OMRON

Machine Automation Controller NJ/NX-series

Motion Device Connection Guide (EtherCAT® Connection)

SANYO DENKI CO.,LTD.

AC Servo Amplifier

SANMOTION R ADVANCED MODEL

TYPE F

EtherCAT Interface Type H

Network Connection Guide

SYSMAC always in control

P707-E1-01

About Intellectual Property Rights and Trademarks

Table of Contents

1. Related Manuals

To ensure system safety, make sure to always read and follow the information provided in all Safety Precautions and Precautions for Safe Use in the manuals for each device which is used in the system.
The table below lists the manuals provided by SANYO DENKI CO., LTD. (hereinafter referred to as "SANYO DENKI") and OMRON Corporation (hereinafter referred to as "OMRON"), which pertain to this guide.

Manufacturer	Cat. No.	Model	Manual name
OMRON	W500	NJ501-□□□□ NJ301-□□□□ NJ101-□□□□	NJ-series CPU Unit Hardware User's Manual
OMRON	W535	NX701-□□□□	NX-series CPU Unit Hardware User's Manual
OMRON	W593	NX102-□□□□	NX-series NX102 CPU Unit Hardware User's Manual
OMRON	W578	NX1P2-□□□□	NX-series NX1P2 CPU Unit Hardware User's Manual
OMRON	W501	NX701-□□□□ NX102-□□□□ NX1P2-□□□□ NJ501-□□□□ NJ301-□□□□ NJ101-□□□□	NJ/NX-series CPU Unit Software User's Manual
OMRON	W502		NJ/NX-series Instructions Reference Manual
OMRON	W505		NJ/NX-series CPU Unit Built-in EtherCAT® Port User's Manual
OMRON	W507		NJ/NX-series CPU Unit Motion Control User's Manual
OMRON	W508		NJ/NX-series Motion Control Instructions Reference Manual
OMRON	W503		NJ/NX-series Troubleshooting Manual
OMRON	W504	SYSMAC-SE2□□□	Sysmac Studio Version 1 Operation Manual
OMRON	I576	R88M-K□ R88D-KN□-ECT	AC SERVOMOTORS/SERVO DRIVES G5-series WITH BUILT-IN EtherCAT® COMMUNICATIONS User's Manual

Manufacturer	Cat. No.	Model	Manual name
SANYO DENKI	M0011195	RF2□□□□H□□	SANMOTION AC SERVO SYSTEMS R ADVANCED MODEL TYPE F with EtherCAT Interface Type H For Rotary Motor, Linear Motor Instruction Manual
SANYO DENKI	M0010842	－	MOTOR SETUP SOFTWARE SERVO SYSTEMS Instruction Manual

2. Terms and Definitions

The terms and definitions used in this guide are given below.

Term	Explanation and Definition
slave unit	A generic name for a device that performs EtherCAT communications with an EtherCAT master. There are various types of slave units such as servo drives that handle position data and I/O terminals that handle bit signals.
object	An object consists of information such as data and parameters within a slave unit. .
PDO communications (Communications using Process Data Objects)	One type of EtherCAT communications in which process data objects (PDOs) are used to exchange information in a fixed cycle and realtime. It is also called process data communications.
SDO communications (Communications using Service Data Objects)	One type of EtherCAT communications. It is a communications method in which EtherCAT communications instructions are used to read and write specified data (SDO data) between an EtherCAT master and slaves whenever required.
PDO mapping	Association of objects used for PDO communications.
PDO entry	A pointer to an object used for PDO mappings.
function module	One of the functional units of the software configuration of a CPU Unit
Motion Control Function Module	One of the function modules. This module performs motion control according to the commands from motion control instructions that are executed in a user program. It sends data to the EtherCAT Master Function Module. (Abbreviation: MC Function Module)
EtherCAT Master Function Module	One of the function modules. This function module communicates with EtherCAT slaves as an EtherCAT master.
PLC Function Module	One of the function modules. This module manages overall scheduling, executes a user program, sends commands to the MC Function Module, and provides interfaces to a USB/SD memory card.
motion control instruction	An instruction that is defined as a function block to execute a motion control function. There are two types of motion control instructions: one is based on function blocks for PLCopen® motion control and the other is specifically developed for the MC Function Module. (Abbreviation: MC instruction)
PLCopen®	PLCopen® is an association that promotes IEC 61131-3. It has its headquarters in Europe and a world-wide membership. PLCopen® standardizes function blocks for motion control to define a program interface for the languages specified in IEC 61131-3. PLCopen® headquarter website: http://www.plcopen.org/
axis	A functional unit within the MC Function Module. An axis is assigned to the drive mechanism in an external servo drive or the sensing mechanism in an external encoder input slave unit.

Term	Explanation and Definition
axis variable	A system-defined variable that is defined as a structure and provides status information and some of the axis parameters for an individual axis. An axis variable is used to specify an axis for MC instructions and to monitor the command position, error information, and other information for the axis.
ESI file (EtherCAT Slave Information file)	An ESI file contains information unique to EtherCAT slave units in XML format. You can load an ESI file into the Sysmac Studio, to allocate EtherCAT slave process data and make other settings.

3. Precautions

(1) Understand the specifications of devices which are used in the system. Allow some margin for ratings and performance. Provide safety measures, such as installing a safety circuit, in order to ensure safety and minimize the risk of abnormal occurrence.

(2) To ensure system safety, make sure to always read and follow the information provided in all Safety Precautions and Precautions for Safe Use in the manuals for each device which is used in the system.

(3) The user is encouraged to confirm the standards and regulations that the system must conform to.

(4) It is prohibited to copy, to reproduce, and to distribute a part or the whole of this guide without the permission of OMRON Corporation.

(5) The information contained in this guide is current as of October 2018. It is subject to change for improvement without notice.

The following notations are used in this guide.

⚠ WARNING	Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury, or may result in serious injury or death. Additionally there may be significant property damage.
⚠ Caution	Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury or property damage.

Precautions for Correct Use

Precautions on what to do and what not to do to ensure proper operation and performance.

Additional Information

Additional information to read as required.
This information is provided to increase understanding or make operation easier.

Symbol

The filled circle symbol indicates operations that you must do.
The specific operation is shown in the circle and explained in the text.
This example shows a general precaution for something that you must do.

4. Overview

This guide describes procedures for connecting and operating a SANYO DENKI AC Servo Amplifier SANMOTION R ADVANCED MODEL TYPE F with EtherCAT Interface Type H (hereinafter referred to as the "Servo Amplifier") using a motion control instruction (hereinafter referred to as an "MC instruction") for an OMRON NJ/NX-series Machine Automation Controller (hereinafter referred to as the "Controller"), as well as for checking the connection status.
The explanations given in this guide assume the use of NX-series Controllers.
The Servo Amplifier is also referred to as the "Motion Control Device" or "slave unit" in some descriptions.

Refer to *Section 6. EtherCAT Settings* and *Section 7. EtherCAT Connection Procedure* to understand setting methods and key points to operate the Motion Control Device using EtherCAT PDO communications. The MC_Power (Power Servo) is given as an example of an MC instruction to check the operation in this guide.
The operation of motion control varies depending on the device you use. Make sure that you understand *Section 8. Restrictions on Motion Control* before you design a system.

⚠ Caution

The scope of this guide covers the "connection check of the Motion Control Device connected via EtherCAT using the MC_Power instruction".
To use MC instructions and design a system not described in this guide, make sure to always read and follow the information provided in all Safety Precautions and Precautions for Safe Use in the manuals for each device you intend to use in the system. Please note that some functions of the MC Function Module may be unavailable, or available but different in behavior from OMRON Motion Control Devices due to the different specifications between non-OMRON and OMRON Motion Control Devices. Make sure to check *Section 8. Restrictions on Motion Control* in this guide when you design a system.

Additional Information

Both the settings and the operation check program described in *7.4. Controller Setup* are made in advance in the Sysmac Studio project file (hereinafter referred to as "the project file") specified below. Refer to *Section 9. Appendix 1: Procedures Using the Project File* for information on how to use the project file.
Obtain the project file with a latest version from OMRON Corporation.
The project file specified below has been created for NX-series Controllers. If you use NJ-series Controllers, change the device information displayed in the Change Device Dialog Box of Sysmac Studio.

Name	File name	Version
Sysmac Studio project file (extension: csm2)	P707_NX_ECAT_SanyoDK_RF2_V100.csm2	Ver.1.00

5. Applicable Devices and Device Configuration

5.1. Applicable Devices

The applicable devices are as follows:

Manufacturer	Name	Model
OMRON	NJ/NX-series CPU Unit	NX701-17□□ NX701-16□□ NX1P2-11□□□□ NX1P2-10□□□□ NX1P2-90□□□□ NJ501-□□□□ NJ301-12□□ NJ301-11□□ NJ101-10□□
SANYO DENKI	Servo Amplifier Type F	RF2□□□□H□□
SANYO DENKI	Servo Motors for Type F (Rotary Motor and Linear Motor)	—

Precautions for Correct Use

In this guide, the devices with models and versions listed in *5.2. Device Configuration* are used as examples of applicable devices to describe the procedures for connecting the devices and checking their connection.
You cannot use devices with versions lower than the versions listed in *5.2*.
To use the above devices with models not listed in *5.2.* or versions higher than those listed in *5.2.*, check the differences in the specifications by referring to the manuals before operating the devices.

Additional Information

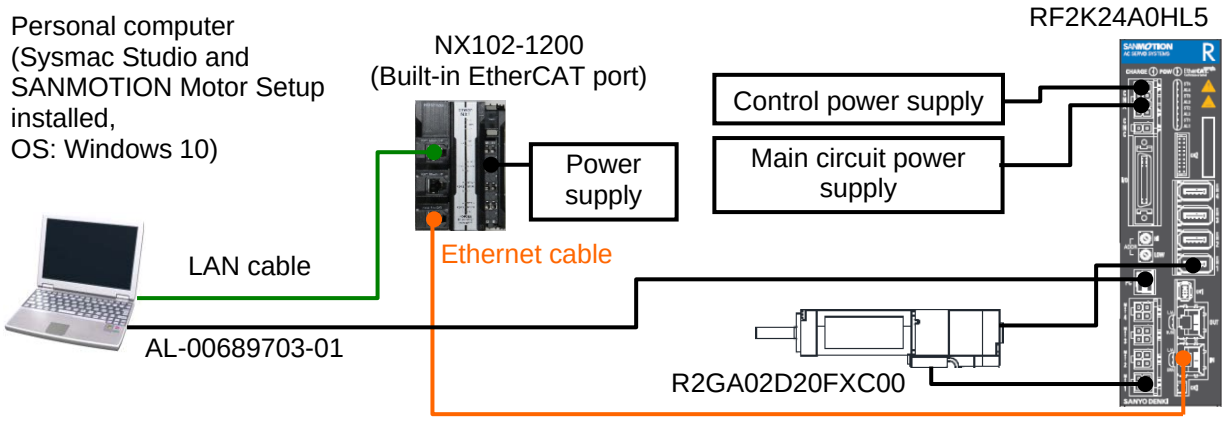
This guide describes the procedures for establishing the network connection.
It does not provide information on operation, installation, wiring method, device functionality, or device operation, which is not related to the connection procedures.
Refer to the manuals or contact the device manufacturer.

Additional Information

Contact SANYO DENKI CO., LTD. for Servo Motors connectable to Servo Amplifiers.

5.2. Device Configuration

This guide describes the connection procedures using an NX-series Controller.
The hardware components to reproduce the connection procedures are shown below.
In this guide, only one axis of the Servo Amplifier is used to connect the Servo Motor.
.



Manufacturer	Name	Model	Version
OMRON	NX series CPU Unit (Built-in EtherNet/IP port)	NX102-1200	Ver.1.30
—	Power supply for the Controller (24 VDC)	—	
OMRON	Sysmac Studio	SYSMAC-SE2□□□	Ver.1.23
—	Personal computer (OS: Windows 10)	—	
—	LAN cable (STP (shielded, twisted-pair) cable of Ethernet category 5 or higher)	—	
OMRON	Ethernet cable (with industrial Ethernet connector)	XS5W-T421-□M□-K	
SANYO DENKI	Servo Amplifier	RF2K24A0HL5	Rev.0x0000 0000
SANYO DENKI	Servo Motor	R2GA02D20FXC00	
SANYO DENKI	ESI file	P0010959C01.xml	
SANYO DENKI	SANMOTION Motor Setup	—	Ver.1.13
SANYO DENKI	PC communication cable	AL-00689703-01	
—	Control power supply (24 VDC)	—	
—	Main circuit power supply (48 VDC)	—	

Precautions for Correct Use

Prepare the ESI file specified above beforehand.
To obtain the ESI file, contact SANYO DENKI CO., LTD.

Precautions for Correct Use

The connection line of EtherCAT communications cannot be shared with other Ethernet networks. Do not use devices for Ethernet such as a switching hub.
Use an Ethernet cable (double shielding with aluminum tape and braiding) of Category 5 or higher, and use a shielded connector of Category 5 or higher.
Connect the cable shield to the connector hood at both ends of the cable.

Precautions for Correct Use

Update Sysmac Studio to the version specified on the previous page or to a higher version. If you use a version higher than the one specified, the procedures and related screenshots described in *Section 7.* and the subsequent sections may not be applicable. In that case, use the equivalent procedures described in this guide by referring to the *Sysmac Studio Version 1 Operation Manual* (Cat. No. W504).

Additional Information

For information on specifications of Ethernet cables and network wiring, refer to *Section 4. EtherCAT Network Wiring* of the *NJ/NX-series CPU Unit Built-in EtherCAT® Port User's Manual* (Cat. No. W505).

Additional Information

For information on power supply specifications of the Controller, refer to the *NX-series NX102 CPU Unit Hardware User's Manual* (Cat. No. W593).

Additional Information

For information on power supply specifications of the Servo Amplifier, refer to the *SANMOTION AC SERVO SYSTEMS R ADVANCED MODEL TYPE F with EtherCAT Interface Type H For Rotary Motor, Linear Motor Instruction Manual* (M0011195).

Additional Information

The scope of this guide covers the "connection check of the Motion Control Device connected via EtherCAT using the MC_Power instruction"; hence, a regenerative resistor is not used. If you connect a regenerative resistor, refer to *4.1 Control power supply, Regeneration resistance, and Wiring protective ground* and *12.2 Capacity Selection of Regenerative Resistor* of the *SANMOTION AC SERVO SYSTEMS R ADVANCED MODEL TYPE F with EtherCAT Interface Type H For Rotary Motor, Linear Motor Instruction Manual* (M0011195).

6. EtherCAT Settings

This section describes the parameter settings for EtherCAT communications and motion control that are defined in this guide, and explains the relationship between motion control via EtherCAT and its parameter settings.

6.1. Parameters

The parameters set in this guide are shown below.
Those parameters are set based on the connection using only Ax1 (axis) of the Servo Amplifier.

6.1.1. EtherCAT Communications Settings

The Servo Amplifier and Controller parameters required for EtherCAT communications are shown below. Use the following settings when you perform *7.3.1. Hardware Settings* and *7.3.2. Parameter Settings*.

Hardware settings

Setting item		Servo Amplifier	Remarks
Station alias address (ADDR)	HI	0	Set the node address to 1.
	LOW	1	

Parameter settings

Setting item	Controller	Servo Amplifier			
		Ax1	Ax2	Ax3	Ax4
Enable destributed clock (SM2 Sync mode[*1])	Enabled (DC-Synchronous (SYNC0))	0002: SYNC0 Event Synchronization (Synchronized with SYNC0 Hardware Signal)(Default)			
Combined motor code		0x049B (Motor model: R2GA02D20F)	–	–	–
Combined sensor resolution setting		0x0002 (1,000 P/R)	–	–	–
Combined sensor type		0x0101 (Asynchronous encoder (incremental system) 2.5 MHz without multi turn output)	–	–	–
Enable axis setting		01: Enabled (Default)	00: Disabled	00: Disabled	00: Disabled
Flag for the axis between the interlock mask		10: Disable (Default)[*2]	00: Enable[*3]	00: Enable[*3]	00: Enable[*3]
Positive limit switch function		00: Always_Disable (Default)	–	–	–
Negative limit switch function		00: Always_Disable (Default)	–	–	–
Emergency stop function		0C:CONT6_ON[*4]	–	–	–

*1 This parameter is set for Ax1.
*2 No emergency stop (EMR) state even when an error is detected at the other axes.
*3 Emergency stop (EMR) state when an error is detected at the other axes.
*4 The emergency stop function is enabled when general input CONT6 is ON.

6.1.2. PDO Mapping

To use motion control functions, you must map the objects that are required for those functions to PDOs.

The PDO entries (objects) used in this guide are shown below.

Use the settings when you perform *7.4.2. PDO Map Settings*.

Precautions for Correct Use

Restrictions on PDO Mapping

The following restrictions are imposed on PDO mapping for the Servo Amplifier.

- The number of objects which can be mapped, are maximum 10 objects per axis for input and output respectively.
- The size of objects are maximum 32 bytes per axis for input and output respectively.
- Must set the mapping data size per axis as even-bytes for input and output respectively. If the data is odd byte, add 1 bit by using Padding object (OD:0x0000 SI:0) to make an even-byte.

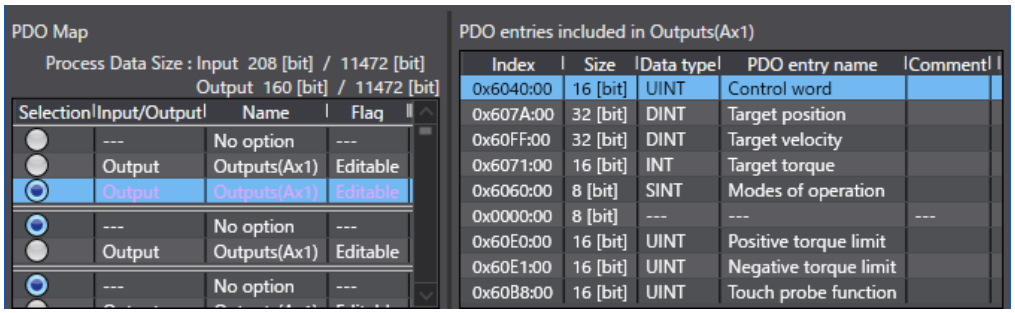
For more information on the restrictions on PDO mapping, refer to *2) PDO Mapping* in *5.3 CoE Communication Area* of the *SANMOTION AC SERVO SYSTEMS R ADVANCED MODEL TYPE F With EtherCAT Interface Type H For Rotary Motor, Linear Motor Instruction Manual* (M0011195)

Additional Information

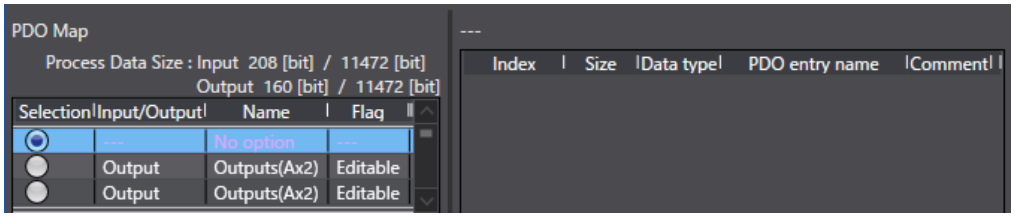
For more information relating to *6.1.2. PDO Mapping* and *6.1.5. Axis Settings for PDO Entries*, refer to *Section 10. Appendix 2: MC Instructions and PDO Entries*.

Output (Controller to Servo Amplifier)

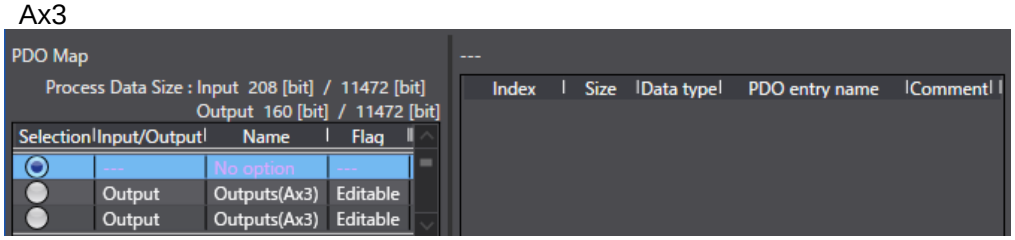
Ax1



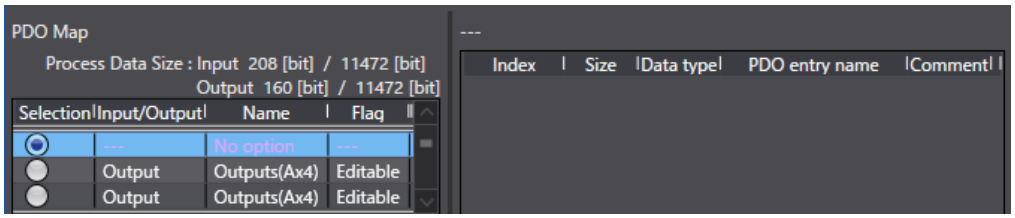
Ax2



Ax3

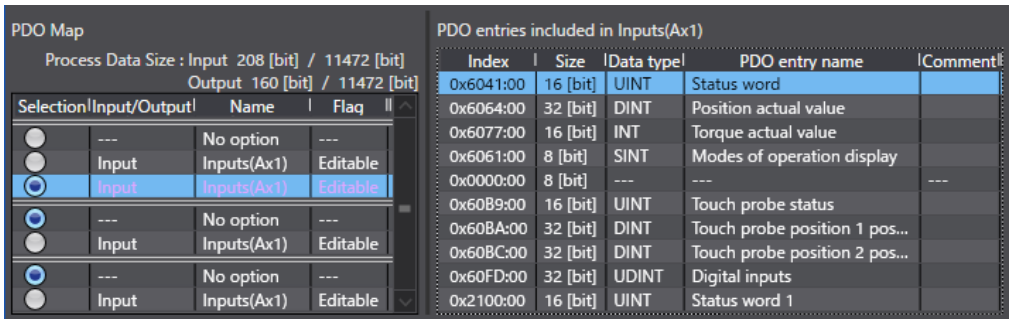


Ax4

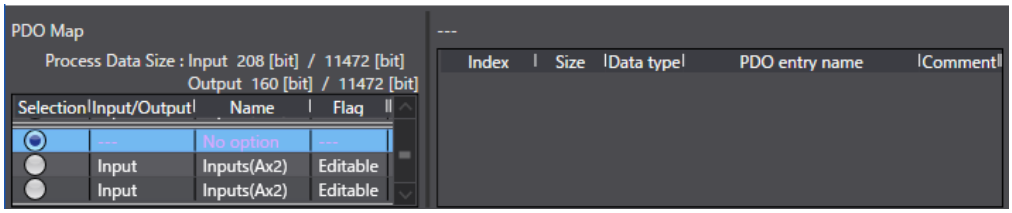


Input (Servo Amplifier to Controller)

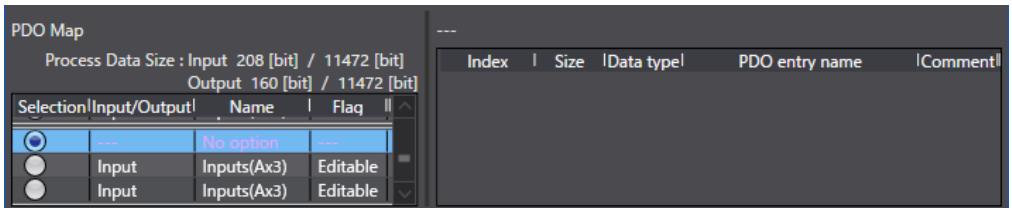
Ax1



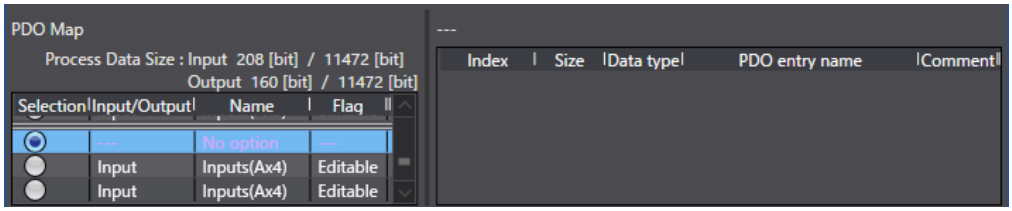
Ax2



Ax3



Ax4



6.1.3. Digital Inputs for Motion Control

Digital inputs such as the home proximity are required to perform motion control.
The following shows the setting items for the Servo Amplifier and connector settings for inputs that are both required to use digital inputs. In this guide, the operation is checked after setting the Servo Amplifier not to detect an error while disconnecting the external inputs.
Use the following settings when you perform *7.3. SANYO DENKI Servo Amplifier Setup*.

General I/O connector settings

Pin No.	Signal name	Description	Digital inputs assignment
1(CONT1+)/ 2(CONT1-)	External Latch Input 1	Set the signal function to "Always_Disable".	Bit16: CONT1
3(CONT2+)/ 4(CONT2-)	External Latch Input 2	Set the signal function to "Always_Disable".	Bit17: CONT2
5(CONT3+)/ 6(CONT3-)	Positive Limit Switch	Set the signal function to "Always_Disable".	Bit18: CONT3
7(CONT4+)/ 8(CONT4-)	Negative Limit Switch	Set the signal function to "Always_Disable".	Bit19: CONT4
19(CONT5+)/ 20(CONT5-)	Home Switch	Set the signal function to "Always_Disable".	Bit20: CONT5
21(CONT6+)/ 22(CONT6-)	Immediate Stop Input (Emergency stop (EMR))	Set the signal function to be enabled while CONT6 is ON.	Bit21: CONT6
23(CONT7+)/ 24(CONT7-)	General Input	Set the signal function to "Always_Disable".	Bit22：CONT7
25(CONT8+)/ 26(CONT8-)	General Input	Set the signal function to "Always_Disable".	Bit23: CONT8

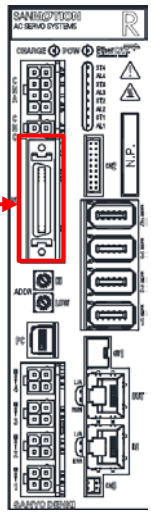
The digital inputs are assigned to the digital inputs object (60FDh) via the general I/O connector on the Servo Amplifier. The relationship between them is described below.

Specifications of the digital inputs object

Index	Sub-index	Name	Data type	Access	PDO mapping	Saving to EEPROM
60FDh	0	Digital inputs	UDINT	RO	Possible	Not possible

Relationship between the digital inputs object and the pin assignment of the general I/O connector

Digital inputs		General I/O connector assignment	Description
Bit	Name		
0	Negative Limit	－	0:OFF, 1: ON
1	Positive Limit	－	0:OFF, 1: ON
2	Home	－	0:OFF, 1: ON
3	EMR	－	0:OFF, 1: ON
4 to 15	－	－	Reserved
16	CONT1	Pins 1 and 2	0:OFF (Open), 1: ON (Close)
17	CONT2	Pins 3 and 4	0:OFF (Open), 1: ON (Close)
18	CONT3	Pins 5 and 6	0:OFF (Open), 1: ON (Close)
19	CONT4	Pins 7 and 8	0:OFF (Open), 1: ON (Close)
20	CONT5	Pins 19 and 20	0:OFF (Open), 1: ON (Close)
21	CONT6	Pins 21 and 22	0:OFF (Open), 1: ON (Close)
22	CONT7	Pins 23 and 24	0:OFF (Open), 1: ON (Close)
23	CONT8	Pins 25 and 26	0:OFF (Open), 1: ON (Close)
24 to 31	－	－	Reserved



The closing brace bracket to the right of the table above indicates the bits that are assigned to the general I/O connector shown on the right (boxed in red).
The red box shown in the table indicates the bits that are used for the digital inputs described in *6.1.5. Axis Settings for PDO Entries*.

6.1.4. Motion Control Axis

The axis number of the Servo Amplifier required for motion control is shown below, which is set in *7.4.3. Axis Settings for Motion Control*.

Axis variable name	Axis number	Displayed in Sysmac Studio
MC_Axis000	0	MC_Axis000(0,MC1)*1

*1 For NJ-series Controllers, the axis name displayed in Sysmac Studio is "*MC_Axis000(0)*".

6.1.5. Axis Settings for PDO Entries

The axis settings for the Servo Amplifier required for motion control are shown below.
For details on each of the objects, refer to *5. Object Dictionary* of the *SANMOTION AC SERVO SYSTEMS R ADVANCED MODEL TYPE F With EtherCAT Interface Type H For Rotary Motor, Linear Motor Instruction Manual* (M0011195).
Use the following settings when you perform *7.4.3. Axis Settings for Motion Control*.

