Omron PMAC EtherCAT: Setup Guide

Application Note 154

This Application Note shows how an Omron PMAC can be used as an EtherCAT Master together with Triamec Drives as Slaves.

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1 Omron PMAC

The Omron PMAC (Programmable Multi Axis Controller) products are motion controllers, formerly known under the name DeltaTau. Depending on the model these controllers can be used via analogue communication or EtherCAT. They can implement the entire motion control loop and directly set the output necessary on the amplifier or as set point generators if the control loop should be run on the amplifier/drive itself.

For this guide we will consider a PMAC using EtherCAT in a set point generator mode, such that we can use the higher control loop frequency of the Triamec Drive.

This guide has been developed and tested with an Omron CK3E-1210 in combination with a TSD130-10 and a TSD80-10.

2 Material needed

Hardware:

- PMAC with power supply and EtherCAT license
- Triamec Drive(s) (EtherCAT compatible) with logic and drive power supply and an already commissioned motor
- EtherCAT compatible Ethernet cable to connect the PMAC and the Triamec Drive
- Ethernet cable to connect the PMAC to the PC
- Optional but recommended: USB/Ethernet/PCI connection from Triamec Drive(s) to PC

Software:

- Power PMAC IDE [1]
- Optional but recommended: Triamec System Explorer [2]

3 Drive setup

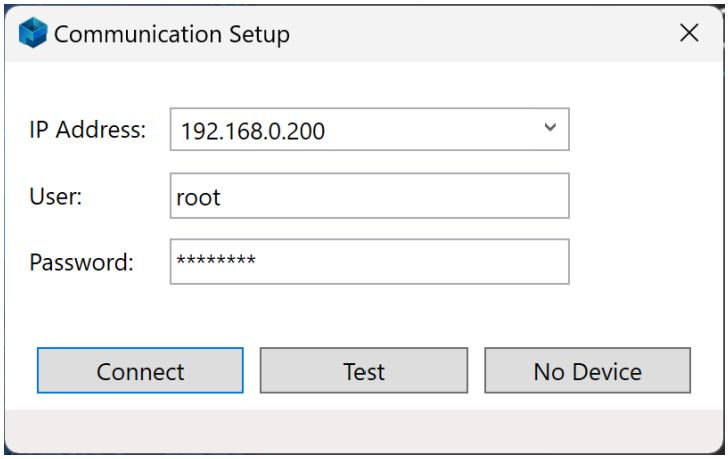
Make sure to consider the following settings to allow the Triamec Drive to work as an EtherCAT slave, see the TwinCAT Setup Guide [3]:

- Set General.Parameters.Standalone to *False*
- Set Axes[i].Commands.General.OverrideControlSystem to 0

4 PMAC setup

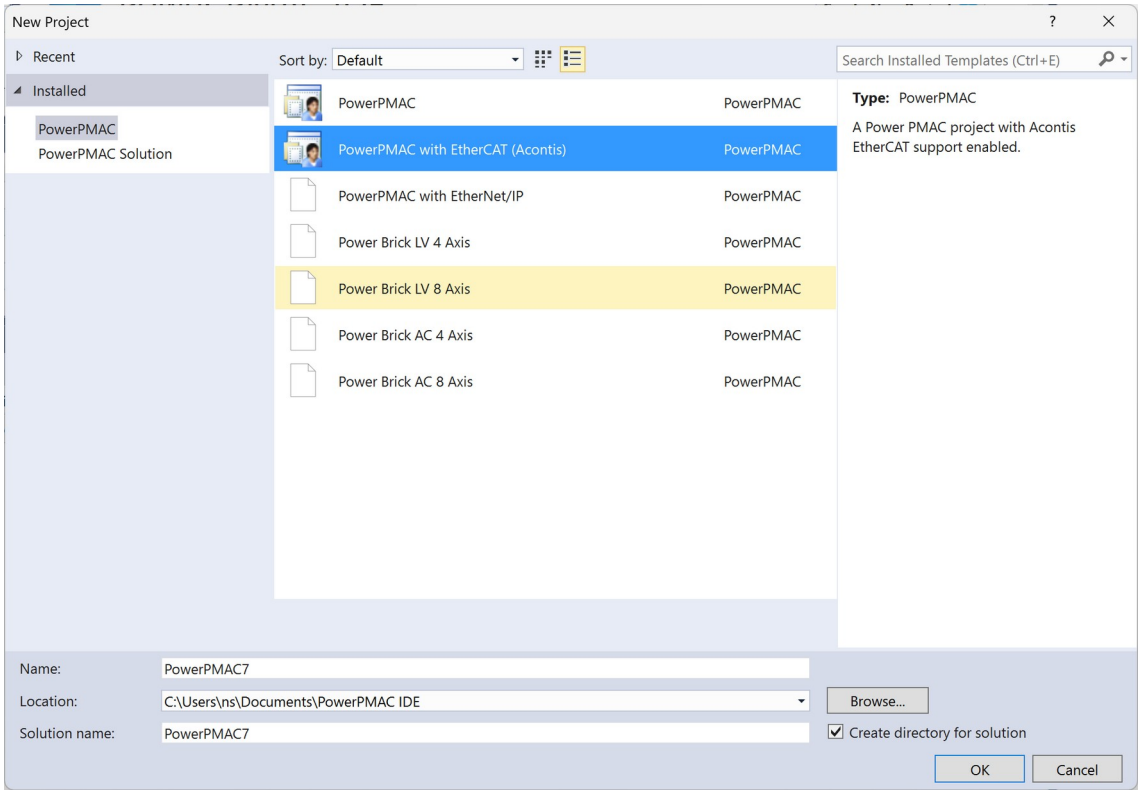
4.1 Connect to PMAC

Open the PowerPMAC IDE and connect to the PMAC according to the Omron PMAC User Manual [4]. Usually, some changes in the settings of the Ethernet connection are required.



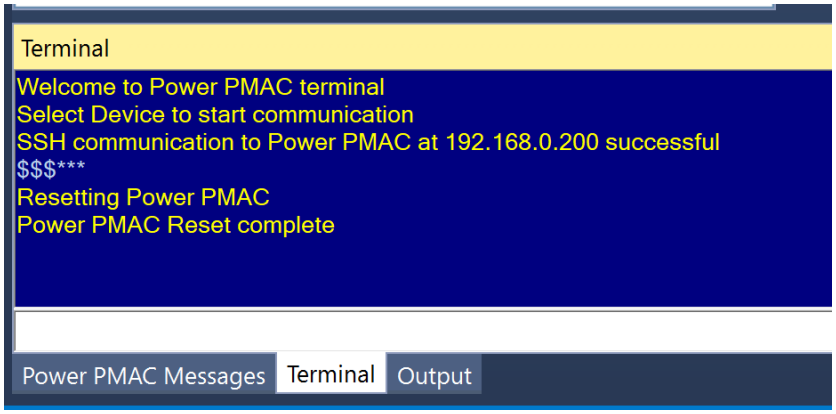
4.2 Start New Project

Start a new project with EtherCAT under **File > New > Project**.



