OMRON

Machine Automation Controller NJ-series

EtherNet/IP™ Connection Guide

Omron Adept Technologies,Inc.

Adept Robot of ePLC

SYSMAC always in control

P649-E1-01

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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 Omron Adept Technologies, Inc. (hereinafter referred to as OAT) and OMRON Corporation (hereinafter referred to as OMRON), which pertain to this document.

Manufacturer	Cat. No.	Model	Manual name
OMRON	W500	NJ501-□□□□ NJ301-□□□□ NJ101-□□□□	NJ-series CPU Unit Hardware User's Manual
OMRON	W501	NJ501-□□□□ NJ301-□□□□ NJ101-□□□□	NJ/NX series CPU Unit Software User's Manual
OMRON	W506	NJ501-□□□□ NJ301-□□□□ NJ101-□□□□	NJ/NX series CPU Unit Built-in EtherNet/IP™ Port User's Manual
OMRON	W504	SYSMAC-SE2□□□	Sysmac Studio Version 1 Operation Manual
OMRON	0969584-7	W4S1-05□ W4S1-03B	Switching Hub W4S1-series Users Manual
OMRON	P103-E	-	MachineAutomationController NJ-series Startup Guide Adept Robot Control Library
OAT	I590-E	-	Robot Safety Guide
OAT	I591-E	Cobra350	Cobra 350 Robot User's Guide
OAT	I592-E	Cobra350	Cobra 350 Robot ePLC Quick Setup Guide
OAT	I593-E	eCobra 600/800/800 Inverted	eCobra 600, 800, and 800 Inverted Robots User's Guide
OAT	I594-E	eCobra 600/800/800 Inverted	eCobra 600, 800, and 800 Inverted Robots ePLC Quick Setup Guide
OAT	I595-E	Hornet 565	Hornet 565 Robot Qucik Setup Guide
OAT	I596-E	Hornet 565	Hornet 565 Robot User's Guide

Manufacturer	Cat. No.	Model	Manual name
OAT	I597-E	Quattro 650H/650HS/800H/800HS	Quattro 650H/650HS/800H/800HS User's Guide
OAT	I598-E	Quattro 650H/650HS/800H/800HS	Quattro 650H/650HS/800H/800HS ePLC Quick Setup Guide
OAT	I599-E	Viper 650/850 eMB-60R	Viper 650/850 Robot with eMB-60R User's Guide
OAT	I600-E	Viper 650/850	Viper 650/850 ePLC Quick Setup Guide
OAT	I601-E	T20	T20 Pendant User's Guide
OAT	I602-E	SmartController EX	SmartController EX User's Guide
OAT	I603-E	ACE	ACE User's Guide, v3.4.x
OAT	I604-E	-	eV+ Language User's Guide,
OAT	I605-E	-	eV+ Language Reference Guide,
OAT	I606-E	-	eV+ Operating System User's Guide
OAT	I607-E	-	eV+ Operating System Reference Guide
OAT	I608-E	SmartVision MX	SmartVision MX User's Guide
OAT	I609-E	ACE Sight	ACE Sight Reference Guide, v3.2.x

2. Terms and Definitions

Term	Explanation and Definition
OAT	OAT is an abbreviation of the company name Omron Adept Technologies, Inc.
Node	Controllers and devices are connected to an EtherNet/IP network via EtherNet/IP ports. EtherNet/IP recognizes each EtherNet/IP port connected to the network as one node. When a device with two EtherNet/IP ports is connected to the EtherNet/IP network, EtherNet/IP recognizes this device as two nodes. EtherNet/IP achieves the communications between controllers or the communications between controllers and devices by exchanging data between these nodes connected to the network.
Tag	A minimum unit of the data that is exchanged on the EtherNet/IP network is called a tag. The tag is defined as a network variable or as a physical address, and it is assigned to the memory area of each device.
Tag set	In the EtherNet/IP network, a data unit that consists of two or more tags can be exchanged. The data unit consisting of two or more tags for the data exchange is called a tag set. Up to eight tags can be configured per tag set for OMRON controllers.
Tag data link	In EtherNet/IP, the tag and tag set can be exchanged cyclically between nodes without using a user program. This standard feature on EtherNet/IP is called a tag data link.
Connection	A connection is used to exchange data as a unit within which data concurrency is maintained. The connection consists of tags or tag sets. Creating the concurrent tag data link between the specified nodes is called a "connection establishment". When the connection is established, the tags or tag sets that configure the connection are exchanged between the specified nodes concurrently. There are two ways to specify the connection: one is to specify a tag set name (tag name), and the other is to specify an instance number of Assembly Object. In Sysmac Studio, the connection is set by specifying the instance number.
Connection type	There are two kinds of connection types for the tag data link connection. One is a multi-cast connection, and the other is a unicast (point-to-point) connection. The multi-cast connection sends an output tag set in one packet to multiple nodes. The unicast connection separately sends one output tag set to each node. Therefore, multi-cast connections can decrease the communications load if one output tag set is sent to multiple nodes.

Term	Explanation and Definition
Originator and Target	To operate tag data links, one node requests the opening of a communications line called a "connection". The node that requests to open the connection is called an "originator", and the node that receives the request is called a "target". Each communication data is called an "originator variable" and a "target variable". In Sysmac Studio, the instance number is specified in the target variable.
Tag data link parameter	A tag data link parameter is the setting data to operate tag data links. It includes the data to set tags, tag sets, and connections.
EDS file	A file that describes the number of I/O points for the EtherNet/IP device and the parameters that can be set via EtherNet/IP.

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 document without the permission of OMRON Corporation.

(5) The information contained in this document is current as of April 2016. It is subject to change for improvement without notice.

The following notations are used in this document.

⚠ 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.

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.

Symbol

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

4. Overview

This document describes the procedures for connecting OAT Adept Robot (hereinafter referred to as Robot Controller) to OMRON NJ Series Machine Automation Controller (hereinafter referred to as Controller) via EtherNet/IP and for checking their connections.
Refer to *Section 6. EtherNet/IP Settings* and *Section 7. EtherNet/IP Connection Procedure* to understand setting methods and key points to operate EtherNet/IP tag data links.

Additional Information

Settings described in *7.3. Controller Setup* are set in advance in the Sysmac Studio project file (hereinafter referred to as project file) listed below. Refer to *Section 9. Appendix: Procedure Using the Project File* for information on how to use the project file.
Obtain a latest project file from OMRON.

Name	File name	Version
Sysmac Studio project file (extension: csm2)	OMRON_ePLC_EIP_EV100.csm2	Ver.1.00

5. Applicable Devices and Device Configuration

5.1. Applicable Devices

The applicable devices are as follows:

Manufacturer	Name	Model
OMRON	NJ-series CPU Unit	NJ501-□□□□ NJ301-□□□□ NJ101-□□□□
OAT	Robot Controller	AIB/eAIB eMB-60R SmartControllerEX
OAT	Robot	Cobra350 eCobra 600/800/800 Inverted Hornet 565 Quattro 650H/650HS/800H/800HS Viper 650/850

Precautions for Correct Use

In this document, the devices with models and versions listed in *5.2. Device Configuration* are used as examples of applicable devices to describe the procedures for connecting the devices and checking their connections.
You cannot use devices with versions lower than the versions listed in *5.2*.
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.

Additional Information

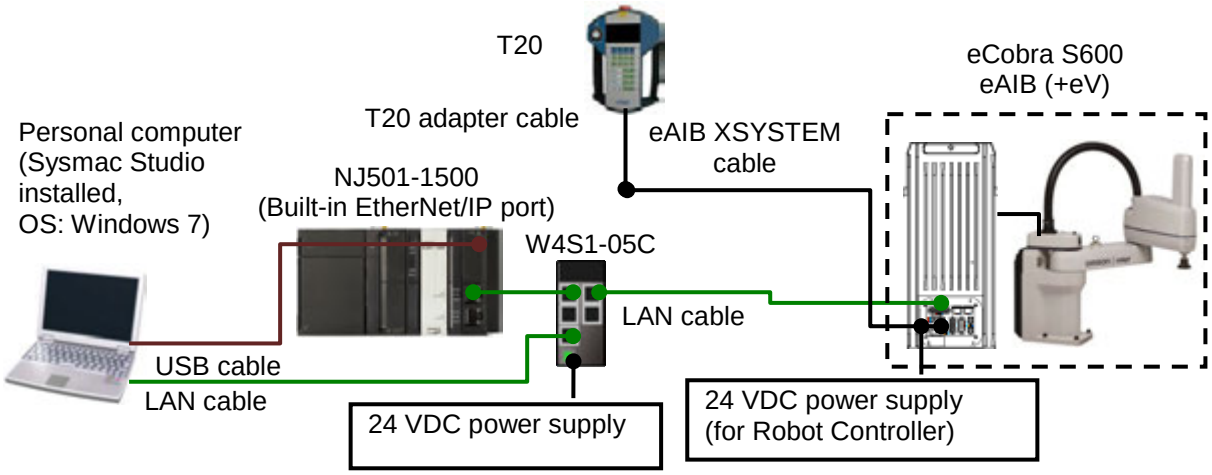
This document describes the procedures for establishing the network connections.
It does not provide information on operation, installation, wiring method, device functionality, or device operation, which is not related to the connection procedures.
Refer to the manuals or contact Omron Adept Technologies, Inc.

Additional Information

Contact Omron Adept Technologies, Inc. for robots connectable to Robot Controller.

5.2. Device Configuration

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



Manufacturer	Name	Model	Version
OMRON	NJ-series CPU Unit (Built-in EtherNet/IP port)	NJ501-1500	Ver.1.11
OMRON	Power Supply Unit	NJ-PA3001	
OMRON	Switching hub	W4S1-05C	Ver.1.0
-	24 VDC power supply (for Switching hub)	-	
OMRON	Sysmac Studio	SYSMAC-SE2□□□	Ver.1.15
OMRON	Adept Robot IP Address Setting Tool	(Supplied with Sysmac Studio)	Ver.1.00
-	Personal computer (OS: Windows 7)	-	
-	USB cable (USB 2.0 type B connector)	-	
-	LAN cable (STP (shielded, twisted-pair) cable of Ethernet category 5 or higher)	-	
OAT	Robot	eCobra S600	
OAT	Robot Controller	eAIB (+eV)	V2.3.C1
OAT	eAIB XSYSTEM cable	(Supplied with Robot)	
OAT	XUSR jumper plug	(Supplied with Robot)	
OAT	Front panel jumper plug	(Supplied with Robot)	
OAT	T20 adapter cable	(Supplied with Robot)	
OAT	XBELTIO jack	(Supplied with Robot)	
OAT	Teaching Pendant	T20	
OAT	24 VDC power supply (for Robot Controller)	-	

Precautions for Correct Use

Update Sysmac Studio to the version specified in this *Clause 5.2.* or to a higher version.
If you use a version higher than the one specified, the procedures and related screenshots described in *Section 7.* and subsequent sections may not be applicable. In that case, use the equivalent procedures described in this document by referring to the *Sysmac Studio Version 1 Operation Manual* (Cat. No. W504).

Additional Information

For specifications of 24 VDC power supply available for Switching hub, refer to the *Switching Hub W4S1-series Users Manual* (Cat. No. 0969584-7).

Additional Information

For specifications of 24 VDC power supply available for Robot Controller, refer to the *eCobra 600, 800, and 800 Inverted Robots User's Guide* (Cat. No. I593-E).

Additional Information

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

6. EtherNet/IP Settings

This section describes the setting contents of parameters, global variables, tag sets, and tag data link table that are all defined in this document.

6.1. Parameters

The parameters that are set in this document are shown below.

6.1.1. Communication Settings of Personal Computer

The parameters for Robot Controller are set on Personal computer for setting via an Ethernet network.

The parameters required for connecting Personal computer for setting and Robot Controller using the Ethernet communications are shown below.

Item	Personal computer for setting	Robot Controller
IP address	172.16.127.10 *2	172.16.127.103 (Default) *1
Subnet mask	255.255.0.0	255.255.0.0 (Default)

*1. Each Robot Controller is allocated with a unique IP address.
Set an IP address of Personal computer for setting according to an IP address of Robot Controller. This IP address provided above is for Robot Controller used in this document.

*2. Set an IP address of Personal computer for setting, which needs to have a different host part of an IP address from the one of Robot Controller.

6.1.2. EtherNet/IP Communications Settings

The parameters required for connecting Controller to Robot Controller via EtherNet/IP are shown below.

Item	Controller	Robot Controller
IP address	192.168.250.1	192.168.250.2
Subnet mask	255.255.255.0	255.255.255.0

6.2. Global variables

The Controller treats the data in tag data links as global variables.

The contents of global variable settings are shown below.

Name	Data type	Network publish	Robot Controller data assignment	Data size (byte)
to_Robot	BYTE[214]	Output	Input area	214
from_Robot	BYTE[284]	Input	Output area	284

■Robot Controller input/output area

Controller		Robot Controller	
Global variable	Array No.	Description	
to_Robot	[0]	4 bytes	
	・・・		
	[3]		
	[4]	DIGITAL OUTPUT 0001 to 0008 (8 points)	
	[5]	209 bytes	
	・・・		
	[213]		
from_Robot	[0]	3 bytes	
	・・・		
	[2]		
	[3]	SOFT SIGNAL 2001 to 2004 (4 points)	4 bits
	[4]	280 bytes	
	・・・		
	[283]		

■DIGITAL OUTPUT

Assignment	7	6	5	4	3	2	1	0
to_Robot[4]	0008	0007	0006	0005	0004	0003	0002	0001

■SOFT SIGNAL

Assignment	7	6	5	4	3	2	1	0
from_Robot[3]	2004	2003	2002	2001	4 bits			

Precautions for Correct Use

If the data size of the tag data link for Robot Controller is an odd-numbered byte, use BYTE type to define, do not use BOOL type.

Additional Information

With Sysmac Studio, two methods can be used to specify an array for a data type.

