


Machine Automation Controller NJ-series

EtherCAT[®] Connection Guide IAI Corporation

Controller SCON-CA

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Network
Connection
Guide

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1. Related Manuals

The table below lists the manuals related to this document.

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

Cat. No.	Model	Manual name
W500	NJ501-□□□□ 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
ME0243	SCON-CA	IAI Corporation SCON-CA 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)	<p>This method is used for cyclic data exchange between the master unit and the slave units.</p> <p>PDO data (i.e., I/O data that is mapped to PDOs) that is allocated in advance is refreshed periodically each EtherCAT process data communications cycle (i.e., the period of primary periodic task).</p> <p>The 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.</p> <p>It is accessed from the NJ-series Machine Automation Controller in the following ways:</p> <ul style="list-style-type: none"> ▪ 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)	<p>This method is used to read and write the specified slave unit data from the master unit when required.</p> <p>The NJ-series Machine Automation Controller uses SDO communications for commands to read and write data, such as for parameter transfers, at specified times.</p> <p>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.</p>
Slave unit	<p>There are various types of slaves such as Servo Drives that handle position data and I/O terminals that handle the bit signals.</p> <p>The slave unit receives output data sent from the master, and sends input data to the master.</p>
Node address	<p>A node address is an address to identify a unit connected to EtherCAT.</p>
ESI file (EtherCAT Slave Information file)	<p>The ESI files contain information unique to the EtherCAT slaves in XML format.</p> <p>Installing an ESI file enables the Sysmac Studio to allocate slave process data and make other settings.</p>

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 SCON-CA 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.

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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	SCON-CA Controller	SCON-CA-[]-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.



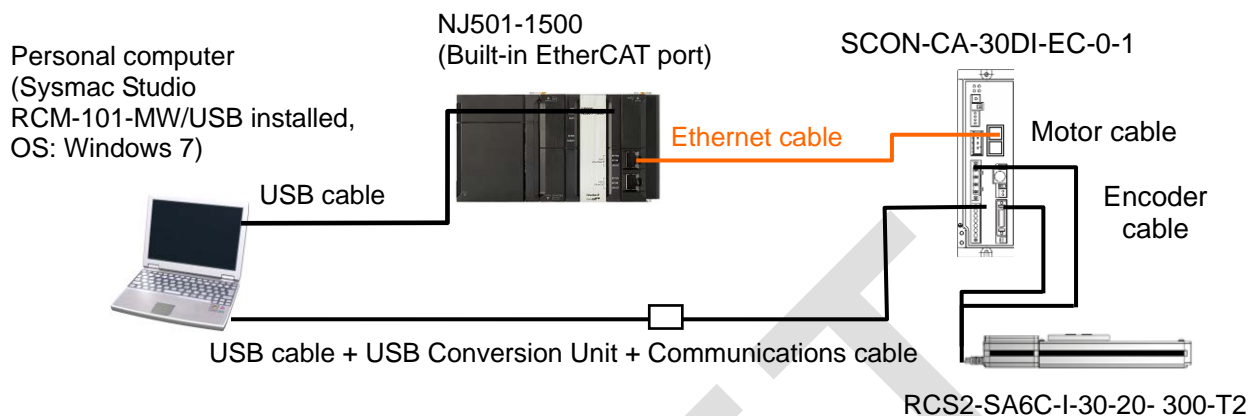
Additional Information

Contact the device manufacturer for actuators connectable to SCON-CA 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: Windows 7)	-	
-	USB cable (USB 2.0 type B connector)	-	
OMRON	Ethernet cable (with industrial Ethernet connector)	XS5W-T421-[]M[]-K	
IAI	SCON-CA Controller	SCON-CA-30DI-EC-0-1	Rev: 0x00010004
IAI	USB cable	CB-SEL-USB010	
IAI	USB Conversion Unit	RCB-CV-USB	
IAI	Communications cable	CB-RCA-SIO050	
IAI	Actuator	RCS2-SA6C-I-30-20-300-T2	
IAI	Motor cable	CB-RCC-MA005	
IAI	Encoder cable	CB-RCP2-PA005	
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 wiring, 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 SCON-CA 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 set in this document.

Hereinafter, the SCON-CA 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.

	SCON-CA 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

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	Servo gain parameter set selection 0
E001_Out_Bit11_GSL1	BOOL	Servo gain parameter set selection 1
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 (from 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	Absolute battery voltage low warning
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

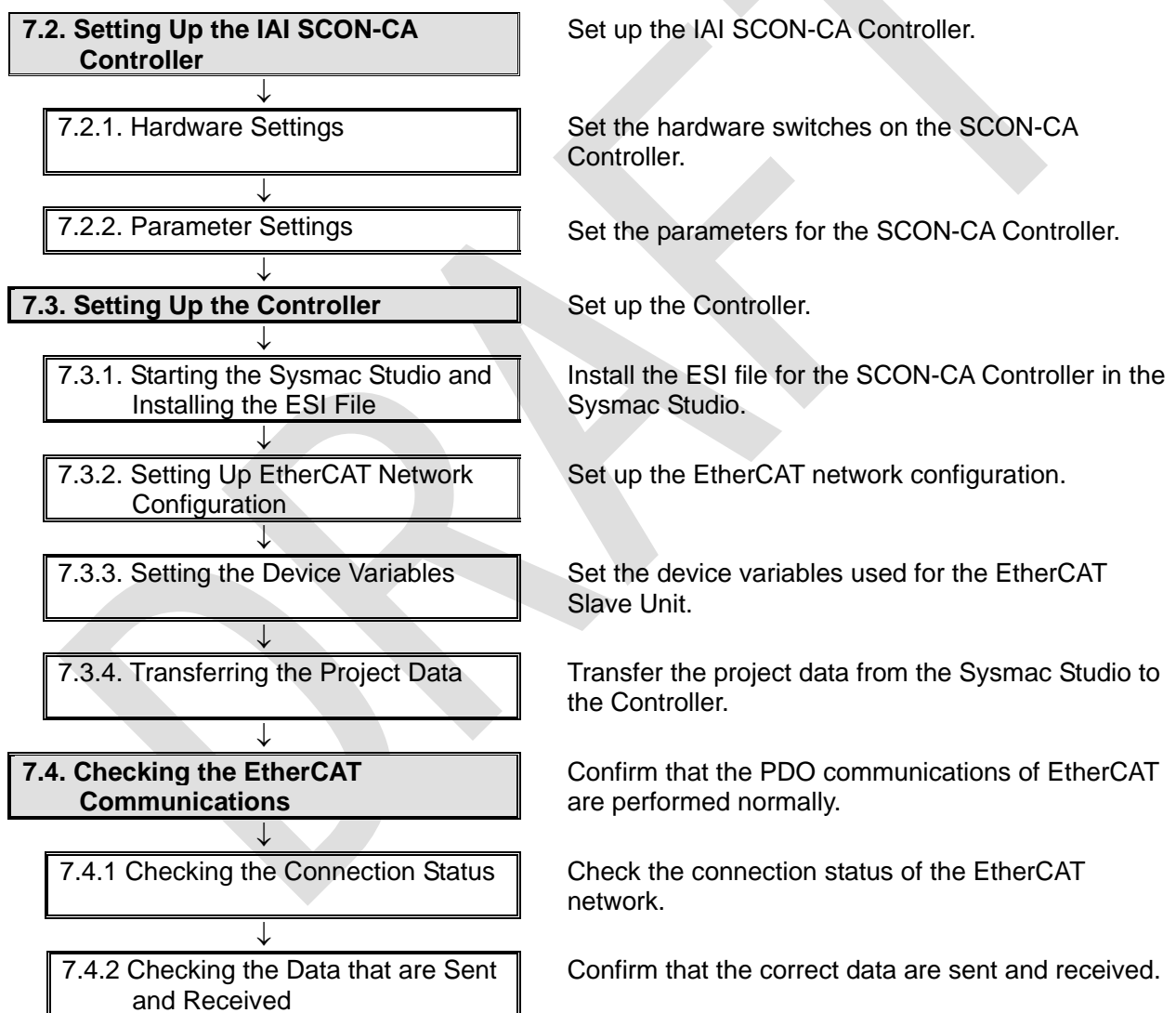
7. EtherCAT Connection Procedure

This section describes the procedure for connecting the Controller to the SCON-CA Controller via EtherCAT.

This document explains the procedures for setting up the Controller and the SCON-CA 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 SCON-CA Controller

Set up the IAI SCON-CA Controller.

7.2.1. Hardware Settings

Set the hardware switches on the SCON-CA Controller.



