

Programmable Multi-Axis Controller

Startup Guide G5-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-E2	Model CK3M-CPU1□1	CK3M-series Programmable Multi-Axis Controller Hardware User's Manual
OMRON	W580-E1	Model NY512-A6001XX21391 X	Industrial PC Platform NY-series IPC Programmable Multi-Axis Controller Industrial Box PC Hardware User's Manual
OMRON	I576-E1	Model R88M-K□ Model R88D-KN□-ECT	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 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 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 April 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 (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-□□□□/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-KN□-ECT Model R88D-KN□-ECT-L
OMRON	AC Servomotor	Model R88M-K□



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 (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	
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.

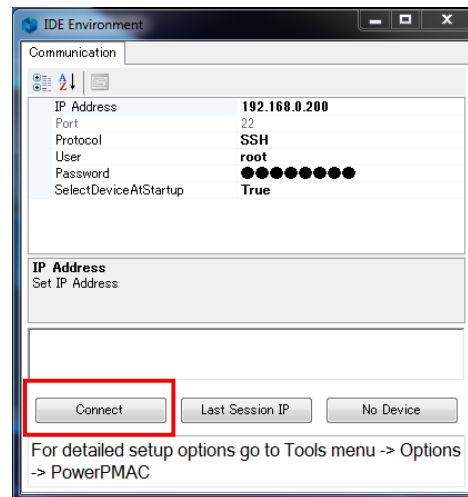
* If the dialog for confirming access rights appears upon start-up, select starting of Power PMAC IDE.



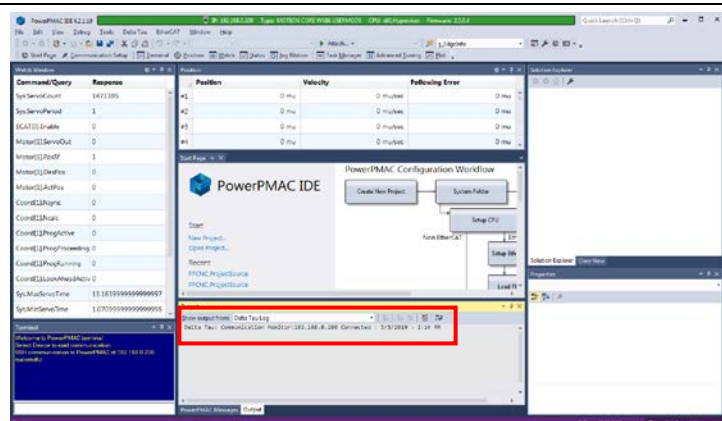
3 The Communication screen appears. Specify the IP address of the destination Controller and click **Connect**.

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

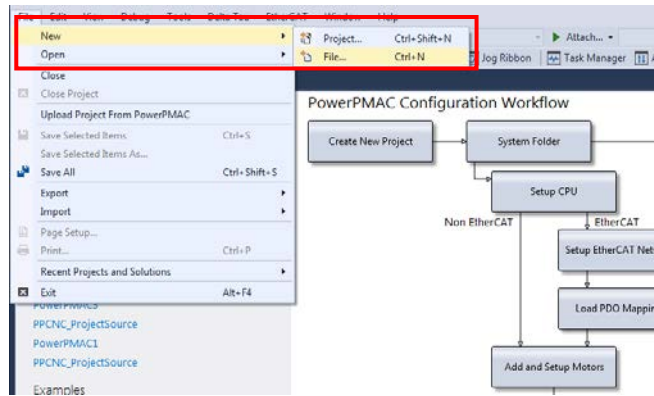
* If necessary, change the Windows IP address to "192.168.0.X".



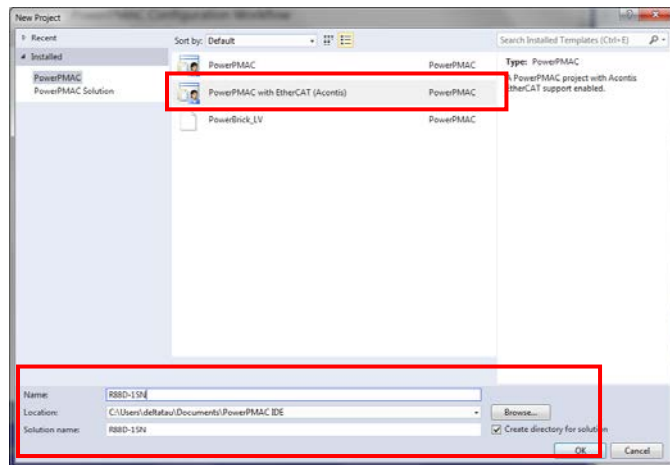
4 Power PMAC IDE starts, and is online to the Controller.



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



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



6.2.2. Initial Settings of the Controller

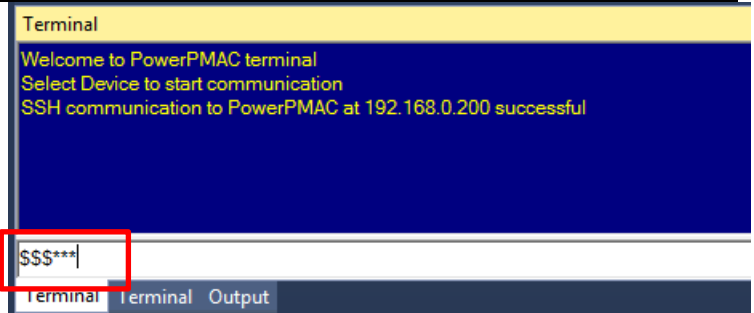
Configure the initial settings for the Controller.



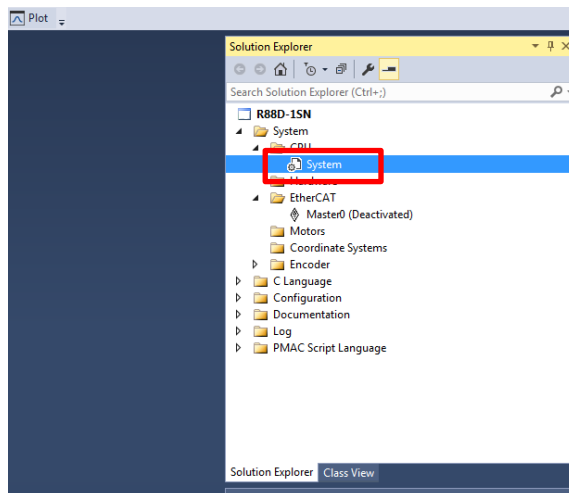
Precautions for Correct Use

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

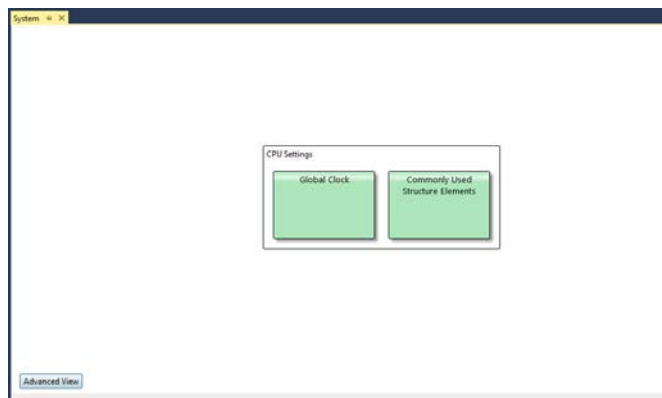
- 1 In the Terminal tab page, type the \$\$\$*** command to reset the Controller to factory default.



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

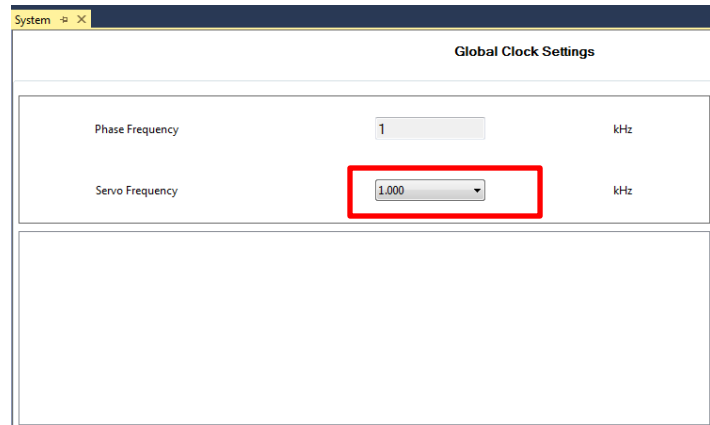


- 3 Select **Global Clock**.

