Quick Start: EtherCAT™ and Commander Series Drives

This application note will describe a step by step procedure to get a motor spinning on a Commander C300 in vl_velocity mode (2) using TwinCAT™ v.3.

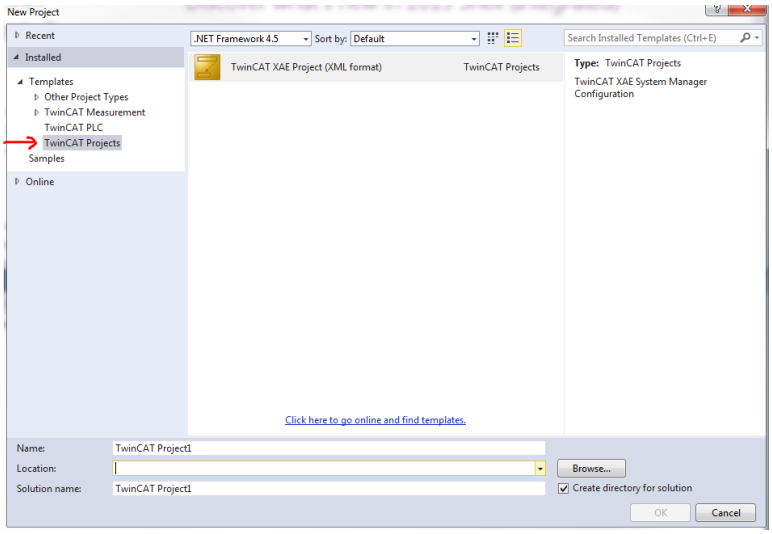
Pre-requisites before running

Ideally, the SI-EtherCAT™ firmware version would match the version of the ESI files loaded into the TwinCAT™ master's config folder. An old batch of ESI files can work with comparatively newer SI-EtherCAT™ modules because the default setting in the TwinCAT™ 3 scan feature allows for searching device versions "equal to or greater than" whatever version of ESI files is already installed in the master. However, there is no "less than or equal to setting" so the converse scenario would not work.

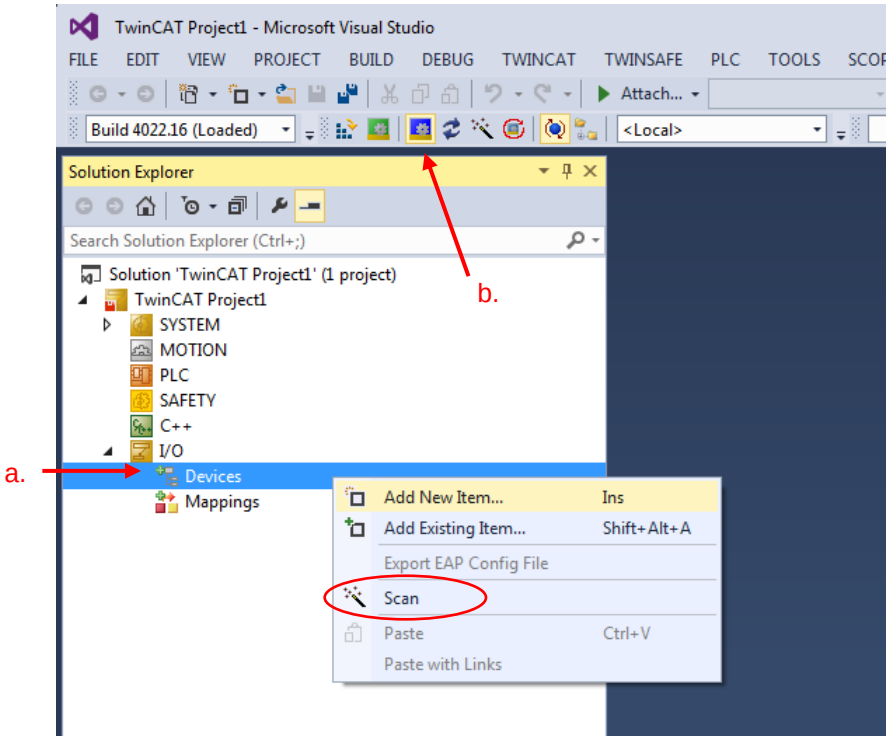
*****For a master device (PC) with an Ethernet port that has never been used in an EtherCAT™ network, follow Appendix A (page 15) before proceeding with this procedure*****

Procedure

1. Open TwinCAT™, File → New → Project. Make sure "TwinCAT™ XAE Project (XML format)" is select as indicated below. Give the project an appropriate Name. Solution name is automatically filled to match Name. Choose a different location from default if desired.

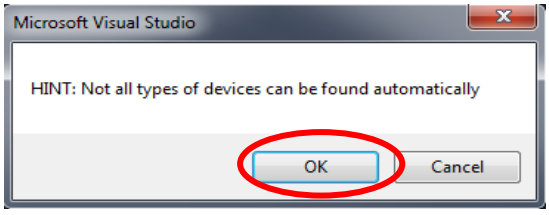


2. Expand the I/O box in the Solution Explorer (a), right click “Devices” select “Scan”

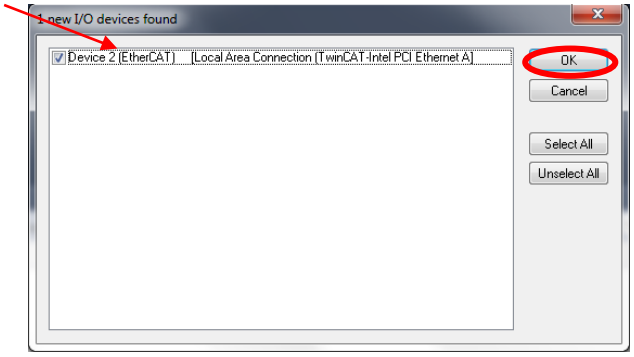


NOTE: If “Scan Devices…” is greyed out in the dropdown list after right-clicking, make sure to go into Config Mode by pressing the icon indicated by (b).

