Safety Network Controller NX-series

EtherNet/IP™ Safety
Connection Procedure

Robot Controller Common
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# Table of Contents

1. Related Manuals ........................................................................................................... 1
2. Terms and Definitions .................................................................................................. 2
3. Precautions .................................................................................................................. 3
4. Overview ...................................................................................................................... 4
5. Applicable Devices and Device Configuration .............................................................. 5
   5.1. Applicable Devices .................................................................................................. 5
   5.2. Device Configuration .............................................................................................. 6
6. EtherNet/IP Safety Settings ........................................................................................... 8
   6.1. Parameters .............................................................................................................. 8
   6.2. Global Variables .................................................................................................... 9
7. EtherNet/IP Safety Connection Procedure ................................................................. 9
   7.1. Work Flow ............................................................................................................. 9
   7.2. Robot Controller Setup ........................................................................................ 11
   7.3. Safety Controller Setup ....................................................................................... 12
   7.4. Network Settings .................................................................................................. 21
   7.5. EtherNet/IP Safety Communication Status Check ............................................. 30
8. Initialization Method .................................................................................................... 36
   8.1. Initializing a Safety Controller ............................................................................. 36
   8.2. Initializing Robot Controller ................................................................................ 37
9. Revision History ........................................................................................................... 38
# 1. Related Manuals

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

The table below lists the manuals provided by Robot and OMRON Corporation (hereinafter referred to as "OMRON"), which pertain to this document.

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Cat. No.</th>
<th>Model</th>
<th>Manual name</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>NX-SI□□□</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>NX-SO□□□</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>NX-CSG□□□</td>
<td></td>
</tr>
<tr>
<td>OMRON</td>
<td>W504</td>
<td>SYMAC-SE2□□□</td>
<td>Sysmac Studio Version 1 Operation Manual</td>
</tr>
<tr>
<td>—</td>
<td></td>
<td>Refer to each robot company's manual</td>
<td>It conforms to each company's Type Instruction manual of CIP Safety function</td>
</tr>
</tbody>
</table>

Robot controller (connection confirmed device ※ Check with sales)
# 2. Terms and Definitions

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

<table>
<thead>
<tr>
<th>Term</th>
<th>Explanation and Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety Network Number (SNN)</td>
<td>A unique number assigned to the safety network. In the CIP Safety, it is used for uniquely identifying and mutually verifying a device in several EtherNet/IP network configurations.</td>
</tr>
<tr>
<td>TUNID</td>
<td>A 10-byte ID consisting of a 6-byte Safety Network Number and a 4-byte Node ID. It is used for uniquely identifying a device.</td>
</tr>
<tr>
<td>Data Packet Interval (EPI)</td>
<td>A data update cycle specified in ms to communicate safety process data between the originator and the target.</td>
</tr>
<tr>
<td>safety application data</td>
<td>The data that contains the settings that are used to operate an NX-series Safety Control Unit. It consists of the safety programs, safety task, and variables. The data is created with Sysmac Studio and then is transferred and executed on a Safety CPU Unit.</td>
</tr>
</tbody>
</table>
3. Precautions

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

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

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

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

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

The following notations are used in this guide.

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

- **Caution**
  Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury or property damage.

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**Precautions for Correct Use**

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

**Additional Information**

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

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**Symbol**

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

This document describes procedures for connecting Robot Controller (hereinafter referred to as the "Robot Controller") to an OMRON NX-series Safety Network Controller (hereinafter referred to as the "Safety Controller") via EtherNet/IP Safety and for checking their communication status.

Refer to Section 6. EtherNet/IP Safety Settings and Section 7. EtherNet/IP Safety Connection Procedure to understand setting methods and key points to perform EtherNet/IP Safety communications.

