Machine Automation Controller NJ-series

EtherCAT
Connection Guide

OMRON Corporation

3G3MX2-Series Inverter
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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.

<table>
<thead>
<tr>
<th>Cat.No.</th>
<th>Model</th>
<th>Manual name</th>
</tr>
</thead>
<tbody>
<tr>
<td>W500</td>
<td>NJ501-[]</td>
<td>NJ-series CPU Unit Hardware User's Manual</td>
</tr>
<tr>
<td>W505</td>
<td>NJ501-[]</td>
<td>NJ-series CPU Unit Built-in EtherCAT Port User's Manual</td>
</tr>
<tr>
<td>W504</td>
<td>SYSMAC-SE2[]</td>
<td>Sysmac Studio Version 1 Operation Manual</td>
</tr>
<tr>
<td>I570</td>
<td>3G3MX2-A[]</td>
<td>MX2 User's Manual</td>
</tr>
<tr>
<td>I574</td>
<td>3G3AX-MX2-ECT</td>
<td>Inverter MX2/RX Series EtherCAT Communication Unit User's Manual</td>
</tr>
</tbody>
</table>
# 2. Terms and Definition

<table>
<thead>
<tr>
<th>Terms</th>
<th>Explanation and Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PDO Communications</strong>&lt;br&gt;(Communications using Process Data objects)&lt;br&gt;&lt;br&gt;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).&lt;br&gt;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.&lt;br&gt;Variables are used to access from the NJ-series CPU Unit in the following ways.&lt;br&gt;• With device variables for EtherCAT slave I/O&lt;br&gt;• With Axis Variables for Servo Drive and encoder input slaves to which assigned as an axis</td>
<td>&lt;br&gt;This method is used for cyclic data exchange between the master unit and the slave units.</td>
</tr>
<tr>
<td><strong>SDO Communications</strong>&lt;br&gt;(Communications using Service Data objects)&lt;br&gt;&lt;br&gt;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.&lt;br&gt;• SDO data in slave units (parameters, error information, etc.)&lt;br&gt;&lt;br&gt;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.</td>
<td>&lt;br&gt;This method is used to read and write the specified slave unit data from the master unit when required.</td>
</tr>
<tr>
<td><strong>Slave Unit</strong>&lt;br&gt;&lt;br&gt;There are various types of slaves such as Servo Drives that handle position data and I/O terminals that control the bit signals.&lt;br&gt;The slave receives output data sent from the master, and transmits input data to the master.</td>
<td>&lt;br&gt;An address to identify the unit connected to the EtherCAT network.</td>
</tr>
<tr>
<td><strong>Node address</strong></td>
<td>&lt;br&gt;The ESI files contain information unique to the EtherCAT slaves in XML format.&lt;br&gt;Install an ESI file into the Sysmac Studio, to easily allocate slave process data and make other settings.</td>
</tr>
<tr>
<td><strong>ESI file</strong>&lt;br&gt;&lt;br&gt;(EtherCAT Slave Information file)</td>
<td>&lt;br&gt;The ESI files contain information unique to the EtherCAT slaves in XML format.</td>
</tr>
</tbody>
</table>
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.

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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.

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Name</th>
<th>Model</th>
<th>Version</th>
</tr>
</thead>
<tbody>
<tr>
<td>OMRON</td>
<td>NJ-series CPU Unit</td>
<td>NJ501-[]</td>
<td>-</td>
</tr>
<tr>
<td>OMRON</td>
<td>Inverter</td>
<td>3G3MX2-A[]</td>
<td>1.1 or later</td>
</tr>
<tr>
<td>OMRON</td>
<td>EtherCAT Communications Unit</td>
<td>3G3AX-MX2-ECT</td>
<td></td>
</tr>
</tbody>
</table>

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:

- Personal computer (Sysmac Studio installed, OS: Windows7)
- USB cable
- Ethernet cable
- NJ501-1500 (Built-in EtherCAT port)
- 3G3MX2-A2015 + 3G3AX-MX2-ECT

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Name</th>
<th>Model</th>
<th>Version</th>
</tr>
</thead>
<tbody>
<tr>
<td>OMRON</td>
<td>CPU Unit (Built-in EtherCAT port)</td>
<td>NJ501-1500</td>
<td></td>
</tr>
<tr>
<td>OMRON</td>
<td>Power Supply Unit</td>
<td>NJ1W-PA3001</td>
<td></td>
</tr>
<tr>
<td>OMRON</td>
<td>Sysmac Studio</td>
<td>Ver.1.00</td>
<td></td>
</tr>
<tr>
<td>-</td>
<td>Personal computer (OS: Windows7)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-</td>
<td>USB cable (USB 2.0 type B connector)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OMRON</td>
<td>Ethernet cable (with industrial Ethernet connector)</td>
<td>XS5W-T421-[]-[M][]-K</td>
<td></td>
</tr>
<tr>
<td>OMRON</td>
<td>Inverter</td>
<td>3G3MX2-A2015</td>
<td>V1.1</td>
</tr>
<tr>
<td>OMRON</td>
<td>EtherCAT Communications Unit</td>
<td>3G3AX-MX2-ECT</td>
<td></td>
</tr>
</tbody>
</table>
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.