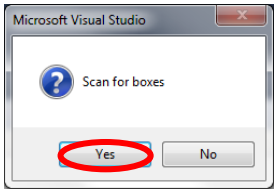
3. Click OK



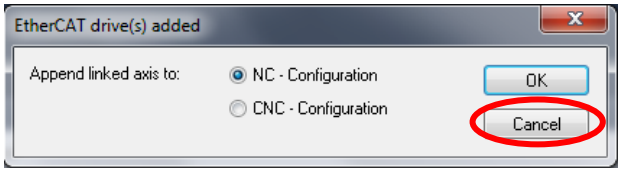
4. There should be a list of available EtherCAT™ ports listed below. Select the required EtherCAT™port and click OK.



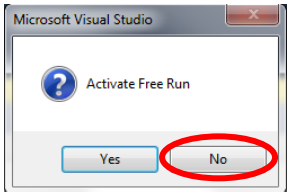
5. Click Yes to scan for EtherCAT™ devices in the network. The correct XML files installed in C:\TwinCAT\Io\EtherCAT will help TwinCAT™ System Manager correctly identify and name each EtherCAT™ node it detects.



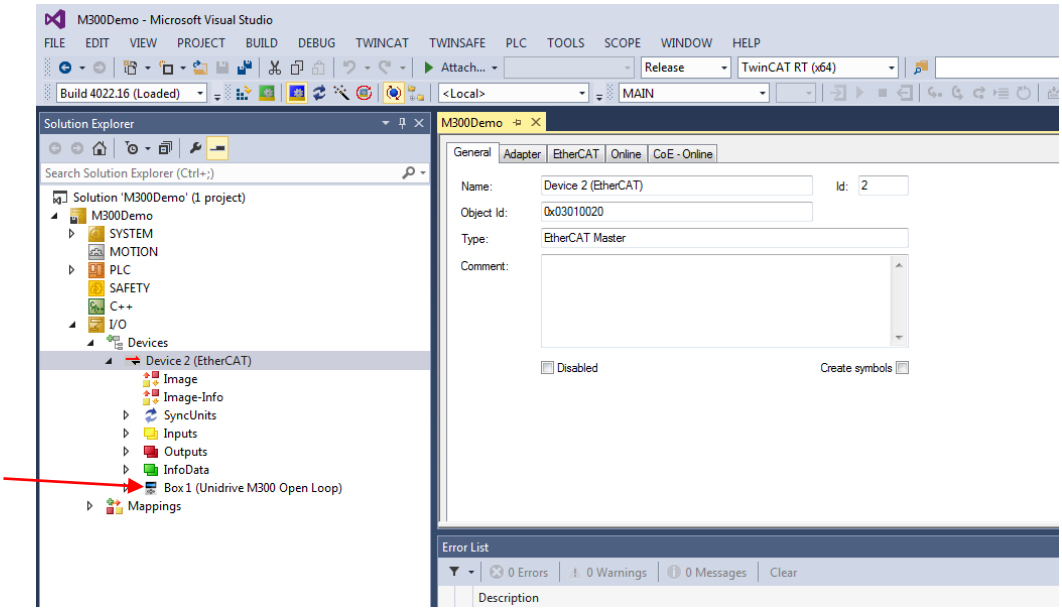
6. Click Cancel to avoid NC or CNC configurations