MC_Axis000(0,MC1)

Function Name	Device	Process Data
- Output (Controller to Device)		
★ 1. Controlword	Node : 1 SanyoDenki RF2 EtherCAT(E001)	6040h-00.0(Outputs(Ax1)_Control word_6040_00)
★ 3. Target position	Node : 1 SanyoDenki RF2 EtherCAT(E001)	607Ah-00.0(Outputs(Ax1)_Target position_607A_00)
5. Target velocity	Node : 1 SanyoDenki RF2 EtherCAT(E001)	60FFh-00.0(Outputs(Ax1)_Target velocity_60FF_00)
7. Target torque	Node : 1 SanyoDenki RF2 EtherCAT(E001)	6071h-00.0(Outputs(Ax1)_Target torque_6071_00)
9. Max profile Velocity	<Not assigned>	<Not assigned>
11. Modes of operation	Node : 1 SanyoDenki RF2 EtherCAT(E001)	6060h-00.0(Outputs(Ax1)_Modes of operation_6060_00)
15. Positive torque limit value	Node : 1 SanyoDenki RF2 EtherCAT(E001)	60E0h-00.0(Outputs(Ax1)_Positive torque limit_60E0_00)
16. Negative torque limit value	Node : 1 SanyoDenki RF2 EtherCAT(E001)	60E1h-00.0(Outputs(Ax1)_Negative torque limit_60E1_00)
21. Touch probe function	Node : 1 SanyoDenki RF2 EtherCAT(E001)	60B8h-00.0(Outputs(Ax1)_Touch probe function_60B8_00)
44. Software Switch of Encoder's Input Slave	<Not assigned>	<Not assigned>
- Input (Device to Controller)		
★ 22. Statusword	Node : 1 SanyoDenki RF2 EtherCAT(E001)	6041h-00.0(Inputs(Ax1)_Status word_6041_00)
★ 23. Position actual value	Node : 1 SanyoDenki RF2 EtherCAT(E001)	6064h-00.0(Inputs(Ax1)_Position actual value_6064_00)
24. Velocity actual value	<Not assigned>	<Not assigned>
25. Torque actual value	Node : 1 SanyoDenki RF2 EtherCAT(E001)	6077h-00.0(Inputs(Ax1)_Torque actual value_6077_00)
27. Modes of operation display	Node : 1 SanyoDenki RF2 EtherCAT(E001)	6061h-00.0(Inputs(Ax1)_Modes of operation display_6061_00)
40. Touch probe status	Node : 1 SanyoDenki RF2 EtherCAT(E001)	60B9h-00.0(Inputs(Ax1)_Touch probe status_60B9_00)
41. Touch probe pos1 pos value	Node : 1 SanyoDenki RF2 EtherCAT(E001)	60BAh-00.0(Inputs(Ax1)_Touch probe position 1 posi_60BA_00)
42. Touch probe pos2 pos value	Node : 1 SanyoDenki RF2 EtherCAT(E001)	60BCh-00.0(Inputs(Ax1)_Touch probe position 2 posi_60BC_00)
43. Error code	<Not assigned>	<Not assigned>
45. Status of Encoder's Input Slave	<Not assigned>	<Not assigned>
46. Reference Position for csp	<Not assigned>	<Not assigned>
- Digital inputs		
28. Positive limit switch	Node : 1 SanyoDenki RF2 EtherCAT(E001)	60FDh-00.18(Inputs(Ax1)_Digital inputs_60FD_00)
29. Negative limit switch	Node : 1 SanyoDenki RF2 EtherCAT(E001)	60FDh-00.19(Inputs(Ax1)_Digital inputs_60FD_00)
30. Immediate Stop Input	Node : 1 SanyoDenki RF2 EtherCAT(E001)	60FDh-00.21(Inputs(Ax1)_Digital inputs_60FD_00)
32. Encoder Phase Z Detection	Node : 1 SanyoDenki RF2 EtherCAT(E001)	2100h-00.2(Inputs(Ax1)_Status word 1_2100_00)
33. Home switch	Node : 1 SanyoDenki RF2 EtherCAT(E001)	60FDh-00.20(Inputs(Ax1)_Digital inputs_60FD_00)
37. External Latch Input 1	Node : 1 SanyoDenki RF2 EtherCAT(E001)	60FDh-00.16(Inputs(Ax1)_Digital inputs_60FD_00)
38. External Latch Input 2	Node : 1 SanyoDenki RF2 EtherCAT(E001)	60FDh-00.17(Inputs(Ax1)_Digital inputs_60FD_00)

6.2. Relationship Between Motion Control via EtherCAT and its Parameter Settings

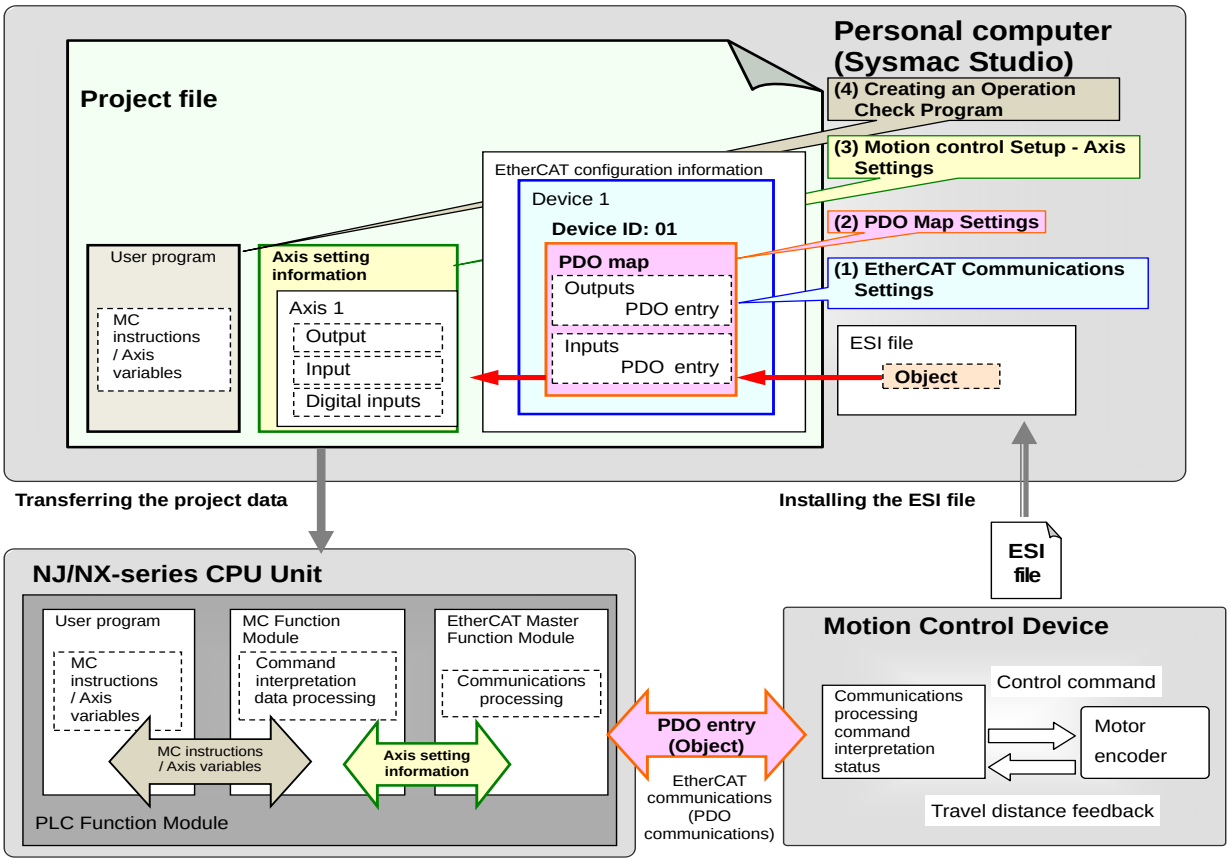
The following describes the relationship between motion control via EtherCAT and its parameter settings.

This guide describes the parameter settings based on the connection using only Ax1 (axis) of the Servo Amplifier.

Four types of parameters listed below are set in this guide.

Parameter setting	Description
(1)EtherCAT Communications Settings	EtherCAT communications settings between the Motion Control Device and the Controller
(2)PDO Map Settings	Data settings for motion control with the Controller
(3)Motion Control Setup - Axis Settings	Axis settings (MC_Axis000) for MC instructions
(4)Creating an Operation Check Program	Program creation and task settings to operate the Motion Control Device

Relationship between motion control via EtherCAT and its parameter settings



This figure shows the configuration elements in each file/device related to this guide only.

7. EtherCAT Connection Procedure

This section describes the procedures for connecting the Controller and the Servo Amplifier via EtherCAT and for operating the Motion Control Device using an MC instruction for the Controller. The procedures for setting up the Controller and the Servo Amplifier in this guide are based on the factory default settings.

⚠ WARNING

Depending on the Controller status, if you use a Controller that has not been initialized, unexpected operation of the Motion Control Device may occur and result in injury when you turn ON the Controller.
To prevent unexpected operation of the Motion Control Device, make sure to initialize the Controller before connecting the Motion Control Device and the Controller with an Ethernet cable.

Additional Information

For information on how to initialize the parameters of a Servo Amplifier, refer to *4.11 Parameter initialization* of the *MOTOR SETUP SOFTWARE SERVO SYSTEMS Instruction Manual* (M0010842).

7.1. Work Flow

Take the following steps to connect the Controller and the Servo Amplifier via EtherCAT and to operate the Motion Control Device using an MC instruction for the Controller.

7.2. Preparation for Controller Setup	Prepare to set up the Controller.
↓	
7.2.1. Starting Sysmac Studio and Going Online	Start Sysmac Studio and go online with the Controller.
↓	
7.2.2. Initializing the Controller	Initialize the data in the Controller.
↓	
7.2.3. Installing the ESI File	Install the ESI file for the Servo Amplifier in Sysmac Studio.
↓	
7.3. SANYO DENKI Servo Amplifier Setup	Set up the SANYO DENKI Servo Amplifier.
↓	
7.3.1. Hardware Settings	Set the hardware switches on the Servo Amplifier and connect the cables.
↓	

7.3.2. Parameter Settings	Set parameters for the Servo Amplifier.
↓	
7.4. Controller Setup	Set up the Controller.
↓	
7.4.1. Setting the EtherCAT Network Configuration	Set the EtherCAT network configuration.
↓	
7.4.2. PDO Map Settings	Map the objects to PDOs for the MC Function Module.
↓	
7.4.3. Axis Settings for Motion Control	Set the axis for the MC Function Module.
↓	
7.4.4. Creating an Operation Check Program	Create a program to check the operation.
↓	
7.4.5. Transferring the Project Data	Transfer the created project data to the Controller.
↓	
7.5. Connection Status Check	Check the connection status of the EtherCAT network.
↓	
7.5.1. Checking the Connection Status	Confirm that EtherCAT communications is performed normally.
↓	
7.5.2. Checking the Connection Status Using the Operation Check Program	Confirm that the Servo Amplifier is operated normally using the operation check program.

7.2. Preparation for Controller Setup

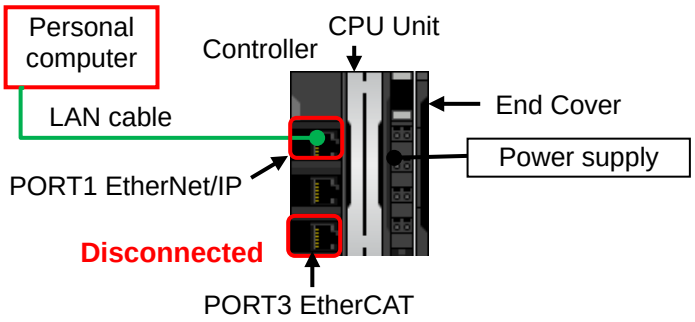
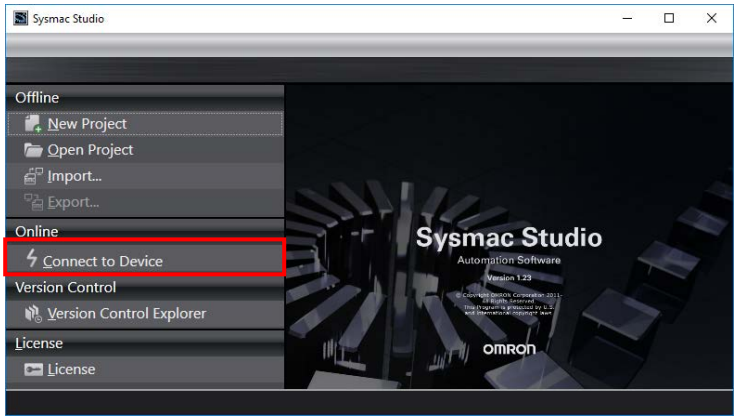
Prepare to set up the Controller.

⚠ WARNING

Depending on the Controller status, if the Controller is being connected to an Ethernet cable, unexpected operation of the Motion Control Device may occur and result in injury when you turn ON the Controller.
Do not connect an Ethernet cable to the Controller when you perform the procedures described here.

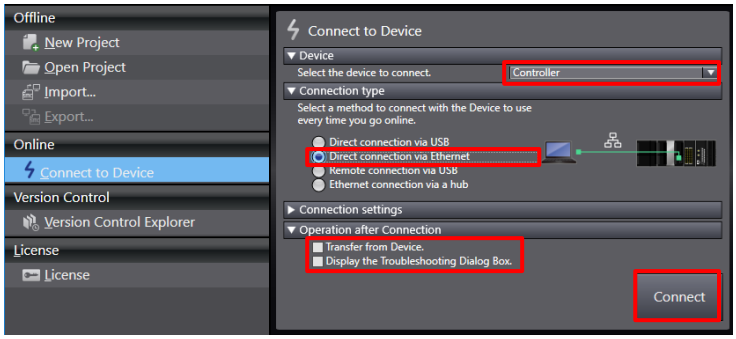
7.2.1. Starting Sysmac Studio and Going Online

Start Sysmac Studio and go online with the Controller.

1	Make sure that Controller is powered OFF.	
2	Connect Personal computer and PORT1 EtherNet/IP on Controller with a LAN cable. Check that an Ethernet cable is **disconnected** from PORT3 EtherCAT on Controller.	
3	Turn ON Controller.	
4	Start Sysmac Studio. *If the User Account Control Dialog Box is displayed at start, make a selection to start Sysmac Studio.	
5	Sysmac Studio is started. Click **Connect to Device**.	

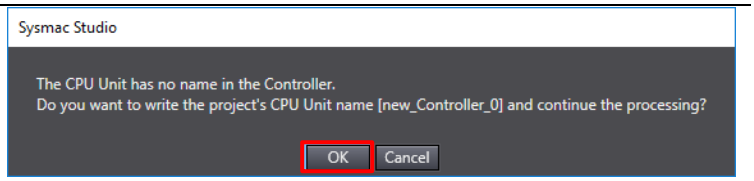
6 The Connect to Device Dialog Box is displayed.
Select ***Controller*** from the pull-down list in the *Device* Field and *Direct connection via Ethernet* in the *Connection type* Field. Uncheck both *Transfer from Device* and *Display the Troubleshooting Dialog Box* in the *Operation after Connection* Field.

Click **Connect**.

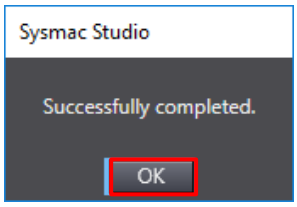


7 A confirmation dialog box is displayed. Check the contents and click **OK**.

*The contents of the dialog box vary depending on the status of Controller. Check the contents and click on an appropriate button to proceed with the processing.



8 The dialog box on the right is displayed. Check the contents and click **OK**.



9 The Auto Connect Project Dialog Box is displayed online. When an online connection is established, a yellow line is displayed under the toolbar.

The following panes are displayed in the window.

Left: Multiview Explorer

Top right: Toolbox

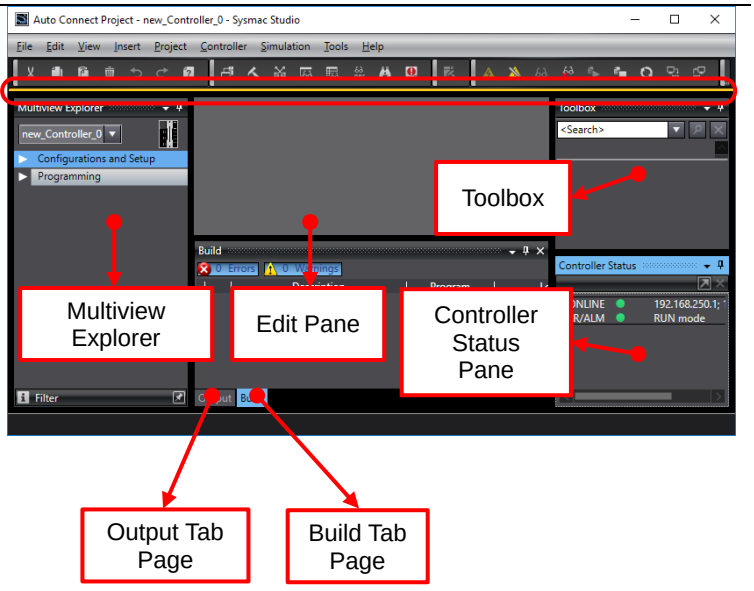
Bottom right: Controller Status Pane

Top middle: Edit Pane

The following tabs are displayed in the bottom middle of the window.

Output Tab Page

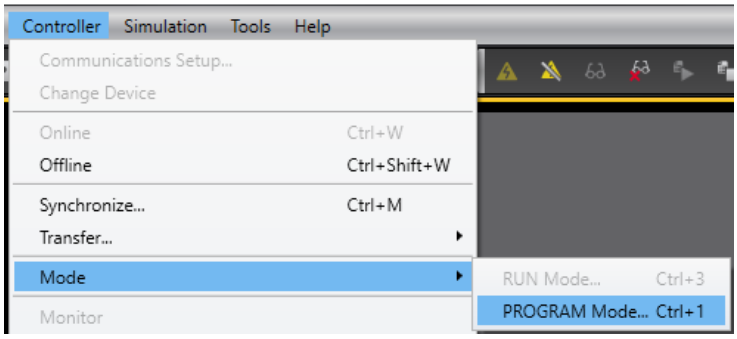
Build Tab Page



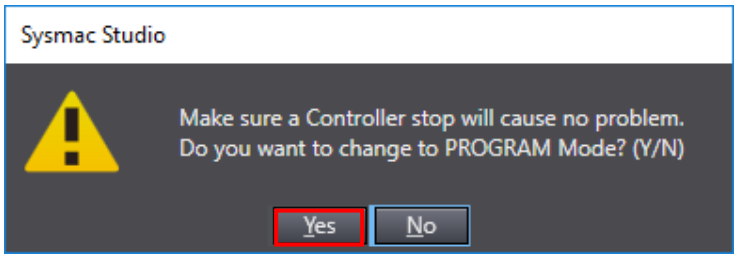
Additional Information

For more information on online connections, refer to *Section 6. Online Connections to a Controller* of the *Sysmac Studio Version 1 Operation Manual* (Cat. No. W504).

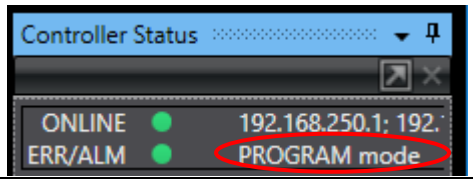
10 Select ***Mode*** – ***PROGRAM Mode*** from the Controller Menu.



The dialog box on the right is displayed. Confirm that there is no problem, and click **Yes**.



The operating mode of Controller displayed in the Controller Status Pane changes to PROGRAM mode.

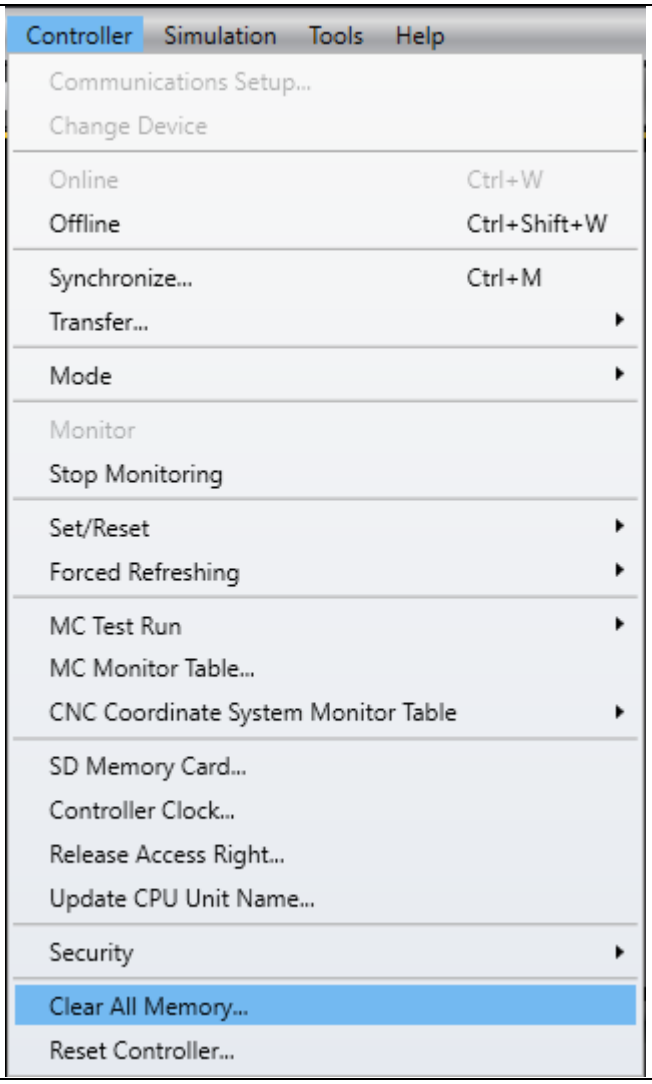


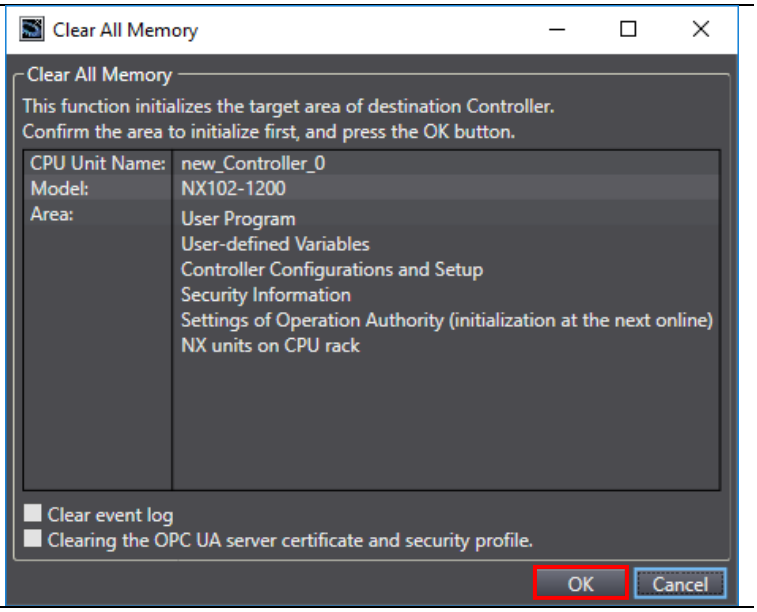
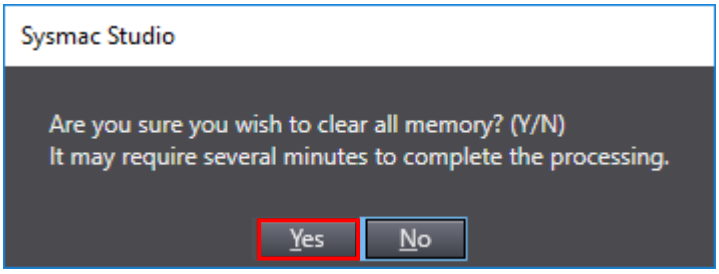
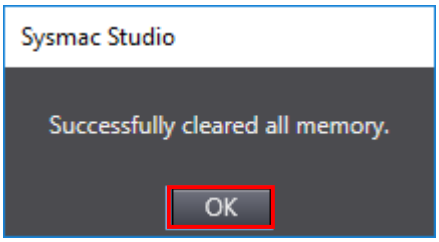
7.2.2. Initializing the Controller

Initialize the data in the Controller.

Precautions for Correct Use

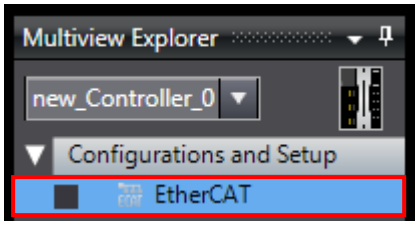
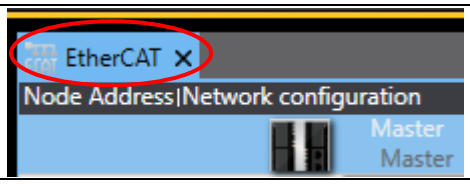
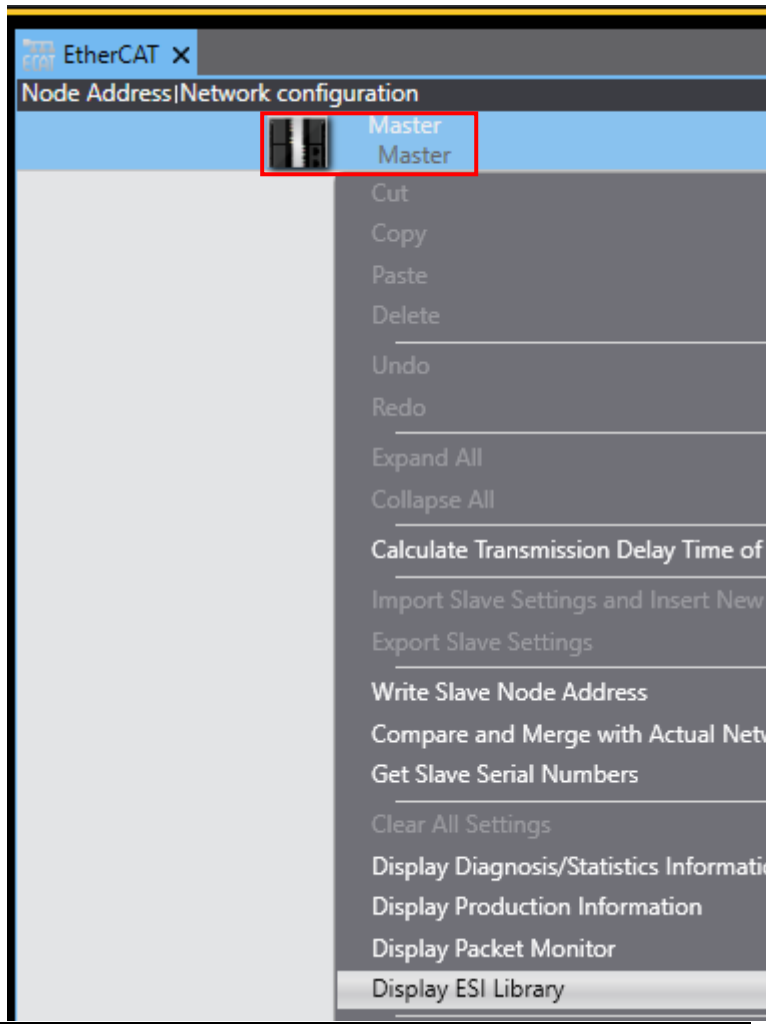
All memory will be cleared after initialization.
If there is necessary data in the Controller, save the data.
Refer to the *Sysmac Studio Version 1 Operation Manual* (Cat. No. W504) for information on operating Sysmac Studio.

1	Select ***Clear All Memory*** from the Controller Menu.	

2	The Clear All Memory Dialog Box is displayed. Click **OK**.	
3	A confirmation dialog box is displayed. Check the contents and click **Yes**.	
4	The dialog box on the right is displayed. Check the contents and click **OK**.	

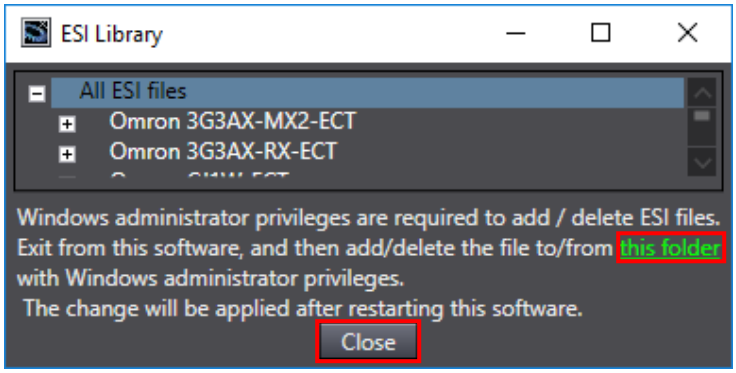
7.2.3. Installing the ESI File

Install the ESI file for the Servo Amplifier in Sysmac Studio.

1	Double-click **EtherCAT** under **Configurations and Setup** in the Multiview Explorer.	
2	The EtherCAT Tab Page is displayed in the Edit Pane.	
3	Right-click **Master** and select ***Display ESI Library***.	

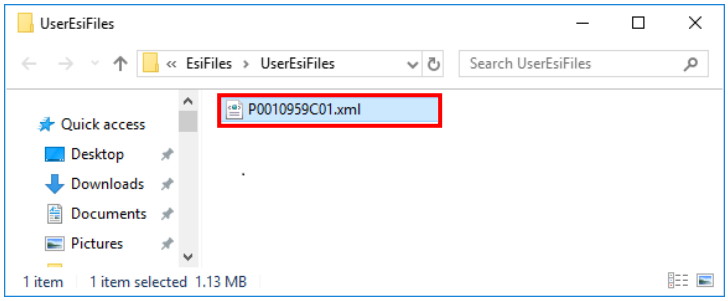
4 The ESI Library Dialog Box is displayed.
Click the **this folder** link.

When the Explorer is started, click **Close** to close the dialog box.



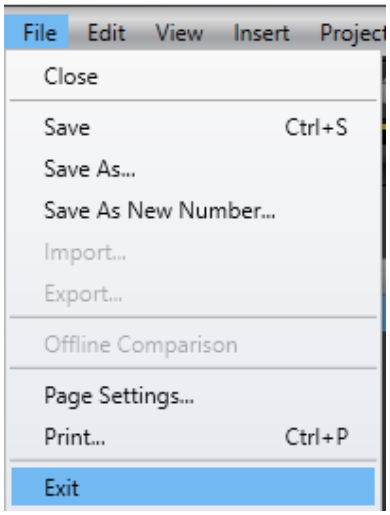
5 The Explorer is started, and a linked folder is opened, allowing you to install the ESI file.
Copy the prepared *P0010959C01.xml* to the linked folder.

*If an access permission confirmation dialog box is displayed when copying the ESI file, permit access to the folder to continue.

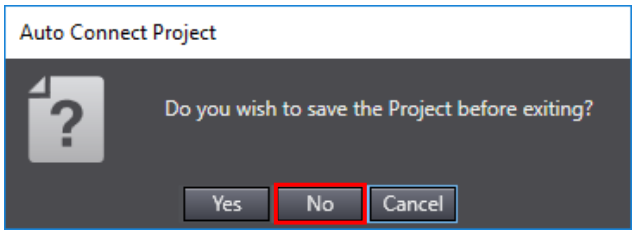


6 Select ***Exit*** from the File Menu to exit Sysmac Studio.

*You need to restart Sysmac Studio after installing the ESI file.



A dialog box is displayed confirming whether to save the project.
Click **No** if you do not need to save.