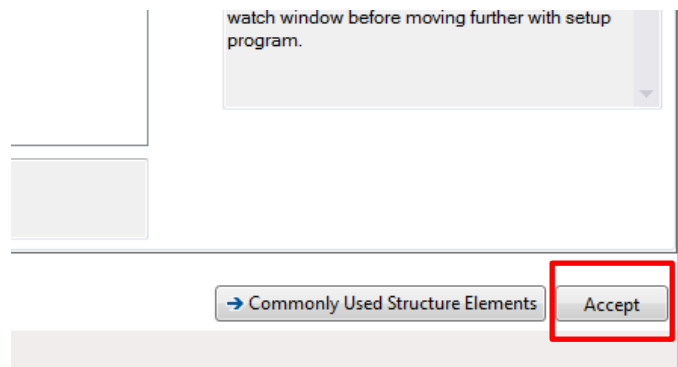


4 Specify **Servo Frequency**.

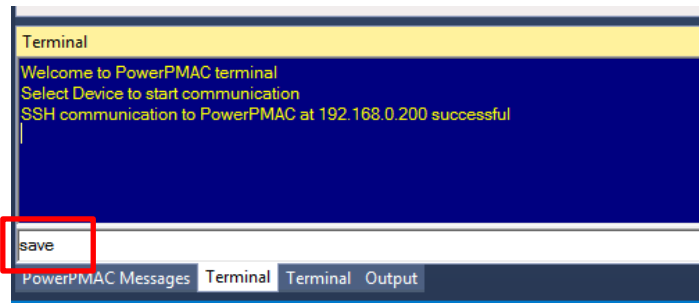
Select the **Servo Frequency** setting from 4 kHz, 2 kHz, or 1 kHz.



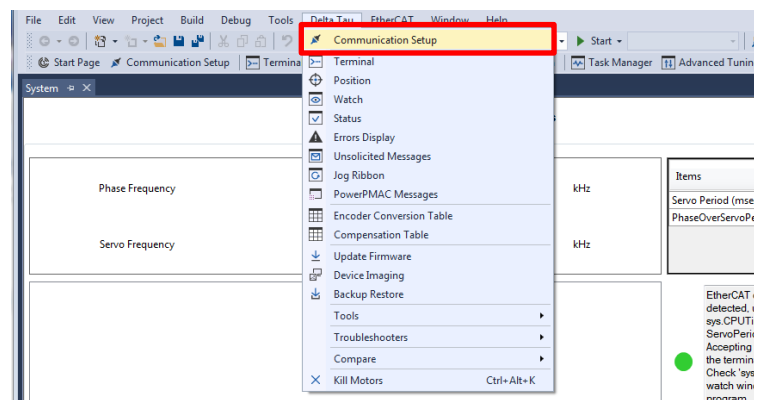
5 Click the **Accept** button.



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.

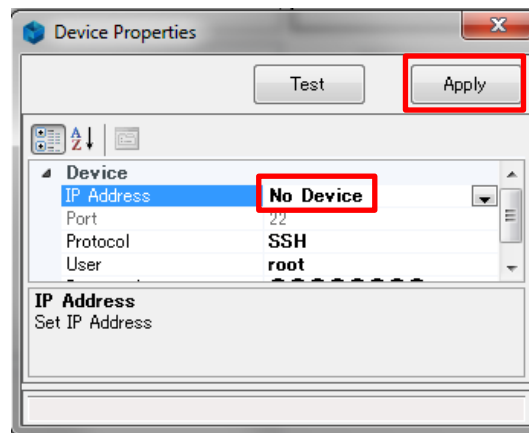


7 Click **Delta Tau – Communication Setup** on the toolbar to display the Device Properties dialog box.



- 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.

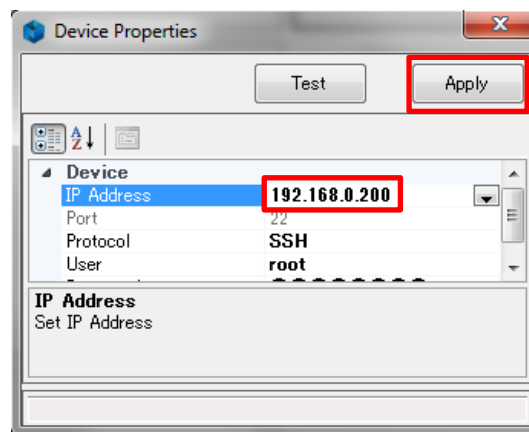


- 9 Restart the Controller.

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

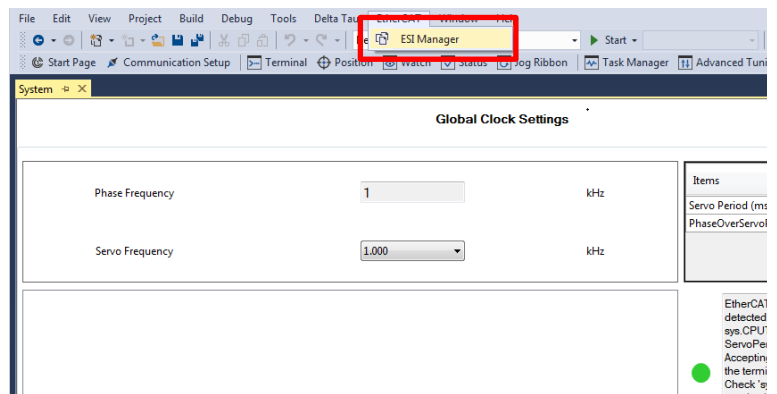
Install the ESI file for Servo Driver into Power PMAC IDE.



Precautions for Correct Use

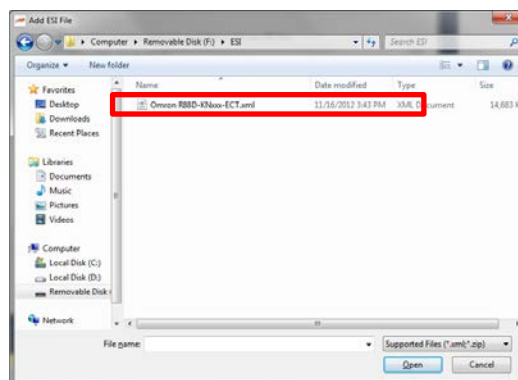
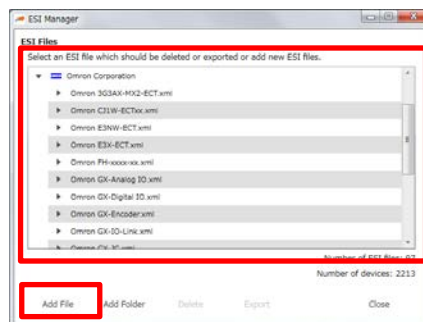
Prepare the ESI file described in this section in advance. Contact your OMRON representative for information on how to procure the ESI file.

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



- 2 Confirm that *Omron R88D-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*.



- 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

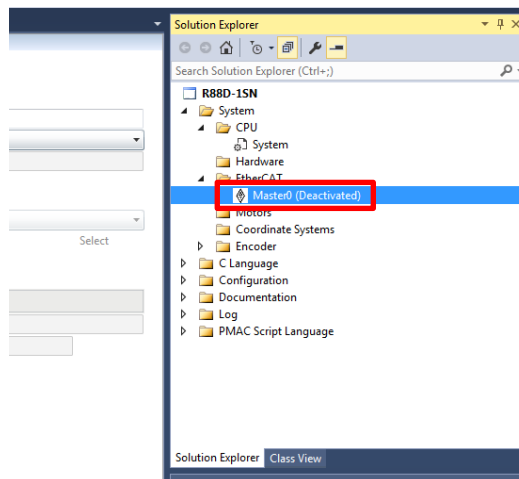
Before taking the following steps, make sure that the devices are connected via an Ethernet cable. If they are not connected, turn OFF the power to the devices, and connect the Ethernet cable.