The communication status in this document is checked without connecting the Robot.
5. Applicable Devices and Device Configuration

5.1. Applicable Devices

The applicable devices are as follows:

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Name</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>OMRON</td>
<td>NX-series Safety CPU Unit</td>
<td>NX-SL5□□□</td>
</tr>
<tr>
<td>OMRON</td>
<td>NX-series Communication Control Unit</td>
<td>NX-CSG□□□</td>
</tr>
<tr>
<td>—</td>
<td>Robot Controller</td>
<td>It conforms to each company's Type</td>
</tr>
<tr>
<td></td>
<td>Robot controller (connection confirmed device)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>※ Check with sales(s)</td>
<td></td>
</tr>
</tbody>
</table>

Precautions for Correct Use

In this document, the devices with models and versions listed in 5.2. OMRON’s Device Configuration are used as examples of applicable devices to describe the procedures for connecting the devices and checking their connection.

Devices listed in 5.2 with versions lower than the versions cannot be used.

To use the above devices with models not listed in 5.2. or versions higher than those listed in 5.2., check the differences in the specifications by referring to the manuals before operating the devices from such as “Version related information”.

Additional Information

This guide describes the procedures for establishing the network connection.

It does not provide information on operation, installation, wiring method, device functionality, or device operation, which is not related to the connection procedures.

Refer to the manuals or contact the device manufacturer.
### 5.2. Device Configuration

The hardware components to reproduce the connection procedures in this guide are as follows:

In this document, the Safety Controller is connected only to the unit power supply.

The I/O power supply is not used.

#### Manufacturer

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Name</th>
<th>Model</th>
<th>Version</th>
</tr>
</thead>
<tbody>
<tr>
<td>OMRON</td>
<td>NX-series Safety CPU Unit</td>
<td>NX-SL5700</td>
<td>Ver.1.1</td>
</tr>
<tr>
<td>OMRON</td>
<td>NX-series Communication Control Unit</td>
<td>NX-CSG320</td>
<td>Ver.1.3</td>
</tr>
<tr>
<td></td>
<td>Power supply (24 VDC) for the Safety Controller</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>OMRON</td>
<td>Sysmac Studio</td>
<td>SYSMAC-SE2□□□</td>
<td>Ver.1.24.2</td>
</tr>
<tr>
<td>OMRON</td>
<td>Compressed CIP device file (Refer to Precautions for Correct Use on use below)</td>
<td>CIP_Safety_XXXXX.zip* XXXXX is a unique name for each target device to be added</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>Personal computer (OS: Windows 10)</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>LAN cable (STP (shielded, twisted-pair) cable of Ethernet category 5 or higher)</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>Robot Controller</td>
<td>It conforms to each company's Type</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>EtherNet/IP Communication Function</td>
<td>Refer to the manual provided by robot manufacturer</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>Teach Pendant</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

#### Precautions for Correct Use

Prepare the compressed CIP device file specified above beforehand.

To obtain the file, contact OMRON Corporation.
Precautions for Correct Use

If a switching hub is used, refer to the *NX-series Safety Control Unit/ Communication Control Unit User's Manual* (Cat. No. Z395) for information on precautions for switching hub selection.

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Precautions for Correct Use

Update Sysmac Studio to the version in 5.2. or to a higher version.

If a version higher than the one specified is used, the procedures and related screenshots described in *Section 7.* and the subsequent sections may not be applicable.

In that case, use the equivalent procedures described in this guide by referring to the *Sysmac Studio Version 1 Operation Manual* (Cat. No. W504).
6. EtherNet/IP Safety Settings

This section describes the parameters and global variables that are all defined in this document.

6.1. Parameters

The following parameters are required to connect the Safety Controller and the Robot Controller via EtherNet/IP Safety.