After specifying, (1) is converted to (2), and the data type is always displayed as (2).

(1)BOOL[16] / (2)ARRAY[0..15] OF BOOL

In this document, the data type is simplified by displaying BOOL[16].

(The example above means a BOOL data type with sixteen array elements.)

6.3. Tag Sets

The contents of tag set settings to operate tag data links are shown below.

■Output area (Controller to Robot Controller)

Originator variable (Tag set name)		Data size (byte)
EIP002_OUT		214
OUT No.	Global variable name (tag name)	Data size (byte)
1	to_Robot	214

■Input area (Robot Controller to Controller)

Originator variable (Tag set name)		Data size (byte)
EIP002_IN		284
IN No.	Global variable name (tag name)	Data size (byte)
1	from_Robot	284

6.4. Tag Data Link Table

The contents of tag data link table settings (connection settings) are shown below.
The values marked with red squares are taken from the values defined in the EDS file for Robot Controller.

Connection Name	Connection I/O Type	RPI (ms)	Timeout Value
default_001	Robot Command/Response	50.0	RPI x 4

Connection I/O Type	Input / Output	Target Variable (Robot Controller set value: instance number)	Size (Byte)	Originator Variable (Tag set name)	Size (Byte)	Connection Type
Robot Command/ Response	Input	3	284	EIP002_IN	284	Multi-cast connection
	Output	4	214	EIP002_OUT	214	Point to Point connection

7. EtherNet/IP Connection Procedure

This section describes the procedures for connecting Robot Controller and Controller on the EtherNet/IP network. The explanation of procedure for setting up Controller given in this document is based on the factory default settings.
For the initialization, refer to *Section 8. Initialization Method*.

7.1. Work Flow

Take the following steps to operate tag data links by connecting Robot Controller and Controller via EtherNet/IP.

7.2. Robot Controller Setup	Set up Robot Controller.
↓	
7.2.1. Cable Connection	Connect cables to Robot Controller.
↓	
7.2.2. IP Address Settings	Set the IP address of Robot Controller.
↓	
7.3. Controller Setup	Set up Controller.
↓	
7.3.1. IP Address Settings	Start Sysmac Studio and set the IP address of Controller.
↓	
7.3.2. Target Device Registration	Register the target device.
↓	
7.3.3. Setting the Global Variables	Set the global variables to use for tag data links.
↓	
7.3.4. Tag Registration	Register the tags and the tag sets.
↓	
7.3.5. Setting the Connections	Set the target variables and the originator variables, and then set the connections.
↓	
7.3.6. Transferring the Project Data	Connect online and transfer the connection settings and the project data to Controller.
↓	
7.4. EtherNet/IP Communication Status Check	Confirm that the EtherNet/IP tag data links are operated normally.
↓	
7.4.1. Checking the Connection Status	Check the connection status of the EtherNet/IP network.
↓	
7.4.2. Checking the Sent and Received Data	Check that the correct data are sent and received.

7.2. Robot Controller Setup

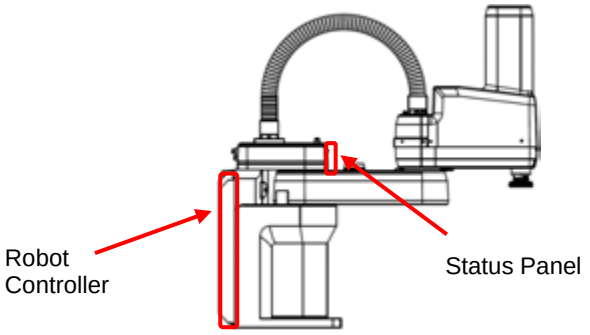
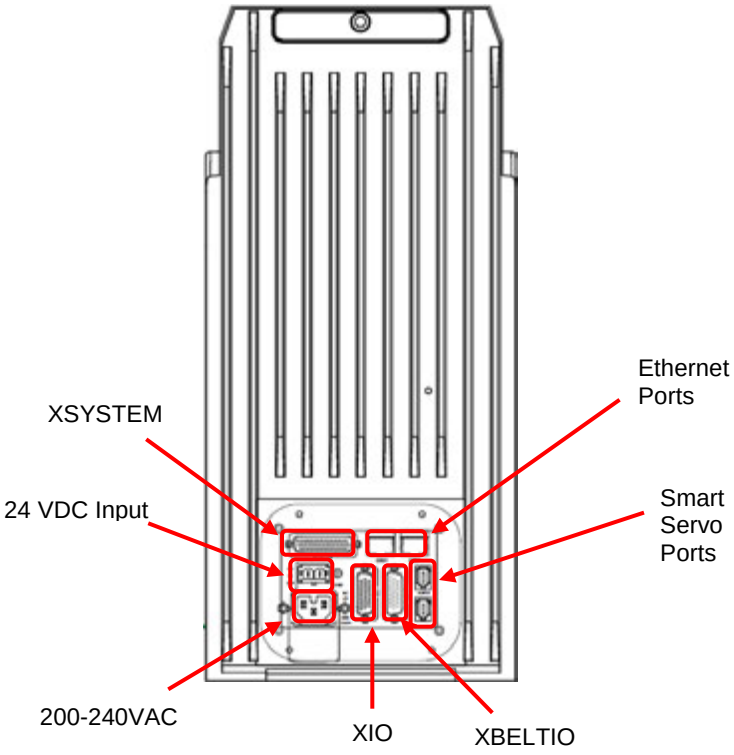
Set up Robot Controller.

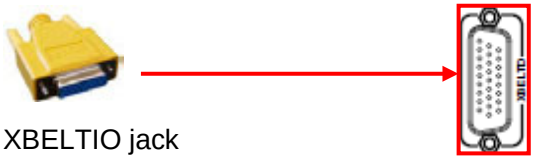
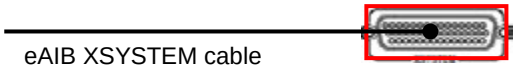
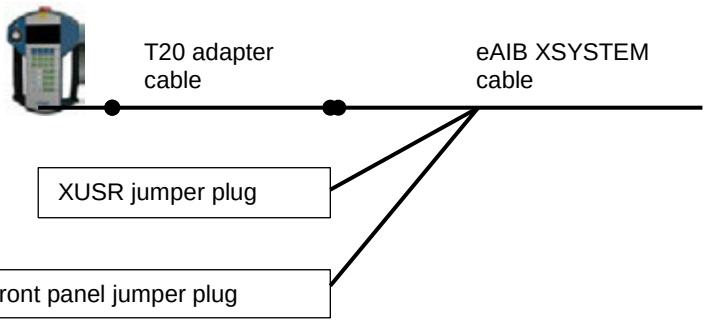
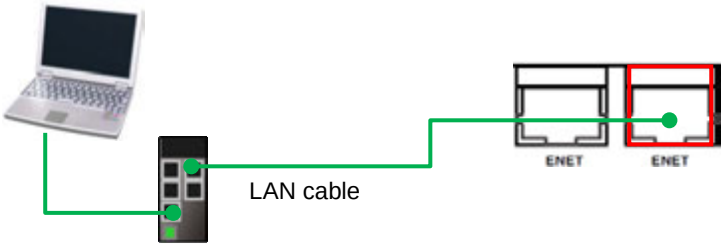
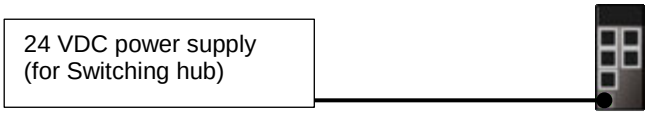
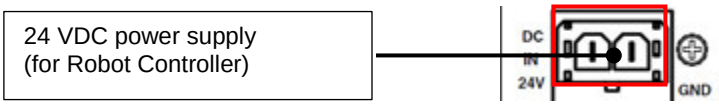
7.2.1. Cable Connection

Connect cables to Robot Controller.

Precautions for Correct Use

Make sure that the power supply is OFF when you set up.

1	Make sure that Robot Controller is powered OFF. *If the power supply is turned ON, the settings described in the following steps and subsequent procedures may not be applicable.	
2	Check the position of Robot Controller by referring to the figure on the right.	
3	Check the position of the connectors on Robot Controller by referring to the figure on the right.	

4	Plug XBELTIO jack into the XBELTIO port.	 XBELTIO jack
5	Connect an eAIB XSYSTEM cable to the XSYSTEM connector.	 eAIB XSYSTEM cable
6	Connect the eAIB XSYSTEM cable and Teaching Pendant with a T20 adapter cable. Connect XUSR jumper plug to one branch of the eAIB XSYSTEM cable. Connect Front panel jumper plug to the other branch of the eAIB XSYSTEM cable.	 T20 adapter cable eAIB XSYSTEM cable XUSR jumper plug Front panel jumper plug
7	Connect Ethernet Port (on the right) to Switching hub with a LAN cable. Connect Switching hub to Personal computer with a LAN cable.	 LAN cable
8	Connect 24 VDC power supply (for Switching hub) to Switching hub.	 24 VDC power supply (for Switching hub)
9	Connect 24 VDC power supply (for Robot Controller) to the 24 VDC Input connector.	 24 VDC power supply (for Robot Controller)
10	Connect 200 VAC power supply to 200-240VAC.	AC200V power supply

7.2.2. IP Address Settings

Set the IP address of Robot Controller.

The IP address is set using Adept Robot IP Address Setting Tool.

Install Sysmac Studio on Personal computer beforehand.

Since the Personal computer and Robot Controller are connected via Ethernet, set the IP address of Personal computer to *172.16.127.10*.

Precautions for Correct Use

The Parameters for Robot Controller are checked using the Ethernet communications with Personal computer.

Note that there may be some changes required for the Personal computer settings depending on the state of Personal computer.

1	Turn ON Personal computer, Switching hub, and Robot Controller.

2 Set the IP address of Personal computer to *172.16.127.10*.

*The IP address can be changed in the following way.

(1)Start Personal computer and log in using an administrator account. From the Windows Start menu, select ***Control Panel*** - ***Network and Internet*** - ***Network and Sharing Center***, and click **Change Adapter Settings**. Double-click **Local Area Connection**.
*The procedure steps may be different depending on the environment settings of Personal computer.

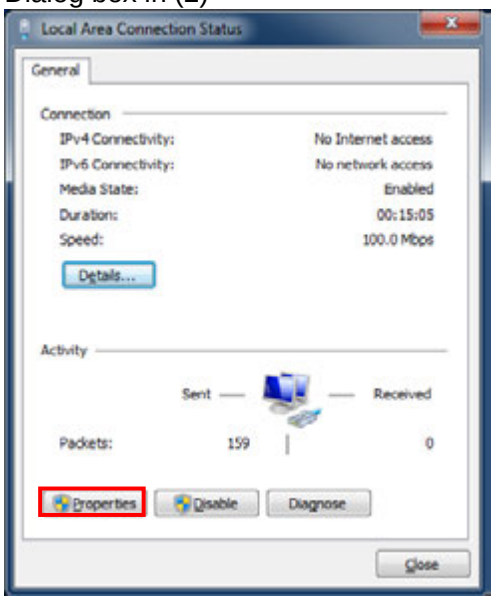
(2)The Local Area Connection Status Dialog Box is displayed. Click **Properties**.

(3)The Local Area Connection Properties Dialog Box is displayed. Select *Internet Protocol Version 4 (TCP/IPv4)*, and click **Properties**.
*The display differs depending on the configuration of Personal computer.

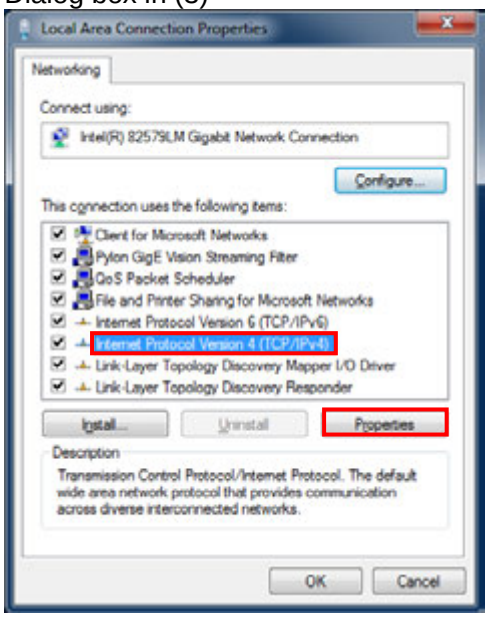
(4)The Internet Protocol Version 4 (TCP/IPv4) Properties Dialog Box is displayed. Select *Use the following IP address*, set the IP address to *172.16.127.10* and the subnet mask to *255.255.0.0*. Click **OK**.

(5)Click **Close** or **OK** to close all the displayed dialog boxes.