6.4.1. Communications Setup for the EtherCAT Master

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

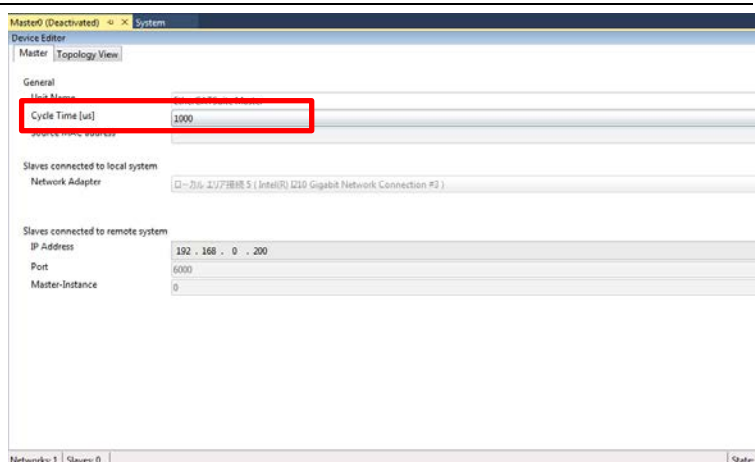
* Refer to the manuals for slave devices to configure them.

- 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.



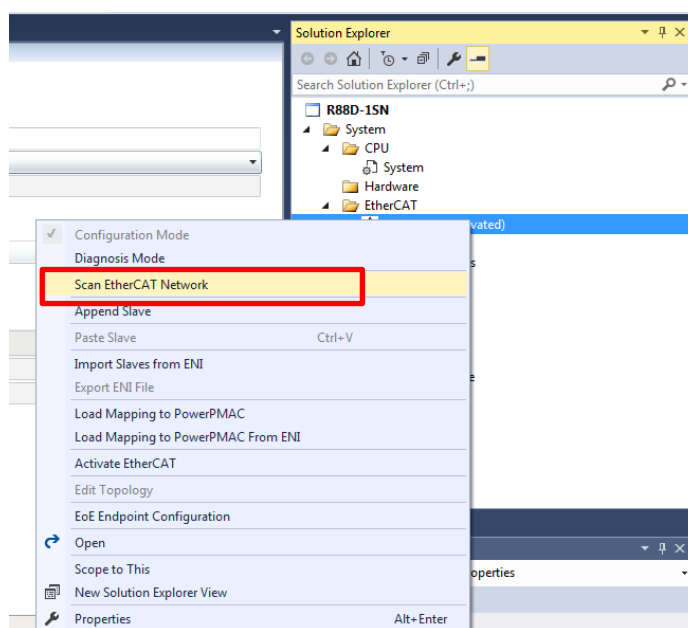
Correspondence between the servo frequencies of the Controller and communication periods is as follows:

4 kHz : 250 us

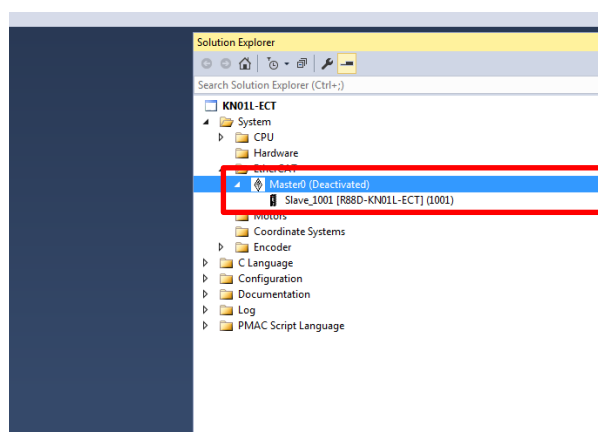
2 kHz : 500 us

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.

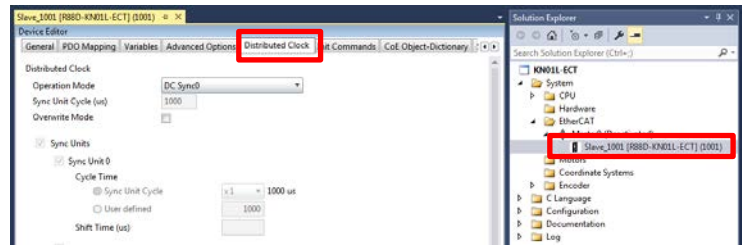
The screenshot shows the 'Master0 (Deactivated)' tab page with the 'Distributed Clocks' tab selected. The 'Device Editor' section has tabs for 'Master', 'Topology View', 'Process Data Image', 'Variables', 'Advanced Options', 'Slave to Slave', 'Distributed Clocks', and 'Tasks + Sync Units'. The 'General' section contains fields for 'Unit Name' (EtherCATSuite Master), 'Cycle Time [us]' (1000), and 'Source MAC address' (00-13-95-25-01-40). The 'Slaves connected to local system' section shows 'Network Adapter' (ローカル エリア接続 5 (Intel(R) I210 Gigabit Network Connection #3)). The 'Slaves connected to remote system' section shows 'IP Address' (192 . 168 . 0 . 200), 'Port' (6000), and 'Master-Instance' (0).

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

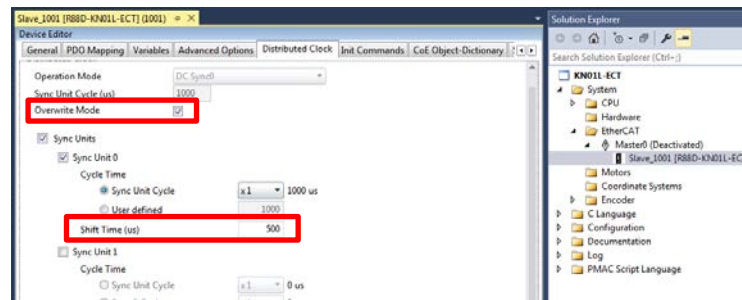
The screenshot shows the 'Master0 (Deactivated)' tab page with the 'Distributed Clocks' tab selected. The 'Reference Clock' section has a 'Name' field (Slave_1001 [R88D-1SN01L-ECT] (1001)). The 'Clock Adjustment' section has three radio buttons: 'Master Shift (EtherCAT Master Time controlled by Reference Clock)' (selected), 'Bus Shift (Reference Clock controlled by EtherCAT Master Time)', and 'External Mode (Reference Clock controlled by External Sync Device)'. The 'Options' section has two checkboxes: 'Sync Window Monitoring' and 'Show 64Bit System Time'. The 'Slaves with active DC' section shows 'Slave_1001 [R88D-1SN01L-ECT] (1001)'.

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

6.4.3. PDO Map Settings

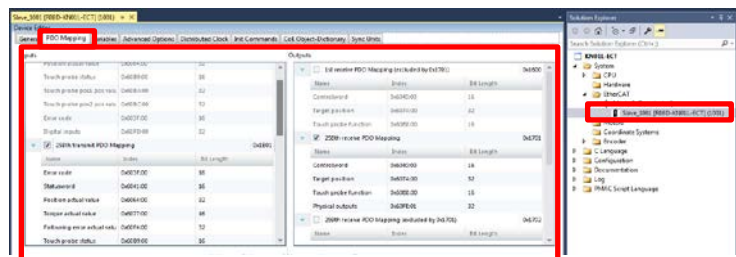
⚠ Caution

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 6.5.2. Motor Setup* must be mapped to PDO entries.



- 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** check box is selected in the Inputs field.

Inputs				
Position actual value	0x0064:00	32		
Touch probe status	0x60B9:00	16		
Touch probe pos1 pos valu	0x60BA:00	32		
Touch probe pos2 pos valu	0x60BC:00	32		
Error code	0x603F:00	16		
Digital inputs	0x60FD:00	32		
▼ <input checked="" type="checkbox"/> 258th transmit PDO Mapping				0x1B01
Name	Index	Bit Length		
Error code	0x603F:00	16		
Statusword	0x6041:00	16		
Position actual value	0x6064:00	32		
Torque actual value	0x6077:00	16		
Following error actual valu	0x60F4:00	32		
Touch probe status	0x60B9:00	16		

3 Setting PDO mapping (Outputs)

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

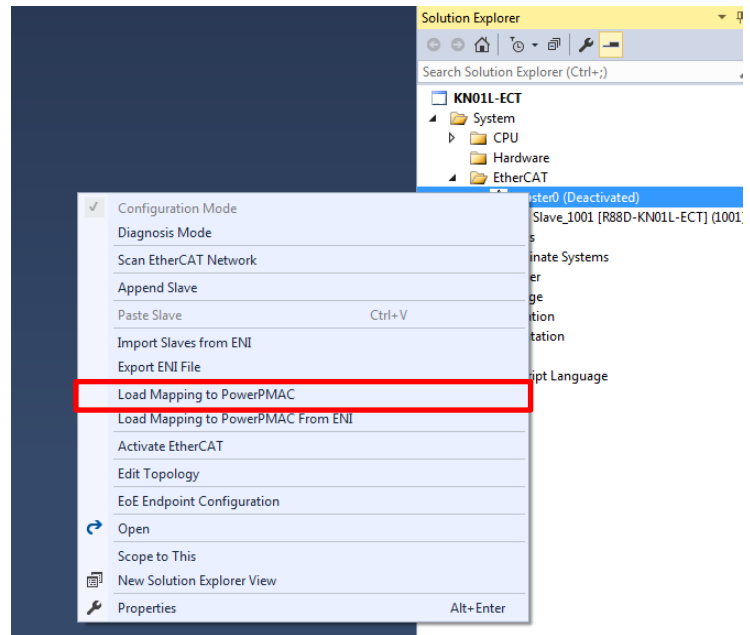
Select the **258th receive PDO Mapping 0x1704** check box.

