OMRON

Programmable Multi-Axis Controller

Startup Guide for 1S-series Servo Drives

CK3E-□□□□
NY51□-A□□□

SYSMAC always in control

O022-E1-01

About Copyrights and Trademarks

Contents

1. Related Manuals

To ensure system safety, always read and follow the information provided in all Safety *Precautions* and *Precautions for Safe Use* in the manuals for each device that is used in the system.
The following shows the manuals for OMRON Corporation (hereafter referred to as OMRON) and Delta Tau Data Systems, Inc (DT).

Manufacturer	Manual No.	Model	Manual name
OMRON	I610-E1	Model CK3E-□□□□	Programmable Multi-Axis Controller Hardware User's Manual
OMRON	W580-E1	Model NY51□-A□□□	Industrial PC Platform NY-series IPC Programmable Multi-Axis Controller Hardware User's Manual
OMRON	I586-E1	Model R88M-1L□/-1M□ Model R88D-1SN□-ECT	R88M-1□□, R88D-1SN□-ECT Built-in EtherCAT® Communications User's Manual
DT	O014-E	-	Power PMAC User's Manual
DT	O015-E	-	Power PMAC Software Reference Manual
DT	O016-E	-	Power PMAC IDE Users Manual

2. Terms and Definitions

Term	Explanation and Definition
Slave	Slaves are devices connected to EtherCAT. There are various types of slaves such as servo drivers handling position data and I/O terminals handling the bit signals.
Object	Represents information such as in-slave data and parameters.
PDO communications (Communications using Process Data Objects)	One type of EtherCAT communications in which Process Data Objects (PDOs) are used to exchange information cyclically and in real time. This is also called “process data communications”.
PDO Mapping	The association of objects used for PDO communications.
PDO Entry	PDO entries are the pointers to individual objects used for PDO mapping.
ESI file (EtherCAT Slave Information file)	An ESI file contains information unique to the EtherCAT slaves in XML format. You can load ESI files into the EC-Engineer, to easily allocate slave process data and make other settings.
ENI file (EtherCAT Network Information file)	An ENI file contains the network configuration information related to EtherCAT slaves.
Power PMAC IDE	This computer software is used to configure the Controller, create user programs, and monitor the programs. PMAC is an acronym for Programmable Multi-Axis Controller.
Acontis EC-Engineer	This computer software is used to configure the EtherCAT network and each slave.

3. Precautions

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

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

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

(4) It is prohibited to copy, reproduce, or distribute all or part of this document without the permission of OMRON Corporation.

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

The following notations are used in this document.

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

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

Precautions for Correct Use

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

Additional Information

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

Symbols

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

4. Overview

This document describes the procedures used to operate the OMRON servo drivers (1S-series EtherCAT communication built-in type, hereafter referred to as Servo Driver) using the motion program for OMROM Programmable Multi-Axis Controller (hereafter referred to as the Controller), model CK3E-□□□□/NY51□-A□□□, as well as for checking the operation. In the document, Servo Driver and servomotors to be connected are collectively called motion control devices. Servo Driver may also be referred to as a slave depending on the explanation.

Refer to *Section 6.* EtherCAT Connection Procedure to learn about the setting methods and key points to perform PDO communications via EtherCAT. In this document, the motion program is used to check operations.

⚠ Caution

The range of usage of this document is checking the connection of motion control devices connected via EtherCAT. When using instructions and constructing systems that are not described in this document, always read and follow the information provided in all *Safety Precautions* and *Precautions for Safe Use* in the manuals for each device that is used in the system.

5. Applicable Devices and Device Configuration

5.1. Applicable Devices

The applicable devices are as follows:

Manufacturer	Name	Model
OMRON	Programmable Multi-Axis Controller	Model CK3E-□□□□
OMRON	Programmable Multi-Axis Controller Industrial Box PC	Model NY51□-A□□□
OMRON	Servo Driver	Model R88D-1SN□-ECT

Precautions for Correct Use

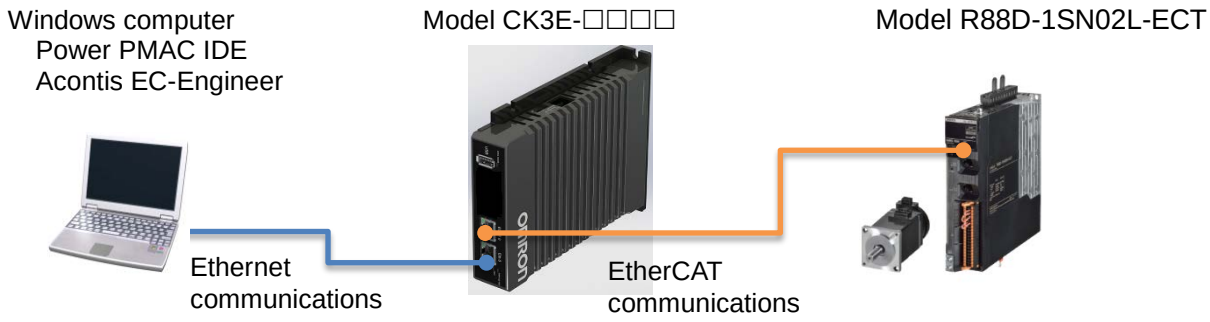
In this document, the devices with models and versions listed in *Section 5.2* are used as examples of applicable devices to describe the procedures to connect the devices and check their connections.
You cannot use devices with versions lower than the versions listed in *Section 5.2*.
To use the devices mentioned above with models 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 procedures to establish the network connections. It does not provide information on operations, installations, wiring methods, device functionalities, or device operations, which are not related to the connection procedures. For more information, refer to the manuals or contact your OMRON representative.

5.2. Device Configuration

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



Manufacturer	Name	Model	Version
OMRON	Programmable Multi-Axis Controller	Model CK3E-□□□□	Ver.2.2
OMRON	Servo Driver (1S-series with Built-in EtherCAT Communications)	Model R88D-1SN02L-ECT	Ver.1.0
OMRON	Ethernet cable (with industrial Ethernet connector)	Model XS5W-T421-□M□-K	
-	Windows computer	-	
DT	Power PMAC IDE setup tool	Power PMAC IDE	Ver.2.2
Acontis	EtherCAT master setup tool	Acontis EC-Engineer	Ver.2.4.3

Precautions for Correct Use

Prepare the ESI file described in this section in advance. Contact your OMRON representative for information on how to procure the ESI file.

Precautions for Correct Use

Do not share the connection line of EtherCAT communications with other Ethernet networks.
Do not use devices for Ethernet such as a switching hub.
Use the Ethernet 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.

Additional Information

This document describes model CK3E-□□□□ as an example. The same procedures can apply to model NY51□-A□□□.

6. EtherCAT Connection Procedure

This section describes the procedures to connect the Controller and Servo Driver via EtherCAT, and to operate the motion control devices. The description assumes that the Controller is set to factory default.

⚠ WARNING

If an uninitialized Controller is used, the motion control devices may perform unexpected operations upon power-on depending on the Controller status, resulting in a personal injury to the user.
To prevent unexpected operations of motion control devices, be sure to initialize the Controller before connecting the motion control devices and the Controller via Ethernet cable.

6.1. Workflow

Take the following steps to operate the motion control devices after connecting the Controller and Servo Driver via EtherCAT.

6.2 Preparation for the Controller Setup	Prepare the Controller settings.
▼	
6.2.1 Creation of a New Project	
▼	
6.2.2 Initial	
▽	
6.3 Installation of ESI Files	Install the ESI file for Servo Driver into Acontis EC-Engineer.
▽	
6.4 EtherCAT Communications Setup	Set up EtherCAT communications.
▼	
6.4.1 Communications Setup for the EtherCAT Master	
▼	
6.4.2 Distributed Clock Setup	
6.4.3 PDO Map Settings	
▼	
6.4.4 Creation of an EtherCAT Network Configuration File	
▽	
6.5 Controller Settings	Set up the Controller.
▼	

6.5.1 EtherCAT Network Configuration Settings

6.5.2 EtherCAT Communications Check

▼

6.5.3 Motor Setup

▼

6.5.4 EtherCAT Variables Settings

▼

6.5.5 Creation of Operation Check Programs

▼

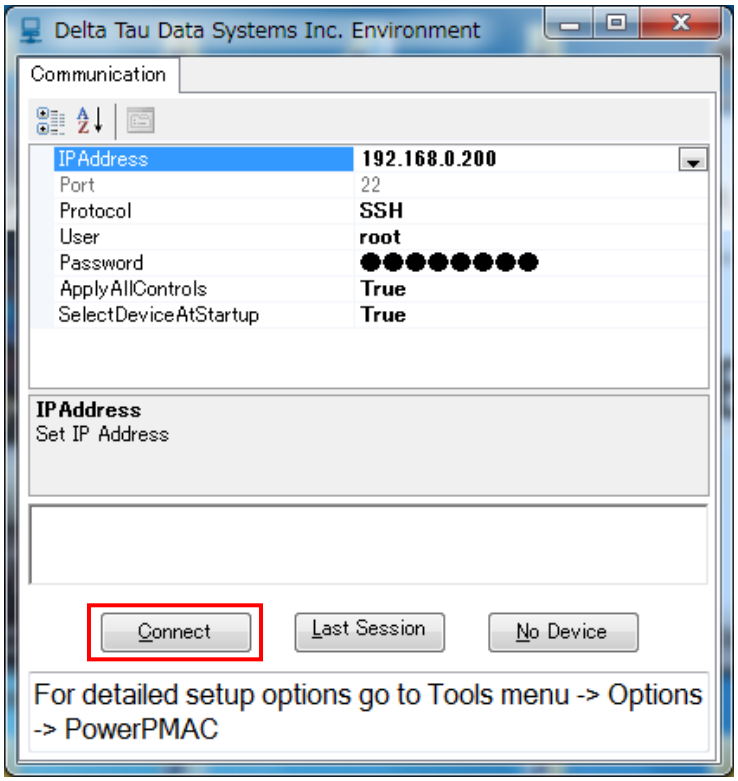
6.5.6 Project Data Transfer and Operation Check

6.2. Preparation for the Controller Setup

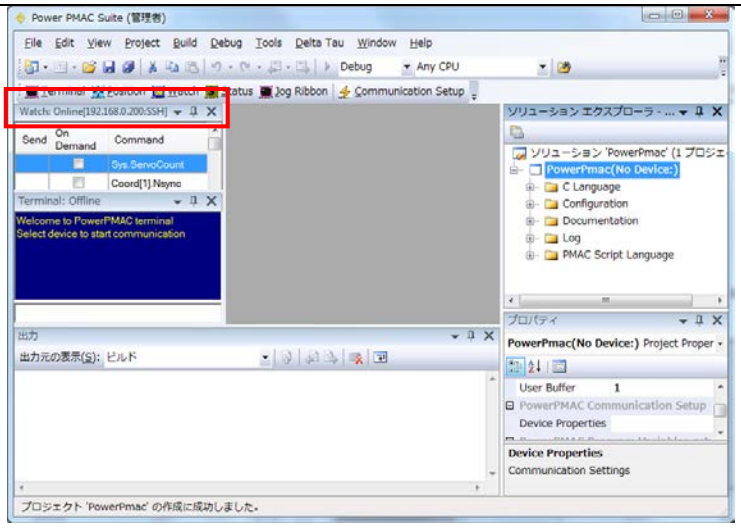
Prepare the Controller settings.

Install Power PMAC IDE and Acontis EC-Engineer on the computer in advance.

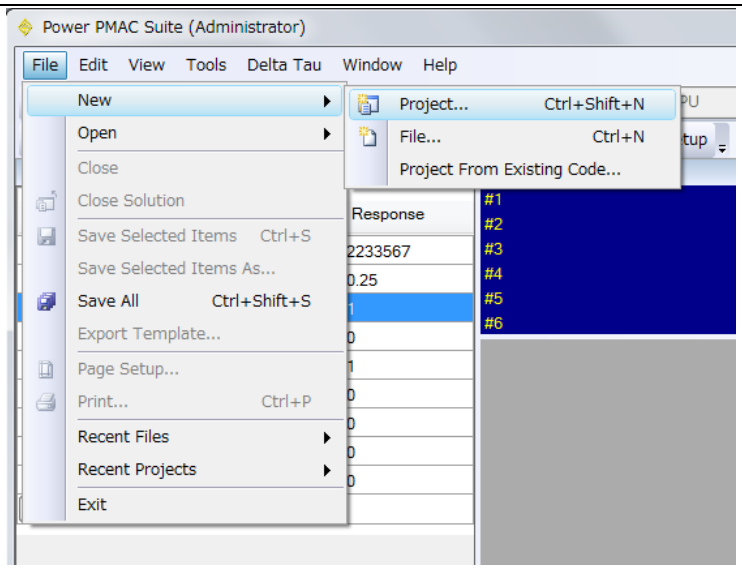
6.2.1. Creation of a New Project

1	Connect the Controller to the computer via Ethernet.	
2	Turn on the power to the Controller.	
3	Start Power PMAC IDE. * If the dialog for confirming access rights appears upon start-up, select starting of Power PMAC IDE.	
4	The Communication screen appears. Specify the IP address of the destination Controller and click **Connect**. * The IP address of the Controller is set to “192.168.0.200” by default. * If necessary, change the Windows IP address to “192.168.0.X”.	

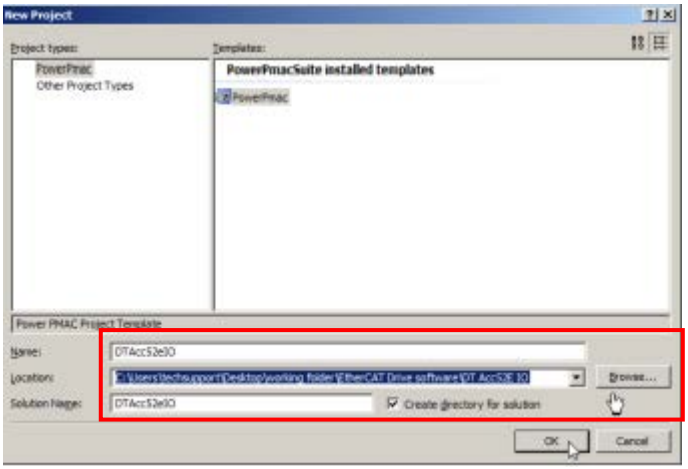
5 Power PMAC IDE starts, and is online to the Controller.



6 From the **File** menu, select **New** then **Project**.



7 Enter a project name, and select **OK**.



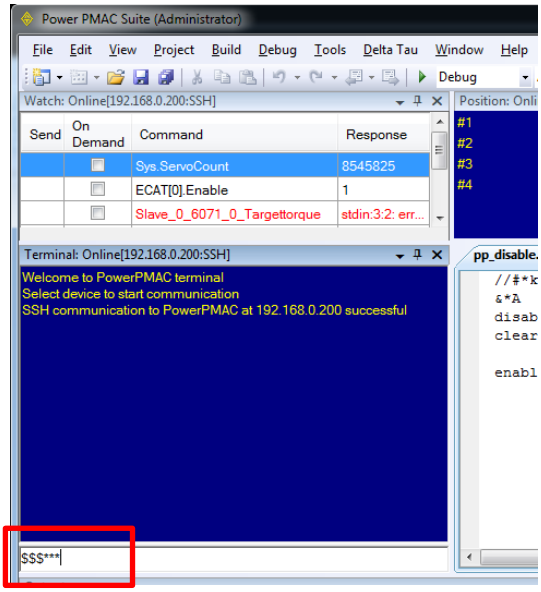
6.2.2. Initial Settings of the Controller

Configure the initial settings for the Controller.

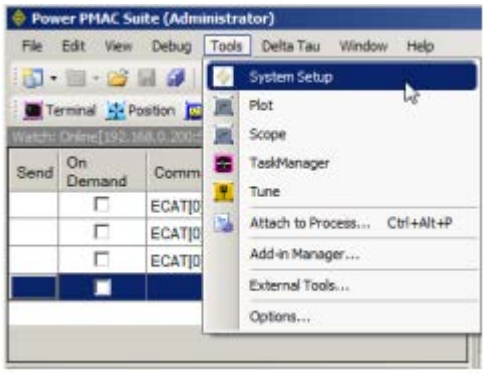
Precautions for Correct Use

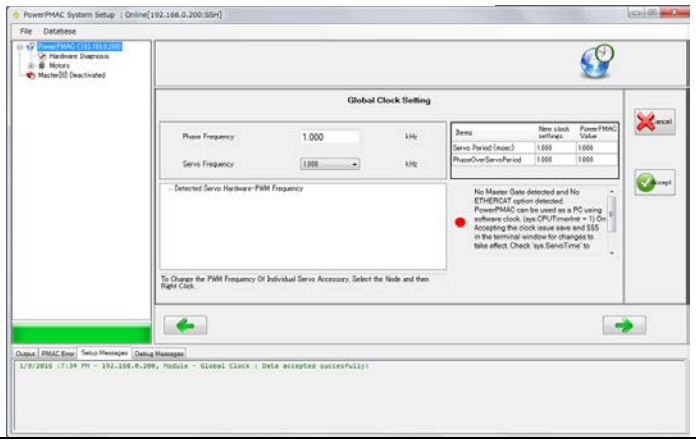
Configuring the initial settings clears all data in the Controller memory. Back up necessary data in advance.

1 In the Terminal pane, type the $$$*** command to reset the Controller to factory default.

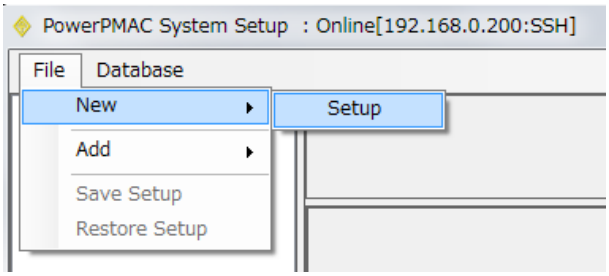


2 From the **Tools** menu, select **System Setup** to start **System Setup**.



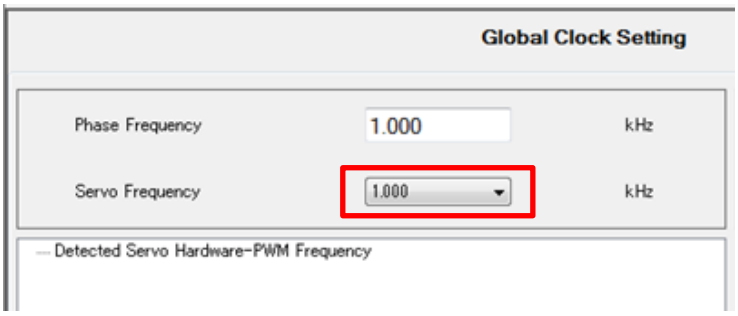


3 From the **File** menu of PowerPMAC System Setup, select **New** then **Setup**.

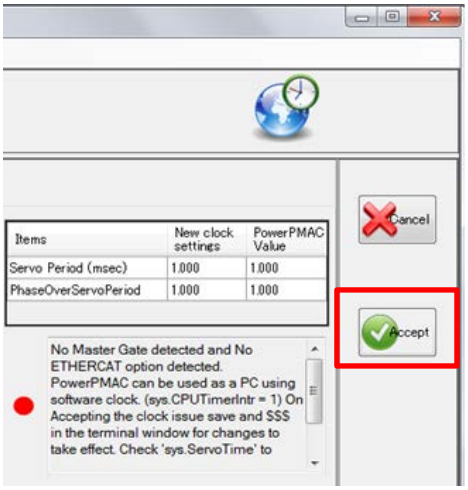


4 Specify **Servo Frequency**.

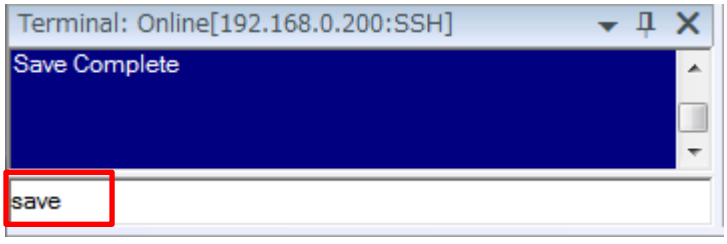
Select the **Servo Frequency** setting from 4 kHz, 2 kHz, or 1 kHz.