7. Click No to the Activate Free Run window. This will keep the master in Config mode.

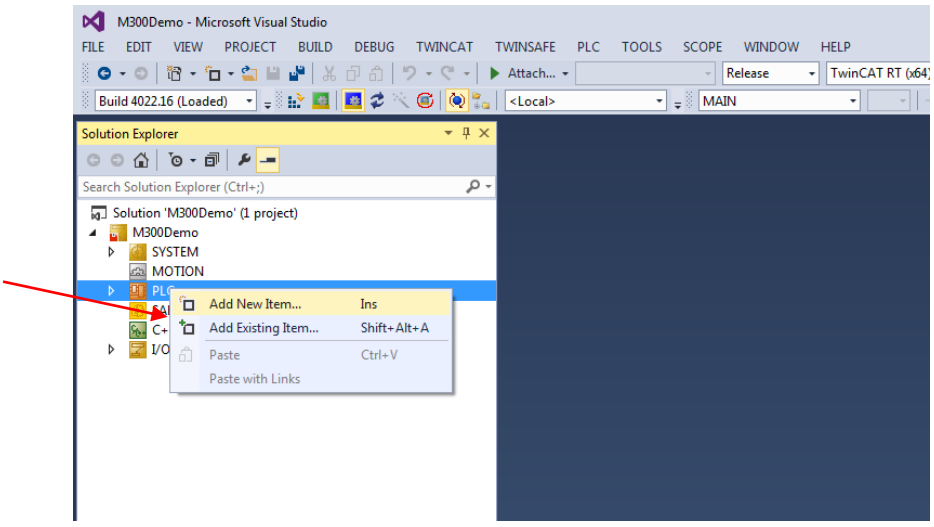


8. The system manager will add the Commander C300 as one node along with other detected nodes in the EtherCAT™ network.

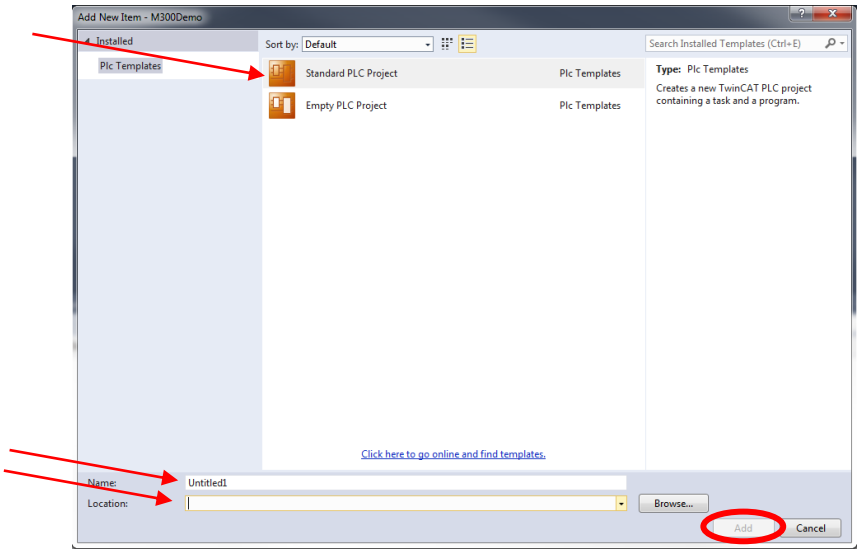


9. For the Commander series general purpose drives, a TwinCAT™ PLC program must be appended to the project in order to link a TwinCAT™ PLC variable to one of the transmit (Tx) PDOs. The following will show a very simple PLC program and a basic variable link to accomplish basic motion of the motor.

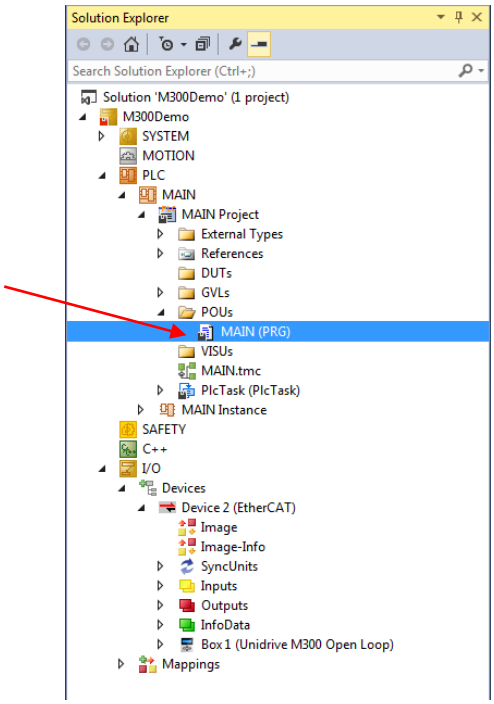
10. Right click the PLC block in the “Solution Explorer” and select “Add New Item…”



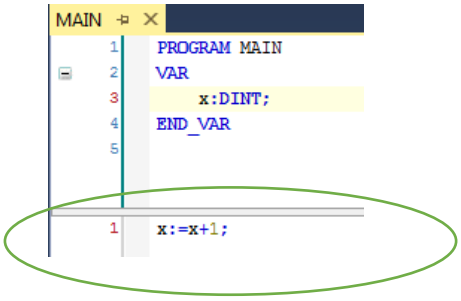
11. Select “Standard PLC Project,” give the project a name such as “MAIN” and select a location. Then click on Add.



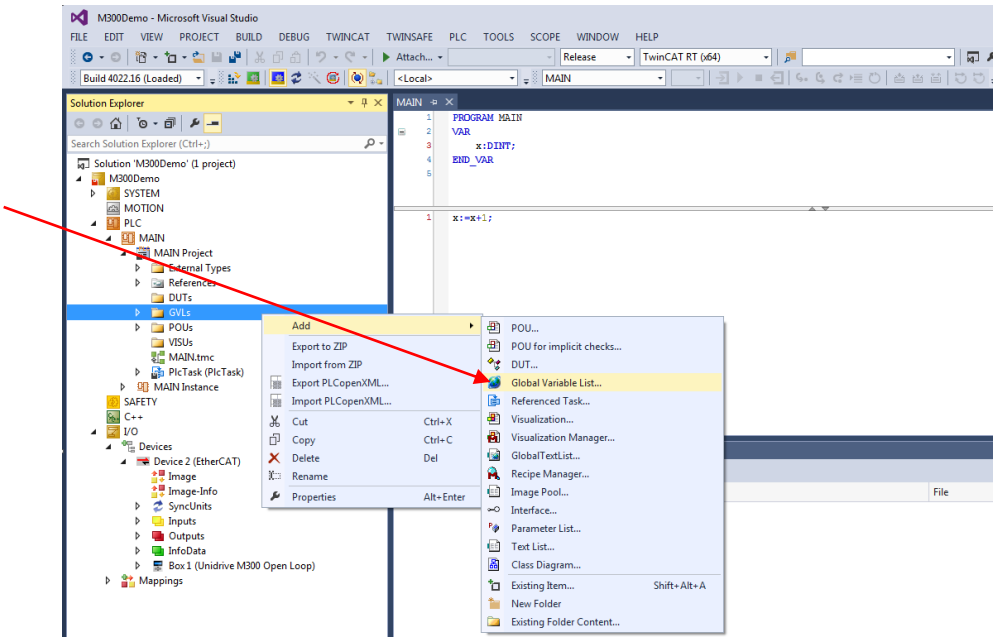
12. Expand “PLC” in the “Solution Explorer” → MAIN → MAIN Project → POUs → MAIN (PRG).



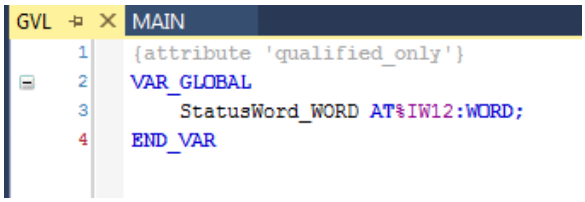
13. Write the following in the MAIN program variable declaration window and the code below in the MAIN programming window.



