

Machine Automation Controller NJ-series

# EtherCAT Connection Guide

## OMRON Corporation

3G3MX2-Series Inverter

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
I570	3G3MX2-A□□□□□	MX2 User's Manual
I574	3G3AX-MX2-ECT	Inverter MX2/RX Series EtherCAT Communication Unit 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>Variables are used to access from the NJ-series CPU Unit in the following ways.</p> <ul style="list-style-type: none"> <li>•With device variables for EtherCAT slave I/O</li> <li>•With Axis Variables for Servo Drive and encoder input slaves to which assigned as an axis</li> </ul>
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"> <li>•SDO data in slave units (parameters, error information, etc.)</li> </ul>
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 March 2013. The information contained in this document is subject to change for improvement without notice.

#### **About Intellectual Property Right and Trademarks**

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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 Inverter (3G3MX2 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	NJ-series CPU Unit	NJ501-□□□□□	-
OMRON	Inverter	3G3MX2-A□□□□□	1.1 or later
OMRON	EtherCAT Communications Unit	3G3AX-MX2-ECT	



#### 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.



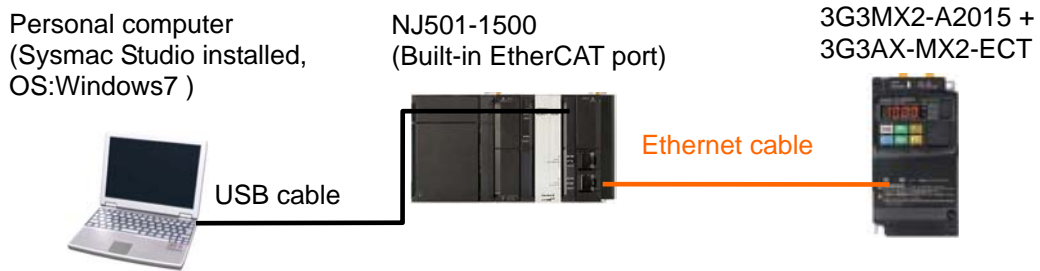
#### Additional Information

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 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		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	Inverter	3G3MX2-A2015	V1.1
OMRON	EtherCAT Communications Unit	3G3AX-MX2-ECT	

**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.

	3G3AX-MX2-ECT (3G3MX2-A[ ][ ][ ][ ])
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
Operation command to Inverter	E001_Command	WORD
Output frequency	E001_Frequency_reference	INT

#### ■ Input area (Controller ← Destination device)

Destination device data	Global variable name	Data type
Status	E001_Status	WORD
Output frequency monitor	E001_Output_frequency_monitor	INT

#### ■ 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

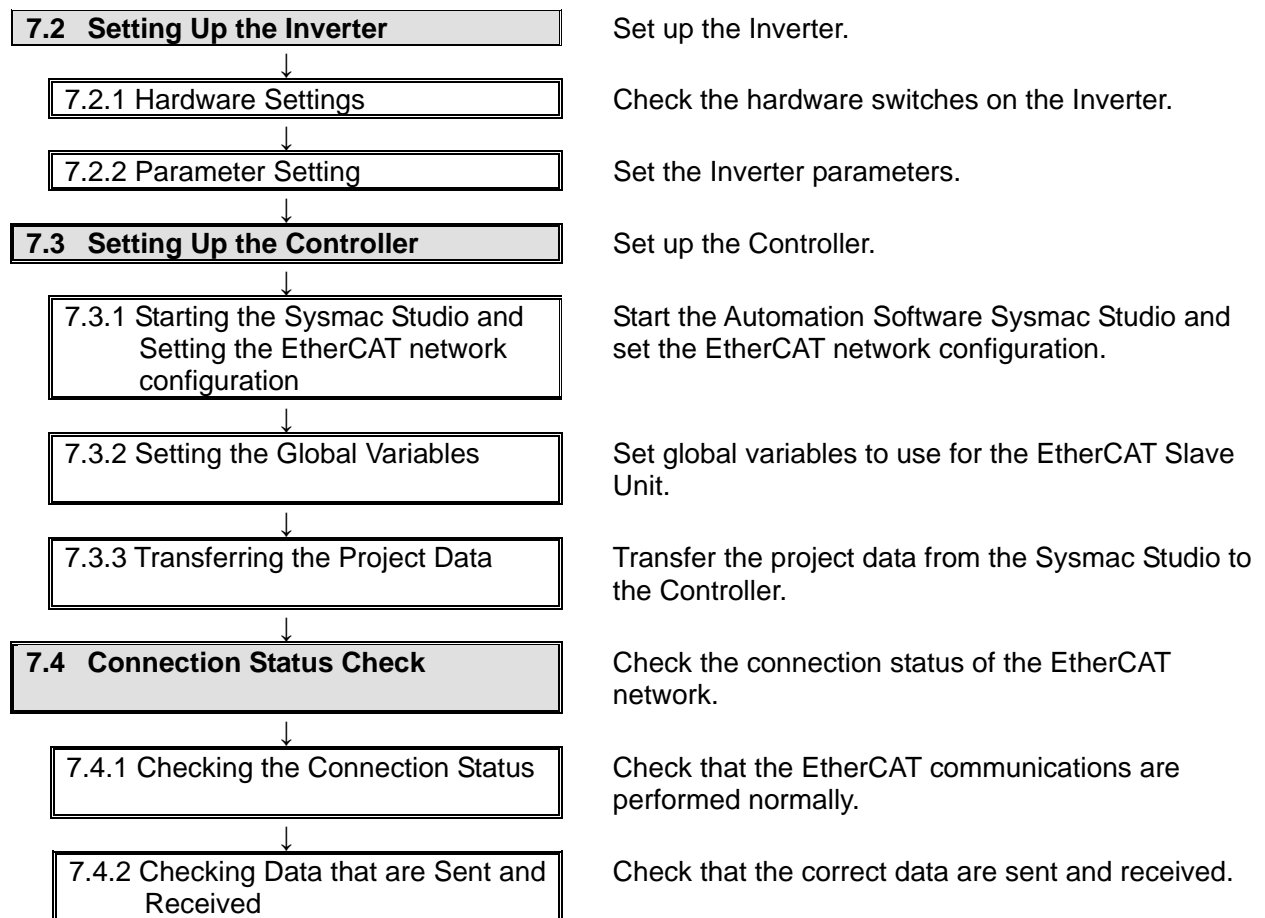
## 7. Connection Procedure

This section describes how to connect the Controller via EtherCAT.

This document explains the procedures for setting up the Controller and Inverter 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 EtherCAT.



## 7.2. Setting Up the Inverter

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Set up the Inverter.

### 7.2.1. Hardware Setting

Check the hardware switches on the Inverter.



#### **Precautions for Correct Use**

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

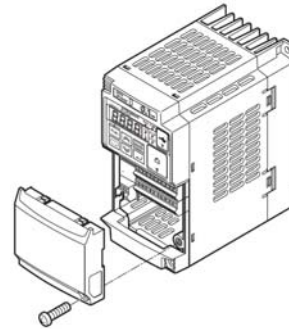
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### 1 Mount the EtherCAT Communications Unit to the Inverter.