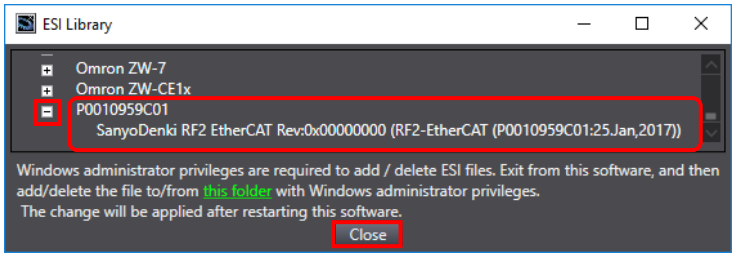


7 Restart Sysmac Studio.
(Perform steps 4 to 9 of *7.2.1. Starting Sysmac Studio and Going Online*.)

8 In the same way as steps 1 to 3, display the ESI Library Dialog Box.
Check that P0010959C01 is displayed. Click the **+** Button to the left of it.
A list of devices that can be used for the ESI file is displayed. Check that the device used is listed in there.

Check that there are no exclamation marks (errors) displayed.

Click **Close**.

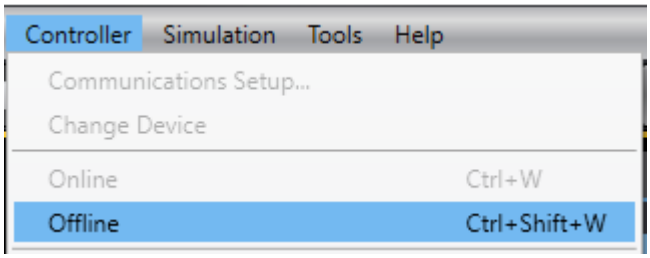


"SanyoDenki RF2 EtherCAT Rev:0x00000000 (RF2-EtherCAT (P0010959C01:25.Jan,2017))" is used in this guide.

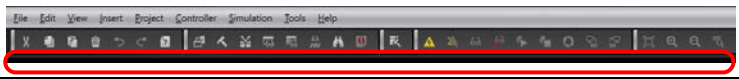
Precautions for Correct Use

If an exclamation mark (error) is displayed for the ESI file, check the name of the ESI file and obtain the ESI file with a correct name.
If an exclamation mark (error) is displayed even when the name of the ESI file is correct, the file may be corrupted. In that case, contact the device manufacturer.

9 Select ***Offline*** from the Controller Menu.



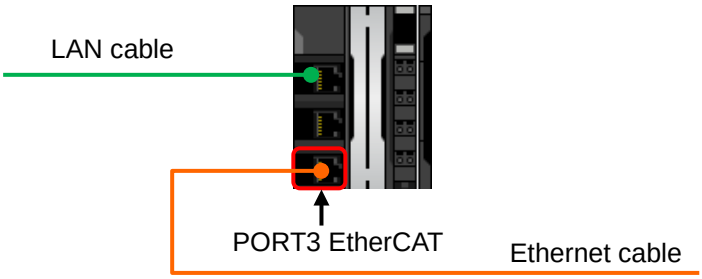
The yellow line under the toolbar disappears.



10 Turn OFF Controller.

11 Connect an Ethernet cable to PORT3 EtherCAT on Controller.

*Make sure that the power supply to Controller remains OFF.



7.3. SANYO DENKI Servo Amplifier Setup

Set up the SANYO DENKI Servo Amplifier.

Additional Information

For details on the external I/O wiring and parameter settings for Servo Amplifiers, refer to the *SANMOTION AC SERVO SYSTEMS R ADVANCED MODEL TYPE F With EtherCAT Interface Type H For Rotary Motor, Linear Motor Instruction Manual* (M0011195).

Additional Information

The scope of this guide covers the "connection check of the Motion Control Device connected via EtherCAT using the MC_Power instruction"; hence, a regenerative resistor is not used. If you connect a regenerative resistor, refer to *4.1 Control power supply, Regeneration resistance, and Wiring protective ground* and *12.2 Capacity Selection of Regenerative Resistor* of the *SANMOTION AC SERVO SYSTEMS R ADVANCED MODEL TYPE F with EtherCAT Interface Type H For Rotary Motor, Linear Motor Instruction Manual* (M0011195).

7.3.1. Hardware Settings

Set the hardware switches on the Servo Amplifier and connect the cables.

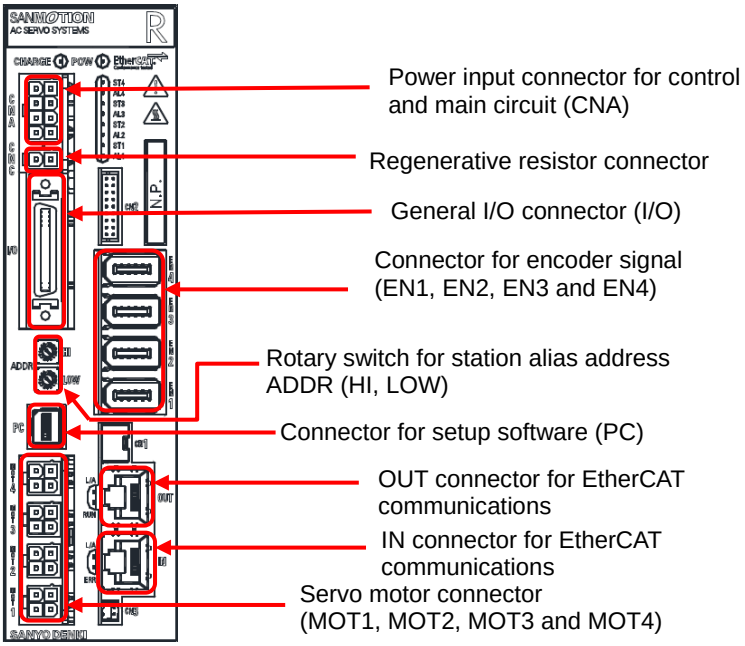
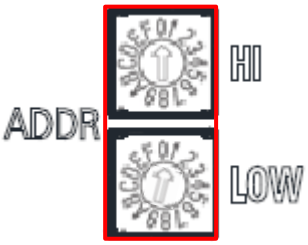
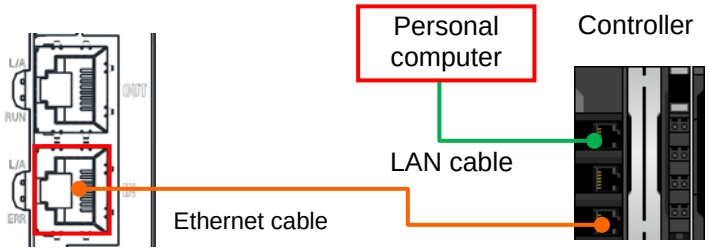
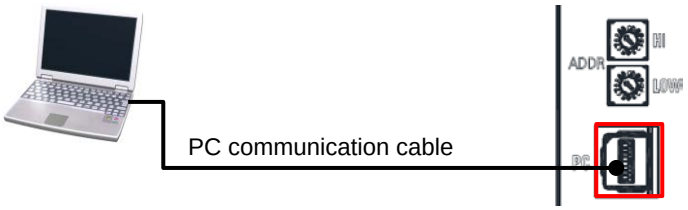
⚠ Caution

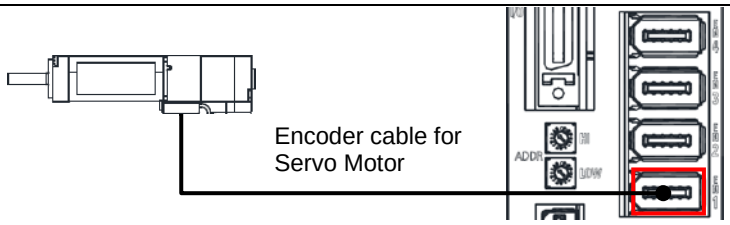
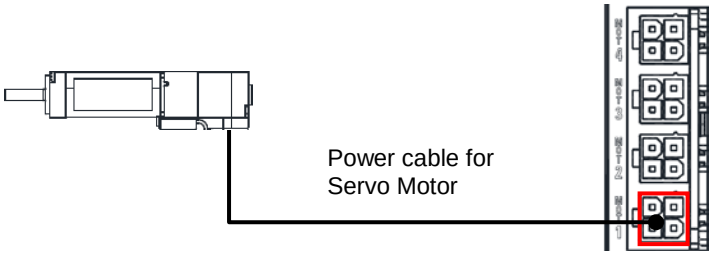
The scope of this guide covers the "connection check of the Motion Control Device connected via EtherCAT using the MC_Power instruction"; accordingly, the positive and negative limit switch functions are always disabled.
The external I/O to turn ON the positive and negative limit switches is not connected to the general I/O connector in this guide.
Make appropriate settings for your device when you actually design a system.

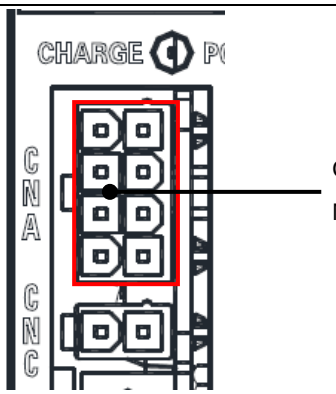
Precautions for Correct Use

Make sure that the power supplies are OFF when you set up.
If either of them is ON, the settings described in the following steps and subsequent procedures may not be applicable.

1	Make sure that Control power supply and Main circuit power supply are OFF.

2	Check the positions of the hardware switches and connectors on Servo Amplifier by referring to the figure on the right.	
3	Set Rotary switch for station alias address ADDR (HI, LOW) as follows: HI: *0* LOW: *1* *The node address is set to 1.	
4	Connect the Ethernet cable to IN connector for EtherCAT communications. *Connect IN connector for EtherCAT communications and PORT3 EtherCAT on Controller with the Ethernet cable.	
5	Connect the COM port on Personal computer and Connector for setup software (PC) with a PC communication cable.	

6	Connect an Encoder cable for Servo Motor to Connector for encoder signal (EN1). *For details on Connector for encoder signal, refer to *4.2 Wiring of Motor Encoder* of the *SANMOTION AC SERVO SYSTEMS R ADVANCED MODEL TYPE F With EtherCAT Interface Type H For Rotary Motor, Linear Motor Instruction Manual* (M0011195).	
7	Connect a Power cable for Servo Motor to Servo motor connector (MOT1). *For details on Servo motor connector, refer to *4.1 Control power supply, Regeneration resistance, and Wiring protective ground* of the *SANMOTION AC SERVO SYSTEMS R ADVANCED MODEL TYPE F With EtherCAT Interface Type H For Rotary Motor, Linear Motor Instruction Manual* (M0011195).	

8	Connect Control and Main circuit power supplies to Power input connector for control and main circuit (CNA). *For details on power supply specifications, refer to *2 Specifications* of the *SANMOTION AC SERVO SYSTEMS R ADVANCED MODEL TYPE F With EtherCAT Interface Type H For Rotary Motor, Linear Motor Instruction Manual* (M0011195). *For information on power supply wiring, refer to *4.1 Control power supply, Regeneration resistance, and Wiring protective ground* of the *SANMOTION AC SERVO SYSTEMS R ADVANCED MODEL TYPE F With EtherCAT Interface Type H For Rotary Motor, Linear Motor Instruction Manual* (M0011195).	

7.3.2. Parameter Settings

Set parameters for the Servo Amplifier.

The SANMOTION Motor Setup software is used to set parameters.

Install the software on your personal computer beforehand.

⚠ Caution

The scope of this guide covers the "connection check of the Motion Control Device connected via EtherCAT using the MC_Power instruction"; accordingly, the positive and negative limit switch functions are always disabled.

The input signal assignment of the positive and negative limit switches is set to "Always_ Disable" to disable their functions. No error therefore occurs even without connecting the positive and negative limit switches.

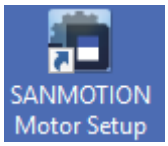
Make appropriate settings for your device when you actually design a system.

Precautions for Correct Use

For information on power-on sequence of the control and main circuit power supplies to a Servo Amplifier, refer to *6.5 Operation Sequence* of the *SANMOTION AC SERVO SYSTEMS R ADVANCED MODEL TYPE F With EtherCAT Interface Type H For Rotary Motor, Linear Motor Instruction Manual* (M0011195).

Additional Information

For information on installing SANMOTION Motor Setup, refer to *SANYO DENKI Global Site* or contact SANYO DENKI CO., LTD.

1	Turn ON Control power supply and Main circuit power supply.
2	Start SANMOTION Motor Setup. 

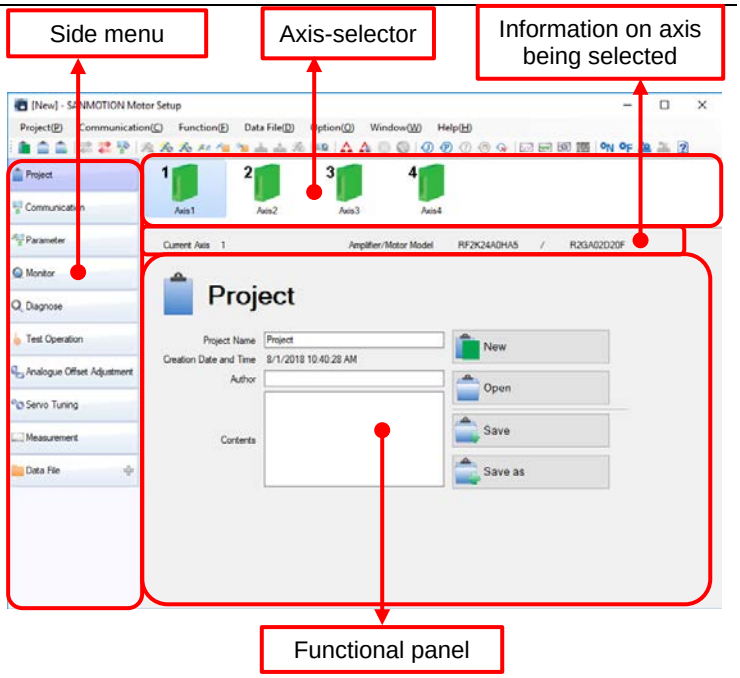
3 SANMOTION Motor Setup is started, and the main window is displayed.

The following parts are displayed in the window.

Left: Side menu

Middle right: Information on axis being selected

Bottom right: Functional panel



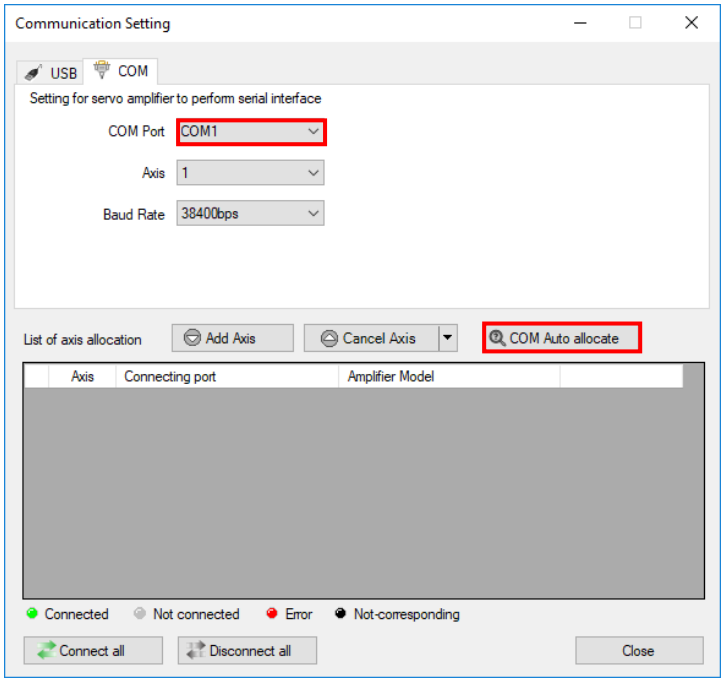
4 The Communication Setting Window is displayed after SANMOTION Motor Setup is started.

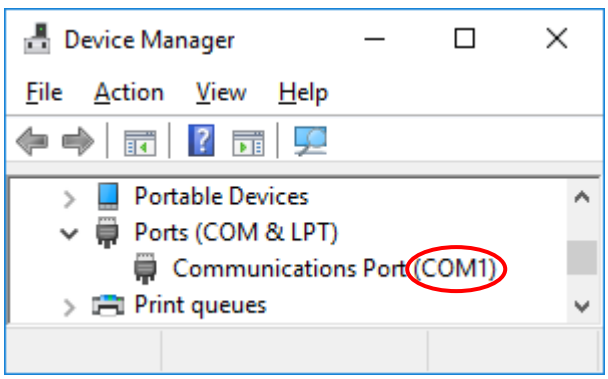
From the pull-down list of COM Port, select the port number to be used.

Click **COM Auto allocate**.

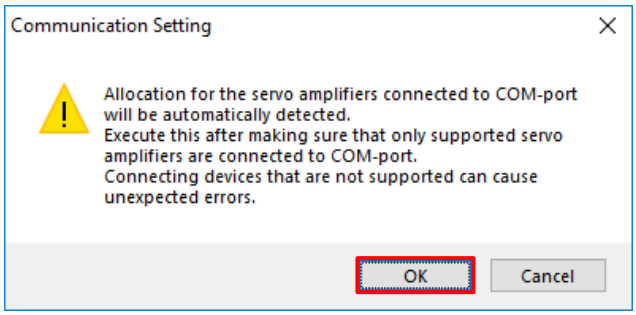
*If there is more than one serial port on your personal computer, display Windows Device Manager and select the same port number as the communications port (displayed under Ports (COM &LPT)) to which Servo Amplifier is connected (example: COM1).

*To open Windows Device Manager, right-click the start button, and click to select ***Device Manager*** from the list.

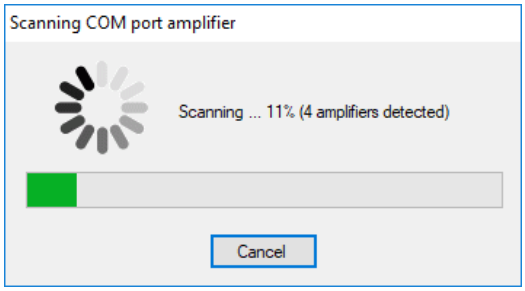




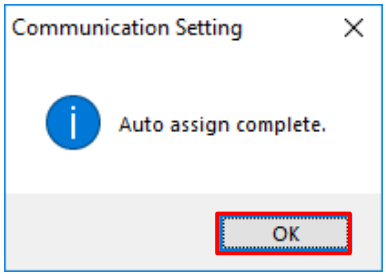
5 A confirmation dialog box is displayed. Confirm that there is no problem, and click **OK**.



The Scanning COM port amplifier Dialog Box is displayed.

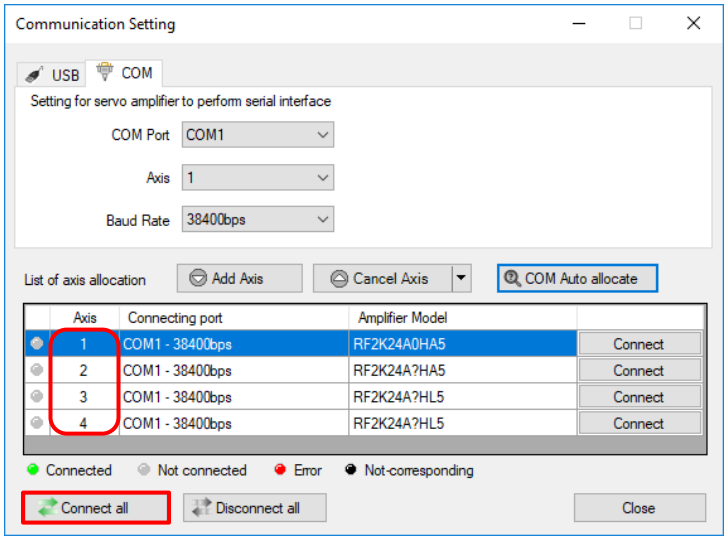


A confirmation dialog box is displayed. Check the contents and click **OK**.



6 Check that the axis numbers from 1 to 4 are displayed in the *Axis* Column in the Communication Setting Window.

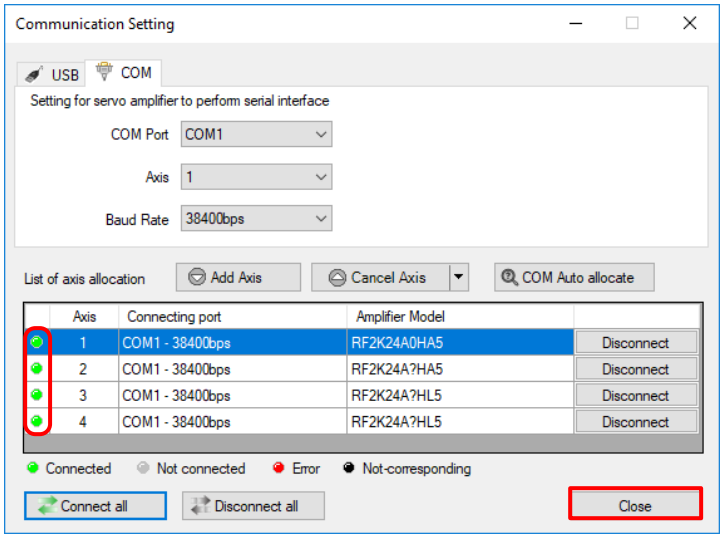
Click **Connect all**.



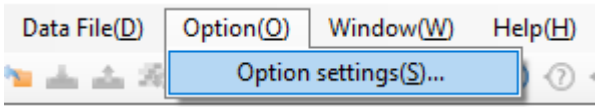
7 Check that the green light ● (to the left of the axis numbers 1 to 4) comes ON.

Click **Close**.

*The Communication Setting Window is closed.

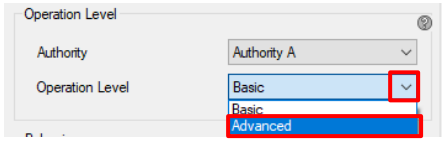


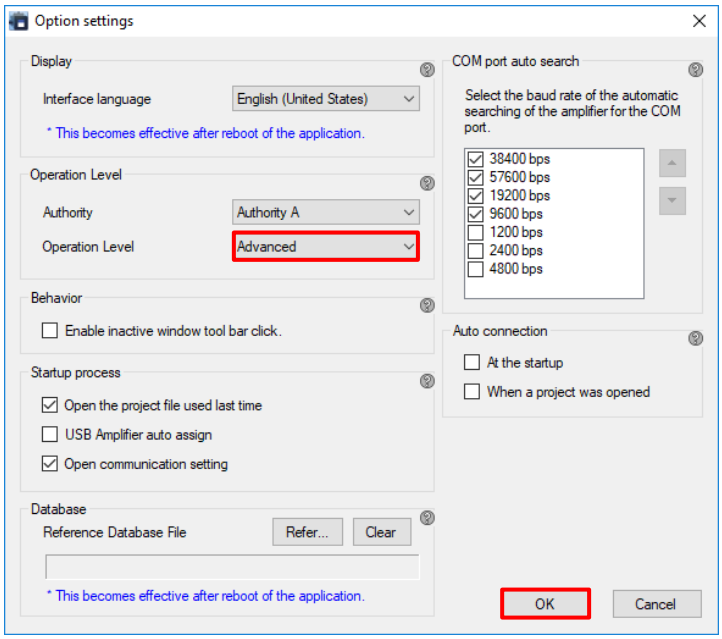
8 Select ***Option settings*** from the Option Menu of the main window.

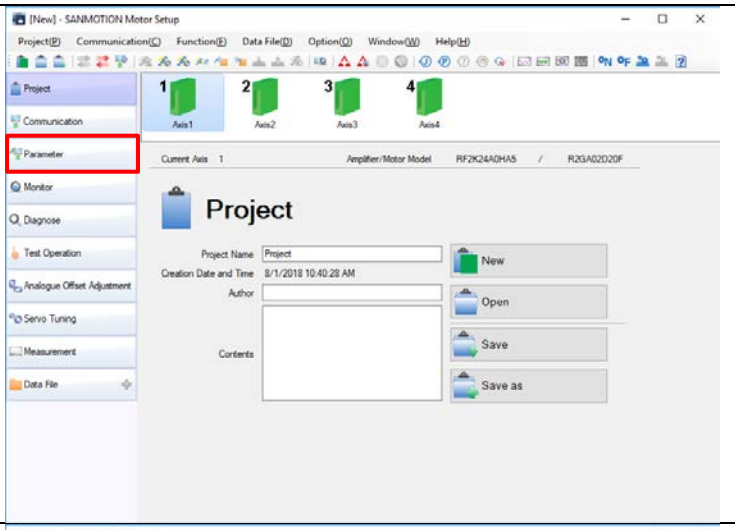
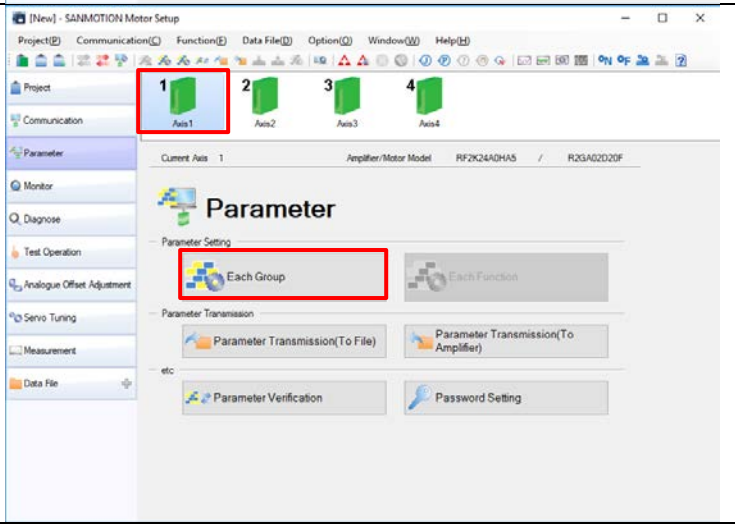
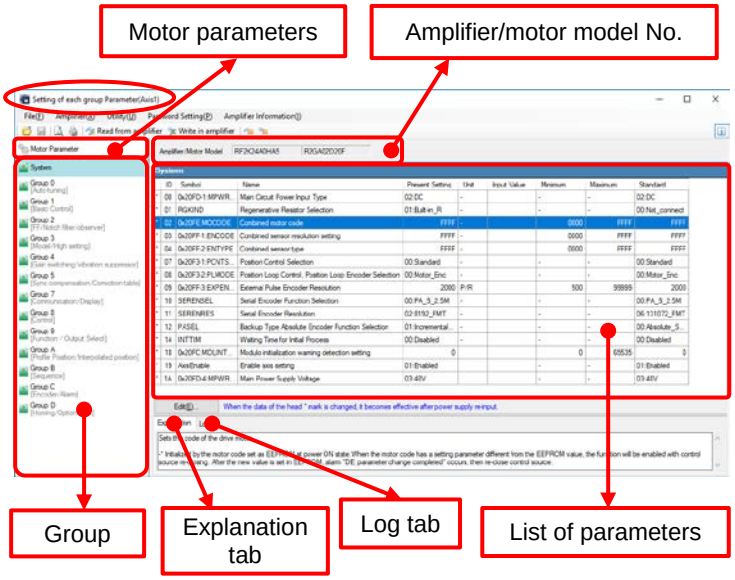


9 The Option settings Window is displayed.
Select ***Advanced*** from the pull-down list of Operation Level.
Click **OK**.

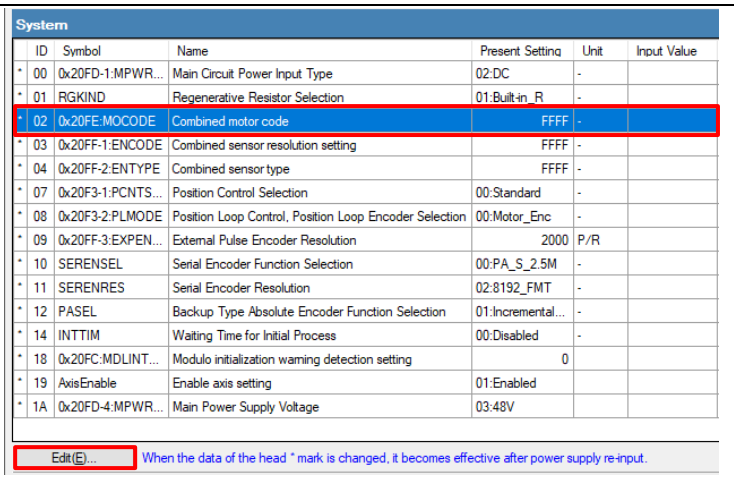
*All the parameters of Servo Amplifier can be edited when setting the operation level to Advanced.





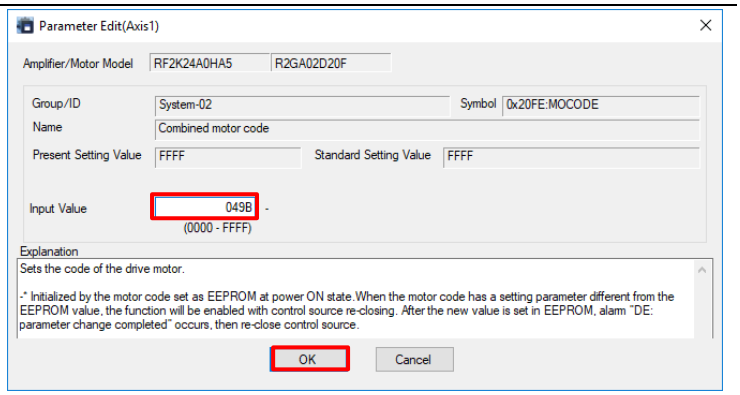
10	The main window is displayed. Select ***Parameter*** from the Side menu.	
11	The Parameter menu window is displayed in the Functional panel. Select *Axis 1* in the Axis-selector and click **Each Group**.	
12	The Setting of each group Parameter (Axis 1) Window is displayed. The system parameter group is displayed in the List of parameters.	

13 Edit the value of Combined motor code listed in the system parameter group, by following the steps below.
Select *Combined motor code* and click **Edit**.