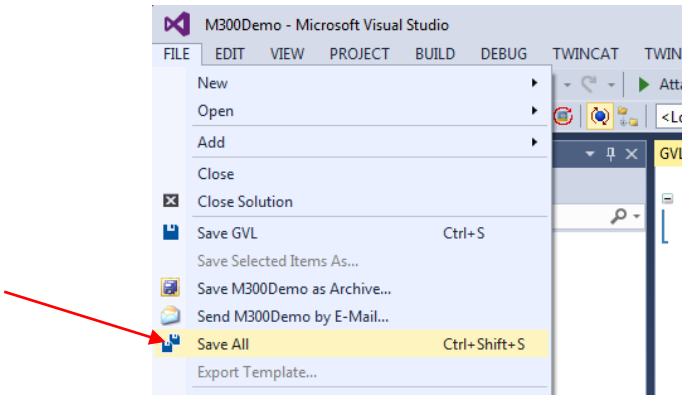
14. Next, go back to the Solution Explorer, go to PLC → MAIN → MAIN Project → GVL and right click the folder. Select Add → Global Variable List…



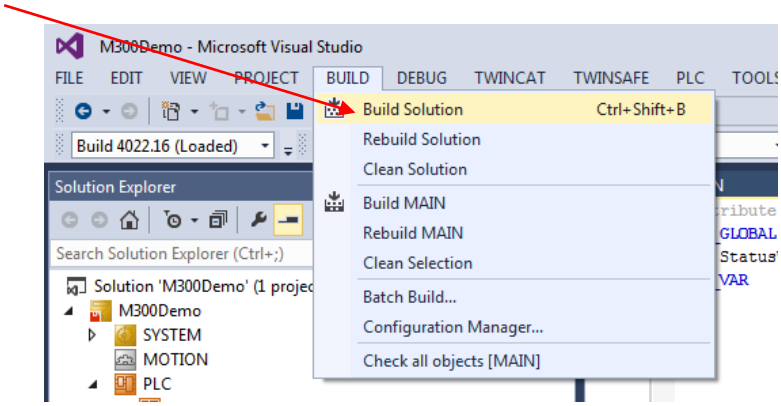
15. After creating a Global Variable List, open it and write the following code in VAR_GLOBAL to declare the status word which will be linked to Status word of the SI-EtherCAT™ module.



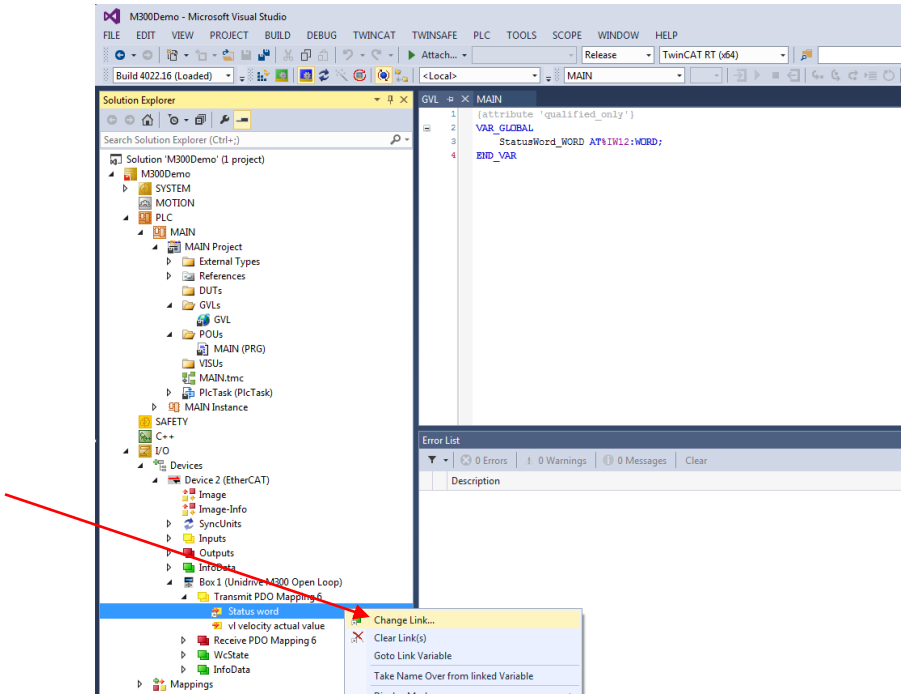
16. Save your project by going to File → Save All (this saves changes to GVL, MAIN and any other windows open).



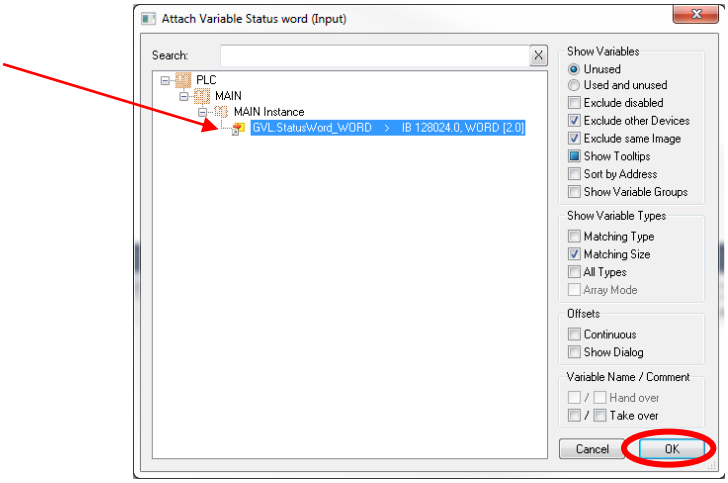
17. Build the program by opening the Build tab, selecting Build Solution.