Outputs

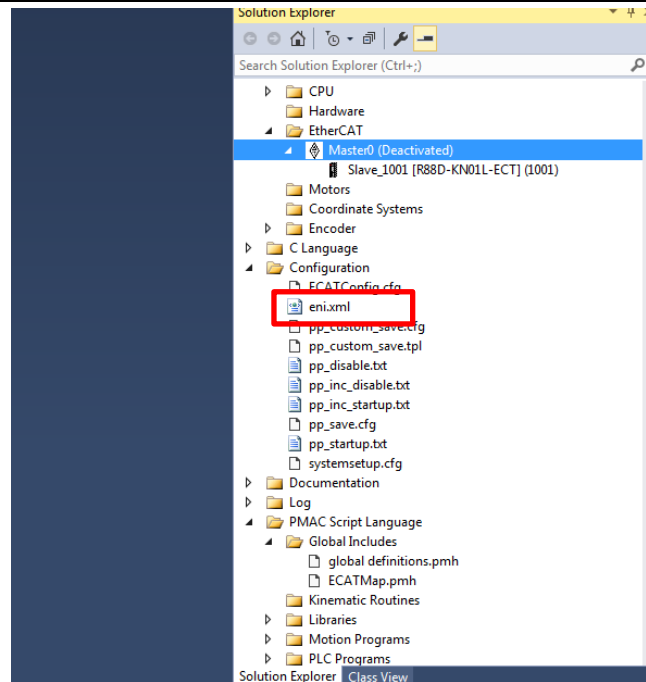
<input type="checkbox"/>	1st receive PDO Mapping (excluded t	0x1600															
<table><thead><tr><th>Name</th><th>Index</th><th>Bit Length</th></tr></thead><tbody><tr><td>Controlword</td><td>0x6040:00</td><td>16</td></tr><tr><td>Target position</td><td>0x607A:00</td><td>32</td></tr><tr><td>Touch probe fu</td><td>0x60B8:00</td><td>16</td></tr></tbody></table>			Name	Index	Bit Length	Controlword	0x6040:00	16	Target position	0x607A:00	32	Touch probe fu	0x60B8:00	16			
Name	Index	Bit Length															
Controlword	0x6040:00	16															
Target position	0x607A:00	32															
Touch probe fu	0x60B8:00	16															
<input checked="" type="checkbox"/>	258th receive PDO Mapping	0x1701															
<table><thead><tr><th>Name</th><th>Index</th><th>Bit Length</th></tr></thead><tbody><tr><td>Controlword</td><td>0x6040:00</td><td>16</td></tr><tr><td>Target position</td><td>0x607A:00</td><td>32</td></tr><tr><td>Touch probe fu</td><td>0x60B8:00</td><td>16</td></tr><tr><td>Physical output</td><td>0x60FE:01</td><td>32</td></tr></tbody></table>			Name	Index	Bit Length	Controlword	0x6040:00	16	Target position	0x607A:00	32	Touch probe fu	0x60B8:00	16	Physical output	0x60FE:01	32
Name	Index	Bit Length															
Controlword	0x6040:00	16															
Target position	0x607A:00	32															
Touch probe fu	0x60B8:00	16															
Physical output	0x60FE:01	32															
<input type="checkbox"/>	259th receive PDO Mapping (exclude	0x1702															
<table><thead><tr><th>Name</th><th>Index</th><th>Bit Length</th></tr></thead></table>			Name	Index	Bit Length												
Name	Index	Bit Length															

6.4.4. Creation of an EtherCAT Network Information File

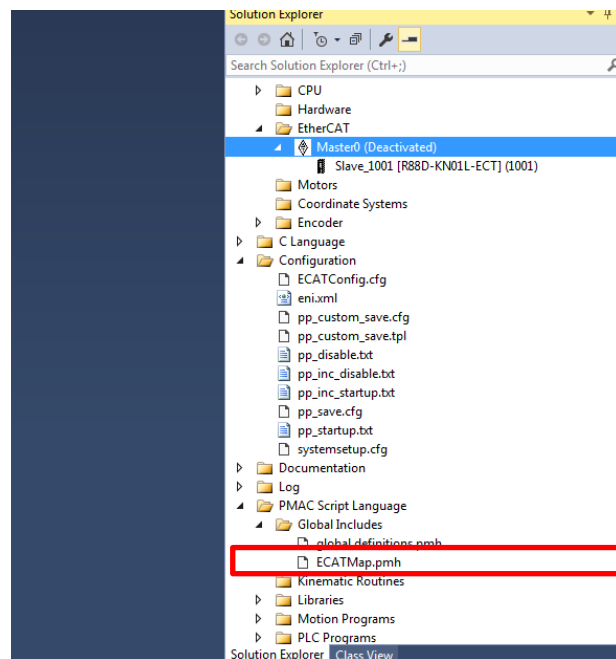
- 1 Select **System – EtherCAT** in the Solution Explorer and right-click on **Master0 (Deactivated)**, then select **Load Mapping to PowerPMAC**.



- 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.

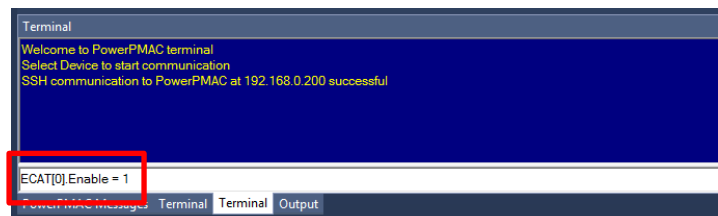


6.5. Controller Settings

6.5.1. EtherCAT Communications Check

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

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



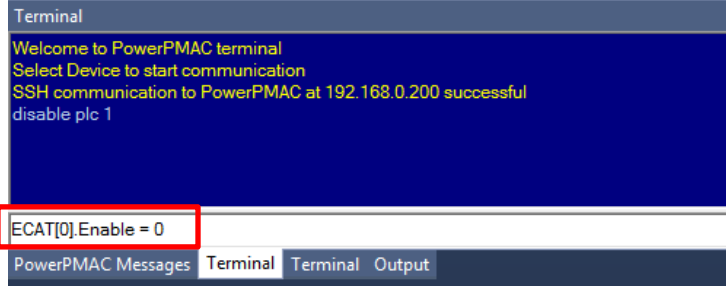
- 2 In the Terminal tab page or Watch Window, make sure that the `ECAT[0].Enable` value turns to 1.

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

Watch Window	
Command/Query	Response
Sys.ServoCount	7712293
ecat[0].Enable	1
ecat[0].MasterState	: 8
Motor[1].ActPos	2

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.



4

In the Terminal tab page or Watch Window, make sure that the ECAT[0].Enable value turns to 0.