Safety Controller

<table>
<thead>
<tr>
<th>Setting item</th>
<th>Setting value</th>
</tr>
</thead>
<tbody>
<tr>
<td>EtherNet/IP Port 2 IP address</td>
<td>192.168.250.1</td>
</tr>
<tr>
<td>Subnet mask</td>
<td>255.255.255.0</td>
</tr>
<tr>
<td>Safety Network Number</td>
<td>0004 00000001</td>
</tr>
</tbody>
</table>

Robot Controller

<table>
<thead>
<tr>
<th>Setting item</th>
<th>Setting value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ether port IP address</td>
<td>192.168.250.2</td>
</tr>
<tr>
<td>Subnet mask</td>
<td>255.255.255.0</td>
</tr>
<tr>
<td>CIP Safety Enable / Bypass</td>
<td>Enable</td>
</tr>
<tr>
<td>CIP Safety input size (byte)</td>
<td>Refer to robot manual</td>
</tr>
<tr>
<td>CIP Safety output size (byte)</td>
<td>Refer to robot manual</td>
</tr>
</tbody>
</table>

*1 The bytes of CIP Safety input and output sizes can be set, refer to the robot manual.

Connection settings

(Target Device to Originator Device)

<table>
<thead>
<tr>
<th>Setting item</th>
<th>Setting value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Originator Device Connection Type</td>
<td>Point to Point Connection</td>
</tr>
<tr>
<td>Target Device I/O Assembly</td>
<td>Refer to robot manual</td>
</tr>
<tr>
<td>Open Type</td>
<td>Open Only (Type2b)</td>
</tr>
<tr>
<td>Expected Packet Interval (EPI)</td>
<td>Refer to robot manual</td>
</tr>
</tbody>
</table>

(Originator Device to Target Device)

<table>
<thead>
<tr>
<th>Setting item</th>
<th>Setting value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Target Device I/O Assembly</td>
<td>Refer to robot manual</td>
</tr>
<tr>
<td>Open Type</td>
<td>Open Only (Type2b)</td>
</tr>
<tr>
<td>Expected Packet Interval (EPI)</td>
<td>Refer to robot manual</td>
</tr>
</tbody>
</table>

The value of EPI from the originator device to the target device can be set by a multiple of the safety task period (default value: 20 ms).
Additional Information

In this document, global variables are automatically generated for communication status check; it is recommended to create and use variables associated with the assignment of I/O ports of the programs used to build a safety control system.

Additional Information

For more information on assignment of the Robot Controller’s I/O data, refer to each Robot Controller’s MANUAL.

6.2. Global Variables

The Safety Controller treats EtherNet/IP Safety data as global variables.

Output area (Safety Controller to Robot Controller)
Input area (Robot Controller to Safety Controller)

Additional Information

In this document, global variables are automatically generated for communication status check; it is recommended to create and use variables associated with the assignment of I/O ports of the programs used to build a safety control system.

Additional Information

For more information on assignment of the Robot Controller’s I/O data, refer to each Robot Controller’s MANUAL.

7. EtherNet/IP Safety Connection Procedure

This section describes the procedures for connecting the Robot Controller and the Safety Controller via EtherNet/IP Safety. The procedures for setting up the Robot Controller and the Safety Controller in this document are based on the factory default settings.

For information on initialization, refer to Section 8. Initialization Method.

7.1. Work Flow

Take the following steps to connect the Robot Controller and the Safety Controller via EtherNet/IP Safety and to perform EtherNet/IP Safety communications.

7.2. Robot Controller Setup

Set up Robot Controller.

7.2.1. IP Address Settings

Set the IP address of the Robot Controller.
7.2.2. Parameter Settings
Set safety-associated parameters for the Robot Controller.

7.3. Safety Controller Setup
Set up the Safety Controller.

7.3.1. Hardware Configuration and IP Address Settings
Configure the hardware of the Safety Controller and set the IP address using the hardware switches.

7.3.2. Adding a CIP Device
Add the Robot Controller as a CIP device that can be used with Sysmac Studio.

7.3.3. Starting Sysmac Studio and Going Online
Start Sysmac Studio and go online with the Safety Controller.

7.3.4. Creating a Unit Configuration for the Safety Controller
Create and set up a unit configuration for the Safety Controller.