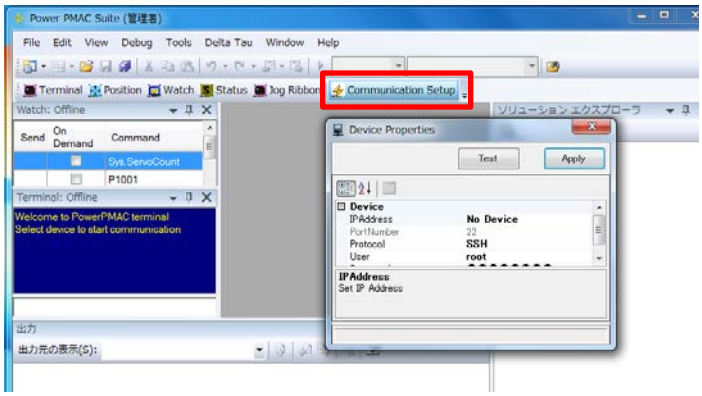
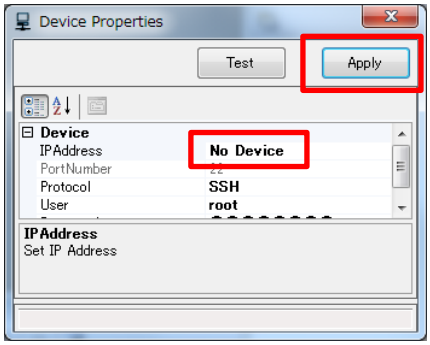
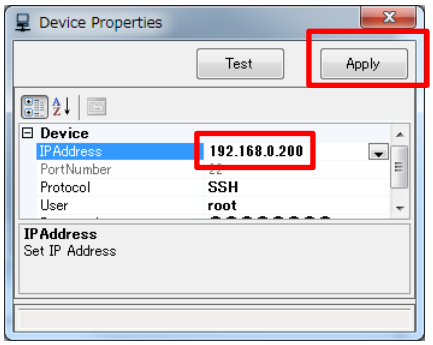


5 Click the **Accept** button.



6 If you have changed the servo frequency setting, type the save command in the Terminal pane of Power PMAC IDE.
When complete, the “Save Complete” message appears in the Terminal pane.



7	Click **Communication Setup** on the toolbar to display the Device Properties dialog box.	
8	In the Device Properties dialog box, select *No Device* for IP Address, then click the **Apply** button. This operation sets the Controller to the offline state.	
9	The Controller restarts. The servo frequency that has been set is reflected.	
10	Wait until the startup process of the Controller is complete. Then click **Communication Setup** on the toolbar to display the Device Properties dialog box. In the Device Properties dialog box, return the IP Address to the previous setting, then click the **Apply** button. This operation sets the Controller to the online state.	

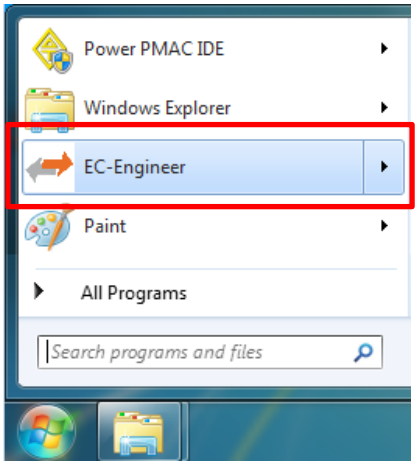
6.3. Installation of ESI Files

Install the ESI file for Servo Driver into Acontis EC-Engineer.

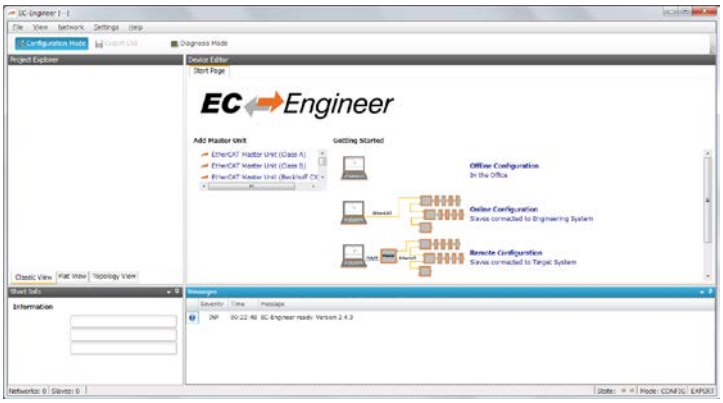
Precautions for Correct Use

Prepare the ESI file described in this section in advance. Contact your OMRON representative for information on how to procure the ESI file.

1 Start EC-Engineer.

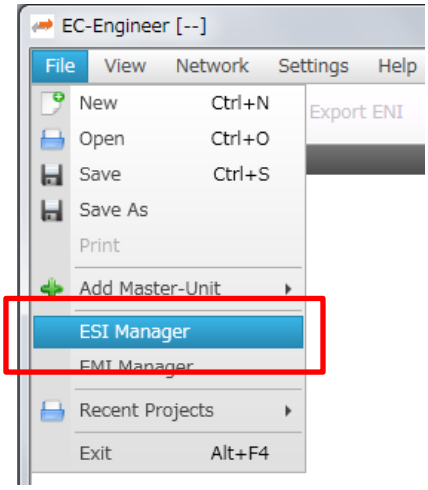


EC-Engineer screen:

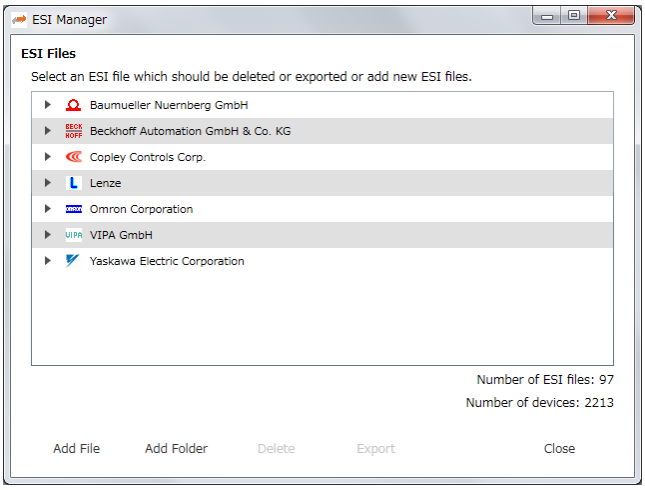


2 From the **File** menu of EC-Engineer, select **ESI Manager**.

The ESI Manager appears.

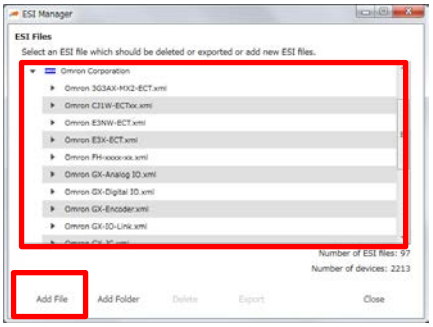


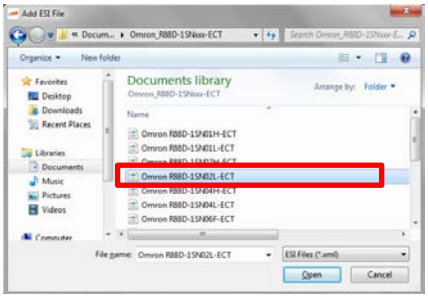
Example of the ESI Manager



3 Confirm that *Omron R88D-1SN02L-ECT.xml* is registered in the ESI file list of ESI Manager.

If it is not yet registered, click **Add File** and register *Omron R88D-1SN02L-ECT.xml*.





4 Click **Close** to close the ESI Manager page.

6.4. EtherCAT Communications Setup

Set up EtherCAT communications.

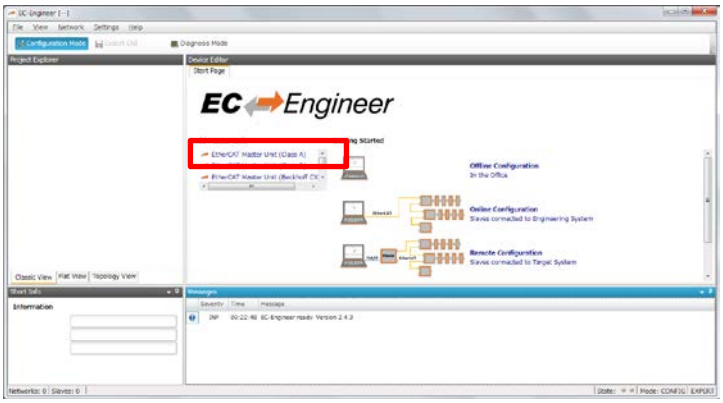
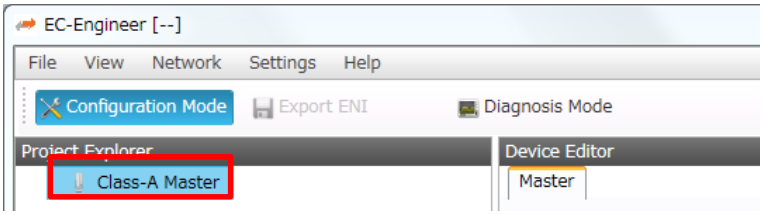
⚠ WARNING

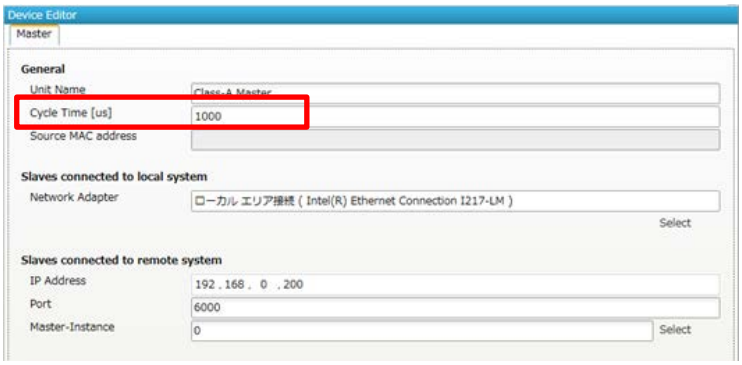
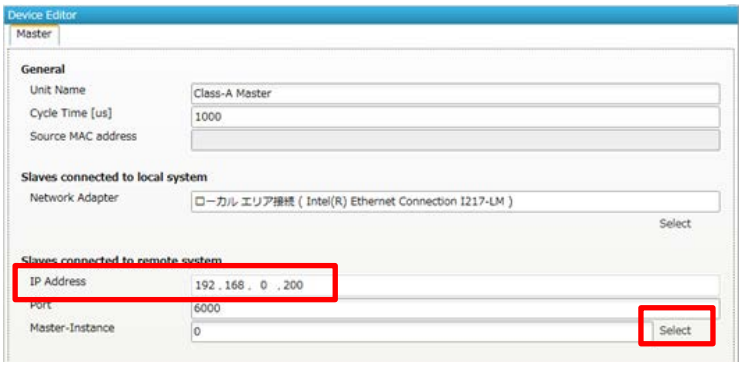
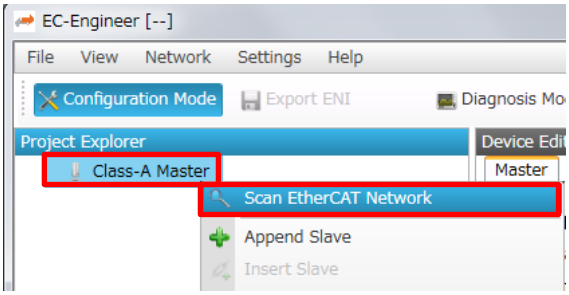
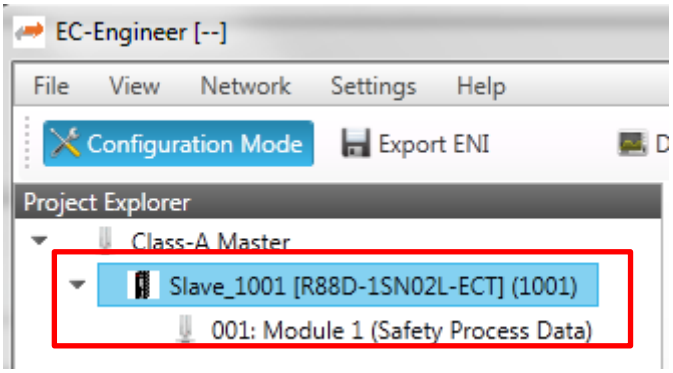
Depending on the Controller status, unexpected operations of the motion control devices may occur when the power to the Controller is turned on, resulting in a personal injury to the user.
Pay attention to safety when the power is turned on.

Precautions for Correct Use

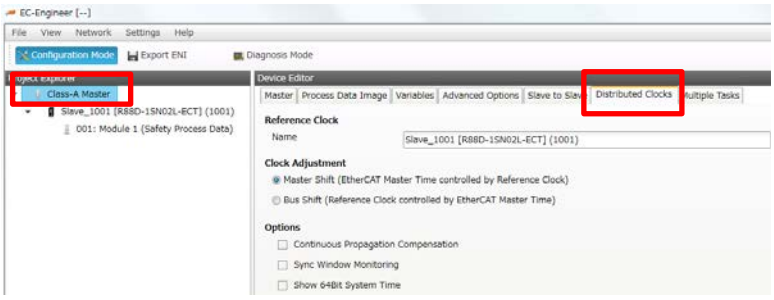
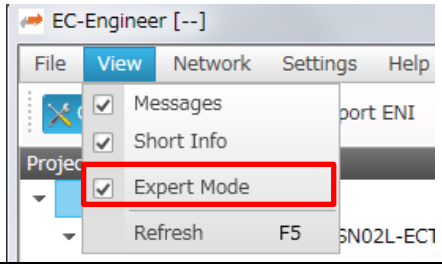
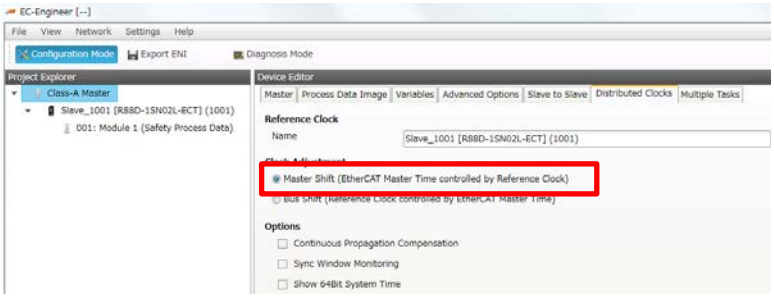
Before taking the following steps, make sure that the devices are connected via an Ethernet cable. If they are not connected, turn OFF the power to the devices, and connect the Ethernet cable.

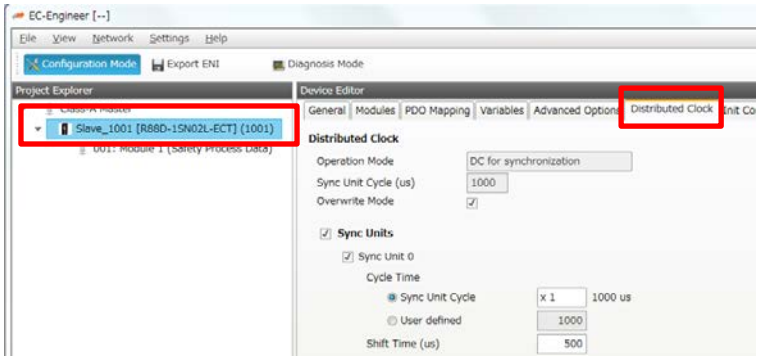
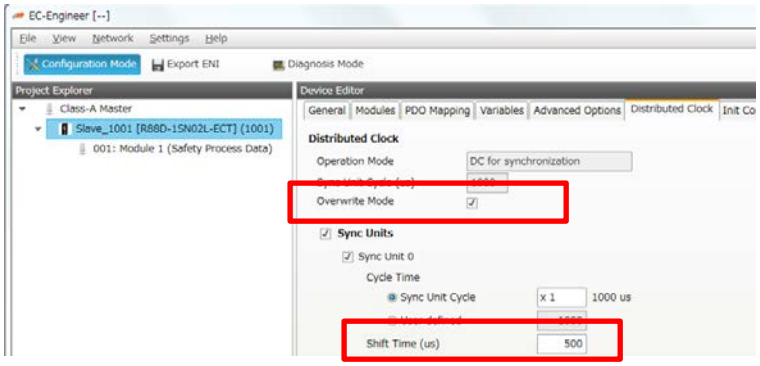
6.4.1. Communications Setup for the EtherCAT Master

1	Connect the Controller with slave devices using an Ethernet cable. * Refer to the manuals for slave devices to configure them.	
2	Display **Start Page** of EC-Engineer, and select **EtherCAT Master Unit (Class A)** from **Add Master Unit**.	
3	**Class-A Master** is added to the Project Explorer.	

4	In the Master page, specify a communication period for **Cycle Time [us]**. * You must specify the communication period in accordance with the servo frequency of the Controller. 1000 us is set in this document.	 Correspondence between the servo frequencies of the Controller and communication periods is as follows: 4 kHz : 250 us 2 kHz : 500 us 1 kHz : 1000 us
5	In the Master page, enter the IP address of the Controller in **IP Address**, and click the **Select** button to apply the setting. * Default IP address “192.168.0.200” is specified in this example. * Do not select **Slaves connected to local system** as it is not used.	
6	Right-click on **Class-A Master** in the Project Explorer, and select **Scan EtherCAT Network** from the menu.	
7	Make sure that the slave is displayed in the Project Explorer.	

6.4.2. Distributed Clock Setup

1	Setting Distributed Clocks (DC) for Master In the Project Explorer, select **Class-A Master** to display the Distributed Clocks tab page.	 * If the Distributed Clocks tab does not appear, select **View** then the **Expert Mode** check box. 
2	Select **Master Shift (EtherCAT Master Time controlled by Reference Clock)**.	

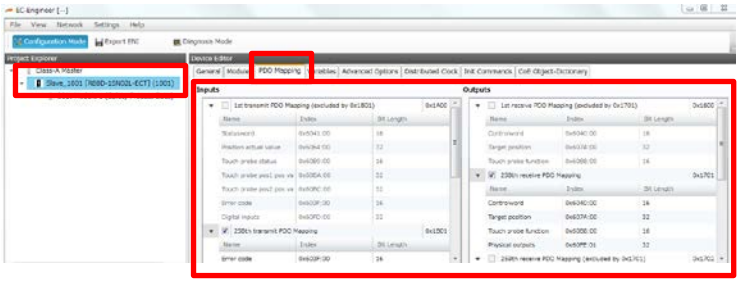
3	Setting Distributed Clock (DC) for the Slave In the Project Explorer, select the target slave to display the Distributed Clock tab page.	
4	Select the **Overwrite Mode** check box and specify **Shift Time**.	 Correspondence between the servo frequencies of the Controller and the Shift Time values is as follows: 4 kHz : 125 us 2 kHz : 250 us 1 kHz : 500 us

6.4.3. PDO Map Settings

⚠ Caution

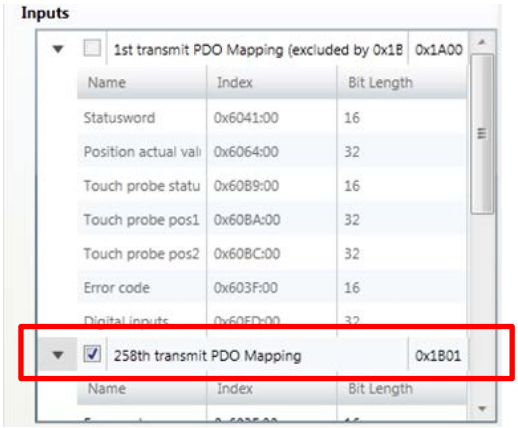
PDO entries without axis settings are subjected to PDO communications as indefinite values. For this reason, unexpected operations of the motion control devices may occur, resulting in a personal injury to the user.
Only objects to be configured in *Section 6.5.3. Motor Setup* must be mapped to PDO entries.