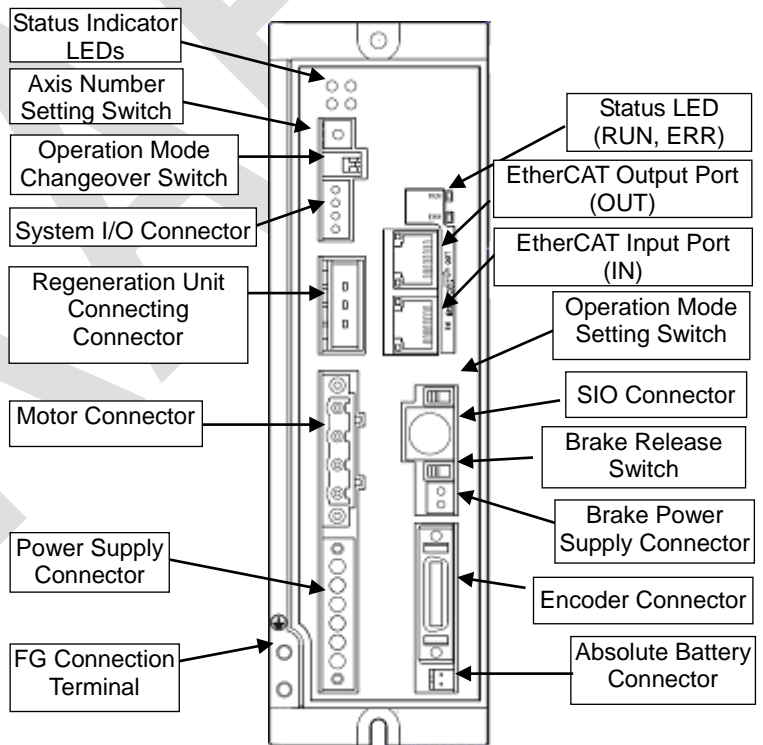
Precautions for Correct Use

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

- 1 Make sure that the power supply to the SCON-CA Controller is OFF.

* If the power supply is turned ON, settings may not be applicable as described in the following procedure.

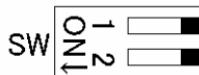
- 2 Check the position of the hardware switches on the front of the SCON-CA Controller by referring to the right figure.



- 3 Set the "ADRS" Axis Number Setting Switch to 0.



4 Set the Operation Mode Changeover Switch 1 to OFF so that the positioner mode is set.



* Do not set the Operation Mode Changeover Switch 2 to ON as it is used by the manufacturer for adjustment purposes.

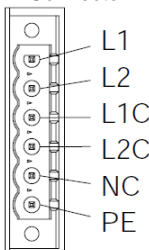
Name	Meaning
1	Operation mode changeover switch OFF :Positioner mode (including field bus specification) ON :Pulse train control mode (Note)This switch becomes effective at power-on.
2	Used by the manufacturer for adjustment purposes.Do not turn it ON. (Changing the setting of the switch is invalid even in the power-on status.)

5 Connect the Encoder Connector and Motor Connector to the actuator.

Connect the Ethernet cable to the EtherCAT Input Port (IN).

Connect the power supply to the Power Supply Connector and turn ON the power supply.

Power Supply Connector



Pin No.	Signal Name	
1	L1	Motor AC power input
2	L2	Motor AC power input
3	L1C	Control AC power input
4	L2C	Control AC power input
5	NC	Unconnected
6	PE	Protective ground line

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7.2.2. Parameter Settings

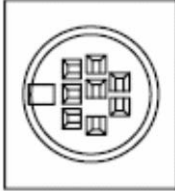


Set the parameters for the SCON-CA Controller.

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 *ROBO CYLINDER PC Software Operation Manual* (Cat. No. ME0155).

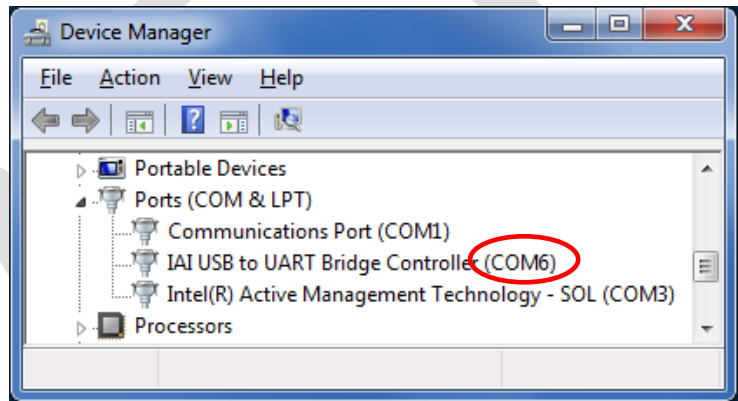
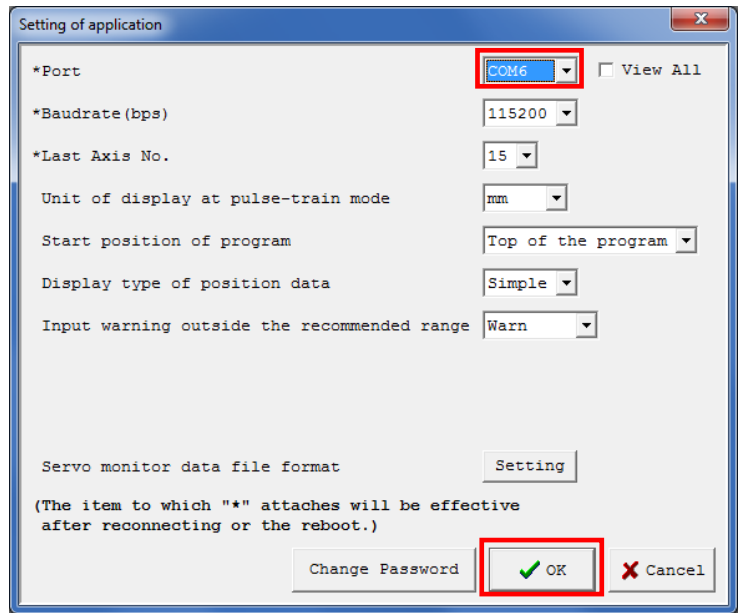
<p>1</p>	<p>Connect the SCON-CA Controller to the personal computer with a USB cable, USB Conversion Unit, and Communications cable.</p> <p>* Connect the USB cable to the USB port on the personal computer. Connect the Communications cable to the SIO Connector on the SCON-CA Controller.</p>	 <p>SIO</p>
<p>2</p>	<p>Set the Operation Mode Changeover Switch on the front of the SCON-CA Controller to the MANU side.</p>	
<p>3</p>	<p>Turn ON the power supply to the SCON-CA Controller and start the RC PC Software from the personal computer.</p>	 <p>PC Interface Software f...</p>

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 SCON-CA Controller is connected under Ports (COM & LPT) (COM6 in this example).

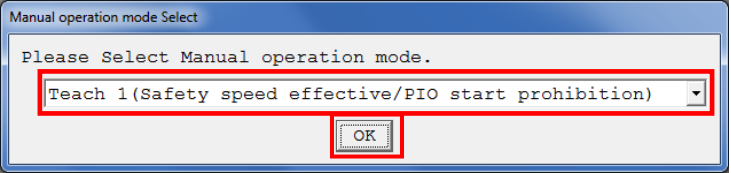
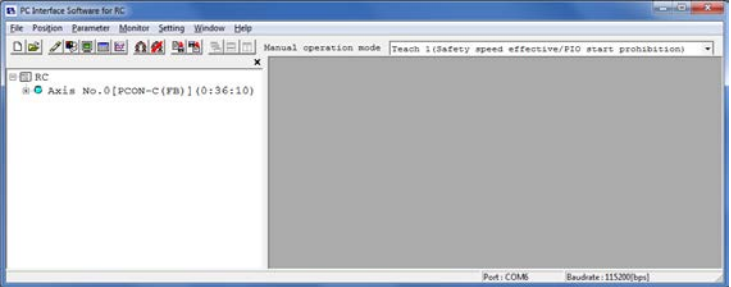
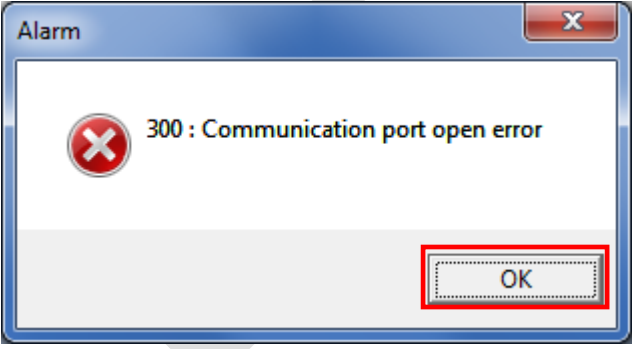
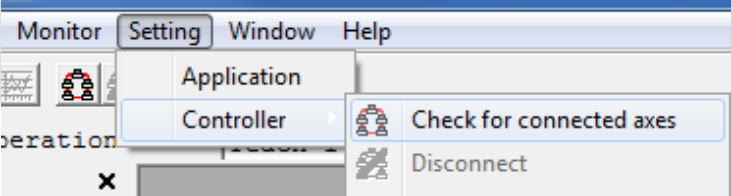
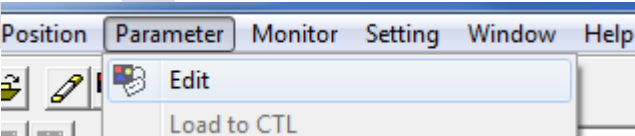
* To display the Device Manager, right-click **My Computer**, click **Properties** from the Windows Menu. Then click **Device Manager** in the window that is displayed.



5 After the software starts, the Check for connected axes Dialog Box is displayed, and then the SCON-CA 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.