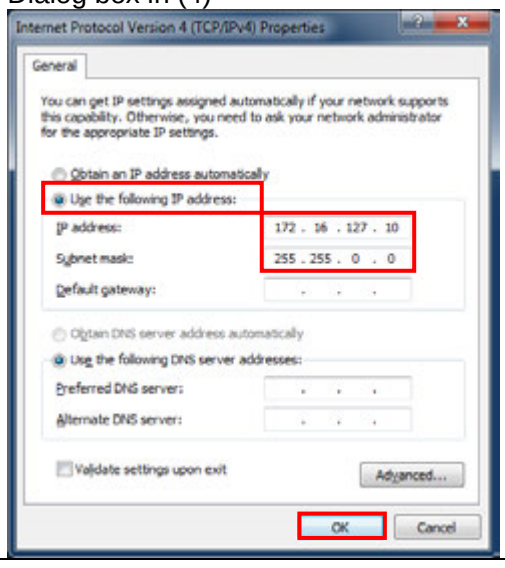
Dialog box in (2)



Dialog box in (3)



Dialog box in (4)

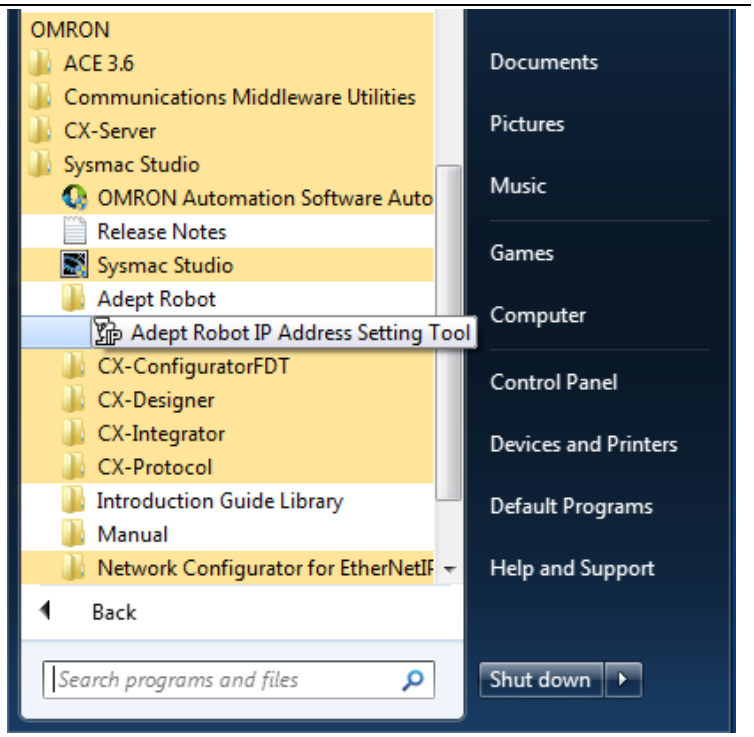
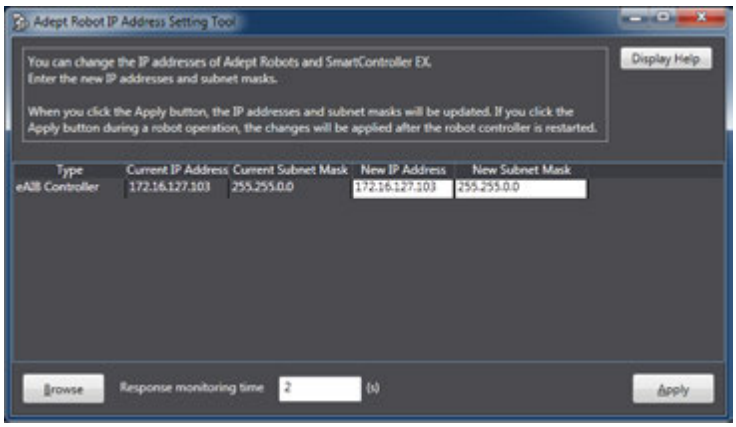


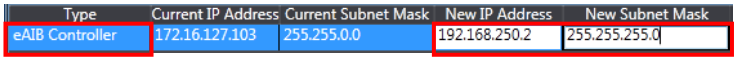
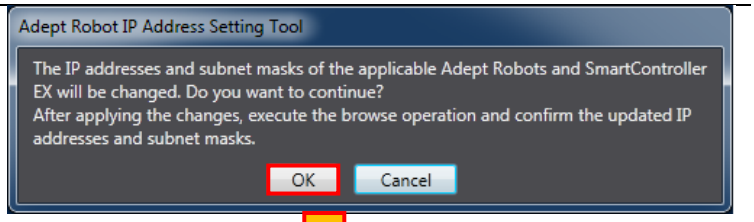
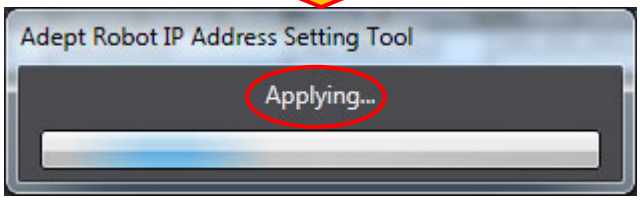
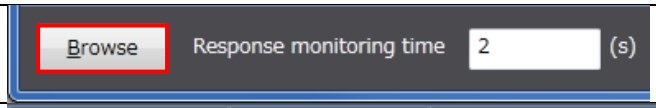
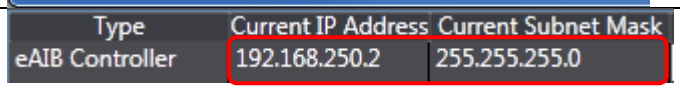
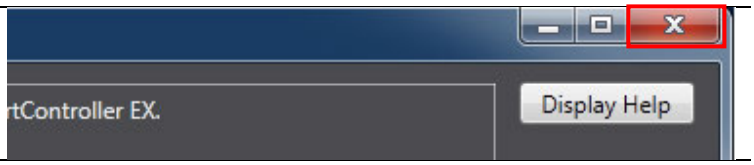
Precautions for Correct Use

If you change the IP address and the subnet mask during the operation of Robot, the changed addresses are applied after power cycling Robot and Robot Controller.

Precautions for Correct Use

If Personal computer and Robot Controller do not exist on the same network segment, it is still possible to browse Robot Controller using Adept Robot IP Address Setting Tool, but, the IP address and the subnet mask are not allowed to be changed.
Make sure that Personal computer and Robot Controller are on the same network segment, and then apply the changed addresses.

3	To start Adept Robot IP Address Setting Tool on Personal computer, select ***OMRON*** - ***Sysmac Studio*** - ***Adept Robot*** from the start menu. Select ***Adept Robot IP Address Setting Tool*** under ***Adept Robot***.	
4	Adept Robot IP Address Setting Tool starts. *The example on the right shows that the following addresses are set for eAIB Controller. Current IP Address: 172.16.127.103 Current Subnet Mask: 255.255.0.0	

5	Select *eAIB Controller* in the *Type* Column and set the addresses as shown below. New IP Address: *192.168.250.2* New Subnet Mask: *255.255.255.0*	
6	Click **Apply**.	
7	The Adept Robot IP Address Setting Tool Dialog Box is displayed. Check the contents and click **OK**. The dialog box indicating "Applying" is displayed. Robot Controller is rebooted when completing the change of IP address.	 
8	Click **Browse**.	
9	Check that the addresses displayed in the *Current IP Address* and the *Current Subnet Mask* Columns are the same as the ones in step 5.	
10	Click of the Adept Robot IP Address Setting Tool Window to close it.	
11	Turn OFF Switching hub.	

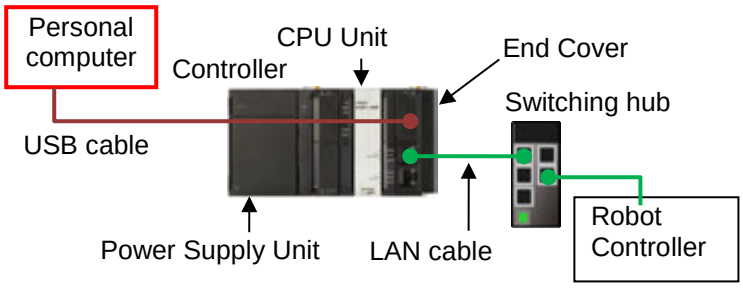
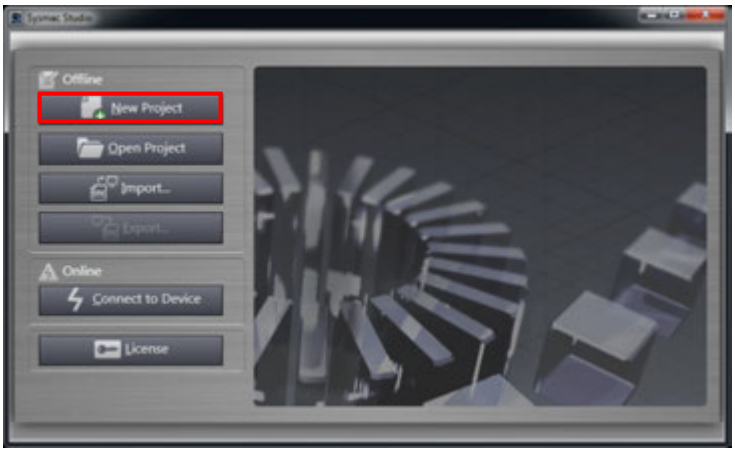
7.3. Controller Setup

Set up Controller.

7.3.1. IP Address Settings

Start Sysmac Studio and set the IP address of Controller.

Install Sysmac Studio and the USB driver on Personal computer beforehand.

1	Connect the LAN cable to the built-in EtherNet/IP port (PORT1) on Controller, and connect a USB cable to the peripheral (USB) port. As shown in *5.2. Device Configuration*, connect Personal computer and Switching hub to 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 starts. Click **New Project**.	

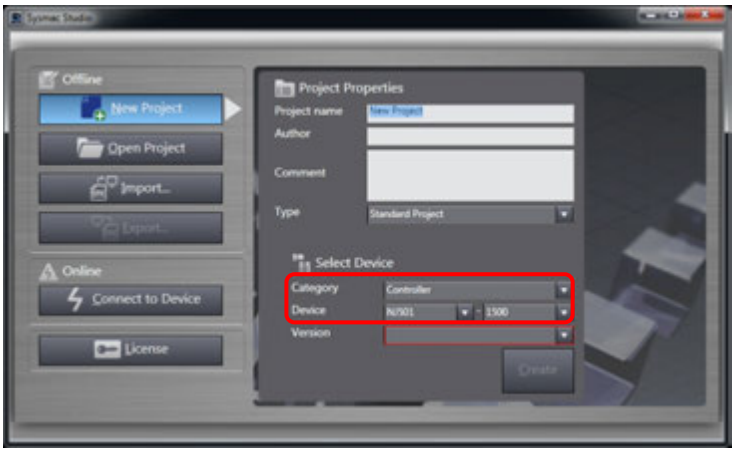
4 The Project Properties Dialog Box is displayed.

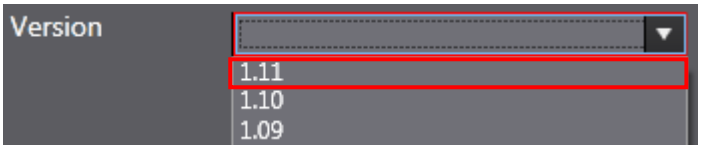
*In this document, New Project is used as the project name.

Check that the device used is shown in the *Category* and the *Device* Fields of Select Device.

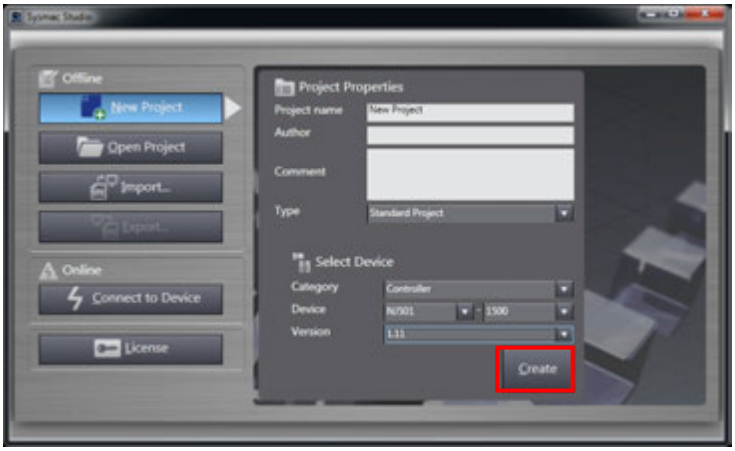
Select an applicable version from the pull-down list of Version.

*Although 1.11 is selected in this document as an example, select the version you actually use.





5 Click **Create**.



6 The New Project is displayed.

The following panes are displayed in this window.

Left: Multiview Explorer

Top right: Toolbox

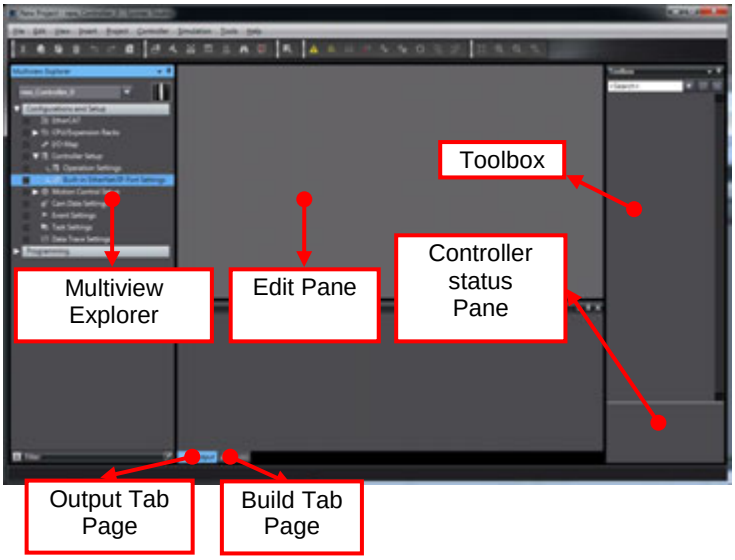
Bottom right: Controller Status Pane

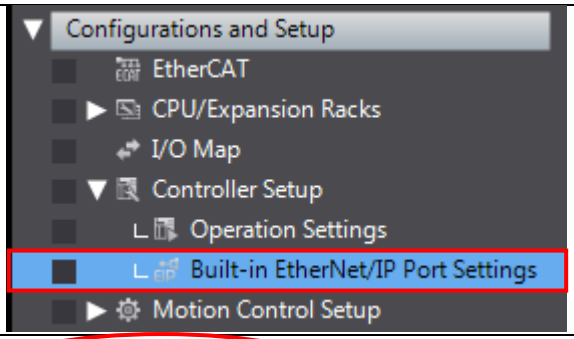
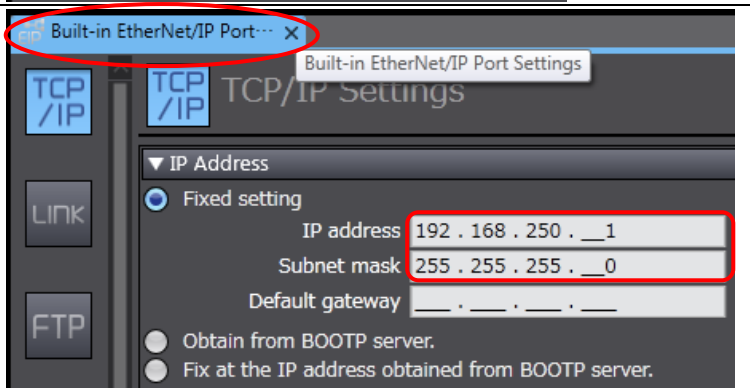
Middle top: Edit Pane

The following tab pages are displayed at the middle bottom of the window.