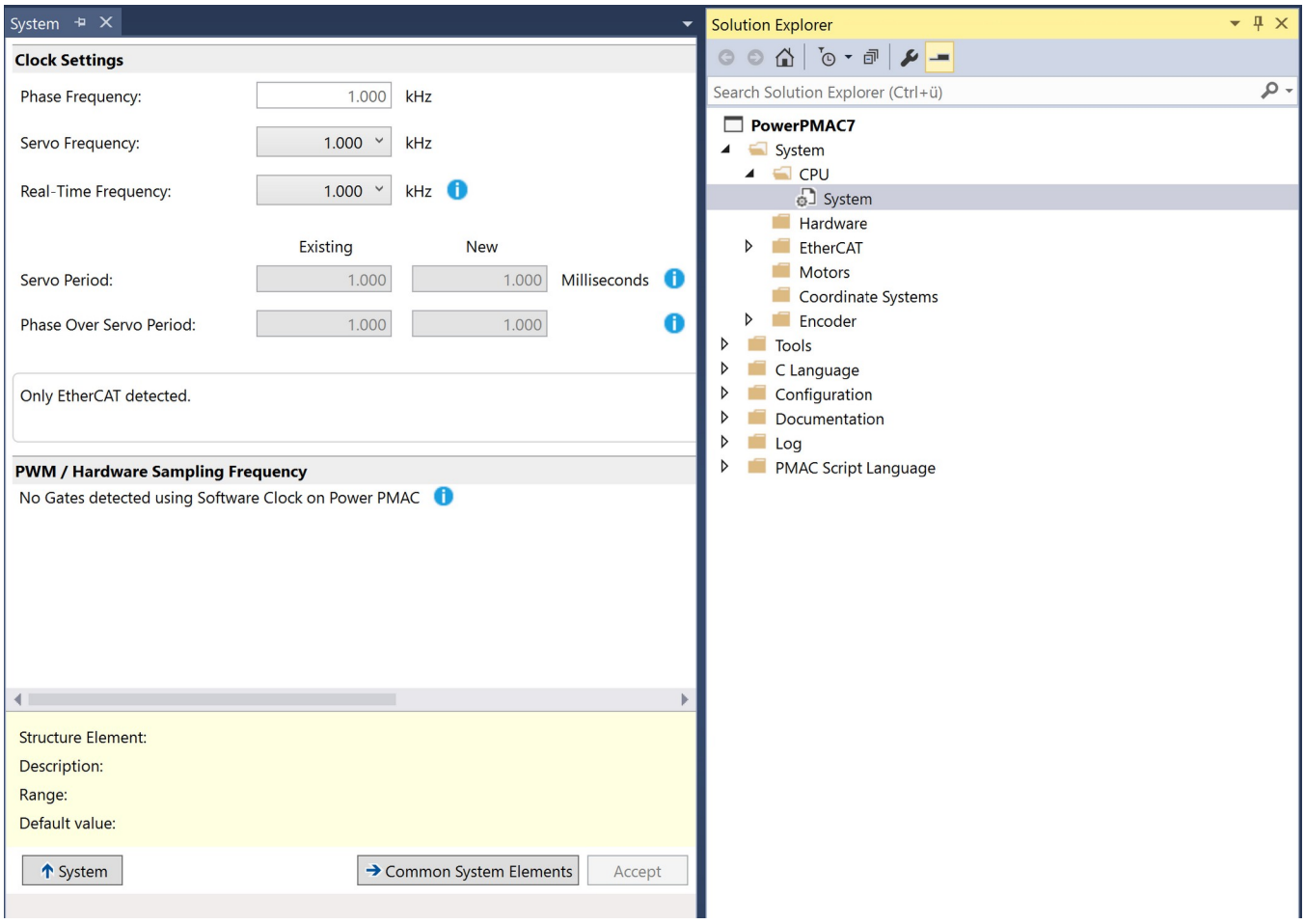
4.3 Reset PMAC

Either click **Reset & Re-Initialize** to establish the factory setting of the PMAC or enter **$$$*** ** into the Terminal.



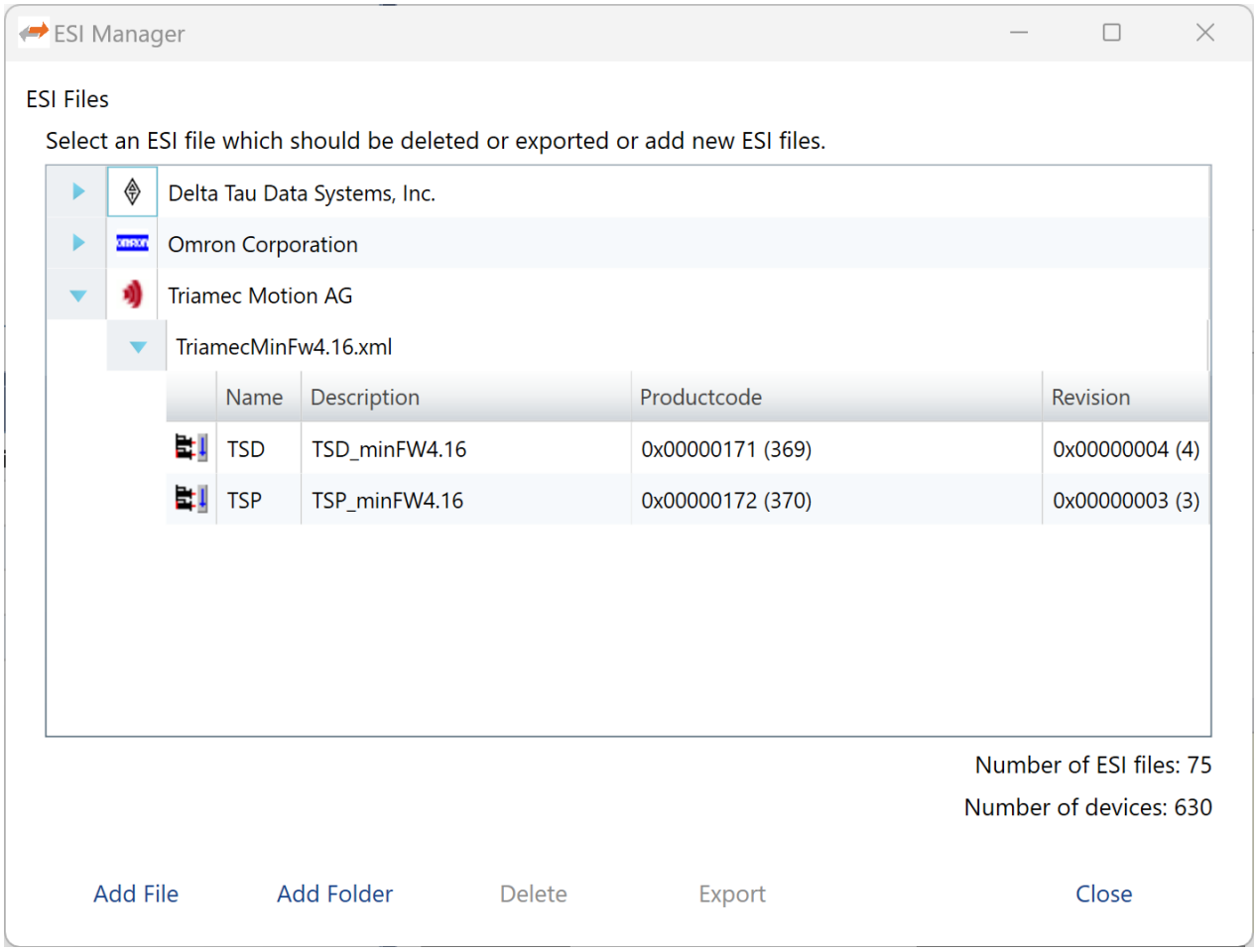
4.4 Set System Clock

In the **Solution Explorer**, go to **System > CPU > System** and set the Clock according to your needs. For this example, we will leave all settings at 1 kHz.



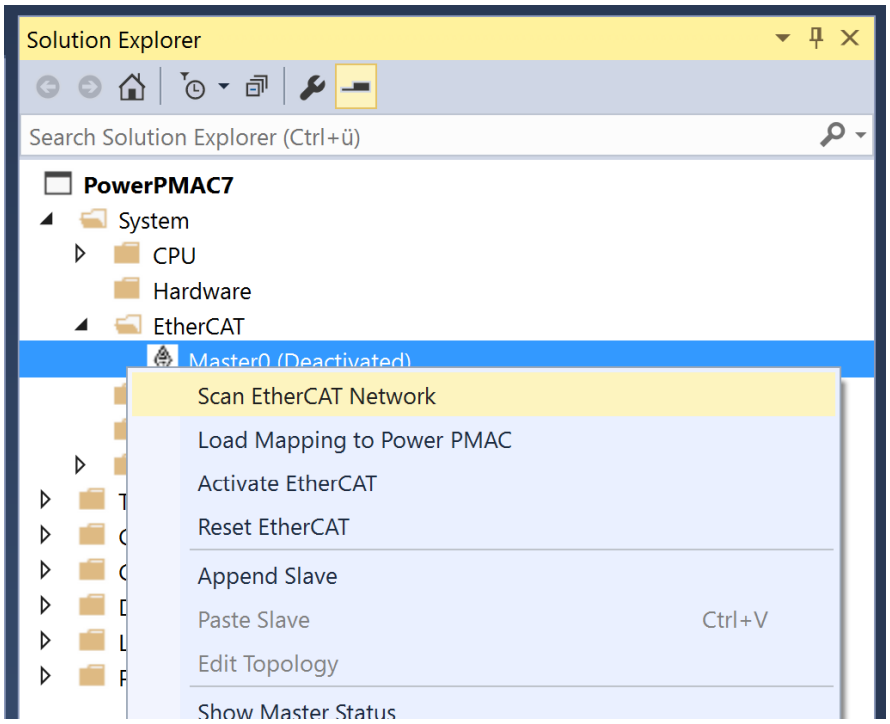
4.5 Set System Clock

Go to **EtherCAT > ESI Manager > Add File** and select the Triamec ESI file (.xml) [5]. After selection, Triamec Motion AG should be visible in the ESI files.

