



Machine Automation Controller NJ-series

EtherCAT Connection Guide

OMRON Corporation

GX-series Digital I/O Terminal

Network
Connection
Guide

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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-□□□□	NJ-series CPU Unit Hardware User's Manual
W501	NJ501-□□□□	NJ-series CPU Unit Software User's Manual
W505	NJ501-□□□□	NJ-series CPU Unit Built-in EtherCAT Port User's Manual
W504	SYSMAC-SE2□□□□	Sysmac Studio Version 1 Operation Manual
W488	GX-series	EtherCAT Slave Units User's Manual

2. Terms and Definition

Terms	Explanation and Definition
PDO Communications (Communications using Process Data Objects)	<p>This method is used for cyclic data exchange between the master unit and the slave units.</p> <p>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).</p> <p>The EtherCAT port built into the NJ-series CPU Unit 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 the Servomotors.</p> <p>It is accessed from the NJ-series CPU Unit in the following ways.</p> <ul style="list-style-type: none"> •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)	<p>This method is used to read and write the specified slave unit data from the master unit when required.</p> <p>The EtherCAT port built into the NJ-series CPU Unit uses SDO communications for commands to read and write data, such as for parameter transfers, at specified times.</p> <p>You can read/write the following specified slave data with the EC_CoESDORead (Read CoE SDO) instruction or the EC_CoESDOWrite (Write CoE SDO) instruction.</p> <ul style="list-style-type: none"> •SDO data in slave units (parameters, error information, etc.)
Slave Unit	<p>There are various types of slaves such as Servo Drives that handle position data and I/O terminals that control the bit signals.</p> <p>The slave receives output data sent from the master, and transmits input data to the master.</p>
Node address	<p>An address to identify the unit connected to the EtherCAT network.</p>
ESI file (EtherCAT Slave Information file)	<p>The ESI files contain information unique to the EtherCAT slaves in XML format.</p> <p>Install an ESI file into the Sysmac Studio, to easily allocate slave process data and make other settings.</p>

3. Remarks

- (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 safety circuit in order to ensure safety and minimize risks of abnormal occurrence.
- (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 which is 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 part of this document without the permission of OMRON Corporation.
- (5) This document provides the latest information as of February 2013. The information contained in this document is subject to change for improvement without notice.

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Windows is a registered trademark of Microsoft Corporation in the USA and other countries.

EtherCAT® is registered trademark and patented technology, licensed by Beckhoff Automation GmbH, Germany.

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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.



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.



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.

4. Overview

This document describes the procedure for connecting the Digital I/O Terminal (GX Series) of OMRON Corporation (hereinafter referred to as OMRON) to the NJ-series Machine Automation Controller (hereinafter referred to as Controller) on 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 following devices can be connected.

Manufacturer	Name	Model	Version
OMRON	NJ5-series CPU Unit	NJ501-□□□□□	-
OMRON	Digital I/O Terminal	GX-□D16□1/OC1601 GX-ID16□2/OD16□2 /MD16□2 GX-□D16□8/□D32□8	1.1
OMRON	Expansion Unit	XWT-□D08(-1)/□D16(-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.



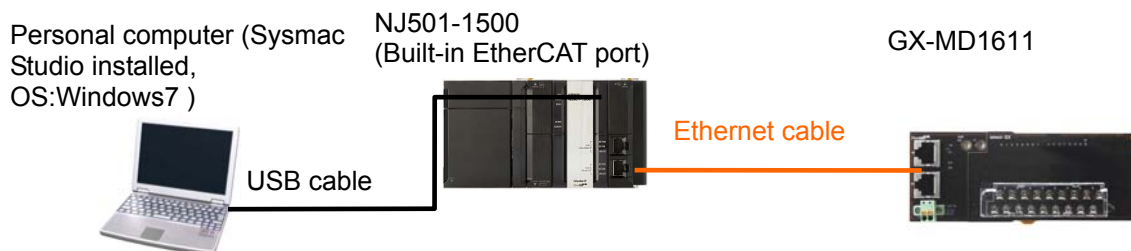
Additional Information

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 above products (other than communication connection procedures), refer to the manuals for the corresponding products or contact your OMRON representative.

5.2. Device Configuration

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



Manufacturer	Name	Model	Version
OMRON	CPU Unit (Built-in EtherCAT port)	NJ501-1500	
OMRON	Power Supply Unit	NJ1W-PA3001	
OMRON	Sysmac Studio	SYSMAC-SE2□□□□	Ver.1.00
-	Personal computer (OS:Windows7)		
-	USB cable (USB 2.0 type B connector)		
OMRON	Ethernet cable (with industrial Ethernet connector)	XS5W-T421-□M□-K	
OMRON	Digital I/O Terminal	GX-MD1611	V1.1

Precautions for Correct Use

The connection line of EtherCAT communication cannot be shared with other network, 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.

Additional Information

For information on the specifications of the Ethernet cable and network wiring, 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 NJ-series CPU Unit. For information on how to install a USB driver, refer to *A-1 Driver Installation for Direct USB Cable Connection* of the *Sysmac Studio Operation Manual* (Cat.No. W504).

6. EtherCAT Settings

This section provides specifications such as communications parameters and variable names that are set in this document.

6.1. EtherCAT Communications Settings

The following is the setting of the destination device.

	GX-MD1611
Node address	01

6.2. Allocating the Global Variables

The device variables of the destination device are allocated to the Controller's global variables.

The relationship between the device data and the global variables is shown below.

•Output area (Controller → Destination device)

Destination device data	Global variable name	Data type
Write output bits (units of 2 bytes)	E001_Write_output_1st_word	WORD
Output bit 00	E001_Out_Bit00	BOOL
Output bit 01	E001_Out_Bit01	BOOL
Output bit 02	E001_Out_Bit02	BOOL
Output bit 03	E001_Out_Bit03	BOOL
Output bit 04	E001_Out_Bit04	BOOL
Output bit 05	E001_Out_Bit05	BOOL
Output bit 06	E001_Out_Bit06	BOOL
Output bit 07	E001_Out_Bit07	BOOL

•Input area (Controller ← Destination device)

Destination device data	Global variable name	Data type
Read input bits (units of 2 bytes)	E001_Read_input_1st_word	WORD
Input bit 00	E001_In_Bit00	BOOL
Input bit 01	E001_In_Bit01	BOOL
Input bit 02	E001_In_Bit02	BOOL
Input bit 03	E001_In_Bit03	BOOL
Input bit 04	E001_In_Bit04	BOOL
Input bit 05	E001_In_Bit05	BOOL
Input bit 06	E001_In_Bit06	BOOL
Input bit 07	E001_In_Bit07	BOOL

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

Destination device data		Global variable name	Data type
Sysmac Error Status		E001_Sysmac_Error_Status	BYTE
	Error information at observation level	E001_Observation	BOOL
	Error information at minor fault level	E001_Minor_Fault	BOOL

