OMRON

Machine Automation Controller NJ-series

EtherCAT Connection Guide

OMRON Corporation

GRT1-ECT SmartSlice

Network Connection Guide

SYSMAC always in control

P524-E1-01

Table of Contents

1. Related Manuals

The table below lists the manuals related to this document.
To ensure system safety, make sure to always read and heed the information provided in all Safety Precautions, Precautions for Safe Use, and Precaution for Correct Use of manuals for each device which is used in the system.

Cat. No.	Model	Manual name
W500	NJ501-[][][][] NJ301-[][][][]	NJ-series CPU Unit Hardware User's Manual
W501	NJ501-[][][][] NJ301-[][][][]	NJ-series CPU Unit Software User's Manual
W505	NJ501-[][][][] NJ301-[][][][]	NJ-series CPU Unit Built-in EtherCAT Port User's Manual
W504	SYSMAC-SE2[][][]	Sysmac Studio Version 1 Operation Manual
W455	GRT1 series	SmartSlice GRT1 Series Slice I/O Units Operation Manual
W18E	GRT1-ECT	GRT1-series EtherCAT Communication Unit Operation Manual

2. Terms and Definition

Terms	Explanation and Definition
PDO Communications (Communications using Process Data Objects)	This method is used for cyclic data exchange between the master unit and the slave units PDO data (i.e., I/O data that is mapped to PDOs) that is allocated in advance is refreshed periodically each EtherCAT process data communications cycle (i.e., the period of primary periodic task). The NJ-series Machine Automation Controller uses process data communications for commands to refresh I/O data in a fixed control period, including I/O data for EtherCAT Slave Units, and the position control data for Servomotors. It is accessed from the NJ-series Machine Automation Controller in the following ways. •With device variables for EtherCAT slave I/O •With Axis Variables for Servo Drive and encoder input slaves to which assigned as an axis.
SDO Communications (Communications using Service Data Objects)	This method is used to read and write the specified slave unit data from the master unit when required. The NJ-series Machine Automation Controller uses SDO communications for commands to read and write data, such as for parameter transfers, at specified times. The NJ-series Machine Automation Controller can read/write the specified slave data (parameters and error information, etc.) with the EC_CoESDORead (Read CoE SDO) instruction or the EC_CoESDOWrite (Write CoE SDO) instruction.
Slave Unit	There are various types of slaves such as Servo Drives that handle position data and I/O terminals that control the bit signals. The slave receives output data sent from the master, and transmits input data to the master.
Node address	An address to identify the unit connected to the EtherCAT.
ESI file (EtherCAT Slave Information file)	The ESI files contain information unique to the EtherCAT slaves in XML format. Install an ESI file into the Sysmac Studio, to allocate slave process data and make other settings.

3. Remarks

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

(2) To ensure system safety, always read and heed the information provided in all Safety Precautions, Precautions for Safe Use, and Precaution for Correct Use of manuals for each device used in the system.

(3) The users are 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 of or whole of this document without the permission of OMRON Corporation.

(5) This document provides the latest information as of December 2012. The information contained in this document is subject to change for improvement without notice.

The following notation is used in this document.

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

Precautions for Safe Use

Indicates precautions on what to do and what not to do to ensure using the product safely.

Precautions for Correct Use

Indicates precautions on what to do and what not to do to ensure proper operation and performance.

Additional Information

Provides useful information.
Additional information to increase understanding or make operation easier.

Symbols

The circle and slash symbol indicates operations that you must not do.
The specific operation is shown in the circle and explained in text.
This example indicates prohibiting disassembly.

The triangle symbol indicates precautions (including warnings).
The specific operation is shown in the triangle and explained in text.
This example indicates a precaution for electric shock.

The triangle symbol indicates precautions (including warnings).
The specific operation is shown in the triangle and explained in text.
This example indicates a general precaution.

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

4. Overview

This document describes the procedure for connecting the SmartSlice (GRT1-ECT) of OMRON Corporation (hereinafter referred to as OMRON) to NJ-series Machine Automation Controller (hereinafter referred to as Controller) on the EtherCAT and provides the procedure for checking their connection.
Refer to *Section 7 Connection Procedure* to understand the setting method and key points to connect the devices via EtherCAT.

5. Applicable Devices and Support Software

5.1. Applicable Devices

The applicable devices are give below.

Manufacturer	Name	Model	Version
OMRON	NJ series CPU Unit	NJ501-[][][][] NJ301-[][][][]	Versions listed in Section 5.2 and higher versions
OMRON	SmartSlice EtherCAT Communications Unit	GRT1-ECT	
OMRON	SmartSlice Slice I/O Unit		
	Digital Input Unit	GRT1-ID[](-1)	
		GRT1-IA4-[]	
	Digital Output Unit	GRT1-OD[](-1)	
		GRT1-ROS2	
	Analog Input Unit	GRT1-AD2	
	Analog Output Unit	GRT1-DA2[]	
	Temperature Input Unit	GRT1-TS2P(K)	
	Counter Unit	GRT1-CT1(-1)	
	Positioning Unit	GRT1-CP1-L	
	Turnback Unit	GRT1-TBR	
		GRT1-TBL	
	I/O Power Feed Unit	GRT1-PD2[]	
		GRT1-PD8(-1)	
	I/O Power Connection Unit	GRT1-PC8(-1)	

Additional Information

As applicable devices above, the devices listed in Section 5.2. are actually used in this document to check the connection. When using devices not listed in Section 5.2, check the connection by referring to the procedure in this document.

Additional Information

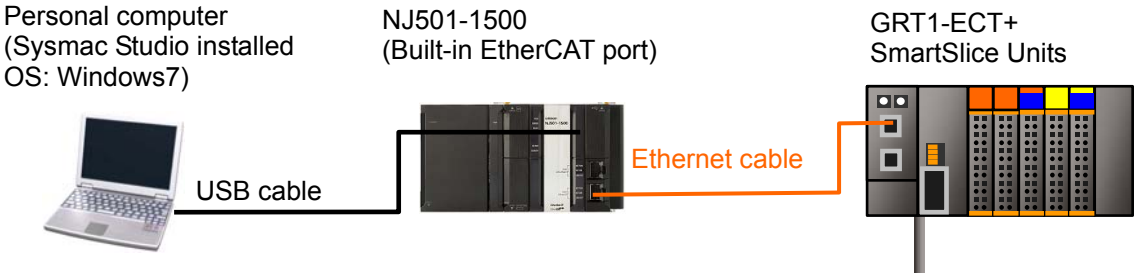
This document describes the procedure to establish the network connection. It does not provide information about operation, installation nor wiring method of each device.
For details on the products (other than communication connection procedures) listed above, refer to the manuals for the corresponding products or contact your OMRON representative.

Additional Information

You can connect devices with the versions listed in Section 5.2 or higher versions.
For devices whose versions are not listed in Section 5.2, versions are not managed or there is no version restriction.
To connect a device whose model number is not listed in Section 5.2, use the same version of the device that is listed.

5.2. Device Configuration

The hardware components to reproduce the connection procedure in this document are as follows.



Manufacturer	Name	Model	Version
OMRON	CPU Unit (Built-in EtherCAT port)	NJ501-1500	Ver.1.03
OMRON	Power Supply Unit	NJ1W-PA3001	
OMRON	Sysmac Studio	SYSMAC-SE2[][][]	Ver.1.04
-	Personal computer (OS:Windows7)	-	
-	USB cable (USB 2.0 type B connector)	-	
OMRON	Ethernet cable (with industrial Ethernet connector)	XS5W-T421-[]M[]-K	
OMRON	SmartSlice EtherCAT Communication Unit	GRT1-ECT	Ver.2.1
OMRON	SmartSlice Digital Input Unit	GRT1-ID8 GRT1-ID4	
OMRON	SmartSlice Analog Input Unit	GRT1-AD2	
OMRON	SmartSlice Digital Output Unit	GRT1-OD4	
OMRON	SmartSlice Analog Output Unit	GRT1-DA2V	
OMRON	SmartSlice End Unit	GRT1-END	

Precautions for Correct Use

The connection line of EtherCAT communication cannot be shared with other networks, such as Ethernet or EtherNet/IP.

The switching hub for Ethernet cannot be used for EtherCAT.

Please use the cable of Category 5 or higher, double-shielded with aluminum tape and braided shielding and the 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 the Sysmac Studio to the version specified in this section or higher version using the auto update function.

If a version not specified in this section is used, the procedures described in Section 7 and subsequent sections may not be applicable. In that case, use the equivalent procedures described in the *Sysmac Studio Version 1 Operation Manual* (Cat.No. W504).

Additional Information

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

Additional Information

The system configuration in this document uses USB for the connection between the personal computer and the Controller. For information on how to install a USB driver, refer to *A-1 Driver Installation for Direct USB Cable Connection* of the *Sysmac Studio Version 1 Operation Manual* (Cat.No. W504).

6. EtherCAT Settings

This section provides specifications such as communications parameters and variable names that are defined in this document.
Hereinafter, the SmartSlice is referred to as the “destination device” or “Slave Unit" in some descriptions.

6.1. EtherCAT Communications Settings

The setting required for EtherCAT communications is as follows.

	GRT1-ECT
Node address	01

6.2. Assignment of EtherCAT Communications

The following table shows the arrangement of the SmartSlice I/O Units.

Unit No.		#1	#2	#3	#4	#5	
Unit Type	EtherCAT Unit	Digital Input Unit	Digital Input Unit	Analog Input Unit	Digital Output Unit	Analog Output Unit	End Unit
Model	GRT1-ECT	GRT1-ID8	GRT1-ID4	GRT1-AD2	GRT1-OD4	GRT1-DA2V	GRT1-END

I/O range setting of the Analog I/O Units

	GRT1-AD2	GRT1-DA2V
I/O range	0 to 5V (Default)	0 to 5V (Default)
I/O range setting method	ON: Set with the DIP switch.	ON: Set with the DIP switch.

The device variables of the destination device are allocated to Controller's device variables.
The relationship between the device data and the device variables is shown below.