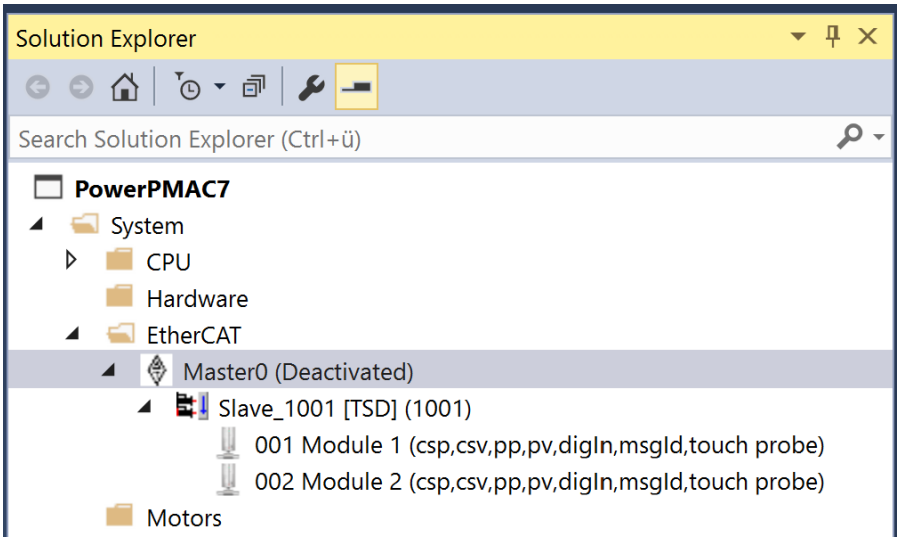


4.6 Scan EtherCAT Network

Go to **System > EtherCAT > Master0** and right-click to select **Scan EtherCAT Network** to automatically find all the connected slaves.

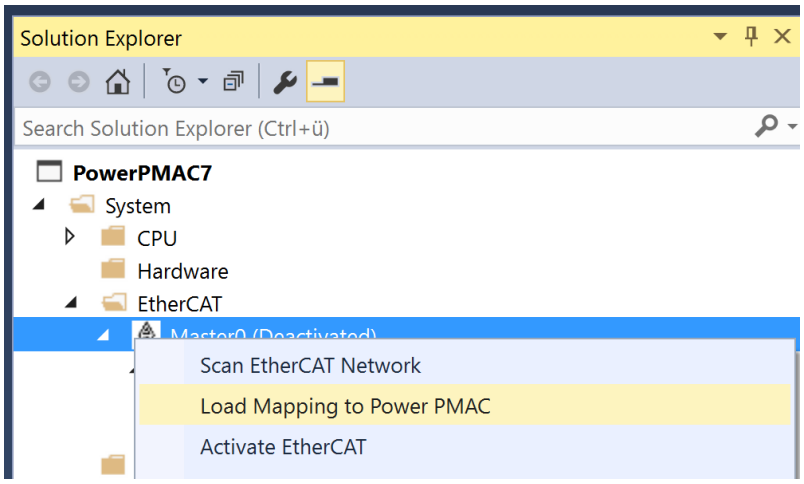


After the scan, at least one slave device should be listed under the Master0.



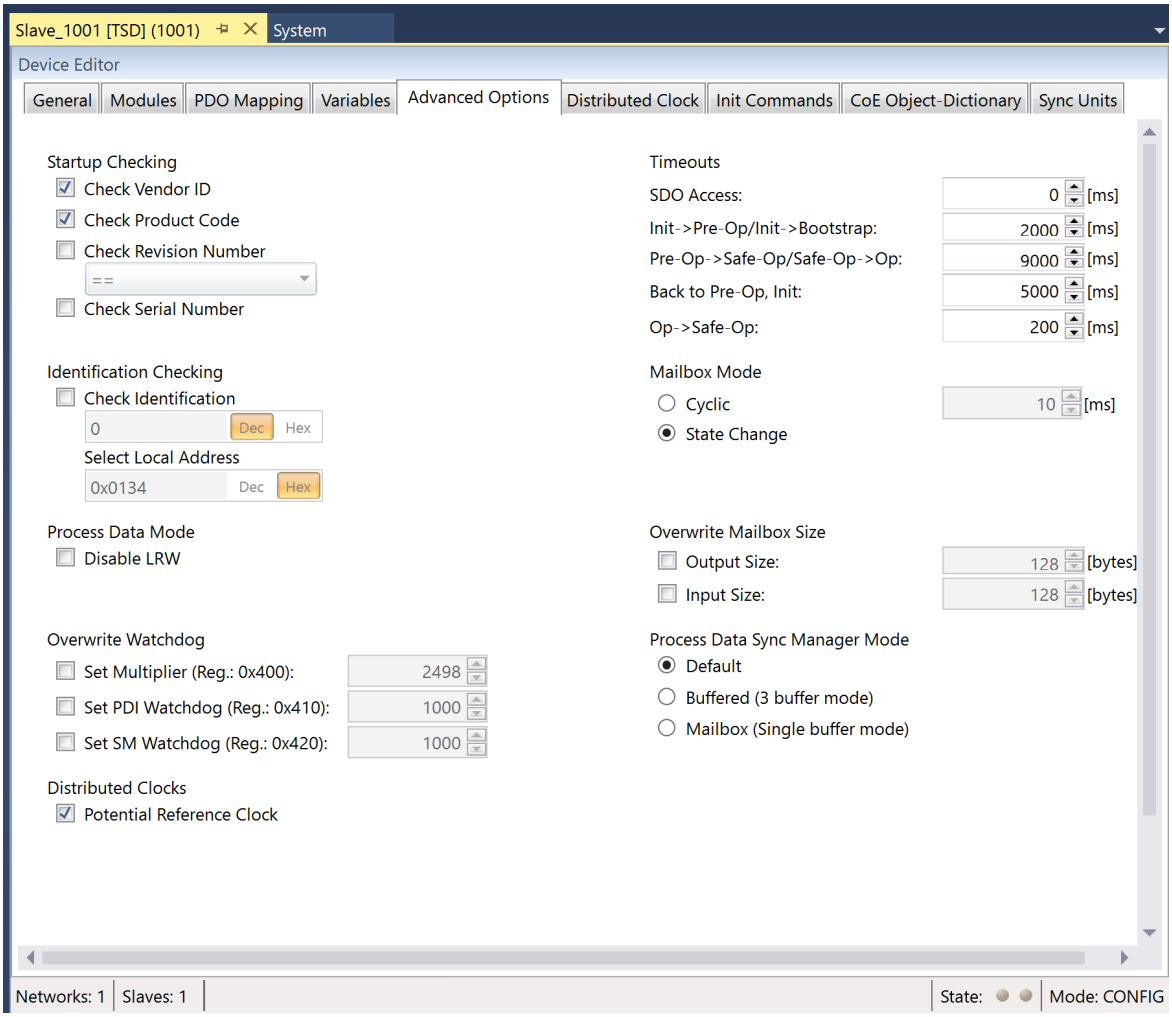
4.7 Load Mapping to PMAC

Go to **System > EtherCAT > Master0** and right-click to select **Load Mapping to Power PMAC** in order to update the EtherCAT info on the PMAC.