\*For details on how to mount the EtherCAT Communications Unit, 2-4 Mounting and Wiring for the EtherCAT Communication Unit in the Inverter MX2/RX Series EtherCAT Communications Unit User's Manual (Cat.No. I574).

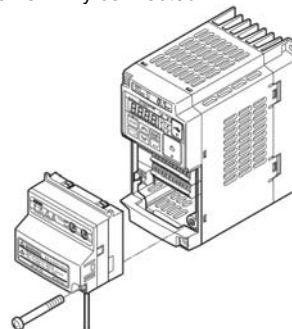
Removing the optional board cover from the Inverter front panel

1. Loosen the mounting screw (x 1) from the optional board cover of the Inverter front panel.
2. Remove the optional board cover.



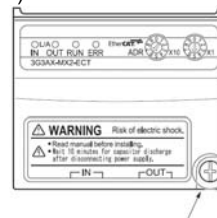
Mounting the EtherCAT Communication Unit onto the Inverter

1. Mount the EtherCAT Communication Unit onto the location where the Inverter optional board cover that you removed was attached. Check that the connector is firmly connected.



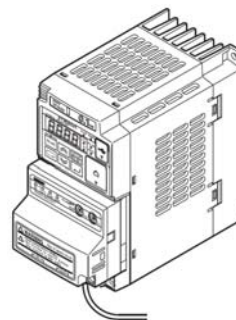
(Notes) When the EtherCAT Communication Unit is mounted, the main circuit and control circuit terminals of the Inverter are hidden. For this reason, be sure to wire the main circuit and control circuit terminals before mounting the EtherCAT Communication Unit.

2. Tighten the mounting screw of the EtherCAT Communication Unit. Tighten the bottom right screw of the EtherCAT Communication Unit with the specified torque (46 N•cm, 4.7 kgf•cm).



Connecting the ground cable of the EtherCAT Communication Unit

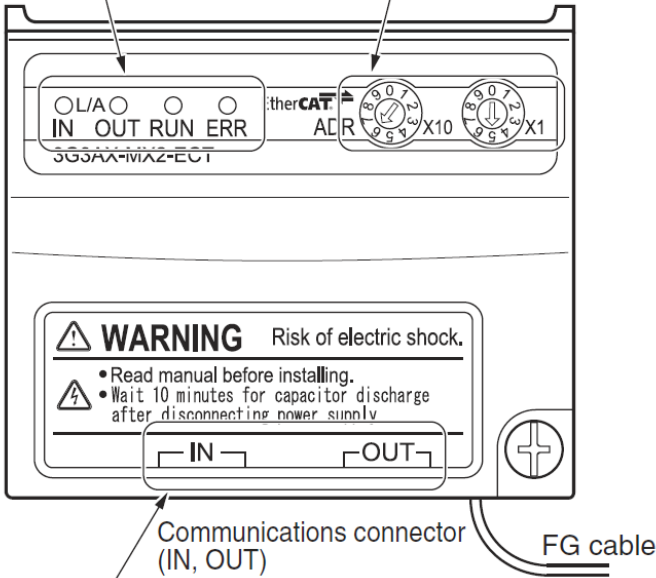
1. Ground the FG cable of the EtherCAT Communication Unit. Cut the ground wire of the unit's FG cable to an appropriate length and ground it to the closest possible ground location. Also refer to the Inverter manual.



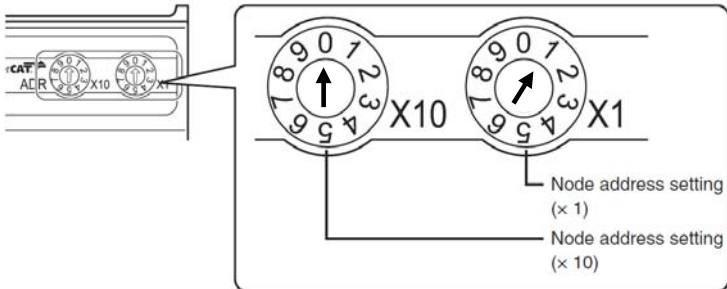
2 Refer to the right figure and check the hardware switches on the EtherCAT Communications Unit.

Status indicator (L/A IN, L/A OUT, RUN, ERR)

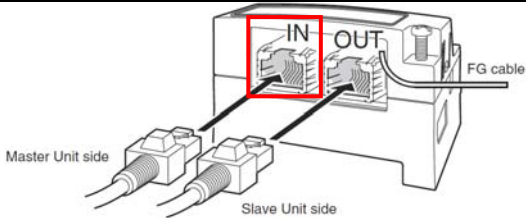
Rotary switches for node address setting (x 10, x 1)



3 Set the node address setting switches to "01".  
  
\*Set the node address to "1".



4 Connect the communications cable to Communications connector (IN).



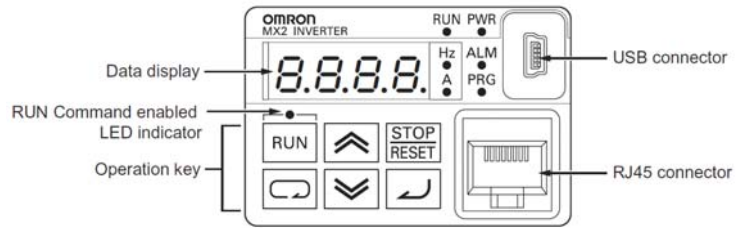
In this document, OUT side is not used.

7.2.2. Parameter Setting

Set the Inverter parameters.

- 1 Turn ON the power supply to the Inverter.

\*Set the parameters by using the digital operator on the front of the Inverter.



	Display	Various parameters, frequency/set value and other data are displayed (red).
	RUN key	Runs the Inverter. Take note that this key is enabled only when the RUN command destination is the Digital Operator.
	STOP/RESET Key	This key decelerates the Inverter to a stop. (Although the STOP/RESET key is enabled even when a RUN command is issued to a destination other than the Digital Operator (factory default), it can be disabled by a Setting (b087).) If the Inverter is already tripped, the trip will be reset (return from the tripping).
	Mode key	Parameter is displayed: Move to the beginning of the next function group. Data is displayed: Cancel the setting and return to the parameter display. Individual input mode: Move the blinking digit to the left. Regardless of the displayed screen, pressing and holding this key (for 1 second or more) displays the data for Output Frequency Monitor (d001).
 	Increment key Decrement key	These keys are used to increment/decrement a parameter or set data. Pressing and holding each key increases the incrementing/decrementing speed. Pressing the Increment and Decrement keys together activates the "Individual Input MODE" where each digit can be edited independently.
	Enter key	Parameter is displayed: Move to the data display. Data is displayed: Confirm/store the setting (in the EEPROM) and return to the parameter display. Individual input mode: Move the blinking digit to the right.

2 After turning ON the power supply, the panel displays as shown on the right. Use the procedure on the right to set the parameter.

0.00

After turning ON the power supply, the panel displays as shown on the left.

Press the  Mode Key 3 times.




[A001] Frequency Reference Selection 1: 04  
[A002] RUN Command Selection 1: 04

A001

A001 parameter is displayed.