7.4. Network Settings
Set the EtherNet/IP Safety connection.

7.4.1. Setting Connections
Set connections between the Safety Controller and the Robot Controller.

7.4.2. Setting Global Variables
Set global variables for the Safety Controller.

7.4.3. Setting the TUNID
Set the TUNID for the Robot Controller.

7.4.4. Safety Validation
Perform the safety validation on the safety application data created with Sysmac Studio.

7.4.5. Transferring the Safety Application Data
Transfer the safety application data to the Safety Controller.

7.5. EtherNet/IP Safety Communication Status Check
Confirm that EtherNet/IP Safety communications is performed normally.

7.5.1. Checking the Connection Status
Check the EtherNet/IP Safety connection status.

7.5.2. Checking Sent Data
Check that correct data is sent.
## 7.2. Robot Controller Setup

Set up robot controller's IP address, safety I / O, and set byte size of I / O.

The settings are made using the Teach Pendant.
Connect the Teach Pendant and the Robot Controller beforehand.

### 7.2.1. IP Address Settings

Set the IP address of the Robot Controller.

<table>
<thead>
<tr>
<th>Step</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Turn ON Robot Controller.</td>
</tr>
<tr>
<td>2</td>
<td>Check the position of the keys on Teach Pendant by referring to the figure on the right.</td>
</tr>
<tr>
<td></td>
<td>Check the position of the operation key Refer to robot manual</td>
</tr>
<tr>
<td>3</td>
<td>Using the teach pendant, Set up below</td>
</tr>
<tr>
<td></td>
<td>- Enable safety I / O</td>
</tr>
<tr>
<td></td>
<td>- IP address</td>
</tr>
<tr>
<td></td>
<td>- Sub-net mask</td>
</tr>
<tr>
<td></td>
<td>- Number of input bytes</td>
</tr>
<tr>
<td></td>
<td>- Number of output bytes.</td>
</tr>
<tr>
<td></td>
<td>· Safety input / output: Enabled</td>
</tr>
<tr>
<td></td>
<td>· IP address: 192.168.250.2</td>
</tr>
<tr>
<td></td>
<td>· Subnet mask: 255.255.255.0</td>
</tr>
<tr>
<td></td>
<td>· Number of input bytes: Refer to robot manual</td>
</tr>
<tr>
<td></td>
<td>· Number of output bytes: Refer to robot manual</td>
</tr>
</tbody>
</table>

Teach pendant image example)
7.3. Safety Controller Setup

Set up the Safety Controller.
The Sysmac Studio is used for the Safety Controller setup, please install before proceeding.

7.3.1. Hardware configuration and IP address Settings
Configure the hardware of the Safety Controller and set the IP address using the hardware switches.

Precautions for Correct Use
Make sure that the power supply is OFF when before setting up.
If it is ON, the settings described in the following steps and subsequent procedures may not be applicable.

1. Make sure that Safety Controller is powered OFF.
2. Connect Safety CPU Unit to Communication Control Unit.
   Check the positions of Rotary switches and Built-in EtherNet/IP ports.
3. Set the IP address (IP address 2) of Built-in EtherNet/IP port (PORT2A / PORT2B) to 192.168.250.1 in the following way.
   Set Rotary switches for IP address 2 as follows:
   - x16: 0
   - x1: 1

*The first 3 octets of the IP address 2 are fixed to 192.168.250 (default).
The last octet is a value that is set by Rotary switches.
Connect Power supply to Safety Controller. As shown in the figure on the right, connect Built-in EtherNet/IP ports (PORT1 and PORT2A) to Personal computer and Port 2 of Robot Controller with LAN cables, respectively.

### 7.3.2. Adding a CIP Device

Add Robot Controller as a CIP device that can be used with Sysmac Studio.

When using safety devices other than those produced by Omron, the relevant CIP device file needs to be installed first in order to be used by Sysmac Studio.