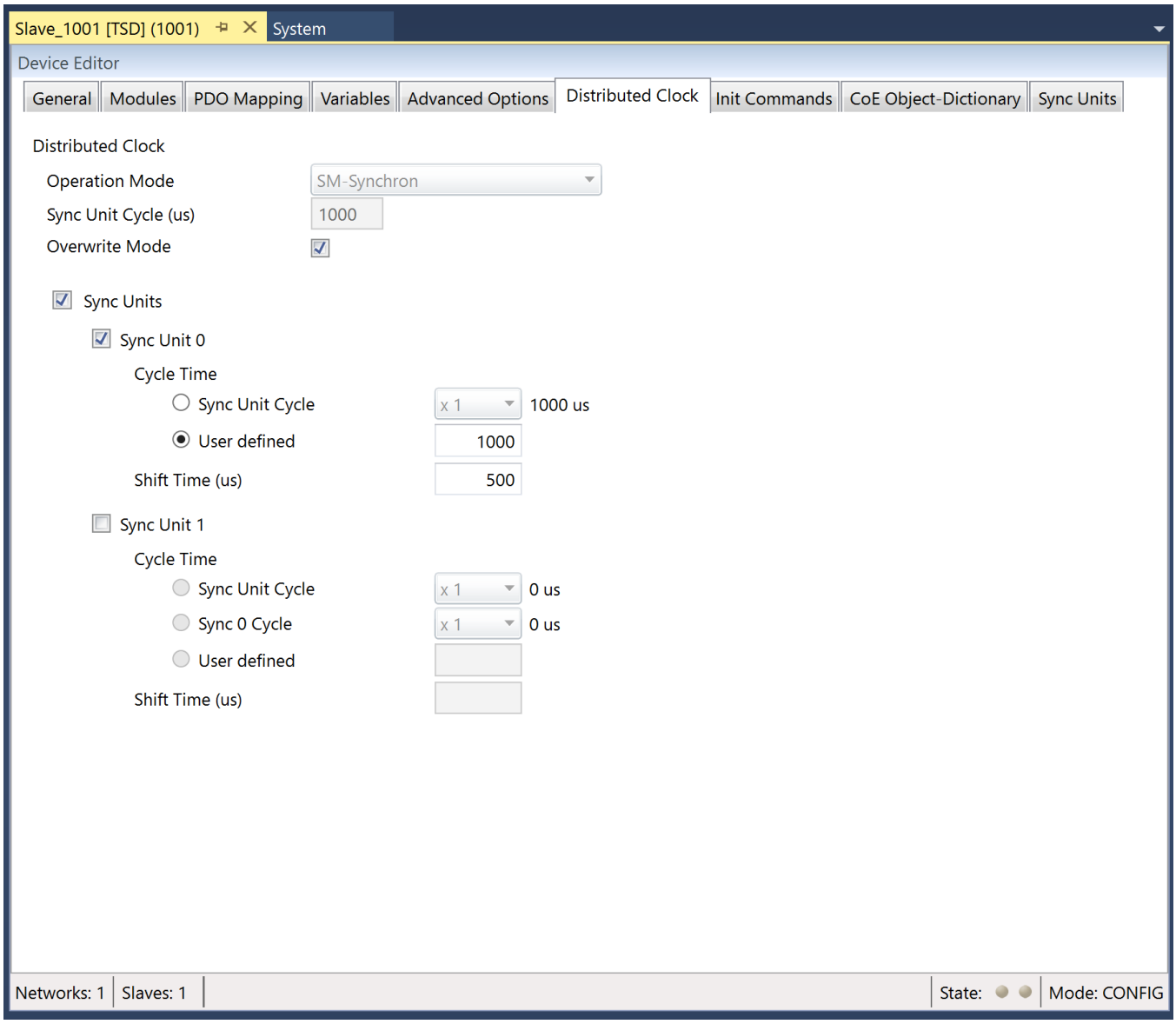


4.8 Adjust Slave Clock(s)

Double-click your first Triamec Slave, go to **Advanced Options** and set **Potential Reference Clock**.

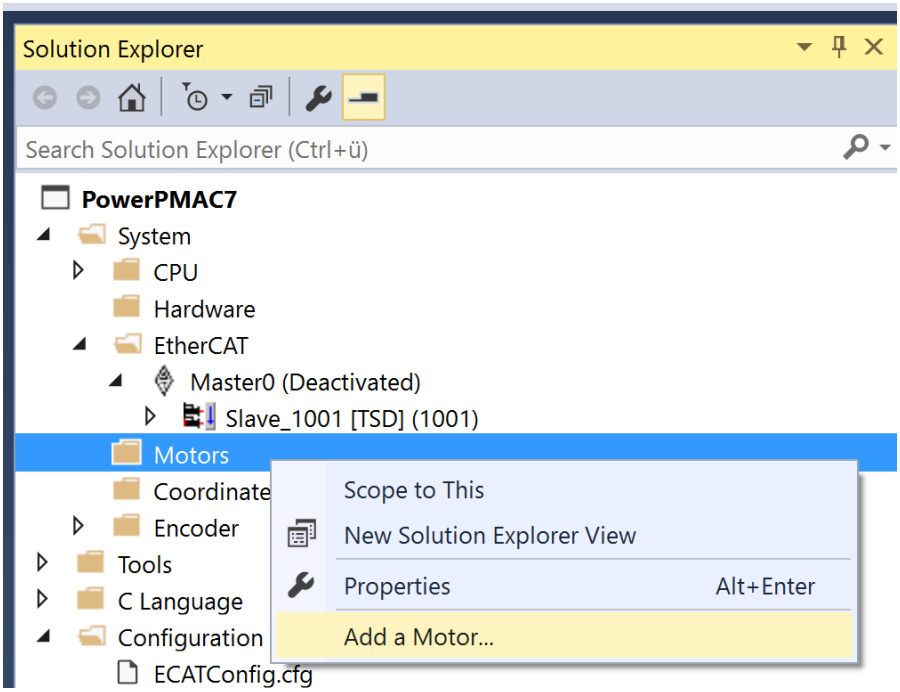


On all of your slaves, go to **Distributed Clock, select Overwrite Mode > Sync Units > Sync Unit 0 > User defined**, set it to your System Clock time and **Shift Time (us)** to half of this value. **Save all** and execute **Load Mapping to Power PMAC** as before.

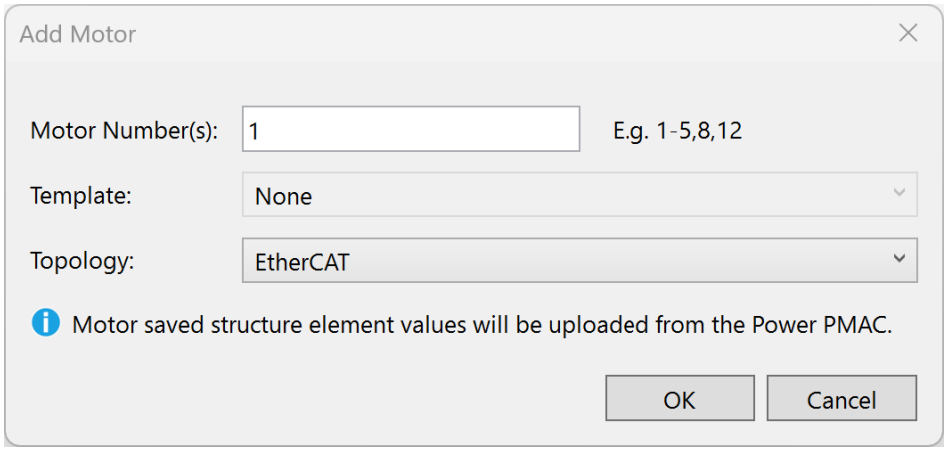

Slave_1001 [TSD] (1001)
System
Device Editor
General
Modules
PDO Mapping
Variables
Advanced Options
Distributed Clock
Init Commands
CoE Object-Dictionary
Sync Units
Distributed Clock
Operation Mode
SM-Synchron
Sync Unit Cycle (us)
1000
Overwrite Mode
Sync Units
Sync Unit 0
Cycle Time
Sync Unit Cycle
x 1
1000 us
User defined
1000
Shift Time (us)
500
Sync Unit 1
Cycle Time
Sync Unit Cycle
x 1
0 us
Sync 0 Cycle
x 1
0 us
User defined
Shift Time (us)
Networks: 1
Slaves: 1
State:
Mode: CONFIG