1 In the Project Explorer, select the target slave to display the PDO Mapping tab page.

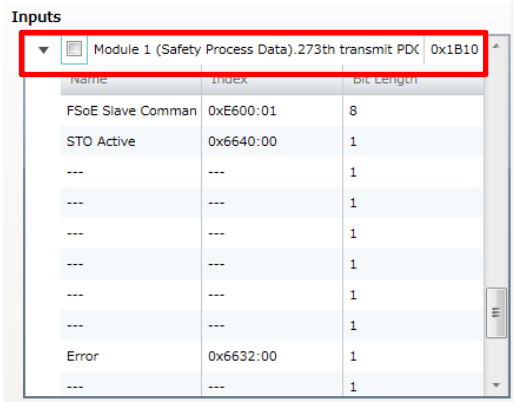


2 Setting PDO mapping (Inputs)

Make sure that the **258th transmit PDO Mapping 0x1B01** check box is selected in the Inputs field.

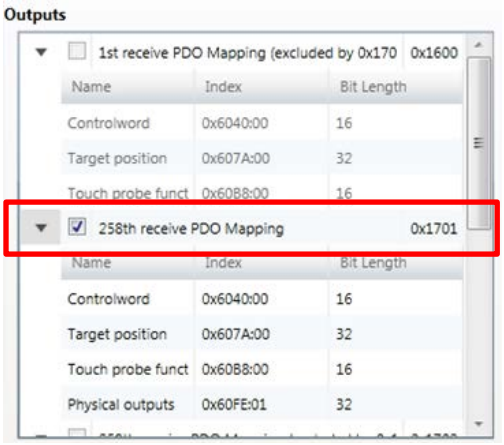


Clear the **273th transmit PDO Mapping 0x1B10** check box if it is selected in the Inputs field.

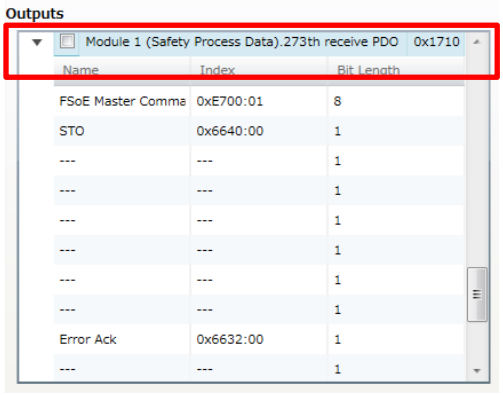


3 Setting PDO mapping (Outputs)

Make sure that the **258th transmit PDO Mapping 0x1701** check box is selected in the Outputs field.

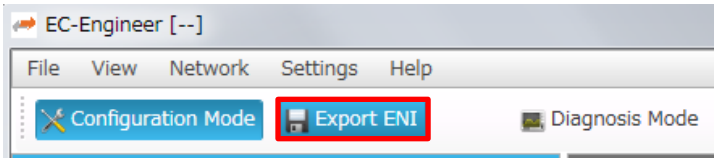


Clear the **273th transmit PDO Mapping 0x1710** check box if it is selected in the Outputs field.

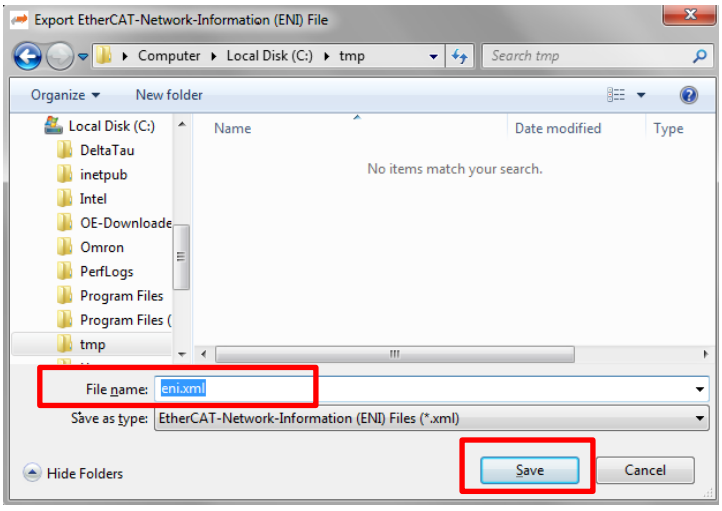


6.4.4. Creation of an EtherCAT Network Configuration File

1 Click **Export ENI** on the upper part of the EC-Engineer page.



2 Enter a file name, and then click **Save** to create an EtherCAT network configuration file.



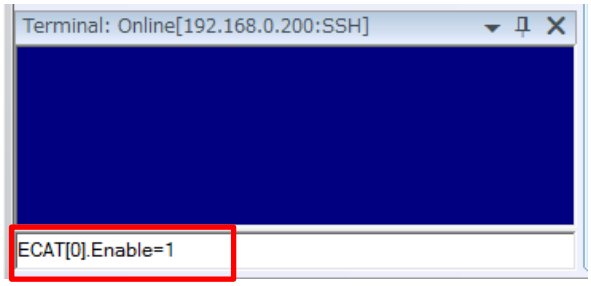
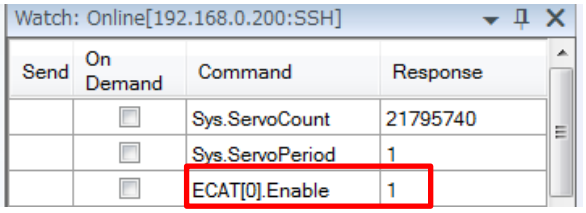
6.5. Controller Settings

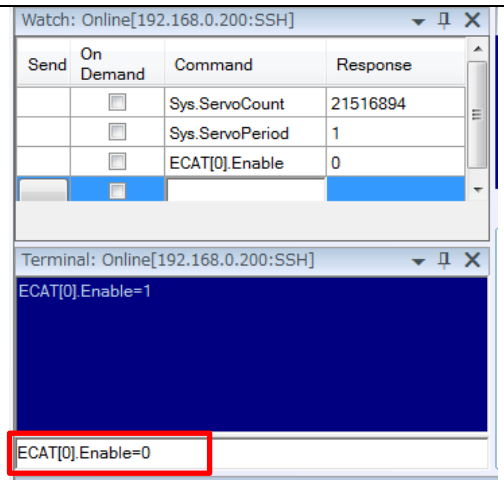
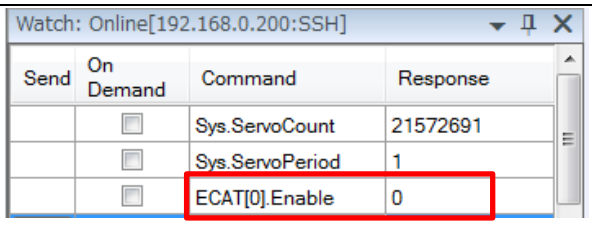
6.5.1. EtherCAT Network Configuration Settings

1	From the **Tools** menu of Power PMAC IDE, select **System Setup**, and after **System Setup** is displayed, select **Master[0] Deactivated**.	
2	Click **Browse**, and load the EtherCAT network configuration file created in *6.4.4 Creation of an EtherCAT Network Configuration File*.	
3	Click **Download ENI file** to download the EtherCAT network configuration to the Controller.	

6.5.2. EtherCAT Communications Check

Take the following steps to ensure that EtherCAT communications are available.

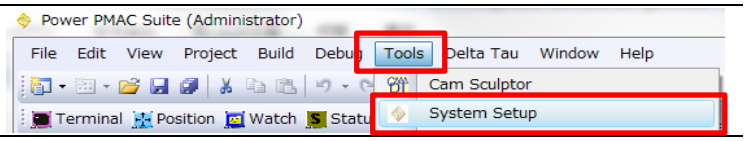
1	From the Terminal pane, run the ECAT[0].Enable=1 command to start EtherCAT communications.	
2	In the Terminal or Watch pane, make sure that the ECAT[0].Enable value turns to *1*. *The OP mode is entered and EtherCAT communications are established.	

3	After making sure that correct communications are available, run the ECAT[0].Enable=0 command from the Terminal pane to stop EtherCAT communications.	
4	In the Terminal or Watch pane, make sure that the ECAT[0].Enable value turns to *0*.	

6.5.3. Motor Setup

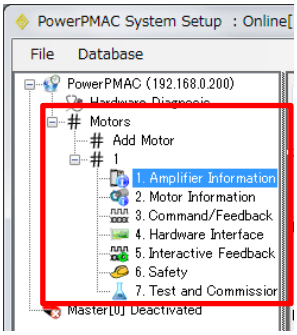
Configure the motor settings for the Controller.

1 From the **Tools** menu of Power PMAC IDE, select **System Setup** to display **System Setup**.



2 Adding motor #1

Click **Add motor** in **Motors** of the tree, and enter *1* for the motor number.

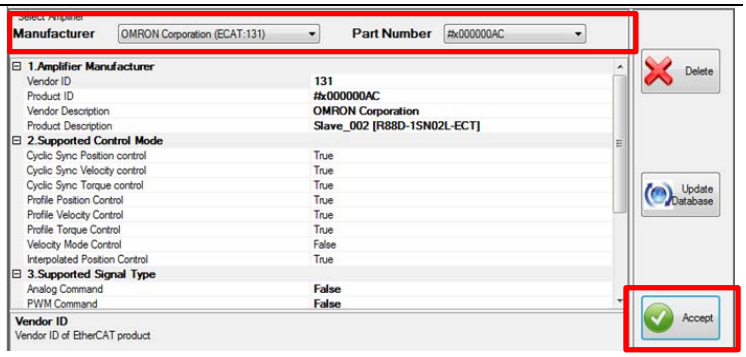


3 Setting motor Amplifier

Select **Motors** – **1** – **1.Amplifier Information** of the tree.

Specify the settings as shown on the right.

Click the **Accept** button to apply the settings.



Manufacturer

Select **OMRON Corporation**.

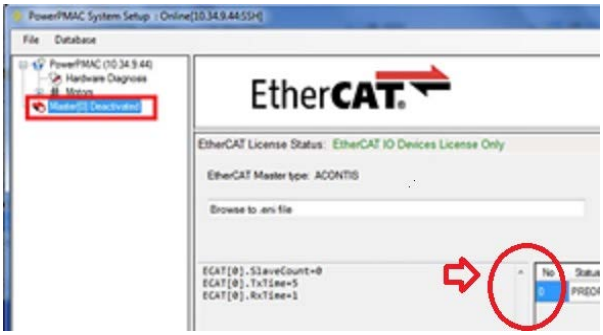
Part Number

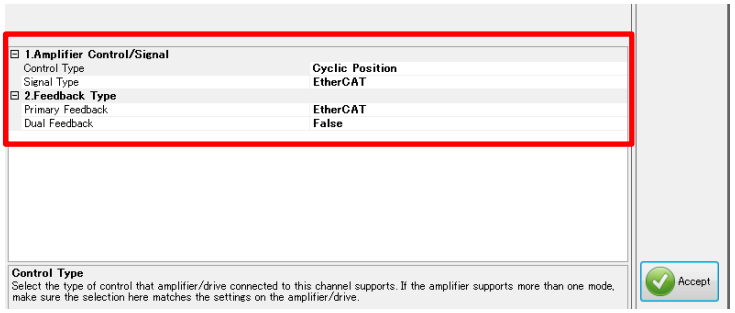
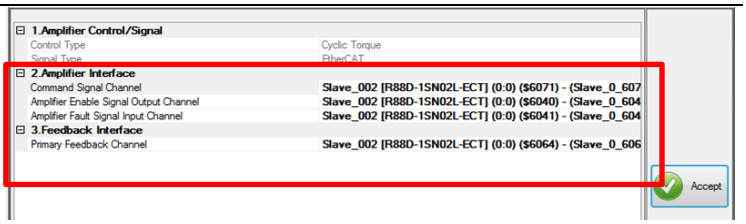
Select **#x000000AC**.

4.ECAT Slave Settings

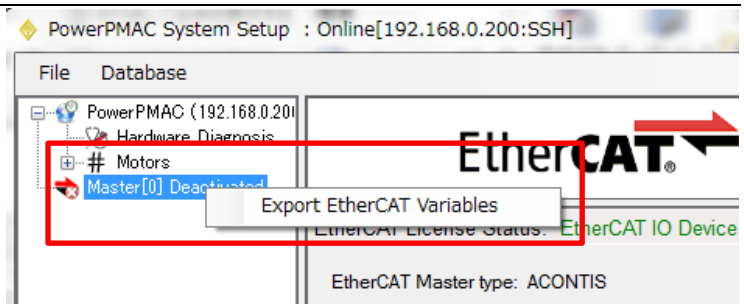
Enter a slave number into **Slave Number**.

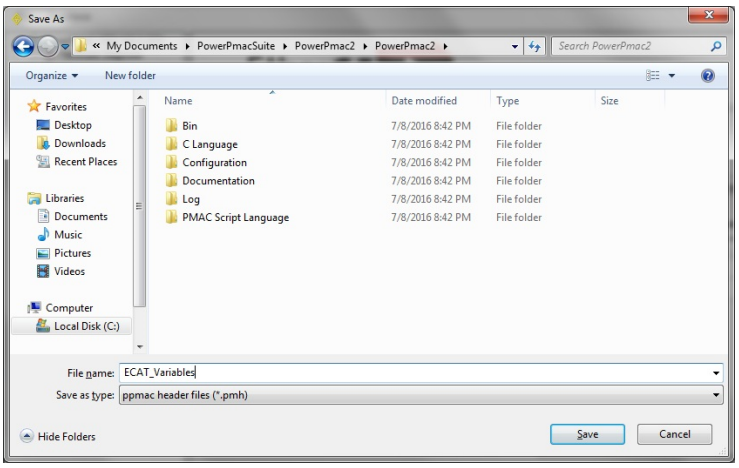
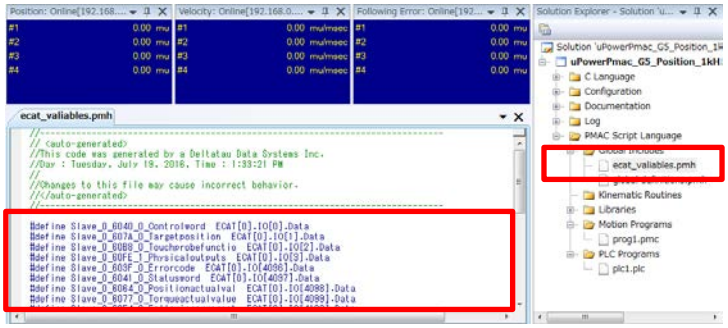
The slave number can be confirmed in the System Setup page.



4	Select **Motors** – **1** – **3.Command/Feedback Information**. Specify the settings as shown on the right. Click the **Accept** button to apply the settings.	 *Control Type* Select **Cyclic Position**. *Primary Feedback* Select **ECAT**.
5	Select **Motors** - **1** - **4.Hardware Interface**. Specify the settings as shown on the right. Click the **Accept** button to apply the settings.	 *Command Signal Channel* Select **#x607A(Target Position)**, and specify the motor control indication value for *Target Position*. *Amplifier Enable Signal Output Channel* Select **#x6040(Controlword)**, and specify **Controlword** for the motor output. *Amplifier Fault Signal Input Channel* Select **#x6041(Statusword)**, and specify **Statusword** for the motor input. *Primary Feedback Channel* Select **#x6064(Position actual value)**, and specify **Position actual value** for the motor control feedback.

6.5.4. EtherCAT Variables Settings

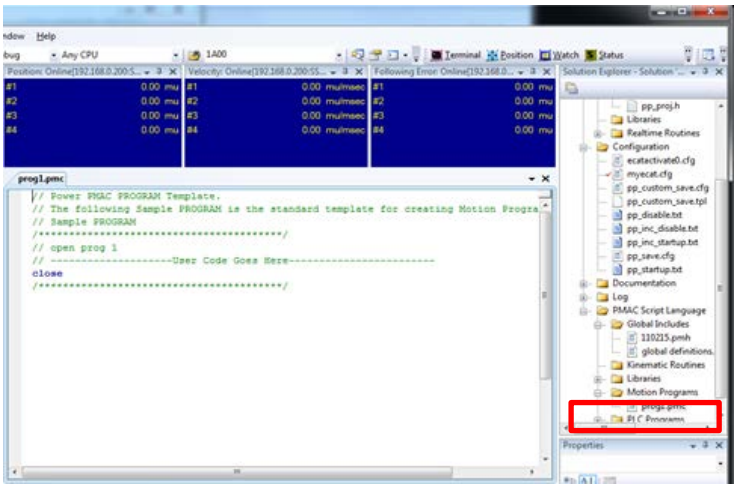
1	In the System Setup page, right-click on **Master[0].Deactivated** to display the pop-up menu, and select **Export EtherCAT Variables**.	

2	Enter a name for the EtherCAT variable definition file for user programs into the root of the project folder.	
3	The created EtherCAT variable definition file is added to under **Global Includes** of **PMAC Script Language** in Solution Explorer.	

6.5.5. Creation of Operation Check Programs

Create programs to be used to check operations.

A specific language is used for the operation check programs. Refer to *Power PMAC User's Manual* and *Power PMAC Software Reference Manual* for details.

1	Creating the Motion program In the Solution Explorer pane, open **Project name** – **PMAC Script Language** – **Motion Programs** – **prog1.pmc**.	

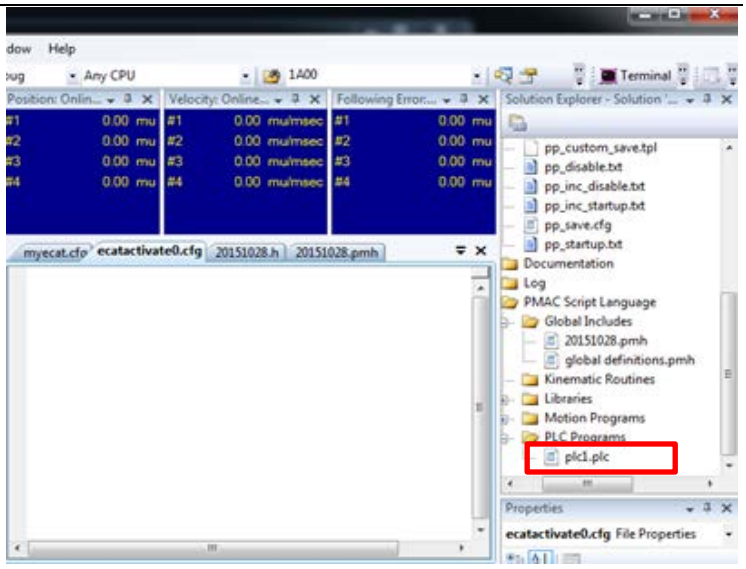
2 In the programming area of the prog1.pmc tab page, write a program as shown on the right.

