

Programmable Multi-Axis Controller

# Startup Guide for G5-series Servo Drives

CK3E-□□□□

NY51□-A□□□



Startup  
Guide

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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-□□□□	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	I576-E1	Model R88M-K□ Model R88D-KN□-ECT	R88M-K□, R88D-KN□-ECT AC Servomotors/Servo Drives (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 a part or the whole of this document without the permission of OMRON Corporation.
- (5) The information contained in this document is current as of July 2016. It is subject to change without prior notice for improvement purposes.

The following notations are used in this document.

 <b>WARNING</b>	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.
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 <b>Caution</b>	Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury, or property damage.
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### Precautions for Correct Use

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

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### Additional Information

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Additional information to read as required.

This information is provided to increase understanding or make operations easier.

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### Symbols

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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.

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## 4. Overview

This document describes the procedures used to operate the OMRON servo drivers (G5-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-□□□□/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-KN□-ECT Model R88D-KN□-ECT-L



#### 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.



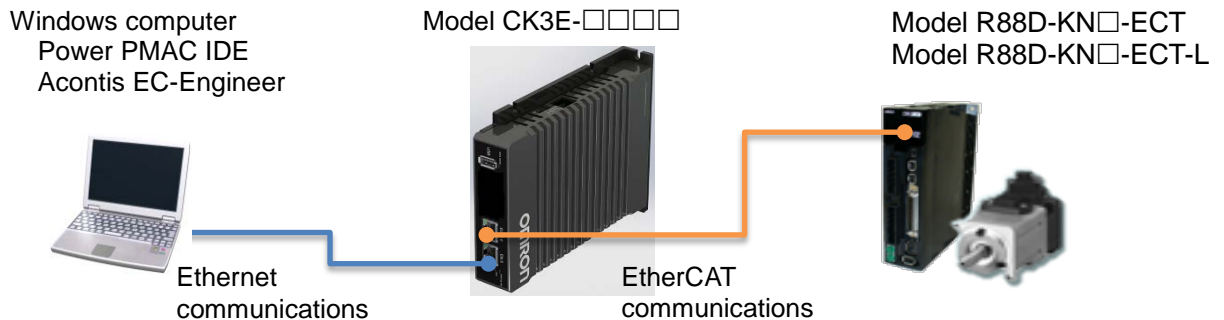
#### Additional Information

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 (G5-series with Built-in EtherCAT Communications)	Model R88D-KN01L-ECT	Ver.2.1
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

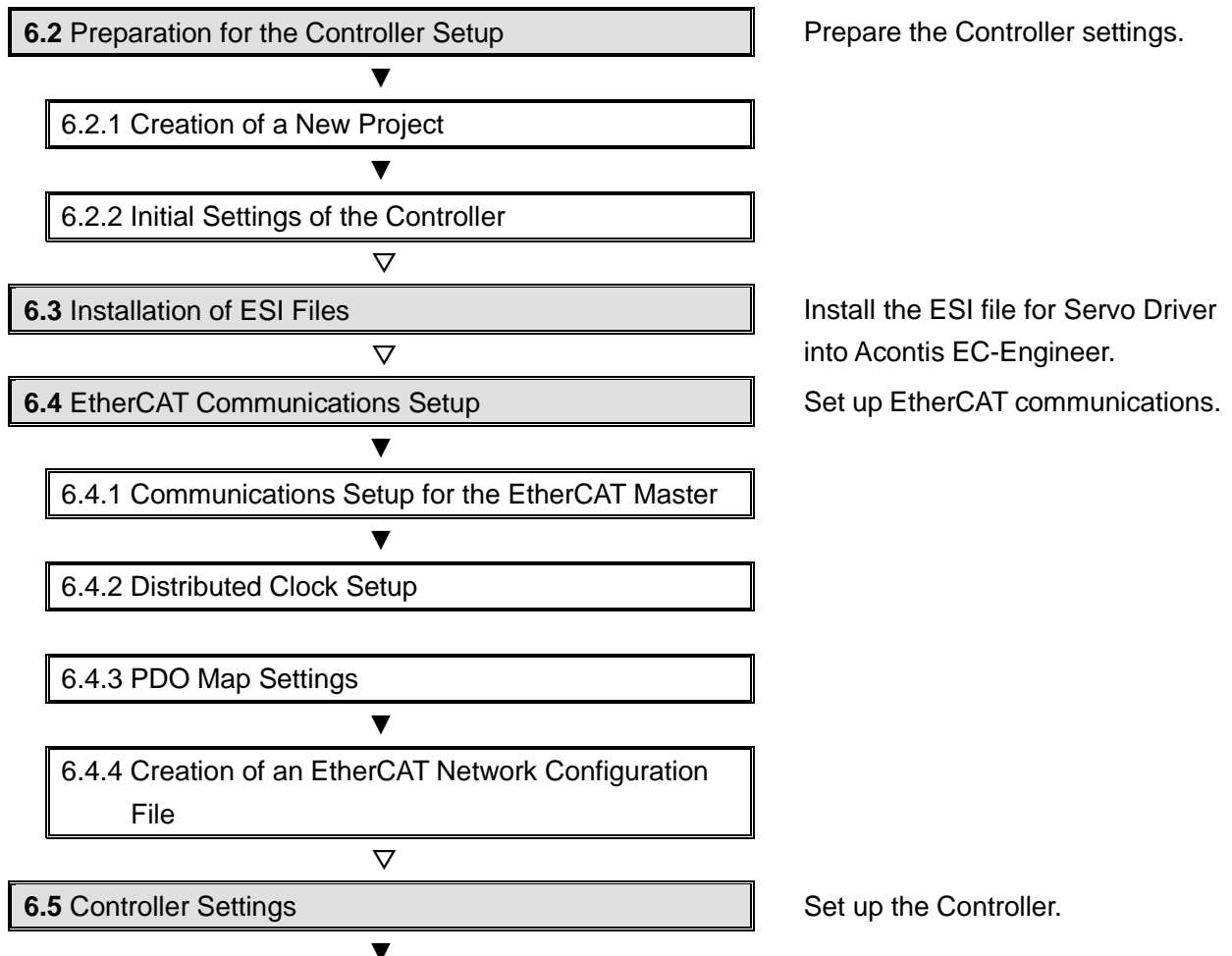
If an uninitialized Controller is used, the motion control devices may perform unexpected operations upon power-on depending on the Controller status, resulting in a personal injury to the user.

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.



6.5.1 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 with the computer via Ethernet cable.

2 Turn on the power to the Controller.

3 Start Power PMAC IDE.

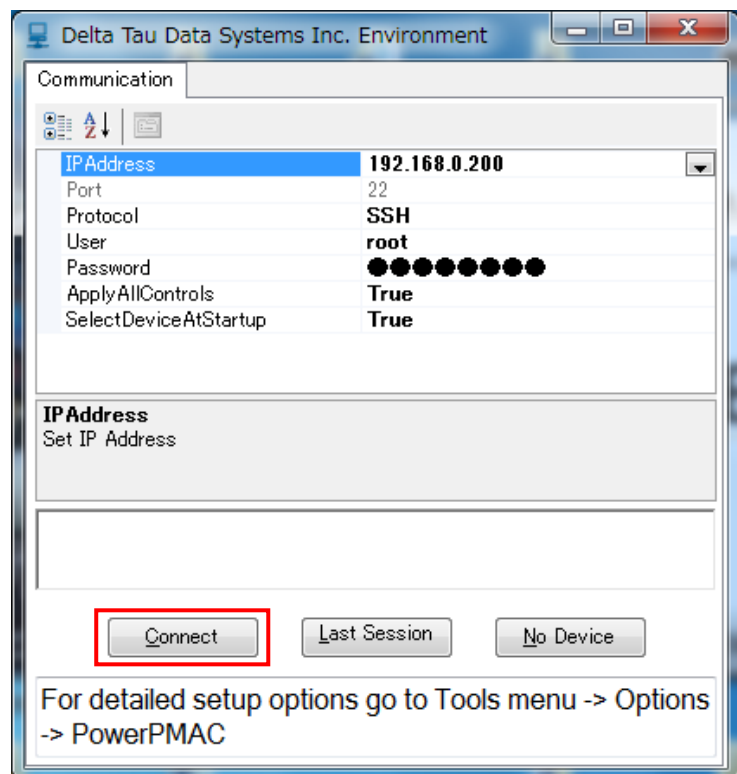
\* If the dialog for confirming access rights appears upon start-up, select starting of Power PMAC IDE.



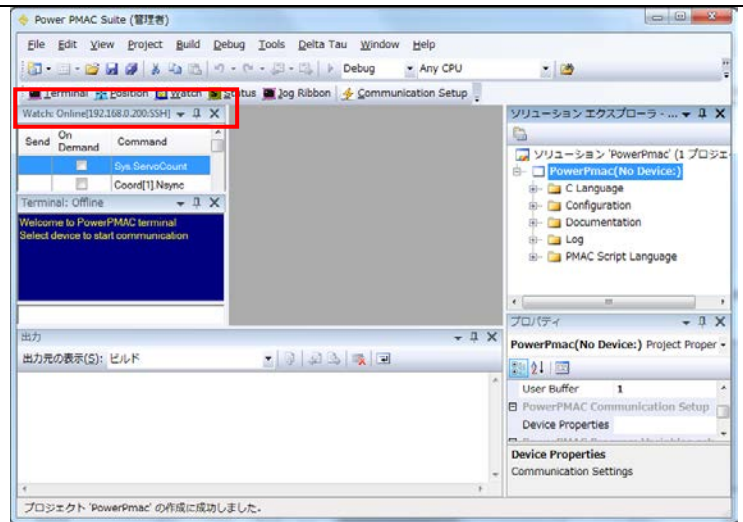
4 The Communication screen appears. Specify the IP address of the destination Controller and click **Connect**.