Press the  Enter Key.

\*Set "04" (optional board).

02

The initial data is displayed.




Press the  Increment Key twice.

\*When the power supply is turned ON, the data of d001 (Output frequency monitor) is displayed. (In the case of factory default value)

04

Change the data to "04".




Press the  Enter Key.

A001

The parameter is displayed again.




Press the  Increment Key once.

A002

A002 parameter is displayed.




Press the  Enter Key.

02

The initial data is displayed.




Press the  Increment Key two times.

04

Change the data to "04".



Press the  Enter Key.

A002

The parameter is displayed again.

3 Use the procedure on the right to set the display selection.

[b037] Display selection: 01

\*Set "01" (Individual display of functions).

\*The parameters on the following step are not displayed when the factory default setting (04: Basic display) is used.

A002

The parameter is displayed.




Press the  Mode Key once.

b001

b001 parameter is displayed.




Press the  Increment Key four times.

b037

b037 parameter is displayed.




Press the  Enter Key.

04

The initial data is displayed.




Press the  Increment Key three times.

01

Change the data to "01".



Press the  Enter Key.

b037

The parameter is displayed again.



- 4 Use the procedure on the right to set the parameter.

[C102] Reset selection: 03.

\*Set "03" (Trip reset only).

6037

The parameter is displayed.




Press the  Mode Key once.

0001

C001 parameter is displayed.



Press the  Increment Key to move to C102.

C 102

C102 parameter is displayed.




Press the  Enter Key.

00

The initial data is displayed.




Press the  Increment Key three times.

03

Change the data to "03".



Press the  Enter Key.

C 102

The parameter is displayed again.


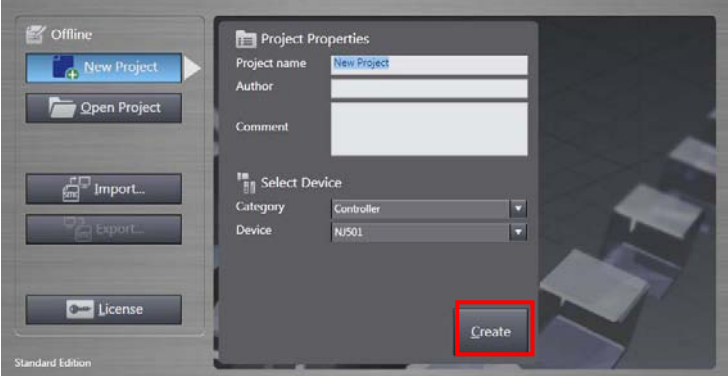
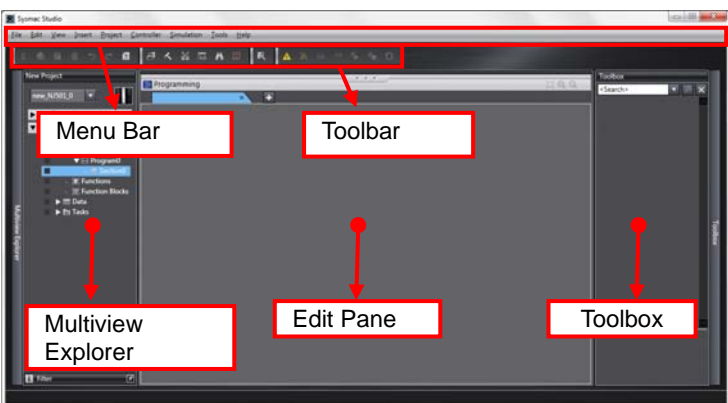
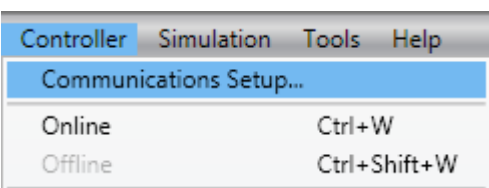
- 5 Cycle the power supply to the Inverter.

### 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.

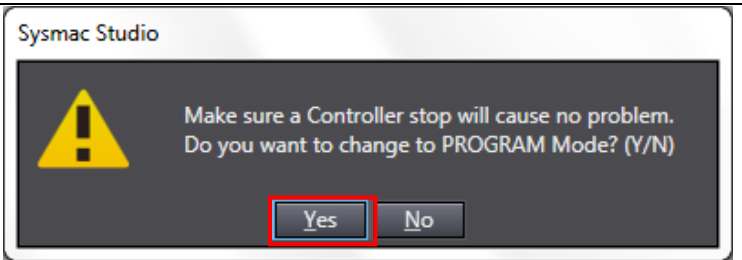
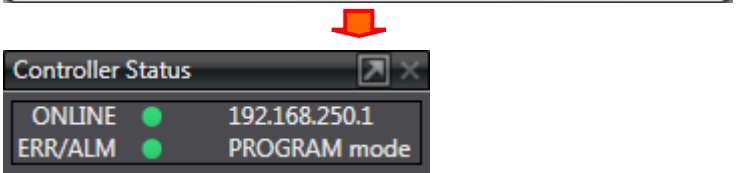

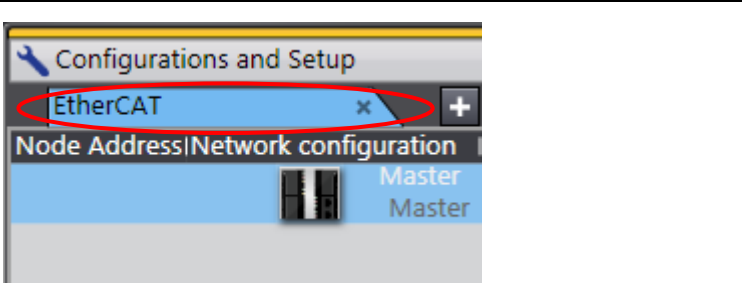
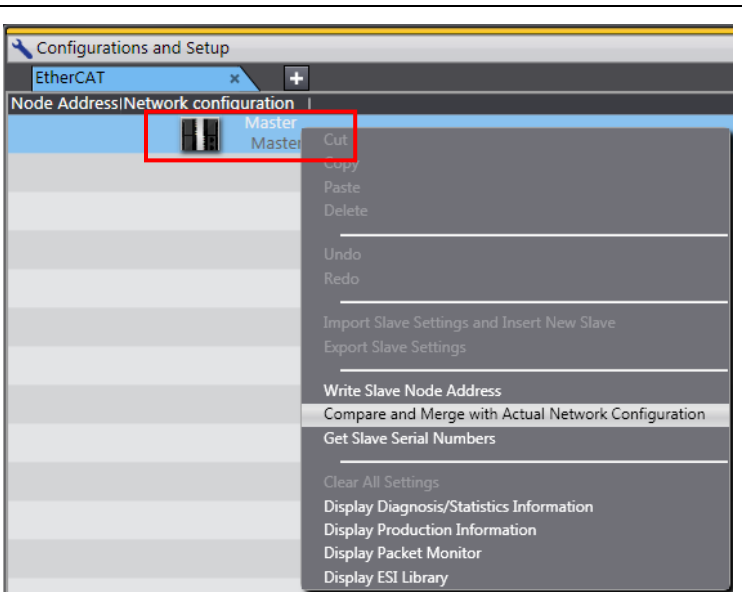
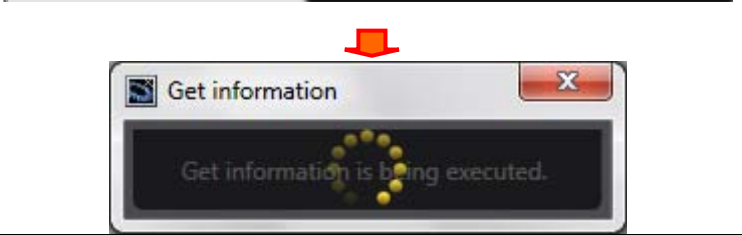
<p>1 Start the Sysmac Studio. Click the <b>New Project</b> Button.</p>	
<p>2 The Project Properties Dialog Box is displayed. Click the <b>Create</b> Button.</p> <p>*In this document, New Project is set as the project name.</p>	
<p>3 The New Project Pane is displayed.</p> <p>There are Menu Bar and Toolbar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



