

Programmable Multi-Axis Controller

Startup Guide

1S-series Servo Drivers

(IDEv4)

CK3E-□□□□
CK3M-CPU1□1
NY51□-A□□□



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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-1□10	CK3E-series Programmable Multi-Axis Controller Hardware User's Manual
OMRON	O036-E1	Model CK3M-CPU1□1	CK3M-series Programmable Multi-Axis Controller Hardware User's Manual
OMRON	W580-E2	Model NY512-A6001XX21391X	Industrial PC Platform NY-series IPC Programmable Multi-Axis Controller Industrial Box PC Hardware User's Manual
OMRON	I586-E1	Model R88M-1L□/-1M□ Model R88D-1SN□-ECT	AC Servomotors/Servo Drives 1S-series with Built-in EtherCAT® Communications User's Manual
OMRON	Z930-E1	Model NX-SL□□□□ Model NX-SI□□□□ Model NX-SO□□□□	Safety Control Unit User's Manual
OMRON	Z930-E1	Model NX-SL□□□□	Safety Control Unit Instructions Reference 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 Power PMAC IDE, 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.

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 March 2019.
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 OMRON Programmable Multi-Axis Controller (hereafter referred to as the Controller), model CK3E-□□□□/CK3M-CPU1□1/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	Model CK3M-CPU1□1
OMRON	Programmable Multi-Axis Controller Industrial Box PC	Model NY51□-A□□□
OMRON	Servo Driver	Model R88D-1SN□-ECT
OMRON	AC Servomotor	Model R88M-1□□□□□□-□



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.

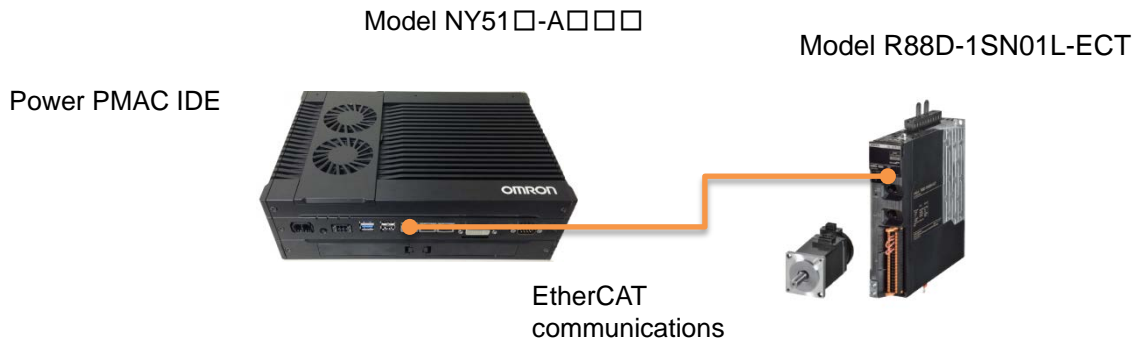


Additional Information

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 NY51□-A□□□	Ver.2.5 or later
OMRON	Servo Driver (1S-series with Built-in EtherCAT Communications)	Model R88D-1SN01L-ECT	Ver.1.0
OMRON	Ethernet cable (with industrial Ethernet connector)	Model XS5W-T421-□M□-K	
DT	Power PMAC IDE		Ver.4.2.1.19



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 NY51□-A□□□ as an example. The same procedures can apply to model CK3E-□□□□/CK3M-CPU1□1.

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 Settings of the Controller

6.3 Installation of ESI Files

Install the ESI file for Servo Driver into Power PMAC IDE.

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 Information File

6.5 Controller Settings

Set up the Controller.

6.5.1 EtherCAT Communications Check

▼
6.5.2 Motor Setup

▼
6.5.3 Creation of Operation Check Programs

▼
6.5.4 Project Data Transfer and Operation Check

6.2. Preparation for the Controller Setup

Prepare the Controller settings.

Install Power PMAC IDE on the computer in advance.

6.2.1. Creation of a New Project

1 Turn on the power to the Controller.

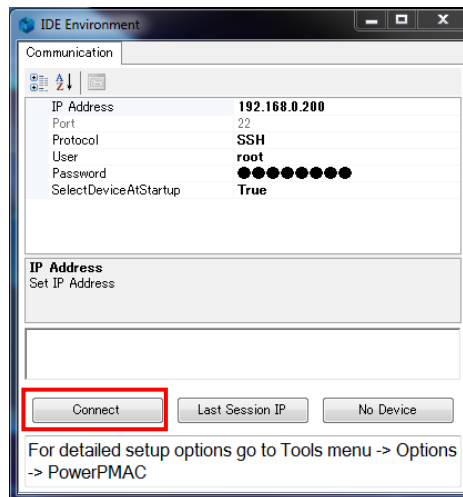
2 Start Power PMAC IDE.

* If the dialog for confirming access rights appears upon start-up, select starting of Power PMAC IDE.

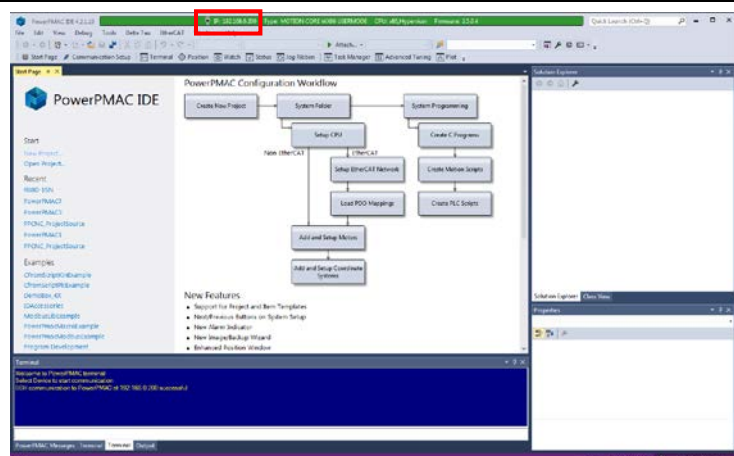


3 The Communication screen appears. Specify the IP address of the destination Controller and click **Connect**.

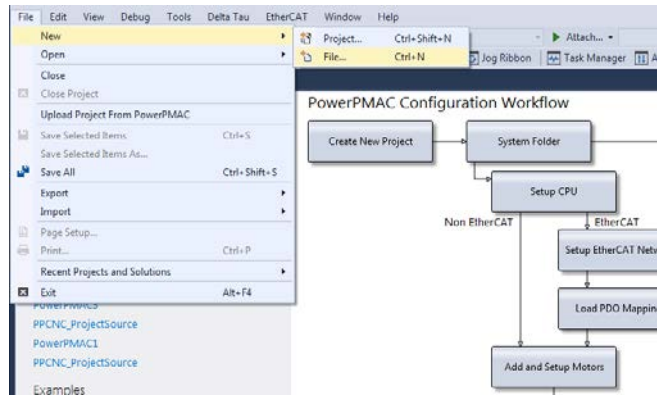
* The IP address of the Controller is set to "192.168.0.200" by default.
* If necessary, change the Windows IP address to "192.168.0.X".



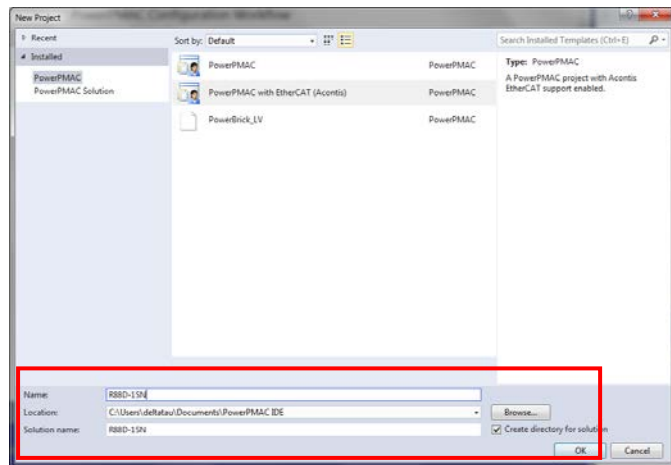
4 Power PMAC IDE starts, and is online to the Controller.



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



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



6.2.2. Initial Settings of the Controller

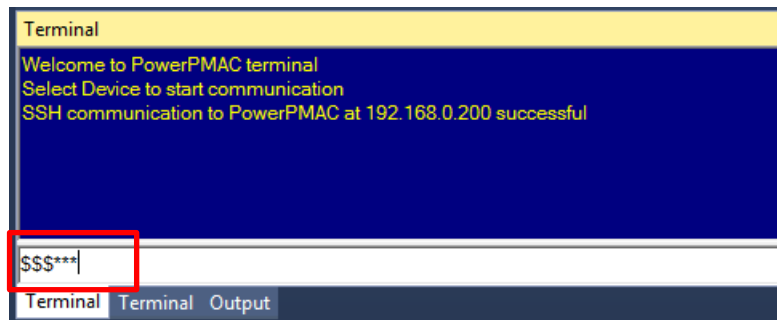
Configure the initial settings for the Controller.



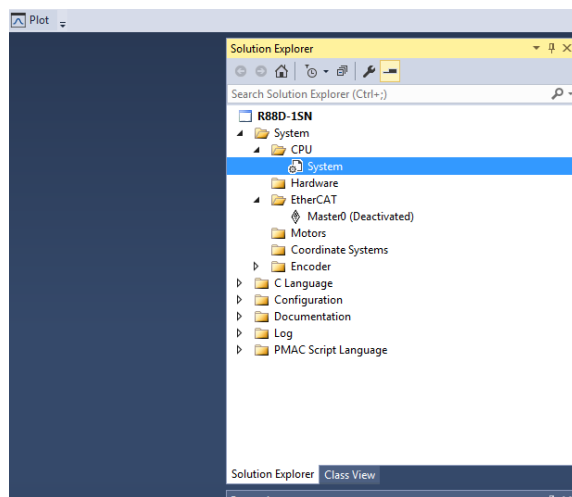
Precautions for Correct Use

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

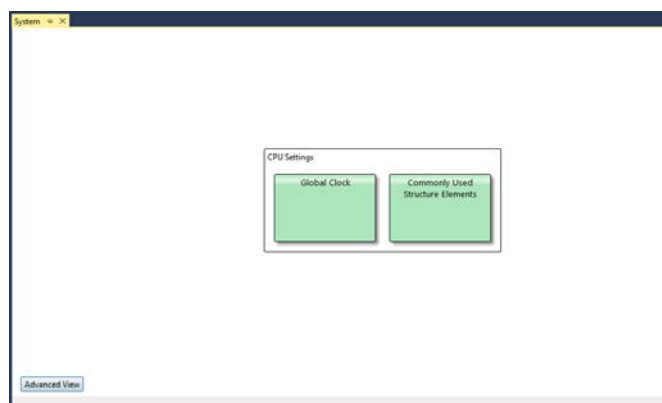
- 1 In the Terminal tab page, type the \$\$\$*** command to reset the Controller to factory default.



- 2 Select **System – CPU – System** in the Solution Explorer.

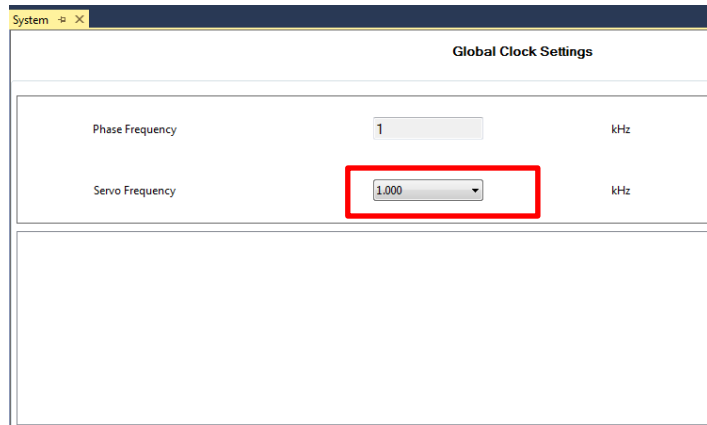


- 3 Select **Global Clock**.

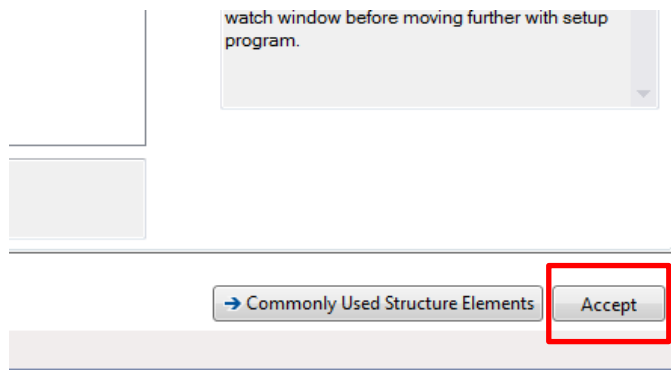


4 Specify **Servo Frequency**.

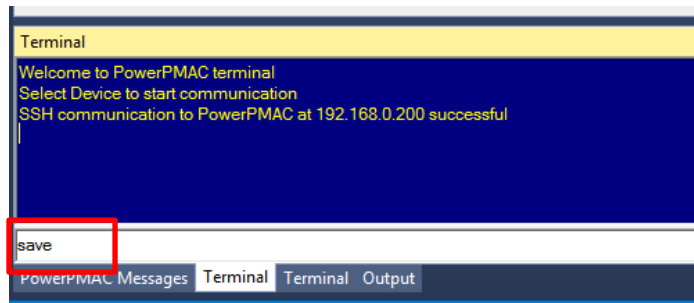
Select the **Servo Frequency** setting from 4 kHz, 2 kHz, or 1 kHz.



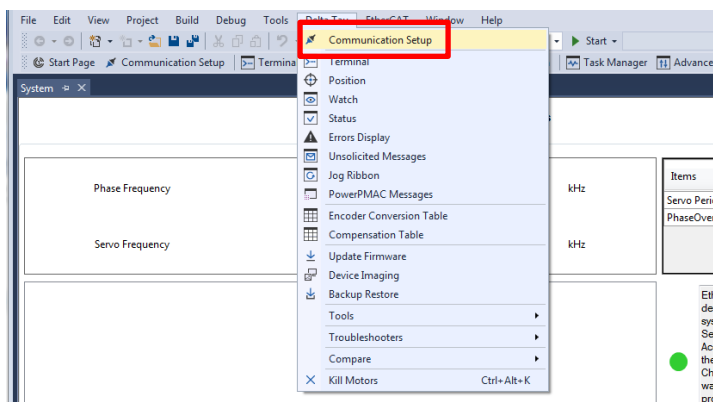
5 Click the **Accept** button.



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

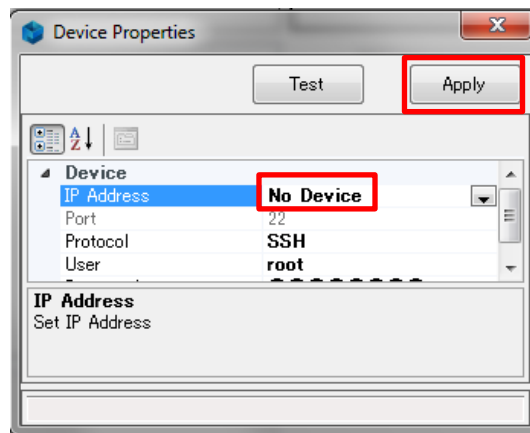


7 Click **Delta Tau – Communication Setup** on the toolbar to display the Device Properties dialog box.



- 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.

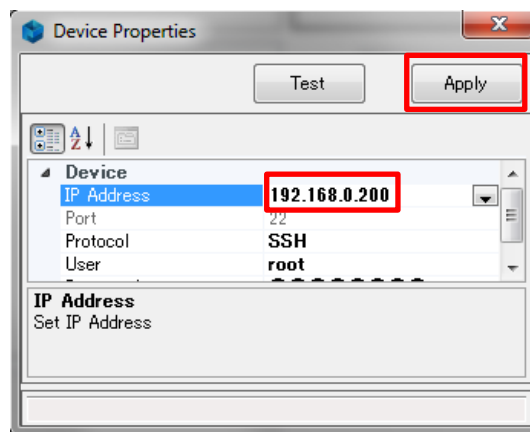


- 9 Restart the Controller.

The servo frequency that has been set is reflected.

- 10 Wait until the startup process of the Controller is complete. Then click **Delta Tau – 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

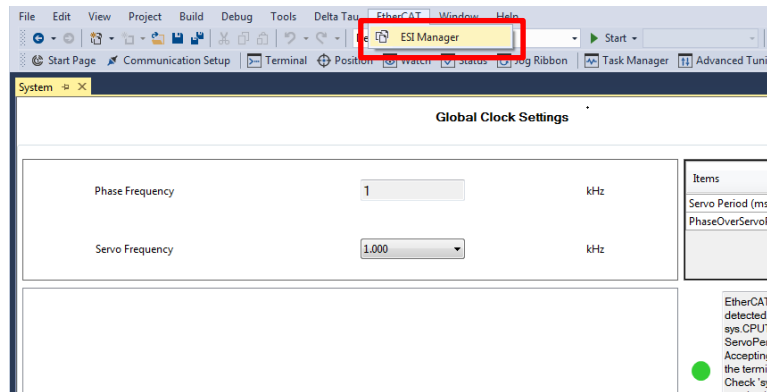
Install the ESI file for Servo Driver into Power PMAC IDE.