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
</table>
| 1    | Extract the compressed CIP device file.  
      | * Place the file in any location on the personal computer. |
| ![Compressed file](image1.png) ![Folder after extraction](image2.png) |  |
| 2    | The following folder and file are contained in Folder after extraction.  
      | * devices folder  
      | * CIP_Device_Addition.exe |
| ![Folder after extraction](image3.png) ![CIP_Device_Addition.exe](image4.png) |  |
| 3    | Double-click CIP_Device_Addition.exe to execute the program.  
      | *If the User Account Control Dialog Box is displayed at start, make a selection to start. |
4 The Choose Setup Language Dialog Box is displayed. Select *English (United States)* and click **OK**.

5 The dialog box for preparation of installation is displayed first, and then the Sysmac Studio CIP Safety Additional Patch Dialog Box is displayed. Click **Next**.

6 The License Agreement Dialog Box is displayed. Check the contents and select *I accept the terms of the license agreement*. Click **Next**.
The Ready to Install the Program Dialog Box is displayed. Click **Install** to start installing the CIP device files (adding the CIP device).

The InstallShield Wizard Complete Dialog Box is displayed when completing the installation of the CIP device files (addition of the CIP device). Click **Finish**.
7.3.3. Starting Sysmac Studio and Going Online
Start Sysmac Studio and go online with the Safety Controller.

1. Turn ON Safety Controller and Robot Controller.

2. Start Sysmac Studio.
   *If the User Account Control Dialog Box is displayed at start, make a selection to start Sysmac Studio.

3. Sysmac Studio is started. Click **Connect to Device**.

4. The Connect to Device Dialog Box is displayed.
   Select **Safety Network Controller** as a device to connect.
   Select **Direct connection via Ethernet** and click **Connect**.

5. If the dialog box on the right is displayed, check the contents and click **OK**.
   *The contents of the dialog box vary depending on the status of Controller. Check the contents and click on an appropriate button to proceed with the processing.

6. The dialog box on the right is displayed. Check the contents and click **OK**.
The Auto Connect Project Dialog Box is displayed online. When an online connection is established, a yellow line is displayed under the toolbar.

The following panes are displayed in the window.
- Left: Multiview Explorer
- Top right: Toolbox
- Bottom right: Controller Status Pane
- Top middle: Edit Pane

The following tabs are displayed in the bottom middle of the window.
- Output Tab Page
- Build Tab Page
7.3.4. Creating a Unit configuration for the Safety Controller
Create and set up a unit configuration for the Safety Controller.

1. Double-click **CPU Rack** under **Configurations and Setup – CPU/Expansion Racks** in the Multiview Explorer while Sysmac Studio is online.

2. The CPU/Expansion Racks Tab Page is displayed in the Edit Pane.

3. Right-click **Unit 0** and select **Compare and Merge with Actual Unit Configuration** from the menu.
4. The comparison results are displayed. Click **Apply Actual Unit Configuration**.

5. Check that the configuration on Sysmac Studio and actual unit configuration match each other. Click **OK**.

6. Check that the actual unit configuration is set up in the CPU/Expansion Racks Tab Page.

7. Select **Offline** from the Controller Menu to go offline with Safety Controller.

The yellow line under the toolbar disappears when offline.
7.4. Network Settings

Set the EtherNet/IP Safety connection.

7.4.1. Setting Connections

Set connections between the Safety Controller and the Robot Controller.

In the connection settings via the built-in EtherNet/IP port 2 of the Safety Controller, configure the Robot Controller to use as a target device, and set connections between the Safety Controller and Robot Controller.

1. In the Multiview Explorer, select `new_SafetyCPU0` in the Controller Selection Box.


3. The Connection Settings (Originator) Tab Page is displayed in the Edit Pane. Click that is displayed to the right of Safety Network Number for EtherNet/IP Port 2.

4. The Safety Network Number Settings Dialog Box for EtherNet/IP Port 2 is displayed. Select Manual and enter the following values.