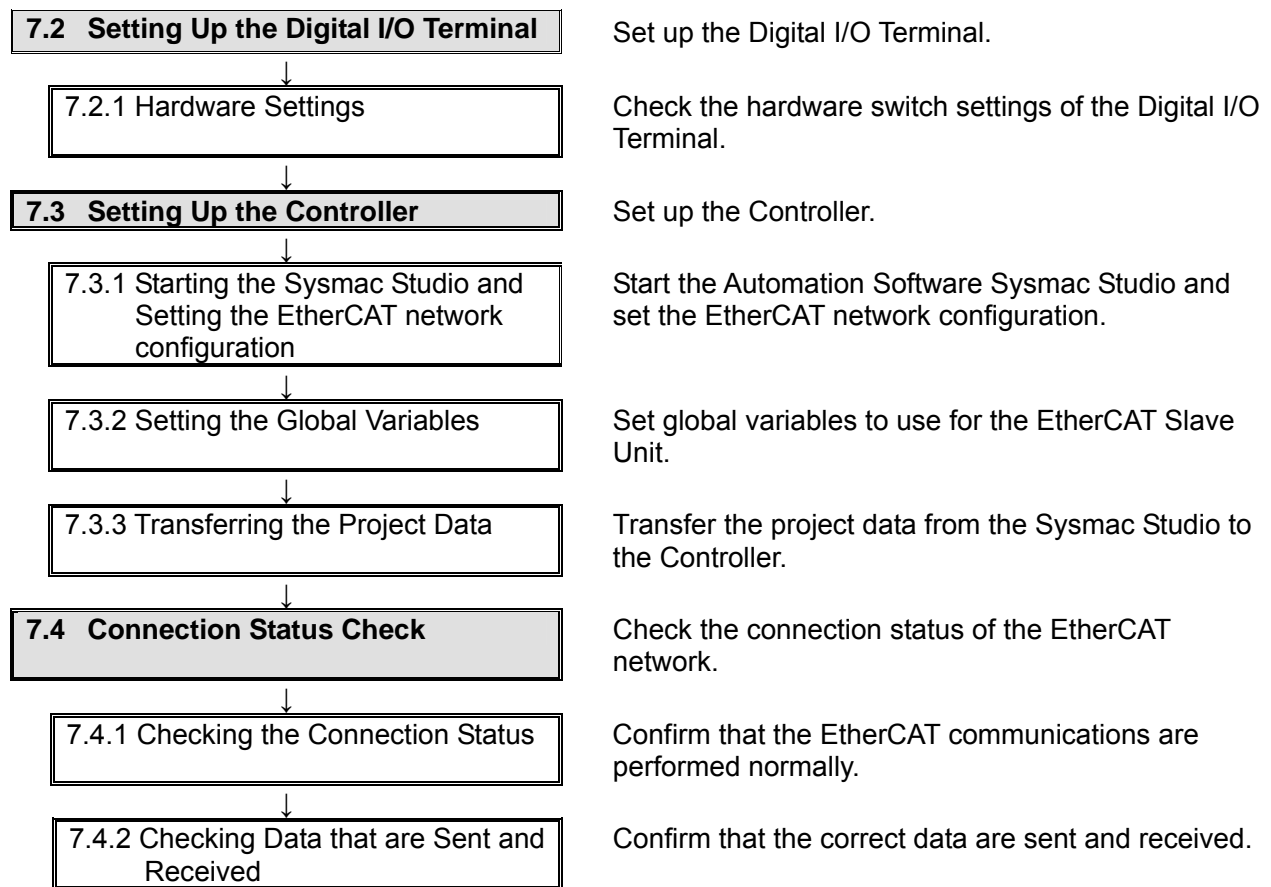
7. Connection Procedure

This section describes how to connect the Controller via EtherCAT.

This document explains the procedures for setting up the Controller and Digital I/O Terminal from the factory default setting. For the 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 Digital I/O Terminal

Set up the Digital I/O Terminal.

7.2.1. Hardware Setting

Check the hardware switch settings of the Digital I/O Terminal.



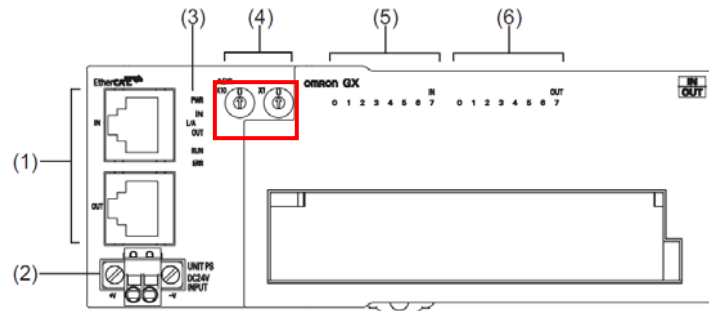
Precautions for Correct Use

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

- 1 Confirm that the power supply to the Digital I/O Terminal is 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.

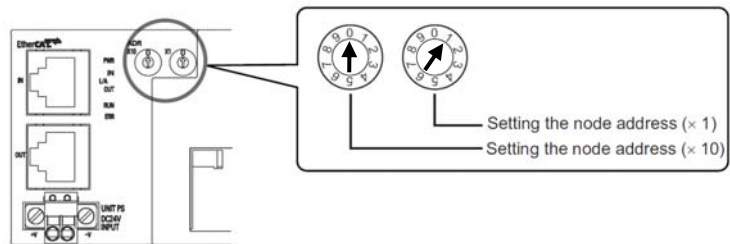


No.	Name
(1)	Communications connectors
(2)	Unit power supply connector
(3)	Status indicators
(4)	Node Address setting Switches
(5)	Input indicators (0 to 7)
(6)	Output indicators (0 to 7)

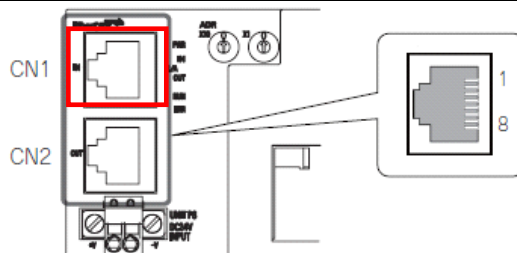
- 3 Set the node address switches as follows:

x10: 0, x1: 1

*Set the node address to "01".



- 4 Connect the Ethernet cable to communication connector CN1 and turn ON the power supply.


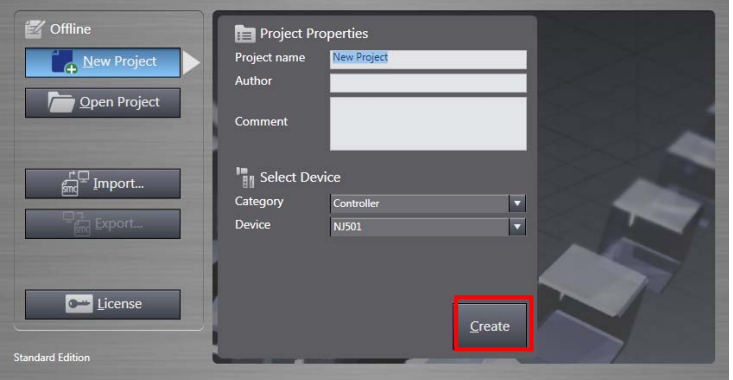
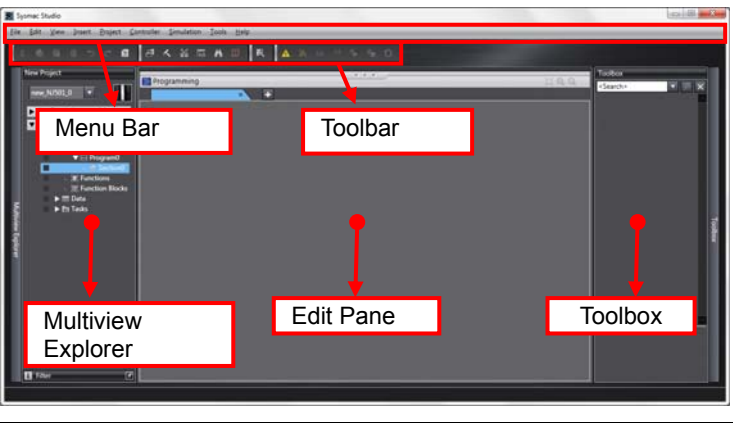
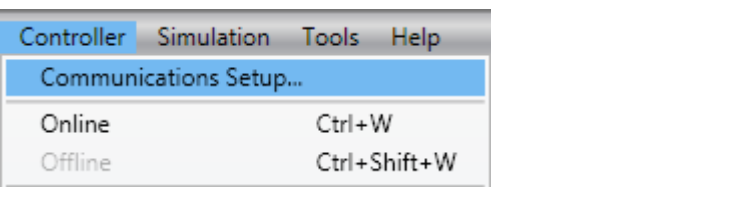