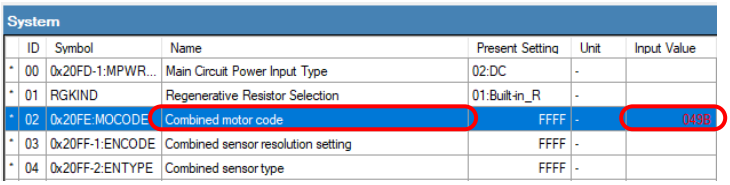


14 The Parameter Edit (Axis 1) Window is displayed.
Enter the combined motor code (example: 049B) that is used for Servo Motor specified in *5.2. Device Configuration*, in the *Input Value* Field.
Click **OK**.

*For more information on the combined motor code, refer to *0x20FE : Combination Motor Code* in *5.6. Manufacturer Specific Area* of the *SANMOTION AC SERVO SYSTEMS R ADVANCED MODEL TYPE F With EtherCAT Interface Type H For Rotary Motor, Linear Motor Instruction Manual* (M0011195).



15 Check that the combined motor code (049B) set in step 14 is displayed in the *Input Value* Column.

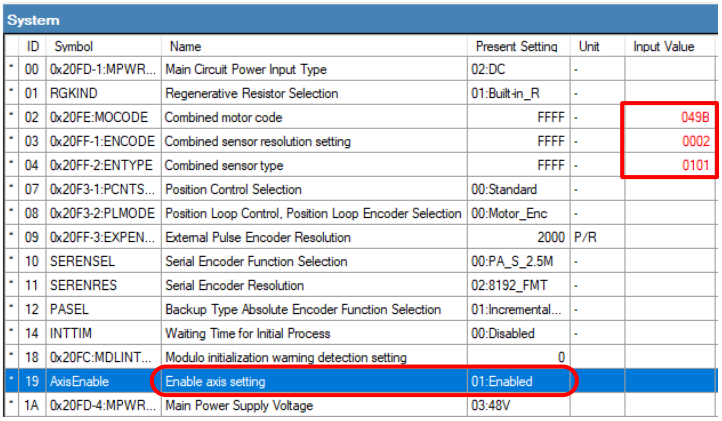


16 In the same way as steps 13 to 15, set the following parameters.

- Combined sensor resolution setting: *0002*
- Combined sensor type: *0101*
- Enable axis setting:

01:Enabled

*For information on the combined sensor resolution setting and combined sensor type, refer to *0x20FF : Combination Encoder Selection* in *5.6. Manufacturer Specific Area* of the *SANMOTION AC SERVO SYSTEMS R ADVANCED MODEL TYPE F With EtherCAT Interface Type H For Rotary Motor, Linear Motor Instruction Manual* (M0011195).



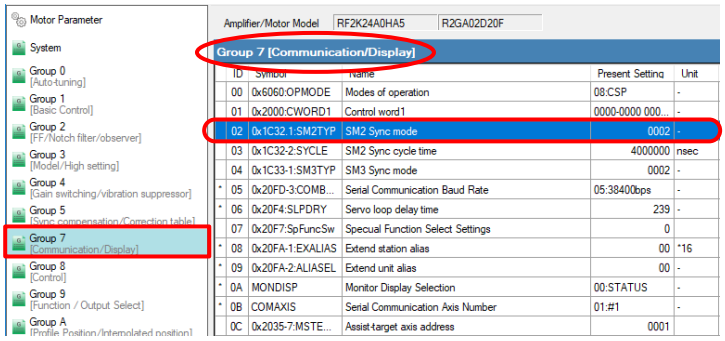
System

	ID	Symbol	Name	Present Setting	Unit	Input Value
*	00	0x20FD-1:MPWR...	Main Circuit Power Input Type	02:DC	-	
*	01	RGKIND	Regenerative Resistor Selection	01:Built-in_R	-	
*	02	0x20FE:MOCODE	Combined motor code	FFFF	-	049B
*	03	0x20FF-1:ENCODE	Combined sensor resolution setting	FFFF	-	0002
*	04	0x20FF-2:ENTYPE	Combined sensor type	FFFF	-	0101
*	07	0x20F3-1:PCNTS...	Position Control Selection	00:Standard	-	
*	08	0x20F3-2:PLMODE	Position Loop Control, Position Loop Encoder Selection	00:Motor_Enc	-	
*	09	0x20FF-3:EXPEN...	External Pulse Encoder Resolution	2000	P/R	
*	10	SERENSEL	Serial Encoder Function Selection	00:PA_S_2.5M	-	
*	11	SERENRES	Serial Encoder Resolution	02:8192_FMT	-	
*	12	PASEL	Backup Type Absolute Encoder Function Selection	01:Incremental...	-	
*	14	INTTIM	Waiting Time for Initial Process	00:Disabled	-	
*	18	0x20FC:MDLINT...	Modulo initialization warning detection setting	0		
*	19	AxisEnable	Enable axis setting	01:Enabled		
*	1A	0x20FD-4:MPWR...	Main Power Supply Voltage	03:48V		

17 Click **Group 7 [Communication /Display]** in the Group.
Group 7 [Communication/ Display] is displayed in the List of parameters.
Check that the following parameter value is set in the *Present Setting Value* Column.

- SM2 Sync mode: 0002 (SYNC0 Event Synchronization (Synchronized with SYNC0 Hardware Signal))

*If the present setting value is different, change the value in the same way as steps 13 to 15.



Motor Parameter

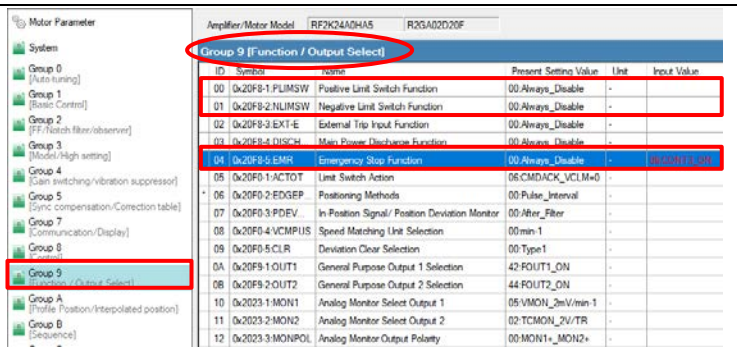
- System
- Group 0 [Auto-tuning]
- Group 1 [Basic Control]
- Group 2 [FF/Notch filter/observer]
- Group 3 [Model/High setting]
- Group 4 [Gain switching/vibration suppressor]
- Group 5 [Sync compensation/Correction table]
- Group 7 [Communication/Display]
- Group 8 [Control]
- Group 9 [Function / Output Select]
- Group A [Profile Position/Interpolated position]

Amplifier/Motor Model RF2K24A0HA5 R2GA02D20F

Group 7 [Communication/Display]

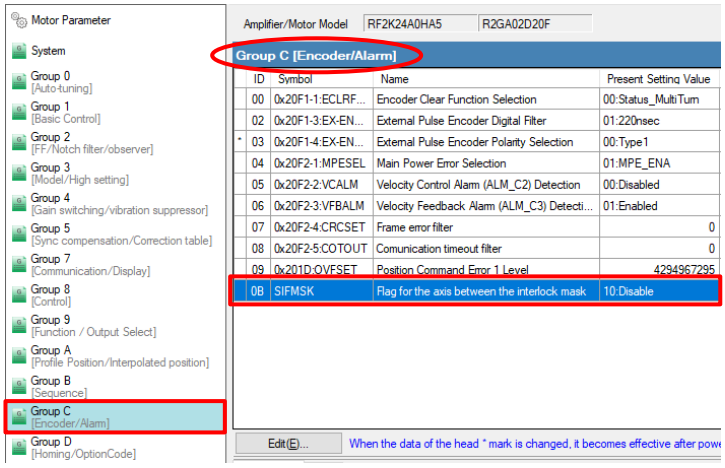
	ID	Symbol	Name	Present Setting	Unit
	00	0x6060:OPMODE	Modes of operation	08:CSP	-
	01	0x2000:CWORD1	Control word1	0000-0000 000...	-
	02	0x1C32.1:SM2TYP	SM2 Sync mode	0002	-
	03	0x1C32-2:SYCLE	SM2 Sync cycle time	4000000	nsec
	04	0x1C33-1:SM3TYP	SM3 Sync mode	0002	-
*	05	0x20FD-3:COMB...	Serial Communication Baud Rate	05:38400bps	-
*	06	0x20F4:SLPDRY	Servo loop delay time	239	-
	07	0x20F7:SpFuncSw	Specual Function Select Settings	0	
*	08	0x20FA-1:EXALIAS	Extend station alias	00	*16
*	09	0x20FA-2:ALIASEL	Extend unit alias	00	-
*	0A	MONDISP	Monitor Display Selection	00:STATUS	-
*	0B	COMAXIS	Serial Communication Axis Number	01:#1	-
	0C	0x2035-7:MSTE...	Assist-target axis address	0001	

18 Click **Group 9 [Function/ Output Select]** in the Group. Group 9 [Function/Output Select] is displayed in the List of parameters.
Set the following parameters in the same way as steps 13 to 15.
・Positive Limit Switch Function:
00:Always_Disable
・Negative Limit Switch Function:
00:Always_Disable
・Emergency Stop Function:
0C:CONT6_ON

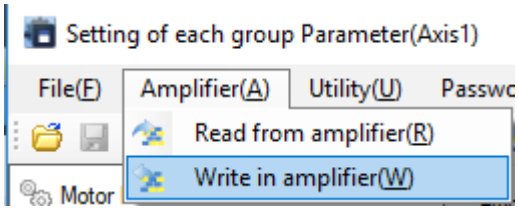


19 Click **Group C [Encoder/ Alarm]** in the Group. Group C [Encoder/Alarm] is displayed in the List of parameters.
Check that the following parameter value is set in the *Present Setting Value* Column.
・Flag for the axis between the interlock mask: 10:Disable

*If the present setting value is different, change the value in the same way as steps 13 to 15.



20 Select ***Write in amplifier*** from the Amplifier Menu.



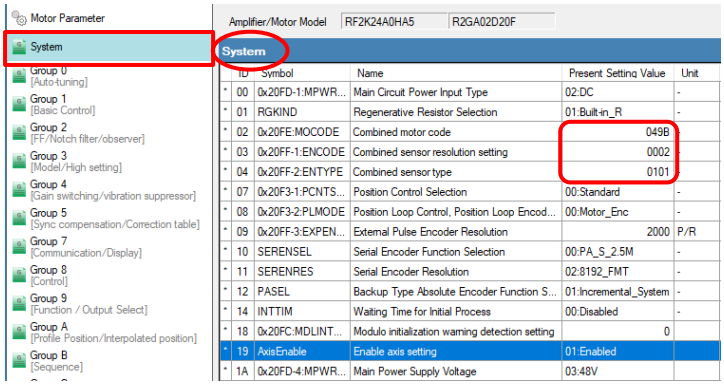
21 Check that the parameter values changed in steps 13 to 19 are reflected.

Click **System** in the Group.

The system parameter group is displayed. Check that the following parameter values are set in the *Present Setting Value* Column.

- Combined motor code: 049B
- Combined sensor resolution setting: 0002
- Combined sensor type: 0101

*The values in the *Input Value* Column will be blank once the parameter settings are reflected.



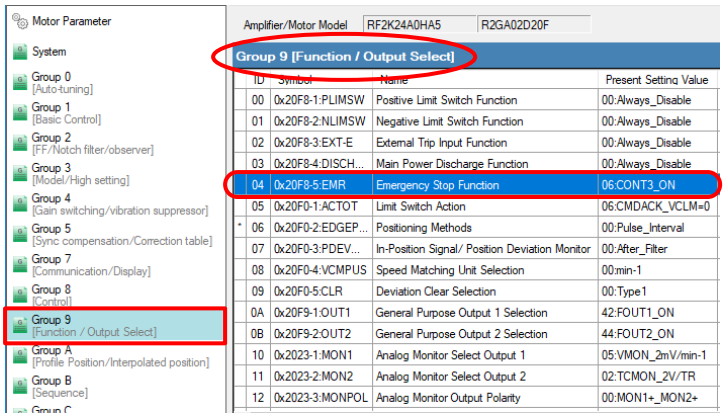
22 Click **Group 9 [Function/ Output Select]** in the Group.

Group 9 [Function/Output Select] is displayed in the List of parameters.

Check that the following parameter value is set in the *Present Setting Value* Column.

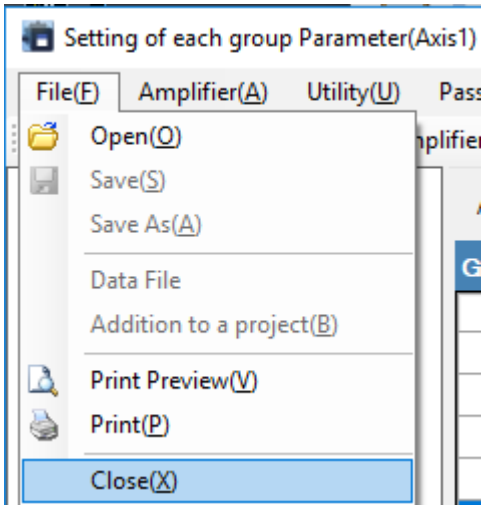
- Emergency Stop Function: 0C:CONT6_ON

*If there are some more parameters you have changed, check that all the changed parameter values are reflected in the *Present Setting Value* Column.

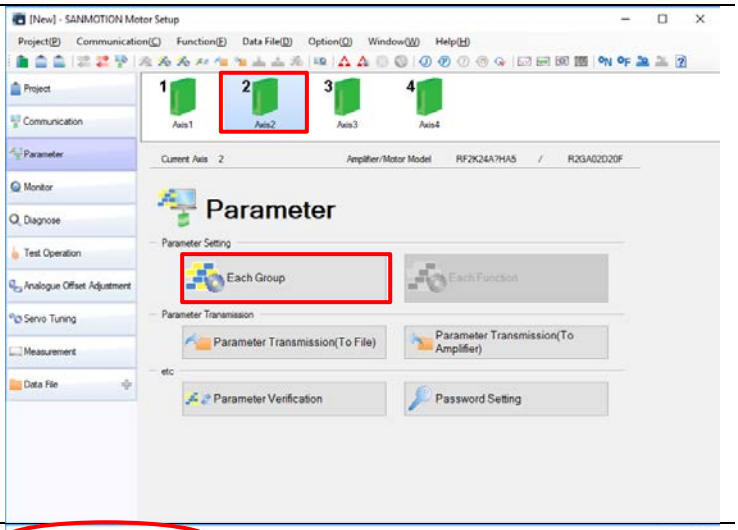


23 Select ***Close*** from the File Menu.

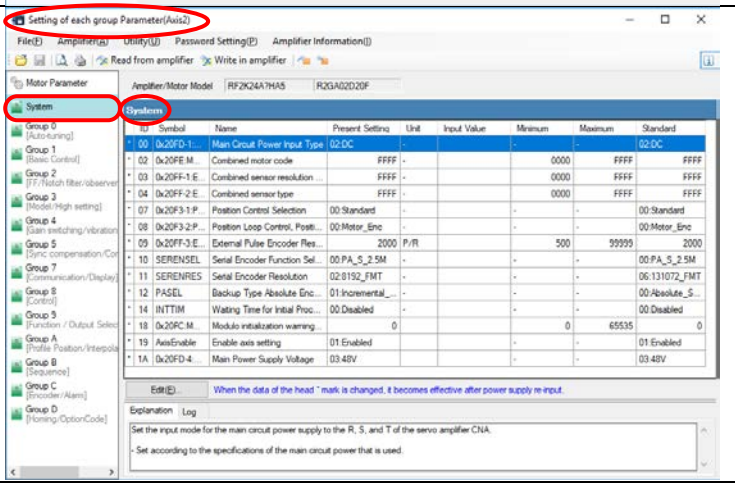
*The Setting of each group Parameter (Axis 1) Window is closed.



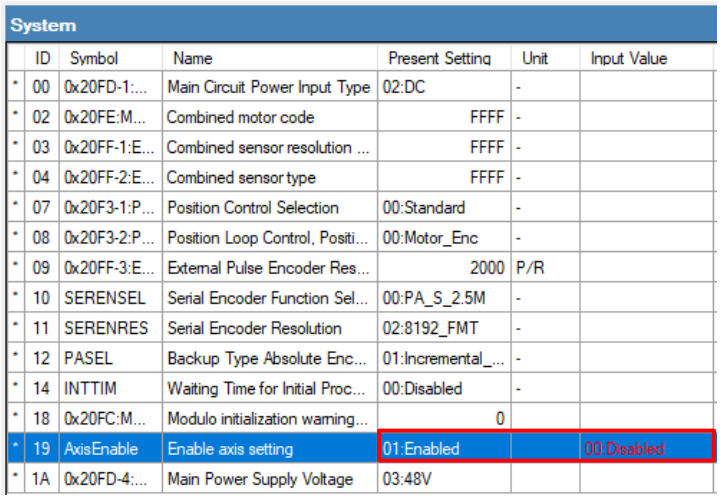
24 Set the unused axes (Ax2 to Ax4) by following the steps below.
Select *Axis 2* in the Axis-selector and click **Each Group** in the Parameter menu window.



25 The Setting of each group Parameter (Axis 2) Window is displayed.
The system parameter group is displayed in the List of parameters.



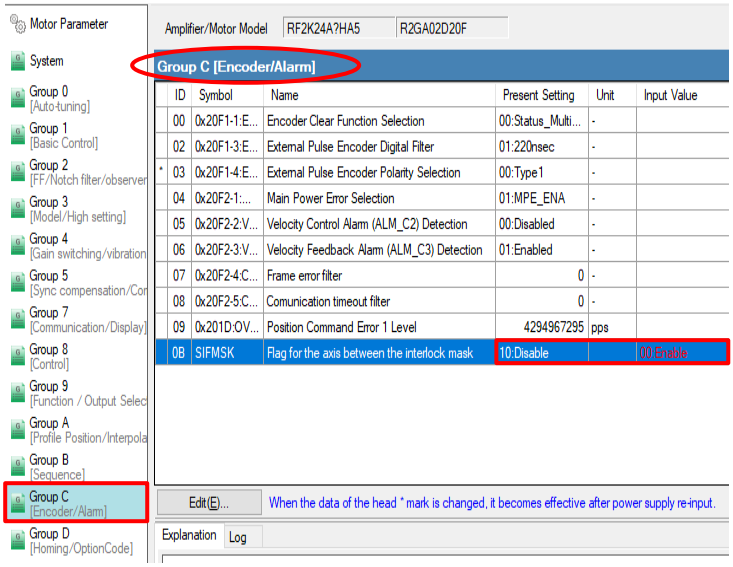
26 Set the following parameter in the same way as steps 13 to 15.
・Enable axis setting:
00:Disabled



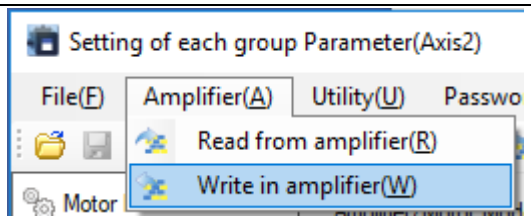
System

	ID	Symbol	Name	Present Setting	Unit	Input Value
*	00	0x20FD-1:...	Main Circuit Power Input Type	02:DC	-	
*	02	0x20FE:M...	Combined motor code	FFFF	-	
*	03	0x20FF-1:E...	Combined sensor resolution ...	FFFF	-	
*	04	0x20FF-2:E...	Combined sensor type	FFFF	-	
*	07	0x20F3-1:P...	Position Control Selection	00:Standard	-	
*	08	0x20F3-2:P...	Position Loop Control, Positi...	00:Motor_Enc	-	
*	09	0x20FF-3:E...	External Pulse Encoder Res...	2000	P/R	
*	10	SERENSEL	Serial Encoder Function Sel...	00:PA_S_2.5M	-	
*	11	SERENRES	Serial Encoder Resolution	02:8192_FMT	-	
*	12	PASEL	Backup Type Absolute Enc...	01:Incremental_...	-	
*	14	INTTIM	Waiting Time for Initial Proc...	00:Disabled	-	
*	18	0x20FC:M...	Modulo initialization warning...	0		
*	19	AxisEnable	Enable axis setting	01:Enabled		00:Disabled
*	1A	0x20FD-4:...	Main Power Supply Voltage	03:48V		

27 Click **Group C [Encoder/ Alarm]** in the Group.
Group C [Encoder/Alarm] is displayed in the List of parameters.
Check that the following parameter is set in the *Present Setting Value* Column.
・Flag for the axis between the interlock mask: 00:Enable

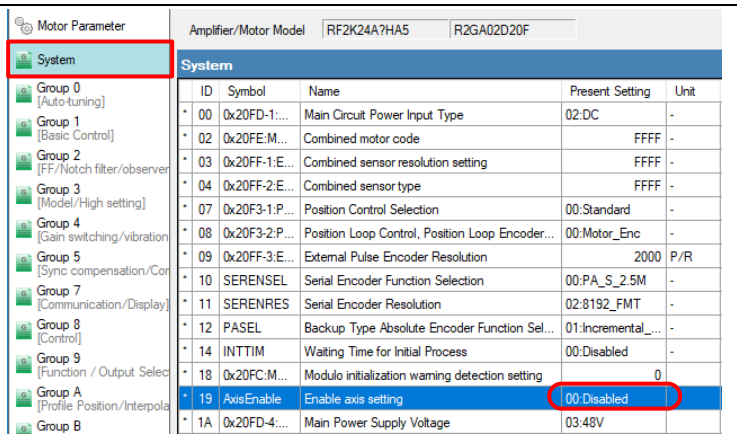


28 Select ***Write in amplifier*** from the Amplifier Menu.

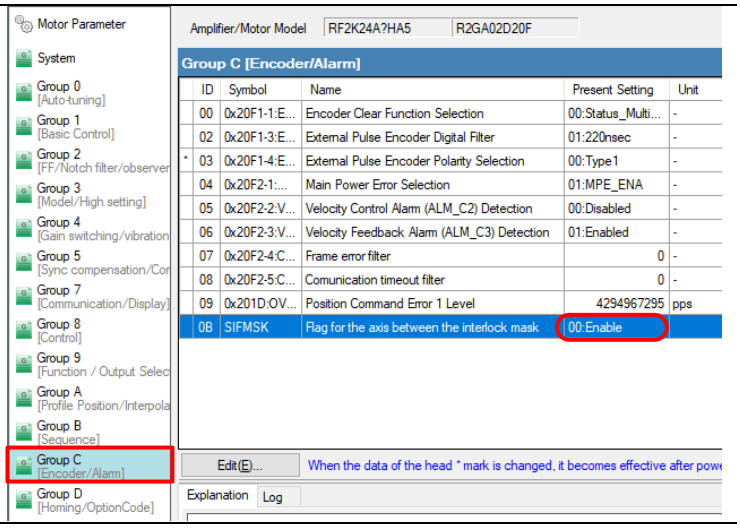


29 Check that the parameter values changed in steps 25 to 28 are reflected.
Click **System** in the Group.
The system parameter group is displayed. Check that the following parameter value is set in the *Present Setting Value* Column.
・Enable axis setting:
00:Disabled

*The values in the *Input Value* Column will be blank once the parameter settings are reflected.

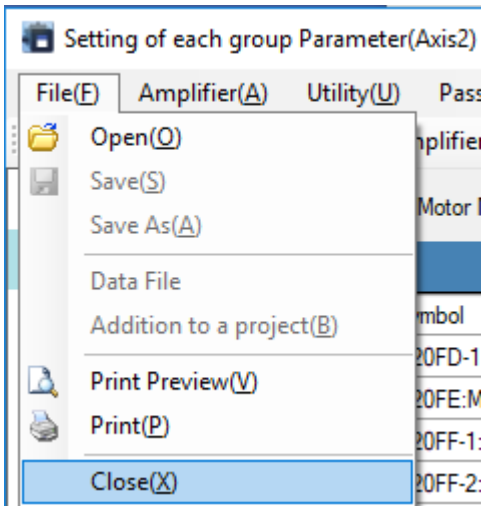


30 Click **Group C [Encoder/ Alarm]** in the Group.
Group C [Encoder/Alarm] is displayed in the List of parameters.
Check that the following parameter is set in the *Present Setting Value* Column.
・Flag for the axis between the interlock mask: 00:Enable



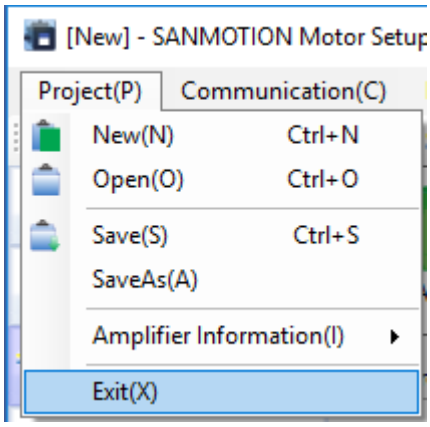
31 Select ***Close*** from the File Menu.

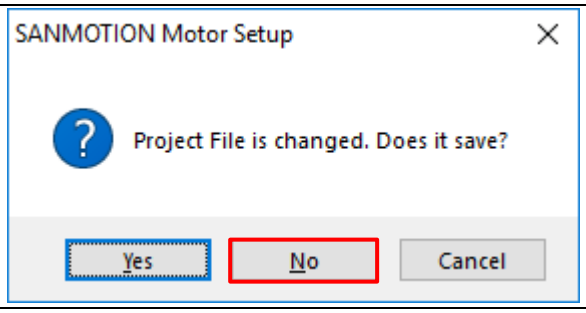
*The Setting of each group Parameter (Axis 2) Window is closed.



32 In the same way as steps 24 to 31, set the following parameters for the other axes (Ax3 and Ax4).
・Enable axis setting:
00:Disabled
・Flag for the axis between the interlock mask: ***00:Enable***

33 Select ***Exit*** from the Project Menu of the main window.



34	A dialog box is displayed confirming whether to save the project. If not required, click **No**. *If you would like to save the parameter settings, click **Yes**.	
35	Turn OFF Control and Main circuit power supplies, then turn them back ON. *The changed parameter values will be valid after turning the power supplies OFF and then back ON.	

7.4. Controller Setup

Set up the Controller.

The settings described here are made beforehand in the project file that is described in *Section 9. Appendix 1: Procedures Using the Project File*.

⚠ WARNING

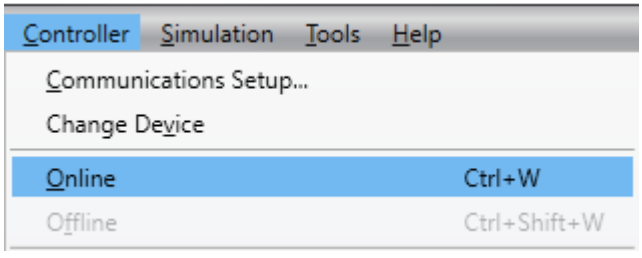
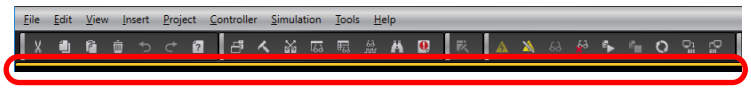
Depending on the Controller status, unexpected operation of the Motion Control Device may occur and result in injury when you turn ON the Controller.
Focus on safety when you turn ON the power supply.

Precautions for Correct Use

Make sure that the Ethernet cable is connected to both devices before performing the following procedure. If not, turn OFF the devices, and then connect the Ethernet cable.

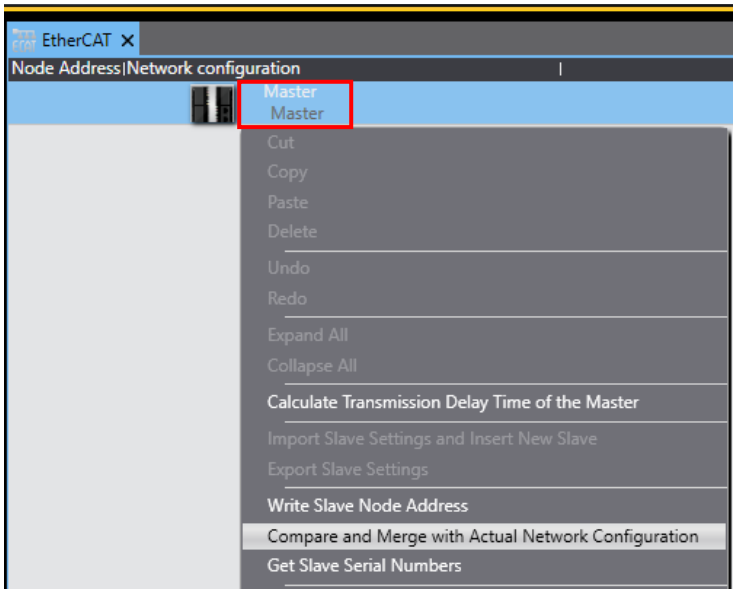
7.4.1. Setting the EtherCAT Network Configuration

Set the EtherCAT network configuration.

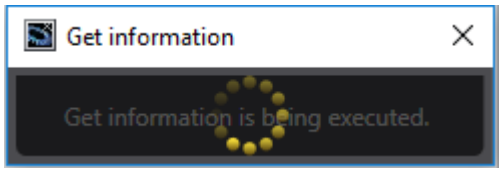
1	Turn ON Controller.	
2	Select ***Online*** from the Controller Menu in Sysmac Studio.	
	When an online connection is established, a yellow line is displayed under the toolbar.	

3 Right-click **Master** on the EtherCAT Tab Page of the Edit Pane, and select ***Compare and Merge with Actual Network Configuration***.

*If the EtherCAT Tab Page is not displayed, double-click **EtherCAT** under **Configurations and Setup** in the Multiview Explorer.

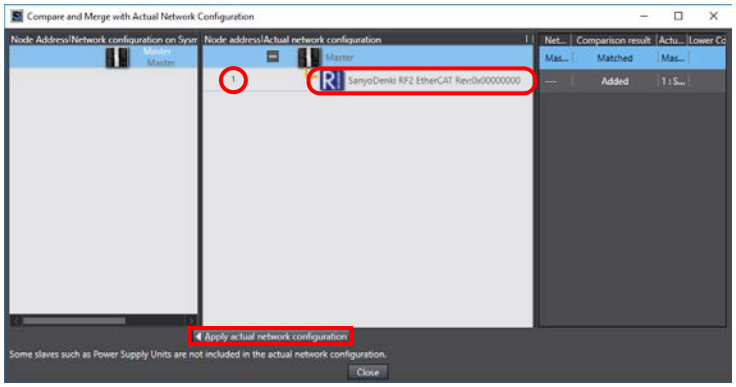


A screen is displayed stating "Get information is being executed".