■Output area (Controller → Destination device)

Destination device data	Device variable name	Data type
#4 GRT1-OD4 Output 0	E001_DO001	BOOL
#4 GRT1-OD4 Output 1	E001_DO002	BOOL
#4 GRT1-OD4 Output 2	E001_DO003	BOOL
#4 GRT1-OD4 Output 3	E001_DO004	BOOL
#5 GRT1-DA2V Output 0	E001_AO001	INT
#5 GRT1-DA2V Output 1	E001_AO002	INT

■Input area (Controller ← Destination device)

Destination device data	Global variable name	Data type
#1 GRT1-ID8 Input 0	E001_DI001	BOOL
#1 GRT1-ID8 Input 1	E001_DI002	BOOL
#1 GRT1-ID8 Input 2	E001_DI003	BOOL
#1 GRT1-ID8 Input 3	E001_DI004	BOOL
#1 GRT1-ID8 Input 4	E001_DI005	BOOL
#1 GRT1-ID8 Input 5	E001_DI006	BOOL
#1 GRT1-ID8 Input 6	E001_DI007	BOOL
#1 GRT1-ID8 Input 7	E001_DI008	BOOL
#2 GRT1-ID4 Input 0	E001_DI009	BOOL
#2 GRT1-ID4 Input 1	E001_DI010	BOOL
#2 GRT1-ID4 Input 2	E001_DI011	BOOL
#2 GRT1-ID4 Input 3	E001_DI012	BOOL
#3 GRT1-AD2 Input 0	E001_AI001	INT
#3 GRT1-AD2 Input 1	E001_AI002	INT

■Details of the status allocation (Controller ← Destination device)

Destination device data		Global variable name	Data type
Communications Unit status		E001_Communication_Unit_Status	WORD
	Slice I/O Bus communication error flag	E001_Bus_Communication_Error	BOOL
	Slice I/O Unit warning flag	E001_Unit_Warning	BOOL
	Slice I/O Unit alarm flag	E001_Unit_Alarm	BOOL
	Unit maintenance flag	E001_Unit_Maintenance	BOOL
	Automatic restore monitor flag	E001_Restore_Monitor	BOOL
	Communication Unit error flag	E001_Unit_Error	BOOL
	I/O refreshing flag	E001_Refreshing	BOOL

7. Connection Procedure

This section describes the procedure for connecting the Controller to the SmartSlice via EtherCAT.

This document explains the procedures for setting up the Controller and SmartSlice from the factory default setting. For the device initialization, refer to *Section 8 Initialization Method*.

7.1. Work Flow

The following is the procedure for connecting to the EtherCAT.

7.2. Setting Up the SmartSlice	Set up the SmartSlice.
↓	
7.2.1 Hardware Settings	Set the hardware switches of the SmartSlice.
↓	
7.3. Setting Up the Controller	Set up the Controller.
↓	
7.3.1 Starting the Sysmac Studio and Setting EtherCAT Network Configuration	Start the Sysmac Studio and set the EtherCAT network configuration.
↓	
7.3.2 Setting the Device Variables	Set device variables to use for the EtherCAT Slave Unit.
↓	
7.3.3. Transferring the Project Data	Transfer the project data from the Sysmac Studio to the Controller.
↓	
7.4. Connection Status Check	Check the EtherCAT network connection status.
↓	
7.4.1 Checking the Connection Status	Confirm that EtherCAT communications are performed normally.
↓	
7.4.2 Checking Data that are Sent and Received	Confirm that the correct data are sent and received.

7.2. Setting Up the SmartSlice

Set up the SmartSlice.

7.2.1. Hardware Setting

Set the hardware switches of the SmartSlice.

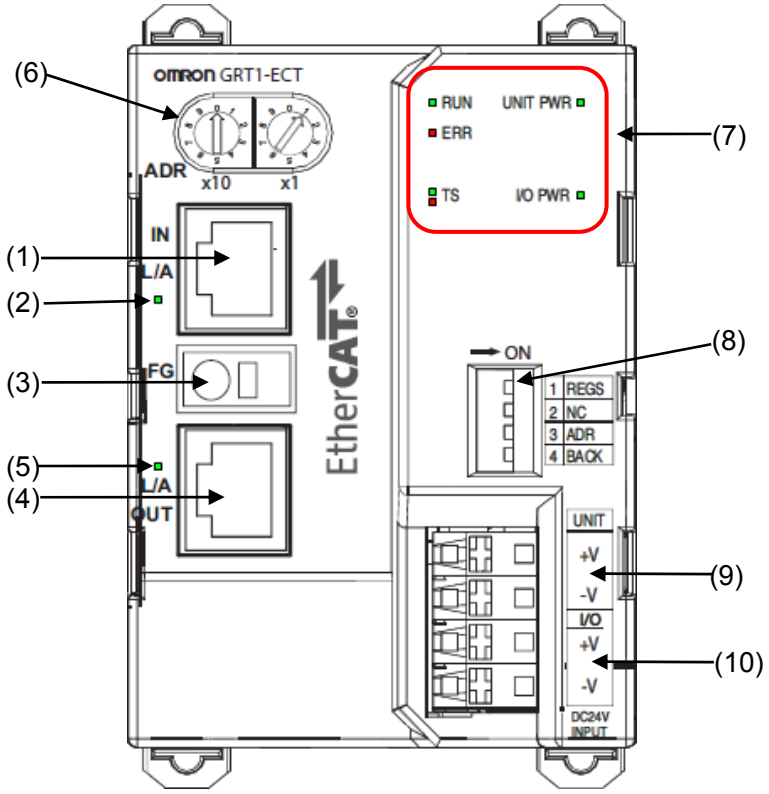
Precautions for Correct Use

Make sure that the power supply is OFF when you perform the settings.

1 Make sure that the power supply to the SmartSlice is turned OFF.

*If the power supply is turned ON, settings may not be applicable as described in the following procedure.

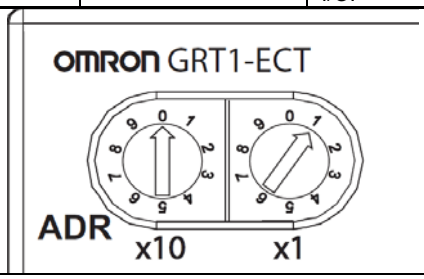
2 Refer to the right figure and check the hardware switches located on the front panel of the SmartSlice EtherCAT Communication Unit.



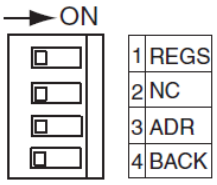
No.	Name	Function
(1)	EtherCAT connector IN port	
(2)	Link/Activity LED IN port	
(3)	Shielding Terminal	
(4)	EtherCAT connector OUT port	
(5)	Link/Activity LED OUT port	

(6)	Rotary switches	Set the Unit's address of the EtherCAT Slave. Set a decimal node address between 0 and 99.
(7)	Indicators	Refer to 7.4.1. Checking the Connection Status for details.
(8)	DIP Switch	Sets the I/O allocation method and registers the I/O Unit configuration information. SW1 (REGS):Create/enable registration table. SW2 (NC):Not used, set to OFF SW3 (ADR):Automatic restore SW4 (BACK):Backup trigger
(9)	Unit power supply terminals	Connect the power supply for the Unit's internal circuits and the connected SmartSlice I/O Units' internal circuits.
(10)	I/O power supply terminals	Connect the power supply for the connected SmartSlice I/O Units' external I/O.

3 Set the rotary switches (node address setting switches) to 01.



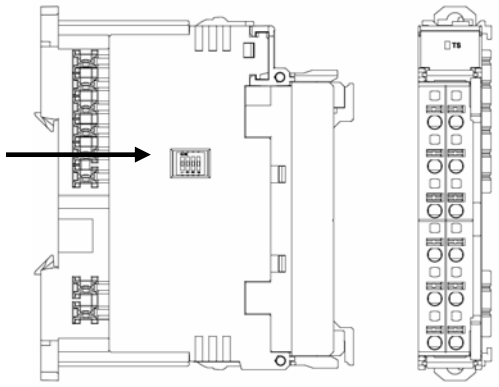
4 Confirm that all DIP switch pins are set to OFF (default).



Pin 1 ON:Registered table is enabled
OFF:Registered table is disabled
OFF to ON:Register I/O unit table
ON to OFF:Clear registered I/O unit table
Pin 2 OFF: Not used.
Pin 3 OFF: Automatic restore disabled.
OFF to ON:When the SmartSlice I/O Units are replaced, the parameter data that was backed up with the BACK dipswitch is automatically restored.
Pin 4 ON to OFF to ON in 3 s:
Parameter data of all connected SmartSlice I/O Units is backed up.

5 Set the DIP switch pins of the Analog I/O Unit.

DIP Switch
Used to set Input/output range.



GRT1-AD2

Pins 1 to 3 :OFF (Default)
Pin 4 :ON

Pin No.	Setting	Specifications
1	Input Terminal: Input range setting for Inputs 0 and 1.	Default setting:All pins OFF
2		
3		
4	Input range setting method	OFF: Set using Setting Tool. ON: Set using DIP switch. (The DIP switch settings are disabled when this pin is OFF, i.e., when the Setting Tool is used.) Note Default setting:OFF

GRT1-DA2V

Pin 1 to 2 :OFF (Default)
Pin 3 :OFF (Fixed)
Pin 4 :ON

Pin No.	Setting	Specifications
1	Set the output range for Outputs 0 and 1.	Default setting:All pins OFF
2		
3	Reserved	Fixed at OFF.
4	Set the range setting method.	OFF: Set using Setting Tool. ON: Set using DIP switch. Default setting:OFF

6 Mount the Units from the left in the following order.

GRT1-ECT
GRT1-ID8
GRT1-ID4
GRT1-AD2
GRT1-OD4
GRT1-DA2V
GRT1-END

*For information on how to mount Units, refer to *3-1-1 Connecting the Communications Unit and Slice I/O Units* in the *SmartSlice GRT1 Series Slice I/O Units Operation Manual* (Cat. No. W455).

