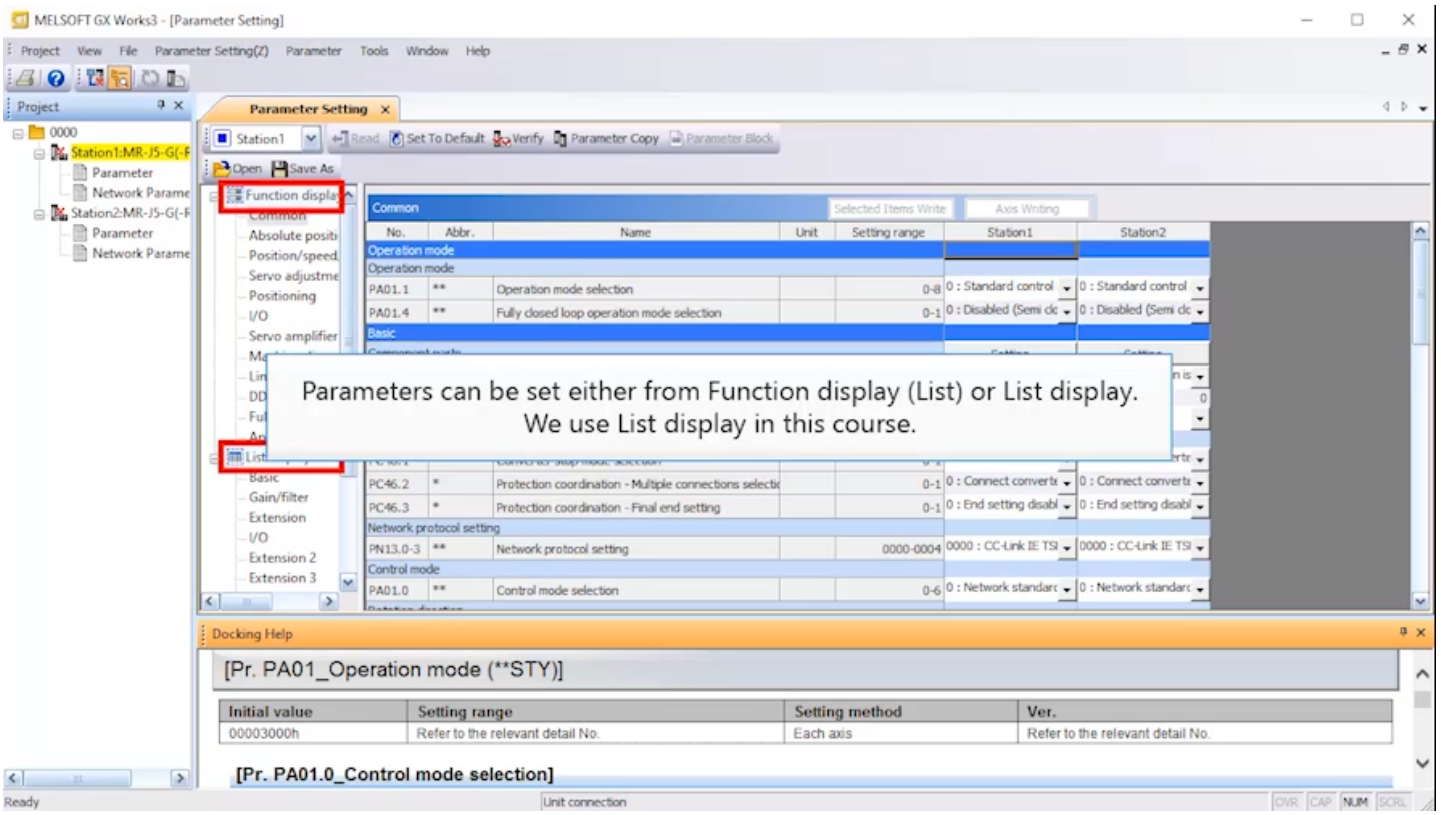


(2) Parameter settings of the servo amplifier (continued)



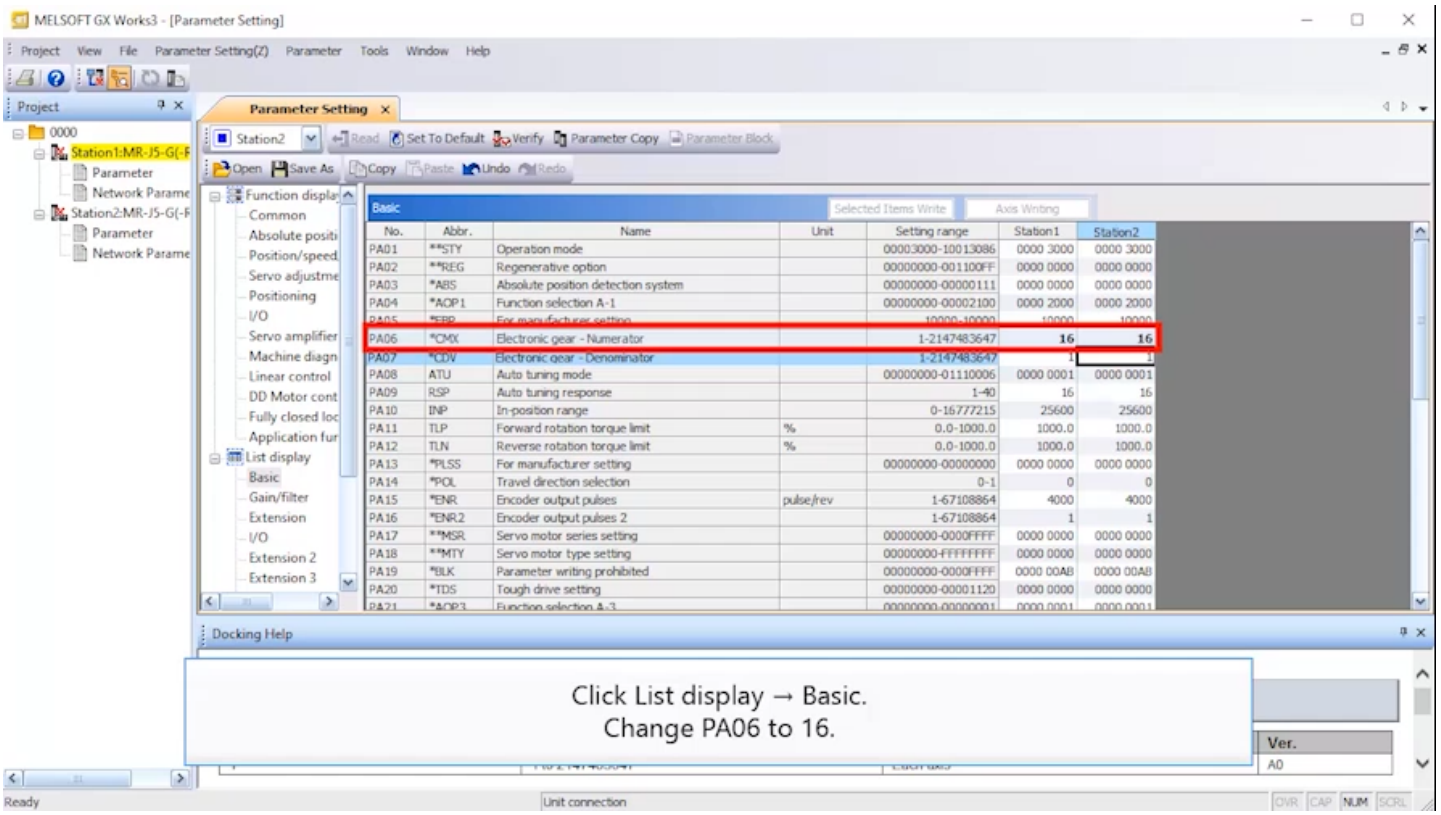
3.3.2 Module parameter (network)

(2) Parameter settings of the servo amplifier (continued)

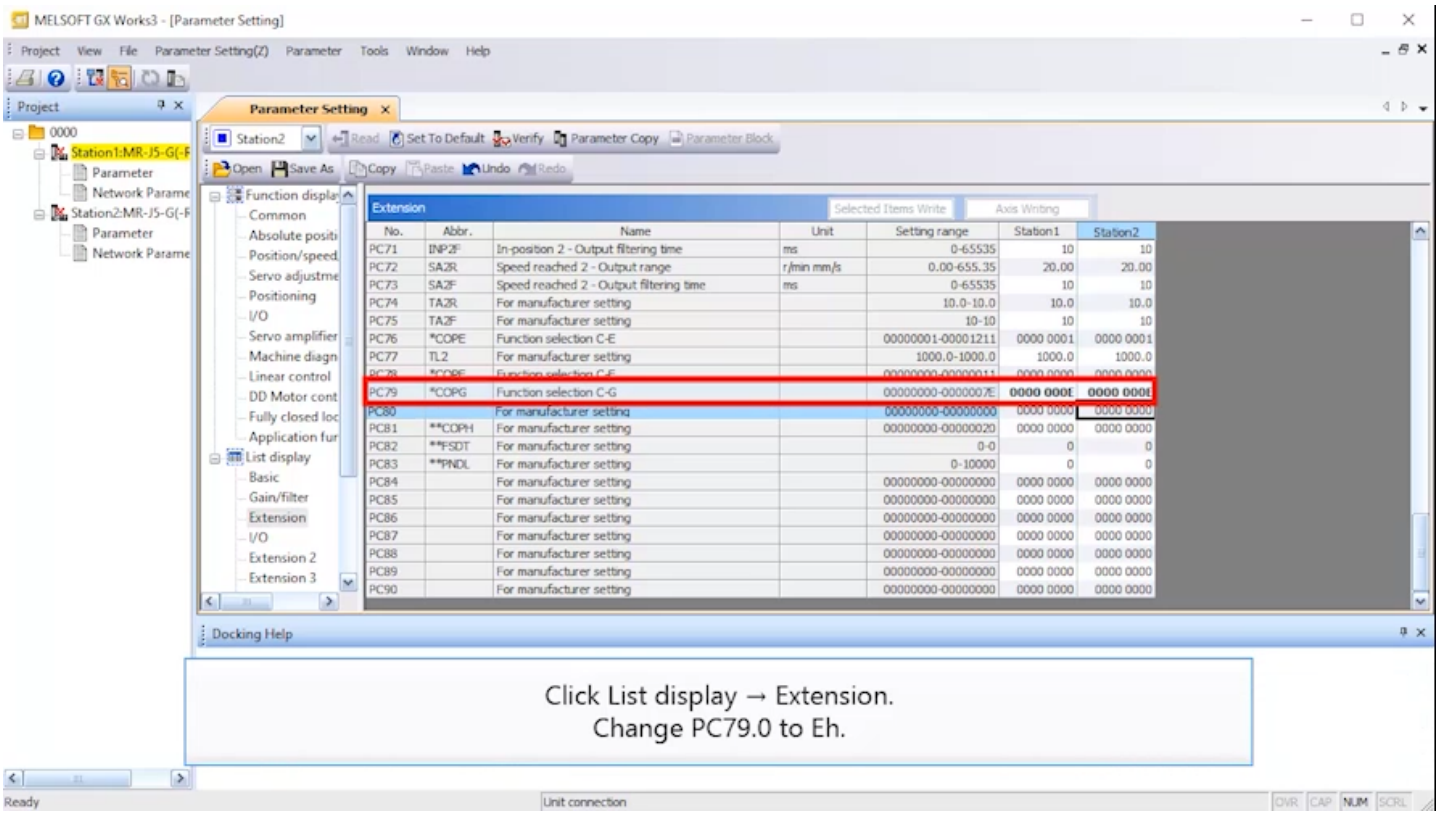


3.3.2 Module parameter (network)

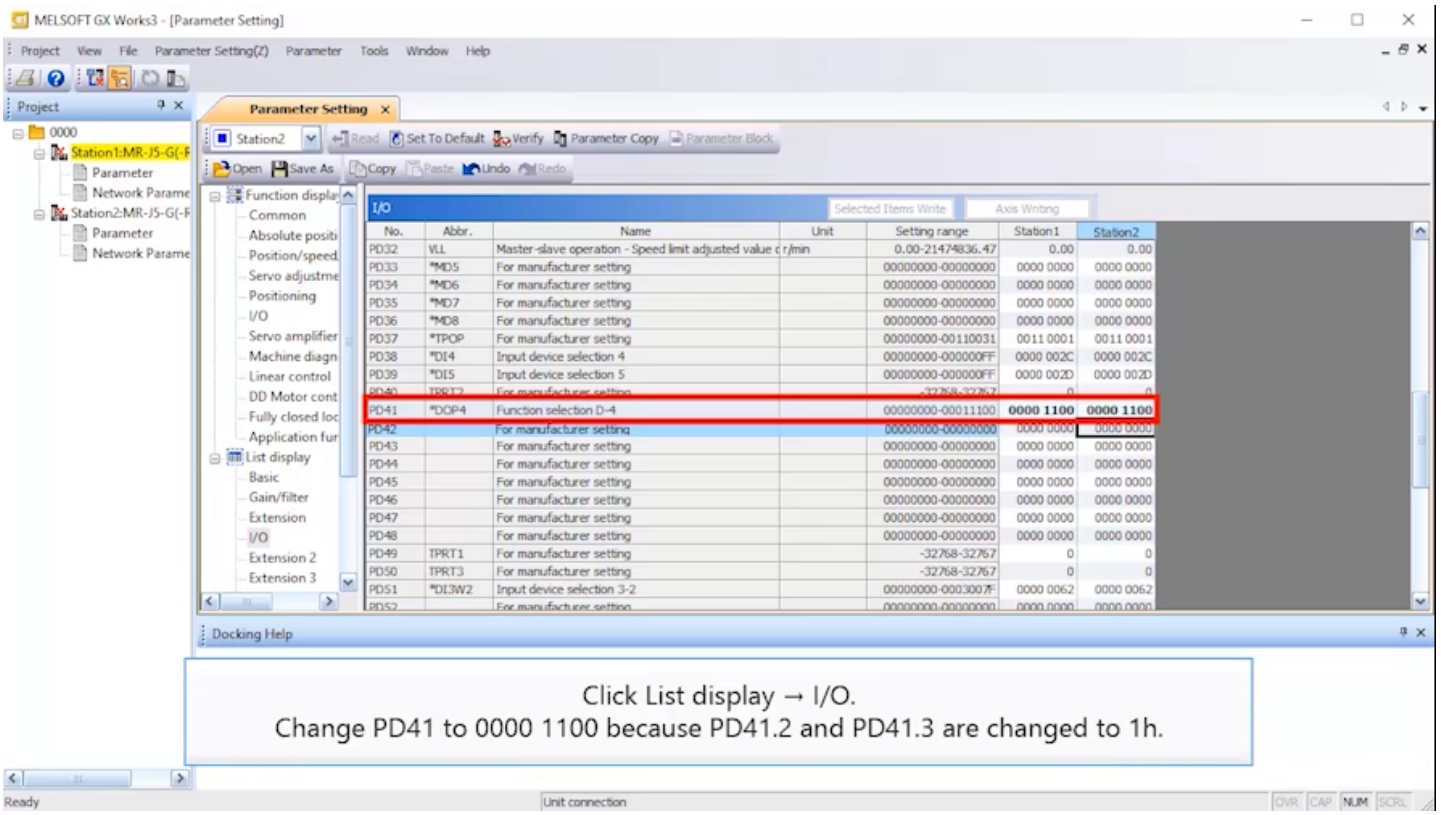
(2) Parameter settings of the servo amplifier (continued)



(2) Parameter settings of the servo amplifier (continued)

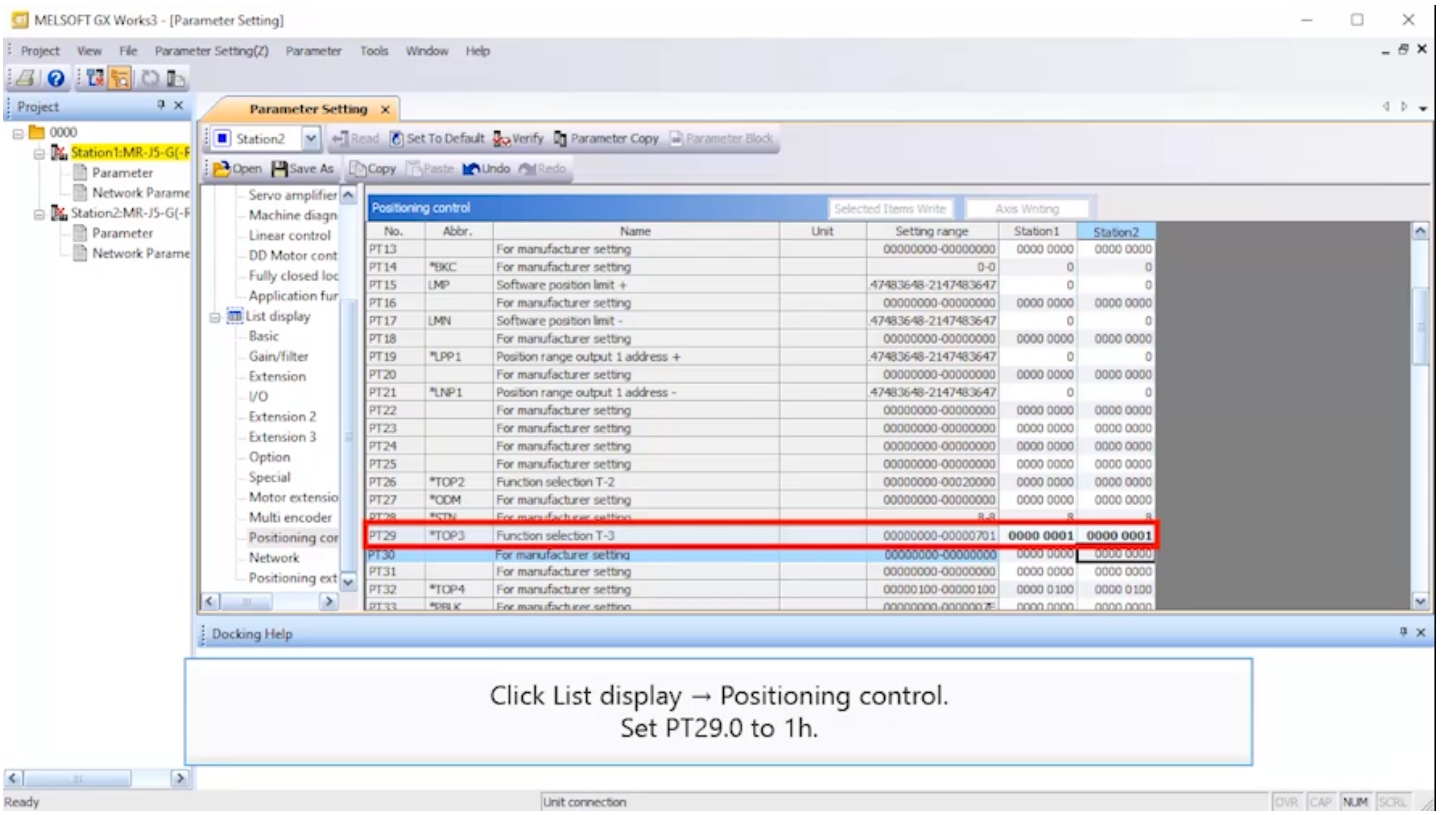


(2) Parameter settings of the servo amplifier (continued)



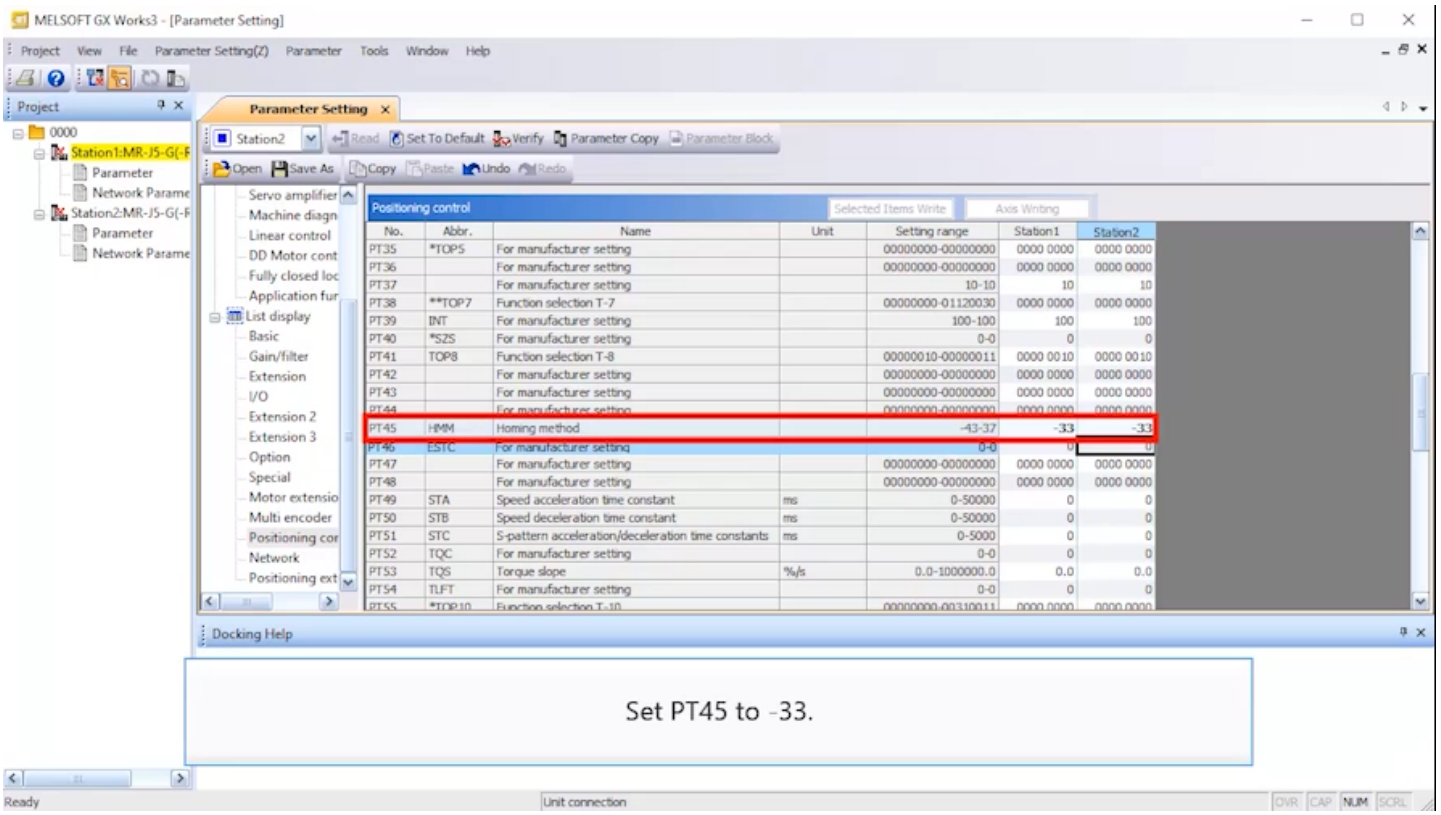
3.3.2 Module parameter (network)

(2) Parameter settings of the servo amplifier (continued)

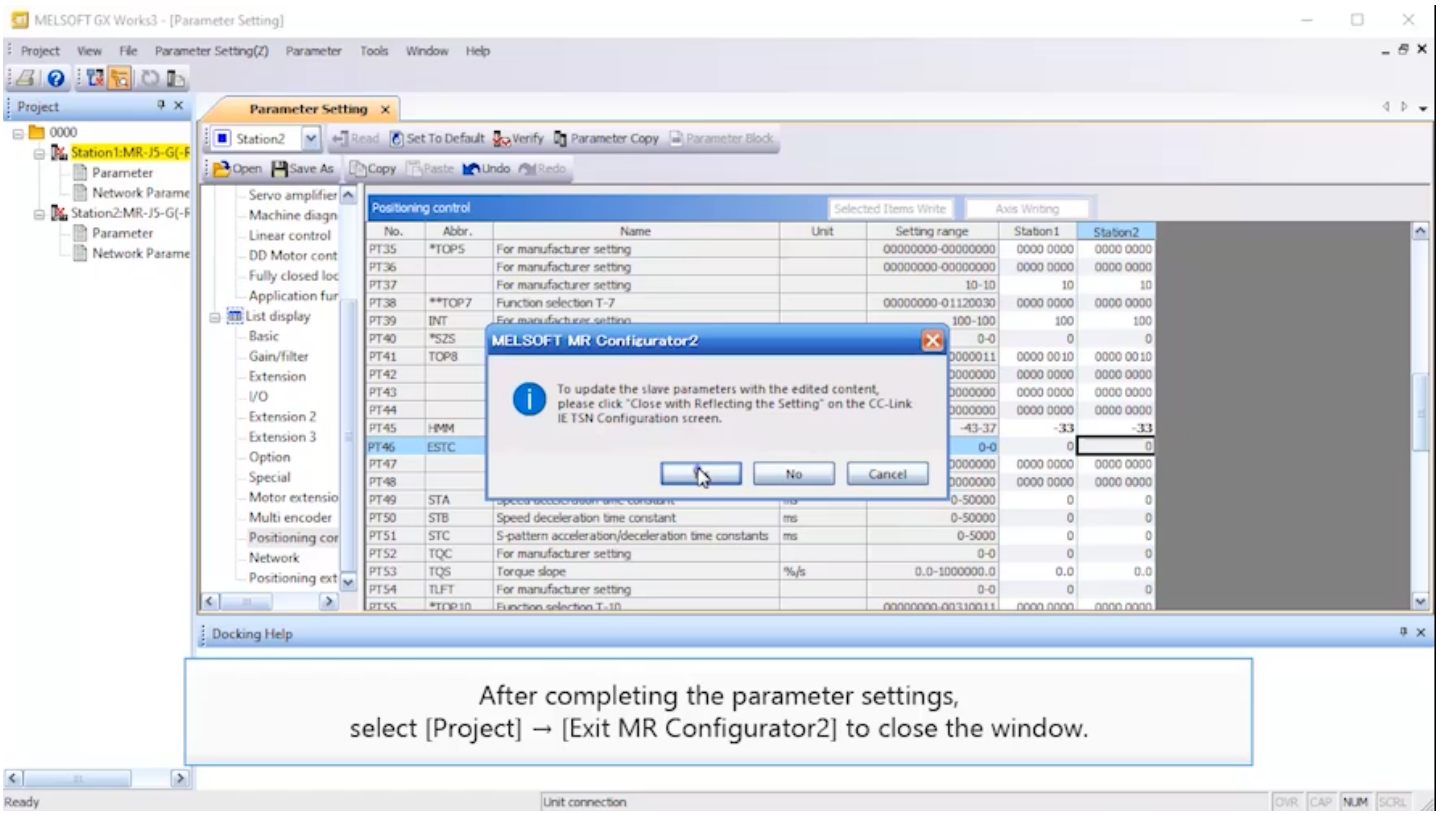


3.3.2 Module parameter (network)

(2) Parameter settings of the servo amplifier (continued)

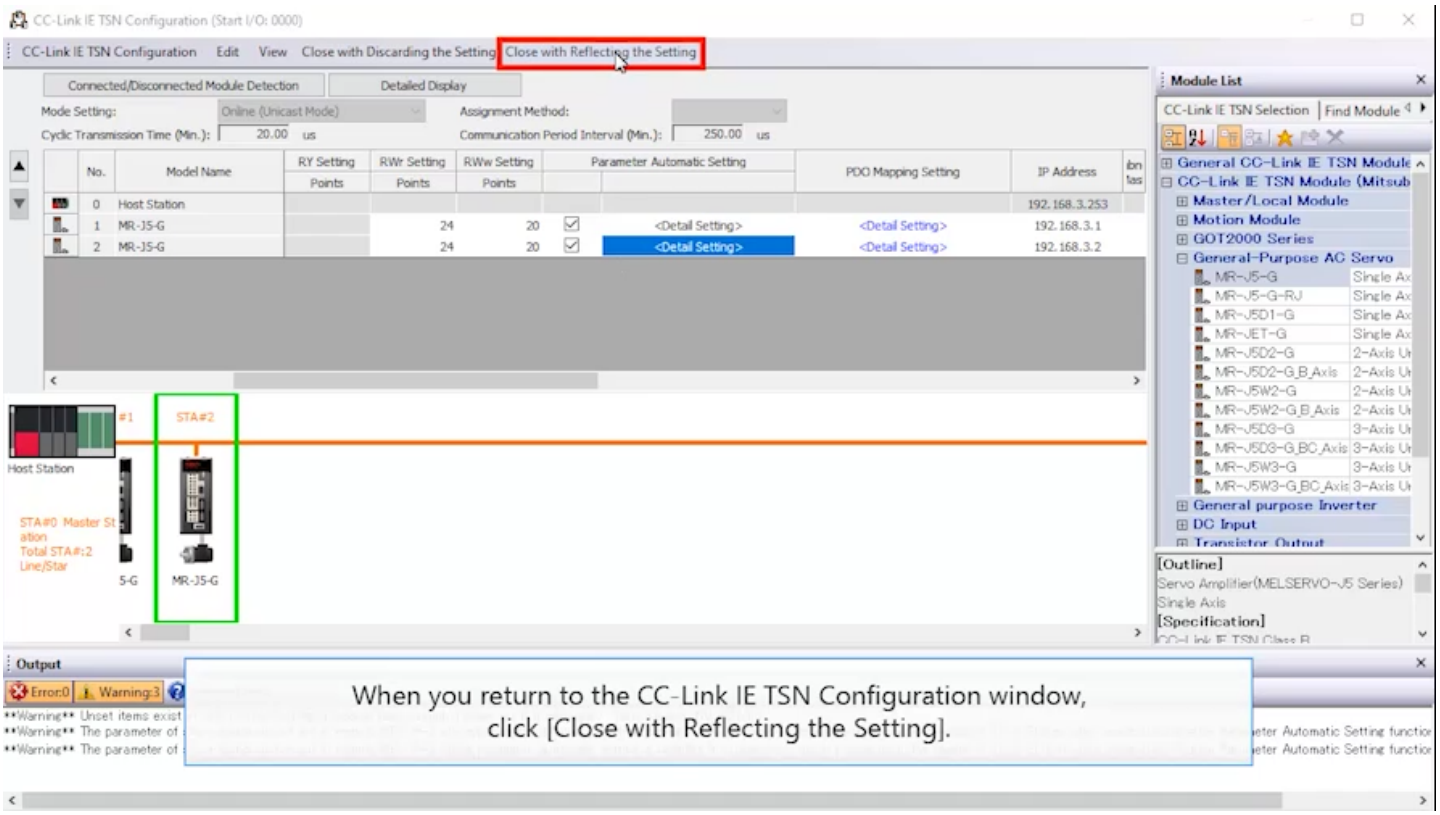


(2) Parameter settings of the servo amplifier (continued)



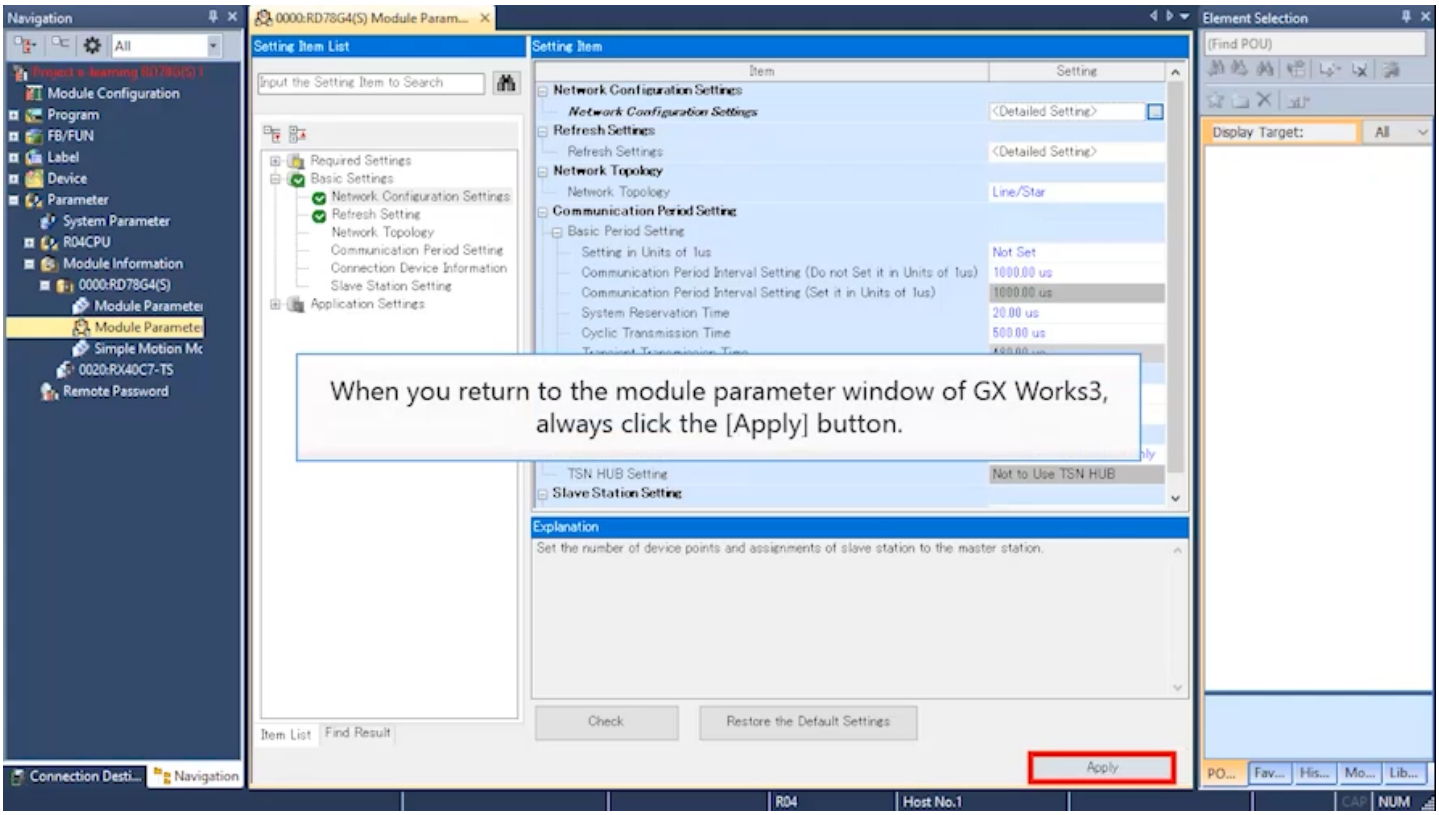
3.3.2 Module parameter (network)

(2) Parameter settings of the servo amplifier (continued)



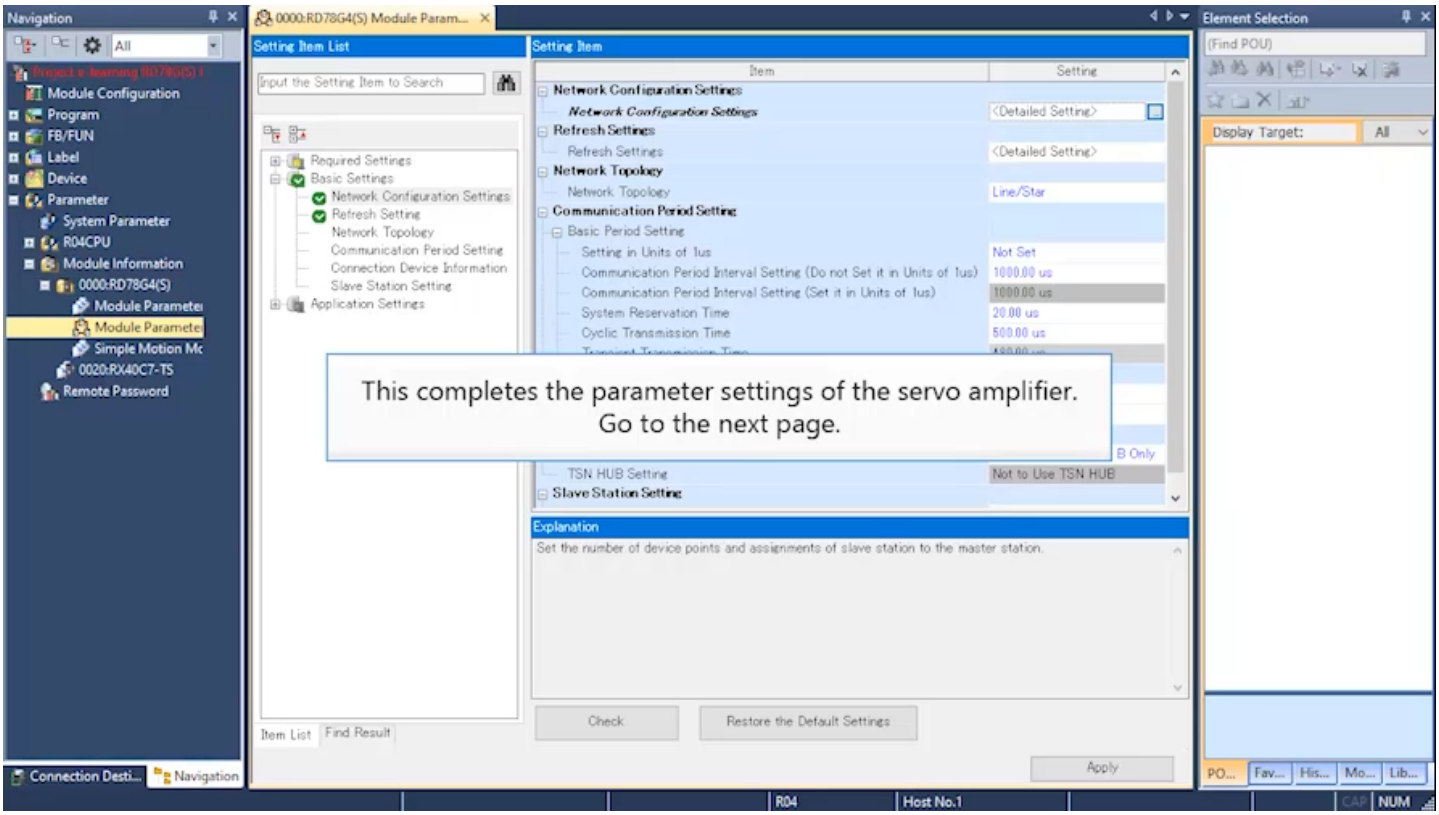
3.3.2 Module parameter (network)

(2) Parameter settings of the servo amplifier (continued)



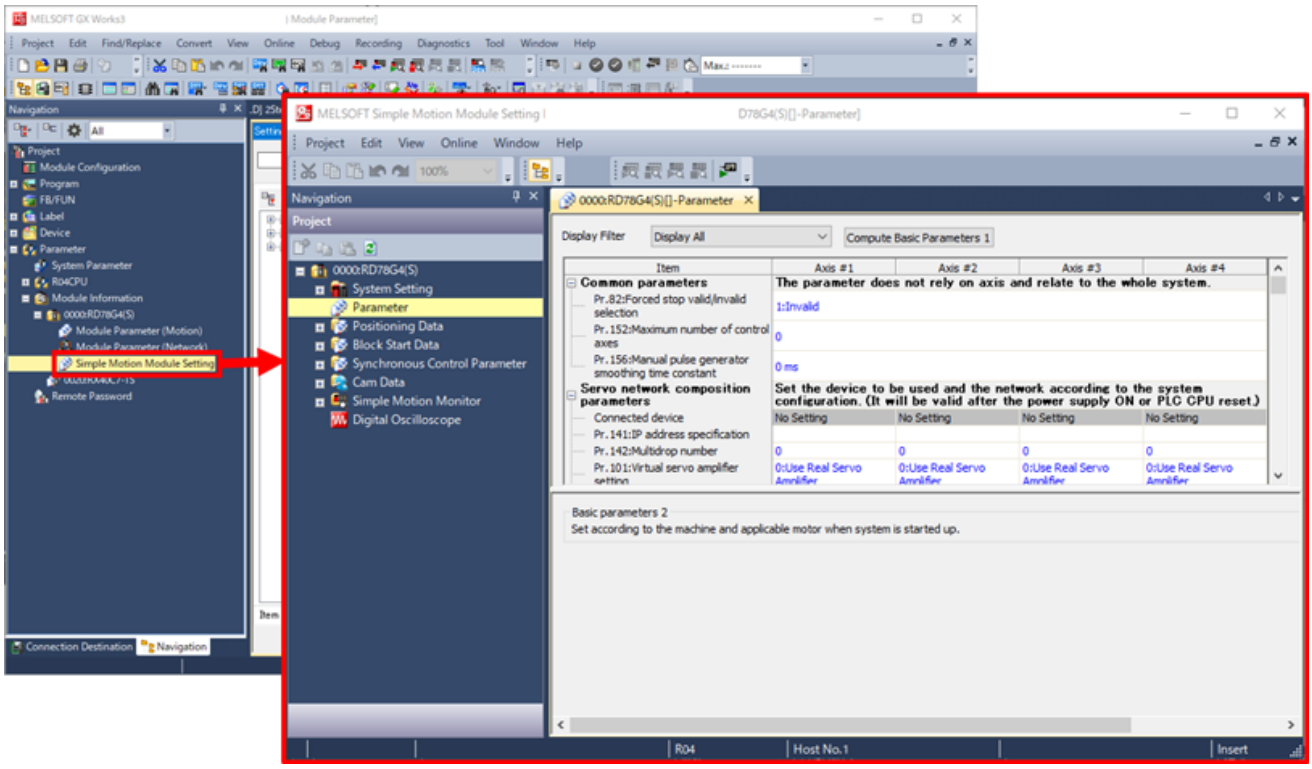
3.3.2 Module parameter (network)

(2) Parameter settings of the servo amplifier (continued)



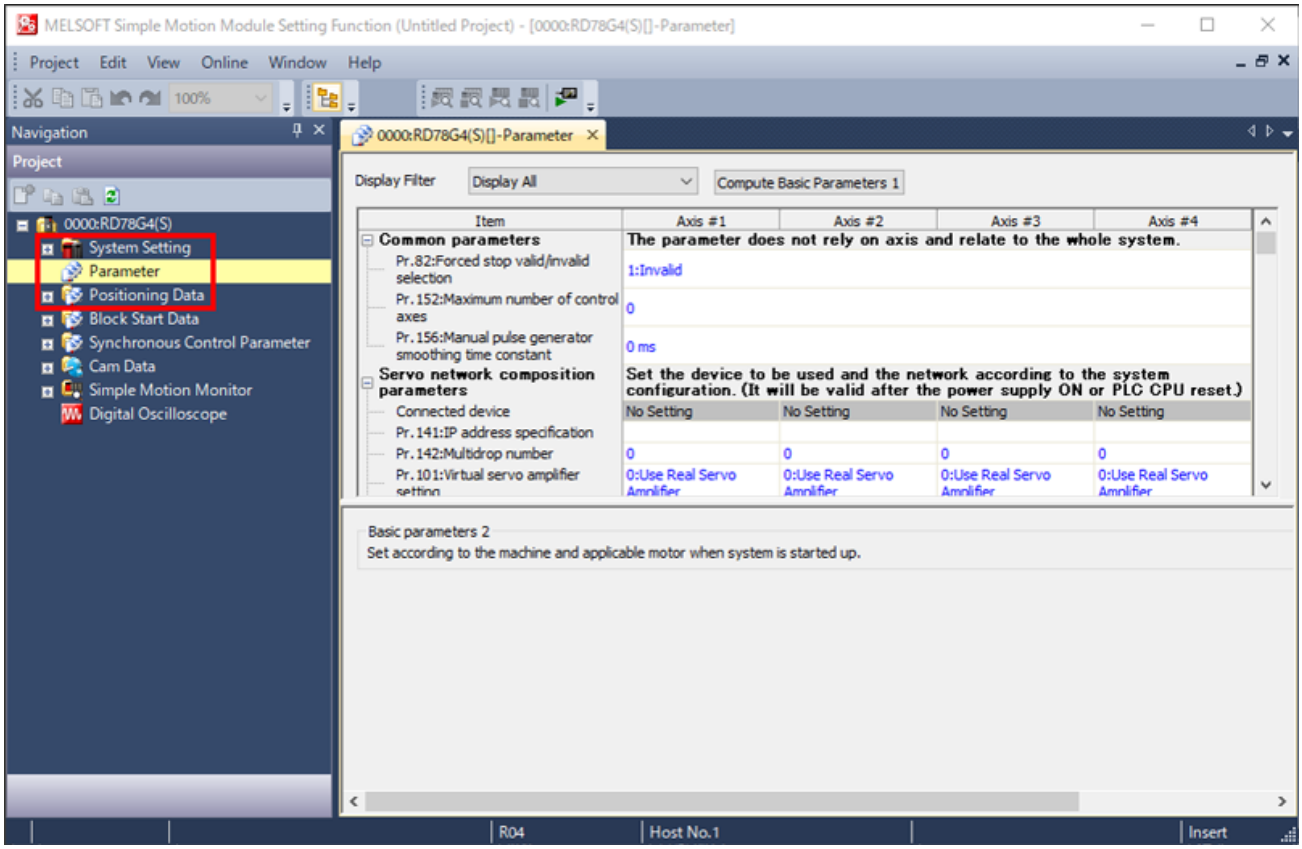
3.3.3 Simple Motion module setting (Module extended parameter)

In the project tree, select [Parameter] → [Module Information] → [0000:RD78G4(S)] and double-click [Simple Motion Module Setting (Module Extended Parameter)].
The Simple Motion Module Setting Function window opens.
Configure the Simple Motion mode settings in this window.



3.4 Simple Motion mode setting

Configure the settings in the order of the project tree in the Simple Motion Module Setting Function window. This section describes each setting from System Setting to Positioning Data in order.



3.4 Simple Motion mode setting

Buffer memory of Simple Motion mode

The following pages contain the description of the buffer memory of Simple Motion mode.
The following provides the basic information on buffer memory such as symbols and setting methods.

(1) Type of buffer memory

There are four main types of buffer memory in Simple Motion mode.

Type	Symbol	Detail
Parameter	[Pr.XX]	Network-related parameters, axis-independent parameters related to the entire system, parameters to be set according to the machine, etc. They are mainly set by the Simple Motion Module Setting Function.
Positioning data	[Da.XX]	Data to be used for positioning control, such as the target position and target speed. They are mainly set by the Simple Motion Module Setting Function.
Control data	[Cd.XX]	Data to be manipulated when any kind of control is performed. "System control data" controls the entire system and "Axis control data" controls each axis.
Monitor data	[Md.XX]	Memory to be used when the operating status of control is monitored. "System monitor data" is used for monitoring of the entire system and "Axis monitor data" is used for monitoring of each axis.

(2) How to access buffer memory

There are two ways to access buffer memory.
One is to specify the buffer memory address directly in the program (U□\Gxxxxx) and the other is to use module labels.
This course uses module labels. The details are described in Chapter 4.

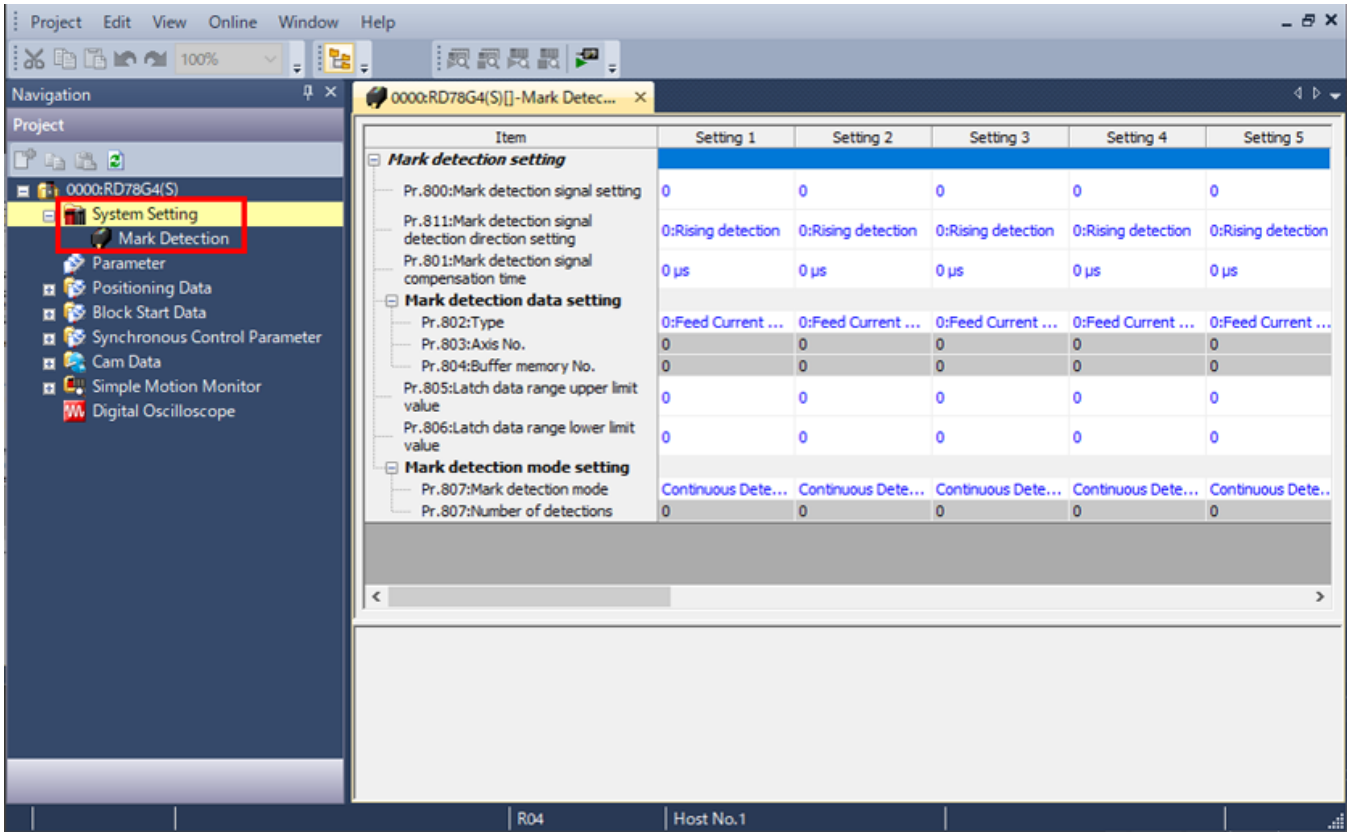
The buffer memory address is described in the following manuals.

MELSEC iQ-R Motion Module User's Manual (Application for Simple Motion Mode)
12.2 List of Buffer Memory Addresses

MELSEC iQ-F FX5 Motion Module/ Simple Motion Module User's Manual (Application)
11.2 List of Buffer Memory Addresses

3.4.1 System setting

Set [System Setting] in the project tree when using the mark detection function.
In this course, use the initial values because the mark detection function is not used.



3.4.2 Parameters (Axis parameters)

Common parameters

Set the parameters related to the entire system. The parameters in the red frame are described below.

Item	Axis #1	Axis #2
Common parameters	The parameter does not rely on axis and relate to the whole system.	
Pr.82:Forced stop valid/invalid selection	1:Invalid	
Pr.152:Maximum number of control axes	0	
Pr.156:Manual pulse generator smoothing time constant	0 ms	

[Pr.82:Forced stop valid/invalid selection]

Set this parameter to "2: Valid (Buffer Memory)" to execute an emergency stop of all axes at once in the program.
In this case, an emergency stop is executed when the buffer memory of [Cd.158: Forced stop input] is set to "0".
In the sample program, it is set to "1:Invalid" since the emergency stop from the controller is not used.

[Pr.152:Maximum number of control axes]

This parameter is used to keep the operation cycle small when the number of control axes to be used is less than the maximum number of control axes for each model.

Servo network composition parameters

Set the parameters related to the network. The parameters in the red frame are described below.

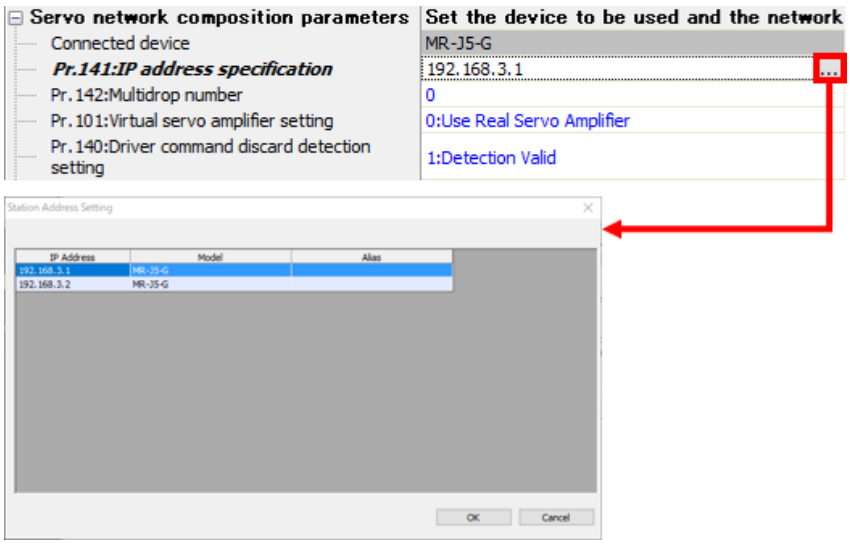
Item	Axis #1	Axis #2
Servo network composition parameters	Set the device to be used and the network according to the system configuratio...	
Connected device	MR-J5-G	MR-J5-G
Pr.141:IP address specification	192.168.3.1	192.168.3.2
Pr.142:Multidrop number	0	0
Pr.101:Virtual servo amplifier setting	0:Use Real Servo Amplifier	0:Use Real Servo Amplifier
Pr.140:Driver command discard detection setting	1:Detection Valid	1:Detection Valid

[Pr.141:IP address specification], [Pr.142:Multidrop number]

Set the IP address of the servo amplifier.
For the multi-axis servo amplifier, specify the A-/B-/C-axis with the multidrop number.

[Point]

Clicking the [...] button in the [Pr.141:IP address specification] or [Pr.142:Multidrop number] field displays the list of servo amplifiers registered in the network configuration setting.
You can select the servo amplifier to be assigned to the axis from the displayed list.



[Pr.101:Virtual servo amplifier setting]

When using the servo amplifier as a virtual servo amplifier, set it to "1:Use as Virtual Servo Amplifier".

The virtual servo amplifier is a function to allow an axis (virtual servo amplifier axis) to generate only commands virtually without connecting a servo amplifier.

Operation can be performed without amplifiers during debugging.

3.4.2 Parameters (Axis parameters)

Basic parameters 1

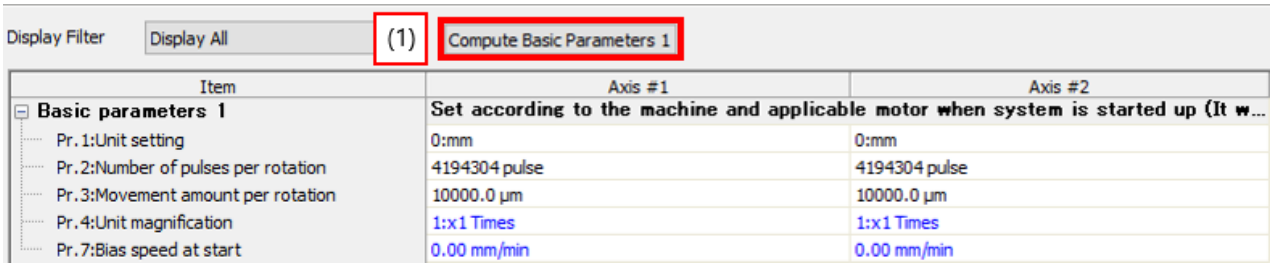
Set the machine specifications.

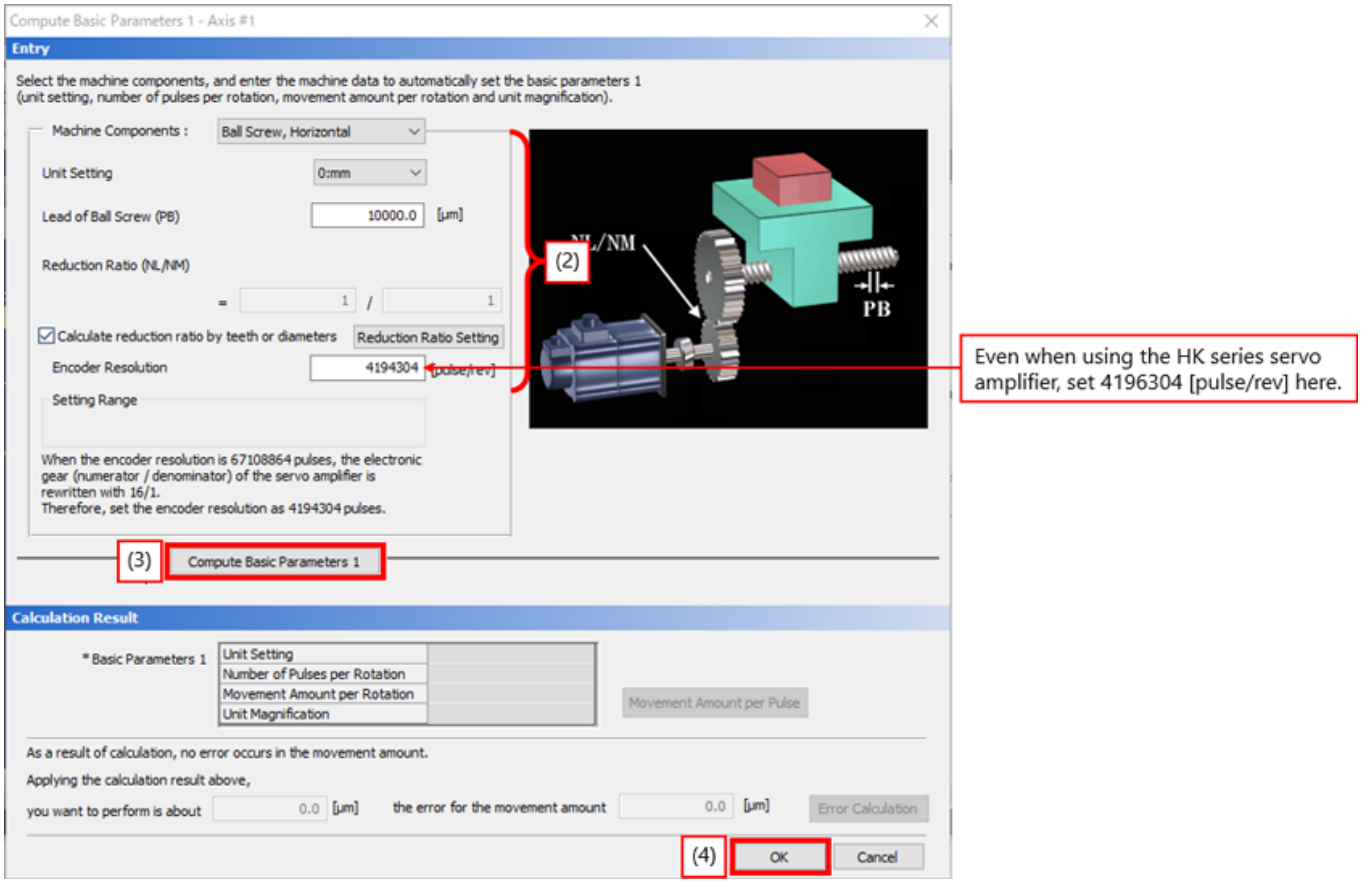
(1) By clicking [Compute Basic parameters 1], the setup assistance window pops up.

(2) Input the machine specifications.

(3) By clicking the [Compute Basic parameters 1] button, basic parameters 1 are calculated.

(4) By clicking [OK], the window is closed and the settings are applied.





3.4.2 Parameters (Axis parameters)

Basic parameters 2

Set the speed limit value and acceleration/deceleration time.

Item	Axis #1	Axis #2
Basic parameters 2	**Set according to the machine and applicable motor when system is started up.**	
Pr.8:Speed limit value	10000.00 mm/min	10000.00 mm/min
Pr.9:Acceleration time 0	1500 ms	1500 ms
Pr.10:Deceleration time 0	1500 ms	1500 ms

[Pr.8:Speed limit value]

Set the maximum speed for positioning control, homing control, and speed/torque control.

[Pr.9:Acceleration time 0], [Pr.10:Deceleration time 0]

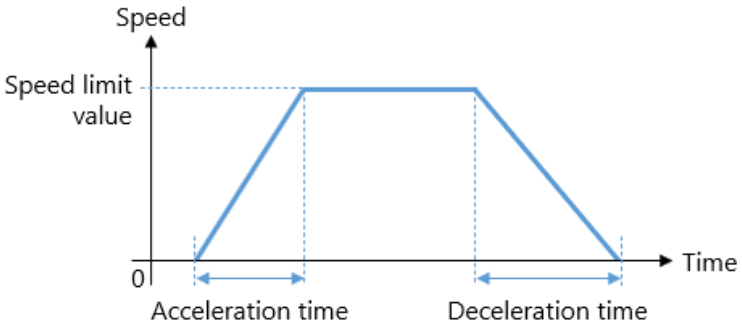
Acceleration time 0 is used to set the time required to reach [Pr.8:Speed limit value] (or [Pr.31:JOG speed limit value] in the case of JOG operation control) from speed 0.

Deceleration time 0 is used to set the time required to reach speed 0 from [Pr.8:Speed limit value] (or [Pr.31:JOG speed limit value] in the case of JOG operation control).

([Pr.31:JOG speed limit value] is set in detailed parameters 2.)

In detailed parameters 2, acceleration time 1 to 3 and deceleration time 1 to 3 can be set.

In Positioning Data (point table) setting, select acceleration/deceleration time 0 to 3.



3.4.2 Parameters (Axis parameters)

Detailed parameters 1

These parameters are set for each axis. The parameters in the red frames are described below.

Item	Axis #1	Axis #2
Detailed parameters 1	Set according to the system configuration when the system is started up.(It will be...	
Pr.11:Backlash compensation amount	0.0 um	0.0 um
Pr.12:Software stroke limit upper limit value	155000.0 µm	15500.0 µm
Pr.13:Software stroke limit lower limit value	-5000.0 µm	-500.0 µm
Pr.14:Software stroke limit selection	0:Apply Software Stroke Limit on Feed Current Value	0:Apply Software Stroke Limit on Feed Current Value
Pr.15:Software stroke limit valid/invalid setting	0:Valid	0:Valid
Pr.16:Command in-position width	10.0 µm	10.0 µm
Pr.17:Torque limit setting value	300.0 %	300.0 %
Pr.18:M-code ON signal output timing	0:WITH Mode	0:WITH Mode
Pr.19: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
Pr.21:Feed current value during speed control	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
Pr.22:Input signal logic selection : Upper limit	0:Negative Logic	0:Negative Logic
Pr.22:Input signal logic selection : Stop signal	0:Negative Logic	0:Negative Logic
Pr.22:Input signal logic selection : External c...	0:Negative Logic	0:Negative Logic
Pr.22:Input signal logic selection : Proximity ...	0:Negative Logic	0:Negative Logic
Pr.81:Speed-position function selection	0:Speed-position Switching Control (INC Mode)	0:Speed-position Switching Control (INC Mode)
Pr.116:FLS signal selection : Input type	1:Servo Amplifier	1:Servo Amplifier
Pr.117:RLS signal selection : Input type	1:Servo Amplifier	1:Servo Amplifier
Pr.118:DOG signal selection : Input type	1:Servo Amplifier	1:Servo Amplifier
Pr.119:STOP signal selection : Input type	2:Buffer Memory	2:Buffer Memory

(Note) They are described in 3.4.3 Positioning Data (Point table).