18. Then, go to back to the Solution Explorer, select I/O → Devices → Device (EtherCAT™) → Box 1 (Commander C300 Open Loop) → Transmit PDO Mapping 6. Right-click Status Word, select Change Link…

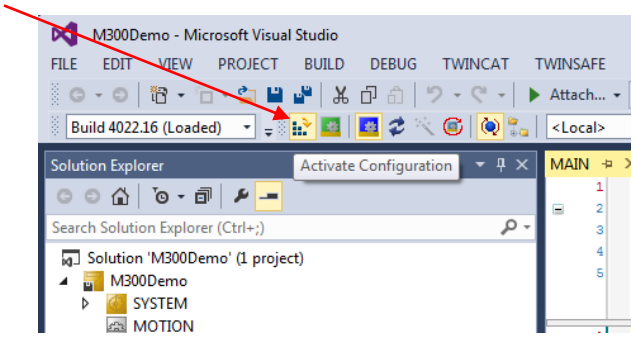


19. Select the global variable from the PLC program, then click OK.

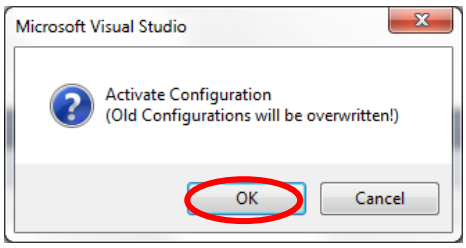


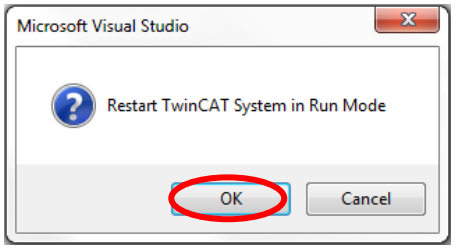
20. Go to File and Save All files again.

21. Click on Activate Configuration.

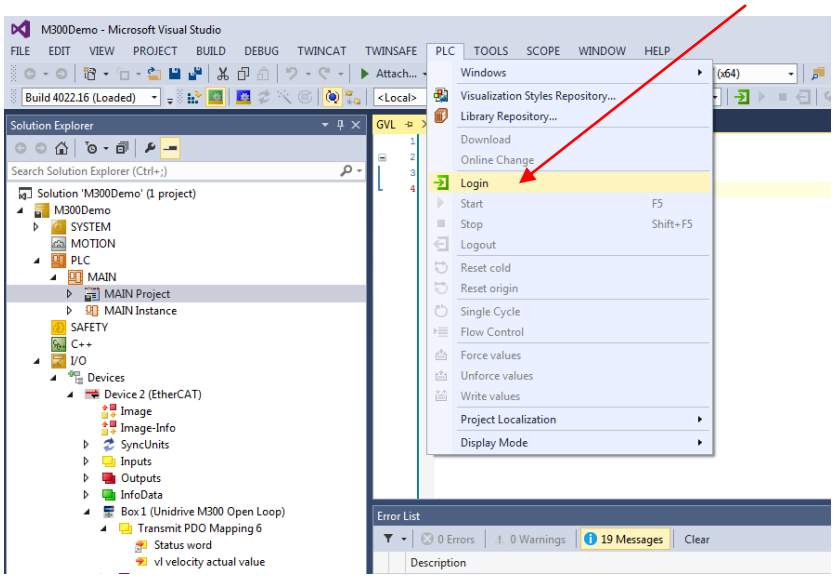


22. Click OK on the two windows below. This will set up Run Mode.

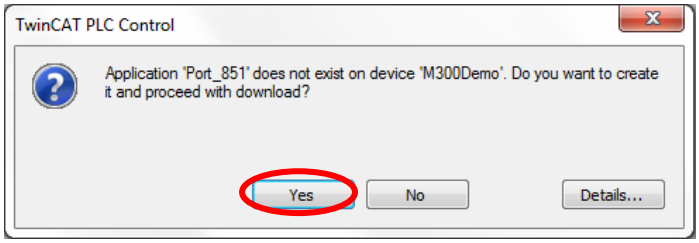




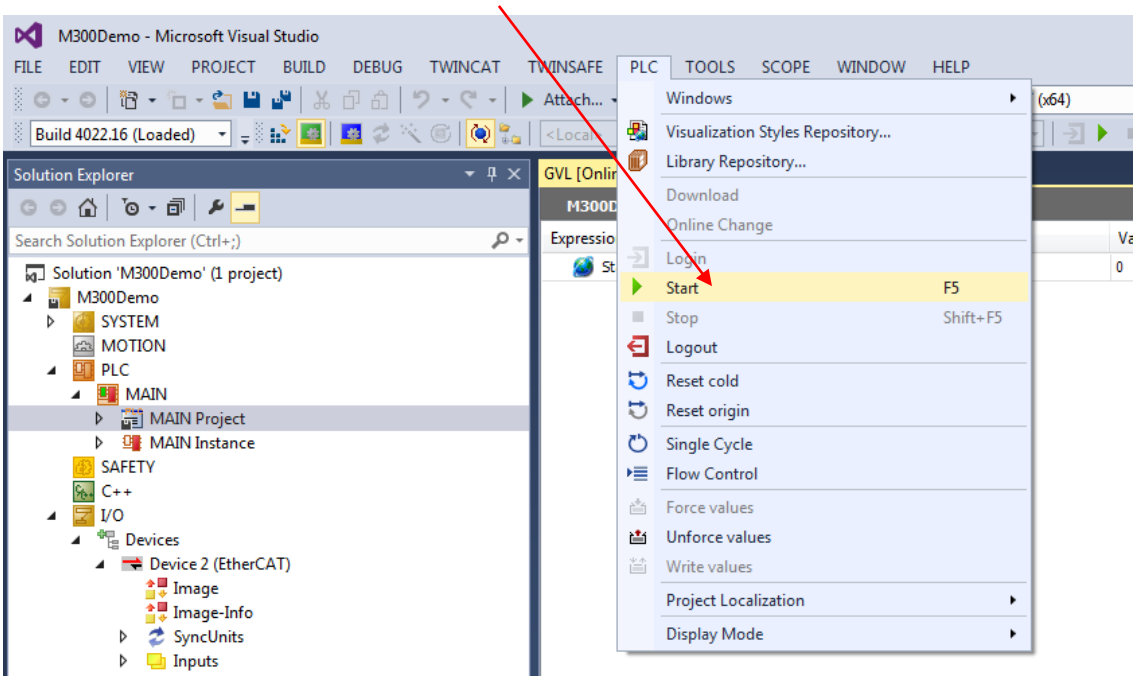
23. Click on the PLC tab on the top navbar of the TwinCAT™ 3 window, select Login.