7 Connect the power cable to the Unit power supply terminals and I/O power supply terminals, and connect the Ethernet cable to the EtherCAT connector IN port.

8

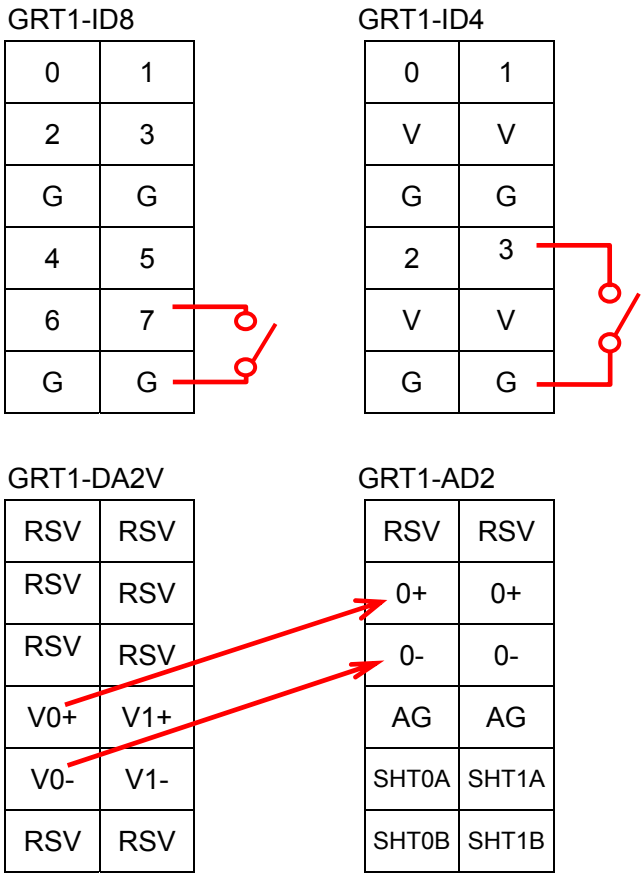
Wire I/O for 7.4.2. Checking Data That Are Sent and Received.

Connect a switch between input terminal 7 and G of GRT1-ID8.

Connect a switch between input terminal 3 and G of GRT1-ID4.

Refer to the figure on the right and connect DA output 0 of GRT1-DA2V to AD input 0 of GRT1-AD2.

*Wiring to the terminal block is necessary for 7.4.2. Checking Data That Are Sent and Received. Please note that the wiring is not necessary to perform EtherCAT communications.



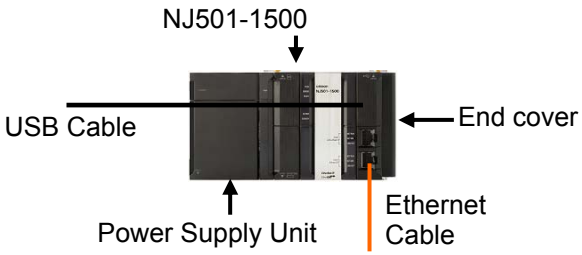
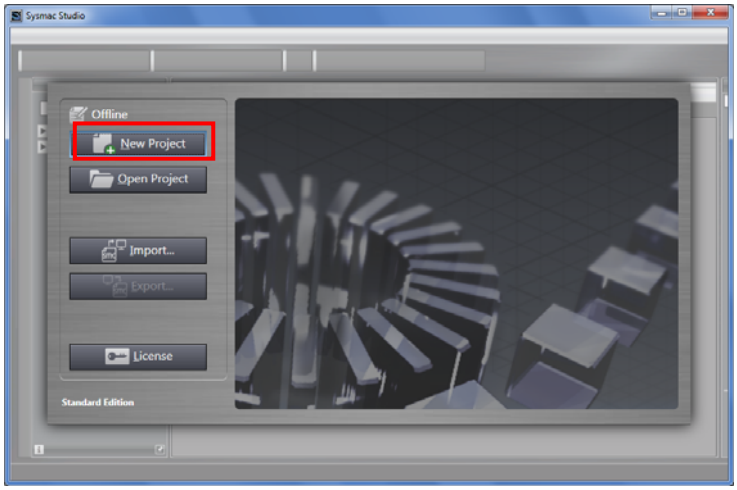
7.3. Setting Up the Controller

Set up the Controller.

7.3.1. Starting the Sysmac Studio and Setting the EtherCAT Network Configuration

Start the Sysmac Studio and set the EtherCAT network configuration.

Install the software and USB driver in the personal computer beforehand.

1	Connect the Ethernet cable to the built-in EtherCAT port (PORT2) of the Controller, and connect the USB cable to the peripheral (USB) port. As shown in 5.2. Device Configuration, connect the personal computer, SmartSlice to the Controller. Turn ON the power supply to the Controller.	
2	Start the Sysmac Studio. Click the **New Project** Button. *If a dialog box is displayed at start confirming the access right, select an option to start.	

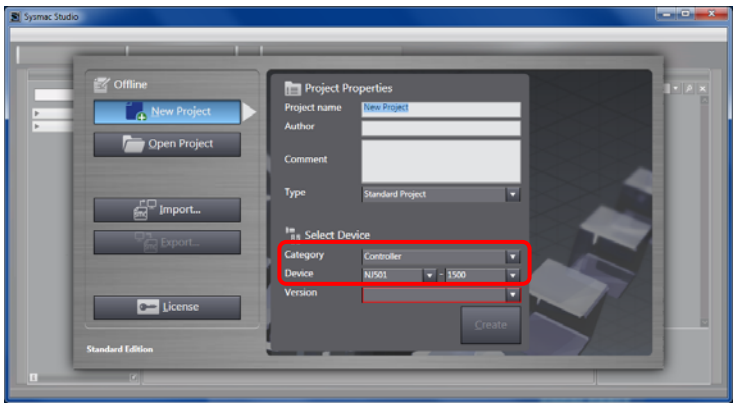
3 The Project Properties Dialog Box is displayed.

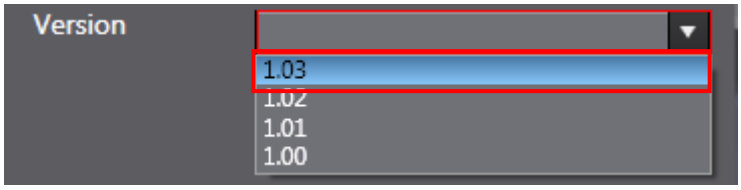
*In this document, New Project is set as the project name.

Confirm that the Category and Device are correctly set in the Select Device Field.

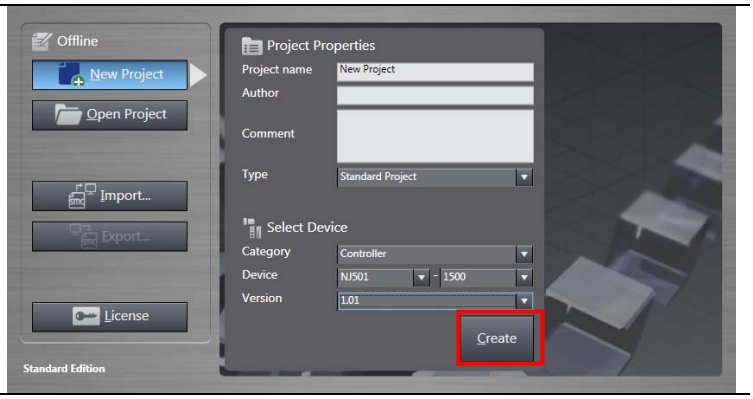
Select *1.03* from the Version pull-down menu.

*Although version 1.03 is selected in this document, select the version you use.

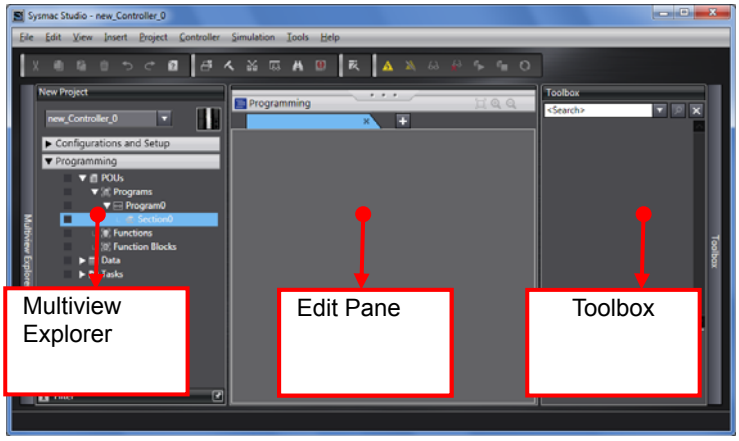




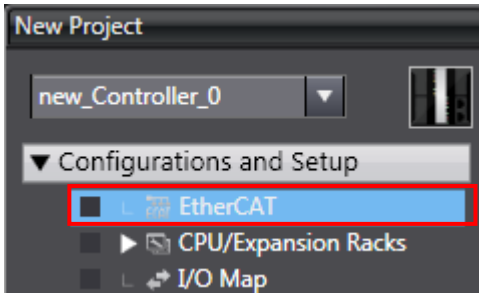
4 Click the **Create** Button.