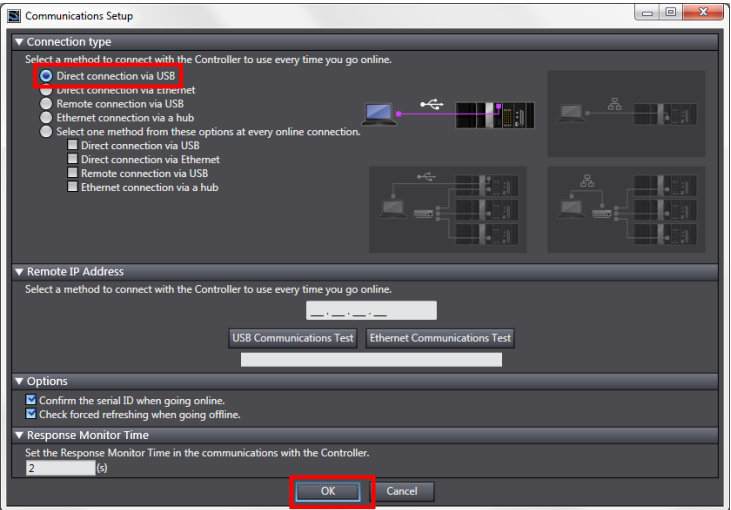
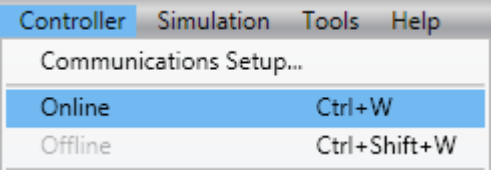
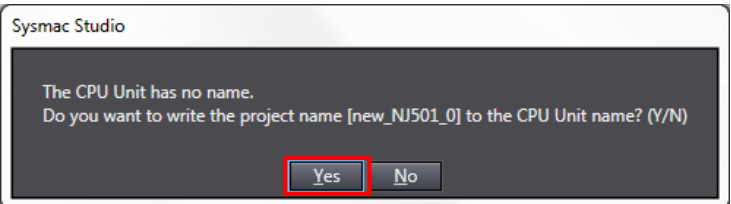
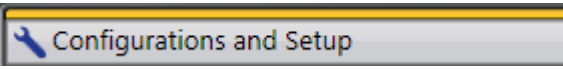
7.3. Setting Up the Controller

Set up the Controller.

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

Start the Automation Software Sysmac Studio and set the EtherCAT network configuration. Install the software and USB driver beforehand.

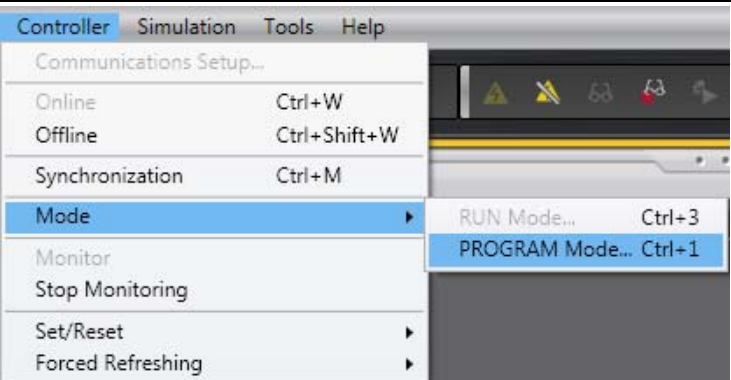
<p>1 Start the Sysmac Studio. Click the New Project Button.</p>	
<p>2 The Project Properties Dialog Box is displayed. Click the Create Button.</p> <p>*In this document, New Project is set as the project name.</p>	
<p>3 The New Project Pane is displayed. There are Menu Bar and Toolbar in the upper part of the pane. The left pane is called Multiview Explorer, the right pane is called Toolbox and the middle pane is called Edit Pane.</p>	
<p>4 Select Communications Setup from the Controller Menu.</p>	

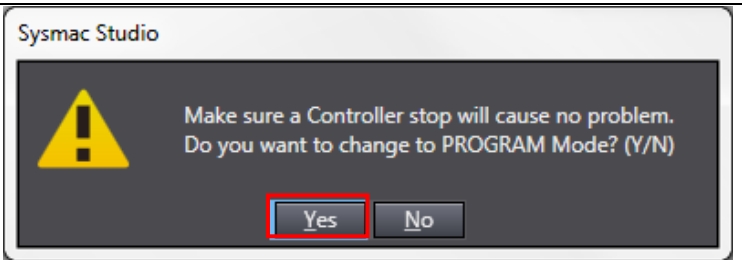
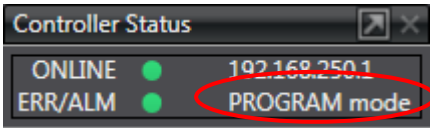
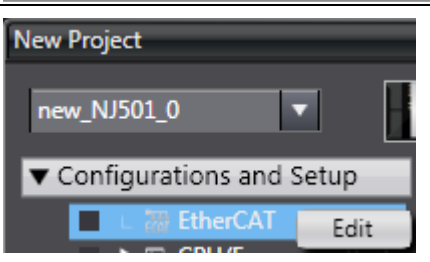
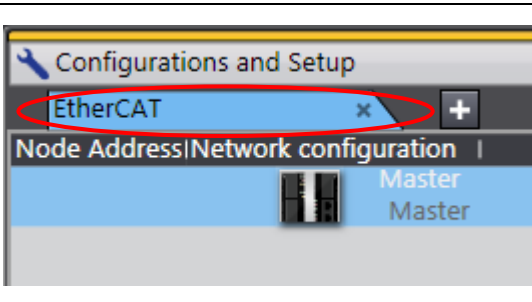
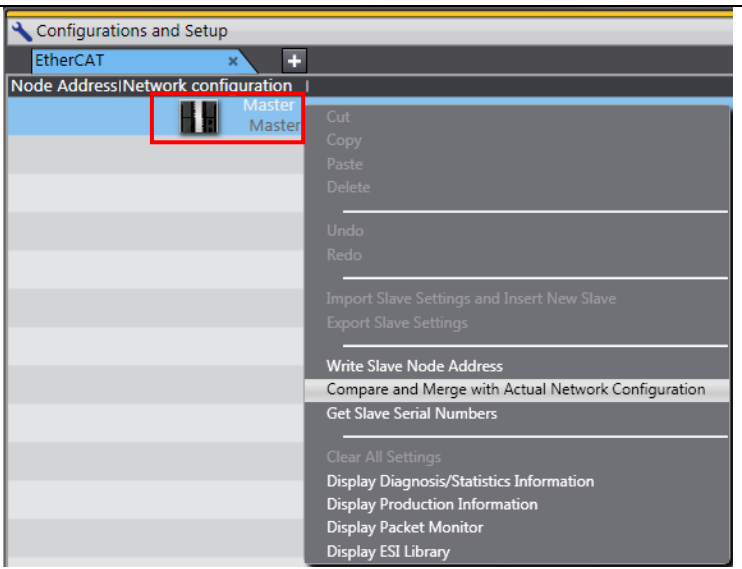
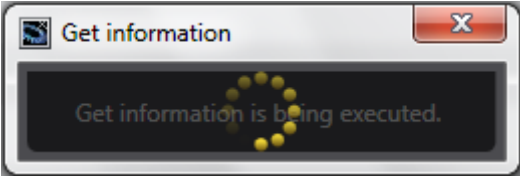
- 5 The Communications Setup Dialog Box is displayed. Select the *Direct connection via USB* Option in the Connection Type Field.
Click the **OK** Button.
- 
- 6 Select **Online** from the Controller Menu.
A confirmation dialog is displayed. Click the **Yes** Button.
*A displayed dialog depends on the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



Additional Information

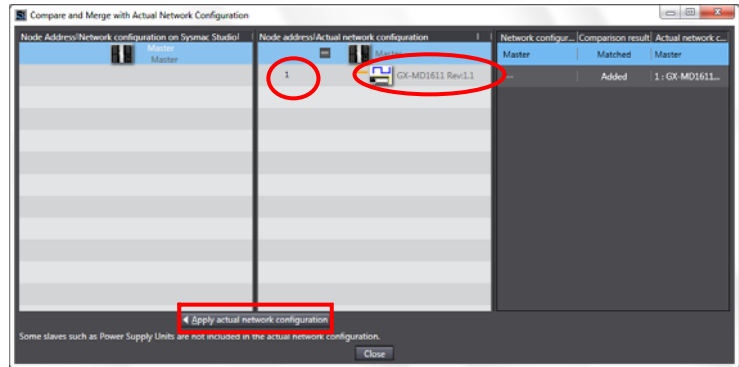
For details on the online connections to a Controller, refer to *Section 5 Going Online with a Controller* in the *Sysmac Studio Version 1.0 Operation Manual* (Cat. No. W504).

