OMRON

Machine Automation Controller NJ-series

EtherCAT®
Connection Guide
IAI Corporation

ACON/PCON Controller

Network

Connection

Guide

SYSMAC
always in control

About Intellectual Property Rights and Trademarks

Table of Contents

1. Related Manuals

The table below lists the manuals related to this document.

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

Cat. No.	Model	Manual name
W500	NJ501-[][][][] NJ301-[][][][]	NJ-series CPU Unit Hardware User's Manual
W501	NJ501-[][][][] NJ301-[][][][]	NJ-series CPU Unit Software User's Manual
W505	NJ501-[][][][] NJ301-[][][][]	NJ-series CPU Unit Built-in EtherCAT Port User's Manual
W504	SYSMAC-SE2[][][]	Sysmac Studio Version 1 Operation Manual
ME0176	ACON-C/CG	IAI Corporation ACON-C/CG Controller Positioner Type Operation Manual
ME0170	PCON-C/CG/CF	IAI Corporation PCON-C/CG/CF Controller Positioner Type Operation Manual
ME0289	PCON-CA/CFA	IAI Corporation POWER CON PCON-CA/CFA Controller Instruction Manual
ME0273	ACON PCON SCON-CA	IAI Corporation EtherCAT Operation Manual
ME0155	RCM-101-MW RCM-101-USB	IAI Corporation ROBO CYLINDER PC Software Operation Manual

2.　Terms and Definitions

Term	Explanation and Definition
PDO communications (Communications using Process Data Objects)	This method is used for cyclic data exchange between the master unit and the slave units. PDO data (i.e., I/O data that is mapped to PDOs) that is allocated in advance is refreshed periodically each EtherCAT process data communications cycle (i.e., the period of primary periodic task). The NJ-series Machine Automation Controller uses the PDO communications for commands to refresh I/O data in a fixed control period, including I/O data for EtherCAT Slave Units, and the position control data for the Servomotors. It is accessed from the NJ-series Machine Automation Controller in the following ways: ・With device variables for EtherCAT slave I/O ・With Axis Variables for Servo Drive and encoder input slave to which assigned as an axis
SDO Communications (Communications using Service Data Objects)	This method is used to read and write the specified slave unit data from the master unit when required. The NJ-series Machine Automation Controller uses SDO communications for commands to read and write data, such as for parameter transfers, at specified times. The NJ-series Machine Automation Controller can read/write the specified slave data (parameters and error information, etc.) with the EC_CoESDORead (Read CoE SDO) instruction or the EC_CoESDOWrite (Write CoE SDO) instruction.
Slave unit	There are various types of slaves such as Servo Drives that handle position data and I/O terminals that handle the bit signals. The slave unit receives output data sent from the master, and transmits input data to the master.
Node address	A node address is an address to identify a unit connected to EtherCAT.
ESI file (EtherCAT Slave Information file)	The ESI files contain information unique to the EtherCAT slaves in XML format. Installing an ESI file enables the Sysmac Studio to allocate slave process data and make other settings.

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 safety circuit in order to ensure safety and minimize risks of abnormal occurrence.

(2) To ensure system safety, always read and heed the information provided in all Safety Precautions, Precautions for Safe Use, and Precaution for Correct Use of manuals for each device 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 December 2013. It is subject to change without notice for improvement.

The following notations are used in this document.

⚠ WARNING	Indicates a potentially hazardous situation which, if not avoided, will 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 Safe Use

Precautions on what to do and what not to do to ensure safe usage of the product.

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.

Symbols

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

4. Overview

This document describes the procedure for connecting ACON/PCON Controller of IAI Corporation (hereinafter referred to as IAI) to NJ-series Machine Automation Controller (hereinafter referred to as the Controller) of OMRON Corporation (hereinafter referred to as OMRON) via EtherCAT and provides the procedure for checking their connection.
Refer to *Section 6 EtherCAT Settings* and *Section 7. EtherCAT Connection Procedure* to understand the setting method and key points to operate PDO communications of EtherCAT.

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-[][][][]
IAI	ACON/PCON Controller	ACON-C/CG-[]-EC-[] PCON-C/CG/CA/CFA -[]-EC-[]
IAI	Actuator	-

📋 **Precautions for Correct Use**

As applicable devices above, the devices with the models and versions listed in *Section 5.2.* are actually used in this document to describe the procedure for connecting devices and checking the connection.

You cannot use devices with versions lower than the versions listed in *Section 5.2.*

To use the above devices with versions not listed in *Section 5.2* or versions higher than those listed in *Section 5.2*, check the differences in the specifications by referring to the manuals before operating the devices.

📝 **Additional Information**

This document describes the procedure to establish the network connection. Except for the connection procedure, it does not provide information on operation, installation or wiring method. It also does not describe the functionality or operation of the devices. Refer to the manuals or contact the device manufacturer.

(IAI Corporation. http://www.intelligentactuator.com/)

This URL is the latest address at the time of this document creation. Contact each device manufacturer for the latest information.
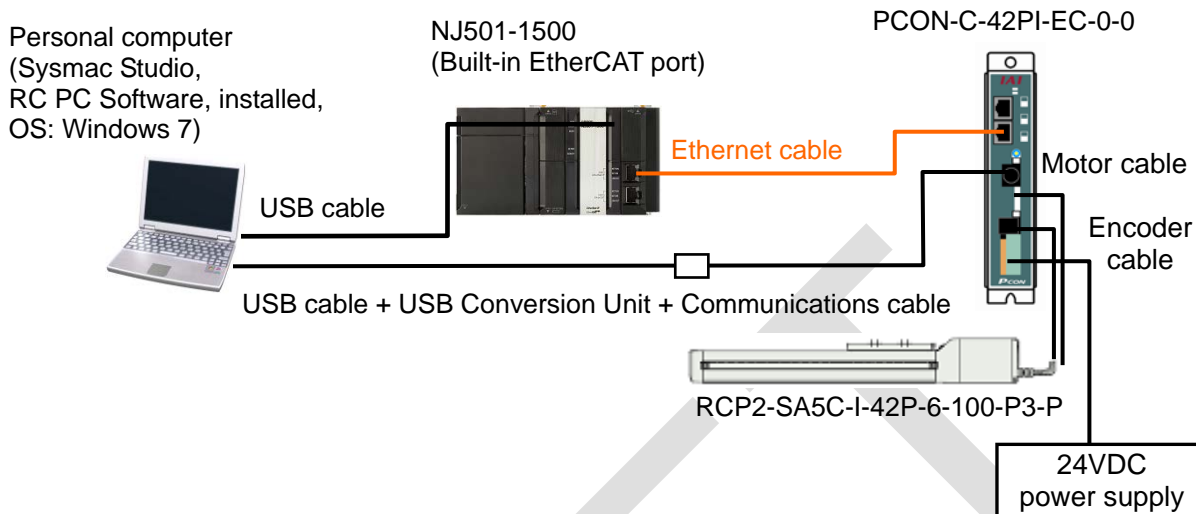
📝 **Additional Information**

Contact the device manufacturer for actuators connectable to ACON/PCON Controllers.

(IAI Corporation. http://www.intelligentactuator.com/)

5.2. Device Configuration

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

Manufacturer	Name	Model	Version
OMRON	CPU Unit (Built-in EtherCAT port)	NJ501-1500	Ver.1.06
OMRON	Power Supply Unit	NJ-PA3001	
OMRON	Sysmac Studio	SYSMAC-SE2[][][]	Ver.1.07
-	Personal computer (OS: Windows7)	-	
-	USB cable (USB 2.0 type B connector)	-	
OMRON	Ethernet cable (with industrial Ethernet connector)	XS5W-T421-[]M[]-K	
IAI	PCON Controller	PCON-C/CG-[]-EC-[]	Rev:0x00010004
IAI	USB cable	CB-SEL-USB010	
IAI	USB Conversion Unit	RCB-CV-USB	
IAI	Communications cable	CB-RCA-SIO050	
IAI	Actuator	RCP2-SA5C-I-42P-6-100-P3-P	
IAI	Motor cable	CB-RCP2-MA050	
IAI	Encoder cable	CB-RCP2-PB050	
-	24VDC power supply	-	
IAI	RC PC Software	RCM-101-MW RCM-101-USB	Ver.9.03.06.02-E
IAI	ESI file	ESI_IAI_CON_ECT_V_1_04_Rev_4.xml	

📝 **Precautions for Correct Use**

Prepare the applicable ESI file beforehand. The latest ESI file can be downloaded from the IAI website.

(http://www.intelligentactuator.com/field-network-configuration-files/)

To obtain the file, contact IAI Corporation.

Precautions for Correct Use

The connection line of EtherCAT communication cannot be shared with other Ethernet networks.

Do not use devices for Ethernet such as a switching hub.

Use the cable (double shielding with aluminum tape and braiding) of Category 5 or higher, and use the shielded connector of Category 5 or higher.

Connect the cable shield to the connector hood at both ends of the cable.

Precautions for Correct Use

Update the Sysmac Studio to the version specified in this section or higher version using the auto update function.

If a version not specified in this section is used, the procedures described in *Section 7* and subsequent sections may not be applicable. In that case, use the equivalent procedures described in the *Sysmac Studio Version 1 Operation Manual* (Cat. No. W504).

Additional Information

For information on the specifications of the Ethernet cable and network wring, refer to *Section 4 EtherCAT Network Wiring* of the *NJ-series CPU Unit Built-in EtherCAT Port User's Manual* (Cat. No. W505).

Additional Information

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

Additional Information

The system configuration in this document uses USB for the connection to the ACON/PCON Controller. For information on how to install a USB driver, refer to *1.3.3 How to Install the USB Conversion Adapter Driver Software* of the *ROBO CYLINDER PC Software Operation Manual* (Cat. No. ME0155).

6.　EtherCAT Settings

This section describes the specifications such as communication parameters and variables that are defined in this document.

Hereinafter, the ACON/PCON Controller is referred to as the "Destination Device" or the "Slave Unit" in some descriptions.