Precautions for Correct Use

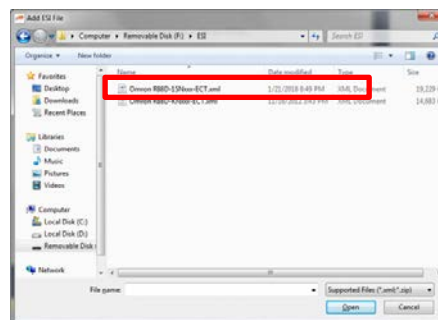
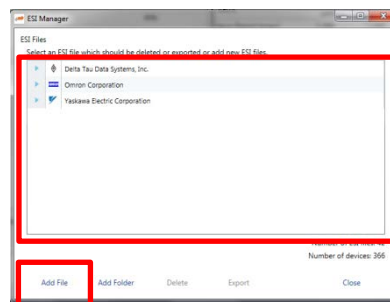
Prepare the ESI file described in this section in advance. Contact your OMRON representative for information on how to procure the ESI file.

- 1 From the **EtherCAT** menu of Power PMAC IDE, select **ESI Manager**.



- 2 Confirm that *Omron R88D-1SN01L-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-1SNxxx-ECT.xml*.



- 3 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.



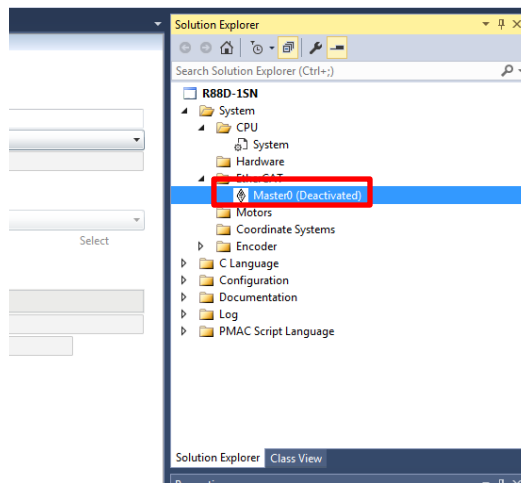
Precautions for Correct Use

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

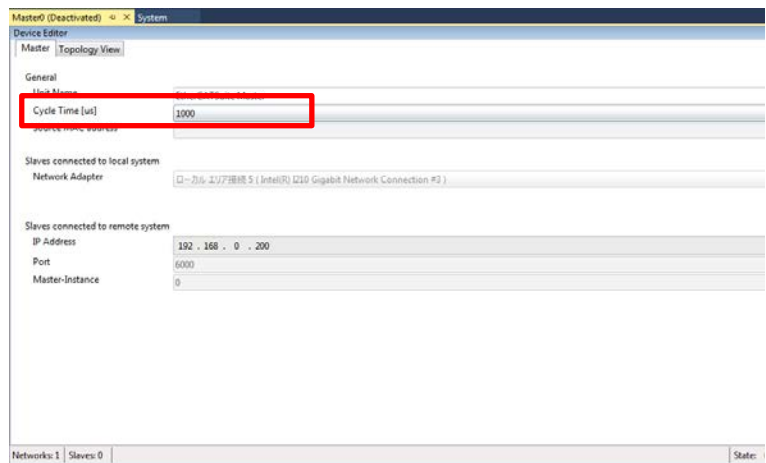
- 1 Connect the Controller with slave devices using an Ethernet cable.
* Refer to the manuals for slave devices to configure them.

- 2 Select **System – EtherCAT – Master0 (Deactivated)** in the Solution Explorer.



- 3 In the Master tab page, specify a communication period for **Cycle Time [us]**.

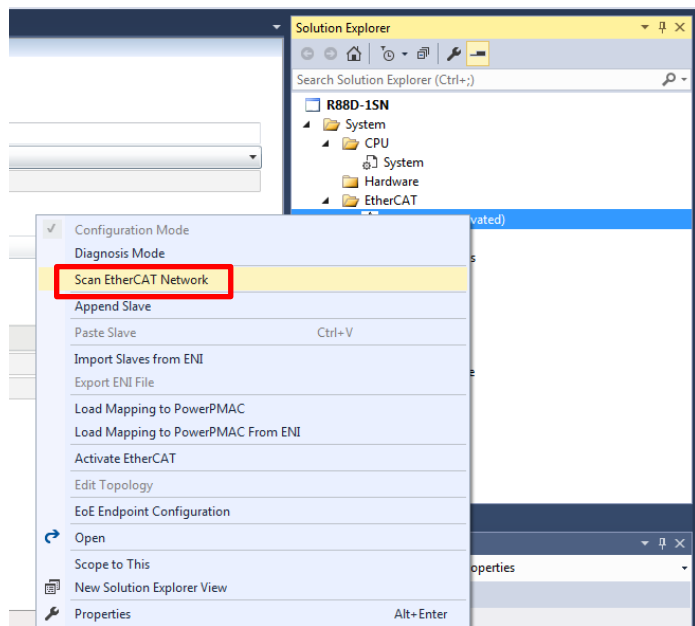
* You must specify the communication period in accordance with the servo frequency of the Controller. 1000 us is set in this document.



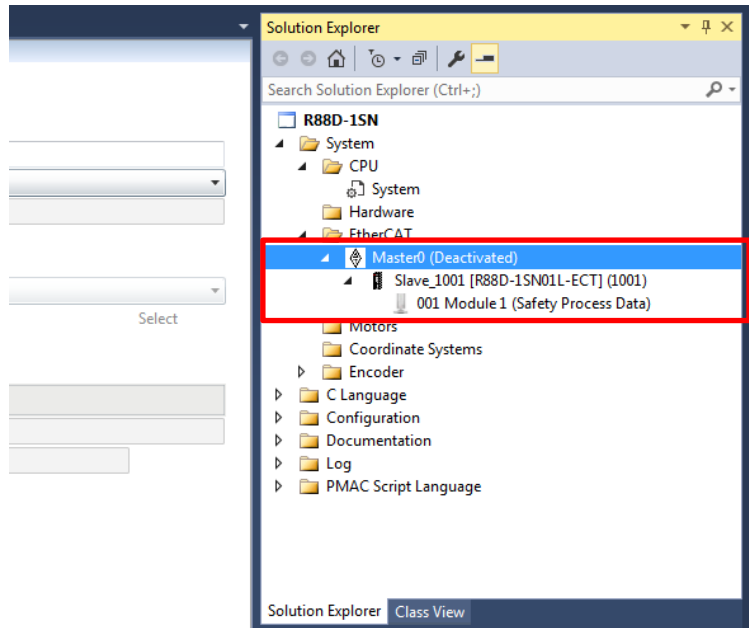
Correspondence between the servo frequencies of the Controller and communication periods is as follows:

4 kHz : 250 us
2 kHz : 500 us
1 kHz : 1000 us

- 4 Select **System – EtherCAT** in the Solution Explorer and right-click on **Master0 (Deactivated)**, then select **Scan EtherCAT Network**.



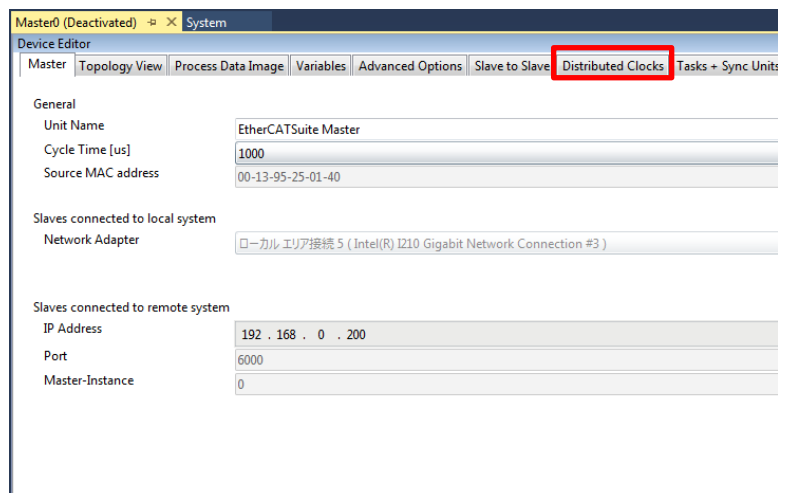
- 5 Make sure that the slave is displayed in the Solution Explorer.



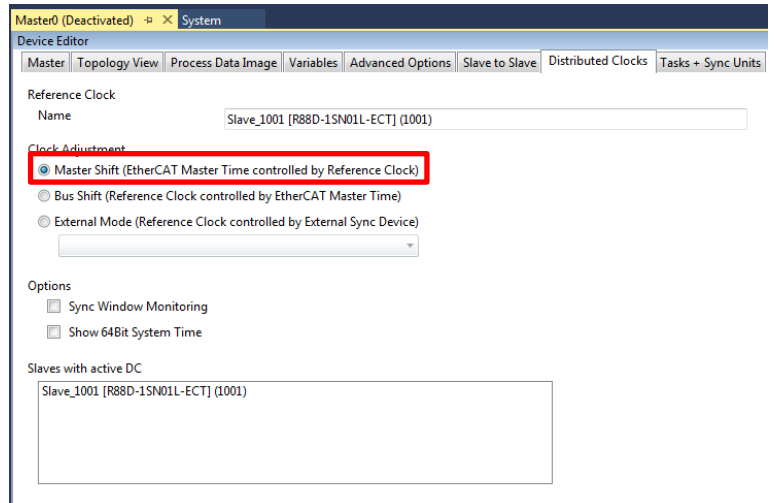
6.4.2. Distributed Clock Setup

- 1 Setting Distributed Clocks (DC) for Master

In the Master0 (Deactivated) tab page, select **Distributed Clocks** tab.

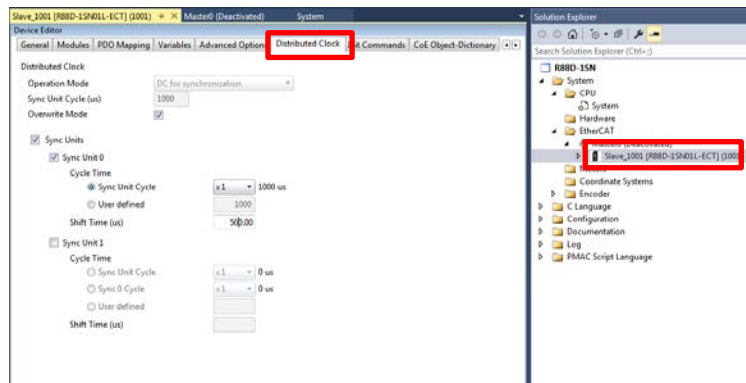


2 Select Master Shift (EtherCAT Master Time controlled by Reference Clock).

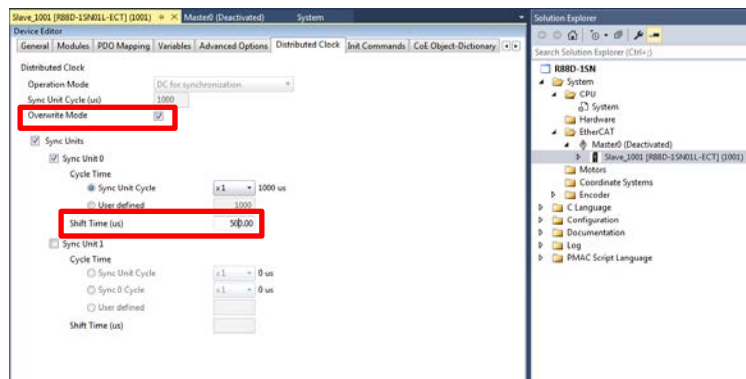


3 Setting Distributed Clock (DC) for the Slave

In the Solution Explorer, select the target slave and display the Distributed Clock tab page.



4 Select the **Overwrite Mode** check box and specify **Shift Time**.



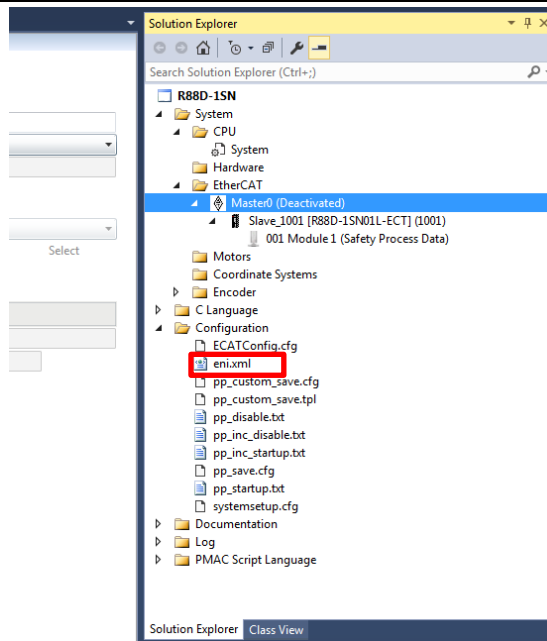
Correspondence between the servo frequencies of the Controller and the Shift Time values is as follows:

4 kHz : 125 us

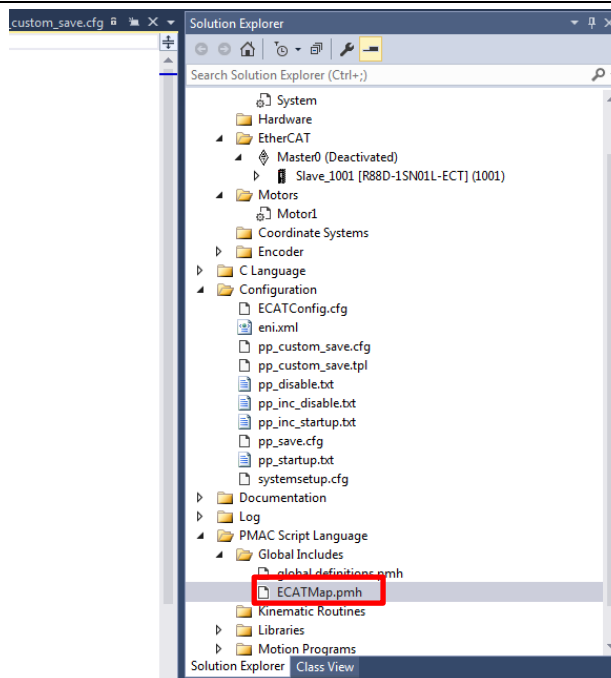
2 kHz : 250 us

1 kHz : 500 us

- 2 An eni.xml file is added under the **Configuration** directory in the Solution Explorer.



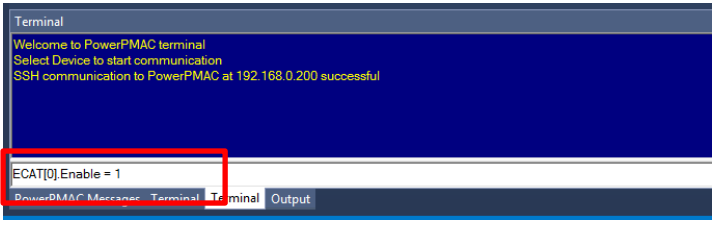
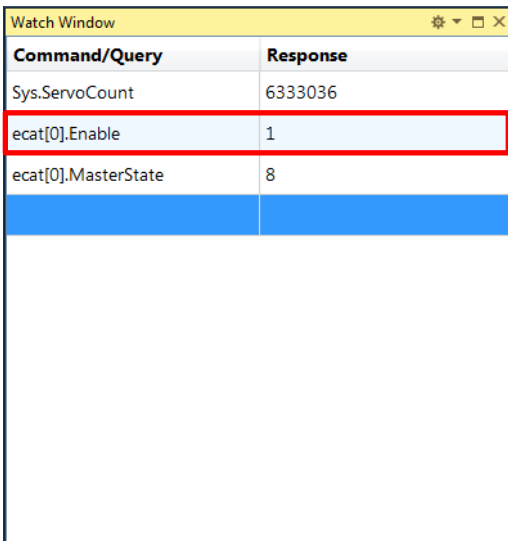
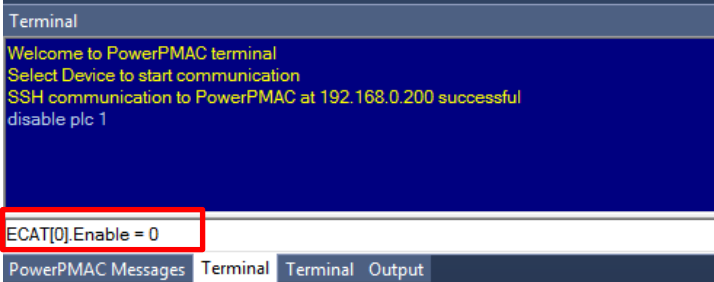
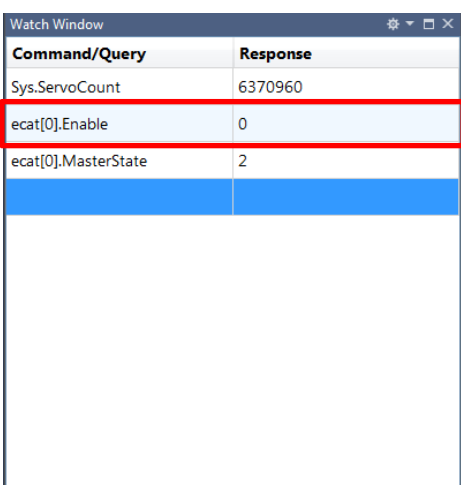
- 3 An ECATMap.pmh file is added under the **PMAC Script Language/Global Includes** directory in the Solution Explorer.