4.9 Add Motor

Go to **System > Motors** and right-click to select **Add a Motor...**

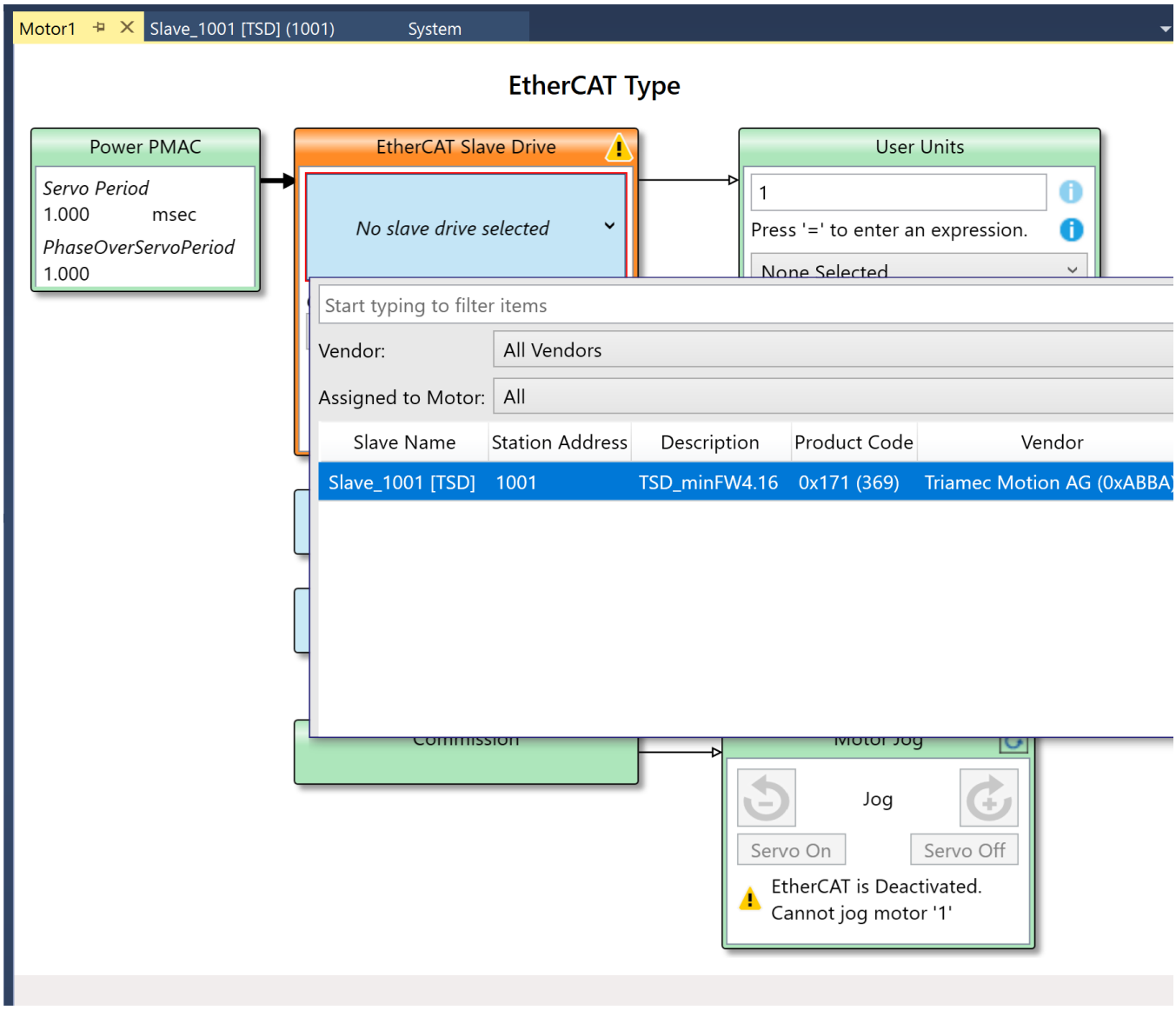


Select the number of motors you want to add and the **Topology: EtherCAT.**

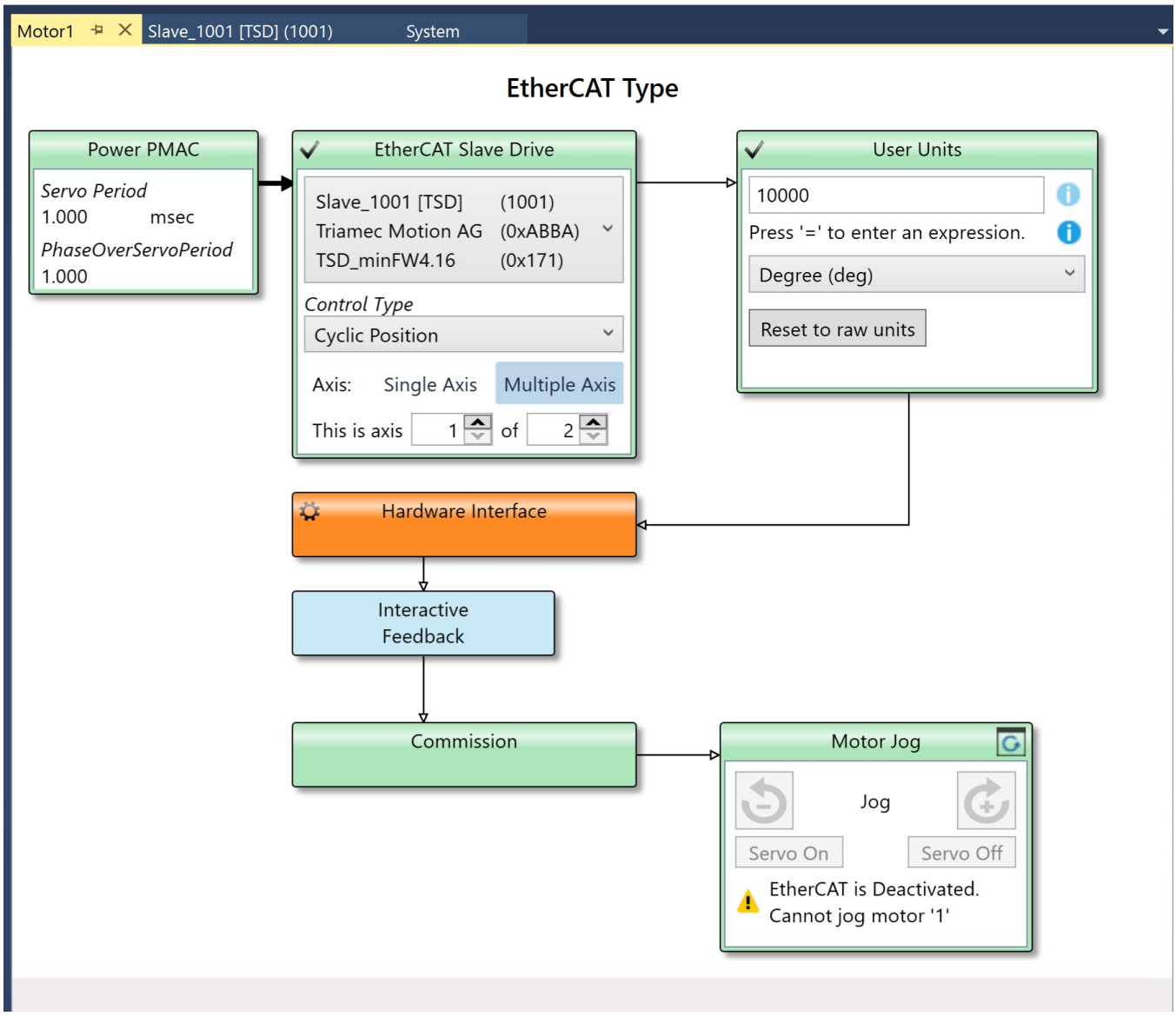


4.10 Configure Motor

Click on the motor you want to configure in the Solution Explorer. Select your slave drive.

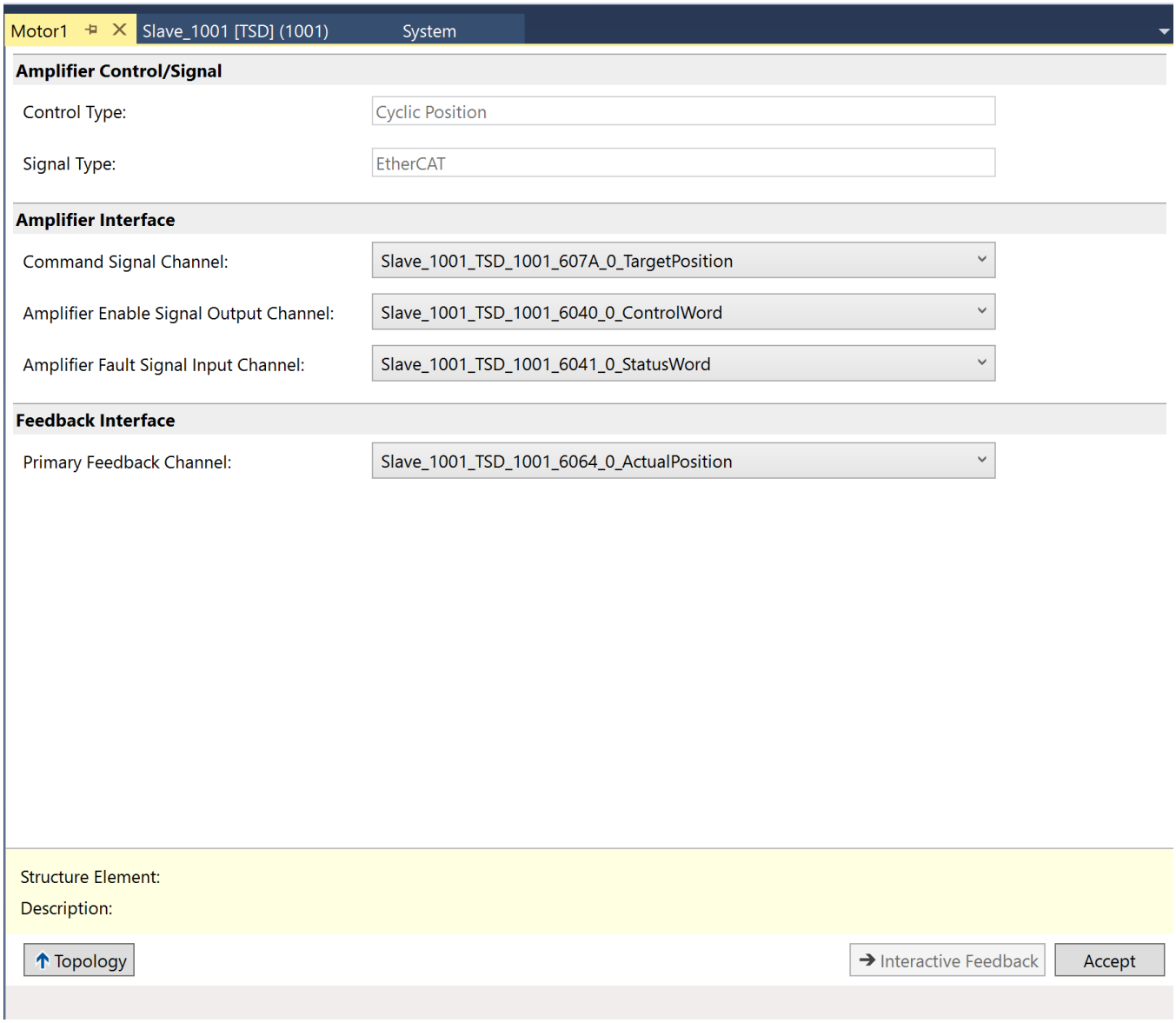


For Drives with two axis, select **Axis: Multiple Axis.** Confirm with the **Save Icon** on the top right of the box.