This example program rotates a motor in the normal direction, stops the rotation, then repeats rotation in the reverse direction and stops.

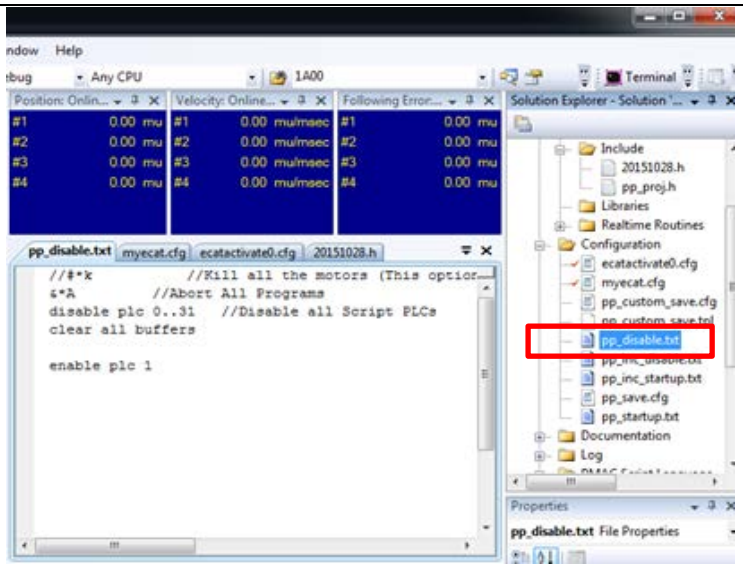
```
&1;
#1->8388608X;

OPEN PROG 1

   INC;
   TA800;
   TS300;
   LINEAR;
   While (1 < 2)
   {
      TA800;
      TS300;
      TM3000;
      X10;
      DWELL2000;
      X-10;
      DWELL2000;
   }

CLOSE
```

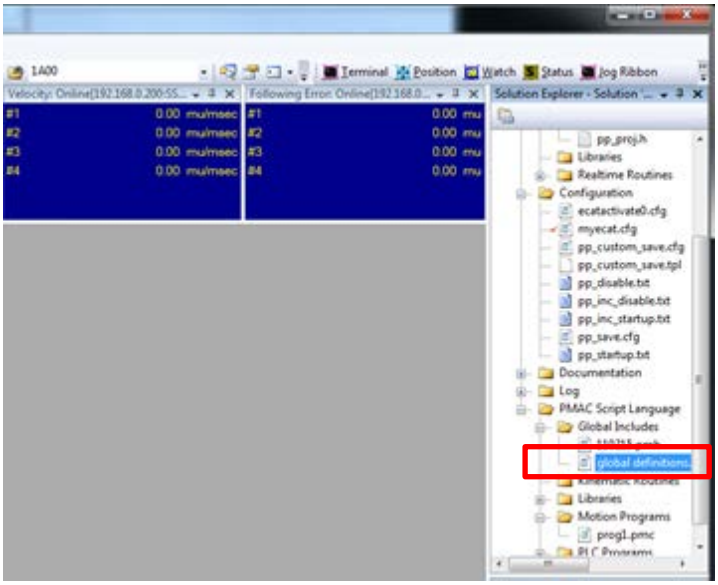
3 Creating the PLC program

In the Solution Explorer pane, open **Project name** – **PMAC Script Language** – **PLC Programs** – **plc1.plc**.



4	In the programming area of the plc1.plc tab page, write a program as shown on the right.
	
	This example program turns a servo ON, starts user program 1 for the motor, then exits periodic execution of the PLC user program.
		open plc 1
		
		while(sys.ecatMasterReady==0){};
		
		ECAT[0].Enable=1;
		
		P1000=Sys.Time+1;
		while(P1000>Sys.Time){};
		
		cmd"&1enable";
		
		P1000=Sys.Time+5;
		while(P1000>Sys.Time){};
		
		cmd"&1b1r";
		
		disable plc 1;
		
		close

5	Setting the start of the user program In the Solution Explorer pane, open **Project name** – **Configuration** – **pp_disable.txt**.	
6	In the programming area of the pp_disable.txt tab page, add the program shown on the right to the last line. The pp_disable.txt program is automatically executed when the Controller starts. This example program runs the PLC1 script.	enable plc 1;

7	Setting motor control parameters In the Solution Explorer pane, open **Project name** – **PMAC Script Language** – **Global Includes** – **global definitions.pmh**.	
8	In the programming area of the global definitions.pmh tab page, write the set values to be set automatically upon power-on. Example settings are shown on the right.	Motor[1].FatalFeLimit=0; Motor[1].AbortTa= -0.1; Motor[1].AbortTs= 0; Motor[1].MaxSpeed= 5000; Motor[1].JogTa= -0.1; Motor[1].JogTs= -1; Motor[1].JogSpeed= 1000; Motor[1].HomeVel= 1000; Coord[1].Tm=100; Coord[1].FeedTime=60000; Coord[1].MaxFeedRate=5000; Coord[1].Td=-0.1; Coord[1].Ta=-0.1; Coord[1].Ts=-1;

6.5.6. Project Data Transfer and Operation Check

Transfer the created project data to the Controller.

When a project is transferred, the program starts automatically and the motor starts rotating.

⚠ WARNING

When the user program and “configuration and setting” data are transferred from Power PMAC IDE, devices or the machine may perform unexpected operations. Therefore, before you transfer project data, ensure the destination slave is operating safely.

⚠ Caution

Transferring project data restarts the Controller and interrupts communications with slaves. The time that communications are interrupted depends on the EtherCAT network configuration.

Before you transfer project data, make sure that the slave settings will not adversely affect the devices.

⚠ Caution

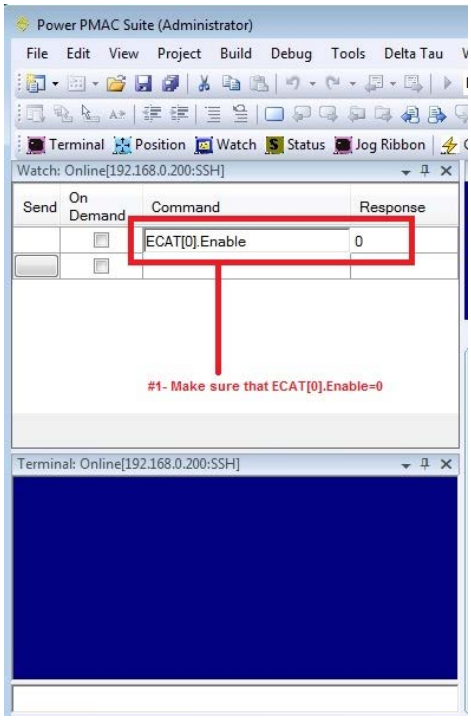
The procedure provided in this section checks the operations of the motion control devices, which may perform unexpected operations.

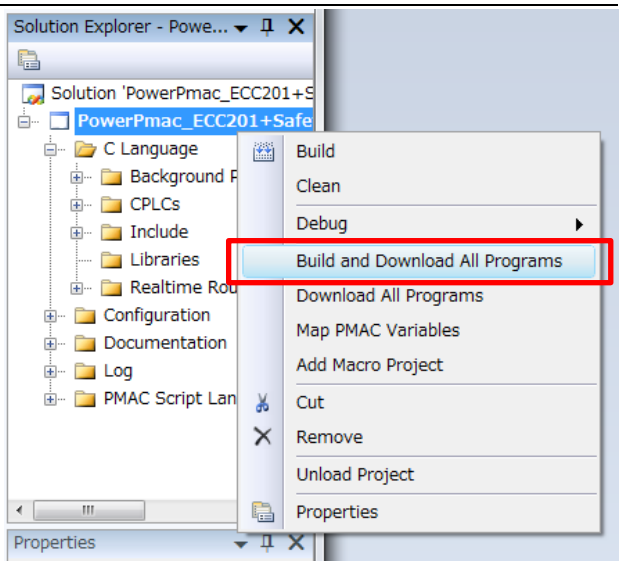
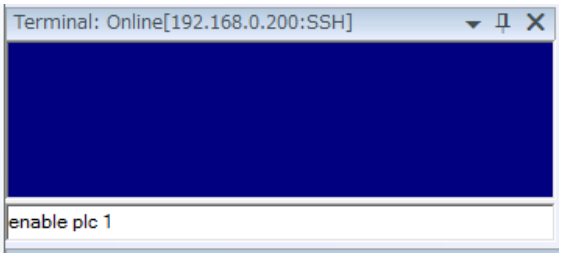
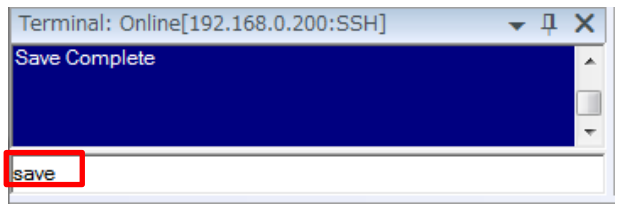
Take adequate safety measures before starting the checking process described in this section. Do not start the checking process unless safety is ensured.

When performing the operation check, implement all the steps described in this section in order to put the output into a safe state.

1 In the Terminal or Watch pane, make sure that the ECAT[0].Enable value is *0*.

If the value is 1, run the ECAT[0].Enable=0 command from the Terminal pane to stop EtherCAT communications.

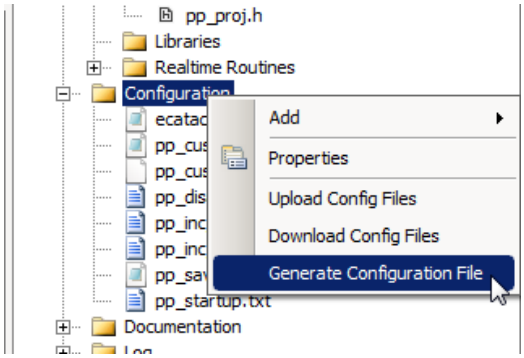
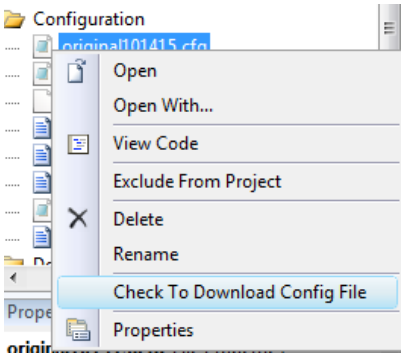
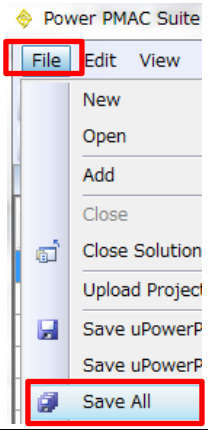


2	Downloading a project Right-click the project name in the Solution Explorer pane on the upper right of the IDE screen, and select **Build and Download All Programs** to run the build and download.	
3	Make sure that there are no errors in the Output tab page. * If the transfer fails, check details of the error in the Output tab page. If the error is a program error, you must review the program. If the error is related to EtherCAT settings, return to System Setup and check whether there are any incorrect settings.	
4	The program starts running when it has been downloaded successfully. Make sure that EtherCAT communications are in the OP state, and that the motor rotates. * If the motor does not rotate, check that the ECAT[0].Enable value is *1* in the Terminal or Watch pane. If the value is *0*, run the following command from the Terminal pane. enable plc 1	
5	After you have confirmed an appropriate operation, save the project to the Controller. Run the save command from the Terminal pane. * The transferred project is not yet saved on the Controller at this stage. If you turn OFF the power to the Controller, the transferred project will be discarded.	

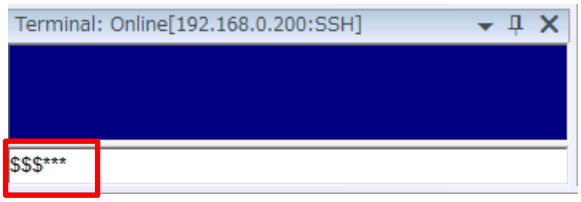
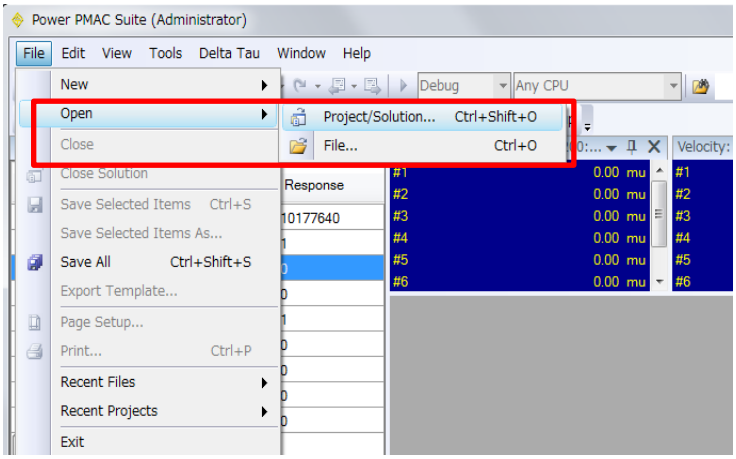
7. Appendix Saving and Loading a Project

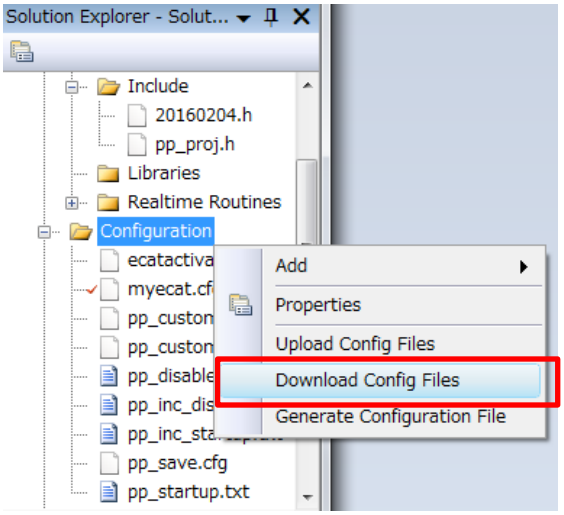
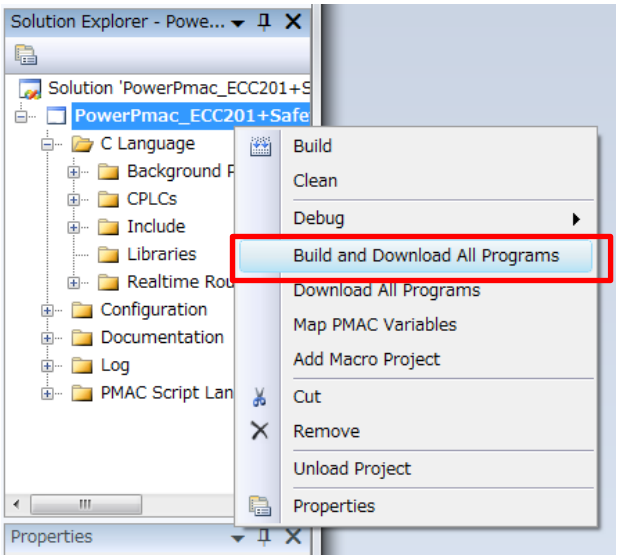
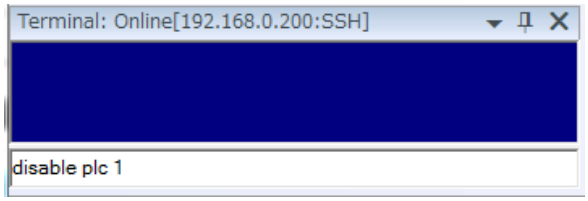
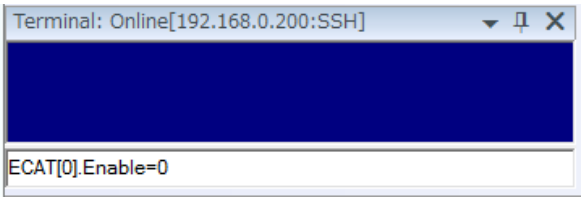
The following describes the procedures to save a Power PMAC IDE project on the computer, and to reuse it.

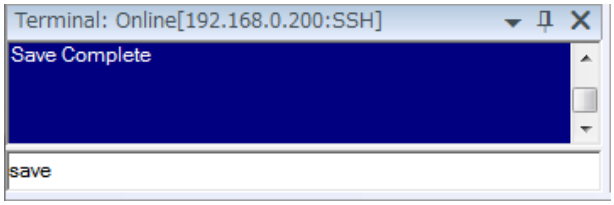
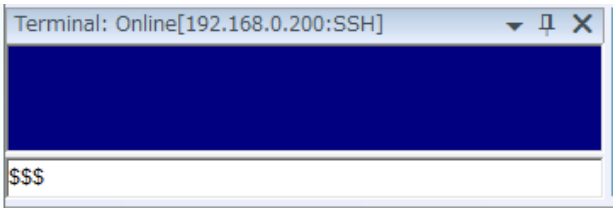
7.1. Saving a Project

1	Creating a Configuration File Create a Configuration File to save parameters you have changed in **System Setup** to the project. Right-click **Configuration** in the Solution Explorer pane, and select **Generate Configuration File**. A Configuration File is added to **Configuration**.	
2	Right-click on the Configuration File, and from the menu, select **Check To Download Config File** to include it in files to be downloaded.	
3	Saving a Project In the **File** menu, run **Save All** to save the project on the computer.	

7.2. Loading and Downloading a Project

1	Start Power PMAC IDE, and connect to the Controller.	
2	In the Terminal pane, type the $$$*** command to reset the Controller settings to factory default.	
3	In the **File** menu, Click **Open** – **Project/Solution** to load the project that you saved.	
4	Downloading an ENI file From the **Tools** menu of Power PMAC IDE, select **System Setup** to display **System Setup**.	
5	Click **Browse**, and load the ENI configuration file that you created in *6.4.4 Creation of an EtherCAT Network Configuration File*.	
6	Click **Download ENI file** to download the EtherCAT network configuration to the Controller.	

7	Right-click **Configuration** in the Solution Explorer pane, and select **Download Config Files** to download the file to the Controller.	
8	Right-click the project name in the Solution Explorer pane, and select **Build and Download All Programs** to run the build and download. When the download process is complete, make sure that there are no errors in the Output tab page.	
9	Stopping a program If a program is running, execute the following command from the Terminal pane to stop the program. disable plc 1 ECAT[0].Enable=0	 

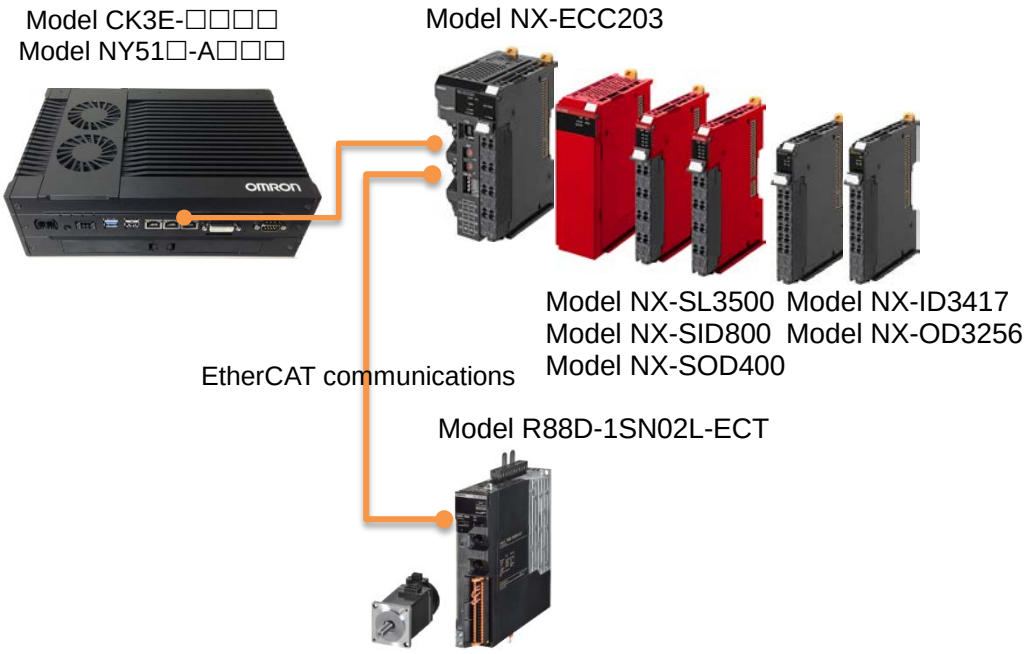
10	Saving the downloaded settings and programs After the download process is complete and you make sure that there are no errors in the Output tab page, run the save command from the Terminal pane. * The save command stores the downloaded project in the Controller. This operation saves the settings to be executed automatically when the power to the Controller is turned on.	
11	Restarting after download Run the following command from the Terminal pane to restart the Controller with the downloaded project. $$$	

8. Appendix Using Safety Function

To use the STO function in EtherCAT communications, you need to configure the settings for the EtherCAT master and Safety CPU Unit.