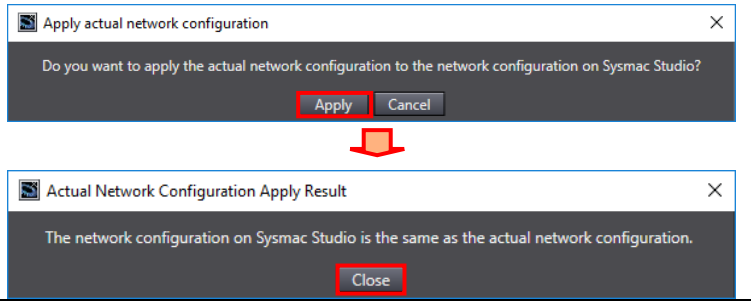
4 The Compare and Merge with Actual Network Configuration Dialog Box is displayed.
The node address 1 and SanyoDenki RF2 EtherCAT Rev:0x00000000 are added to the Actual network configuration after the comparison.

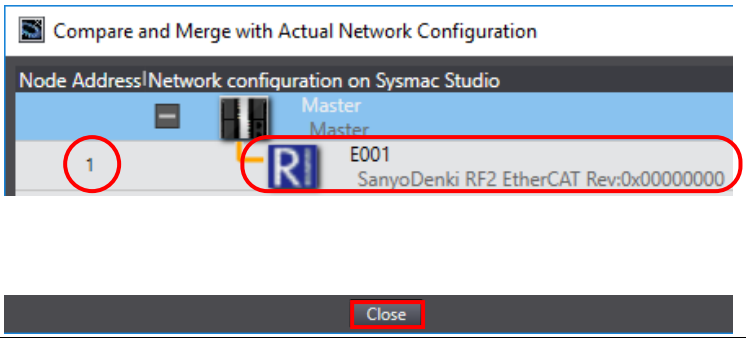
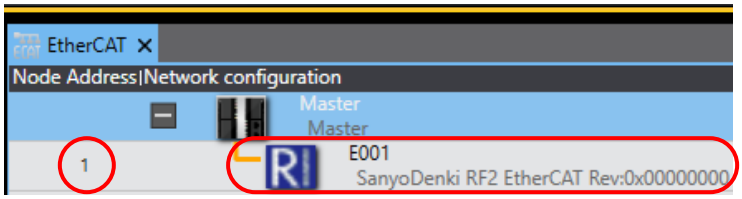
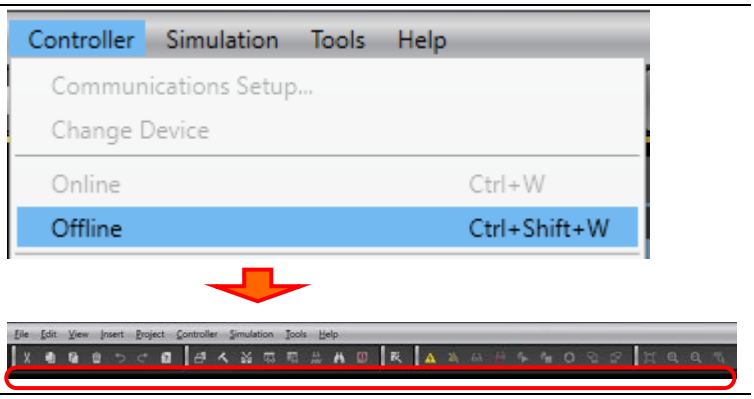
Click **Apply actual network configuration**.



5 A confirmation dialog box is displayed. Check the contents and click **Apply**.

The dialog box on the right is displayed. Check the contents and click **Close**.



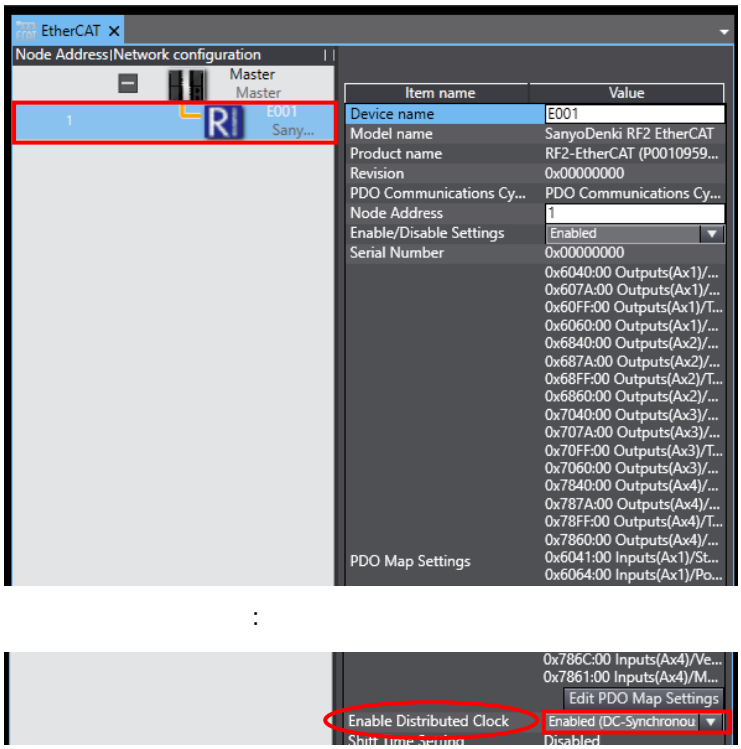
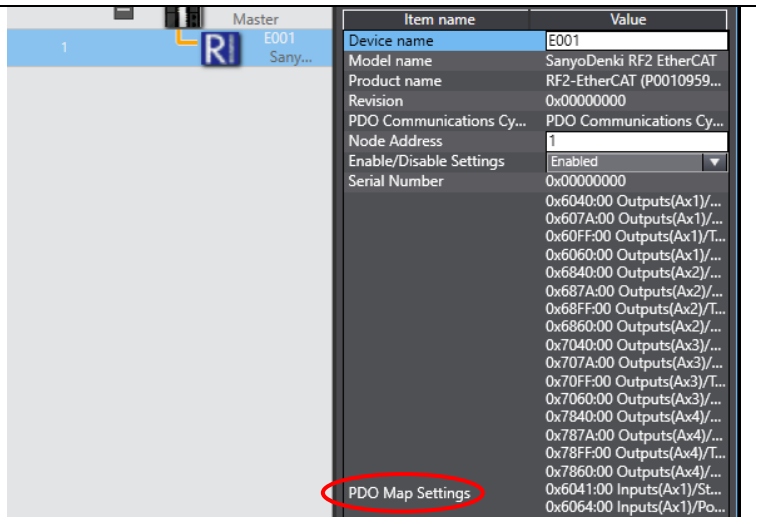
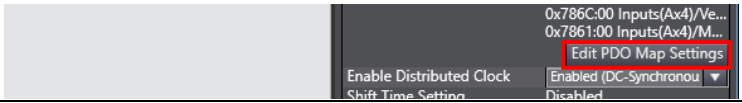
6	As a node address 1 slave, E001 SanyoDenki RF2 EtherCAT Rev:0x00000000 is added to the Network configuration on Sysmac Studio. Check that the data above is added. Click **Close**.	
7	The node address 1 and E001 SanyoDenki RF2 EtherCAT Rev:0x00000000 are added to the EtherCAT Tab Page of the Edit Pane.	
8	Select ***Offline*** from the Controller Menu. The yellow line under the toolbar disappears.	

7.4.2. PDO Map Settings

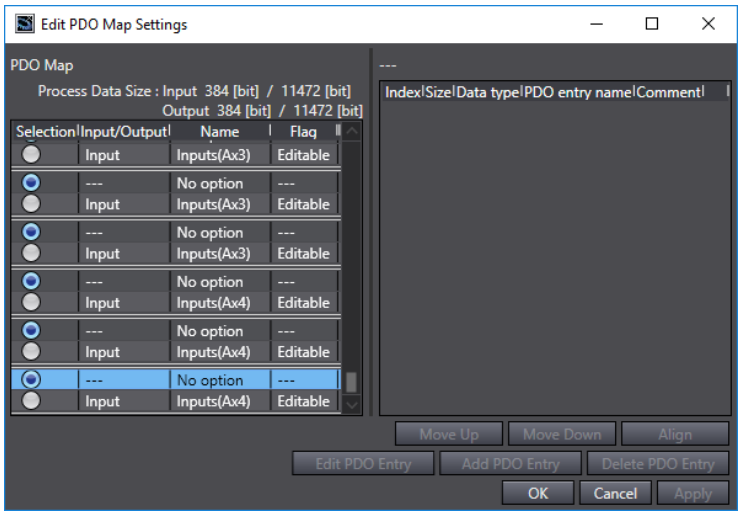
Map the objects to PDOs for the MC Function Module.

Additional Information

The objects described in *6.1.2. PDO Mapping* are available for the MC Function Module of the Controller from among the objects supported by the Motion Control Device.
Refer to *Section 10. Appendix 2: MC Instructions and PDO Entries* for details on the objects available for the MC Function Module.

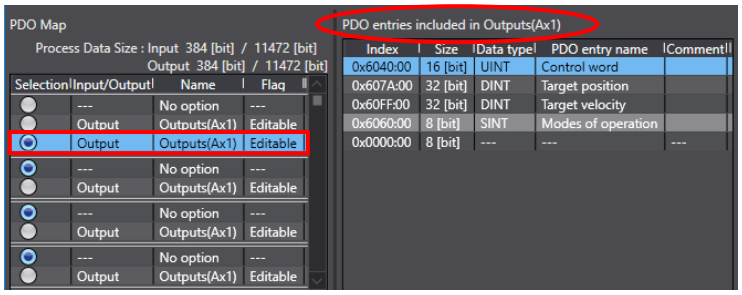
1	Select the node address 1 slave added on the EtherCAT Tab Page in the previous procedure *7.4.1*. Check that Enable Distributed Clock is set to Enabled (DC-Synchronous (SYNC0)).	 :
2	Click **Edit PDO Map Settings** in the *PDO Map Settings* Field.	 : 

3 The Edit PDO Map Settings Dialog Box is displayed.



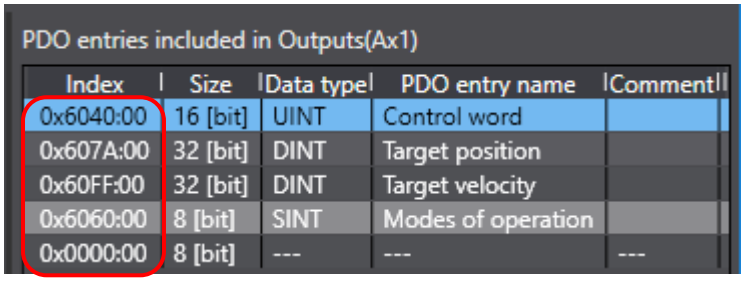
4 Change the PDO mapping for Ax1 by following the steps below.
Click *Outputs(Ax1)* that has been selected by default.
"PDO entries included in Outputs(Ax1)" is displayed on the right side of the dialog box.

*In this guide, the procedure is described based on the PDOs mapped by default. You can also select a mapping different from the one in this guide.

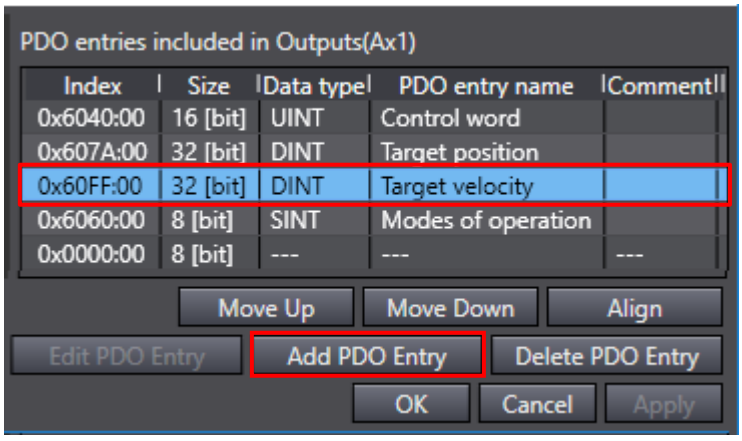


5 Check that the following objects are set.

- 0x6040:00
- 0x607A:00
- 0x60FF:00
- 0x6060:00
- 0x0000:00



6 Select *0x60FF:00* and click **Add PDO Entry**.

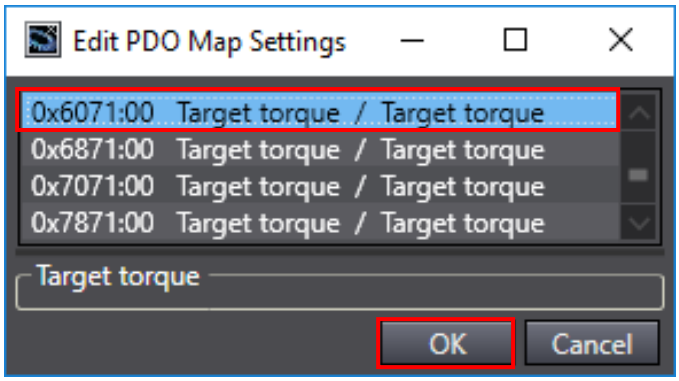


7 The Edit PDO Map Settings Dialog Box is displayed.

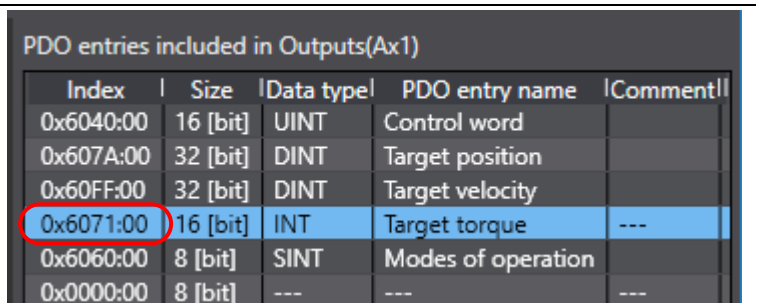
Among the objects listed in *6.1.2. PDO Mapping*, select the following object that is not yet set.

・*0x6071:00*

Click **OK**.

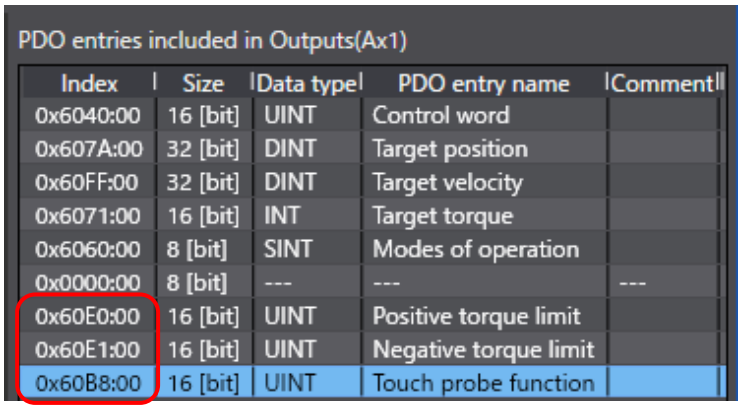


8 Check that the object is added.

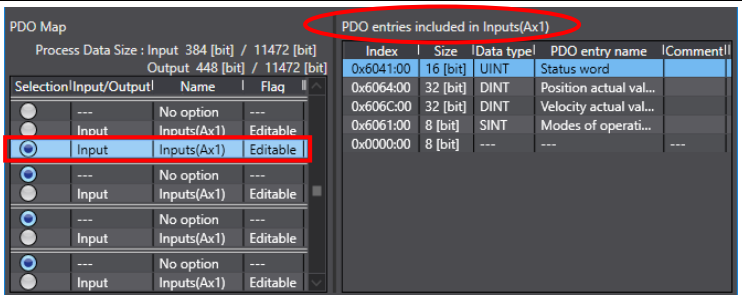


9 In the same way as steps 6 to 8, add the following objects.

・0x60E0:00
・0x60E1:00
・0x60B8:00

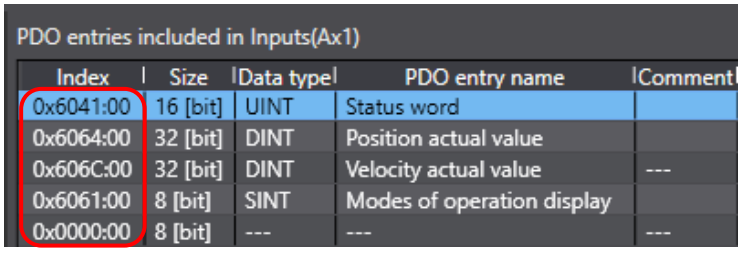


10 Click *Inputs(Ax1)* that has been selected by default.
"PDO entries included in Inputs(Ax1)" is displayed on the right side of the dialog box.



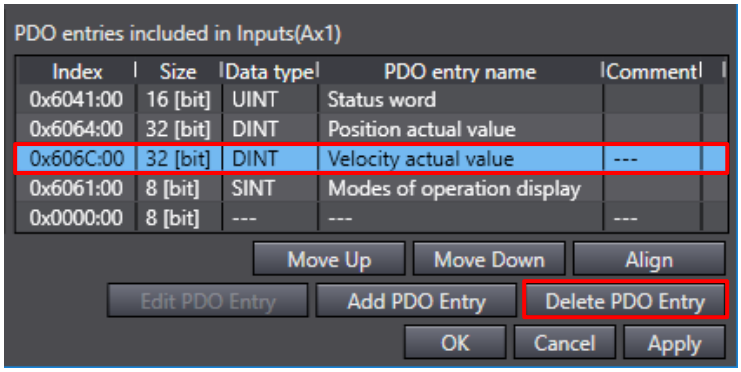
11 Check that the following objects are set.

・0x6041:00
・0x6064:00
・0x606C:00
・0x6061:00
・0x0000:00

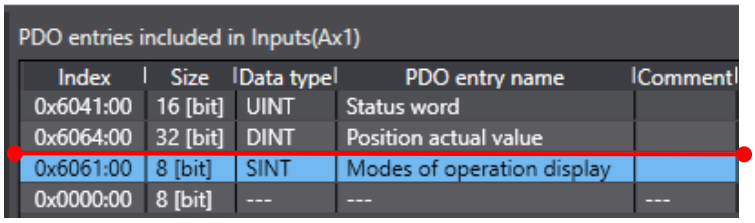


12 Delete the object that is not described in *6.1.2. PDO Mapping*, in the following way. Select the following object and click **Delete PDO Entry**.

- *0x606C:00*

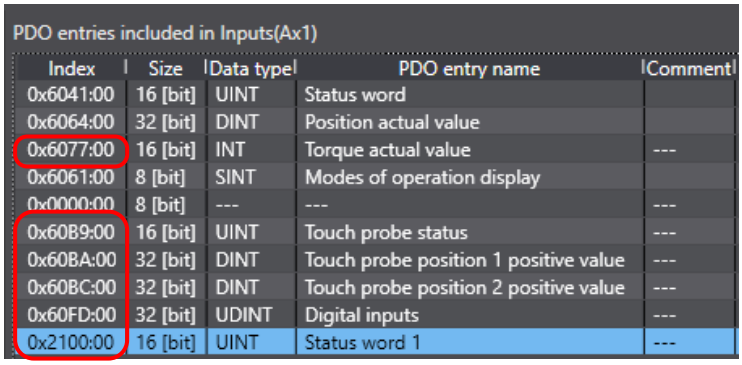


13 Check that the object is deleted.

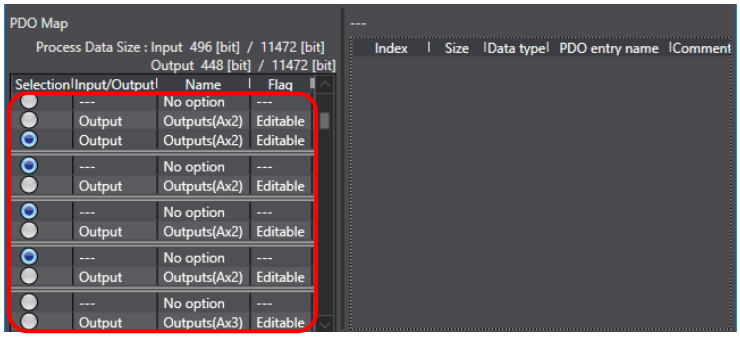


14 In the same way as steps 6 to 8, add the following objects.

- 0x6077:00
- 0x60B9:00
- 0x60BA:00
- 0x60BC:00
- 0x60FD:00
- 0x2100:00

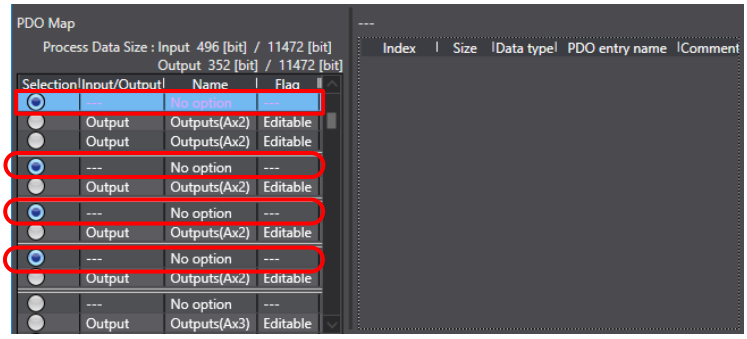


15 Change the PDO mapping for the other axes (Ax2 to Ax4) by following the steps below. Display the output process data for Ax2 in the PDO Map.



Select *No option* for all the output process data for Ax2.

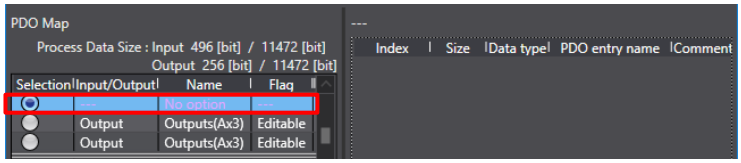
*This guide does not use Ax2.



16 In the same way as step 15, select *No option* for all the output process data for Ax3 and Ax4.

*This guide does not use Ax3 and Ax4.

・Ax3

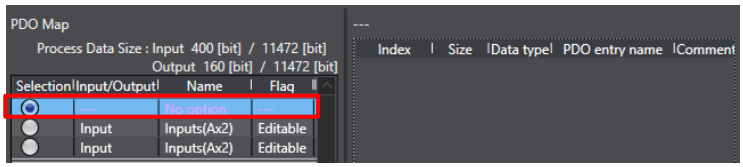


・Ax4

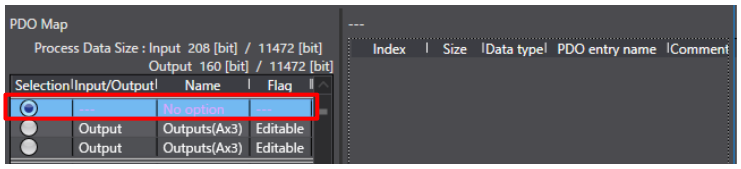
17 In the same way as steps 15 and 16, select *No option* for all the input process data for the other axes (Ax2 to Ax4).

*This guide does not use Ax2, Ax3 and Ax4

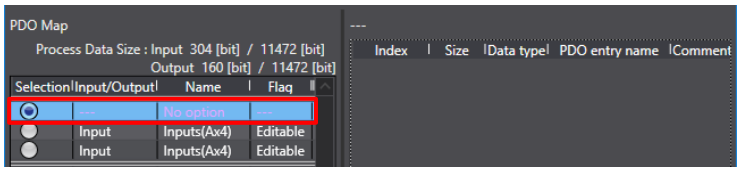
・Ax2



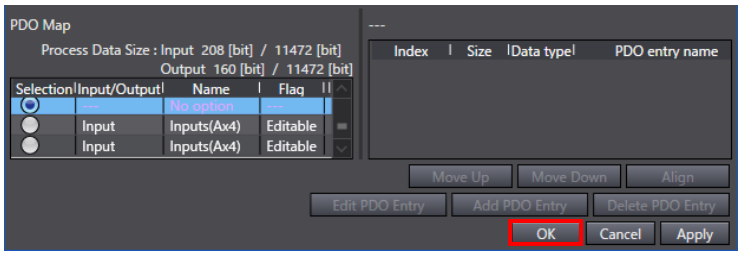
・Ax3

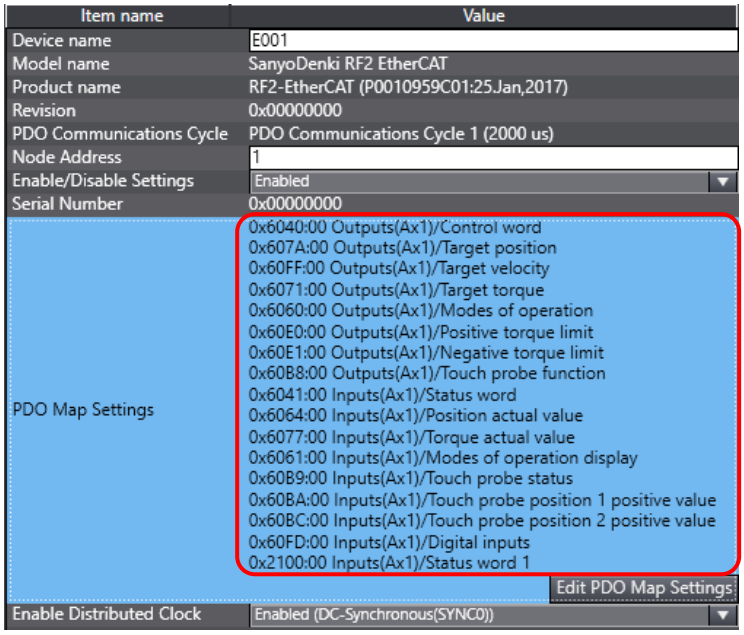


・Ax4



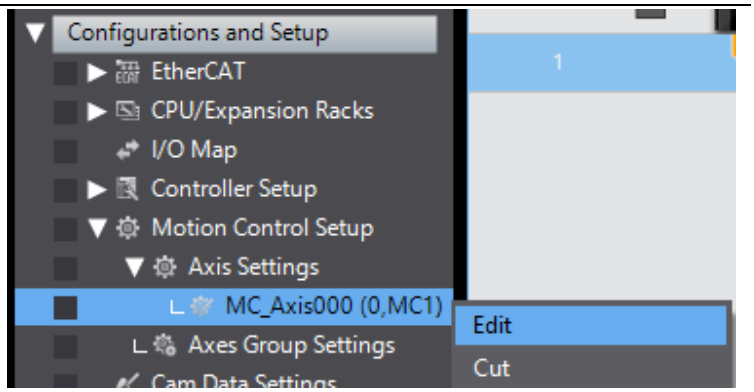
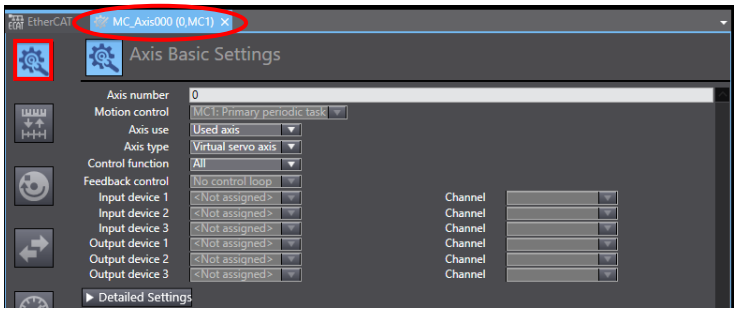
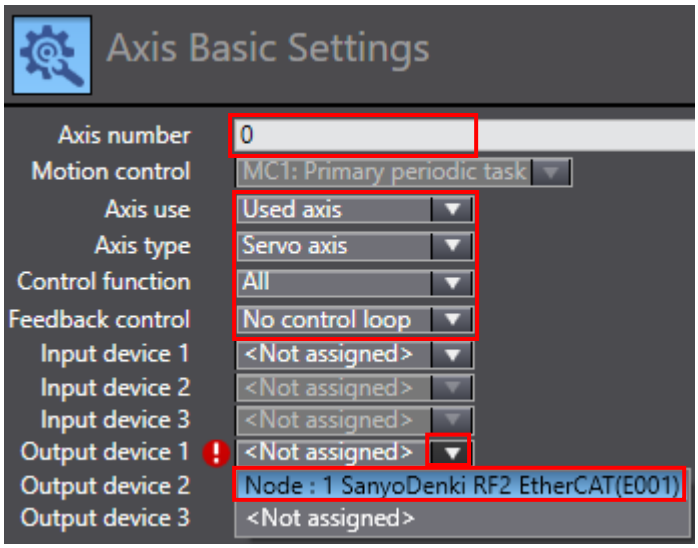
18 Click **OK**.



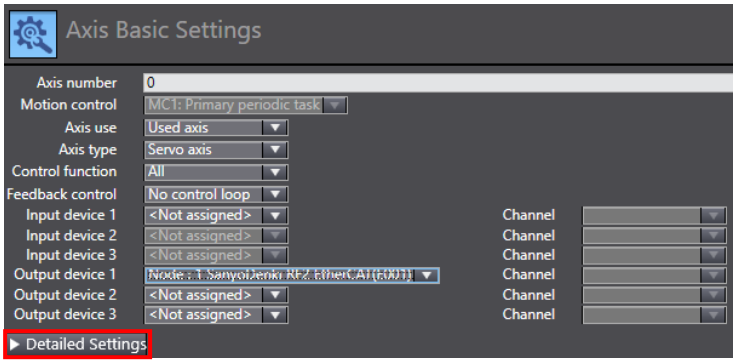
19	The same PDO entries as described in *6.1.2. PDO Mapping* are displayed in the *PDO Map Settings* Field.	

7.4.3. Axis Settings for Motion Control

Set the axis for the MC Function Module.