[Pr.12:Software stroke limit upper limit value], [Pr.13:Software stroke limit lower limit value]
Set the upper and lower limits of the machine motion range during positioning control.

[Pr.14:Software stroke limit selection]
Set whether to apply the software stroke limit to "Feed Current Value" or "Machine Feed Value".

[Pr.15:Software stroke limit valid/invalid setting]
Whether to enable or disable the software stroke limit during JOG operation , inching operation, and manual pulser operation.
To disable the software stroke limit at all times, set the same value for the upper and lower limits.

[Pr.22:Input signal logic selection] (Lower limit, Upper limit, and Proximity dog signal)
Switch the logic of the external input signals (upper/lower limit signal (FLS/RLS) and Proximity dog signal (DOG)) from the servo amplifier or buffer memory.

[Point]
Positive Logic and Negative Logic are as shown below.

	Negative Logic	Positive Logic
No current flows through the input signal contact.	FLS, RLS: Limit signal ON DOG: Invalid (outside DOG)	FLS, RLS: Limit signal OFF DOG: Valid (inside DOG)
Current flows through the input signal contact.	FLS, RLS: Limit signal OFF DOG: Valid (inside DOG)	FLS, RLS: Limit signal ON DOG: Invalid (outside DOG)

[Pr.116:FLS signal selection : Input type], [Pr.117:RLS signal selection : Input type], [Pr.118:DOG signal selection : Input type] Select whether to connect each external input signal to the servo amplifier, use the buffer memory of [Cd.44:External input signal operation device], or disable them.

Detailed parameters 2

These parameters are set for each axis. The parameters in the red frame are described below.

Item	Axis #1	Axis #2
Detailed parameters 2	Set according to the system configuration when the system is started up(Set as re...	
Pr.25:Acceleration time 1	1000 ms	1000 ms
Pr.26:Acceleration time 2	1000 ms	1000 ms
Pr.27:Acceleration time 3	1000 ms	1000 ms
Pr.28:Deceleration time 1	1000 ms	1000 ms
Pr.29:Deceleration time 2	1000 ms	1000 ms
Pr.30:Deceleration time 3	1000 ms	1000 ms
Pr.31:JOG speed limit value	2000.00 mm/min	2000.00 mm/min
Pr.32:JOG operation acceleration time select...	1:1000	1:1000
Pr.33:JOG operation deceleration time selec...	1:1000	1:1000
Pr.34:Acceleration/deceleration process sele...	0:Trapezoidal Acceleration/Deceleration Process	0:Trapezoidal Acceleration/Deceleration Process
Pr.35:S-curve ratio	100 %	100 %
Pr.36:Rapid stop deceleration time	1000 ms	1000 ms
Pr.37:Stop group 1 rapid stop selection	0:Normal Deceleration Stop	0:Normal Deceleration Stop
Pr.38:Stop group 2 rapid stop selection	0:Normal Deceleration Stop	0:Normal Deceleration Stop
Pr.39:Stop group 3 rapid stop selection	0:Normal Deceleration Stop	0:Normal Deceleration Stop
Pr.40:Positioning complete signal output time	300 ms	300 ms
Pr.41:Allowable circular interpolation error w...	10.0 µm	10.0 µm
Pr.42:External command function selection	0:External Positioning Start	0:External Positioning Start
Pr.83:Speed control 10x multiplier setting fo...	0:Invalid	0:Invalid
Pr.84:Restart allowable range when servo O...	0 pulse	0 pulse
Pr.90:Operation setting for SPD-TRQ Cont. ...	0:Command Torque	0:Command Torque
Pr.90:Operation setting for SPD-TRQ Cont. ...	0:Command Speed	0:Command Speed
Pr.90:Operation setting for SPD-TRQ Cont. ...	0:Check the Switching Conditions in Simple Motion ...	0:Check the Switching Conditions in Simple Motion ...
Pr.127:Speed limit value input selection at c...	0:Input Enable	0:Input Enable
Pr.95:External command signal selection	0:Not Used	0:Not Used
Pr.112:Servo OFF command valid/invalid set...	0:Servo OFF Command Invalid	0:Servo OFF Command Invalid
Pr.122:Manual pulse generator speed limit m...	0:Do Not Execute Speed Limit	0:Do Not Execute Speed Limit
Pr.123:Manual pulse generator speed limit v...	200.00 mm/min	200.00 mm/min

Only for the iQ-R series Motion module

[Pr.25 to Pr.27:Acceleration time 1 to 3] and [Pr.28 to Pr.30:Deceleration time 1 to 3]

Set the acceleration time and deceleration time in the same way as [Pr.9:Acceleration time 0] and [Pr.10:Deceleration time 0]. For details, refer to the items of Basic parameters 2.

In Positioning Data (point table) setting, select acceleration/deceleration time 0 to 3.

[Pr.31:JOG speed limit value]

Set the upper speed limit for JOG operation.

[Pr.32:JOG operation acceleration time selection]

Select the acceleration time for JOG operation from acceleration time 0 to 3.

[Pr.33:JOG operation deceleration time selection]

Select the deceleration time for JOG operation from deceleration time 0 to 3.

3.4.2 Parameters (Axis parameters)

Home position return parameters

Set the parameters related to home position return. The parameters in the red frame are described below.

Item	Axis #1	Axis #2
HPR parameters	Set the parameters required for HPR, which are not set on the driver (servo amplif...	
Pr.44:HPR direction	0:Forward Direction (Address Increase Direction)	0:Forward Direction (Address Increase Direction)
Pr.45:HP address	0.0 μm	0.0 μm
Pr.46:HPR speed	0.01 mm/min	0.01 mm/min
Pr.51:HPR acceleration time selection	0:1500	0:1500
Pr.52:HPR deceleration time selection	0:1500	0:1500
Pr.55:Operation setting for incompletion of ...	0:Positioning Control is Not Executed	0:Positioning Control is Not Executed

[Pr.45:Home position address]

When the machine home position return is finished, the address of the stop position is changed to the address set here. At the same time, it is stored in [Md.20: Feed current value] and [Md.21: Machine feed value].

[Pr.46:Home position return speed]

Set the travel speed when high-speed home position return (positioning number 9002) is executed.

[Pr.51:Home position return acceleration time selection], [Pr.52:Home position return deceleration time selection]

Select the acceleration/deceleration time when high-speed home position return (positioning number 9002) is executed from acceleration time 0 to 3 and deceleration time 0 to 3.

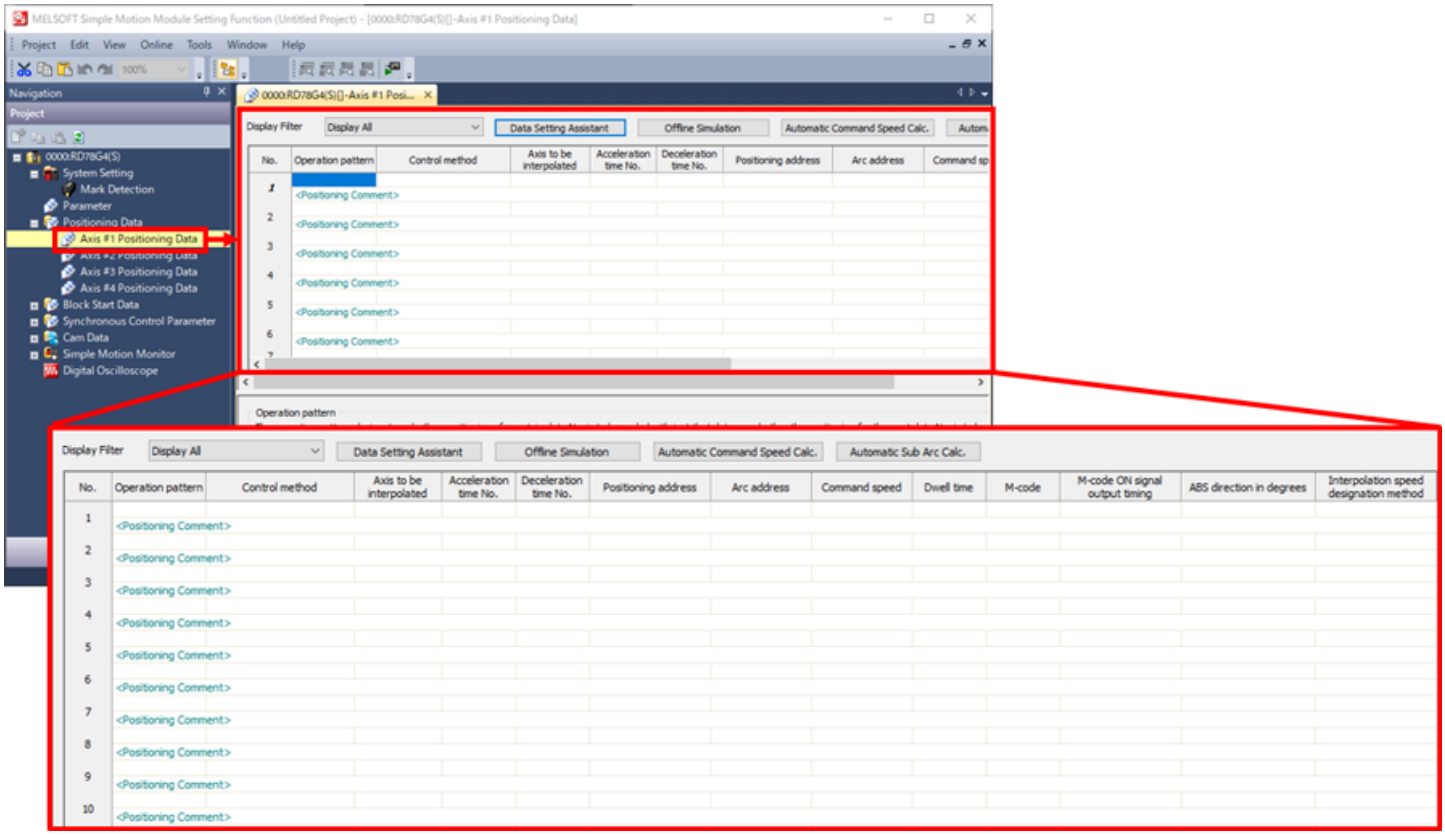
[Point]
Use the parameters of the servo amplifier to set the homing method and direction.
[Pr.46], [Pr.51], and [Pr.52] are valid only for high-speed home position return.

Extended parameters

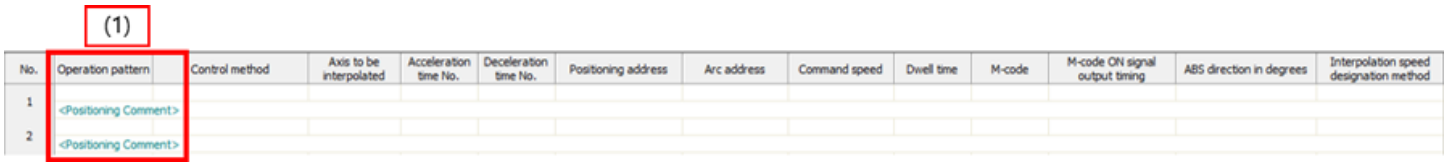
Configure the settings related to the desired data monitor function. Description of the settings is omitted in this course.

3.4.3 Positioning Data (Point table)

Set the positioning data (point table) of each axis.



3.4.3 Positioning Data (Point table)



(1) Operation pattern

Select the operation pattern from 0: END / 1: CONT / 3: LOCATION.

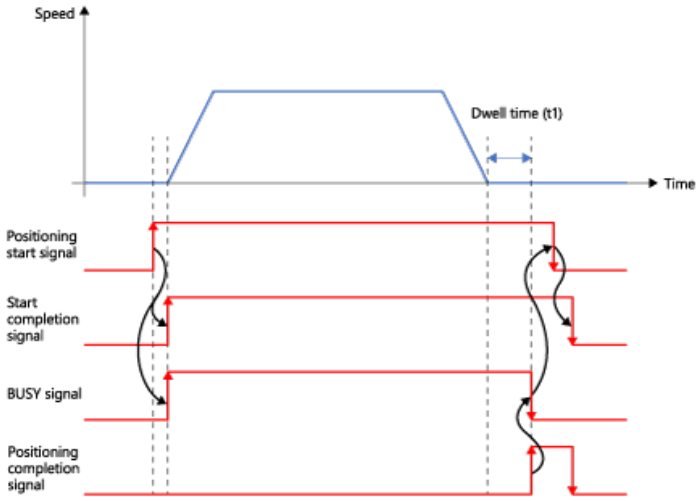
The following shows the difference of each setting when Positioning Data No. 1 is executed.

0: END

Only Positioning Data No. 1 is executed.

Processing stops at the target position.

No.	Operation pattern	Control method	・・・	Dwell time
1	0: END	01: ABS Linear 1		(t1)



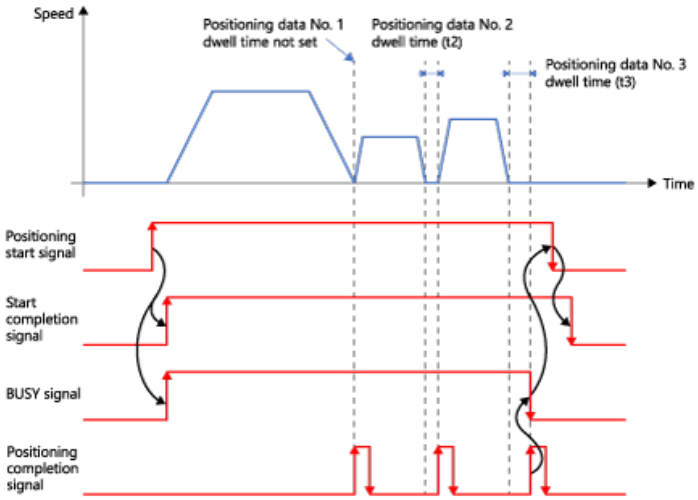
1: CONT

Positioning Data No. 1 is executed and when the machine stops at the target position, Positioning Data No. 2 is immediately executed.

Processing is repeatedly executed until the positioning data where the operation pattern is [0: END].

Processing stops at the target position.

No.	Operation pattern	Control method	・・・	Dwell time
1	1: CONT	01: ABS Linear 1		0
2	1: CONT	01: ABS Linear 1		(t2)
3	0: END	01: ABS Linear 1		(t3)



3: LOCATION

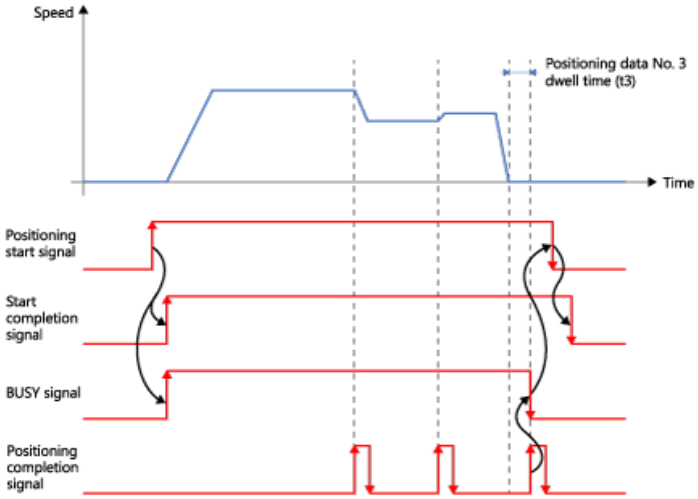
Speed is changed between the Positioning Data No. in operation and the next Positioning Data No. without deceleration stop.

Speed change is not performed when the speed is the same.

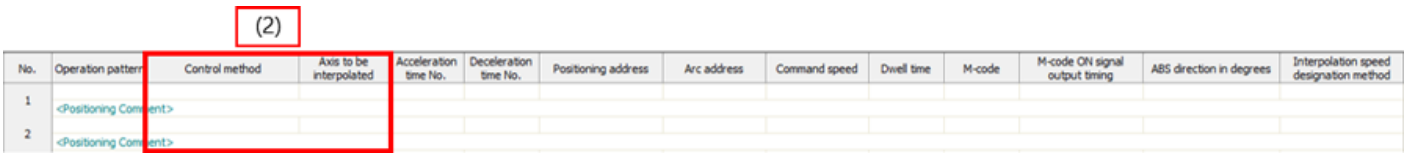
Dwell time setting in the middle of the processing is ignored.

Processing is repeatedly executed until the positioning data where the operation pattern is [0: END].

No.	Operation pattern	Control method	・・・	Dwell time
1	3: LOCATION	01: ABS Linear 1		(t1)
2	3: LOCATION	01: ABS Linear 1		(t2)
3	0: END	01: ABS Linear 1		(t3)



3.4.3 Positioning Data (Point table)



(2) Control method and axis to be interpolated

Select the control method from the following items. For the axis to be interpolated, set another axis number to be used for interpolation control.

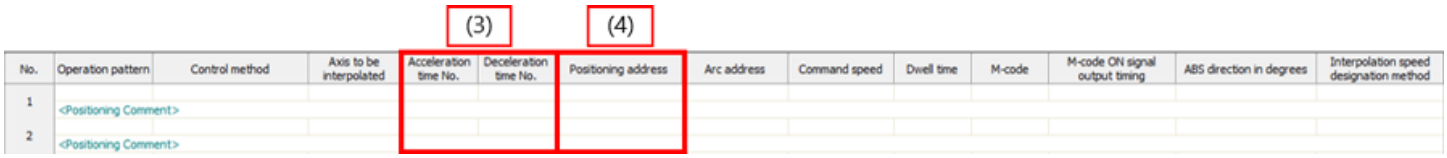
Control method	Description
01h: ABS Linear 1	1-axis linear control (ABS)
02h: INC Linear 1	1-axis linear control (INC)
03h: Feed 1	1-axis fixed-feed control
04h: FWD V1	1-axis speed control (forward)
05h: RVS V1	1-axis speed control (reverse)
06h: FWD V/P	Speed-position switching control (forward)
07h: RVS V/P	Speed-position switching control (reverse)
08h: FWD P/V	Position-speed switching control (forward)
09h: RVS P/V	Position-speed switching control (reverse)
0Ah: ABS Linear 2	2-axis linear interpolation control (ABS)
0Bh: INC Linear 2	2-axis linear interpolation control (INC)
0Ch: Feed 2	2-axis fixed-feed control
0Dh: ABS ArcMP	Circular interpolation control with sub point designation (ABS)
0Eh: INC ArcMP	Circular interpolation control with sub point designation (INC)
0Fh: ABS ArcRGT	Circular interpolation control with center point designation (ABS, CW)
10h: ABS ArcLFT	Circular interpolation control with center point designation (ABS, CCW)
11h: INC ArcRGT	Circular interpolation control with center point designation (INC, CW)
12h: INC ArcLFT	Circular interpolation control with center point designation (ABS, CCW)
13h: FWD V2	2-axis speed control (forward)
14h: RVS V2	2-axis speed control (reverse)
15h: ABS Linear 3	3-axis linear interpolation control (ABS)
16h: INC Linear 3	3-axis linear interpolation control (INC)
17h: Feed 3	3-axis fixed-feed control
18h: FWD V3	3-axis speed control (forward)
19h: RVS V3	3-axis speed control (reverse)

1Ah: ABS Linear 4	4-axis linear interpolation control (ABS)
1Bh: INC Linear 4	4-axis linear interpolation control (INC)
1Ch: Feed 4	4-axis fixed-feed control
1Dh: FWD V4	4-axis speed control (forward)
1Eh: RVS V4	4-axis speed control (reverse)
20h: ABS HldMP	Helical interpolation control with sub point designation (ABS)
21h: INC HldMP	Helical interpolation control with sub point designation (INC)
22h: ABS HldRGT	Helical interpolation control with center point designation (ABS, CW)
23h: ABS HldLFT	Helical interpolation control with center point designation (ABS, CCW)
24h: INC HldRGT	Helical interpolation control with center point designation (INC, CW)
25h: INC HldRGT	Helical interpolation control with center point designation (ABS, CCW)
80h: NOP	NOP instruction
81h: Address CHG	Current value change
82h: JUMP	JUMP instruction
83h: LOOP	Start of LOOP to LEND
84h:LEND	End of LOOP to LEND

Helical interpolation is available only for the iQ-R series Motion module.

[Point]
The interpolation control uses a set of the same number of positioning data for the reference axis and interpolation axis.
Setting examples are shown in 3.4.4.

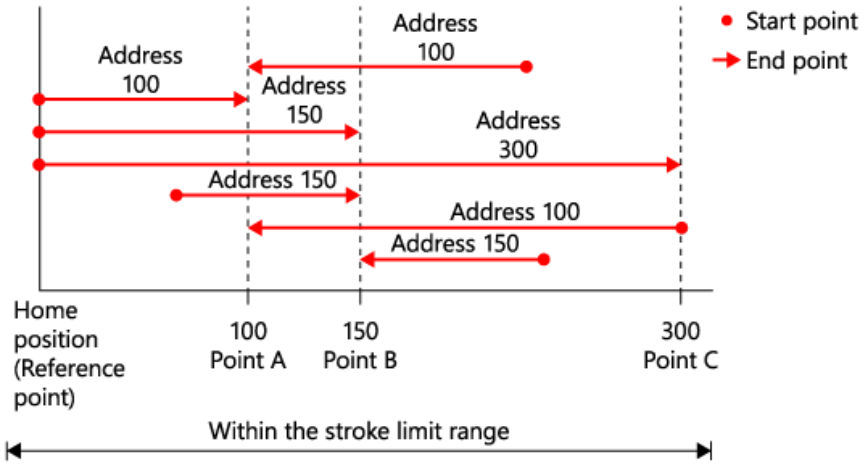
3.4.3 Positioning Data (Point table)



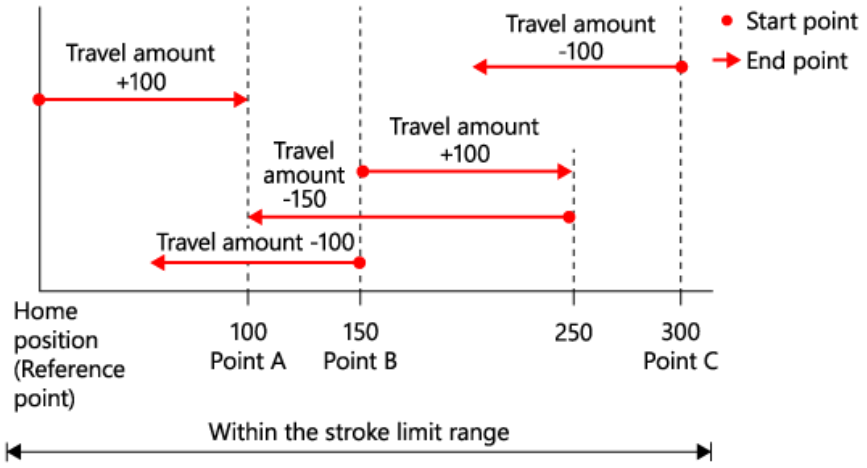
(3) Acceleration time No. and deceleration time No.
Select the acceleration time and deceleration time from Acceleration time No. 0 to 3 and deceleration time No. 0 to 3 set with the axis parameters (refer to 3.4.2).

(4) Positioning address
Set the coordinates of the target position.
The values change depending on the absolute position specification (ABS, absolute system) and relative position specification (INC, incremental system).
Refer to the following figures.

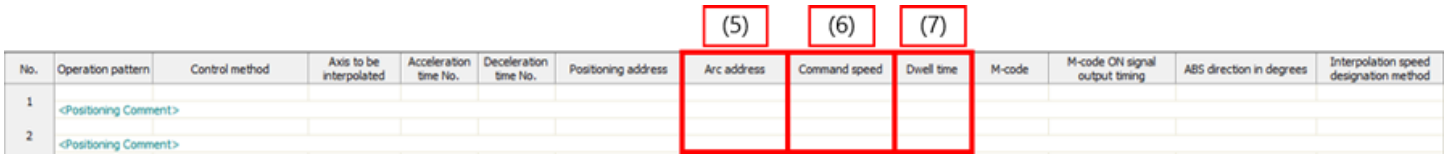
Absolute method
Positioning is carried out to a designated position (absolute address) with reference to the home position.
This address is regarded as the positioning address. (The start point can be anywhere.)



Incremental system
The position where the machine is currently stopped is regarded as the start point, and positioning is carried out for a designated movement amount in a designated movement direction.



3.4.3 Positioning Data (Point table)



							(5)	(6)	(7)				
No.	Operation pattern	Control method	Axis to be interpolated	Acceleration time No.	Deceleration time No.	Positioning address	Arc address	Command speed	Dwell time	M-code	M-code ON signal output timing	ABS direction in degrees	Interpolation speed designation method
1	<Positioning Comment>												
2	<Positioning Comment>												

(5) Arc address

The values to be input change depending on the circular interpolation method.

ArcMP ····· Input the coordinates of the sub point.

ArcRGT/ArcLFT ··· Input the coordinates of the center point.

Setting examples are shown in 3.4.4.

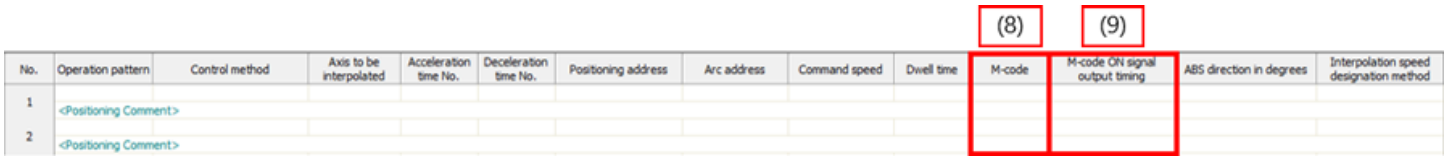
(6) Command speed

Set the command speed for positioning control. Input a value less than or equal to the speed limit.

(7) Dwell time

Set the dwell time (time from completion of positioning until the positioning completion signal is turned on) in milliseconds.

3.4.3 Positioning Data (Point table)



(8) M code

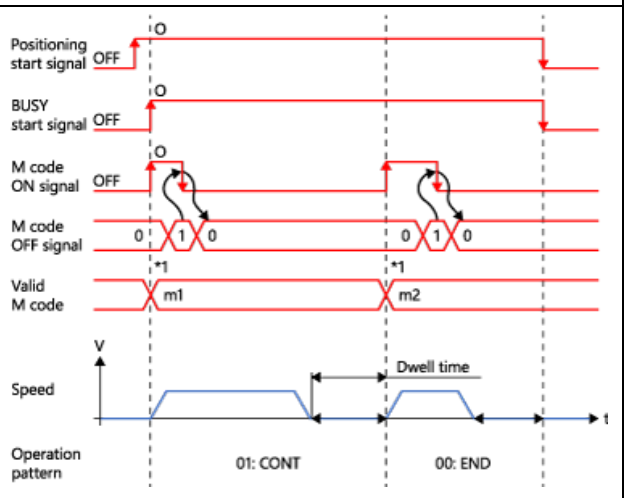
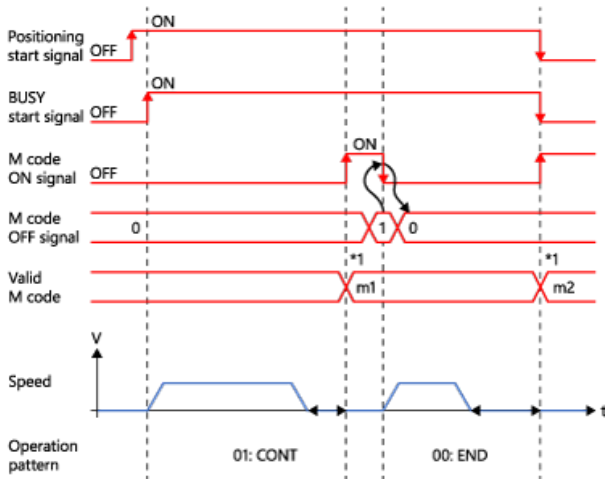
M code is a code number between 0 to 65535 that can be set for each positioning control.

It is used to command auxiliary operation such as clamping, drill rotation, and tool change related to the positioning data being executed.

M codes are read from the CPU module and used to command auxiliary operation.

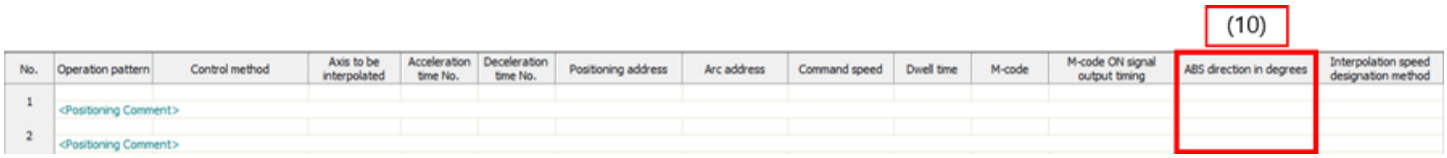
(9) M code ON signal output timing (only for the iQ-R series Motion module)

The output (storage) timing of M codes can be set.

Setting value	Description	Timing chart
0: Uses the setting value of M code ON signal output timing	Follows the setting value of the axis parameter [Pr.18].	[Pr.18] is 0: WITH Mode (Initial value). [Pr.18] is 1: AFTER Mode.
1: WITH Mode	Turns on the M code ON signal at the start of positioning and stores the M code in the buffer memory.	
2: AFTER Mode	Turns on the M code ON signal at the end of positioning and stores the M code in the buffer memory.	

*1 m1 and m2 are M codes set in the positioning data.

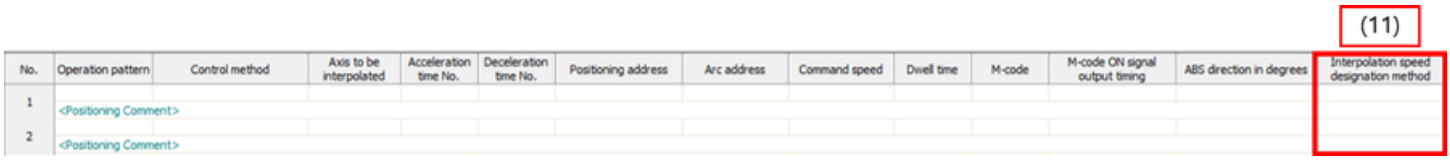
3.4.3 Positioning Data (Point table)



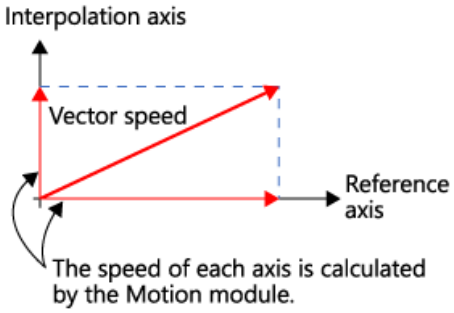
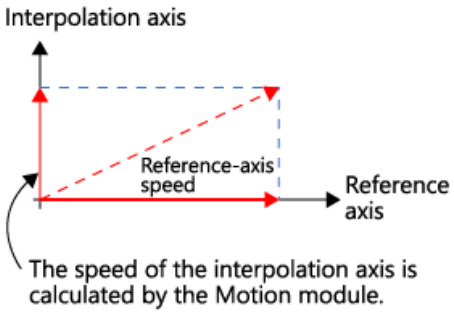
(10) ABS direction in degrees (only for the iQ-R series Motion module)
Set the operation of ABS positioning when the control unit is degree and the software stroke limit is disabled.

Setting value	Description	Operation image
0: Uses the setting value of ABS direction in degrees	Uses the setting of [Cd.40].	[Cd.40] is 0: Shortcut. (Initial value) [Cd.40] is 1: ABS Clockwise. [Cd.40] is 2: ABS Counterclockwise.
1: ABS Clockwise	Always travels clockwise.	315° to 45° 315° 45° 45° to 315° 315° 45°
2: ABS Counterclockwise	Always travels counterclockwise.	315° to 45° 315° 45° 45° to 315° 315° 45°
3: Shortcut (Direction setting invalid)	Travels in the closest direction to the specified address.	315° to 45° 315° 45° 45° to 315° 315° 45°

3.4.3 Positioning Data (Point table)



(11) Interpolation speed designation method (only for the iQ-R series Motion module)
Select whether to set the command speed to vector speed or reference axis (major axis) speed during interpolation control.

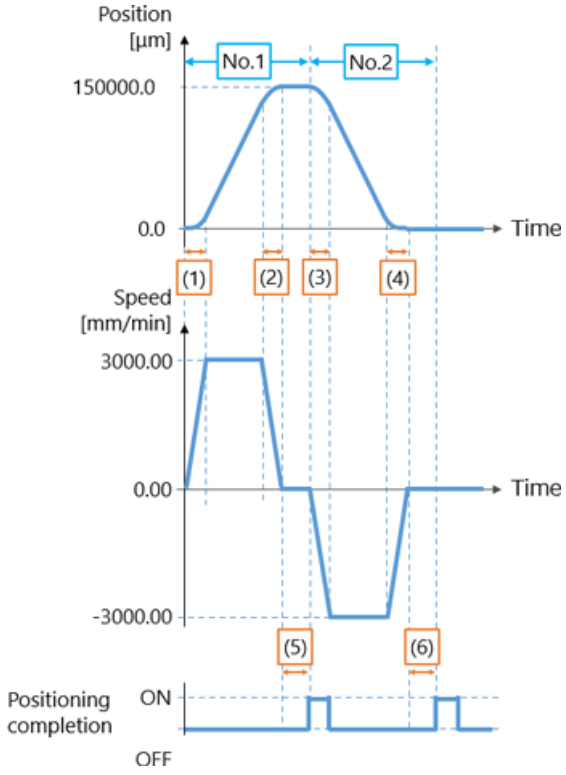
Setting value	Description	Operation image
0: Uses the setting value of Interpolation speed designation method	Follows the setting value of the axis parameter [Pr.20].	[Pr.20] is 0: Vector speed. (Initial value) [Pr.20] is 1: Reference-axis speed.
1: Vector speed	The movement speed for the control target is designated, and the speed for each axis is calculated by the Motion module.	
2: 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 Motion module.	

3.4.4 Setting examples of positioning data

This section provides setting examples of positioning data.

(1) Single axis positioning

The following shows the setting examples for the operation pattern shown below.



Absolute position specification

For both axis 1 and axis 2, data is registered in positioning data No. 1 and 2 of the sample program.

(Note)

No.	Operation pattern	Control method	Axis to be interpolated	Acceleration time No.	Deceleration time No.	Positioning address	Arc address	Command speed	Dwell time
				(1)	(2)			(5)	
1	1:CONT	01h:ABS Linear 1	-	0:1500	0:1500	150000.0 μm	0.0 μm	3000.00 mm/min	500 ms
	<Positioning Comment>			(3)	(4)			(6)	
2	0:END	01h:ABS Linear 1	-	0:1500	0:1500	0.0 μm	0.0 μm	3000.00 mm/min	500 ms
	<Positioning Comment>								

The positioning address is specified based on the absolute position.

Relative position specification

(Note)

No.	Operation pattern	Control method	Axis to be interpolated	Acceleration time No.	Deceleration time No.	Positioning address	Arc address	Command speed	Dwell time
				(1)	(2)			(5)	
1	1:CONT	02h:INC Linear 1	-	0:1500	0:1500	150000.0 μm	0.0 μm	3000.00 mm/min	500 ms
	<Positioning Comment>			(3)	(4)			(6)	
2	0:END	02h:INC Linear 1	-	0:1500	0:1500	-150000.0 μm	0.0 μm	3000.00 mm/min	500 ms
	<Positioning Comment>								

For the positioning address, specify the travel amount from the current position in the positive/negative direction.

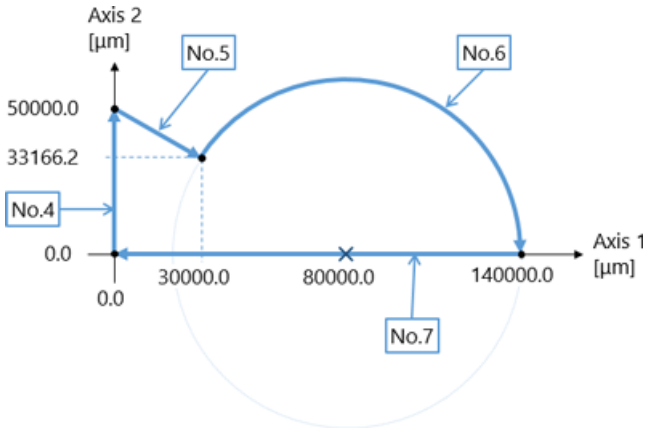
(Note) Acceleration time and deceleration time set here are the time required to reach the axis parameter [Pr.8:Speed limit value] from speed 0.
When the command speed is less than the speed limit, the actual acceleration time and deceleration time are shorter than the time set here. (Refer to 3.4.2 Axis parameters - Basic parameters 2.)

(2) Interpolation control

The following shows the setting examples for the operation pattern shown below.

The interpolation control uses a set of the same number of positioning data for the reference axis and interpolation axis.

When the interpolation control command is input to the control method for the point table of the reference axis, some fields of the same number in the point table of the interpolation axis are automatically displayed in yellow and reserved.



Absolute position specification

The positioning address (coordinates of the target point) and arc address (coordinates of the center point) of the circular interpolation area are as follows.

Positioning address (14000.0, 0.0), center point address (80000.0, 0.0)

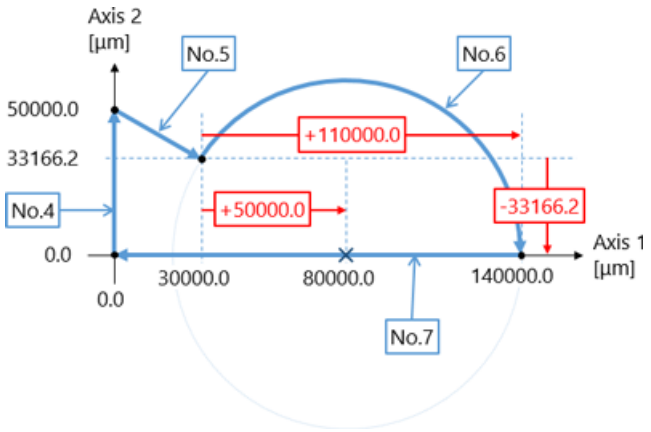
In this setting example, the command speed changes depending on the setting of the axis parameter [Pr.20].

[Axis 1]

No.	Operation pattern	Control method	Axis to be interpolated	Acceleration time No.	Deceleration time No.	Positioning address	Arc address	Command speed	Dwell time	M-code	M-code ON signal output timing	ABS direction in degrees	Interpolation speed designation method
4	3:LOCATION	0Ah:ABS Linear 2	#2	0:1500	0:1500	0.0 µm	0.0 µm	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
	<Positioning Comment>												
5	3:LOCATION	0Ah:ABS Linear 2	#2	0:1500	0:1500	30000.0 µm	0.0 µm	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
	<Positioning Comment>												
6	3:LOCATION	0Fh:ABS ArcRGT	#2	0:1500	0:1500	140000.0 µm	80000.0 µm	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
	<Positioning Comment>												
7	0:END	0Ah:ABS Linear 2	#2	0:1500	0:1500	0.0 µm	0.0 µm	3000.00 mm/min	500 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
	<Positioning Comment>												

[Axis 2]

No.	Operation pattern	Control method	Axis to be interpolated	Acceleration time No.	Deceleration time No.	Positioning address	Arc address	Command speed	Dwell time	M-code	M-code ON signal output timing	ABS direction in degrees	Interpolation speed designation method
4						50000.0 µm	0.0 µm	0.00 mm/min		0			
	<Positioning Comment>												
5						33166.2 µm	0.0 µm	0.00 mm/min		0			
	<Positioning Comment>												
6						0.0 µm	0.0 µm	0.00 mm/min		0			
	<Positioning Comment>												
7						0.0 µm	0.0 µm	0.00 mm/min		0			
	<Positioning Comment>												



Relative position specification

Data is registered in positioning data No. 4 to 7 of the sample program.

The positioning address (coordinates of the target point) and arc address (coordinates of the center point) of the circular interpolation area are as follows.
The coordinates of the center point are also set relative to the start point.
Positioning address (11000.0, -33166.2), arc address (50000.0, -33166.2)

In this setting example, the command speed changes depending on the setting of the axis parameter [Pr.20].

[Axis 1]

No.	Operation pattern	Control method	Axis to be interpolated	Acceleration time No.	Deceleration time No.	Positioning address	Arc address	Command speed	Dwell time	M-code	M-code ON signal output timing	ABS direction in degrees	Interpolation speed designation method
4	3:LOCATION	0Bh:INC Linear 2	#2	0:1500	0:1500	0.0 µm	0.0 µm	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
	<Positioning Comment>												
5	3:LOCATION	0Bh:INC Linear 2	#2	0:1500	0:1500	30000.0 µm	0.0 µm	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
	<Positioning Comment>												
6	3:LOCATION	11h:INC ArcRGT	#2	0:1500	0:1500	110000.0 µm	50000.0 µm	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
	<Positioning Comment>												
7	0:END	0Bh:INC Linear 2	#2	0:1500	0:1500	-140000.0 µm	0.0 µm	3000.00 mm/min	500 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
	<Positioning Comment>												

[Axis 2]

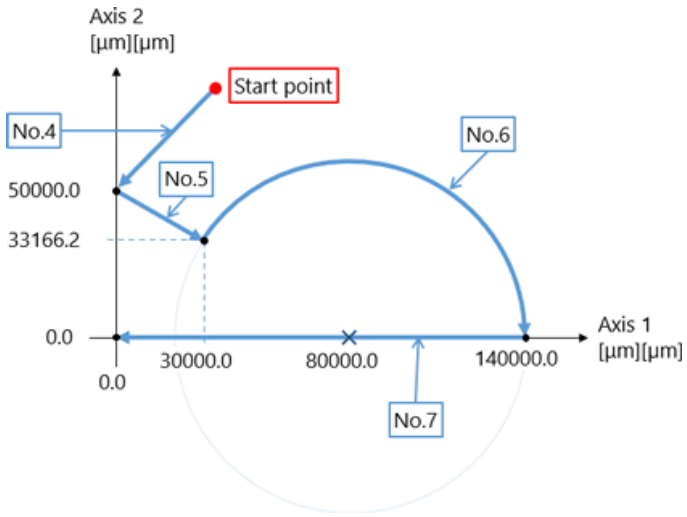
No.	Operation pattern	Control method	Axis to be interpolated	Acceleration time No.	Deceleration time No.	Positioning address	Arc address	Command speed	Dwell time	M-code	M-code ON signal output timing	ABS direction in degrees	Interpolation speed designation method
4						50000.0 µm	0.0 µm	0.00 mm/min		0			
	<Positioning Comment>												
5						-16833.3 µm	0.0 µm	0.00 mm/min		0			
	<Positioning Comment>												
6						-33166.2 µm	-33166.2 µm	0.00 mm/min		0			
	<Positioning Comment>												
7						0.0 µm	0.0 µm	0.00 mm/min		0			
	<Positioning Comment>												

(3) Notes on interpolation control

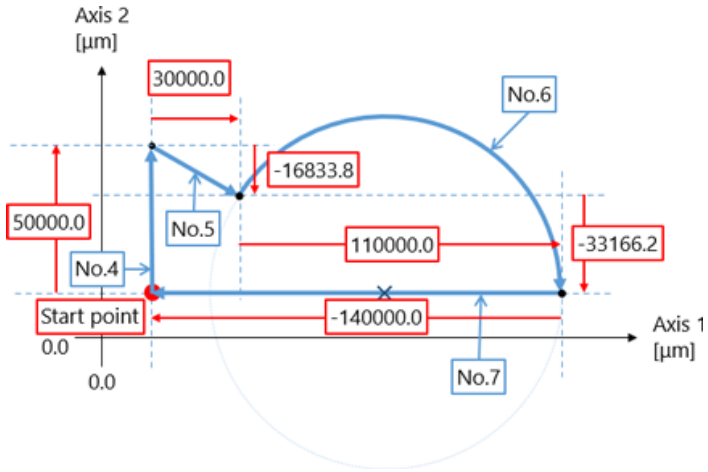
When positioning data for interpolation control is created based on the absolute position specification, the point positioned to the specified coordinates regardless of the operation start point.

Therefore, for example, when interpolation control based on the absolute position specification set on the previous page is started from a point other than the home position (0.0, 0.0), the axis is always moved to the point (0.0, 50000.0) by the first positioning (No. 4).

In this case, the path is as follows.

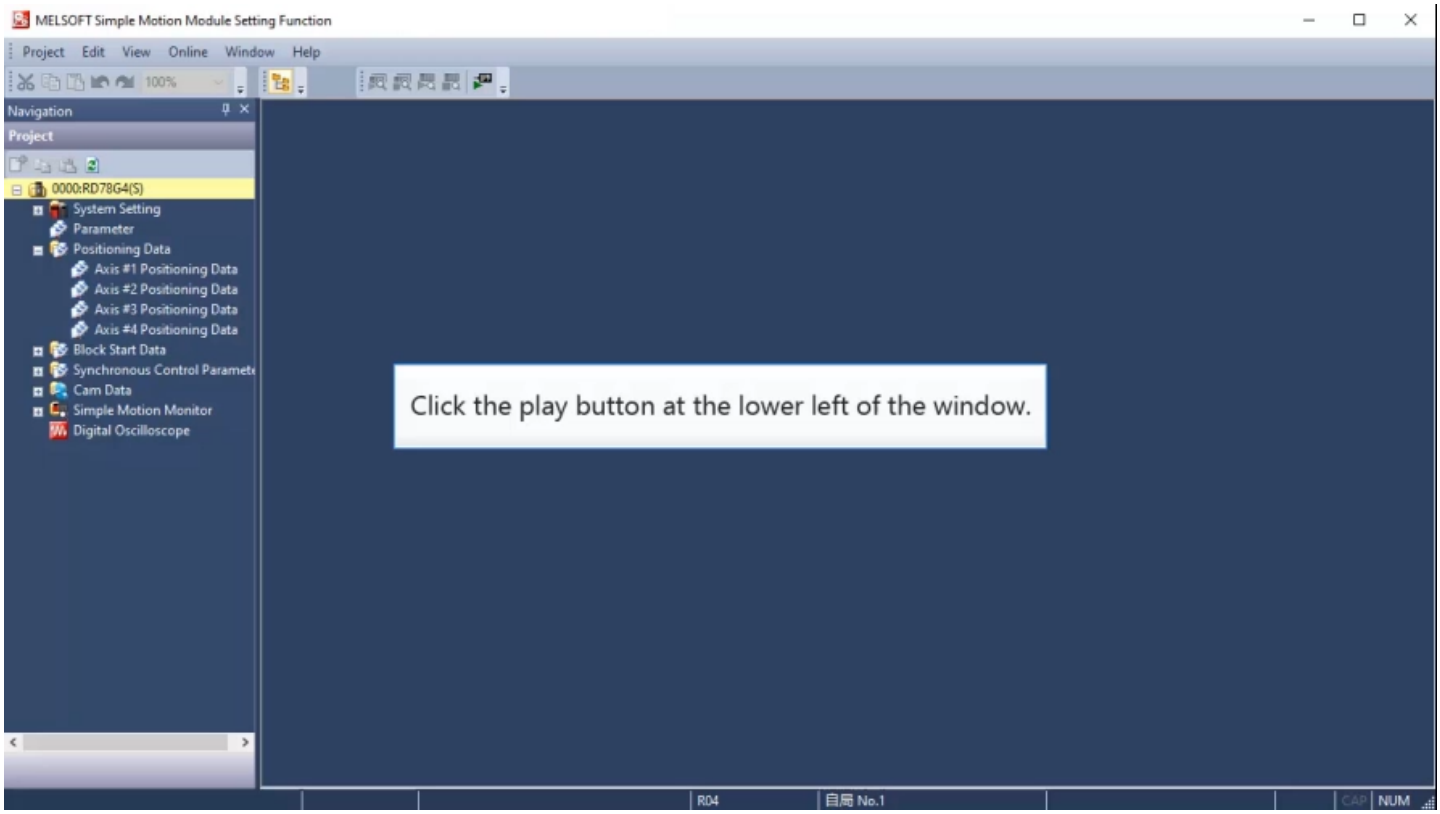


To plot the same path regardless of the coordinates of the start point, create positioning data based on the relative position specification.



3.4.5 Data Setting Assistant

Data Setting Assistant allows the user to easily set the positioning data for interpolation control.



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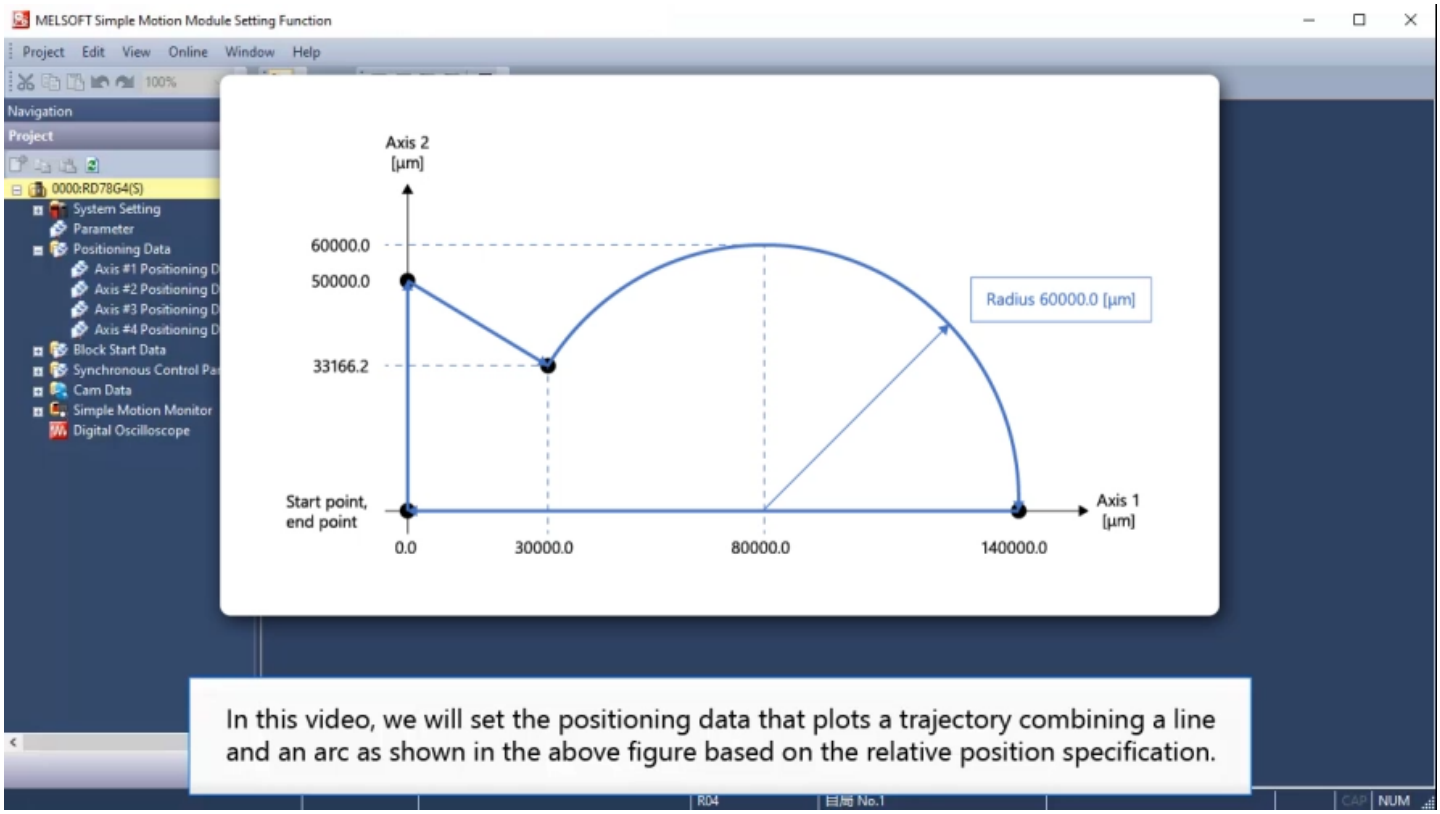

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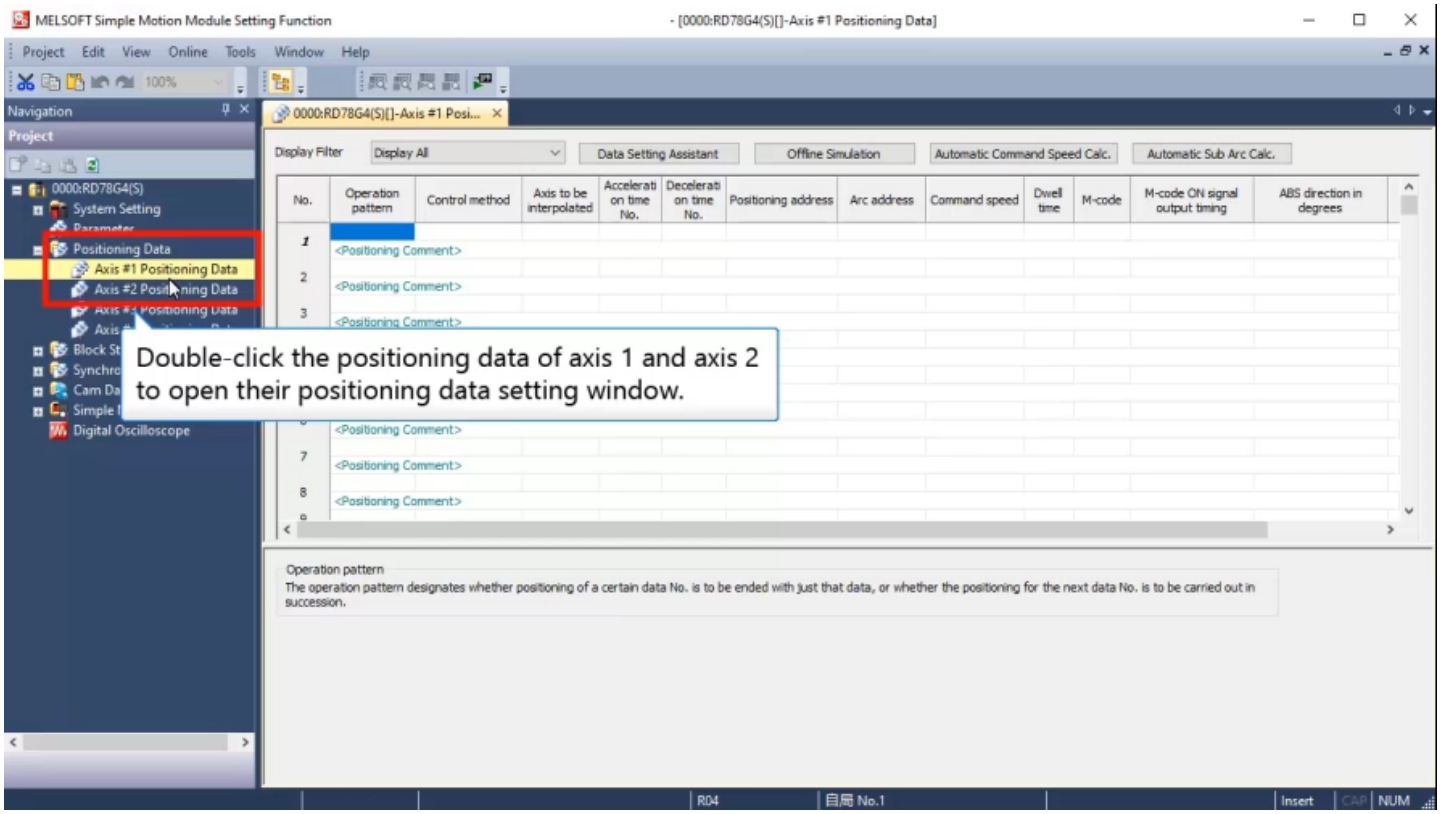

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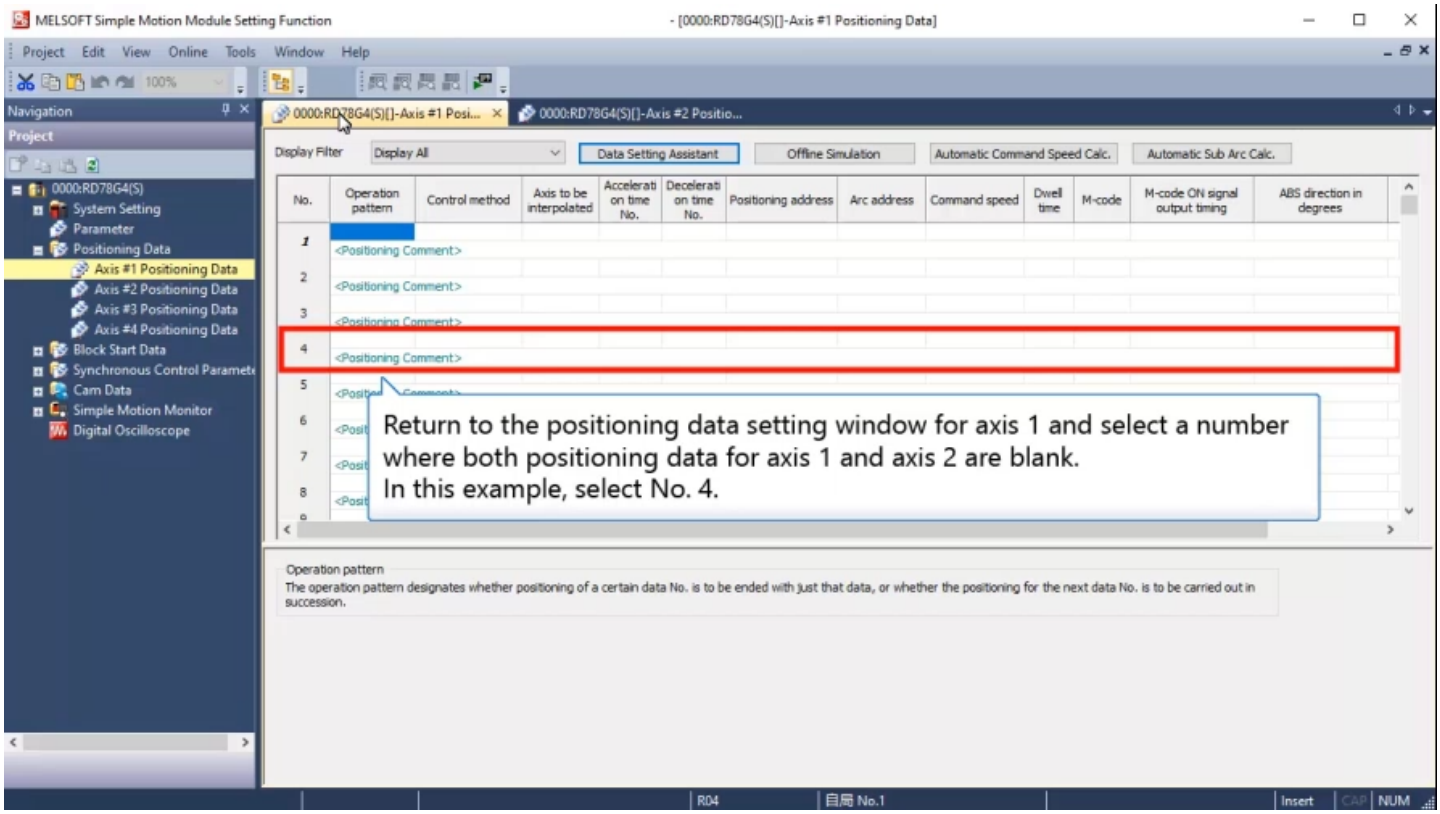

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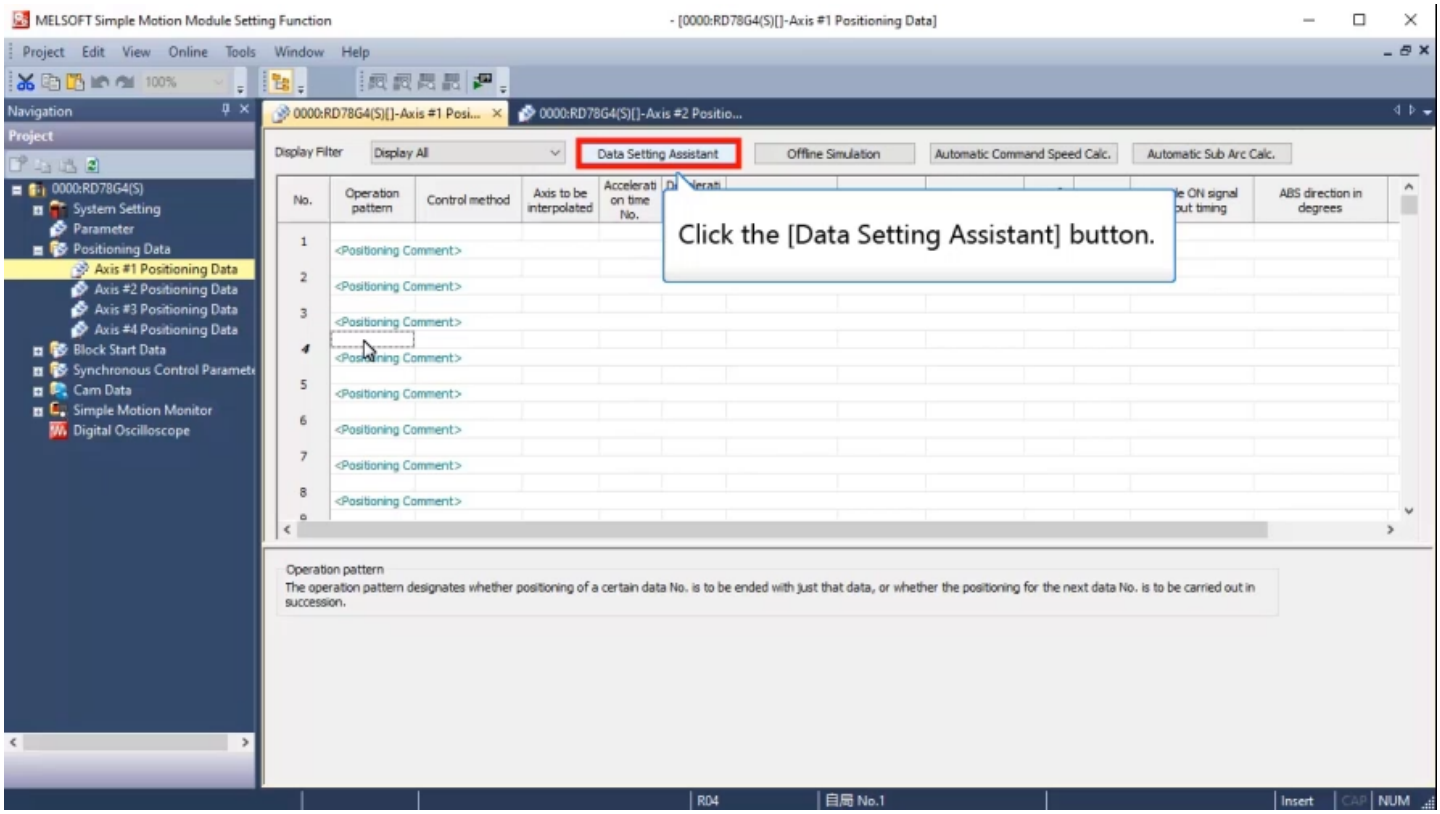