6.1.　EtherCAT Communications Parameter Settings

The communications parameter required connecting the Controller and the Destination Device via EtherCAT is given below.

	ACON/PCON Controller
Node address	1
Axis number	0
Operation mode	2 (Half direct value mode)
I/O format	3 (Default setting)

6.2.　Allocation for PDO Communications

The EtherCAT PDO communications data of the Destination Device are allocated to the Controller's device variables. The device variables and the data types are shown below.

■ Output area (from Controller to Destination Device)

Device variable name	Data type	Meaning
E001_Out_Target_Position_2003_01	DINT	Target position
E001_Out_Positioning_Band_2003_02	UDINT	Positioning band
E001_Out_Velocity_2003_03	UINT	Velocity
E001_Out_Acceleration_Deceleration_2003_04	UINT	Acceleration/ Deceleration
E001_Out_Pressing_Current_Limit_2003_05	UINT	Pressing current limit value

8

Device variable name	Data type	Meaning
E001_Out_Control_signal_2003_06	WORD	Control signal
E001_Out_Bit00_DSTR	BOOL	Positioning command
E001_Out_Bit01_HOME	BOOL	Home return
E001_Out_Bit02_STP	BOOL	Pause
E001_Out_Bit03_RES	BOOL	Reset
E001_Out_Bit04_SON	BOOL	Servo ON command
E001_Out_Bit05_JISL	BOOL	Jog/inch switching
E001_Out_Bit06_JVEL	BOOL	Jog-speed/inch-distance switching
E001_Out_Bit07_JOG_0	BOOL	- Jog
E001_Out_Bit08_JOG_0	BOOL	+ Jog
E001_Out_Bit09_Reserved_0	BOOL	Unavailable
E001_Out_Bit10_GSL0	BOOL	Unavailable
E001_Out_Bit11_GSL1	BOOL	Unavailable
E001_Out_Bit12_PUSH	BOOL	Push-motion specification
E001_Out_Bit13_DIR	BOOL	Push direction specification
E001_Out_Bit14_RMOD	BOOL	Operating mode selector
E001_Out_Bit15_BKRL	BOOL	Forced brake release

■ Input area (Destination Device to Controller)

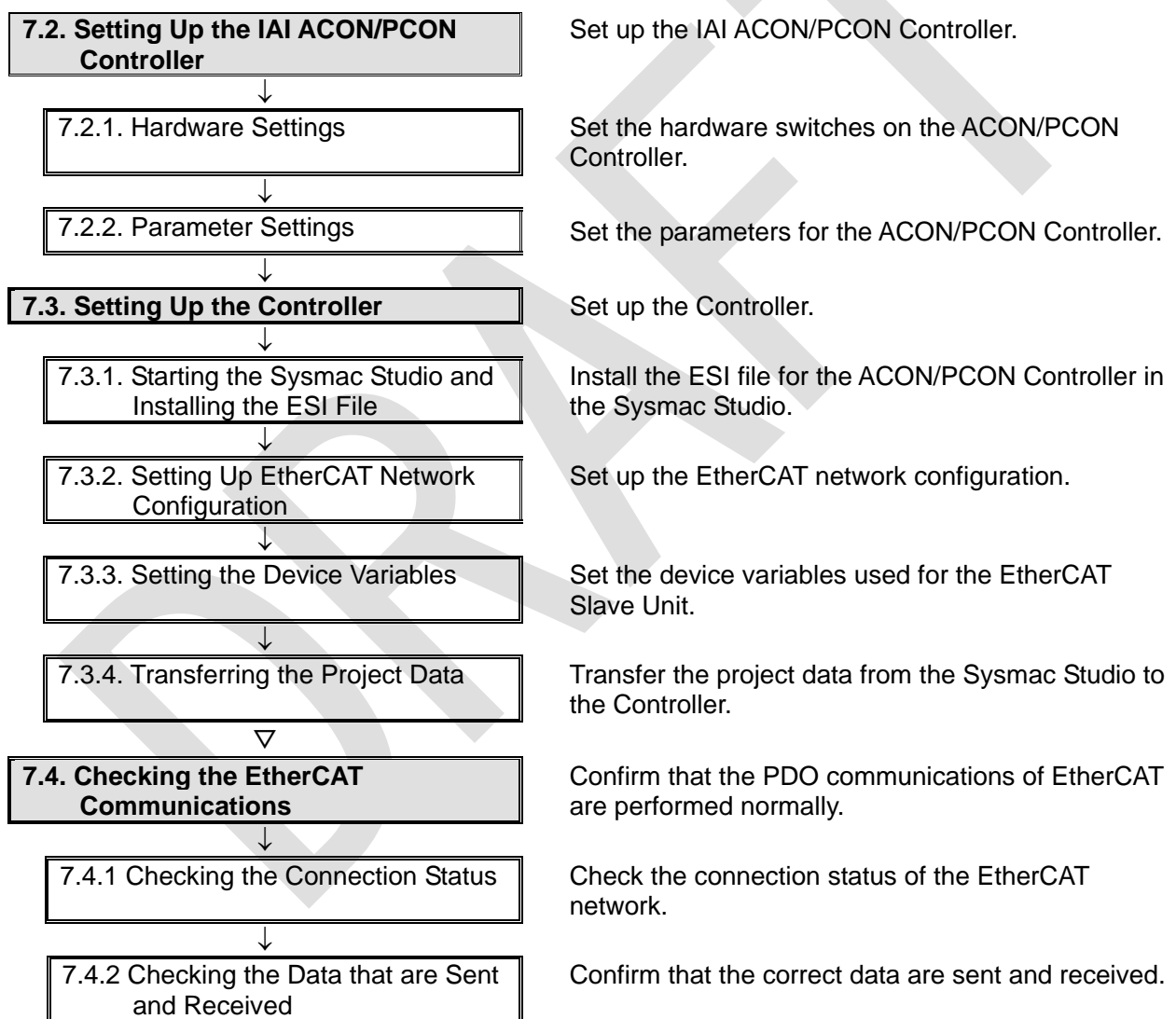| Device variable name	Data type	Meaning
E001_In_Current_Position_2004_01	DINT	Current position
E001_In_Command_Current_2004_02	UDINT	Command current
E001_In_Current_Speed_2004_03	DINT	Current speed
E001_In_Alarm_Code_2004_04	UINT	Alarm code
E001_In_Status_Signal_2004_05	WORD	Status signal
E001_In_Bit00_PEND	BOOL	Positioning completion signal
E001_In_Bit01_HEND	BOOL	Home return completion
E001_In_Bit02_MOVE	BOOL	Moving signal
E001_In_Bit03_ALM	BOOL	Alarm
E001_In_Bit04_SV	BOOL	Operation preparation end
E001_In_Bit05_PSFL	BOOL	Pressing and a miss
E001_In_Bit06_Reserved_0	BOOL	Unavailable
E001_In_Bit07_BALM_ALML	BOOL	Unavailable
E001_In_Bit08_RMDS	BOOL	Operation mode status
E001_In_Bit09_Reserved_0	BOOL	Unavailable
E001_In_Bit10_Reserved_0	BOOL	Unavailable
E001_In_Bit11_Reserved_0	BOOL	Unavailable
E001_In_Bit12_ZONE1	BOOL	Zone 1
E001_In_Bit13_ZONE2	BOOL	Zone 2
E001_In_Bit14_PWR	BOOL	Controller ready
E001_In_Bit15_EMGS	BOOL	Emergency stop

7. EtherCAT Connection Procedure

This section describes the procedure for connecting the Controller to the ACON/PCON Controller via EtherCAT.

This document explains the procedures for setting up the Controller and the ACON/PCON Controller from the factory default setting. For the initialization, refer to *Section 8 Initialization Method*.

7.1. Work Flow

Take the following steps to perform PDO communications of EtherCAT.

7.2. Setting Up the IAI ACON/PCON Controller	Set up the IAI ACON/PCON Controller.
↓	
7.2.1. Hardware Settings	Set the hardware switches on the ACON/PCON Controller.
↓	
7.2.2. Parameter Settings	Set the parameters for the ACON/PCON Controller.
↓	
7.3. Setting Up the Controller	Set up the Controller.
↓	
7.3.1. Starting the Sysmac Studio and Installing the ESI File	Install the ESI file for the ACON/PCON Controller in the Sysmac Studio.
↓	
7.3.2. Setting Up EtherCAT Network Configuration	Set up the EtherCAT network configuration.
↓	
7.3.3. Setting the Device Variables	Set the device variables used for the EtherCAT Slave Unit.
↓	
7.3.4. Transferring the Project Data	Transfer the project data from the Sysmac Studio to the Controller.
▽	
7.4. Checking the EtherCAT Communications	Confirm that the PDO communications of EtherCAT are performed normally.
↓	
7.4.1 Checking the Connection Status	Check the connection status of the EtherCAT network.
↓	
7.4.2 Checking the Data that are Sent and Received	Confirm that the correct data are sent and received.

7.2. Setting Up the IAI ACON/PCON Controller

Set up the IAI ACON/PCON Controller.

7.2.1. Hardware Settings

Set the hardware switches on the ACON/PCON Controller.