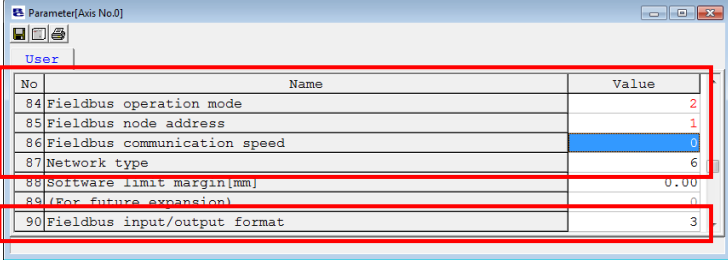
Axis No.	Status
0	Connected
1	
2	
3	(Checking)
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	

<p>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.</p> <p>The RC PC Software starts.</p>	 
<p>7 If the Alarm Dialog Box is displayed, check the connection settings such as cable connections and port numbers.</p> <p>After the error is cleared, click the OK Button.</p> <p>* To connect to the SCON-CA Controller again, select Controller - Check for connected axes from the Setting Menu. (Refer to the right figure)</p>	 
<p>8 Select Edit from the Parameter Menu.</p>	

9 The parameter 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)

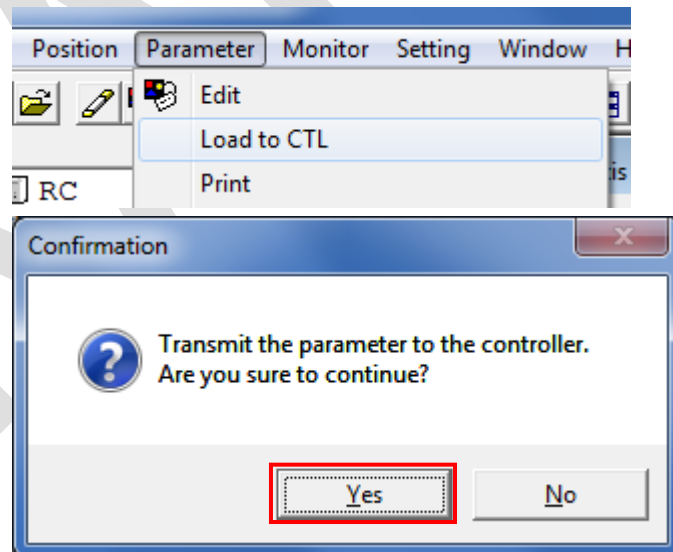


No	Name	Value
84	Fieldbus operation mode	2
85	Fieldbus node address	1
86	Fieldbus communication speed	0
87	Network type	6
88	Software limit margin[mm]	0.00
89	(For future expansion)	0
90	Fieldbus input/output format	3

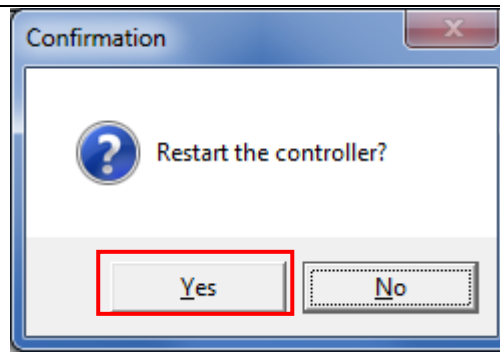
10 Select **Load to CTL** from the Parameter Menu.

A Confirmation Dialog Box is displayed as shown on the right. Check the contents and click the **Yes** Button.

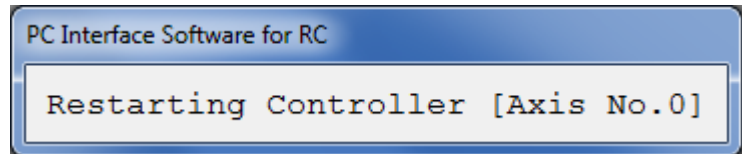
* The Confirmation Dialog Box does not appear if any change is made in the previous step. Go to the next step.



- 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 SCON-CA Controller restarts, set the Operation Mode Changeover Switch on the front of the SCON-CA Controller to the AUTO side.



* The Operation Mode Changeover Switch can be changed even when the power supply to the SCON-CA Controller turns ON.

7.3. Setting Up the Controller

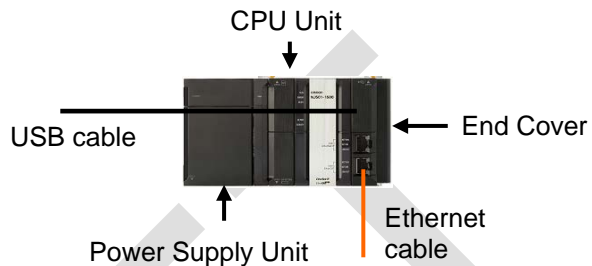
Set up the Controller.

7.3.1. Starting the Sysmac Studio and Installing the ESI File

Install the ESI file for the SCON-CA Controller in the Sysmac Studio.

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

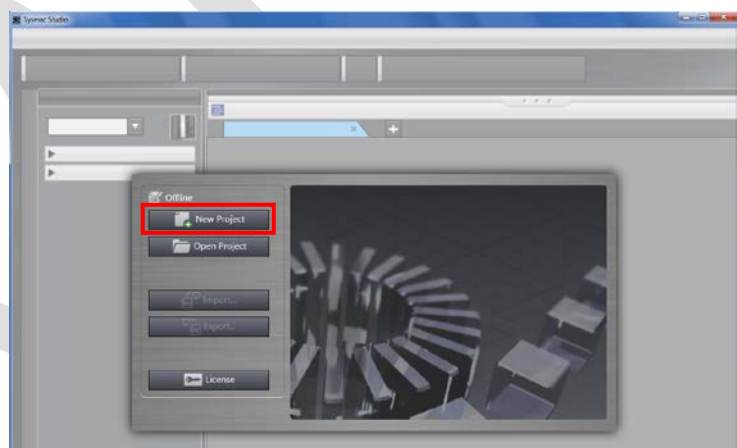
- 1 Connect the Ethernet cable to the built-in EtherCAT port (PORT2) of the Controller and the USB cable to the peripheral (USB) port. As shown in 5.2. *Device Configuration*, connect the personal computer, SCON-CA Controller, and the Controller.



- 2 Turn ON the power supply to the Controller.

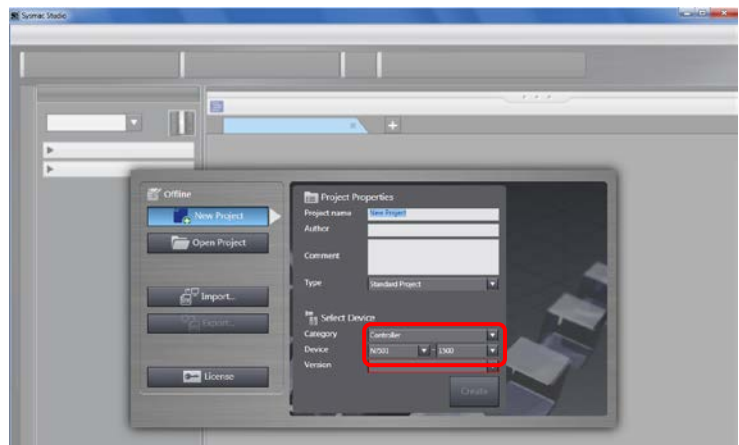
- 3 Start the Sysmac Studio. Click the **New Project** Button.

* If a confirmation dialog for an access right is displayed at start, select to start.



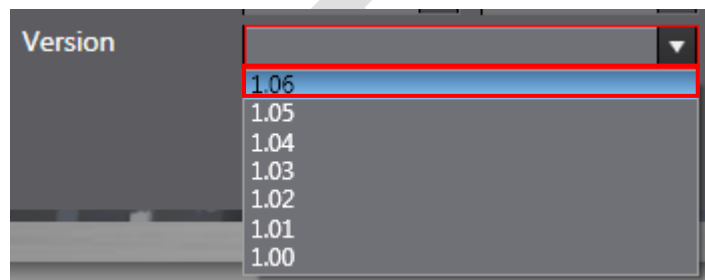
- 4 The Project Properties Dialog Box is displayed.
 * In this document, New Project is used as the Project name.

Confirm that the device you use is shown in the *Category* and *Device* Fields of Select Device.

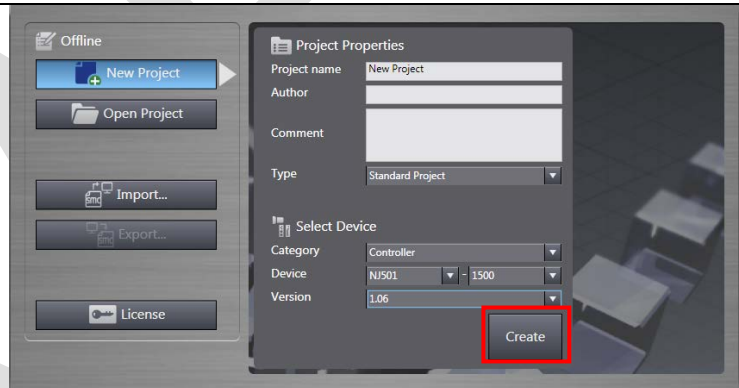


Select version **1.06** from the pull-down list of Version.