- 8 Select **Mode - PROGRAM Mode** from the Controller Menu.
- 

<p>9 A confirmation dialog is displayed. Click the Yes Button.</p> <p>Confirm that the controller status on the Toolbox is changed to the PROGRAM mode.</p>	 <p>Sysmac Studio</p> <p>Make sure a Controller stop will cause no problem. Do you want to change to PROGRAM Mode? (Y/N)</p> <p>Yes No</p>  <p>Controller Status</p> <p>ONLINE ● 192.168.250.1</p> <p>ERR/ALM ● PROGRAM mode</p>
<p>10 Double-click EtherCAT under Configurations and Setup in the Multiview Explorer. Or, right-click EtherCAT under Configurations and Setup and select Edit.</p>	 <p>New Project</p> <p>new_NJ501_0</p> <p>Configurations and Setup</p> <p>EtherCAT Edit</p>
<p>11 The EtherCAT Tab Page is displayed in the Edit Pane.</p>	 <p>Configurations and Setup</p> <p>EtherCAT</p> <p>Node AddressNetwork configuration Master Master</p>
<p>12 Right-click the Master Icon and select Compare and Merge with Actual Network Configuration.</p> <p>A screen is displayed stating "Get information is being executed".</p>	 <p>Configurations and Setup</p> <p>EtherCAT</p> <p>Node AddressNetwork configuration Master Master</p> <ul style="list-style-type: none">CutCopyPasteDeleteUndoRedoImport Slave Settings and Insert New SlaveExport Slave SettingsWrite Slave Node AddressCompare and Merge with Actual Network ConfigurationGet Slave Serial NumbersClear All SettingsDisplay Diagnosis/Statistics InformationDisplay Production InformationDisplay Packet MonitorDisplay ESI Library  <p>Get information</p> <p>Get information is being executed.</p>

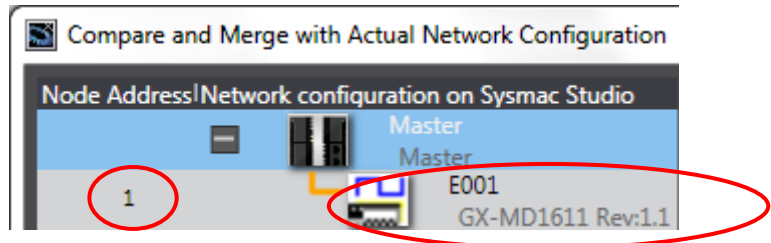
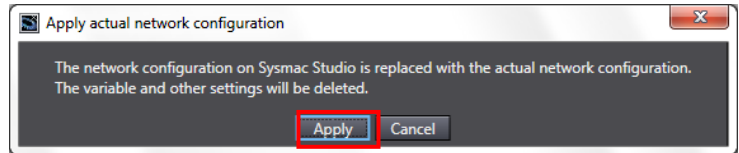
13 The Compare and Merge with Actual Network Configuration Pane is displayed. Node address 1 and GX-MD1611 Rev.1.1 are added to the actual network configuration of the comparison result.

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

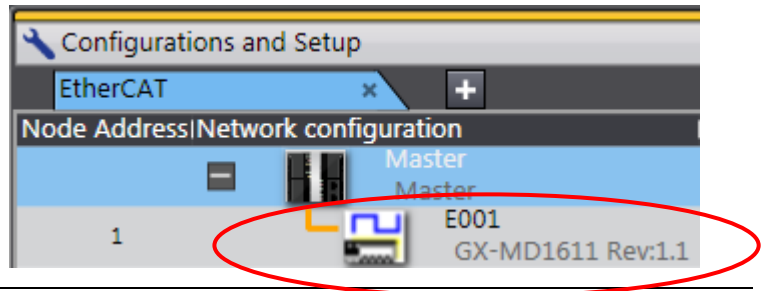


14 A confirmation dialog box is displayed. Click the **Apply** Button.

Confirm that node address 1 and E001 GX-MD1611 Rev.1.1 are added to the network configuration of the Sysmac Studio. Click the **Close** Button.

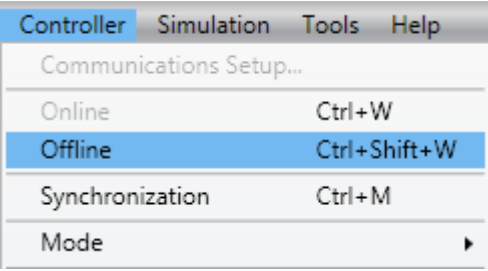
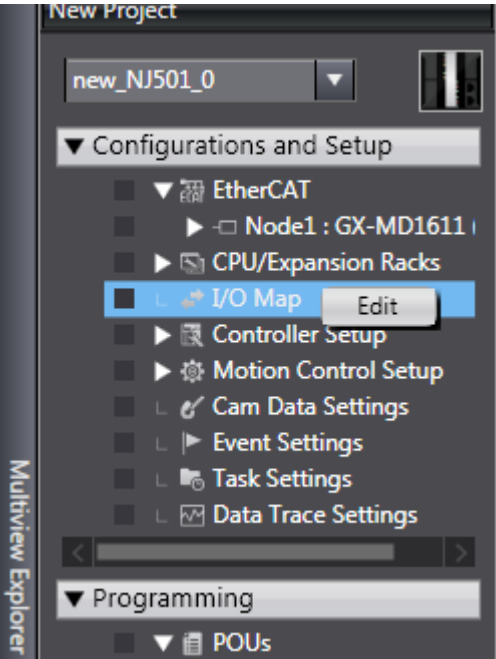
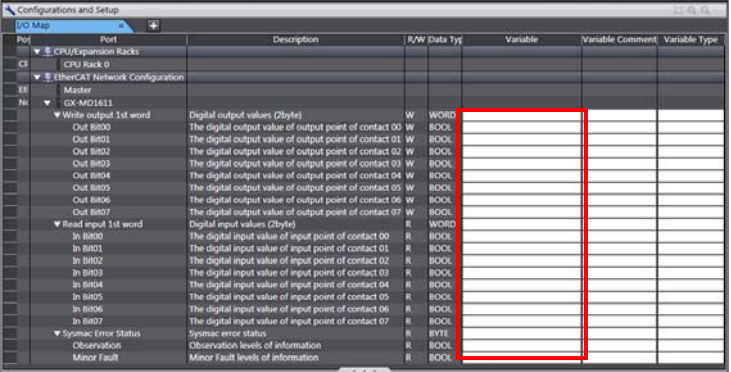


15 Node address 1 and E001 GX-MD1611 Rev:1.1 are added to the EtherCAT Tab Page in the Edit Pane.

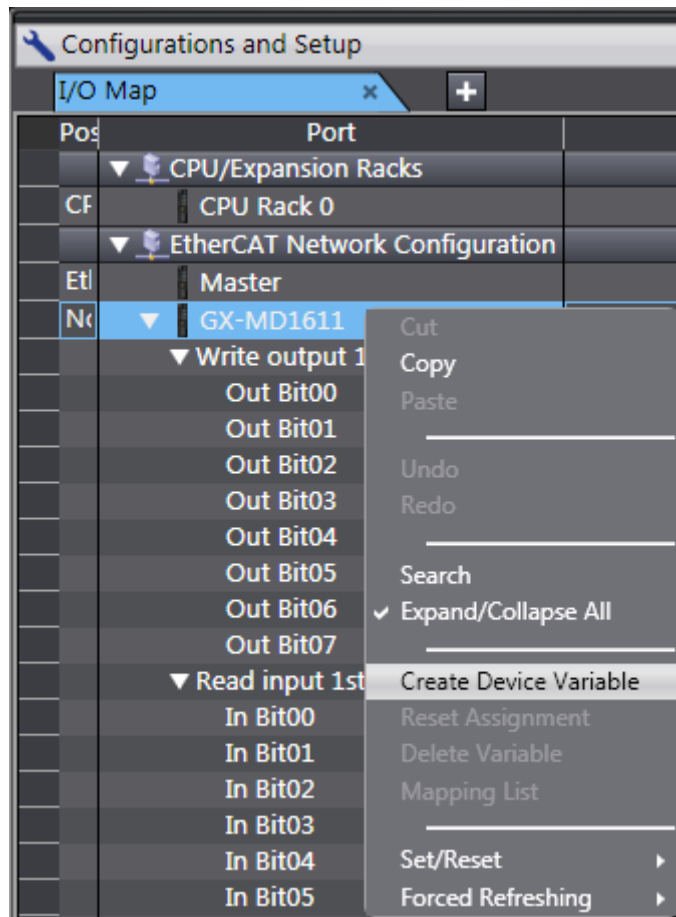


7.3.2. Setting Global Variables

Set global variables to use for the EtherCAT Slave Unit.