Precautions for Correct Use

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

1	Make sure that the power supply to the ACON/PCON Controller is OFF. * If the power supply is turned ON, settings may not be applicable as described in the following procedure.
2	Check the position of the hardware switches on the front of the ACON/PCON Controller by referring to the right figure.
3	Set the "ADRS" address switch to *0*.
4	Connect the encoder connector and motor connector to the actuator. Connect the Ethernet cable to the EtherCAT input port. Connect the power supply to the power-supply terminal block.
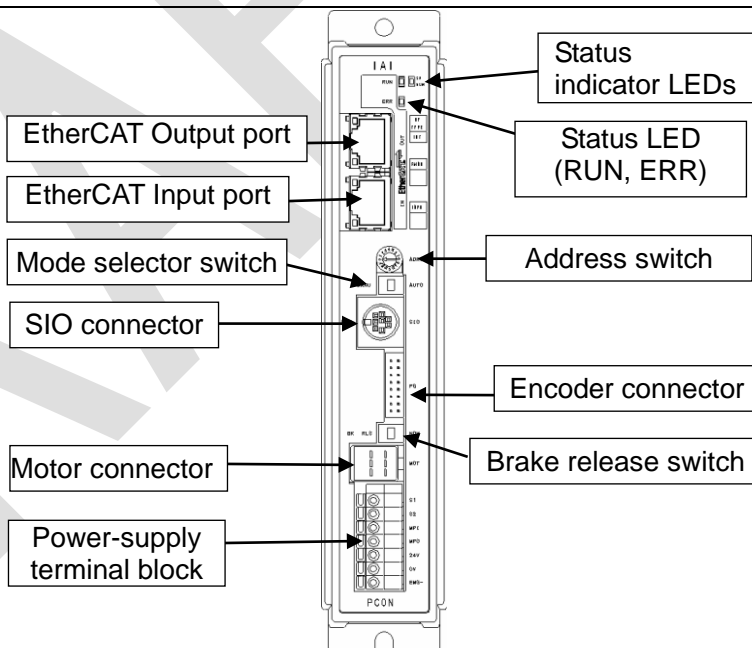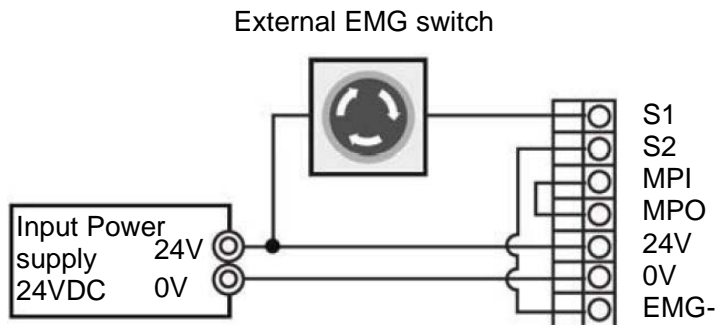
7.2.2. Parameter Settings

Set the parameters for the ACON/PCON Controller.

Parameters are set by RC PC Software. Install the software and USB Driver to the personal computer beforehand.

Additional Information

For information on how to install a driver, refer to the *ROBO CYLINDER PC Software Operation Manual* (Cat. No. ME0155).

1	Connect the ACON/PCON Controller to the personal computer with a USB cable, USB Conversion Unit, and Communications cable. * Connect the USB cable to the USB port on the personal computer. Connect the Communications cable to the SIO connector on the ACON/PCON Controller.	SIO
2	Set the Mode selector switch on the front of the ACON/PCON Controller to the MANU side.	MANU ☐ AUTO
3	Turn ON the power supply to the ACON/PCON Controller and start the RC PC Software from the personal computer.	PC Interface Software f...

4 The Setting of application Dialog Box is displayed only at the initial start after the software has been installed.
Select the communications port No. to be used in the *Port* Field and click the **OK** Button.

* If there are multiple serial ports on the personal computer, display the Windows Device Manager. Then select the same port as the communications port No. where the ACON/PCON Controller is connected under Ports (COM & LPT) (COM6 in this example).

* To display the Device Manager, right-click *My Computer,* click *Properties* from the Windows Menu. Then click *Device Manager* in the window that is displayed.

Setting of application

*Port	COM6 ▼ □ View All
*Baudrate(bps)	115200 ▼
*Last Axis No.	15 ▼
Unit of display at pulse-train mode	mm ▼
Start position of program	Top of the program ▼
Display type of position data	Simple ▼
Input warning outside the recommended range	Warn ▼
Servo monitor data file format	Setting

(The item to which "*" attaches will be effective after reconnecting or the reboot.)

Change Password   ✔ OK   ✘ Cancel

Device Manager

File   Action   View   Help

� Portable Devices
◢ Ports (COM & LPT)
    Communications Port (COM1)
    IAI USB to UART Bridge Controller (COM6)
    Intel(R) Active Management Technology - SOL (COM3)
◢ Processors

5 After the software starts, the Check for connected axes Dialog Box is displayed, and then the ACON/PCON Controller goes online.

After the software connection checks go through all axes (up to the Axis No. 15 in the right figure), the Manual operation mode Select Dialog Box is displayed.

Check for connected axes

Axis No.	Status
0	Connected
1	
2	
3	(Checking)
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
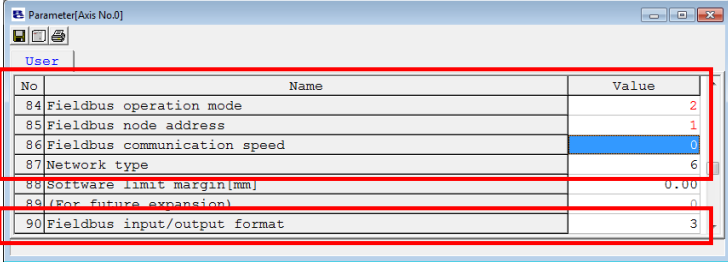
6	The Manual operation mode Select Dialog Box is displayed. Select *Teach 1(Safety speed effective/PIO start prohibition)* for manual operation mode and click the **OK** Button. The RC PC Software starts.	
7	If the Alarm Dialog Box is displayed, check the connection settings such as cable connections and port numbers. After the error is cleared, click the **OK** Button. * To connect to the ACON/PCON Controller again, select *Controller - Check for connected axes* from the Setting Menu. (Refer to the right figure)	
8	Select *Edit* from the Parameter Menu.	

9	The parameter edit window is displayed as shown on the right. Scroll through the parameter options to check and change the following parameters: ・Fieldbus operation mode (No.84): *2* (Default: 0) ・Fieldbus node address (No.85): *1* (Default: 17) ・Fieldbus communication speed (No.86): *0* (Default) ・Network type (No.87): *6* (Default) ・Fieldbus Input/output format (No.90): *3* (Default) * When the set value is changed, it appears in red. (e.g. If the value is changed from 0 to 2, 2 is displayed in red)	 **Parameter[Axis No.0]** **User** 	No	Name	Value
84	Fieldbus operation mode	2
85	Fieldbus node address	1
86	Fieldbus communication speed	0
87	Network type	6
88	Software limit margin[mm]	0.00
89	(For future expansion)	0
90	Fieldbus input/output format	3	
10	Select *Load to CTL* from the Parameter Menu. A Confirmation Dialog Box is displayed as shown on the right. Check the contents and click the **Yes** Button. * The Confirmation Dialog Box does not appear if any change is made in the previous step. Go to the next step.	Position Parameter Monitor Setting Window H Edit Load to CTL Print RC **Confirmation** Transmit the parameter to the controller. Are you sure to continue? Yes No
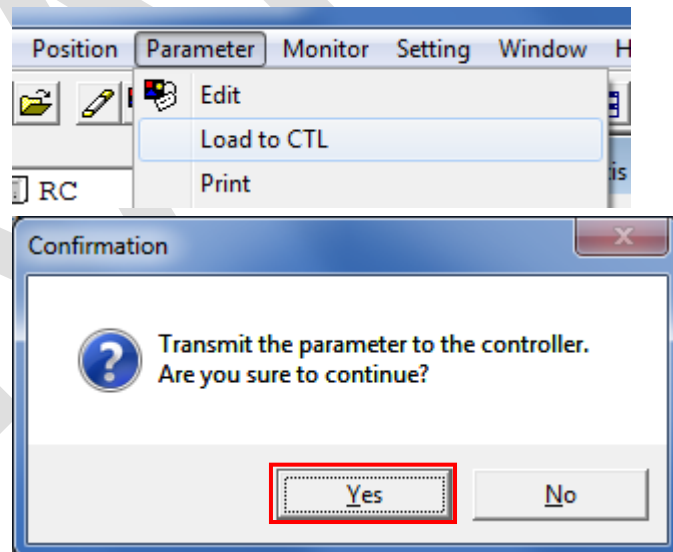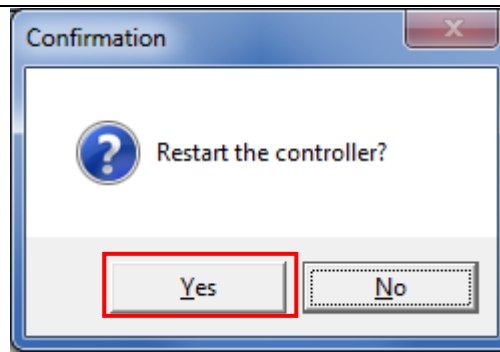
11	A Confirmation Dialog Box is displayed as shown on the right. Check the contents and click the **Yes** Button.	
	The right dialog box is displayed stating "Restarting Controller".	
12	After the ACON/PCON Controller restarts, Set the Mode selector switch on the front of the ACON/PCON Controller to the AUTO side. * The Mode selector switch can be changed even when the power supply to the ACON/PCON Controller turns ON.	
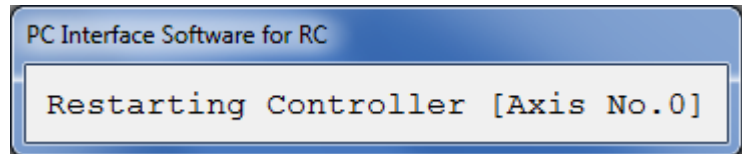
7.3. Setting Up the Controller

Set up the Controller.

7.3.1. Starting the Sysmac Studio and Installing the ESI File

Install the ESI file for the ACON/PCON Controller in the Sysmac Studio.

Install the Sysmac Studio and USB driver in the personal computer beforehand.