Output Tab Page

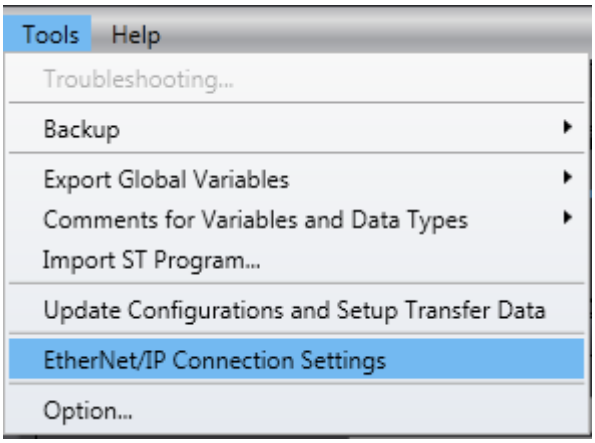
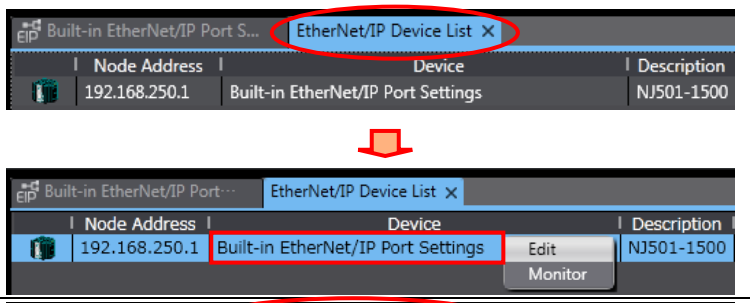
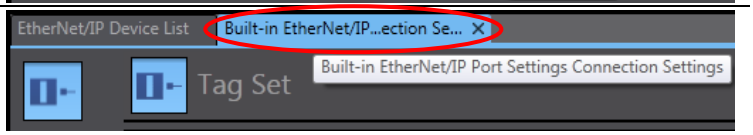
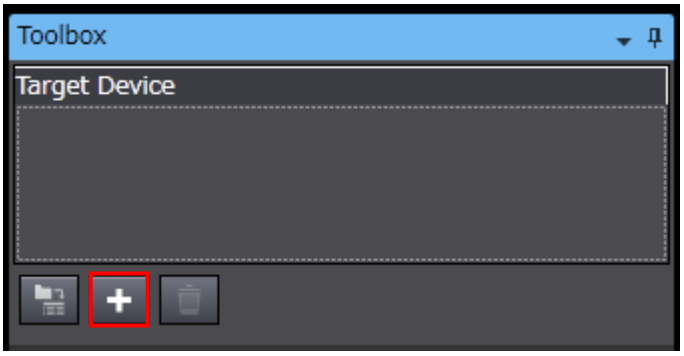
Build Tab Page

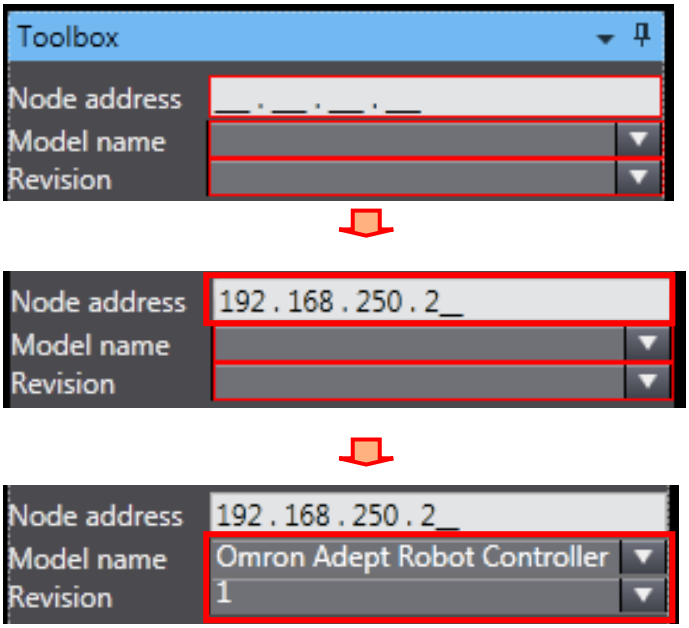
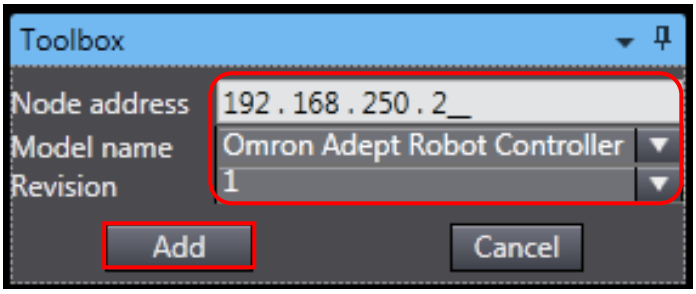
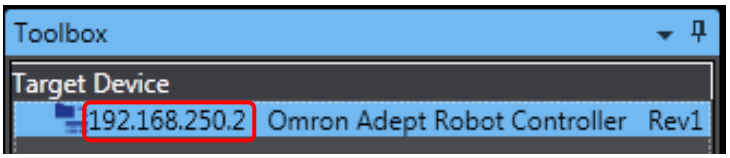


7	Double-click **Built-in EtherNet/IP Port Settings** under **Configurations and Setup** - **Controller Setup** in the Multiview Explorer.	
8	The Built-in EtherNet/IP Port Settings Tab Page is displayed in the Edit Pane. Check that the following settings are made in the *IP Address* Field. IP address: 192.168.250.1 Subnet mask: 255.255.255.0	

7.3.2. Target Device Registration

Register the target device.

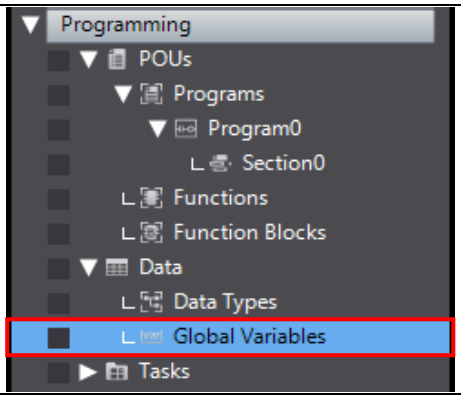
1	Select ***EtherNet/IP Connection Settings*** from the Tools Menu.	
2	The EtherNet/IP Device List Tab Page is displayed in the Edit Pane. Right-click **Built-in EtherNet/IP Port Settings** and select ***Edit*** from the menu.	
3	The Built-in EtherNet/IP Port Settings Connection Settings Tab Page is displayed in the Edit Pane.	
4	Click the **+** Button in the Toolbox.	

5	Data fields of the target device registration are displayed. Enter *192.168.250.2* in the *Node address* Field. Select the following values from the pull-down lists of Model name and Revision. Model name: ***Omron Adept Robot Controller*** Revision: ***1***	
6	Check the settings and click **Add**.	
7	192.168.250.2 is registered in Target Device of the Toolbox.	

7.3.3. Setting the Global Variables

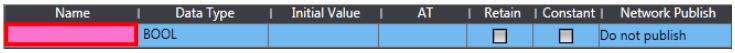
Set the global variables to use for tag data links.

1 Double-click **Global Variables** under **Programming** - **Data** in the Multiview Explorer.

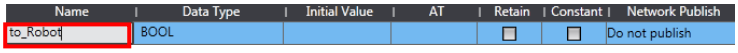


2 The Global Variables Tab Page is displayed in the Edit Pane.

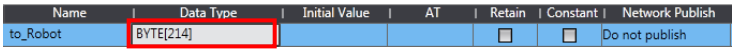
Click the *Name* entry cell for the column to enter a new variable.



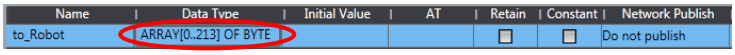
Enter *to_Robot* in the *Name* Column.



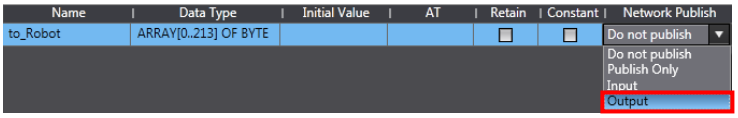
Enter *BYTE[214]* in the *Data Type* Column.

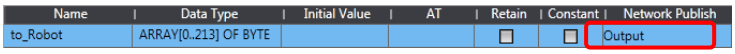


After entering, check that the data type changes to ARRAY[0..213] OF BYTE.



Select ***Output*** from the pull-down list of Network Publish.

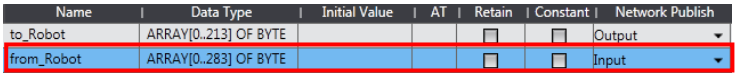




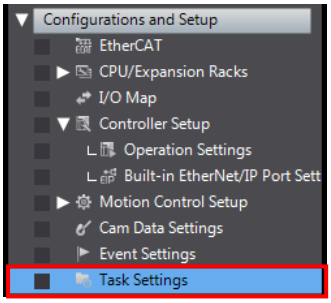
3 After entering, right-click and select ***Create New*** from the menu.

4 In the same way as step 2, enter the following data in the newly added row.

Name: *from_Robot*
Data type: *BYTE[284]*
Network Publish: ***Input***

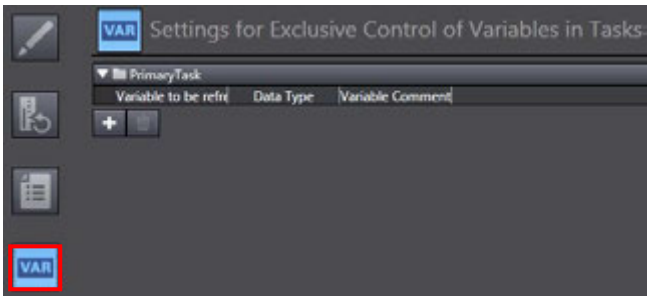


5 Double-click **Task Settings** under **Configurations and Setup** in the Multiview Explorer.

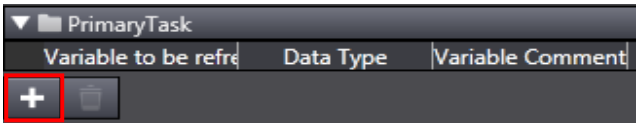


The Task Settings Tab Page is displayed in the Edit Pane.

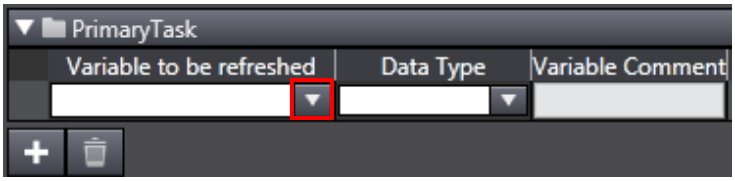
Click **VAR**.



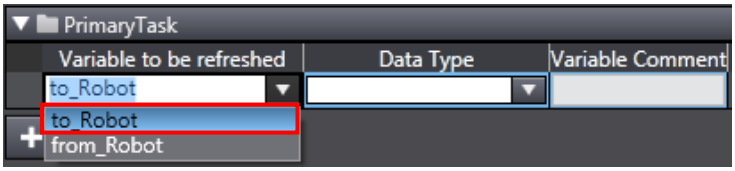
6 Click the **+** Button.



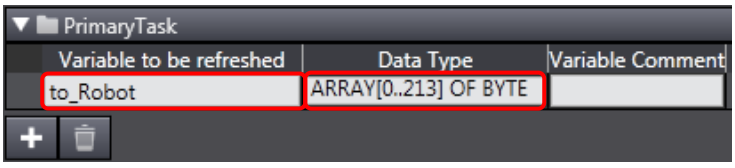
A row for new entry is added.
Click the **Down Arrow** Button of the entry cell in the *Variable to be refreshed* Column (the left side of the figure).



The variables set in the previous steps are displayed.
Select ***to_Robot***.

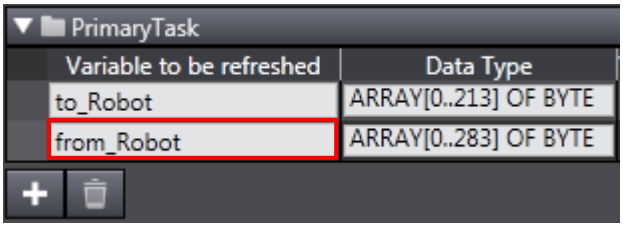


to_Robot is added.



*Since the data types are displayed automatically, you do not need to set them.