The screenshot shows the 'Watch Window' in the PowerPMAC interface. It displays a table with two columns: 'Command/Query' and 'Response'. The table contains the following data:

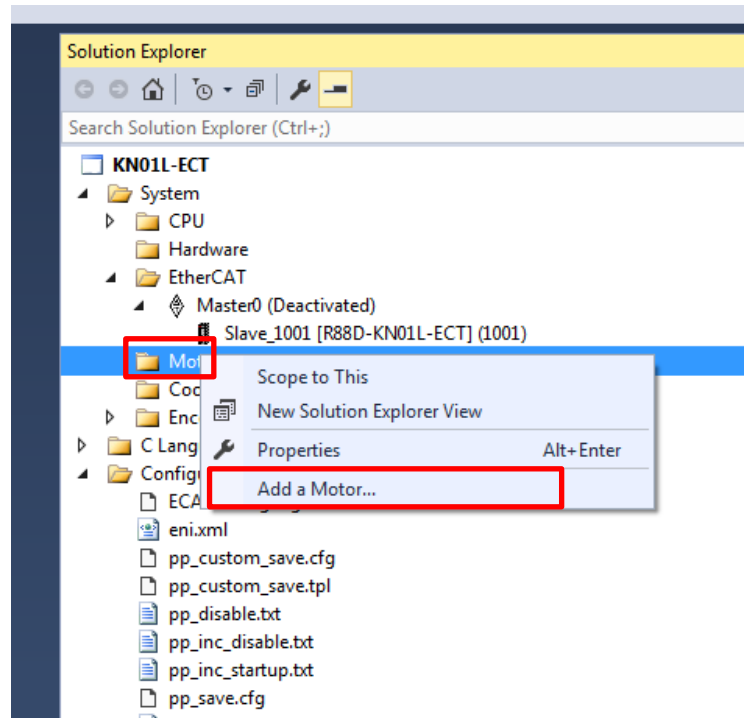
Command/Query	Response
Sys.ServoCount	7778040
ecat[0].Enable	0
ecat[0].MasterState	2
Motor[1].ActPos	2

The row for 'ecat[0].Enable' is highlighted with a red rectangle, showing the value '0' in the 'Response' column.

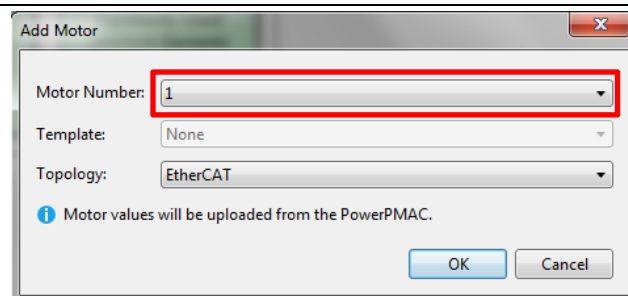
6.5.2. Motor Setup

Configure the motor settings for the Controller.

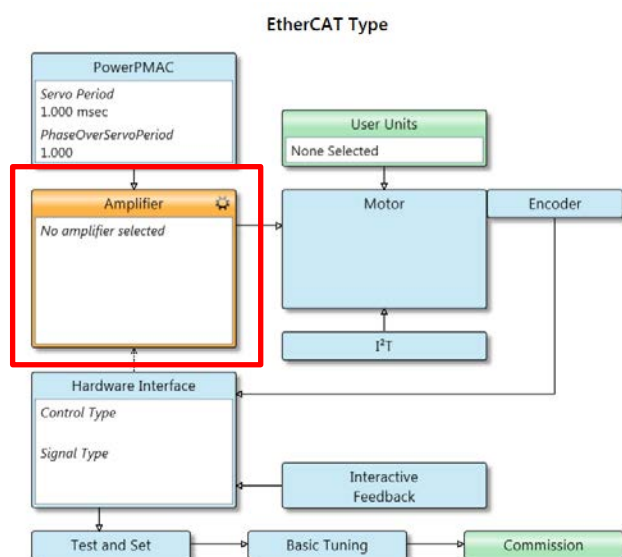
- 1 Select **System – Motor** in the Solution Explorer and right-click on it, then select **Add a Motor....**



- 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.

Motor Amplifier configuration window. The Manufacturer is set to Omron Corporation (ECAT:131) and the Part Number is #x00000002. The window shows various control modes and signal types. The Accept button is highlighted with a red box.

Manufacturer

Select **OMRON Corporation**.

Part Number

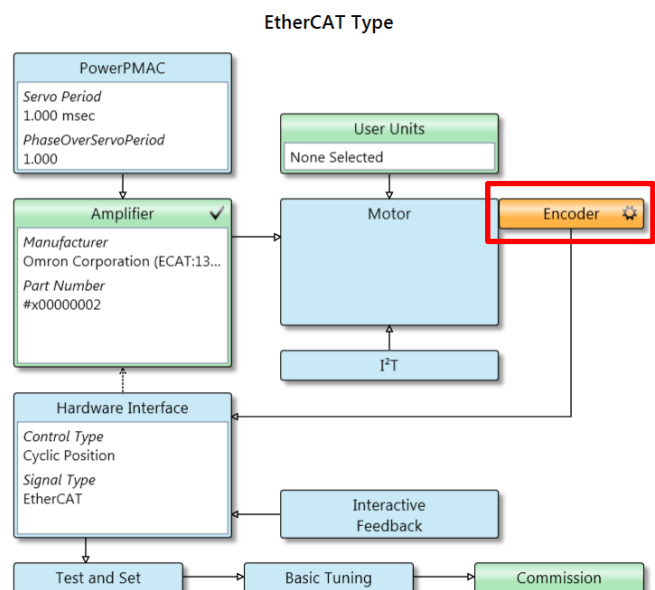
Select **#x00000002**.

4.ECAT Slave Settings

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

4.ECAT Slave Settings window. The Slave Number field is highlighted with a red box and contains the value 0.

5 Select **Encoder**.



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

Hardware Interface

Control Type	Signal Type
Cyclic Position	EtherCAT
Primary Feedback	EtherCAT

Control Type
Select the type of control that Amplifier/Drive connected to this channel supports. If the Amplifier supports more than one mode, make sure the selection this matches the settings on the Amplifier/Drive.

Up Amplifier Hardware Interface Accept

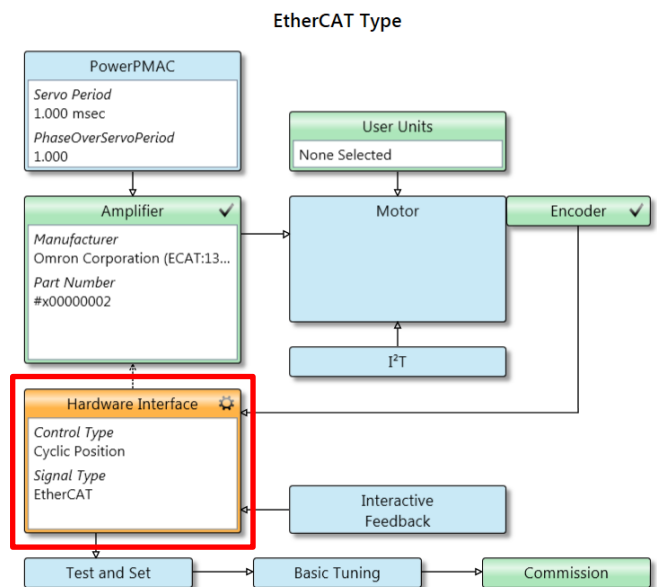
Control Type

Select **Cyclic Position**.

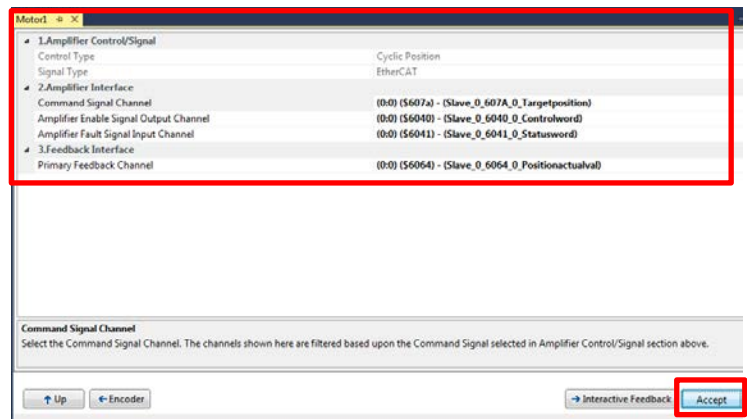
Primary Feedback

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.