1	Connect the Ethernet cable to the built-in EtherCAT port (PORT2) of the Controller and the USB cable to the peripheral (USB) port. As shown in *5.2. Device Configuration*, connect the personal computer, ACON/PCON Controller, and the Controller.	
2	Turn ON the power supply to the Controller.	
3	Start the Sysmac Studio. Click the **New Project** Button. * If a confirmation dialog for an access right is displayed at start, select to start.	
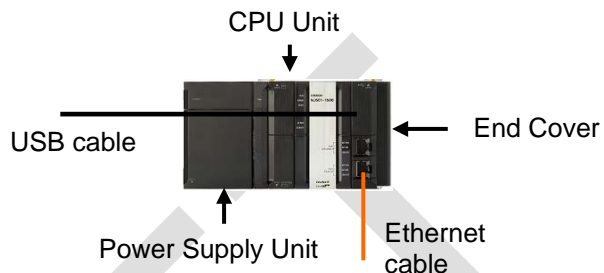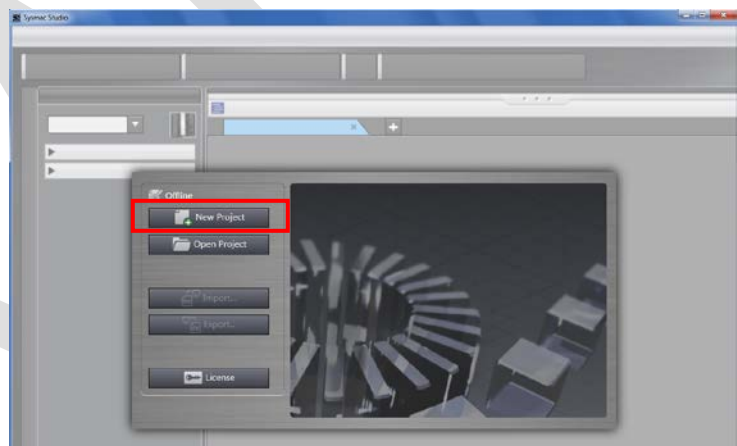
4	The Project Properties Dialog Box is displayed. * In this document, New Project is used as the Project name. Confirm that the device you use is shown in the *Category* and *Device* Fields of Select Device. Select version *1.06* from the pull-down list of Version. * Although 1.06 is selected in this document for example, select the version you actually use.	
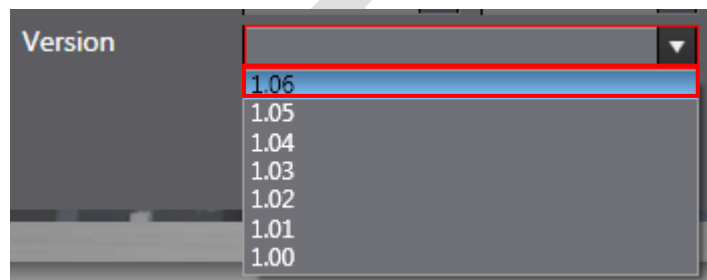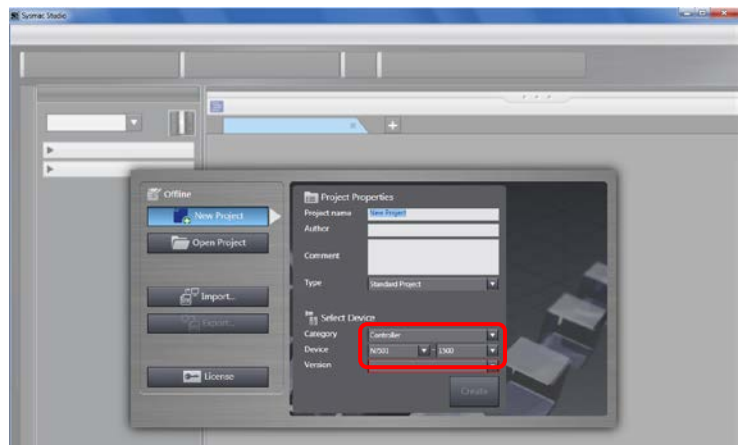
5	Click the **Create** Button.	
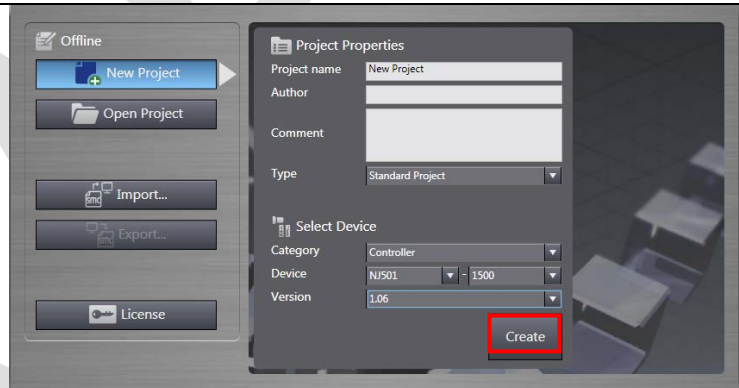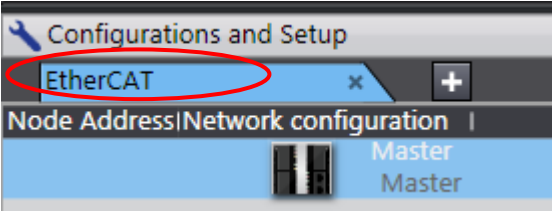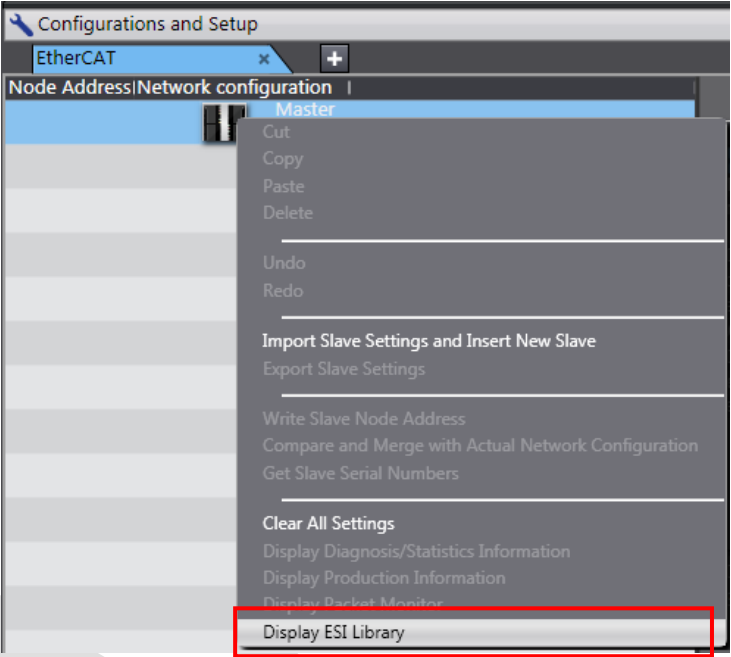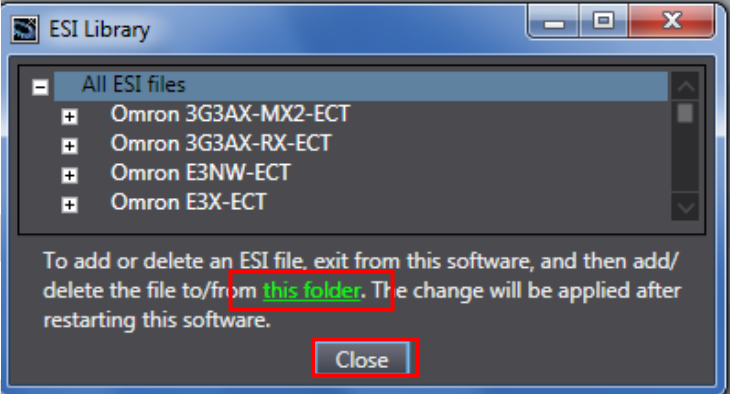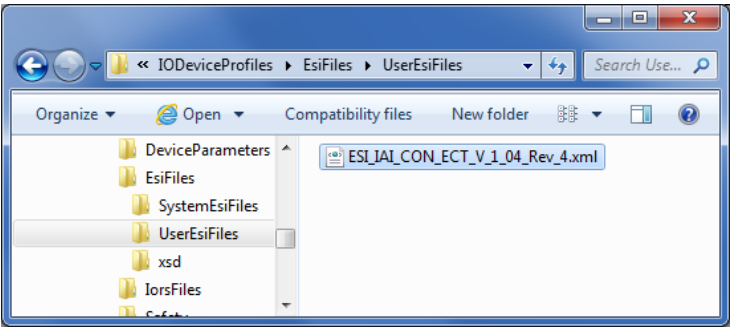
6	The New Project is displayed. The left pane is called Multiview Explorer, the right pane is called Toolbox and the middle pane is called Edit Pane.	
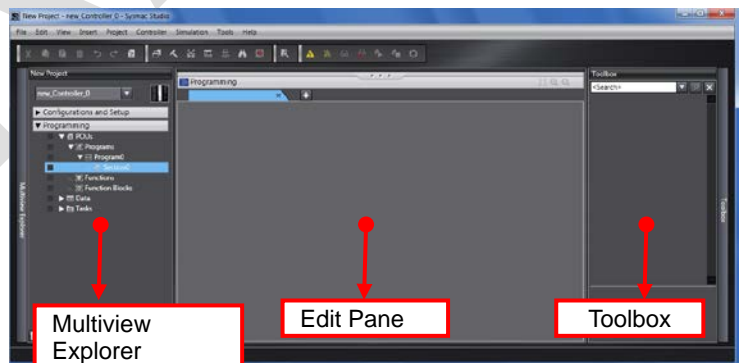
7	Double-click **EtherCAT** under **Configurations and Setup** in the Multiview Explorer.	
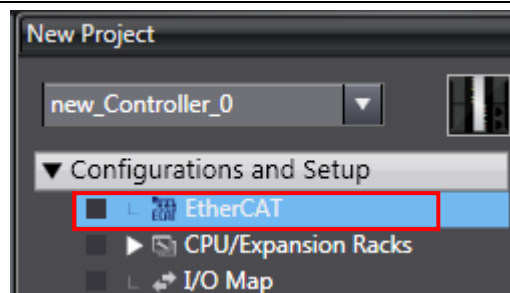
8	The EtherCAT Tab is displayed on the Edit Pane.	
9	Right-click **Master** and select *Display ESI Library*.	
10	The ESI Library Dialog Box is displayed. Click the **this folder** link. When the Explorer starts, close the dialog box by clicking the **Close** Button.	
11	The Explorer starts and a folder is opened, allowing you to install the ESI file. Copy the prepared *ESI_IAI_CON_ECT_V_1_04_Rev_4.xml* to this folder.	