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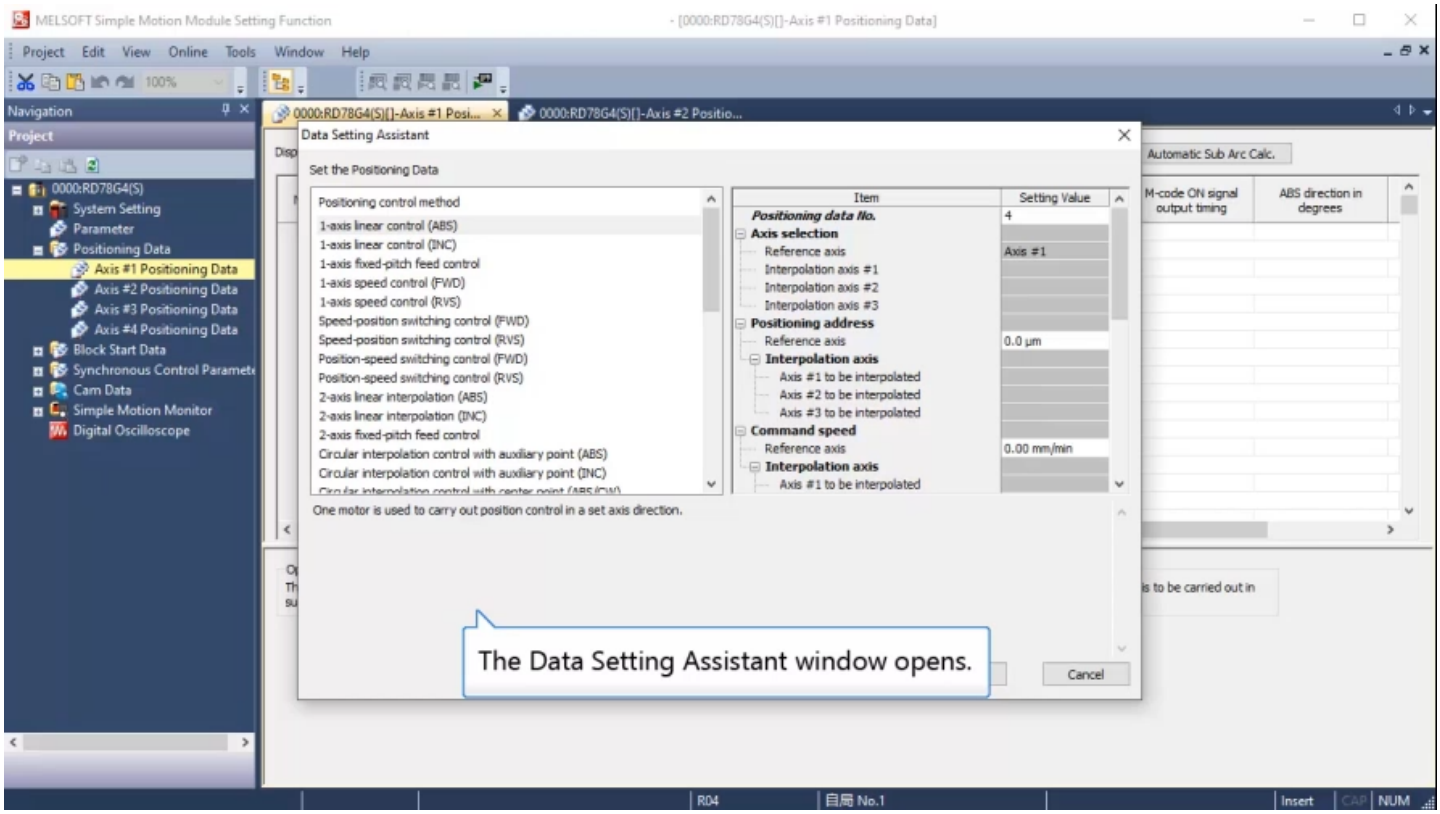

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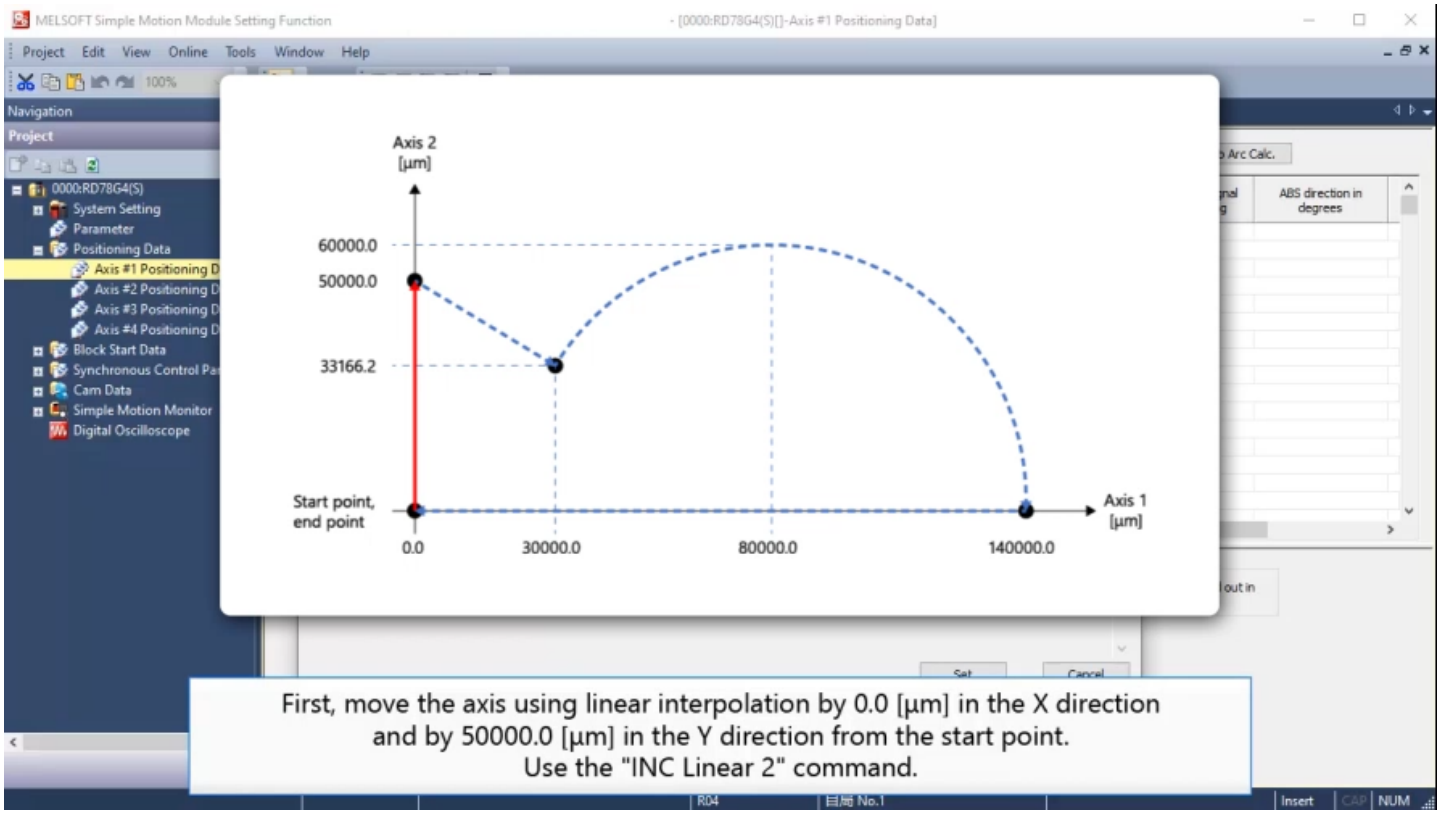

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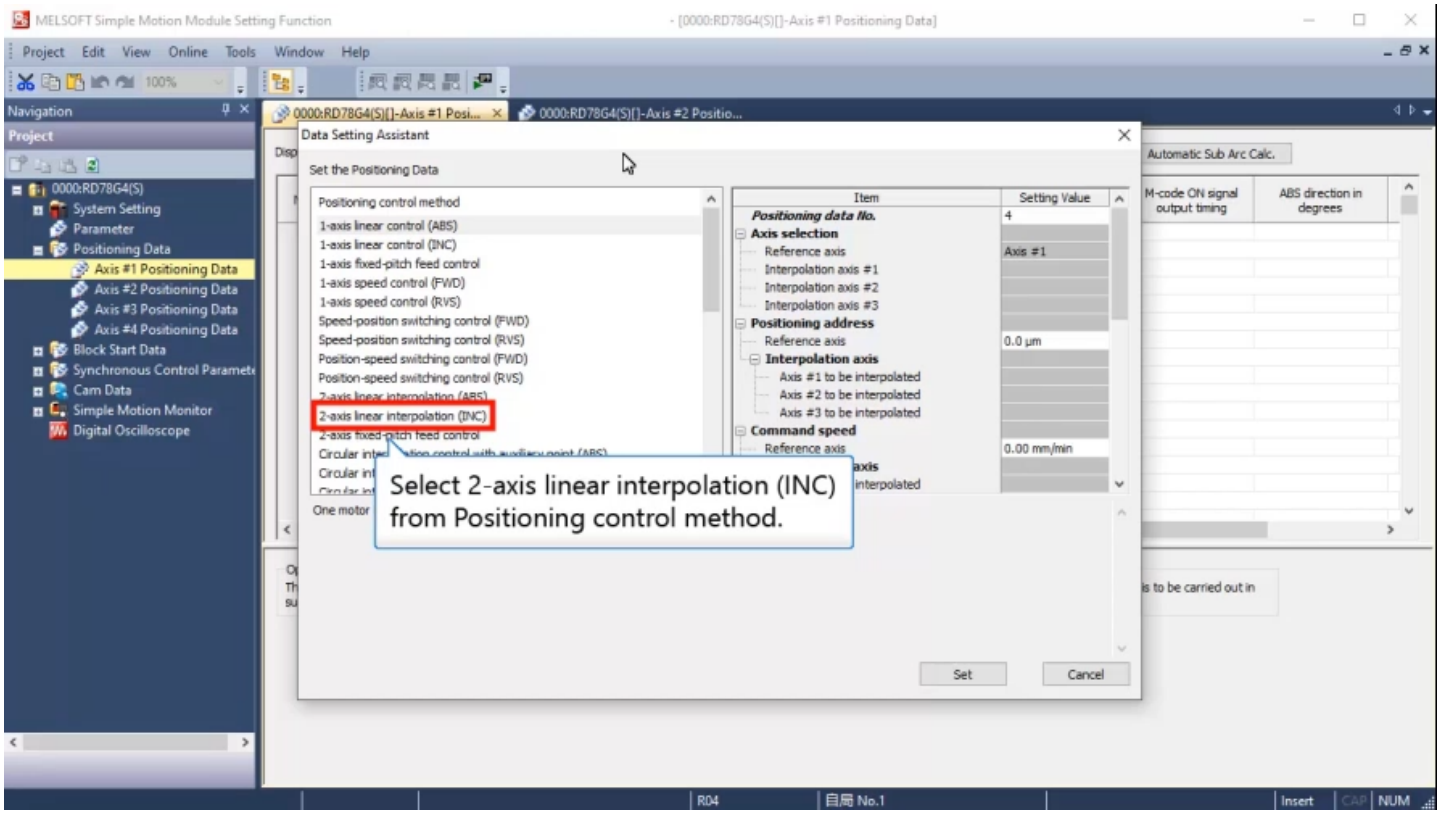

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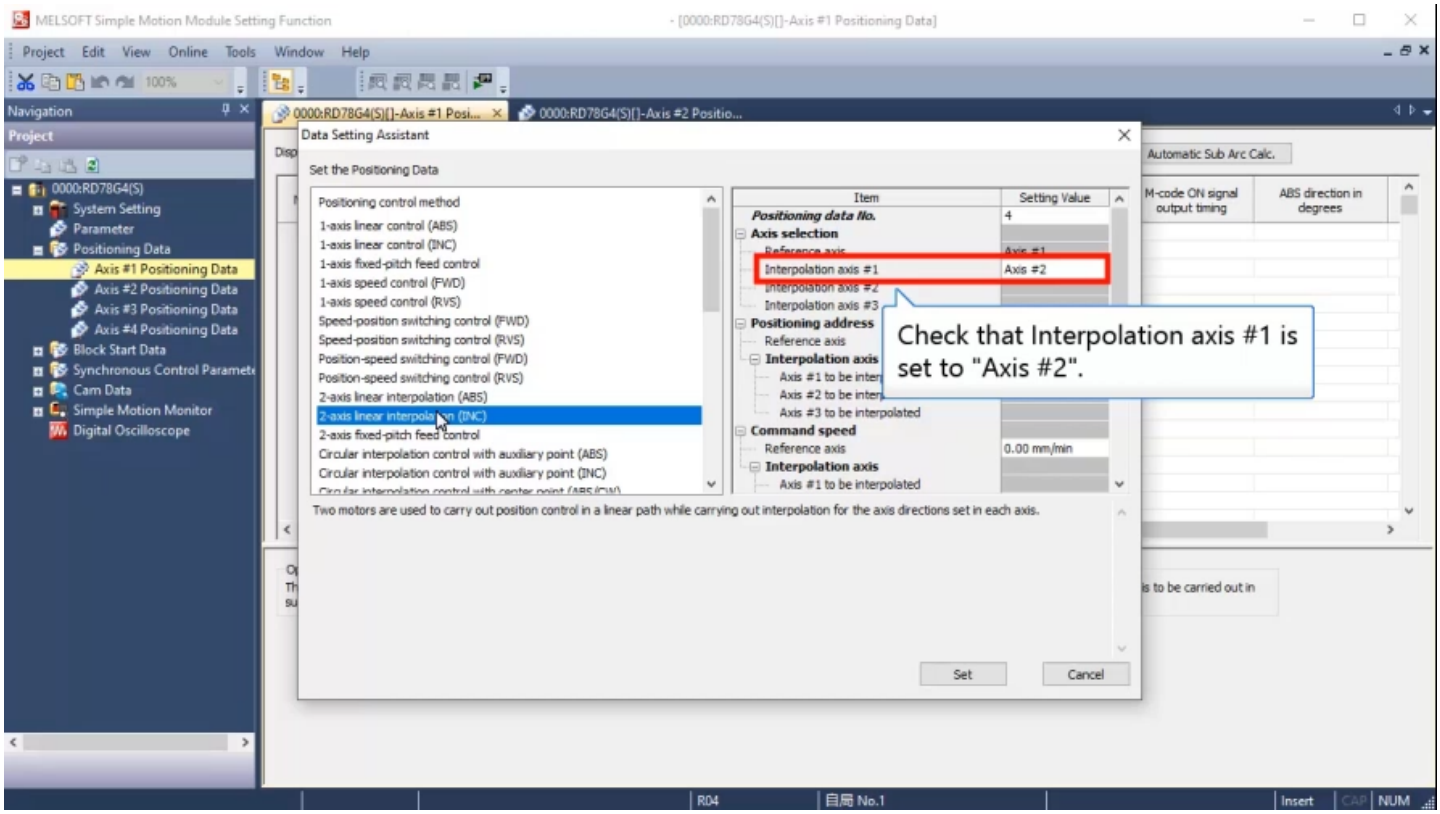

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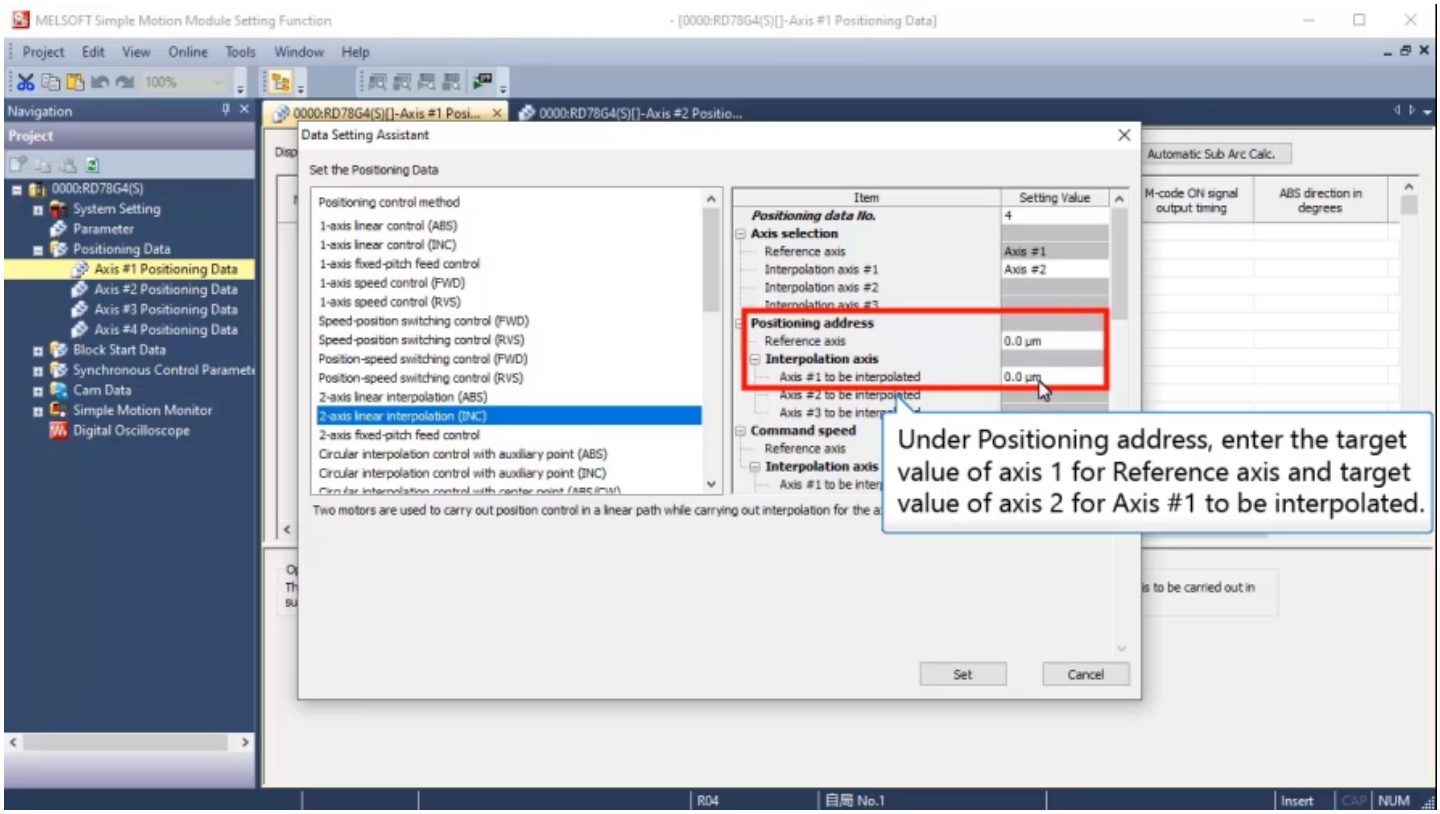

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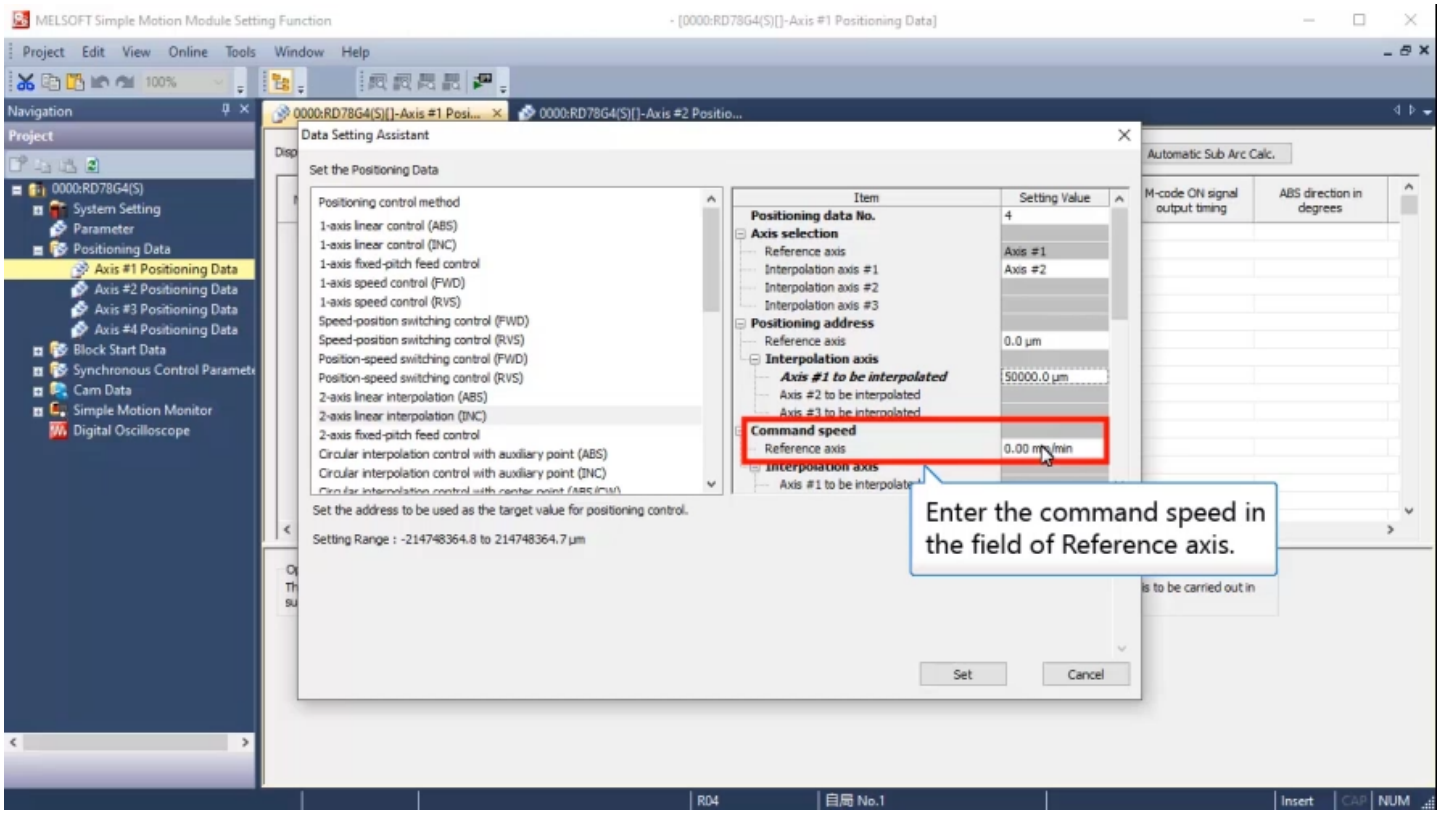

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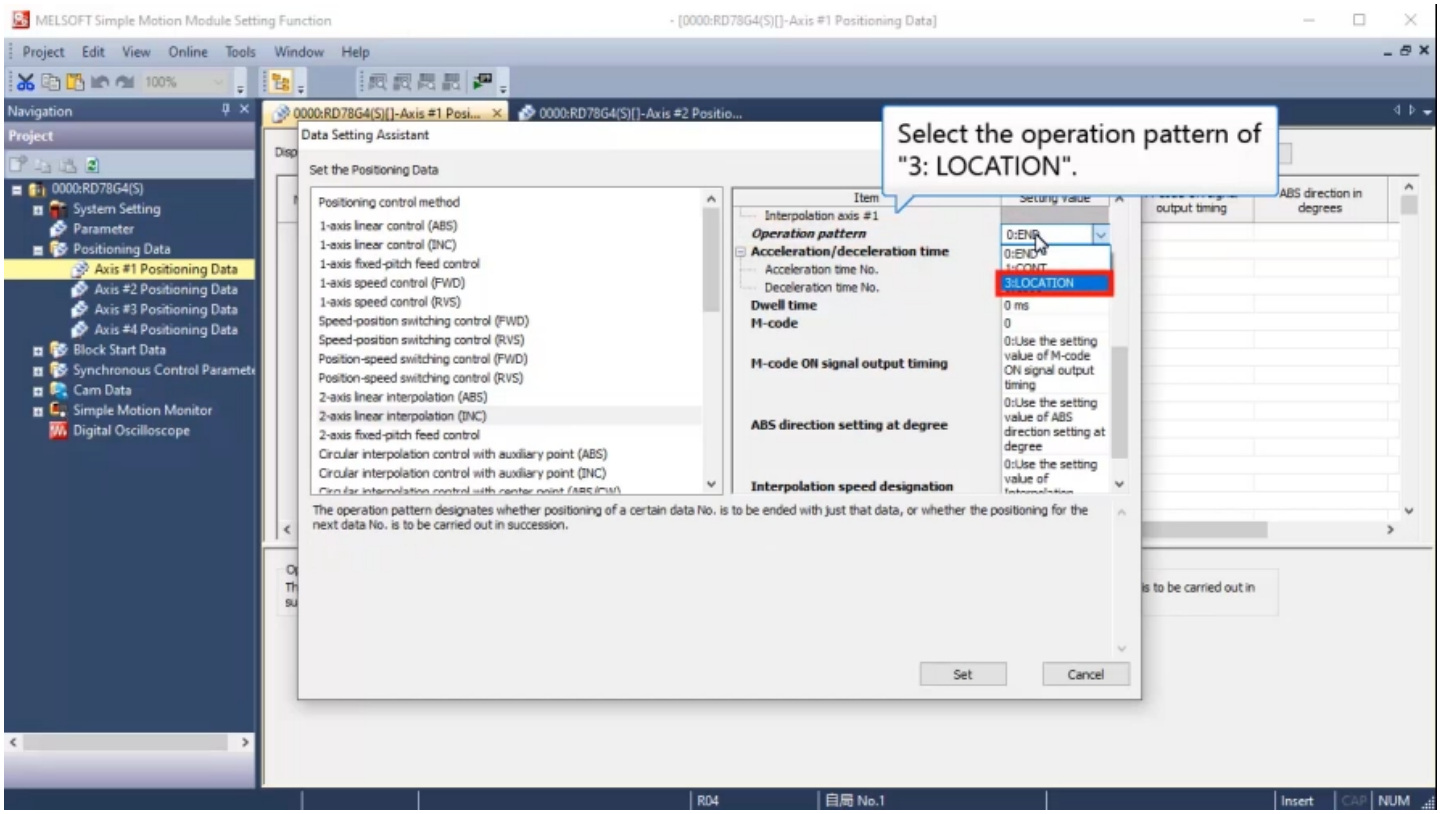

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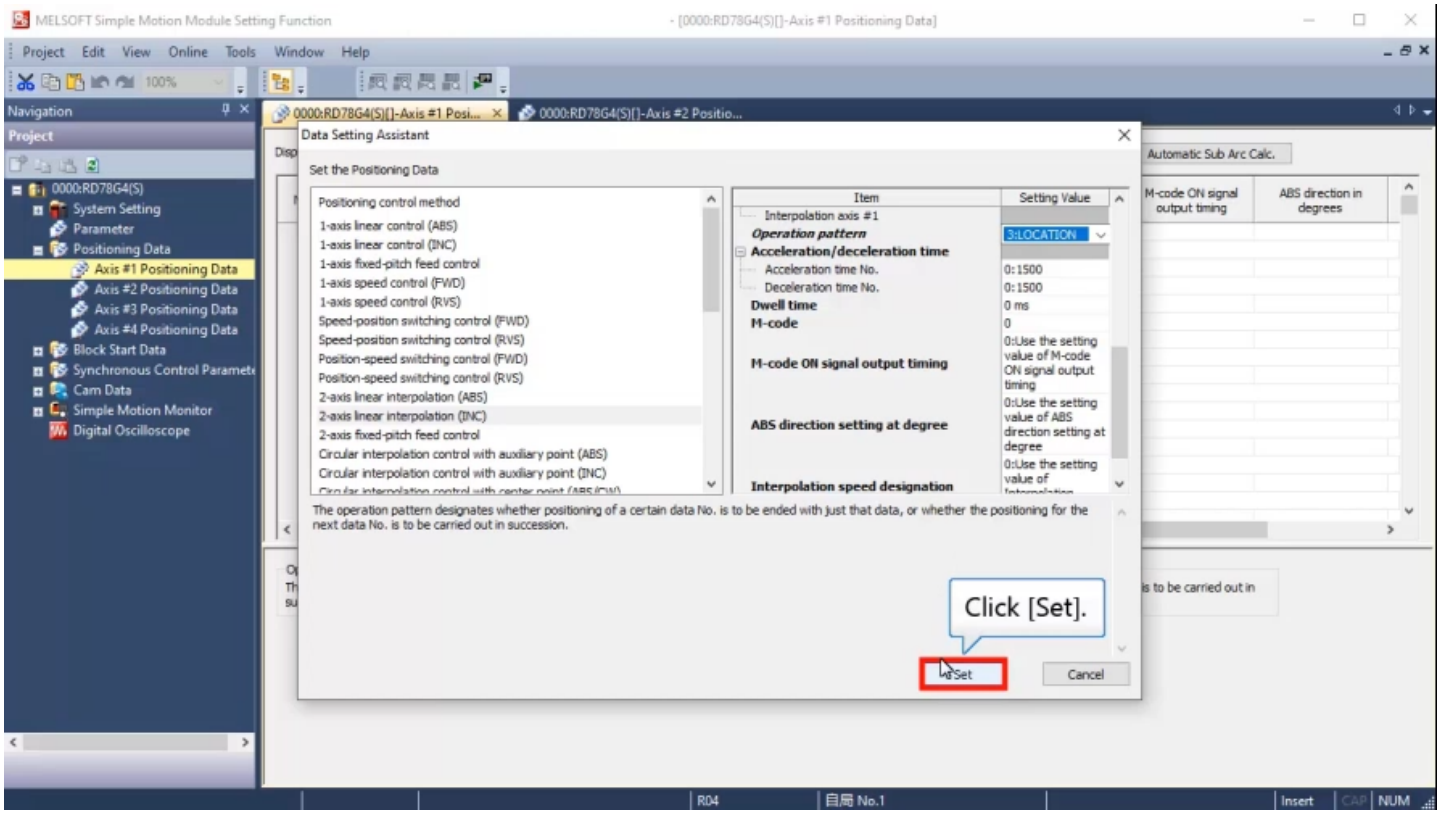

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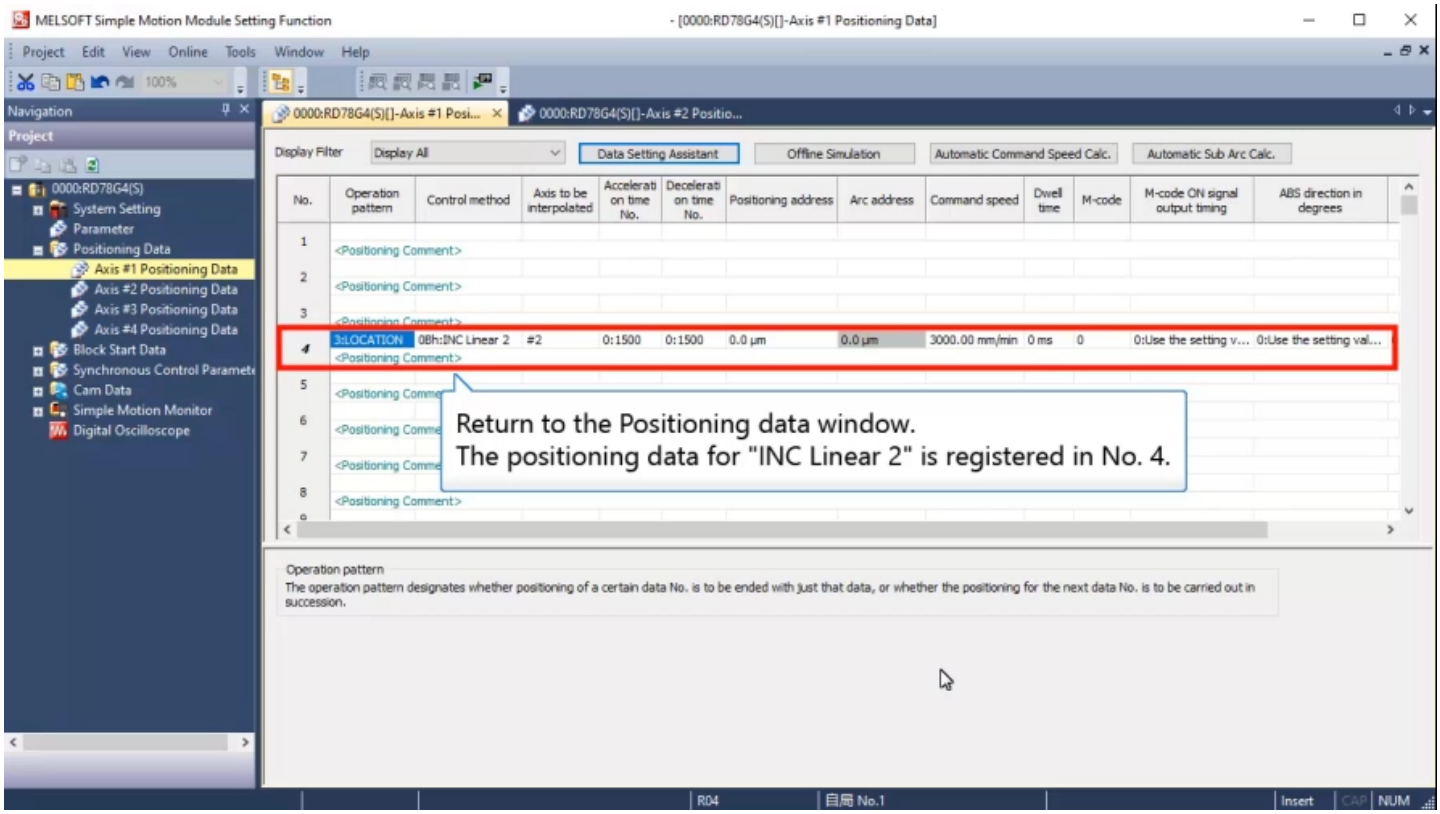

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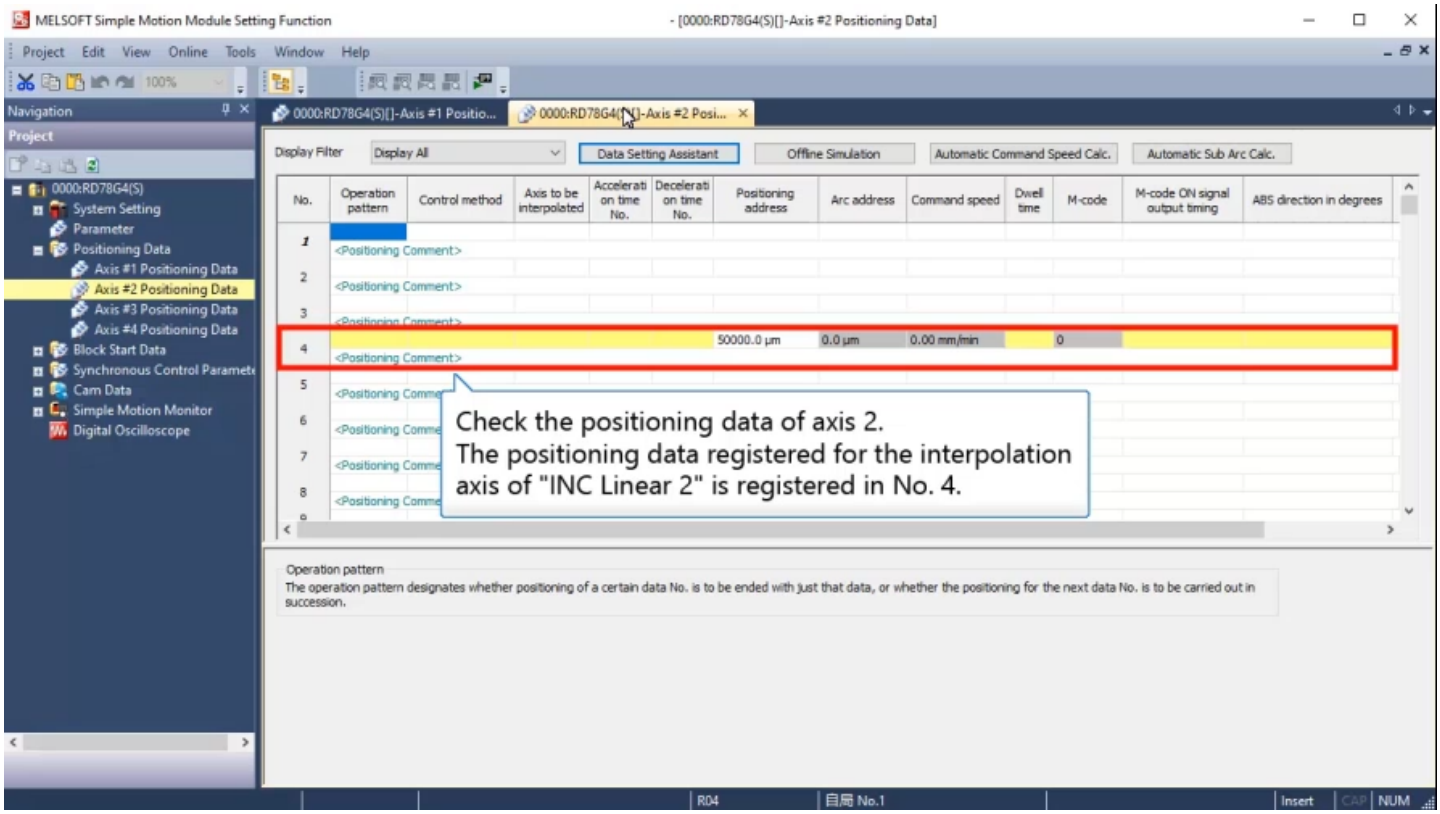

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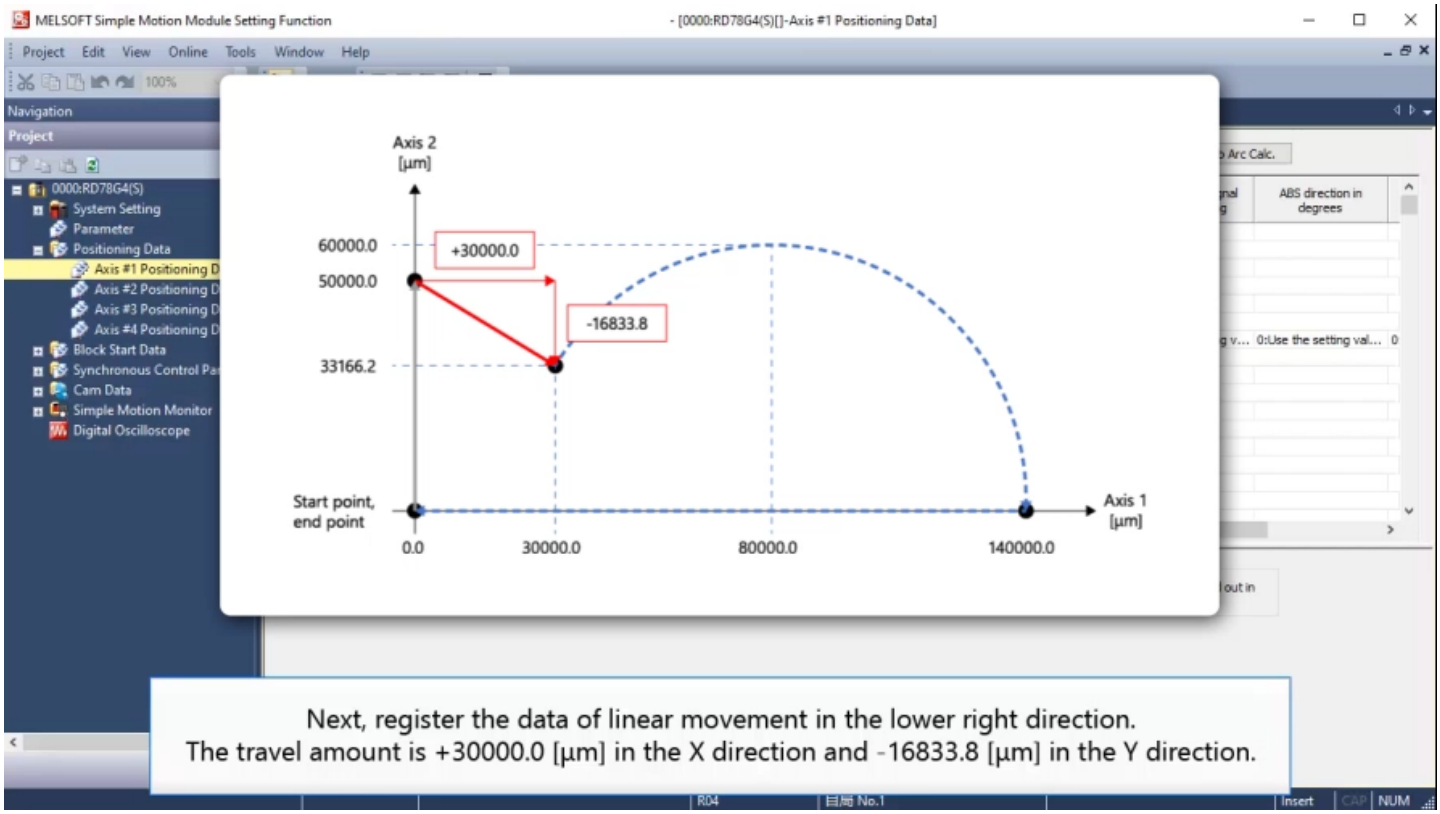

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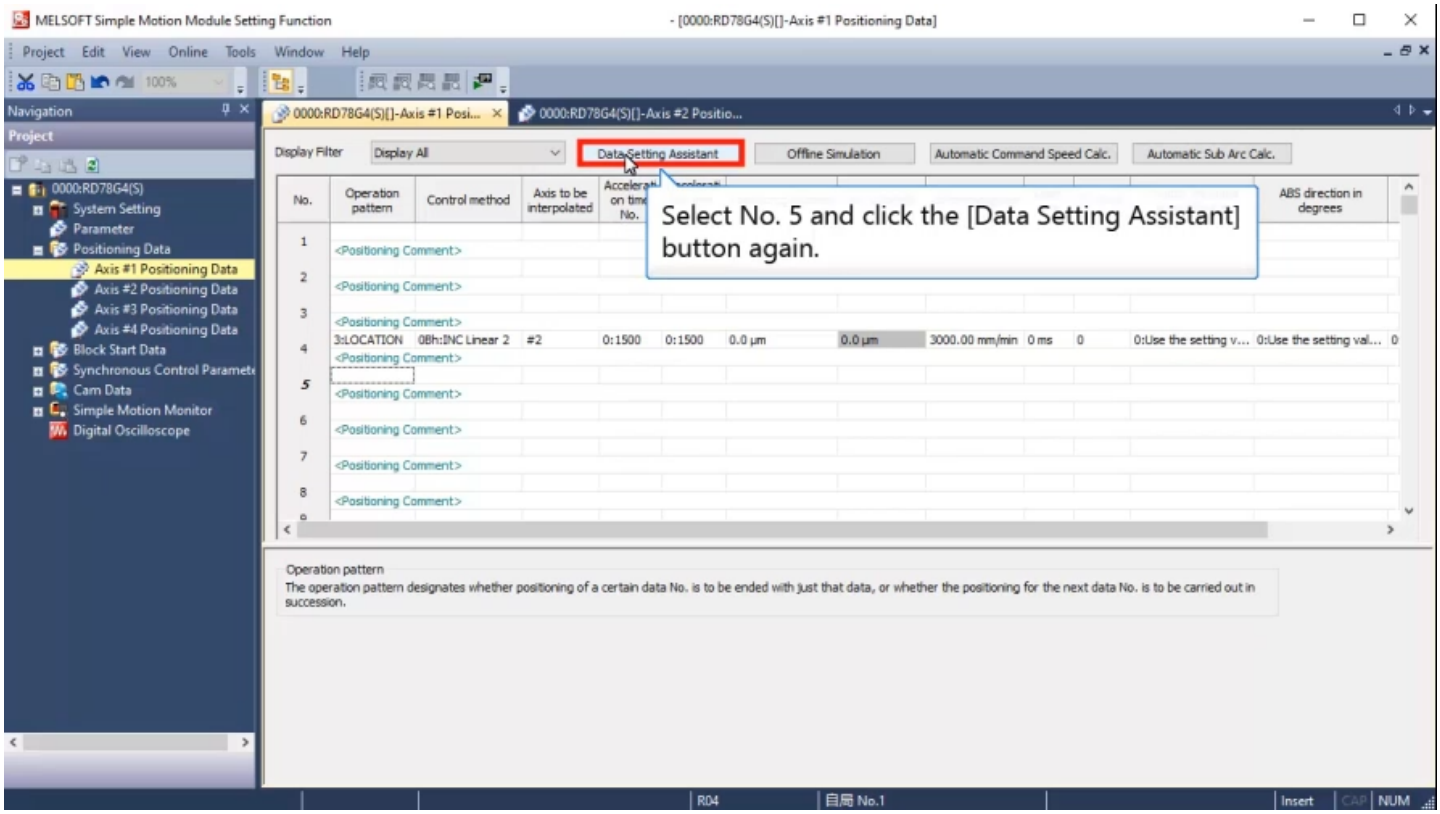

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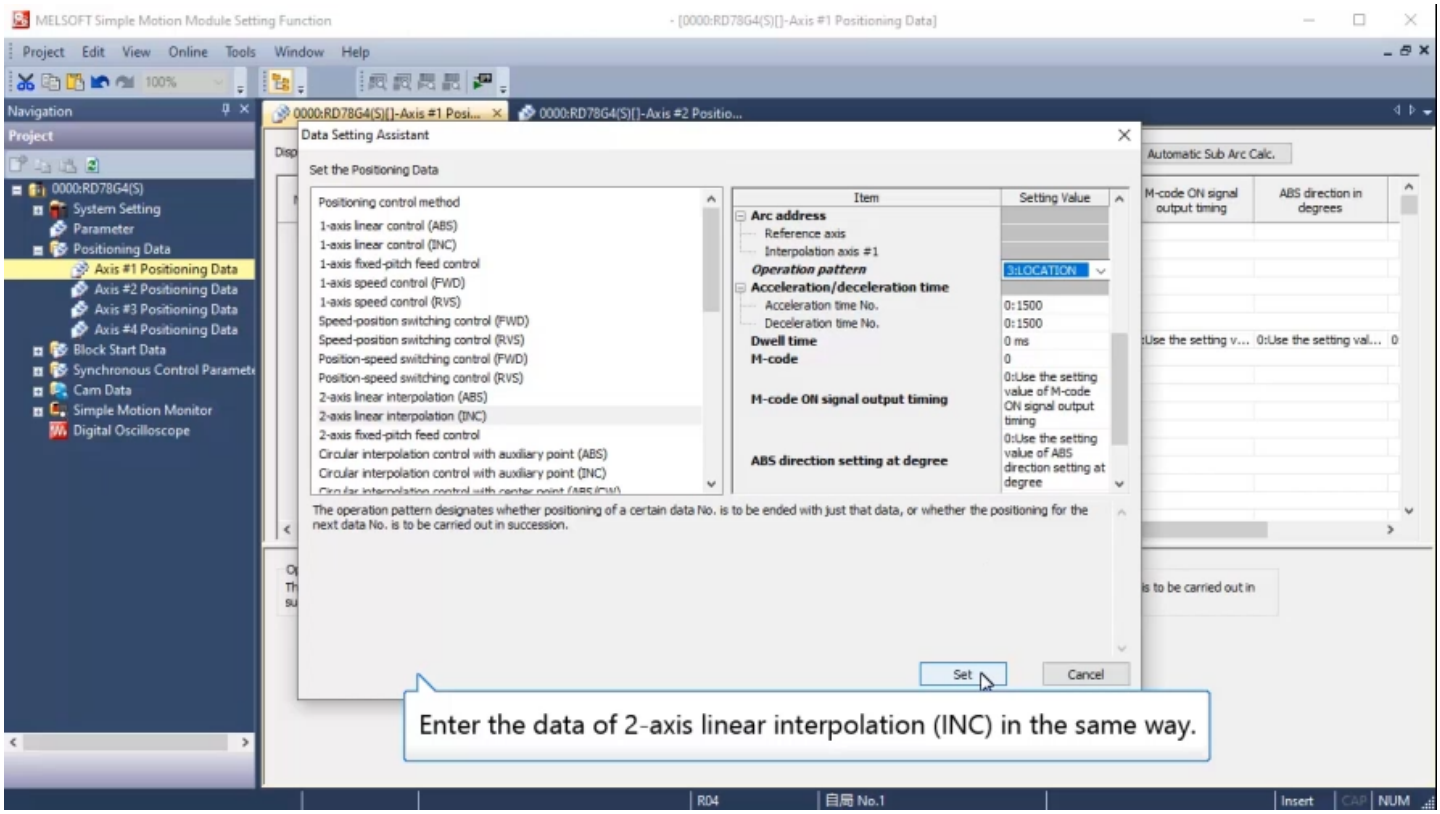

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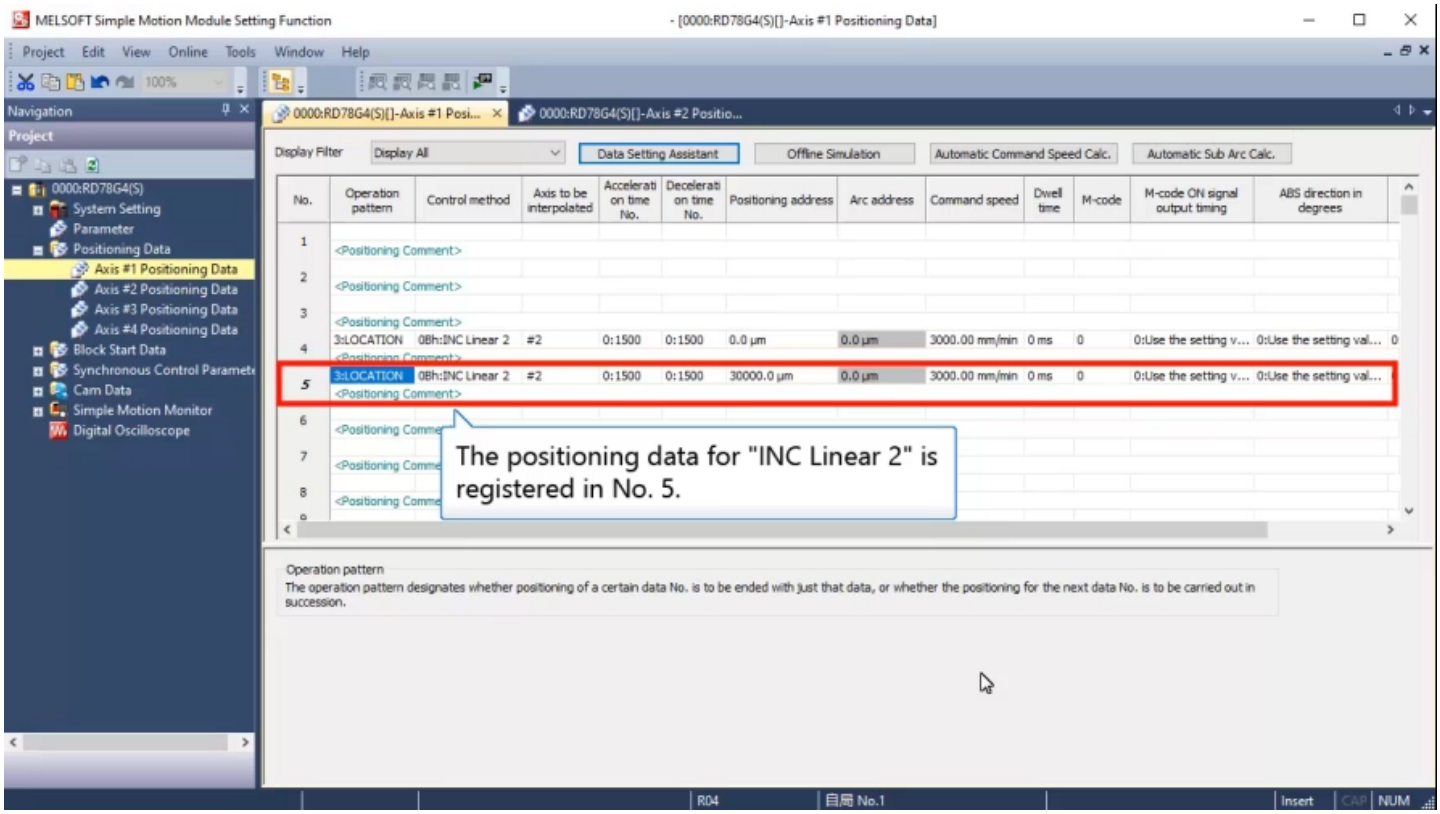

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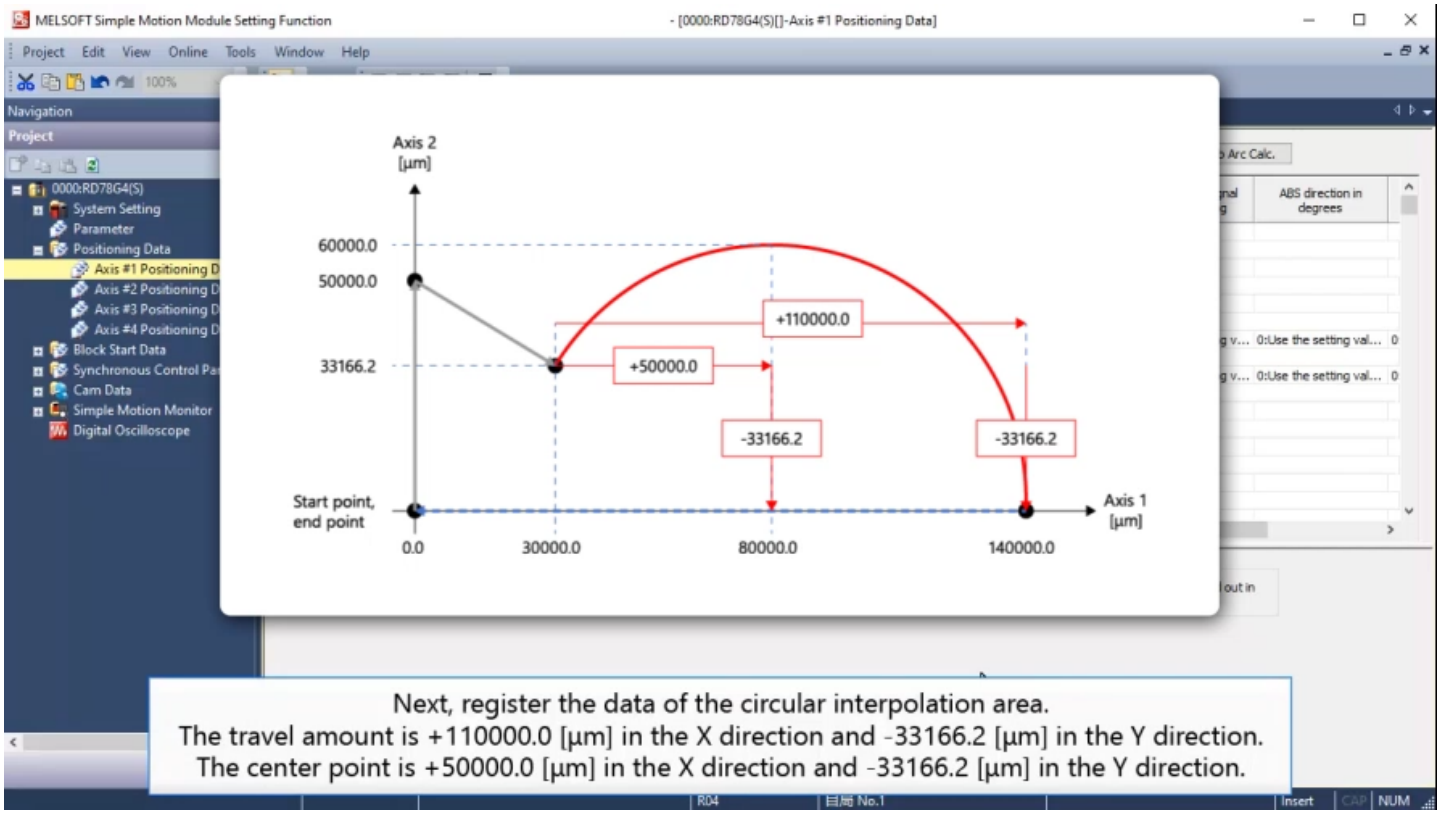

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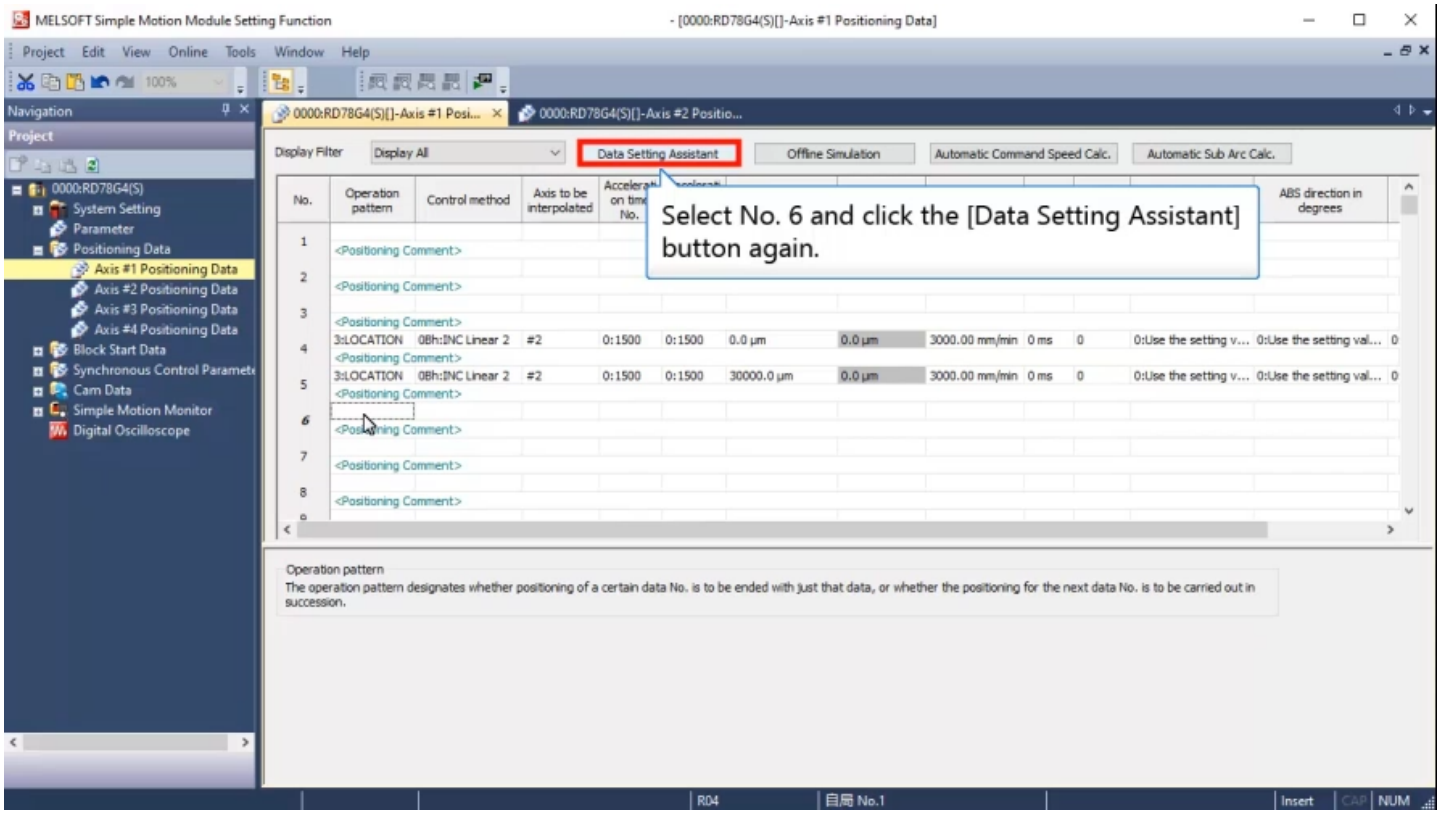

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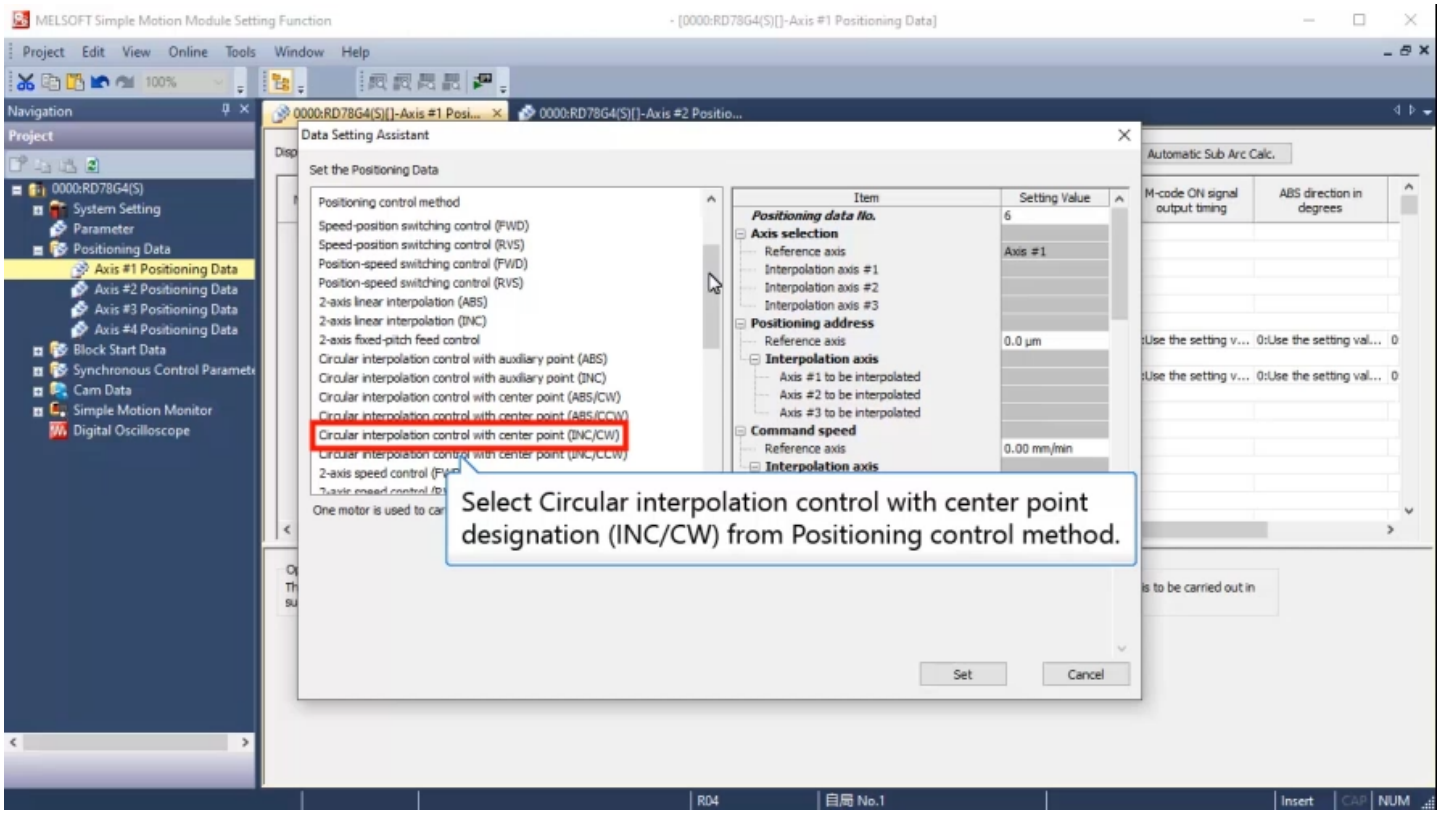