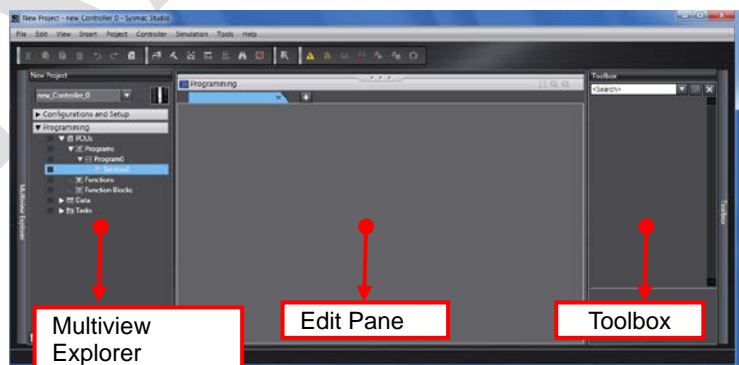
- * Although 1.06 is selected in this document for example, select the version you actually use.



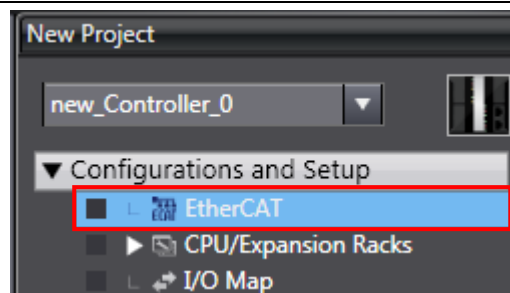
- 5 Click the **Create** Button.

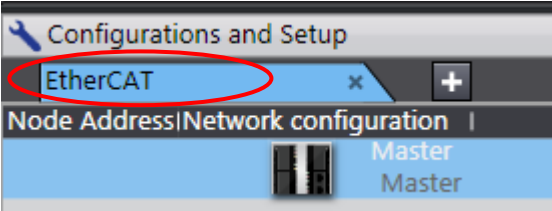
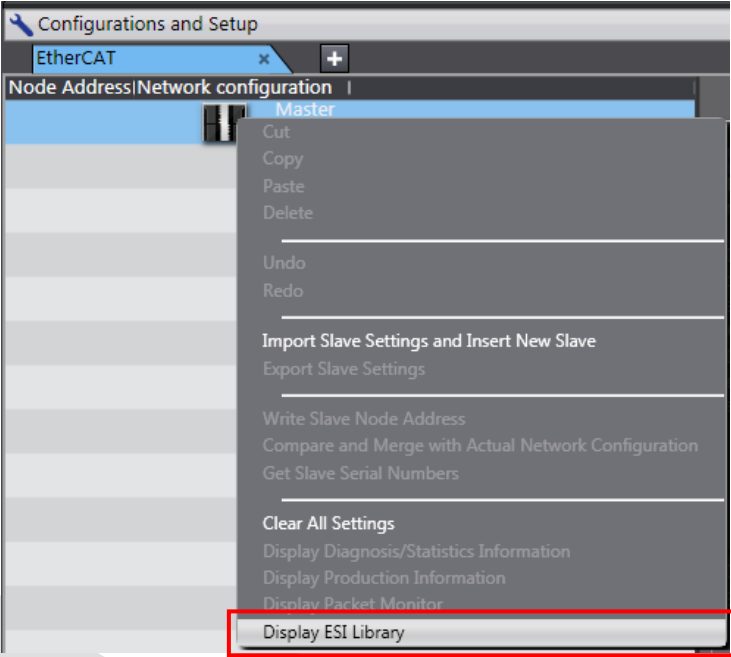
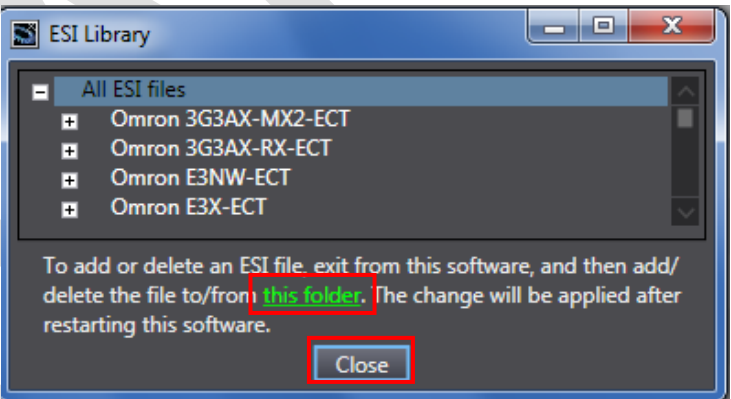
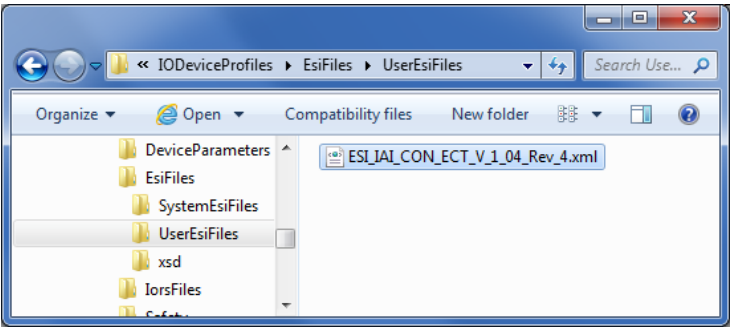


- 6 The New Project is displayed.
 The left pane is called Multiview Explorer, the right pane is called Toolbox and the middle pane is called Edit Pane.



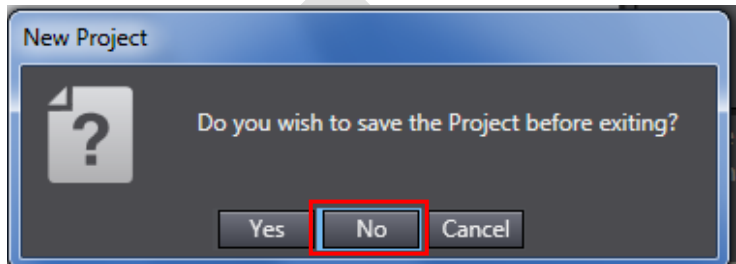
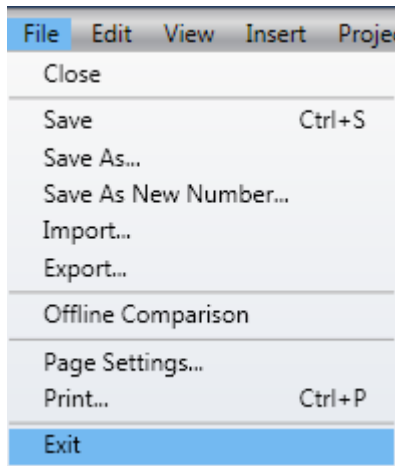
- 7 Double-click **EtherCAT** under **Configurations and Setup** in the Multiview Explorer.



- 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.

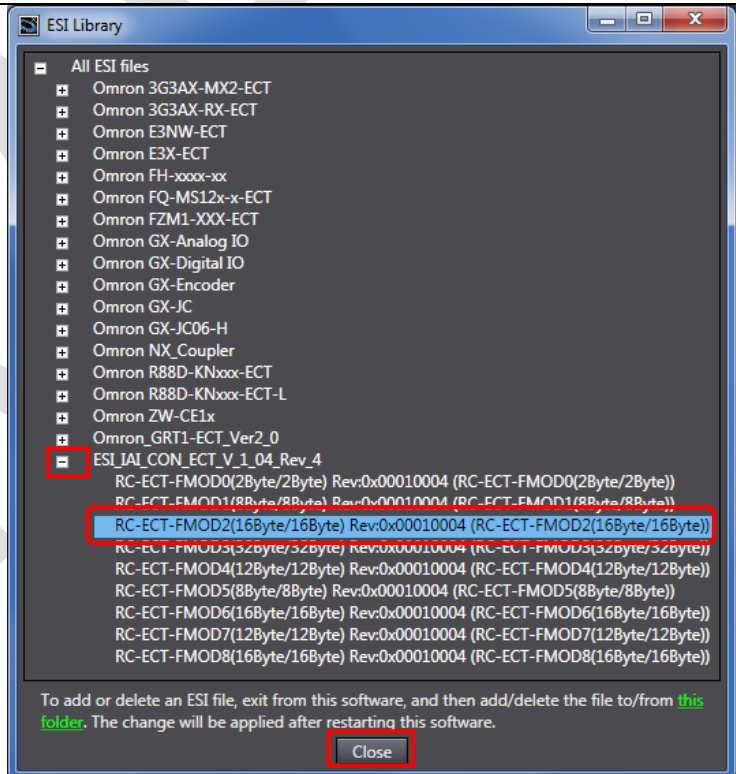


13 In the same way as steps 2 to 8, restart the Sysmac Studio and display the ESI Library Dialog Box.

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.