12 Select *Exit* from the File Menu to exit the Sysmac Studio.
A dialog box is displayed confirming whether to save the project. If you do not need to save, click the **No** Button.

* You need to restart the Sysmac Studio after installing the ESI file.

File	Edit	View	Insert	Proje
Close				
Save				Ctrl+S
Save As...				
Save As New Number...				
Import...				
Export...				
Offline Comparison				
Page Settings...				
Print...				Ctrl+P
Exit				

New Project

? Do you wish to save the Project before exiting?

Yes [No] Cancel
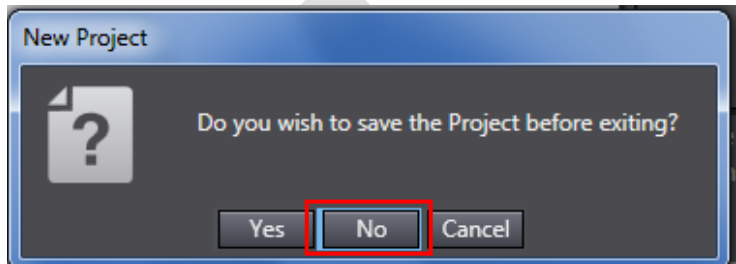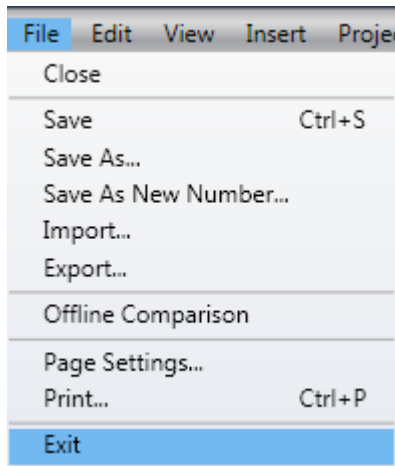
13 In the same way as steps 2 to 8, restart the Sysmac Studio and display the ESI Library Dialog Box.
Click the **+** Button of *ESI_IAI_CON_ECT_V1_04_Rev_4* to confirm that *RC-ECT-FMOD2(16Byte/16Byte) Rev:0x00010004* is displayed.

Confirm that an exclamation mark (warning) is not displayed.

Click the **Close** Button.

ESI Library

- All ESI files
  - Omron 3G3AX-MX2-ECT
  - Omron 3G3AX-RX-ECT
  - Omron E3NW-ECT
  - Omron E3X-ECT
  - Omron FH-xxxx-xx
  - Omron FQ-MS12x-x-ECT
  - Omron FZM1-XXX-ECT
  - Omron GX-Analog IO
  - Omron GX-Digital IO
  - Omron GX-Encoder
  - Omron GX-JC
  - Omron GX-JC06-H
  - Omron NX_Coupler
  - Omron R88D-KNxxx-ECT
  - Omron R88D-KNxxx-ECT-L
  - Omron ZW-CE1x
  - Omron_GRT1-ECT_Ver2_0
  - ESI_IAI_CON_ECT_V_1_04_Rev_4
    - RC-ECT-FMOD0(2Byte/2Byte) Rev:0x00010004 (RC-ECT-FMOD0(2Byte/2Byte))
    - RC-ECT-FMOD1(8Byte/8Byte) Rev:0x00010004 (RC-ECT-FMOD1(8Byte/8Byte))
    - RC-ECT-FMOD2(16Byte/16Byte) Rev:0x00010004 (RC-ECT-FMOD2(16Byte/16Byte))
    - RC-ECT-FMOD3(32Byte/32Byte) Rev:0x00010004 (RC-ECT-FMOD3(32Byte/32Byte))
    - RC-ECT-FMOD4(12Byte/12Byte) Rev:0x00010004 (RC-ECT-FMOD4(12Byte/12Byte))
    - RC-ECT-FMOD5(8Byte/8Byte) Rev:0x00010004 (RC-ECT-FMOD5(8Byte/8Byte))
    - RC-ECT-FMOD6(16Byte/16Byte) Rev:0x00010004 (RC-ECT-FMOD6(16Byte/16Byte))
    - RC-ECT-FMOD7(12Byte/12Byte) Rev:0x00010004 (RC-ECT-FMOD7(12Byte/12Byte))
    - RC-ECT-FMOD8(16Byte/16Byte) Rev:0x00010004 (RC-ECT-FMOD8(16Byte/16Byte))

To add or delete an ESI file, exit from this software, and then add/delete the file to/from this folder. The change will be applied after restarting this software.
Close

Precautions for Correct Use

If an exclamation mark (warning) is displayed for the ESI file, check the name of the ESI file and obtain the ESI file with a correct name. If an exclamation mark (warning) is displayed even when the name of the ESI file is correct, the file may be corrupted. Contact the device manufacturer.

7.3.2.   Setting Up the EtherCAT Network Configuration
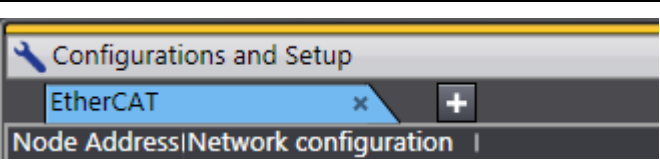
Set up EtherCAT network configuration with the Sysmac Studio.

1	Select *Communications Setup* from the Controller Menu.	
2	The Communications Setup Dialog Box is displayed. Select the *Direct connection via USB* Option for Connection Type. Click the **OK** Button.	
3	Select *Online* from the Controller Menu. A confirmation dialog box is displayed. Click the **Yes** Button. * The displayed dialog depends on the status of the Controller used. Check the contents and click the **Yes** Button to proceed with the processing.	

📖 **Additional Information**

For details on online connections to a Controller, refer to *Section 5 Online Connections to a Controller* of the *Sysmac Studio Version 1 Operation Manual* (Cat. No. W504).

4	When an online connection is established, a yellow bar is displayed on the top of the Edit Pane.	

5	Right-click **Master** on the EtherCAT Tab Page, and select *Compare and Merge with Actual Network Configuration*.	
	A screen is displayed stating "Get information is being executed".	
6	The Compare and Merge with Actual Network Configuration Pane is displayed. Node address 1 and RC-ECT-FMOD2(16Byte/16Byte) Rev:0x00010004 are added to the Actual network configuration after the comparison. Click the **Apply actual network configuration** Button.	
7	A confirmation dialog box is displayed. Check the contents and click the **Apply** Button.	
	Node address 1, E001 and RC-ECT-FMOD2(16Byte/16Byte) Rev:0x00010004 are added to the Network configuration on Sysmac Studio.	
	Confirm that they were added and click the **Close** Button.	
8	Node address 1, E001, and RC-ECT-FMOD2(16Byte/16Byte) Rev:0x00010004 are added to the EtherCAT Tab Page on the Edit Pane.	
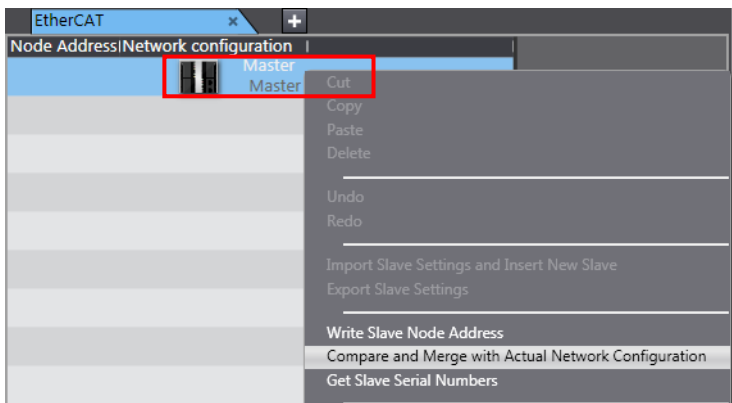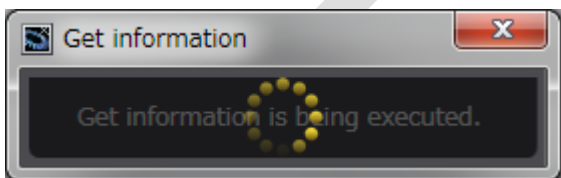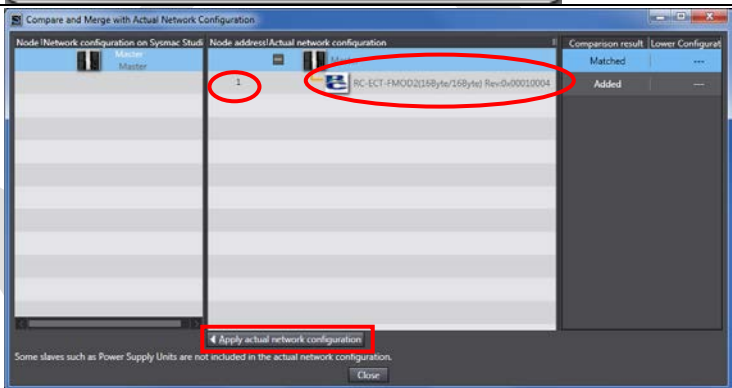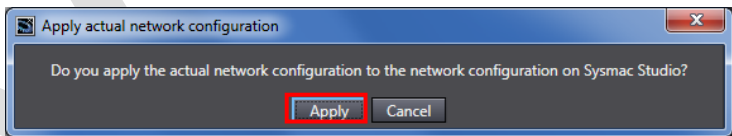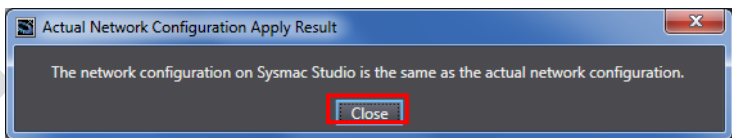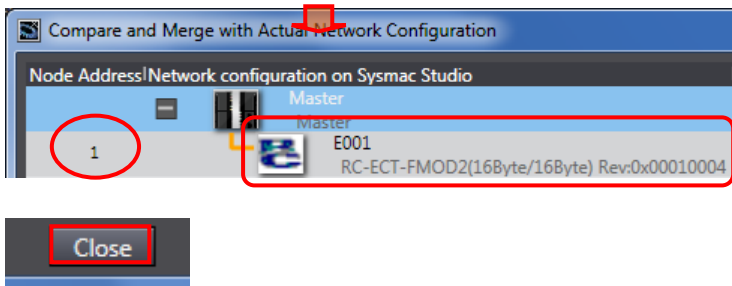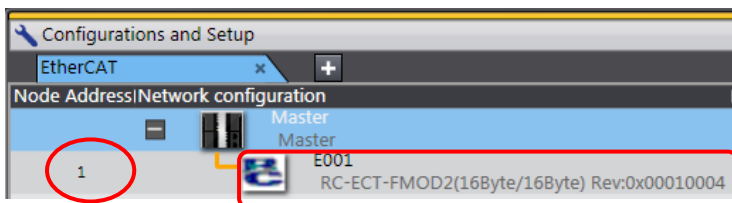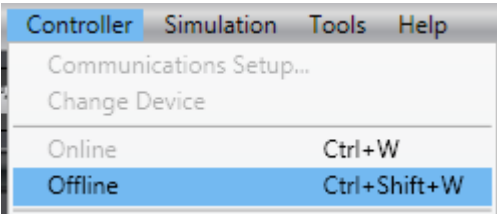
7.3.3. Setting the Device Variables
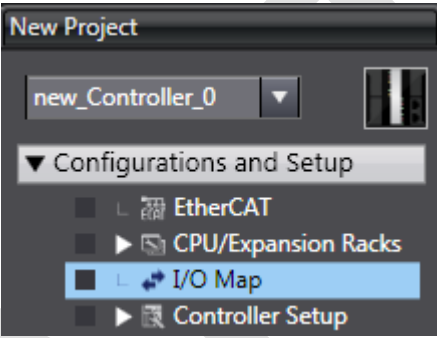
Set the device variables used for the EtherCAT Slave Unit.