**Additional Information**

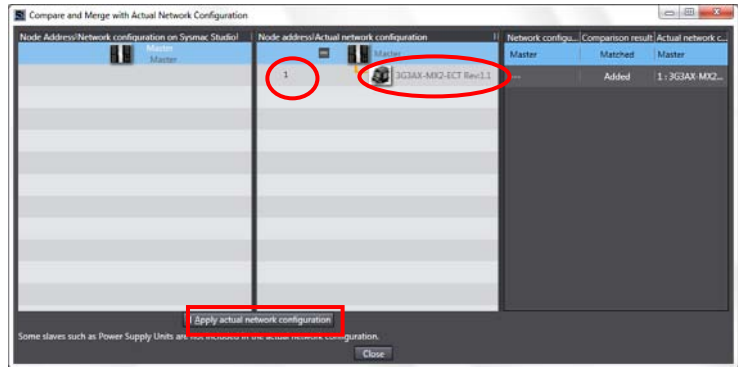
For details on the online connections to a Controller, refer to *Section 5 Going Online with a Controller* in the *Sysmac Studio Version 1.0 Operation Manual (Cat. No. W504)*.

- |          |  |  |
|----------|--|--|
| <p>5</p> | <p>The Communications Setup Dialog Box is displayed. Select the <i>Direct connection via USB</i> Option in the Connection Type Field.</p> <p>Click the <b>OK</b> Button.</p>   |  |
| <p>6</p> | <p>Select <b>Online</b> from the Controller Menu. A confirmation dialog is displayed. Click the <b>Yes</b> Button.</p> <p>*A displayed dialog depends on the status of the Controller used. Select the <b>Yes</b> Button or other button to proceed with the processing.</p> |  |
| <p>7</p> | <p>When an online connection is established, a yellow bar is displayed on the top of the Edit Pane.</p>  |  |
| <p>8</p> | <p>Select <b>Mode - PROGRAM Mode</b> from the Controller Menu.</p>   |  |

<p>9 A confirmation dialog is displayed. Click the <b>Yes</b> Button.</p> <p>Check that the controller status on the Toolbox was changed to the PROGRAM mode.</p>	 
<p>10 Double-click <b>EtherCAT</b> under Configurations and Setup in the Multiview Explorer. Or, right-click <b>EtherCAT</b> under Configurations and Setup and select <b>Edit</b>.</p>	
<p>11 The EtherCAT Tab Page is displayed in the Edit Pane.</p>	
<p>12 Right-click the Master Icon and select <b>Compare and Merge with Actual Network Configuration</b>.</p> <p>A screen is displayed stating "Get information is being executed".</p>	 

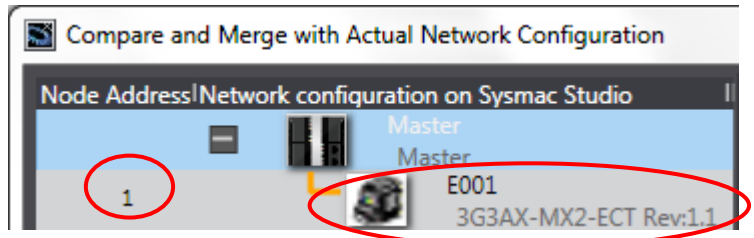
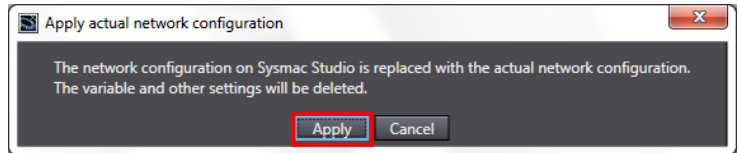
13 The Compare and Merge with Actual Network Configuration Pane is displayed. Node address 1 and 3G3AX-MX2-ECT Rev:1.1 are added to the actual network configuration of the comparison result.

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

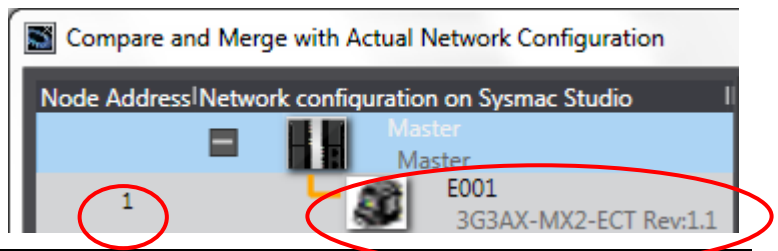


14 A confirmation dialog box is displayed. Click the **Apply** Button.

Check that node address 1 and E001 3G3AX-MX2-ECT Rev:1.1 were added to the network configuration of the Sysmac Studio. Click the **Close** Button.



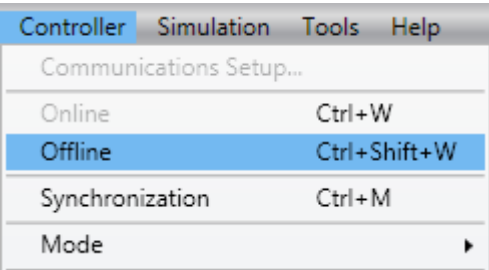
15 Node address 1 and E001 3G3AX-MX2-ECT Rev:1.1 are added to the EtherCAT Tab Page in the Edit Pane.



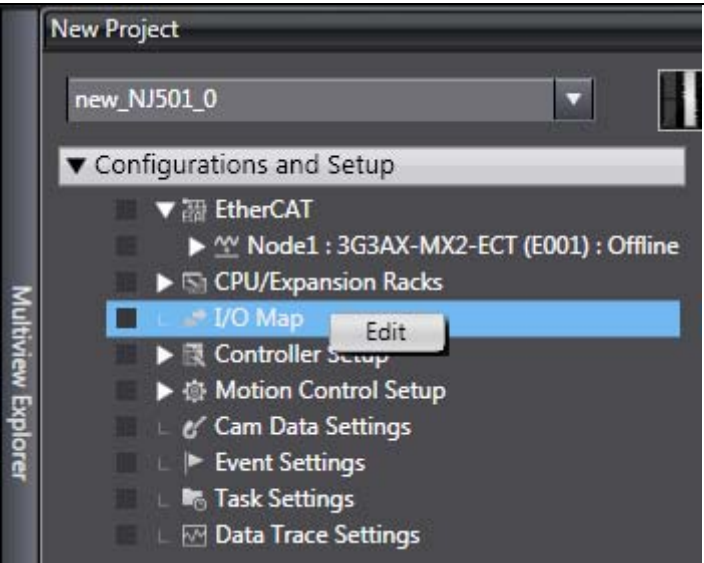
7.3.2. Setting Global Variables

Set global variables to use for the EtherCAT Slave Unit.