6.5. Controller Settings

6.5.1. EtherCAT Communications Check

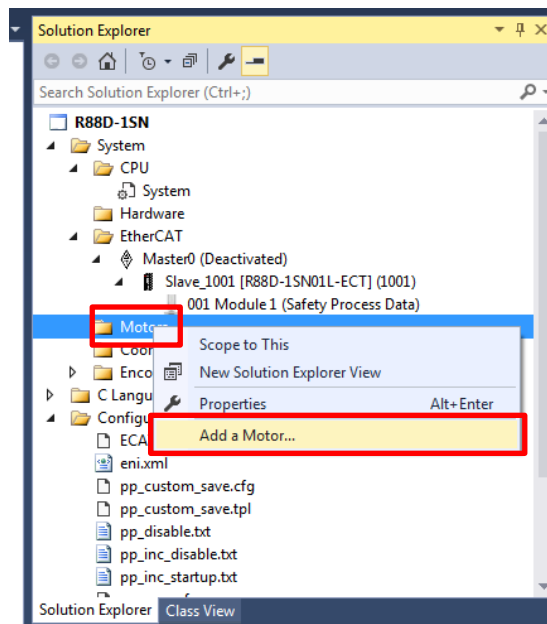
Take the following steps to ensure that EtherCAT communications are available.

<p>1 From the Terminal tab page, run the ECAT[0].Enable=1 command to start EtherCAT communications.</p>	 <p>The image shows a terminal window with a dark blue background. The text reads: "Welcome to PowerPMAC terminal", "Select Device to start communication", "SSH communication to PowerPMAC at 192.168.0.200 successful". Below this, the command "ECAT[0].Enable = 1" is entered and highlighted with a red box. At the bottom, there are tabs for "PowerPMAC Messages", "Terminal", "Terminal", and "Output".</p>								
<p>2 In the Terminal tab page or Watch Window, make sure that the ECAT[0].Enable value turns to 1.</p> <p>*The OP mode is entered and EtherCAT communications are established.</p>	 <p>The image shows a "Watch Window" with a table of data. The table has two columns: "Command/Query" and "Response". The rows are:</p> <table border="1"><thead><tr><th>Command/Query</th><th>Response</th></tr></thead><tbody><tr><td>Sys.ServoCount</td><td>6333036</td></tr><tr><td>ecat[0].Enable</td><td>1</td></tr><tr><td>ecat[0].MasterState</td><td>8</td></tr></tbody></table> <p>The row for "ecat[0].Enable" is highlighted with a red box.</p>	Command/Query	Response	Sys.ServoCount	6333036	ecat[0].Enable	1	ecat[0].MasterState	8
Command/Query	Response								
Sys.ServoCount	6333036								
ecat[0].Enable	1								
ecat[0].MasterState	8								
<p>3 After making sure that correct communications are available, run the ECAT[0].Enable=0 command from the Terminal tab page to stop EtherCAT communications.</p>	 <p>The image shows a terminal window with a dark blue background. The text reads: "Welcome to PowerPMAC terminal", "Select Device to start communication", "SSH communication to PowerPMAC at 192.168.0.200 successful", "disable plc 1". Below this, the command "ECAT[0].Enable = 0" is entered and highlighted with a red box. At the bottom, there are tabs for "PowerPMAC Messages", "Terminal", "Terminal", and "Output".</p>								
<p>4 In the Terminal tab page or Watch Window, make sure that the ECAT[0].Enable value turns to 0.</p>	 <p>The image shows a "Watch Window" with a table of data. The table has two columns: "Command/Query" and "Response". The rows are:</p> <table border="1"><thead><tr><th>Command/Query</th><th>Response</th></tr></thead><tbody><tr><td>Sys.ServoCount</td><td>6370960</td></tr><tr><td>ecat[0].Enable</td><td>0</td></tr><tr><td>ecat[0].MasterState</td><td>2</td></tr></tbody></table> <p>The row for "ecat[0].Enable" is highlighted with a red box.</p>	Command/Query	Response	Sys.ServoCount	6370960	ecat[0].Enable	0	ecat[0].MasterState	2
Command/Query	Response								
Sys.ServoCount	6370960								
ecat[0].Enable	0								
ecat[0].MasterState	2								

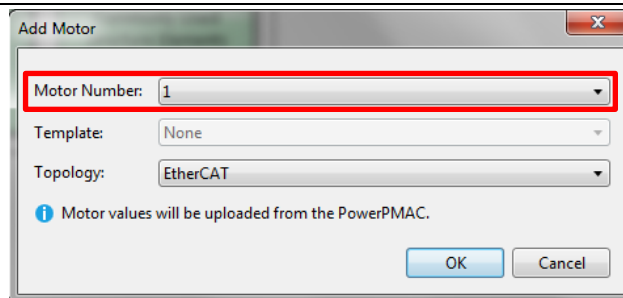
6.5.2. Motor Setup

Configure the motor settings for the Controller.

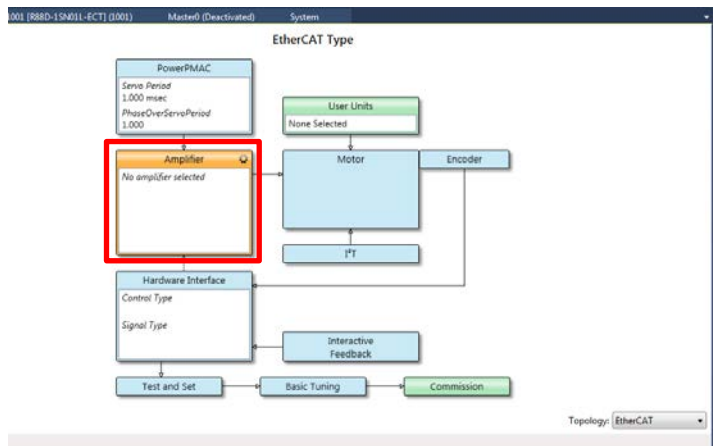
- 1 Select **System – Motor** in the Solution Explorer and right-click on it, then select **Add a Motor....**



- 2 Adding motor #1
Specify 1 for Motor Number and click the **OK** button.



- 3 Select **Amplifier**.



4 Setting motor Amplifier

Specify the settings as shown on the right.

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

Manufacturer	Part Number
Omron Corporation (ECAT:13...)	A6880AB

Parameter	Value
Vendor ID	215
Product ID	A6880000AB
Vendor Description	Omron Corporation
Product Description	Manufacturer (ECAT:13...)
4 Supported Control Mode	
Cyclic Type Position Control	True
Cyclic Type Velocity Control	True
Cyclic Type Torque Control	True
Position Feedback Control	False
Position Velocity Control	False
Position Torque Control	False
Velocity Mode Control	False
Intermittent Position Control	False
4 Supported Signal Type	
Intermittent Command	False
Intermittent Command	False
4 EtherCAT Network	
Stop and Direction Command	False
EtherCAT	EtherCAT
MAC ID	True
4 EtherCAT Slave Settings	
Slave Number	0
No. Of Axes	1
Axis Index	1
4 S.EtherCAT	
Max Command Output	1000

Manufacturer

Select **OMRON Corporation**.

Part Number

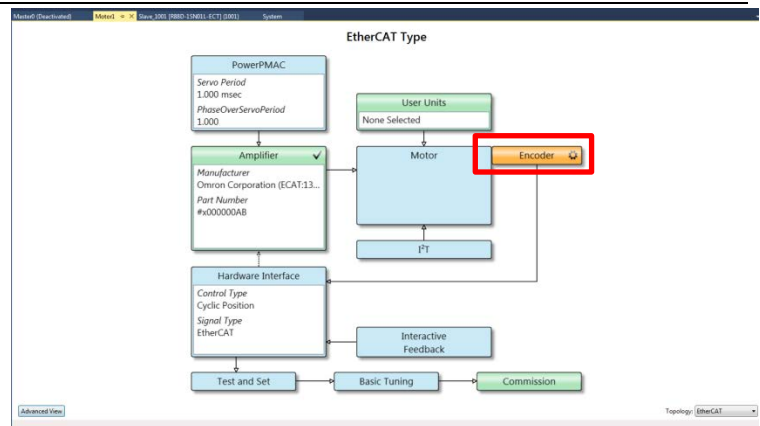
Select **#x000000AB**.

4.EtherCAT Slave Settings

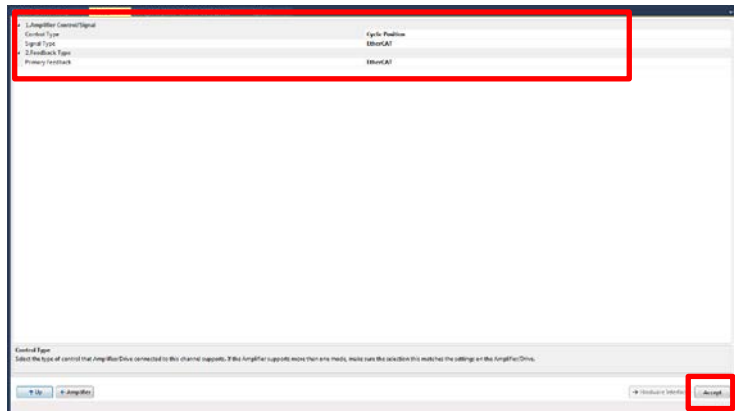
Enter a slave number into **Slave Number**.

Parameter	Value
MACRO	False
4.EtherCAT Slave Settings	
Slave Number	0
No. Of Axes	1
Axis Index	1
4.EtherCAT	
Max Command Output	1000

5 Select Encoder.



- 6 Specify the settings as shown on the right.
Click the **Accept** button to apply the settings.



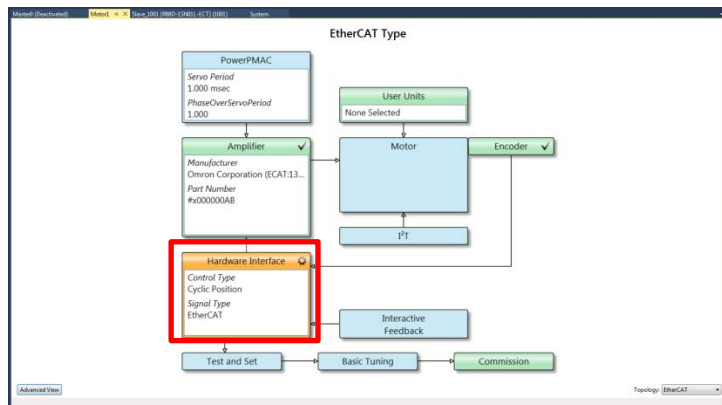
Control Type

Select **Cyclic Position**.

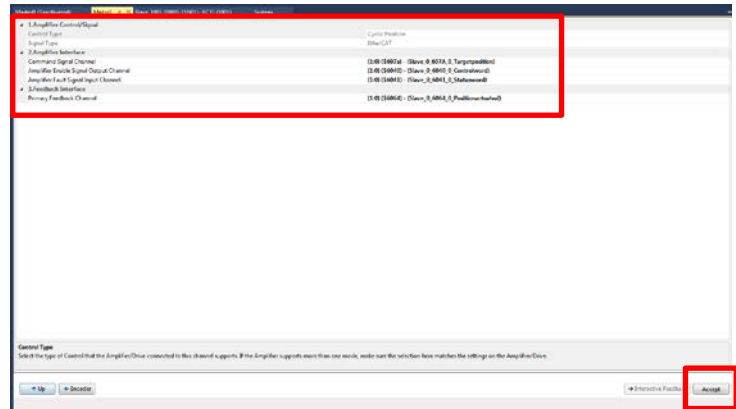
Primary Feedback

Select **ECAT**.

- 7 Select **Hardware Interface**.



- 8 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.

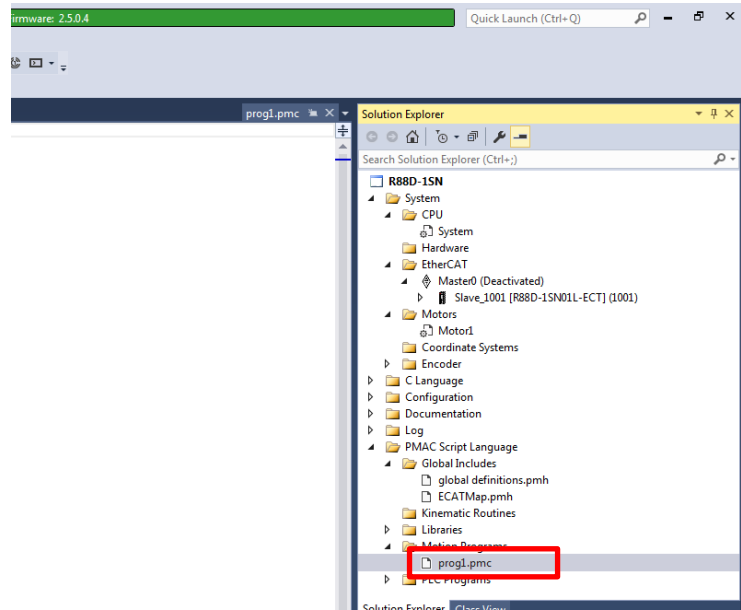
6.5.3. Creation of Operation Check Programs

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, open
**Project name – PMAC Script
Language – Motion Programs
– prog1.pmc.**



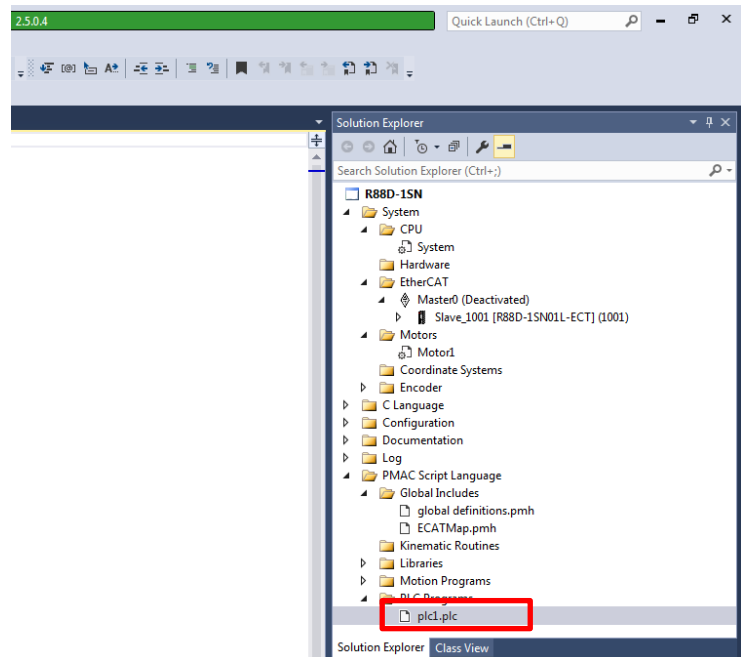
2 In the programming area of the prog1.pmc tab page, write a program as shown on the right.

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, 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){};

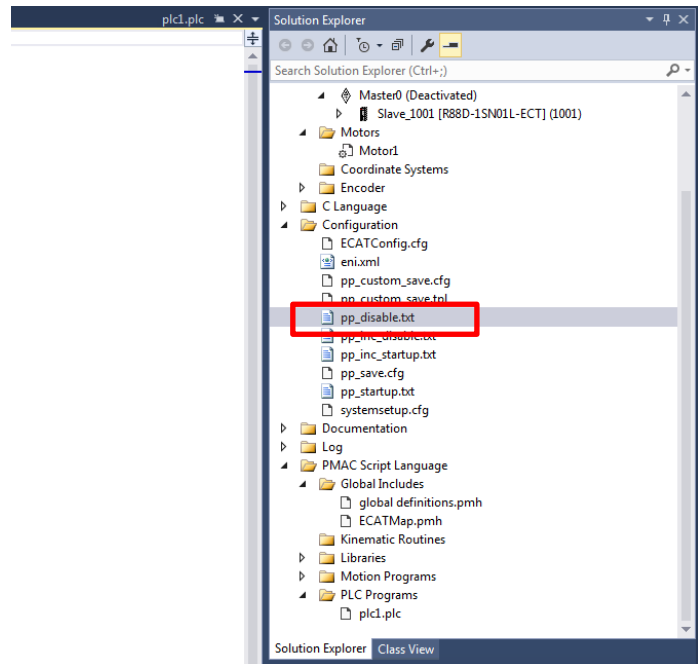
cmd"&1b1r";

disable plc 1;

close
```


5 Setting the start of the user program

In the Solution Explorer, open **Project name – Configuration – pp_disable.txt**.



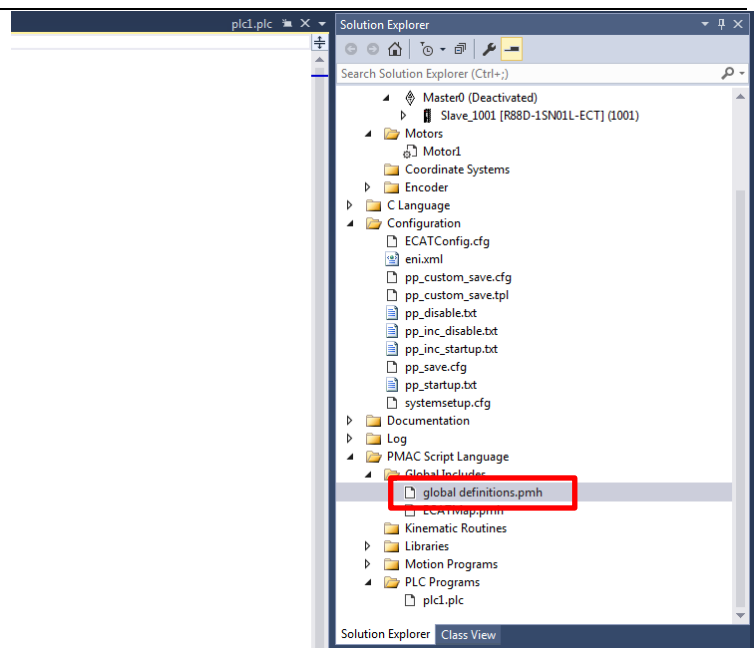
6 In the programming area of the pp_disable.txt tab page, add the program shown on the right to the last line.