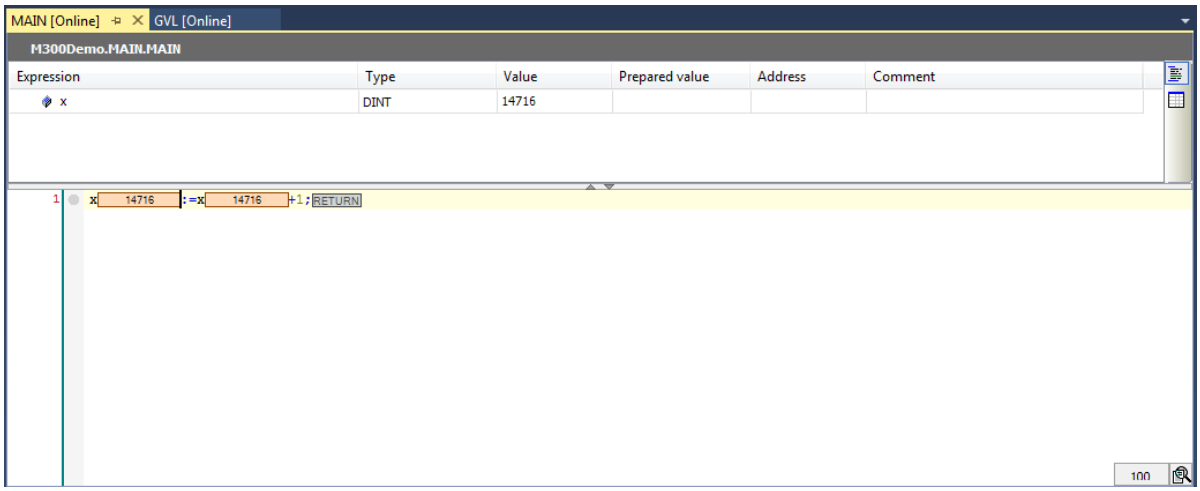
24. Click Yes and proceed with the download.



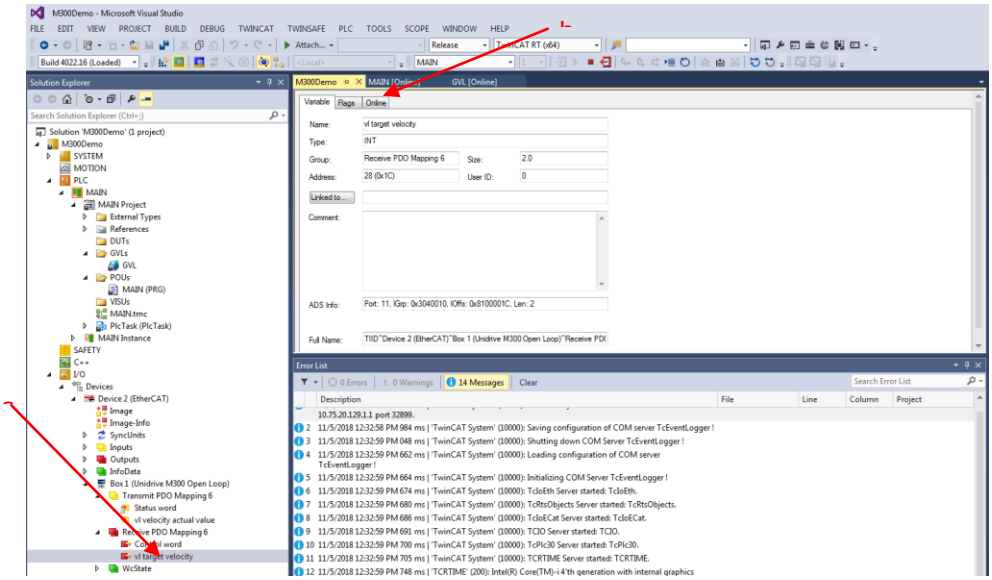
25. Click on PLC from the navbar, select Start to run the PLC program.



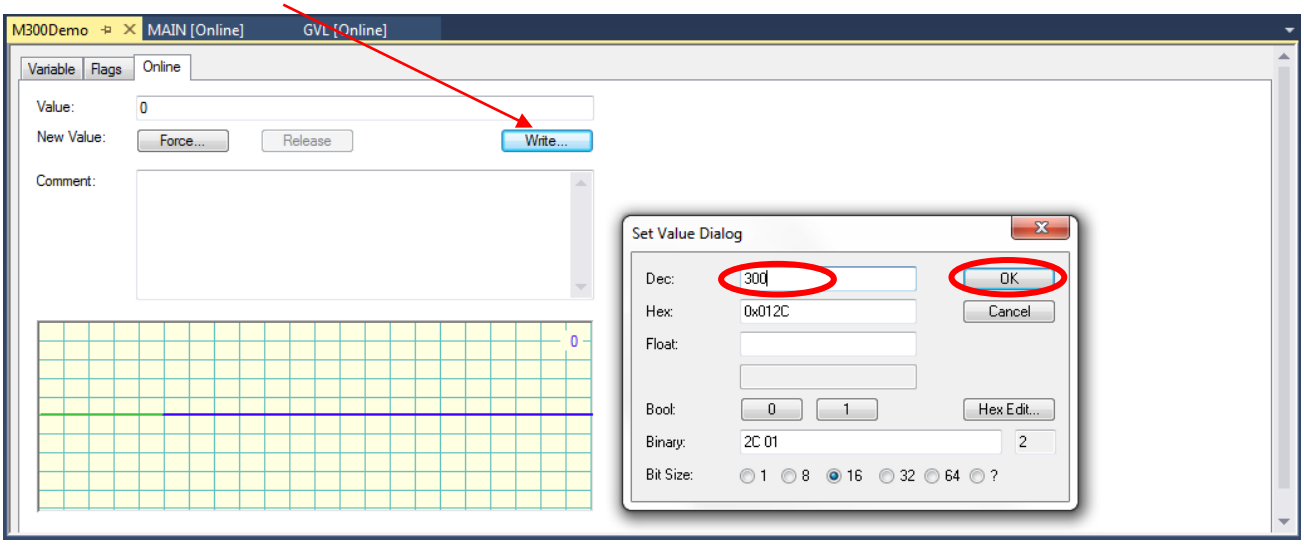
26. TwinCAT™ PLC control will indicate that it is in a Run state and is Online. The MAIN program will show updates to the variable created earlier.