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

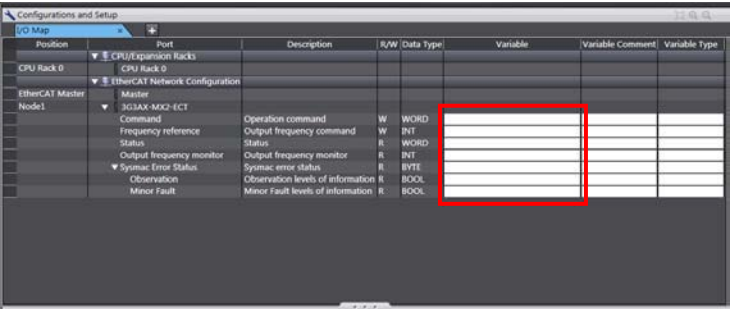


2 Double-click **I/O Map** under Configurations and Setup on the Multiview Explorer, or right-click it and select **Edit**.



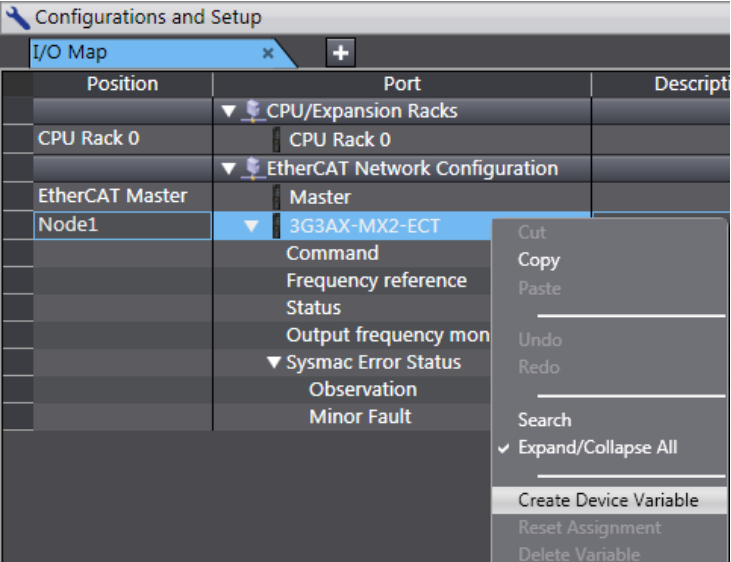
3 The I/O Map Tab Page is displayed on the Edit Pane.

Click a column under Variable to enter a new variable.



Position	Port	Description	R/W	Data Type	Variable	Variable Comment	Variable Type
CPU/Expansion Racks							
CPU Rack 0	CPU Rack 0						
EtherCAT Network Configuration							
EtherCAT Master							
Node1							
3G3AX-MX2-ECT							
		Operation command	W	WORD			
		Command	W	INT			
		Frequency reference	W	INT			
		Output frequency command	R	WORD			
		Status	R	WORD			
		Output frequency monitor	R	INT			
		Output frequency monitor	R	INT			
System Error Status							
		System error status	R	BYTE			
		Observation	R	BOOL			
		Observation levels of information	R	BOOL			
		Minor Fault	R	BOOL			

4 Right-click the row for Node1 and 3G3AX-MX2-ECT. Then, select **Create Device Variable**.



Position	Port	Description
	▼ CPU/Expansion Racks	
CPU Rack 0	CPU Rack 0	
	▼ EtherCAT Network Configuration	
EtherCAT Master	Master	
Node1	▼ 3G3AX-MX2-ECT	
	Command	
	Frequency reference	
	Status	
	Output frequency monitor	
	▼ Sysmac Error Status	
	Observation	
	Minor Fault	

5 The Variable names and Variable Types are automatically set.



Position	Port	Description	I/W	Data Type	Variable	Variable Comment	Variable Type
	▼ CPU/Expansion Racks						
CPU Rack 0	CPU Rack 0						
	▼ EtherCAT Network Configuration						
EtherCAT Master	Master						
Node1	▼ 3G3AX-MX2-ECT						
	Command	Operation command	W	WORD	E001_Command		Global Variables
	Frequency reference	Output frequency command	W	INT	E001_Frequency_reference		Global Variables
	Status	Status	R	WORD	E001_Status		Global Variables
	Output frequency monitor	Output frequency monitor	R	INT	E001_Output_frequency_monitor		Global Variables
	▼ Sysmac Error Status						
	Observation	Systemac error status	R	BYTE	E001_Systemac_Error_Status		Global Variables
	Minor Fault	Observation levels of information	R	BOOL	E001_Observation		Global Variables
		Minor Fault levels of information	R	BOOL	E001_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**

In the example above, a device variable name is automatically created for each slave. However, a name 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

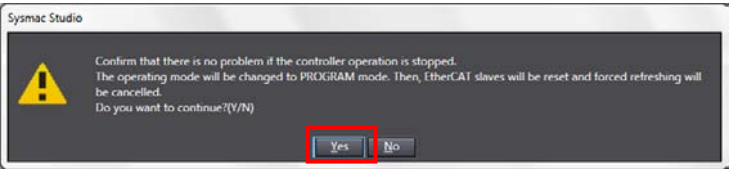
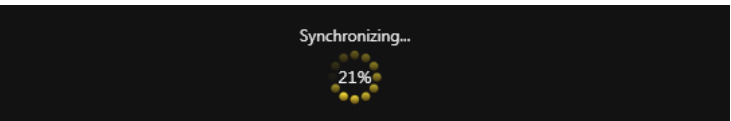
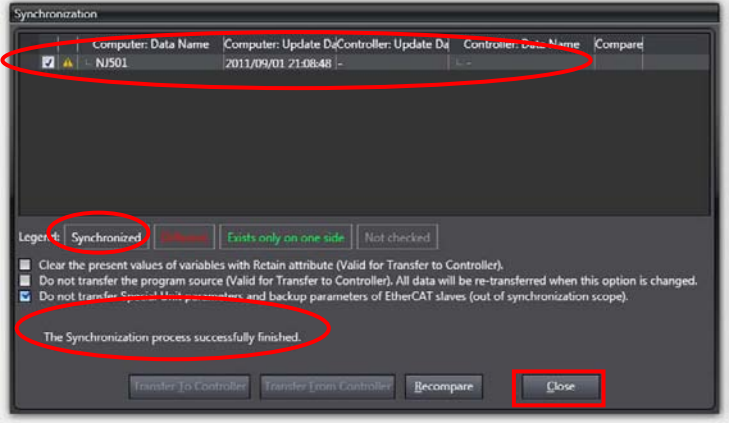
Always confirm safety at the destination node before you transfer a user program, configuration data, setup data, device variables, or values in memory used for CJ-series Units from the Sysmac Studio.