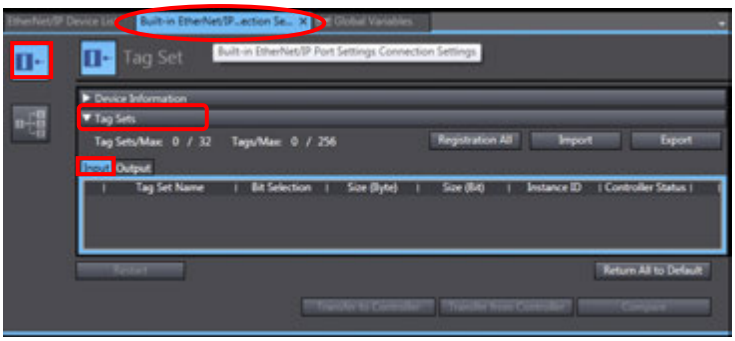
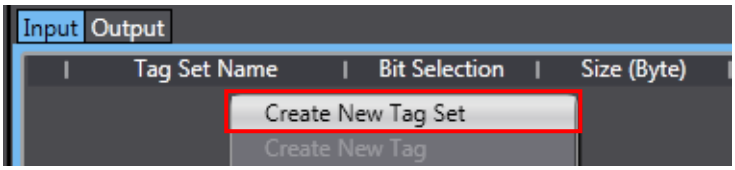
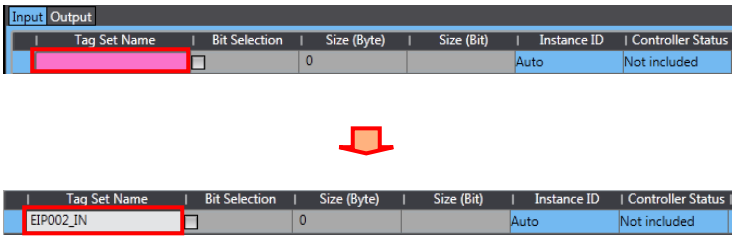
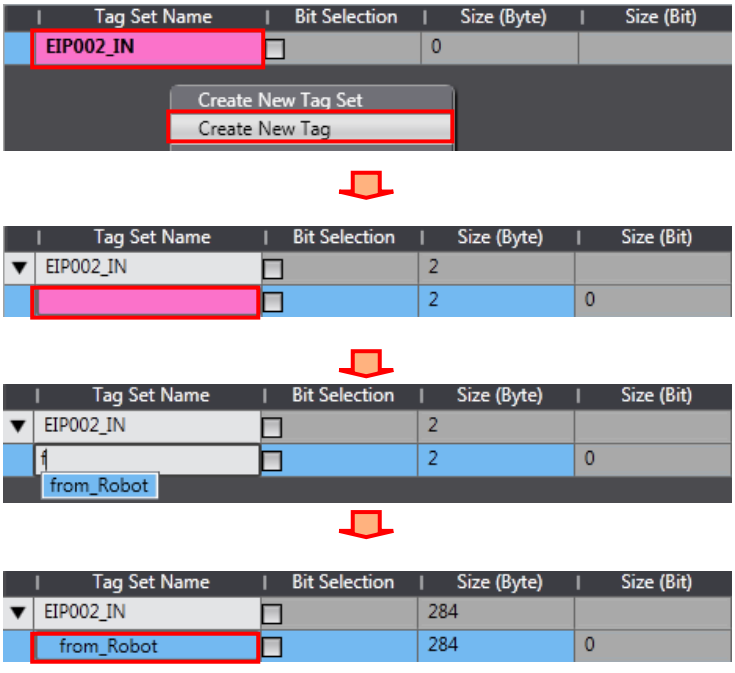
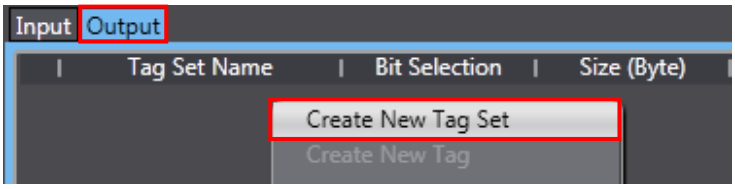
7 In the same way as step 6, add all the variables that you set in this procedure to the *Variable to be refreshed* Column (the left side of the figure).

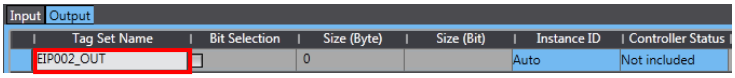
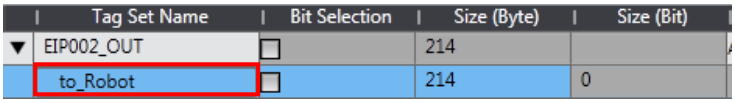
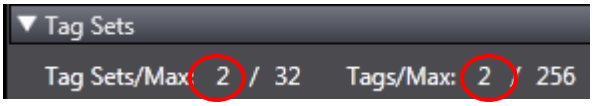


*Since the data types are displayed automatically, you do not need to set them.

7.3.4. Tag Registration

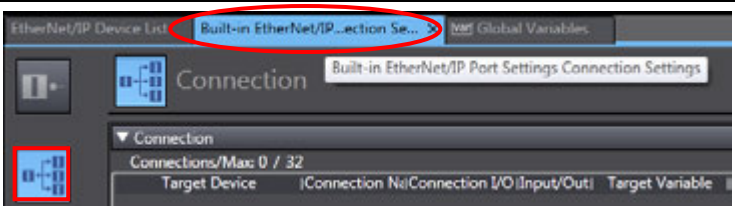
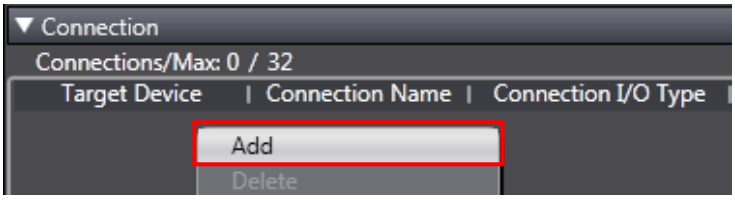
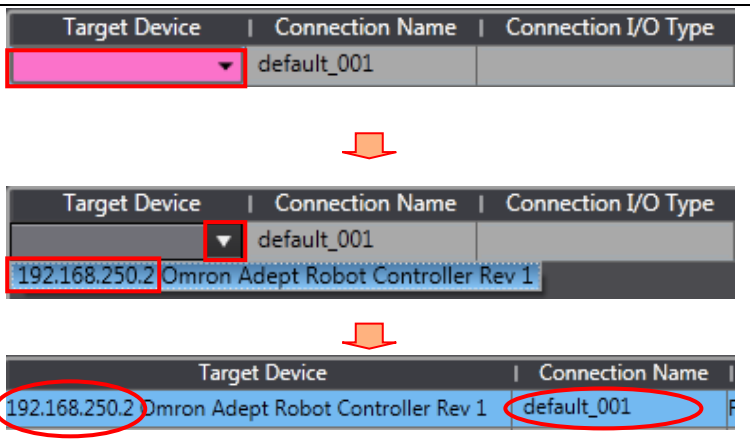
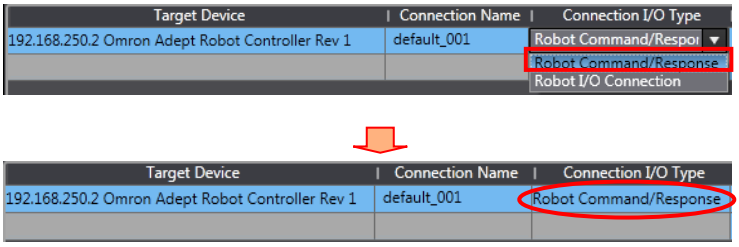
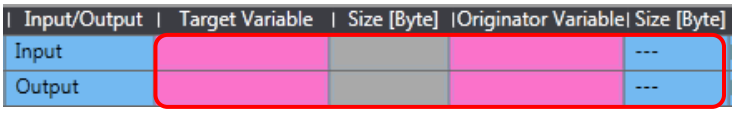
Register the tags and the tag sets.

1	Click the **Tag Set** Button on the Built-in EtherNet/IP Port Settings Connection Settings Tab Page. Select the **Input** Tab in Tag Sets.	
2	Right-click any open space on the Input Tab Page and select ***Create New Tag Set*** from the menu.	
3	A new tag name can be entered. Select the newly added entry cell. Enter *EIP002_IN*.	
4	Right-click **EIP002_IN** and select ***Create New Tag*** from the menu. A new tag name can be entered under EIP002_IN. Select the newly added entry cell. Set the global variable for input listed in *6.3. Tag Sets*. *When the first character of the set variable name is typed, an appropriate name beginning with the character appears as shown on the right.	
5	Select **Output** Tab. Right-click any open space on the Output Tab Page and select ***Create New Tag Set*** from the menu.	

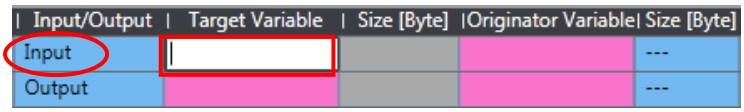
6	A new name can be entered in the *Tag Set Name* Column. In the same way as step 3, enter *EIP002_OUT*.	
7	In the same way as step 4, set the global variable for output as a tag, which is listed in *6.3. Tag Sets*.	
8	Check that Tag Sets shows 2 and that the number of Tags shows the same as the number of the global variables you set.	

7.3.5. Setting the Connections

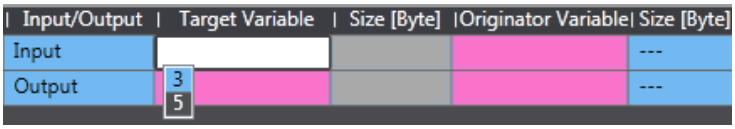
Set the target variables (that receive the open request) and the originator variables (that request for opening), and then set the connections (tag data link table).

1	Click the **Connection** Button on the Built-in EtherNet/IP Port Settings Connection Settings Tab Page.	
2	Right-click any open space in Connection and select ***Add*** from the menu.	
3	A new connection can be entered. Select the newly added entry cell. Select ***192.168.250.2*** from the pull-down list of Target Device. 192.168.250.2 is displayed in the *Target Device* Column. The default_001 connection is created.	
4	Select ***Robot Command/Response*** from the pull-down list of Connection I/O Type. Robot Command/Response is displayed in the *Connection I/O Type* Column.	
5	The target variable and the originator variable can be set.	

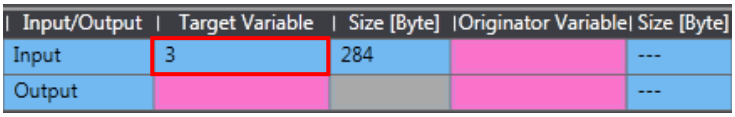
6 Click the entry cell for Input in the *Target Variable* Column.



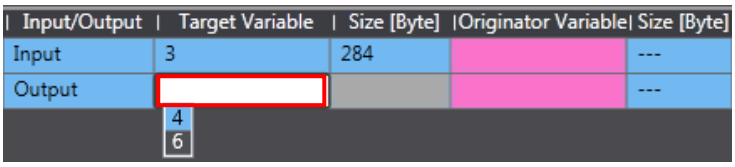
When you press **Ctrl** + **Space** on the keyboard, an appropriate instance number appears.



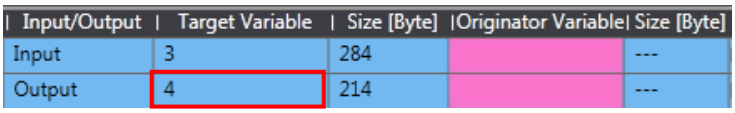
Select the instance number.



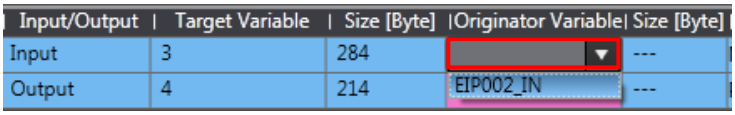
Likewise, set the target variable for Output.



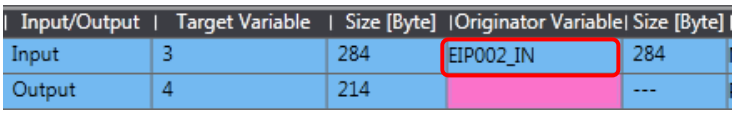
Select the instance number.



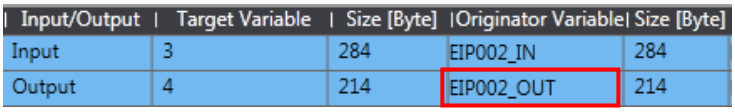
7 Click the entry cell for Input in the *Originator Variable* Column.



The pull-down list is displayed. Select the tag set name to use.

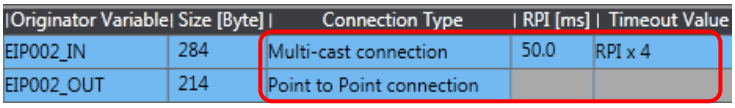


Likewise, set the originator variable for Output.

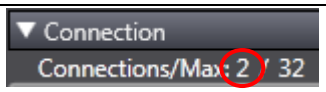


8 Set the connection type, RPI [ms], and timeout value as required.

*In this document, the default values are used for these settings.