\* The IP address of the Controller is set to "192.168.0.200" by default.

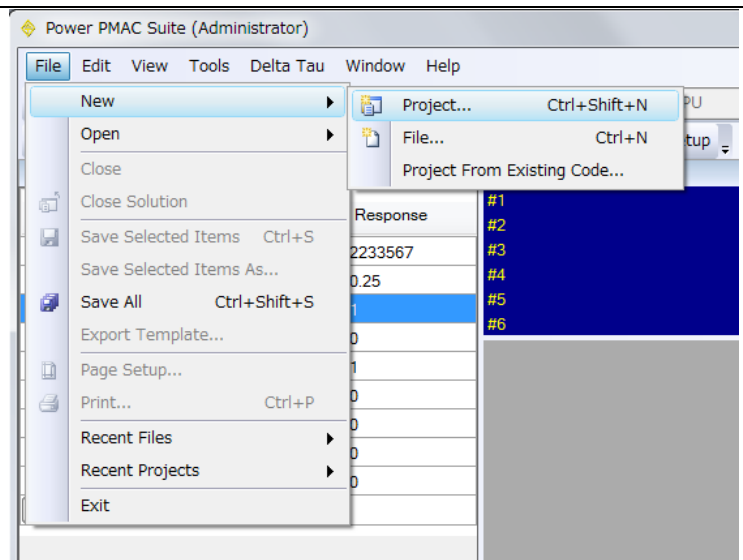
\* If necessary, change the Windows IP address to "192.168.0.X".



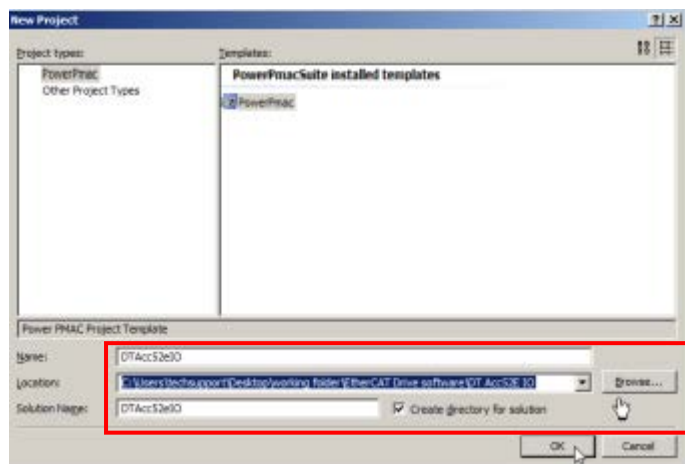
- 5 Power PMAC IDE starts, and is online to the Controller.



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



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



## 6.2.2. Initial Settings of the Controller

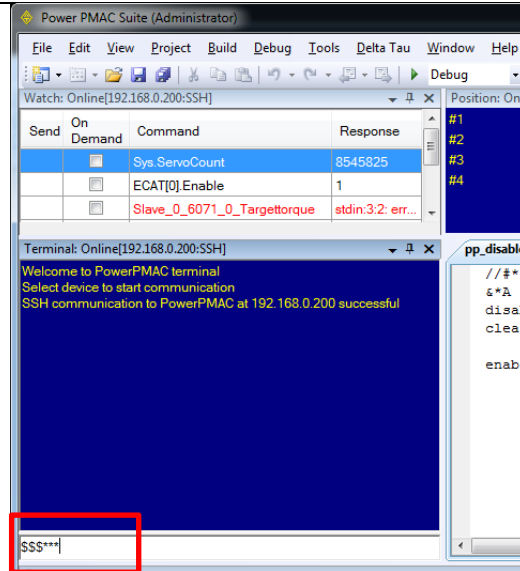
Configure the initial settings for the Controller.



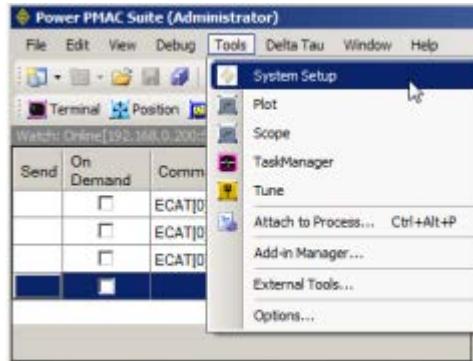
### Precautions for Correct Use

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

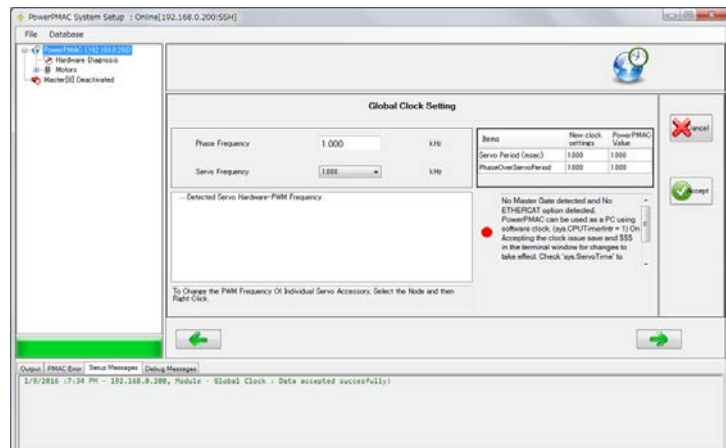
- 1 In the Terminal pane, type the `$$$***` command to reset the Controller to factory default.



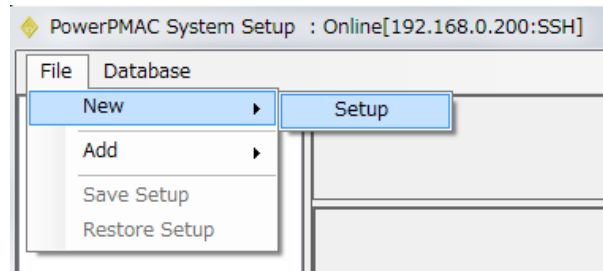
- 2 From the **Tools** menu, select **System Setup** to start **System Setup**.



PowerPMAC System Setup starts.

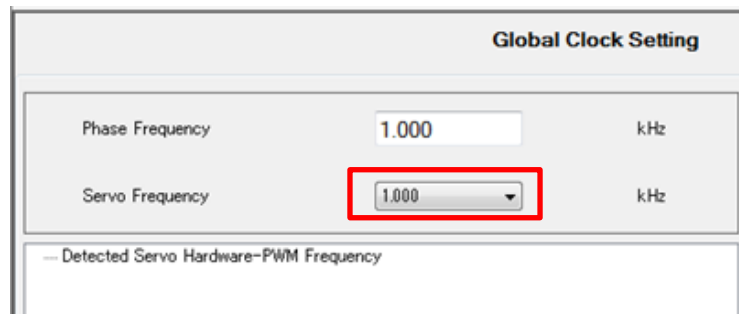


- 3 From the **File** menu of PowerPMAC System Setup, select **New** then **Setup**.

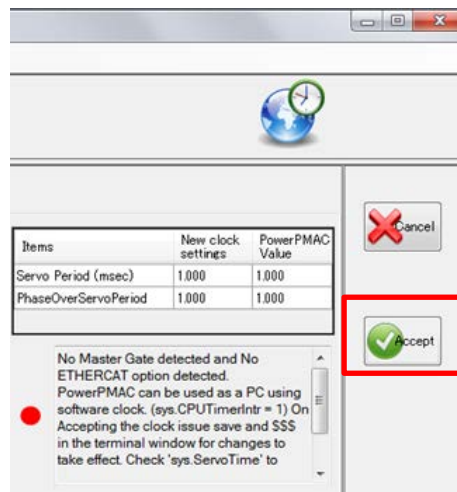


- 4 Specify **Servo Frequency**.  
Select the **Servo Frequency** setting from 4 kHz, 2 kHz, or 1 kHz.

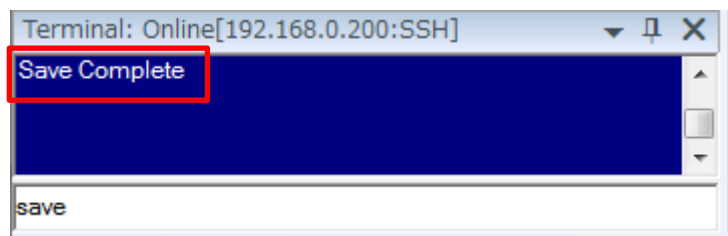
\* Servo Frequency is set to 1 kHz for the example in this document.



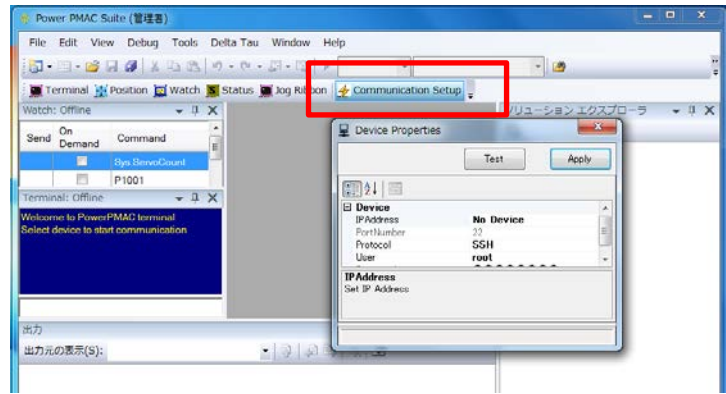
- 5 Click the **Accept** button.



- 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.