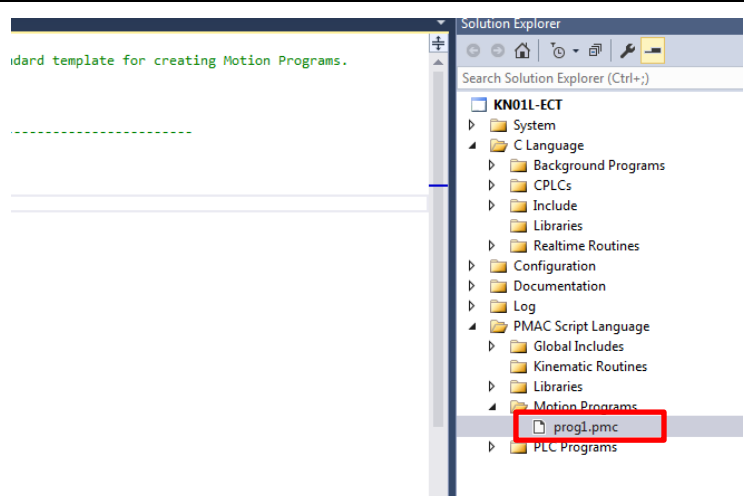
6.5.3. Creation of Operation Check Programs

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



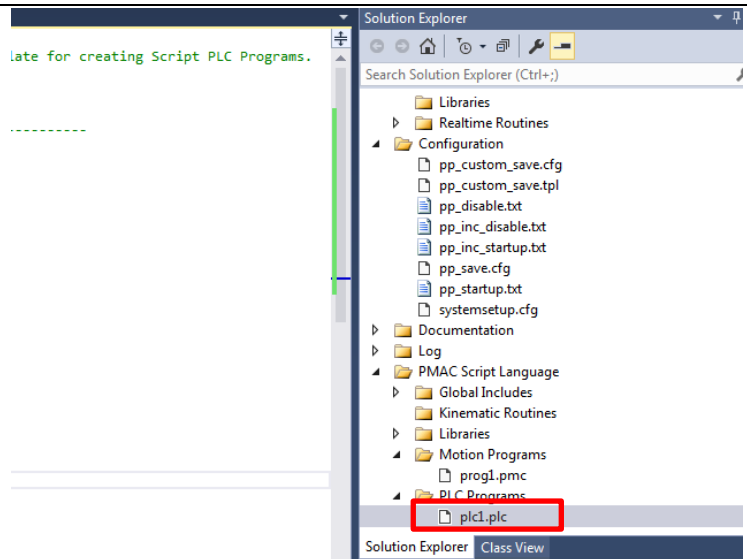
- 2 In the programming area of the prog1.pmc tab page, write a program as shown on the right.

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){};

P1000=Sys.Time+1;
while(P1000>Sys.Time){};

ECAT[0].Enable=1;

P1000=Sys.Time+1;
while(P1000>Sys.Time){};

cmd"&1enable";

P1000=Sys.Time+5;
while(P1000>Sys.Time){};

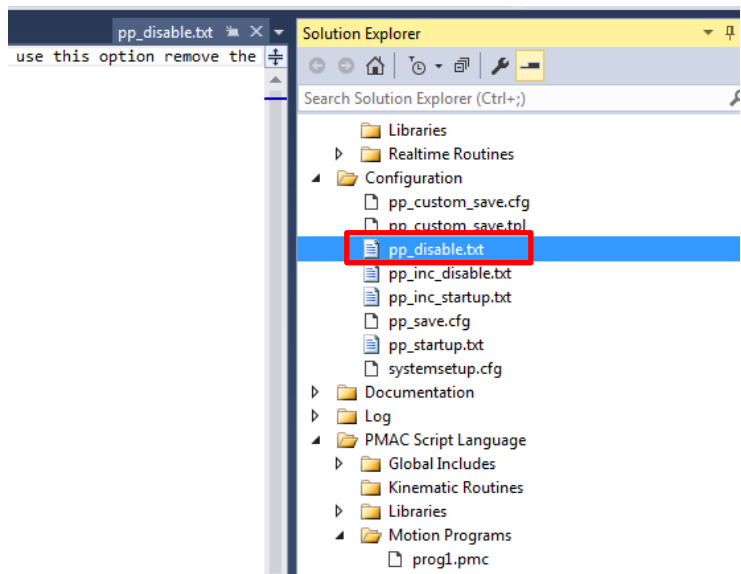
cmd"&1b1r";

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.

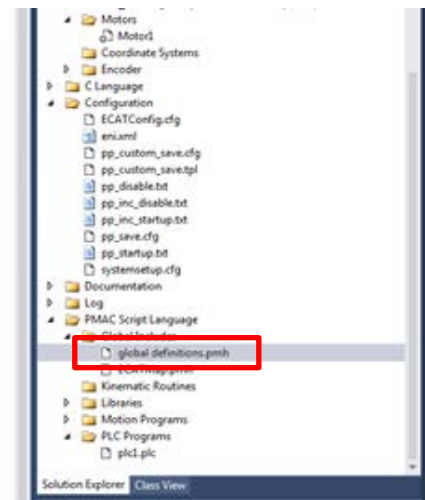
The pp_disable.txt program is automatically executed when the Controller starts.