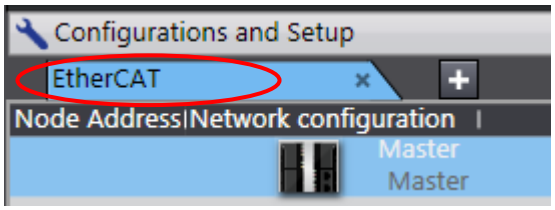
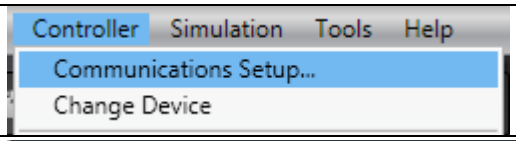
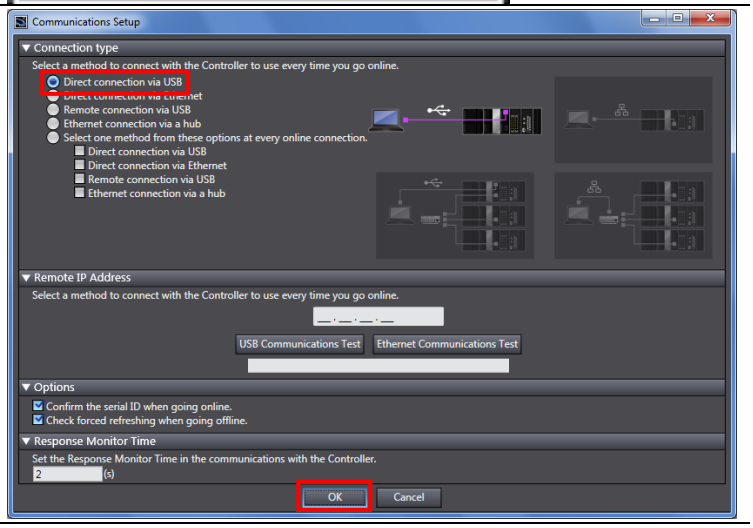
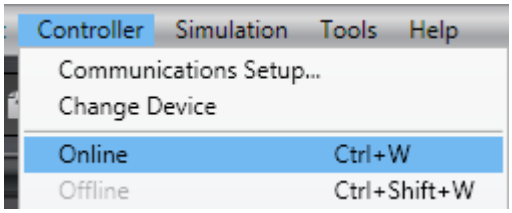
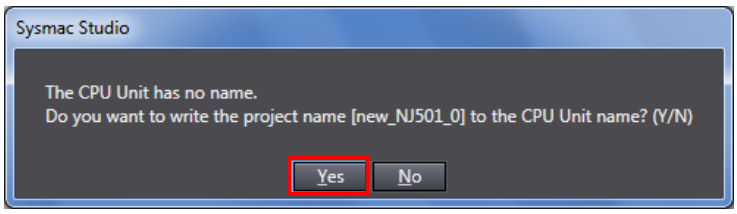


5 The New Project is displayed. The left pane is called Multiview Explorer, the right pane is called Toolbox and the middle pane is called Edit Pane.



6 Double-click **EtherCAT** under **Configurations and Setup** in the Multiview Explorer.

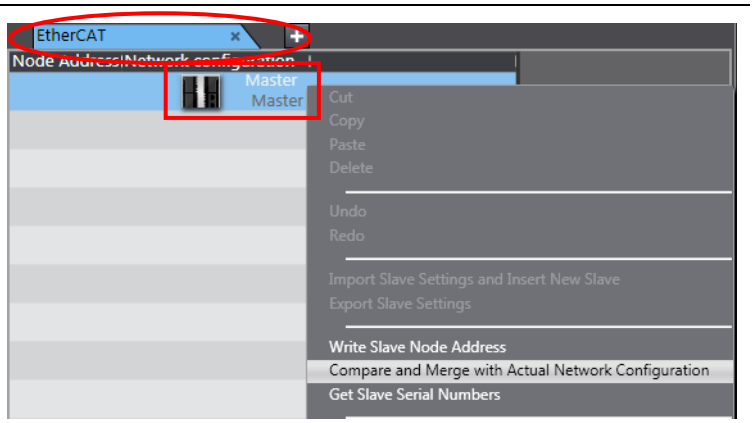


7	The EtherCAT Tab is displayed in the Edit Pane.	
8	Select ***Controller*** - ***Communications Setup***.	
9	The Communications Setup Dialog Box is displayed. Select the *Direct Connection via USB Option* from Connection Type. Click the **OK** Button.	
10	Select ***Online*** from the Controller Menu. A confirmation dialog is displayed. Click the **Yes** Button. *The displayed dialog depends on the status of the Controller used. Select the **Yes** Button to proceed with the processing.	 
11	When an online connection is established, a yellow bar is displayed on the top of the Edit Pane.	

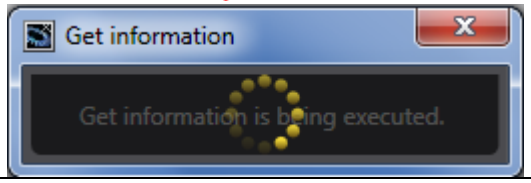
Additional Information

For details on the online connections to a Controller, refer to *Section 5 Going Online with a Controller* in the *Sysmac Studio Version 1 Operation Manual* (Cat. No. W504).

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

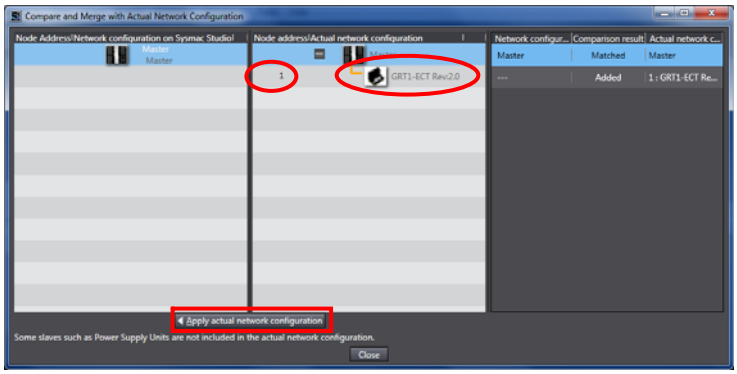


A screen is displayed stating "Get information is being executed".

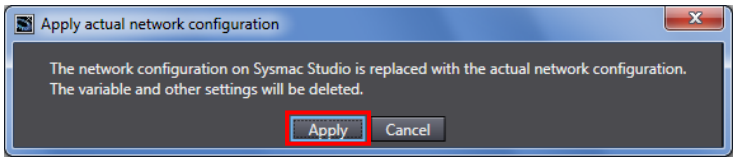


13 The Compare and Merge with Actual Network Configuration Pane is displayed.
Node address 1 and GRT1-ECT Rev:2.0 are added to the actual network configuration of the comparison result.

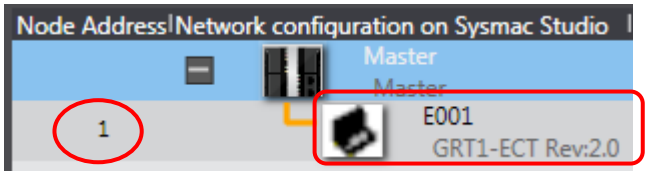
Click the **Apply actual network configuration** Button.



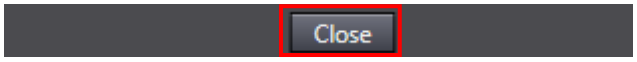
14 A confirmation dialog box is displayed. Click the **Apply** Button.



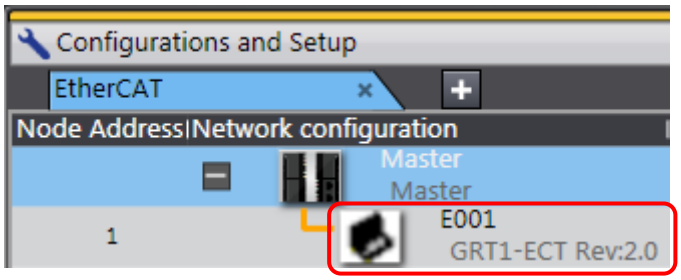
Node address 1 and E001 GRT1-ECT Rev:2.0 are added to the network configuration of the Sysmac Studio.



Click the **Close** Button.

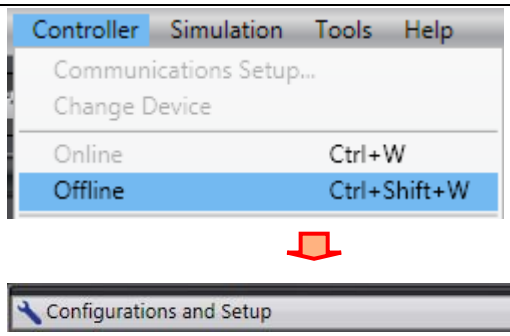
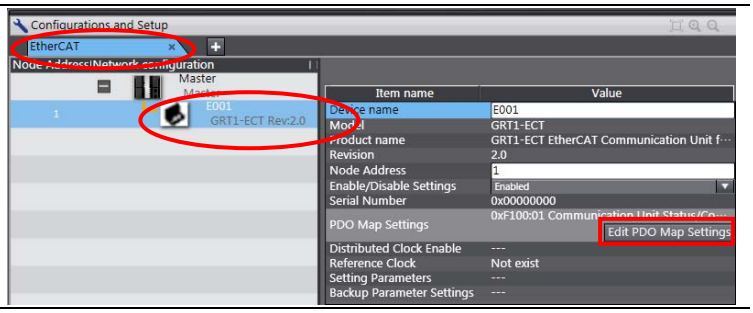
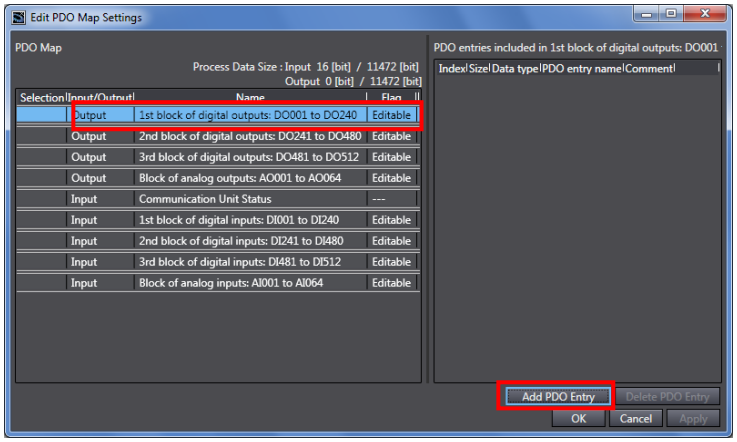