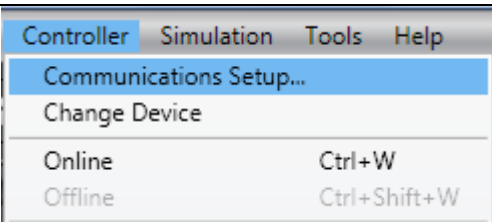
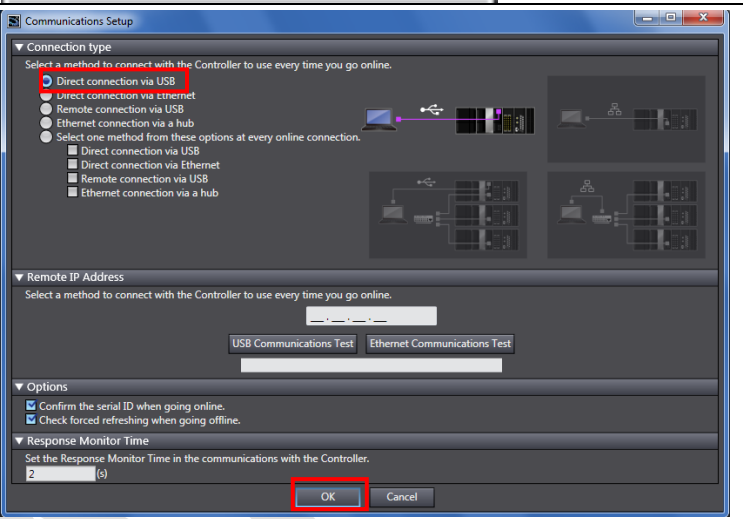
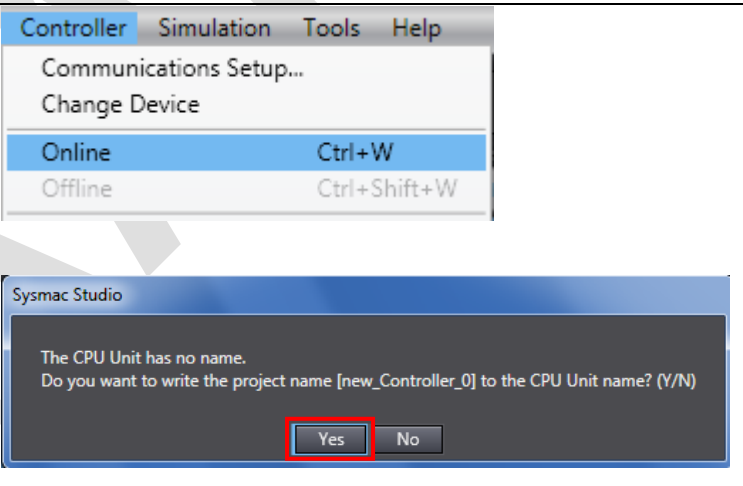


Precautions for Correct Use

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

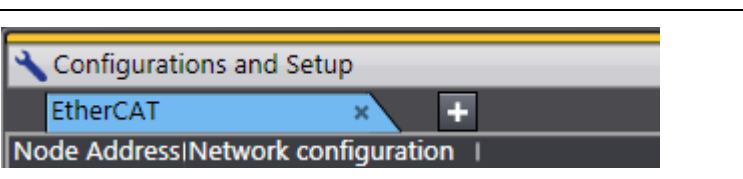
Set up EtherCAT network configuration with the Sysmac Studio.

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

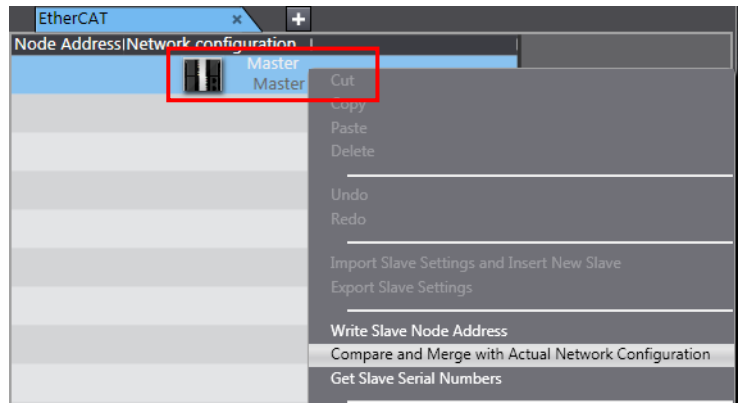


Additional Information

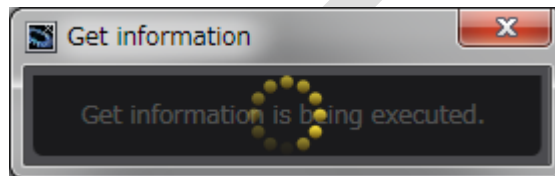
For details on online connections to a Controller, refer to *Section 5 Online Connections to a Controller* of the *Sysmac Studio Version 1 Operation Manual* (Cat. No. W504).

<p>4 When an online connection is established, a yellow bar is displayed on the top of the Edit Pane.</p>	
---	--

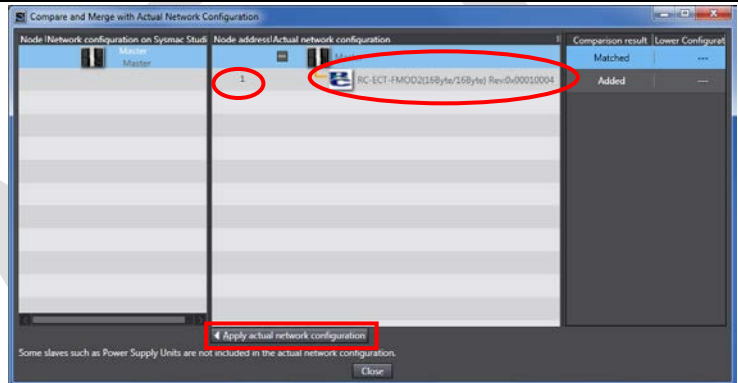
- 5 Right-click **Master** on the EtherCAT Tab Page, and select **Compare and Merge with Actual Network Configuration**.



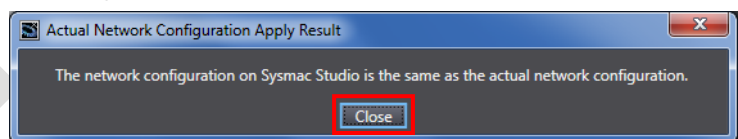
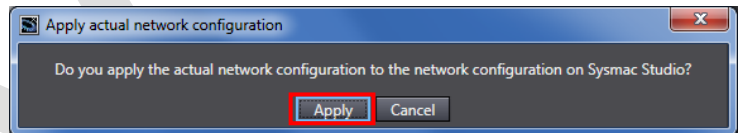
A screen is displayed stating "Get information is being executed".



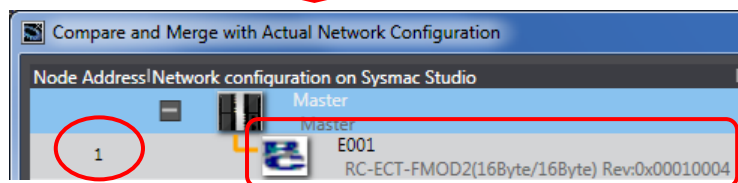
- 6 The Compare and Merge with Actual Network Configuration Pane is displayed. Node address 1 and RC-ECT-FMOD2(16Byte/16Byte) Rev:0x00010004 are added to the Actual network configuration after the comparison. Click the **Apply actual network configuration** Button.



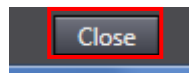
- 7 A confirmation dialog box is displayed. Check the contents and click the **Apply** Button.



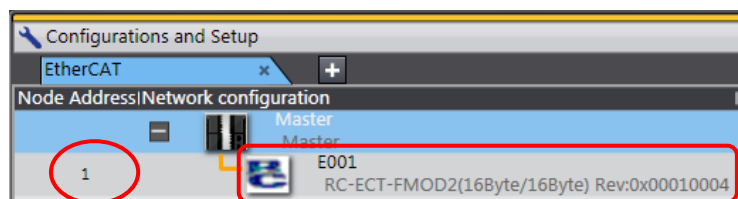
Node address 1, E001, and RC-ECT-FMOD2(16Byte/16Byte) Rev:0x00010004 are added to the Network configuration on Sysmac Studio.



Confirm that they were added and click the **Close** Button.



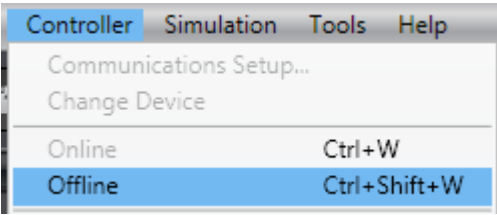
- 8 Node address 1, E001, and RC-ECT-FMOD2(16Byte/16Byte) Rev:0x00010004 are added to the EtherCAT Tab Page on the Edit Pane.



7.3.3. Setting the Device Variables

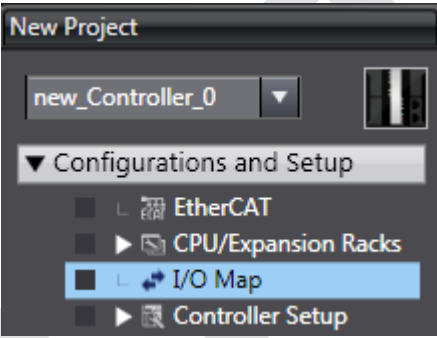
Set the device variables used for the EtherCAT Slave Unit.