8.1. Device Configuration

The following shows an example of hardware components connected to the safety controller.



8.2. Workflow

8.3 EtherCAT Coupler Unit Settings — Prepare to set the EtherCAT Coupler Unit.

▼

8.3.1 Creation of a New Project

▼

8.3.2 Network Configuration Settings

▼

8.3.3 I/O Map Settings

▼

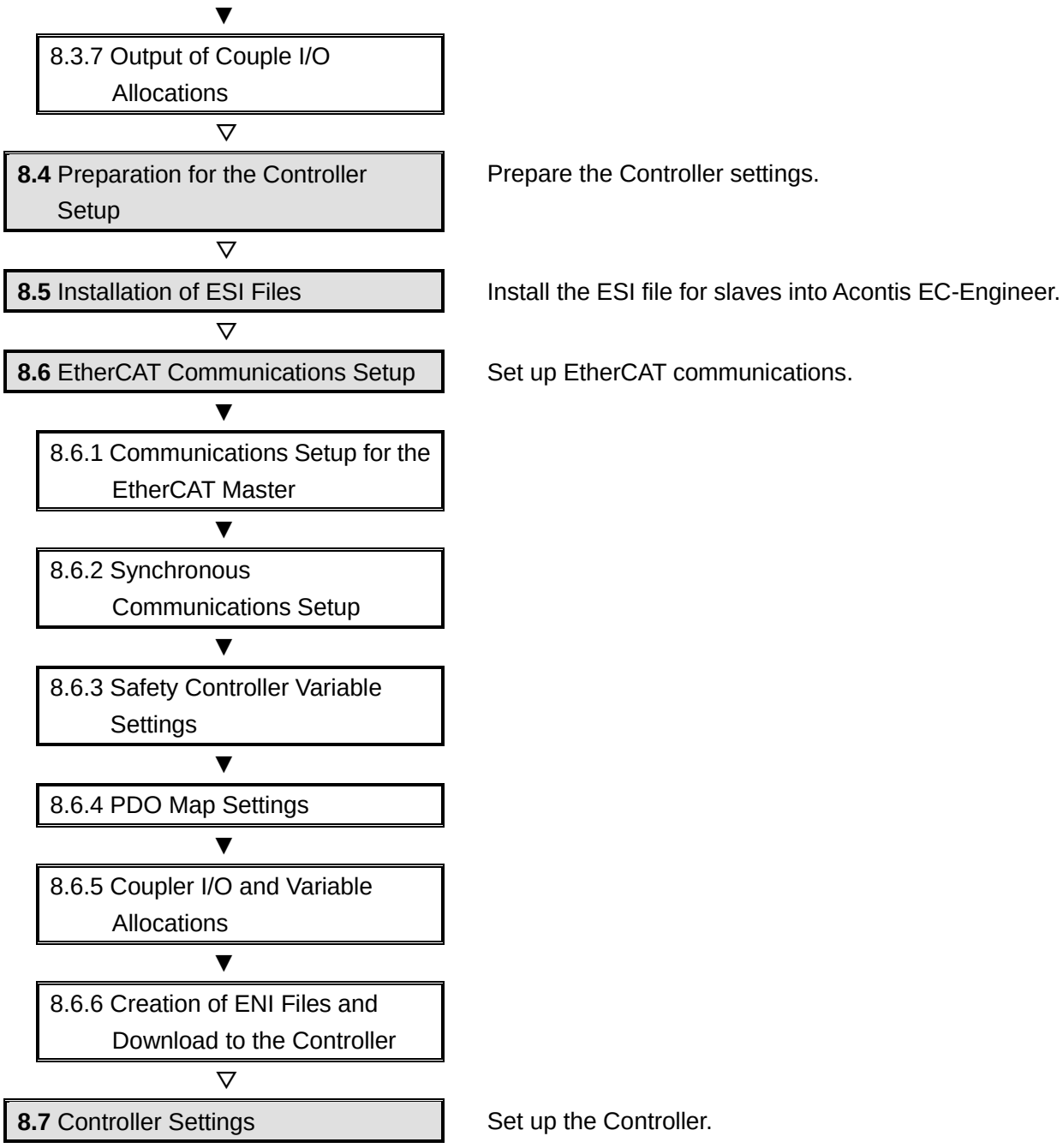
8.3.4 Safety I/O Function Settings

▼

8.3.5 Creation of Safety Programs

▼

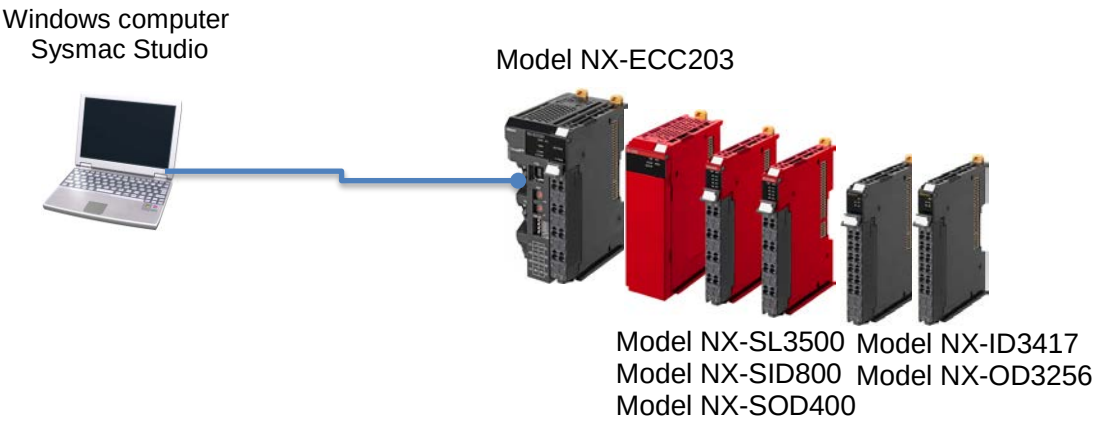
8.3.6 Transfer via Connection to the Communications Coupler Unit


8.3.7 Output of Couple I/O Allocations
8.4 Preparation for the Controller Setup
Prepare the Controller settings.
8.5 Installation of ESI Files
Install the ESI file for slaves into Acontis EC-Engineer.
8.6 EtherCAT Communications Setup
Set up EtherCAT communications.
8.6.1 Communications Setup for the EtherCAT Master
8.6.2 Synchronous Communications Setup
8.6.3 Safety Controller Variable Settings
8.6.4 PDO Map Settings
8.6.5 Coupler I/O and Variable Allocations
8.6.6 Creation of ENI Files and Download to the Controller
8.7 Controller Settings
Set up the Controller.

8.3. EtherCAT Coupler Unit Settings

Configure the slave terminal settings for the EtherCAT Coupler Unit.

Prepare a computer with Sysmac Studio installed.

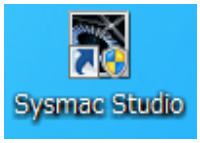


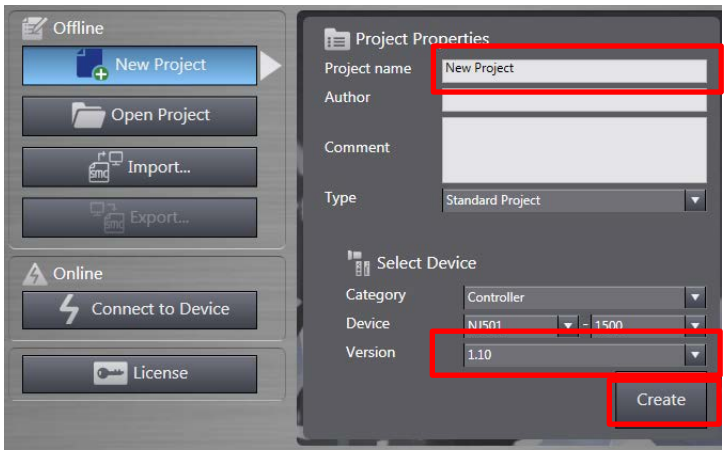
Additional Information

For the setting procedures for the EtherCAT Coupler Unit and Safety CPU Unit, also refer to *Programmable Multi-Axis Controller Startup Guide* for *EtherCAT® Communication Coupler Safety Controllers* and *I/O Units*.

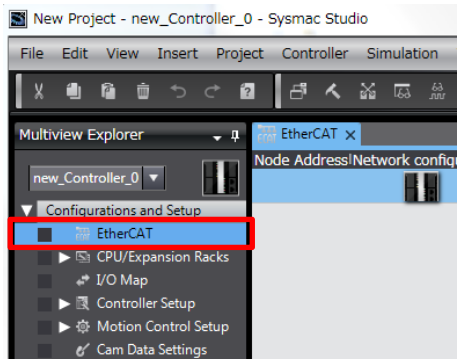
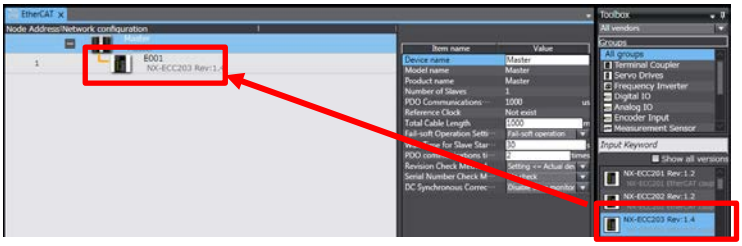
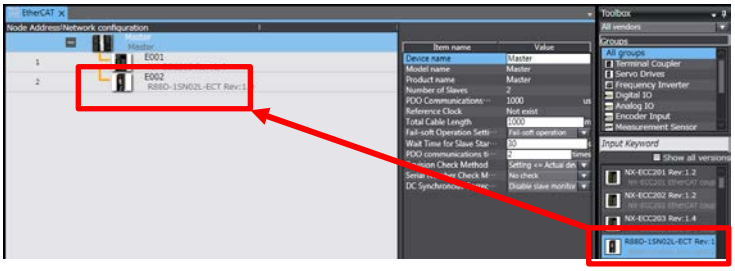
8.3.1. Creation of a New Project

1	Connect the coupler to the computer using a USB cable.
2	Turn on the power to the coupler and safety controller.
3	Start the Sysmac Studio. * If the dialog for confirming access rights appears upon start-up, select starting of Sysmac Studio.



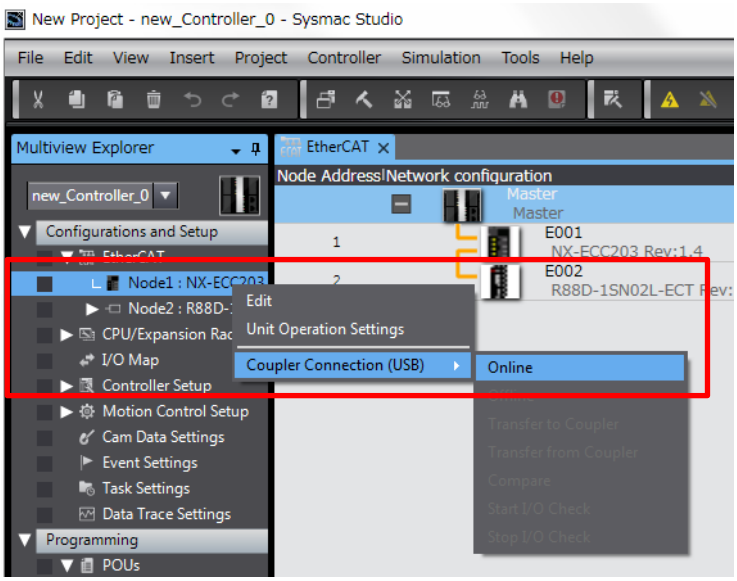
4	Create a project in the Sysmac Studio. Enter **Project name** and other items of information. Select *1.10* for **Version**, then, click **Create**.	

8.3.2. Network Configuration Settings

1	Double-click **EtherCAT** under **Configurations and Setup** in the Multiview Explorer.	
2	Select EtherCAT Coupler Unit **NX-ECC203** in the toolbox, and drag and drop it directly below the master in the EtherCAT Configuration Edit tab page.	
3	Select **R88D-1SN02L-ECT** in the toolbox, and drag and drop it directly below **NX-ECC203** in the EtherCAT Configuration Edit tab page.	

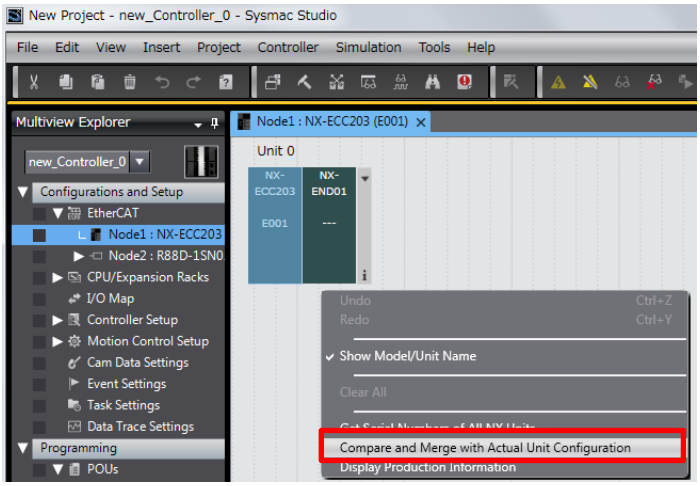
Right-click **NX-ECC203** in the Multiview Explorer, and select **Coupler Connection (USB)** then **Online**.

After you have confirmed the destination of the USB connection, click the **OK** button.



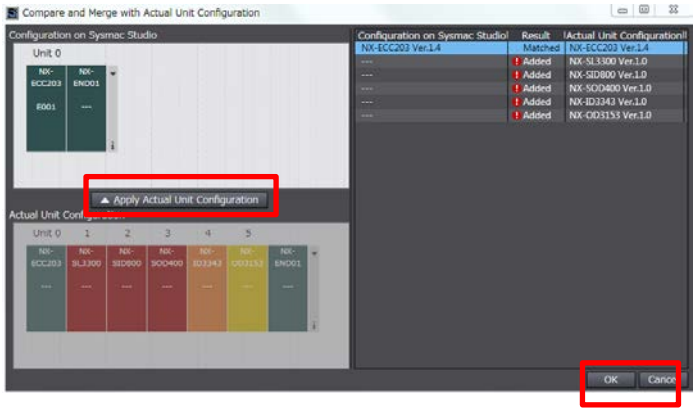
4 Double-click **NX-ECC203** in the Multiview Explorer to open the NX-ECC203 edit page.

Right-click in the NX-ECC203 tab page and select **Compare and Merge with Actual Unit Configuration** from the menu.

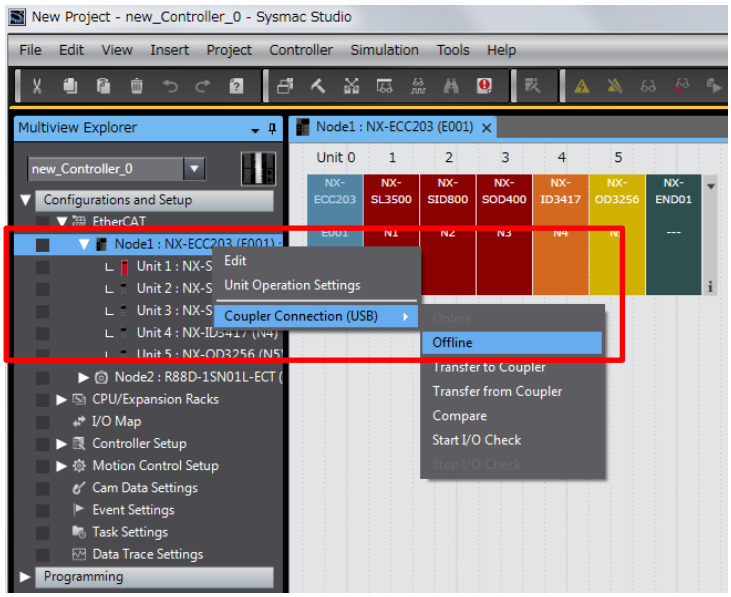


5 Click **Apply Actual Unit Configuration** to apply the actual unit configuration.

When the setting is complete, click **OK**.



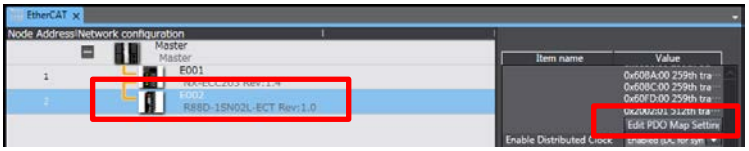
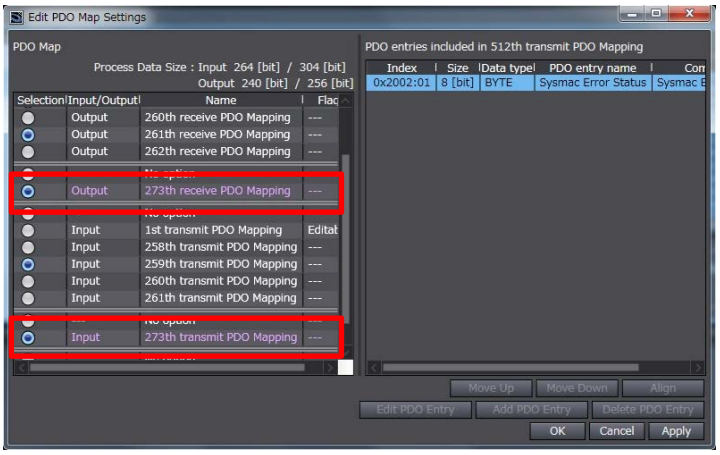
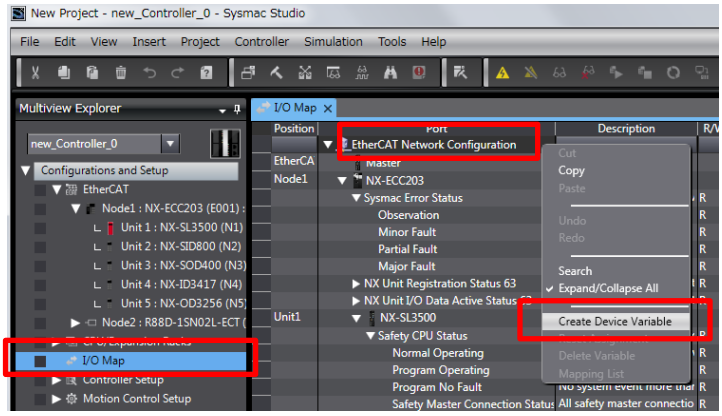
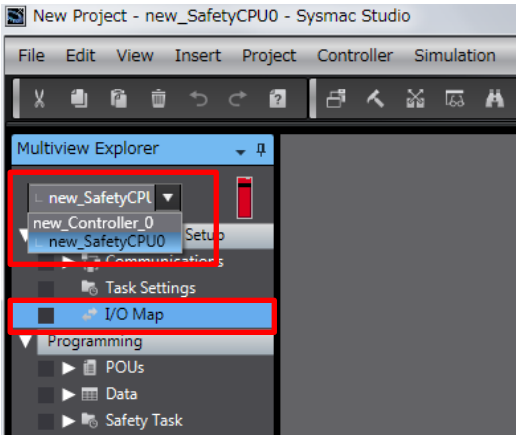
6 Right-click **NX-ECC203** in the Multiview Explorer, and select **Coupler Connection (USB)** then **Offline**.