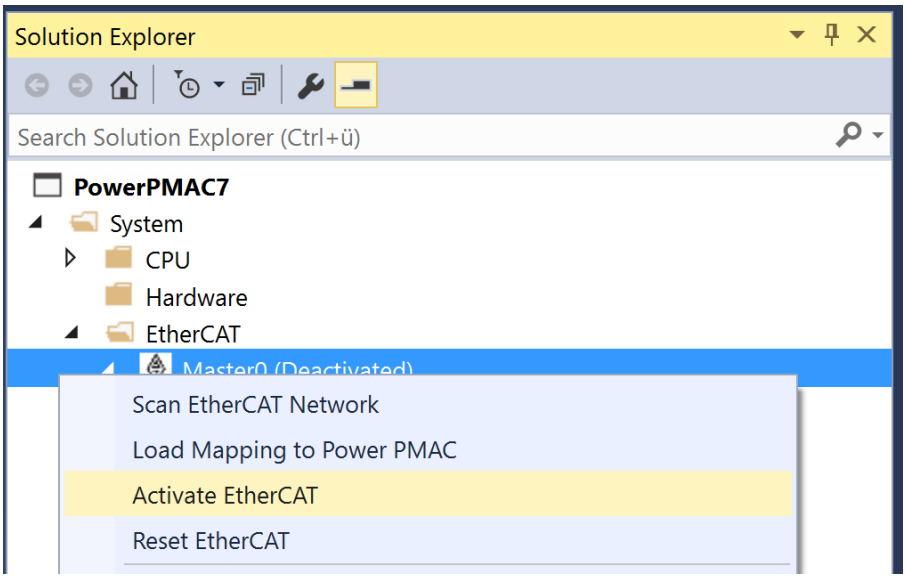


Enter the number of EtherCAT increments that equal one axis unit (standard is 10’000) and select the **User Units** that similar to the axis unit on the drive. Save your settings.

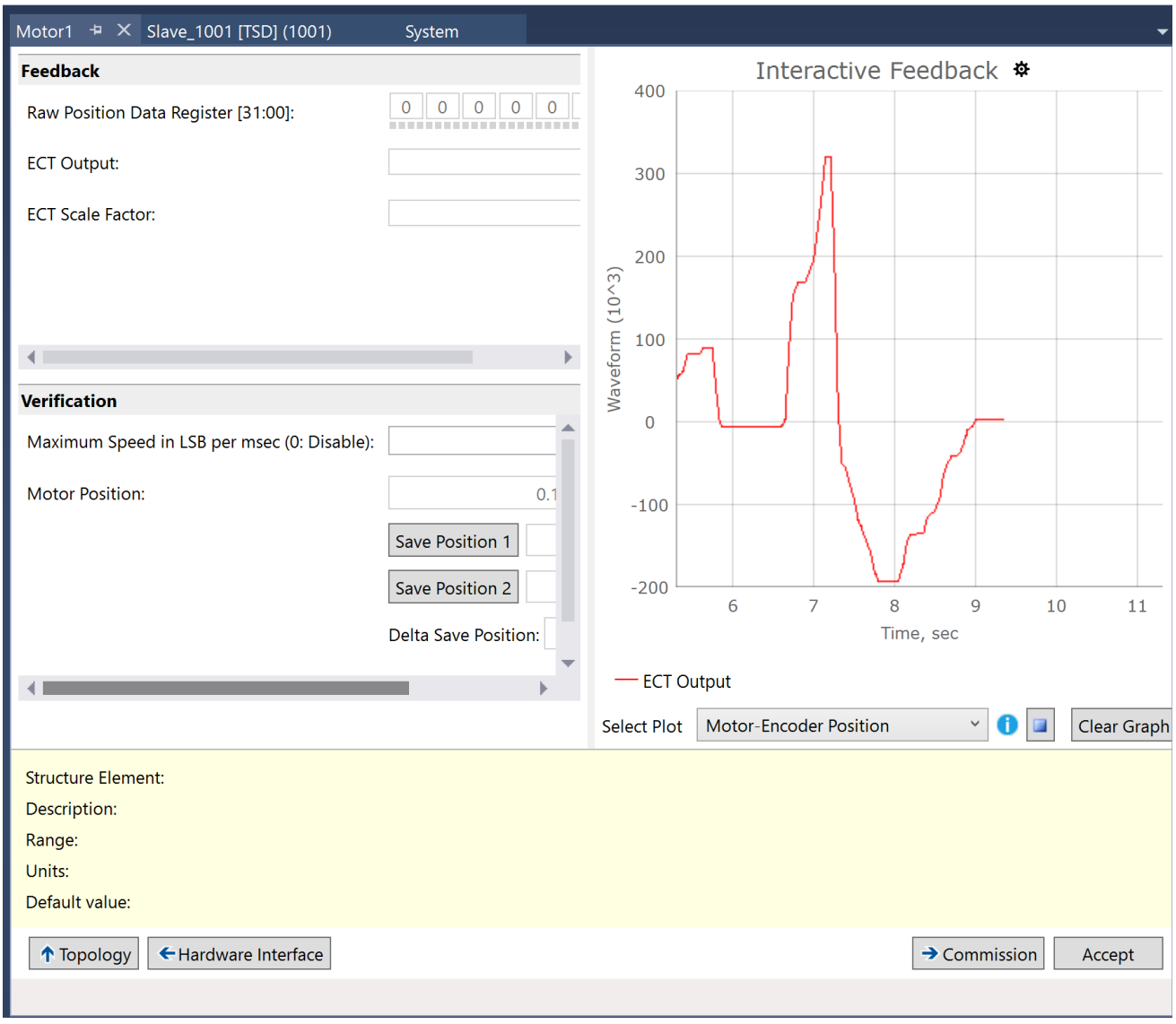
Double-click **Hardware Interface**. Check if the correct Interface Variables have been found, change them if necessary. At the end, click **Accept**.