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



The yellow bar on the top of the Edit Pane disappears.

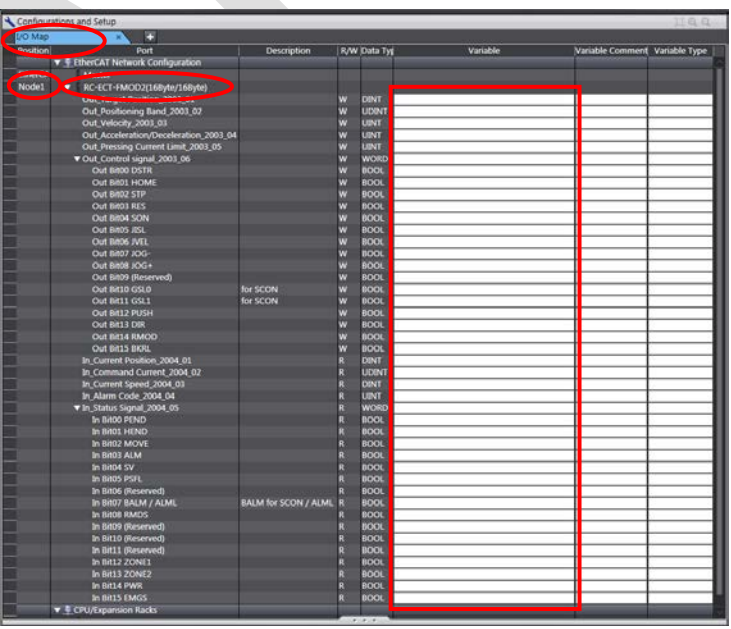
2 Double-click **I/O Map** under **Configurations and Setup** in the Multiview Explorer.



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

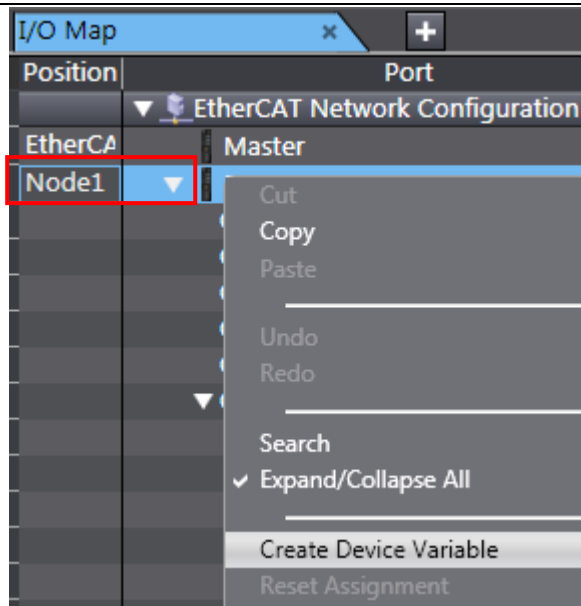
Confirm that Node1 is displayed in the *Position* Column and the Slave Unit is displayed.

* To manually set a variable name for the Slave Unit, click a column under the *Variable* Column and enter a name.



Position	Port	Description	R/W	Data Typ	Variable	Variable Comment	Variable Type
Node1	IC-ECT-IMOD2(16byte/16Byte)		W	DINT			
		Out_Velocity_2003_01	W	UNINT			
		Out_Velocity_2003_01	W	UNINT			
		Out_Acceleration/Deceleration_2003_04	W	UNINT			
		Out_Pressing Current Limit_2003_05	W	UNINT			
		Out_Control signal_2003_06	W	WORD			
		Out_B800 DSTR	W	BOOL			
		Out_B801 HOME	W	BOOL			
		Out_B802 STP	W	BOOL			
		Out_B803 RES	W	BOOL			
		Out_B804 SON	W	BOOL			
		Out_B805 ZSL	W	BOOL			
		Out_B806 AVEL	W	BOOL			
		Out_B807 JOG	W	BOOL			
		Out_B808 JOG+	W	BOOL			
		Out_B809 (Reserved)	W	BOOL			
		Out_B810 OSLO for SCON	W	BOOL			
		Out_B811 OSL1 for SCON	W	BOOL			
		Out_B812 PUSH	W	BOOL			
		Out_B813 OR	W	BOOL			
		Out_B814 RMOD	W	BOOL			
		Out_B815 BCOL	W	BOOL			
		In_Current Position_2004_01	R	DINT			
		In_Command Current_2004_02	R	UNINT			
		In_Current Speed_2004_03	R	DINT			
		In_Alarm Code_2004_04	R	UNINT			
		In_Status Signal_2004_05	R	WORD			
		In_B800 FEND	R	BOOL			
		In_B801 HEND	R	BOOL			
		In_B802 MOVE	R	BOOL			
		In_B803 ALM	R	BOOL			
		In_B804 2V	R	BOOL			
		In_B805 PSFL	R	BOOL			
		In_B806 (Reserved)	R	BOOL			
		In_B807 BALM / ALM	R	BOOL			
		In_B808 RMDS	R	BOOL			
		In_B809 (Reserved)	R	BOOL			
		In_B810 (Reserved)	R	BOOL			
		In_B811 (Reserved)	R	BOOL			
		In_B812 ZONE1	R	BOOL			
		In_B813 ZONE2	R	BOOL			
		In_B814 PWR	R	BOOL			
		In_B815 EMGS	R	BOOL			

- 4 Right-click **Node1** and select **Create Device Variable**.



- 5 The variable names and variable types are automatically set.

Position	Port	Description	R/W	Data Typ	Variable	Variable Comment	Variable Type
EtherCAT	Master	Out Target Position_2003_01	W	DINT	E001_Out_Target_Position_2003_01		Global Variables
EtherCAT	Master	Out Positioning Band_2003_02	W	UDINT	E001_Out_Positioning_Band_2003_02		Global Variables
EtherCAT	Master	Out Velocity_2003_03	W	ULINT	E001_Out_Velocity_2003_03		Global Variables
EtherCAT	Master	Out Acceleration/Deceleration_2003_04	W	ULINT	E001_Out_Acceleration_Deceleration_2003_04		Global Variables
EtherCAT	Master	Out Pressing Current Limit_2003_05	W	ULINT	E001_Out_Pressing_Current_Limit_2003_05		Global Variables
EtherCAT	Master	Out Control signal_2003_06	W	WORD	E001_Out_Control_signal_2003_06		Global Variables
EtherCAT	Master	Out B000 DSTR	W	BOOL	E001_Out_B000_DSTR		Global Variables
EtherCAT	Master	Out B001 HOME	W	BOOL	E001_Out_B001_HOME		Global Variables
EtherCAT	Master	Out B002 STP	W	BOOL	E001_Out_B002_STP		Global Variables
EtherCAT	Master	Out B003 RES	W	BOOL	E001_Out_B003_RES		Global Variables
EtherCAT	Master	Out B004 SCIN	W	BOOL	E001_Out_B004_SCIN		Global Variables
EtherCAT	Master	Out B005 JEL	W	BOOL	E001_Out_B005_JEL		Global Variables
EtherCAT	Master	Out B006 JVEL	W	BOOL	E001_Out_B006_JVEL		Global Variables
EtherCAT	Master	Out B007 JOG	W	BOOL	E001_Out_B007_JOG		Global Variables
EtherCAT	Master	Out B008 PUSH	W	BOOL	E001_Out_B008_PUSH		Global Variables
EtherCAT	Master	Out B009 (Reserved)	W	BOOL	E001_Out_B009_Reserved_0		Global Variables
EtherCAT	Master	Out B010 G5L0	W	BOOL	E001_Out_B010_G5L0		Global Variables
EtherCAT	Master	Out B011 G5L1	W	BOOL	E001_Out_B011_G5L1		Global Variables
EtherCAT	Master	Out B012 PUSH	W	BOOL	E001_Out_B012_PUSH		Global Variables
EtherCAT	Master	Out B013 DIR	W	BOOL	E001_Out_B013_DIR		Global Variables
EtherCAT	Master	Out B014 RMOOD	W	BOOL	E001_Out_B014_RMOOD		Global Variables
EtherCAT	Master	Out B015 BKRL	W	BOOL	E001_Out_B015_BKRL		Global Variables
EtherCAT	Master	In Current Position_2004_01	R	DINT	E001_In_Current_Position_2004_01		Global Variables
EtherCAT	Master	In Command Current_2004_02	R	UDINT	E001_In_Command_Current_2004_02		Global Variables
EtherCAT	Master	In Current Speed_2004_03	R	DINT	E001_In_Current_Speed_2004_03		Global Variables
EtherCAT	Master	In Alarm Code_2004_04	R	ULINT	E001_In_Alarm_Code_2004_04		Global Variables
EtherCAT	Master	In Status Signal_2004_05	R	WORD	E001_In_Status_Signal_2004_05		Global Variables
EtherCAT	Master	In B000 PEND	R	BOOL	E001_In_B000_PEND		Global Variables
EtherCAT	Master	In B001 HEND	R	BOOL	E001_In_B001_HEND		Global Variables
EtherCAT	Master	In B002 MOVE	R	BOOL	E001_In_B002_MOVE		Global Variables
EtherCAT	Master	In B003 ALM	R	BOOL	E001_In_B003_ALM		Global Variables
EtherCAT	Master	In B004 SV	R	BOOL	E001_In_B004_SV		Global Variables
EtherCAT	Master	In B005 PSFL	R	BOOL	E001_In_B005_PSFL		Global Variables
EtherCAT	Master	In B006 (Reserved)	R	BOOL	E001_In_B006_Reserved_0		Global Variables
EtherCAT	Master	In B007 BARM / ALML	R	BOOL	E001_In_B007_BARM_ALML		Global Variables
EtherCAT	Master	In B008 RMDS	R	BOOL	E001_In_B008_RMDS		Global Variables
EtherCAT	Master	In B009 (Reserved)	R	BOOL	E001_In_B009_Reserved_0		Global Variables
EtherCAT	Master	In B010 (Reserved)	R	BOOL	E001_In_B010_Reserved_0		Global Variables
EtherCAT	Master	In B011 (Reserved)	R	BOOL	E001_In_B011_Reserved_0		Global Variables
EtherCAT	Master	In B012 ZONE1	R	BOOL	E001_In_B012_ZONE1		Global Variables
EtherCAT	Master	In B013 ZONE2	R	BOOL	E001_In_B013_ZONE2		Global Variables
EtherCAT	Master	In B014 PWR	R	BOOL	E001_In_B014_PWR		Global Variables
EtherCAT	Master	In B015 EMGS	R	BOOL	E001_In_B015_EMGS		Global Variables



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.