   - Hex: 0004
   - Decimal: 1

   Click OK.

5. Check that the Safety Network Number (SNN) for EtherNet/IP Port 2 is set to 000400000001.
6 Select Robot Safety Slave (Robot Controller) to open a connection from the Toolbox. Drag and drop it under the column header Target Device / Target I/O Assembly for EtherNet/IP Port 2.

7 Check that Robot Safety Slave (Robot Controller) is added as a target device for EtherNet/IP Port 2.

8 Click the target device and select Edit to set the IP address of Robot Controller (target device).

9 The Robot Safety Slave Dialog Box is displayed. Set the following IP address of the target device and click OK.

   - IP address: 192.168.250.2

10 Check the instance name given to each of the target I/O assemblies.

   *If the device variables are automatically generated, these instance names are respectively used as a part of each device variable.

   The instance names used in this document are as follows:
   - Safety Input Assembly * Bytes - [*Bytes]: CIPOriginator_Instance0
   - Safety Output Assembly * Bytes - [4Bytes]: CIPOriginator_Instance1
7.4.2. Setting Global Variables
Set global variables for the Safety Controller.

1. Click **Go To I/O Map** in the Connection Settings (Originator) Tab Page.

2. The I/O Map Tab Page is displayed.
   Click ▼ to the left of EtherNet/IP Port 2 (Originator) to expand.

3. Right-click **EtherNet/IP Port 2 (Originator)** and select **Create Device Variable** from the menu.

4. The variable names and types are set.
### 7.4.3. Setting the TUNID

Set the TUNID for the Robot Controller.

#### Precautions for Correct Use

Make sure that the LAN cables are connected to the devices before performing the following procedure. If not, turn OFF the devices, and then connect the LAN cables.

1. Select **Online** from the Controller Menu to go online with Safety Controller.
   - When an online connection is established, a yellow line is displayed under the toolbar.

2. Select **Configurations and Setup** – **Communications** – **Safety** – **EtherNet/IP Safety Connection Settings**, and double-click **Connection Settings (Originator)**.

3. The Connection Settings (Originator) Tab Page is displayed.

4. Clear the memory area (TUNID) of the target device. Right-click the target device (192.168.250.2) and select **Target Device – Clear Memory** from the menu.
5. The Target Memory Clear Dialog Box is displayed. Select **IP address** and **Password** from the list displayed in Option. Click **OK**.

6. Check that the dialog box on the right is displayed. Click **OK**.

7. Right-click the target device (192.168.250.2) and select **Target Device – Set TUNID** from the menu.

8. Check that the dialog box on the right is displayed. Click **OK**.
7.4.4. Safety Validation
Perform the safety validation on the safety application data created with Sysmac Studio.

1. Select **Mode – DEBUG Mode** from the Controller Menu.

2. The Mode change Dialog Box is displayed. Click **Yes**.

3. The Connect to safety device Dialog Box is displayed. Check the contents and click **OK**.

4. The transfer confirmation dialog box is displayed. Check the contents and click **Yes**.
5 The password confirmation dialog box is displayed. Leave the Password Field blank and click OK.


6 Select Safety Validation from the Controller Menu.

7 The confirmation dialog box on the right is displayed. Check the contents and click Yes.

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

9 The Safety Validation Dialog Box is displayed. Check the contents and click OK.
7.4.5. Transferring the Safety Application Data

Transfer the safety application data to the Safety Controller.

**WARNING**

Regardless of the operating mode of the Safety CPU Unit, devices or machines may perform unexpected operation when data is transferred, such as configuration data, setup data and device variables, from Sysmac Studio. Always confirm safety at the destination node before transferring the safety application data.

1. In the Multiview Explorer, select `new_Controller_0` in the Controller Selection Box.

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

3. The Synchronization Dialog Box is displayed. Check that the data to transfer (NX as an example) is selected. Click **Transfer To Controller**.