```
enable plc 1;
```

The pp_disable.txt program is automatically executed when the Controller starts.
This example program runs the PLC1 script.

7 Setting motor control parameters

In the Solution Explorer, 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;
```

6.5.4. 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.



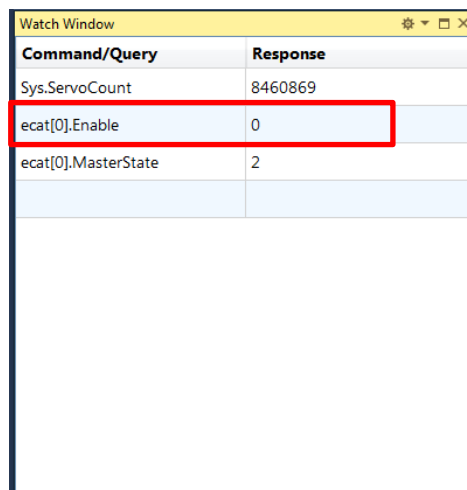
Caution

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 tab page or Watch Window, 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 tab page to stop EtherCAT communications.



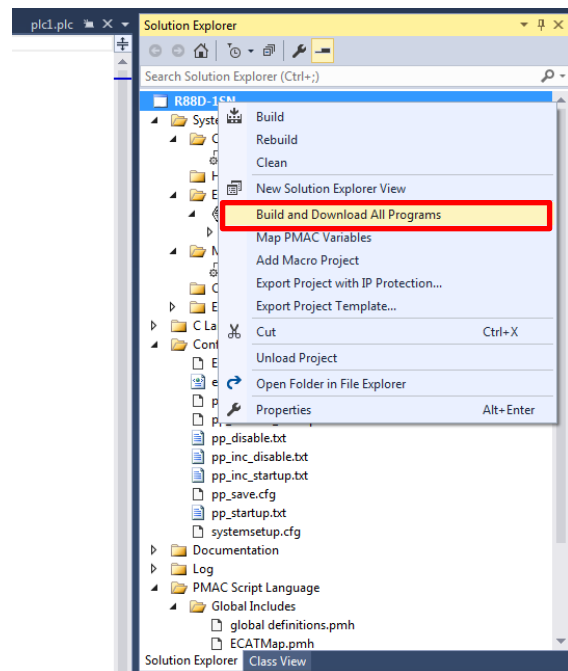
Command/Query	Response
Sys.ServoCount	8460869
ecat[0].Enable	0
ecat[0].MasterState	2

2 Downloading a project

Right-click the project name in the Solution Explorer on the upper right of the IDE screen, and select **Build and Download All Programs** to run the build and download.

* 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.



3 Make sure that there are no errors in the Output Window.

* If the transfer fails, check details of the error in the Output Window.

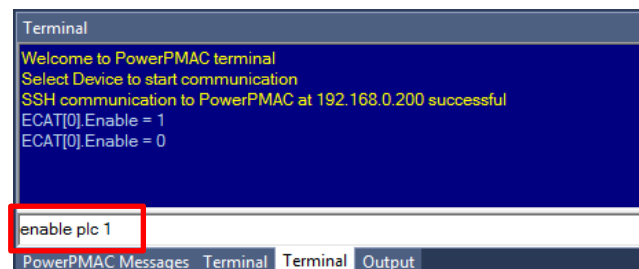
If the error is a program error, you must review the program.

If the error is related to EtherCAT settings, return to 6.4 EtherCAT Communications 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.

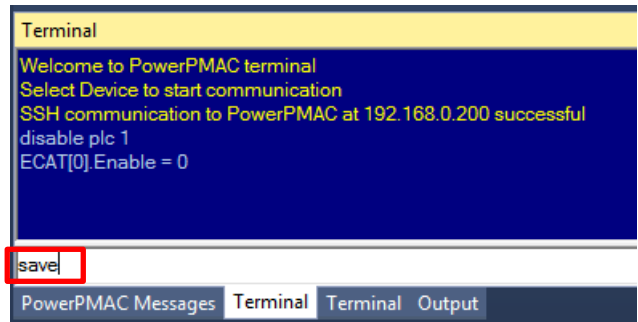
* If the motor does not rotate, check that the ECAT[0].Enable value is 1 in the Terminal tab page or Watch Window. If the value is 0, run the following command from the Terminal tab page.
enable plc 1



5 After you have confirmed an appropriate operation, save the project to the Controller.

Run the save command from the Terminal tab page.

* 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.



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.

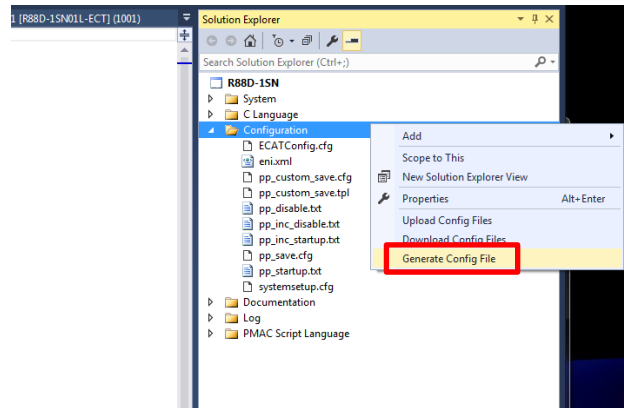
7.1. Saving a Project

1 Creating a Configuration File

Create a Configuration File to save parameters you have changed.

Right-click **Configuration** in the Solution Explorer, and select **Generate Config File**.

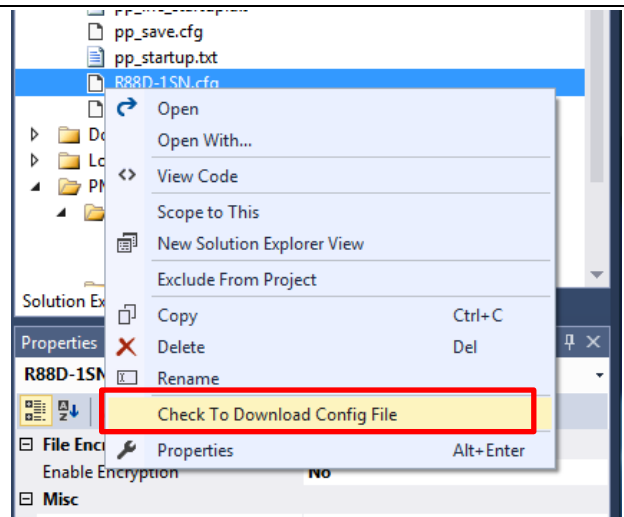
A Configuration File is added to **Configuration**.



2 Enter a file name in the textbox, then click the OK button.

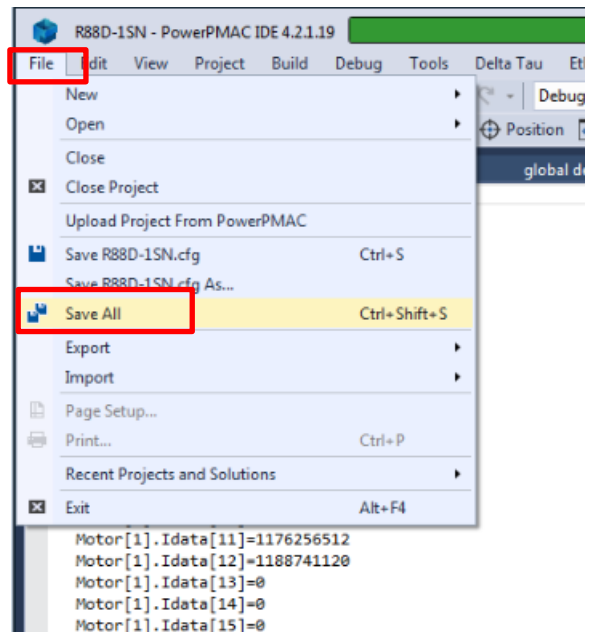


3 Right-click on the Configuration File, and from the menu, select **Check To Download Config File** to include it in files to be downloaded.



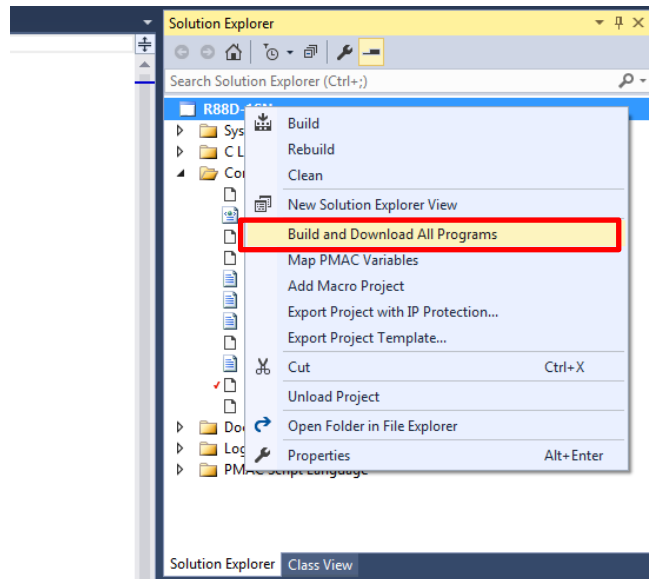
4 Saving a Project

In the **File** menu, run **Save All** to save the project on the computer.



- 5 Right-click the project name in the Solution Explorer, and select **Build and Download All Programs** to run the build and download.

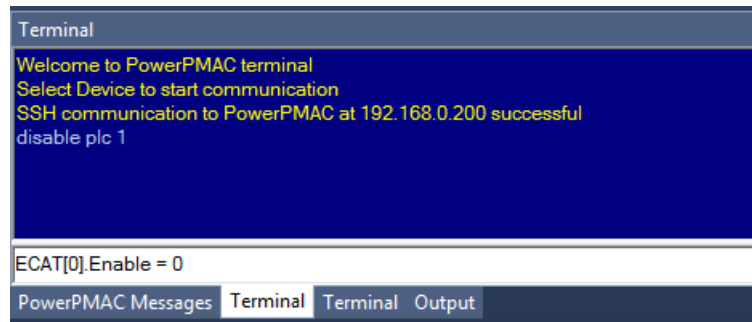
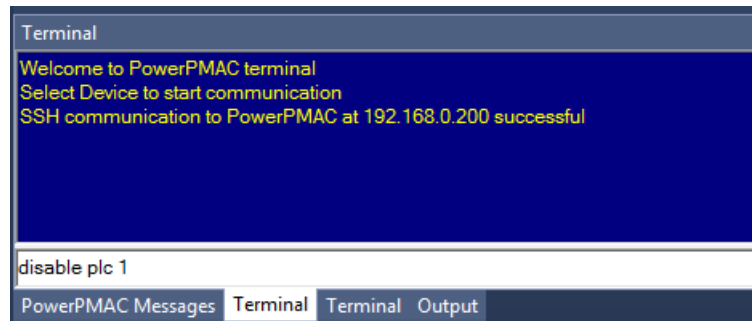
When the download process is complete, make sure that there are no errors in the Output Window.



- 6 Stopping a program

If a program is running, execute the following command from the Terminal tab page to stop the program.

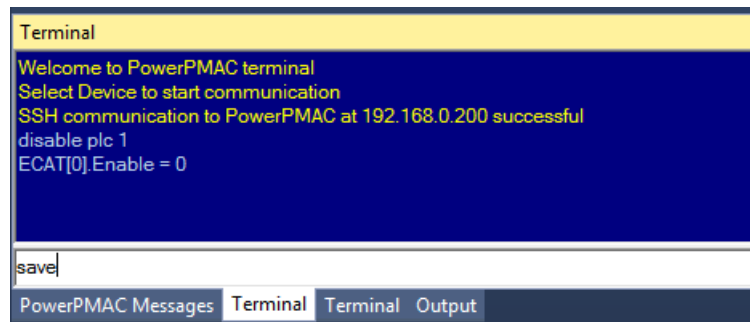
```
disable plc 1  
ECAT[0].Enable=0
```



7 Saving the downloaded settings and programs

After the download process is complete and you make sure that there are no errors in the Output Window, run the save command from the Terminal tab page.

* 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.



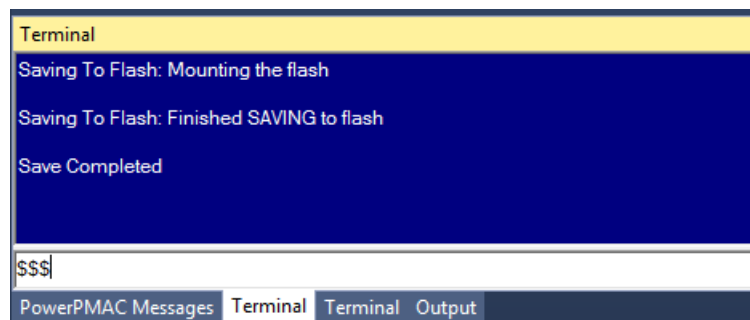
```
Terminal
Welcome to PowerPMAC terminal
Select Device to start communication
SSH communication to PowerPMAC at 192.168.0.200 successful
disable plc 1
ECAT[0].Enable = 0

save|
PowerPMAC Messages Terminal Terminal Output
```

8 Restarting after download

Run the following command from the Terminal tab page to restart the Controller with the downloaded project.

\$\$\$



```
Terminal
Saving To Flash: Mounting the flash
Saving To Flash: Finished SAVING to flash
Save Completed

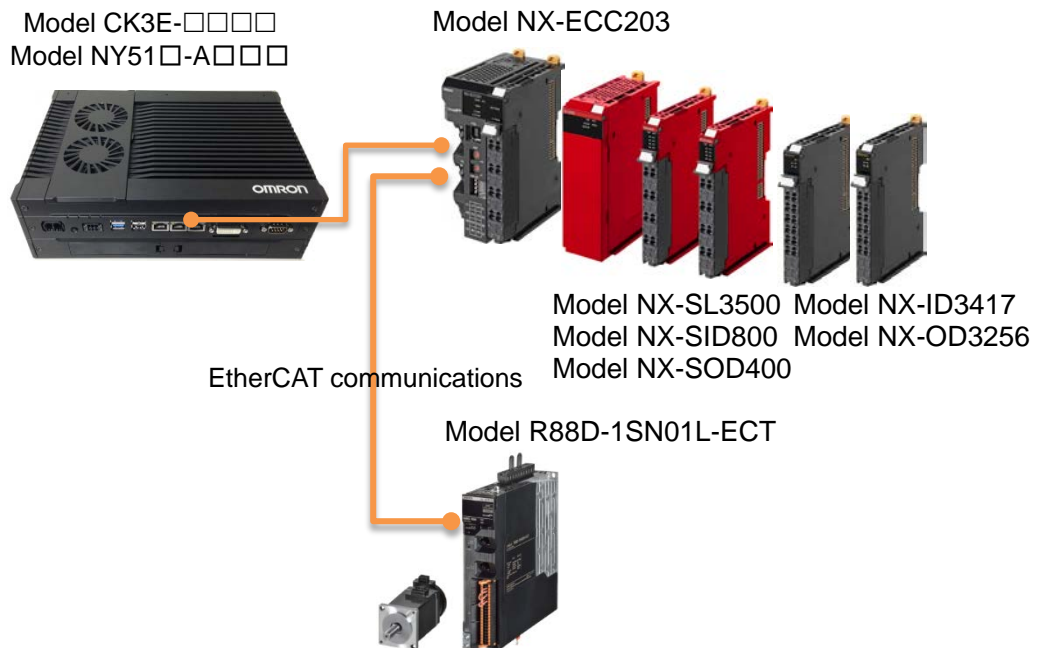
$$$|
PowerPMAC Messages Terminal Terminal Output
```