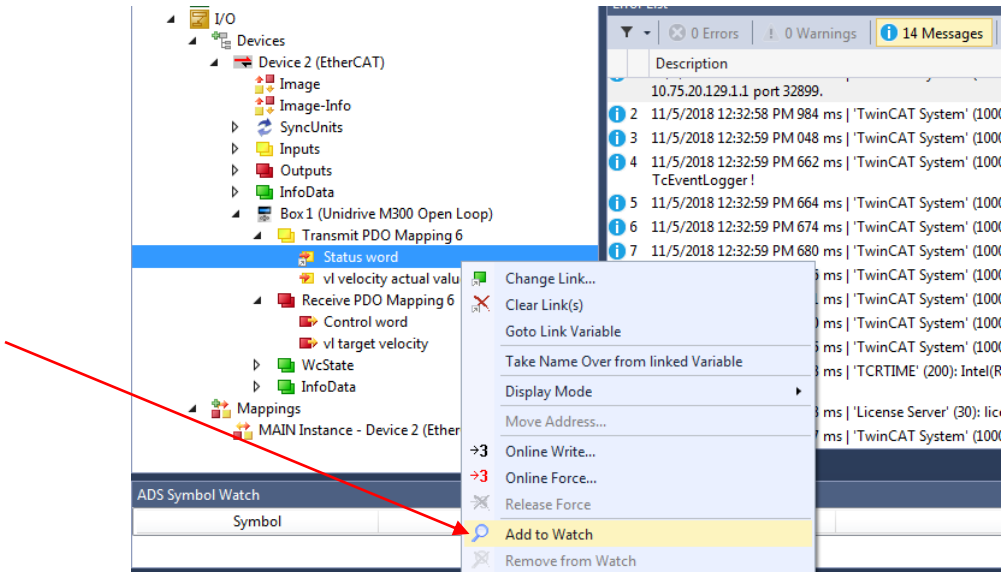
27. In TwinCAT™ Solution Explorer, expand Receive PDO Mapping 6, double left click vl target velocity (a). The window for this object will open. Click on the Online tab (b) in this window.



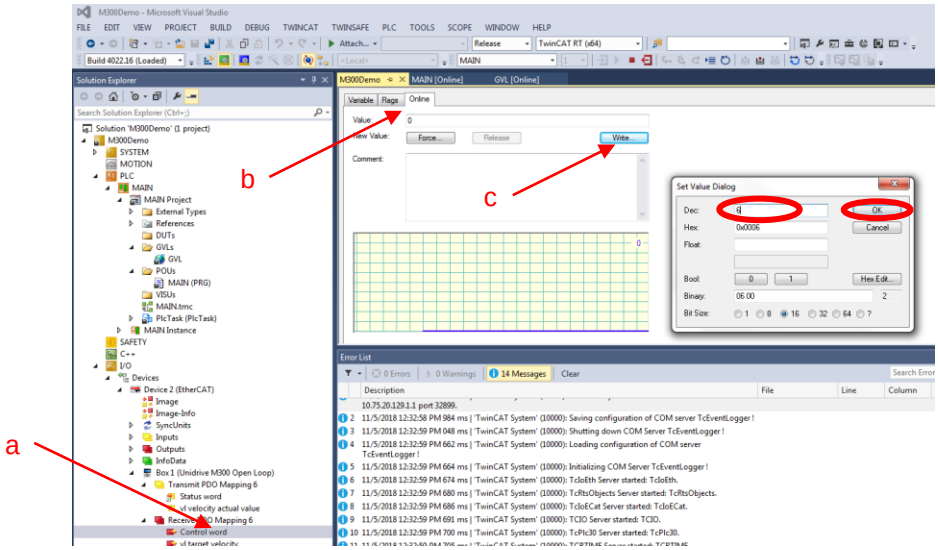
28. In the Online tab, a trace window will appear showing the value of object vl target velocity. Click on the Write button on the right. In the Set Value Dialog window, set a Decimal value of 300 as shown below. Click OK. This will set a 300rpm target velocity.



29. Then, navigate to the Solution Explorer, right click Status Word under Transmit PDO Mapping 6. Click Add to Watch. A watch window will appear showing the value of the status word in decimal. Use this to diagnose issues with the following steps.

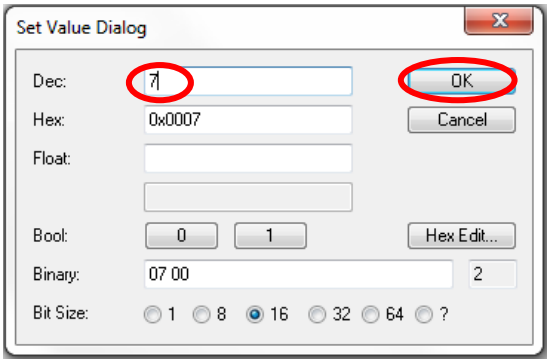


30. Next, left click on Control Word (a) under Receive PDO Mapping 6. Click on the Online tab (b) of the window that opens. Click on Write (c). Set a decimal value of 6 in the Set Value Dialog window, click OK. This will set the control word to give a Shutdown command. The status word in the watch window should indicate a decimal value of “560.”