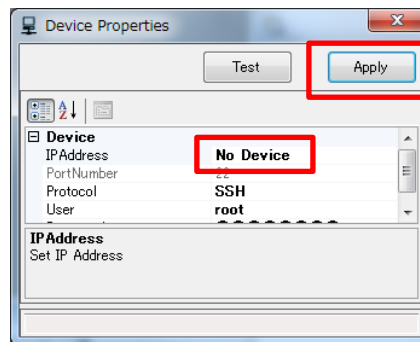


- 7 Click **Communication Setup** on the toolbar to display the Device Properties dialog box.



- 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.

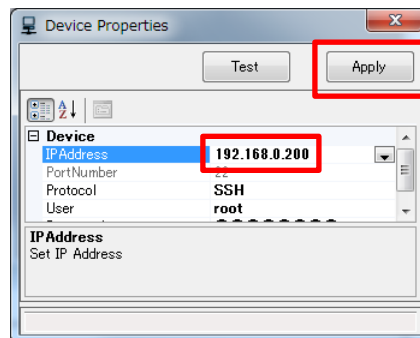


- 9 The Controller restarts.

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

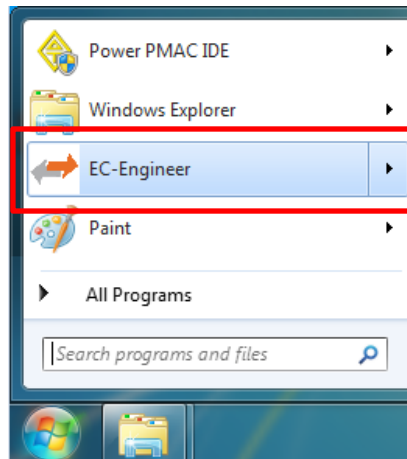
Install the ESI file for Servo Driver into Acontis EC-Engineer.



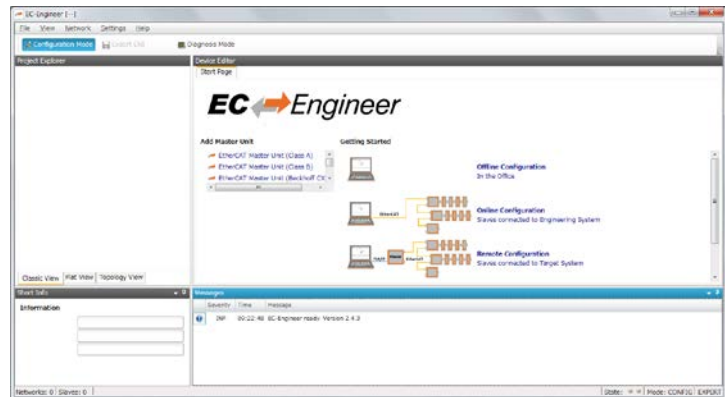
### Precautions for Correct Use

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.

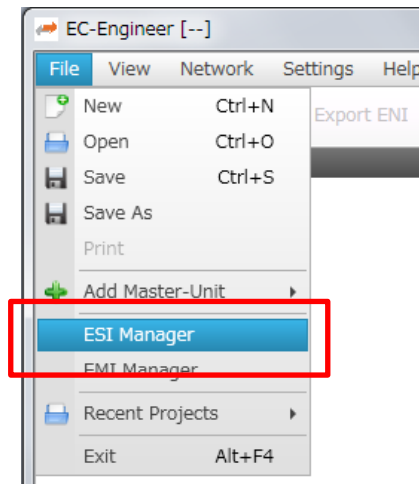


EC-Engineer screen:

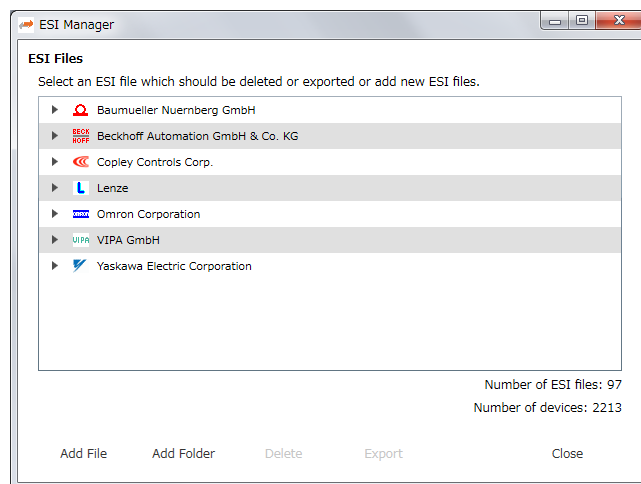


- 2 From the **File** menu of EC-Engineer, select **ESI Manager**.

The ESI Manager appears.

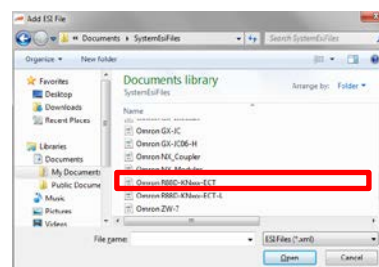
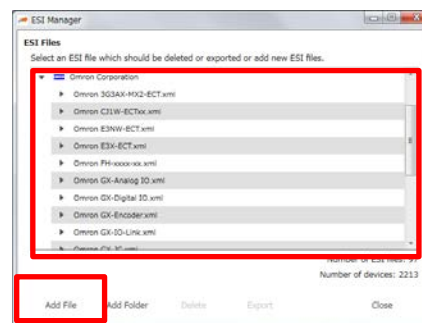


Example of the ESI Manager



- 3 Confirm that *Omron R88D-KNxxx-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-KNxxx-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

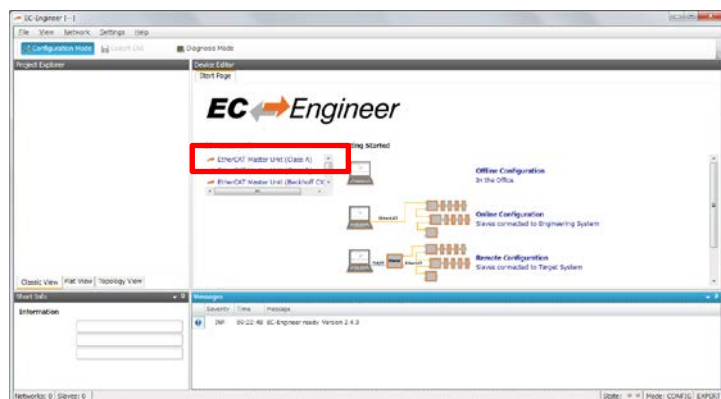
Before taking the following steps, make sure that the devices are connected via an Ethernet cable. If they are not connected, turn OFF the power to the devices, and connect the Ethernet cable.

#### 6.4.1. Communications Setup for the EtherCAT Master

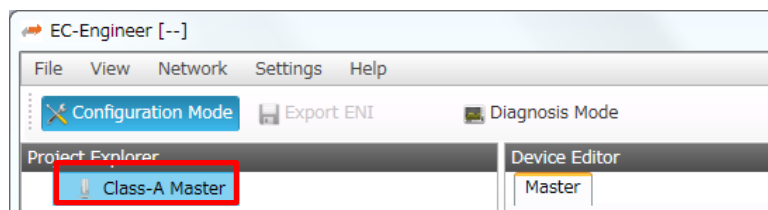
- 1 Connect the Controller with slave devices using an Ethernet cable.

\* 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**.

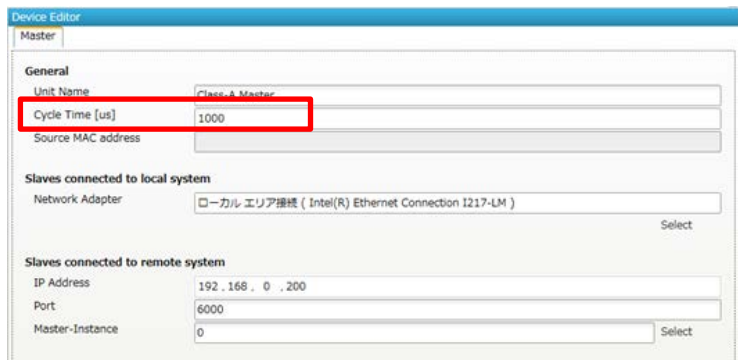


- 3 **Class-A Master** is added to the Project Explorer.



- 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.

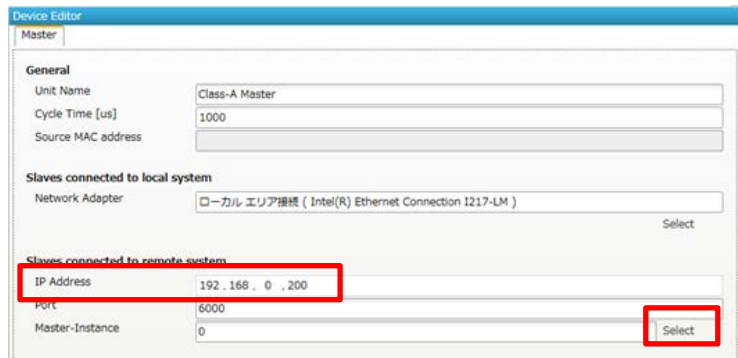


Correspondence between the servo frequencies of the Controller and communication periods is as follows:

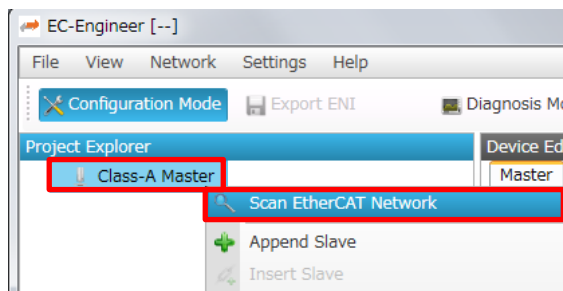
- 4 kHz : 250 us
- 2 kHz : 500 us
- 1 kHz : 1000 us

- 5 In the Master page, enter the IP address of the Controller in **IP Address**, and click the **Select** button to apply the setting.