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

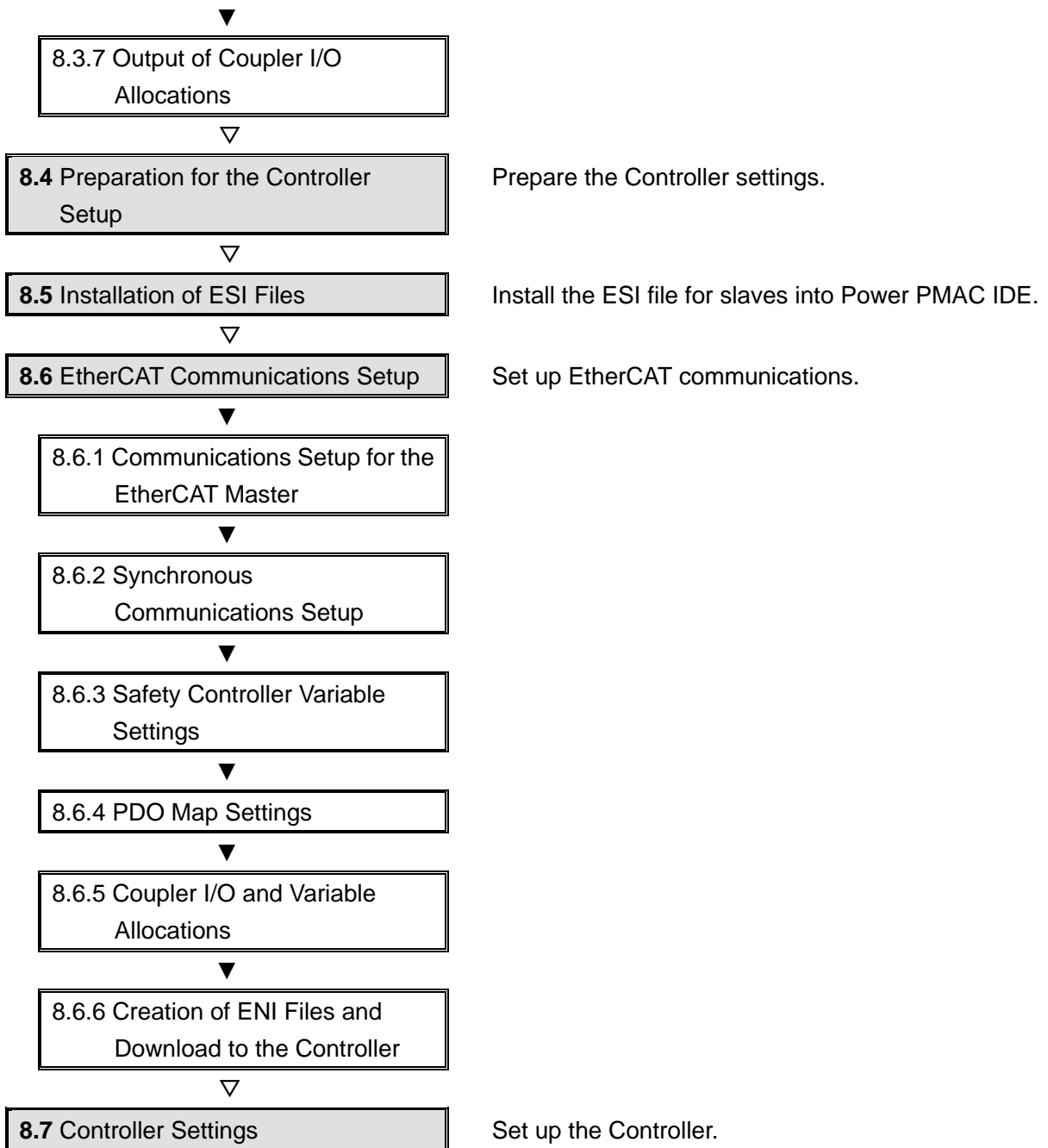
8.3.2 Network Configuration
Settings

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. EtherCAT Coupler Unit Settings

Configure the slave terminal settings for the EtherCAT Coupler Unit.
Prepare a computer with Sysmac Studio installed.

Windows computer
Sysmac Studio



Model NX-ECC203



Model NX-SL3500 Model NX-ID3417
Model NX-SID800 Model NX-OD3256
Model NX-SOD400



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.

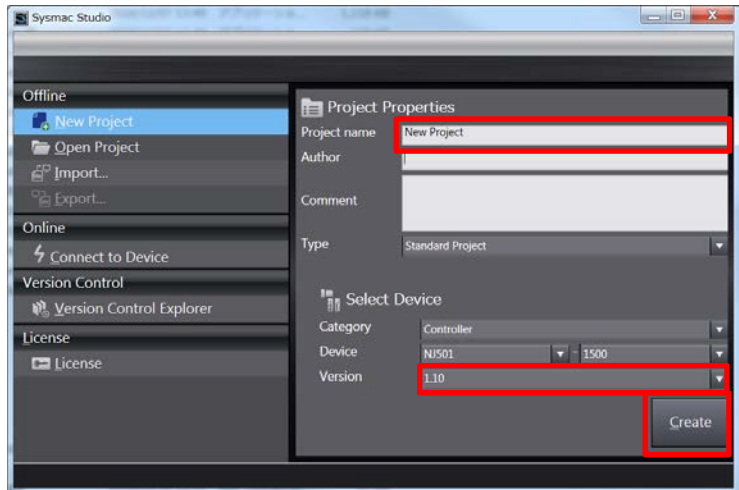
3 Start the Sysmac Studio.

* If the dialog for confirming access rights appears upon start-up, select starting of Sysmac Studio.



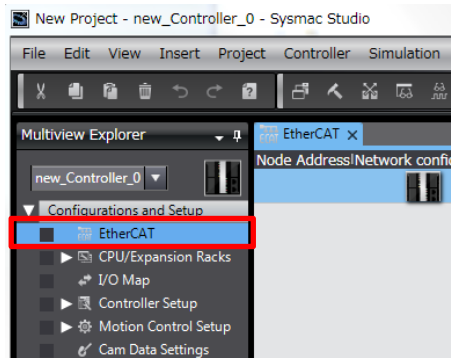
- 4 Create a project in the Sysmac Studio.

Enter **Project name** and other items of information. Select **1.10** for **Version**, then, click **Create**.

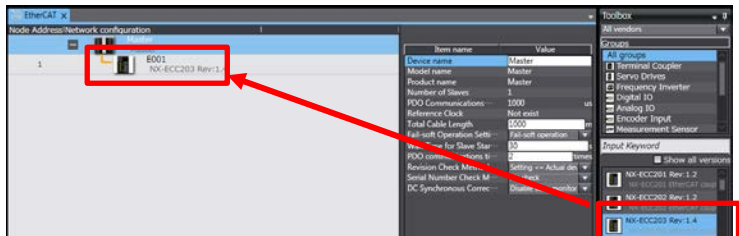


8.3.2. Network Configuration Settings

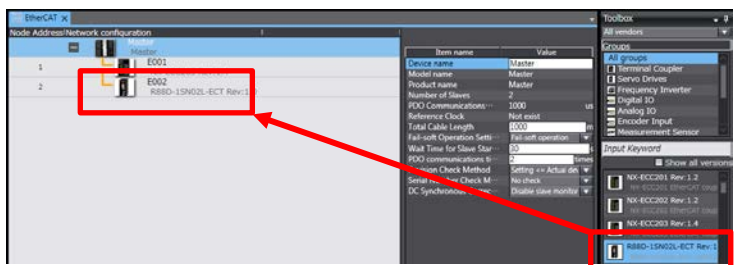
- 1 Double-click **EtherCAT** under **Configurations and Setup** in the Multiview Explorer.



- 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.

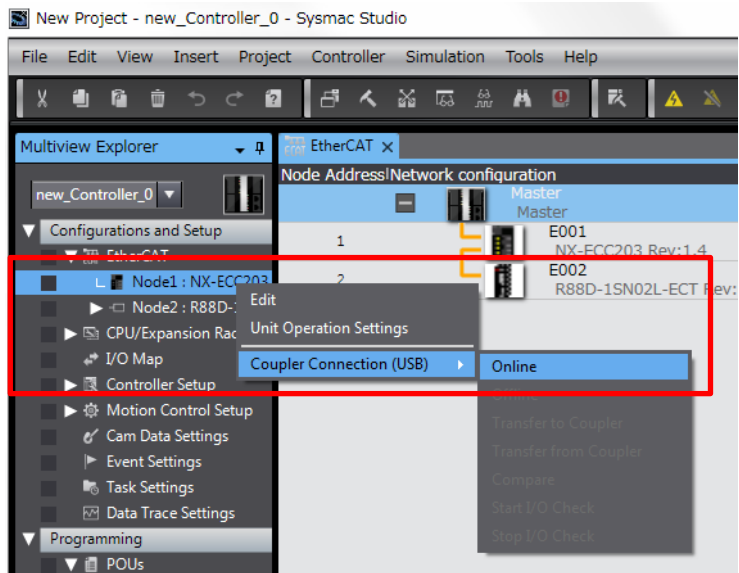


- 3 Select **R88D-1SN01L-ECT** in the toolbox, and drag and drop it directly below **NX-ECC203** in the EtherCAT Configuration Edit tab page.



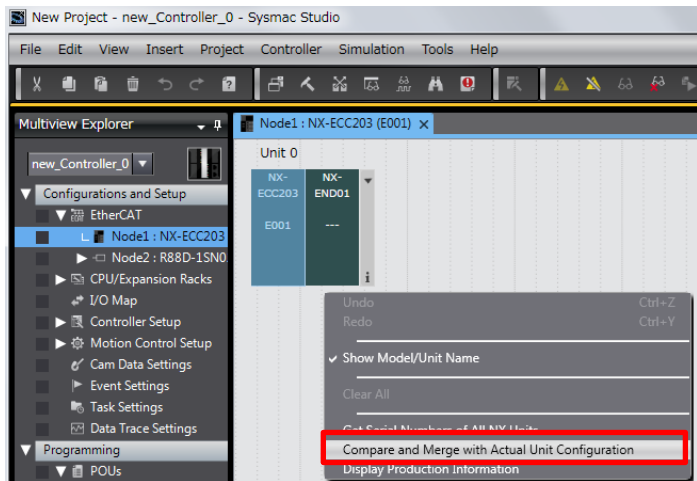
Right-click **NX-ECC203** in the Multiview Explorer, and select **Coupler Connection (USB)** then **Online**.

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



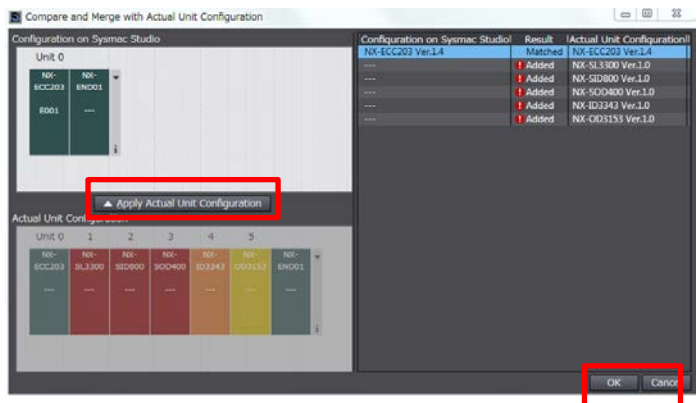
4 Double-click **NX-ECC203** in the Multiview Explorer to open the NX-ECC203 edit page.

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

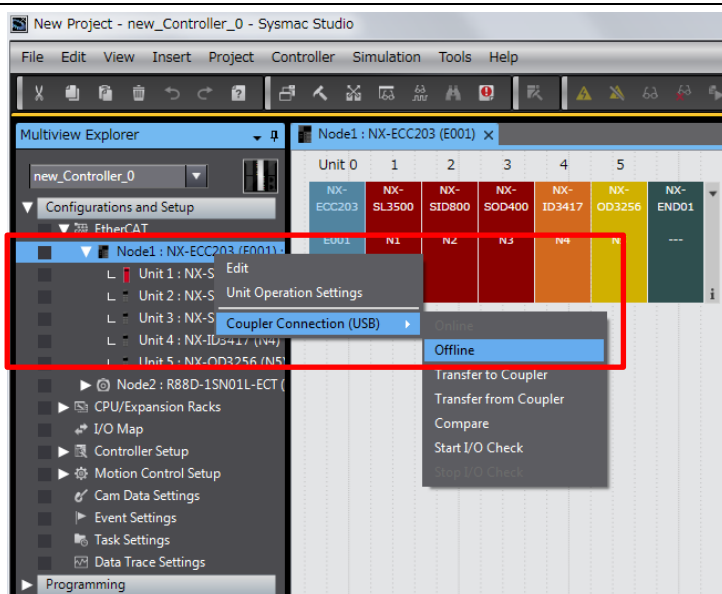


5 Click **Apply Actual Unit Configuration** to apply the actual unit configuration.

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



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



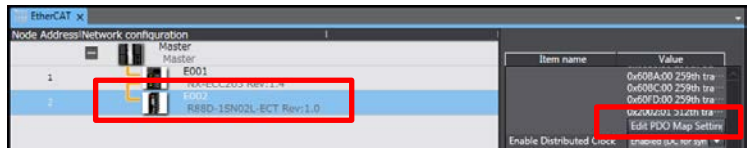
Precautions for Correct Use

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.

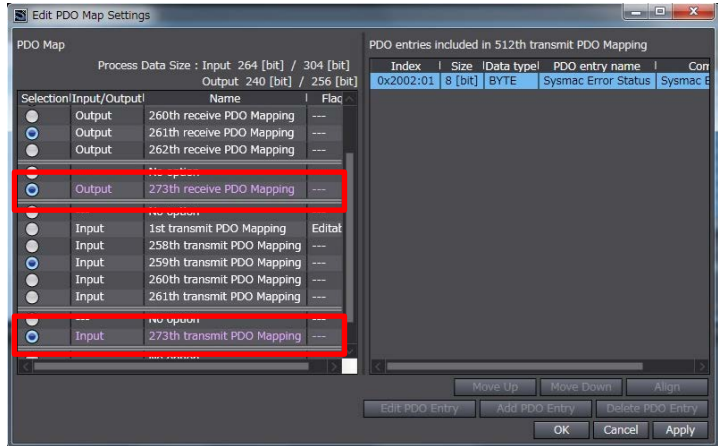
8.3.3. I/O Map Settings

- 1 Configure the PDO mapping settings for Servo Driver.

Select R88D-1SN01L-ECT, then click **Edit PDO Map Settings**.



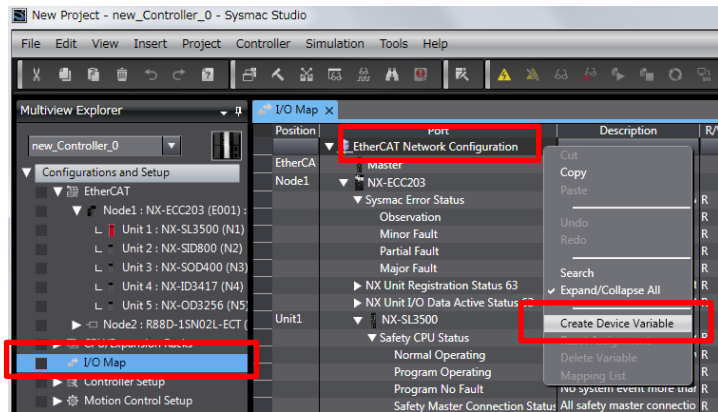
- 2 In the Edit PDO Map Settings page, select **output 273th** and **input 273th**, then click **OK**.



- 3 In the Multiview Explorer, select **Configurations and Setup**, then **I/O map** tab page to open the I/O map pane.

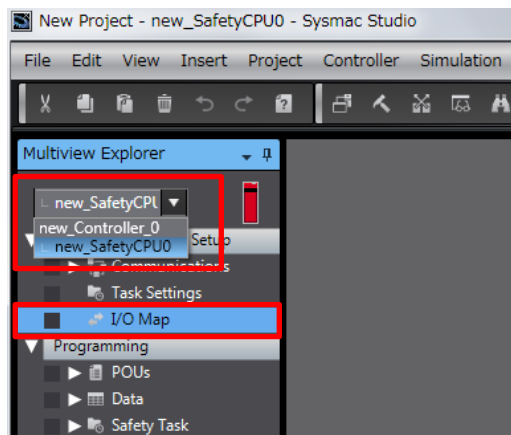
Right-click on **NX-ECC203**, and select **Create Device Variable** from the menu.

Similarly, right-click on **R88D-1SN01L-ECT**, and select **Create Device Variable** from the menu.

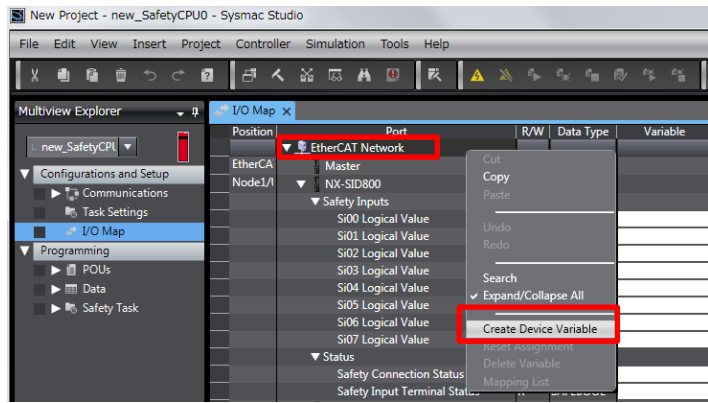


- 4 From the controller selection box in the Multiview Explorer, select the target Safety CPU Unit.

Double-click **I/O map** to open the Safety I/O map tab page.



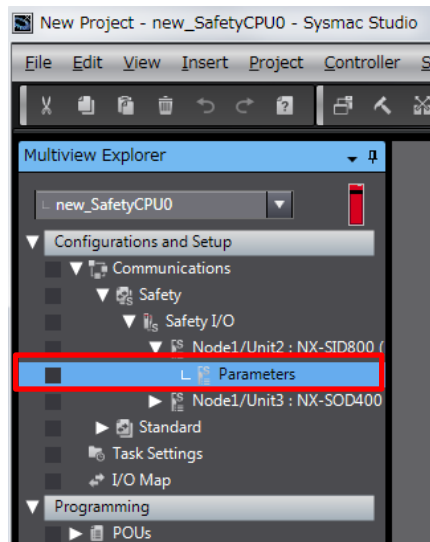
- Right-click on **EtherCAT Network**, and select **Create Device Variable** from the menu.