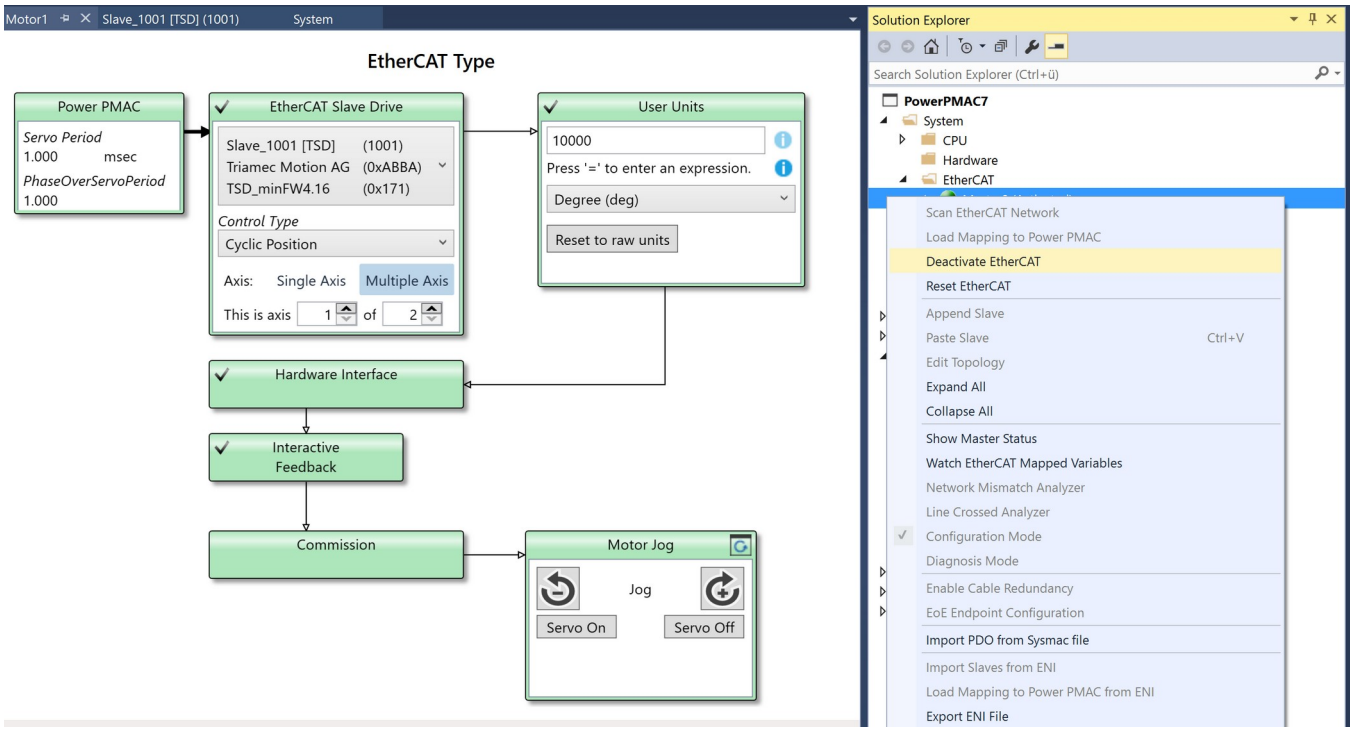
Continue to Interactive Feedback. In order to see the feedback, you need to go to **System > EtherCAT > Master0** and right-click to select **Activate EtherCAT.**



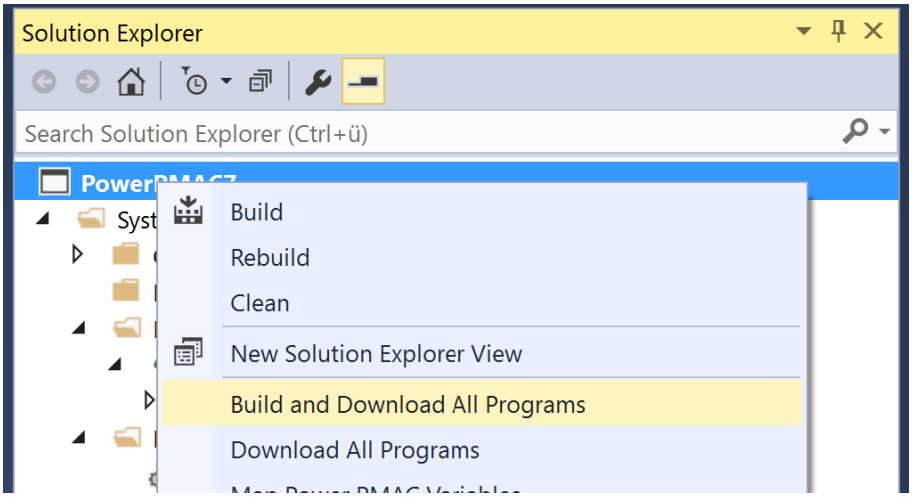
The graph in Interactive Feedback should now be running. Verify the feedback by moving the motor manually.



Click **Accept** and continue to **Commission**. Fill out all variables in Commissioning according to your setup and click **Accept**. All components in the Motor Wizard should now be green. Go to **System > EtherCAT > Master0** and right-click to select **Deactivate EtherCAT** in order to be able to execute **Load Mapping to Power PMAC afterwards.**



Right-click on the **project name** to select **Build and Download All Programs**.

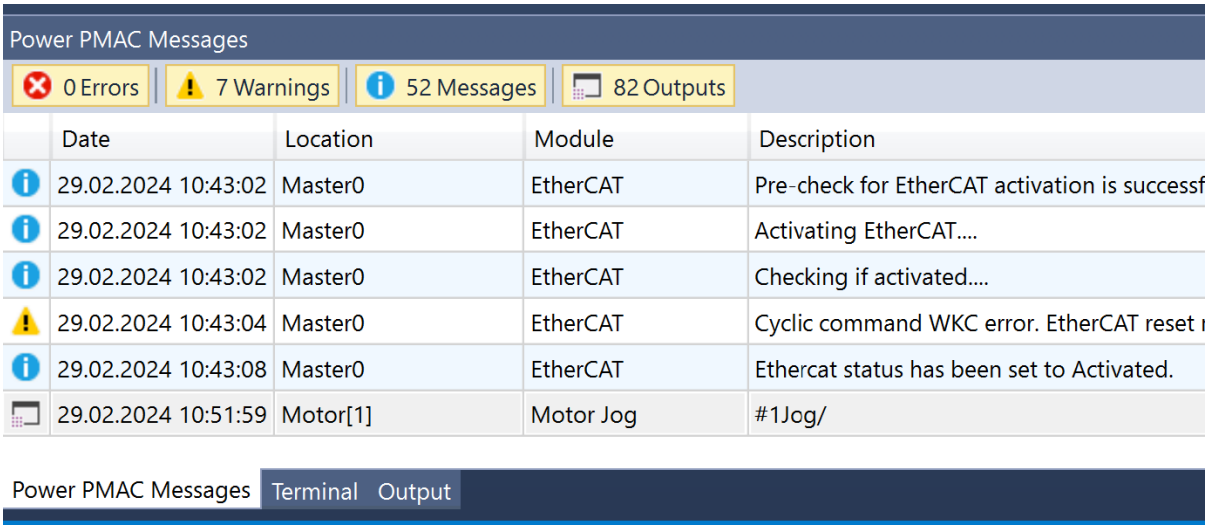


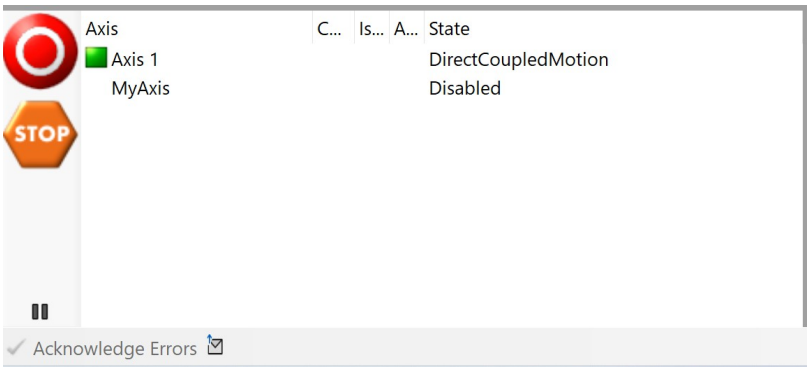
4.11 Test PMAC Setup

Activate EtherCAT again and enter **Slave_1001_TSD_1001_6060_0_ModeofOperation = 8** to activate Axis[0] or **Slave_1001_TSD_1001_6860_0_ModeofOperation = 8** to activate Axis[1] in the Terminal.

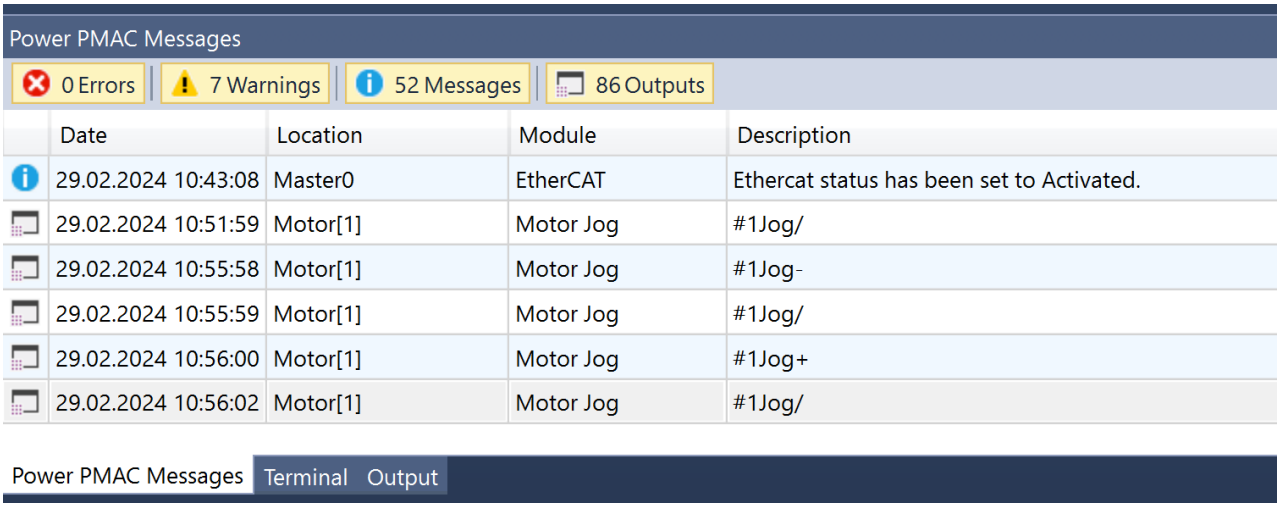
Note Setting ModeofOperation = 8 is not persistent and has to be executed after each startup. See 4.13 on how to automate this behavior