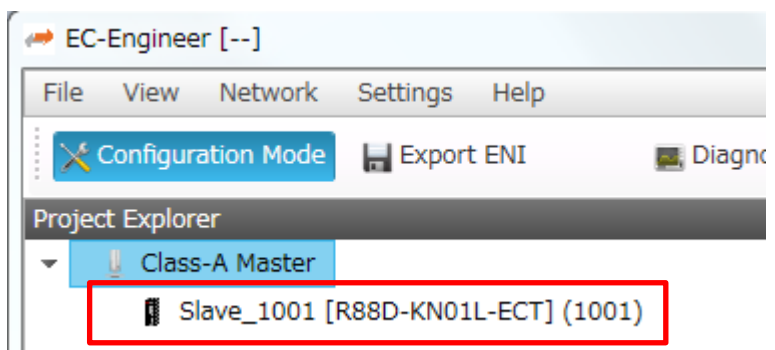
\* Default IP address "192.168.0.200" is specified in this example.  
\* Do not select **Slaves connected to local system** as it is not used.



- 6 Right-click on **Class-A Master** in the Project Explorer, and select **Scan EtherCAT Network** from the menu.



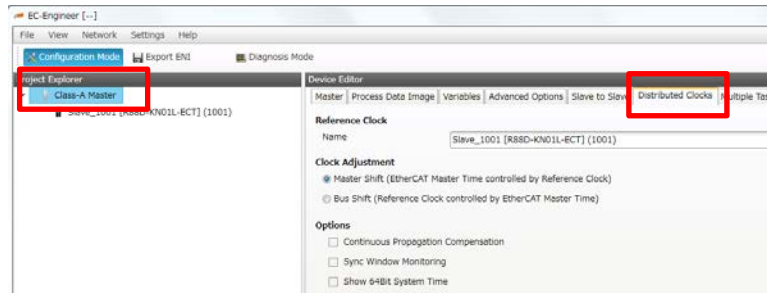
- 7 Make sure that the slave is displayed in the Project Explorer.



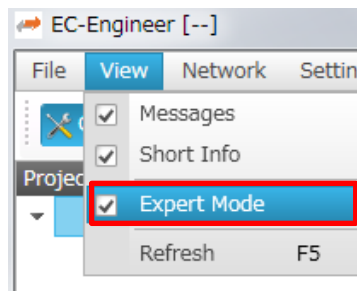
## 6.4.2. Distributed Clock Setup

### 1 Setting Distributed Clocks (DC) for Master

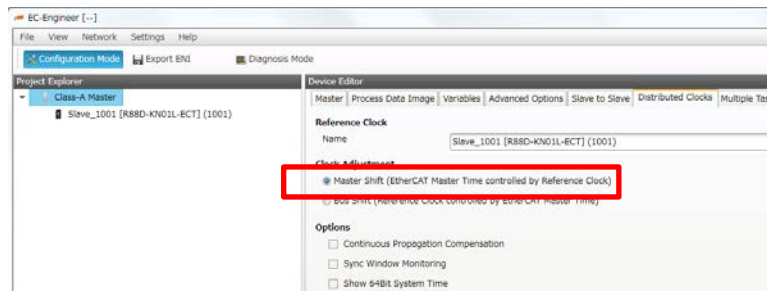
In the Project Explorer, select **Class-A Master** to display the Distributed Clocks tab page.



\* If the Distributed Clocks tab does not appear, select **View** then the **Expert Mode** check box.

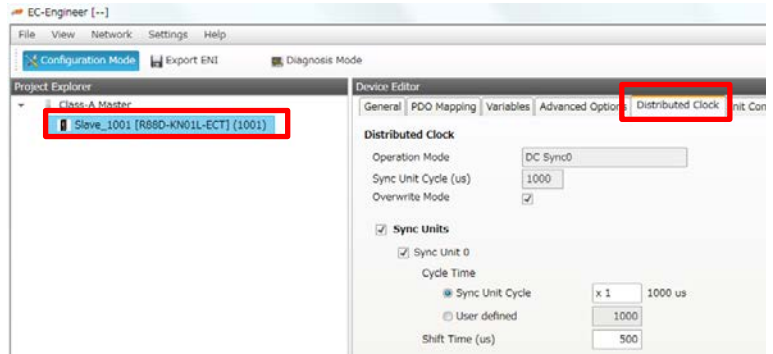


### 2 Select **Master Shift (EtherCAT Master Time controlled by Reference Clock)**.

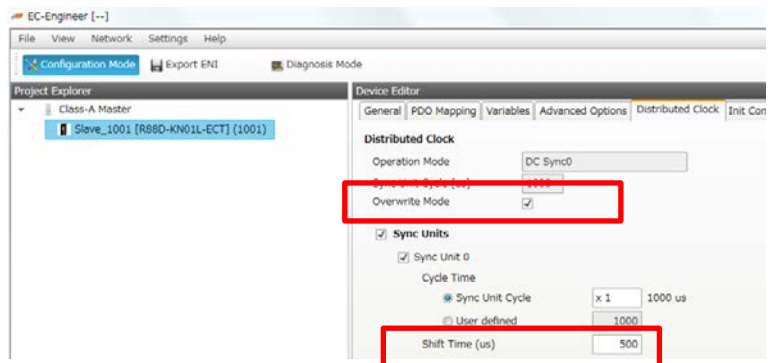


### 3 Setting Distributed Clock (DC) for the Slave

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

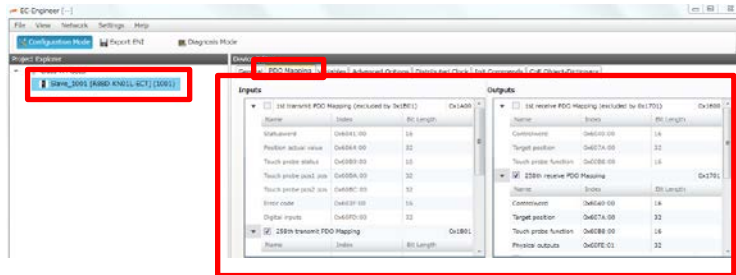
## ⚠ Caution

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.

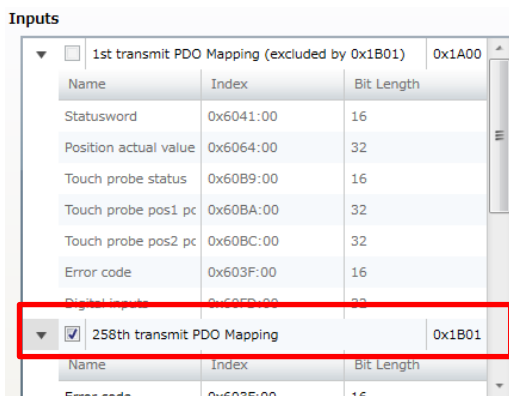


- 1 In the Project Explorer, select the target slave to display the PDO Mapping tab page.



- 2 Setting PDO mapping (Inputs)

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

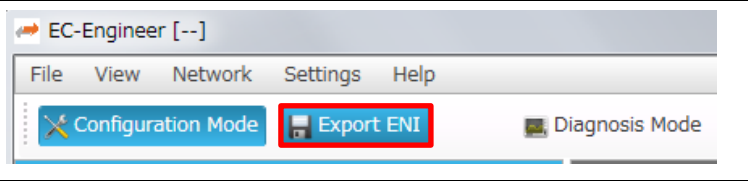
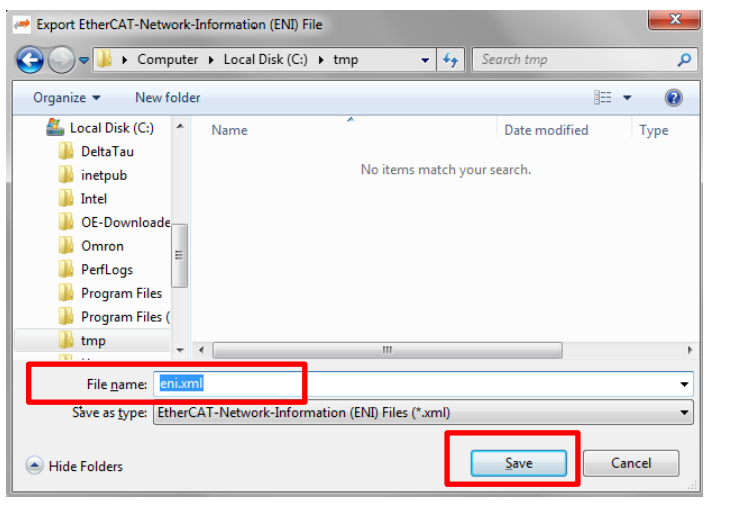


- 3 Setting PDO mapping (Outputs)

Clear the **258th receive PDO Mapping 0x1701** check box in the Outputs field.  
Select the **258th receive PDO Mapping 0x1704** check box.