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;
```

6.5.4. 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.

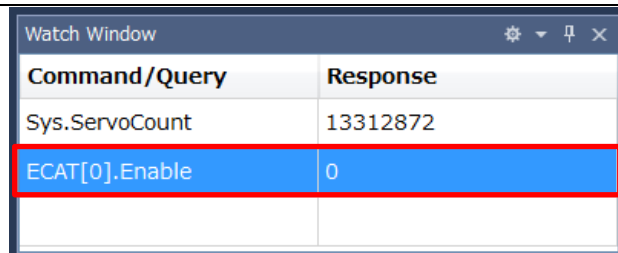
Take adequate safety measures before starting the checking process described in this section. Do not start the checking process unless safety is ensured.

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.



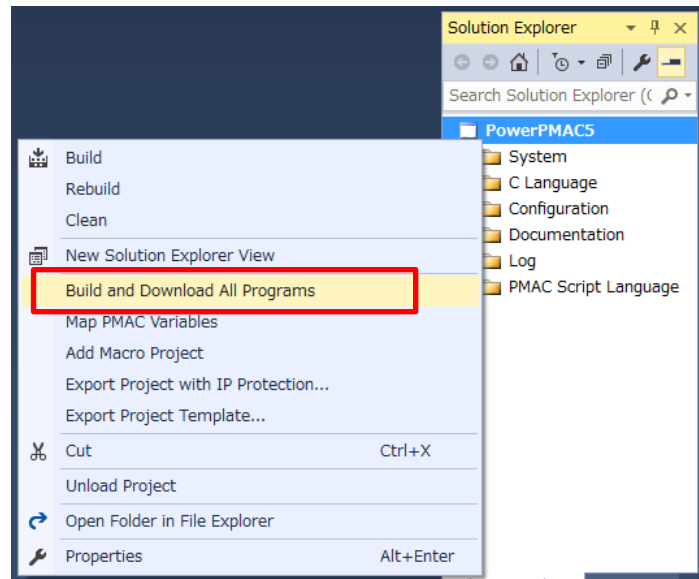
Watch Window	
Command/Query	Response
Sys.ServoCount	13312872
ECAT[0].Enable	0

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.

* 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.



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.

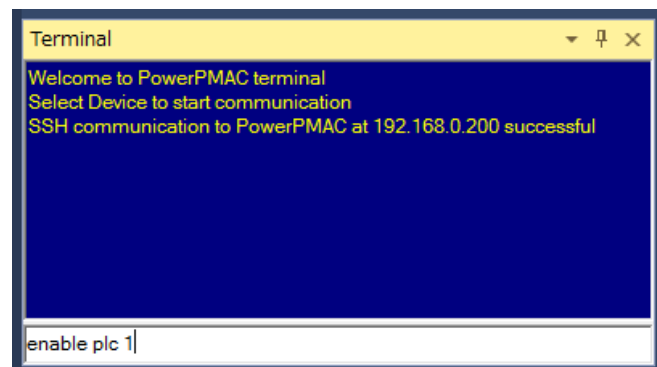
4 The program starts running when it has been downloaded successfully.

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.

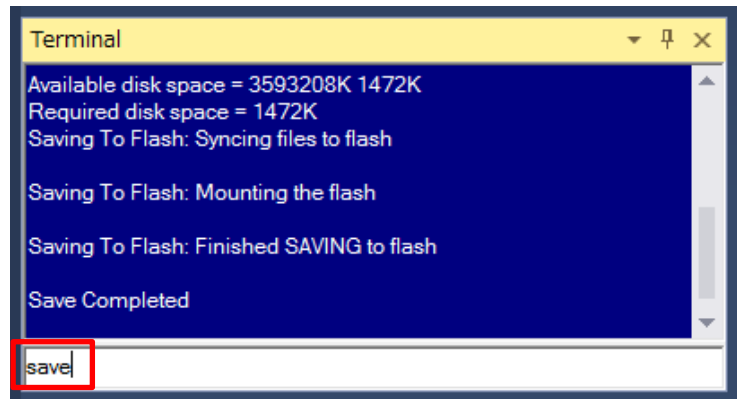
enable plc 1



- 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

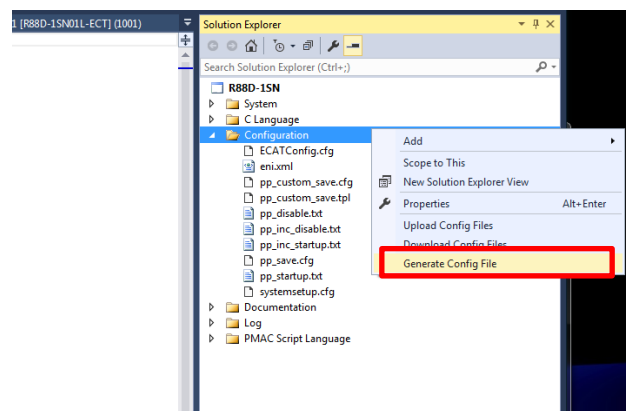
The following describes the procedures to save a Power PMAC IDE project on the computer, and to reuse it.

7.1. Saving a Project

- 1 Creating a Configuration File

Create a Configuration File to save parameters you have changed.

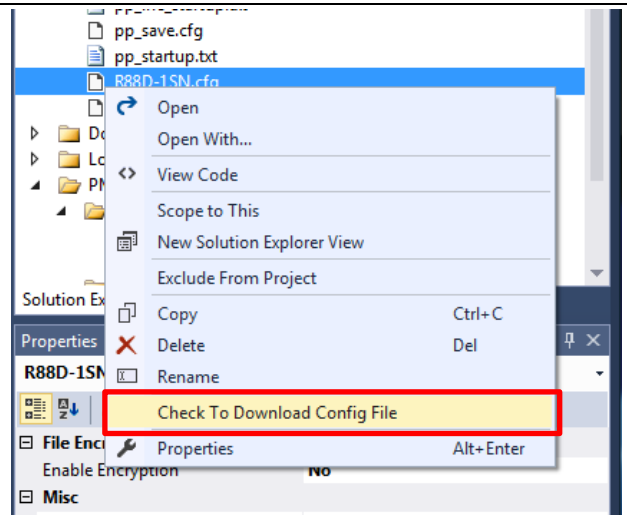
Right-click **Configuration** in the Solution Explorer pane, and select **Generate Configuration File**.
A Configuration File is added to **Configuration**.



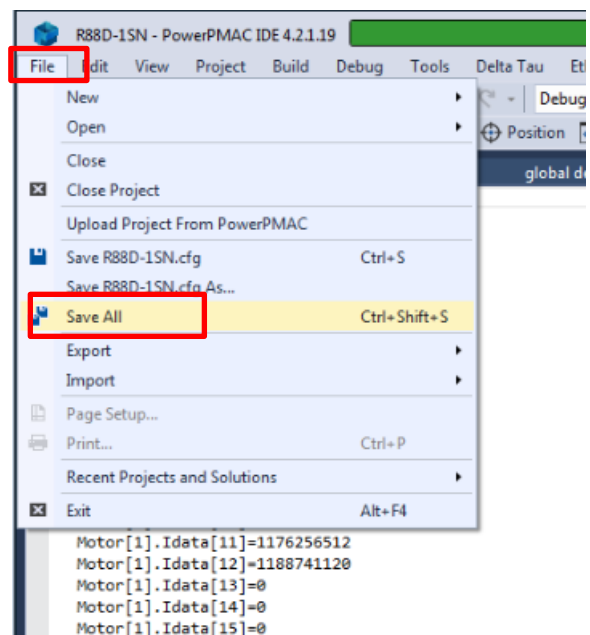
- 2 Enter a file name in the textbox, then click the OK button.



- 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.

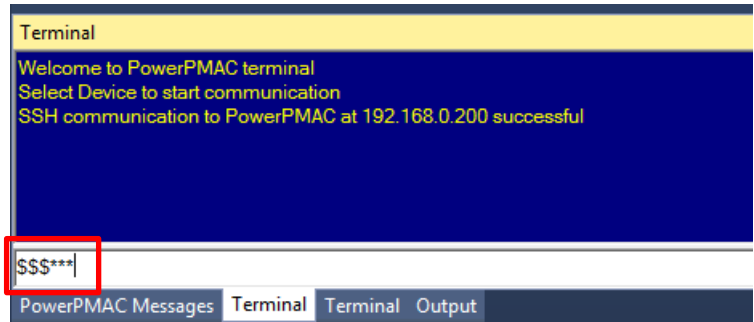


- 4 Saving a Project
- In the **File** menu, run **Save All** to save the project on the computer.

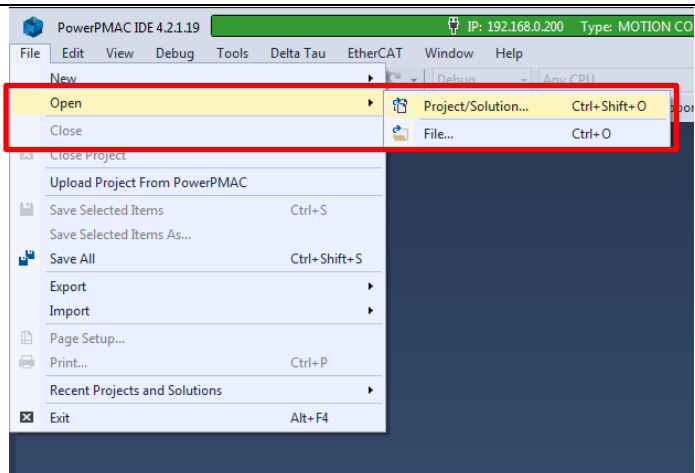


7.2. Loading and Downloading a Project

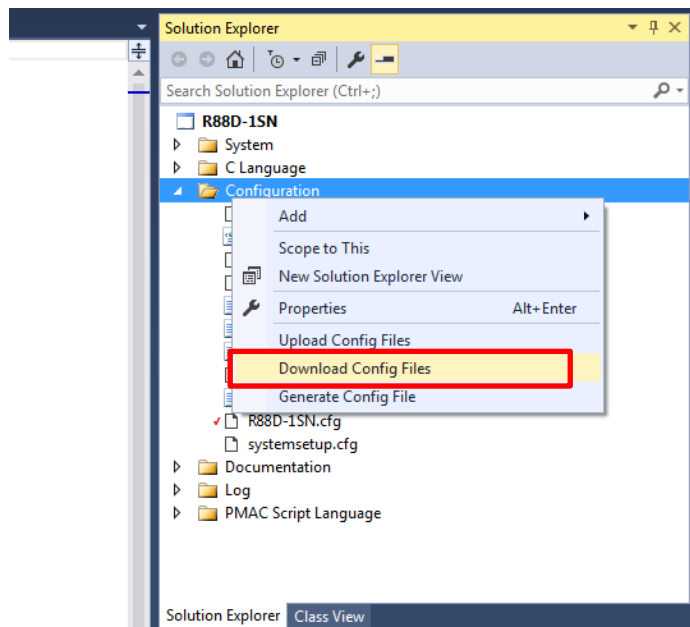
- 1 Start Power PMAC IDE, and connect to the Controller.
- 2 In the Terminal tab page, type the \$\$\$*** command to reset the Controller settings to factory default.



- 3 In the **File** menu, click **Open – Project/Solution** to load the project that you saved.

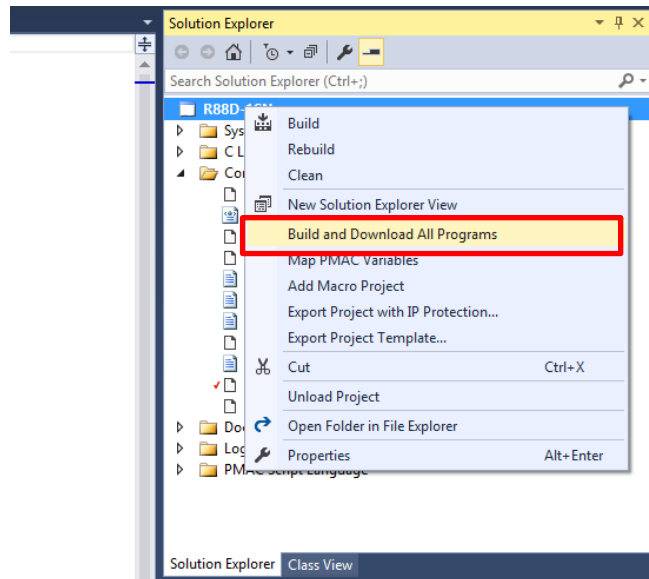


- 7 Right-click **Configuration** in the Solution Explorer pane, and select **Download Config Files** to download the file to the Controller.



- 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 Window.

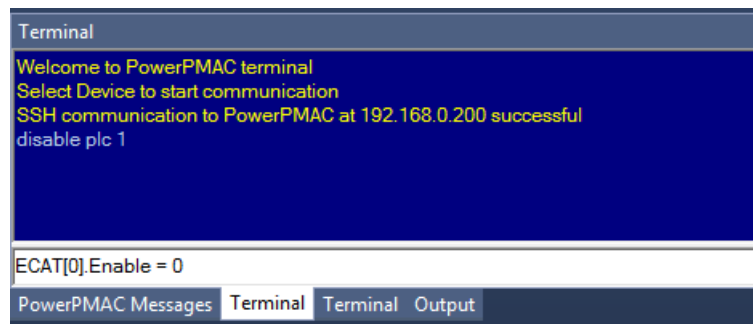
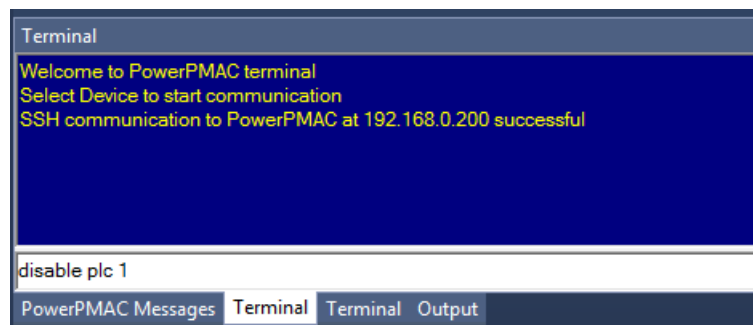


- 9 Stopping a program

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

disable plc 1

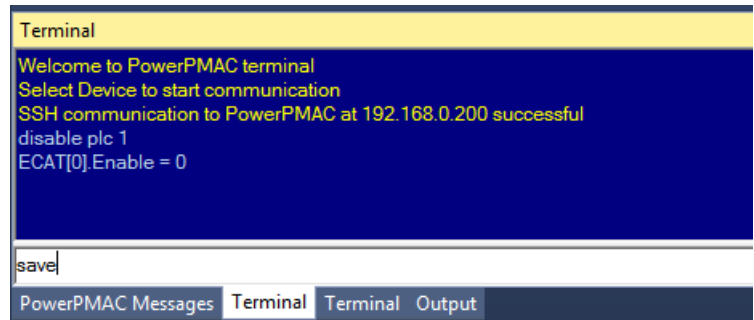
ECAT[0].Enable=0



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 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.

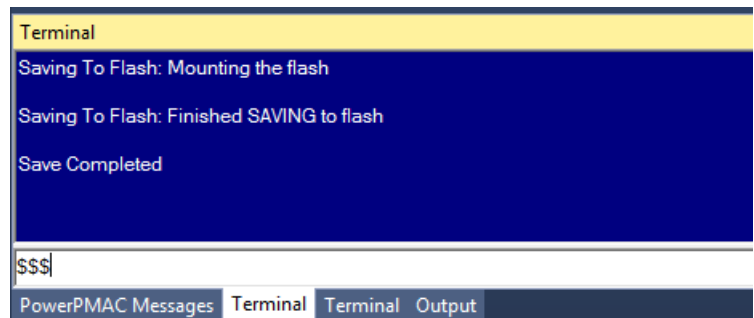