Go to the **Motor Wizard** and click **Servo On**. If everything worked, you should now see the **Jog/** command in the **Power PMAC Messages** and the status **DirectCoupledMotion** in the **Axis Info Window in the TAM System Explorer.**



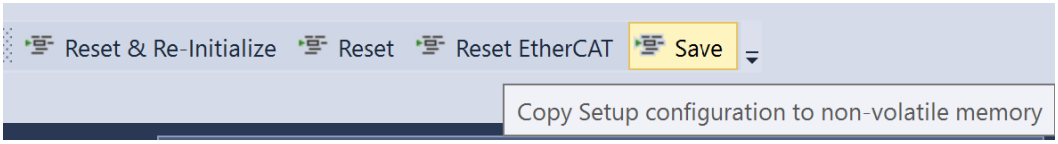


In the Motor Wizard, click the Jog Minus or Jog Plus Button to verify that the PMAC can move the drive motor. If it worked, your Power PMAC Messages should show the Jog commands without any error.



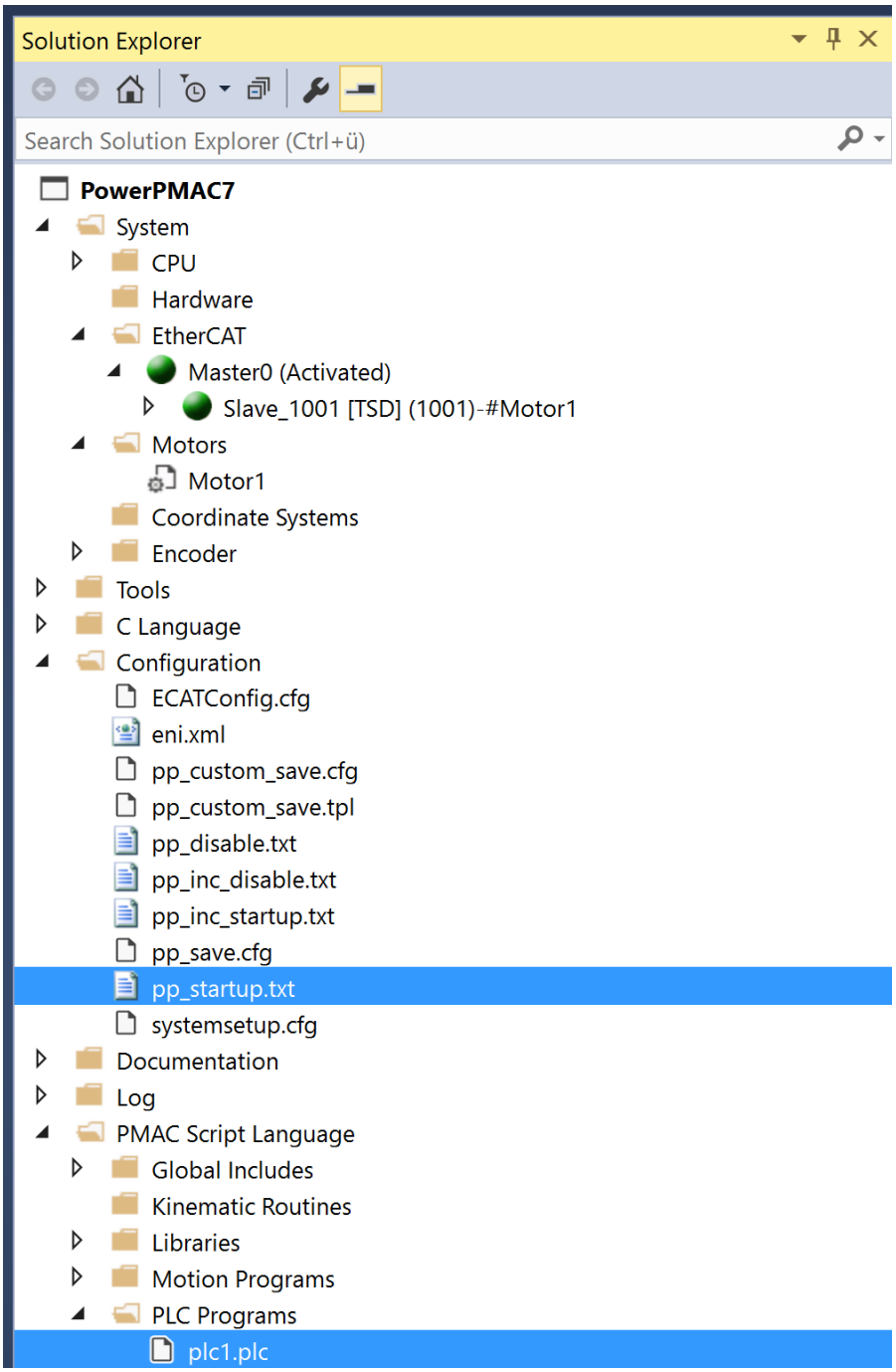
4.12 Save PMAC setup

Click Save in order to write down the current settings to the PMAC.



4.13 Automate Startup

In order to activate EtherCAT and set the ModeofOperation automatically, scripts can be executed automatically on startup of the PMAC. For this we are altering **Configuration > pp_startup.txt and PMAC Script Language > plc1.plc.**



Add the following content to **plc1.plc**:

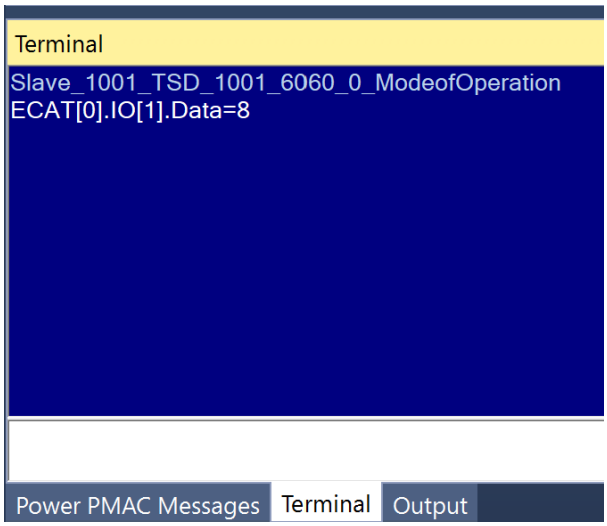
```
open plc 1
//
call Timer.sec(1)
Slave_1001_TSD_1001_6060_0_ModeofOperation = 8 // Adjust according to your Drive and Axis
//
//
while (ECAT[0].MasterState != 2 && ECAT[0].Enable == 0){}
if (ECAT[0].Enable == 0)
```

```
{
    ECAT[0].Enable = 1
    while (ECAT[0].MasterState != 8){}
    call Timer.sec(3)
}

//homez 1..x
//call Timer.sec(1)
//jog 1..x
//call Timer.sec(1

enable plc2..3

disable plc 1

close
```

Add the following content to **pp_startup.txt**:

```
enable plc1
```

Click **Save all** and **Save** for the PMAC to make the settings non-volatile. Execute **Reset** and verify that EtherCAT starts automatically. In the Terminal, you can also check if the ModeofOperation has been set correctly.



References

[1] Power PMAC IDE, accessed on 28.02.2024
https://automation.omron.com/en/ca/products/family/PMAC%20IDE

[2] Triamec System Explorer, accessed on 28.02.2024
https://www.triamec.com/en/tam-software-support.html

[3] TwinCAT Setup Guide, accessed on 29.02.2024
https://www.triamec.com/en/documents.html?file=files/medien/documents/manuals/SWTC_TwinCAT-UserGuideEcat_EP014.pdf&cid=2298

[4] Omron PMAC User Manual, accessed on 28.02.2024
https://assets.omron.com/m/2c1a63d391d6bfa3/original/Power-PMAC-Users-Manual.pdf

[5] Triamec ECAT Integration, accessed on 29.02.2024
https://www.triamec.com/en/ethercat.html

Revision History

Version	Date	Editor	Comment
001	2024-03-08	ns	Initial version

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