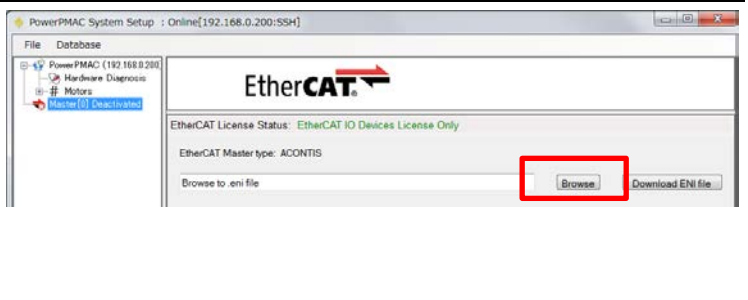
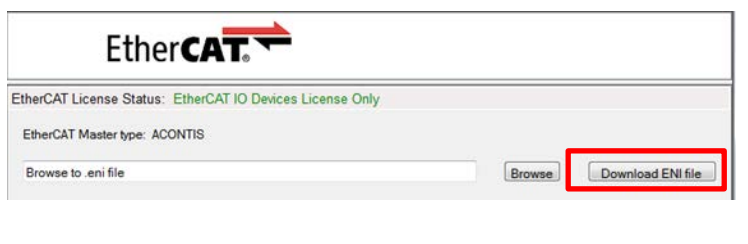


## 6.4.4. Creation of an EtherCAT Network Configuration File

1	Click <b>Export ENI</b> on the upper part of the EC-Engineer page.	
2	Enter a file name, and then click <b>Save</b> to create an EtherCAT network configuration file.	

## 6.5. Controller Settings

### 6.5.1. EtherCAT Network Configuration Settings

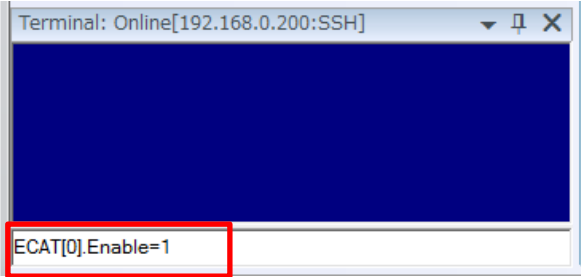
1	From the <b>Tools</b> menu of Power PMAC IDE, select <b>System Setup</b> to display it, then select <b>Master[0] Deactivated</b> .	
2	Click <b>Browse</b> , and load the EtherCAT network configuration file created in 6.4.4 <i>Creation of an EtherCAT Network Configuration File</i> .	
3	Click <b>Download ENI file</b> to download the EtherCAT network configuration to the Controller.	



## 6.5.2. EtherCAT Communications Check

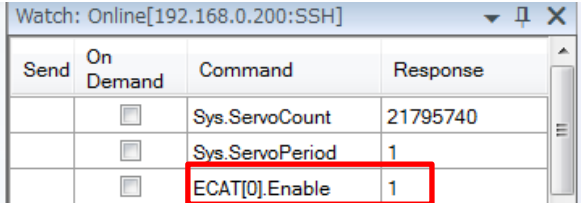
Take the following steps to ensure that EtherCAT communications are available.

- 1 From the Terminal pane, run the ECAT[0].Enable=1 command to start EtherCAT communications.



The image shows a terminal window titled "Terminal: Online[192.168.0.200:SSH]". The command "ECAT[0].Enable=1" is entered in the input field at the bottom of the terminal, highlighted with a red box.
- 2 In the Terminal or Watch pane, make sure that the ECAT[0].Enable value turns to 1.

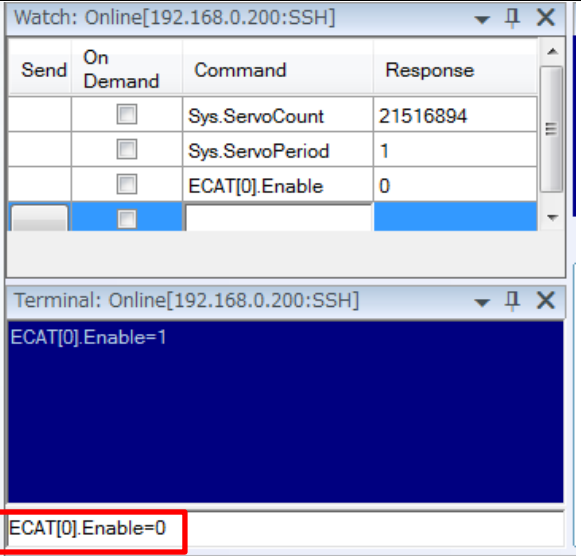
\*The OP mode is entered and EtherCAT communications are established.



The image shows a "Watch" pane titled "Watch: Online[192.168.0.200:SSH]". It contains a table with the following data:

Send	On Demand	Command	Response
	<input type="checkbox"/>	Sys.ServoCount	21795740
	<input type="checkbox"/>	Sys.ServoPeriod	1
	<input type="checkbox"/>	ECAT[0].Enable	1

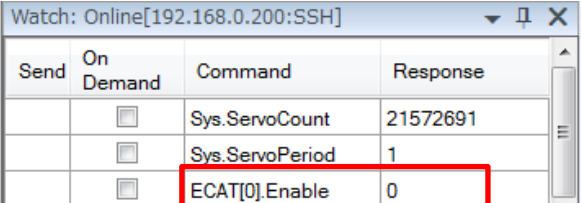
The row for "ECAT[0].Enable" with response "1" is highlighted with a red box.
- 3 After making sure that correct communications are available, run the ECAT[0].Enable=0 command from the Terminal pane to stop EtherCAT communications.



The image shows two panes. The top pane is a "Watch" pane titled "Watch: Online[192.168.0.200:SSH]" with the following table:

Send	On Demand	Command	Response
	<input type="checkbox"/>	Sys.ServoCount	21516894
	<input type="checkbox"/>	Sys.ServoPeriod	1
	<input type="checkbox"/>	ECAT[0].Enable	0

The row for "ECAT[0].Enable" with response "0" is highlighted with a red box. Below the watch pane is a terminal window titled "Terminal: Online[192.168.0.200:SSH]" showing the command "ECAT[0].Enable=0" entered in the input field, highlighted with a red box.
- 4 In the Terminal or Watch pane, make sure that the ECAT[0].Enable value turns to 0.



The image shows a "Watch" pane titled "Watch: Online[192.168.0.200:SSH]" with the following table:

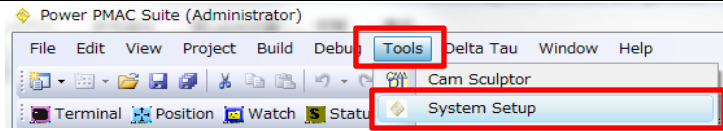
Send	On Demand	Command	Response
	<input type="checkbox"/>	Sys.ServoCount	21572691
	<input type="checkbox"/>	Sys.ServoPeriod	1
	<input type="checkbox"/>	ECAT[0].Enable	0

The row for "ECAT[0].Enable" with response "0" is highlighted with a red box.

### 6.5.3. Motor Setup

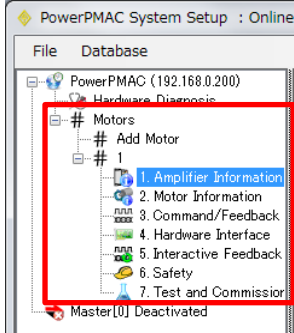
Configure the motor settings for the Controller.

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



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

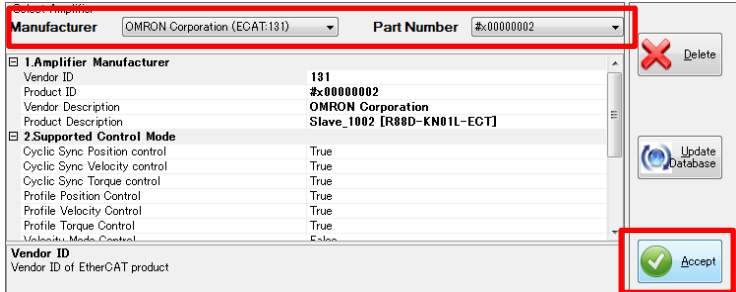
Add motor #1.



- Select **Motors – 1 – 1. Amplifier Information**.

Specify the settings as shown on the right.

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



#### Manufacturer

Select **OMRON Corporation**.

#### Part Number

Select **#x00000002**.

#### 4. ECAT Slave Settings

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

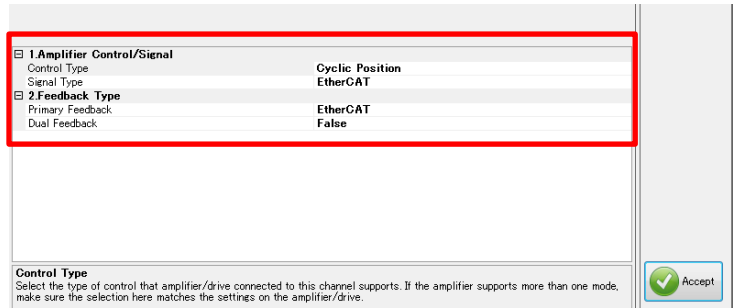


The slave number can be confirmed in the System Setup page.



4 Select **Motors – 1 – 3.Command/Feedback Information.**

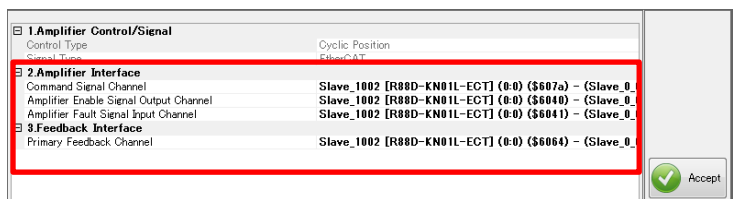
Specify the settings as shown on the right.  
Click the **Accept** button to apply the settings.



Control Type  
Select **Cyclic Position**.  
Primary Feedback  
Select **ECAT**.