<p>1</p>	<p>Select Offline from the Controller Menu.</p>																																																																																																																																																																																							
<p>2</p>	<p>Double-click I/O Map under Configurations and Setup on the Multiview Explorer, or right-click it and select Edit.</p>																																																																																																																																																																																							
<p>3</p>	<p>The I/O Map Tab Page is displayed on the Edit Pane. Click a column under Variable to enter a new variable.</p>	 <table border="1" data-bbox="710 1321 1444 1691"> <thead> <tr> <th>Port</th> <th>Point</th> <th>Description</th> <th>I/O Data Type</th> <th>Variable</th> <th>Variable Comment</th> <th>Variable Type</th> </tr> </thead> <tbody> <tr> <td>CI</td> <td>CPU Rack 0</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>CI</td> <td>EtherCAT Network Configuration</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>MI</td> <td>Master</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>MI</td> <td>GX-MD1611</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td>Write output 1st word</td> <td>Digital output values (2byte)</td> <td>W</td> <td>WORD</td> <td></td> <td></td> </tr> <tr> <td></td> <td>Out 8B00</td> <td>The digital output value of output point of contact 00</td> <td>W</td> <td>BOOL</td> <td></td> <td></td> </tr> <tr> <td></td> <td>Out 8B01</td> <td>The digital output value of output point of contact 01</td> <td>W</td> <td>BOOL</td> <td></td> <td></td> </tr> <tr> <td></td> <td>Out 8B02</td> <td>The digital output value of output point of contact 02</td> <td>W</td> <td>BOOL</td> <td></td> <td></td> </tr> <tr> <td></td> <td>Out 8B03</td> <td>The digital output value of output point of contact 03</td> <td>W</td> <td>BOOL</td> <td></td> <td></td> </tr> <tr> <td></td> <td>Out 8B04</td> <td>The digital output value of output point of contact 04</td> <td>W</td> <td>BOOL</td> <td></td> <td></td> </tr> <tr> <td></td> <td>Out 8B05</td> <td>The digital output value of output point of contact 05</td> <td>W</td> <td>BOOL</td> <td></td> <td></td> </tr> <tr> <td></td> <td>Out 8B06</td> <td>The digital output value of output point of contact 06</td> <td>W</td> <td>BOOL</td> <td></td> <td></td> </tr> <tr> <td></td> <td>Out 8B07</td> <td>The digital output value of output point of contact 07</td> <td>W</td> <td>BOOL</td> <td></td> <td></td> </tr> <tr> <td></td> <td>Read input 1st word</td> <td>Digital input values (2byte)</td> <td>R</td> <td>WORD</td> <td></td> <td></td> </tr> <tr> <td></td> <td>In 8B00</td> <td>The digital input value of input point of contact 00</td> <td>R</td> <td>BOOL</td> <td></td> <td></td> </tr> <tr> <td></td> <td>In 8B01</td> <td>The digital input value of input point of contact 01</td> <td>R</td> <td>BOOL</td> <td></td> <td></td> </tr> <tr> <td></td> <td>In 8B02</td> <td>The digital input value of input point of contact 02</td> <td>R</td> <td>BOOL</td> <td></td> <td></td> </tr> <tr> <td></td> <td>In 8B03</td> <td>The digital input value of input point of contact 03</td> <td>R</td> <td>BOOL</td> <td></td> <td></td> </tr> <tr> <td></td> <td>In 8B04</td> <td>The digital input value of input point of contact 04</td> <td>R</td> <td>BOOL</td> <td></td> <td></td> </tr> <tr> <td></td> <td>In 8B05</td> <td>The digital input value of input point of contact 05</td> <td>R</td> <td>BOOL</td> <td></td> <td></td> </tr> <tr> <td></td> <td>In 8B06</td> <td>The digital input value of input point of contact 06</td> <td>R</td> <td>BOOL</td> <td></td> <td></td> </tr> <tr> <td></td> <td>In 8B07</td> <td>The digital input value of input point of contact 07</td> <td>R</td> <td>BOOL</td> <td></td> <td></td> </tr> <tr> <td></td> <td>Synmac Error Status</td> <td>Synmac error status</td> <td>R</td> <td>BYTE</td> <td></td> <td></td> </tr> <tr> <td></td> <td>Observation</td> <td>Observation levels of information</td> <td>R</td> <td>BOOL</td> <td></td> <td></td> </tr> <tr> <td></td> <td>Minor Fault</td> <td>Minor fault levels of information</td> <td>R</td> <td>BOOL</td> <td></td> <td></td> </tr> </tbody> </table>	Port	Point	Description	I/O Data Type	Variable	Variable Comment	Variable Type	CI	CPU Rack 0						CI	EtherCAT Network Configuration						MI	Master						MI	GX-MD1611							Write output 1st word	Digital output values (2byte)	W	WORD				Out 8B00	The digital output value of output point of contact 00	W	BOOL				Out 8B01	The digital output value of output point of contact 01	W	BOOL				Out 8B02	The digital output value of output point of contact 02	W	BOOL				Out 8B03	The digital output value of output point of contact 03	W	BOOL				Out 8B04	The digital output value of output point of contact 04	W	BOOL				Out 8B05	The digital output value of output point of contact 05	W	BOOL				Out 8B06	The digital output value of output point of contact 06	W	BOOL				Out 8B07	The digital output value of output point of contact 07	W	BOOL				Read input 1st word	Digital input values (2byte)	R	WORD				In 8B00	The digital input value of input point of contact 00	R	BOOL				In 8B01	The digital input value of input point of contact 01	R	BOOL				In 8B02	The digital input value of input point of contact 02	R	BOOL				In 8B03	The digital input value of input point of contact 03	R	BOOL				In 8B04	The digital input value of input point of contact 04	R	BOOL				In 8B05	The digital input value of input point of contact 05	R	BOOL				In 8B06	The digital input value of input point of contact 06	R	BOOL				In 8B07	The digital input value of input point of contact 07	R	BOOL				Synmac Error Status	Synmac error status	R	BYTE				Observation	Observation levels of information	R	BOOL				Minor Fault	Minor fault levels of information	R	BOOL		
Port	Point	Description	I/O Data Type	Variable	Variable Comment	Variable Type																																																																																																																																																																																		
CI	CPU Rack 0																																																																																																																																																																																							
CI	EtherCAT Network Configuration																																																																																																																																																																																							
MI	Master																																																																																																																																																																																							
MI	GX-MD1611																																																																																																																																																																																							
	Write output 1st word	Digital output values (2byte)	W	WORD																																																																																																																																																																																				
	Out 8B00	The digital output value of output point of contact 00	W	BOOL																																																																																																																																																																																				
	Out 8B01	The digital output value of output point of contact 01	W	BOOL																																																																																																																																																																																				
	Out 8B02	The digital output value of output point of contact 02	W	BOOL																																																																																																																																																																																				
	Out 8B03	The digital output value of output point of contact 03	W	BOOL																																																																																																																																																																																				
	Out 8B04	The digital output value of output point of contact 04	W	BOOL																																																																																																																																																																																				
	Out 8B05	The digital output value of output point of contact 05	W	BOOL																																																																																																																																																																																				
	Out 8B06	The digital output value of output point of contact 06	W	BOOL																																																																																																																																																																																				
	Out 8B07	The digital output value of output point of contact 07	W	BOOL																																																																																																																																																																																				
	Read input 1st word	Digital input values (2byte)	R	WORD																																																																																																																																																																																				
	In 8B00	The digital input value of input point of contact 00	R	BOOL																																																																																																																																																																																				
	In 8B01	The digital input value of input point of contact 01	R	BOOL																																																																																																																																																																																				
	In 8B02	The digital input value of input point of contact 02	R	BOOL																																																																																																																																																																																				
	In 8B03	The digital input value of input point of contact 03	R	BOOL																																																																																																																																																																																				
	In 8B04	The digital input value of input point of contact 04	R	BOOL																																																																																																																																																																																				
	In 8B05	The digital input value of input point of contact 05	R	BOOL																																																																																																																																																																																				
	In 8B06	The digital input value of input point of contact 06	R	BOOL																																																																																																																																																																																				
	In 8B07	The digital input value of input point of contact 07	R	BOOL																																																																																																																																																																																				
	Synmac Error Status	Synmac error status	R	BYTE																																																																																																																																																																																				
	Observation	Observation levels of information	R	BOOL																																																																																																																																																																																				
	Minor Fault	Minor fault levels of information	R	BOOL																																																																																																																																																																																				