1	Select *Offline* from the Controller Menu.	
	The yellow bar on the top of the Edit Pane disappears.	
2	Double-click **I/O Map** under **Configurations and Setup** in the Multiview Explorer.	
3	The I/O Map Tab is displayed on the Edit Pane. Confirm that Node1 is displayed in the *Position* Column and the Slave Unit is displayed. * To manually set a variable name for the Slave Unit, click a column under the *Variable* Column and enter a name.	
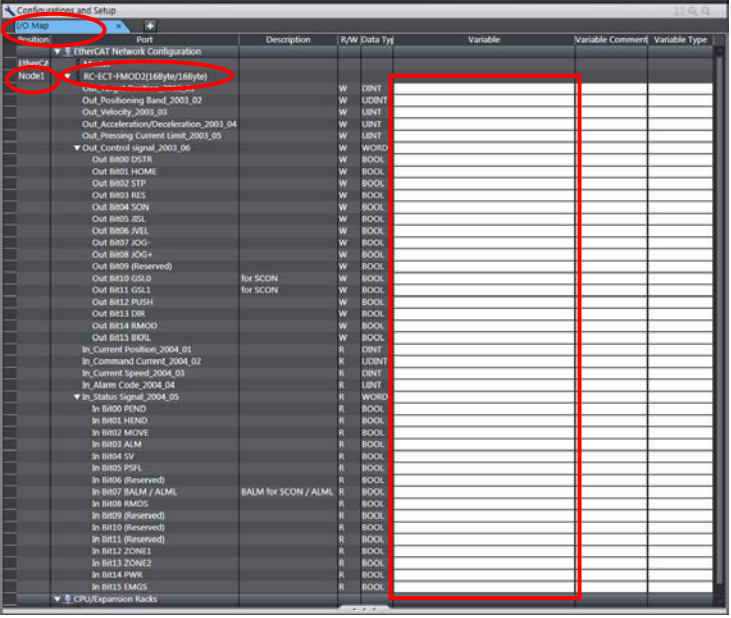
4	Right-click **Node1** and select *Create Device Variable*.	
5	The variable names and variable types are automatically set.	
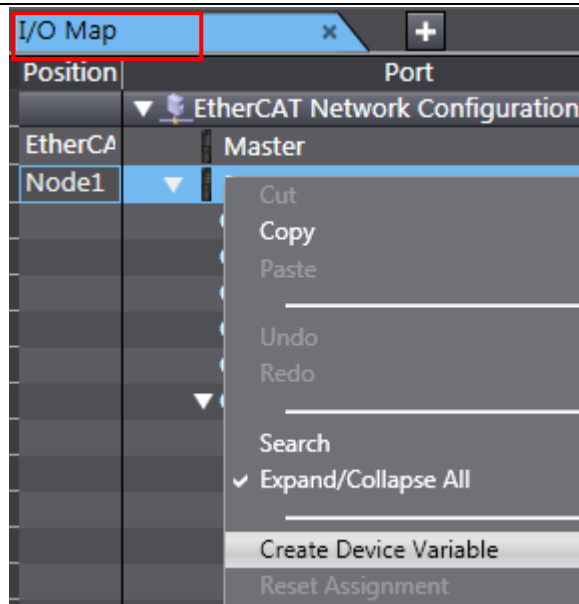
📖 **Additional Information**

The device variables are named automatically from a combination of the device names and the port names.
For slave units, the default device names start with an "E" followed by a sequential number starting from "001".

📖 **Additional Information**

In this document, device variables are automatically named for a unit (a slave). Device variables can also be manually named for I/O ports.

7.3.4. Transferring the Project Data

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

⚠ **WARNING**

Always confirm safety at the Destination Device before you transfer a user program, configuration data, setup data, device variables, or values in memory used for CJ-series Units from the Sysmac Studio.
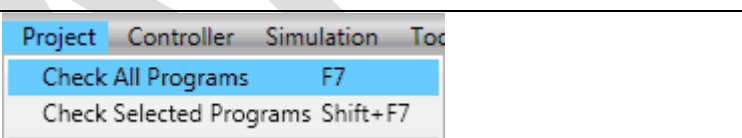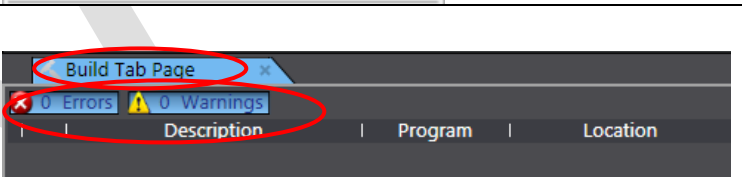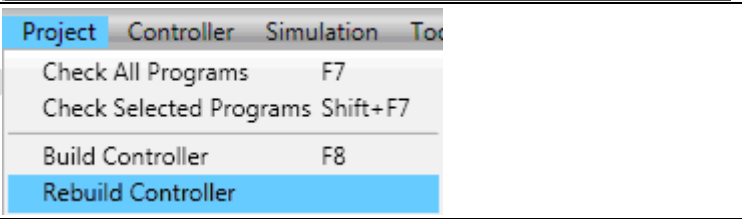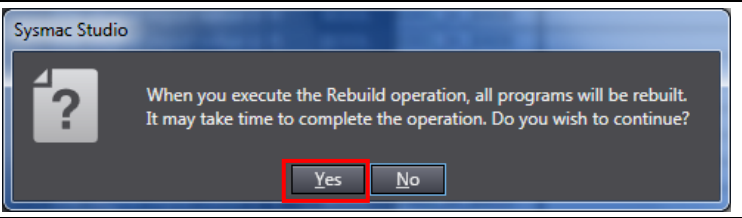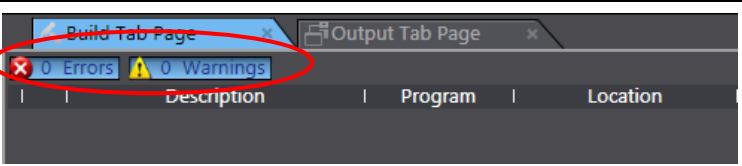
The devices or machines may perform unexpected operation regardless of the operating mode of the CPU Unit.
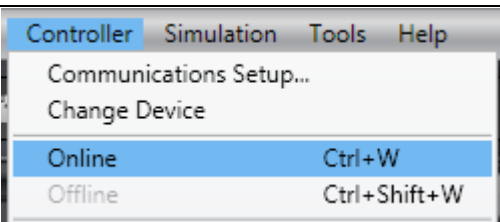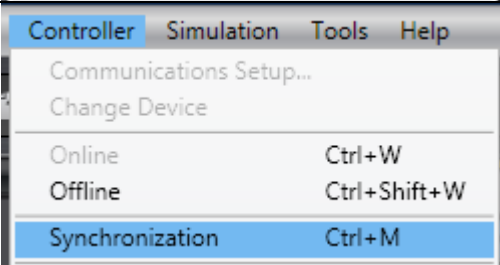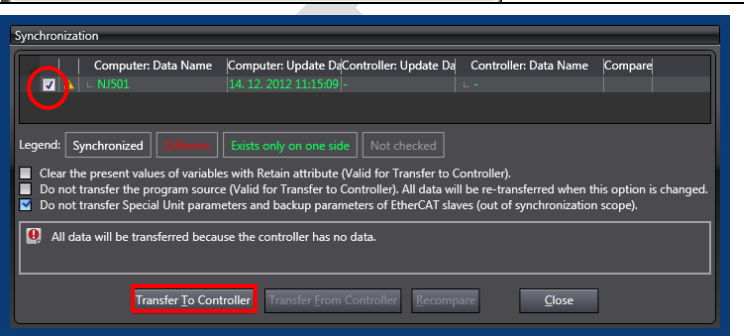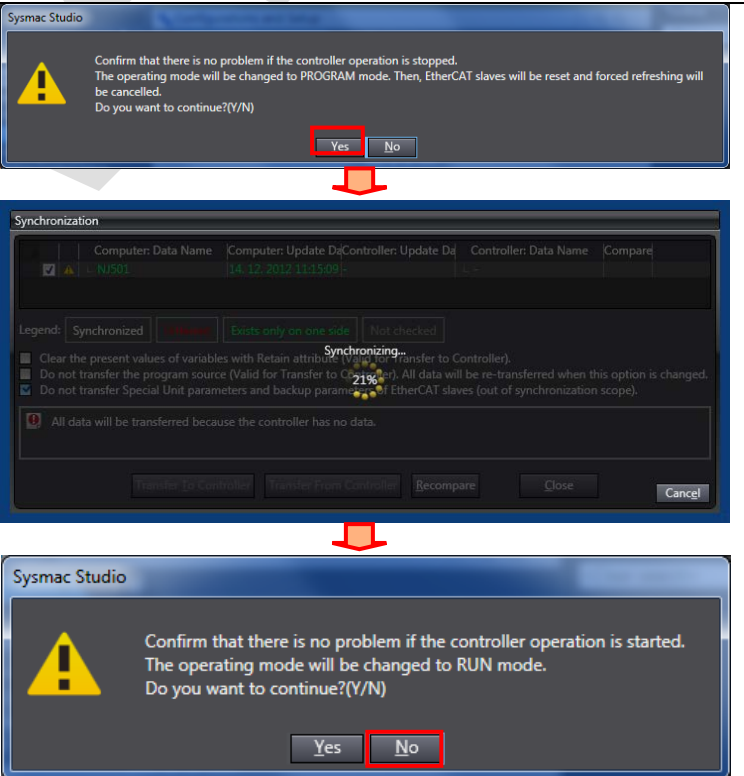
◁ **Precautions for Safe Use**