5 Select **Motors - 1 - 4.Hardware Interface.**

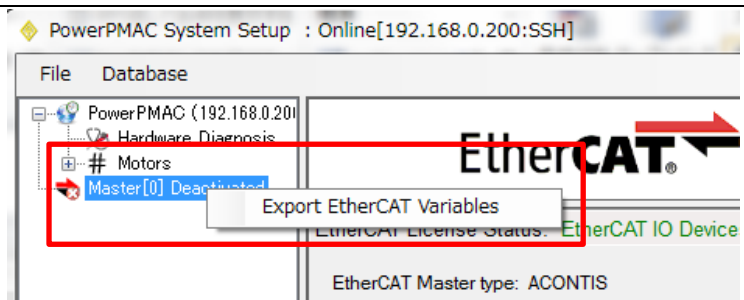
Specify the settings as shown on the right.  
Click the **Accept** button to apply the settings.



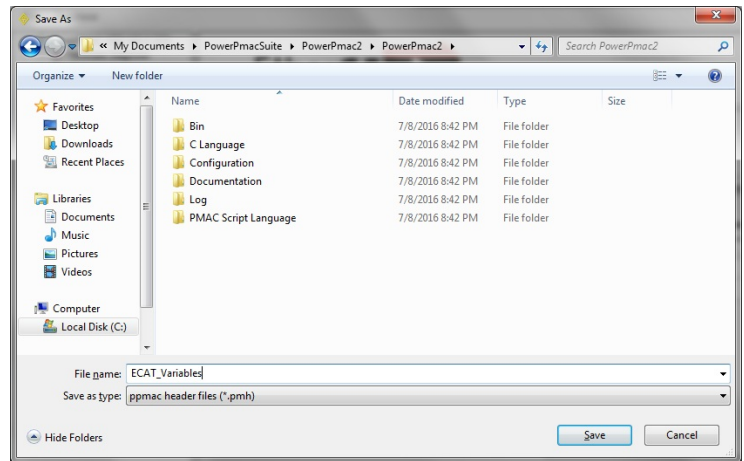
Command Signal Channel  
Select **#x607A(Target Position)**, and specify the motor control indication value for *Target Position*.  
Amplifier Enable Signal Output Channel  
Select **#x6040(Controlword)**, and specify **Controlword** for the motor output.  
Amplifier Fault Signal Input Channel  
Select **#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

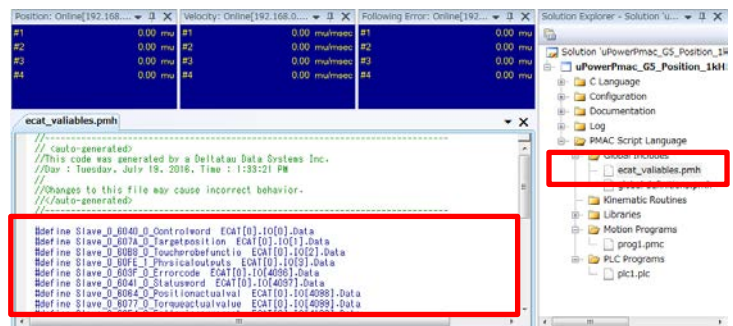
1 In the System Setup page, right-click on **Master[0].Deactivated** to display the pop-up menu, and select **Export EtherCAT Variables**.



- 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.



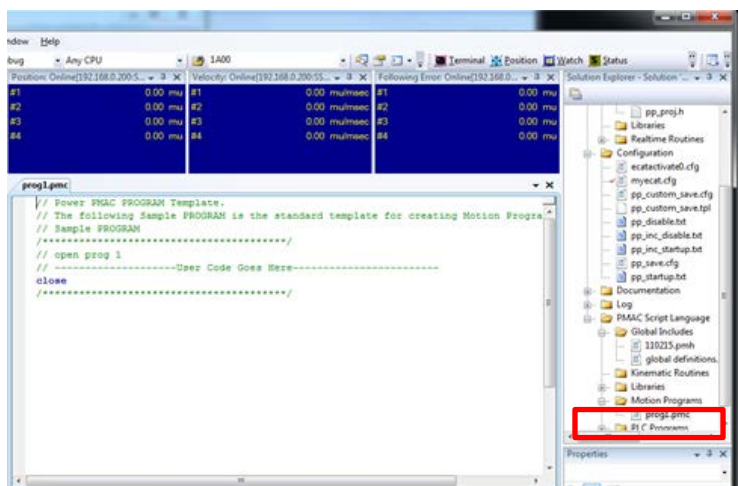
### 6.5.5. Creation of Operation Check Programs

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**.



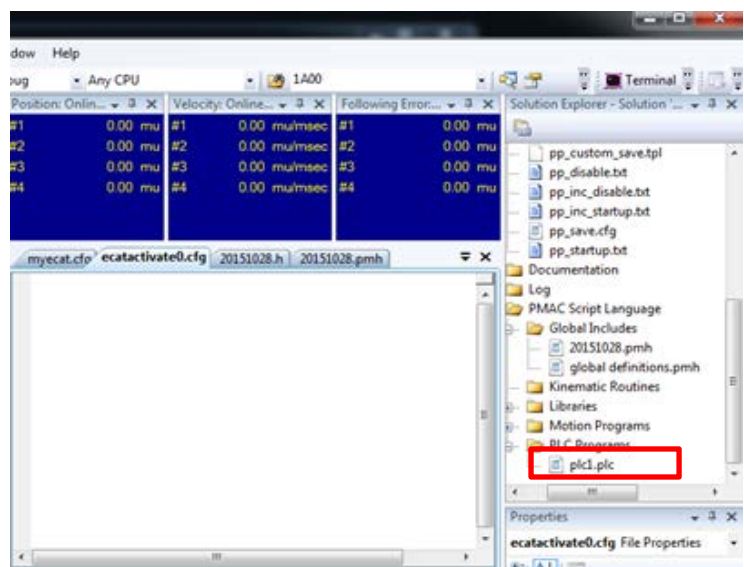
- 2 In the programming area of the prog1.pmc tab page, write a program as shown on the right.

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

```
&1;  
#1->131072X;  
  
OPEN PROG 1  
  
INC;  
TA800;  
TS300;  
LINEAR;  
While (1 < 2)  
{  
  TA800;  
  TS300;  
  TM3000;  
  X20;  
  DWELL2000;  
  X-20;  
  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){};

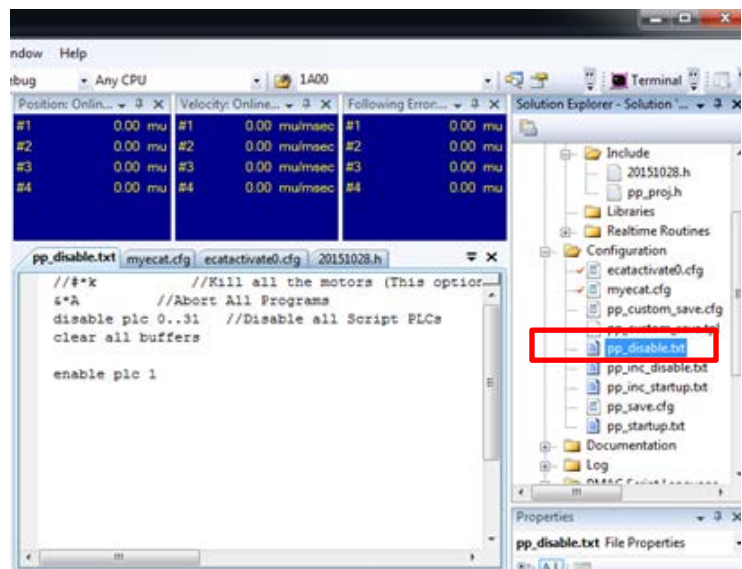
cmd"&1b1r";

disable plc 1;

close
```

- 5 Setting the start of the user program

In the Solution Explorer pane, open **Project name – Configuration – pp\_disable.txt**.



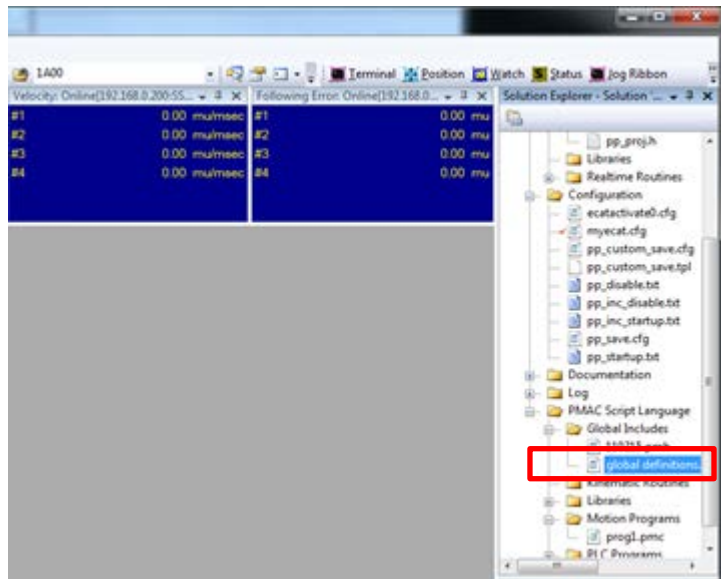
- 6 In the programming area of the pp\_disable.txt tab page, add the program shown on the right to the last line.

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.