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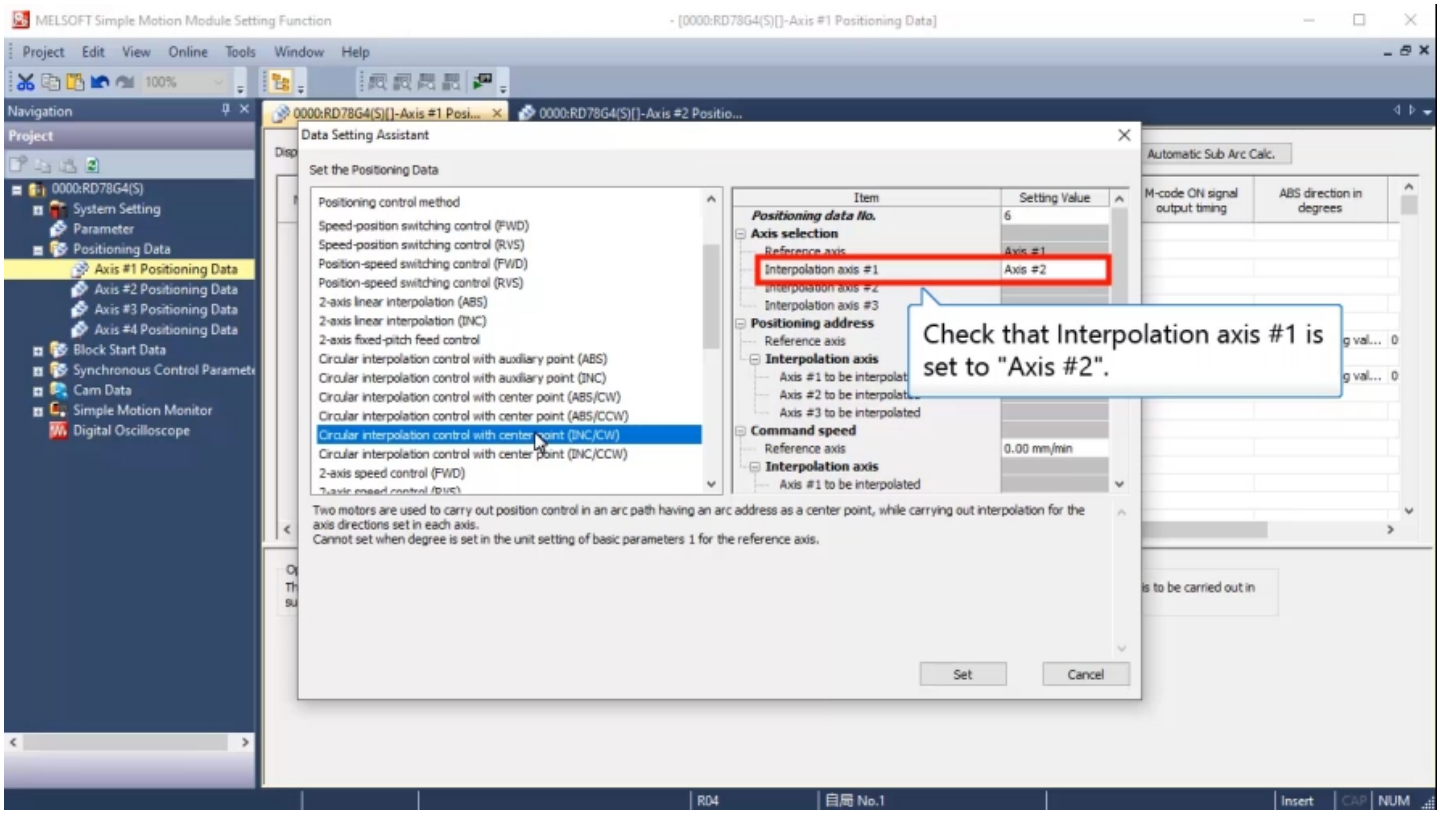

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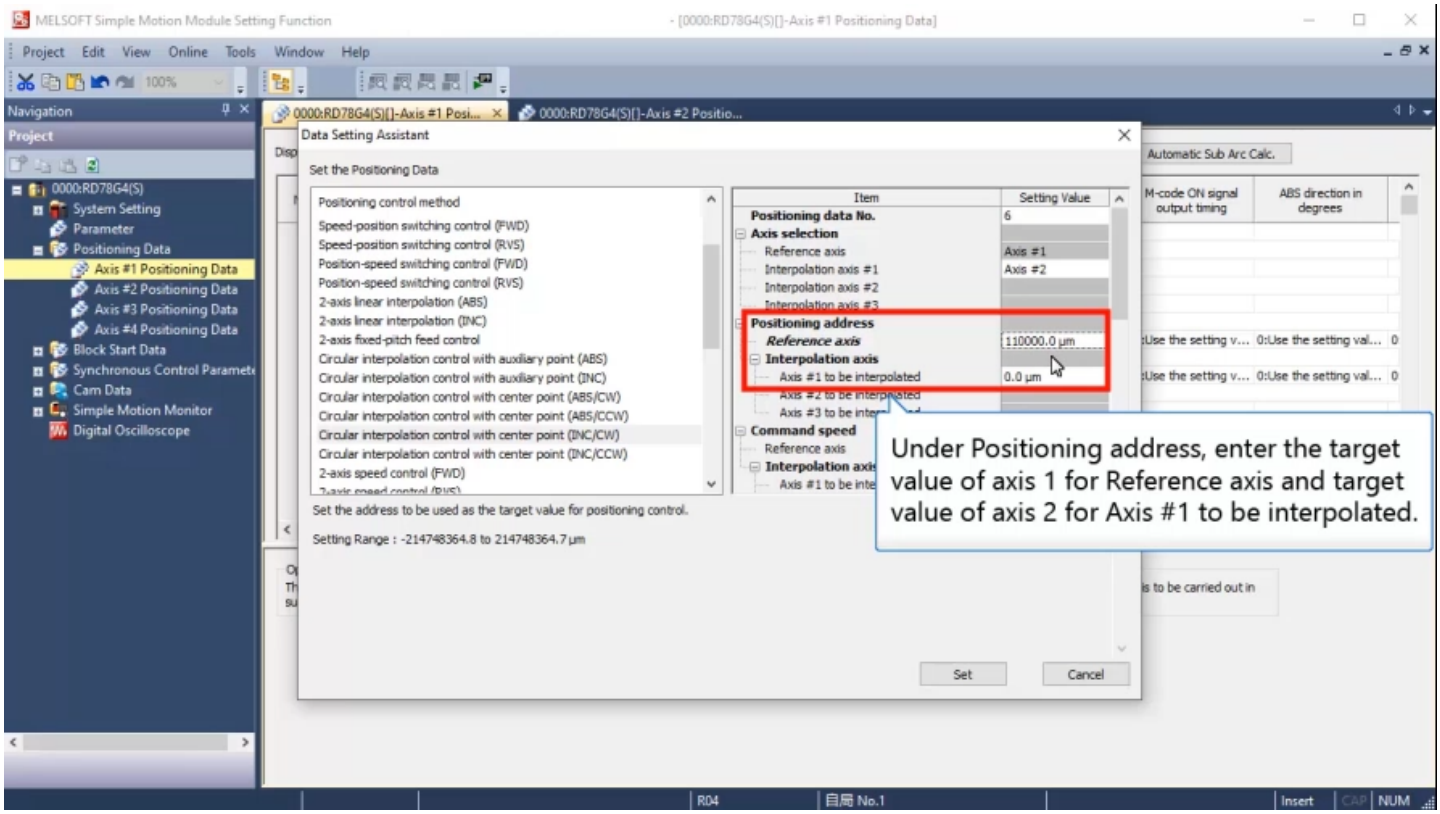

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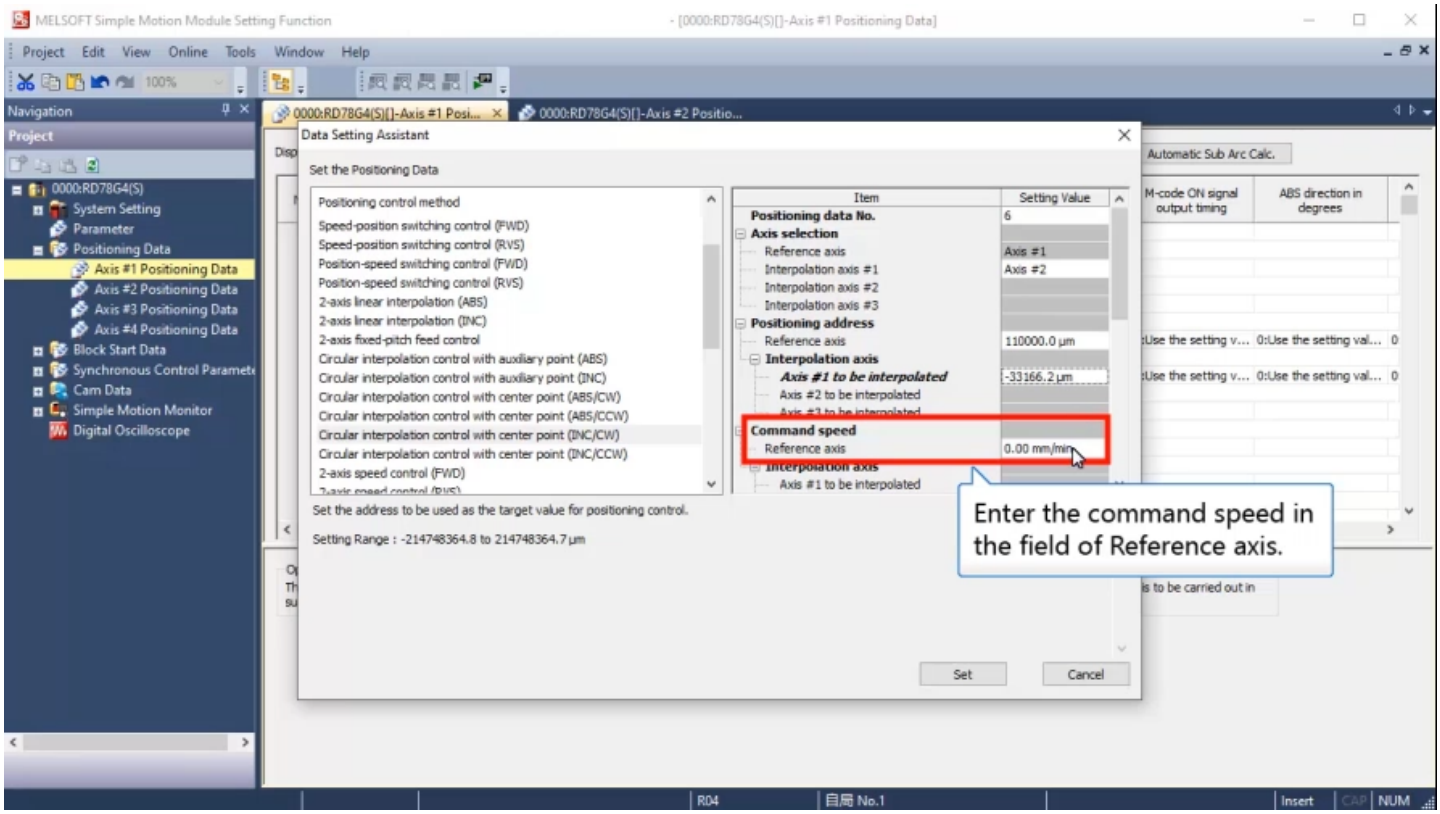

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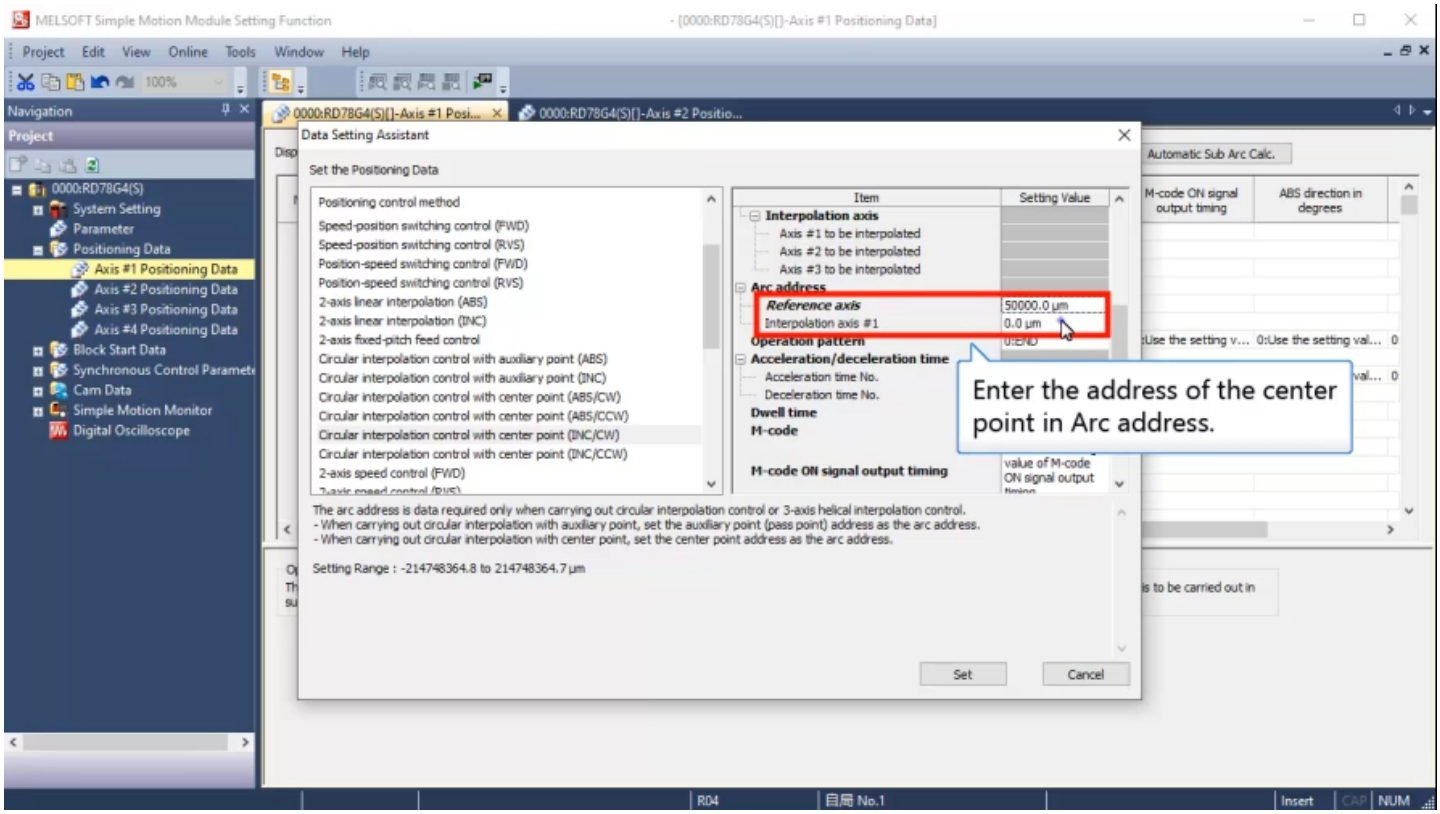

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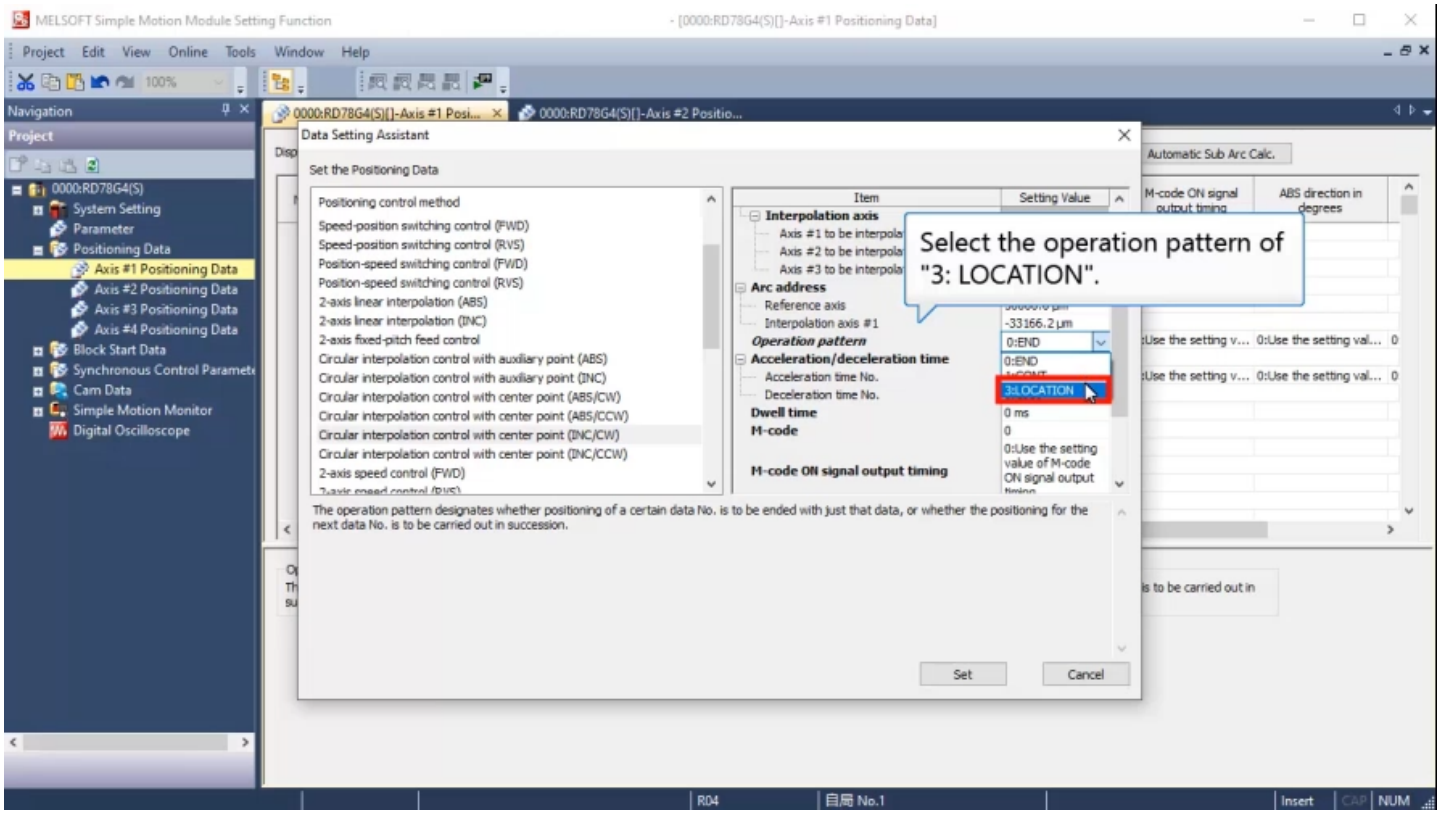

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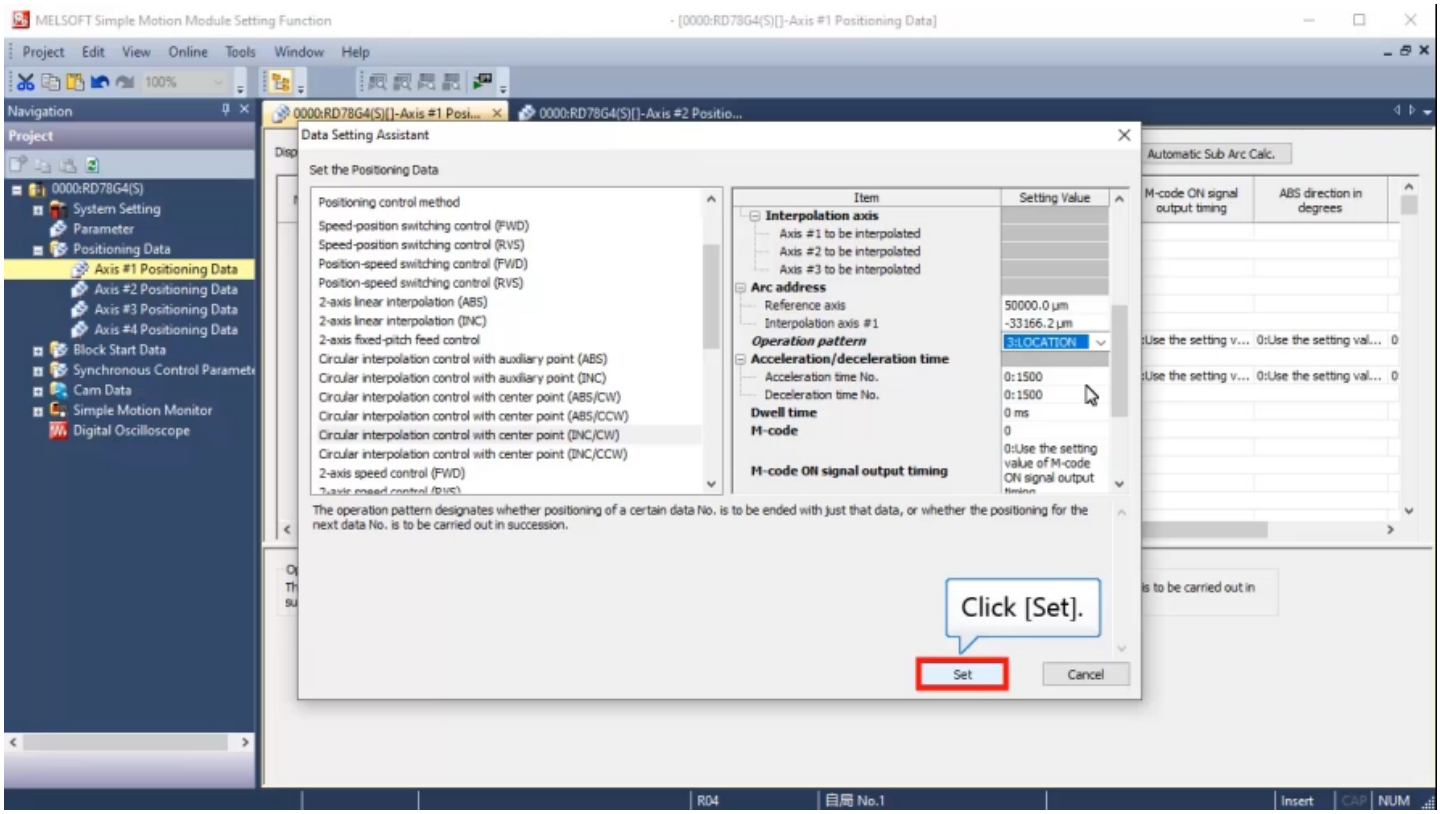

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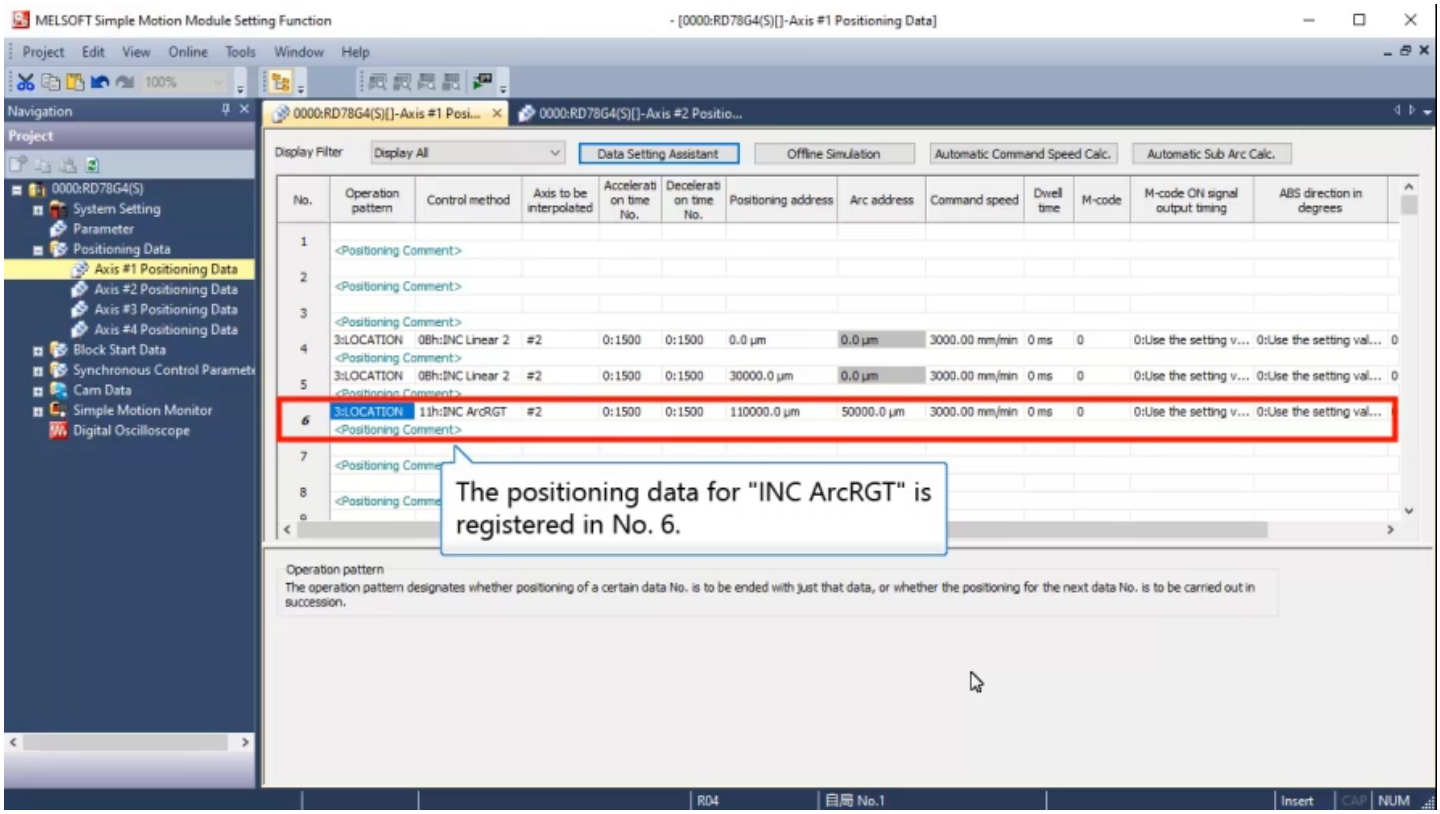

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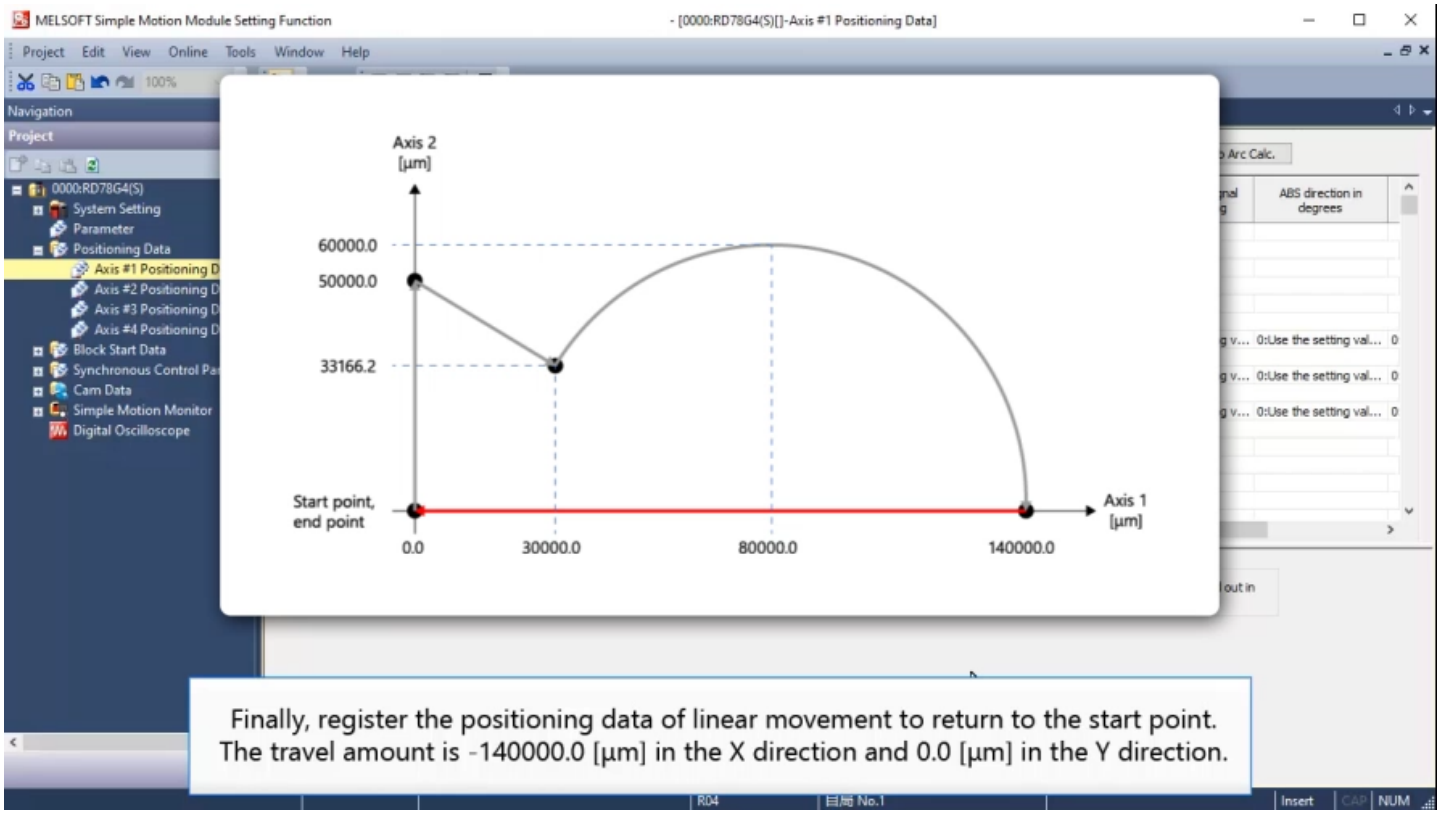

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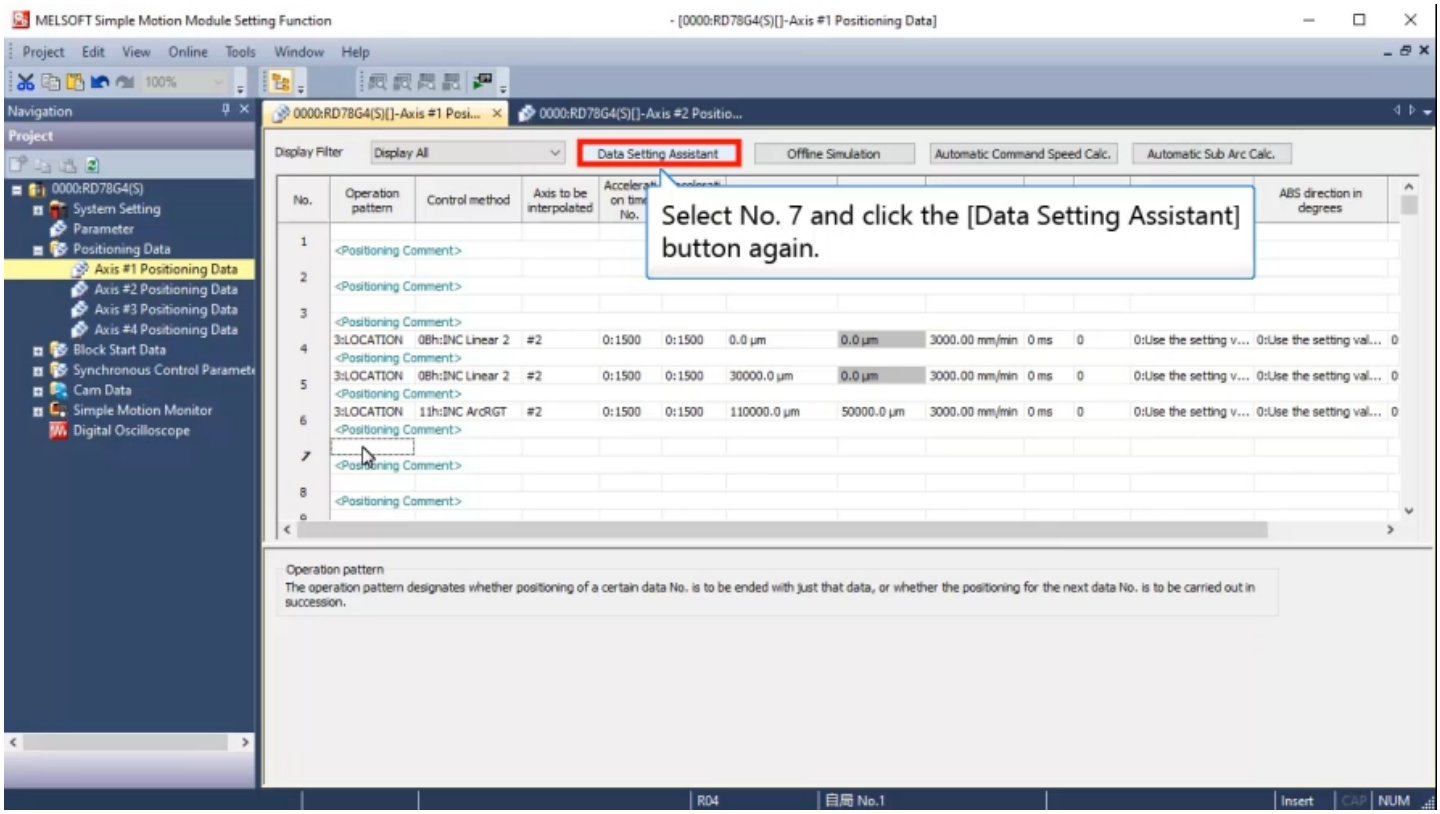

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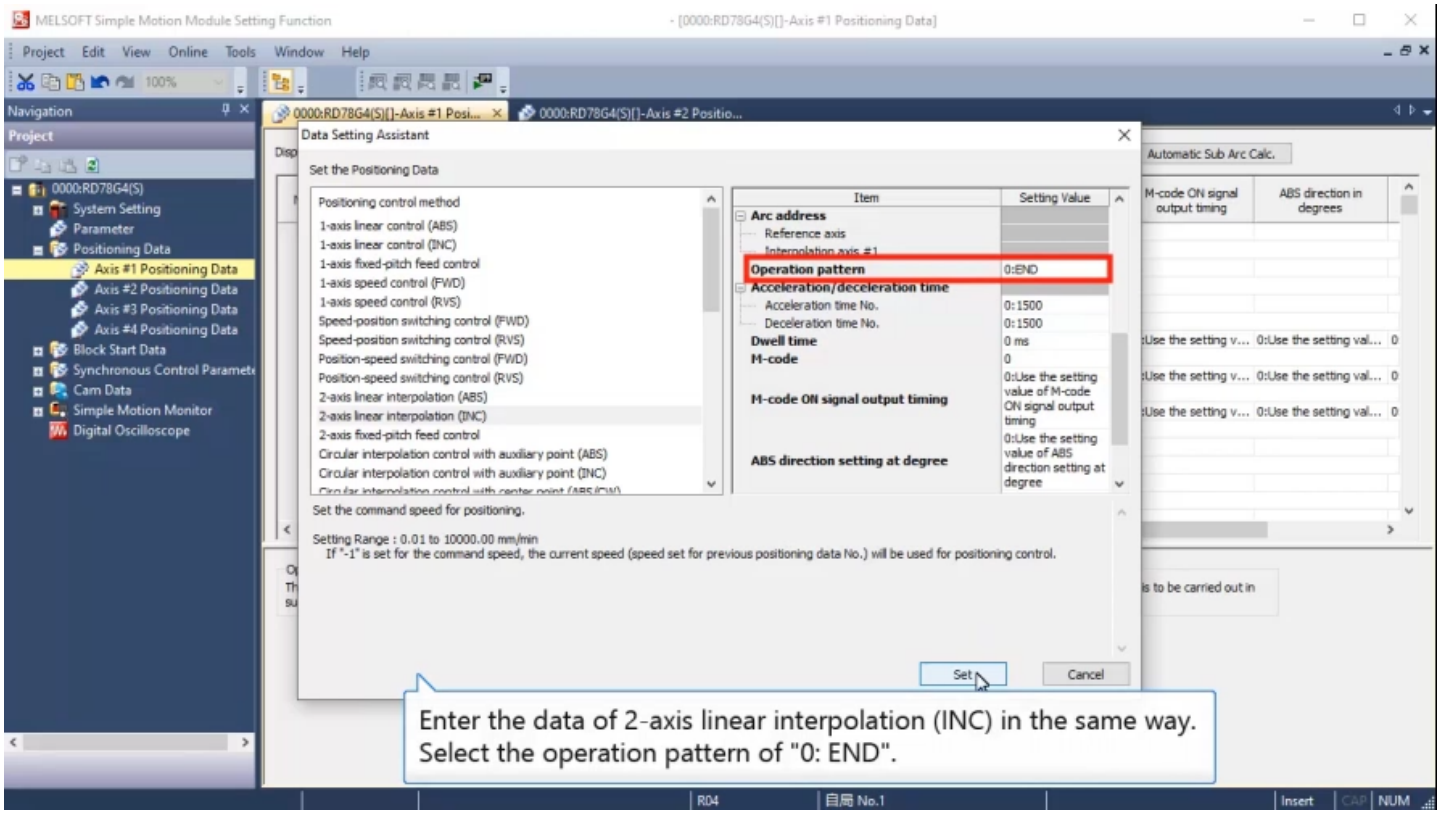

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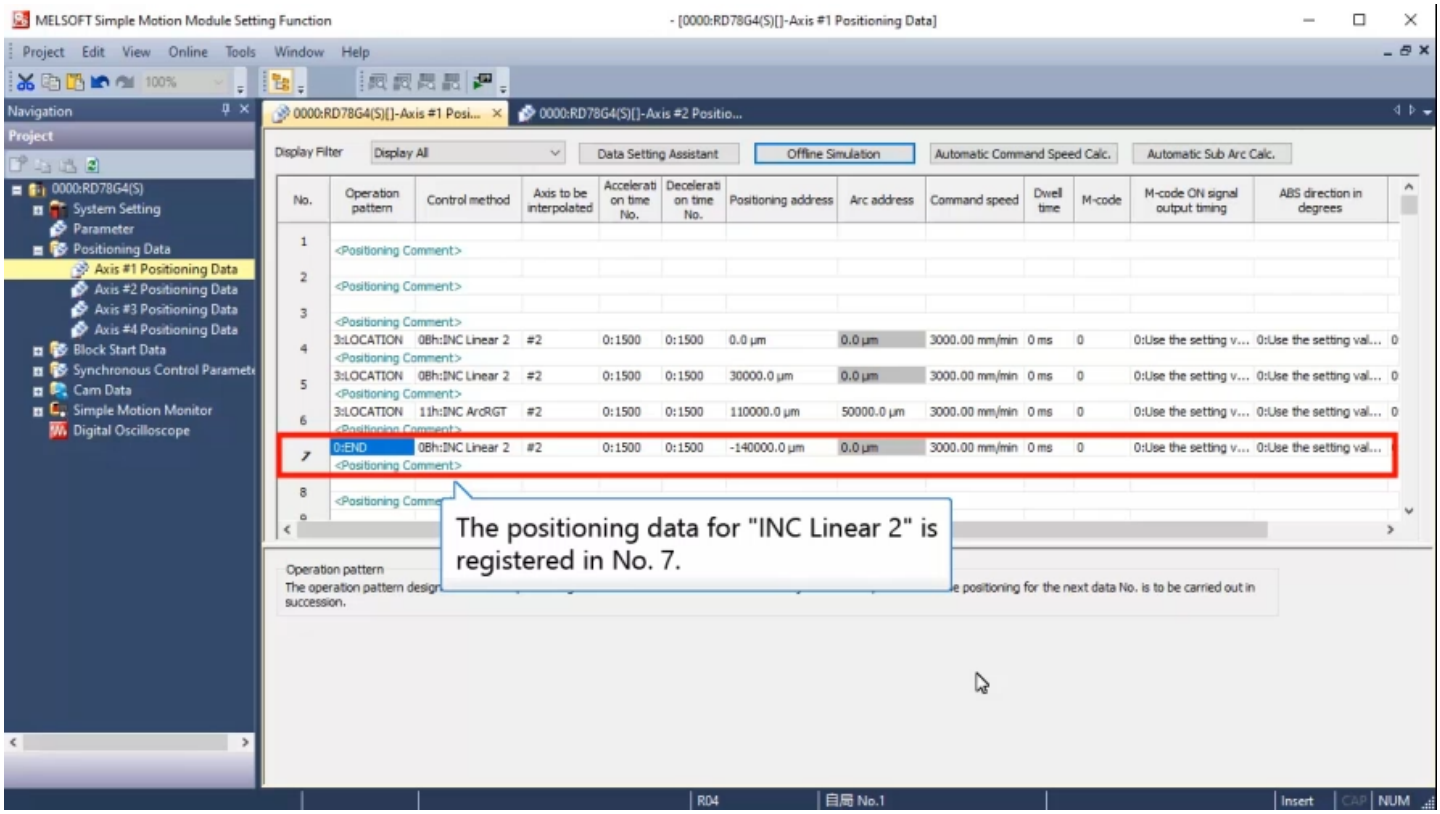

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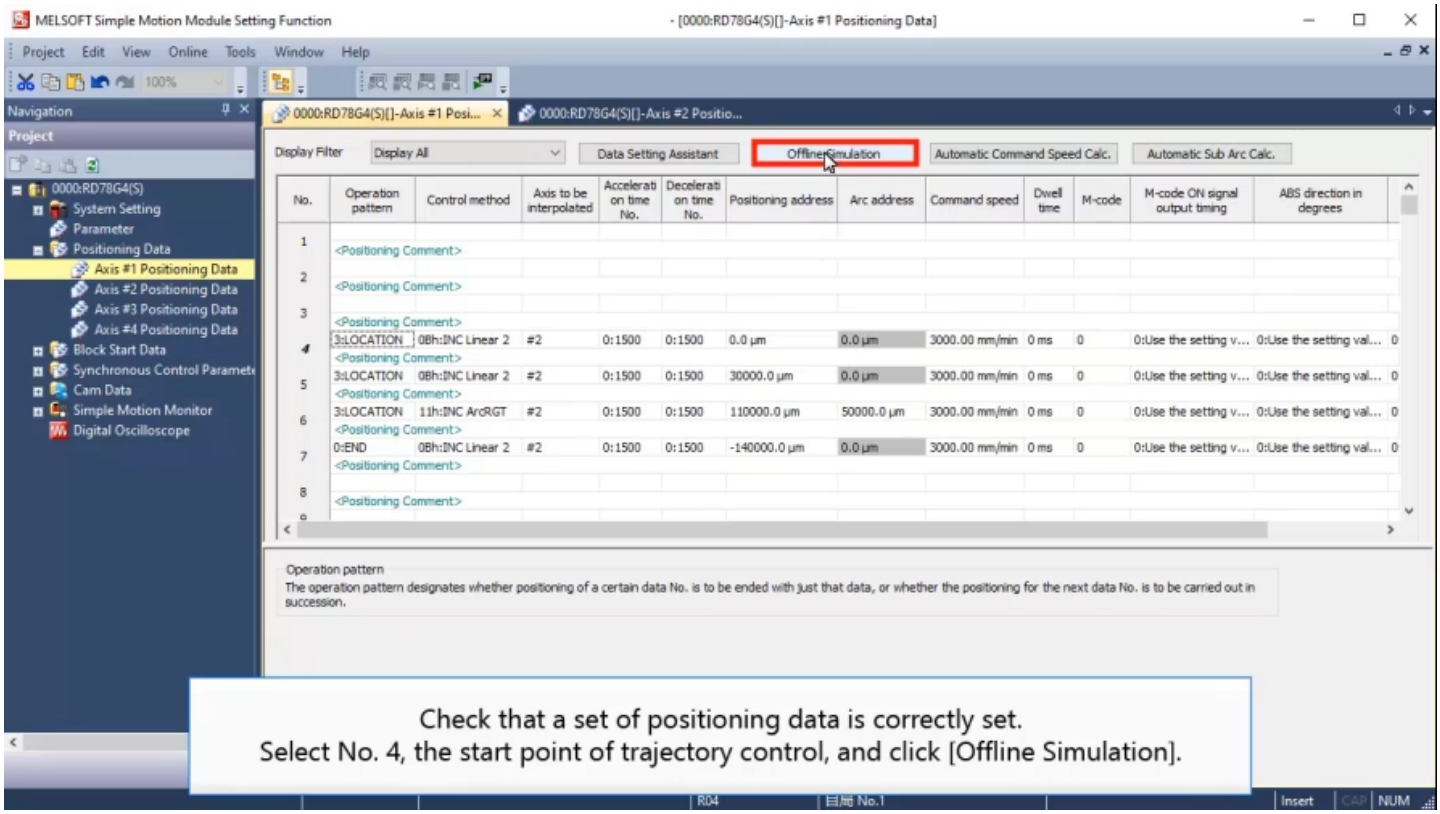

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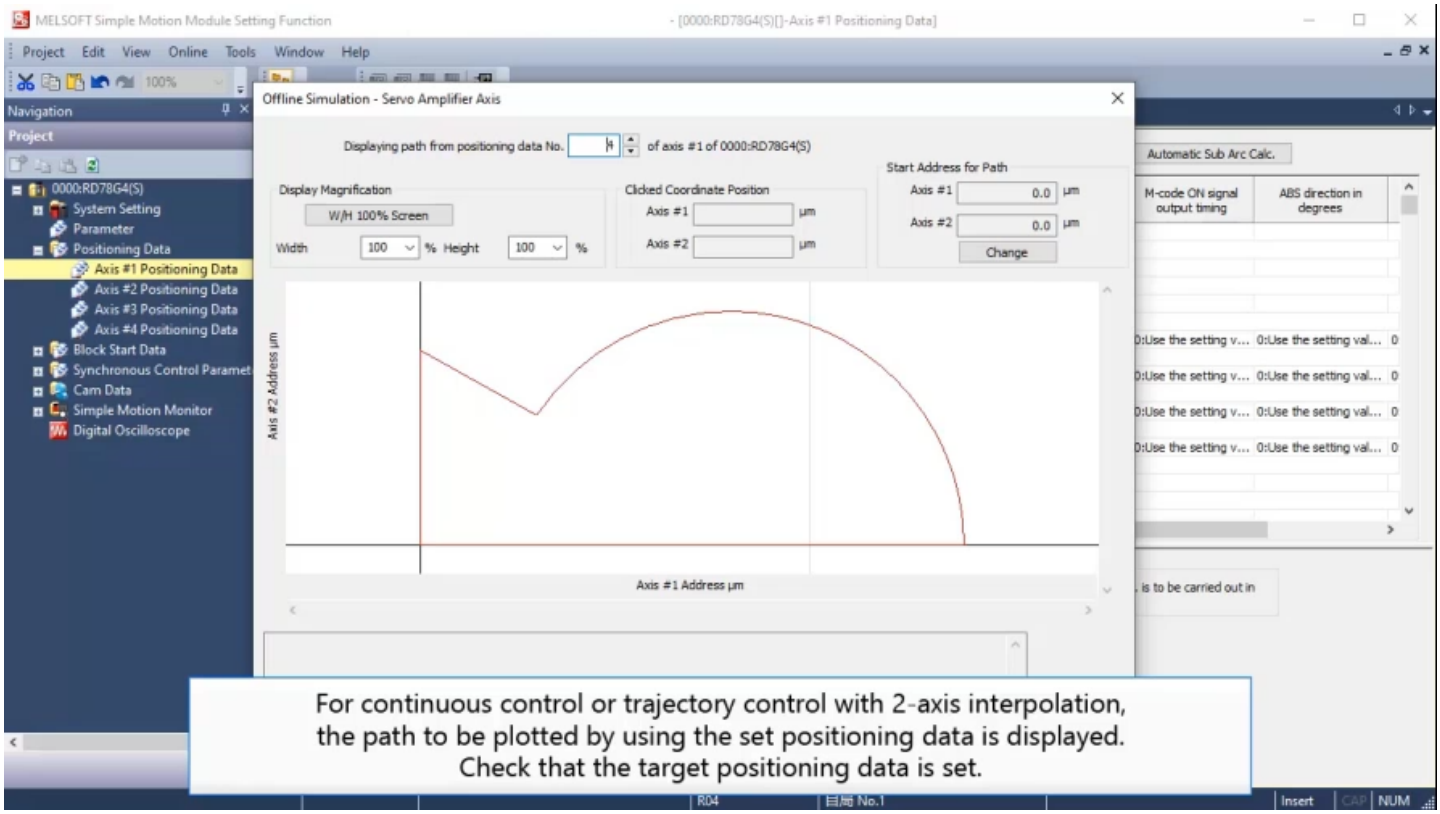

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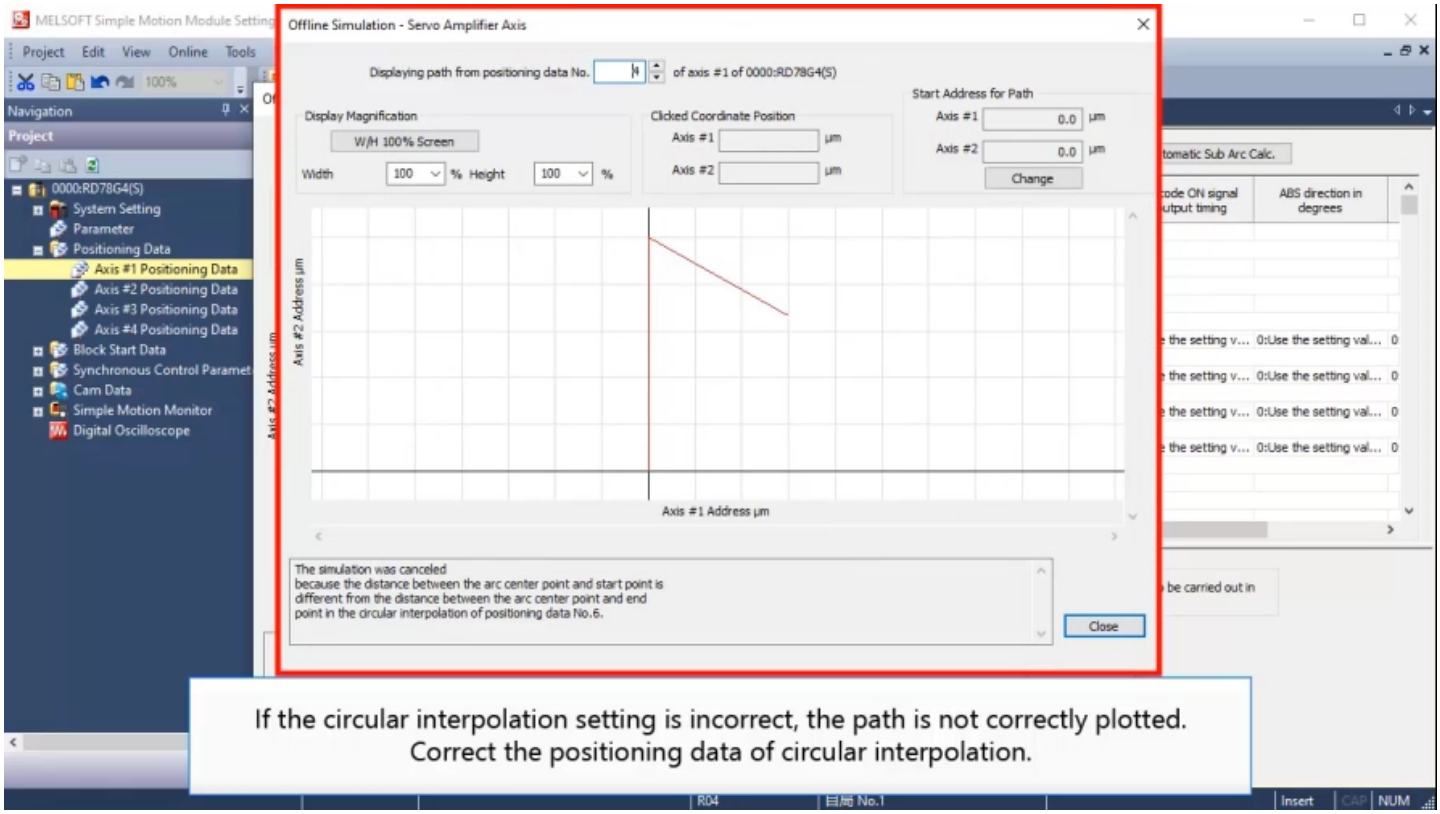

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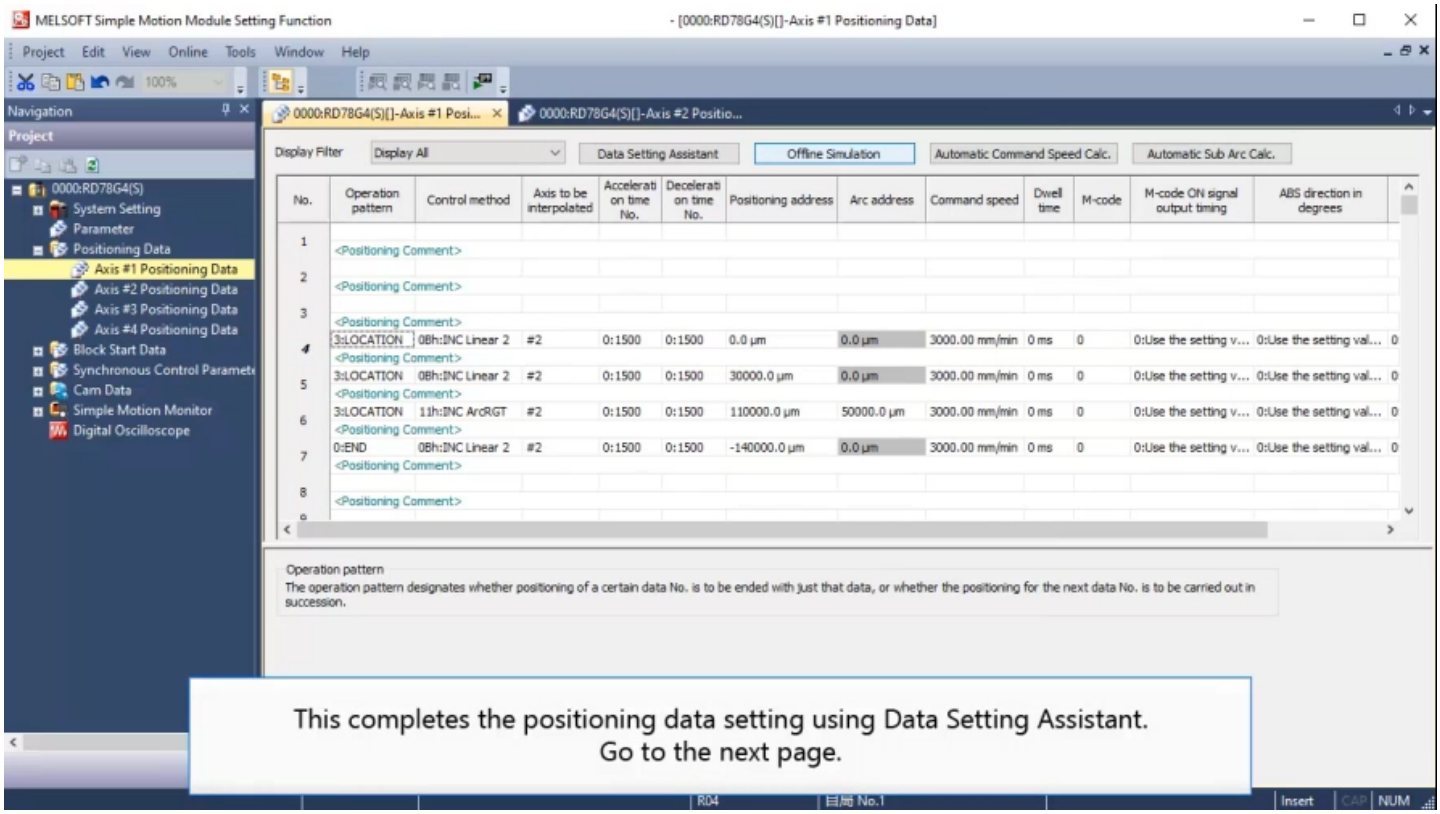


3.5 Summary of This Chapter

In this chapter, you have learned:

- Creating a new project
- PLC CPU setting
- Motion module setting
- Simple Motion mode setting

Point

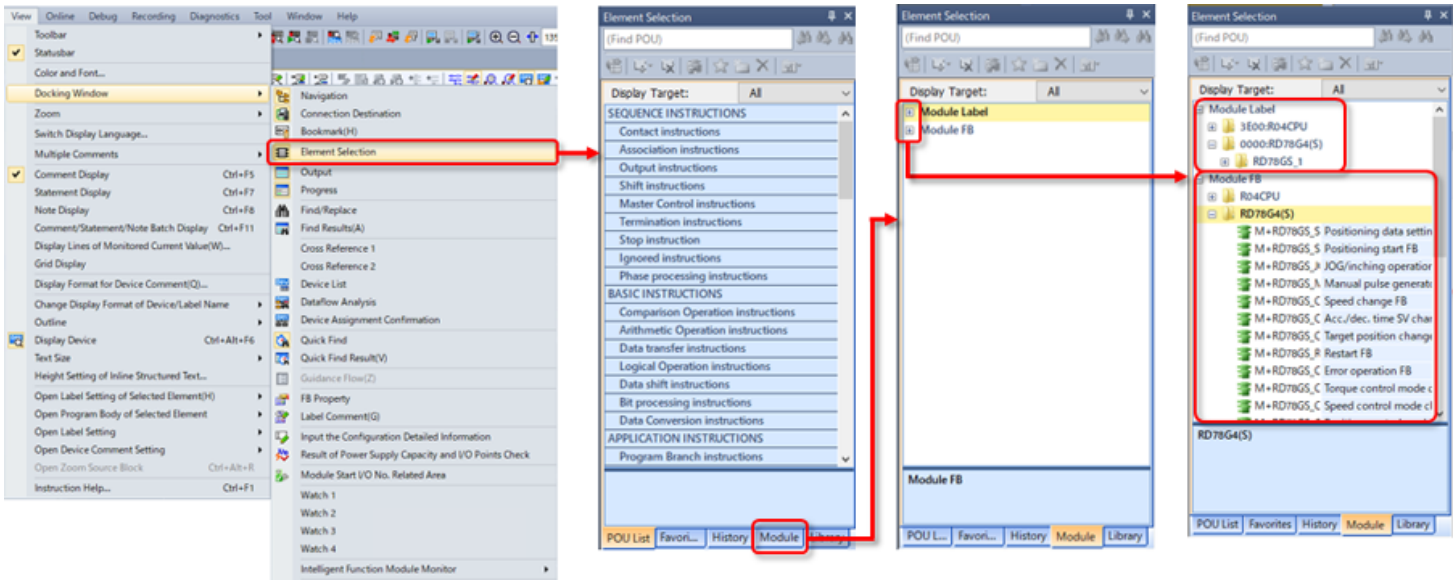
Creating a new project	• Create a new GX Works3 project and module configuration diagram. Simple Motion mode is available by registering the Motion module with (S) in the module configuration diagram.
PLC CPU setting	• Only for the iQ-R series, change Link Direct Device Setting to Extended Mode (iQ-R Series Mode).
Motion module setting	• Open the network configuration window from the module parameter (network) window. • In the network configuration window, register the servo amplifier to be connected to the Internet and set the IP address. PDO mapping is not performed in Simple Motion mode. • To write the parameters of the servo amplifier from the controller, select the [Parameter Automatic Setting] checkbox of the remote station. • Some servo parameters must be set in Simple Motion mode. Incorrect setting values will cause "Servo parameter invalid" and write correct parameters automatically when the power is turned on again.
Simple Motion mode setting	• Set the motion-related parameters in the Simple Motion Module Setting Function window. • Set the operation pattern in the point table. Data Setting Assistant helps you register operation patterns of interpolation control using multiple axes.

Chapter 4 Positioning Control and Interpolation Control Program

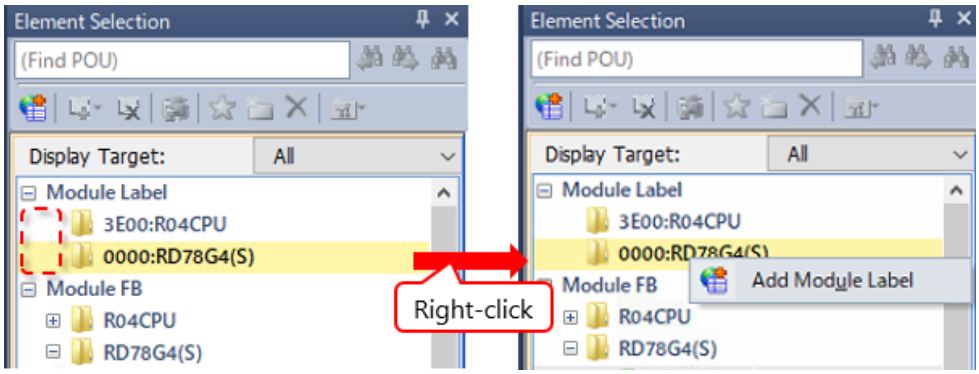
This chapter describes the program for operating the initial setting (all axis servo ON), JOG operation, and the positioning data set in the previous chapters.