- Right-click the row for Node1 and GX-MD1611. Then, select **Create Device Variable**.



- The Variable names and Variable Types are automatically set.

The screenshot shows the 'Configurations and Setup' window with the 'I/O Map' tab active. The table lists various components and their I/O points. The 'GX-MD1611' node is selected, and the table shows the following columns: Pos, Port, Description, I/W Data Typ, Variable, Variable Comment, and Variable Type. The 'Variable' and 'Variable Type' columns are circled in red, showing that they are automatically set for each I/O point.

Pos	Port	Description	I/W Data Typ	Variable	Variable Comment	Variable Type
CF	CPU Rack 0					
Et	Master					
Nc	GX-MD1611					
	Write output 1st word	Digital output values (2byte)	W	WORD	Write_output_1st_wor	Global Variables
	Out Bit00	The digital output value of output point of contact 00	W	BOOL	0001_Out_0000	Global Variables
	Out Bit01	The digital output value of output point of contact 01	W	BOOL	0001_Out_0001	Global Variables
	Out Bit02	The digital output value of output point of contact 02	W	BOOL	0001_Out_0002	Global Variables
	Out Bit03	The digital output value of output point of contact 03	W	BOOL	0001_Out_0003	Global Variables
	Out Bit04	The digital output value of output point of contact 04	W	BOOL	0001_Out_0004	Global Variables
	Out Bit05	The digital output value of output point of contact 05	W	BOOL	0001_Out_0005	Global Variables
	Out Bit06	The digital output value of output point of contact 06	W	BOOL	0001_Out_0006	Global Variables
	Out Bit07	The digital output value of output point of contact 07	W	BOOL	0001_Out_0007	Global Variables
	Read input 1st word	Digital input values (2byte)	R	WORD	Read_input_1st_wor	Global Variables
	In Bit00	The digital input value of input point of contact 00	R	BOOL	0001_In_0000	Global Variables
	In Bit01	The digital input value of input point of contact 01	R	BOOL	0001_In_0001	Global Variables
	In Bit02	The digital input value of input point of contact 02	R	BOOL	0001_In_0002	Global Variables
	In Bit03	The digital input value of input point of contact 03	R	BOOL	0001_In_0003	Global Variables
	In Bit04	The digital input value of input point of contact 04	R	BOOL	0001_In_0004	Global Variables
	In Bit05	The digital input value of input point of contact 05	R	BOOL	0001_In_0005	Global Variables
	In Bit06	The digital input value of input point of contact 06	R	BOOL	0001_In_0006	Global Variables
	In Bit07	The digital input value of input point of contact 07	R	BOOL	0001_In_0007	Global Variables
	System Error Status	System error status	R	BYTE	0001_Sysmac_Error_Statu	Global Variables
	Observation	Observation levels of information	R	BOOL	0001_Observation	Global Variables
	Minor Fault	Minor Fault levels of information	R	BOOL	0001_Minor_Fault	Global Variables



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 a device variable name is automatically created for each slave unit in the above example, they can also be automatically created for each I/O port.

Also, you can set any device variables.

7.3.3. Transferring Project Data

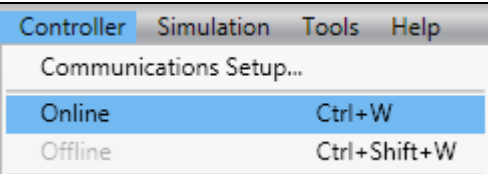
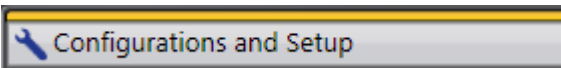
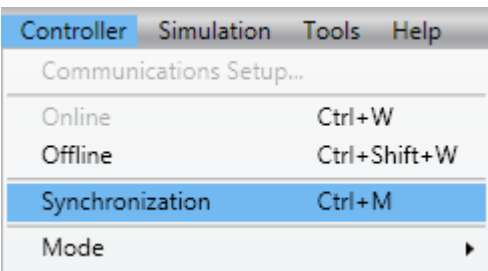
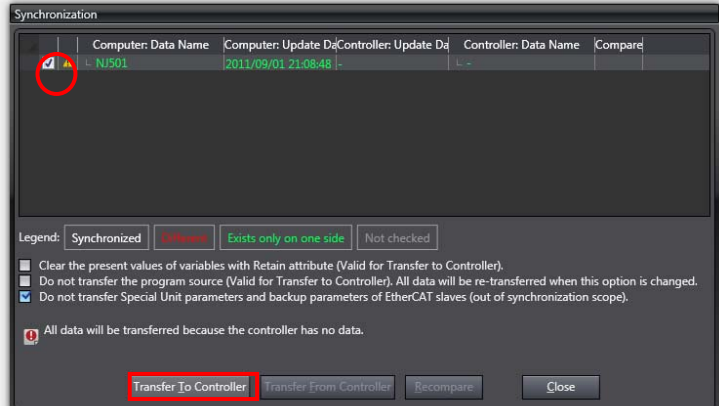
Transfer the project data from the Sysmac Studio to the Controller.

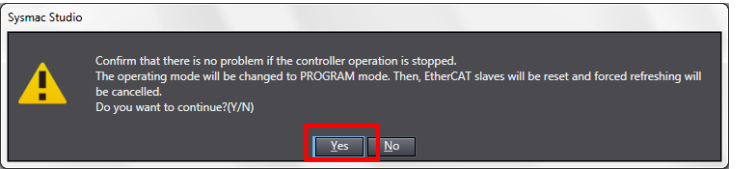

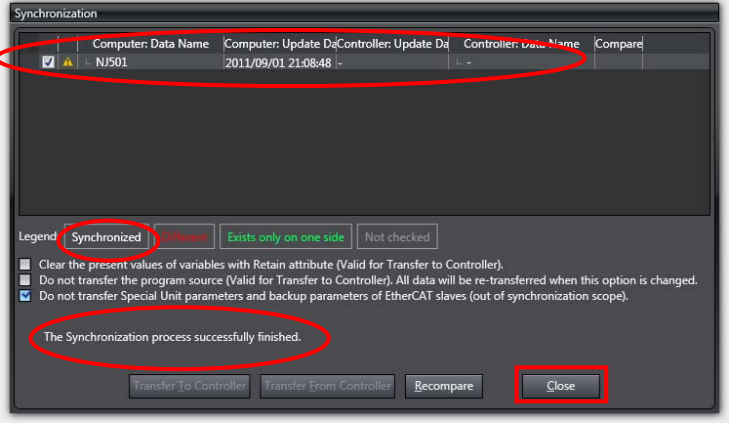
WARNING

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.