15 Node address 1 and E001 GRT1-ECT Rev:2.0 are added to the EtherCAT Tab Page in the Edit Pane.



7.3.2. Setting the Device Variables

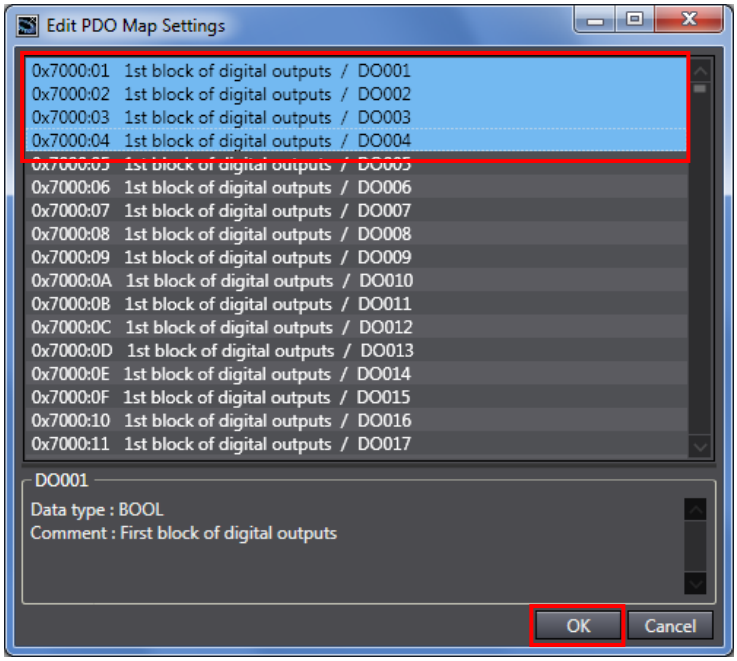
Set the device variables used for the EtherCAT Slave Unit.

1	Select ***Offline*** from the Controller Menu. The yellow bar on the top of the Edit Pane disappears.	
2	Select *E001* from the EtherCAT Tab Page of the Edit Pane. The PDO map settings are displayed on the right side of the Pane.	
3	The Edit PDO Map Settings Window is displayed. Set digital outputs. Select *Output 1st block of digital outputs: DO001 to DO240* and click the **Add PDO Entry** Button.	

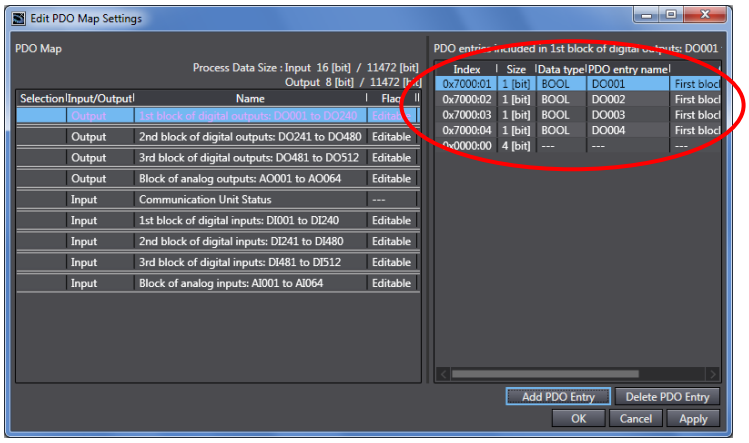
4 Register the output points of the connected SmartSlice Digital Output Unit.

In this document, unit number 4 is allocated to the GRT1-OD4 Digital Output Unit. Thus, there are 4 output points. Register *DO001* to *DO004*.
Select items from *0x7000:01 1st block of digital outputs / DO001* to *0x7000:04 1st block of digital outputs / DO004*, and click the **OK** Button.

*To select multiple items, select *0x7000:01 1st block of digital outputs / DO001*, hold down the Shift Key, then click *0x7000:04 1st block of digital outputs / DO004*.

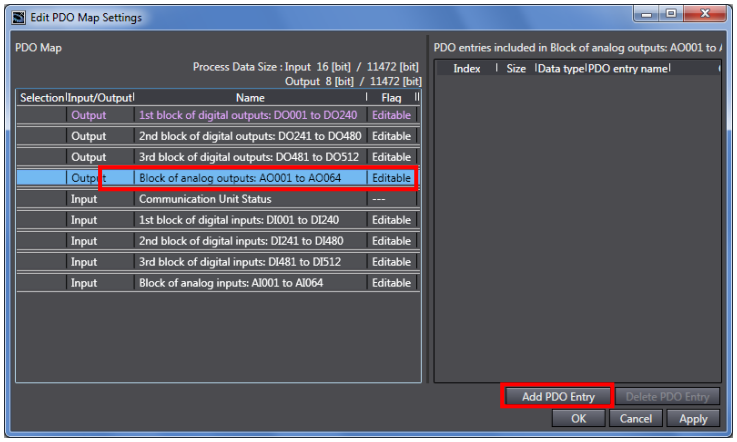


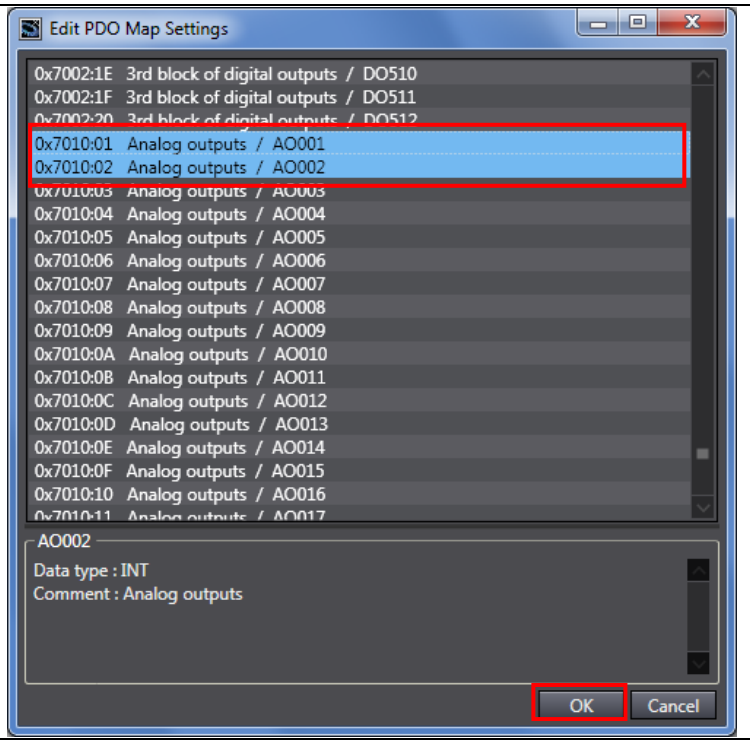
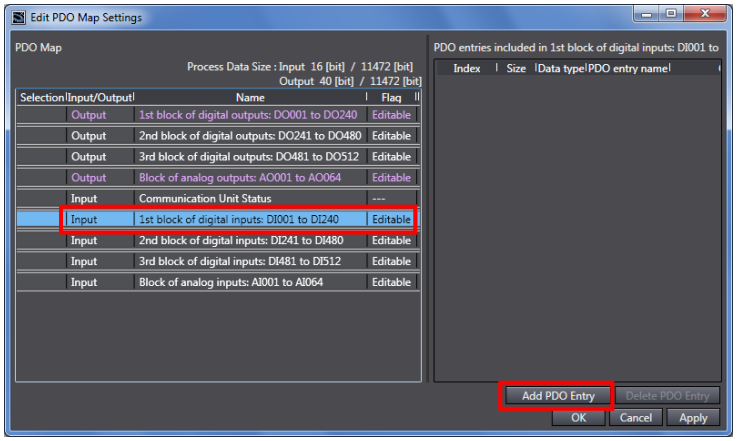
5 Confirm that *DO001* to *DO004* are registered in the PDO entries included in *1st block of digital outputs DO001* to *DO240*.

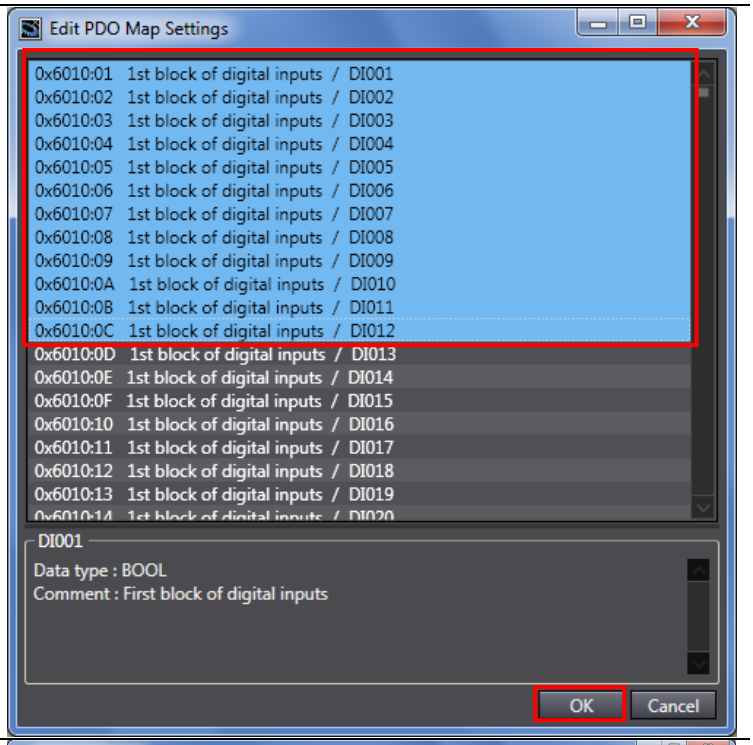
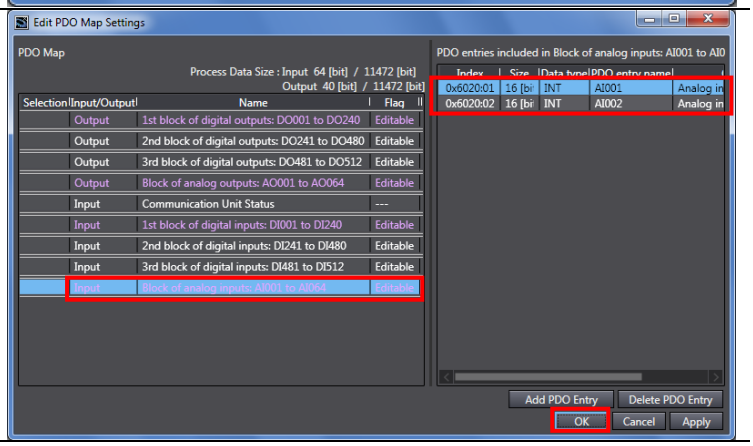
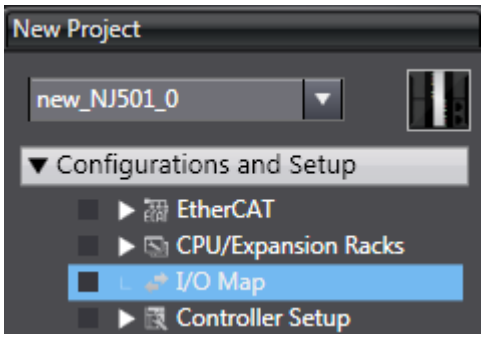