```
Terminal
Welcome to PowerPMAC terminal
Select Device to start communication
SSH communication to PowerPMAC at 192.168.0.200 successful
disable plc 1
ECAT[0].Enable = 0

save|
PowerPMAC Messages Terminal Terminal Output
```

11 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 Troubleshooting

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

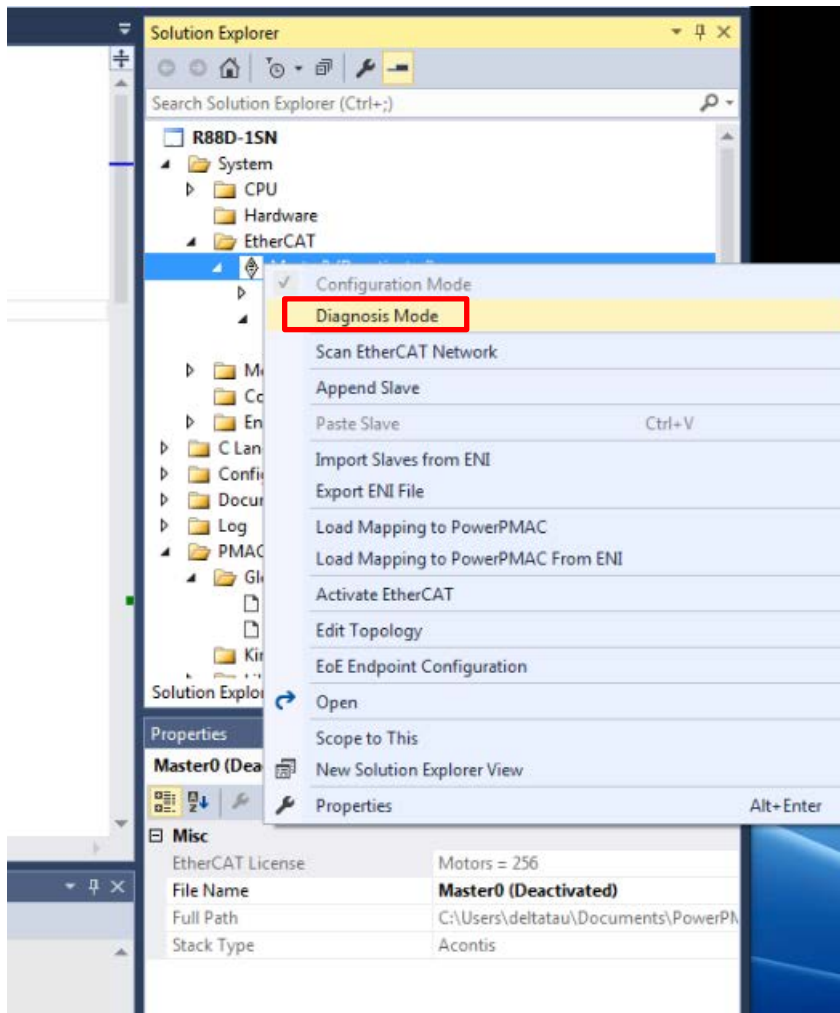
Description	Factor	Corrective Action
The link is not established.	The Ethernet cable is broken or the specified cable is not being used.	If the Ethernet cable is broken or if the specified cable was not used, replace the cable.
	A connector on the Ethernet cable used for EtherCAT communications is disconnected, 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 **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

Init Bootstrap

Pre-Op Safe-Op

Op

Information

Number of found slaves 2

Number of slaves in configuration 2

Number of DC slaves 2

DC in-sync Yes

Topology Ok Yes

Link Connected Yes

Slaves in Master State Yes

Frame Counter

Sent frames 55067

Lost frames 0

Cyclic frames 44678

Acyclic frames 10389

Clear counters

Networks: 1 Slaves: 2 State: [red light] Mode: DIAGNOSIS

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.

Status

Motor Status Coordinate Status Global Status MACRO Status

Global Status

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.

Status			
Motor Status Coordinate Status Global Status MACRO Status			
Motor 1 ▲ ▼ ● Motor activated			
Description	Status	Description	Status
AmpEna	False	I2tFault	False
AmpFault	False	InPos	False
AmpWarn	False	InterlockStop	False
AuxFault	False	LimitStop	False
BI Dir	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.

Status			
Motor Status Coordinate Status Global Status MACRO 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	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

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	5-Apr, 2019	First edition

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

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