After you transfer the user program, the CPU Unit restarts and communications with the EtherCAT slaves are cut off. During that period, the slave outputs behave according to the slave settings. The time that communications are cut off depends on the EtherCAT network configuration.

Before you transfer the user program, confirm that it will not adversely affect the device.

1	Select *Check All Programs* from the Project Menu.	Project Controller Simulation Too Check All Programs F7 Check Selected Programs Shift+F7
2	The Build Tab Page is displayed on the Edit Pane. Confirm that "0 Errors" and "0 Warnings" are displayed.	Build Tab Page × ❌ 0 Errors ⚠ 0 Warnings Description Program Location
3	Select *Rebuild Controller* from the Project Menu.	Project Controller Simulation Too Check All Programs F7 Check Selected Programs Shift+F7 Build Controller F8 Rebuild Controller
4	A confirmation dialog box is displayed. Confirm that there is no problem and click the **Yes** Button.	Sysmac Studio ❓ When you execute the Rebuild operation, all programs will be rebuilt. It may take time to complete the operation. Do you wish to continue? Yes No
5	Confirm that "0 Errors" and "0 Warnings" are displayed in the Build Tab Page.	Build Tab Page × Output Tab Page × ❌ 0 Errors ⚠ 0 Warnings Description Program Location

6	Select *Online* from the Controller Menu.	
7	Select *Synchronization* from the Controller Menu.	
8	The Synchronization Dialog Box is displayed. Confirm that the data to transfer (NJ501 in the right dialog) is selected. Then, click the **Transfer To Controller** Button. * After executing the Transfer To Controller, the Sysmac Studio data is transferred to the Controller and the data are compared.	
9	A confirmation dialog box is displayed. Confirm that there is no problem and click the **Yes** Button. A screen stating "Synchronizing" is displayed. A confirmation dialog box is displayed. Confirm that there is no problem and click the **No** Button. * Do not return it to RUN mode.	

10 Confirm that the synchronized data is displayed with the color specified by "Synchronized" and that a message is displayed stating "The synchronization process successfully finished". If there is no problem, click the **Close** Button.
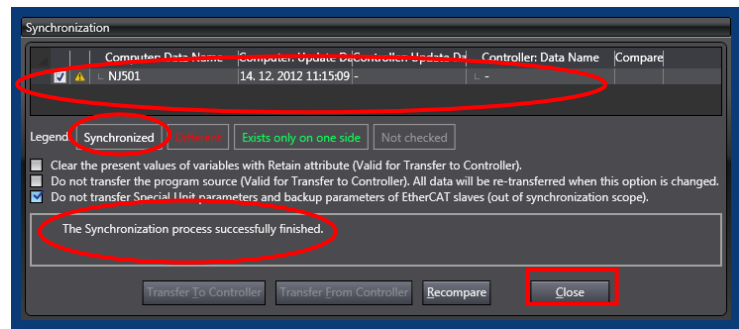
* A message stating "The synchronization process successfully finished" is displayed if the Sysmac Studio project data and the data in the Controller match.

* If the synchronization fails, check the wiring and repeat from step 1.

7.4. Checking the EtherCAT Communications

Confirm that the PDO communications of EtherCAT are performed normally.

7.4.1. Checking the Connection Status

Check the connection status of the EtherCAT network.

1	Confirm that the EtherCAT communications are performed normally by checking the LED indicators on the Controller. LED indicators in normal status are as follows: 　[NET RUN]: Lit green 　[NET ERR]: Not lit 　[LINK/ACT]: Flashing yellow	
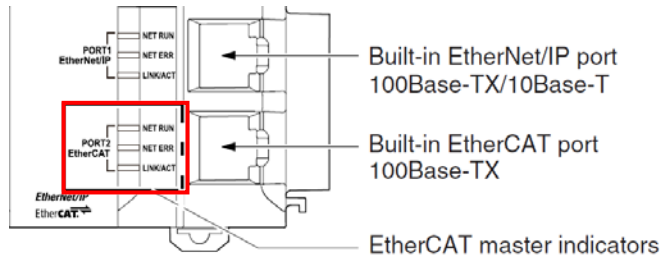
Label	Name	Color	Status	Meaning
EtherCAT NET RUN	RUN	Green	Lit	EtherCAT communications are in progress. • I/O data is being input and output.
			Flashing	EtherCAT communications are established. Communications is in one of the following states. • Only message communications is functioning. • Only message communications and I/O data input operations are functioning.
			Not lit	EtherCAT communications are stopped. • Power is OFF or the Unit is being reset. • There is a MAC address error, communications controller error, or other error.
EtherCAT NET ERR	ERROR	Red	Lit	There is an unrecoverable error, such as a hardware error or an exception.
			Flashing	There is a recoverable error.
			Not lit	There is no error.
EtherCAT LINK/ACT	Link/Activity	Yellow	Lit	The link is established.
			Flashing	A link is established and data is being sent and received.
				The indicator flashes whenever data is sent or received.
			Not lit	The link is not established.

2 Check the LED indicators on the ACON/PCON Controller.

LED indicators in normal status are as follows:

   [RUN]: Lit green

   [ERR]: Not lit

   [Link/Activity]: Flashing green

The LED flash timing is the same as the Controller.

Status indicator LEDs

Status LED (RUN, ERR)

EtherCAT$_R$ Output port

Link/Activity LED

EtherCAT$_R$ Input port

Link/Activity LED
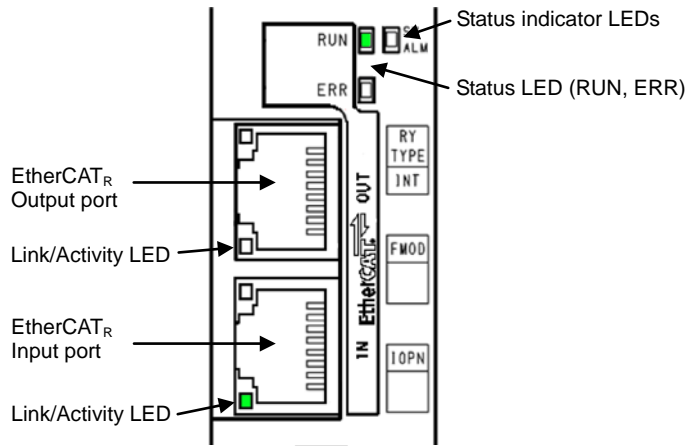
Name	Color	Meaning
RUN	Not lit	Initial status or the power is turned off.
	Green (Lit)	Normal operation
	Green (Flashing: blinking)	PRE-OPERATION status
	Green (Flashing: single flash)	SAFE-OPERATION status
	Orange (Lit)	A communication part (module) error
ERR	Not lit	No error, or the power is turned off.
	Orange (Flashing: blinking)	Configuration information (setting) error
	Orange (Flashing: double flash)	Communication part circuit error (Watchdog timer timeout)
	Orange (Lit)	A communication part (module) error
Link/ Activity	Not lit	Link condition is not detected, or the power is turned off.
	Green (Lit)	Link established (No heavy traffic on the line)
	Green (Flashing 50ms ON/OFF)	Link established (Heavy traffic on the line)

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7.4.2. Checking the Data that are Sent and Received

Confirm that the correct data are sent and received.

⚠ **WARNING**

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

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

⚠ **Caution**

The Destination Device will run if you proceed to this section. Confirm safety before operation. If you cannot confirm safety, do not proceed to this section after completing until *Section 7.4.1*.

If you proceed to this section, make sure to complete all the steps and place the Destination Device in the safe state.

1	Select **Watch Tab Page** from the View Menu.	
2	The Watch Window1 Tab Page is displayed in the lower section of the Edit Pane.	
3	Enter the following names in the Watch Window1 Tab Page for monitoring. *E001_Out_Bit04_SON* *E001_In_Status_Signal_2004_05* To enter a new name, click the *Input Name* Column.	
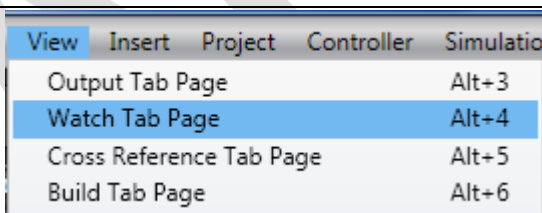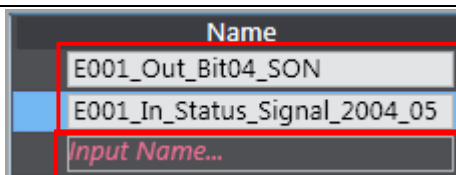
4 Select **Status** from the Monitor Menu of the RC PC Software.