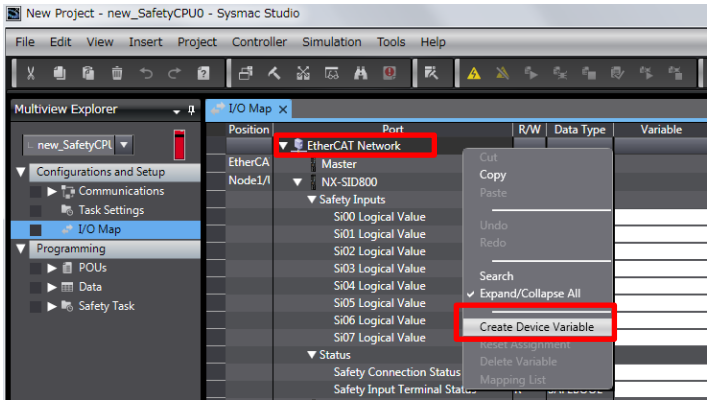


Precautions for Correct Use

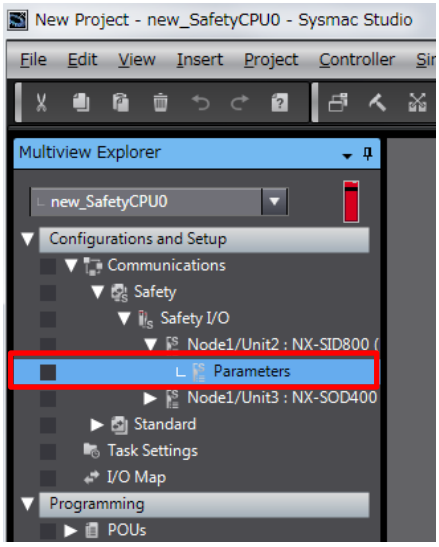
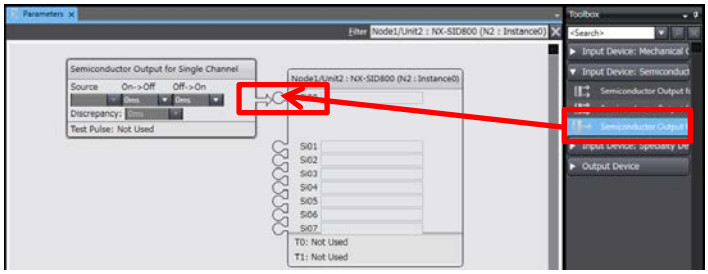
You can read only the Unit configuration in the Slave Terminal by comparing and merging with the actual Unit configuration. You cannot read the I/O allocation information, Unit operation settings, and Unit application data.

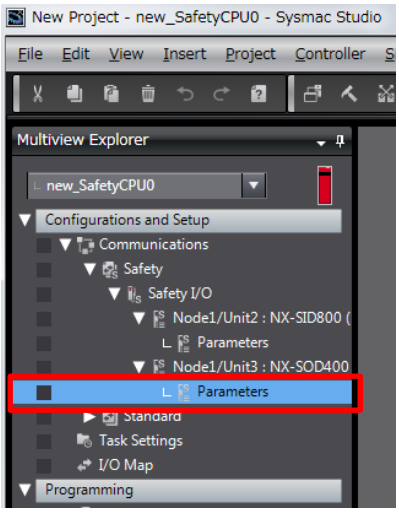
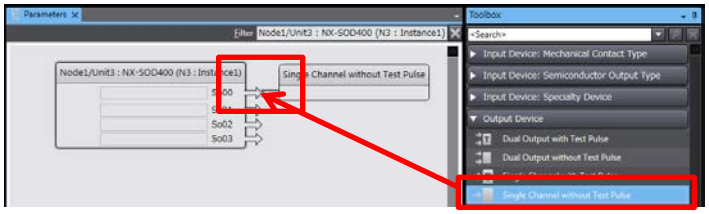
8.3.3. I/O Map Settings

1	Configure the PDO mapping settings for Servo Driver. Select R88D-1SN02L-ECT, then click **Edit PDO Map Settings**.	
2	In the Edit PDO Map Settings page, select **output 273th** and **input 273th**, then click **OK**.	
3	In the Multiview Explorer, select **Configurations and Setup**, then I/O map tab page to open the I/O map pane. Right-click on **EtherCAT Network Configuration**, and select **Create Device Variable** from the menu.	
4	From the controller selection box in the Multiview Explorer, select the target Safety CPU Unit. Double-click **I/O map** to open the Safety I/O map tab page.	

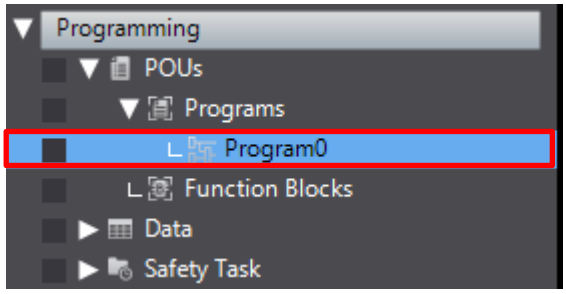
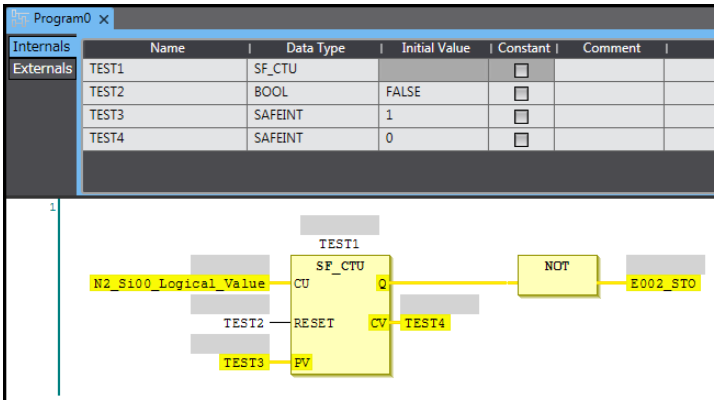
5	Right-click on **EtherCAT Network**, and select **Create Device Variable** from the menu.	

8.3.4. Safety I/O Function Settings

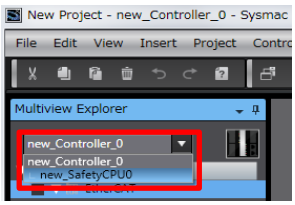
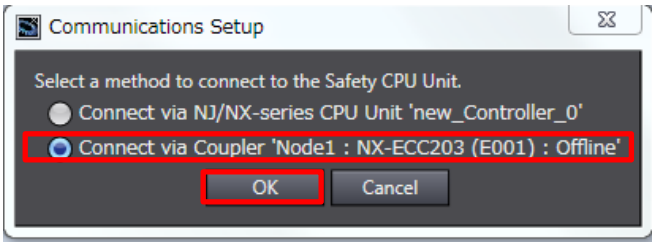
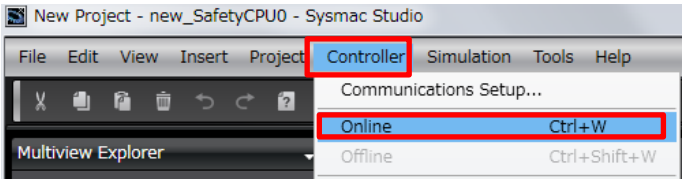
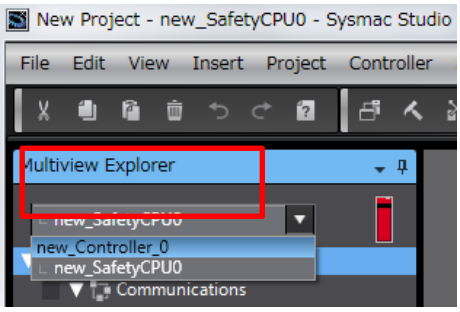
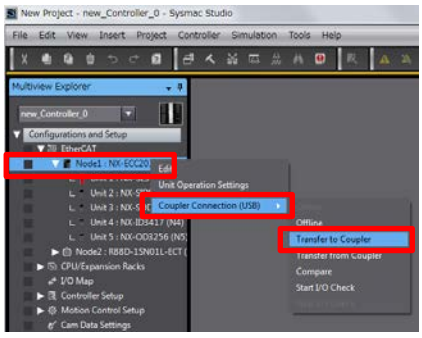
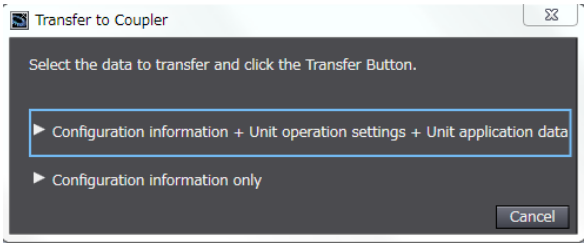
1	From the controller selection box in the Multiview Explorer, select the target Safety CPU Unit. Double-click **Safety Slave Unit Parameter Settings** under NX-SID800 of **Configurations and Setup**.	
2	Select **Output Single-channel Semi-conductor** from the toolbox, and drag and drop it on to input terminal Si00.	

3	Double-click **Safety Slave Unit Parameter Settings** under NX-SO400 of **Configurations and Setup**.	
4	Select **Single Channel (without test pulse)** from the toolbox, and drag and drop it on to output terminal So00.	

8.3.5. Creation of Safety Programs

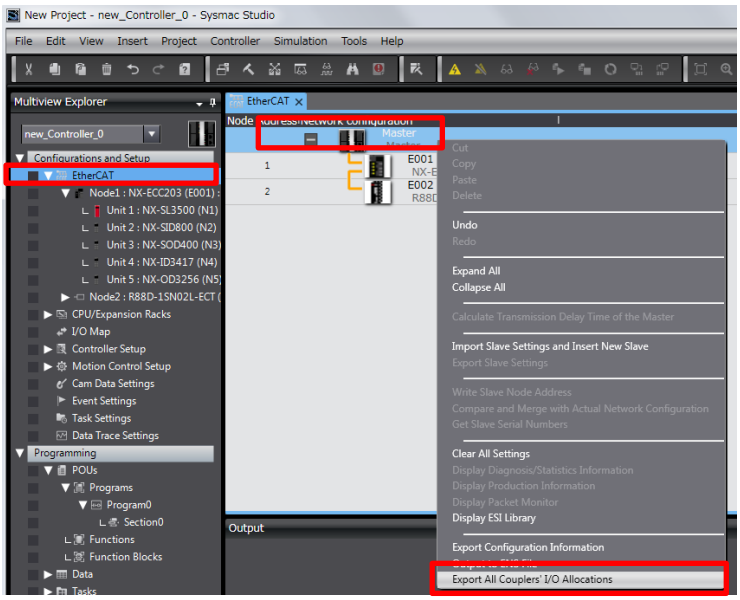
1	Registering programs Right-click **Programs** under **Programming** – **POUs** in the Multiview Explorer, and select **Add** – **Programs** from the menu.	
2	Creating programs Refer to *Section 7 Programming* in the Safety Control Unit User's Manual to create safety programs.	

8.3.6. Transfer via Connection to the Communications Coupler Unit

1	From the controller selection box in the Multiview Explorer, select a Safety CPU Unit.	
2	Select **Controller**, then **Communications Setup** from the menu. Select **Connect via Coupler** in the Communications Setup dialog box, then click the **OK** button.	
3	Select **Controller**, then **Online** from the menu. The unit is in online connection with slave terminals.	
4	From the controller selection box in the Multiview Explorer, select a controller.	
5	In the edit page for slave terminals, right-click the Communications Coupler Unit, then select **Transfer the Settings from computer to Communications Coupler**.	
	Click **Configuration information only** or **Configuration information + Unit operation setting + Unit application data.**	

8.3.7. Output of Couple I/O Allocations

1	Select **Controller**, then **Offline** from the menu.
2	Double-click **EtherCAT** under **Configurations and Setup** in the Multiview Explorer. Right-click on **Master**, then select **Export All Coupler's I/O Allocations**.



8.4. Preparation for the Controller Setup

Perform the procedure provided in *6.2 Preparation for the Controller Setup*.

8.5. Installation of ESI Files

Perform the procedure provided in *6.3 Installation of ESI Files*.

8.6. EtherCAT Communications Setup

8.6.1. Communications Setup for the EtherCAT Master

Perform the procedure provided in *6.4.1 Communications Setup for the EtherCAT Master*.

8.6.2. Synchronous Communications Setup

Perform the procedure provided in *6.4.2 Distributed Clock Setup*.

8.6.3. Safety Controller Variable Settings

(1) Checking the coupler I/O allocations

Decompress the ZIP file you saved in *8.3.7 Output of Couple I/O Allocations*, open the expanded "CouplerMemoryMap.xml", and check the contents.

The following is an example displayed using Internet Explorer.

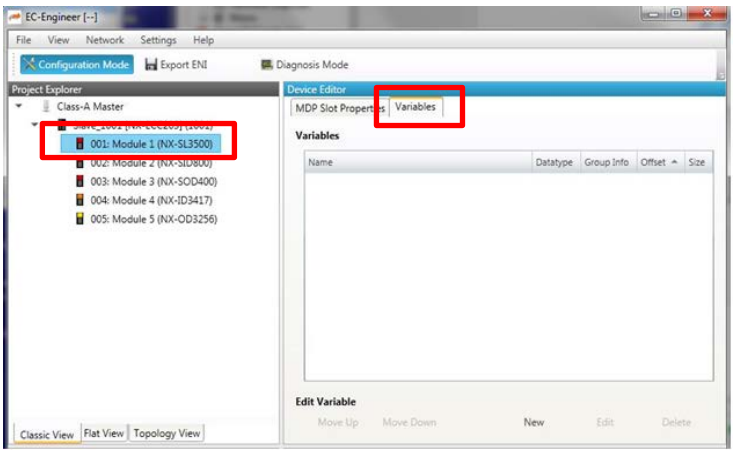
Deviece	PDO Mapping					PDO entry				
Name	Name	Index	SM	Offset	Size	Name	Index	Data type	Offset	Size
E001	TxPDO									
	Slot0(NX-ECC203)505th transmit PDO Mapping	#x1BF8	3	0.00	16.00	NX Unit Registration Status 63	#x2003:03	ARRAY [0..7] OF BYTE	0.00	8.00
						NX Unit I/O Data Active Status 63	#x2005:03	ARRAY [0..7] OF BYTE	8.00	8.00
	Slot0(NX-ECC203)512th transmit PDO Mapping	#x1BFF	3	16.00	1.00	Sysmac Error Status	#x2001:01	USINT	16.00	1.00
	Slot0(NX-ECC203)PaddingTxPdo	#x1BF4	3	17.00	1.00	---	---	---	---	1.00
	Slot4(NX-ID3417)Input Data Set 1	#x1A0C	3	18.00	0.04	Input Bit 00	#x6060:01	BOOL	18.00	0.01
						Input Bit 01	#x6060:02	BOOL	18.01	0.01
						Input Bit 02	#x6060:03	BOOL	18.02	0.01
						Input Bit 03	#x6060:04	BOOL	18.03	0.01
	Slot0(NX-ECC203)PaddingTxPdo	#x1BF6	3	18.04	1.04	---	---	---	---	1.04
	Slot1(NX-SL3500)Input Data Set 1	#x1A00	3	20.00	20.00	Node1/Unit2	#x6000:01	ARRAY [0..6] OF BYTE	20.00	7.00
						Node1/Unit3	#x6000:02	ARRAY [0..5] OF BYTE	27.00	6.00
						Node2	#x6000:03	ARRAY [0..6] OF BYTE	33.00	7.00
	Slot1(NX-SL3500)Input Data Set 2	#x1A01	3	40.00	2.00	Safety CPU Status	#x6004:01	UINT	40.00	2.00
	Slot2(NX-SID800)Input Data Set 1	#x1A04	3	42.00	7.00	FSoE Slave CMD	#x6020:01	USINT	42.00	1.00
						Safety Input 1st Word	#x6021:01	UINT	43.00	2.00
						FSoE Slave CRC_0	#x6020:03	UINT	45.00	2.00
						FSoE Slave Conn_ID	#x6020:02	UINT	47.00	2.00
	Slot2(NX-SID800)Input Data Set 2	#x1A05	3	49.00	3.00	Standard Input 1st Word	#x6022:01	UINT	49.00	2.00
						Standard Input 2nd Byte	#x6022:02	USINT	51.00	1.00
	Slot3(NX-SOD400)Input Data Set 1	#x1A08	3	52.00	6.00	FSoE Slave CMD	#x6040:01	USINT	52.00	1.00
						Safety Input 1st Byte	#x6041:01	USINT	53.00	1.00
						FSoE Slave CRC_0	#x6040:03	UINT	54.00	2.00
						FSoE Slave Conn_ID	#x6040:02	UINT	56.00	2.00
	Slot3(NX-SOD400)Input Data Set 2	#x1A09	3	58.00	2.00	Standard Input 1st Byte	#x6042:01	USINT	58.00	1.00
						Standard Input 2nd Byte	#x6042:02	USINT	59.00	1.00
	RxPDO									
	Slot5(NX-OD3256)Output Data Set 1	#x1610	2	0.00	0.04	Output Bit 00	#x7080:01	BOOL	0.00	0.01
						Output Bit 01	#x7080:02	BOOL	0.01	0.01
						Output Bit 02	#x7080:03	BOOL	0.02	0.01
						Output Bit 03	#x7080:04	BOOL	0.03	0.01
	Slot0(NX-ECC203)PaddingRxPdo	#x17F6	2	0.04	1.04	---	---	---	---	1.04
	Slot1(NX-SL3500)Output Data Set 1	#x1600	2	2.00	20.00	Node1/Unit2	#x7000:01	ARRAY [0..6] OF BYTE	2.00	7.00
						Node1/Unit3	#x7000:02	ARRAY [0..5] OF BYTE	9.00	6.00
						Node2	#x7000:03	ARRAY [0..6] OF BYTE	15.00	7.00
	Slot1(NX-SL3500)Output Data Set 2	#x1601	2	22.00	0.00					
	Slot2(NX-SID800)Output Data Set 1	#x1604	2	22.00	7.00	FSoE Master CMD	#x7020:01	USINT	22.00	1.00
						Safety Output 1st Word	#x7021:01	UINT	23.00	2.00
						FSoE Master CRC_0	#x7020:03	UINT	25.00	2.00
						FSoE Master Conn_ID	#x7020:02	UINT	27.00	2.00
	Slot2(NX-SID800)Output Data Set 2	#x1605	2	29.00	3.00	Standard Output 1st Word	#x7022:01	UINT	29.00	2.00
						Standard Output 2nd Byte	#x7022:02	USINT	31.00	1.00
	Slot3(NX-SOD400)Output Data Set 1	#x1608	2	32.00	6.00	FSoE Master CMD	#x7040:01	USINT	32.00	1.00
						Safety Output 1st Byte	#x7041:01	USINT	33.00	1.00
						FSoE Master CRC_0	#x7040:03	UINT	34.00	2.00
						FSoE Master Conn_ID	#x7040:02	UINT	36.00	2.00
	Slot3(NX-SOD400)Output Data Set 2	#x1609	2	38.00	2.00	Standard Output 1st Byte	#x7042:01	USINT	38.00	1.00
						Standard Output 2nd Byte	#x7042:02	USINT	39.00	1.00

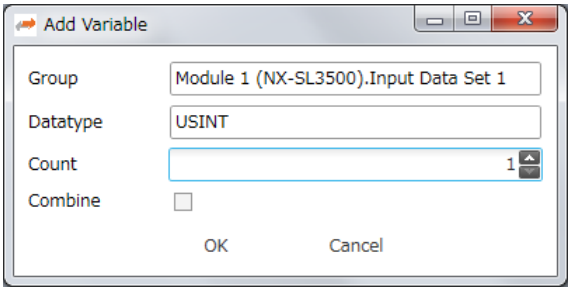
(2) Setting Input Data

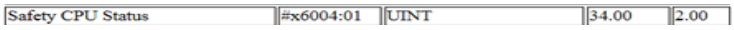
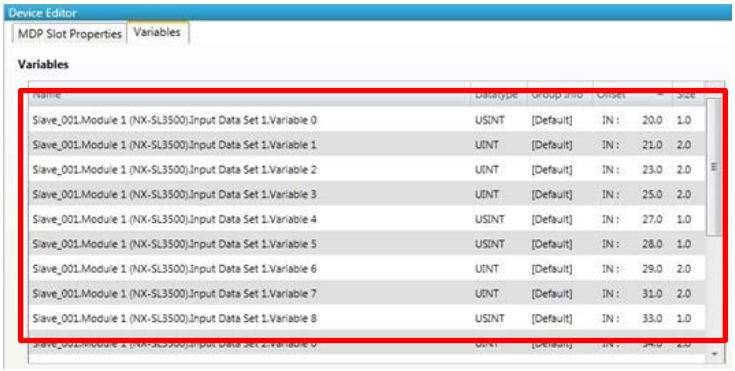
Register the following input data.