4.1 Module label and module FB

The sample program in this course uses module labels and module FBs.
From the menu, select [View] → [Docking Window] → [Element Selection] to display the Element Selection window.
Select [Module] in the Element Selection window to display the module labels and module FBs.

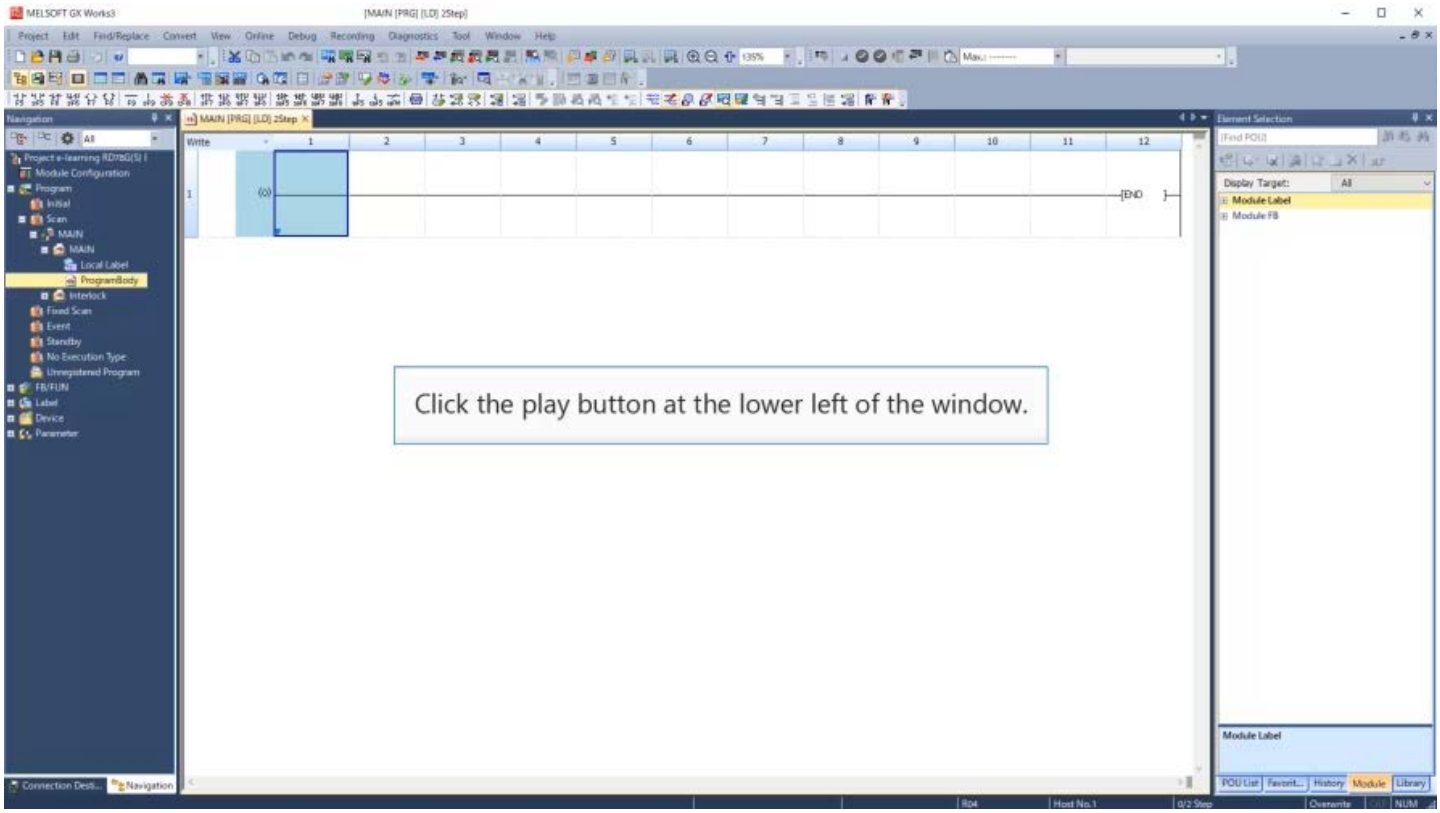


[Point]
Module labels are not displayed if Module Label is set to "Not use" when the project is created (refer to 3.1 (2)) and module configuration diagram is created (refer to 3.1 (3)). (The + mark is not displayed.)
In this case, right-click a module label folder and select [Add Module Label] to add a module label.



4.2 How to add module labels and module FBs

This video explains how to add module labels and module FBs.



[Point]
To wrap the label name as shown in the video, select [View] → [Change Display Format of Device/Label Name] from the menu bar and select [Wrapping Ladder Display].

In the program display in this course, Comment Display, Statement Display, Note Display, and Display Device are enabled for explanatory purposes.
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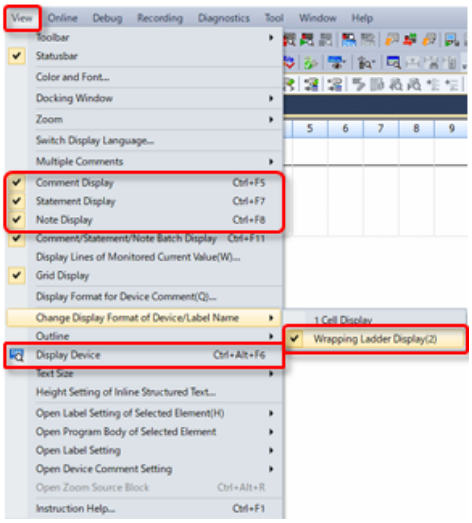

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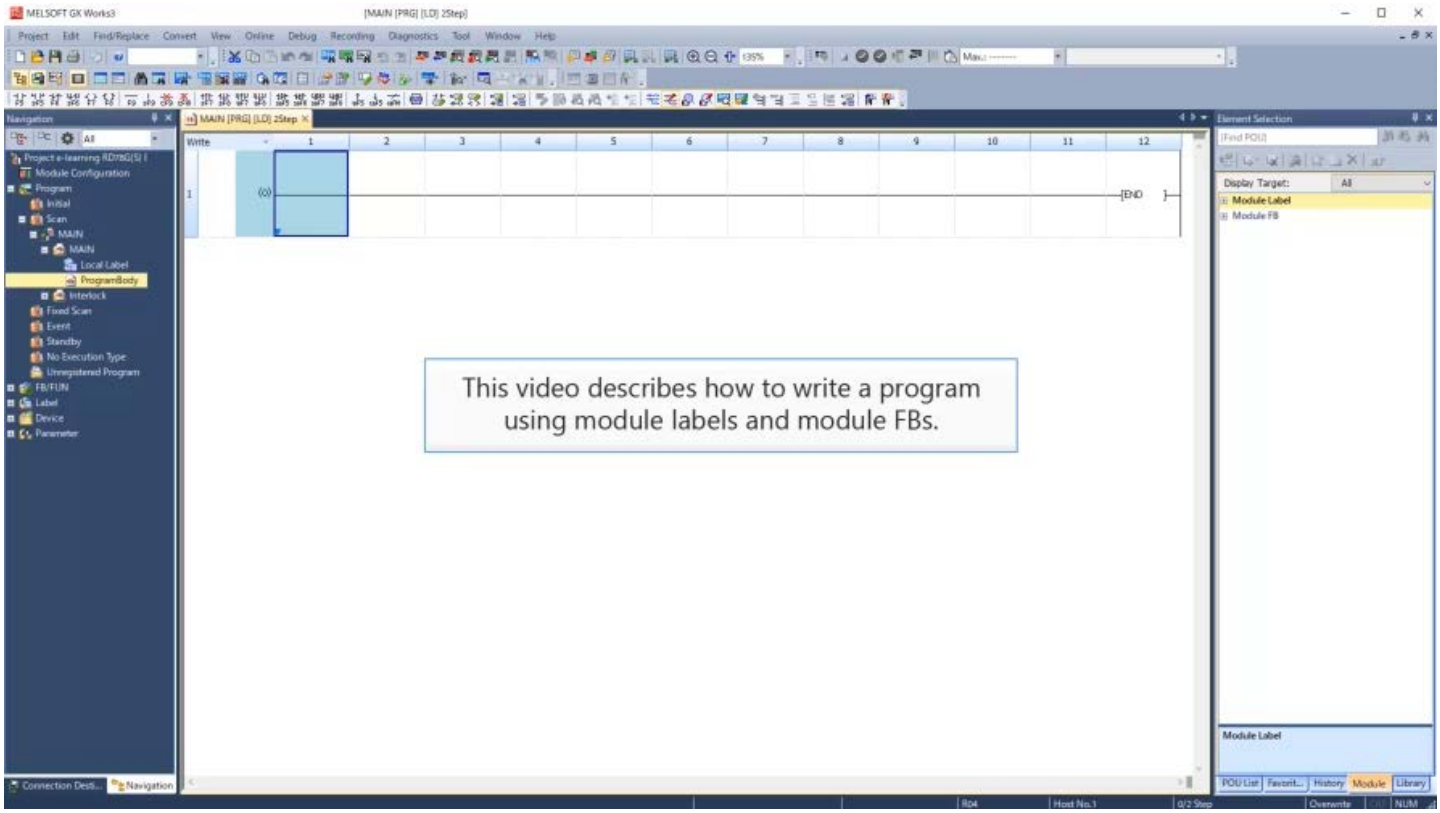

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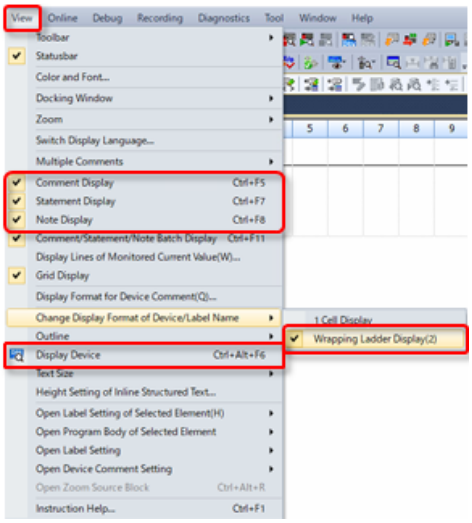

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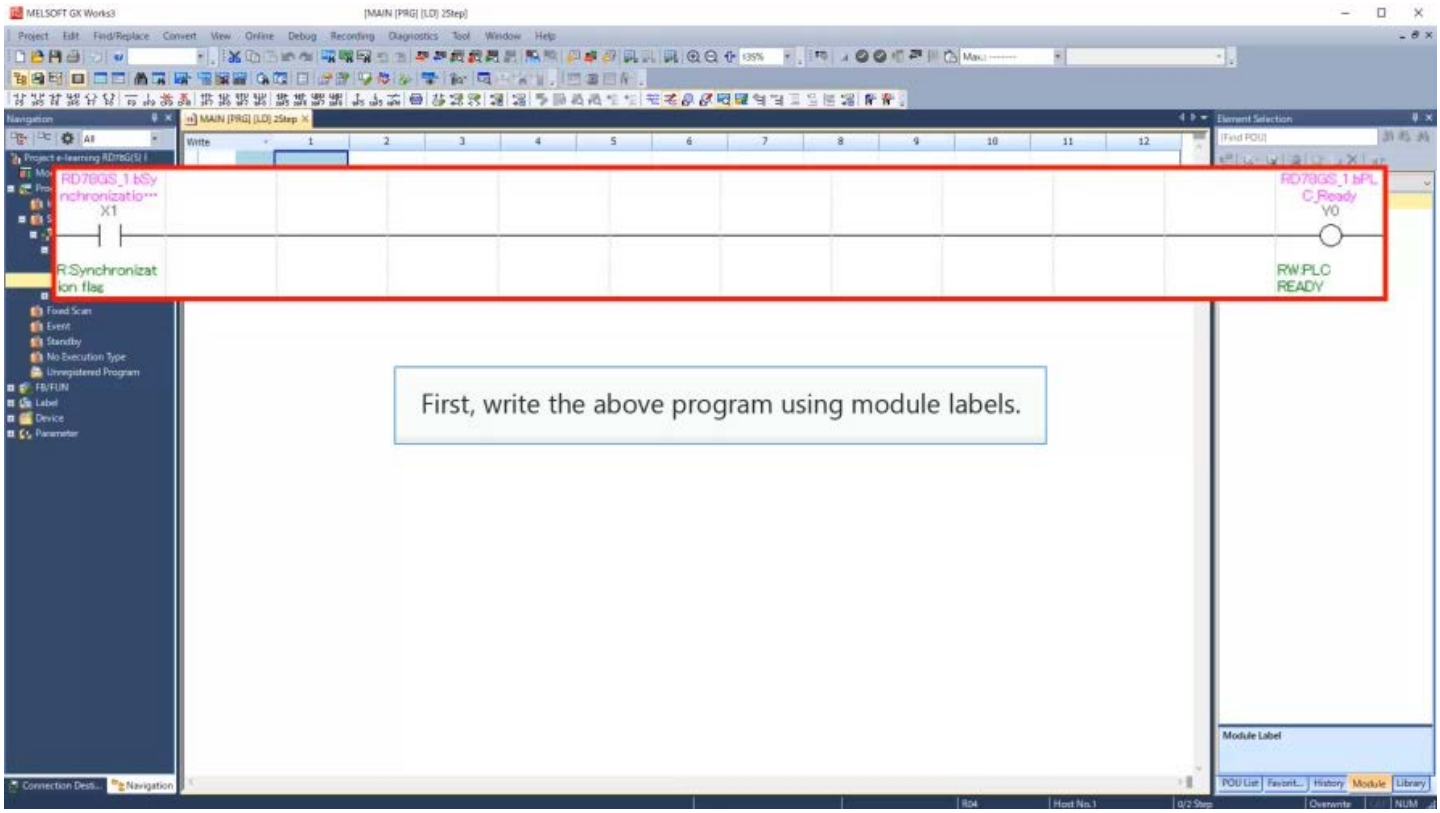

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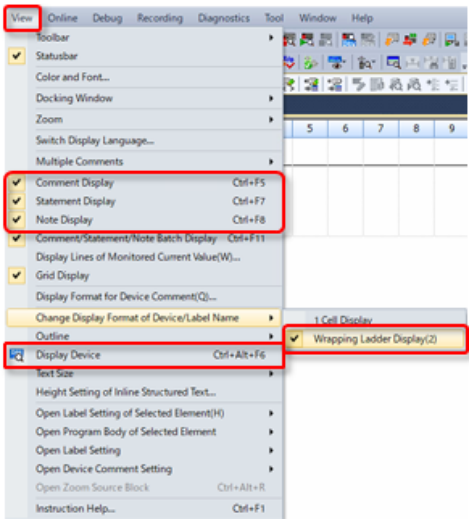

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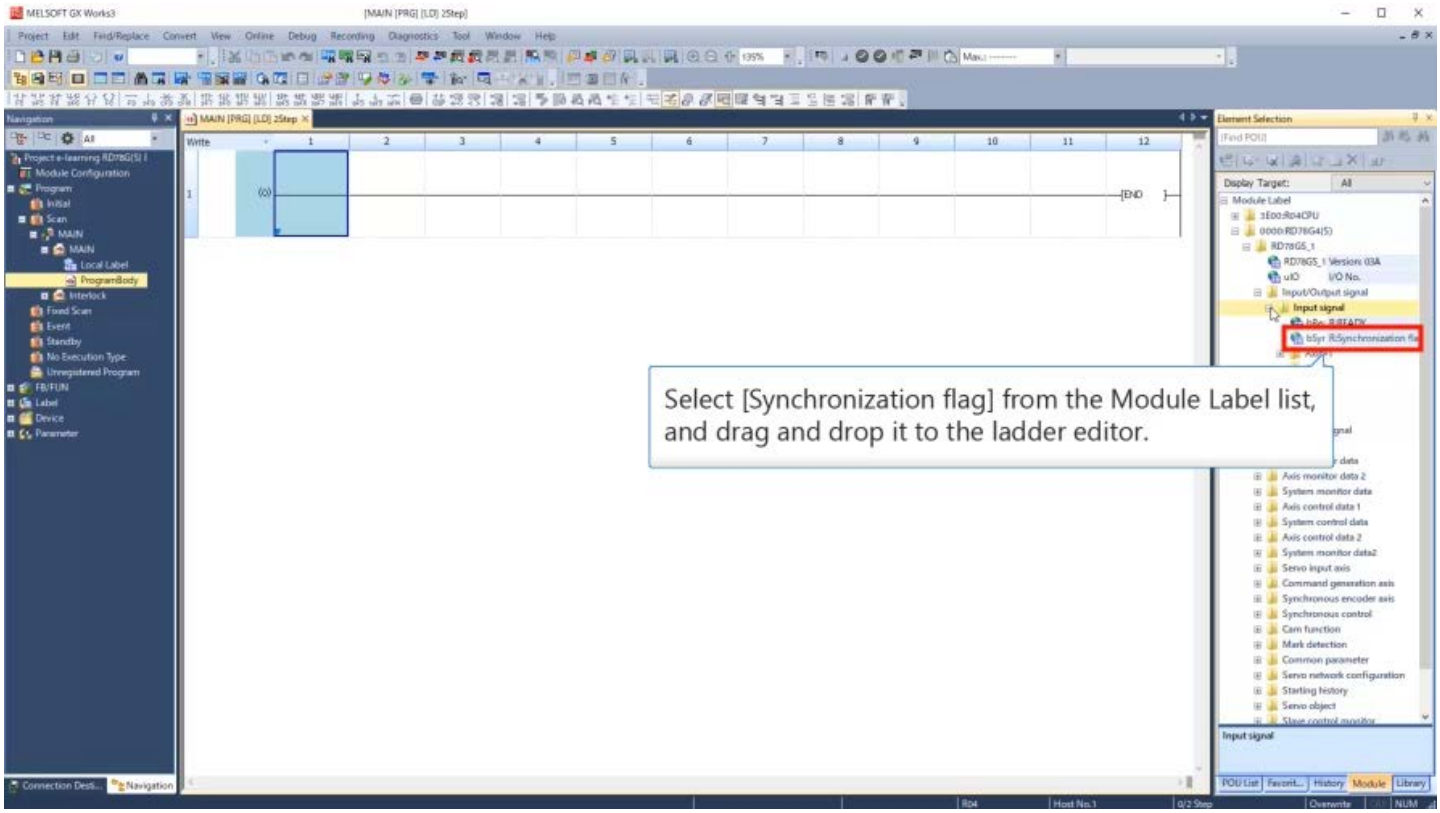

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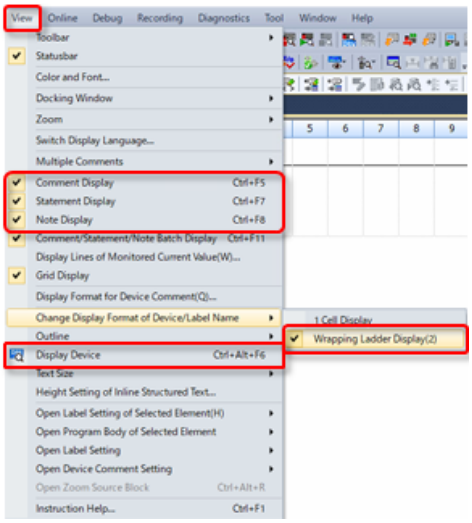

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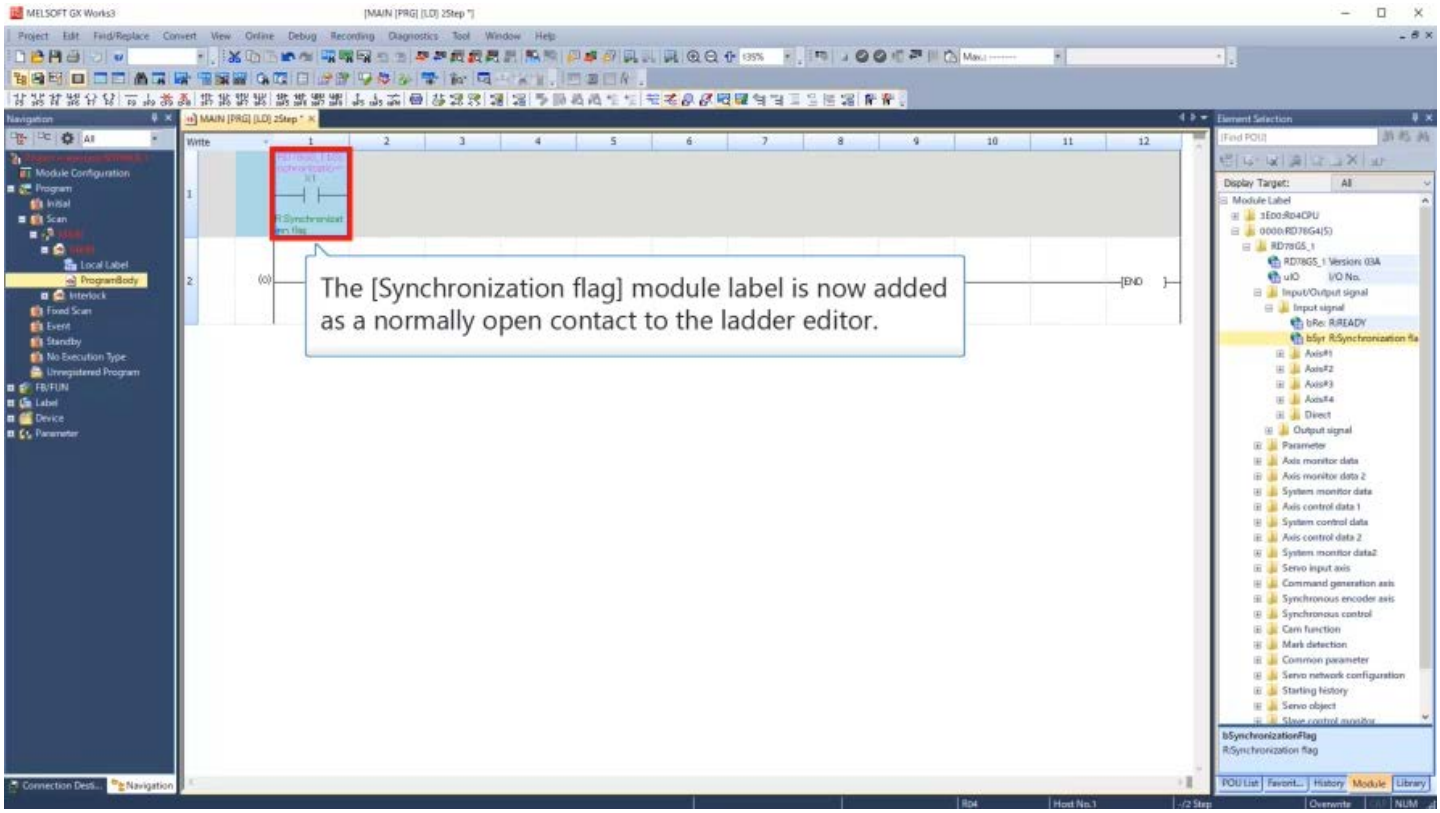

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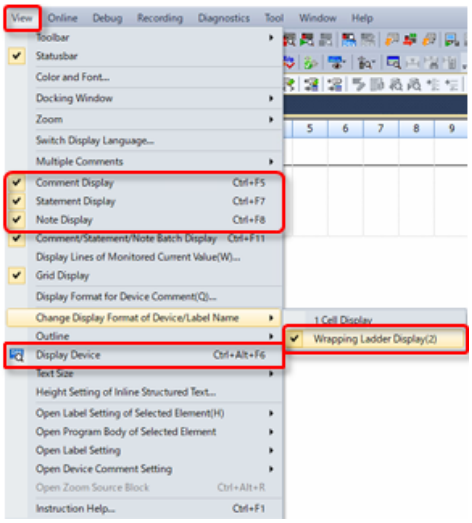

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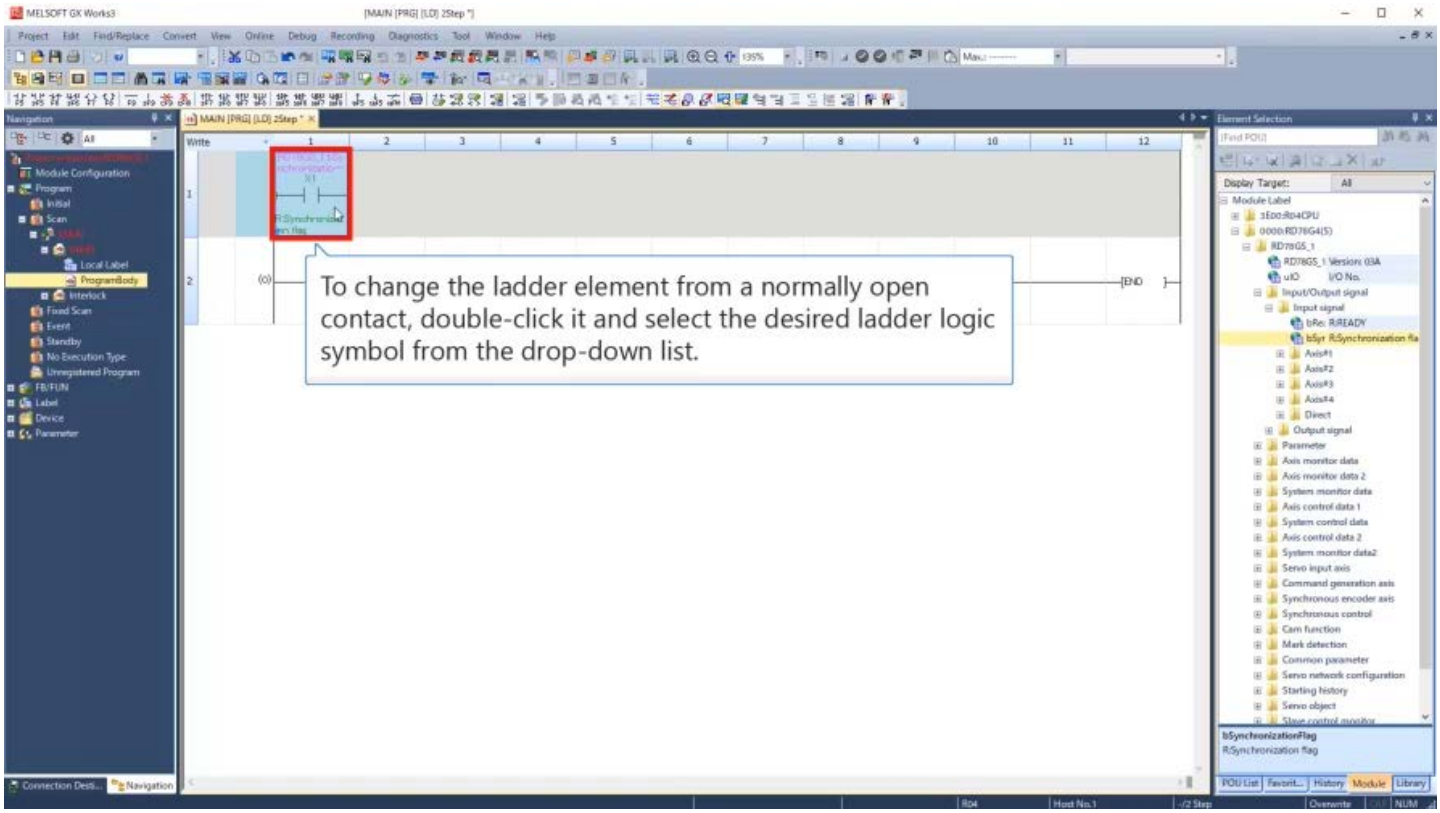

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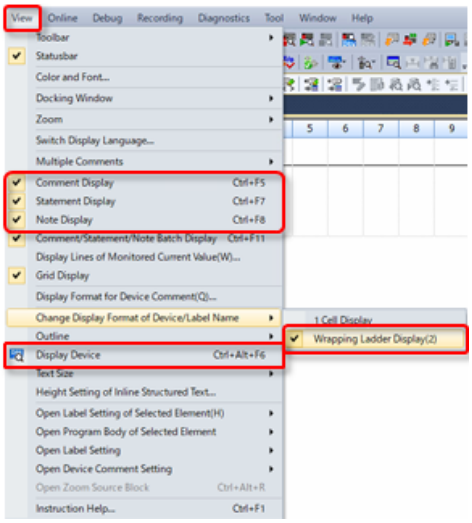

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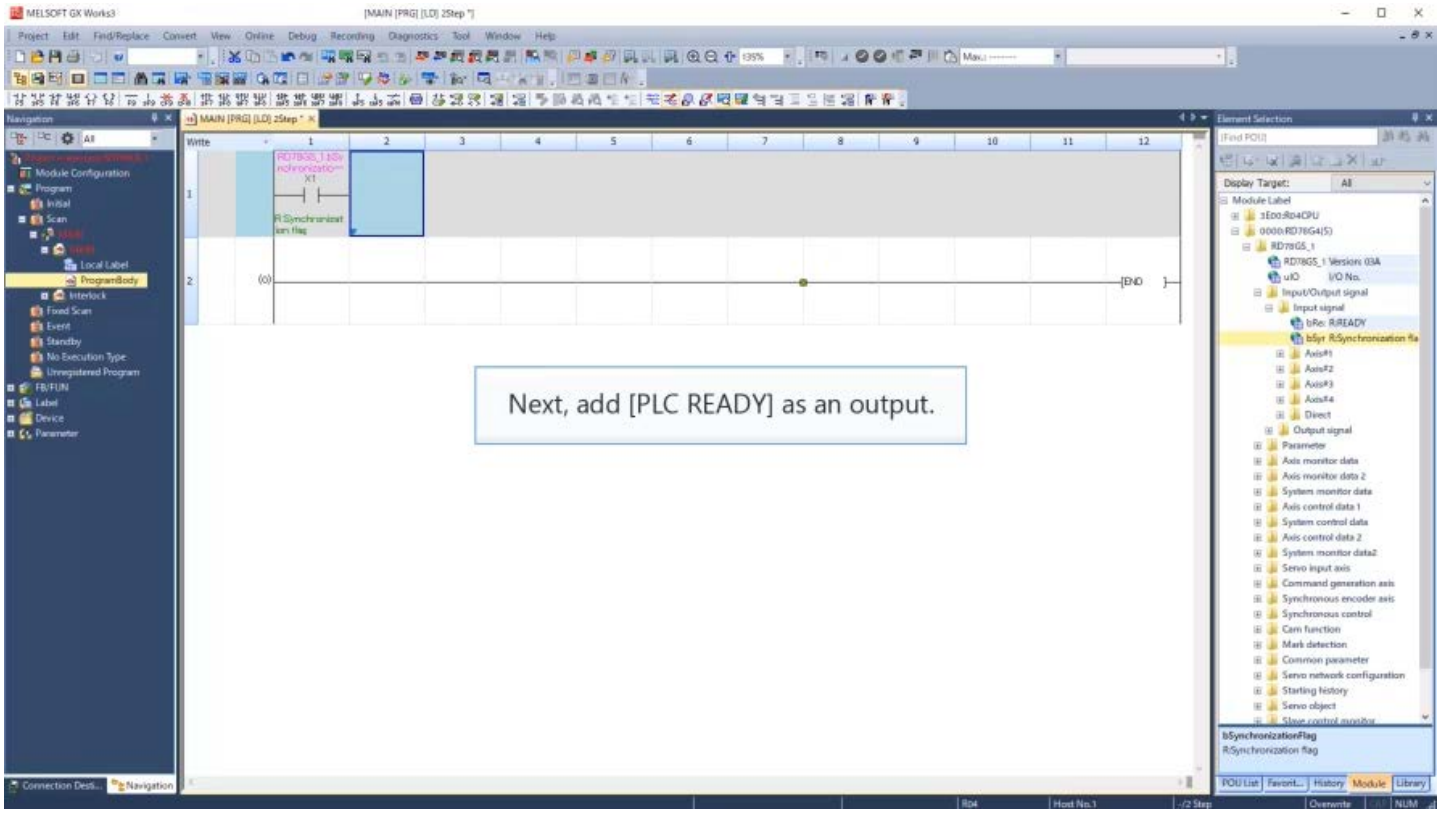

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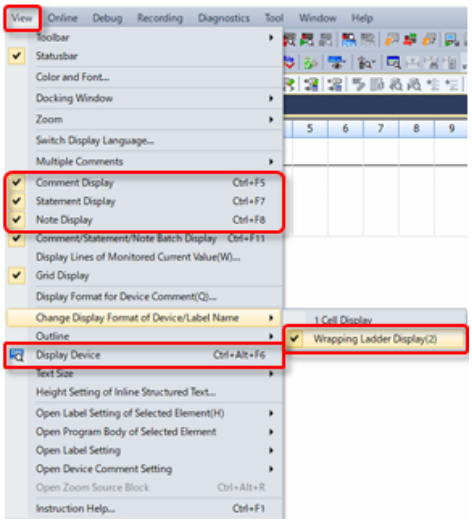

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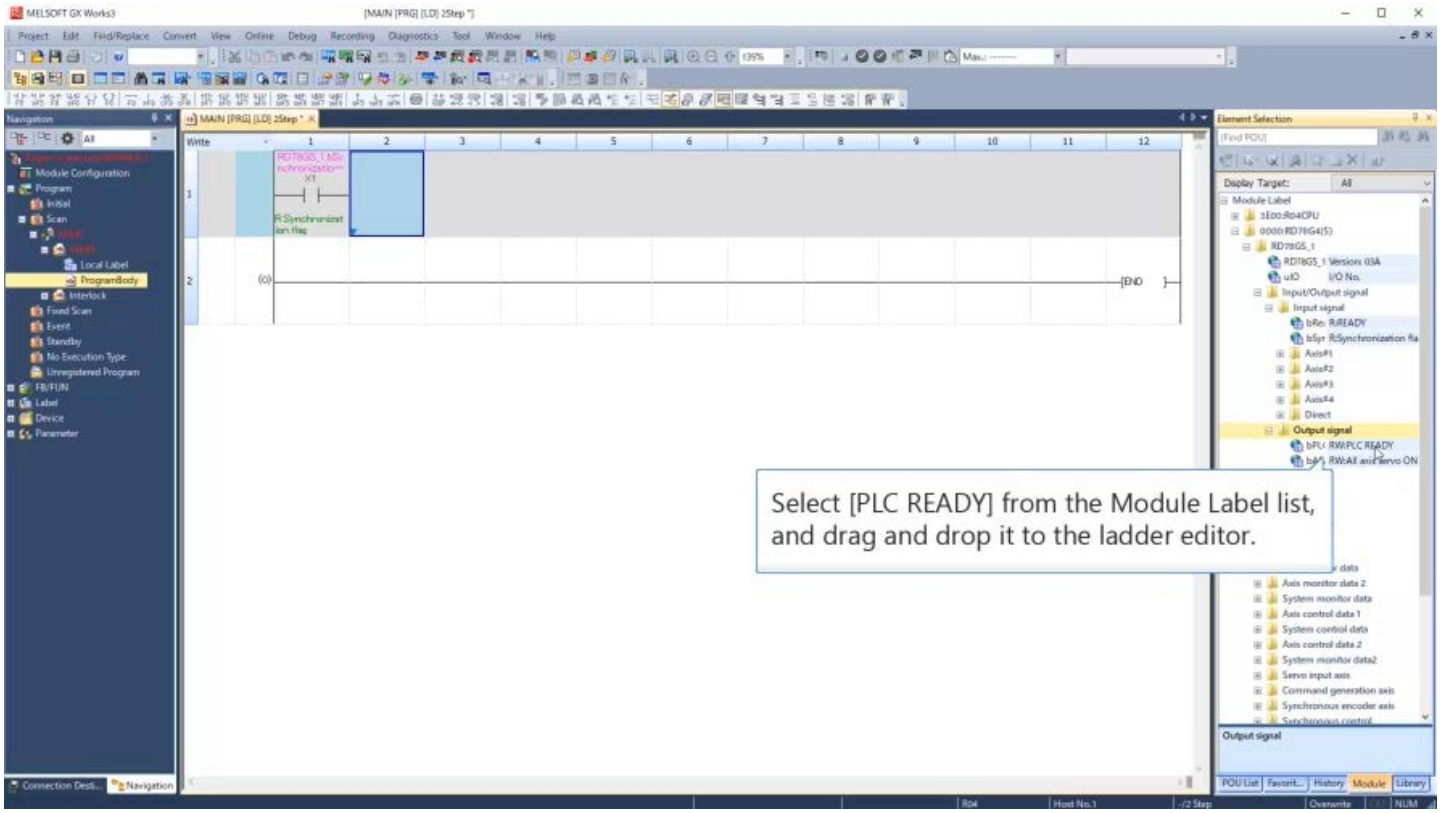

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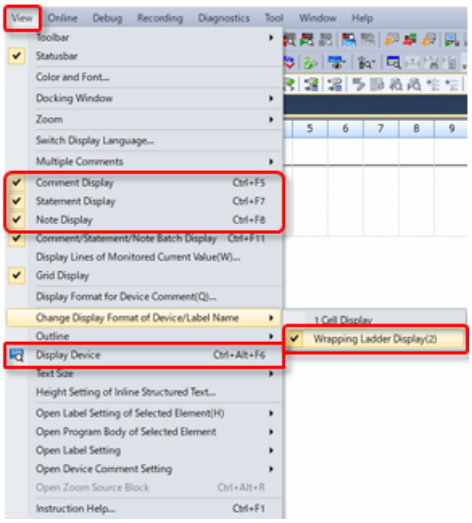

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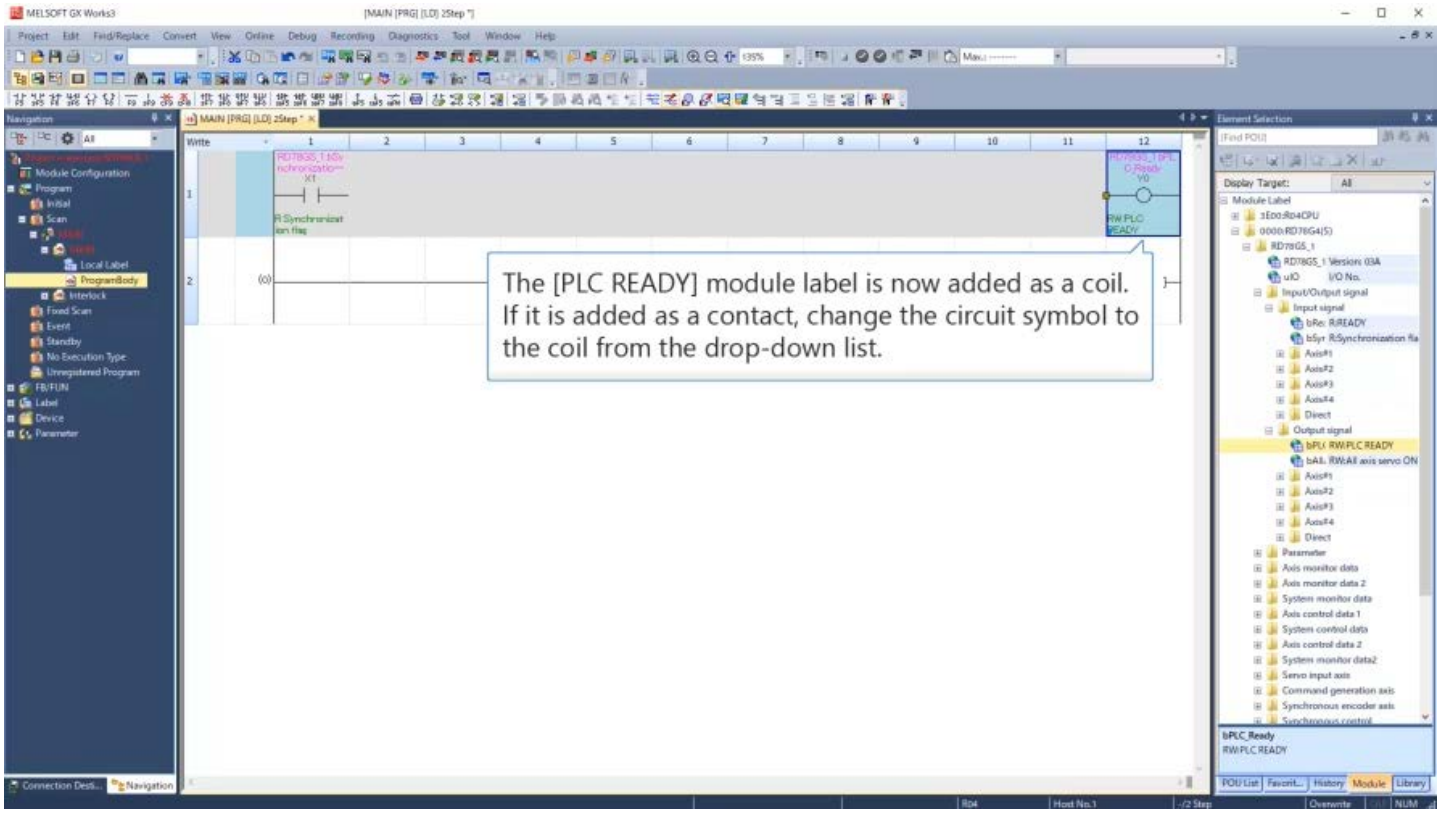

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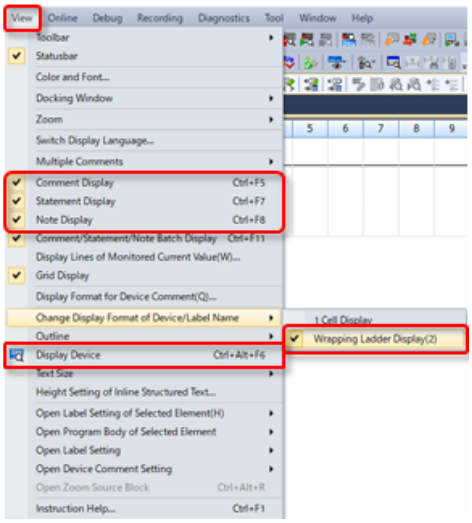

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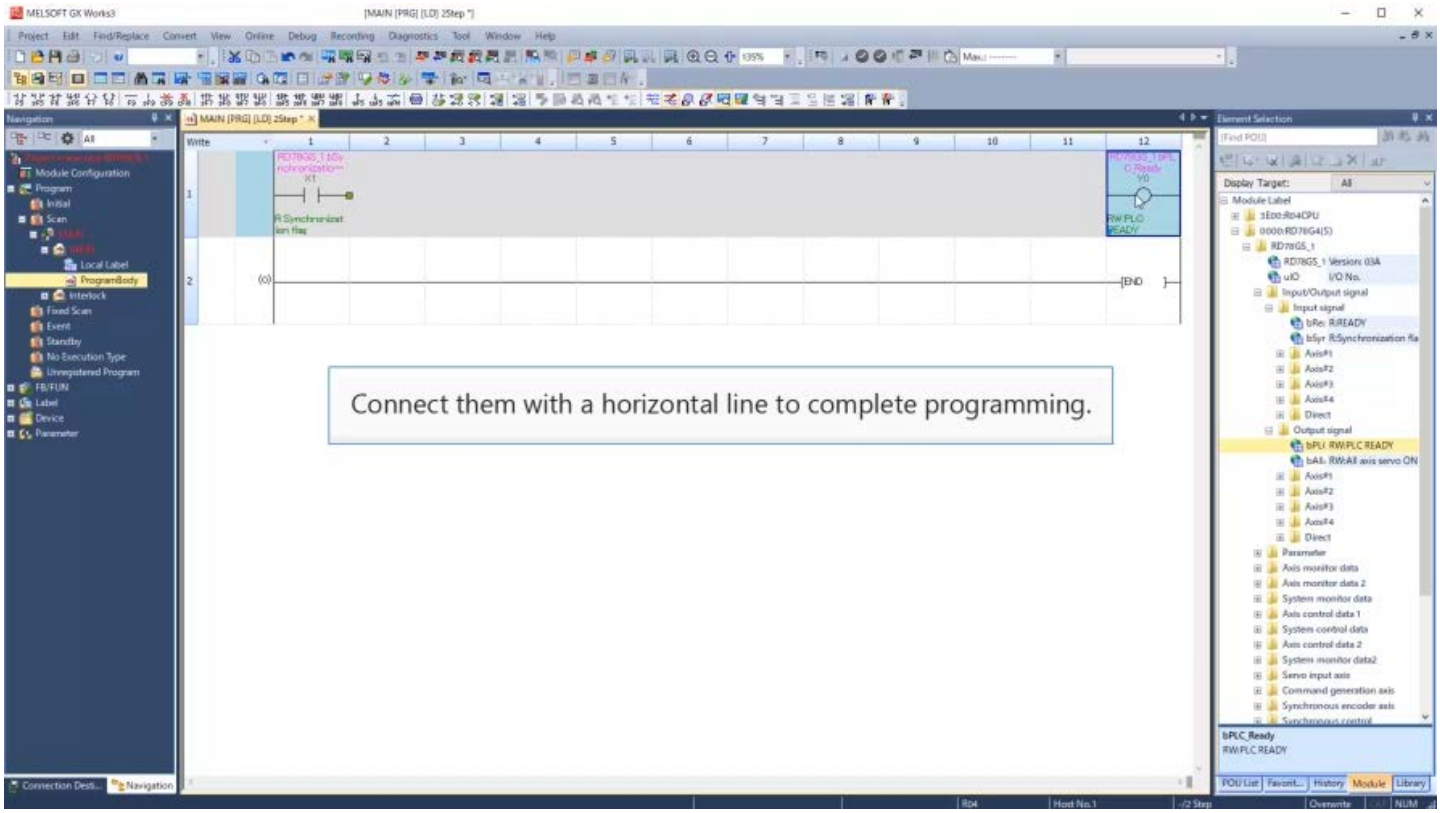

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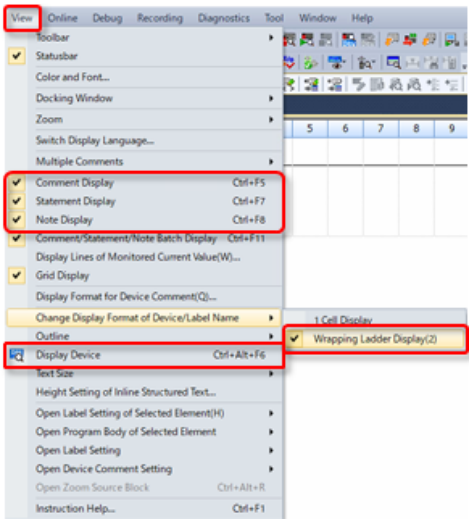

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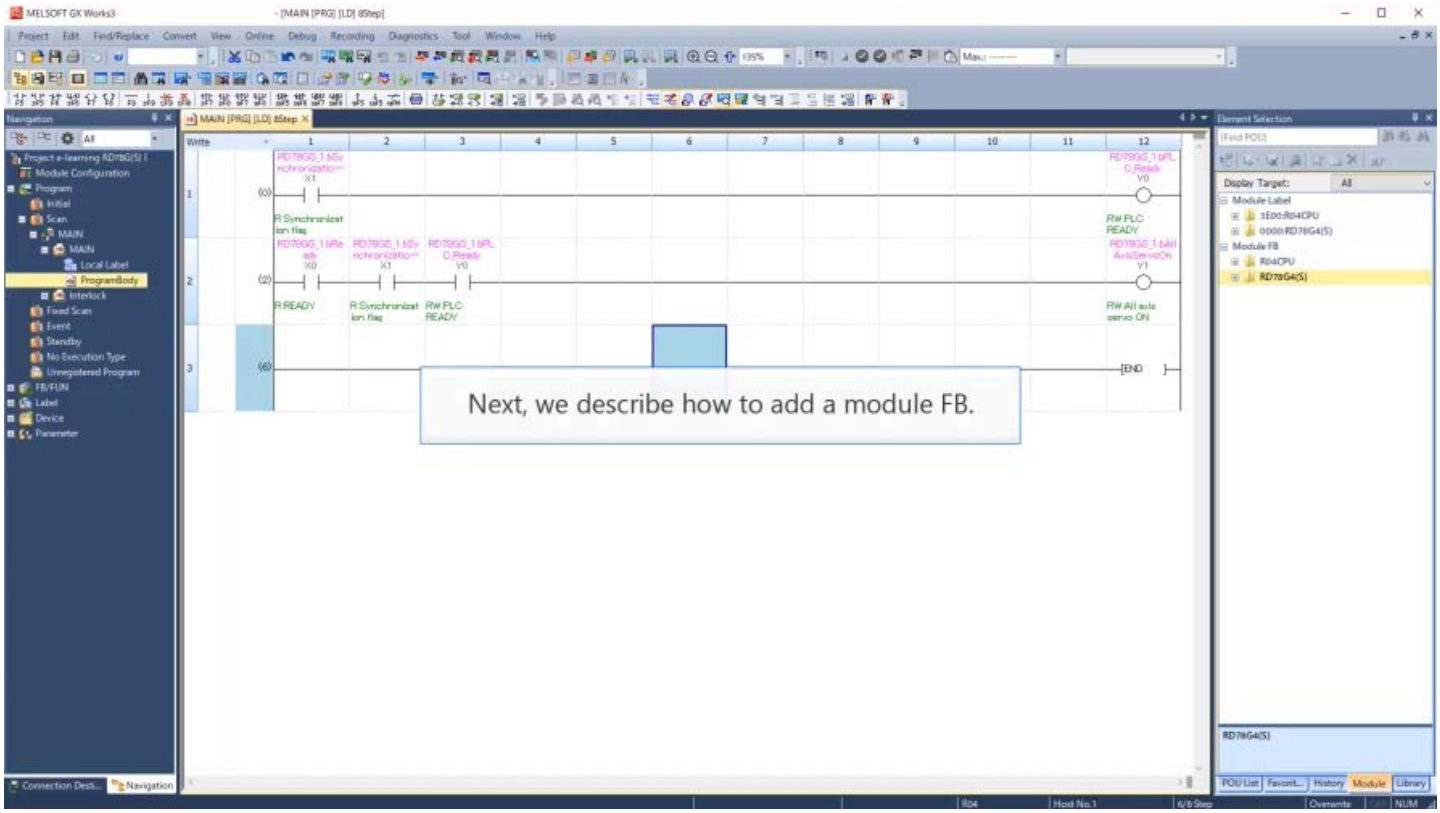

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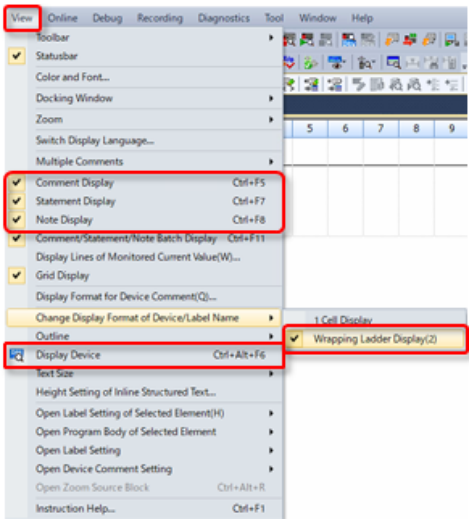

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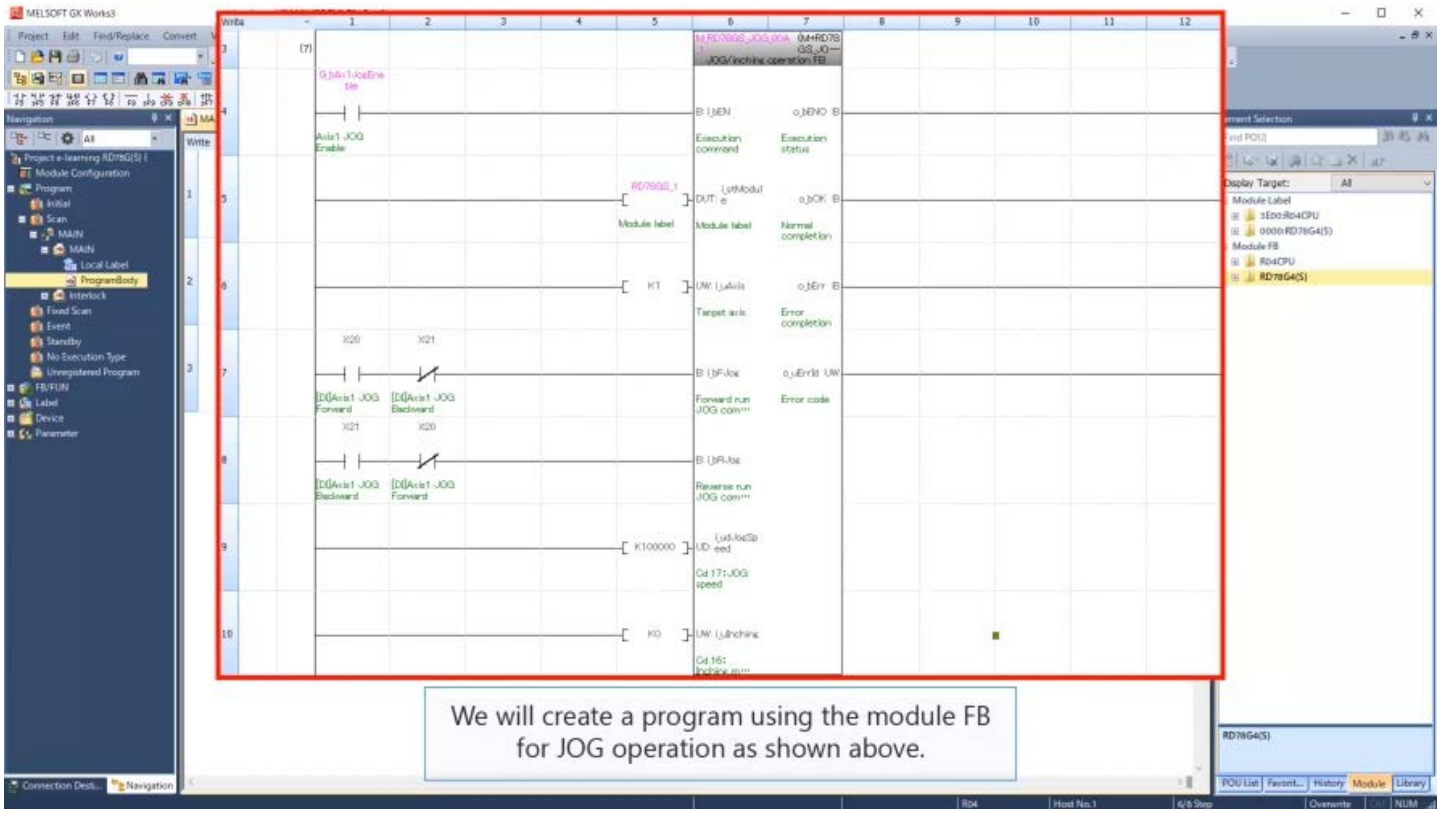

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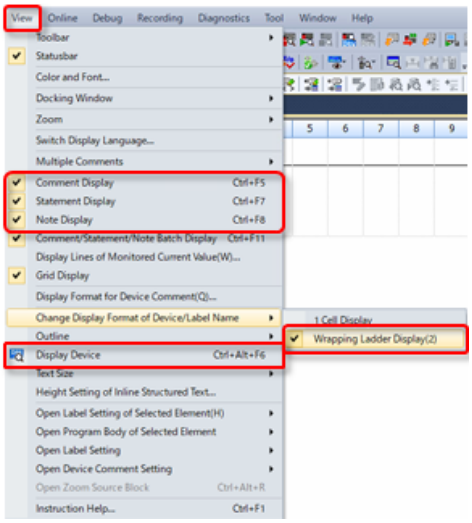

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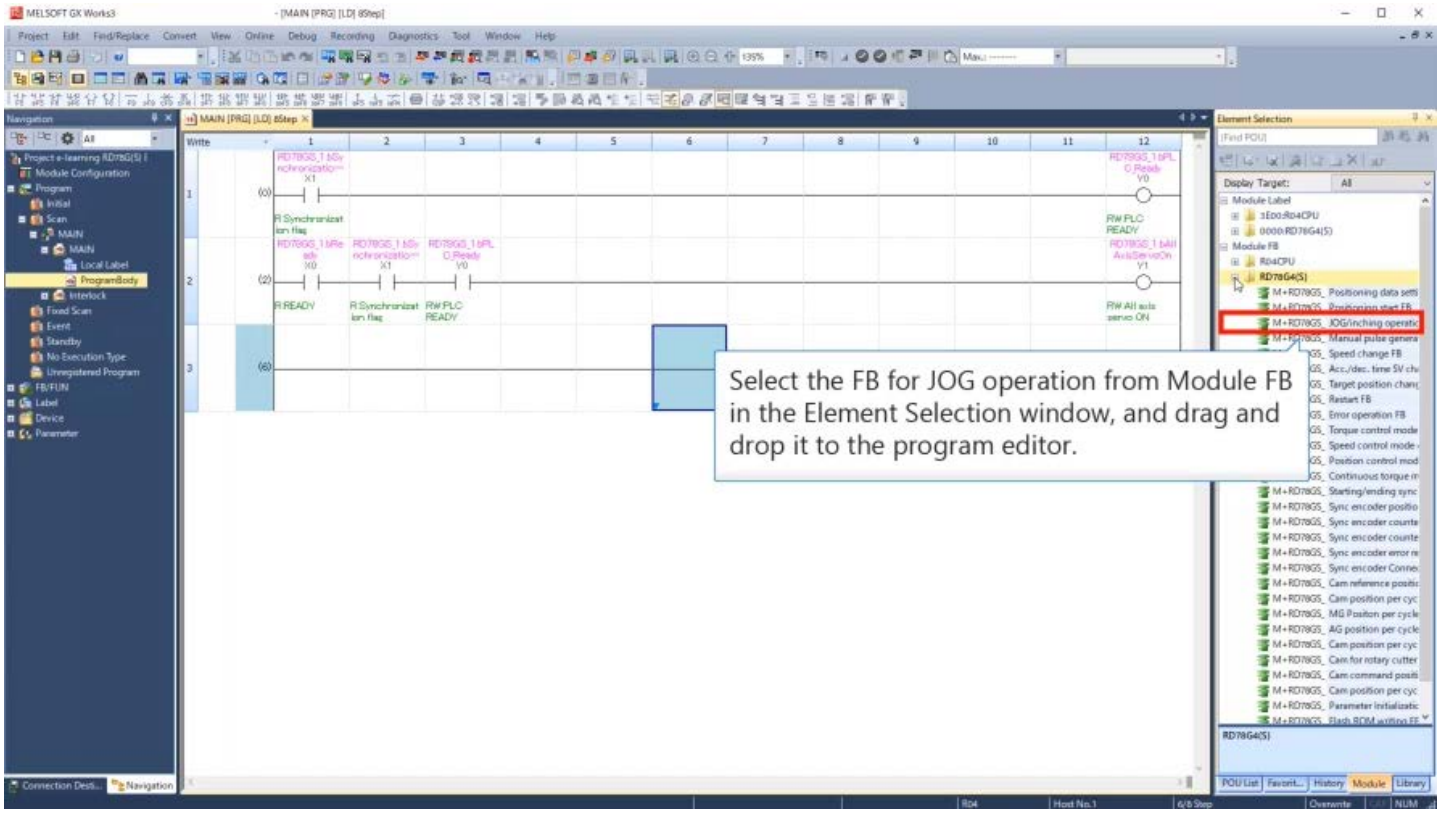

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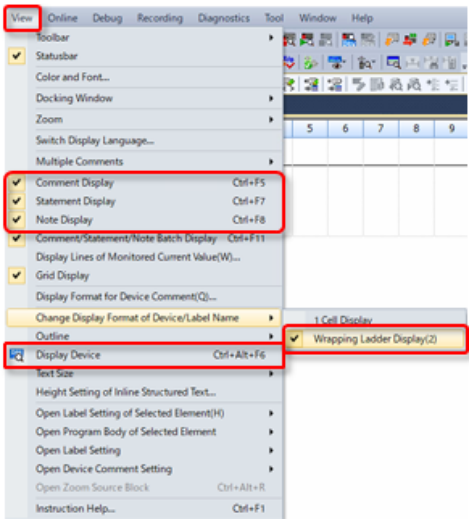

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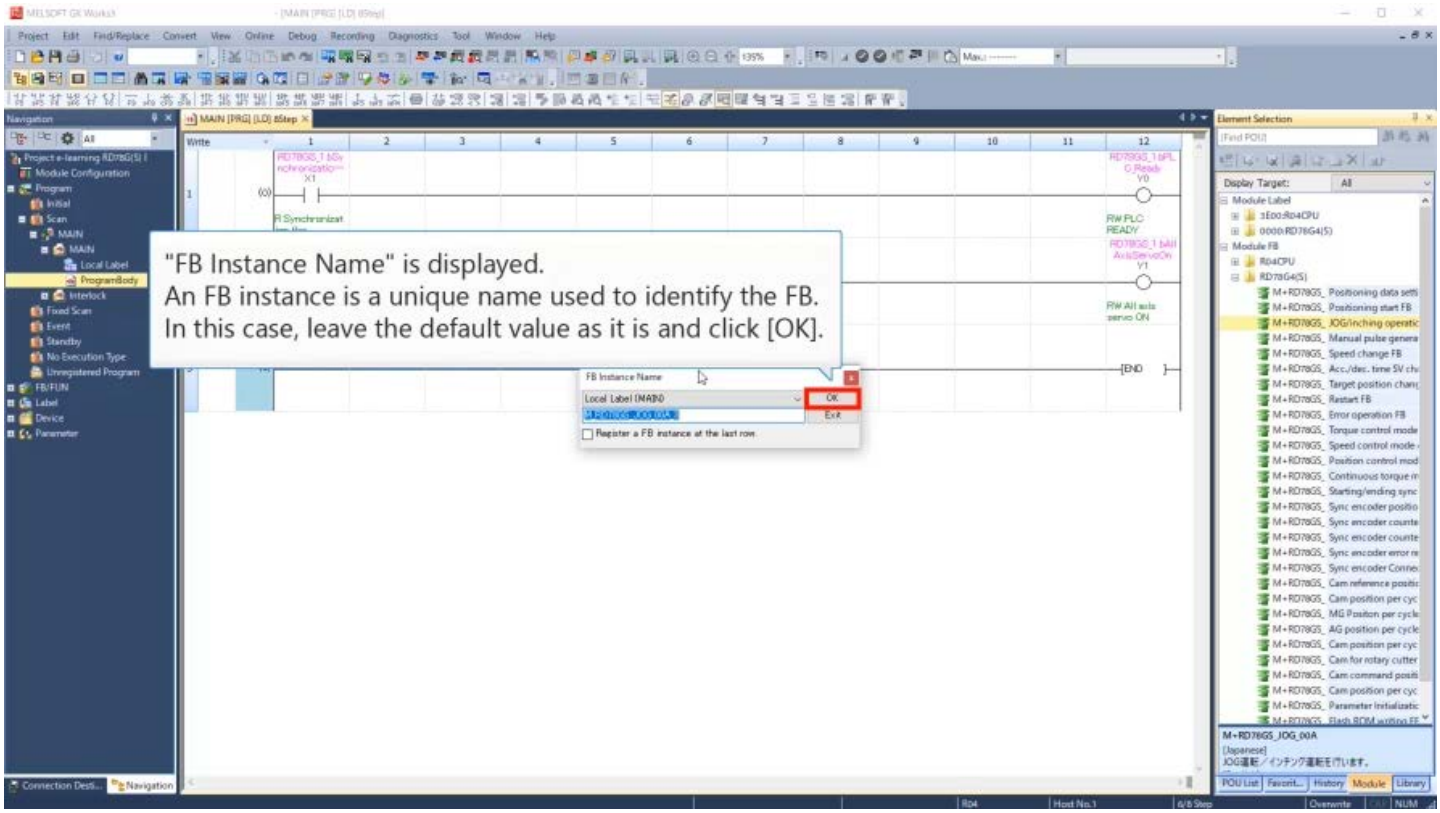