* If the RC PC Software has not been started, refer to *7.2.2. Parameter Settings* to start the software and connect the ACON/PCON Controller again.
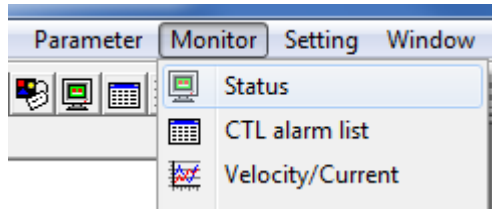
5 The Status Dialog Box is displayed.
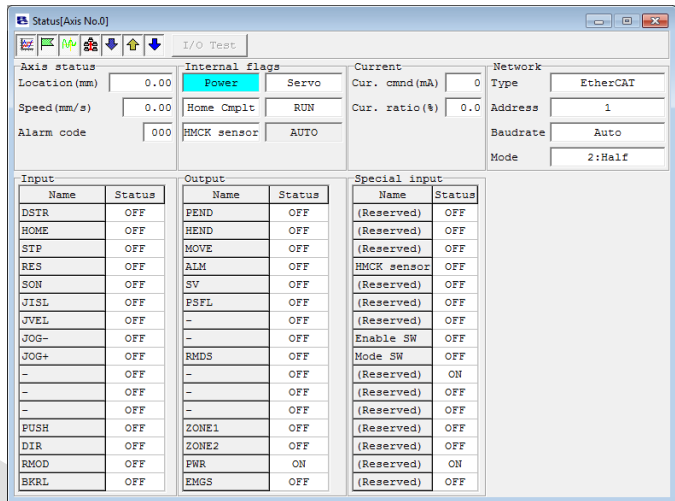
6 Confirm that the *SON* Field of Input is OFF and the *Servo* and *Run* Fields of Internal flags are not lit.

7	Confirm that the Online value of *E001_Out_Bit04_SON* is False and click **TRUE** in the *Modify* Column on the Sysmac Studio. The Online value of *E001_Out_Bit04_SON* changes to True.	<table><tr><td>Name</td><td>Online value</td><td>Modify</td><td>Data type</td></tr><tr><td>E001_Out_Bit04_SON</td><td>False</td><td>TRUE FALSE</td><td>BOOL</td></tr><tr><td>E001_In_Status_Signal_2004_05</td><td>4000</td><td></td><td>WORD</td></tr><tr><td>Input Name...</td><td></td><td></td><td></td></tr></table> <table><tr><td>Name</td><td>Online value</td><td>Modify</td><td>Data type</td></tr><tr><td>E001_Out_Bit04_SON</td><td>True</td><td>TRUE FALSE</td><td>BOOL</td></tr><tr><td>E001_In_Status_Signal_2004_05</td><td>4011</td><td></td><td>WORD</td></tr><tr><td>Input Name...</td><td></td><td></td><td></td></tr></table>

8	Confirm that the *SON* Field of Input changed to ON and the *Servo* and *Run* Fields of Internal flags are lit on the RC PC Software.
	
	Confirm that the following data of Output is ON.
	  - PEND (b0)
	  - SV (b4)
	  - PWR (b14)
	
	They are 4011 in hexadecimal notation.
		Axis status
		Location (mm) 0.08
		Speed (mm/s) 0.00
		Alarm code 000
		
		Internal flags
		Power / Servo
		Home Cmplt / RUN
		HMCK sensor / AUTO
		
		Input
		<table><tr><td>Name</td><td>Status</td></tr><tr><td>DSTR</td><td>OFF</td></tr><tr><td>HOME</td><td>OFF</td></tr><tr><td>STP</td><td>OFF</td></tr><tr><td>RES</td><td>OFF</td></tr><tr><td>SON</td><td>ON</td></tr><tr><td>JISL</td><td>OFF</td></tr><tr><td>JVEL</td><td>OFF</td></tr><tr><td>JOG-</td><td>OFF</td></tr><tr><td>JOG+</td><td>OFF</td></tr><tr><td>-</td><td>OFF</td></tr><tr><td>-</td><td>OFF</td></tr><tr><td>-</td><td>OFF</td></tr><tr><td>PUSH</td><td>OFF</td></tr><tr><td>DIR</td><td>OFF</td></tr><tr><td>RMOD</td><td>OFF</td></tr><tr><td>BKRL</td><td>OFF</td></tr></table>
		Output
		<table><tr><td>Name</td><td>Status</td></tr><tr><td>PEND</td><td>ON</td></tr><tr><td>HEND</td><td>OFF</td></tr><tr><td>MOVE</td><td>OFF</td></tr><tr><td>ALM</td><td>OFF</td></tr><tr><td>SV</td><td>ON</td></tr><tr><td>PSFL</td><td>OFF</td></tr><tr><td>-</td><td>OFF</td></tr><tr><td>-</td><td>OFF</td></tr><tr><td>RMDS</td><td>OFF</td></tr><tr><td>-</td><td>OFF</td></tr><tr><td>-</td><td>OFF</td></tr><tr><td>-</td><td>OFF</td></tr><tr><td>ZONE1</td><td>OFF</td></tr><tr><td>ZONE2</td><td>OFF</td></tr><tr><td>PWR</td><td>ON</td></tr><tr><td>EMGS</td><td>OFF</td></tr></table>

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	B3	b2	b1	b0
Status Signal	EMGS	PWR	ZONE2	ZONE1	-	-	-	RMDS	-	-	PSEL	SV	ALM	MOVE	HEND	PEND

|		
9	You can confirm that the Online values of *E001_In_Status_Signal_2004_05* displays the same value as you set in the previous step.	<table><tr><td>Name</td><td>Online value</td><td>Modify</td><td>Data type</td></tr><tr><td>E001_Out_Bit04_SON</td><td>True</td><td>TRUE FALSE</td><td>BOOL</td></tr><tr><td>E001_In_Status_Signal_2004_05</td><td>4011</td><td></td><td>WORD</td></tr><tr><td>Input Name...</td><td></td><td></td><td></td></tr></table>
10	Click **FALSE** in the *Modify* Column of *E001_Out_Bit04_SON* on the Sysmac Studio. Confirm that the Online value of *E001_In_Status_Signal_2004_05* changed to 4000 that is the default shown in step 7. That means the Servo ON status is cleared.	<table><tr><td>Name</td><td>Online value</td><td>Modify</td><td>Data type</td></tr><tr><td>E001_Out_Bit04_SON</td><td>False</td><td>TRUE FALSE</td><td>BOOL</td></tr><tr><td>E001_In_Status_Signal_2004_05</td><td>4000</td><td></td><td>WORD</td></tr><tr><td>Input Name...</td><td></td><td></td><td></td></tr></table>

8. Initialization Method

This document explains the setting procedure from the factory default setting.
Some settings may not be applicable as described in this document unless you use the devices with the factory default setting.

8.1. Initializing the Controller

To initialize the settings of the Controller, select ***Clear All Memory*** from the Controller Menu of the Sysmac Studio. The Clear All Memory Dialog Box is displayed. Check the contents and click the **OK** Button.
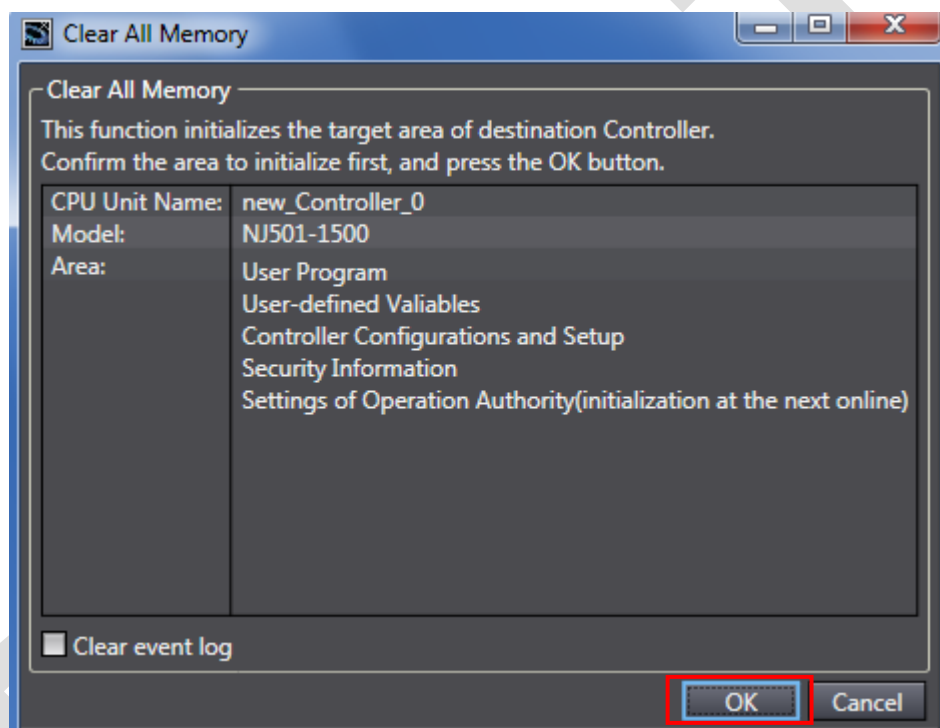
8.2. Initializing the IAI ACON/PCON Controller

For information on how to initialize the IAI ACON/PCON Controller, refer to *Appendix 14.1 Parameter (Factory Default Setting) Initializing Method* of the *ROBO CYLINDER PC Software Operation Manual* (Cat. No. ME0155).

9. Revision History

Revision code	Date of revision	Revision reason and revision page
01	Dec. 16, 2013	First edition