6 Next, set the analog outputs.

Select *Output Block of analog outputs:AO001 to AO64* and click the **Add PDO Entry** Button.

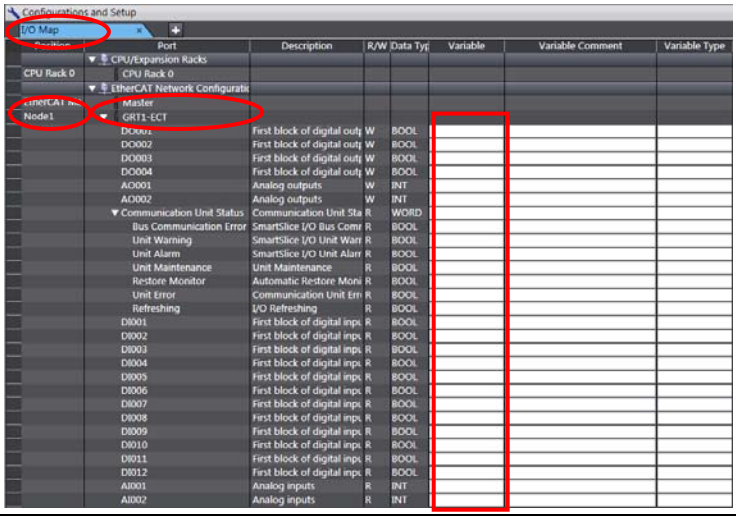


7	Register the output points of the connected SmartSlice Analog Output Unit. In this document, unit number 5 is allocated to the GRT1-DA2V Analog Output Unit. Thus, there are 2 output points. Register *AO001* to *AO002*. All output entries including digital and analog outputs are displayed. Scroll the screen and select *0x7010:01 Analog outputs / AO001* and *0x7010:02 Analog outputs / AO002*, and click the **OK** Button.	
8	Set the digital input. Select *Input Block of digital inputs:DI001* to *DI240* and click the **Add PDO Entry**.	

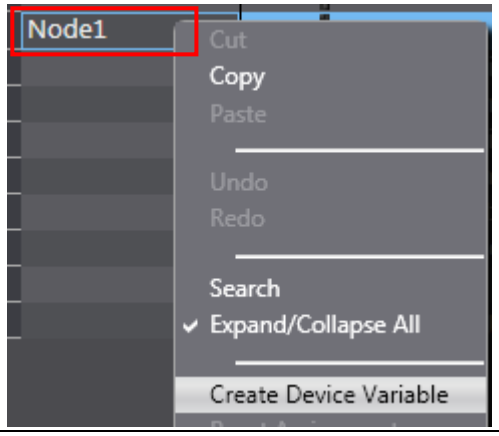
9	Register the input points of the connected SmartSlice Digital Input Unit. In this document, unit number 1 is allocated to the GRT1-ID8 Digital Input Unit and unit number 2 is allocated to GRT1-ID4 Digital Input Unit. Thus, there is a total of 12 input points. Register *DI001* to *DI012*. Select the entries from *0x6010:01 1st block of digital inputs / DI001* to *0x6010:0C 1st block of digital inputs / DI012*, and click the **OK** Button.	
10	Set analog inputs in the same way. In *Input Block of analog inputs:AI001 to AI64*, register *0x6020:01 Analog inputs / AI001* and *0x6020:02 Analog inputs / AI002*. Confirm that all inputs are registered and click the **OK** Button.	
11	Double-click **I/O Map** under **Configurations and Setup** on the Multiview Explorer.	

12 The I/O Map Tab is displayed on the Edit Pane.
Confirm that Node1 and the Slave Unit is displayed in columns under Position.

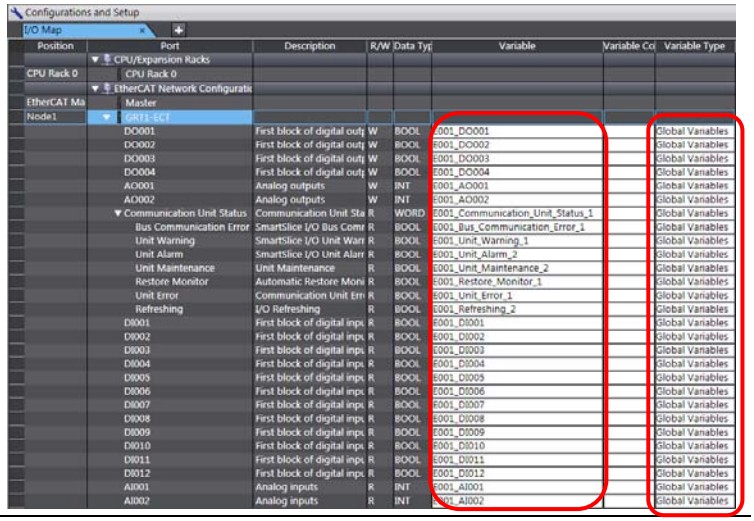
*To assign your own variable name for the slave, click the corresponding area and enter a name.



13 Right-click **Node1** and select ***Create Device Variable***.



14 The Variable names and Variable Types are automatically set.



Additional Information

The device variable names are created automatically from a combination of the device names and the I/O port names.
For slave units, the default device names start with an "E" followed by a sequential number starting from "001".

Additional Information

Although the device variable names are automatically created by slaves in the example above, they can be automatically created by I/O ports.
Also, you can set any device variables.

7.3.3. Transferring Project Data

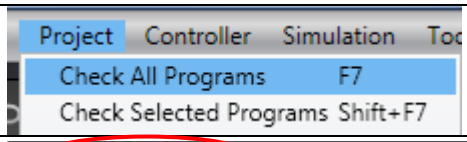
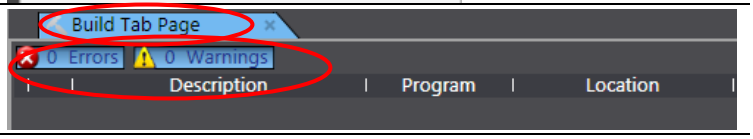
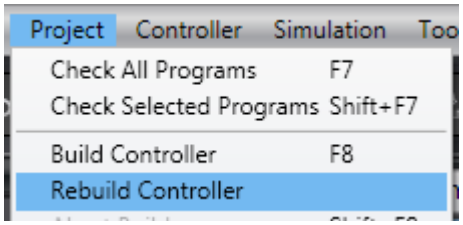
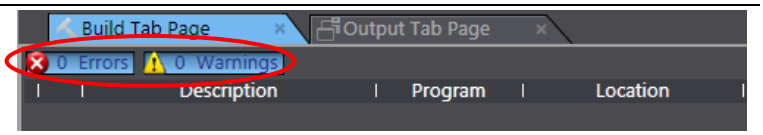
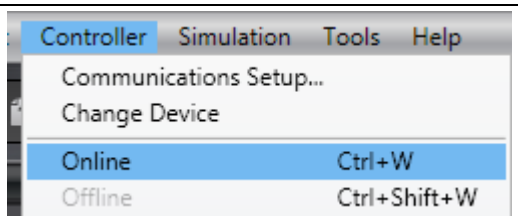
Transfer the project data from the Sysmac Studio to the Controller.

⚠ WARNING

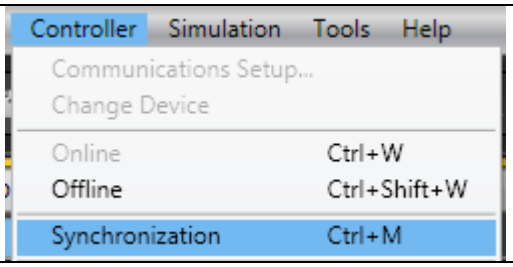
Always confirm safety at the destination node before you transfer a user program, configuration data, setup data, device variables, or values in memory used for CJ-series Units from the Sysmac Studio.
The devices or machines may perform unexpected operation regardless of the operating mode of the CPU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

⚠ Caution

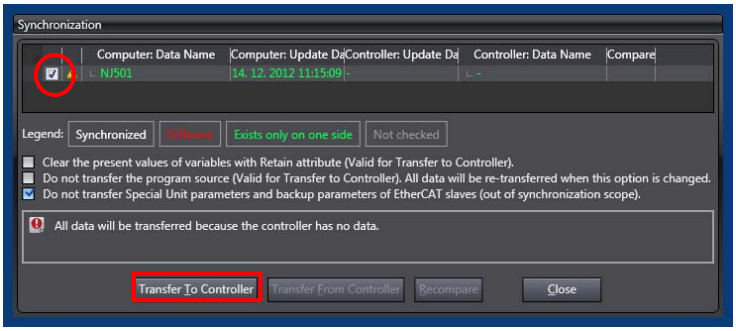
After you transfer the user program, the CPU Unit is restarted and communications with the EtherCAT slaves are cut off for a maximum of 45 seconds. During that period, the slave outputs behave according to the slave settings. Before you transfer the user program, confirm that the system will not be adversely affected.