9 Check that Connections shows 2.

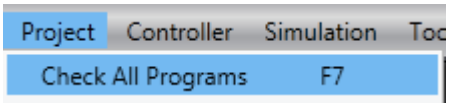
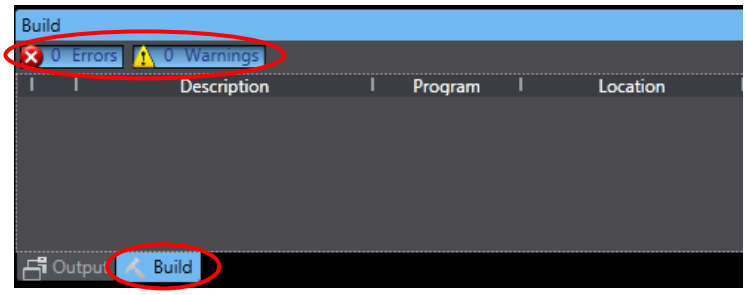
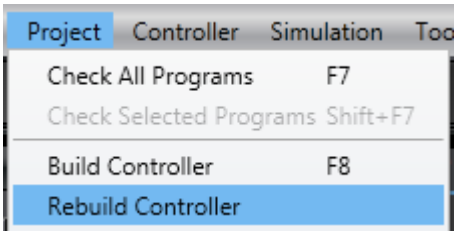
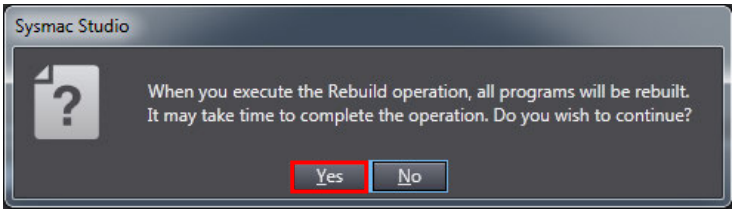
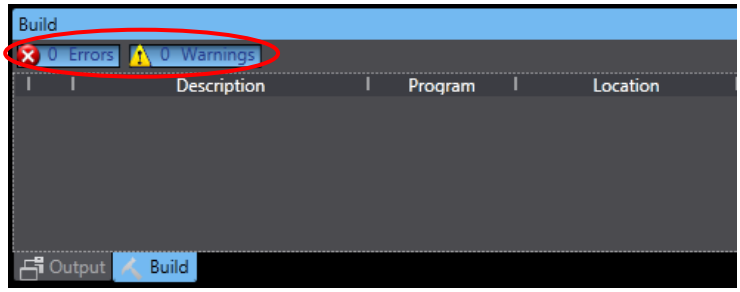


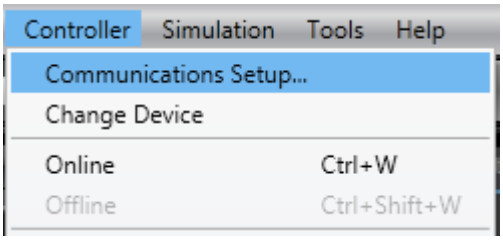
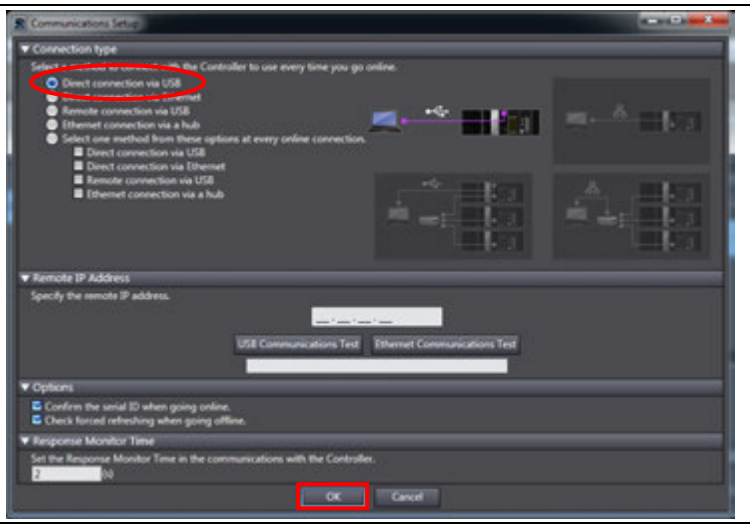
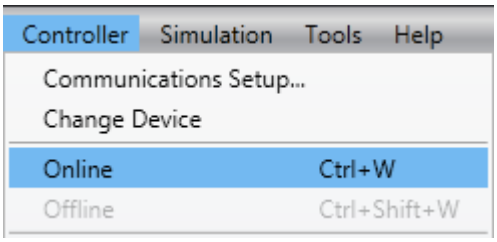
7.3.6. Transferring the Project Data

Connect online and transfer the connection settings and the project data to Controller.

⚠ WARNING

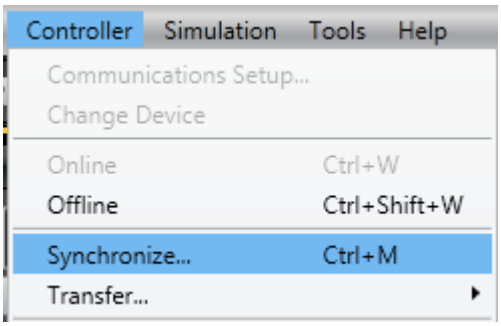
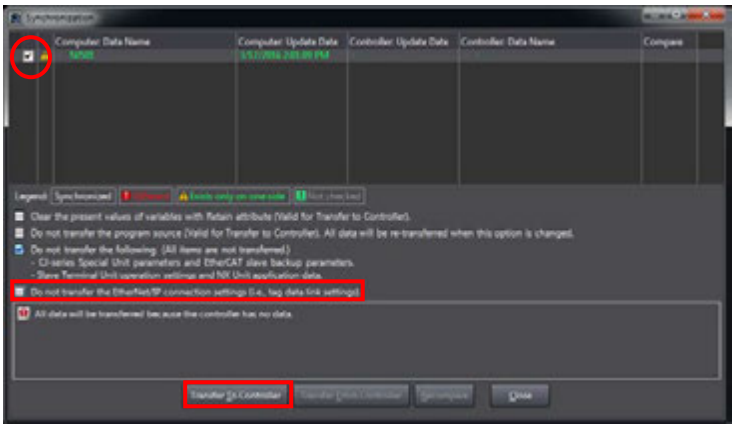
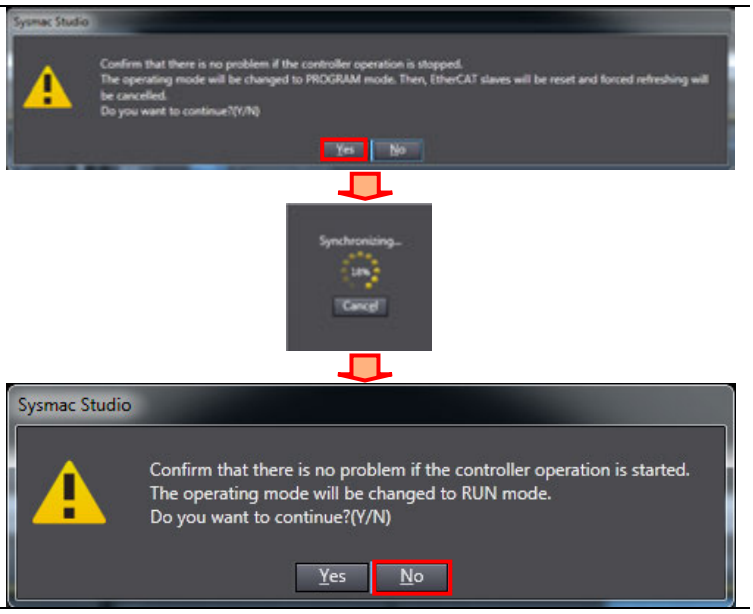
When you transfer a user program, configuration data, setup data, device variables, or values in memory used for CJ-series Units from Sysmac Studio, the devices or machines may perform unexpected operation regardless of the operating mode of CPU Unit.
Always confirm safety at the destination node before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

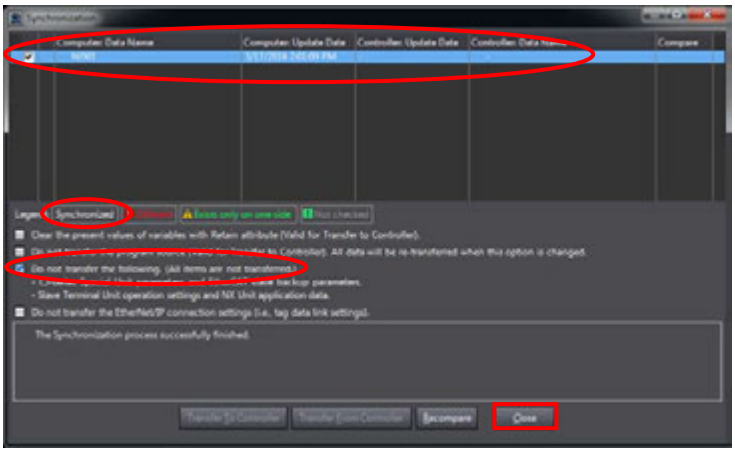
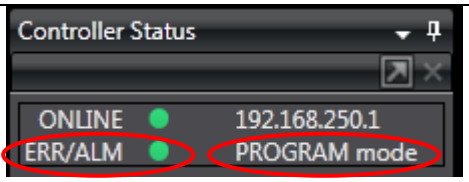
1	Turn ON Controller and Switching hub.	
2	Select ***Check All Programs*** from the Project Menu.	
3	The Build Tab Page is displayed. Check that "0 Errors" and "0 Warnings" are displayed.	
4	Select ***Rebuild Controller*** from the Project Menu.	
5	A confirmation dialog box is displayed. Check the contents and click **Yes**.	
6	Check that "0 Errors" and "0 Warnings" are displayed on the Build Tab Page.	

7	Select ***Communications Setup*** from the Controller Menu.	
8	The Communications Setup Dialog Box is displayed. Check that the *Direct connection via USB* Option is selected in Connection type. Click **OK**.	
9	Select ***Online*** from the Controller Menu. A confirmation dialog box is displayed. Check the contents and click **Yes**. *The displayed dialog depends on the status of Controller. Check the contents and click on an appropriate button to proceed with the processing.	
10	When an online connection is established, a yellow bar is displayed under the toolbar.	

Additional Information

For details on online connections to Controller, refer to *Section 6. Online Connections to a Controller* of the *Sysmac Studio Version 1 Operation Manual* (Cat. No. W504).

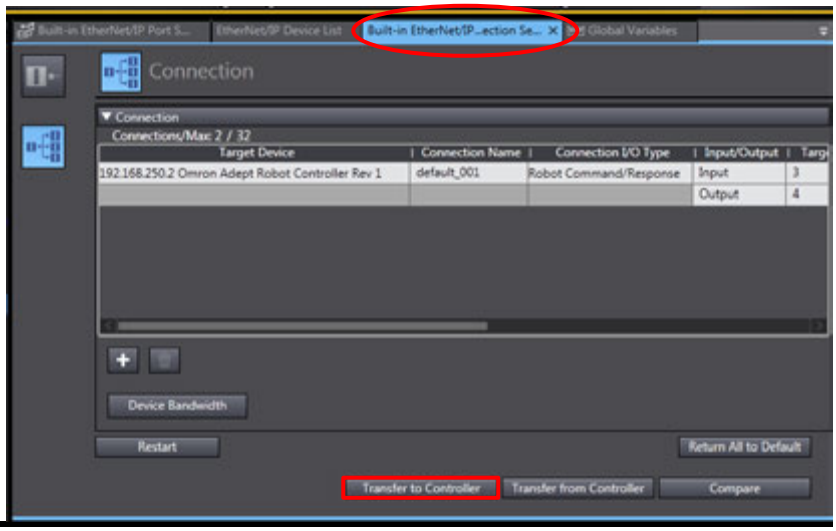
11	Select ***Synchronize*** from the Controller Menu.	
12	The Synchronization Dialog Box is displayed. Check that the data to transfer (NJ501 in the right dialog box) is selected. Uncheck *Do not transfer the EtherNet/IP connection settings (i.e., tag data link settings)*. Click **Transfer To Controller**. *After executing Transfer To Controller, the Sysmac Studio data is transferred to Controller, and the data is compared.	
13	A confirmation dialog box is displayed. Confirm that there is no problem and click **Yes**. A screen stating "Synchronizing" is displayed. A confirmation dialog box on the right is displayed. Confirm that there is no problem and click **No**. *Do not return to RUN mode.	

14	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 **Close**. *A message stating "The synchronization process successfully finished" is displayed if the Sysmac Studio project data coincides with the Controller data. *If the synchronization fails, check the wiring and repeat from step 1.	
15	Check that ERR/ALM indicator in the Controller Status Pane changes to green color and that PROGRAM mode is displayed.	

Precautions for Correct Use

If you change the connection settings (tag data link table) after performing the synchronization, the changed connection settings (tag data link table) are not transferred even when performing the synchronization again.

When you transfer the changed connection settings, click **Transfer to Controller** on the Built-in EtherNet/IP Port Settings Connection Settings Tab Page.