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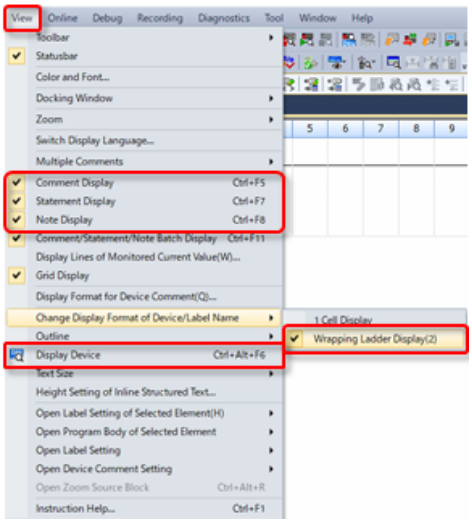

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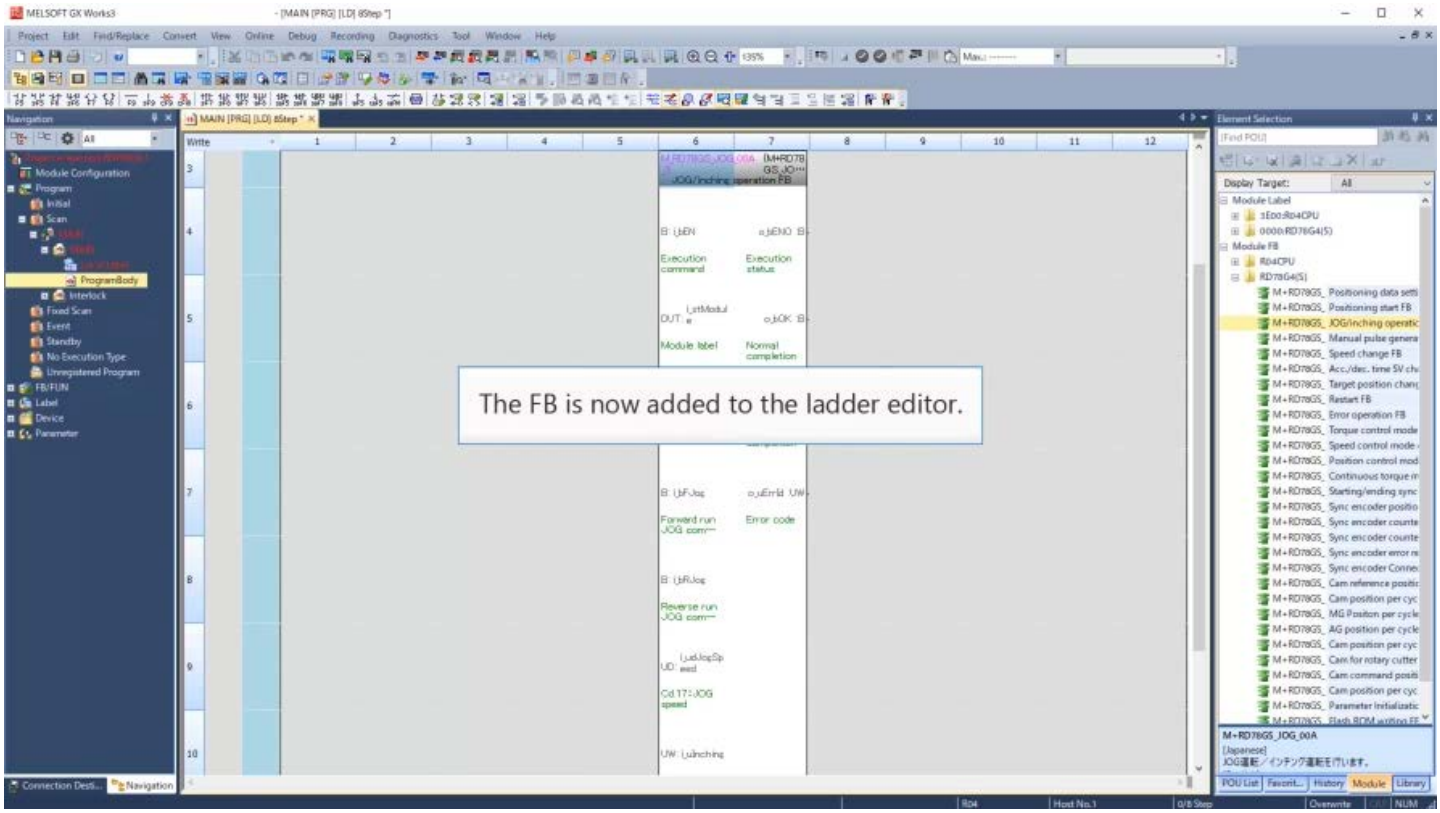

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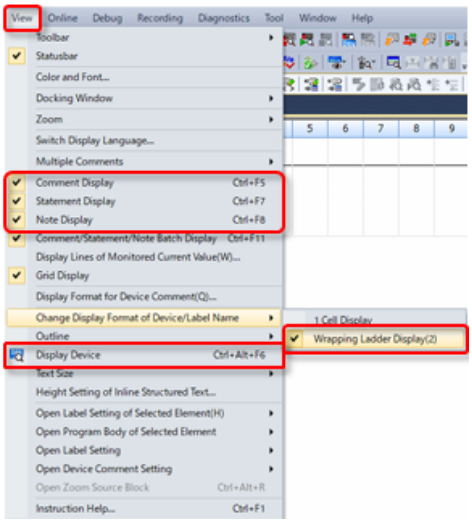

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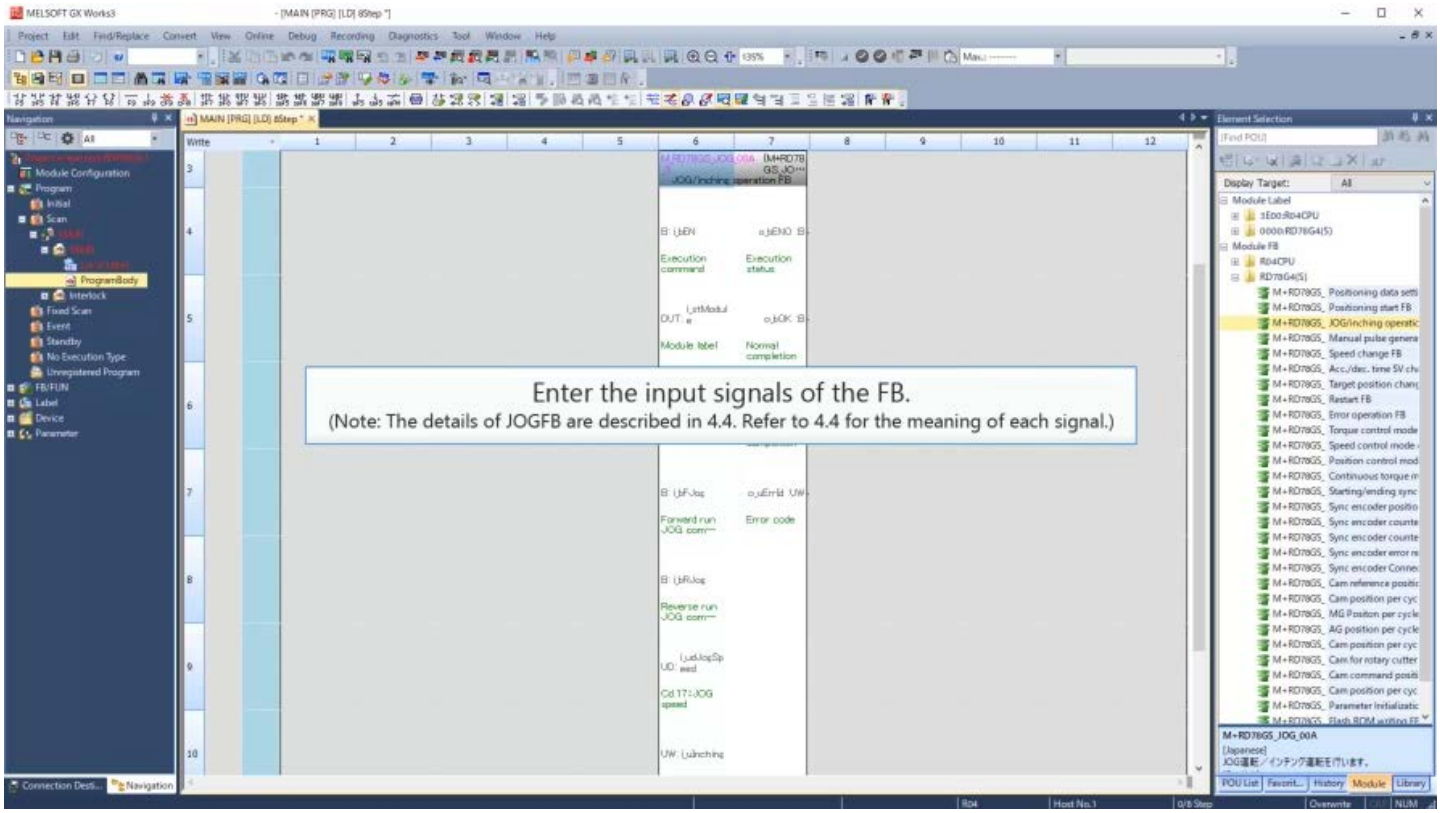

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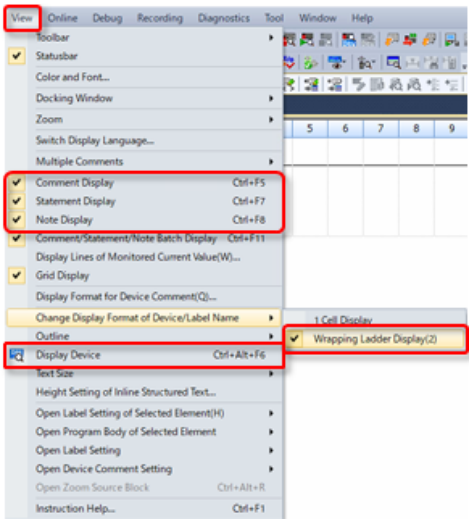

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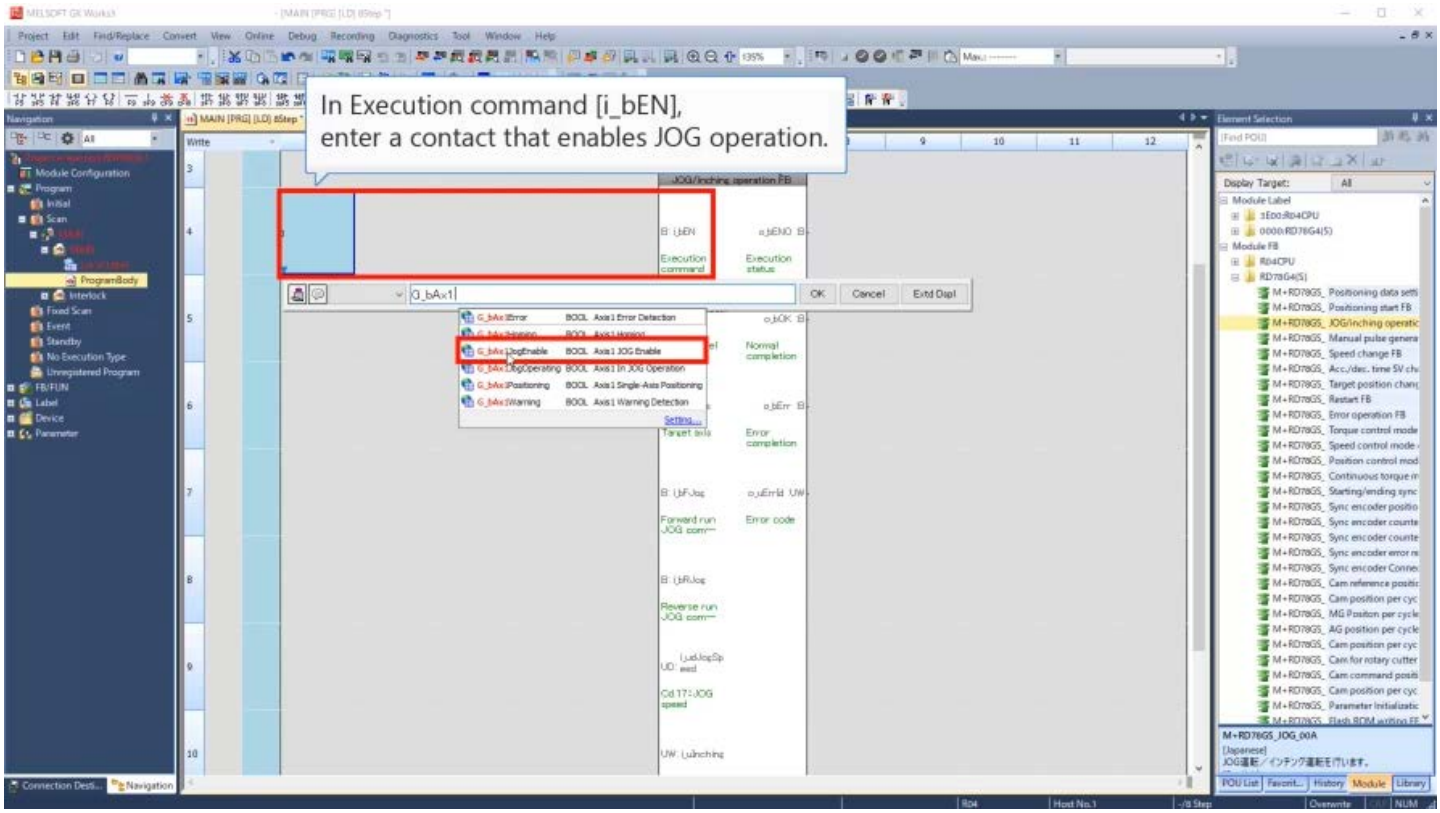

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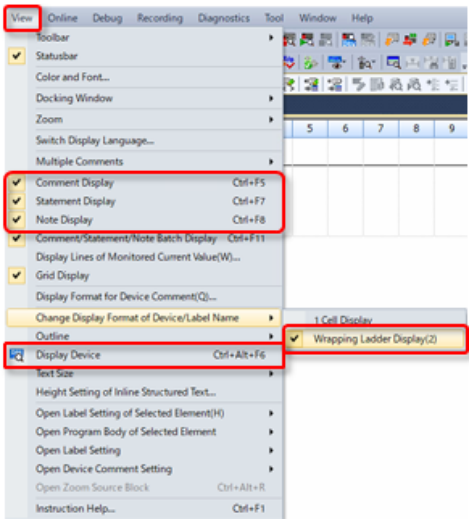

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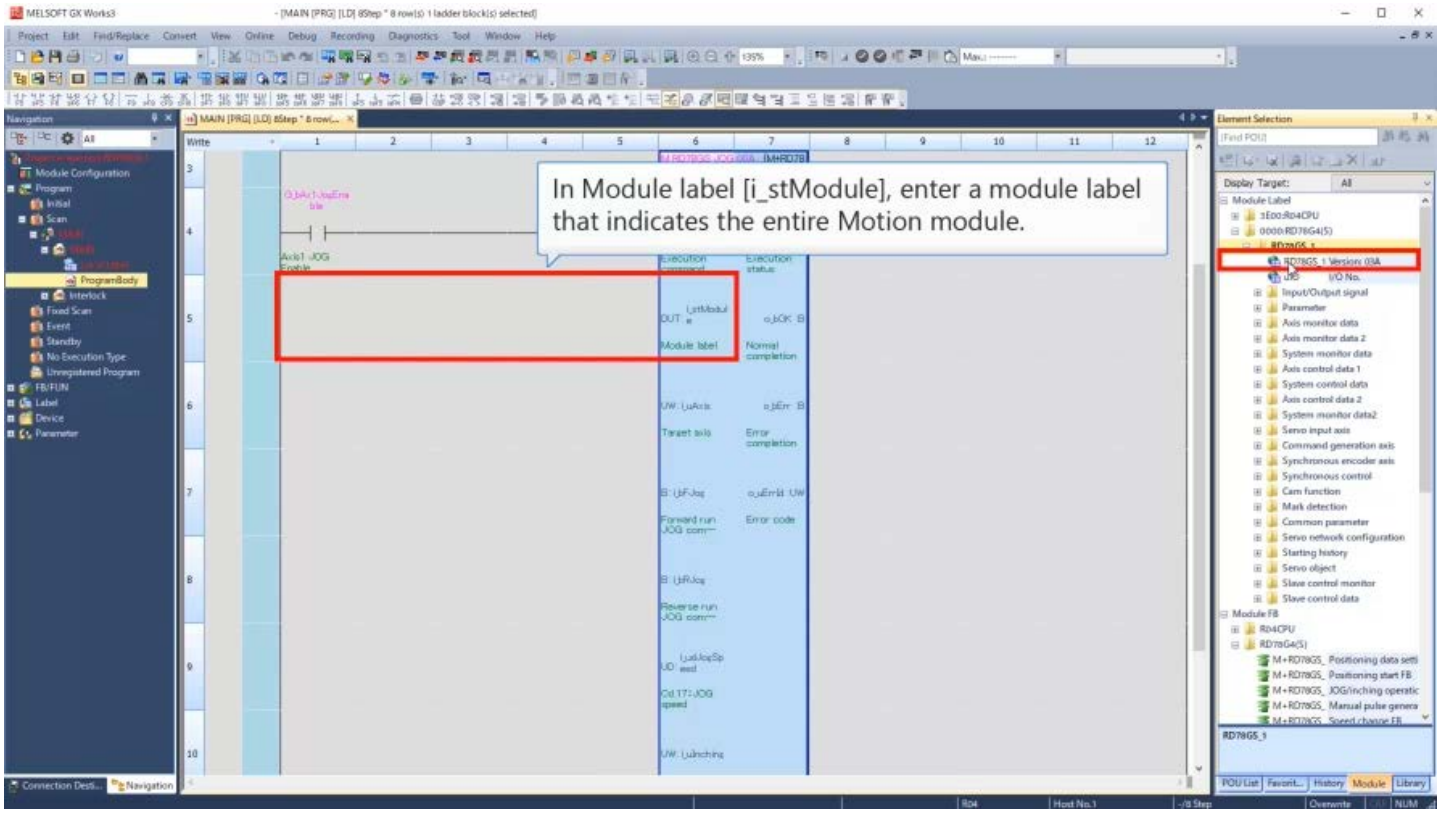

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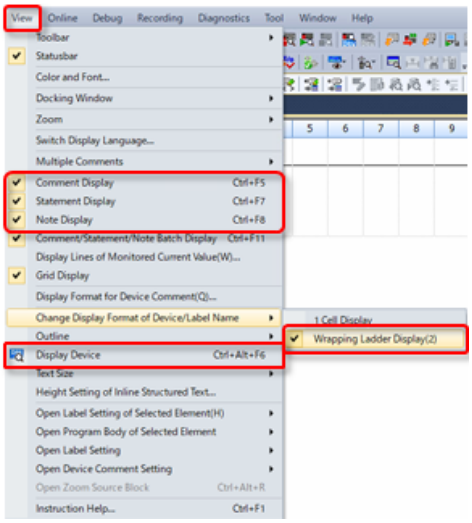

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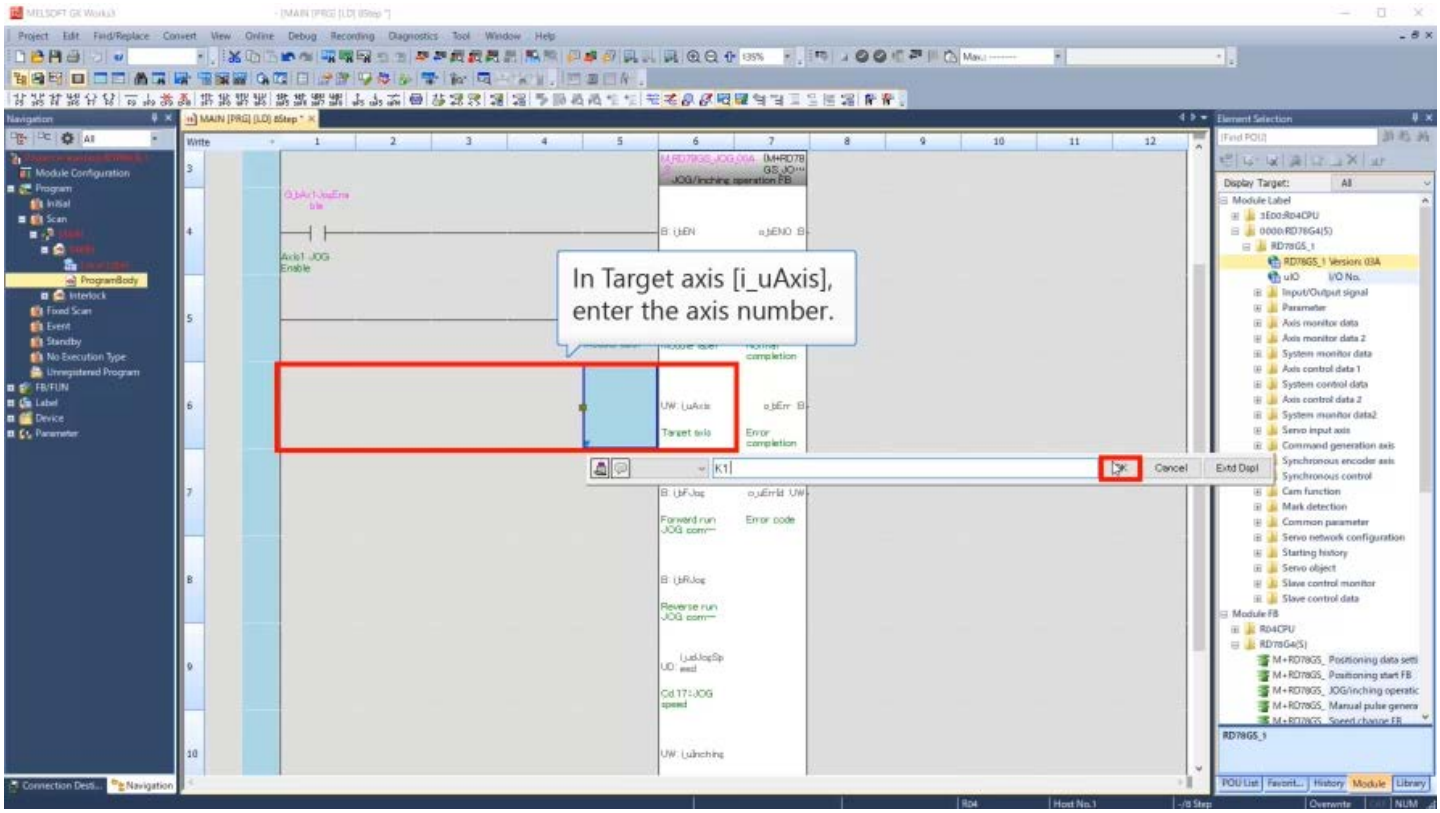

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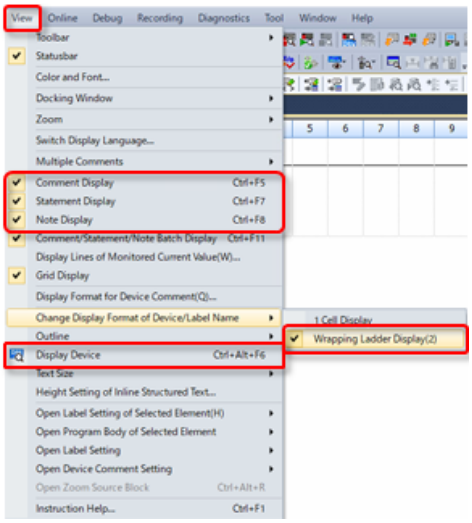

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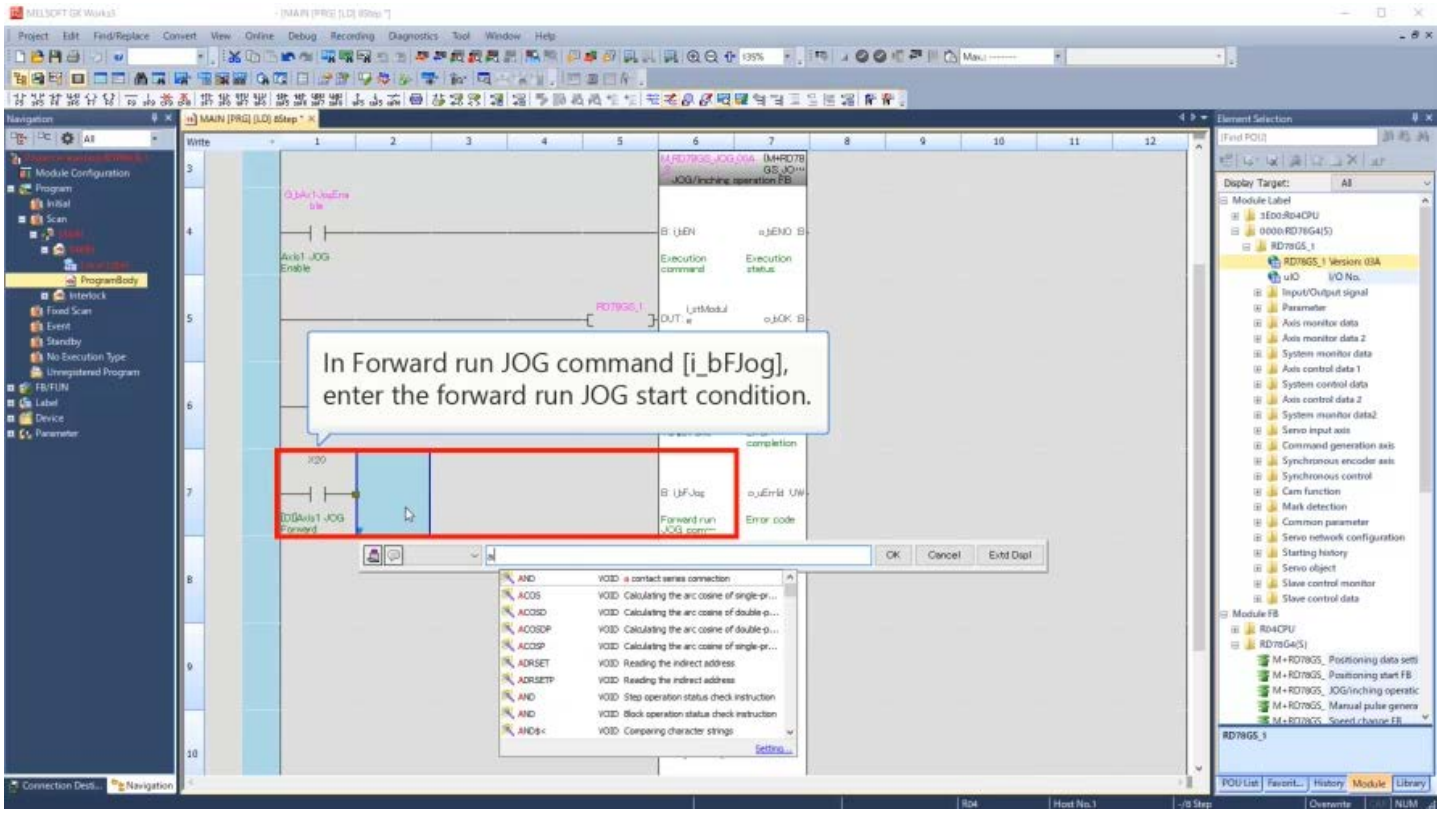

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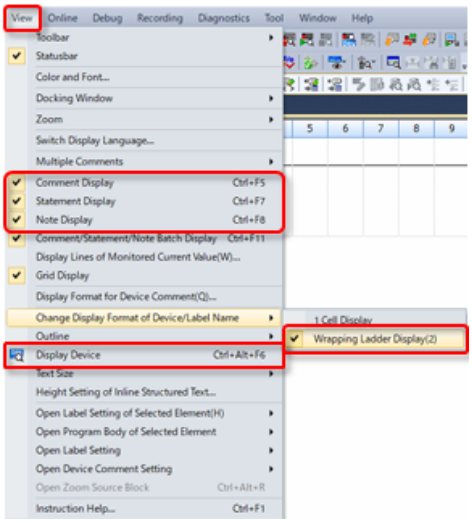

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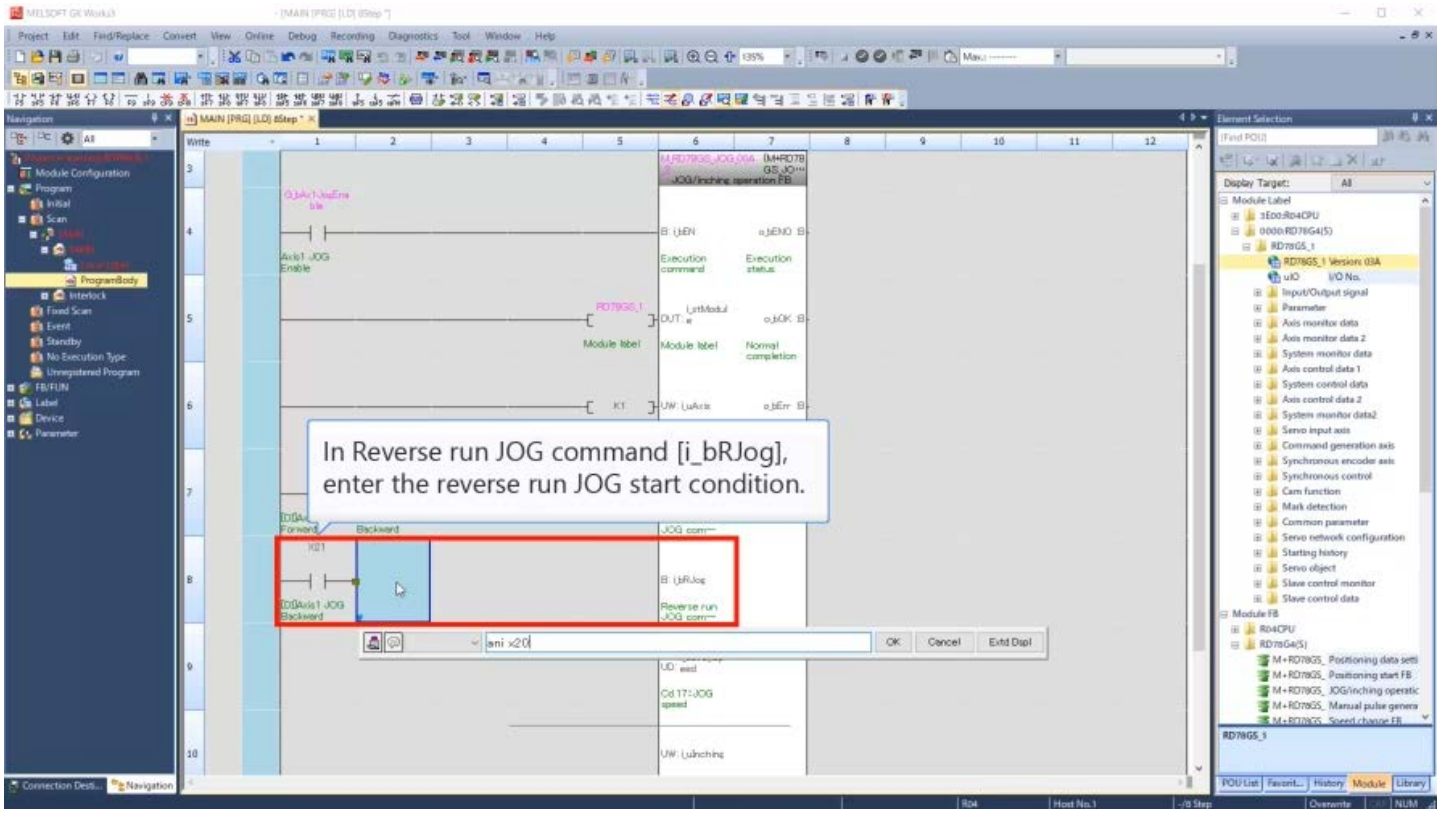

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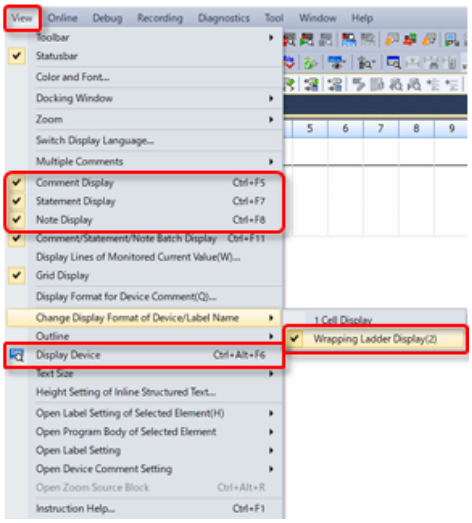

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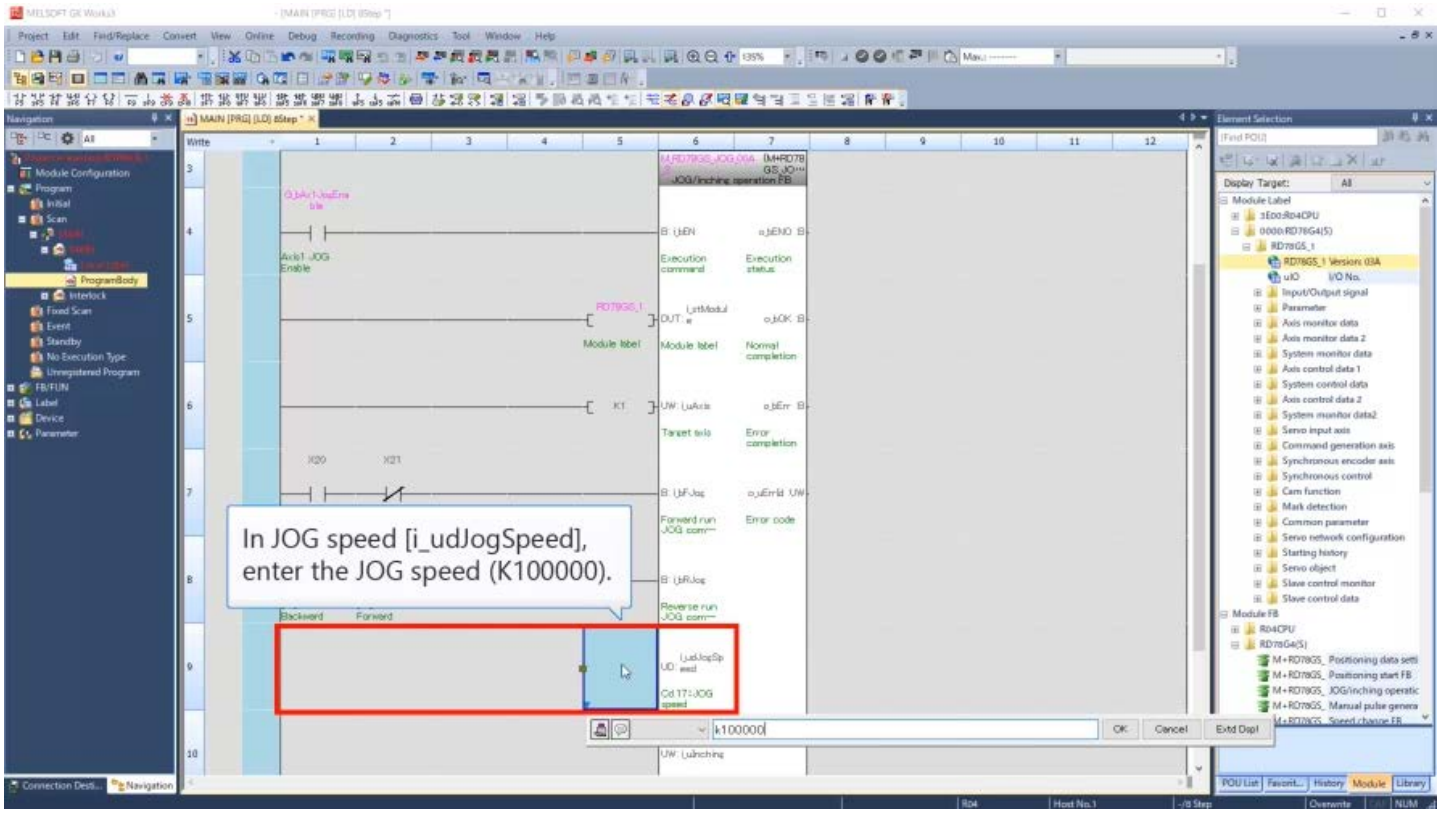
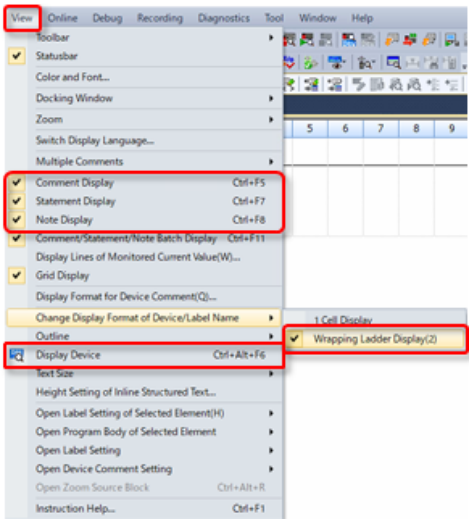


[Point]
To wrap the label name as shown in the video, select [View] → [Change Display Format of Device/Label Name] from the menu bar and select [Wrapping Ladder Display].

In the program display in this course, Comment Display, Statement Display, Note Display, and Display Device are enabled for explanatory purposes.
Select [View] from the menu bar and select [Comment Display], [Statement Display], [Note Display], and [Display Device] checkboxes.



4.2 How to add module labels and module FBs

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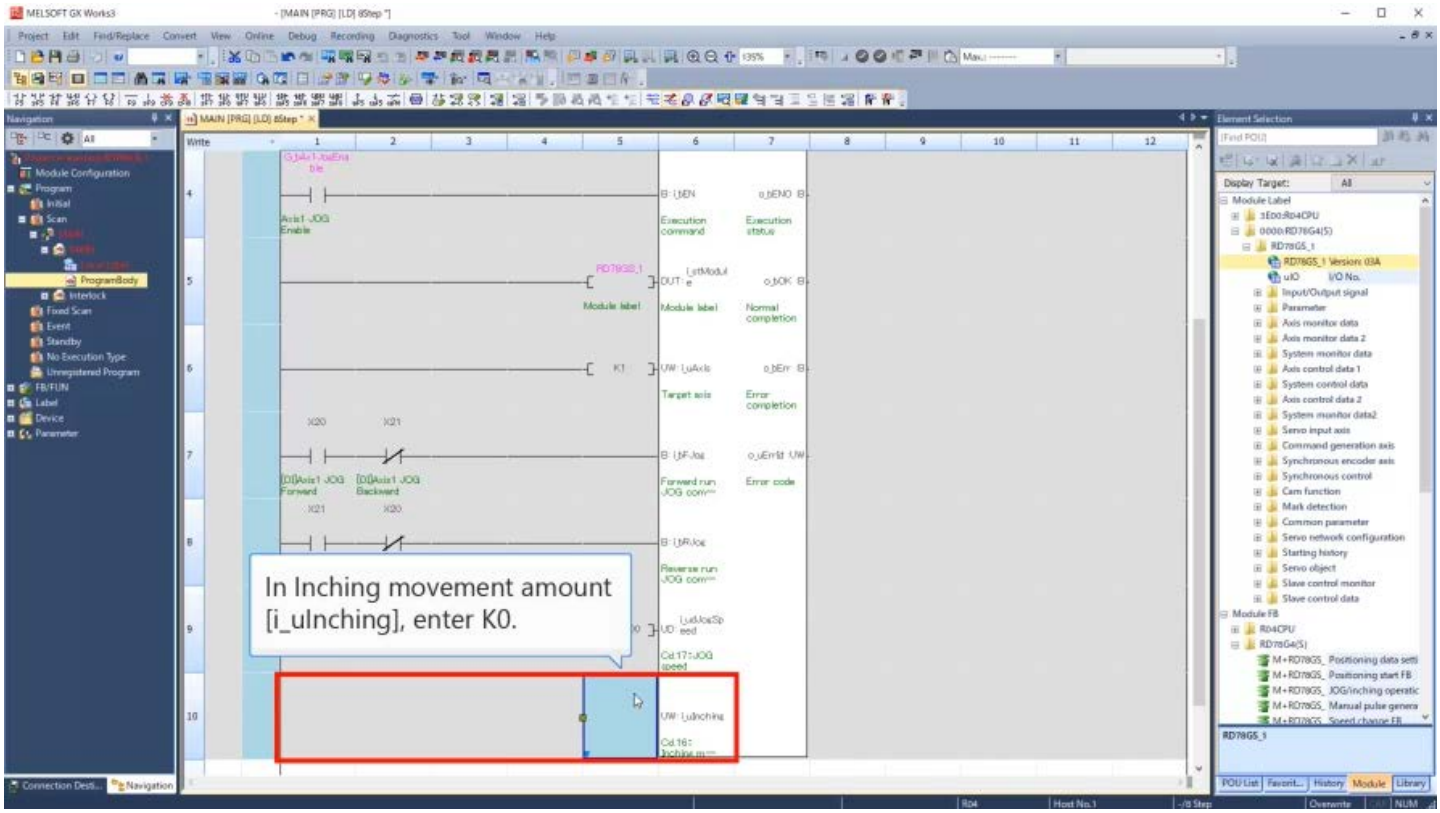
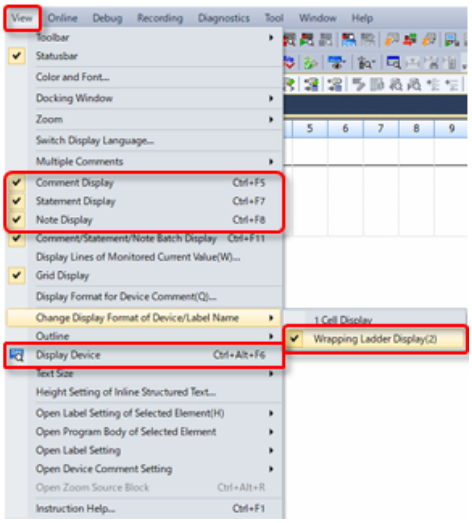


[Point]
To wrap the label name as shown in the video, select [View] → [Change Display Format of Device/Label Name] from the menu bar and select [Wrapping Ladder Display].

In the program display in this course, Comment Display, Statement Display, Note Display, and Display Device are enabled for explanatory purposes.
Select [View] from the menu bar and select [Comment Display], [Statement Display], [Note Display], and [Display Device] checkboxes.



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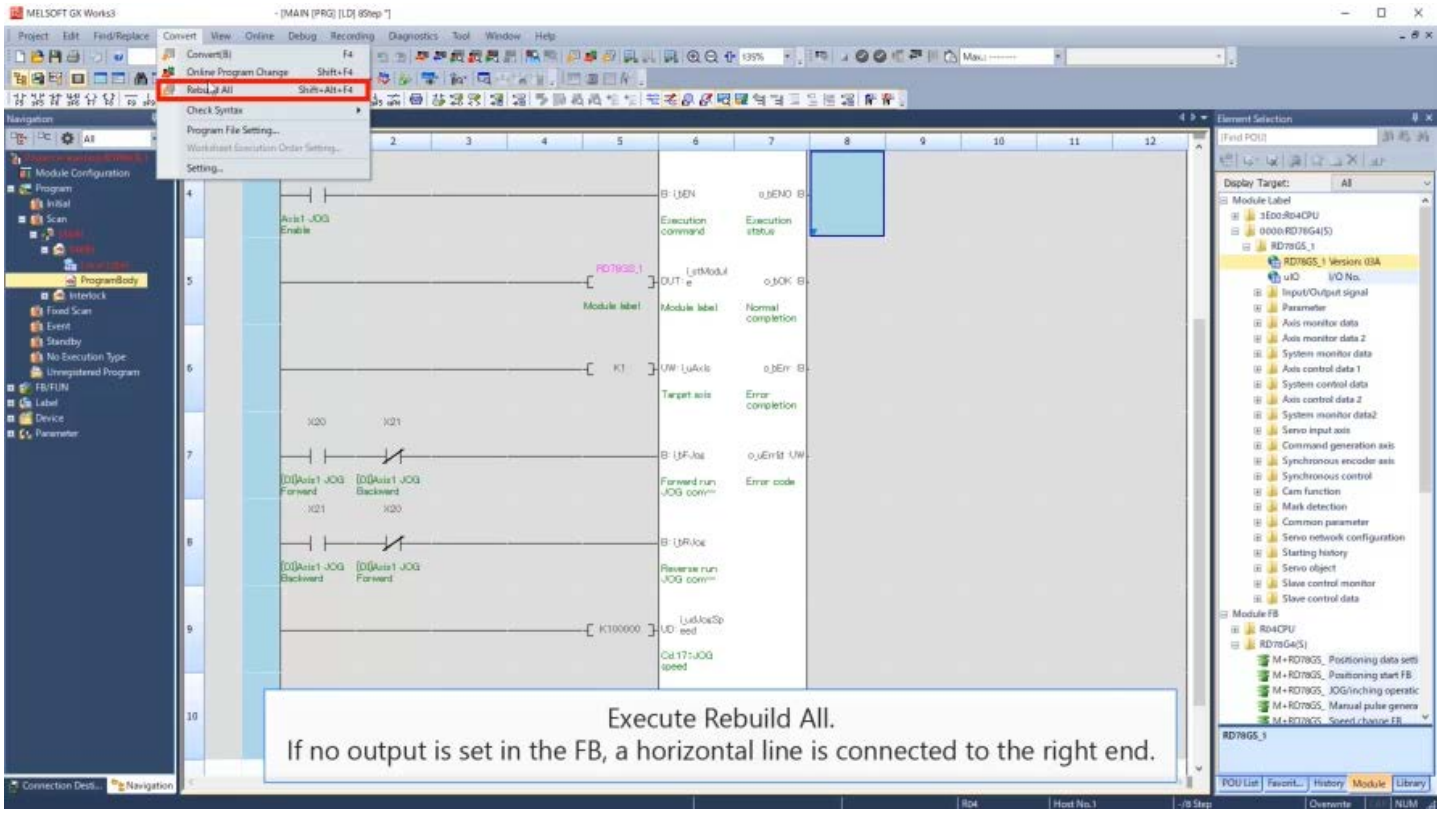
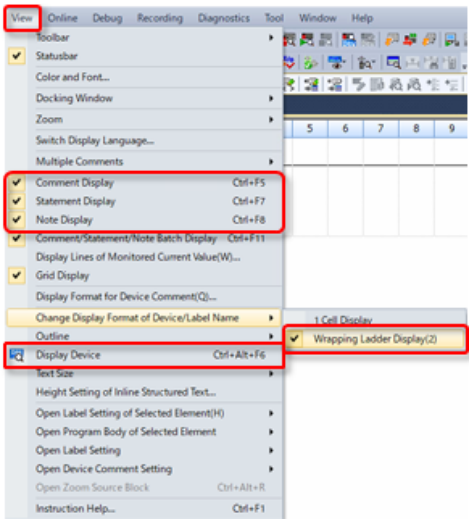


[Point]
To wrap the label name as shown in the video, select [View] → [Change Display Format of Device/Label Name] from the menu bar and select [Wrapping Ladder Display].

In the program display in this course, Comment Display, Statement Display, Note Display, and Display Device are enabled for explanatory purposes.
Select [View] from the menu bar and select [Comment Display], [Statement Display], [Note Display], and [Display Device] checkboxes.



4.2 How to add module labels and module FBs

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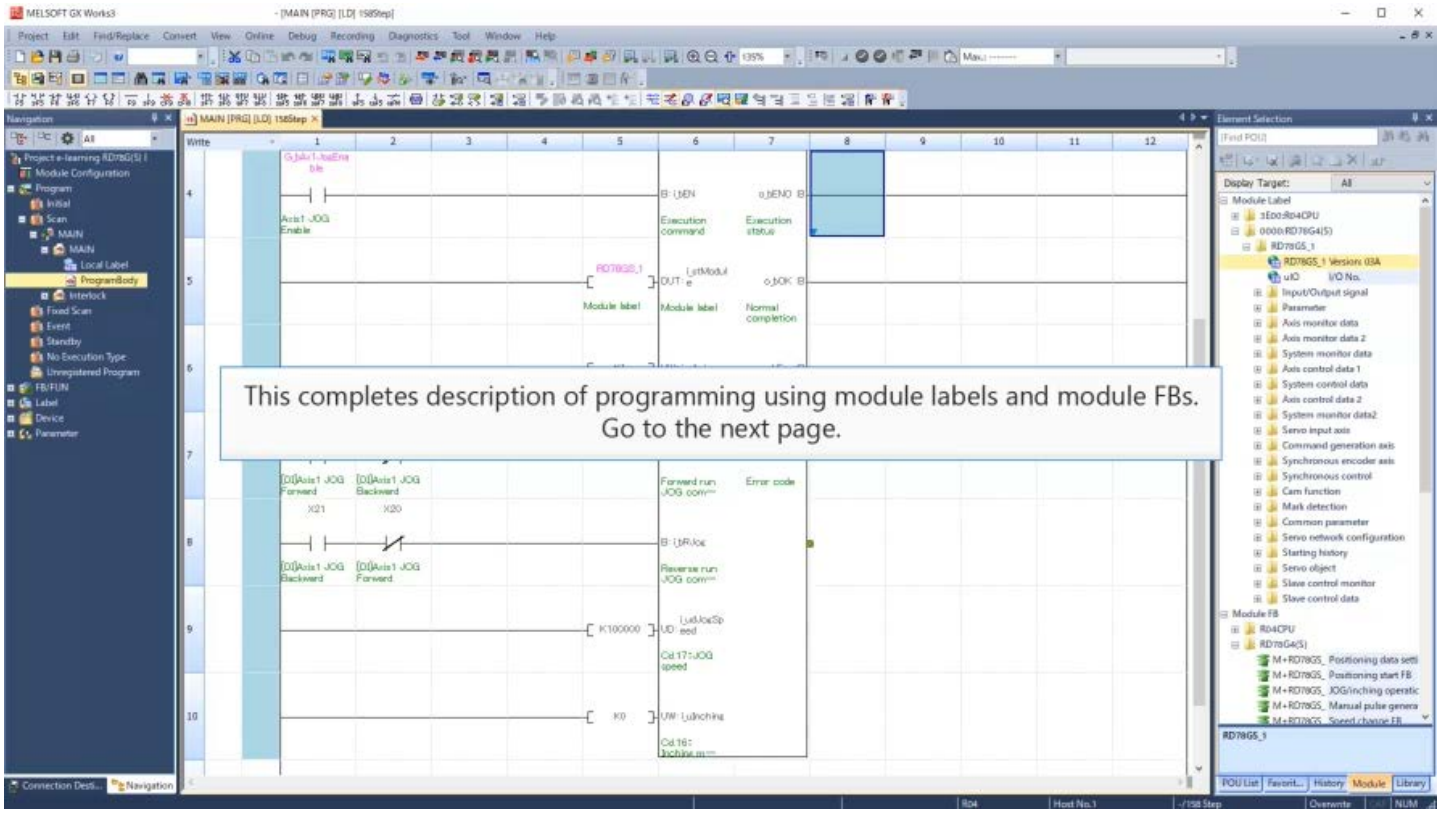
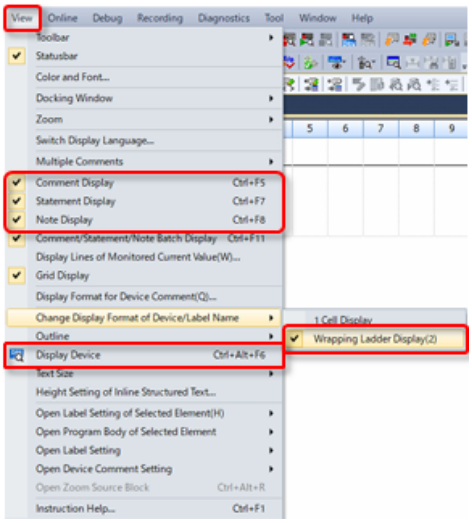


[Point]
To wrap the label name as shown in the video, select [View] → [Change Display Format of Device/Label Name] from the menu bar and select [Wrapping Ladder Display].

In the program display in this course, Comment Display, Statement Display, Note Display, and Display Device are enabled for explanatory purposes.
Select [View] from the menu bar and select [Comment Display], [Statement Display], [Note Display], and [Display Device] checkboxes.

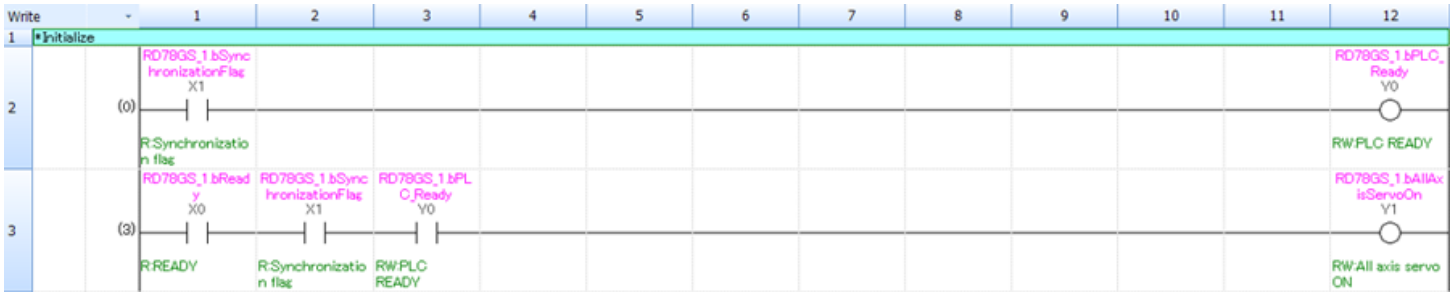


4.3 From the initial setting to all axis servo ON

To use Simple Motion mode of the Motion module, always create a program as shown below.

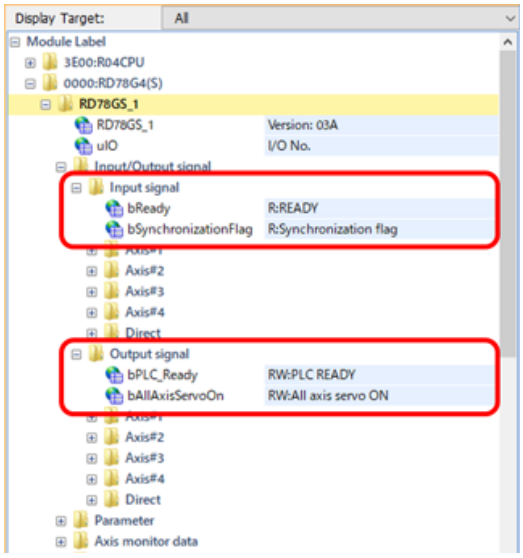
After the programmable controller enters the RUN state, [Synchronization flag] turns ON when the buffer memory becomes accessible.
↓
Turn ON [PLC READY].
↓
[READY] turns ON.
↓
Turn ON [All axis servo ON].

[Program example]

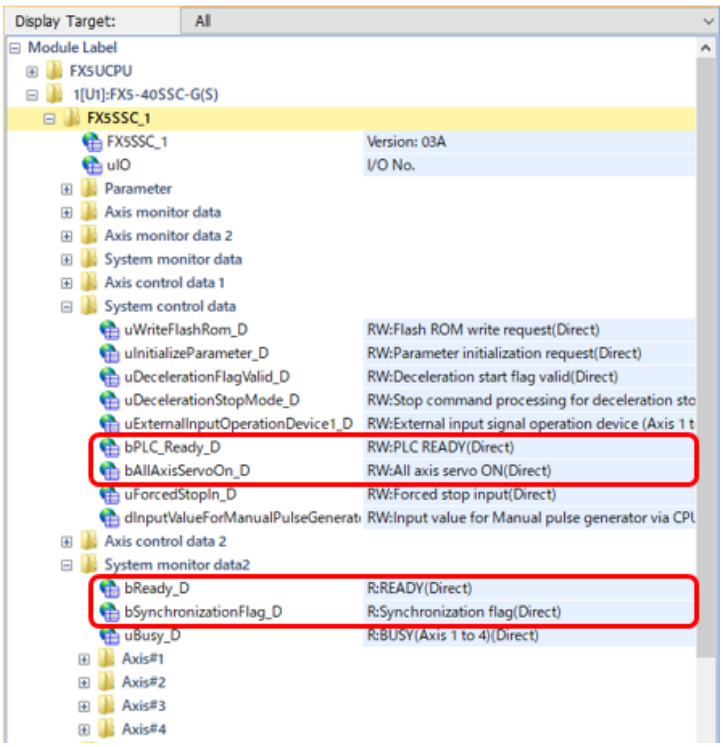


[Point]
The module label of each signal is located as shown below.

(iQ-R)

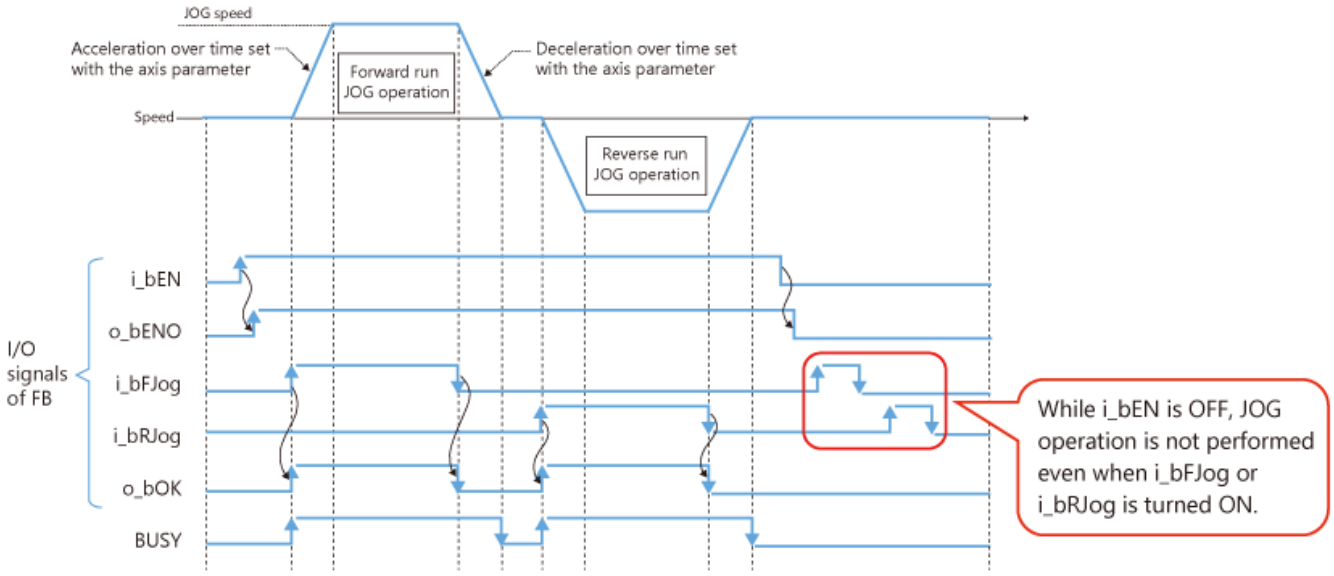


(iQ-F)



4.4 JOG operation

The sample program in this course uses the module FB "(Model)_JOG_(Version)" (hereafter referred to as JOGFB) for JOG operation.
JOGFB is enabled while the input signal i_bEN is ON.
By turning ON the input signal i_bFJog or i_bRJog, commands are output from the Motion module to the servo amplifier and the workpiece is moved in the specified direction while the signal is ON.



Pay attention to the following when using JOGFB.

- Since [Cd.181:Forward run JOG start] and [Cd.182:Reverse run JOG start] are turned ON/OFF by JOGFB, do not turn ON/OFF [Cd.181:Forward run JOG start] or [Cd.182:Reverse run JOG start] outside the FB while the FB is running.
- When using multiple JOGFBs, be careful not to use the same target axis.

For other precautions, refer to the following manuals.

MELSEC iQ-R Motion Module (Simple Motion Mode) Function Block Reference
2 Motion Module FB
2.3 M+RD78GS_JOG

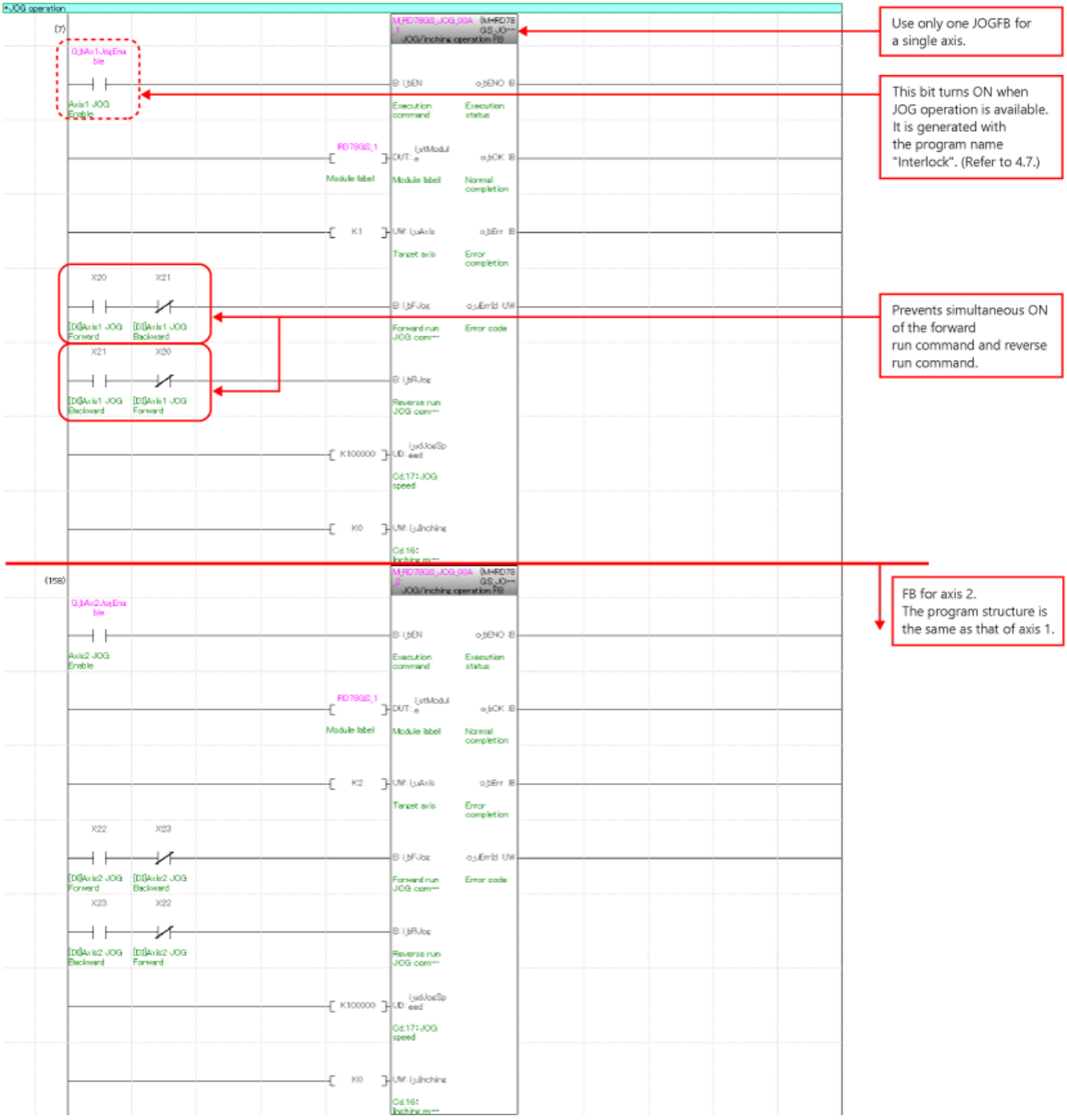
MELSEC iQ-R Simple Motion Module Function Block Reference
2 Simple Motion Module FB/Motion Module FB
2.3 M+FX5SSC_JOG

[Point]
Inching operation is performed when a value other than "0" is input to the FB input i_uInching.
For inching operation, refer to the following manuals.