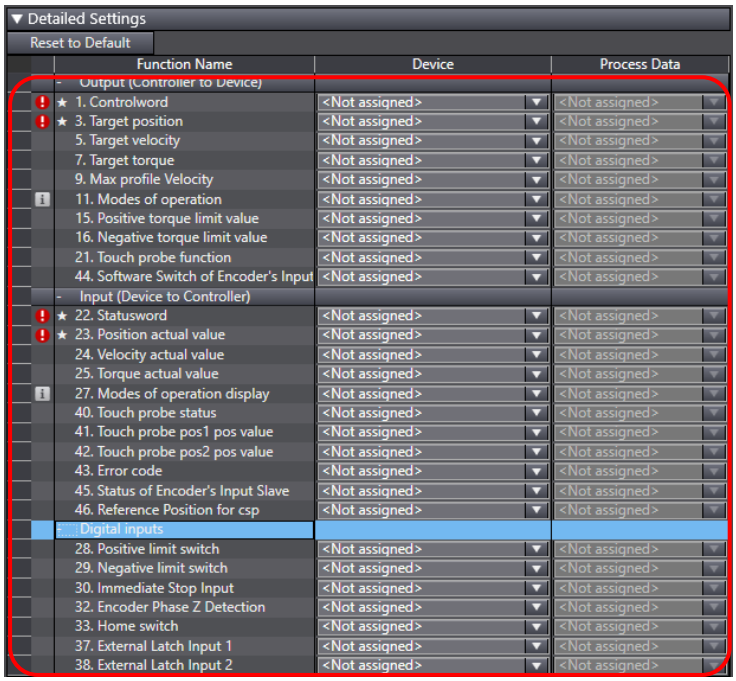
1	Select **Configurations and Setup** – **Motion Control Setup** – **Axis Settings** in the Multiview Explorer. Right-click **Axis Settings** and select ***Add*** – ***Motion Control Axis*** from the menu.	
2	MC_Axis000 (0,MC1) is added under Motion Control Setup – Axis Settings. Right-click **MC_Axis000 (0,MC1)** and select ***Edit*** from the menu. *For NJ-series Controllers, the axis name displayed in Sysmac Studio is "MC_Axis000 (0)".	
3	The MC_Axis000 (0,MC1) Tab Page is displayed in the Edit Pane. Click the **Axis Basic Settings** Button.	
4	Enter or select the following values from the pull-down list to make the axis basic settings. ・Axis number: *0* ・Axis use: ***Used axis*** ・Axis type: ***Servo axis*** ・Feedback control: ***No control loop*** ・Output device 1: ***Node:1SanyoDenki RF2 EtherCAT(E001)***	

5 Click **Detailed Settings**.

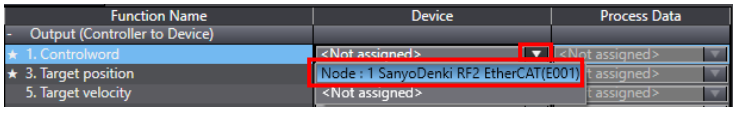


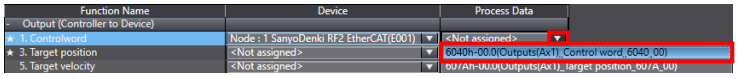
Click the **+** Button to the left of the three function names to expand.

6 The list of function names is expanded.



7 Open the pull-down list in the *Device* Column for 1.Controlword.
Select ***Node:1SanyoDenki RF2 EtherCAT(E001)***.





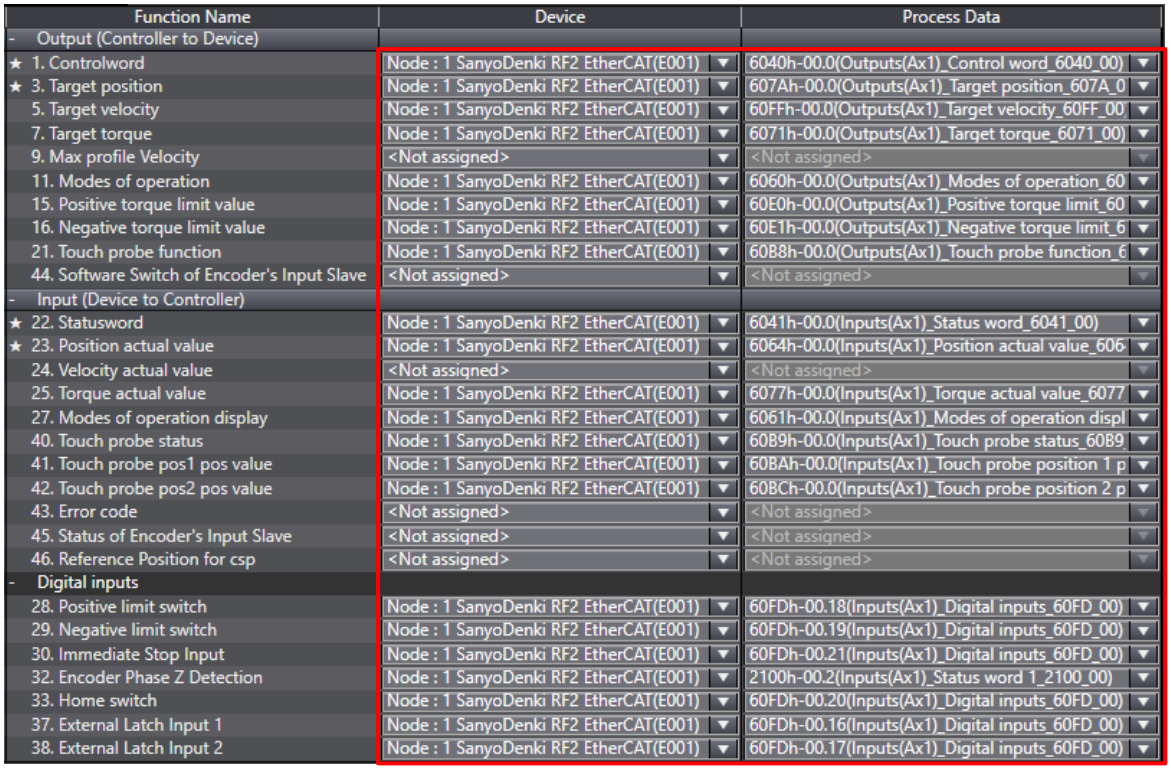
Select the following object from the pull-down list in the *Process Data* Column.

・***6040h-00.0***

8 Likewise, as shown in the figure below, set the device and process data for the other functions by referring to *6.1.5. Axis Settings for PDO Entries*.

Select ***Node:1SanyoDenki RF2 EtherCAT(E001)*** for the device that process data needs to be assigned to.

Select ***<Not assigned>*** for the device that process data does not needs to be assigned to.



Function Name	Device	Process Data
- Output (Controller to Device)		
★ 1. Controlword	Node : 1 SanyoDenki RF2 EtherCAT(E001)	6040h-00.0(Outputs(Ax1)_Control word_6040_00)
★ 3. Target position	Node : 1 SanyoDenki RF2 EtherCAT(E001)	607Ah-00.0(Outputs(Ax1)_Target position_607A_0
5. Target velocity	Node : 1 SanyoDenki RF2 EtherCAT(E001)	60FFh-00.0(Outputs(Ax1)_Target velocity_60FF_00
7. Target torque	Node : 1 SanyoDenki RF2 EtherCAT(E001)	6071h-00.0(Outputs(Ax1)_Target torque_6071_00)
9. Max profile Velocity	<Not assigned>	<Not assigned>
11. Modes of operation	Node : 1 SanyoDenki RF2 EtherCAT(E001)	6060h-00.0(Outputs(Ax1)_Modes of operation_60
15. Positive torque limit value	Node : 1 SanyoDenki RF2 EtherCAT(E001)	60E0h-00.0(Outputs(Ax1)_Positive torque limit_60
16. Negative torque limit value	Node : 1 SanyoDenki RF2 EtherCAT(E001)	60E1h-00.0(Outputs(Ax1)_Negative torque limit_6
21. Touch probe function	Node : 1 SanyoDenki RF2 EtherCAT(E001)	60B8h-00.0(Outputs(Ax1)_Touch probe function_6
44. Software Switch of Encoder's Input Slave	<Not assigned>	<Not assigned>
- Input (Device to Controller)		
★ 22. Statusword	Node : 1 SanyoDenki RF2 EtherCAT(E001)	6041h-00.0(Inputs(Ax1)_Status word_6041_00)
★ 23. Position actual value	Node : 1 SanyoDenki RF2 EtherCAT(E001)	6064h-00.0(Inputs(Ax1)_Position actual value_606
24. Velocity actual value	<Not assigned>	<Not assigned>
25. Torque actual value	Node : 1 SanyoDenki RF2 EtherCAT(E001)	6077h-00.0(Inputs(Ax1)_Torque actual value_6077
27. Modes of operation display	Node : 1 SanyoDenki RF2 EtherCAT(E001)	6061h-00.0(Inputs(Ax1)_Modes of operation displ
40. Touch probe status	Node : 1 SanyoDenki RF2 EtherCAT(E001)	60B9h-00.0(Inputs(Ax1)_Touch probe status_60B9
41. Touch probe pos1 pos value	Node : 1 SanyoDenki RF2 EtherCAT(E001)	60BAh-00.0(Inputs(Ax1)_Touch probe position 1 p
42. Touch probe pos2 pos value	Node : 1 SanyoDenki RF2 EtherCAT(E001)	60BCh-00.0(Inputs(Ax1)_Touch probe position 2 p
43. Error code	<Not assigned>	<Not assigned>
45. Status of Encoder's Input Slave	<Not assigned>	<Not assigned>
46. Reference Position for csp	<Not assigned>	<Not assigned>
- Digital inputs		
28. Positive limit switch	Node : 1 SanyoDenki RF2 EtherCAT(E001)	60FDh-00.18(Inputs(Ax1)_Digital inputs_60FD_00)
29. Negative limit switch	Node : 1 SanyoDenki RF2 EtherCAT(E001)	60FDh-00.19(Inputs(Ax1)_Digital inputs_60FD_00)
30. Immediate Stop Input	Node : 1 SanyoDenki RF2 EtherCAT(E001)	60FDh-00.21(Inputs(Ax1)_Digital inputs_60FD_00)
32. Encoder Phase Z Detection	Node : 1 SanyoDenki RF2 EtherCAT(E001)	2100h-00.2(Inputs(Ax1)_Status word 1_2100_00)
33. Home switch	Node : 1 SanyoDenki RF2 EtherCAT(E001)	60FDh-00.20(Inputs(Ax1)_Digital inputs_60FD_00)
37. External Latch Input 1	Node : 1 SanyoDenki RF2 EtherCAT(E001)	60FDh-00.16(Inputs(Ax1)_Digital inputs_60FD_00)
38. External Latch Input 2	Node : 1 SanyoDenki RF2 EtherCAT(E001)	60FDh-00.17(Inputs(Ax1)_Digital inputs_60FD_00)

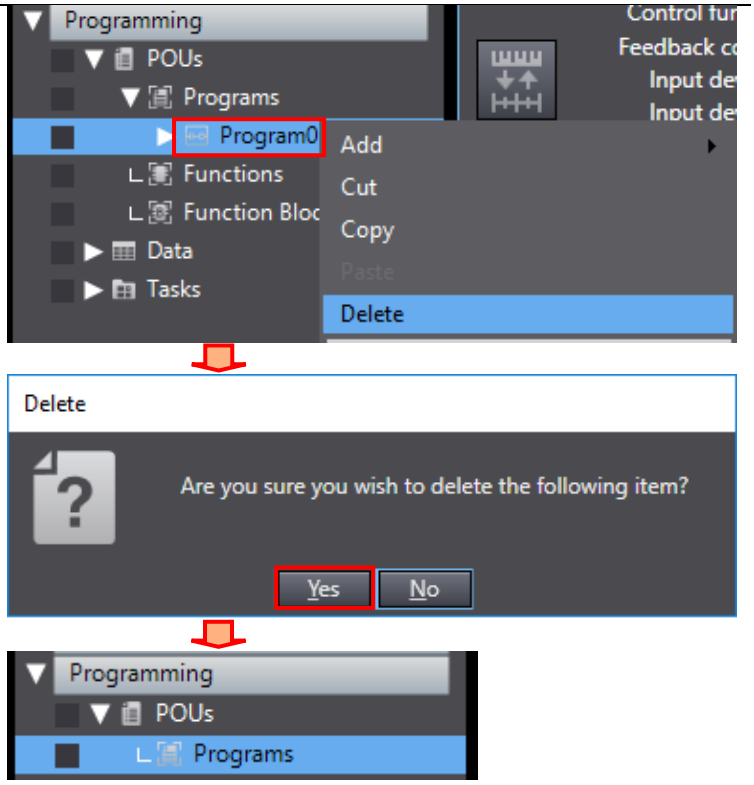
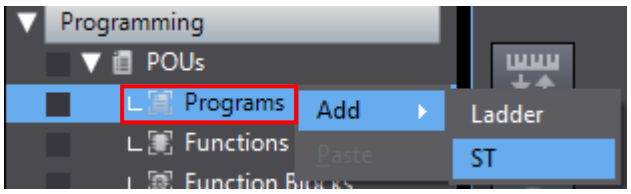
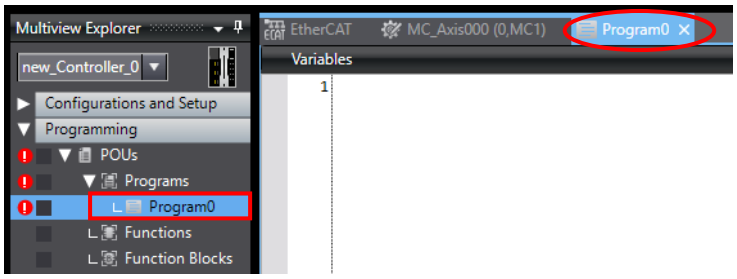
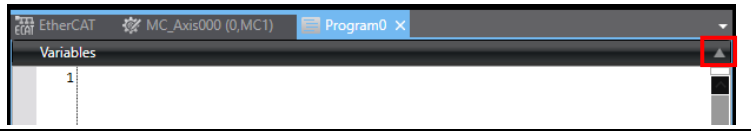
7.4.4. Creating an Operation Check Program

Create a program to check the operation.

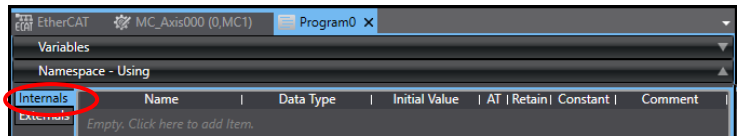
The MC_Power instruction is used as an example in this program.

For information on MC instructions, refer to the *NJ/NX-series Motion Control Instructions Reference Manual* (Cat. No. W508).

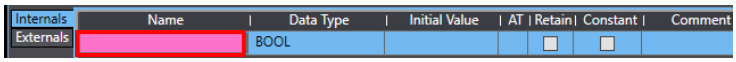
For details on the program in ST (structured text) language, refer to *Section 11. Appendix 3: Program*.

1	Select **Programming** – **POUs** – **Programs** – **Program0** in the Multiview Explorer. Right-click **Program0** and select ***Delete*** from the menu. *The default "Program0" is automatically created in ladder language. It is not used in this guide because a program in ST language is manually created and used, as described in the following steps. The Delete Dialog Box is displayed. Click **Yes**. Program0 is deleted from Programming in the Multiview Explorer.	
2	Right-click **Programs** under **Programming** – **POUs** and select ***Add*** – ***ST*** from the menu.	
3	Double-click **Program0** added in the Multiview Explorer. The Program0 Tab Page is displayed in the Edit Pane.	
4	Click the **Up Arrow** Button in the *Variables* Field.	

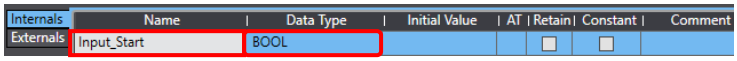
5 The Internals Side Tab is displayed in the variable table.



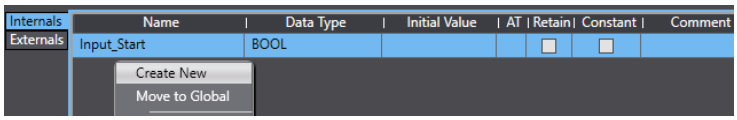
Click on a space to create an entry cell in the *Name* Column.



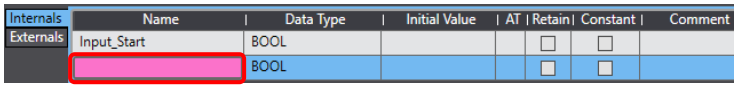
Enter *Input_Start* in the *Name* Column, and check that BOOL is displayed in the *Data Type* Column.



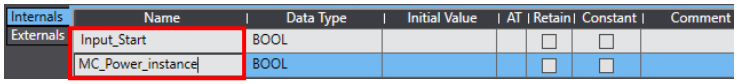
6 After entering, right-click and select ***Create New*** from the menu.



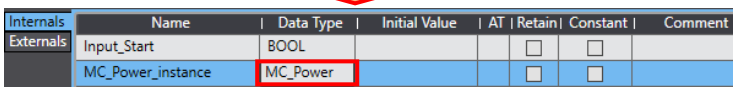
A new variable can be entered.



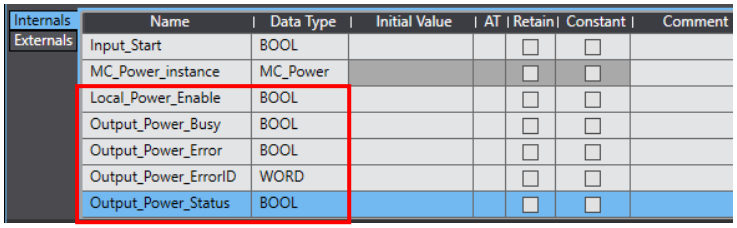
Enter *MC_Power_instance* in the *Name* Column.



Enter *MC_Power* in the *Data Type* Column.

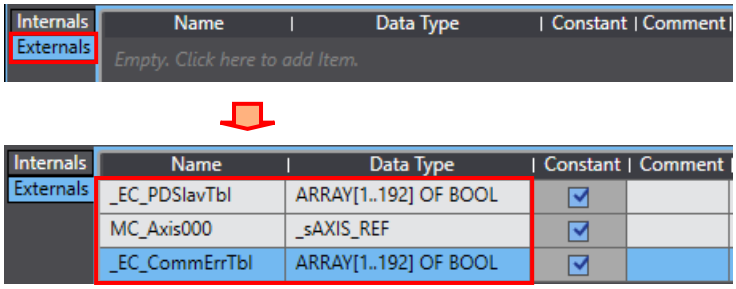


7 In the same way as step 6, enter the following data in newly created cells of the columns on the Internals Side Tab Page.



- *Local_Power_Enable*: *BOOL*
- *Output_Power_Status*: *BOOL*
- *Output_Power_Busy*: *BOOL*
- *Output_Power_Error*: *BOOL*
- *Output_Power_ErrorID*: *WORD*

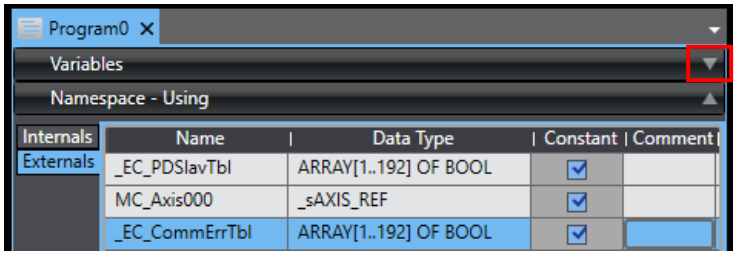
8 Select the **Externals** Side Tab.



In the same way as steps 5 and 6, enter the following variable names in newly created cells of the *Name* Column on the Externals Side Tab Page.
The data types are automatically set.

- *_EC_PDSlavTbl*
- *MC_Axis000*
- *_EC_CommErrTbl*

9 Click the **Down Arrow** Button to close the variable table.



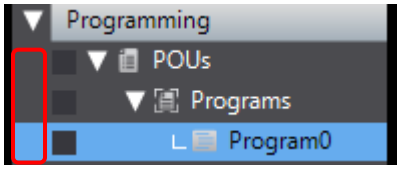
10 The programming area of the Program0 Tab Page is displayed again. Write a program with the MC instruction.

*For details on how to use MC instructions, refer to the *NJ/NX-series Motion Control Instructions Reference Manual* (Cat. No. W508).

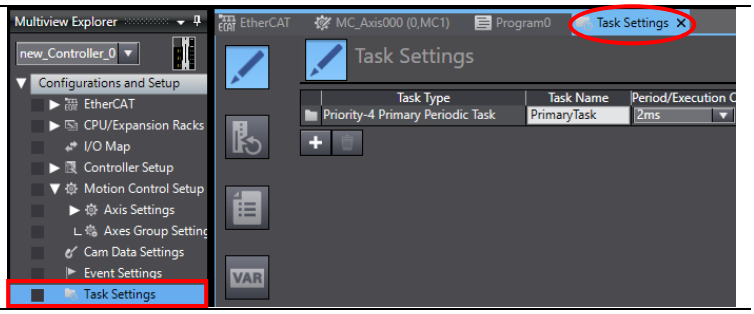
*The program on the right is only given as an example. You must write a program according to the specifications of the Motion Control Device you use. Refer to *Section 11. Appendix 3: Program* for details on the program shown on the right.

```
(* Section 01: Motion Control Device Start/Stop *)
IF Input_Start
   AND _EC_PDSlavTbl[MC_Axis000.Cfg.NodeAddress]
   AND NOT _EC_CommErrTbl[MC_Axis000.Cfg.NodeAddress]
THEN
   IF NOT MC_Axis000.DrvStatus.ServoOn THEN
      Local_Power_Enable:= TRUE;
   END_IF;
ELSE Local_Power_Enable:= FALSE;
END_IF;

(* Section 02: Error Operation *)
IF MC_Axis000.MFaultLvl.Active THEN
   Local_Power_Enable:= FALSE;
END_IF;

(* Section 03: MC Instruction Execute *)
MC_Power_instance(
   Axis:= MC_Axis000,
   Enable      := Local_Power_Enable,
   Status      => Output_Power_Status,
   Busy        => Output_Power_Busy,
   Error       => Output_Power_Error,
   ErrorID     => Output_Power_ErrorID);
```

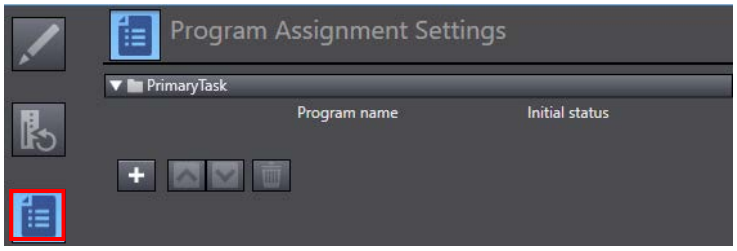
11 Check that the exclamation marks (errors) disappear from the Multiview Explorer.



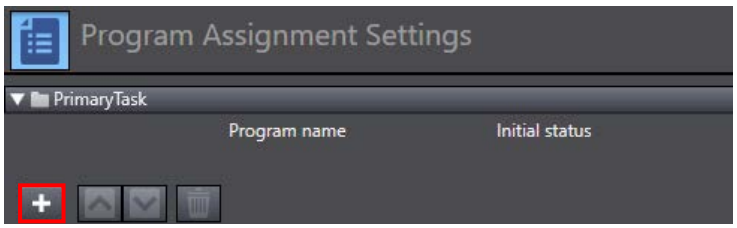
12 Double-click **Task Settings** under **Configurations and Setup** in the Multiview Explorer. The Task Settings Tab Page is displayed in the Edit Pane.



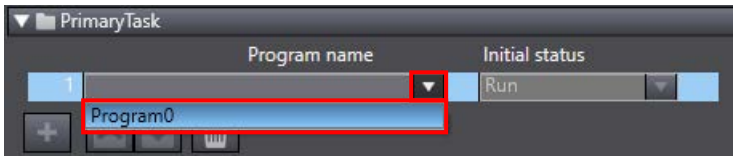
13 Click the **Program Assignment Settings** Button.



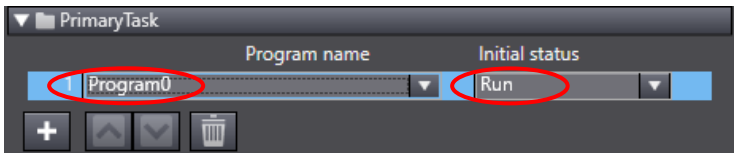
14 Click the **+** Button in the *Primary Task* Field.



An entry cell is displayed in the *Program name* Column. Select ***Program0*** from the pull-down list.



Program0 is set.
Check that the initial status is Run.



7.4.5. Transferring the Project Data

Transfer the created project data to the Controller.

⚠ WARNING

Regardless of the operating mode of the CPU Unit, devices or machines may perform unexpected operation when you transfer any of the following data from Sysmac Studio: a user program, configuration data, setup data, device variables or values in memory used for CJ-series Units.
Always confirm safety at the destination node before you transfer the project data.

⚠ WARNING

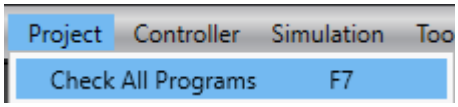
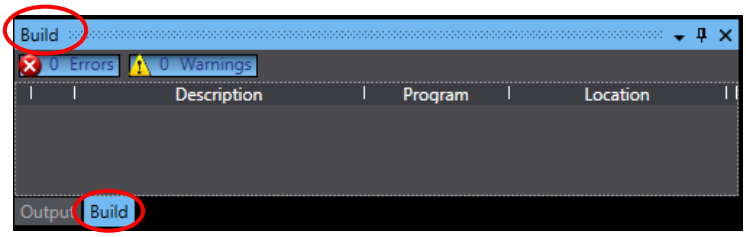
If you use EtherCAT slave units, check the specifications of those slave units in manuals or other documentation and confirm that the system will not be adversely affected before you transfer parameters.

⚠ Caution

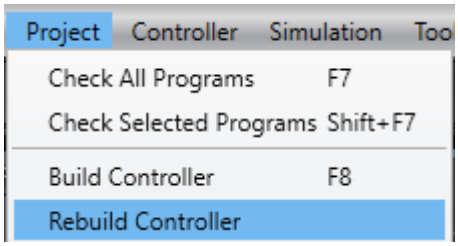
After you transfer the project data, the CPU Unit is restarted, and communications with the slave unit is cut off. During the period, the outputs of the slave unit behave according to the slave unit settings. The time that communications is cut off depends on the EtherCAT network configuration.
Before you transfer the project data, confirm that the slave unit settings will not adversely affect the system.

Additional Information

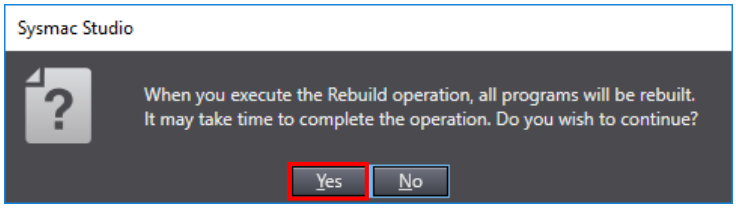
Refer to the *Sysmac Studio Version 1 Operation Manual* (Cat. No. W504) for information on how to handle errors and warnings that have occurred as results of a program check and building.

1	Select ***Check All Programs*** from the Project Menu.	
2	The Build Tab Page is displayed. Check that "0 Errors" and "0 Warnings" are displayed.	

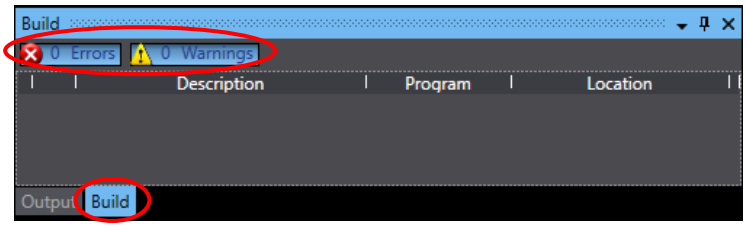
3 Select ***Rebuild Controller*** from the Project Menu.



4 The dialog box on the right is displayed. Confirm that there is no problem, and click **Yes**.

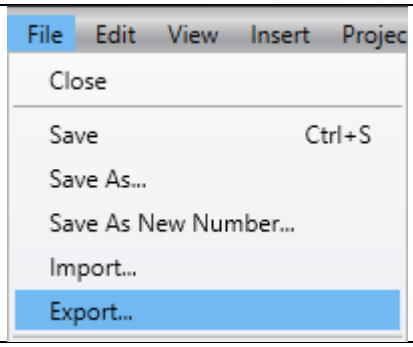


5 Check that "0 Errors" and "0 Warnings" are displayed on the Build Tab Page.

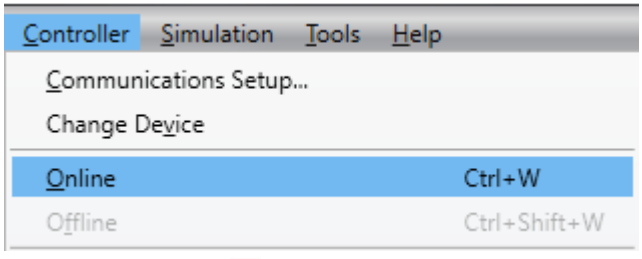


6 If you need to save the created project file, select ***Export*** from the File Menu.

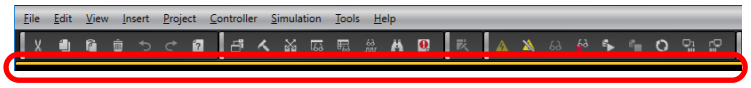
*Refer to *Section 9. Appendix 1: Procedures Using the Project File* if you use the exported data.