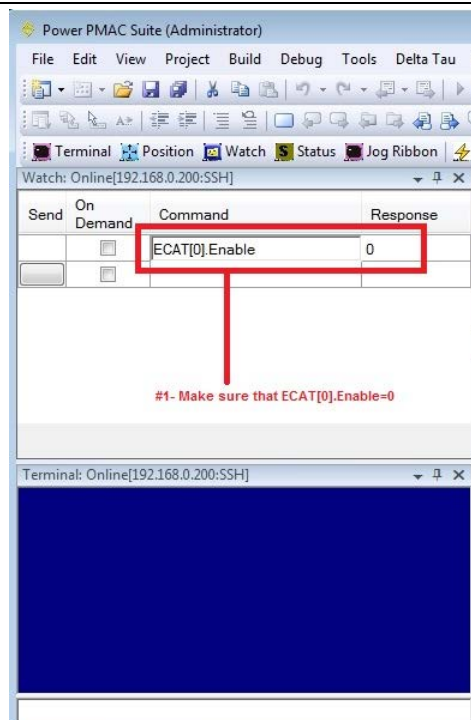
#### Caution

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.

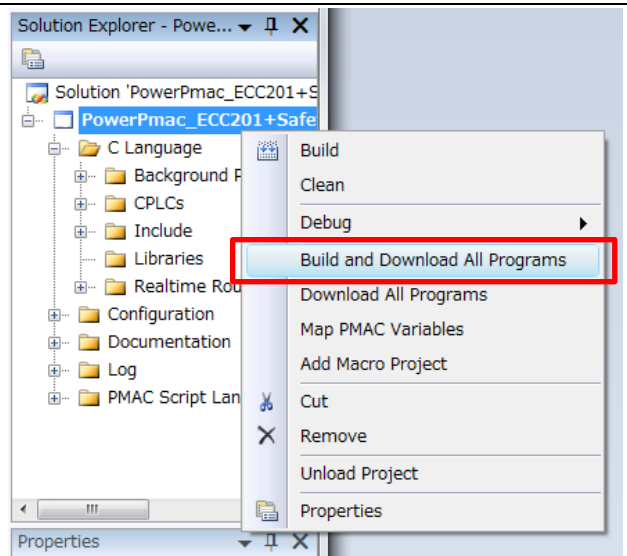
If the value is 1, run the ECAT[0].Enable=0 command from the Terminal pane to stop EtherCAT communications.





## 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.



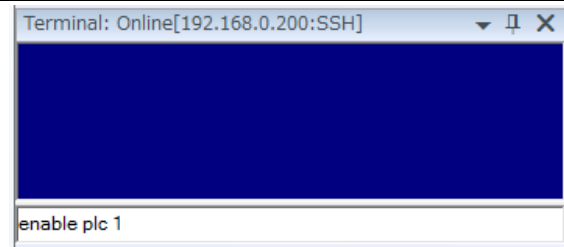
## 3 Make sure that there are no errors in the Output tab page.

\* 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.

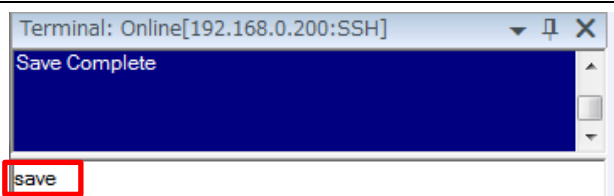
\* If the motor does not rotate, check that the ECAT[0].Enable value is 1 in the Terminal or Watch pane.  
If the value is 0, run the following command from the Terminal pane.  
enable plc 1



## 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 to 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.

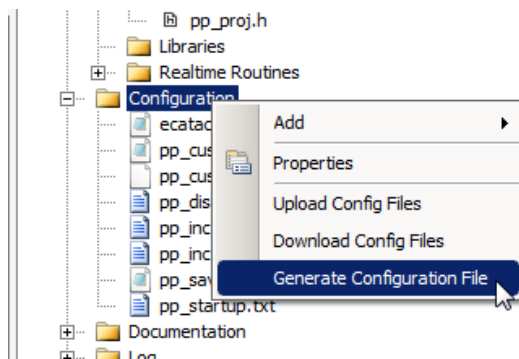
### 7.1. Saving a Project

#### 1 Creating a Configuration File

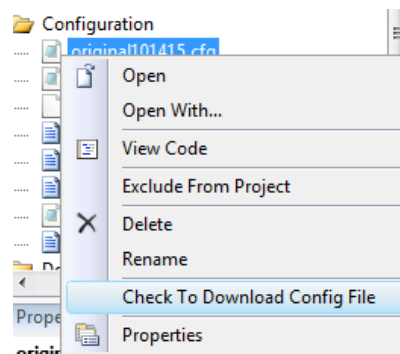
Create a Configuration File to save parameters you have changed in **System Setup** to the project.

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

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

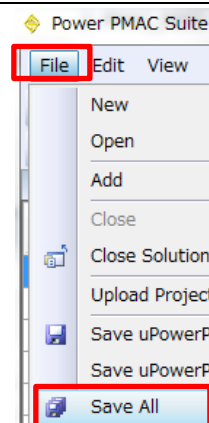


#### 2 Right-click on the Configuration File, and from the menu, select **Check To Download Config File** to include it in files to be downloaded.

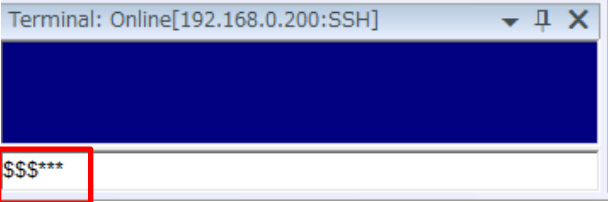
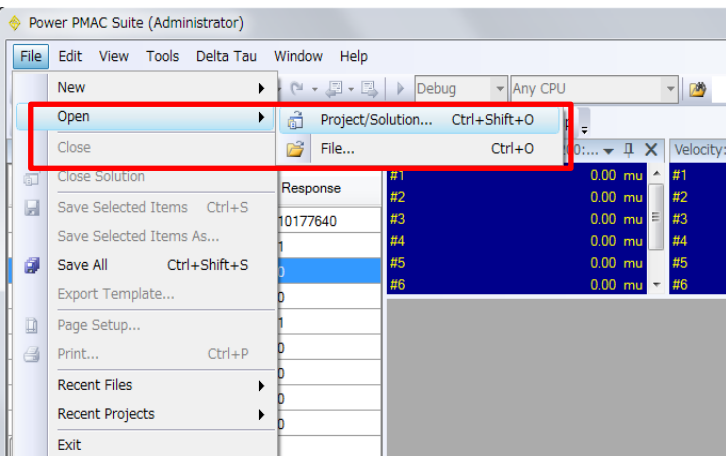





#### 3 Saving a Project

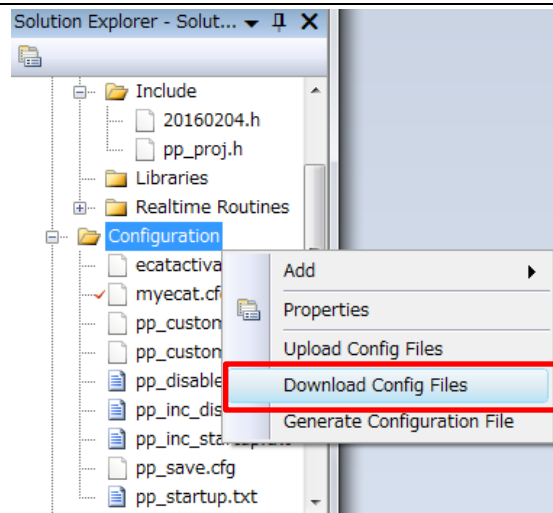
In the **File** menu, run **Save All** to save the project on the computer.



## 7.2. Loading and Downloading a Project

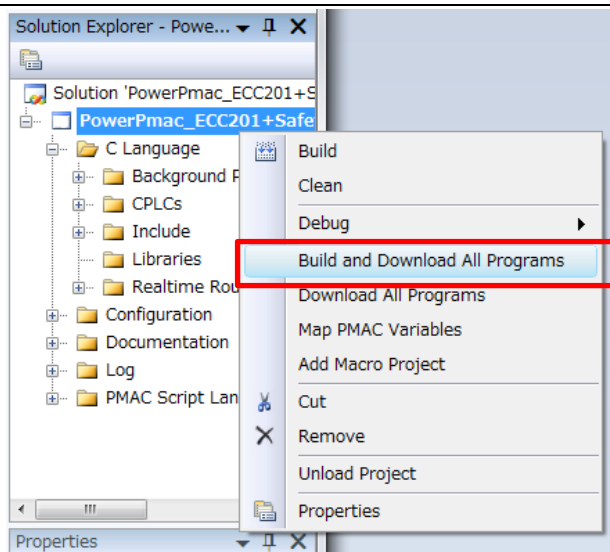
1	Start Power PMAC IDE, and connect to the Controller.	
2	In the Terminal pane, type the \$\$\$*** command to reset the Controller settings to factory default.	
3	In the <b>File</b> menu, Click <b>Open – Project/Solution</b> to load the project that you saved.	
4	Downloading an ENI file From the <b>Tools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

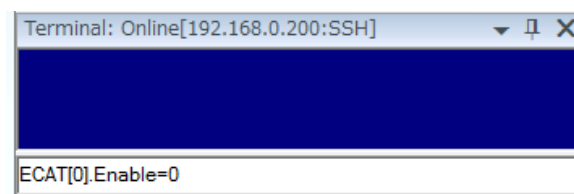
When the download process is complete, make sure that there are no errors in the Output tab page.



- 9 Stopping a program

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

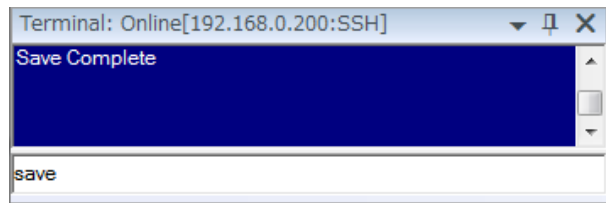
```
disable plc 1
ECAT[0].Enable=0
```



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.