The devices or machines may perform unexpected operation regardless of the operating mode of the CPU Unit.



1	Select <b>Online</b> 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 <b>Synchronization</b> from the Controller Menu.	
4	The Synchronization Dialog Box is displayed. Check that the data to transfer (NJ501 in the right figure) is selected. Then, click the <b>Transfer to Controller</b> Button.	




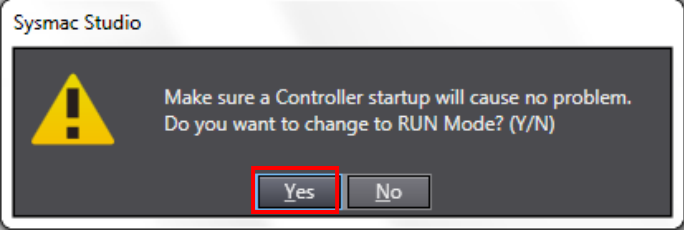
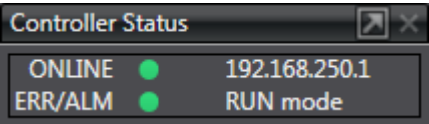
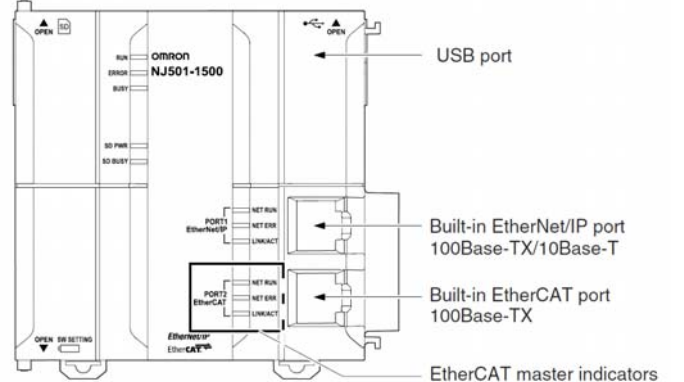
<p>5 A confirmation dialog is displayed. Click the <b>Yes</b> Button.</p> <p>A screen stating "Synchronizing" is displayed.</p>	 <p>The screenshot shows a dialog box titled "Sysmac Studio" with a warning icon. The text reads: "Confirm that there is no problem if the controller operation is stopped. The 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 showing 21% completion.</p>												
<p>6 Check 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 <b>Close</b> Button.</p> <p>*If the synchronization fails, check the wiring and repeat the procedure described in this section.</p>	 <p>The screenshot shows the "Synchronization" dialog box. A table lists data items with columns for Computer, Update Date, Controller, and Compare. The first row is highlighted in green, indicating it is synchronized. The "Synchronized" legend item is circled in red. Below the table, there are checkboxes for "Clear the present values of variables with Retain attribute", "Do not transfer the program source", and "Do not transfer Special Macro parameters and backup parameters". The message "The Synchronization process successfully finished." is circled in red. The "Close" button is also circled in red.</p> <table border="1" data-bbox="718 526 1428 593"> <thead> <tr> <th>Computer</th> <th>Data Name</th> <th>Update Date</th> <th>Controller</th> <th>Update Date</th> <th>Compare</th> </tr> </thead> <tbody> <tr> <td><input checked="" type="checkbox"/></td> <td>NJ501</td> <td>2011/09/01 21:08:48</td> <td>-</td> <td>-</td> <td>-</td> </tr> </tbody> </table>	Computer	Data Name	Update Date	Controller	Update Date	Compare	<input checked="" type="checkbox"/>	NJ501	2011/09/01 21:08:48	-	-	-
Computer	Data Name	Update Date	Controller	Update Date	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

Check that the EtherCAT communications are performed normally.

<p>1 Select <b>Mode - RUN Mode</b> from the Controller Menu.</p>																																	
<p>2 A confirmation dialog is displayed. Click the <b>Yes</b> Button.</p> <p>Check that the controller status on the Toolbox was changed to the RUN mode.</p>	 																																
<p>3 Check the LED indicators on the Controller to confirm if EtherCAT communication is normally performed.</p> <p>LED indicators in normal status.          [NET RUN]: Lit green          [NET ERR]: Not lit          [LINK/ACT]: Flashing</p>	 <table border="1" data-bbox="790 1579 1460 2038"> <thead> <tr> <th>Label</th> <th>Name</th> <th>Color</th> <th>Status</th> <th>Meaning</th> </tr> </thead> <tbody> <tr> <td rowspan="3">EtherCAT NET RUN</td> <td rowspan="3">RUN</td> <td rowspan="3">Green</td> <td>Lit</td> <td>EtherCAT communications are in progress. • I/O data is being input and output.</td> </tr> <tr> <td>Flashing</td> <td>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.</td> </tr> <tr> <td>Not lit</td> <td>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.</td> </tr> <tr> <td rowspan="3">EtherCAT NET ERR</td> <td rowspan="3">ERROR</td> <td rowspan="3">Red</td> <td>Lit</td> <td>There is an unrecoverable error, such as a hardware error or an exception.</td> </tr> <tr> <td>Flashing</td> <td>There is a recoverable error.</td> </tr> <tr> <td>Not lit</td> <td>There is no error.</td> </tr> <tr> <td rowspan="3">EtherCAT LINK/ACT</td> <td rowspan="3">Link/Activity</td> <td rowspan="3">Yellow</td> <td>Lit</td> <td>The link is established.</td> </tr> <tr> <td>Flashing</td> <td>A link is established and data is being sent and received. The indicator flashes whenever data is sent or received.</td> </tr> <tr> <td>Not lit</td> <td>The link is not established.</td> </tr> </tbody> </table>	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.
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.																													
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			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 LED indicators on the Inverter.

LED indicators in normal status.

[L/A IN]: Flickering

[RUN]: Green ON

[ERR]: OFF

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



Meaning	Color	Status	Description
L/A IN	Green	OFF	Link not established in physical layer
		ON	Link established in physical layer
		Flickering	In operation after establishing link
L/A OUT	Green	OFF	Link not established in physical layer
		ON	Link established in physical layer
		Flickering	In operation after establishing link
RUN	Green	OFF	Init state
		Blinking	Pre-Operational state
		Single flash	Safe-Operational state
		ON	Operational state
ERR	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 that the correct data are sent and received.

## WARNING

The Inverter will start the operation if you perform the following procedure. Confirm safety before you perform the procedure. If you cannot confirm the safety, complete the check procedure in Section 7.4.1 and do not perform the procedure in this section. When you perform the check procedure in this section, make sure to complete all the steps and to place the operation in the safe state.