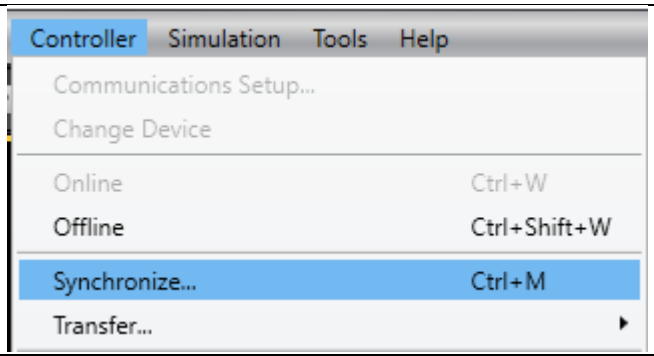
7 Select ***Online*** from the Controller Menu.

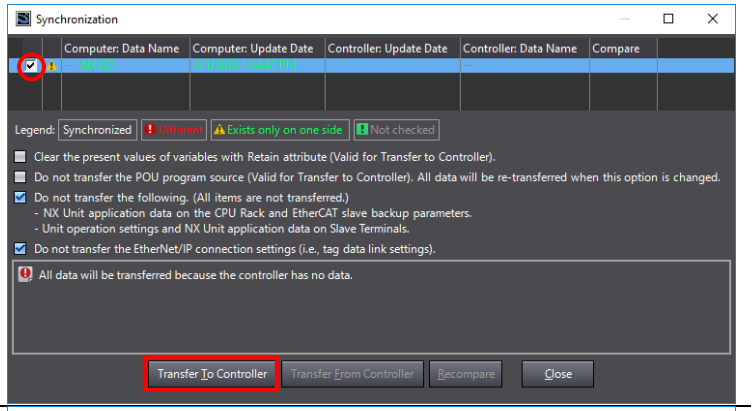
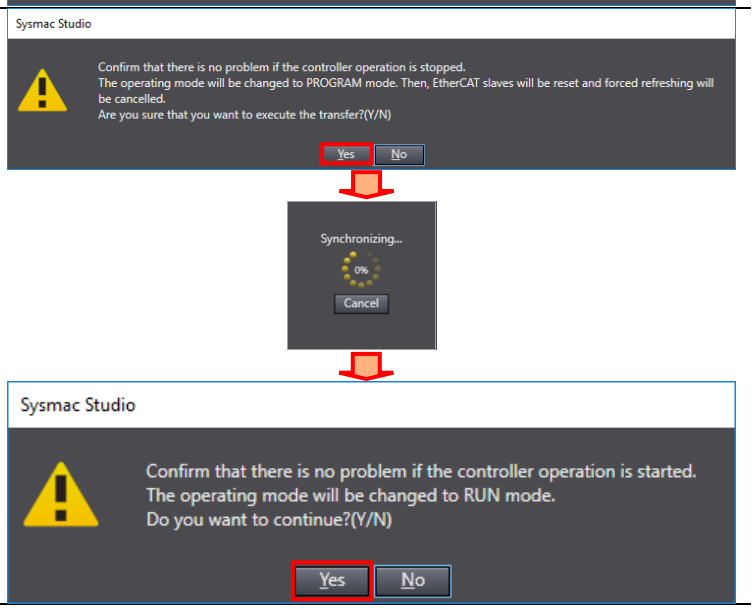


When an online connection is established, a yellow line is displayed under the toolbar.

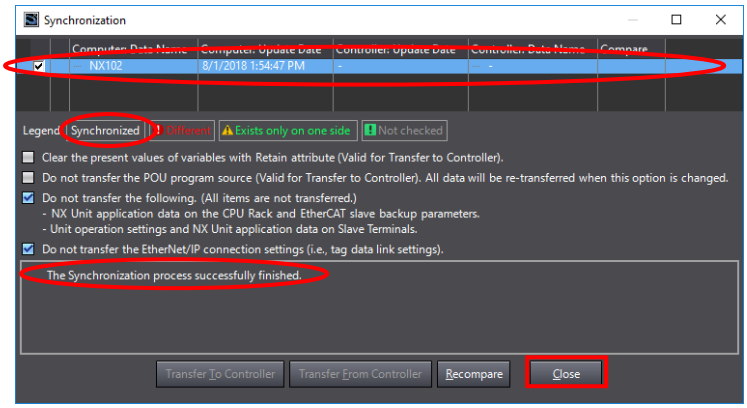


8 Select ***Synchronize*** from the Controller Menu.



9	The Synchronization Dialog Box is displayed. Check that the data to transfer (example: NX102) is selected. Click **Transfer To Controller**. *After executing "Transfer To Controller", the Sysmac Studio data is transferred to Controller, and the data is synchronized.	
10	A confirmation dialog box is displayed. Confirm that there is no problem, and click **Yes**. A screen is displayed stating "Synchronizing". A confirmation dialog box is displayed. Confirm that there is no problem, and click **Yes**.	

11 As shown in the figure on the right, the font color that is used to display the synchronized data changes to the same color as the one used to specify "Synchronized".
Check that a message is displayed stating "The Synchronization process successfully finished".
Confirm that there is no problem, and click **Close**.



*When the Sysmac Studio project data matches the Controller data, a message is displayed stating "The Synchronization process successfully finished".

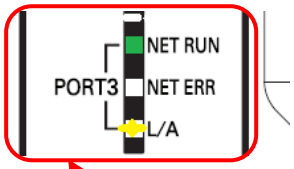
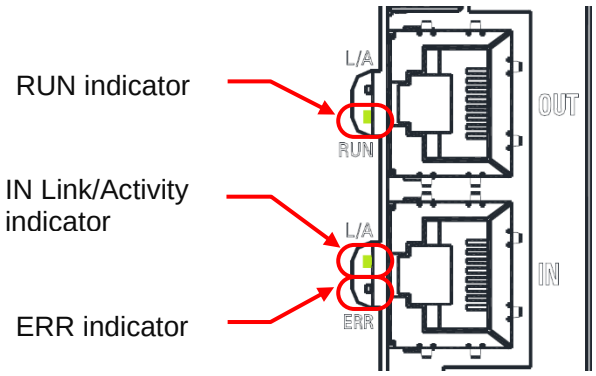
*If the synchronization fails, check the wiring and repeat from step 1.

7.5. Connection Status Check

Check the connection status of the EtherCAT network.

7.5.1. Checking the Connection Status

Confirm that EtherCAT communications is performed normally.

1	Check with LED indicators on Controller that PDO communications via EtherCAT is performed normally. The LED indicators in normal status are as follows: NET RUN: Green lit NET ERR: Not lit LINK/ACT: Yellow flashing *The NJ-series Controllers also have the same LED indicator status.	 Built-in EtherCAT (Port 3) Status Indicators
2	Check the LED indicators on Servo Amplifier. The LED indicators in normal status are as follows: RUN indicator: Green lit IN Link/Activity indicator: Green flickering ERR indicator: Not lit	

7.5.2. Checking the Connection Status Using the Operation Check Program

Confirm that the Servo Amplifier is operated normally using the operation check program.
The MC_Power instruction is used in this program.

⚠ Caution

In this procedure, the operation of the Motion Control Device is checked, which may perform unexpectedly.
Ensure safety before you proceed with this operation check described here.
If you cannot ensure safety, do not proceed. When you perform this operation check, make sure to complete all the steps and make the output of the Slave Amplifier safe.

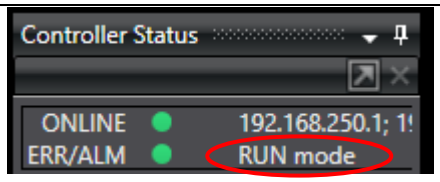
⚠ Caution

If you change the variable values on a Watch Tab Page when Sysmac Studio is online with the CPU Unit, the devices connected to the Controller may operate regardless of the operating mode of the CPU Unit.
Always ensure safety before you change the variable values on a Watch Tab Page when Sysmac Studio is online with the CPU Unit.

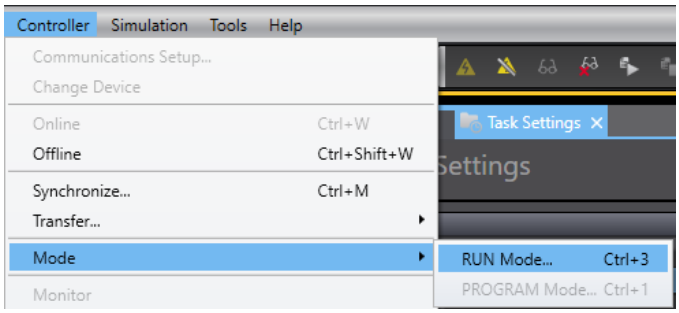
⚠ Caution

Please note that some functions of the MC Function Module may be unavailable, or available but different in behavior from OMRON Motion Control Devices due to the different specifications between non-OMRON and OMRON Motion Control Devices. Make sure to check *Section 8. Restrictions on Motion Control* in this guide when you design a system.

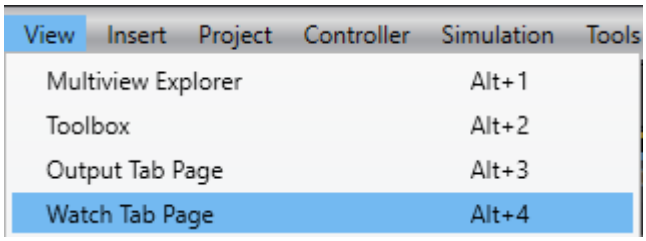
1 Check that RUN mode (operating mode of Controller) is displayed in the Controller Status Pane of Sysmac Studio.



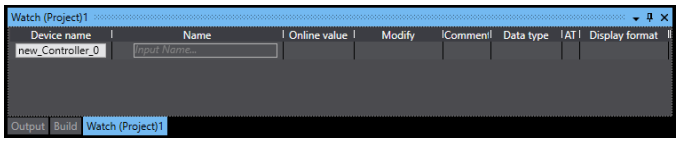
If not, select ***Mode*** – ***RUN Mode*** from the Controller Menu to change the operating mode to RUN mode.



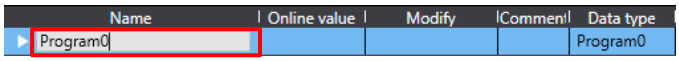
2 Select ***Watch Tab Page*** from the View Menu.



3 The Watch (Project)1 Tab Page is displayed.

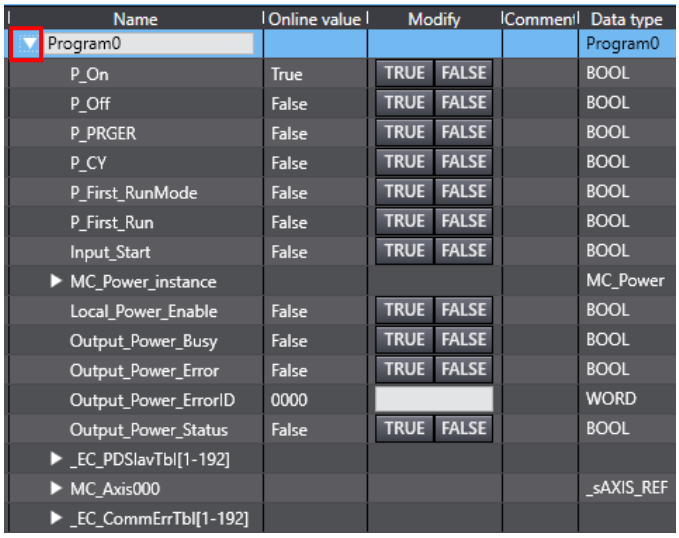


4 Enter *Program0* in the *Name* Column.



5 Click the **Down Arrow** Button to the left of Program0. The variables used in Program0 are displayed.

*The order of variable names may be changed depending on the operating environment.



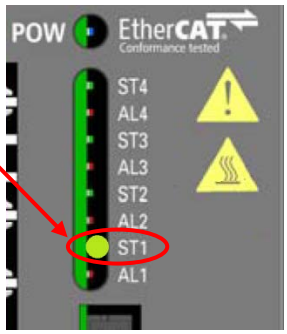
6 Check with the following LED indicator on Servo Amplifier that Ax1 is in the “state of operation preparation completion". (operation-ready state)

The LED indicator that indicates the state is as follows:

Amplifier status indicator ST1:

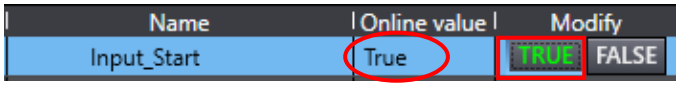
Green blinking with 256 ms cycle

Amplifier status indicator ST1



7 With Sysmac Studio, click **TRUE** in the *Modify* Column for *Input_Start*. The online value is changed from False to True.

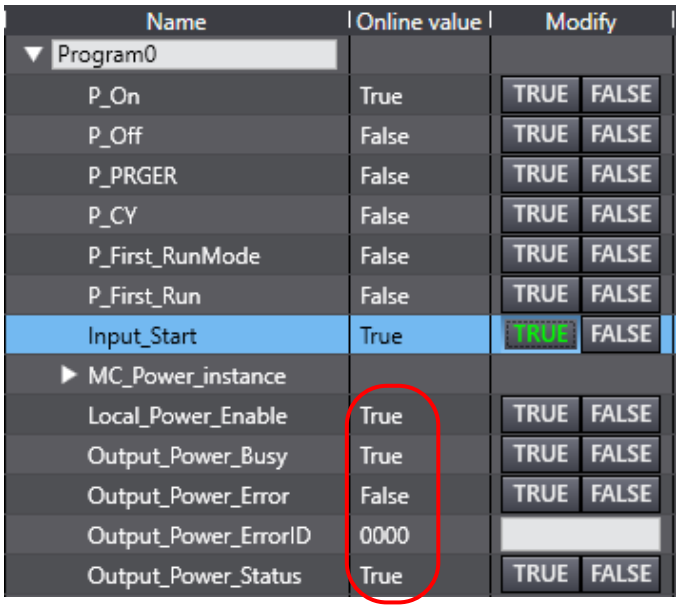
*The MC_Power instruction is executed.



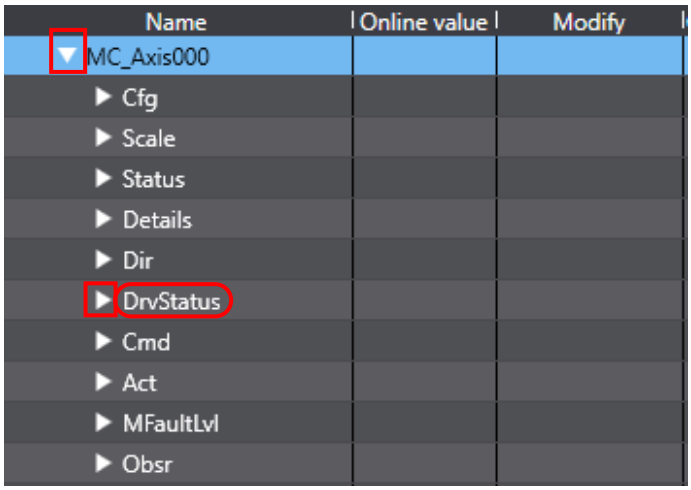
8 Check that the following online values of the variables are displayed.

Local_Power_Enable: True
(Indicates that the instruction is ready for execution.)
Output_Power_Busy: True
(Indicates that the instruction is being executed.)
Output_Power_Error: False
(Indicates that there is no error.)
Output_Power_ErrorID: 0000
(Indicates that there is no error.)
Output_Power_Status: True
(Indicates that Servo Amplifier is ready for operation.)

*They indicate that the MC_Power instruction is operating normally.

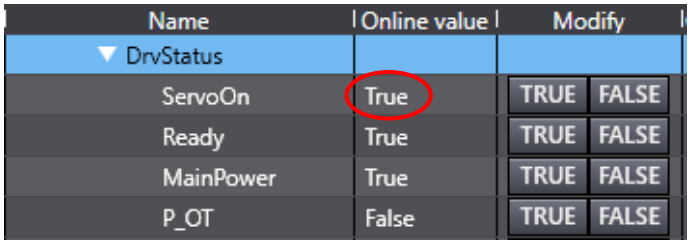


9 Click the **Down Arrow** Button to the left of *MC_Axis000*.
DrvStatus is displayed.
Likewise, click the **Down Arrow** Button to the left of *DrvStatus*.



10 Check that *ServoOn* is True.

*This indicates that the motor is energized.



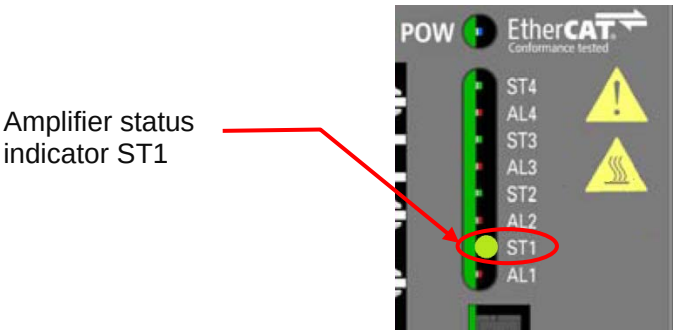
11 Check with the following LED indicator on Servo Amplifier that Ax1 is in the "state of servo ON".

The LED indicator that indicates the state is as follows:

Amplifier status indicator ST1:

Green blinking with 1.024 s cycle

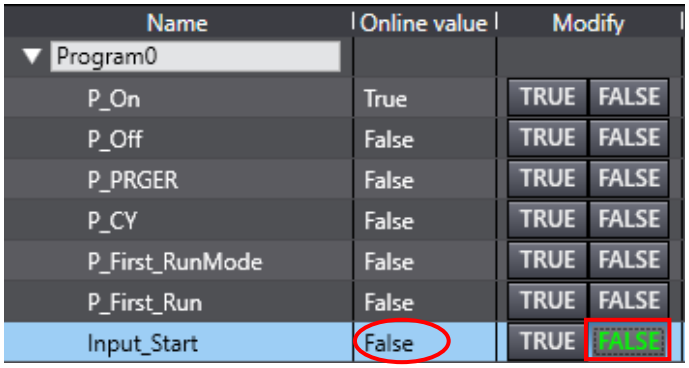
*The blinking cycle of the LED indicator is slower than the one described in step 6.



12 With Sysmac Studio, click **FALSE** in the *Modify* Column for *Input_Start* on the Watch1 Tab Page.

The online value is changed from True to False.

*The MC_Power instruction is ended.



13 Check that the following online values of the variables are displayed.

Local_Power_Enable: False
(Indicates that the instruction is not executed.)

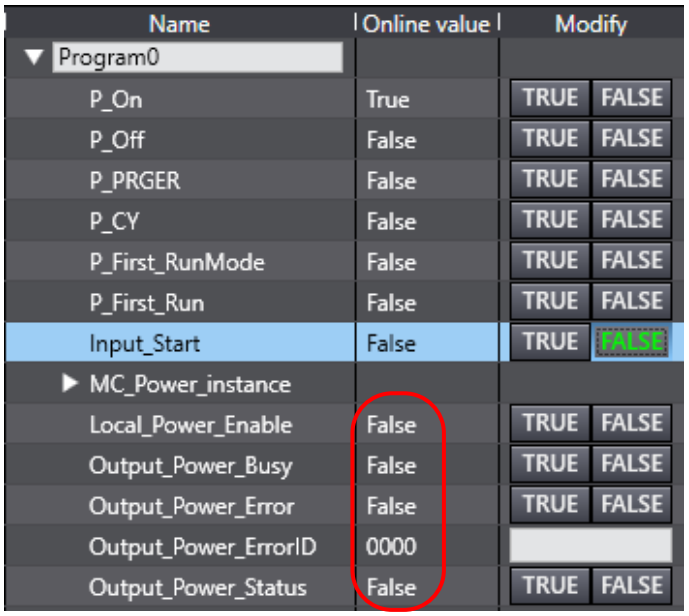
Output_Power_Busy: False
(Indicates that the instruction is buffered for execution.)

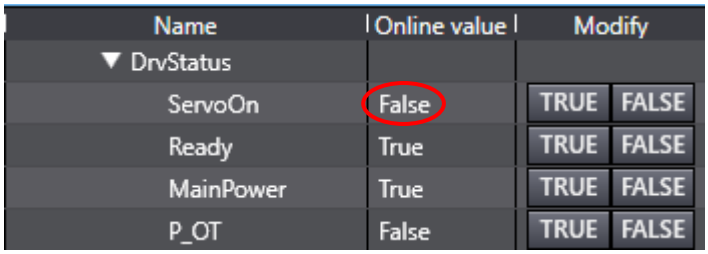
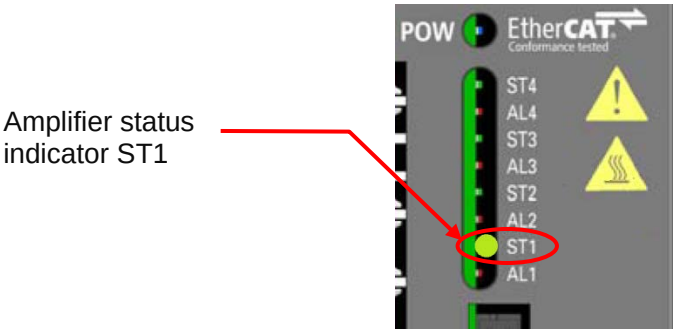
Output_Power_Error: False
(Indicates that there is no error.)

Output_Power_ErrorID: 0000
(Indicates that there is no error.)

Output_Power_Status: False
(Indicates that Servo Amplifier is not ready for operation.)

*They indicate that the MC_Power instruction has been properly ended.



14	Check that False is displayed in the *Online value* Column for *ServoOn* under *MC_Axis000 – DrvStatus*. *This indicates that the motor is not energized.	
15	Check with the following LED indicator on Servo Amplifier that Ax1 is in the "state of operation preparation completion". (operation-ready state) LED indicator that indicates the state is as follows: Amplifier status indicator ST1: Green blinking with 256 ms cycle *The blinking cycle of the LED indicator is faster than the one described in step 11.	

8. Restrictions on Motion Control

This section describes restrictions on when the Servo Amplifier that is connected to the Controller via EtherCAT is used as a motion control axis for the MC Function Module of the Controller.

⚠ Caution

Some functions of the MC Function Module may be unavailable, or available but different in behavior from OMRON Motion Control Devices due to the different specifications between non-OMRON and OMRON Motion Control Devices.
Those functions may cause unexpected operation of the Motion Control Device, resulting in injury.
Carefully check differences before using the functions of the MC Function Module that are different in behavior from OMRON Motion Control Devices.
Do not use the functions that are unavailable for use.

Additional Information

For NX1P2 and NX102 Controllers, a Servo Drive can be used as a single-axis position control axis. For information on the differences between the single-axis position control axis and the motion control axis, refer to the *NJ/NX-series CPU Unit Motion Control User's Manual* (Cat. No. W507).

8.1. List of Restrictions

The following table shows the restrictions on when you use the Servo Amplifier connected to the Controller.

Item	Function restricted in use and its status	Details
Axis variable	**DrvStatus.ILA (Drive Internal Limiting)** The conditions to change this axis variable to TRUE depend on the specifications of a Motion Control Device defined by a manufacturer.	Refer to *8.2*
MC instruction	**Automatic Torque Limit Function of the MC_Home and MC_HomeWithParameter Instructions** The automatic torque limit function of these MC instructions cannot work.	Refer to *8.3*
	Velocity Limit Function of the MC_TorqueControl Instruction (Cyclic Synchronous Torque Control) The velocity limit function of this MC instruction cannot work.	
Others	**Stop Processing During the Cyclic Synchronous Torque Control** When performing a stop that is triggered by the MC_Stop instruction or an error during Cyclic Synchronous Torque Control (MC_TorqueControl instruction in execution), stop processing is performed differently from that of OMRON Motion Control Devices.	Refer to *8.4*
	MC Test Run This function cannot be used.	

8.2. Axis Variable

The restriction on the axis variable is described below.

8.2.1. DrvStatus.ILA (Drive Internal Limiting)

DrvStatus.ILA shows the status of bit 11 (internal limit active) of the Status word (6041 hex).
The conditions for this axis variable to change to TRUE depend on the specifications of a Motion Control Device defined by a manufacturer.
Refer to *4) Status Word* in *5.4. PDS FSA* of the *SANMOTION AC SERVO SYSTEMS R ADVANCED MODEL TYPE F With EtherCAT Interface Type H For Rotary Motor, Linear Motor Instruction Manual* (M0011195) for information on the conditions for this axis variable to change to TRUE.

8.3. MC Instruction

The restrictions on the MC instructions are described below.

8.3.1. Automatic Torque Limit Function of the MC_Home and MC_HomeWithParameter Instructions

The OMRON Motion Control Devices can use the automatic torque limit function of the MC_Home or MC_HomeWithParameter instruction for the Homing Operation Mode "Proximity reverse turn/holding time" or "No home proximity input/holding home input".
The automatic torque limit function is unique to OMRON.
This function does not work for non-OMRON Motion Control Devices.

Additional Information

If you use a non-OMRON Motion Control Device and attempt to use the automatic torque limit function of the MC_Home or MC_HomeWithParameter instruction for the Homing Operation Mode "Proximity reverse turn/holding time" or "No home proximity input/holding home input", use the MC_SetTorqueLimit instruction instead, or if the Motion Control Device has a function to perform the torque limit, create a program to activate the function via SDO communications.

8.3.2. Velocity Limit Function of the MC_TorqueControl Instruction (Cyclic Synchronous Torque Control)

The OMRON Motion Control Devices can limit the maximum velocity of a Servo Motor by using the velocity limit function when the torque is controlled by the MC_TorqueControl instruction (Cyclic Synchronous Torque Control).

The velocity limit function is performed according to OMRON's own specifications.

This function does not work for non-OMRON Motion Control Devices.

Additional Information

If you use the velocity limit function of the MC_TorqueControl instruction (Cyclic Synchronous Torque Control) for non-OMRON Motion Control Devices, monitor the command current velocity or the actual current velocity in the axis variable.

In case that the velocity is high, create a program that corrects the target torque.

8.4. Others

The other restrictions are described below.

8.4.1. Stop Processing During the Cyclic Synchronous Torque Control

When you use a Non-OMRON Motion Control Device and perform a stop that is triggered by the MC_Stop instruction or an error during Cyclic Synchronous Torque Control (MC_TorqueControl instruction in execution), stop processing is performed differently from that of OMRON Motion Control Devices.

Motion Control Device	Stop Processing During the Cyclic Synchronous Torque Control
Non-OMRON	Stop processing is performed in the following way. 1. The control mode of the Motion Control Device is changed to Cyclic Synchronous Position (CSP). 2. At the actual position (as the starting point) where the control mode is changed to Cyclic Synchronous Position (CSP), the Motion Control Device outputs the command position that allows the current velocity to change to 0 by calculating from the current velocity and given deceleration rate. 3. The Motion Control Device decelerates to a stop at the given deceleration rate.
OMRON	Stop processing is performed in the following way. 1. The velocity limit value is immediately changed to 0. 2. After the velocity limit value is changed to 0, the MC Function Module confirms that the actual position meets the stopping criterion. 3. After the confirmation, the control mode is changed from Cyclic Synchronous Torque (CST) to Cyclic Synchronous Position (CSP). 4. The Motion Control Device performs an immediate stop.

8.4.2. MC Test Run

The MC test run is a dedicated function of Sysmac Studio for OMRON Motion Control Devices. This function cannot be used for non-OMRON Motion Control Devices.

9. Appendix 1: Procedures Using the Project File

This section describes the procedures when using the following project file or the project file you exported in *7.4. Controller Setup*.
Obtain the project file with a latest version from OMRON.
The project file specified below has been created for NX-series Controllers. If you use an NJ-series Controller, change the device information displayed in the Change Device Dialog Box of Sysmac Studio.

Name	File name	Version
Sysmac Studio project file (extension: csm2)	P707_NX_ECAT_SanyoDK_RF2_V100.csm2	Ver.1.00

The following table lists references for the settings made in the project file.

Item	Reference
Communications parameter settings	6.1. Parameters
How to set communications parameters	7.4. Controller Setup
Relationship between PDO entries and MC instructions	10.Appendix 2: MC Instructions and PDO Entries
Details on the operation check program	11.Appendix 3: Program

9.1. Work Flow

Take the following steps with the prepared project file to connect the Controller and the Servo Amplifier via EtherCAT and to operate the Motion Control Device using the MC instruction for the Controller. Refer back to each of the following procedures for details except for *9.2. Controller Setup* boxed in red.

7.2. Preparation for Controller Setup	Prepare to set up the Controller.
↓	
7.3. SANYO DENKI Servo Amplifier Setup	Set up the SANYO DENKI Servo Amplifier.
↓	
9.2. Controller Setup	Set up the Controller using the project file.
↓	
9.2.1. Importing the Project File	Import the project file to Sysmac Studio.
↓	
9.2.2. Checking the EtherCAT Network Configuration	Check the EtherCAT network configuration with Sysmac Studio.
↓	
7.4.5. Transferring the Project Data	Transfer the created project data to the Controller.
↓	
7.5. Connection Status Check	Check the connection status of the EtherCAT network.