- Slot1(NX-SL3500)Input Data Set1
- Slot1(NX-SL3500)Input Data Set2

Slot1(NX-SL3500)Input Data Set 1	#x1A00	3	20.00	20.00	Node1/Unit2	#x6000:01	ARRAY [0..6] OF BYTE	20.00	7.00
					Node1/Unit3	#x6000:02	ARRAY [0..5] OF BYTE	27.00	6.00
					Node2	#x6000:03	ARRAY [0..6] OF BYTE	33.00	7.00
Slot1(NX-SL3500)Input Data Set 2	#x1A01	3	40.00	2.00	Safety CPU Status	#x6004:01	UINT	40.00	2.00
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	FSoE Slave CMD	#x6020:01	USINT	42.00	1.00
					Safety Input 1st Word	#x6021:01	UINT	43.00	2.00
					FSoE Slave CRC_0	#x6020:03	UINT	45.00	2.00
					FSoE Slave Conn_ID	#x6020:02	UINT	47.00	2.00
Slot2(NX-SID800)Input Data Set 2	#x1A05	3	49.00	3.00	Standard Input 1st Word	#x6022:01	UINT	49.00	2.00
					Standard Input 2nd Byte	#x6022:02	USINT	51.00	1.00
Slot3(NX-SOD400)Input Data Set 1	#x1A08	3	52.00	6.00	FSoE Slave CMD	#x6040:01	USINT	52.00	1.00
					Safety Input 1st Byte	#x6041:01	USINT	53.00	1.00
					FSoE Slave CRC_0	#x6040:03	UINT	54.00	2.00
					FSoE Slave Conn_ID	#x6040:02	UINT	56.00	2.00
Slot3(NX-SOD400)Input Data Set 2	#x1A09	3	58.00	2.00	Standard Input 1st Byte	#x6042:01	USINT	58.00	1.00
					Standard Input 2nd Byte	#x6042:02	USINT	59.00	1.00

1	Select a safety controller in the Project Explorer of EC-Engineer. Display the Variables tab page.	

2	[Slot1(NX-SL3500)Input Data Set1] Registering Node1/Unit2 (NX-SID800) Click **New** in the Variables tab page, and register two variables shown on the right.	 FSoE Slave CMD | #x6020:01 | USINT Group: Module 1(NX-SL3500).Input Data Set 1 Datatype: USINT Count: 1 Safety Input 1st Word | #x6021:01 | UINT FSoE Slave CRC_0 | #x6020:03 | UINT FSoE Slave Conn_ID | #x6020:02 | UINT Group: Module 1(NX-SL3500).Input Data Set 1 Datatype: UINT Count: 3
3	[Slot1(NX-SL3500)Input Data Set1] Registering Node1/Unit3 (NX-SOID400) Click **New** in the Variables tab page, and register two variables shown on the right.	FSoE Slave CMD | #x6040:01 | USINT Safety Input 1st Byte | #x6041:01 | USINT Group: Module 1(NX-SL3500).Input Data Set 1 Datatype : USINT Count : 2 FSoE Slave CRC_0 | #x6040:03 | UINT FSoE Slave Conn_ID | #x6040:02 | UINT Group: Module 1(NX-SL3500).Input Data Set 1 Datatype : UINT Count : 2
4	[Slot1(NX-SL3500)Input Data Set1] Registering Node2 Click **New** in the Variables tab page, and register three variables shown on the right.	Group: Module 1(NX-SL3500).Input Data Set 1 Datatype : USINT Count : 1 Group: Module 1(NX-SL3500).Input Data Set 1 Datatype : BOOL Count : 16 Group: Module 1(NX-SL3500).Input Data Set 1 Datatype : UINT Count : 2

5	[Slot1(NX-SL3500)Input Data Set2] Registering Safety CPU Status Click **New** in the Variables tab page, and register the variable shown on the right.	 Group: Module 1(NX-SL3500).Input Data Set 2 Datatype: UINT Count: 1
6	Checking Input Data Make sure that the settings (Input) in the Variables tab page are correct.	

(3) Setting Output Data

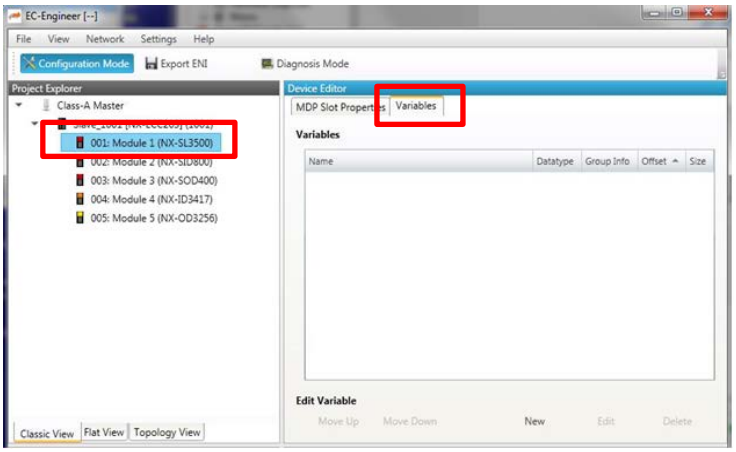
Register the following output data.

- Slot1(NX-SL3500)Output Data Set1
- Slot1(NX-SL3500)Output Data Set2

Slot1(NX-SL3500)Output Data Set 1	#x1600	2	2.00	20.00	Node1/Unit2	#x7000:01	ARRAY [0..6] OF BYTE	2.00	7.00
					Node1/Unit3	#x7000:02	ARRAY [0..5] OF BYTE	9.00	6.00
					Node2	#x7000:03	ARRAY [0..6] OF BYTE	15.00	7.00
Slot1(NX-SL3500)Output Data Set 2	#x1601	2	22.00	0.00					
Slot2(NX-SID800)Output Data Set 1	#x1604	2	22.00	7.00	FSoE Master CMD	#x7020:01	USINT	22.00	1.00
					Safety Output 1st Word	#x7021:01	UINT	23.00	2.00
					FSoE Master CRC_0	#x7020:03	UINT	25.00	2.00
					FSoE Master Conn_ID	#x7020:02	UINT	27.00	2.00
Slot2(NX-SID800)Output Data Set 2	#x1605	2	29.00	3.00	Standard Output 1st Word	#x7022:01	UINT	29.00	2.00
					Standard Output 2nd Byte	#x7022:02	USINT	31.00	1.00
Slot3(NX-SOD400)Output Data Set 1	#x1608	2	32.00	6.00	FSoE Master CMD	#x7040:01	USINT	32.00	1.00
					Safety Output 1st Byte	#x7041:01	USINT	33.00	1.00
					FSoE Master CRC_0	#x7040:03	UINT	34.00	2.00
					FSoE Master Conn_ID	#x7040:02	UINT	36.00	2.00
Slot3(NX-SOD400)Output Data Set 2	#x1609	2	38.00	2.00	Standard Output 1st Byte	#x7042:01	USINT	38.00	1.00
					Standard Output 2nd Byte	#x7042:02	USINT	39.00	1.00

7 Select a safety controller in the Project Explorer pane of EC-Engineer.

Display the Variables tab page.



8 [Slot1(NX-SL3500)Output Data Set1]

Registering Node1/Unit2 (NX-SID800)

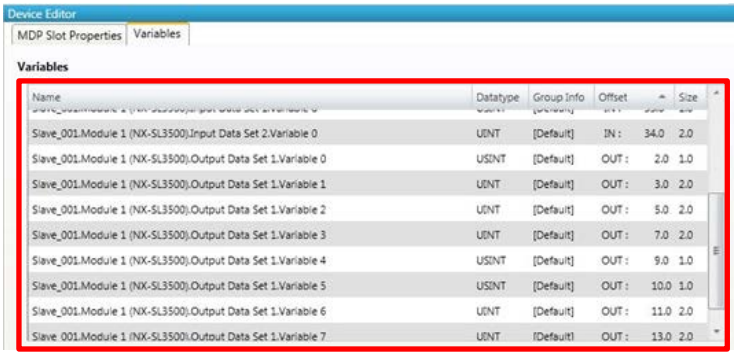
Click **New** in the Variables tab page, and register two variables shown on the right.

FSoE Master CMD	#x7020:01	USINT

Group: Module 1(NX-SL3500).Output Data Set 1
Datatype: USINT
Count: 1

Safety Output 1st Word	#x7021:01	UINT
FSoE Master CRC_0	#x7020:03	UINT
FSoE Master Conn_ID	#x7020:02	UINT

Group: Module 1(NX-SL3500).Output Data Set 1
Datatype: UINT
Count: 3

9	[Slot1(NX-SL3500)Output Data Set1] Registering Node1/Unit3 (NX-SOID400) Click **New** in the Variables tab page, and register two variables shown on the right.	FSoE Master CMD | #x7040:01 | USINT Safety Output 1st Byte | #x7041:01 | USINT Group: Module 1(NX-SL3500).Output Data Set 1 Datatype : USINT Count : 2 FSoE Master CRC_0 | #x7040:03 | UINT FSoE Master Conn_ID | #x7040:02 | UINT Group: Module 1(NX-SL3500).Output Data Set 1 Datatype : UINT Count : 2
10	[Slot1(NX-SL3500)Output Data Set1] Registering Node2 Click **New** in the Variables tab page, and register three variables shown on the right.	Group: Module 1(NX-SL3500).Output Data Set 1 Datatype : USINT Count : 1 Group: Module 1(NX-SL3500).Output Data Set 1 Datatype : BOOL Count : 16 Group: Module 1(NX-SL3500).Output Data Set 1 Datatype : UINT Count : 2
11	[Slot1(NX-SL3500)Output Data Set2] * *Output Data Set2* is not used and does not need to be set.	
12	Checking Output Data Make sure that the settings (Output) in the Variables tab page are correct.	

8.6.4. PDO Map Settings

Perform the procedure provided in *6.4.3 PDO Map Settings*.

8.6.5. Coupler I/O and Variable Allocations

(1) Checking the coupler I/O allocations

Decompress the ZIP file you saved in *8.3.7 Output of Couple I/O Allocations*, open the expanded "CouplerCopyInfo.xml", and check the contents.

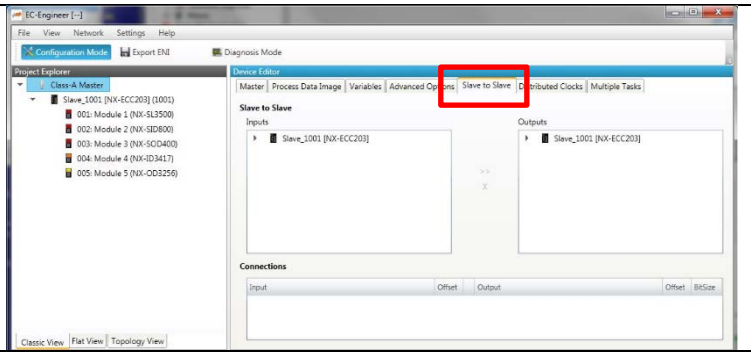
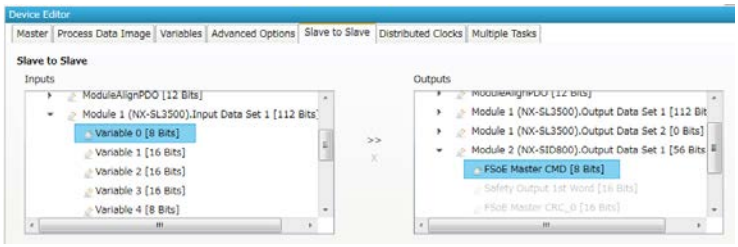
The following is an example displayed using Internet Explorer.

Original device name	Original slave model	Original SM	Original bit offset	Destination device name	Destination slave model	Destination SM	Destination bit offset	Bit size
E001	NX-ECC203	3	160	E001	NX-ECC203	2	176	56
E001	NX-ECC203	3	216	E001	NX-ECC203	2	256	48
E001	NX-ECC203	3	264	E002	R88D-1SN02L-ECT	2	184	56
E001	NX-ECC203	3	336	E001	NX-ECC203	2	16	56
E001	NX-ECC203	3	416	E001	NX-ECC203	2	72	48
E002	R88D-1SN02L-ECT	3	208	E001	NX-ECC203	2	120	56

(2) Setting Input Data

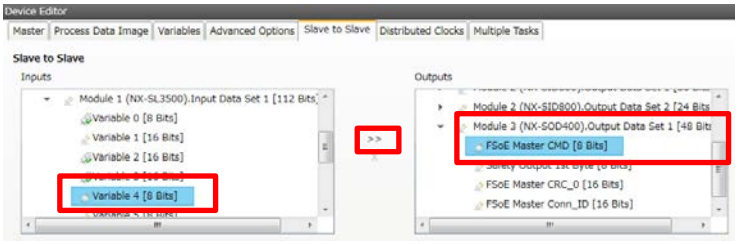
Associate the following items:

- **Module 1 (NX-SL3500).Input Data Set 1**, and **Module 2 (NX-SID800).Output Data Set 1**
- **Module 1 (NX-SL3500).Input Data Set 1**, and **Module 3 (NX-SOD400).Output Data Set 1**

1	Select *Class-A Master* in the Project Explorer page of EC-Engineer. Display the Slave to Slave tab page.	
2	Expand **Slave_1001 [NX-ECC203]** – **Module 1 (NX-SL3500).Input Data Set 1** in Inputs. Expand **Slave_1001 [NX-ECC203]** – **Module 2 (NX-SID800).Output Data Set 1** in Outputs. Select an Inputs item, then select the corresponding Outputs item and click **>>**.	 Associate the following items: Inputs / Outputs Variable 0 / FSoE Master CMD Variable 1 / Safety Output 1st Word Variable 2 / FSoE Master CRC_0 Variable 3 / FSoE Master Conn_ID

3 Expand **Slave_1001 [NX-ECC203]** – **Module 1 (NX-SL3500).Input Data Set 1** in Inputs.
Expand **Slave_1001 [NX-ECC203]** – **Module 3 (NX-SOD400).Output Data Set 1** in Outputs.

Select an Inputs item, then select the corresponding Outputs item and click **>>**.

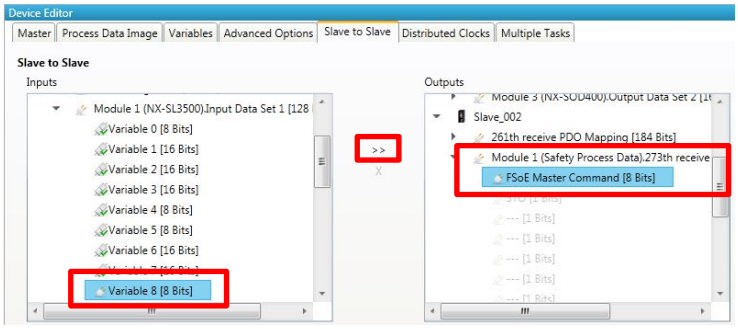


Associate the following items:

Inputs	Outputs
Variable 4	FSoE Master CMD
Variable 5	Safety Output 1st Word
Variable 6	FSoE Master CRC_0
Variable 7	FSoE Master Conn_ID

4 Expand **Slave_1001 [NX-ECC203]** – **Module 1 (NX-SL3500).Input Data Set 1** in Inputs.
Expand **Salve_002** – **Module 1 (Safety Process Data). 273th receive PDO Mapping** in Outputs.

Select an Inputs item, then select the corresponding Outputs item and click **>>**.



Associate the following items:

Inputs	Outputs
Variable 8	FSoE Master Command
Variable 9	
Variable 10	

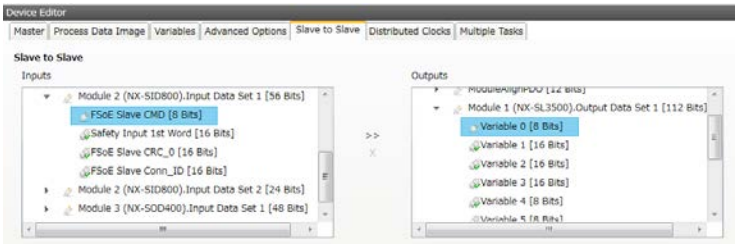
(3) Setting Output Data

Associate the following items:

- **Module 2 (NX-SID800).Input Data Set 1**, and **Module 1 (NX-SL3500).Output Data Set 1**
- **Module 3 (NX-SOD800).Input Data Set 1**, and **Module 1 (NX-SL3500).Output Data Set 1**

5 Expand **Slave_1001 [NX-ECC203]** – **Module 2 (NX-SID800).Input Data Set 1** in Inputs.
Expand **Slave_1001 [NX-ECC203]** – **Module 1 (NX-SL3500).Output Data Set 1** in Outputs.

Select an Inputs item, then select the corresponding Outputs item and click **>>**.