1	Select Online from the Controller Menu.	
2	When an online connection is established, a yellow bar is displayed on the top of the Edit Pane.	
3	Select Synchronization from the Controller Menu.	
4	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.	

<p>5 A confirmation dialog is displayed. Click the Yes Button.</p> <p>A screen stating "Synchronizing" is displayed.</p>	 <p>The screenshot shows a 'Sysmac Studio' dialog box with a yellow warning icon. The text reads: 'Confirm that there is no problem if the controller operation is stopped. The operating mode will be changed to PROGRAM mode. Then, EtherCAT slaves will be reset and forced refreshing will be cancelled. Do you want to continue?(Y/N)'. The 'Yes' button is highlighted with a red box. A red arrow points down to the next screenshot.</p>  <p>The screenshot shows a black screen with the text 'Synchronizing...' and a progress indicator consisting of a circle of yellow dots with '4%' in the center.</p>										
<p>6 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".</p> <p>If there is no problem, click the Close Button.</p> <p>*If the synchronization fails, check the wiring and repeat the procedure described in this section.</p>	 <p>The screenshot shows a 'Synchronization' dialog box with a table of data. The 'Synchronized' column is highlighted in green. The 'The Synchronization process successfully finished.' message is circled in red. The 'Close' button is also highlighted in red.</p> <table border="1" data-bbox="718 526 1428 705"> <thead> <tr> <th>Computer: Data Name</th> <th>Computer: Update Date</th> <th>Controller: Update Date</th> <th>Controller: Data Name</th> <th>Compare</th> </tr> </thead> <tbody> <tr> <td><input checked="" type="checkbox"/> NJ501</td> <td>2011/09/01 21:08:48</td> <td>-</td> <td>-</td> <td>-</td> </tr> </tbody> </table> <p>Legend: Synchronized (green), Not checked (grey), Exists only on one side (yellow), Not checked (grey).</p> <p><input type="checkbox"/> Clear the present values of variables with Retain attribute (Valid for Transfer to Controller).</p> <p><input type="checkbox"/> Do not transfer the program source (Valid for Transfer to Controller). All data will be re-transferred when this option is changed.</p> <p><input checked="" type="checkbox"/> Do not transfer Special Unit parameters and backup parameters of EtherCAT slaves (out of synchronization scope).</p> <p>The Synchronization process successfully finished.</p> <p>Buttons: Transfer To Controller, Transfer From Controller, Recompare, Close</p>	Computer: Data Name	Computer: Update Date	Controller: Update Date	Controller: Data Name	Compare	<input checked="" type="checkbox"/> NJ501	2011/09/01 21:08:48	-	-	-
Computer: Data Name	Computer: Update Date	Controller: Update Date	Controller: Data Name	Compare							
<input checked="" type="checkbox"/> NJ501	2011/09/01 21:08:48	-	-	-							


7.4. Connection Status Check

Check the connection status of the EtherCAT network.

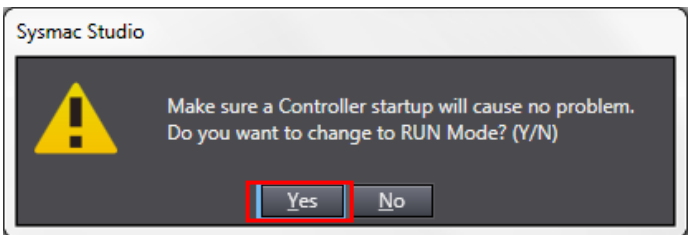
7.4.1. Checking the Connection Status

Confirm that the EtherCAT communications are performed normally.

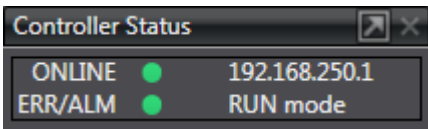
1 Select **Mode - RUN Mode** from the Controller Menu.



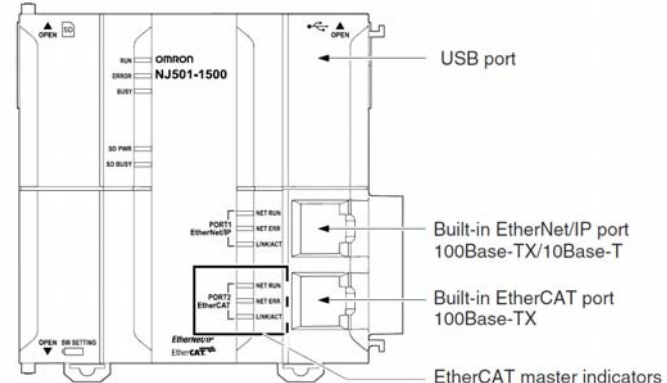
2 A confirmation dialog is displayed. Click the **Yes** Button.



RUN mode is displayed on the Controller Status Pane.



3 Check the LED indicators on the Controller to confirm if EtherCAT communication is normally performed.

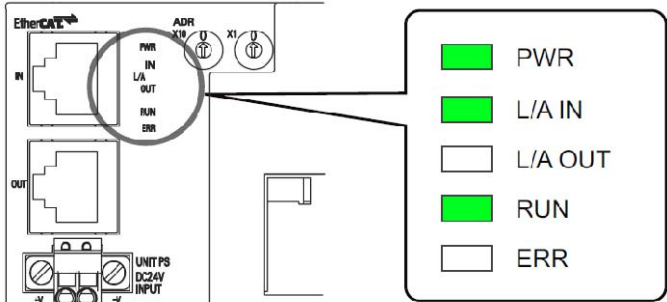


LED indicators in normal status.

- NET RUN: Green ON
- NET ERR: OFF
- [LINK/ACT]: Flickering

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.

- 4 Check the indicators on the Digital I/O Terminal.
 LED indicators in normal status.
 [PWR]: Green ON
 [L/A IN]: Flickering
 [RUN]: Green ON
 [ERR]: OFF
 The LED indicators flash at the same timing as those of the Controller.



[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 Unit.

[L/A IN] indicator

Indicates the communication state (input side).

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

[RUN] indicator

It 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 "5-3 Communications State Transitions" in page 5 - 4.

[ERR] indicator

It indicates the information of an error.

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

7.4.2. Checking Data That Are Sent and Received

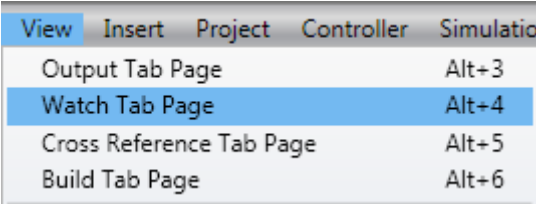
Check if the correct data are sent and received.

Caution

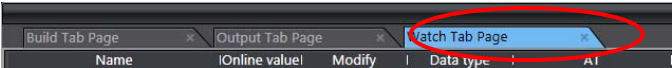
Sufficiently confirm safety before you change the values of variables on a Watch Tab Page when the Sysmac Studio is online with the CPU Unit. Incorrect operation may cause the devices that are connected to Output Units to operate regardless of the operating mode of the Controller.



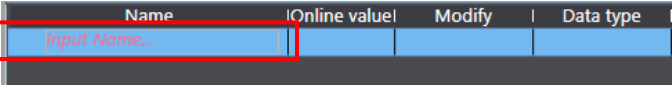
- 1 Select **Watch Tab Page** from the View Menu.



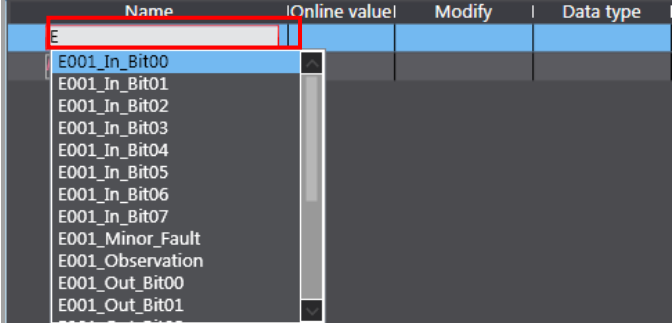
View	Insert	Project	Controller	Simulation
Output Tab Page				Alt+3
Watch Tab Page				Alt+4
Cross Reference Tab Page				Alt+5
Build Tab Page				Alt+6
- 2 The Watch Tab Page is displayed in the lower section of the Edit Pane.