MELSEC iQ-R Motion Module User's Manual (Application for Simple Motion Mode)
5 MANUAL CONTROL
5.3 Inching Operation

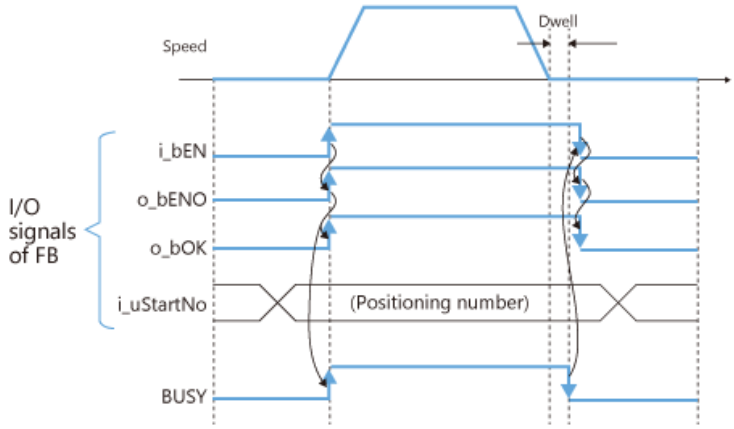
MELSEC iQ-F FX5 Motion Module/ Simple Motion Module User's Manual (Application)
5 MANUAL CONTROL
5.3 Inching Operation

[Program example]



4.5 Home position return, single positioning, and interpolation control

The sample program in this course uses the module FB "(Model)_StartPositioning_(Version)"
(hereafter referred to as StartPositioningFB) to execute home position return and positioning start.
To execute home position return, enter "9001" as the positioning number and execute the FB.
To start positioning, enter the number of the positioning data (point table) as the positioning number and execute the FB.
In the case of interpolation control, execute positioning of the reference axis.



Pay attention to the following when using StartPositioningFB.

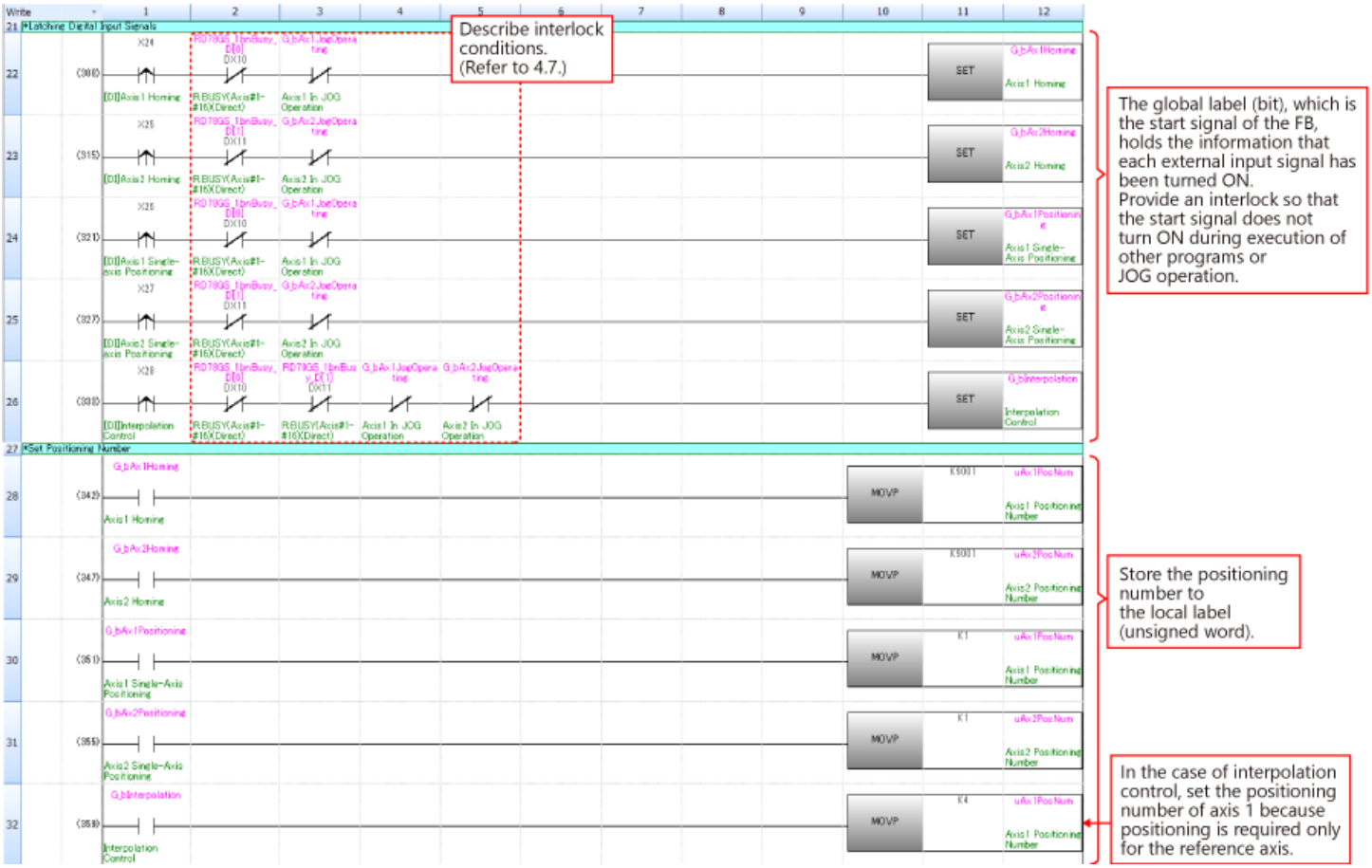
- Since the positioning start signals (Y10 to Y1F) are turned ON/OFF by StartPositioningFB, do not turn ON/OFF them outside the FB while StartPositioningFB is running.
- When using multiple StartPositioningFBs or when using an FB that operates the same Y signals as those operated by StartPositioningFB together, provide an interlock to prevent the FBs from being executed at the same time.
- When using multiple StartPositioningFBs, be careful not to use the same target axis.

For other precautions, refer to the following manuals.

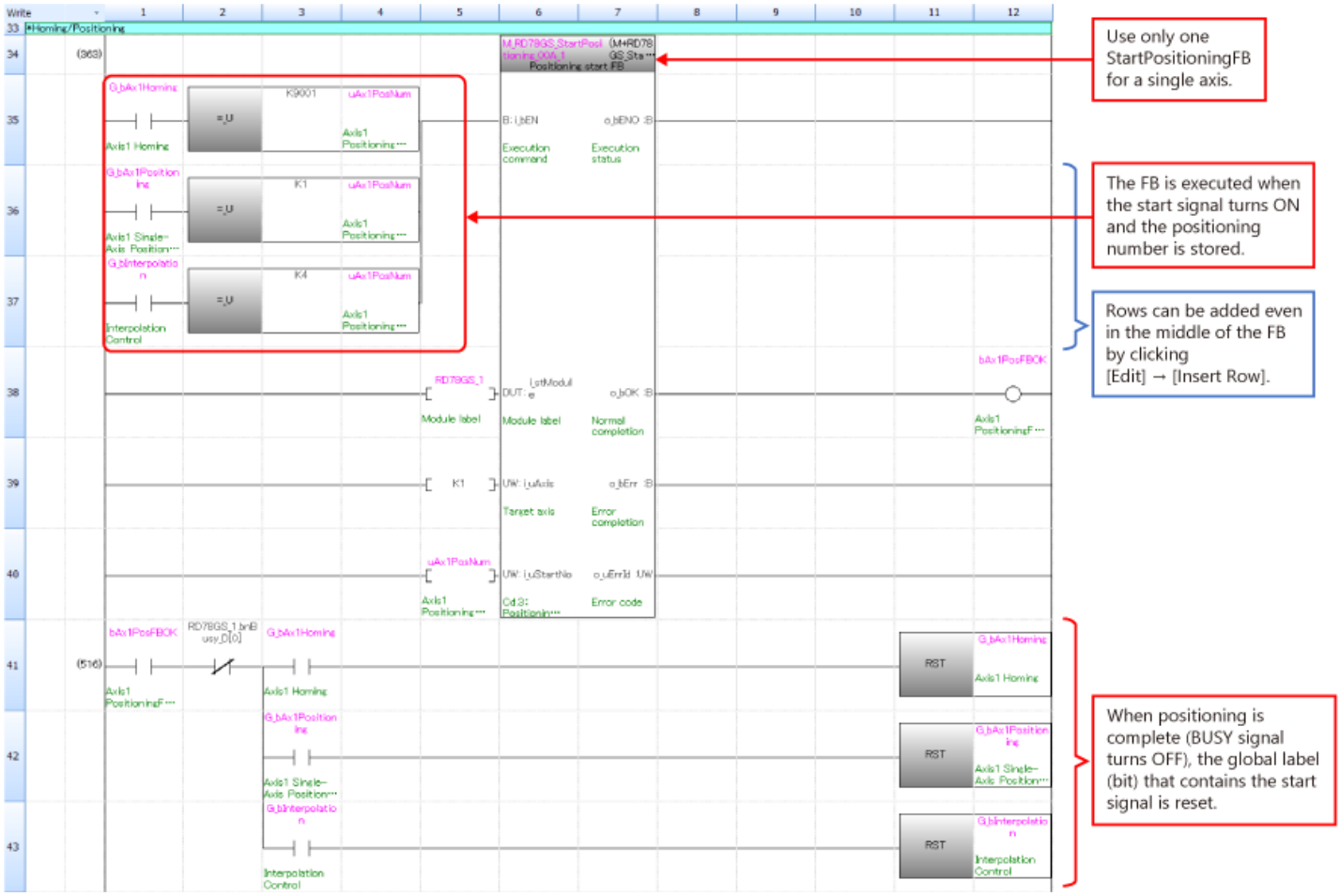
MELSEC iQ-R Motion Module (Simple Motion Mode) Function Block Reference
2 Motion Module FB
2.2 M+RD78GS_StartPositioning

MELSEC iQ-R Simple Motion Module Function Block Reference
2 Simple Motion Module FB/Motion Module FB
2.2 M+FX5SSC_StartPositioning

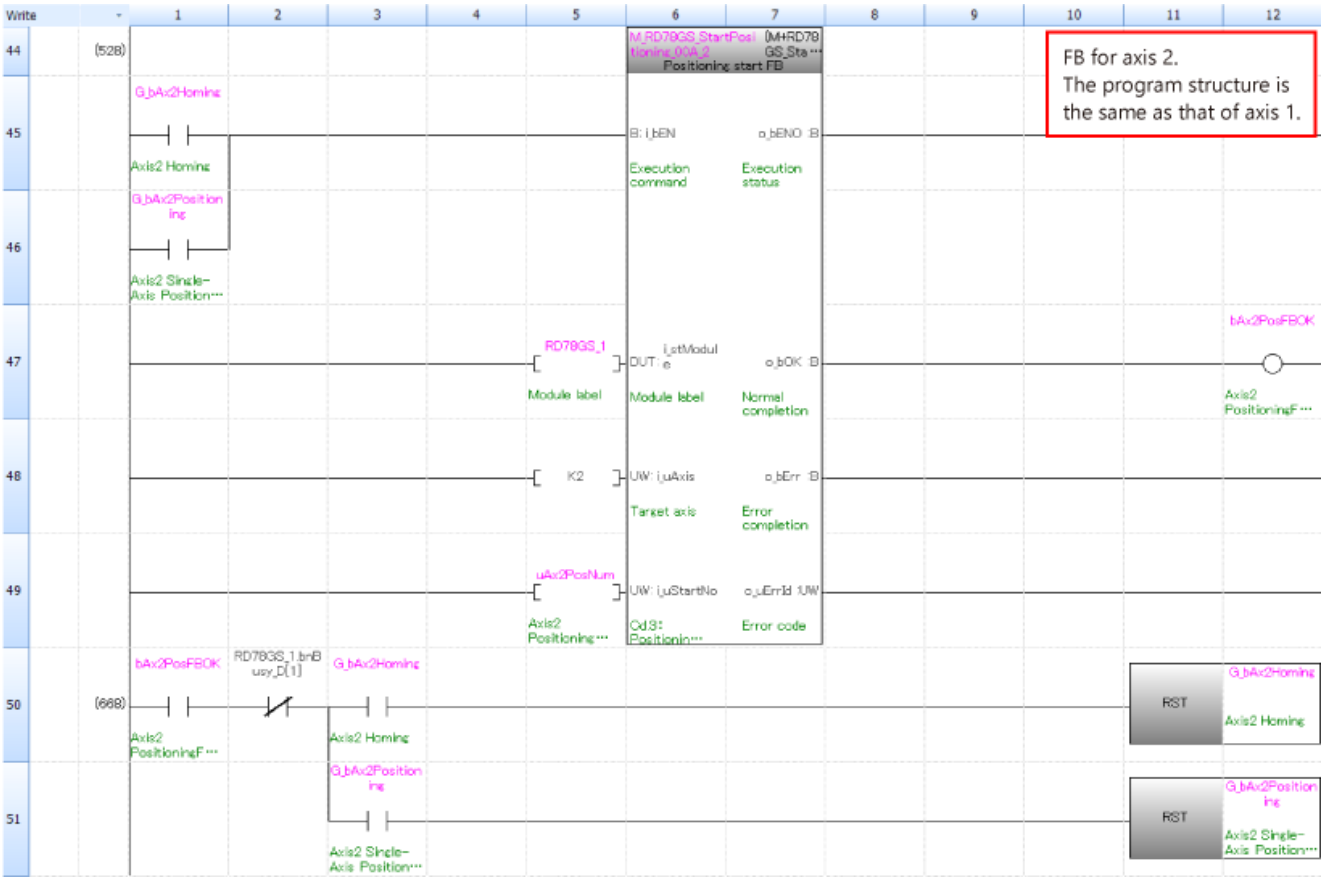
[Program example (1/3)]



[Program example (2/3)]

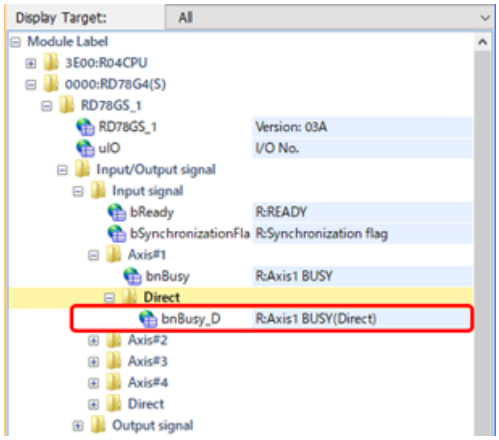


[Program example (3/3)]

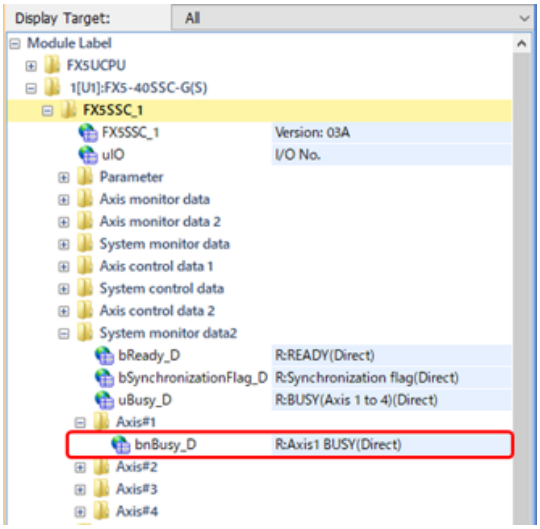


[Point]
The module label of the BUSY signal (direct input) for each axis is located as shown below.

(iQ-R)

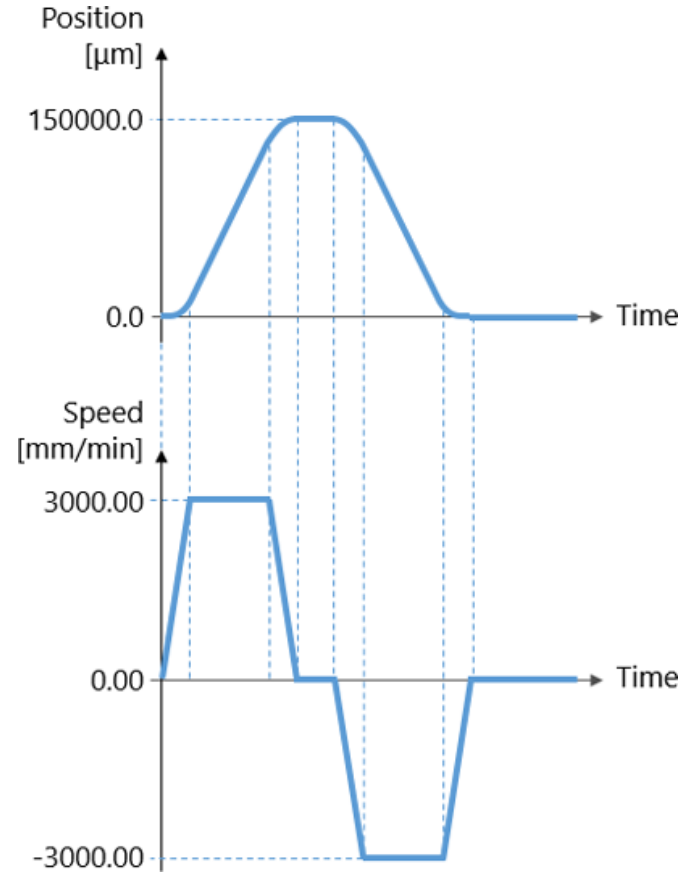
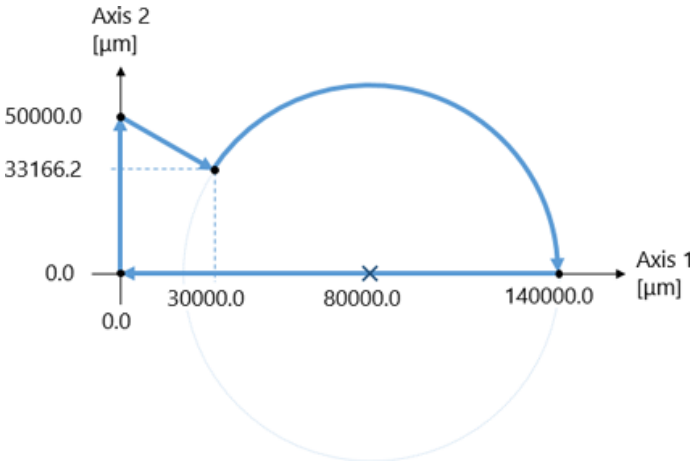


(iQ-F)



4.5 Home position return, single positioning, and interpolation control

[Operation patterns in the sample program]

<table>
<tr><th>Operation</th><th>Start signal</th><th>Operation pattern</th></tr>
<tr><td>Axis 1 single positioning</td><td>For iQ-R: X26
For iQ-F: X6</td><td rowspan="2"> 
</td></tr>
<tr><td>Axis 2 single positioning</td><td>For iQ-R: X27
For iQ-F: X7</td></tr>
<tr><td>Interpolation control</td><td>For iQ-R: X28
For iQ-F: X10</td><td> 
</td></tr>
</table>

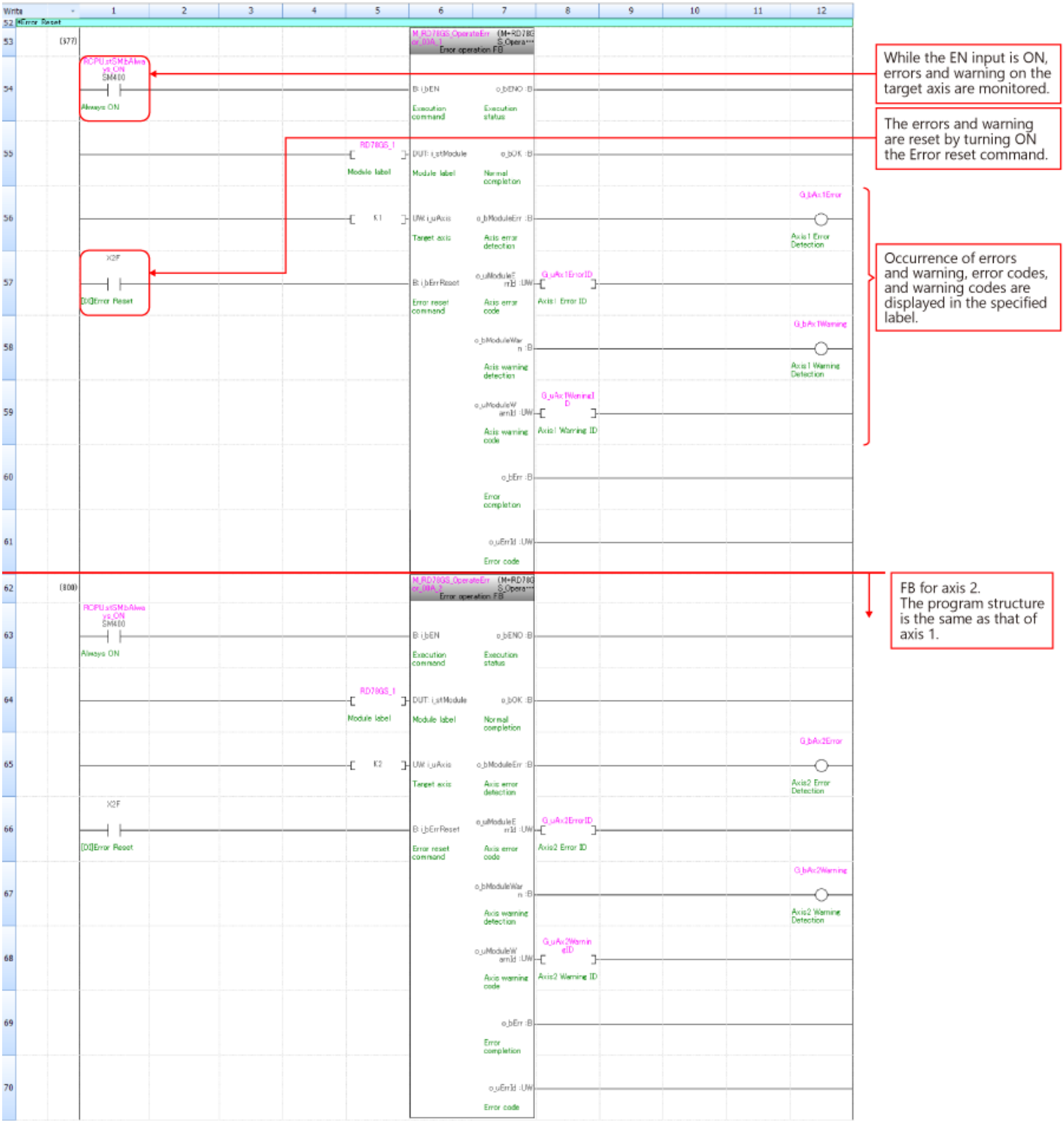
4.6 Error reset

Errors and warnings can be monitored and errors can be reset by using the module FB "(Model)_OperateError_(Version)" (hereafter referred to as ErrorFB).
For details of ErrorFB, refer to the following manual.

MELSEC iQ-R Motion Module (Simple Motion Mode) Function Block Reference
2 Motion Module FB
2.9 M+RD78GS_OperateError

MELSEC iQ-R Simple Motion Module Function Block Reference
2 Simple Motion Module FB/Motion Module FB
2.9 M+FX5SSC_OperateError

[Program example]



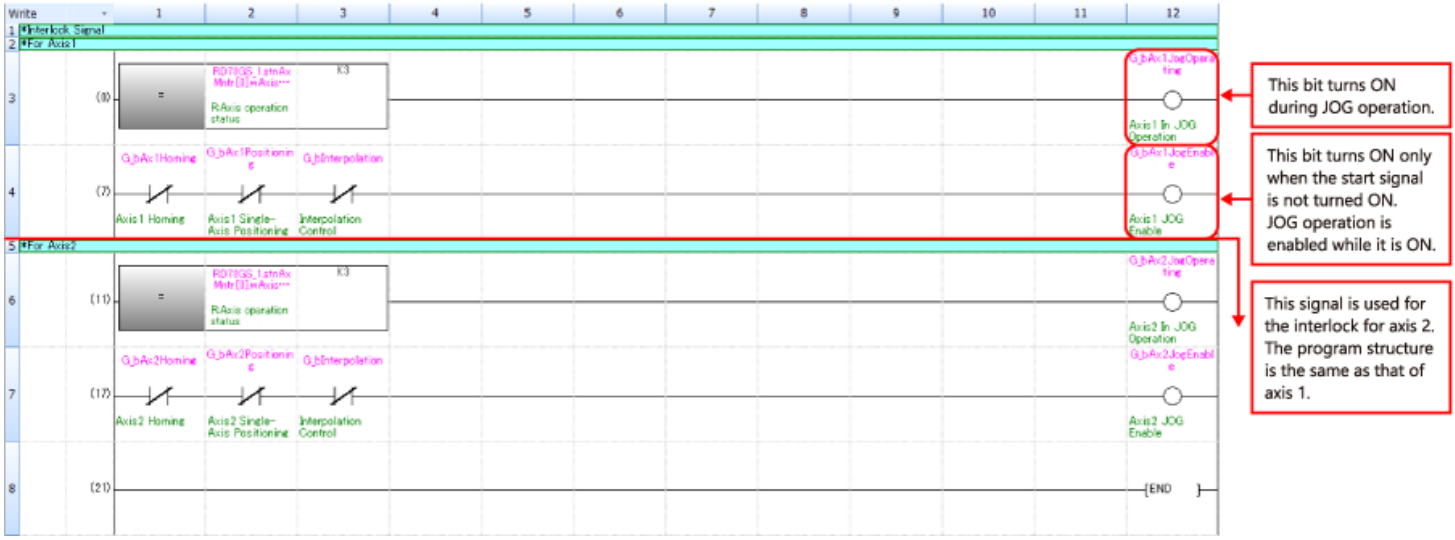
4.7 Interlock

In the sample program, an interlock is provided to ensure the following:

- JOG operation is not performed during positioning operation.
- A positioning start signal is not turned ON during JOG operation or positioning operation.

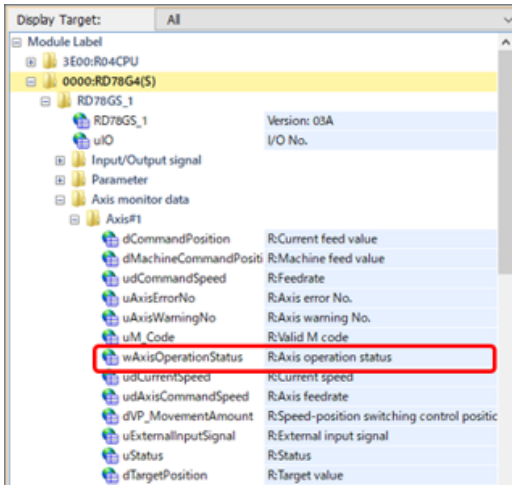
This interlock condition is an example. Change the condition to suit your system when using the sample program.

[Program example (In the sample program, the program name is Interlock)]

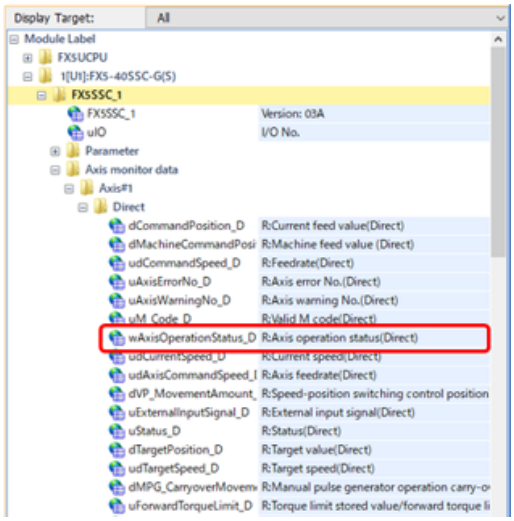


[Point]
The module label [Md.26:Axis operation status] of each axis is located as shown below.

(iQ-R)



(iQ-F)



4.8 Operation check of the sample program

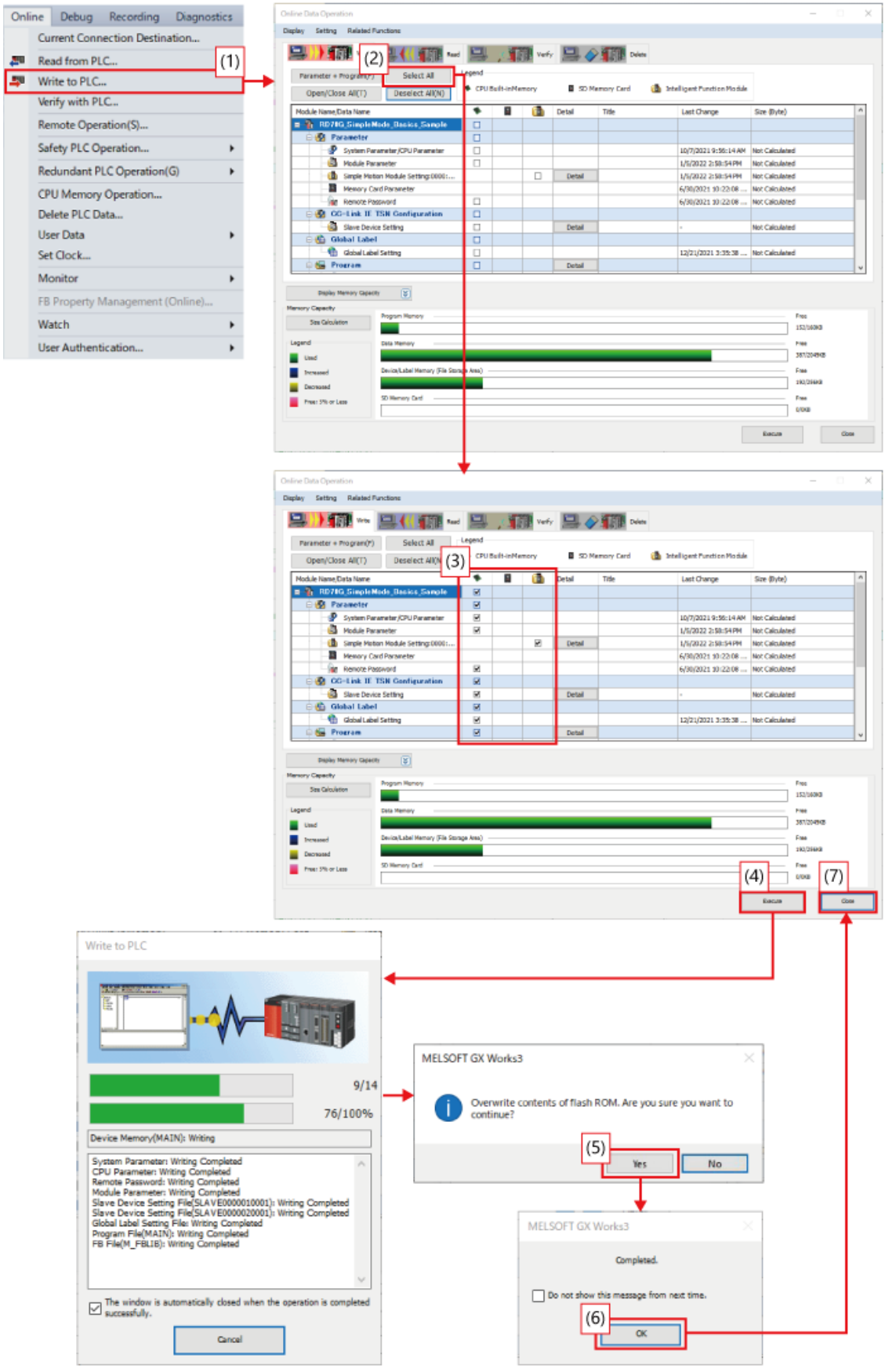
Write the sample program to the programmable controller and check the operation.

4.8.1 Writing a program

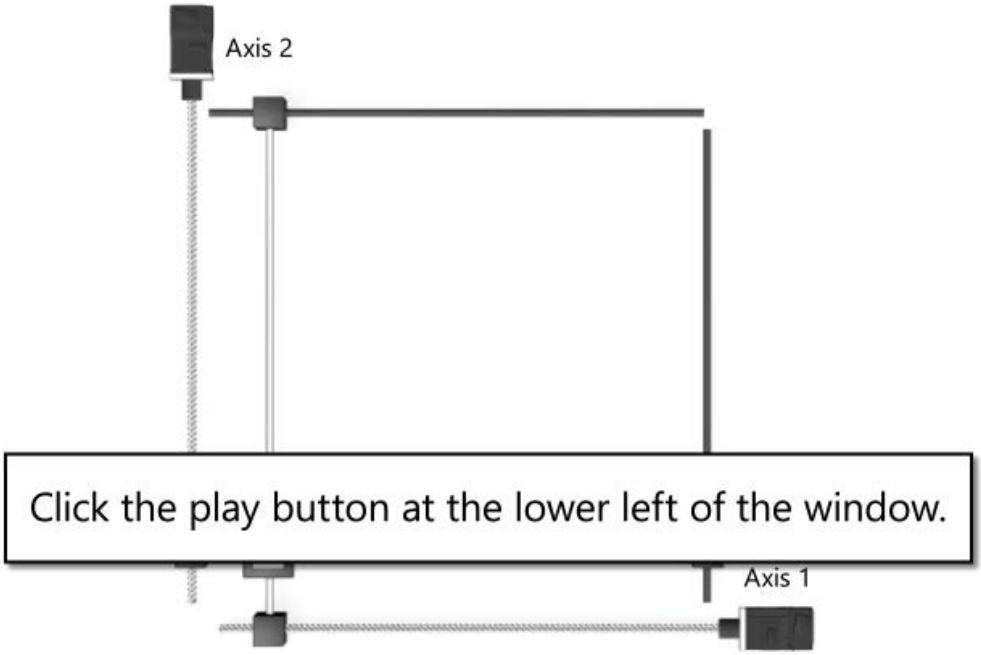
For how to connect a personal computer and programmable controller and how to set the connection destination, check the e-learning course for each programmable controller.

After the rebuild all process of the program, follow the steps below to write the program to the programmable controller.

(1) From the GX Works3 menu bar, select [Online] → [Write to PLC] to display the Online Data Operation window.
(2) Click [Select All].
(3) All checkboxes are selected.
(4) Click [Execute] to start writing.
(5) As the writing process proceeds, a message appears to confirm flash ROM writing. Click [Yes].
(6) After writing the program, click [OK] to close the window.
(7) Back to the Online Data Operation window and click [Close] to close the window.
This completes writing the program. Cycle the power of the programmable controller.

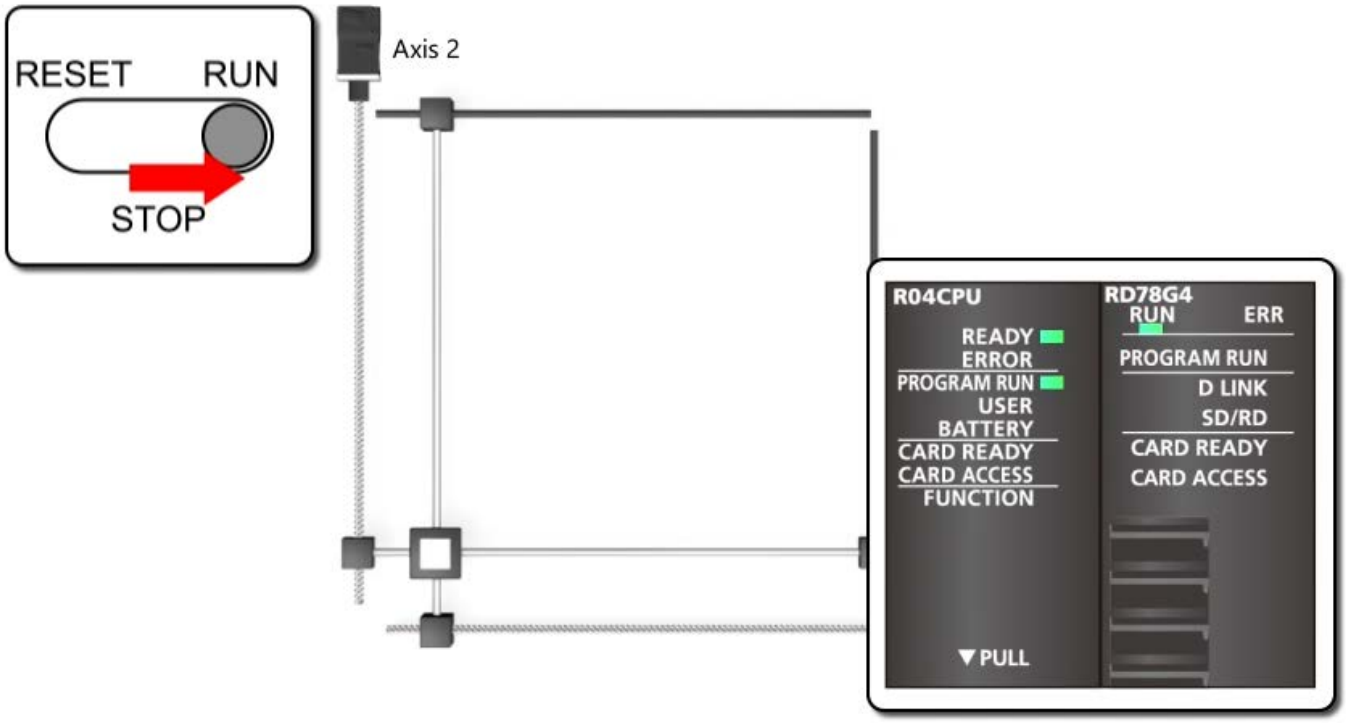

Online
Debug
Recording
Diagnostics
Current Connection Destination...
Read from PLC...
Write to PLC...
Verify with PLC...
Remote Operation(S)...
Safety PLC Operation...
Redundant PLC Operation(G)
CPU Memory Operation...
Delete PLC Data...
User Data
Set Clock...
Monitor
FB Property Management (Online)...
Watch
User Authentication...
(1)
(2)
Select All
Deselect All(N)
(3)
(4)
(5)
(6)
(7)
Write to PLC
9/14
76/100%
Device Memory(MAIN): Writing
System Parameter: Writing Completed
CPU Parameter: Writing Completed
Remote Password: Writing Completed
Module Parameter: Writing Completed
Slave Device Setting File(SLAVE0000010001): Writing Completed
Slave Device Setting File(SLAVE0000020001): Writing Completed
Global Label Setting File: Writing Completed
Program File(MAIN): Writing Completed
FB File(M_FBLIB): Writing Completed
The window is automatically closed when the operation is completed successfully.
Cancel
MELSOFT GX Works3
Overwrite contents of flash ROM. Are you sure you want to continue?
Yes
No
MELSOFT GX Works3
Completed.
Do not show this message from next time.
OK

4.8.2 Operation check



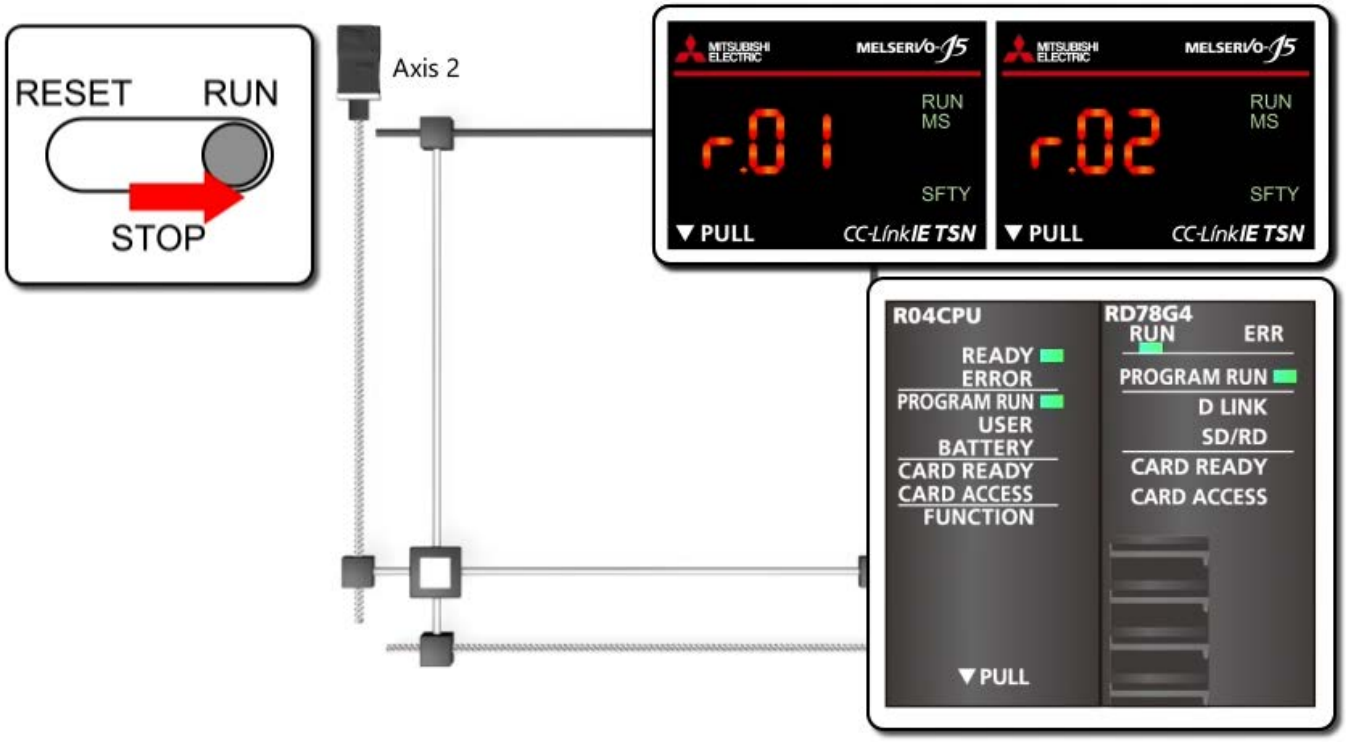
Check the sample program operation.
Before starting operation, make sure that the program is written to the PLC CPU.

4.8.2 Operation check



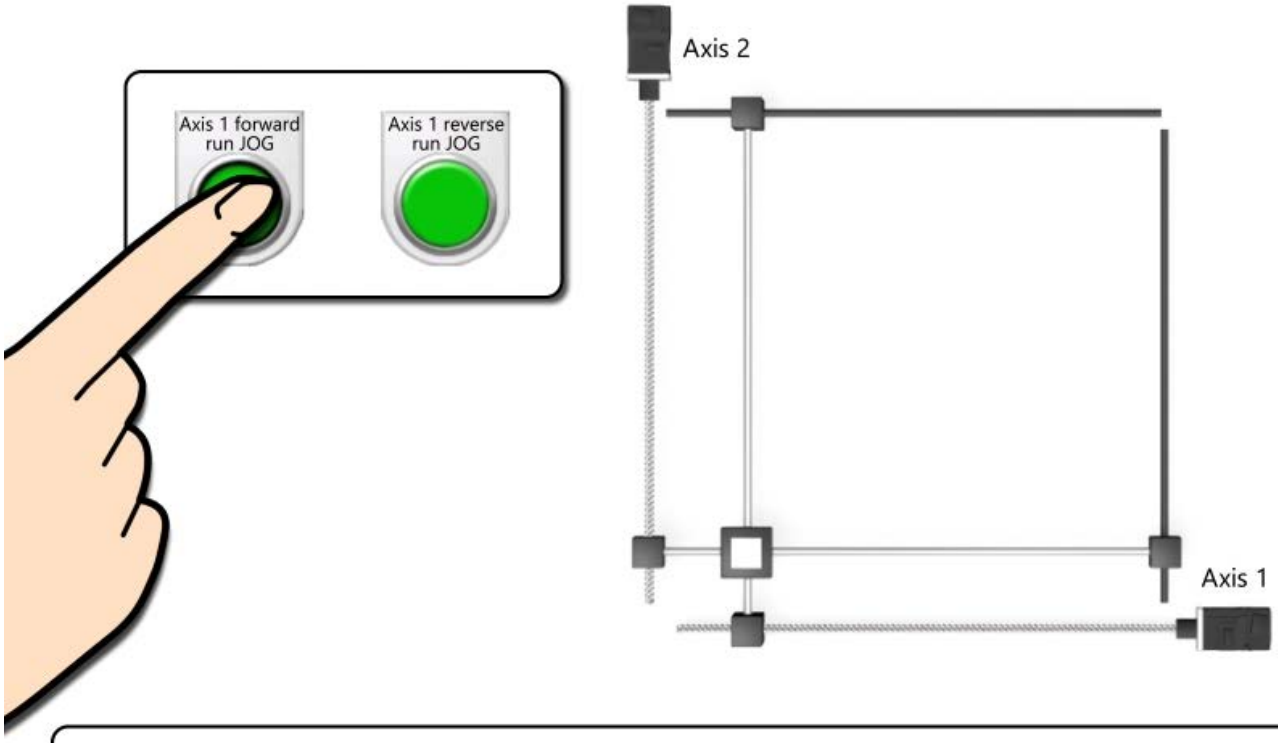
Set the RUN/STOP/RESET switch of the PLC CPU to RUN.
READY lamp and PROGRAM RUN lamp of the programmable controller turn on.
RUN lamp of the Motion module turns on.

4.8.2 Operation check



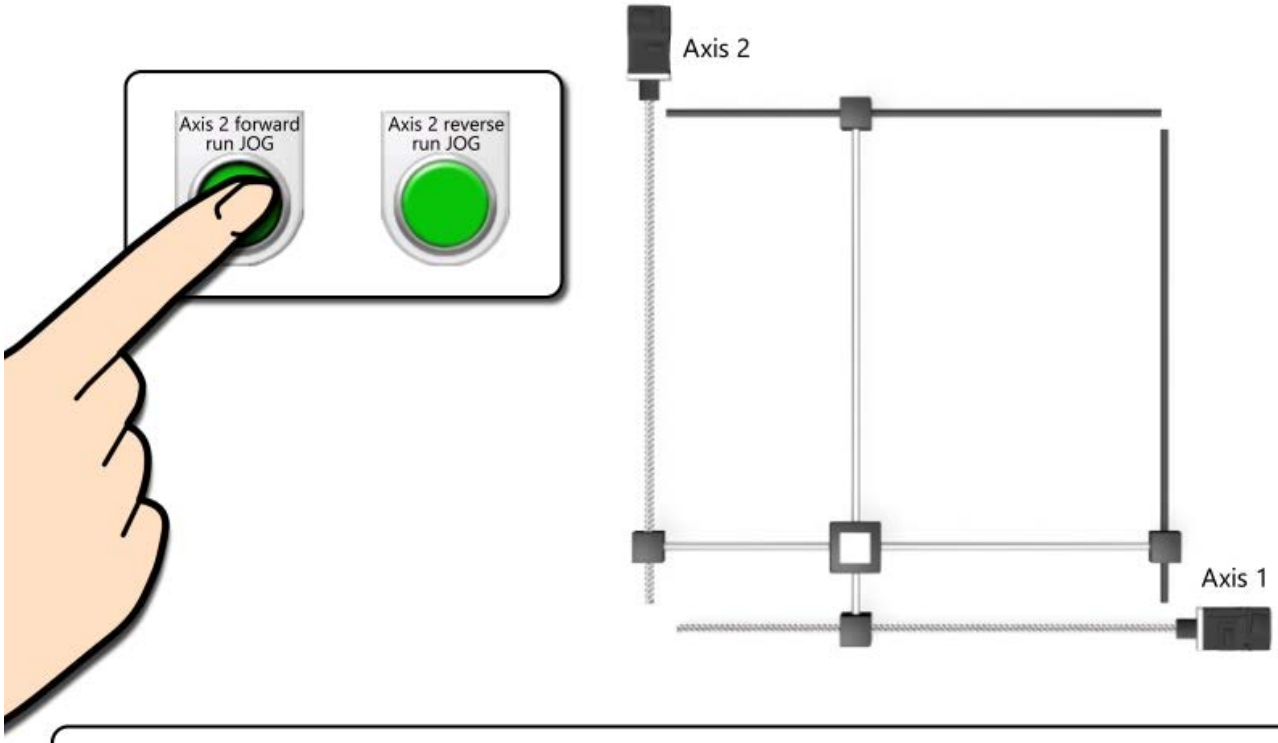
Wait until the PROGRAM RUN lamp of the Motion module turns on.
"r.01" and "r.02" are displayed on the servo amplifier. (The dots are lit.)
The servo motor enters the servo ON state.

4.8.2 Operation check



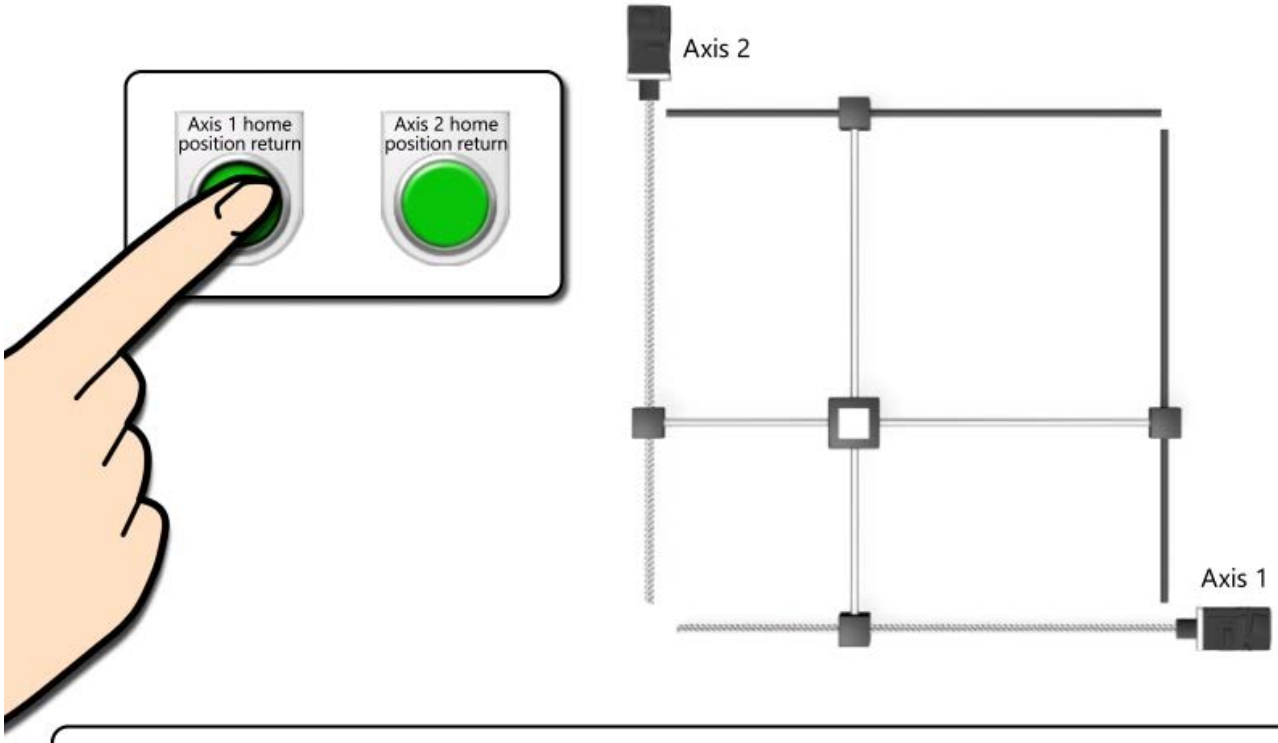
Turning ON the external input signal [Axis 1 forward run JOG] moves the axis in the direction of increasing address, and tuning OFF the signal stops the axis. Turning ON the external input signal [Axis 1 reverse run JOG] moves the axis in the direction of decreasing address, and tuning OFF the signal stops the axis.

4.8.2 Operation check



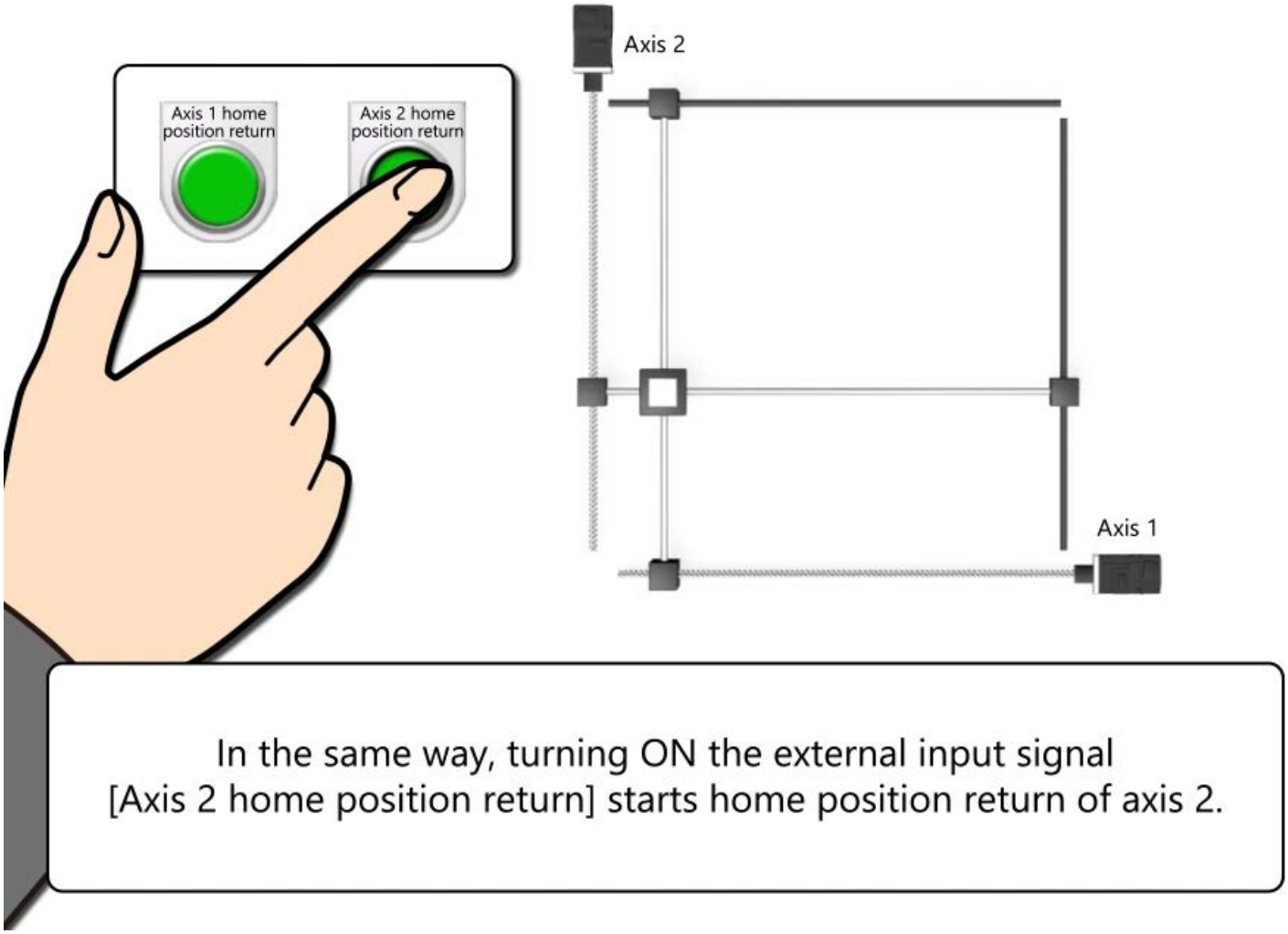
Turning ON the external input signal [Axis 2 forward run JOG] moves the axis in the direction of increasing address, and tuning OFF the signal stops the axis. Turning ON the external input signal [Axis 2 reverse run JOG] moves the axis in the direction of decreasing address, and tuning OFF the signal stops the axis.

4.8.2 Operation check



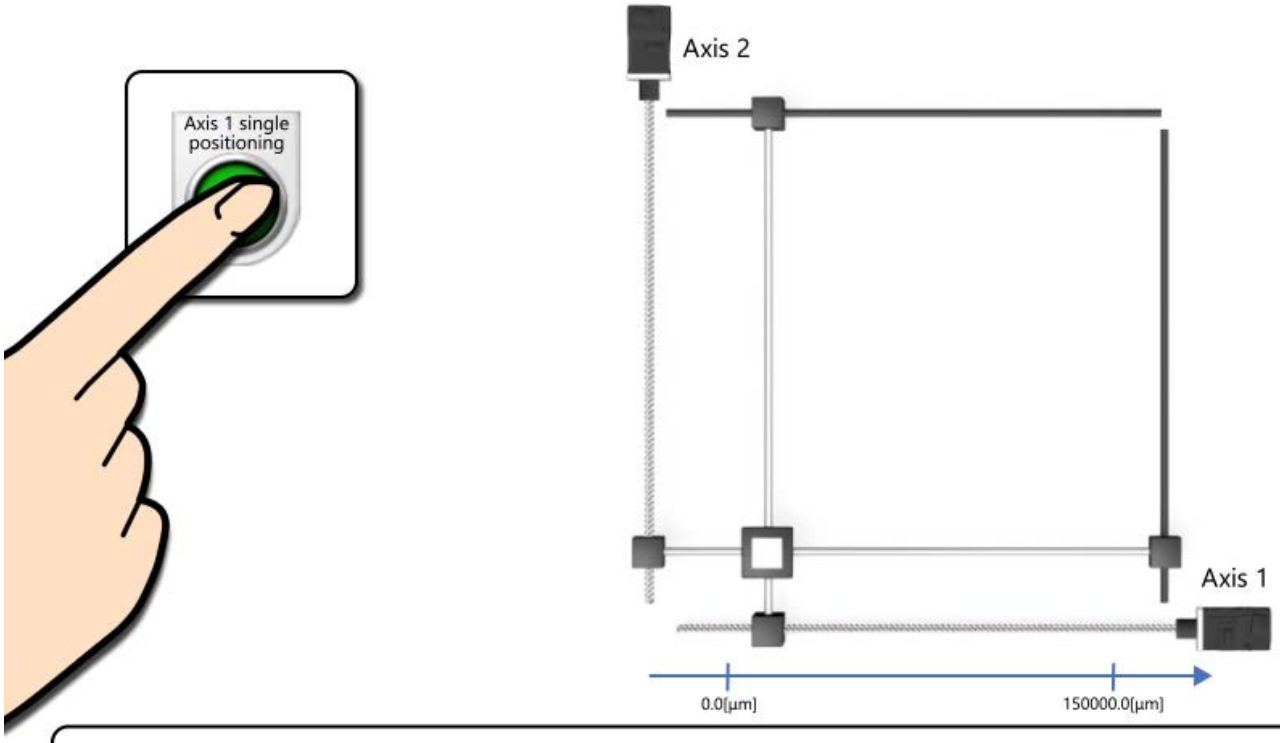
Turning ON the external input signal [Axis 1 home position return] starts home position return of axis 1.
Execute the home position return of the proximity dog type (Pr.PT45 = -33).
The axis stops at the point where the Z-phase of the encoder is first detected after passing through the dog, and that point is regarded as the home position.

4.8.2 Operation check



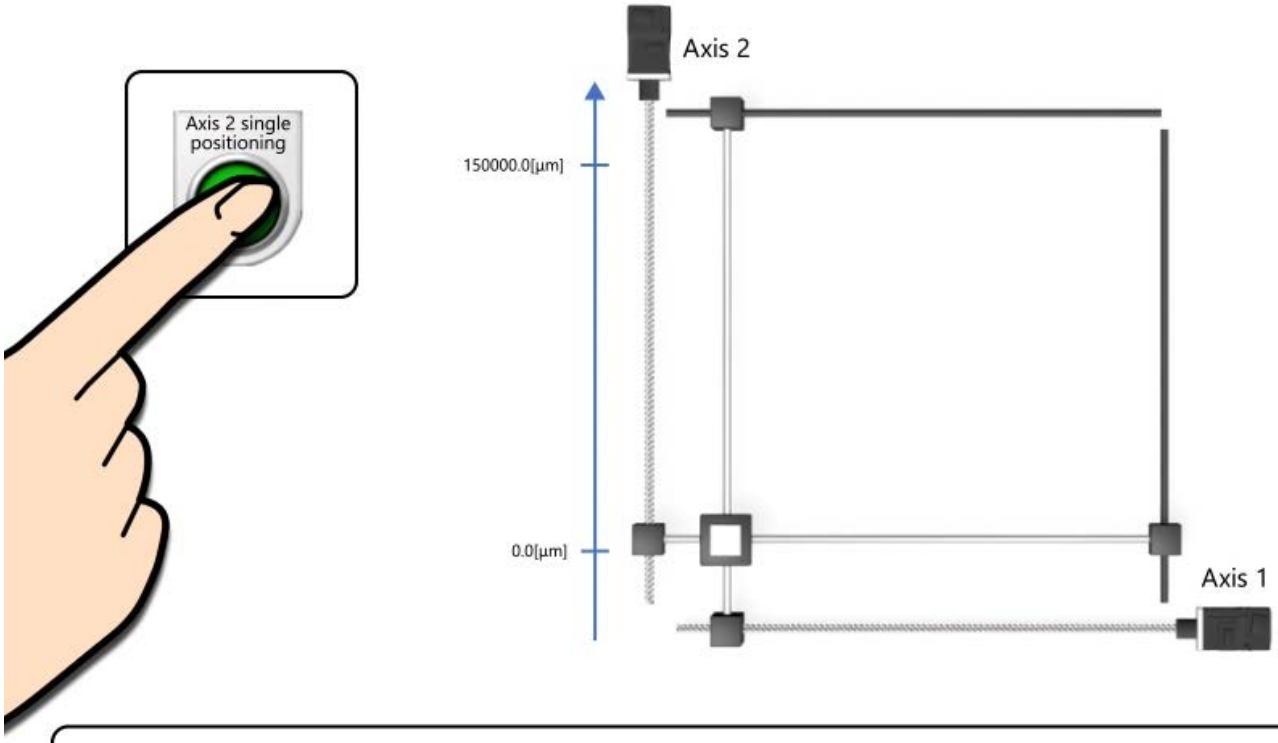
In the same way, turning ON the external input signal [Axis 2 home position return] starts home position return of axis 2.