## 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.

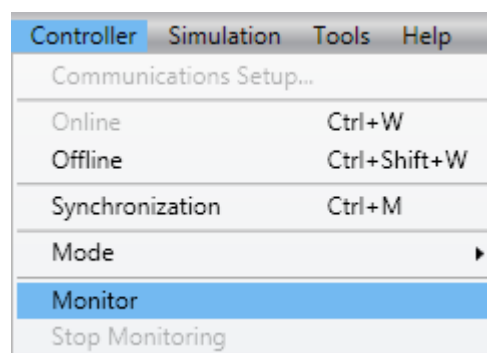


- 1 Check the Monitor Button and Stop Monitoring Button on the toolbar of the Sysmac Studio to see if the Controller is in monitor status. Check that the Monitor Button is selected and is not selectable and that the Stop Monitoring Button is selectable (monitor status) as shown in the right figure.



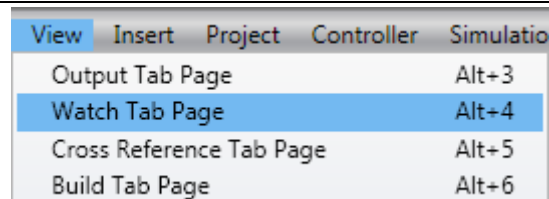
-  Monitor
-  Stop Monitoring


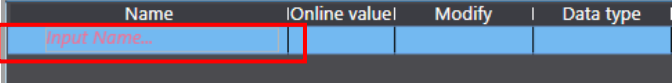
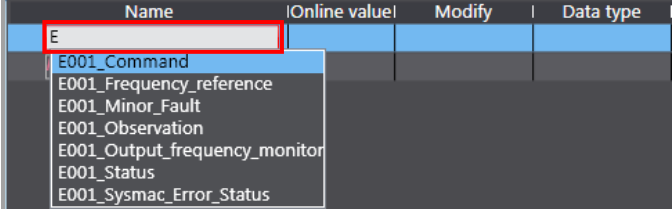
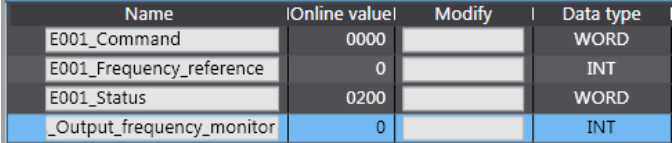
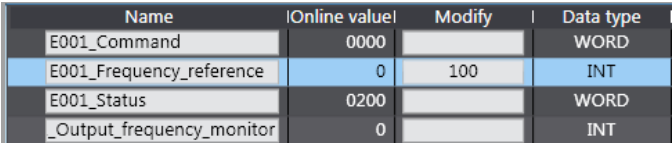
\*If the Controller is not in monitor status, select **Monitor** from the Controller Menu of the Sysmac Studio.



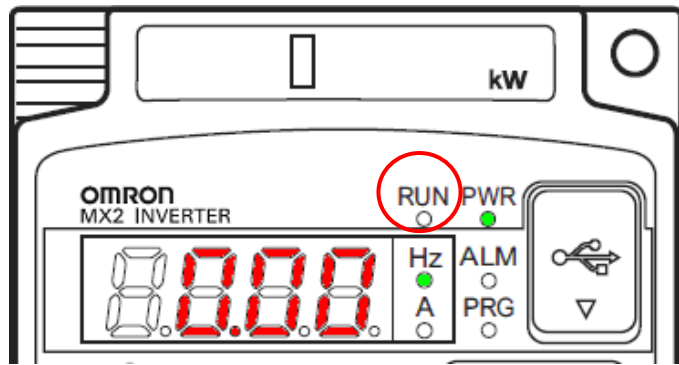
\*If the Sysmac Studio is offline, go online by following steps 1 to 4 of 7.3.2.

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



- 3 The Watch Tab Page is displayed in the lower section of the Edit Pane.
- 
- 4 Click the cell that states Input Name at the bottom of the Watch Tab Page.
- 
- 5 Now, characters can be entered. Enter the device variable name. Enter Operation command to Inverter: *E001\_Command*. Type the first character E. A list of device variables starting with E is displayed. Scroll the list and select *E001\_Command*. Double-click *E001\_Command*. *E001\_Command* is entered in the Name Column.
- 
- 6 In the same way, enter the following variables.  
 Output frequency: *E001\_Frequency\_reference*  
 Status: *E001\_Status*  
 Output frequency monitor: *E001\_Output\_frequency\_monitor*
- 
- 7 Check that the online value of Status: *E001\_Status* is 0200 (bit 9: Remote is 1).
- \*Status bit 9: Remote  
 0:Local: (Operations from EtherCAT are disabled)  
 1:Remote: (Operations from EtherCAT are enabled)
- Status (Status)
- |    |   |   |    |   |   |   |   |   |   |   |   |   |   |   |
|----|---|---|----|---|---|---|---|---|---|---|---|---|---|---|
| 15 | - | - | 12 | - | - | 9 | - | 7 | - | - | 3 | - | 1 | 0 |
|----|---|---|----|---|---|---|---|---|---|---|---|---|---|---|
- | Bit | Name  | Meaning  |
|-----|---|--|
| 0   | Forward operation in progress                           | 0:Stopped/during reverse operation<br>1:During forward operation   |
| 1   | Reverse Operation in progress                           | 0:Stopped/during forward operation<br>1:During reverse operation   |
| 3   | Fault   | 0:No error or trip occurred for the unit or Inverter<br>1:Error or trip occurred for the unit or Inverter    |
| 7   | Warning   | 0:No warning occurred for the unit or Inverter<br>1:Warning occurred for the unit or Inverter                |
| 9   | Remote  | 0:Local (Operations from EtherCAT are disabled)<br>1:Remote (Operations from EtherCAT are enabled)           |
| 12  | Frequency matching                                      | 0:During acceleration/deceleration<br>1:Frequency matching   |
| 15  | Connection error between the Optional Unit and Inverter | 0:Normal<br>1:Error (Cannot update data for the Inverter. To restore, turn the power OFF and then ON again.) |
| -   | (Reserved)  | The reserved area.   |
- 8 Enter "100" in Output frequency: *E001\_Frequency\_reference*.
- 

- 9 Check that the RUN LED indicator on the Inverter is unlit and the 7-segment display (Output frequency) is "0.00".



- 10 Enter "1" in the Operation command to Inverter: *E001\_Command*.

\*Command bit 0: Forward/stop  
 0:Stop  
 1:Forward command

Name	Online value	Modify	Data type
E001_Command	0000	1	WORD
E001_Frequency_reference	100	100	INT
E001_Status	0200		WORD
_Output_frequency_monitor	0		INT

Command

- - - - - 7 - - - - - 1 0

Bit	Name	Meaning
0	Forward/stop	0:Stop 1:Forward command
1	Reverse/stop	0:Stop 1:Reverse command
7	Fault reset	Resets an error or trip for the unit or Inverter.
-	(Reserved)	The reserved area. Set 0.

- 11 Check that Status:*E001\_Status* is "1201" and Output frequency monitor:*E001\_Output\_frequency\_monitor* is "100".