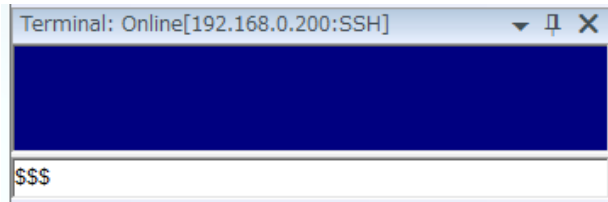
\* The save command stores the downloaded project in the Controller. This operation saves the settings to be executed automatically when the power to the Controller is turned on.



11 Restarting after download

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

\$\$\$



## 8. Appendix Troubleshooting

### 8.1. 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 <i>6.4 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.

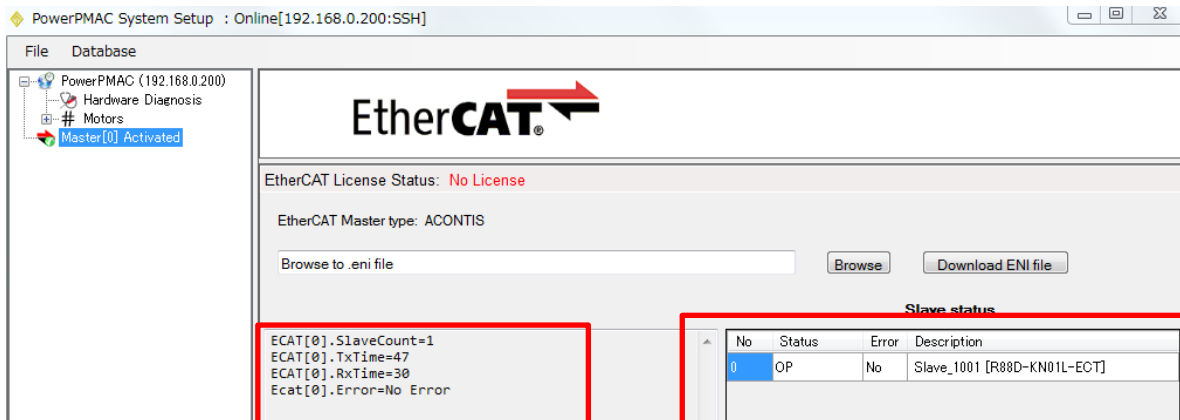
## 8.2. How to Check for Errors

### 8.2.1. 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.



The screenshot shows the 'PowerPMAC System Setup' window. The left sidebar shows a tree view with 'Master[0] Activated'. The main area displays the 'EtherCAT' logo and 'EtherCAT License Status: No License'. Below this, it shows 'EtherCAT Master type: ACONTIS' and a 'Browse to .eni file' button. A 'Slave status' table is visible, with the following data:

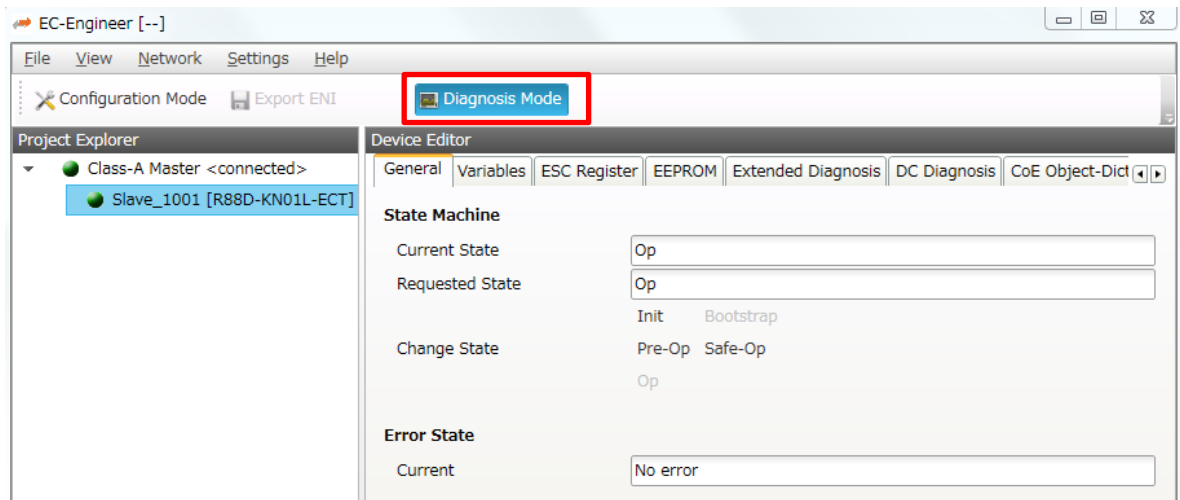
No	Status	Error	Description
0	OP	No	Slave_1001 [R88D-KN01L-ECT]

Additional status information is shown in a text box:

```
ECAT[0].SlaveCount=1  
ECAT[0].TxTime=47  
ECAT[0].RxTime=30  
Ecat[0].Error=No Error
```

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

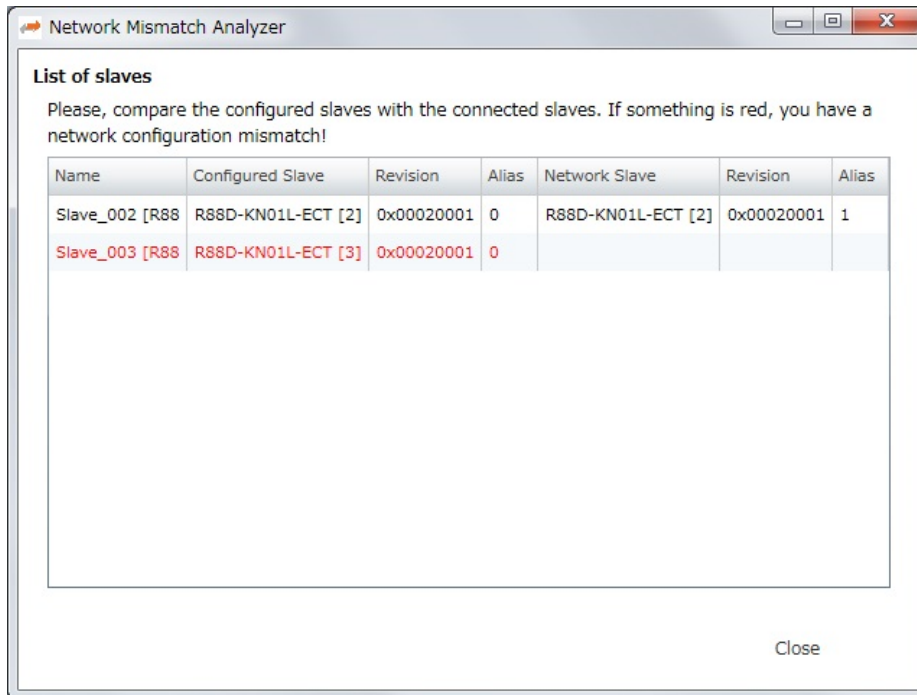
You can check the status of the slaves in the Diagnosis Mode page of Acontis EC-Engineer.



The screenshot shows the 'EC-Engineer' window in 'Diagnosis Mode'. The 'Project Explorer' shows 'Class-A Master <connected>' and 'Slave\_1001 [R88D-KN01L-ECT]'. The 'Device Editor' shows the 'State Machine' section with the following fields:

Field	Value
Current State	Op
Requested State	Op
Change State	Init Bootstrap Pre-Op Safe-Op Op
Error State Current	No error

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



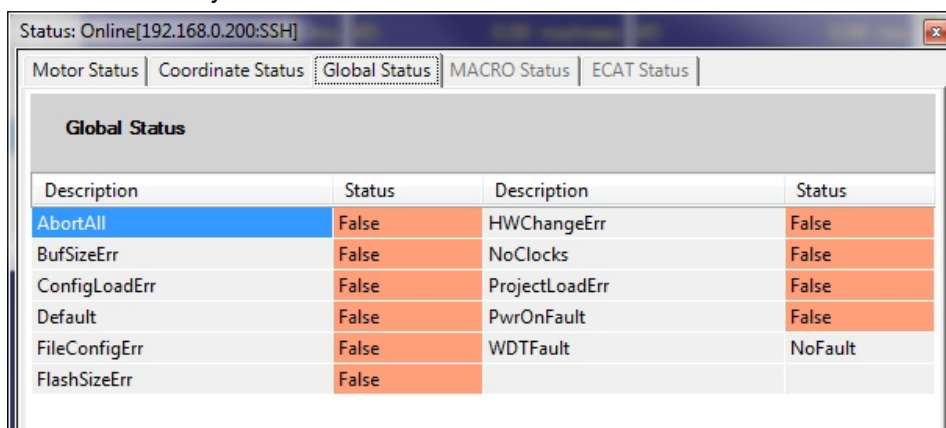
### 8.2.2. Checking the Controller Status

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.

Status: Online[192.168.0.200:SSH]

Motor Status | Coordinate Status | Global Status | MACRO Status | ECAT Status

Motor 0 ● Motor not activated

Description	Status	Description	Status
AmpEna	False	I2tFault	False
AmpFault	False	InPos	False
AmpWarn	False	LimitStop	False
AuxFault	False	MinusLimit	False
BIDir	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.

Status: Online[192.168.0.200:SSH]

Motor Status | Coordinate Status | Global Status | MACRO Status | ECAT Status

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	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

## 9. 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

## 10. Revision History

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

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