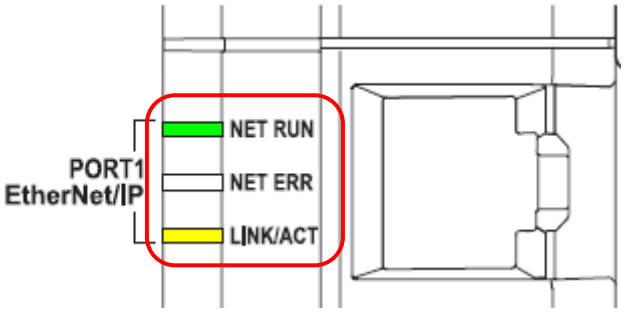
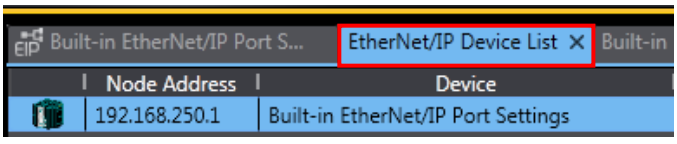
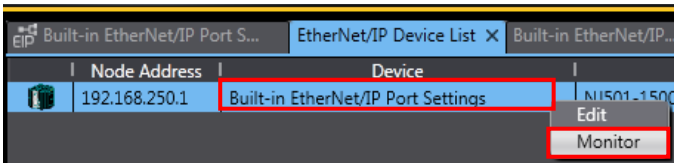
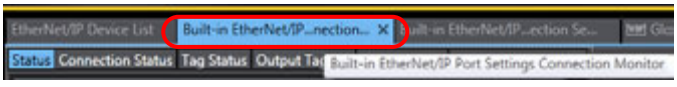


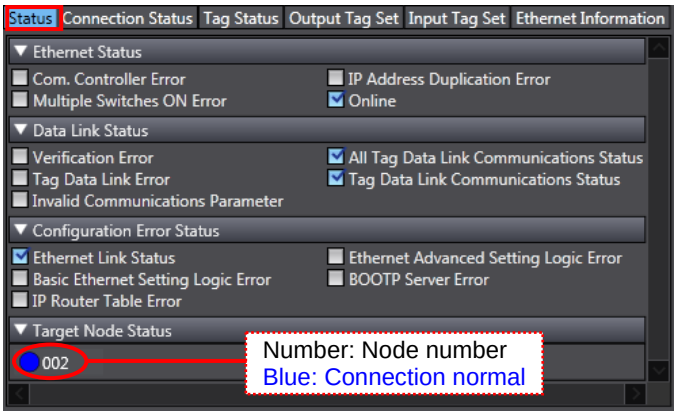
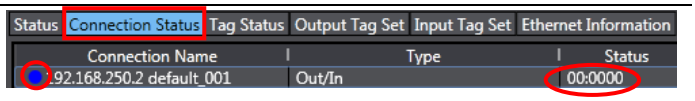
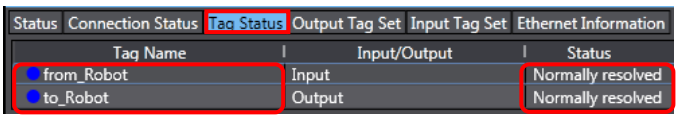
7.4. EtherNet/IP Communication Status Check

Confirm that the EtherNet/IP tag data links are operated normally.

7.4.1. Checking the Connection Status

Check the connection status of the EtherNet/IP network.

1	Check with LED indicators on Controller that the tag data links are operated normally. The LED indicators in normal status are as follows: NET RUN: Green lit NET ERR: Not lit LINK/ACT: Yellow flashing (Flashing while packets are being sent and received.)	
2	Check the LED indicators on Robot. The LED indicators in normal status are as follows: STATUS: OK (high power disabled) ON (high power enabled) EF(ePLC connect start up error) *For information on how to release the error “EF”, refer to the *Machine Automation Controller NJ-series Startup Guide Adept Robot Control Library* (Cat. No. P103-E).	
3	Select the **EtherNet/IP Device List** Tab.	
4	Right-click **Built-in EtherNet/IP Port Settings** and select ***Monitor*** from the menu.	
5	The Built-in EtherNet/IP Port Settings Connection Monitor Tab Page is displayed.	

6	Select the **Status** Tab. When the same check boxes are selected as shown on the right, the tag data links are normally in operation.	
7	Select the **Connection Status** Tab. Check that a blue circle is displayed next to the applicable connection listed in the *Connection Name* Column. Check that the Status is 00:0000.	
8	Select the **Tag Status** Tab. Check that all tags in the *Tag Name* Column are displayed and that blue circles are displayed next to them. Check that the status of all tags is normally resolved.	

7.4.2. Checking the Sent and Received Data

Check that the correct data are sent and received.

⚠ Caution

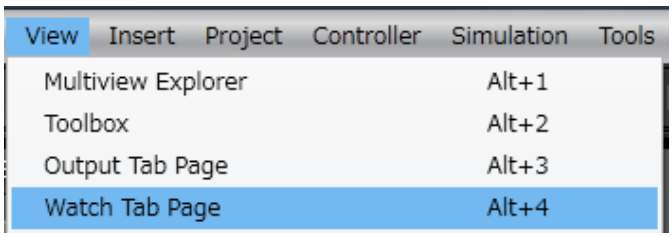
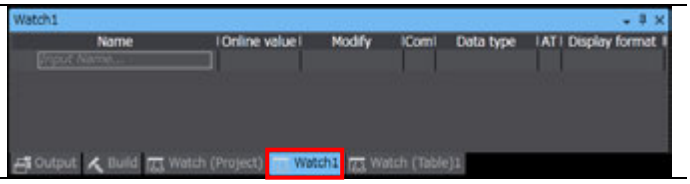
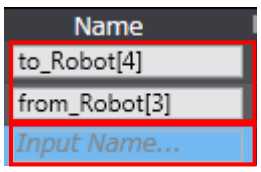
In this procedure, the output of Robot Controller is performed, which may have a risk of unexpected operation of Robot Controller.
Take adequate safety precautions before you proceed with this operation check described here. If you cannot ensure safety, do not proceed. When you perform this operation check, make sure to complete all the steps and make the Robot Controller output safe.

⚠ Caution

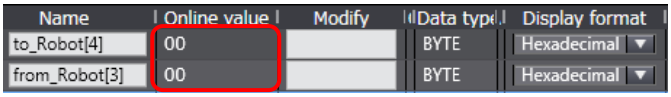
If you wire the I/O in the state where the devices are powered ON, doing so may cause damage to the devices.
Always read and follow the information provided in all safety precautions in the manuals for each device to be wired.

⚠ Caution

If you change the values of variables on a Watch Tab Page in the online state, the devices connected to the output unit may operate regardless of the operating mode of CPU Unit.
Sufficiently confirm safety before you change the values of variables on a Watch Tab Page when Sysmac Studio is online with CPU Unit.

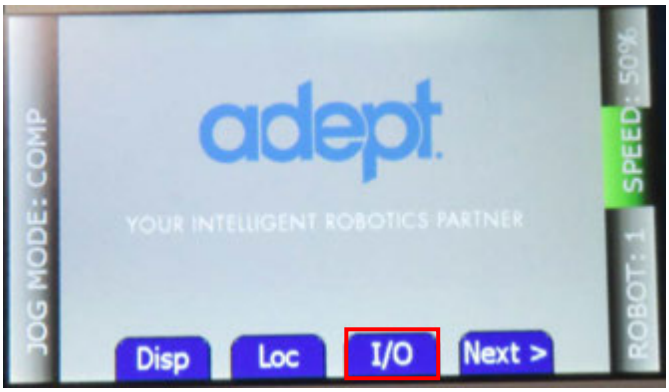
1	Select ***Watch Tab Page*** from the View Menu.	
2	Select the **Watch1** Tab.	
3	Enter the following names for monitoring on the Watch1 Tab Page. To enter a new name, click *Input Name*. *to_Robot[4]* *from_Robot[3]*	

4 Check that the online value of each variable is 00.



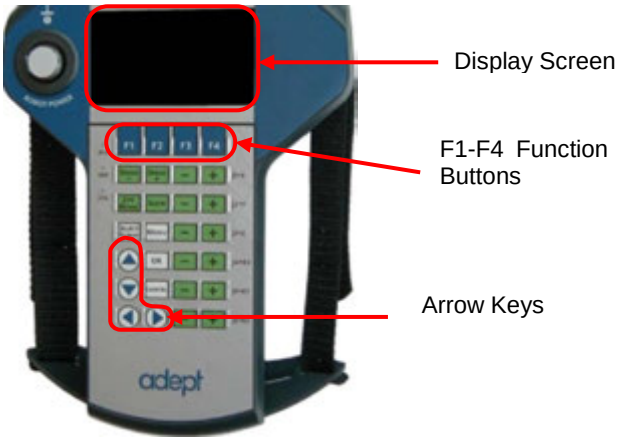
5 Check that the Home 1 Screen is displayed as an initial screen of Teaching Pendant.
Press **F3** (I/O).

Home 1 Screen

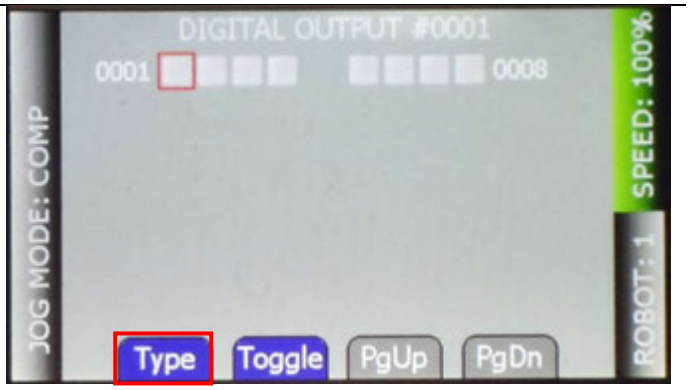


[F3]

*This procedure is implemented using Display Screen, F1-F4 Function Buttons, and Arrow Keys on Teaching Pendant.



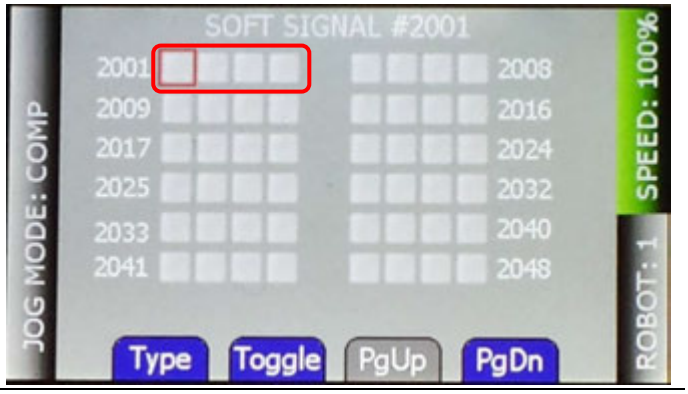
6 The DIGITAL OUTPUT #0001 Screen is displayed.
Press **F1** (Type) twice.

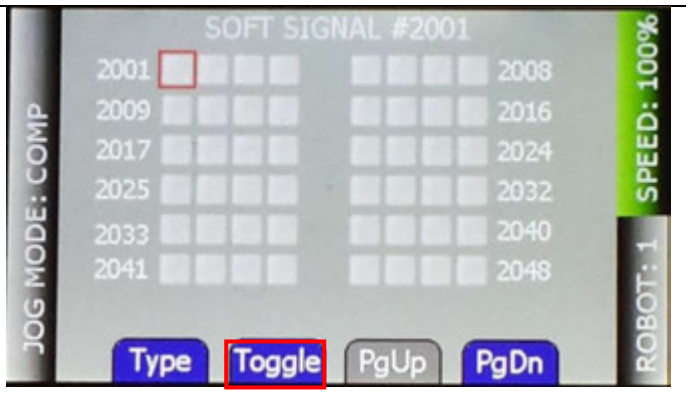
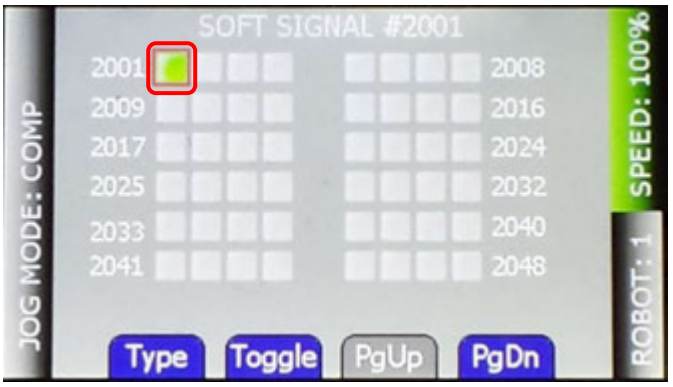
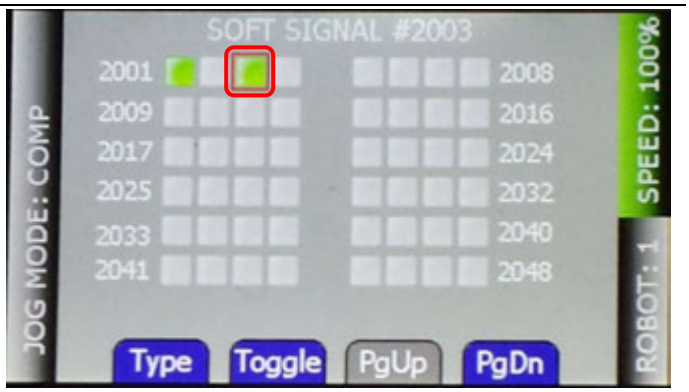
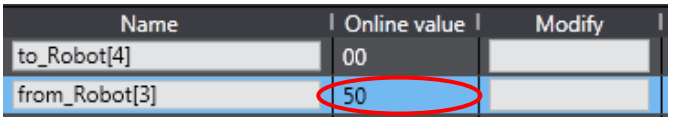


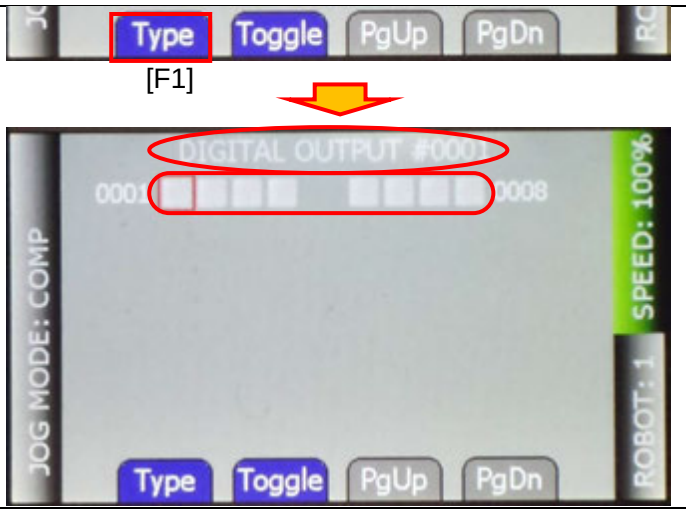
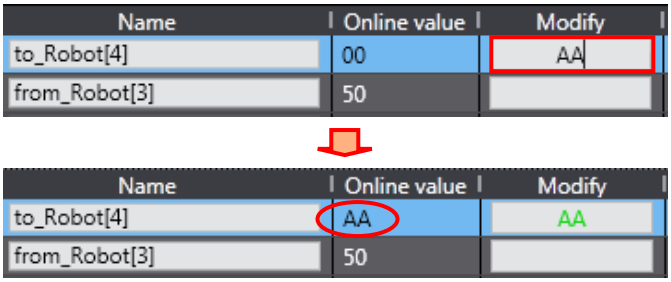
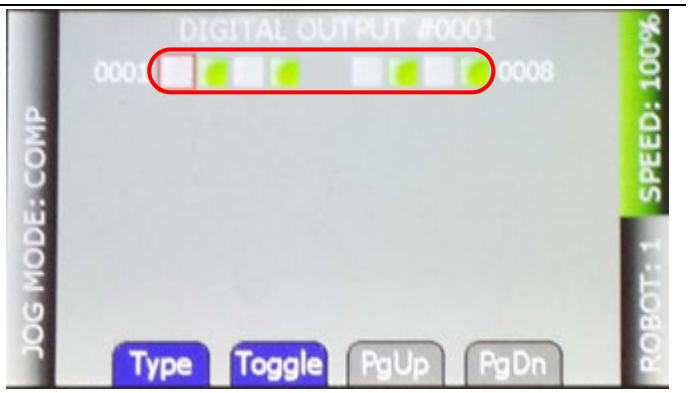
[F1]

The SOFT SIGNAL #2001 Screen is displayed.
Check that 2001 to 2004 do not light up.