4.8.2 Operation check



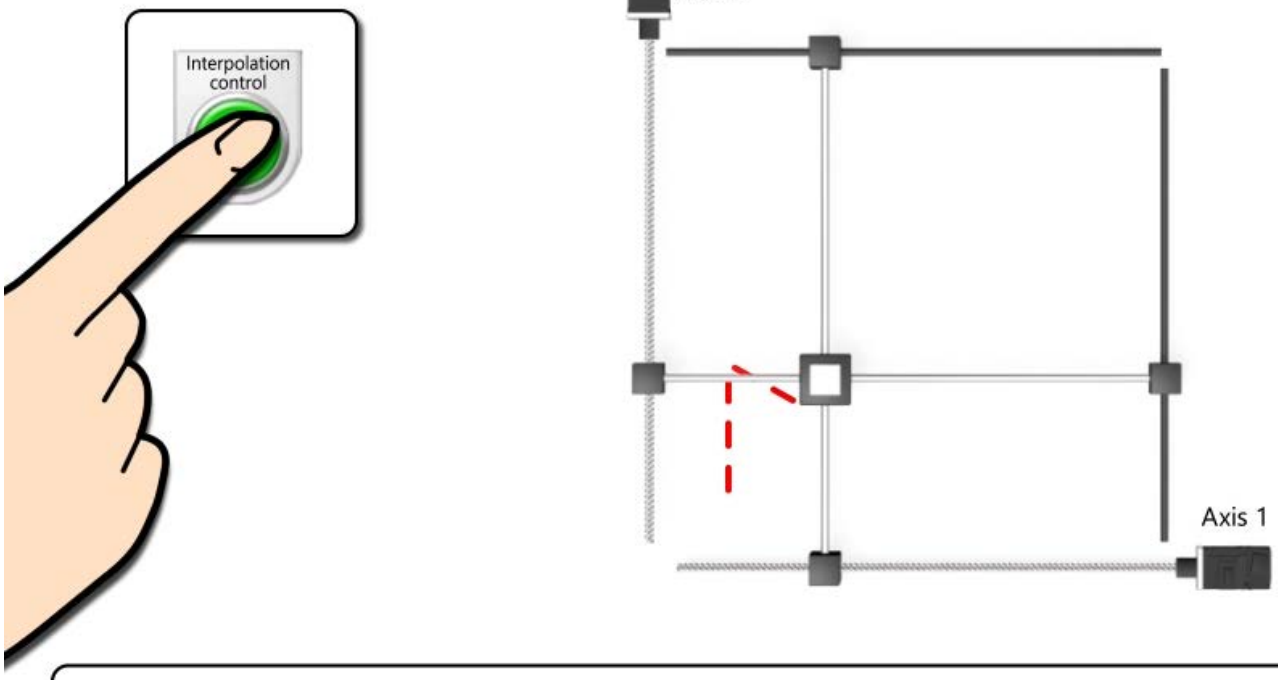
When the external input signal [Axis 1 single positioning] is turned ON, axis 1 starts reciprocating motion.

4.8.2 Operation check



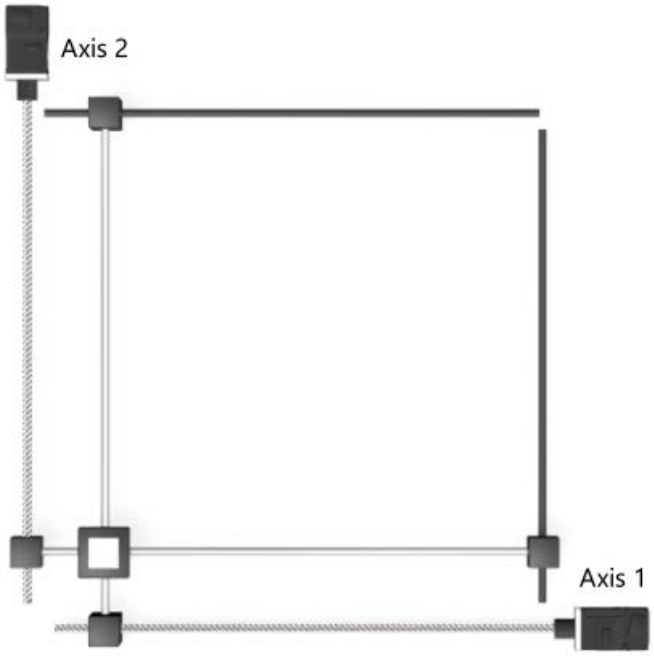
When the external input signal [Axis 2 single positioning] is turned ON, axis 2 starts reciprocating motion.

4.8.2 Operation check



Turning ON the external input signal [Interpolation control] executes interpolation control using axis 1 and axis 2.
Plot a combined path of linear interpolation and circular interpolation described in 3.4.

4.8.2 Operation check



This completes the operation check.
Go to the next page.

4.9 Summary of This Chapter

In this chapter, you have learned:

- Module label and module FB
- How to add module labels and module FBs
- From the initial setting to all axis servo ON
- JOG operation
- Home position return, single positioning, and interpolation control
- Error reset
- Interlock
- Operation check

Point

Module label and module FB	• The sample program uses module labels and module FBs.
How to add module labels and module FBs	• Input a module label or module FB by dragging and dropping it from the Element Selection window to the program editor.
From the initial setting to all axis servo ON	• When using Simple Motion mode, always turn ON [PLC READY] and then turn ON [All axis servo ON].
JOG operation	• The sample program uses a module FB to execute JOG operation. • If the EN input of the FB is OFF, JOG operation is not performed even when the forward/reverse run JOG start is turned ON.
Home position return, single positioning, and interpolation control	• The sample program uses a module FB to execute positioning start and home position return. • Home position return is executed by entering 9001 as a positioning number. • When a point table number is entered as a positioning number, positioning is performed according to the positioning pattern set in the corresponding point table. • In the case of interpolation control, positioning is performed only for the reference axis.
Error reset	• The sample program uses a module FB to monitor alarms and warnings and execute error reset.
Interlock	• The interlock condition of the sample program is an example. Provide an appropriate interlock for your system.
Operation check	• You have checked the operation of the sample program in the video.

Chapter 5 Digital Oscilloscope

This chapter describes how to check the operation of the sample program by using a digital oscilloscope.

5.1 Digital oscilloscope

A digital oscilloscope has a function to measure and record the I/O signals (X and Y) of the Motion module (Simple Motion mode) and buffer memory values.

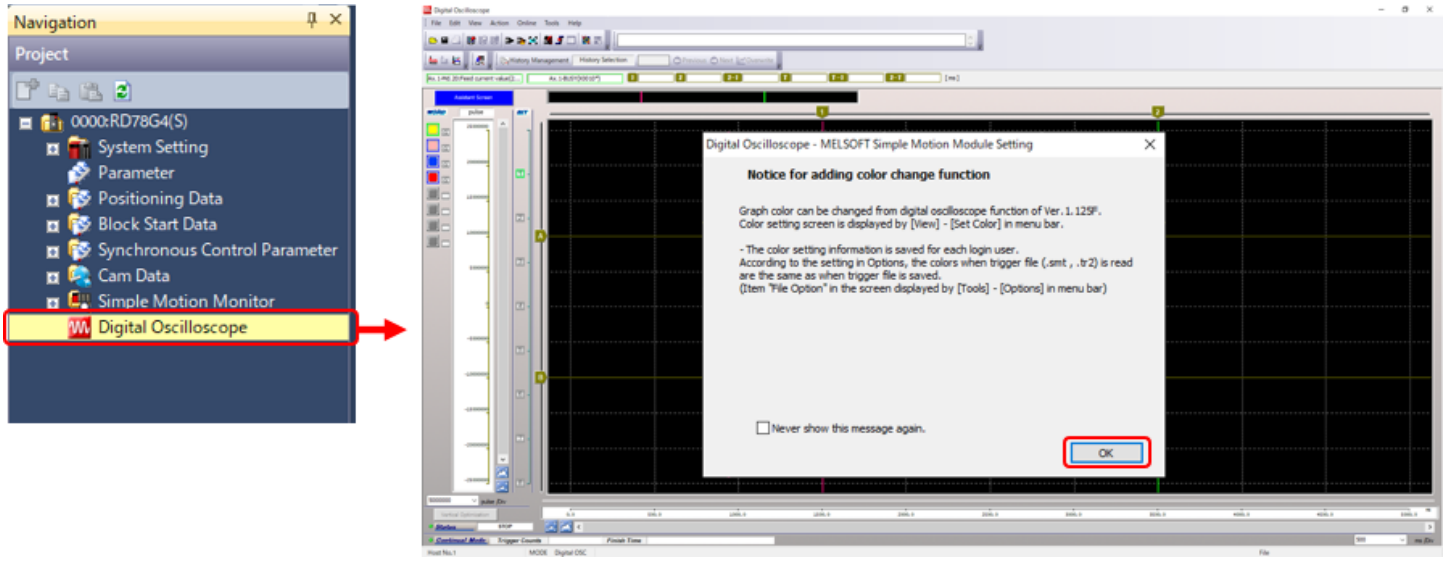
The following data (number of channels) can be measured at the same time.

- Word data: 16 channels
- Bit data: 16 channels

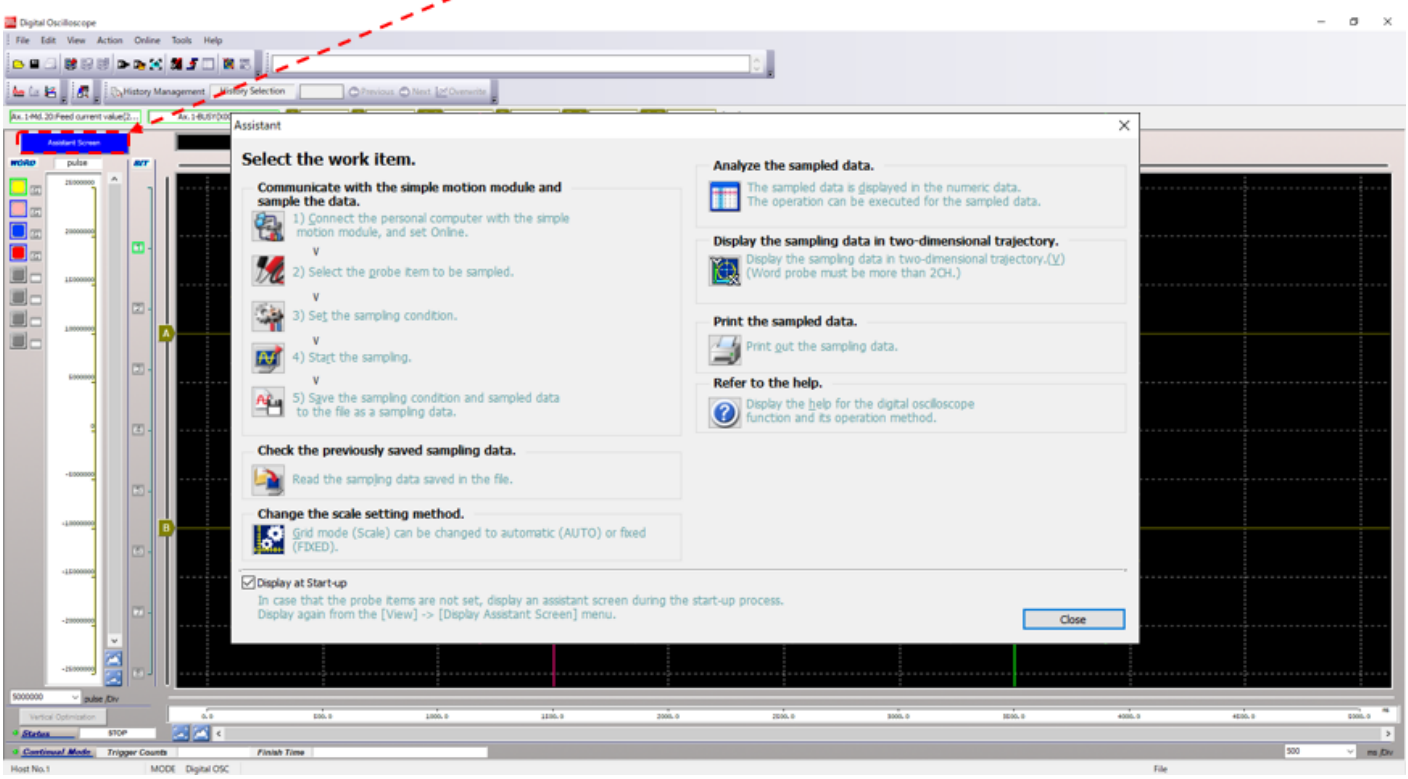
Note that the maximum number of channels that can be simultaneously displayed as waveform is 8 for both word data and bit data.

5.2 Starting a digital oscilloscope

[Digital Oscilloscope] is located at the bottom of the project tree in the Simple Motion setup tool.
Double-click it to open the Digital Oscilloscope window.

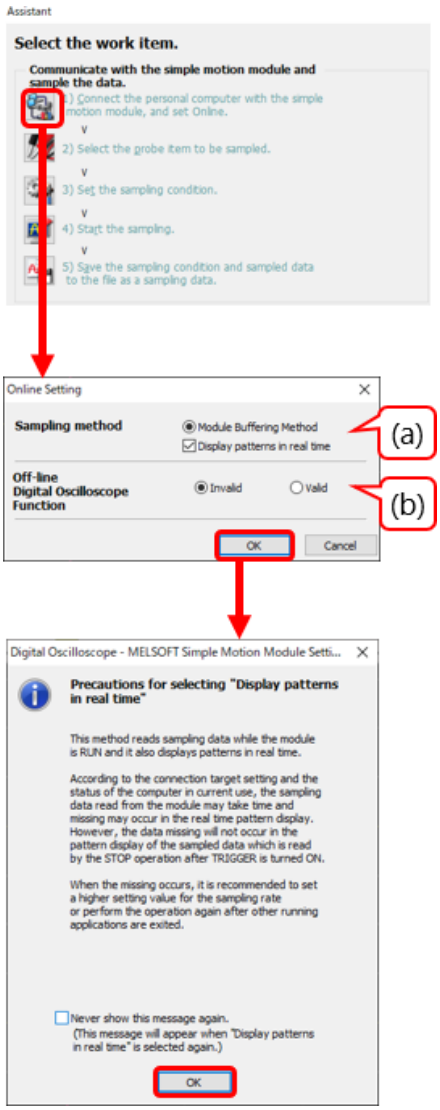


When "Notice for adding color change function" appears, click [OK] to close the window.
After that, the Assistant window appears. In this course, we will configure the digital oscilloscope settings in this window.
If the Assistant window does not appear, click [Assistant Screen] on the window.



5.3 Digital oscilloscope settings

(1) Online Setting



Click the  icon on the Assistant window to open the Online Setting window. Set as follows in this window.

No.	Description
(a)	To display real-time waveform during measurement, select "Display patterns in real time".
(b)	Set whether to continue measurement if the personal computer and Motion module is disconnected. Select "Valid" to continue measurement even if the connection is interrupted.

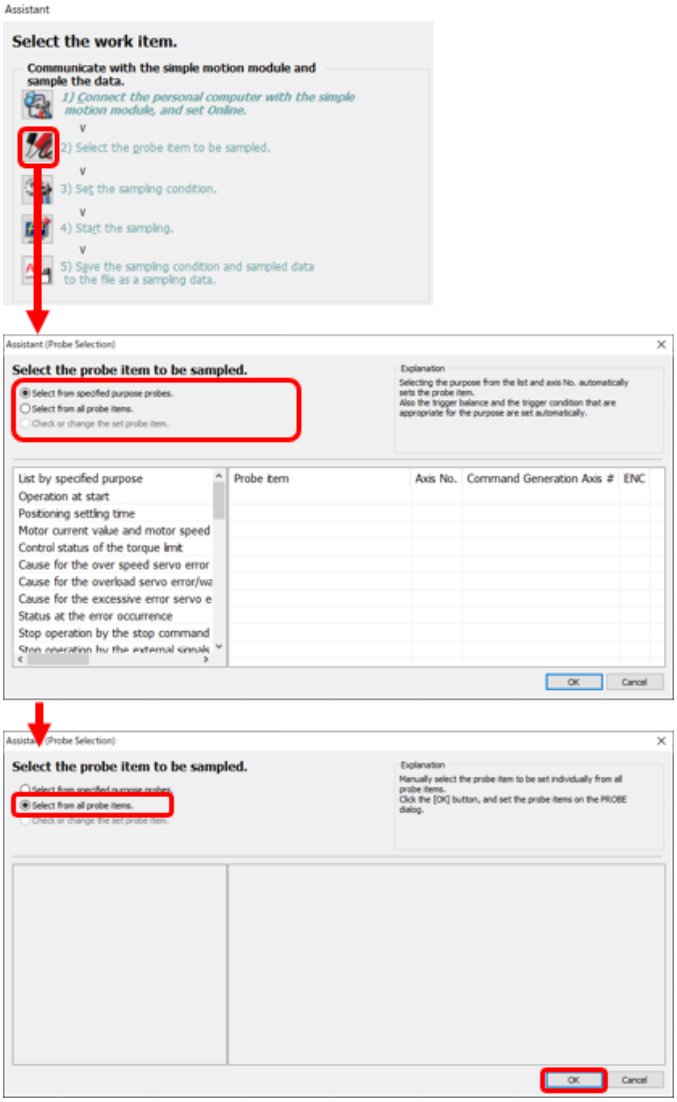
In this course, select "Display patterns in real time" and set Digital Oscilloscope to "Invalid".

After completing the settings, click [OK] to close the window.

When "Display patterns in real time" is selected, precautions are displayed. Check the precautions, and click [OK] to close the window.

* The Online Setting window can also be opened by selecting [Online] → [Online Setting] from the tool bar.

(2) Probe Selection



Click the icon on the Assistant window to open the Probe Selection window.
Set the data to be measured in this window.

The Probe Selection window can also be opened by selecting [Edit] → [Probe Selection] from the tool bar or clicking the icon on the tool bar.

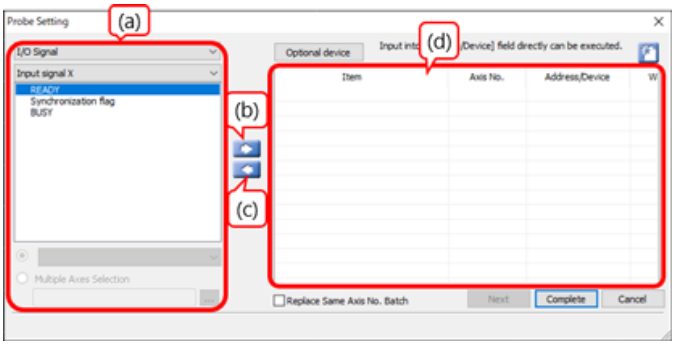
Next, select the probe setting method.

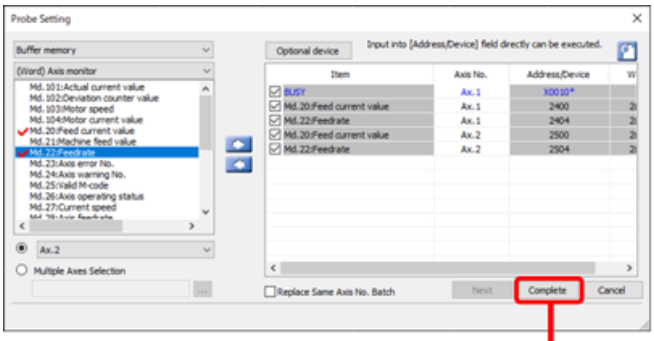
Option	Description
Select from specified purpose probes.	When the measurement purpose is selected from List by specified purpose at the bottom of the window, the required probes are automatically set.
Select from all probes.	Select this option to manually set the items to be measured.
Check or change the set probe item.	Select this option to check or change the probes that have already been set. It cannot be selected if no probe is registered.

This course explains how to manually set probes.
Select "Select from all probes." and click [OK].

(2) Probe Selection (continued)

The Probe Selection window changes. Register the items to be measured in this window.





No.	Description
(a)	Select "I/O Signal" or "Buffer memory" from the upper drop-down box and select the category from the lower drop-down box. Then, select the item to be measured from the list under the drop-down box and add the item to the field (d). In the case of data for multiple axes (such as Feed current value), select the data of the axis to be measured from the drop-down menu under the list.
(b)	The items selected in the field (a) are added to the probe.
(c)	The data added to the probe is deleted.
(d)	A list of selected probes is displayed.

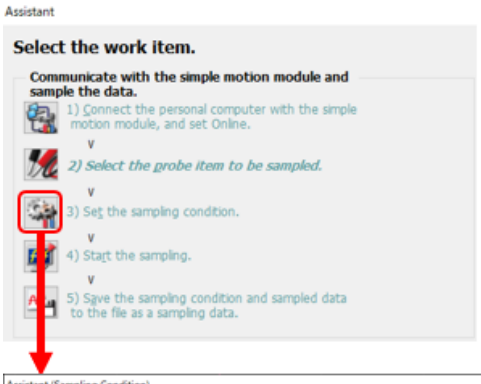
Register the following items in this course.

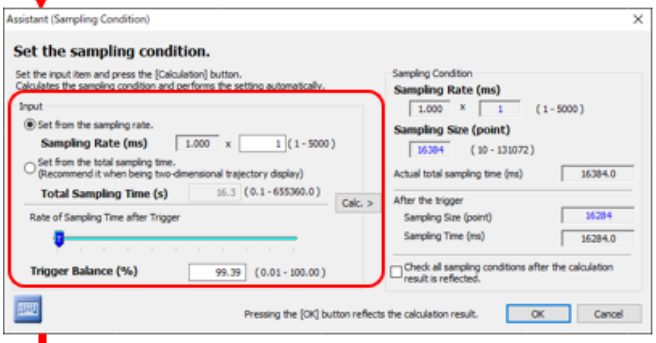
- BUSY signal of Ax.1
- Feed current value of Ax.1
- Feedrate of Ax.1
- Feed current value of Ax.2
- Feedrate of Ax.2

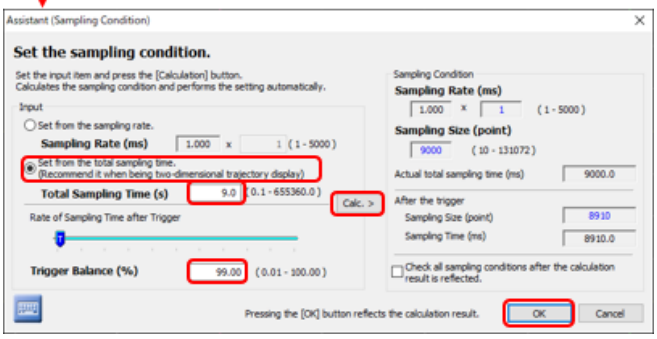
After registration, click [OK].
"Registration of probe item is completed." is displayed. Click [OK] to close the window.

(3) Sampling condition setting

Set the sampling interval or total sampling time and trigger balance.







Click the  icon on the Assistant window to open the Sampling Condition window.

Set the sampling interval and trigger balance in the "Input" field.

Option	Description
Set from the sampling rate.	Set the sampling rate at intervals of N times the minimum operation cycle. The default number of sampling points is 16384 for the iQ-R series and 8192 for the iQ-F series. (Note)
Set from the total sampling time.	Set this item to specify the sampling time.
Trigger Balance	Set the measurement rate before and after a trigger occurs. Change the trigger balance mainly depending on whether you want to measure the waveform before or after a trigger occurs. For example, if a start signal is a trigger, increase the number of points after the trigger and if an alarm signal is a trigger, increase the number of points before the trigger.

(Note) To change the number of sampling points, use the Initial Setting tab in the Sampling Setting window to be opened on the next page.

In this course, configure the settings as follows.

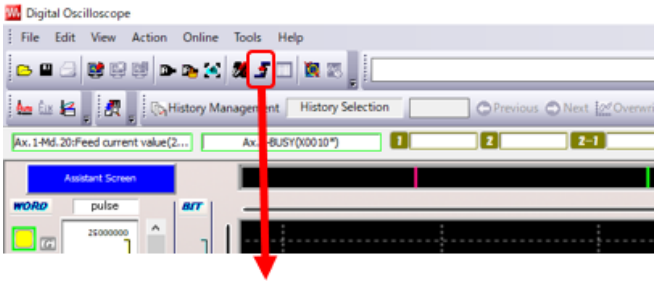
- Set from the total sampling time. → 9.0 [s]
- Trigger Balance 99.0%

Click [Calc.>] and confirm the number of sampling points and sampling time.

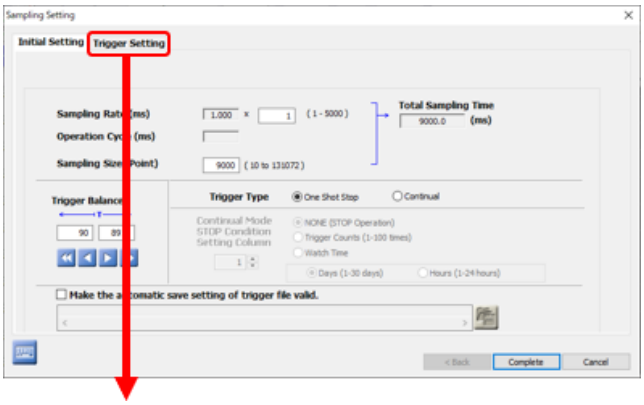
Click [OK] to close the window.

(4) Trigger setting

The trigger setting cannot be opened from the Assistant window. Close the Assistant window.

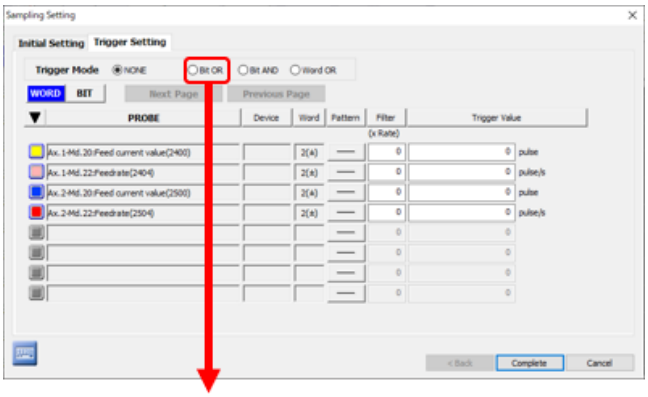


Click the icon on the tool bar in the Digital Oscilloscope window or click [Edit] → [Sampling Setting].



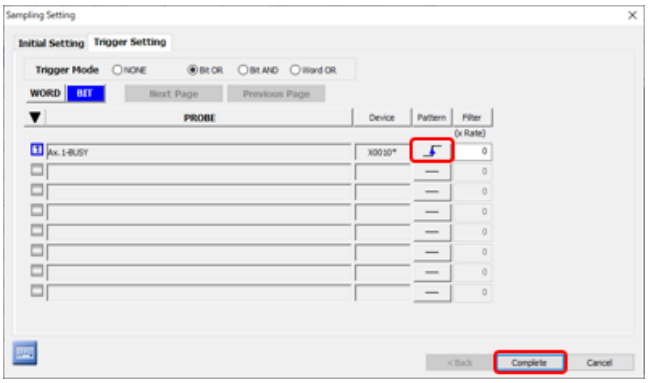
A different Sampling Setting window from (3) will open.
The items set in (3) are displayed in the [Initial Setting] tab.

Select the [Trigger Setting] tab.

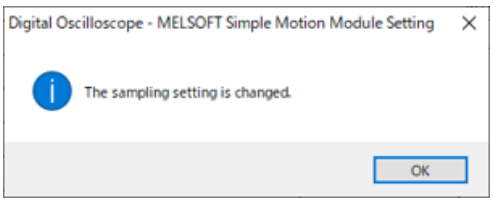


In the trigger setting, select the channel to be used as a trigger from the probes that have been set.
In this course, set the rising BUSY signal of Ax.1 as a trigger.

For Trigger Mode, select "Bit OR".
[BIT] under Trigger Mode turns blue and the BIT probe that has been set (only the BUSY signal of Ax.1 in this example) is registered in the probe list.
Click the pattern several times to set (rising).

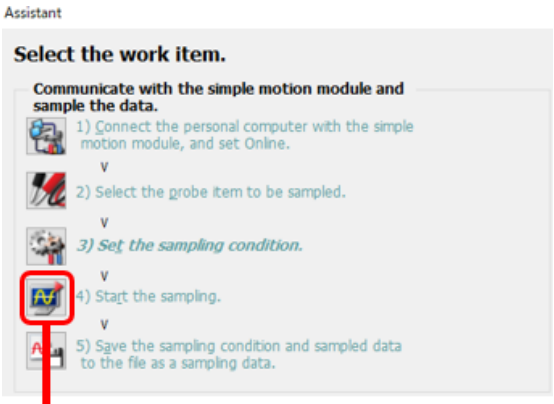


After completing the settings, click [Complete].
When "The sampling setting is changed." is displayed, click [OK] to close the window.



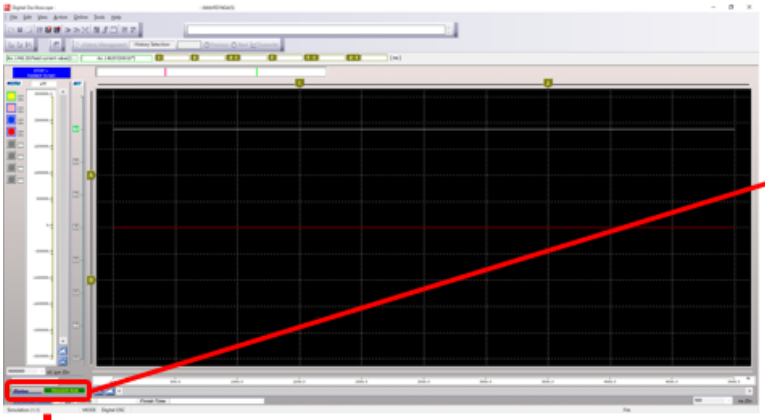
5.4 Measurement method

After the sampling setting, probe selection, and trigger setting, operate the machine to perform measurement.

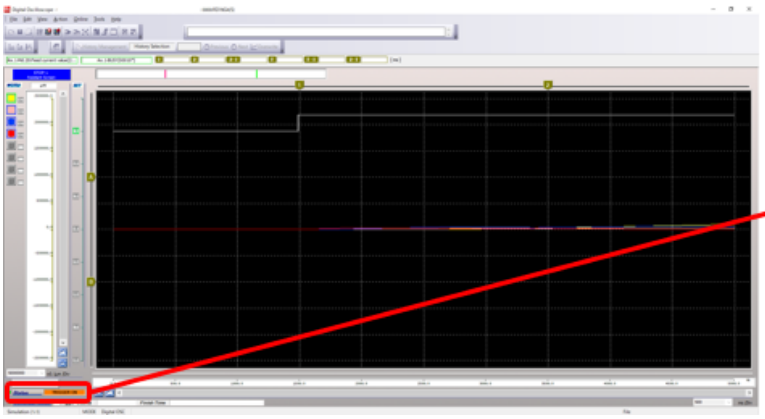


Start sampling by following one of the steps below.

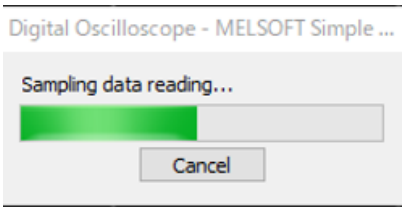
- Display the Assistant window again and click the icon.
- Click the icon on the tool bar in the Digital Oscilloscope window.
- Click [Action] → [Run].



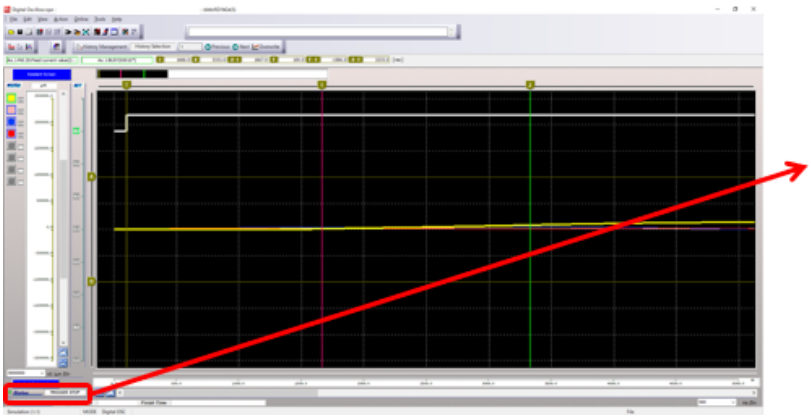
When the measurement starts, the program enters the trigger waiting state.
Status at the left corner of the window changes to [TRIGGER RUN].



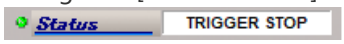
In this case, execute "Interpolation control" in the sample program.
When the trigger condition is satisfied, Status at the bottom left corner of the window changes to [TRIGGER ON].



When the set measurement time (9 [s] before and after the trigger in this example) elapses, measurement is finished and sampling data is read. After the data is read, the display becomes as shown on the left.



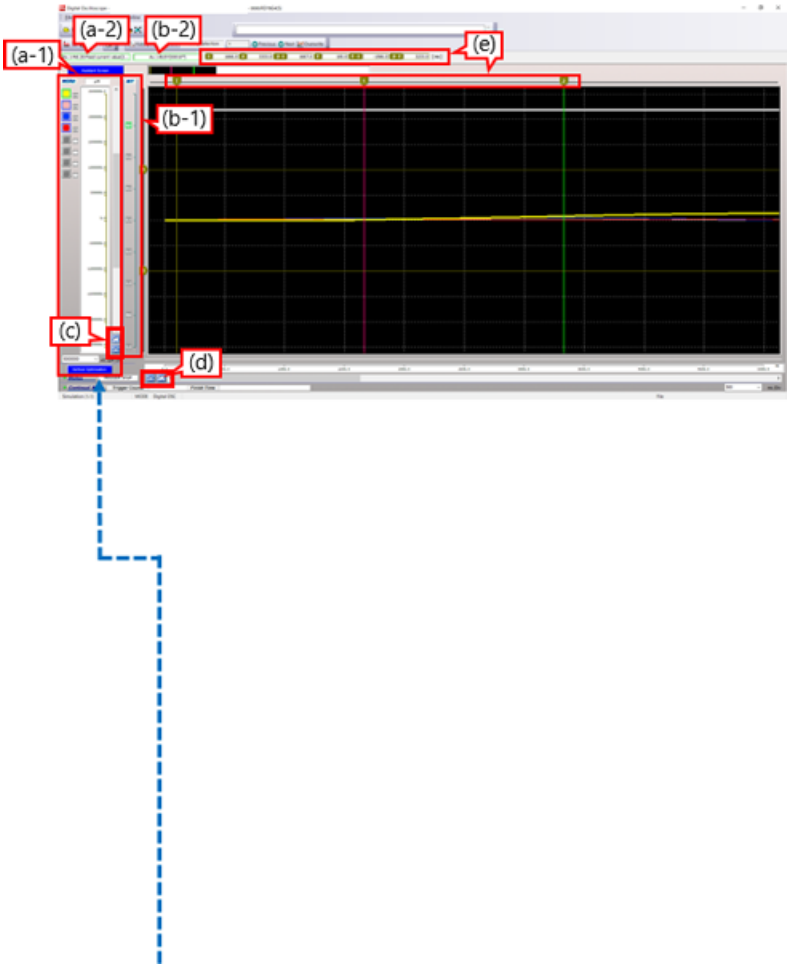
Status at the bottom left corner of the window changes to [TRIGGER STOP].



5.5 Checking the measurement result

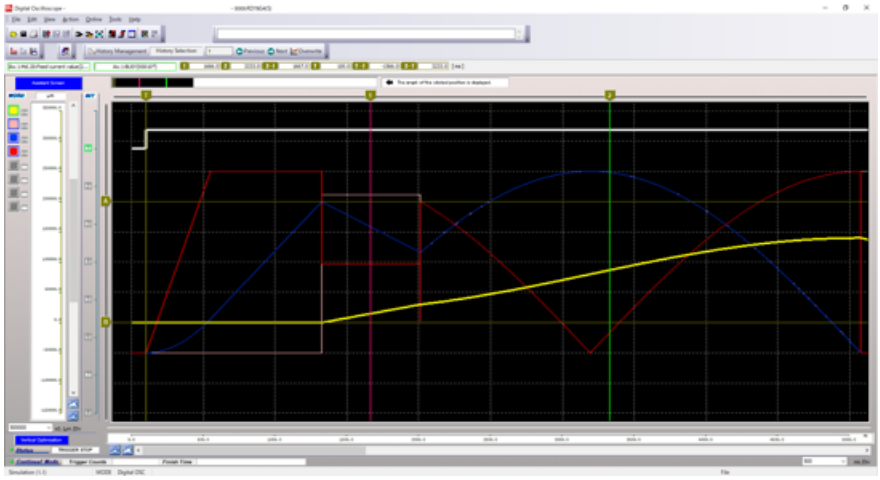
(1) Description of the window

The following describes the function of each part of the measurement result window.



No.	Description
(a-1)	The vertical axis of word data. Click a colored box on the left to make the line of the measured word data thicker. Click [Vertical Optimization] at the bottom to automatically adjust Division on the vertical axis so that the selected word waveform fits within the window.
(a-2)	The name of the selected word data is displayed.
(b-1)	The vertical axis of bit data. Click a number enclosed in a box to make the line of the measured bit data thicker.
(b-2)	The name of the selected bit data is displayed.
(c)	Zoom in/out buttons for the vertical axis.
(d)	Zoom in/out buttons for the horizontal axis.
(e)	The position (time) of the horizontal cursors 1 and 2 and a trigger cursor T, and the time between each cursor are displayed. The cursors 1 and 2 at the top can be dragged to move their positions.

Clicking [Vertical Optimization] for the word data (4ch) of the measurement result of "Interpolation control" displays the following window.



[Point]

Click the Auto icon on the tool bar or select [View] → [Grid Mode] from the menu bar and select AUTO Grid to automatically adjust the vertical axis and horizontal axis for the measurement data at once.

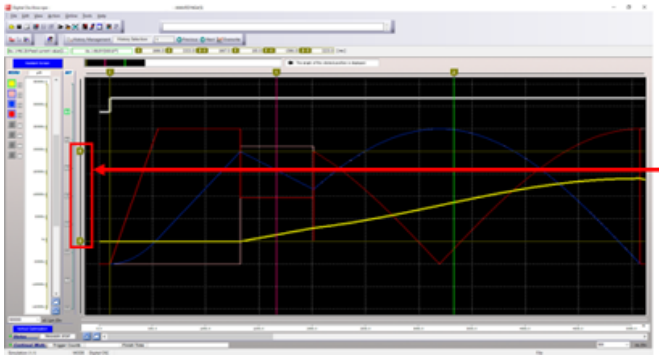
(2) How to check the values

1) Checking on the graph

The values on the graph can be checked by displaying the cursor window.
Select [View] → [Cursor] from the tool bar to display the cursor window.

Cursor

	Unit	Div	A	B	A - B	1
Ax.1-Md.20:Feed current value(2400)	x0.1μm	5000000	1400000	600000	800000	812552
Ax.1-Md.28:Axis feedrate(2412)	x0.01mm/min	5000000	210000	90000	120000	299937
Ax.2-Md.20:Feed current value(2500)	x0.1μm	5000000	420000	180000	240000	599868
Ax.2-Md.28:Axis feedrate(2512)	x0.01mm/min	5000000	210000	90000	120000	6151
Ax.1-BUSY(X0010*)						1

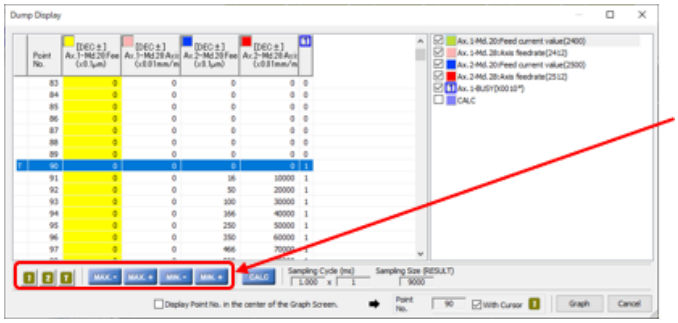


The values at the point where the graph intersects the vertical axis cursors A and B, the value between A and B, and the value at the point where the graph intersects the horizontal axis cursor 1 are displayed.
The vertical axis cursors A B can be dragged to move their positions.

2) Checking on Displaying dump

Open the Displaying dump window by following one of the steps below.

- Display the Assistant window again and click the icon.
- Click the icon on the tool bar in the Digital Oscilloscope window.
- Click [Edit] → [DUMP].



The values of all sampling data are displayed.

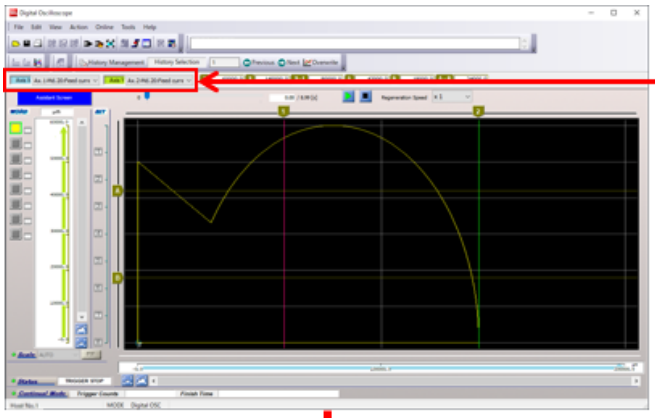
The positions of the horizontal axis cursors 1 2 and trigger cursor T can be displayed as well as the positions of the maximum value and minimum value before/after the selected point.

(3) Two-dimensional trajectory display

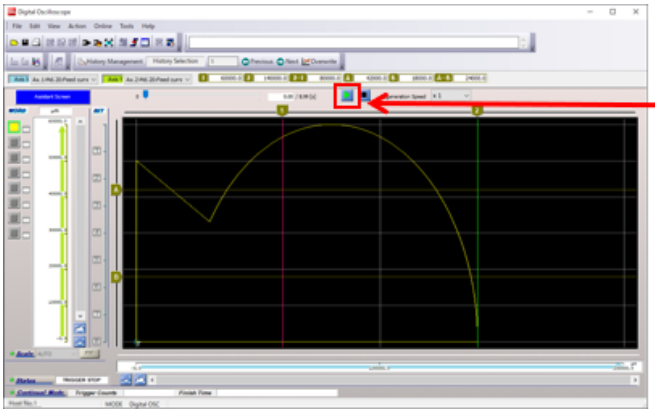
Probes can be assigned to the horizontal direction (X direction) and vertical direction (Y direction) of the graph to display a two-dimensional graph (trajectory) using the X-/Y-axes.

Open the Displaying dump window by following one of the steps below.

- Display the Assistant window again and click the icon.
- Click the icon on the tool bar.
- Click [View] → [Two-dimensional Trajectory Display] from the menu bar.



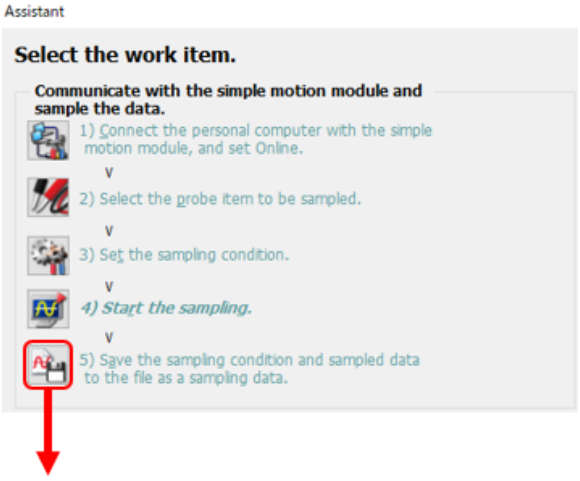
Select the data to be assigned to the X-axis and Y-axis.
In this example, select Ax.1 Feed current value for the X-axis and Ax.2 Feed current value for the Y-axis.



Now you can display the trajectory of the machine moved by the interpolation control program.
Click the icon to replay the changes in the two-dimensional trajectory over time.

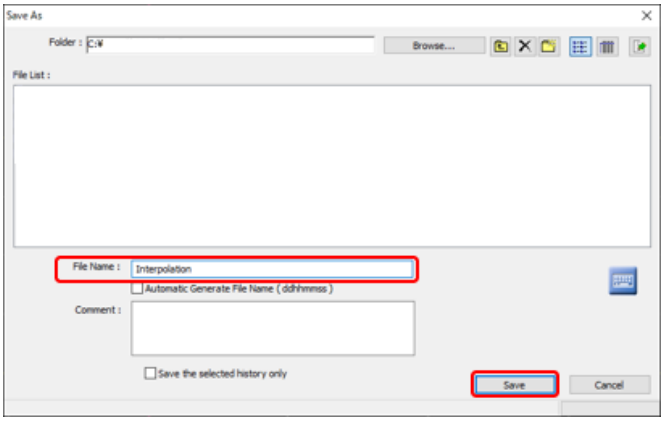
5.6 Saving the measurement result

The measurement result can be saved as a file.



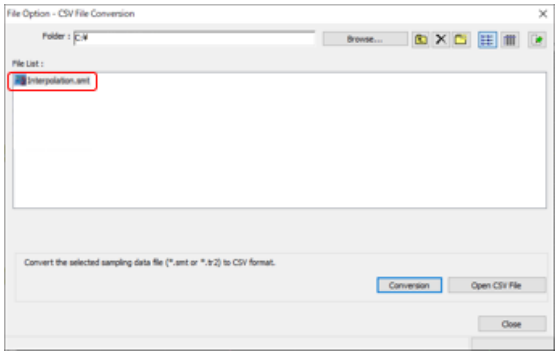
Save a file by following one of the steps below.

- Display the Assistant window again and click the icon.
- Click the icon on the tool bar in the Digital Oscilloscope window.
- Click [File] → [Save] from the tool bar.



Enter the file name and click [Save].

[Point]
The saved file (.smt) can be converted to the CSV format.
Open [File] → [File Option] from the tool bar, select the saved file (.smt), and click [Conversion].



5.7 Summary of This Chapter

In this chapter, you have learned:

- Digital oscilloscope
- Starting a digital oscilloscope
- Digital oscilloscope settings
- Measurement method
- Checking the measurement result
- Saving the measurement result

Point

Digital oscilloscope	• A digital oscilloscope has a function to measure and record the I/O signals (X and Y) of the Motion module (Simple Motion mode) and buffer memory values. • For both bit data and word data, 16 channels can be measured at the same time. The maximum number of channels that can be simultaneously displayed as waveform is 8 for both word data and bit data.
Starting a digital oscilloscope	• Double-click "Digital Oscilloscope" in the project tree in the Simple Motion setup tool to start it.
Digital oscilloscope settings	• Online Setting: Set whether to display real-time waveform and whether to enable offline data measurement. • Probe Selection: Set the data to be measured. • Sampling Condition Setting: Set the sampling interval or total sampling time and trigger balance. • Trigger Setting: Set the trigger as the condition for measuring data.
Measurement method	• After completing the settings, operate the machine and execute [Run]. • When the trigger condition has been set, data before and after the trigger occurs is measured according to the set trigger balance.
Checking the measurement result	• Waveform of each type of data can be checked by displaying a graph. • The value at a specific time can be checked by operating the cursor on the graph or displaying dump. • A two-dimensional trajectory can be displayed to check the X-axis travel amount and Y-axis travel amount.
Saving the measurement result	• The measurement result can be saved as a file (smt). • The smt file can be converted to the CSV format.

Test Final Test

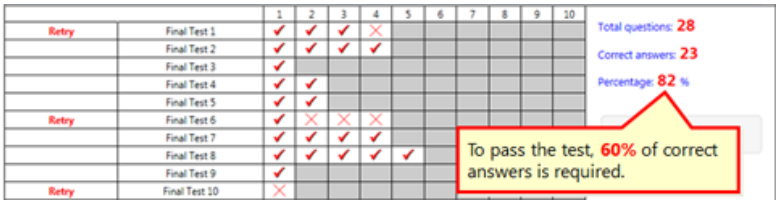
Now that you have completed all of the lessons of the **MELSEC iQ-R/iQ-F Series Motion Module Basics (Simple Motion Mode)** Course, you are ready to take the final test. If you are unclear on any of the topics covered, please take this opportunity to review those topics.

There are a total of 5 questions (19 items) in this Final Test.

You can take the final test as many times as you like.

Score results

The number of correct answers, the number of questions, the percentage of correct answers, and the pass/fail result will appear on the score page.



Test **Final Test 1**

Select the correct sentence(s) to describe the specifications of Simple Motion mode of the Motion module.

- [ ] **Simple Motion mode and PLCopen® motion control FB mode can be used for each axis in a single Motion module.**
- [ ] **In Simple Motion mode, only the PLC CPU should be programmed.**
- [ ] **Simple Motion mode is available in all Motion modules (RD78G(H)□ and FX5-□SSC-G).**
- [ ] **For positioning, Simple Motion mode uses the same point table method as the one used by the Simple Motion module.**
- [ ] **Since the Motion module has no external input (manual pulser input), prepare a high-speed counter module separately to use a manual pulser.**

Test **Final Test 2**

Select the correct word to fill in the blank ( ) to complete the sentences below.

- To execute test operation, change (Q1) of the servo amplifier and turn on the power supply.
- Check the rotation direction of the servo motor with the test operation function of (Q2).
- Set the (Q3) with the rotary switch on the servo amplifier.

Q1 Select the appropriate answer.

Q2 Select the appropriate answer.

Q3 Select the appropriate answer.

Q1: 1：DIP switch
2：Rotary switch
3：Command switch

Q2: 1：GX Works3
2：MR Configurator2
3：Motion Control Setting Function

Q3: 1：IP address
2：Station number

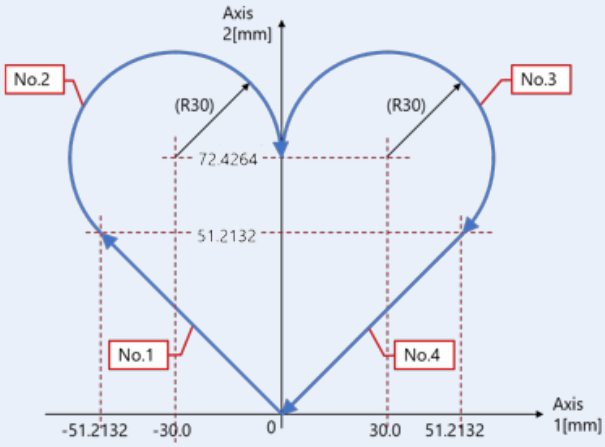
Test **Final Test 3**

Select the correct sentence(s) to describe the settings of Simple Motion mode.

- [ ] **Simple Motion mode is available by registering the Motion module with (S) in the module configuration diagram.**
- [ ] **After registering the servo amplifier in the network configuration window, perform PDO mapping.**
- [ ] **To configure Simple Motion mode, use the same window (Motion Control Setting Function) as the one used for the Motion module.**
- [ ] **Set the acceleration time to the time required to reach the speed limit from speed 0 and deceleration time to the time required to reach speed 0 from the speed limit.**
- [ ] **To plot the same trajectory regardless of the start point of operation during interpolation control, create positioning data based on the relative position specification.**

Test **Final Test 4**

Complete the following point tables to plot a trajectory as shown on the right figure.
Circular interpolation with center point designation is used for arcs.
The addresses are specified by the absolute position specification.



[Axis 1]

No.	Operation pattern	Control method	Axis to be interpolated	Acceleration time No.	Deceleration time No.	Positioning address	Arc address	Command speed	Dwell time	M code
1	LOCATION	ABS Linear 2	2	0:1000	0:1000	-51213.2μm		3000.00mm/min	0 ms	0
2	CONT	(Q1)	2	0:1000	0:1000	(Q2) μm	(Q3) μm	3000.00mm/min	100 ms	0
3	LOCATION	(Q4)	2	0:1000	0:1000	(Q5) μm	(Q6) μm	3000.00mm/min	0 ms	0
4	END	ABS Linear 2	2	0:1000	0:1000	0.0 μm		3000.00mm/min	500 ms	0

[Axis 2]

No.	Operation pattern	Control method	Axis to be interpolated	Acceleration time No.	Deceleration time No.	Positioning address	Arc address	Command speed	Dwell time	M code
1						51213.2μm				
2						(Q7) μm	(Q8) μm			
3						(Q9) μm	(Q10) μm			
4						0.0 μm				

Q1 Select the appropriate answer.

Q2 Select the appropriate answer.

Q3 Select the appropriate answer.

Q4 Select the appropriate answer.

Q5 Select the appropriate answer.

Q6 Select the appropriate answer.

Q7 Select the appropriate answer.

Q8 Select the appropriate answer.

Q9 Select the appropriate answer.

Q10 Select the appropriate answer.

Q1:
- ABS ArcMP
- ABS ArcRGT
- ABS ArcLFT

Q2:
- -51213.2
- 0.0
- 51213.2
- 72426.4

Q3:
- -51213.2
- -30000.0
- 30000.0
- 51213.2
- 72426.4

Q4:
- ABS ArcMP
- ABS ArcRGT
- ABS ArcLFT

Q5:
- -51213.2
- 0.0
- 51213.2
- 72426.4

Q6:
- -51213.2
- -30000.0
- 30000.0
- 51213.2
- 72426.4

Q7:
- -51213.2
- 0.0
- 51213.2
- 72426.4

Q8:
- -51213.2
- -30000.0
- 30000.0
- 51213.2
- 72426.4

Q9:
- -51213.2
- 0.0
- 51213.2
- 72426.4

Q10:
- -51213.2
- -30000.0
- 30000.0
- 51213.2
- 72426.4

Test **Final Test 5**

Select the correct sentence to describe each setting item for the Digital Oscilloscope function.

Q1 Online Setting
Q2 Probe Selection
Q3 Sampling Setting
Q4 Trigger Setting

Q1 Select the appropriate answer.

Q2 Select the appropriate answer.

Q3 Select the appropriate answer.

Q4 Select the appropriate answer.

Q1: 1：Set the measurement time and sampling interval.
2：Set the conditions to start and end measurement.
3：Select whether to display waveform in real-time during measurement and whether to continue measurement if the connection with the personal computer is interrupted.
4：Set the I/O signal to be measured and buffer memory.

Q2: 1：Set the measurement time and sampling interval.
2：Set the conditions to start and end measurement.
3：Select whether to display waveform in real-time during measurement and whether to continue measurement if the connection with the personal computer is interrupted.
4：Set the I/O signal to be measured and buffer memory.

Q3: 1：Set the measurement time and sampling interval.
2：Set the conditions to start and end measurement.
3：Select whether to display waveform in real-time during measurement and whether to continue measurement if the connection with the personal computer is interrupted.
4：Set the I/O signal to be measured and buffer memory.

Q4: 1：Set the measurement time and sampling interval.
2：Set the conditions to start and end measurement.
3：Select whether to display waveform in real-time during measurement and whether to continue measurement if the connection with the personal computer is interrupted.
4：Set the I/O signal to be measured and buffer memory.

Test **Final Test 1**

Select the correct sentence(s) to describe the specifications of Simple Motion mode of the Motion module.

- [ ] **Simple Motion mode and PLCopen® motion control FB mode can be used for each axis in a single Motion module.**
- [x] **In Simple Motion mode, only the PLC CPU should be programmed.**
- [ ] **Simple Motion mode is available in all Motion modules (RD78G(H)□ and FX5-□SSC-G).**
- [x] **For positioning, Simple Motion mode uses the same point table method as the one used by the Simple Motion module.**
- [x] **Since the Motion module has no external input (manual pulser input), prepare a high-speed counter module separately to use a manual pulser.**

Test **Final Test 2**

Select the correct word to fill in the blank ( ) to complete the sentences below.

- To execute test operation, change (Q1) of the servo amplifier and turn on the power supply.
- Check the rotation direction of the servo motor with the test operation function of (Q2).
- Set the (Q3) with the rotary switch on the servo amplifier.

Q1 1: DIP switch

Q2 2：MR Configurator2

Q3 1: IP address

Q1: 1：DIP switch
2：Rotary switch
3：Command switch

Q2: 1：GX Works3
2：MR Configurator2
3：Motion Control Setting Function

Q3: 1：IP address
2：Station number

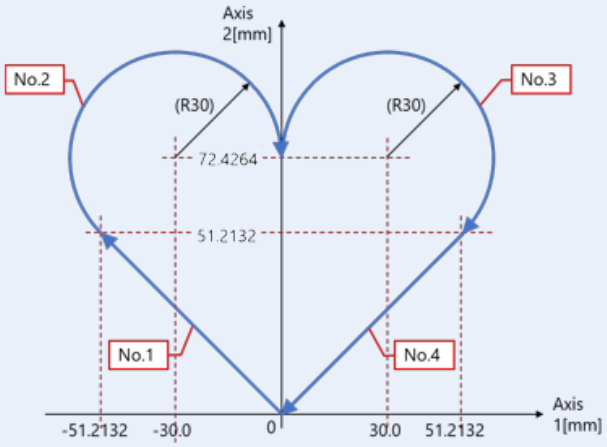
Test Final Test 3

Select the correct sentence(s) to describe the settings of Simple Motion mode.

- [x] **Simple Motion mode is available by registering the Motion module with (S) in the module configuration diagram.**
- [ ] **After registering the servo amplifier in the network configuration window, perform PDO mapping.**
- [ ] **To configure Simple Motion mode, use the same window (Motion Control Setting Function) as the one used for the Motion module.**
- [x] **Set the acceleration time to the time required to reach the speed limit from speed 0 and deceleration time to the time required to reach speed 0 from the speed limit.**
- [x] **To plot the same trajectory regardless of the start point of operation during interpolation control, create positioning data based on the relative position specification.**

Test **Final Test 4**

Complete the following point tables to plot a trajectory as shown on the right figure.
Circular interpolation with center point designation is used for arcs.
The addresses are specified by the absolute position specification.



[Axis 1]

No.	Operation pattern	Control method	Axis to be interpolated	Acceleration time No.	Deceleration time No.	Positioning address	Arc address	Command speed	Dwell time	M code
1	LOCATION	ABS Linear 2	2	0:1000	0:1000	-51213.2μm		3000.00mm/min	0 ms	0
2	CONT	(Q1)	2	0:1000	0:1000	(Q2) μm	(Q3) μm	3000.00mm/min	100 ms	0
3	LOCATION	(Q4)	2	0:1000	0:1000	(Q5) μm	(Q6) μm	3000.00mm/min	0 ms	0
4	END	ABS Linear 2	2	0:1000	0:1000	0.0 μm		3000.00mm/min	500 ms	0

[Axis 2]

No.	Operation pattern	Control method	Axis to be interpolated	Acceleration time No.	Deceleration time No.	Positioning address	Arc address	Command speed	Dwell time	M code
1						51213.2μm				
2						(Q7) μm	(Q8) μm			
3						(Q9) μm	(Q10) μm			
4						0.0 μm				

Q1 ABS ArcRGT

Q2 0.0

Q3 -30000.0

Q4 ABS ArcRGT

Q5 51213.2

Q6 30000.0

Q7 72426.4

Q8 72426.4

Q9 51213.2

Q10 72426.4

Q1:
- ABS ArcMP
- ABS ArcRGT
- ABS ArcLFT

Q2:
- -51213.2
- 0.0
- 51213.2
- 72426.4

Q3:
- -51213.2
- -30000.0
- 30000.0
- 51213.2
- 72426.4

Q4:
- ABS ArcMP
- ABS ArcRGT
- ABS ArcLFT

Q5:
- -51213.2
- 0.0
- 51213.2
- 72426.4

Q6:
- -51213.2
- -30000.0
- 30000.0
- 51213.2
- 72426.4

Q7:
- -51213.2
- 0.0
- 51213.2
- 72426.4

Q8:
- -51213.2
- -30000.0
- 30000.0
- 51213.2
- 72426.4

Q9:
- -51213.2
- 0.0
- 51213.2
- 72426.4

Q10:
- -51213.2
- -30000.0
- 30000.0
- 51213.2
- 72426.4

Test **Final Test 5**

Select the correct sentence to describe each setting item for the Digital Oscilloscope function.

Q1 Online Setting
Q2 Probe Selection
Q3 Sampling Setting
Q4 Trigger Setting

Q1	Select whether to display waveform in real-time during measurement and whether to continu...
Q2	Set the I/O signal to be measured and buffer memory.
Q3	Set the measurement time and sampling interval.
Q4	Set the conditions to start and end measurement.

Q1: 1：Set the measurement time and sampling interval.
2：Set the conditions to start and end measurement.
3：Select whether to display waveform in real-time during measurement and whether to continue measurement if the connection with the personal computer is interrupted.
4：Set the I/O signal to be measured and buffer memory.

Q2: 1：Set the measurement time and sampling interval.
2：Set the conditions to start and end measurement.
3：Select whether to display waveform in real-time during measurement and whether to continue measurement if the connection with the personal computer is interrupted.
4：Set the I/O signal to be measured and buffer memory.

Q3: 1：Set the measurement time and sampling interval.
2：Set the conditions to start and end measurement.
3：Select whether to display waveform in real-time during measurement and whether to continue measurement if the connection with the personal computer is interrupted.
4：Set the I/O signal to be measured and buffer memory.

Q4: 1：Set the measurement time and sampling interval.
2：Set the conditions to start and end measurement.
3：Select whether to display waveform in real-time during measurement and whether to continue measurement if the connection with the personal computer is interrupted.
4：Set the I/O signal to be measured and buffer memory.

Test Score

You have completed the Final Test. You results area as follows.
To end the Final Test, proceed to the next page.

		1	2	3	4	5	6	7	8	9	10
	Final Test 1	✓									
	Final Test 2	✓	✓	✓							
	Final Test 3	✓									
	Final Test 4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Final Test 5	✓	✓	✓	✓						

Total questions: **19**

Correct answers: **19**

Percentage: **100** %

Clear

You have completed the "MELSEC iQ-R/iQ-F Series Motion Module Basics (Simple Motion Mode)" Course.

Thank you for taking this course.

We hope you enjoyed the lessons and the information you acquired in this course is useful for configuring systems in the future.

You can review the course as many times as you want.

Review

Close