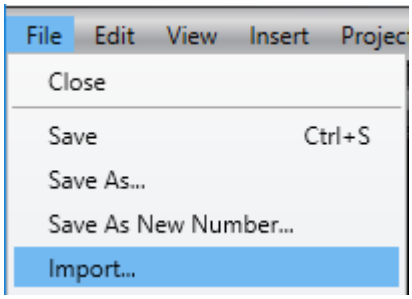
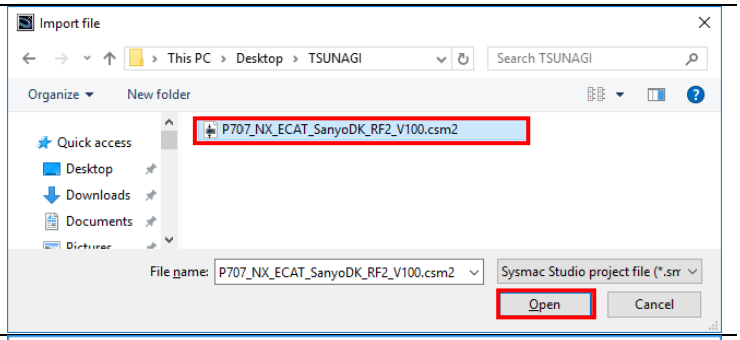
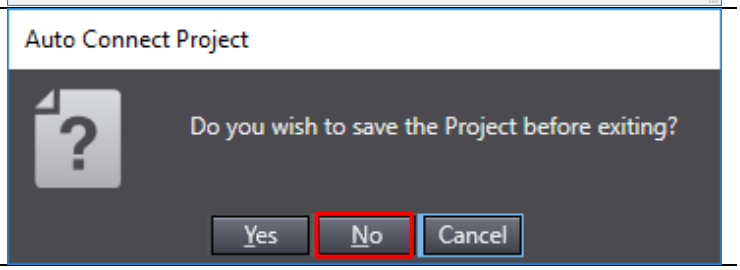
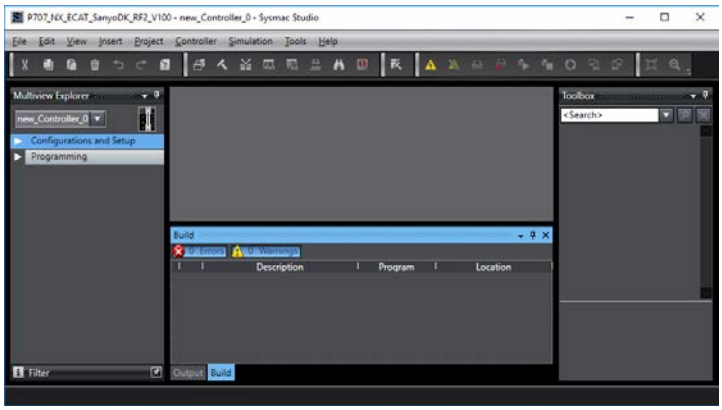
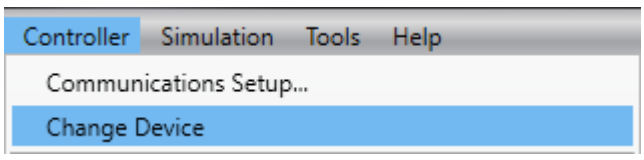
9.2. Controller Setup

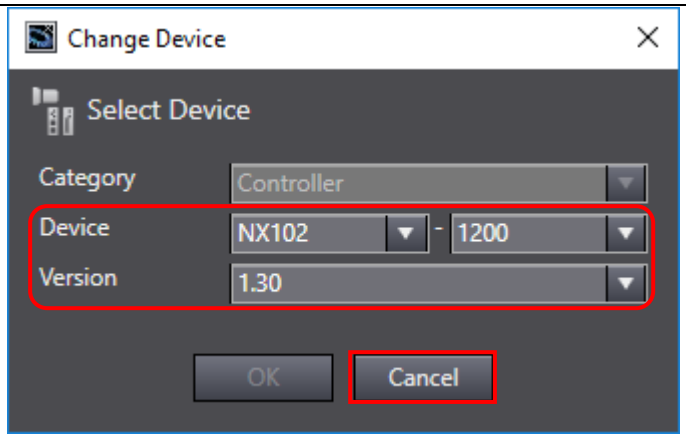
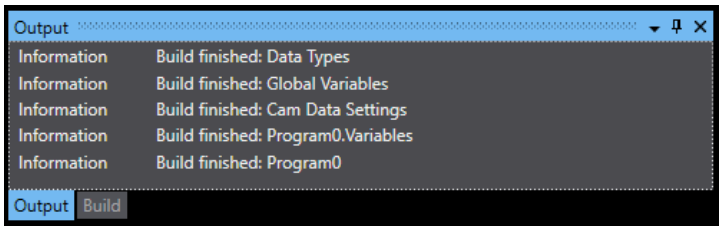
Set up the Controller using the project file.

Perform *7.2. Preparation for Controller Setup* and *7.3. SANYO DENKI Servo Amplifier Setup* before following the steps.

9.2.1. Importing the Project File

Import the project file to Sysmac Studio.

1	Select ***Import*** from the File Menu.	
2	The Import file Dialog Box is displayed. Select *P707_NX_ECAT_SanyoDK_RF2_V100.csm2* (project file) or the project file you exported in *7.4. Controller Setup*. Click **Open**.	
3	A confirmation dialog box is displayed asking you whether to save the project. Click **No** if you do not need to save.	
4	The P707_NX_ECAT_SanyoDK_RF2_V100 project is displayed. *If an error message is displayed stating "Failed to Load Descendants", change the version of Sysmac Studio to the version specified in *5.2. Device Configuration* or to a higher version.	
5	Select ***Change Device*** from the Controller Menu.	

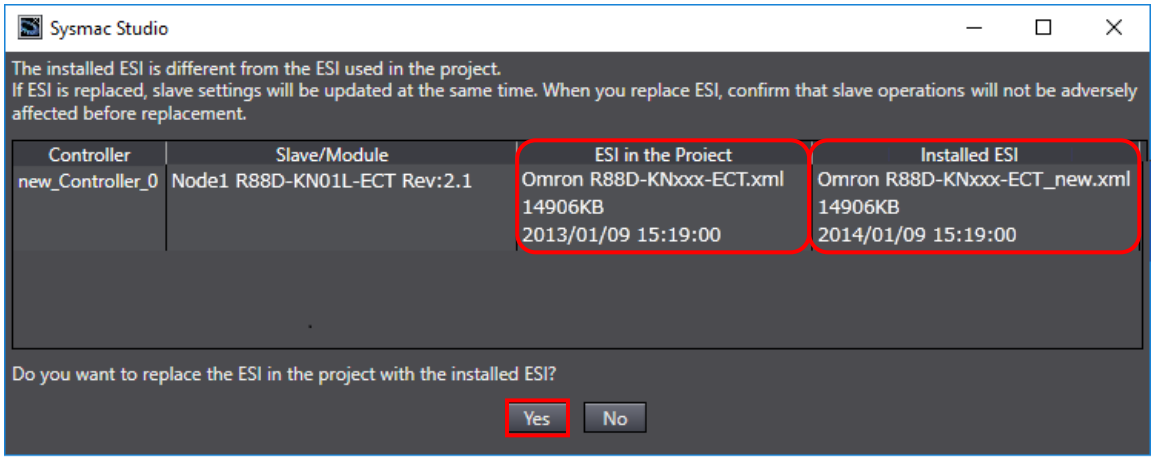
6	The Change Device Dialog Box is displayed. Check that the *Device* and *Version* Fields are set as shown on the right. Click **Cancel**. *If the settings are different, select the items from the pull-down list, and click **OK**. * The setting items and the supported range of values vary depending on the Controller model. Refer to *A-10 Changing models among NJ-, NX-, and NY-series Controllers* of the *Sysmac Studio Version 1 Operation Manual* (Cat. No. W504) for details.	
7	If you change the settings in step 6, "Build finished" is displayed on the Output Tab Page.	

Precautions for Correct Use

If an error occurs, refer to the following troubleshooting tip.
The following screenshot is given only for explanation purposes. The data in the screenshot is different from those obtained with the applicable devices specified in this guide.

■ESI file error

If the following dialog box is displayed, the information contained in the installed ESI file is different from the ESI in the project file. If the installed ESI file is the same as the one specified in *5.2. Device Configuration*, click **Yes** and proceed to the next step.
If not, obtain the correct ESI file from the device manufacturer and repeat the procedures from *7.2.3. Installing the ESI File*.



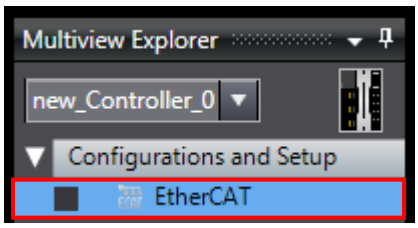
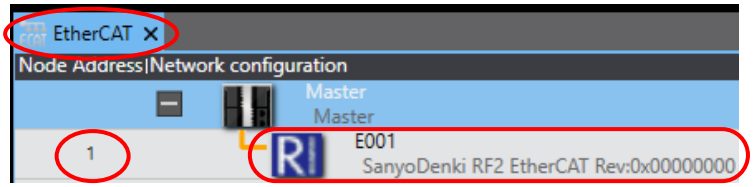
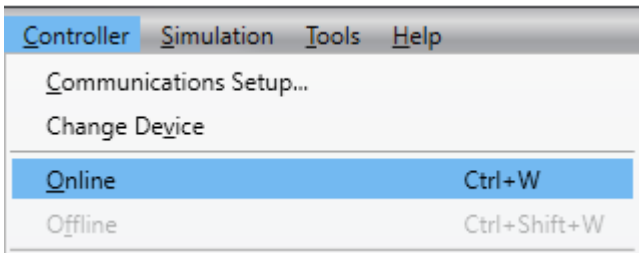
9.2.2. Checking the EtherCAT Network Configuration

Check the EtherCAT network configuration with Sysmac Studio.

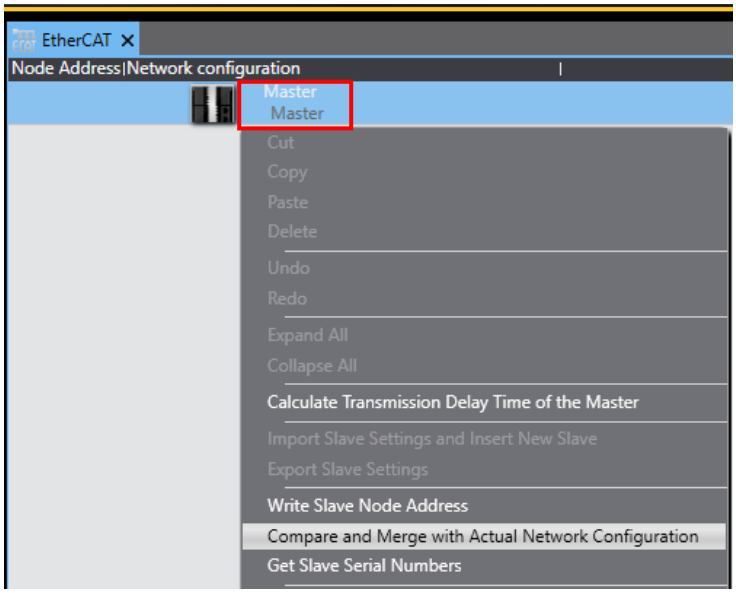
Perform the following steps, and then follow *7.4.5. Transferring the Project Data* and *7.5. Connection Status Check*.

Precautions for Correct Use

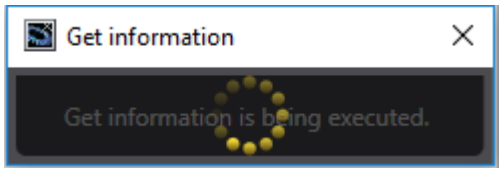
Make sure that the Ethernet cable is connected to both devices before performing the following procedure. If not, turn OFF the devices, and then connect the Ethernet cable.

1	Turn ON Controller.	
2	Double-click **EtherCAT** under **Configurations and Setup** in the Multiview Explorer.	
3	The EtherCAT Tab Page is displayed in the Edit Pane. As a node address 1 slave, E001 SanyoDenki RF2 EtherCAT Rev:0x00000000 is displayed.	
4	Select ***Online*** from the Controller Menu. When an online connection is established, a yellow line is displayed under the toolbar.	

5 Right-click **Master** on the EtherCAT Tab Page, and select ***Compare and Merge with Actual Network Configuration***.

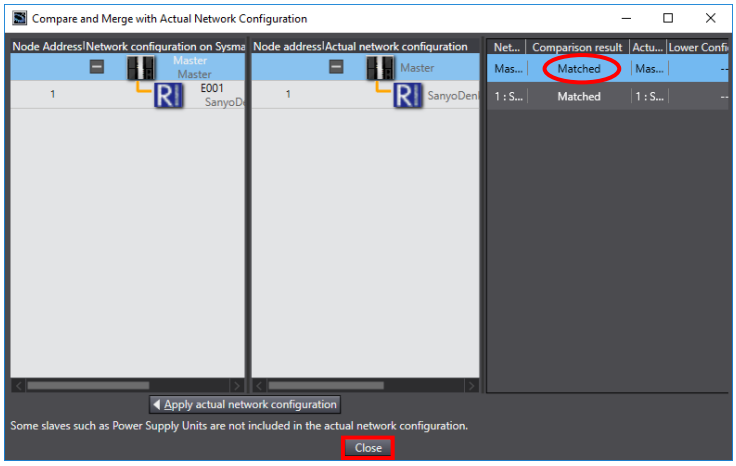


A screen is displayed stating "Get information is being executed".

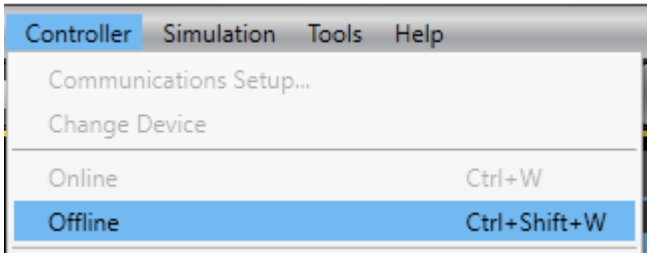


6 The Compare and Merge with Actual Network Configuration Dialog Box is displayed.
Check that the comparison result is "Matched".
Click **Close** to close the dialog box.

*If "Matched" is not displayed as the comparison result, follow the *Precautions for Correct Use* on the next page.



7 Select ***Offline*** from the Controller Menu.



The yellow line under the toolbar disappears.

Precautions for Correct Use

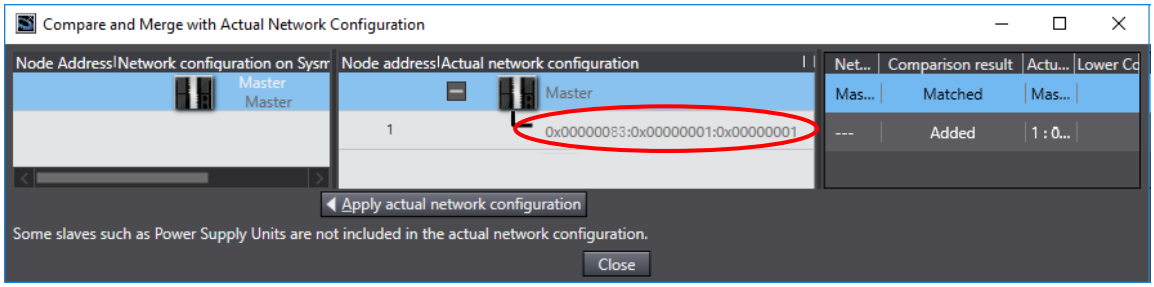
If "Matched" is not displayed as the comparison result, do not click the Apply actual network configuration Button in the Compare and Merge with Actual Network Configuration Dialog Box.

If you click the button, the settings including PDO map settings and axis settings in the project file will be cleared (initialized). If you accidentally click the button, repeat the procedures from *9.2.1. Importing the Project File*. The following screenshots are given only for explanation purposes. The data in the screenshots are different from those obtained with the applicable devices specified in this guide.

If an error occurs, refer to the following troubleshooting tips.

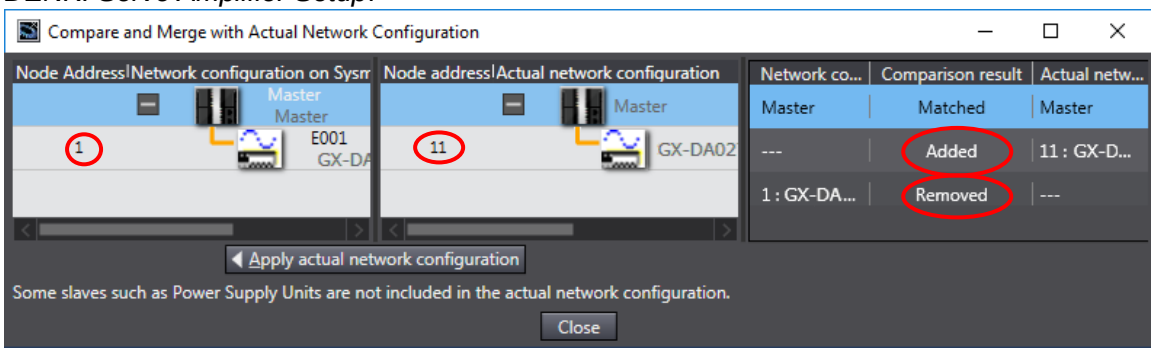
■Error 1 (ESI file error)

If the following dialog box is displayed, the correct ESI file for your Motion Control Device is not installed. Obtain the correct ESI file from the device manufacturer and repeat the procedures from *7.2.3. Installing the ESI File*.



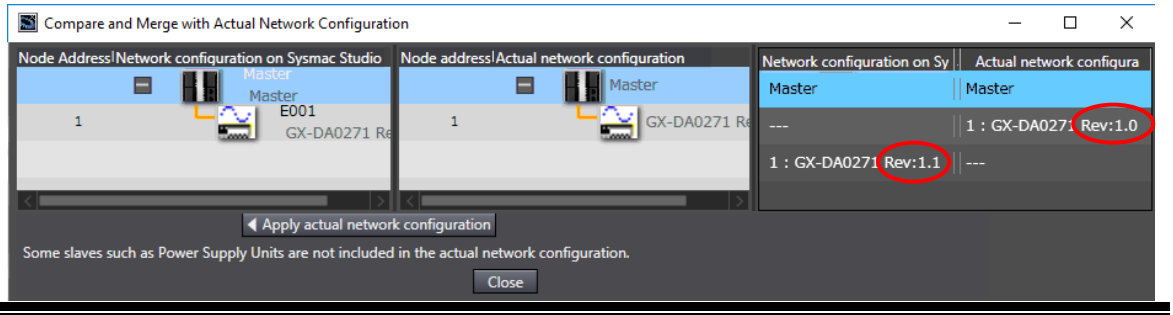
■Error 2 (Node address mismatch)

If the node addresses do not match as shown below, repeat the procedures from *7.3. SANYO DENKI Servo Amplifier Setup*.



■Error 3 (Revision mismatch)

If the revisions do not match as shown below, contact the device manufacturer to see if the ESI file is correct for the Motion Control Device. Or, prepare the device with the same revision as the one described in the ESI file, and repeat the procedures from *7.2.3. Installing the ESI File*.



10. Appendix 2: MC Instructions and PDO Entries

The objects (PDO entries) that can be used for MC instructions have been assigned to the axis variables in the project file used in this guide.
Some objects are neither required to be assigned to axis variables nor to be mapped to PDOs, depending on the MC instructions you use. Refer to this section if you change the project file.

Additional Information

For more information on PDO mappings, MC instructions and parameter settings for motion control, refer to the *NJ/NX-series CPU Unit Motion Control User's Manual* (Cat. No. W507) and the *NJ/NX-series Motion Control Instructions Reference Manual* (Cat. No. W508)

10.1. Required Objects for MC Instructions

To use MC instructions, the following objects have to be mapped to PDOs and be assigned to the axis variables. If even one of the required objects is not set, an error "Required Process Data Object Not Set" (error code 3460 hex) occurs.

Input/Output	Function name of axis variable	Index	PDO entry name
Output	1.Controlword	0x6040	Control word
	3.Target position	0x607A	Target position
Input	22.Statusword	0x6041	Status word
	23.Position actual value	0x6064	Position actual value

Additional Information

If you use a CPU Unit version 1.09 or lower, "Modes of operation" (6060 hex) and "Modes of operation display" (6061 hex) are required to be mapped.
If you use a CPU Unit version 1.10 or higher, the operation differs depending on whether or not "Modes of operation" (6060 hex) and "Modes of operation display" (6061 hex) are mapped. Refer to the *NJ/NX-series Motion Control Instructions Reference Manual* (Cat. No. W508) for details.

10.2. Required Objects for Specific MC Instructions

If you use the following MC instructions, the objects required for those MC instructions have to be mapped to PDOs and be assigned to axis variables.

Output setting

MC instruction	Function name of axis variable	5.Target velocity	7.Target torque	21.Touch probe function (Latch function)	15.Forward torque limit	16.Reverse torque limit
	Index	0x60FF	0x6071	0x60B8	0x60E0	0x60E1
	PDO entry name	Target velocity	Target torque	Touch probe function	Positive torque limit value	Negative torque limit value
MC_Home MC_HomeWithParameter				Conditionally required*1		
MC_MoveFeed				Conditionally required*2		
MC_MoveLink				Conditionally required*3		
MC_TorqueControl			Required			
MC_SetTorqueLimit					Required	Required
MC_TouchProbe				Conditionally required*2		
MC_SyncMoveVelocity		Required				

*1. Setting is not required for the following Homing Operation Modes: "Limit inputs only", "Proximity reverse turn/holding time" and "Zero position preset".
*2. Setting is required when *Mode* is set to Drive Mode.
*3. Setting is required when *LinkOption* (Synchronization Start Condition) is set to _mcTriggerDetection and *Mode* is set to Drive Mode.

Input setting

MC instruction	Function name of axis variable	25.Torque actual value	40.Touch probe status (Latch status)	41.Touch probe pos1 pos value	42.Touch probe pos2 pos value	Digital inputs
	Index	0x6077	0x60B9	0x60BA	0x60BC	0x60FD
	PDO entry name	Torque actual value	Touch probe status	Touch probe pos1 pos value	Touch probe pos2 pos value	Digital inputs
MC_Home MC_HomeWithParameter			Conditionally required*1	Conditionally required*1		Conditionally required*2
MC_MoveFeed			Conditionally required*3	Conditionally required*4	Conditionally required*5	
MC_MoveLink			Conditionally required*6	Conditionally required*7	Conditionally required*8	
MC_TorqueControl		Required				
MC_TouchProbe			Conditionally required*3	Conditionally required*4	Conditionally required*5	

*1. Setting is not required for the following Homing Operation Modes: "Limit inputs only", "Proximity reverse turn/holding time" and "Zero position preset".
*2. Setting is not required for the Homing Operation Mode "Zero position preset".
*3. Setting is required when *Mode* is set to Drive Mode.
*4. Setting is required when *Mode* is set to Drive Mode and *LatchID* is set to _mcLatch1 (Latch 1).
*5. Setting is required when *Mode* is set to Drive Mode and *LatchID* is set to _mcLatch2 (Latch 2).
*6. Setting is required when *LinkOption* (Synchronization Start Condition) is set to _mcTriggerDetection and *Mode* is set to Drive Mode.
*7. Setting is required when *LinkOption* (Synchronization Start Condition) is set to _mcTriggerDetection, *Mode* is set to Drive Mode, and *LatchID* is set to _mcLatch1 (Latch 1).
*8. Setting is required when *LinkOption* (Synchronization Start Condition) is set to _mcTriggerDetection, *Mode* is set to Drive Mode, and *LatchID* is set to _mcLatch2 (Latch 2).

10.3. Digital Inputs Assignment

The assignment of the digital inputs object (60FDh) to the axis variables is described here. Please note that the assignment varies depending on the specifications of the Motion Control Device you use. The table below shows an example of an assignment using OMRON G5 series Servo Amplifiers. For details on each function, refer to the *AC SERVOMOTORS/SERVO DRIVES G5-series WITH BUILT-IN EtherCAT® COMMUNICATIONS User's Manual* (Cat. No. I576).

Function name of axis variable	Description	Assignment for G5 series	Assignment in this guide
28.Forward Drive Prohibition Input	Assign the object that shows the ON/OFF status of the positive limit input	60FDh-00.1	60FDh-00.18
29.Reverse Drive Prohibition Input	Assign the object that shows the ON/OFF status of the negative limit input.	60FDh-00.0	60FDh-00.19
30.Immediate Stop Input	Assign the object that shows the ON/OFF status of the immediate stop input.	60FDh-00.25	60FDh-00.21
32.Encoder Phase Z Detection	Assign the object that shows the ON/OFF status of phase Z.	60FDh-00.16	2100h-00.02
33.Origin Proximity Input	Assign the object that shows the ON/OFF status of the home switch.	60FDh-00.2	60FDh-00.20
37.External Latch Input 1	Assign the object that shows the ON/OFF status of the external latch input 1.	60FDh-00.17	60FDh-00.16
38.External Latch Input 2	Assign the object that shows the ON/OFF status of the external latch input 2.	60FDh-00.18	60FDh-00.17

11. Appendix 3: Program

This section explains the operation check program used in this guide.

11.1. MC Instruction

The MC instruction used in the operation check program is described below.

11.1.1. MC_Power instruction

The MC_Power instruction makes a Servo Drive ready to operate.

Instruction	Meaning	ST expression
MC_Power	Power servo	MC_Power_instance (Axis := parameter, Enable := parameter, Status => parameter, Busy => parameter, Error => parameter, ErrorID =>parameter);

Input variable

Name	Meaning	Data type	Valid range	Default setting	Description
Enable	Enable	BOOL	TRUE or FALSE	FALSE	The device is ready for operation when *Enable* is TRUE, and not ready when it is FALSE.

Output variables

Name	Meaning	Data type	Valid range	Description
Status	Servo ON	BOOL	TRUE or FALSE	TRUE when the device is ready for operation.
Busy	Executing	BOOL	TRUE or FALSE	TRUE when the instruction is acknowledged.
Error	Error	BOOL	TRUE or FALSE	TRUE while there is an error.
ErrorID	Error Code	WORD	*1	It contains the error code when an error occurs. A value of 16#0000*2 indicates normal execution.

*1. Refer to *A-1 Error Codes* of the *NJ/NX-series Motion Control Instructions Reference Manual* (Cat. No. W508).
*2. 16#0000 indicates 0000 in hexadecimal.

In-out variable

Name	Meaning	Data type	Valid range	Description
Axis	Axis	_sAXIS_REF	–	Specify the axis.*1

*1. Specify an axis variable that was created in the Axis Basic Settings of Sysmac Studio. (Default: *MC_Axis****).

11.2. Program (ST Language)

The program written in ST language to check the operation is described below.

11.2.1. Details on the Program

The details on the operation check program are shown below.

Processing

Section	Processing name	Processing
Section 01	Motion Control Device Start/Stop	Changes the value of the start flag for *MC_Power_instance* to TRUE or FALSE according to the value (TRUE or FALSE) of *Input_Start*. Using system-defined variables, determines whether PDO communications is performed normally.
Section 02	Error Operation	Checks the system-defined variables, and detects if a minor fault level error occurs. This processing stops the execution of MC_Power when an error is detected.
Section 03	MC Instruction Execute	Executes *MC_Power_instance*.

Source code

```
(* Section 01: Motion Control Device Start/Stop *)
IF Input_Start
   AND _EC_PDSlavTbl[MC_Axis000.Cfg.NodeAddress]
   AND NOT _EC_CommErrTbl[MC_Axis000.Cfg.NodeAddress] THEN
   IF NOT MC_Axis000.DrvStatus.ServoOn THEN
      Local_Power_Enable:= TRUE;
   END_IF;
ELSE Local_Power_Enable:= FALSE;
END_IF;

(* Section 02: Error Operation *)
IF MC_Axis000.MFaultLvl.Active THEN
   Local_Power_Enable:= FALSE;
END_IF;

(* Section 03: MC Instruction Execute *)
MC_Power_instance(
   Axis  := MC_Axis000,
   Enable := Local_Power_Enable,
   Status => Output_Power_Status,
   Busy => Output_Power_Busy,
   Error => Output_Power_Error,
   ErrorID => Output_Power_ErrorID);
```

11.2.2. Lists of Variables

The variables used in the operation check program are listed below.

Internal variables

Name	Data type	Description
Input_Start	BOOL	This flag is used to execute or stop the function provided by the operation check program. TRUE during the execution. FALSE during the stop.
MC_Power_instance	MC_Power	This is an instance to execute the MC_Power instruction (function block).
Local_Power_Enable	BOOL	This variable is assigned to the *Enable* input variable of the MC_Power instruction. The device is ready for operation when *Enable* is TRUE, and not ready when it is FALSE.
Output_Power_Status	BOOL	This variable is assigned to the *Status* (Servo ON) output variable of the MC_Power instruction. TRUE when the device is ready for operation.
Output_Power_Busy	BOOL	This variable is assigned to the *Busy* (Executing) output variable of the MC_Power instruction. TRUE when the instruction is acknowledged.
Output_Power_Error	BOOL	This variable is assigned to the *Error* output variable of the MC_Power instruction. TRUE while there is an error.
Output_Power_ErrorID	WORD	This variable is assigned to the *ErrorID* output variable of the MC_Power instruction. It contains the error code when an error occurs. A value of 16#0000[*1] indicates normal execution

*1. 16#0000 indicates 0000 in hexadecimal.

External variables

Name	Meaning	Data type	Description
_EC_PDSlavTbl	Process Data Communicating Slave Table	ARRAY[1..192] OF BOOL	This table indicates the slaves that are performing process data communications. Slaves are given in the table in the order of slave node addresses. The element for a slave is TRUE if process data of the corresponding slave is enabled (operational) for both slave inputs and outputs.
_EC_CommErrTbl	Communications Error Slave Table	ARRAY[1..192] OF BOOL	Slaves are given in the table in the order of slave node addresses. The corresponding slave element is TRUE if the master detected an error for the slave.
MC_Axis000	Axis 0	_sAXIS_REF	Axis variable for axis 0
DrvStatus	Servo Amplifier status	_sAXIS_REF_STA_DRV	Gives the status of the Servo Amplifier.
ServoOn	Servo ON	BOOL	TRUE when the Servo Motor is powered.

12. Revision History

Revision code	Date of revision	Description of revision
01	October 2018	First edition

OMRON Corporation **Industrial Automation Company**
Tokyo, JAPAN
Contact: www.ia.omron.com

Regional Headquarters
OMRON EUROPE B.V.
Wegalaan 67-69, 2132 JD Hoofddorp
The Netherlands
Tel: (31)2356-81-300/Fax: (31)2356-81-388

OMRON ELECTRONICS LLC
2895 Greenspoint Parkway, Suite 200
Hoffman Estates, IL 60169 U.S.A
Tel: (1) 847-843-7900/Fax: (1) 847-843-7787

OMRON ASIA PACIFIC PTE. LTD.
No. 438A Alexandra Road # 05-05/08 (Lobby 2),
Alexandra Technopark,
Singapore 119967
Tel: (65) 6835-3011/Fax: (65) 6835-2711

OMRON (CHINA) CO., LTD.
Room 2211, Bank of China Tower,
200 Yin Cheng Zhong Road,
PuDong New Area, Shanghai, 200120, China
Tel: (86) 21-5037-2222/Fax: (86) 21-5037-2200

Authorized Distributor:

Cat. No. P707-E1-01 1018-(1018)