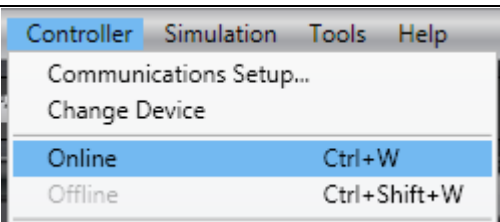
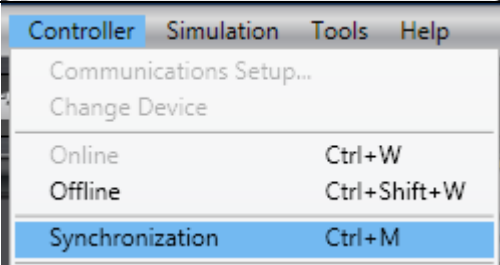
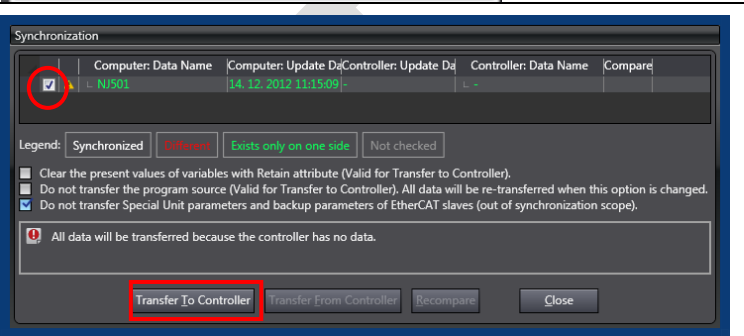
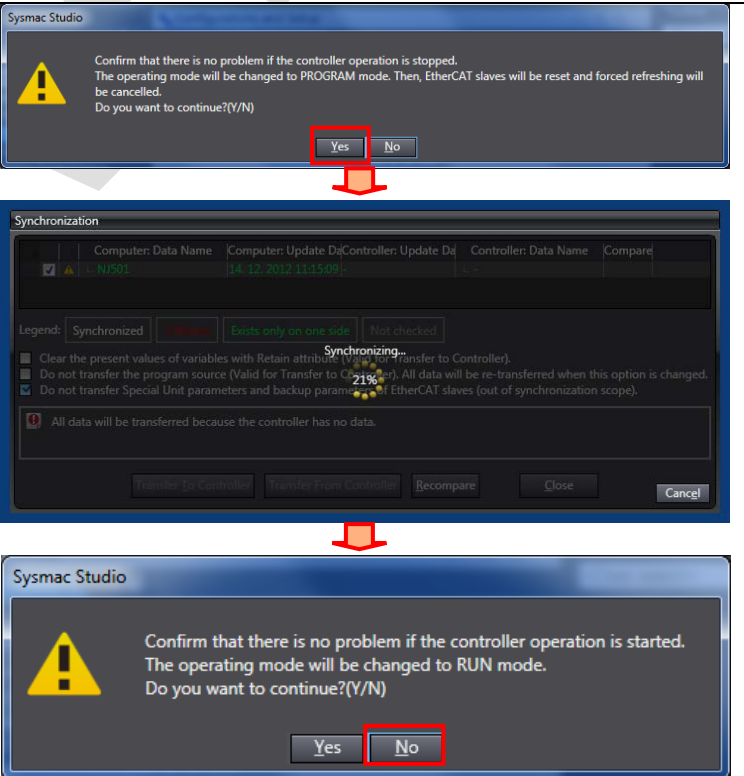


⚠ Precautions for Safe Use

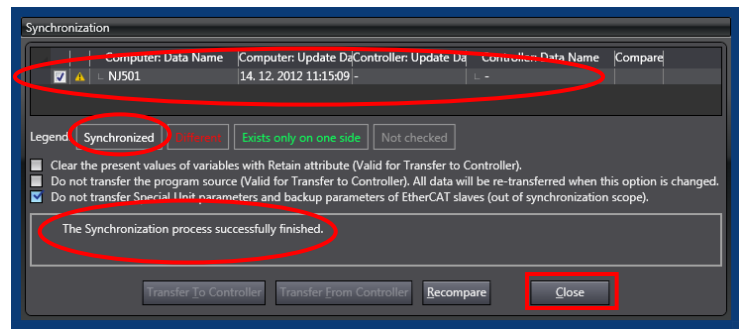
After you transfer the user program, the CPU Unit restarts and communications with the EtherCAT slaves are cut off. During that period, the slave outputs behave according to the slave settings. The time that communications are cut off depends on the EtherCAT network configuration.

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

1	Select Check All Programs from the Project Menu.	
2	The Build Tab Page is displayed on the Edit Pane. Confirm that "0 Errors" and "0 Warnings" are displayed.	
3	Select Rebuild Controller from the Project Menu.	
4	A confirmation dialog box is displayed. Confirm that there is no problem and click the Yes Button.	
5	Confirm that "0 Errors" and "0 Warnings" are displayed in the Build Tab Page.	

<p>6 Select Online from the Controller Menu.</p>	
<p>7 Select Synchronization from the Controller Menu.</p>	
<p>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.</p> <p>* After executing the Transfer To Controller, the Sysmac Studio data is transferred to the Controller and the data is compared.</p>	
<p>9 A confirmation dialog box is displayed. Confirm that there is no problem and click the Yes Button.</p> <p>A screen stating "Synchronizing" is displayed.</p> <p>A confirmation dialog box is displayed. Confirm that there is no problem and click the No Button.</p> <p>* Do not return it to RUN mode.</p>	

- 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.

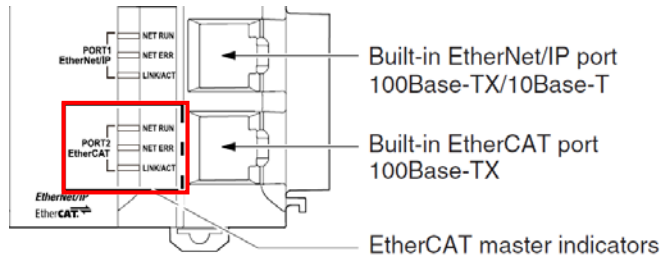
7.4.1. Checking the Connection Status

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.

The 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 SCON-CA Controller.

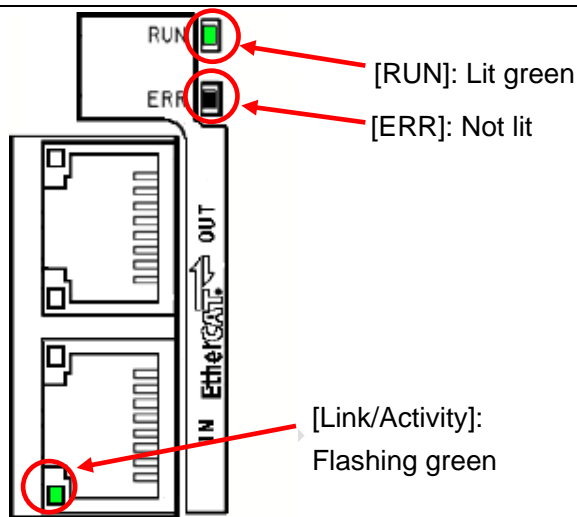
The LED indicators in normal status are as follows:

[RUN]: Lit green

[ERR]: Not lit

[Link/Activity]:Flashing green

The LED flash timing is the same as the Controller.



Name	Color	Meaning
RUN	Not lit	Initial status ("INIT" status of EtherCAT (R) communication), or the power is turned off
	Green (Lit)	Normal operation ("OPERATION" status of EtherCAT(R) communication)
	Green (Flashing: blinking)	("PRE-OPERATION" status of EtherCAT(R) communication)
	Green (Flashing: single flash)	("SAFE-OPERATION" status of EtherCAT(R) communication)
	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 (Information received from the master cannot be configured.)
	Orange (Flashing: double flash)	Communication part circuit error (Watchdog timer timeout)
	Orange (Lit)	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)

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.