   *After executing "Transfer To Controller", the Sysmac Studio data is transferred to Controller, and the data is synchronized.*

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

   A screen is displayed stating "Synchronizing".
5 The Warning Dialog Box is displayed. Confirm that there is no problem, and click OK.

6 A dialog box is displayed stating "No connection to the safety device". Check the contents and click OK.

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

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

*If the synchronization fails, check the wiring and repeat from step 1.
7.5. EtherNet/IP Safety Communication Status Check

Confirm that EtherNet/IP Safety communications is performed normally.

7.5.1. Checking the Connection Status

Check the EtherNet/IP Safety connection status.

1. Check with LED indicators on Safety Controller (Safety CPU Unit) that EtherNet/IP Safety communications is performed normally.

   The LED indicators in normal status are as follows:
   - Seven-segment indicator: White alphanumeric characters, flashing
   - TS: Green lit
   - NS: Green lit

2. Check the status of Robot Controller using Teach Pendant.

   * Check with teaching pendant
7.5.2. Checking Sent Data
Check that correct data is sent.

⚠️ Caution
In this procedure, the output of the Robot Controller is performed, which may have a risk of unexpected operation of the devices connected to the Robot Controller. Ensure safety before proceeding with this operation check described here. If safety cannot be assured, do not proceed. When performing this operation check, make sure to complete all the steps and make the output of the Robot Controller safe.

⚠️ Caution
If I/O is wired in a state where the devices are powered ON, this may cause damage to the devices. Always read and follow the information provided in all safety precautions in the manuals for each device before wiring.

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

1. In the Multiview Explorer of Sysmac Studio, select `new_SafetyCPU0` in the Controller Selection Box.

2. Select `Watch Tab Page` from the View Menu in Sysmac Studio.
3 The Watch (Project) Tab Page is displayed. Check that the device name shows new_SafetyCPU0.

*If not, select new_SafetyCPU0 in the Controller Selection Box.

4 Click Input Name in the Name Column and enter the following variable. Select Boolean from the pull down list in the Display format Column.

- CIPOriginator_Instance1_Safety_Output_Data_Bit0

5 Check the output from Safety Controller to Robot Controller.

To change the operating mode of Safety Controller to DEBUG Mode, first temporarily change the mode to PROGRAM Mode. Select Mode – PROGRAM Mode from the Controller Menu.

6 The Mode Change Dialog Box is displayed. Confirm that there is no problem, and click Yes.

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

8 Next, change the operating mode of Safety Controller to DEBUG Mode. Select Mode – DEBUG Mode from the Controller Menu.
<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>9</strong></td>
<td>The Mode Change Dialog Box is displayed. Confirm that there is no problem, and click <strong>Yes</strong>.</td>
</tr>
<tr>
<td><img src="image1.png" alt="Mode Change Dialog Box" /></td>
<td></td>
</tr>
<tr>
<td><strong>10</strong></td>
<td>The dialog box on the right is displayed. Confirm that there is no problem, and click <strong>Yes</strong>.</td>
</tr>
<tr>
<td><img src="image2.png" alt="Dialog Box 1" /></td>
<td></td>
</tr>
<tr>
<td><strong>11</strong></td>
<td>The dialog box on the right is displayed. Check the contents and click <strong>OK</strong>.</td>
</tr>
<tr>
<td><img src="image3.png" alt="Dialog Box 2" /></td>
<td></td>
</tr>
<tr>
<td><strong>12</strong></td>
<td>The dialog box on the right is displayed. Check the contents and click <strong>OK</strong>.</td>
</tr>
<tr>
<td><img src="image4.png" alt="Dialog Box 3" /></td>
<td></td>
</tr>
<tr>
<td><strong>13</strong></td>
<td>The dialog box on the right is displayed. Confirm that there is no problem, and click <strong>Yes</strong>.</td>
</tr>
<tr>
<td><img src="image5.png" alt="Dialog Box 4" /></td>
<td></td>
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</tbody>
</table>
The password confirmation dialog box is displayed. Leave the Password Field blank and click OK.