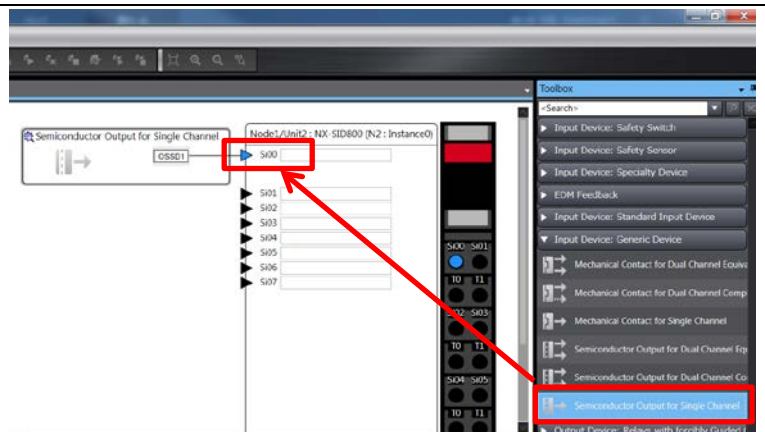
8.3.4. Safety I/O Function Settings

- From the controller selection box in the Multiview Explorer, select the target Safety CPU Unit.

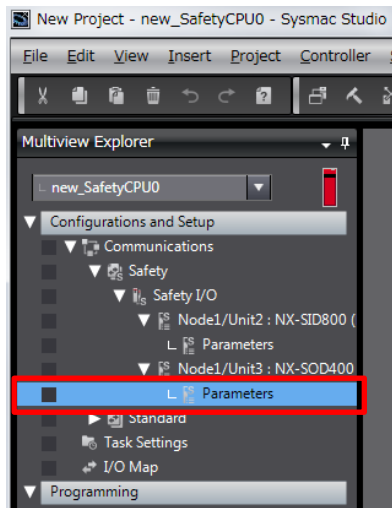
Double-click **Parameters** under NX-SID800 of **Configurations and Setup**.



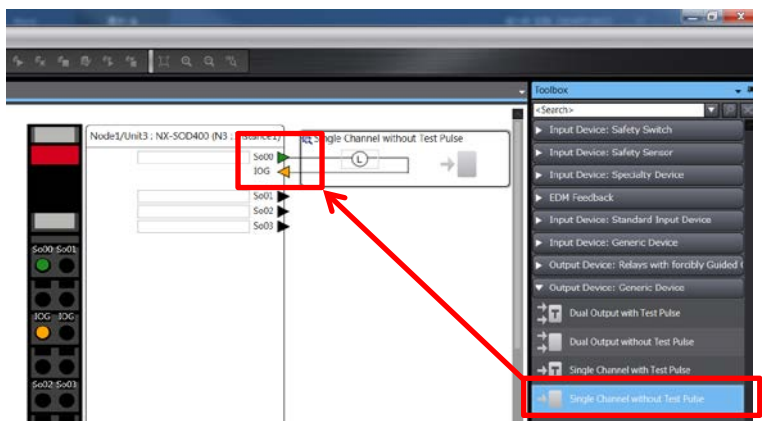
- Select an output device according to the type of external device that is connected to the safety input terminal from the toolbox, and drag and drop it on to input terminal Si00



- 3 Double-click **Parameters** under NX-SOD400 of **Configurations and Setup**.

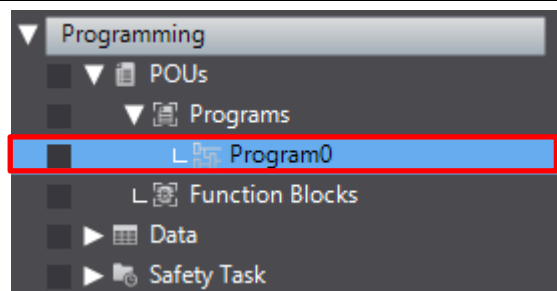


- 4 Select an input device according to the type of external device that is connected to the safety output terminal from the tool box, and drag and drop it on to output terminal So00.

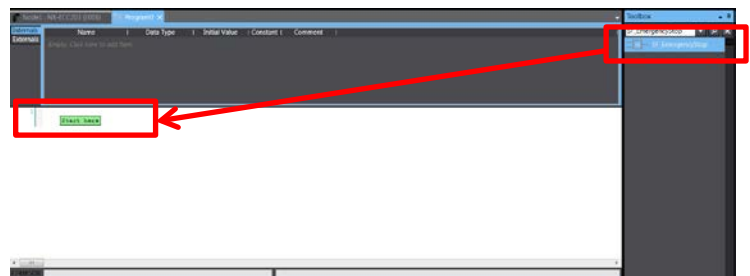


8.3.5. Creation of Safety Programs

- 1 Registering programs
Right-click **Programs** under **Programming – POU's** in the Multiview Explorer, and select **Add – Programs** from the menu.



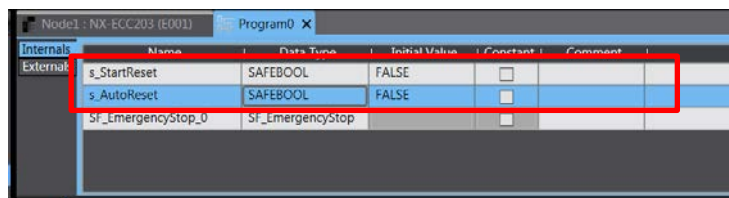
- 2 Drag a SF_EmergencyStop from the ToolBox to a new network where the words **Start Here** are displayed.



- 3 Select the tab for internal variables, and then register and edit the local variables.

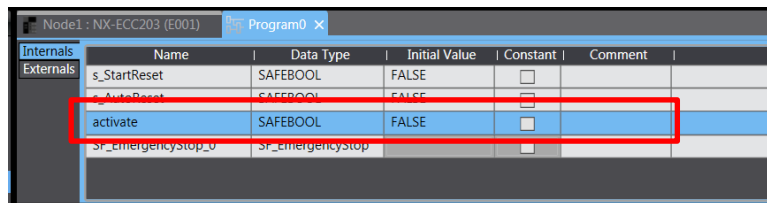
Name : s_StartReset
Data Type : SAFEBOOL
Initial Value : TRUE

Name : s_AutoReset
Data Type : SAFEBOOL
Initial Value : TRUE



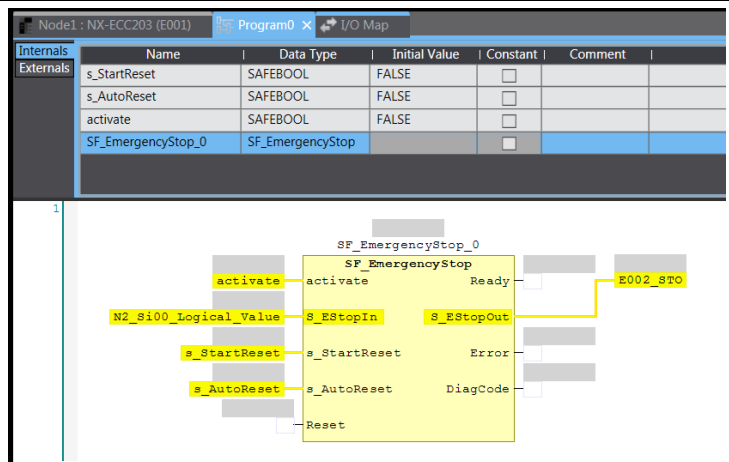
- 4 Register and edit the local variables.

Name : activate
Data Type : SAFEBOOL
Initial Value : FALSE



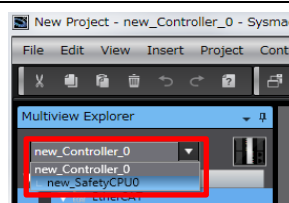
- 5 Select parameters on the FBD network and directly enter the variable names.

Activate : activate
 E_StopIn:
 N2_Si00_Logical_Value
 S_StartReset : s_StartReset
 S_AutoReset : s_AutoReset
 S_EstopOut : E002_STO



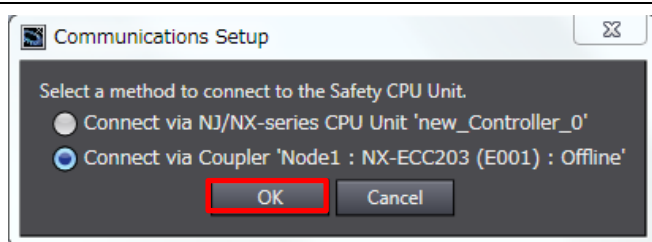
8.3.6. Transfer via Connection to the Communications Coupler Unit

- 1 From the controller selection box in the Multiview Explorer, select a Safety CPU Unit.



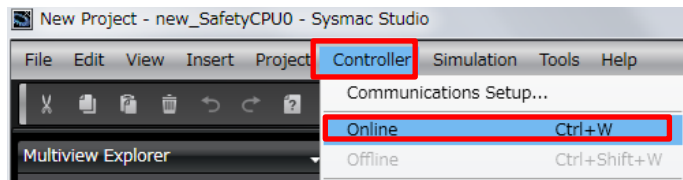
- 2 Select **Controller**, then **Communications Setup** from the menu.

Select **Connect via Coupler** in the Communications Setup dialog box, then click the **OK** button.

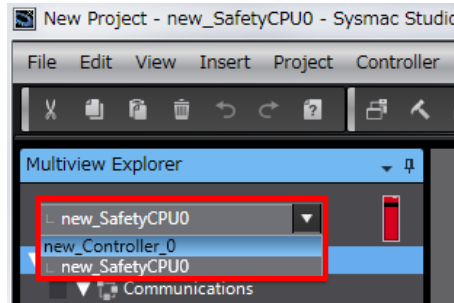


- 3 Select **Controller**, then **Online** from the menu.

The unit is in online connection with slave terminals.

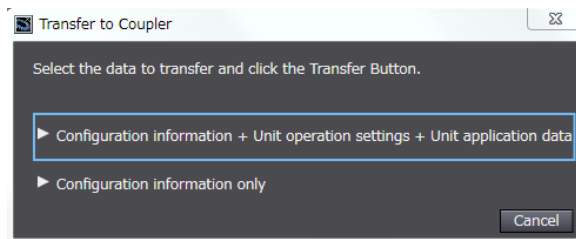
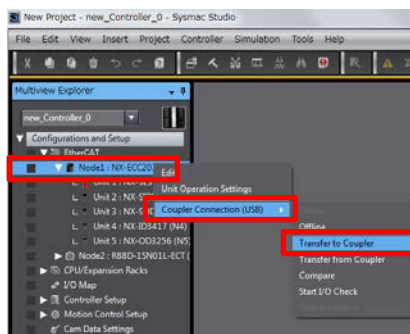


- 4 From the controller selection box in the Multiview Explorer, select a Controller Unit.



- 5 In the edit page for slave terminals, right-click the Communications Coupler Unit, then select **Coupler Connection (USB) – Transfer to Computer**.

Click **Configuration information only** or **Configuration information + Unit operation settings + Unit application data**.

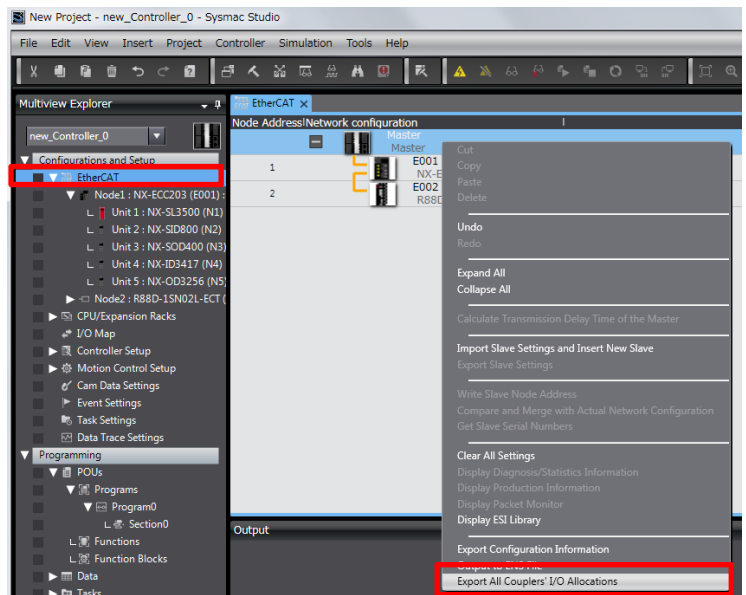


8.3.7. Output of Coupler I/O Allocations

- 1 Select **Controller**, then **Offline** from the menu.

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

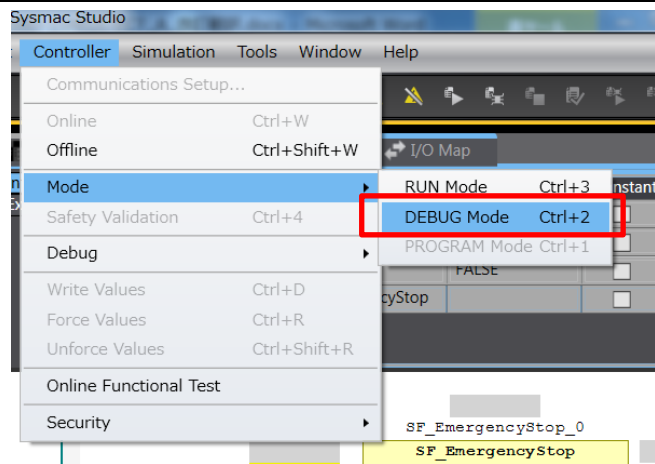
Right-click on **Master**, then select **Export All Coupler's I/O Allocations**.



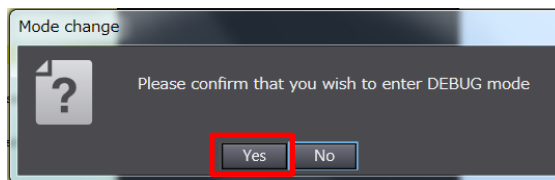
8.3.8. Changing to DEBUG Mode

- 1 Select the Safety CPU Unit from the Controller Selection Box in the Multiview Explorer.

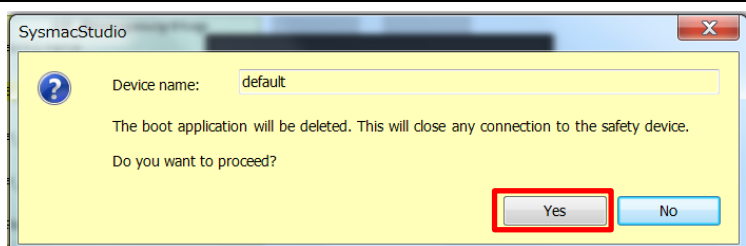
- 2 Select **Mode – DEBUG Mode** from **Controller Menu**.



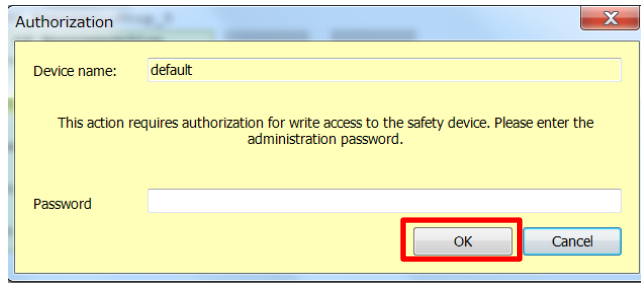
- 3 The following mode confirmation Dialog Box is displayed. Click the **Yes** Button.



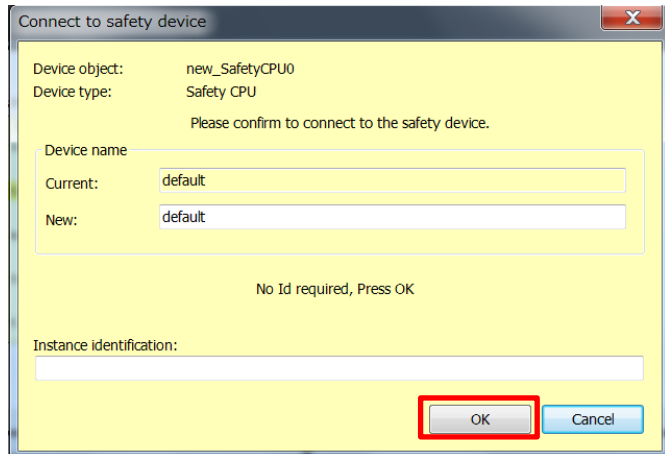
- 4 The following Connect to Safety Device Dialog Box is displayed. Click the **Yes** Button.



5 The following transfer confirmation Dialog Box is displayed. Click the safety of the system and then click the **Yes** Button.