*If the SOFT SIGNAL #2001 Screen is not displayed, keep pressing **F1** (Type) until it is displayed.



7	Check that 2001 is selected on the screen. Press **F2** (Toggle). *If 2001 is not selected, press the **Up**, **Down**, **Right**, or **Left Arrow** Keys to select 2001.	 [F2]
8	Check that 2001 is ON (Green) as shown on the right.	
9	In the same way as steps 7 and 8, turn 2003 ON (Green). *2001 is placed in the first position in the area of soft signals for Robot Controller.	
10	Check with the Controller variable corresponding to the Robot Controller signals that turn ON in steps 7 to 9. The online value of the *from_Robot[3]* variable is 50. It shows that the bits 4 and 6 of the *from_Robot[3]* variable are ON, which correspond to the active signals in the SOFT SIGNAL Screen in step 9.	

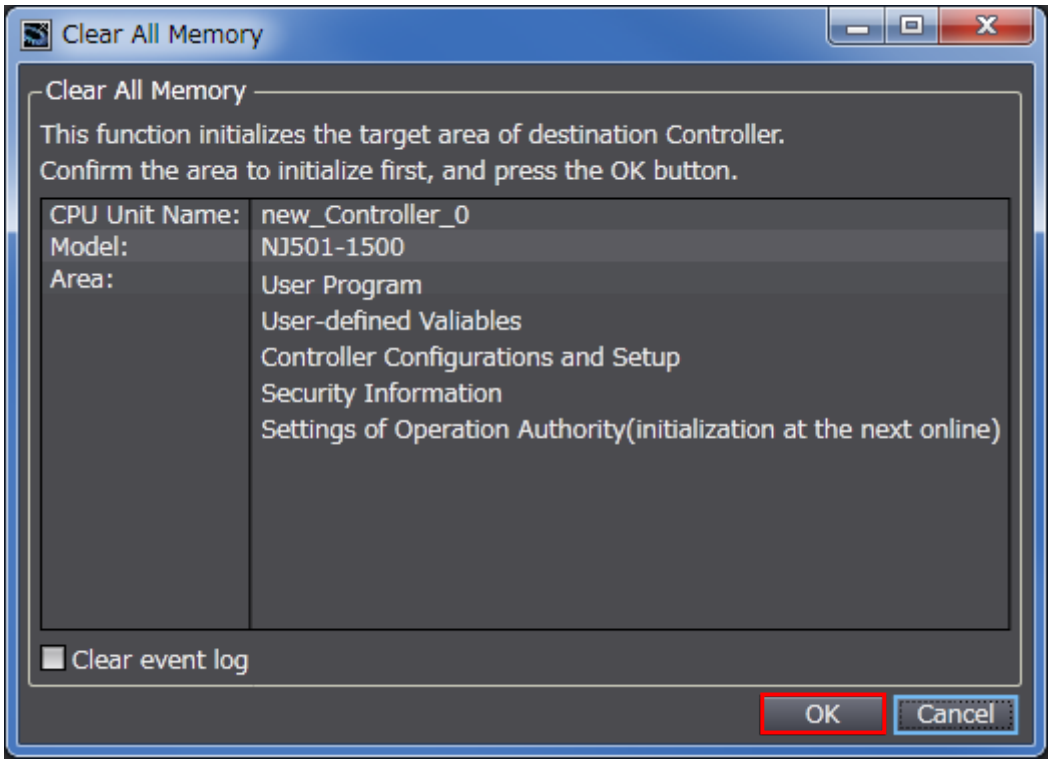
11	Keep pressing **F1** (Type) until the DIGITAL OUTPUT #0001 Screen is displayed. Check that 0001 to 0008 do not light up.	
12	Enter *AA* for the *to_Robot[4]* variable in the *Modify* Column. The online value of the *to_Robot[4]* variable changes to AA. *The bits 1, 3, 5, and 7 of the *to_Robot[4]* variable turn ON.	
13	Check that the signals in the DIGITAL OUTPUT Screen are ON, which correspond to the Controller variable set in step 12. The figure on the right shows that 0002, 0004, 0006, and 0008 are ON (Green), which correspond to the variable set in step 12.	

8. Initialization method

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

8.1. Initializing Controller

To initialize the Controller settings, it is necessary to initialize CPU Unit.
Change the operating mode of Controller to PROGRAM mode and select ***Clear All Memory*** from the Controller Menu in Sysmac Studio. The Clear All Memory Dialog Box is displayed.
Check the contents and click **OK**.



9. Appendix: Procedure Using the Project File

This section describes the procedure in which you use the following project file.
The project file includes the setting contents described in *7.3. Controller Setup*.
Obtain a latest project file from OMRON.

Name	File name	Version
Sysmac Studio project file (extension: csm2)	OMRON_ePLC_EIP_EV100.csm2	Ver.1.00

9.1. Work Flow

Take the following steps to make the EtherNet/IP tag data link settings using the project file.
Refer back to each of the following procedures for details except for *9.2.1. Importing the Project File* marked with a red square.

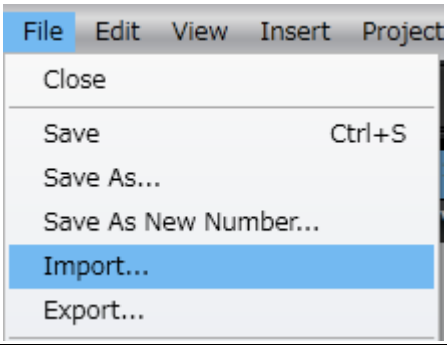
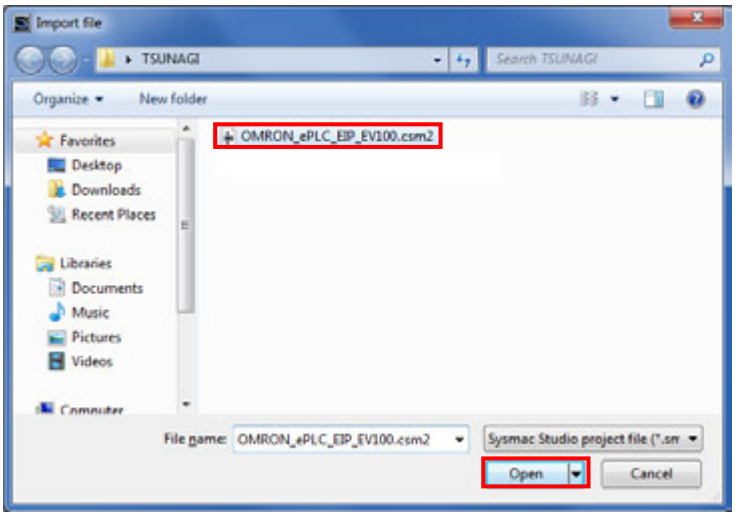
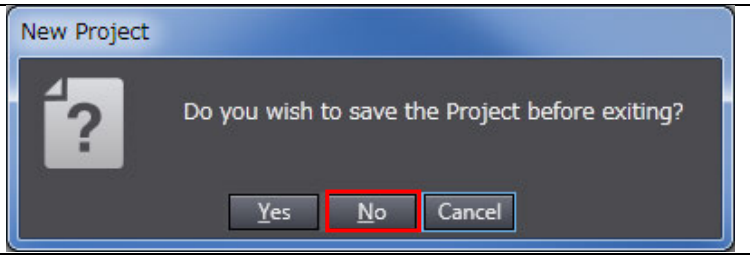
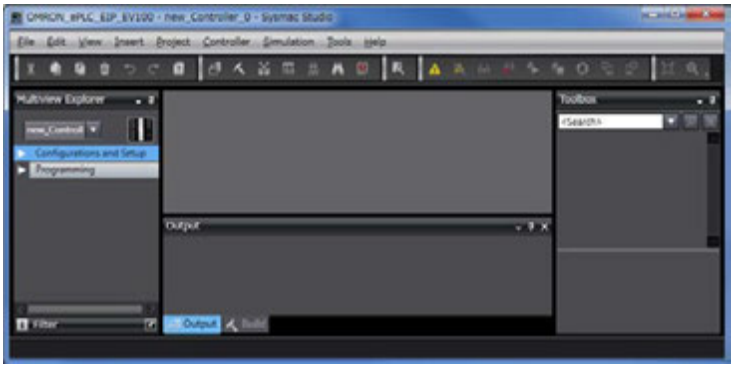
7.2. Robot Controller Setup	Set up Robot Controller.
↓	
9.2. Controller Setup	Set up Controller using the project file.
↓	
7.3.1. IP Address Settings	Start Sysmac Studio and set the IP address of Controller.
↓	
9.2.1. Importing the Project File	Import the project file to Sysmac Studio.
↓	
7.3.6. Transferring the Project Data	Connect online and transfer the connection settings and the project data to Controller.
↓	
7.4. EtherNet/IP Communication Status Check	Confirm that the EtherNet/IP tag data links are operated normally.

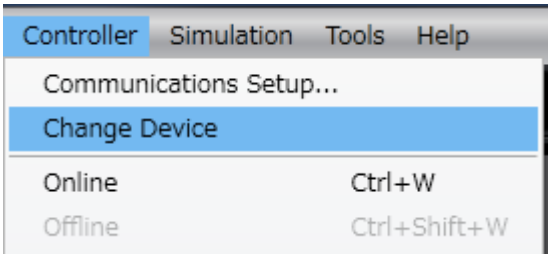
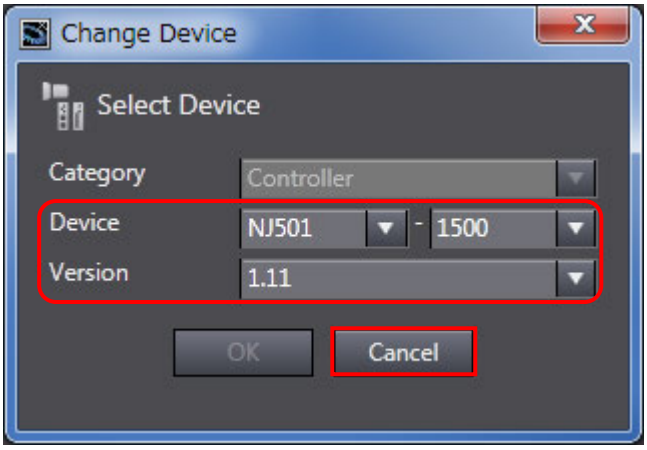
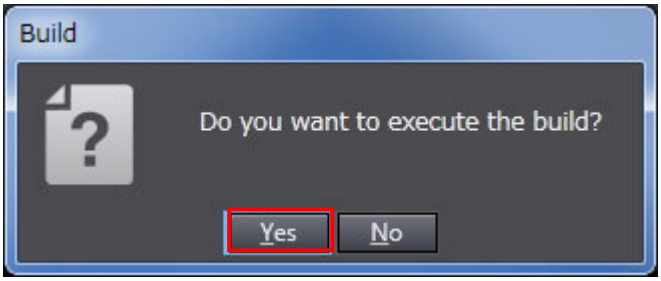
9.2. Controller Setup

Set up Controller using the project file.

9.2.1. Importing the Project File

Import the project file to Sysmac Studio.

1	Select ***Import*** from the File Menu.	
2	The Import file Dialog Box is displayed, Select *OMRON_ePLC_EIP_EV100.csm2* (project file) and click **Open**. *Obtain the project file from OMRON.	
3	The New Project Dialog Box is displayed. Check the contents and click **No**.	
4	The OMRON_ePLC_EIP_ EV100 project is displayed. * If an error message is displayed informing you that the project file cannot be imported, change the version of Sysmac Studio to the version specified in *5.2. Device Configuration* or to a higher version.	

5	Select ***Change Device*** from the Controller Menu.	
6	The Change Device Dialog Box is displayed. Check that the *Device* and the *Version* Fields are set as shown on the right. Click **Cancel**. *If the settings are different, select the setting items from the pull-down list, and click **OK**.	
7	If you changed the settings in step 6, the Build Dialog Box is displayed. Check the contents and click **Yes**.	

10. Revision History

Revision code	Date of revision	Description of revision
01	April 12, 2016	First edition

Note: Do not use this document to operate the Unit.

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