There are two buttons TRUE and FALSE in the Modify Column displayed on the Watch Tab Page. Check that False is displayed in the Online value Column for CIPOriginator_Instance1_Safety_0utput_Data_Byte_1_Bit0.

*The Safety Controller can be output to Robot Controller on the Watch Tab Page.

Perform steps 1 and 2 in 7.2.2. Check the status of safety IO.

The Safety I/O status screen is displayed. Check that the status of CSI[1] is OFF.

* Confirmed by robot controller

Click TRUE in the Modify Column for CIPOriginator_Instance1_Safety_Output_Data_Byte_1_Bit0 on the Watch Tab Page.

Check that True is displayed in the Online value Column.

On the Safety I/O status screen, check that the status is ON.

* Confirmed by robot controller
20 Click **FALSE** in the *Modify Column* for *CIPOriginator_Instance1_Safety_Output_Data _Byte_1_Bit0* on the Watch Tab Page.

Check that the online value is **False**.

21 On the Safety I/O status screen, check that the status is **OFF**.  

*Confirmed by robot controller*
8. Initialization Method

The setting procedures in this document are based on the factory default settings. Some settings may not be applicable unless devices with the factory default settings are used.

8.1. Initializing a Safety Controller

To initialize the settings of a Safety Controller, it is necessary to initialize a Communication Control Unit and a Safety CPU Unit.

8.1.1. Initializing a Communication Control Unit

Initialize a Communication Control Unit in the following way.

Go online with Safety Controller and change the operating mode to PROGRAM mode. Select Communication Control Unit from the Controller Selection Box in the Multiview Explorer, and select Clear All Memory from the Controller Menu. The Clear All Memory Dialog Box is displayed. Check the contents and click OK.
8.1.2. Initializing a Safety CPU Unit

Initialize a Safety CPU Unit in the following way.

Go online with Safety Controller and change the operating mode to PROGRAM mode.

On the CPU Expansion Racks Tab Page, right-click Safety CPU Unit and select **Clear All Memory for NX Unit** from the menu.

The Clear All Memory for NX Unit Dialog Box is displayed. Check the contents and click **Execute**.

---

8.2. Initializing Robot Controller

The settings of Robot Controller can be initialized by the parameter backup and restore operations (factory default settings).

For information on the parameter backup and restore operations, refer to each **Robot Controller Operation Manual**.
9. Revision History

<table>
<thead>
<tr>
<th>Revision code</th>
<th>Date of revision</th>
<th>Description of revision</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>September 2018</td>
<td>First edition</td>
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Controllers & I/O
- Machine Automation Controllers (MAC) • Motion Controllers
- Programmable Logic Controllers (PLC) • Temperature Controllers • Remote I/O

Robotics
- Industrial Robots • Mobile Robots

Operator Interfaces
- Human Machine Interface (HMI)

Motion & Drives
- Machine Automation Controllers (MAC) • Motion Controllers • Servo Systems
- Frequency Inverters

Vision, Measurement & Identification
- Vision Sensors & Systems • Measurement Sensors • Auto Identification Systems

Sensing
- Photoelectric Sensors • Fiber-Optic Sensors • Proximity Sensors
- Rotary Encoders • Ultrasonic Sensors

Safety
- Safety Light Curtains • Safety Laser Scanners • Programmable Safety Systems
- Safety Mats and Edges • Safety Door Switches • Emergency Stop Devices
- Safety Switches & Operator Controls • Safety Monitoring/Force-guided Relays

Control Components
- Power Supplies • Timers • Counters • Programmable Relays
- Digital Panel Meters • Monitoring Products

Switches & Relays
- Limit Switches • Pushbutton Switches • Electromechanical Relays
- Solid State Relays

Software
- Programming & Configuration • Runtime