<table>
<thead>
<tr>
<th>Destination device data</th>
<th>Global variable name</th>
<th>Data type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operation command to Inverter</td>
<td>E001_Command</td>
<td>WORD</td>
</tr>
<tr>
<td>Output frequency</td>
<td>E001_Frequency_reference</td>
<td>INT</td>
</tr>
</tbody>
</table>

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)**

<table>
<thead>
<tr>
<th>Destination device data</th>
<th>Global variable name</th>
<th>Data type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Status</td>
<td>E001_Status</td>
<td>WORD</td>
</tr>
<tr>
<td>Output frequency monitor</td>
<td>E001_Output_frequency_monitor</td>
<td>INT</td>
</tr>
</tbody>
</table>

- **Input area (Controller ← Destination device)**

<table>
<thead>
<tr>
<th>Destination device data</th>
<th>Global variable name</th>
<th>Data type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Status</td>
<td>E001_Status</td>
<td>WORD</td>
</tr>
<tr>
<td>Output frequency monitor</td>
<td>E001_Output_frequency_monitor</td>
<td>INT</td>
</tr>
</tbody>
</table>

- **Details of the status allocation (Controller ← Destination device)**

<table>
<thead>
<tr>
<th>Destination device data</th>
<th>Global variable name</th>
<th>Data type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sysmac error status</td>
<td>E001_Sysmac_Error_Status</td>
<td>BYTE</td>
</tr>
<tr>
<td>Error information at observation level</td>
<td>E001_Observation</td>
<td>BOOL</td>
</tr>
<tr>
<td>Error information at minor fault level</td>
<td>E001_Minor_Fault</td>
<td>BOOL</td>
</tr>
</tbody>
</table>
### 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.

<table>
<thead>
<tr>
<th><strong>7.2 Setting Up the Inverter</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>7.2.1 Hardware Settings</td>
<td>Set up the Inverter. Check the hardware switches on the Inverter.</td>
</tr>
<tr>
<td>7.2.2 Parameter Setting</td>
<td>Set the Inverter parameters.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>7.3 Setting Up the Controller</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>7.3.1 Starting the Sysmac Studio and Setting the EtherCAT network configuration</td>
<td>Set up the Controller. Start the Automation Software Sysmac Studio and set the EtherCAT network configuration.</td>
</tr>
<tr>
<td>7.3.2 Setting the Global Variables</td>
<td>Set global variables to use for the EtherCAT Slave Unit.</td>
</tr>
<tr>
<td>7.3.3 Transferring the Project Data</td>
<td>Transfer the project data from the Sysmac Studio to the Controller.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>7.4 Connection Status Check</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>7.4.1 Checking the Connection Status</td>
<td>Check the connection status of the EtherCAT network. Check that the EtherCAT communications are performed normally.</td>
</tr>
<tr>
<td>7.4.2 Checking Data that are Sent and Received</td>
<td>Check that the correct data are sent and received.</td>
</tr>
</tbody>
</table>
7. Connection Procedure

7.2. Setting Up the Inverter

Set up the Inverter.

7.2.1. Hardware Setting

Check the hardware switches on the Inverter.

Precautions for Correct Use

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

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.

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

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

*Set "04" (optional board).

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

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0.00

After turning ON the power supply, the panel displays as shown on the left. Press the Mode Key 3 times.

A001

A001 parameter is displayed. Press the Enter Key.

02

The initial data is displayed. Press the Increment Key twice.

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.
### 7. Connection Procedure

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

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A002</td>
<td>The parameter is displayed. Press the Mode Key once.</td>
</tr>
<tr>
<td>b001</td>
<td>b001 parameter is displayed. Press the Increment Key four times.</td>
</tr>
<tr>
<td>b037</td>
<td>b037 parameter is displayed. Press the Enter Key.</td>
</tr>
<tr>
<td>04</td>
<td>The initial data is displayed. Press the Increment Key three times.</td>
</tr>
<tr>
<td>01</td>
<td>Change the data to &quot;01&quot;. Press the Enter Key.</td>
</tr>
<tr>
<td>b037</td>
<td>The parameter is displayed again.</td>
</tr>
</tbody>
</table>
4 Use the procedure on the right to set the parameter.

[C102] Reset selection: 03.

*Set "03" (Trip reset only).

5 Cycle the power supply to the Inverter.
7. Connection Procedure

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.

1. Start the Sysmac Studio.
   Click the **New Project** Button.

2. The Project Properties Dialog Box is displayed. Click the **Create** Button.
   *In this document, New Project is set as the project name.

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.

4. Select **Communications Setup** from the Controller Menu.
7. Connection Procedure

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).

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.

8. Select Mode - PROGRAM Mode from the Controller Menu.
9 A confirmation dialog is displayed. Click the Yes Button.

Check that the controller status on the Toolbox was changed to the PROGRAM mode.

10 Double-click EtherCAT under Configurations and Setup in the Multiview Explorer. Or, right-click EtherCAT under Configurations and Setup and select Edit.