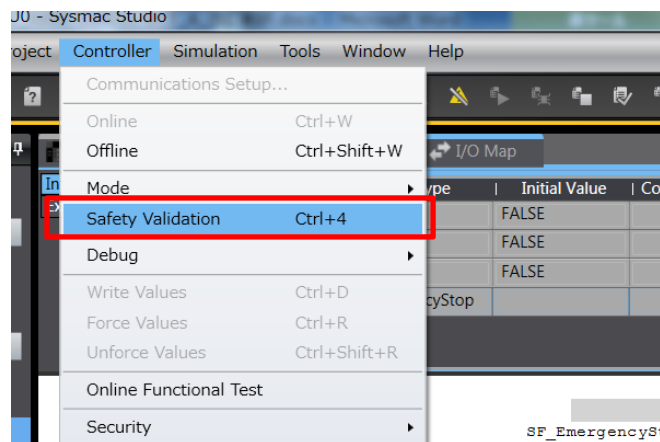


6 The following password confirmation dialog box is displayed. When you use the DEBUG mode for the first time, or when the safety password is not specified, leave the **Password** field blank and click the **OK** button.

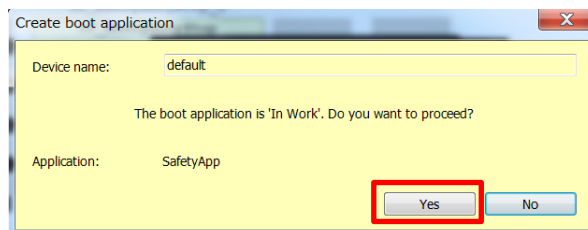


8.3.9. Performing Safety Validation

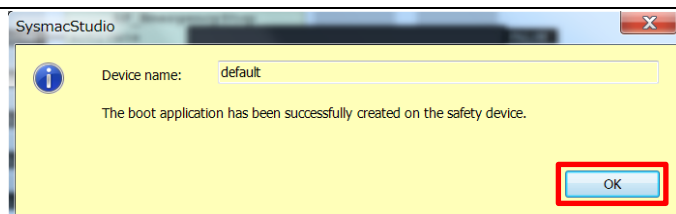
1 Select **Safety Validation** from the Controller Menu.



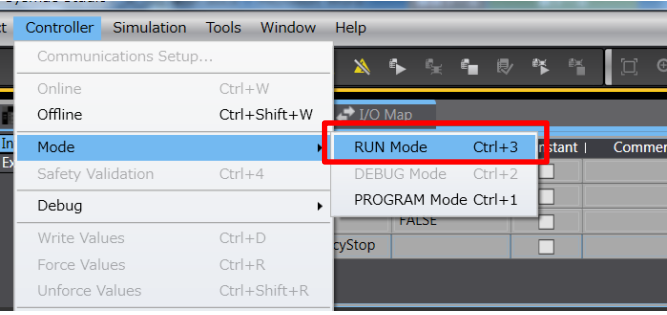
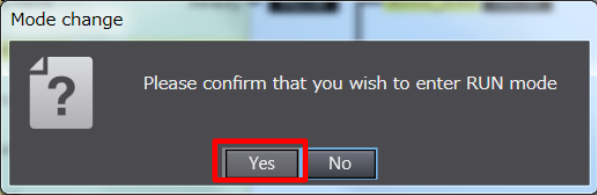
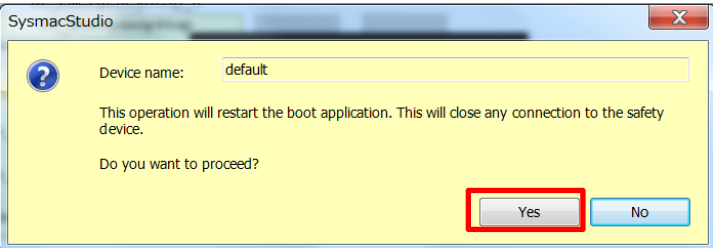
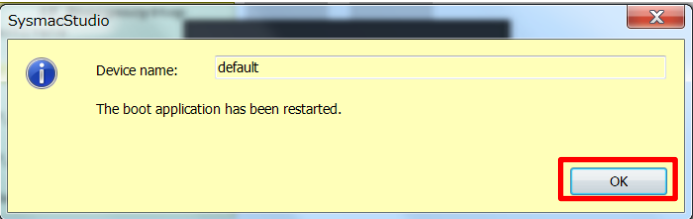
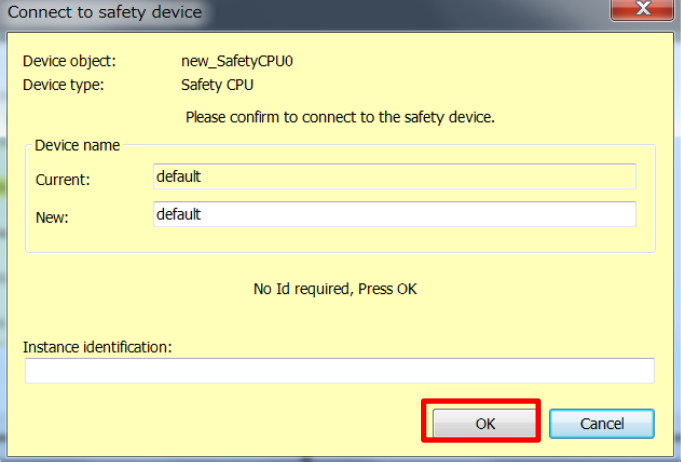
2 Click the **Yes** Button.



3 Click the **OK** Button



8.3.10. Changing to RUN Mode

1	Select Mode – RUN Mode from the Controller Menu.	 A screenshot of the SysmacStudio software interface. The 'Controller' menu is open, showing options like 'Online', 'Offline', 'Mode', 'Safety Validation', 'Debug', 'Write Values', 'Force Values', and 'Unforce Values'. The 'Mode' option is selected, and a sub-menu is displayed with 'RUN Mode Ctrl+3' highlighted by a red box. Other options in the sub-menu include 'DEBUG Mode Ctrl+2' and 'PROGRAM Mode Ctrl+1'.
2	Click the Yes Button.	 A dialog box titled 'Mode change' with a question mark icon. The text reads: 'Please confirm that you wish to enter RUN mode'. At the bottom, there are two buttons: 'Yes' and 'No'. The 'Yes' button is highlighted with a red box.
3	Click the Yes Button.	 A SysmacStudio dialog box with a question mark icon. It contains the text: 'Device name: default', 'This operation will restart the boot application. This will close any connection to the safety device.', and 'Do you want to proceed?'. At the bottom right, there are 'Yes' and 'No' buttons. The 'Yes' button is highlighted with a red box.
4	Click the OK Button.	 A SysmacStudio dialog box with an information icon. It contains the text: 'Device name: default' and 'The boot application has been restarted.'. At the bottom right, there is an 'OK' button highlighted with a red box.
5	Click the OK Button.	 A 'Connect to safety device' dialog box. It shows 'Device object: new_SafetyCPU0' and 'Device type: Safety CPU'. Below, it says 'Please confirm to connect to the safety device.' and has fields for 'Device name', 'Current: default', and 'New: default'. At the bottom, it says 'No Id required, Press OK' and has 'OK' and 'Cancel' buttons. The 'OK' button is highlighted with a red box.

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

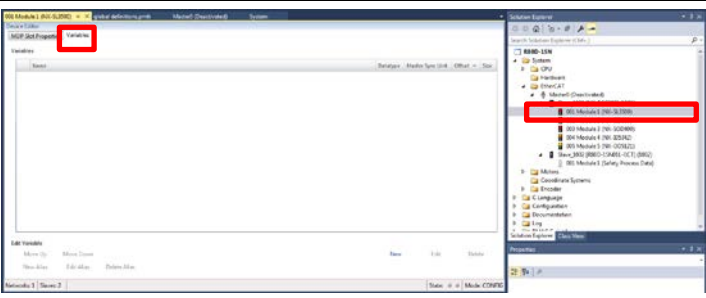
(1) Checking the coupler I/O allocations

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

(2) Setting Input Data

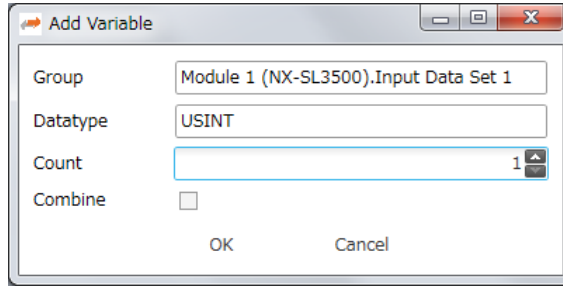
Register the following input data.

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

<p>1 Select a safety controller in the Solution Explorer of Power PMAC IDE.</p> <p>Display the Variables tab page.</p>	 The screenshot shows the Power PMAC IDE interface. On the left, the Solution Explorer displays a tree view with 'Safety Controller' selected and highlighted in red. The main workspace shows the 'Variables' tab, which is currently empty. The status bar at the bottom indicates 'State: Idle' and 'Module: CN502'.
---	---

2 [Slot1(NX-SL3500)Input Data Set1]
 Registering Node1/Unit2
 (NX-SID800)

Click **New** in the Variables tab page, and register 4 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-SOD400)

Click **New** in the Variables tab page, and register 4 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 19 variables shown on the right.

FSoE Master CMD	#xE700:01	USINT
-----------------	-----------	-------

Group: Module 1(NX-SL3500).Input Data Set 1

Datatype : USINT

Count : 1

STO Command	#x6640:00	BOOL
-	-	BOOL
-	-	BOOL
-	-	BOOL
-	-	BOOL
-	-	BOOL
-	-	BOOL
Error acknowledge	#x6632:00	BOOL
-	-	BOOL
-	-	BOOL
-	-	BOOL
-	-	BOOL
-	-	BOOL
-	-	BOOL
-	-	BOOL
-	-	BOOL

Group: Module 1(NX-SL3500).Input Data Set 1

Datatype : BOOL

Count : 16

FSoE Slave CRC_0	#xE600:03	UINT
FSoE Slave Conn_ID	#xE600:02	UINT

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.

Safety CPU Status	#x6004:01	UINT
-------------------	-----------	------

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.

The screenshot shows the 'Device Editor' window for '001 Module 1 (NX-SL3500)'. The 'Variables' tab is active, displaying a table of variables for 'Slave_1001'. The table has columns for Name, Datatype, Master Sync Const, Offset, and Size. A red box highlights the table content.

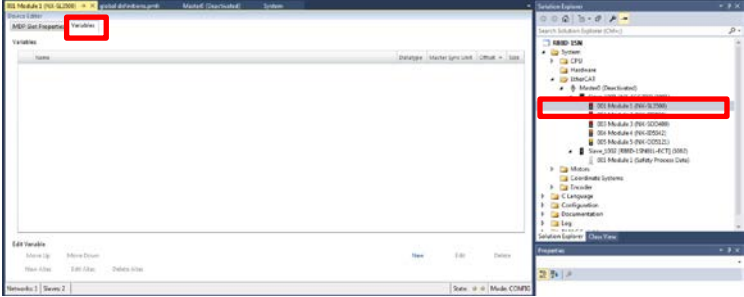
Name	Datatype	Master Sync Const	Offset	Size
Slave_1001 [NX-ECC03];Module 1 [NX-SL3500];Input Data Set 1;Variable 15	BOOL	Id 0: Default 0	IN:	34.6 0.1
Slave_1001 [NX-ECC03];Module 1 [NX-SL3500];Input Data Set 1;Variable 16	BOOL	Id 0: Default 0	IN:	34.7 0.1
Slave_1001 [NX-ECC03];Module 1 [NX-SL3500];Input Data Set 1;Variable 17	BOOL	Id 0: Default 0	IN:	35.0 0.1
Slave_1001 [NX-ECC03];Module 1 [NX-SL3500];Input Data Set 1;Variable 18	BOOL	Id 0: Default 0	IN:	35.1 0.1
Slave_1001 [NX-ECC03];Module 1 [NX-SL3500];Input Data Set 1;Variable 19	BOOL	Id 0: Default 0	IN:	35.2 0.1
Slave_1001 [NX-ECC03];Module 1 [NX-SL3500];Input Data Set 1;Variable 20	BOOL	Id 0: Default 0	IN:	35.3 0.1
Slave_1001 [NX-ECC03];Module 1 [NX-SL3500];Input Data Set 1;Variable 21	BOOL	Id 0: Default 0	IN:	35.4 0.1
Slave_1001 [NX-ECC03];Module 1 [NX-SL3500];Input Data Set 1;Variable 22	BOOL	Id 0: Default 0	IN:	35.5 0.1
Slave_1001 [NX-ECC03];Module 1 [NX-SL3500];Input Data Set 1;Variable 23	BOOL	Id 0: Default 0	IN:	35.6 0.1
Slave_1001 [NX-ECC03];Module 1 [NX-SL3500];Input Data Set 1;Variable 24	BOOL	Id 0: Default 0	IN:	35.7 0.1
Slave_1001 [NX-ECC03];Module 1 [NX-SL3500];Input Data Set 1;Variable 25	UNBT	Id 0: Default 0	IN:	36.0 2.0
Slave_1001 [NX-ECC03];Module 1 [NX-SL3500];Input Data Set 1;Variable 26	UNBT	Id 0: Default 0	IN:	30.0 2.0
Slave_1001 [NX-ECC03];Module 1 [NX-SL3500];Input Data Set 2;Variable 0	UNBT	Id 0: Default 0	IN:	40.0 2.0

Below the table, there are controls for 'Edit Variable' (Move Up, Move Down, New Alias, Edit Alias, Delete Alias) and buttons for 'New', 'Edit', and 'Delete'. The status bar at the bottom shows 'Networks: 1 | Slaves: 2' and 'State: @ | Mode: CONFIG'.

(3) Setting Output Data

Register the following output data.

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

<p>7</p>	<p>Select a safety controller in the Solution Explorer pane of Power PMAC IDE.</p> <p>Display the Variables tab page.</p>													
<p>8</p>	<p>[Slot1(NX-SL3500)Output Data Set1] Registering Node1/Unit2 (NX-SID800)</p> <p>Click New in the Variables tab page, and register 4 variables shown on the right.</p>	<table border="1" data-bbox="707 712 1437 757"> <tr> <td>FSoE Master CMD</td> <td>#x7020:01</td> <td>USINT</td> </tr> </table> <p>Group: Module 1(NX-SL3500).Output Data Set 1 Datatype: USINT Count: 1</p> <table border="1" data-bbox="707 931 1437 1061"> <tr> <td>Safety Output 1st Word</td> <td>#x7021:01</td> <td>UINT</td> </tr> <tr> <td>FSoE Master CRC_0</td> <td>#x7020:03</td> <td>UINT</td> </tr> <tr> <td>FSoE Master Conn_ID</td> <td>#x7020:02</td> <td>UINT</td> </tr> </table> <p>Group: Module 1(NX-SL3500).Output Data Set 1 Datatype: UINT Count: 3</p>	FSoE Master CMD	#x7020:01	USINT	Safety Output 1st Word	#x7021:01	UINT	FSoE Master CRC_0	#x7020:03	UINT	FSoE Master Conn_ID	#x7020:02	UINT
FSoE Master CMD	#x7020:01	USINT												
Safety Output 1st Word	#x7021:01	UINT												
FSoE Master CRC_0	#x7020:03	UINT												
FSoE Master Conn_ID	#x7020:02	UINT												
<p>9</p>	<p>[Slot1(NX-SL3500)Output Data Set1] Registering Node1/Unit3 (NX-SOD400)</p> <p>Click New in the Variables tab page, and register 4 variables shown on the right.</p>	<table border="1" data-bbox="707 1279 1437 1368"> <tr> <td>FSoE Master CMD</td> <td>#x7040:01</td> <td>USINT</td> </tr> <tr> <td>Safety Output 1st Byte</td> <td>#x7041:01</td> <td>USINT</td> </tr> </table> <p>Group: Module 1(NX-SL3500).Output Data Set 1 Datatype : USINT Count : 2</p> <table border="1" data-bbox="707 1543 1437 1632"> <tr> <td>FSoE Master CRC_0</td> <td>#x7040:03</td> <td>UINT</td> </tr> <tr> <td>FSoE Master Conn_ID</td> <td>#x7040:02</td> <td>UINT</td> </tr> </table> <p>Group: Module 1(NX-SL3500).Output Data Set 1 Datatype : UINT Count : 2</p>	FSoE Master CMD	#x7040:01	USINT	Safety Output 1st Byte	#x7041:01	USINT	FSoE Master CRC_0	#x7040:03	UINT	FSoE Master Conn_ID	#x7040:02	UINT
FSoE Master CMD	#x7040:01	USINT												
Safety Output 1st Byte	#x7041:01	USINT												
FSoE Master CRC_0	#x7040:03	UINT												
FSoE Master Conn_ID	#x7040:02	UINT												

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

Registering Node2

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

FSoE Slave CMD	#xE600:01	USINT
----------------	-----------	-------

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

Datatype : USINT

Count : 1

STO Command	#x6640:00	BOOL
-	-	BOOL
-	-	BOOL
-	-	BOOL
-	-	BOOL
-	-	BOOL
-	-	BOOL
Error acknowledge	#x6632:00	BOOL
-	-	BOOL
-	-	BOOL
-	-	BOOL
-	-	BOOL
-	-	BOOL
-	-	BOOL
-	-	BOOL
Safety Connection Status	#x6010:01	BOOL

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

Datatype : BOOL

Count : 16

FSoE Slave CRC_0	#xE600:03	UINT
FSoE Slave Conn_ID	#xE600:02	UINT

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

Datatype : UINT

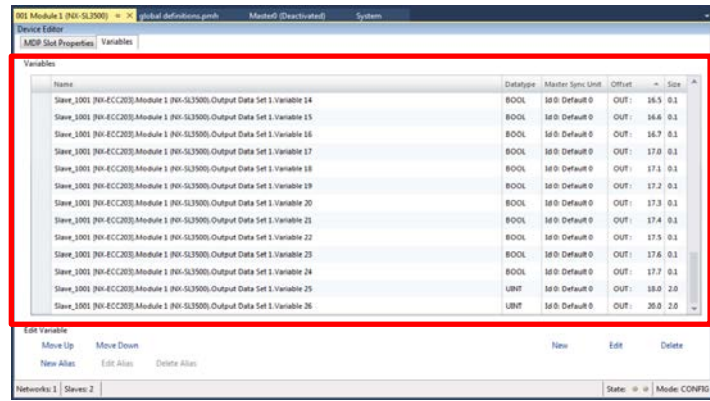
Count : 2

11 [Slot1(NX-SL3500)Output Data Set2]

* *Output Data Set2* is not used and does not need to be set.