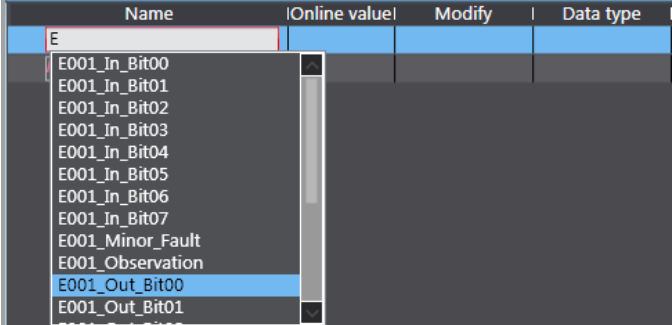
Name	Online value	Modify	Data type	Alt
Input Name...				
- 3 Click the cell that states Input Name at the bottom of the Watch Tab Page.



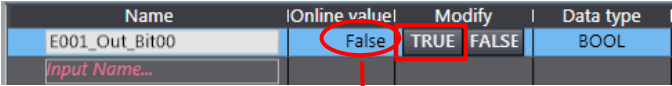
Name	Online value	Modify	Data type
Input Name...			
- 4 Now, characters can be entered. Enter the device variable name. Here, enter *E001_Out_Bit00* of bit 0 of the output port. Type the first character E. A list of device variables starting with E is displayed. Scroll the list and select *E001_Out_Bit00*. Double-click *E001_Out_Bit00*. *E001_Out_Bit00* is entered in the Name Column.




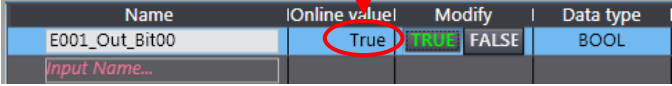
Name	Online value	Modify	Data type
E			
E001_In_Bit00			
E001_In_Bit01			
E001_In_Bit02			
E001_In_Bit03			
E001_In_Bit04			
E001_In_Bit05			
E001_In_Bit06			
E001_In_Bit07			
E001_Minor_Fault			
E001_Observation			
E001_Out_Bit00			
E001_Out_Bit01			

Name	Online value	Modify	Data type
E			
E001_In_Bit00			
E001_In_Bit01			
E001_In_Bit02			
E001_In_Bit03			
E001_In_Bit04			
E001_In_Bit05			
E001_In_Bit06			
E001_In_Bit07			
E001_Minor_Fault			
E001_Observation			
E001_Out_Bit00			
E001_Out_Bit01			
- 5 Confirm that the online value is False, and click **TRUE** on the Modify Column.

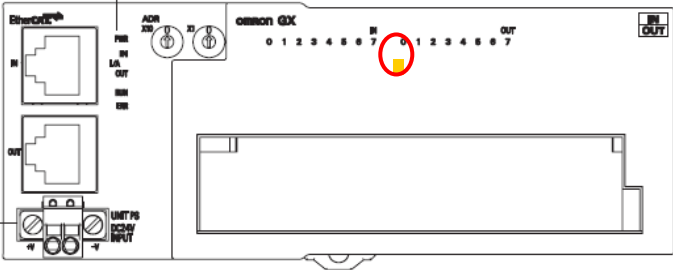
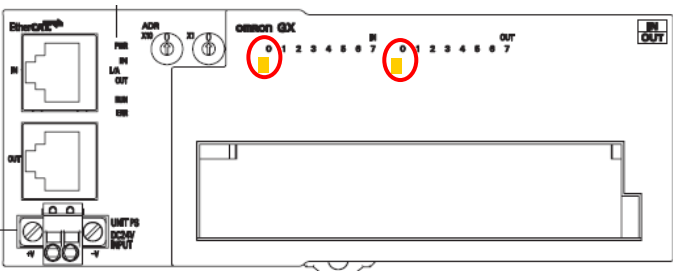


Name	Online value	Modify	Data type
E001_Out_Bit00	False	TRUE	BOOL
Input Name...			

Name	Online value	Modify	Data type
E001_Out_Bit00	True	FALSE	BOOL
Input Name...			

Confirm that the online value is changed to True.

- 6 Confirm that OUT No.0 of the Remote I/O Unit is turned ON (corresponding LED indicator is lit yellow).
- 
- 7 Click the cell that states Input Name at the bottom of the Watch Tab Page, and enter *E001_In_Bit00*.
- | Name | Online value | Modify | Data type |
|------------------|--------------|------------|-----------|
| E001_Out_Bit00 | True | TRUE FALSE | BOOL |
| E001_In_Bit00 | | | |
| E001_In_Bit01 | | | |
| E001_In_Bit02 | | | |
| E001_In_Bit03 | | | |
| E001_In_Bit04 | | | |
| E001_In_Bit05 | | | |
| E001_In_Bit06 | | | |
| E001_In_Bit07 | | | |
| E001_Minor_Fault | | | |
| E001_Observation | | | |
| E001_Out_Bit00 | | | |
| E001_Out_Bit01 | | | |
- 8 Confirm that the online value of *E001_In_Bit00* is True.
*IN bit 0 of GX-MD1611 is connected with OUT bit 0.
- | Name | Online value | Modify | Data type |
|----------------|--------------|------------|-----------|
| E001_Out_Bit00 | True | TRUE FALSE | BOOL |
| E001_In_Bit00 | True | TRUE FALSE | BOOL |
| Input Name... | | | |
- 9 IN No.0 and OUT No.0 LED indicators of GX-MD1611 are turned ON as shown on the right.
- 

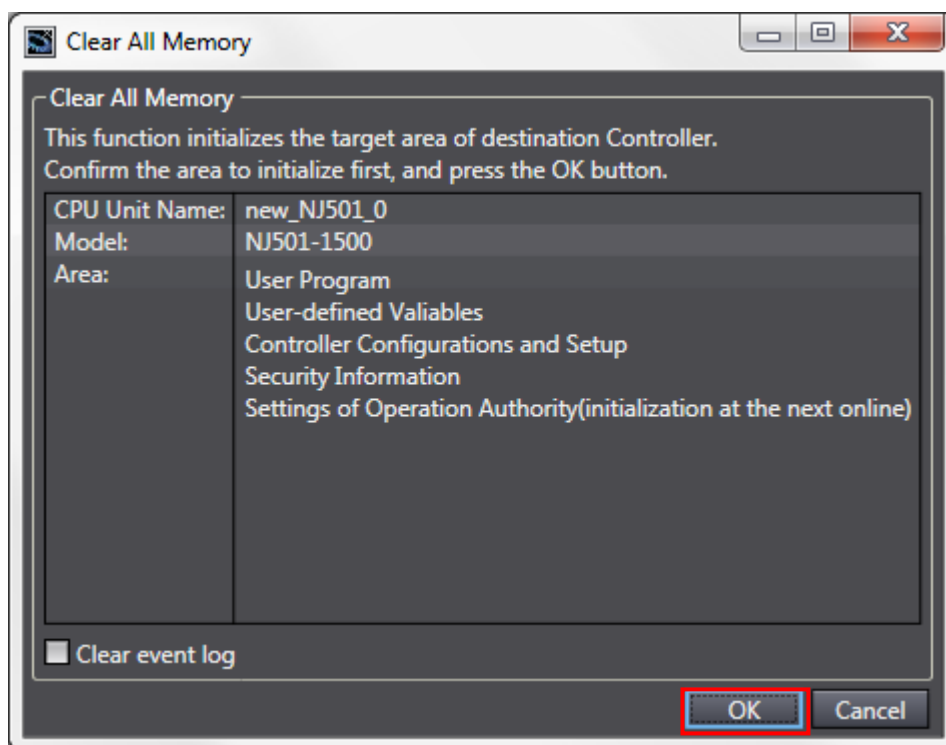
8. Initialization Method

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	Feb. 28, 2013	First edition

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