1	Select ***Check All Programs*** from the Project Menu.	
2	The Build Tab Page is displayed in the Edit Pane. Confirm that “0 Errors” and “0 Warnings” are displayed.	
3	Select ***Rebuild Controller*** from the Project Menu.	
4	Confirm that “0 Errors” and “0 Warnings” are displayed in the Build Tab Page.	
5	Select ***Online*** from the Controller Menu.	

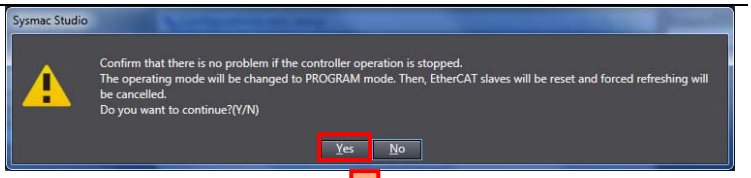
6 Select ***Synchronization*** from the Controller Menu.



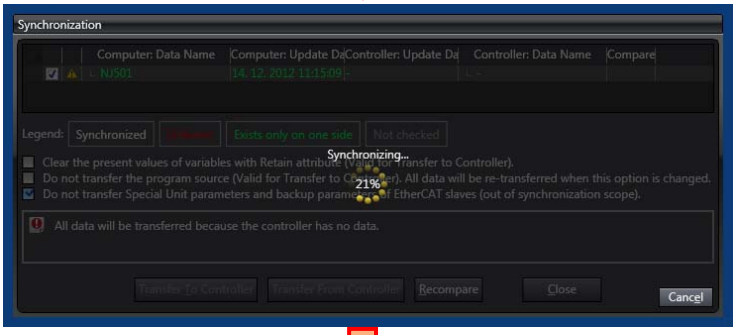
7 The Synchronization Dialog Box is displayed.
Confirm that the data to transfer (NJ501 in the right figure) is selected. Then, click the **Transfer to Controller** Button.



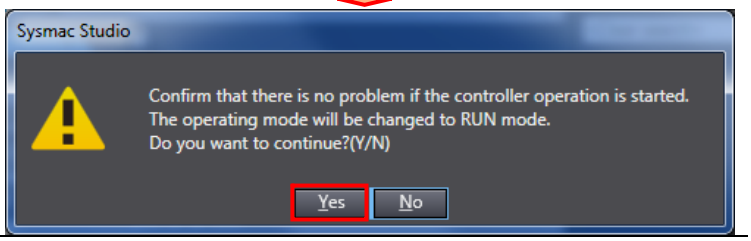
8 A confirmation dialog is displayed. Click the **Yes** Button.



A screen stating "Synchronizing" is displayed.



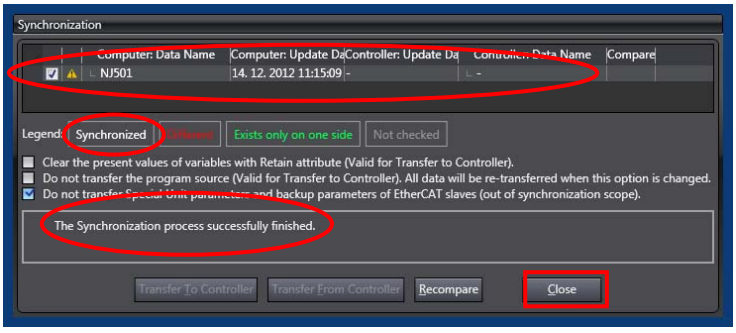
A confirmation dialog is displayed. Click the **Yes** Button.



9 Confirm that the synchronized data is displayed with the color specified by “Synchronized”, and that a message is displayed stating "The synchronization process successfully finished".

If there is no problem, click the **Close** Button.

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



7.4. Connection Status Check

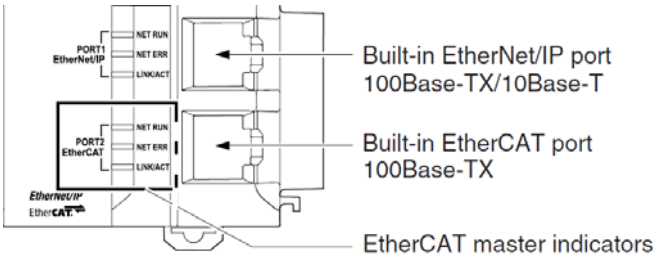
Check the EtherCAT network connection status.

7.4.1. Checking the Connection Status

Confirm that EtherCAT communications are performed normally.

1 Check the LED indicators on the Controller to confirm that the EtherCAT communications are performed normally.

LED indicators in normal status.
[NET RUN]: Lit green
[NET ERR]: Not lit
[LINK/ACT]: Flashing yellow



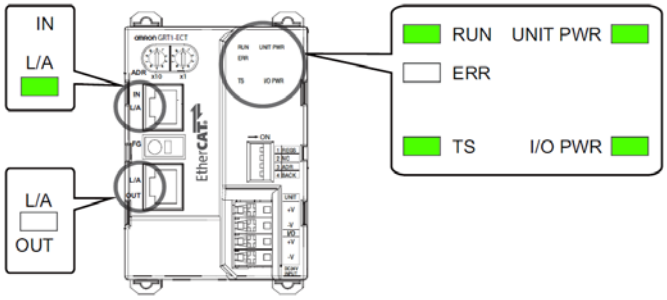
Label	Name	Color	Status	Meaning
EtherCAT NET RUN	RUN	Green	Lit	EtherCAT communications are in progress. • I/O data is being input and output.
			Flashing	EtherCAT communications are established. Communications is in one of the following states. • Only message communications is functioning. • Only message communications and I/O data input operations are functioning.
			Not lit	EtherCAT communications are stopped. • Power is OFF or the Unit is being reset. • There is a MAC address error, communications controller error, or other error.
EtherCAT NET ERR	ERROR	Red	Lit	There is an unrecoverable error, such as a hardware error or an exception.
			Flashing	There is a recoverable error.
			Not lit	There is no error.
EtherCAT LINK/ACT	Link/Activity	Yellow	Lit	The link is established.
			Flashing	A link is established and data is being sent and received. The indicator flashes whenever data is sent or received.
			Not lit	The link is not established.

2 Check the LED indicators of the SmartSlice.

LED indicators in normal status.

[UNIT PWR]: Lit green
[I/O PWR]: Lit green
[RUN]: Lit green
[ERR]: Not lit
[L/A]: Flashing
[TS]: Lit green

The LED indicators flash at the same timing as those of the Controller.



[UNIT PWR] indicator

Indicates the unit power supply state.

Color	State	Contents
Green	OFF	Unit power OFF state
	ON	The unit power (24 VDC) is supplied to the Slave.

[I/O PWR] indicator

Indicates the I/O power supply state.

Color	State	Contents
Green	OFF	Unit power OFF state
	ON	The unit power (24 VDC) is supplied to the Slave.

[RUN] indicator

Indicates the operation state.

Color	State	Contents
Green	OFF	Init state
	Blinking	Pre-Operational state
	Single flash	Safe-Operational state
	ON	Operational state

For details on each state, refer to "2-5 Communication State Transitions" in Page 2 - 7

[ERR] indicator

It indicates the information of an error.

Color	State	Contents
Red	OFF	No error
	Blinking	Communication setting error
	Single flash	Synchronization error or communication data error
	Double flash	Application WDT timeout
	Flickering	Boot error
	ON	PDI WDT timeout

[L/A] indicators

Indicates the communication state of the input side (IN) and output side (OUT)

Color	State	Contents
Green	OFF	Link not established in physical layer
	Flickering	In operation after establishing link
	ON	Link established in physical layer

[TS] indicator

Indicates the status of the SmartSlice I/O system.

Color	State	Contents
N/A	OFF	No power supply Communication with SmartSlice I/O Unit has not started Overcurrent detected
Green	Flashing (every second)	SmartSlice I/O Unit added to the system
	Flashing (every 0.5 second)	Backup/Restore function operating: Restoring settings to SmartSlice I/O Unit, backup function operating Downloading SmartSlice I/O Unit settings
	ON	Communication with SmartSlice I/O Unit established
Red	Flashing	Non-fatal communication error occurred. Communication timeout Verification error occurred with registered table Different model unit detected after SmartSlice I/O Unit replacement
	ON	Fatal communication error occurred.
	Lit for 2 s	Failure occurred while restoring settings to I/O unit or downloading I/O unit settings

7.4.2. Checking Data That Are Sent and Received

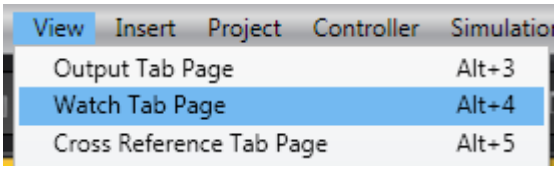
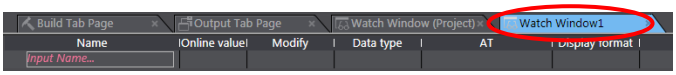
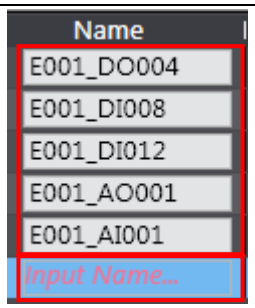
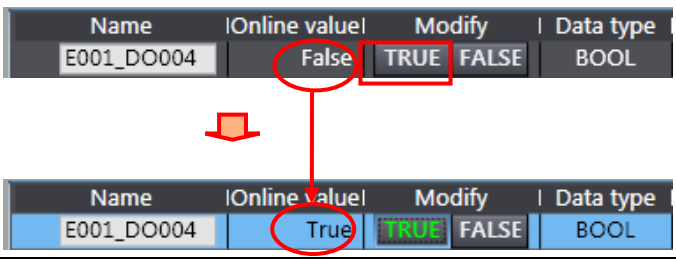
Confirm that the correct data are sent and received.