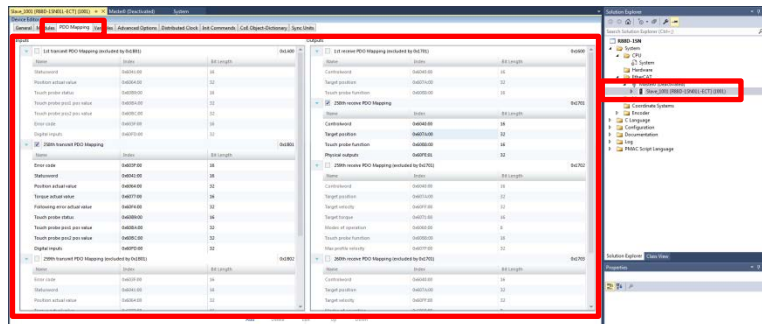
12 Checking Output Data

Make sure that the settings (Output) in the Variables tab page are correct.



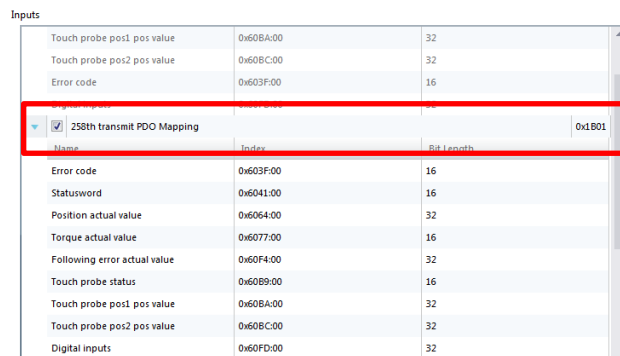
8.6.4. PDO Map Settings

- 1 In the Solution Explorer, select the target slave and display the PDO Mapping tab page.



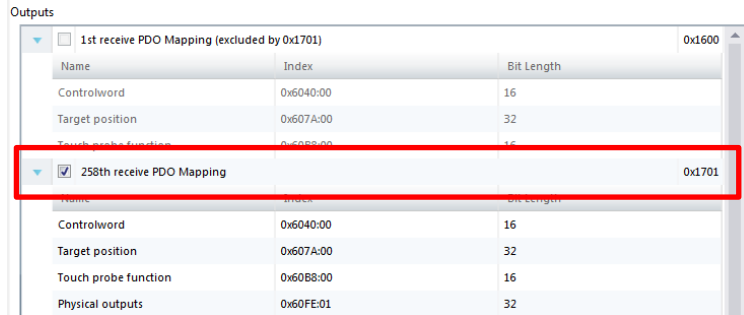
- 2 Setting PDO mapping (Inputs)

Make sure that the **258th transmit PDO Mapping 0x1B01** , **273th transmit PDO Mapping 0x1B10** check boxes are selected.



3 Setting PDO mapping (Outputs)

Make sure that the **258th receive PDO Mapping 0x1701** and **273th receive PDO Mapping 0x1710** check boxes are selected.



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 Coupler I/O Allocations*, open the expanded “CouplerCopyInfo.xml”, and check the contents.

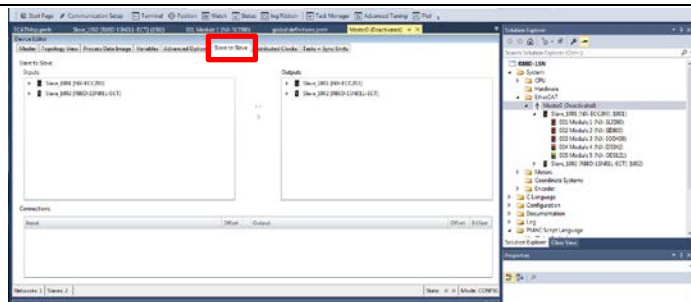
(2) Setting Input Data

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**

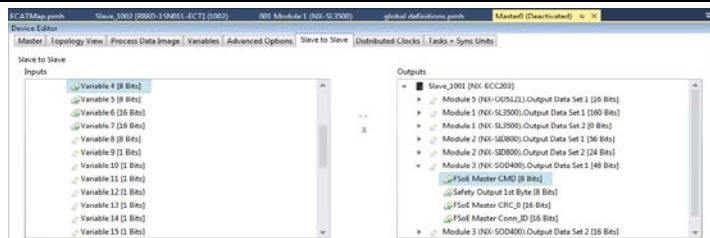
1 Select *Master* in the Solution Explorer of Power PMAC IDE.

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.

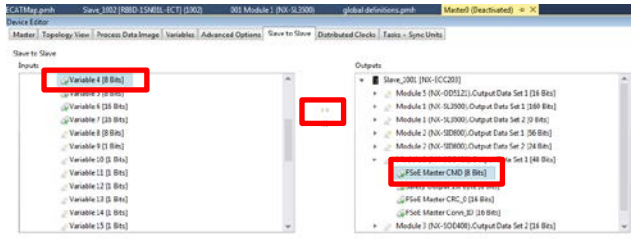
Select an Inputs item, then select the corresponding Outputs item and click >>.



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.

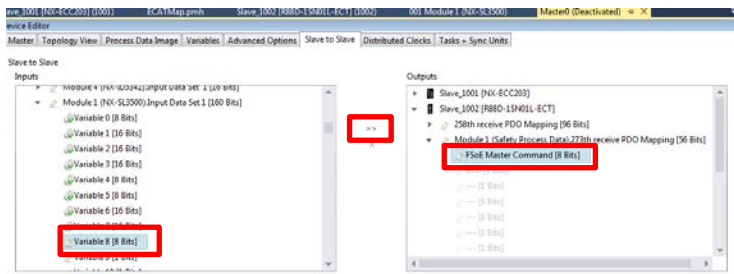


Associate the following items:

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

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

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.



Associate the following items:

Inputs	Outputs
Variable 8	FSoE Master Command
Variable 9	
Variable 10	

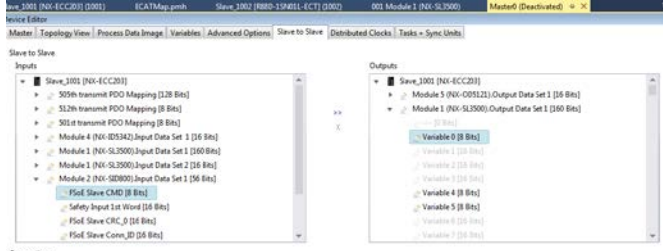
Select an Inputs item, then
 select the corresponding
 Outputs item and click >>.

(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.



Associate the following items:

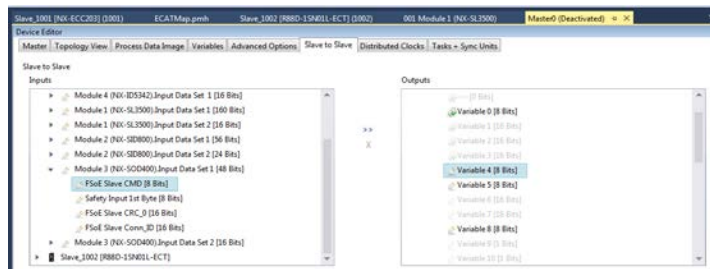
Inputs	Outputs
FSoE Slave CMD	Variable 0
Safety Input 1st Word	Variable 1
FSoE Slave CRC_0	Variable 2
FSoE Slave Conn_ID	Variable 3

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

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 >>.



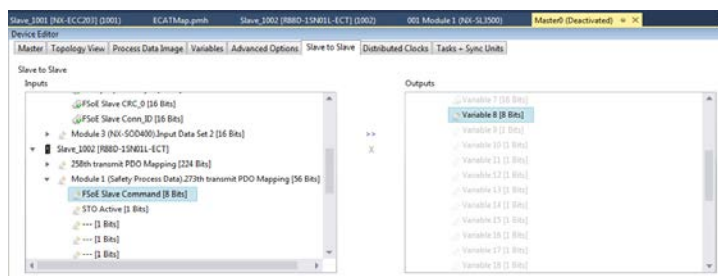
Associate the following items:

Inputs	Outputs
FSoE Slave CMD	Variable 4
Safety Input 1st Word	Variable 5
FSoE Slave CRC_0	Variable 6
FSoE Slave Conn_ID	Variable 7

7 Expand
Slave_1001[R88D-1SN01L-EC
T] – 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 6.4.4 *Creation of an EtherCAT Network Information File*.

8.7. Controller Settings

Perform the procedure provided in 6.5 *Controller Settings*.

9. Appendix Troubleshooting

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

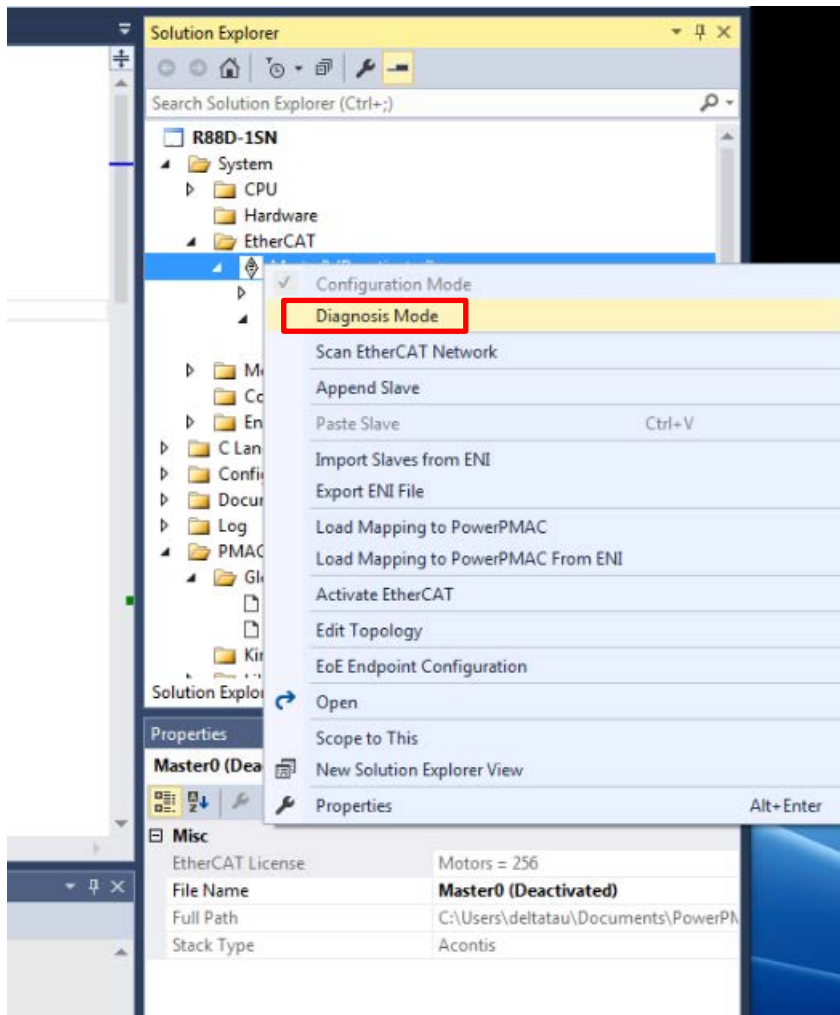
Description	Factor	Corrective Action
The link is not established.	The Ethernet cable is broken or the specified cable is not being used.	If the Ethernet cable is broken or if the specified cable was not used, replace the cable.
	A connector on the Ethernet cable used for EtherCAT communications is disconnected, 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 tab page, 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 <i>1.1 EtherCAT Communications Setup</i> .
	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 <i>6.4.2 Distributed Clock Setup</i> .
	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 **Diagnosis Mode** of Power PMAC IDE.

Right-click on **Master0 (Deactivated)** under **EtherCAT** in the Solution Explorer, then select **Diagnosis Mode** to open the Diagnosis Mode page



You can check the status of the slaves in the Diagnosis Mode page.

ECATMap.pmh | Master0 (Deactivated) | global definitions.pmh | System

Device Editor

General | Process Data Image | Watch list | Performance | Variables | CoE Object-Dictionary | History

State Machine


Current State: Pre-Op

Requested State: Pre-Op

Change State: Pre-Op, Safe-Op, Op

Information

Number of found slaves	2	Frame Counter	
Number of slaves in configuration	2	Sent frames	55067
Number of DC slaves	2	Lost frames	0
DC in-sync	Yes	Cyclic frames	44678
Topology Ok	Yes	Acyclic frames	10389
Link Connected	Yes		Clear counters
Slaves in Master State	Yes		

Networks: 1 | Slaves: 2 | State:  | Mode: DIAGNOSIS

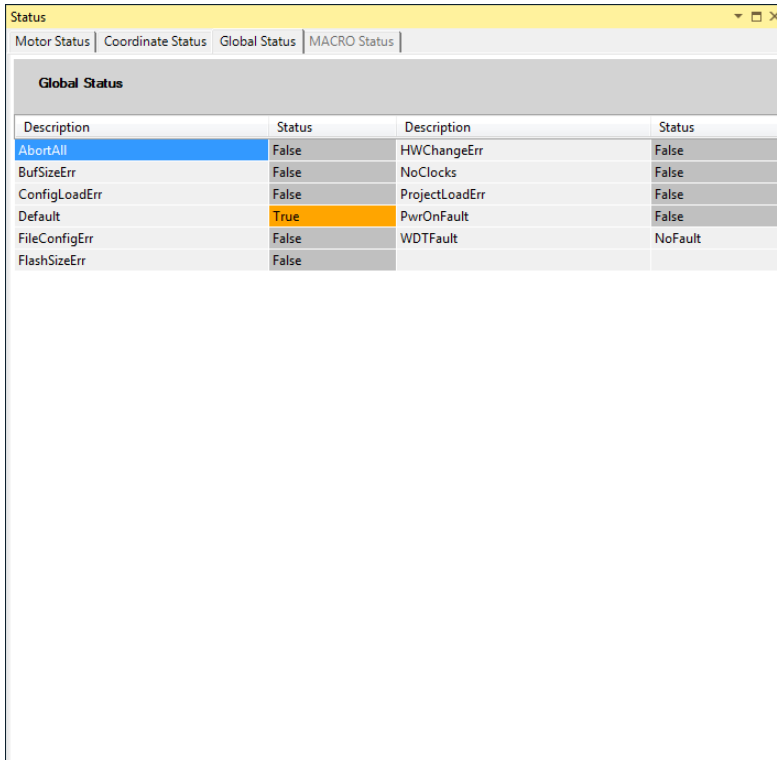
9.2.2. Checking the Controller Status

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.



Description	Status	Description	Status
AbortAll	False	HWChangeErr	False
BufSizeErr	False	NoClocks	False
ConfigLoadErr	False	ProjectLoadErr	False
Default	True	PwrOnFault	False
FileConfigErr	False	WDTFault	NoFault
FlashSizeErr	False		

■ Motor Status

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

Motor 1 ● Motor activated

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

■ Coordinate Status

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

Coordinate System 0

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	SegHaltReq	False
EncLoss	False	SegMove	Off
EndDelayActive	False	SegMoveAccel	False
ErrorStatus	NoError	SegMoveDecel	False
FeedHold	Off	SegStopReq	False
FeFatal	False	SharpCornerStop	False
FeWarn	False	SoftMinusLimit	False
HomeComplete	False	SoftPlusLimit	False
HomeInProgress	False	TimerEnabled	False
I2tFault	False	TimersEnabled	False
InPos	False	TriggerMove	False
InterlockStop	False	TriggerNotFound	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	5-Apr, 2019	First edition

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

OMRON Corporation Industrial Automation Company

Tokyo, JAPAN

Contact: www.ia.omron.com

Regional Headquarters

OMRON EUROPE B.V.

Wegalaan 67-69, 2132 JD Hoofddorp
The Netherlands
Tel: (31)2356-81-300/Fax: (31)2356-81-388

OMRON ELECTRONICS LLC

2895 Greenspoint Parkway, Suite 200
Hoffman Estates, IL 60169 U.S.A
Tel: (1) 847-843-7900/Fax: (1) 847-843-7787

OMRON ASIA PACIFIC PTE. LTD.

No. 438A Alexandra Road # 05-05/08 (Lobby 2),
Alexandra Technopark,
Singapore 119967
Tel: (65) 6835-3011/Fax: (65) 6835-2711

OMRON (CHINA) CO., LTD.

Room 2211, Bank of China Tower,
200 Yin Cheng Zhong Road,
PuDong New Area, Shanghai, 200120, China
Tel: (86) 21-5037-2222/Fax: (86) 21-5037-2200

Authorized Distributor:

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