\*Status bit 0: Forward Operation in progress  
 0:Stopped/during reverse operation  
 1:During forward operation  
 \*Status bit 12: Frequency matching  
 0:During acceleration/deceleration  
 1:Frequency matching

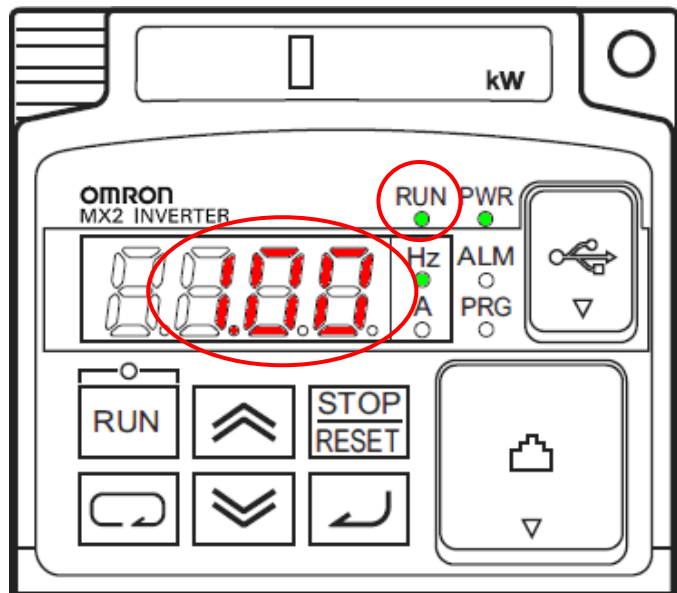
Name	Online value	Modify	Data type
E001_Command	0001	1	WORD
E001_Frequency_reference	100	100	INT
E001_Status	1201		WORD
_Output_frequency_monitor	100		INT

Status

15 - - - 12 - - - 9 - - 7 - - - 3 - - 1 0

Bit	Name	Meaning
0	Forward operation in progress	0:Stopped/during reverse operation 1:During forward operation
1	Reverse operation in progress	0:Stopped/during forward operation 1:During reverse operation
3	Fault	0:No error or trip occurred for the unit or Inverter 1>Error or trip occurred for the unit or Inverter
7	Warning	0:No warning occurred for the unit or Inverter 1:Warning occurred for the unit or Inverter
9	Remote	0:Local (Operations from EtherCAT are disabled) 1:Remote (Operations from EtherCAT are enabled)
12	Frequency matching	0:During acceleration/deceleration 1:Frequency matching
15	Connection error between the Optional Unit and Inverter	0:Normal 1:Error (Cannot update data for the Inverter. To restore, turn the power OFF and then ON again.)
-	(Reserved)	The reserved area.

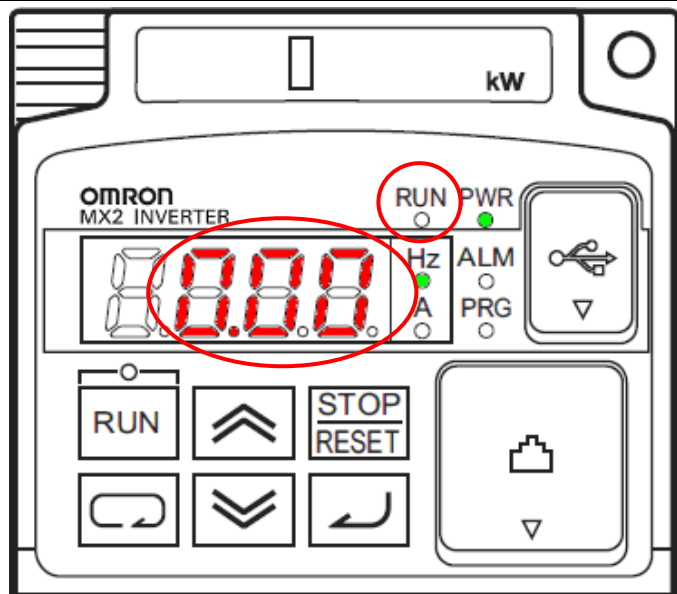
- 12 Check that the RUN LED indicator on the Inverter is lit and the 7-segment LED indicator (Output frequency) is "1.00".



- 13 Enter "0" in the Output frequency: *E001\_Frequency\_reference* and "0" in Operation command to Inverter: *E001\_Command*.

Name	Online value	Modify	Data type
E001_Command	0000	0	WORD
E001_Frequency_reference	0	0	INT
E001_Status	0200		WORD
_Output_frequency_monitor	0		INT

- 14 Check that the 7-segment LED display (Output frequency) on the Inverter shows "0.00" again and RUN LED indicator is unlit.



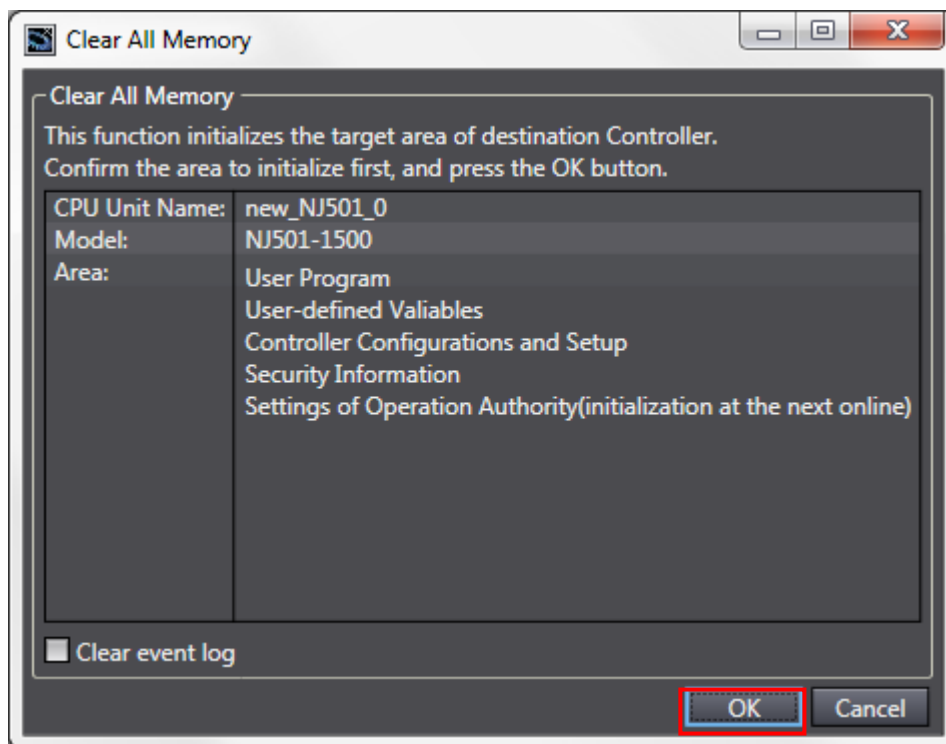
## 8. Initialization Method

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.



### 8.2. Inverter

To initialize the settings of the Inverter, refer to *Initialization Setting of 5-14 Other Functions* in the *MX2 User's Manual* (Cat.No. I570).



## 9. Revision History

Revision code	Date of revision	Revision reason and revision page
01	Mar. 26, 2013	First edition

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