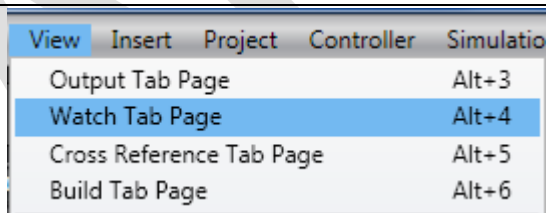
Caution

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*.

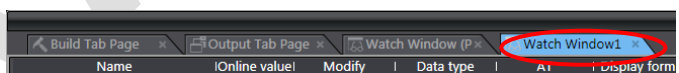
If you proceed to this section, make sure to complete all the steps and place the Destination Device in the safe state.



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



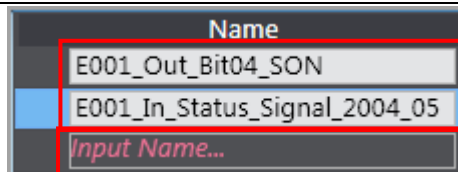
- 2 The Watch Window1 Tab Page is displayed in the lower section of the Edit Pane.



- 3 Enter the following names in the Watch Window1 Tab Page for monitoring.

E001_Out_Bit04_SON

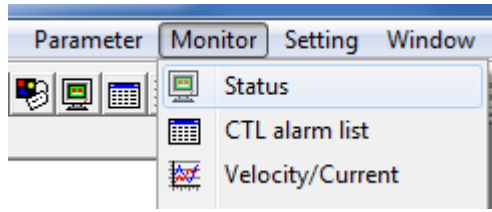
E001_In_Status_Signal_2004_05



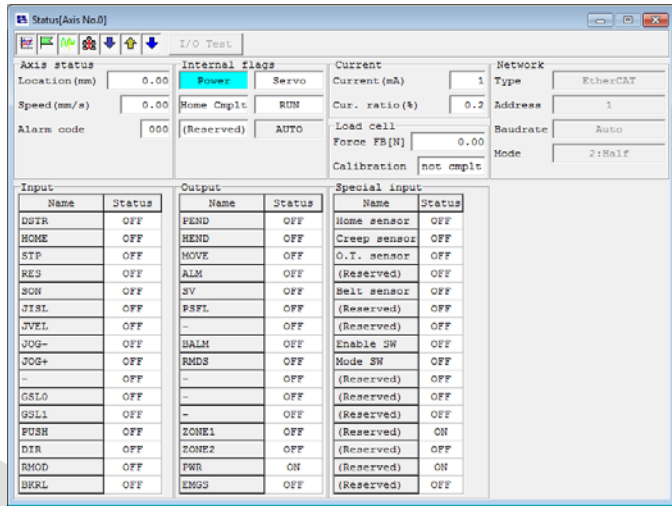
To enter a new name, click the *Input Name* Column.

- 4 Select **Status** from the Monitor Menu of the RC PC Software.

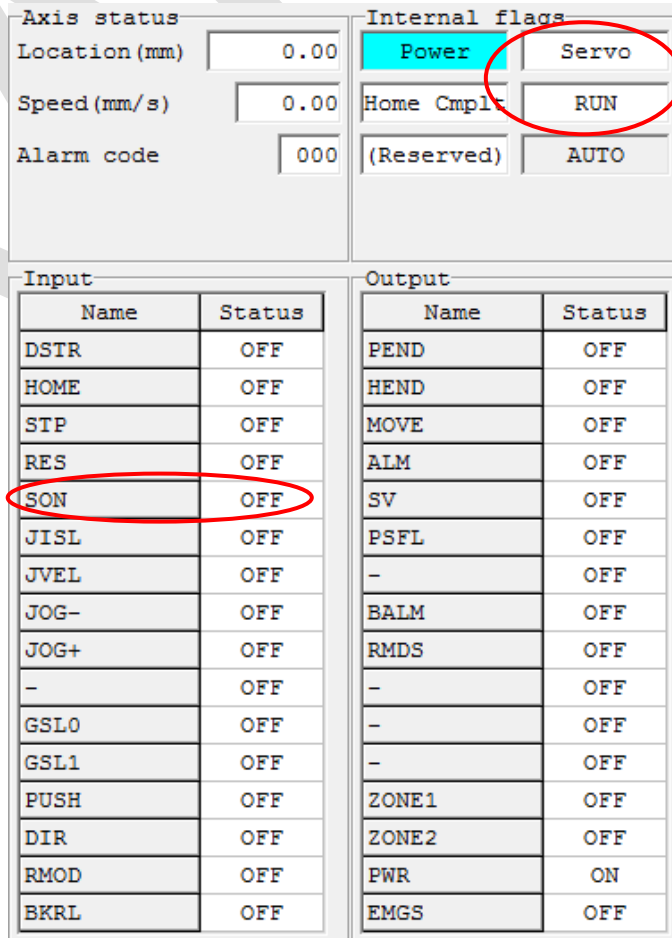
* If the RC PC Software has not been started, refer to 7.2.2. *Parameter Settings* to start the software and connect the SCON-CA Controller again.



- 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.

Name	Online value	Modify	Data type
E001_Out_Bit04_SON	False	TRUE FALSE	BOOL
E001_In_Status_Signal_2004_05	4000		WORD
Input Name...			

Name	Online value	Modify	Data type
E001_Out_Bit04_SON	True	TRUE FALSE	BOOL
E001_In_Status_Signal_2004_05	4011		WORD
Input Name...			

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		Internal flags	
Location (mm)	0.00	Power	Servo
Speed (mm/s)	0.00	Home Cmplt	RUN
Alarm code	000	(Reserved)	AUTO

Input		Output	
Name	Status	Name	Status
DSTR	OFF	PEND	ON
HOME	OFF	HEND	OFF
STP	OFF	MOVE	OFF
RES	OFF	ALM	OFF
SON	ON	SV	ON
JISL	OFF	PSFL	OFF
JVEL	OFF	-	OFF
JOG-	OFF	BALM	OFF
JOG+	OFF	RMDS	OFF
-	OFF	-	OFF
GSL0	OFF	-	OFF
GSL1	OFF	-	OFF
PUSH	OFF	ZONE1	OFF
DIR	OFF	ZONE2	OFF
RMOD	OFF	PWR	ON
BKRL	OFF	EMGS	OFF

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	B3	b2	b1	b0
Status																
Signal	EMGS	PWR	ZONE2	ZONE1	.	.	RMDS	BALM	.	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.

Name	Online value	Modify	Data type
E001_Out_Bit04_SON	True	TRUE FALSE	BOOL
E001_In_Status_Signal_2004_05	4011		WORD
Input Name...			

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.

Name	Online value	Modify	Data type
E001_Out_Bit04_SON	False	TRUE FALSE	BOOL
E001_In_Status_Signal_2004_05	4000		WORD
Input Name...			

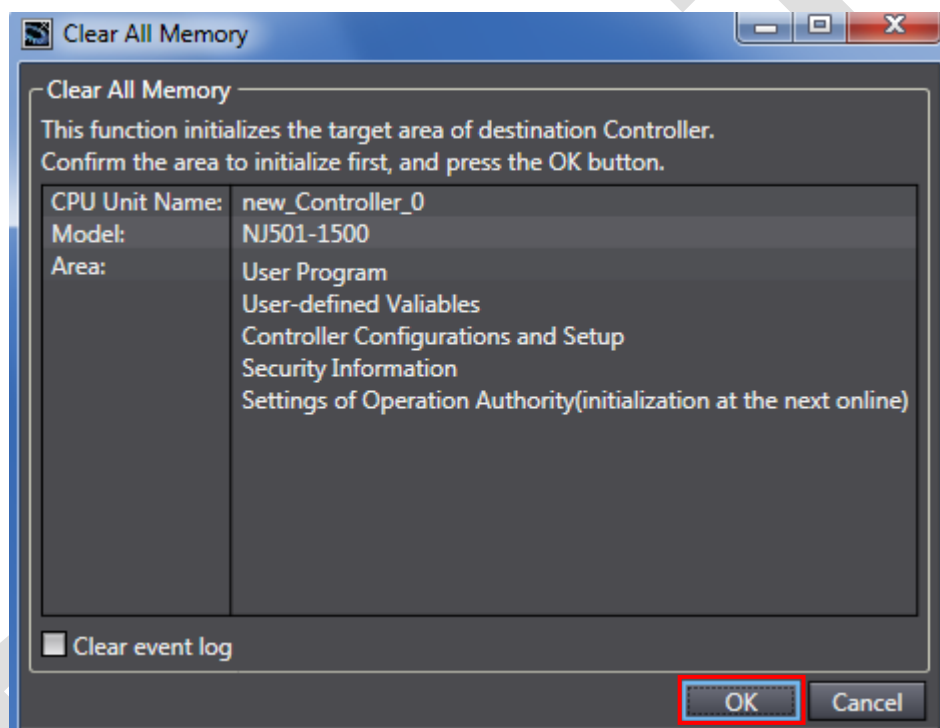
8. Initialization Method

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 SCON-CA Controller

For information on how to initialize the IAI SCON-CA 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

DRAFT

DRAFT

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