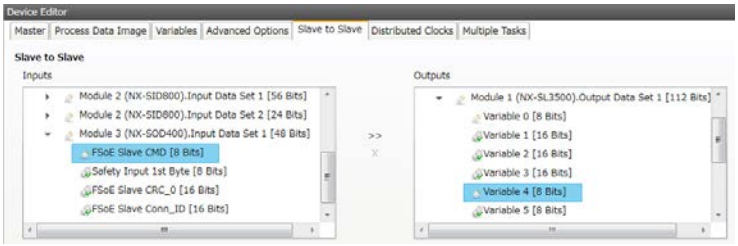


Associate the following items:

Inputs	Outputs
FSoE Master CMD	Variable 0
Safety Output 1st Word	Variable 1
FSoE Master CRC_0	Variable 2
FSoE Master Conn_ID	Variable 3

6 Expand **Slave_1001 [NX-ECC203]** – **Module 3 (NX-SOD800).Input Data Set 1** in Inputs.
Expand **Slave_1001 [NX-ECC203]** – **Module 1 (NX-SL3500).Output Data Set 1** in Outputs.

Select an Inputs item, then select the corresponding Outputs item and click **>>**.

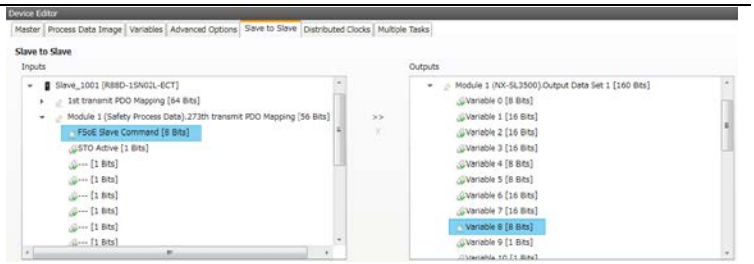


Associate the following items:

Inputs	Outputs
FSoE Master CMD	Variable 4
Safety Output 1st Word	Variable 5
FSoE Master CRC_0	Variable 6
FSoE Master Conn_ID	Variable 7

7 Expand **Slave_1001[R88D-1SN02L-ECT]** – **Module 1 (Safety Process Data). 273th receive PDO Mapping** in Inputs.
Expand **Module 1 (NX-SL3500).Output Data Set 1** in Outputs.

Select an Inputs item, then select the corresponding Outputs item and click **>>**.



Associate the following items:

Inputs	Outputs
FSoE Slave Command	Variable 8
	Variable 9
	Variable 10
	Variable 11

8.6.6. Creation of ENI Files and Download to the Controller

Perform the procedure provided in *8.6.6 Creation of ENI Files and Download to the Controller*.

8.7. Controller Settings

Perform the procedure provided in *8.7 Controller Settings*.

9. Appendix Troubleshooting

9.1. Factors Causing EtherCAT Communications To Be Unavailable, and Corrective Actions

Description	Factor	Corrective Action
The link is not established.	The Ethernet cable is broken or the specified cable is not being used.	If the Ethernet cable is broken or if the specified cable was not used, replace the cable.
	A connector on the Ethernet cable used for EtherCAT communications is disconnected, the contact is faulty, or parts are faulty.	Reconnect the connector and make sure it is mated correctly.
	A slave within the EtherCAT network configuration failed.	Replace the slave.
EtherCAT communications do not start.	ECAT[0].Enable is set to *0*.	From the Terminal pane, run the ECAT[0].Enable=1 command to start EtherCAT communications.
	The EtherCAT network configuration in the Controller does not agree with the physical network configuration.	Review the settings according to the procedures provided in *6.4 EtherCAT Communications Setup*.
	The Ethernet cable is broken at a slave in the network, or a connector is disconnected.	Connect the Ethernet cable correctly.
	Some errors have occurred, and the ECAT[0].error is set to a value other than *0*.	Check the ECAT[0].error value.
A synchronization error occurs at a slave.	The distribution clock is not set correctly.	Review the settings according to the procedures provided in *6.4.2 Distributed Clock Setup*.
	A slave in Free-Run Mode is set to the reference clock.	
	The servo task processing time exceeds the set period.	Review the program or servo frequency to adjust it, so that the servo task processing time does not exceed the period.

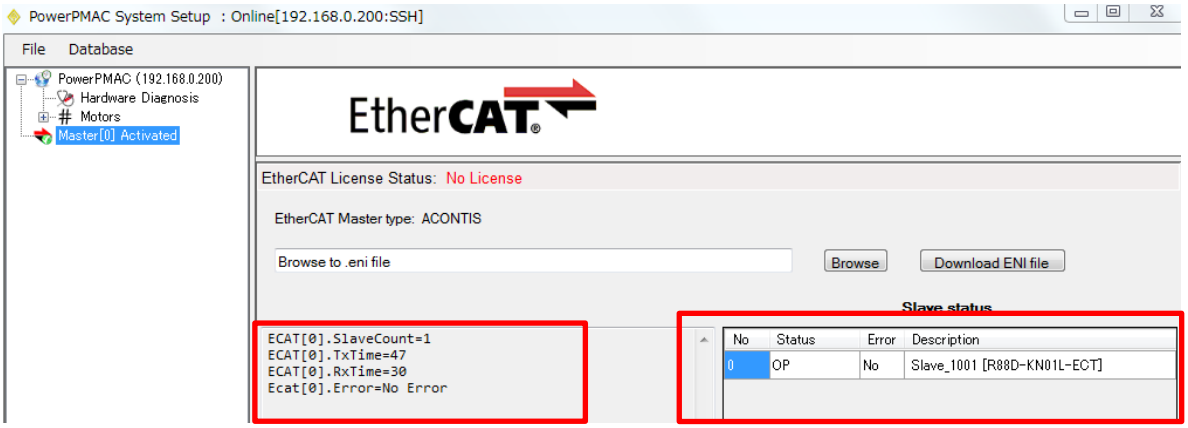
9.2. How to Check for Errors

9.2.1. Checking the EtherCAT Status

You can check the EtherCAT status from **System Setup** of Power PMAC IDE and **Diagnosis Mode** of Acontis EC-Engineer.

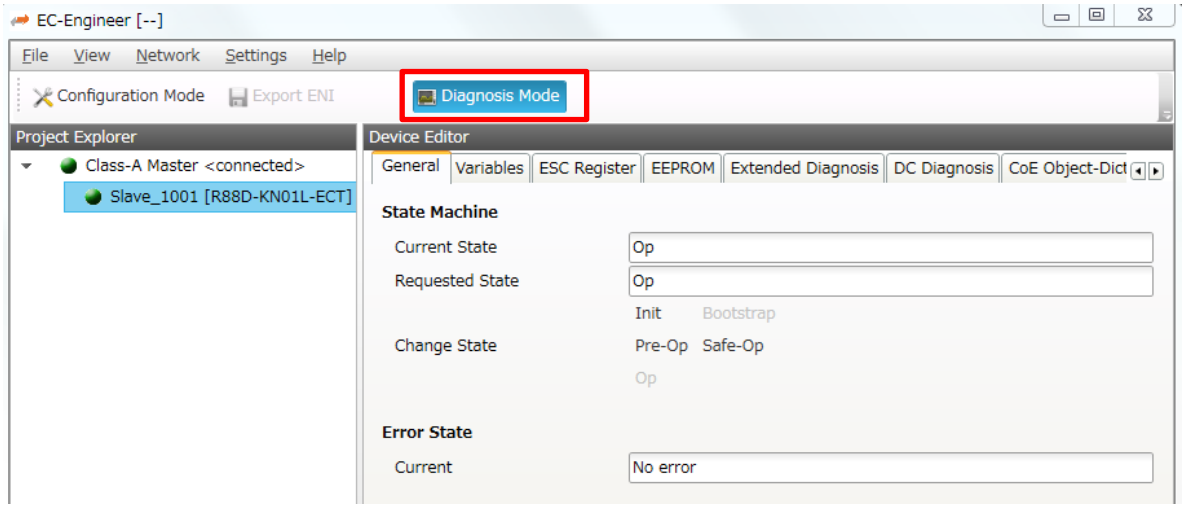
■ **System Setup** of Power PMAC IDE

You can check the status of the EtherCAT master and slaves in the System Setup page of Power PMAC IDE.

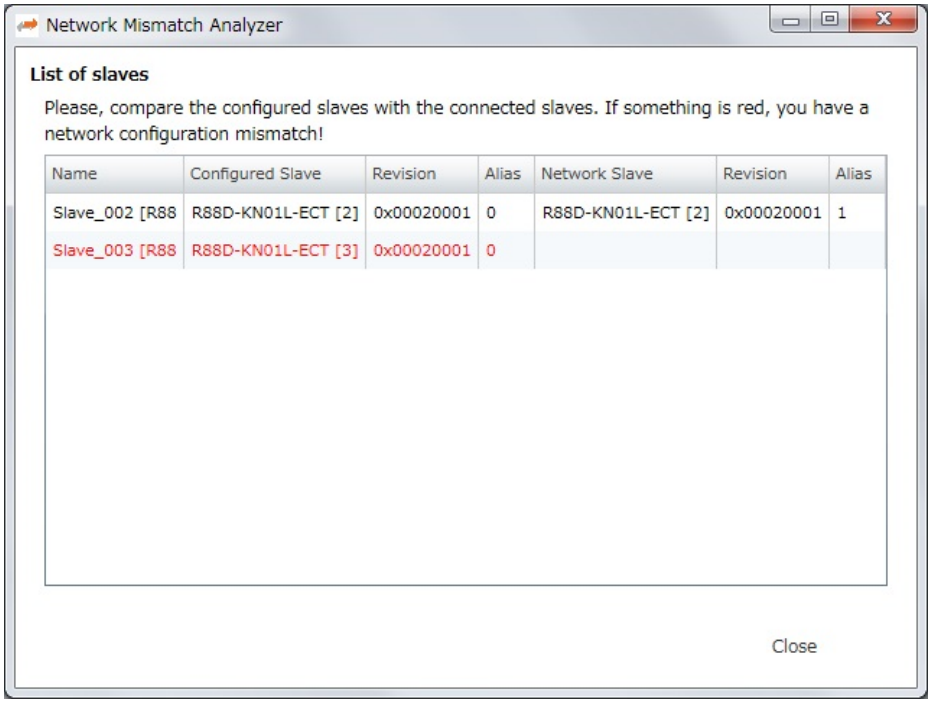


■ **Diagnosis Mode** of Acontis EC-Engineer

You can check the status of the slaves in the Diagnosis Mode page of Acontis EC-Engineer.



Select **Network** then **Network Mismatch Analyzer** from the menu to verify the network configuration.



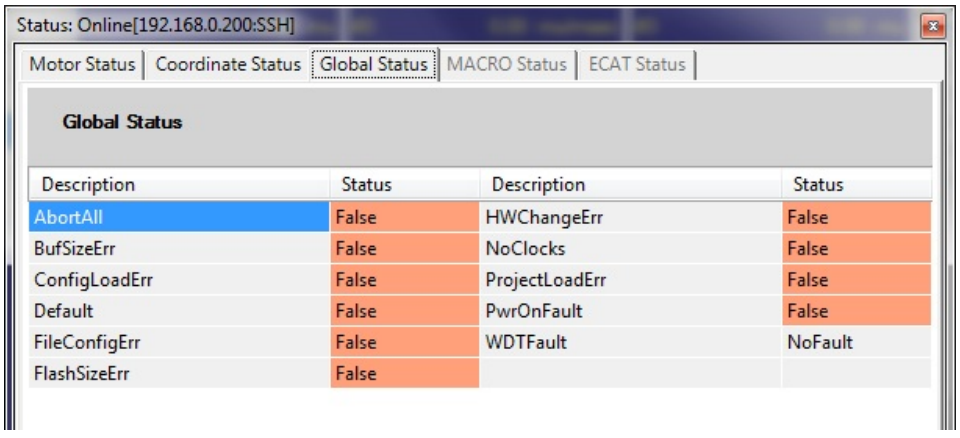
9.2.2. Checking the Controller Status

In the Status page of Power PMAC IDE, you can check the status of the motor, coordinate system, and system.

To display the Status page, click **Status** on the toolbar.

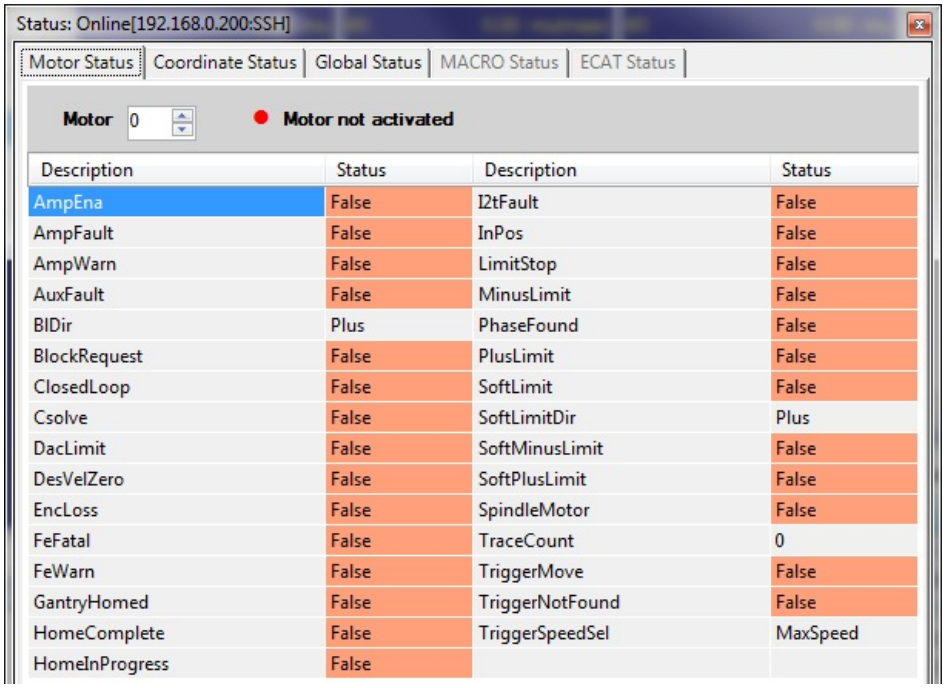
■ Global Status

You can check system errors such as the WDT error.



■ Motor Status

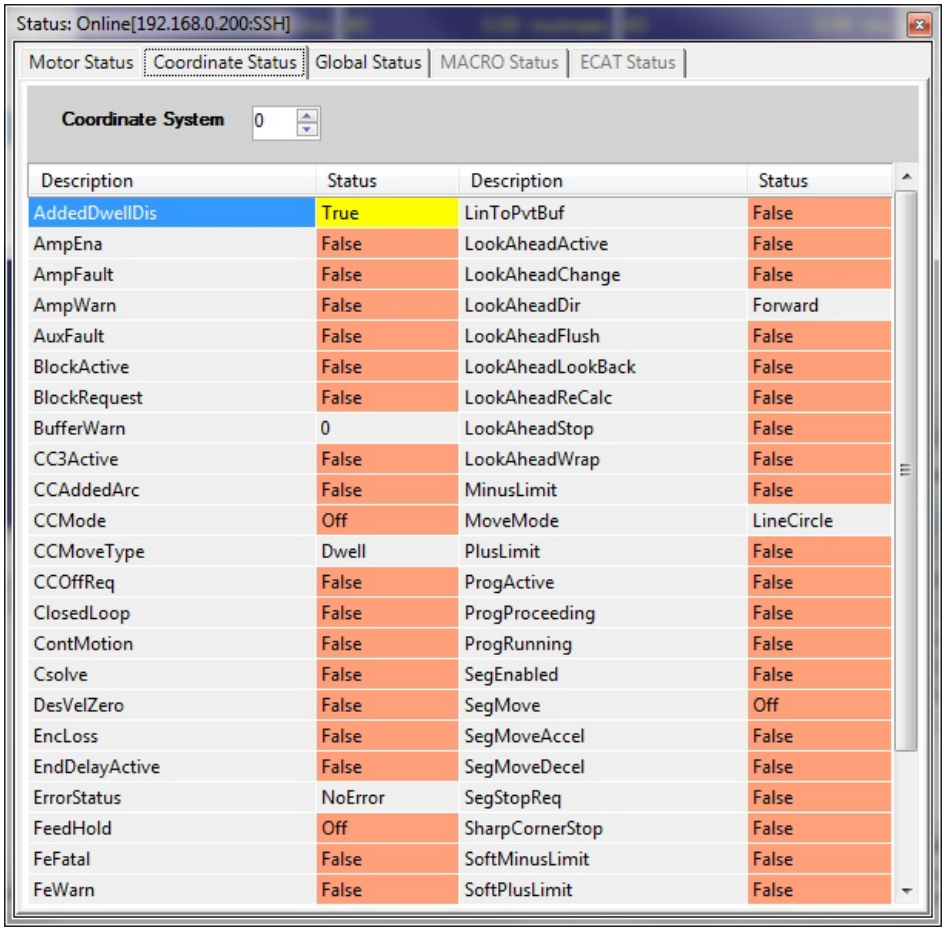
You can check deviation errors, limit errors, and other states of the motor.



Description	Status	Description	Status
AmpEna	False	I2tFault	False
AmpFault	False	InPos	False
AmpWarn	False	LimitStop	False
AuxFault	False	MinusLimit	False
BlDir	Plus	PhaseFound	False
BlockRequest	False	PlusLimit	False
ClosedLoop	False	SoftLimit	False
Csolve	False	SoftLimitDir	Plus
DacLimit	False	SoftMinusLimit	False
DesVelZero	False	SoftPlusLimit	False
EncLoss	False	SpindleMotor	False
FeFatal	False	TraceCount	0
FeWarn	False	TriggerMove	False
GantryHomed	False	TriggerNotFound	False
HomeComplete	False	TriggerSpeedSel	MaxSpeed
HomeInProgress	False		

■ Coordinate Status

You can check deviation errors, limit errors and other states of the coordinate system.



Description	Status	Description	Status
AddedDwellDis	True	LinToPvtBuf	False
AmpEna	False	LookAheadActive	False
AmpFault	False	LookAheadChange	False
AmpWarn	False	LookAheadDir	Forward
AuxFault	False	LookAheadFlush	False
BlockActive	False	LookAheadLookBack	False
BlockRequest	False	LookAheadReCalc	False
BufferWarn	0	LookAheadStop	False
CC3Active	False	LookAheadWrap	False
CCAddedArc	False	MinusLimit	False
CCMode	Off	MoveMode	LineCircle
CCMoveType	Dwell	PlusLimit	False
CCOffReq	False	ProgActive	False
ClosedLoop	False	ProgProceeding	False
ContMotion	False	ProgRunning	False
Csolve	False	SegEnabled	False
DesVelZero	False	SegMove	Off
EncLoss	False	SegMoveAccel	False
EndDelayActive	False	SegMoveDecel	False
ErrorStatus	NoError	SegStopReq	False
FeedHold	Off	SharpCornerStop	False
FeFatal	False	SoftMinusLimit	False
FeWarn	False	SoftPlusLimit	False

10. Appendix ECAT[i] Structure Elements

The Controller uses motion controller technology developed by Delta Tau Data Systems, Inc., (hereafter referred to as DT) in the U.S., however, the ECAT[i] structure elements differ from those of DT controllers. The following table shows the major changes that have been made from DT controllers.

Element name	Description	Change
ECAT[i].Enable	Enabling the EtherCAT network	0: Disable, 1: Enable (2 and 3 are not supported.)
ECAT[i].LPIO[k]	Elements of low priority I/O module	Not supported
ECAT[i].Slave[j]	Slave elements	Not supported
ECAT[i].Error	Error code of enabling EtherCAT network	$ 9811000C: Invalid network configuration $ 9811002E: Disconnected network connection
ECAT[i].LinkUp ECAT[i].LPDomainOutputState ECAT[i].LPDomainState ECAT[i].LPRxTime ECAT[i].LPTxTime ECAT[i].MasterStat ECAT[i].RTDomainOutputState ECAT[i].RTDomainState	Status data structure elements	Not supported

11. Revision History

Revision code	Revised date	Revised content
A	July 1, 2016	First edition

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