11 The EtherCAT Tab Page is displayed in the Edit Pane.

12 Right-click the Master Icon and select Compare and Merge with Actual Network Configuration.

A screen is displayed stating "Get information is being executed".
### 7. Connection Procedure

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>13</td>
<td>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 <strong>Apply actual network configuration</strong> Button.</td>
</tr>
<tr>
<td>14</td>
<td>A confirmation dialog box is displayed. Click the <strong>Apply</strong> 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 <strong>Close</strong> Button.</td>
</tr>
<tr>
<td>15</td>
<td>Node address 1 and E001 3G3AX-MX2-ECT Rev:1.1 are added to the EtherCAT Tab Page in the Edit Pane.</td>
</tr>
</tbody>
</table>
7. Connection Procedure

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

5 The Variable names and Variable Types are automatically set.

---

**Additional Information**

The device variable names are created automatically from a combination of the device names and the I/O port names.

For slave units, the default device names start with an "E" followed by a sequential number starting from "001".

---

**Additional Information**

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.

<table>
<thead>
<tr>
<th>Step</th>
<th>Action</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Select <strong>Online</strong> from the Controller Menu.</td>
<td>![Controller Menu with Online selected]</td>
</tr>
<tr>
<td>2</td>
<td>When an online connection is established, a yellow bar is displayed on the top of the Edit Pane.</td>
<td>![Edit Pane with I/O Map]</td>
</tr>
<tr>
<td>3</td>
<td>Select <strong>Synchronization</strong> from the Controller Menu.</td>
<td>![Controller Menu with Synchronization selected]</td>
</tr>
<tr>
<td>4</td>
<td>The Synchronization Dialog Box is displayed. Check that the data to transfer (NJ501 in the right figure) is selected. Then, click the <strong>Transfer to Controller</strong> Button.</td>
<td>![Transfer to Controller Button]</td>
</tr>
</tbody>
</table>

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

A screen stating “Synchronizing” is displayed.

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".

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

*If the synchronization fails, check the wiring and repeat the procedure described in this section.*
7. Connection Procedure

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.

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

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

   Check that the controller status on the Toolbox was changed to the RUN mode.

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

<table>
<thead>
<tr>
<th>LED Indicators</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>[NET RUN]</strong>: Lit green</td>
<td>EtherCAT communications are in progress.</td>
</tr>
<tr>
<td><strong>[NET ERR]</strong>: Not lit</td>
<td>There is an unrecoverable error, such as a hardware error or an exception.</td>
</tr>
<tr>
<td><strong>[LINK/ACT]</strong>: Flashing</td>
<td>EtherCAT communications are established. Communication is in one of the following states.</td>
</tr>
</tbody>
</table>
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.

<table>
<thead>
<tr>
<th>Meaning</th>
<th>Color</th>
<th>Status</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>L/A IN</td>
<td>Green</td>
<td>OFF</td>
<td>Link not established in physical layer</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ON</td>
<td>Link established in physical layer</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Flickering</td>
<td>In operation after establishing link</td>
</tr>
<tr>
<td>L/A OUT</td>
<td>Green</td>
<td>OFF</td>
<td>Link not established in physical layer</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ON</td>
<td>Link established in physical layer</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Flickering</td>
<td>In operation after establishing link</td>
</tr>
<tr>
<td>RUN</td>
<td>Green</td>
<td>OFF</td>
<td>Init state</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Blinking</td>
<td>Pre-Operational state</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Single flash</td>
<td>Safe-Operational state</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ON</td>
<td>Operational state</td>
</tr>
<tr>
<td>ERR</td>
<td>Red</td>
<td>OFF</td>
<td>No error</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Blinking</td>
<td>Communications Setting Error</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Single flash</td>
<td>Synchronization error or communications data error</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Double flash</td>
<td>Application WDT timeout</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Flickering</td>
<td>Boot error</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ON</td>
<td>PDI WDT timeout</td>
</tr>
</tbody>
</table>
7. Connection Procedure

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.

   *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.

   ![Monitor Button and Stop Monitoring Button](image)

   ![Watch Tab Page Menu](image)
7. Connection Procedure

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 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)

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

   Command

<table>
<thead>
<tr>
<th>Bit</th>
<th>Name</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Forward/stop</td>
<td>0:Stop</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1:Forward command</td>
</tr>
<tr>
<td>1</td>
<td>Reverse/stop</td>
<td>0:Stop</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1:Reverse command</td>
</tr>
<tr>
<td>7</td>
<td>Fault reset</td>
<td>Resets an error or trip for the unit or Inverter.</td>
</tr>
<tr>
<td></td>
<td>(Reserved)</td>
<td>The reserved area. Set 0.</td>
</tr>
</tbody>
</table>

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

   Status

<table>
<thead>
<tr>
<th>Bit</th>
<th>Name</th>
<th>Meaning</th>
</tr>
</thead>
</table>
   | 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.                                |
7. Connection Procedure

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.

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

<table>
<thead>
<tr>
<th>Revision code</th>
<th>Date of revision</th>
<th>Revision reason and revision page</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Mar. 26, 2013</td>
<td>First edition</td>
</tr>
</tbody>
</table>