⚠ WARNING

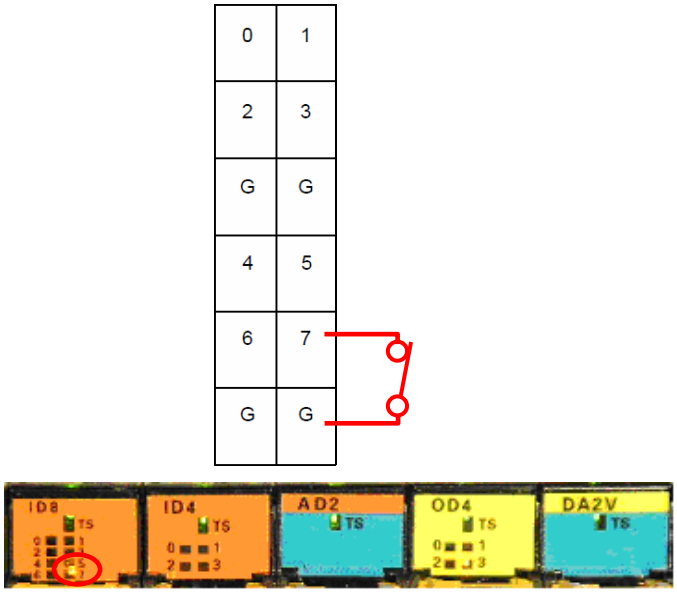
Always confirm safety at the destination node before you transfer a user program, configuration data, setup data, device variables, or values in memory used for CJ-series Units from the Sysmac Studio.
The devices or machines may perform unexpected operation regardless of the operating mode of the CPU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

⚠ Caution

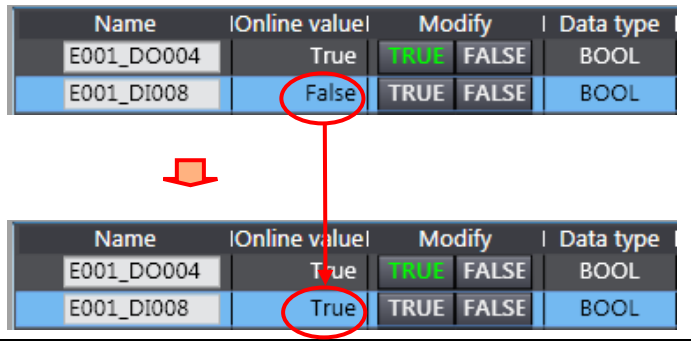
Always turn OFF the power supply to the devices and confirm safety before I/O wiring.
Read the safety related descriptions in manuals for the devices which you wire and make sure to wire in an appropriate state.

1	Select ***Watch Tab Page*** from the View Menu.	
2	The Watch Tab Page 1 Tab Page is displayed in the lower section of the Edit Pane.	
3	Enter the following names to monitor in the Watch Tab Page 1. To enter a new name, click the column that says Input Name... E001_O004 E001_DI008 E001_DI012 E001_AO001 E001_AI01	
4	If the online value for *E001_DO004* is False, click **TRUE** in the Modify Column. Confirm that the online value is changed to True.	
5	Confirm that the operation LED indicator 3 of GRT1-OD4 is lit.	

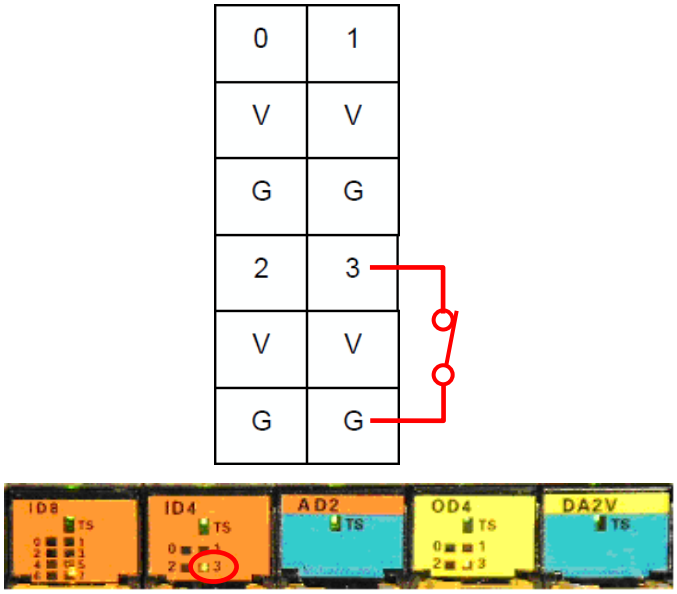
6 Turn ON the switch connected between input terminal 7 and G of GRT1-ID8.
The operation LED indicator 7 is lit.

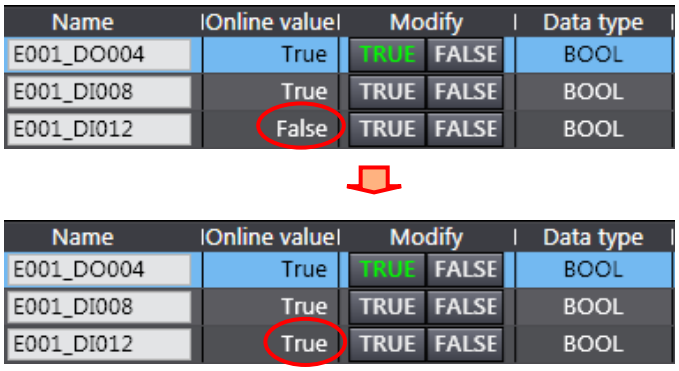
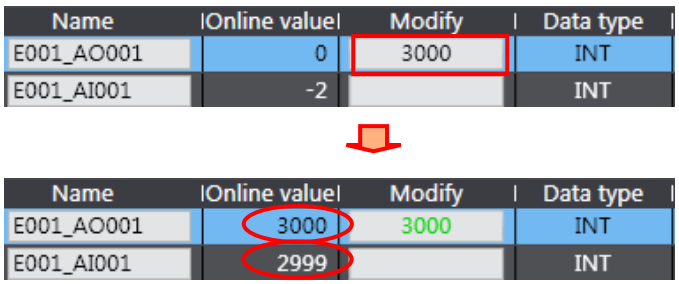


7 Confirm that the online value of *E001_DI008* changes from False to True.



8 Turn ON the switch connected between input terminal 3 and G of GRT1-ID4.
The operation LED indicator 3 is lit.



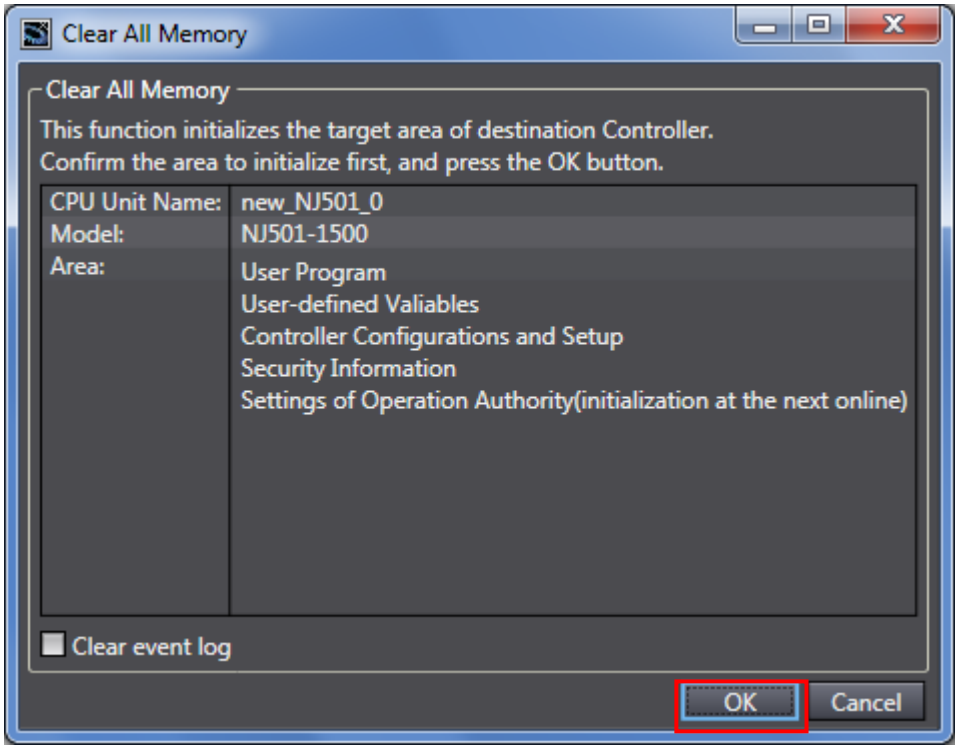
9	Confirm that the online value of *E001_DI0012* changes from False to True.	
10	Enter 3000 in the Modify Column of *E001_AO001*. The online value of *E001_AO001* changes to 3000. [E001_AO001]: GRT1-DA2V analog output 0 Confirm that 3000 or a value close to it is set as the online value of *E001_AI001*. (Here, 2999 is set.) [E001_AI001]: GRT1-AD2 analog input 0	

8. Initialization Method

This document explains the setting procedure from the factory default setting.
If the device settings have been changed from the factory default setting, some settings may not be applicable as described in this procedure.

8.1. Controller

To initialize the settings of the Controller, select ***Clear All Memory*** from the Controller Menu of the Sysmac Studio.



9. Revision History

Revision code	Date of revision	Revision reason and revision page
01	Jan. 31, 2013	First edition

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