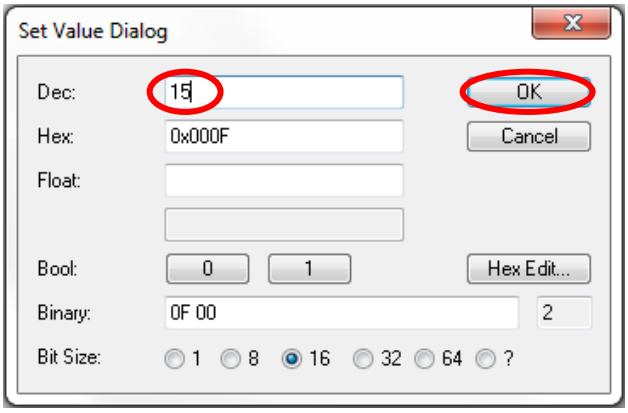
31. Enable the C300’s STOs. The status word will now indicate a decimal value of “561.” The drive keypad will still indicate an Inhibit state. For C200 models, the status word would skip “560” and go to “561” since all enabling is handled via EtherCAT™ for those model drives.

32. Click the Write button again, set a decimal value of 7 in the dialog box, click OK. This will set the control word to give a Switch On command. The status word in the watch window should indicate a decimal value of “563.”



The C300 drive keypad will indicate a Ready state at this point. If the drive's STOs were not enabled before a giving a Switch On command, the status word should indicate a decimal value of "560" and probably stay there. Start over from step 30. A C200 drive will indicate a Ready state at this point regardless of the hardware enable being applied.

33. Click the Write button again, set a decimal value of 15 in the dialog box, click OK. This will set the control word to give an Enable Operation command. The status word in the watch window should indicate a decimal value of "567."

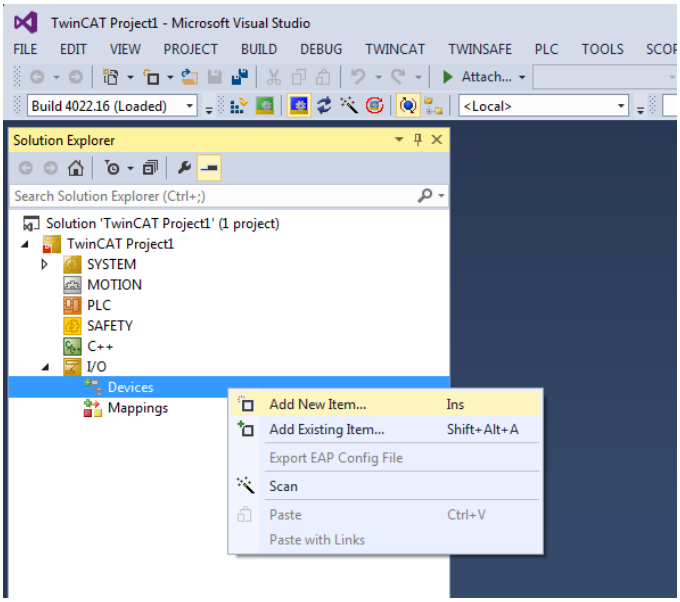


The motor on the drive should now be running at 300 rpm (or 10.0 Hz).

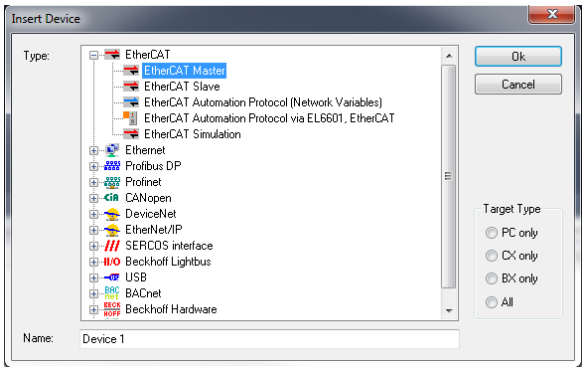
Appendix A: TwinCAT™ Adapter set up

A TwinCAT™ master needs to have an Ethernet port configured with the TwinCAT™ RT-Ethernet Adapter. Only Ethernet ports with an Intel PCI chip are compatible with this driver. Typically, a built-in Ethernet port on the PC is compatible. The following steps will let you find out if your available Ethernet ports are listed as compatible devices.

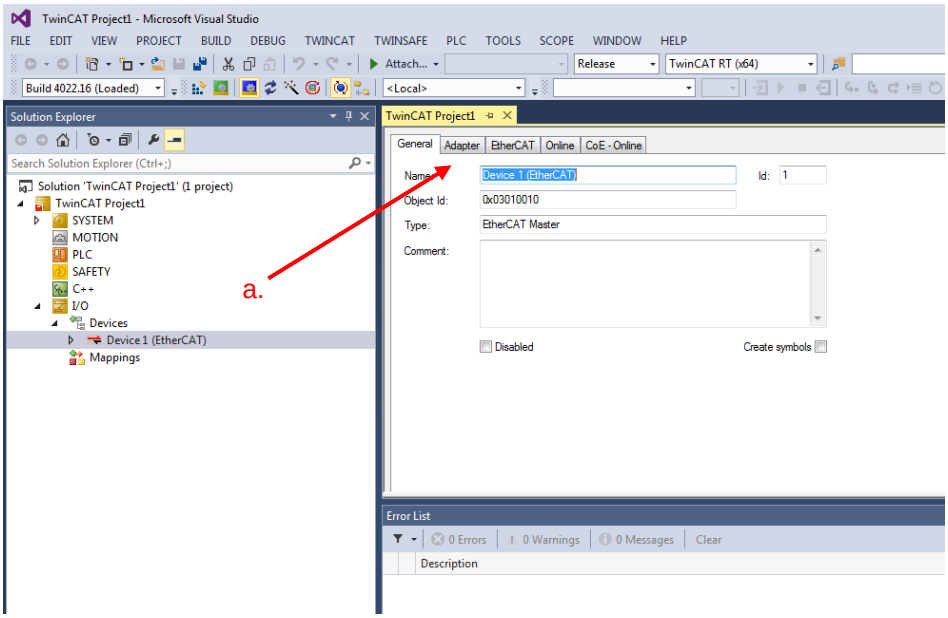
1. Select Devices → Add New Item…



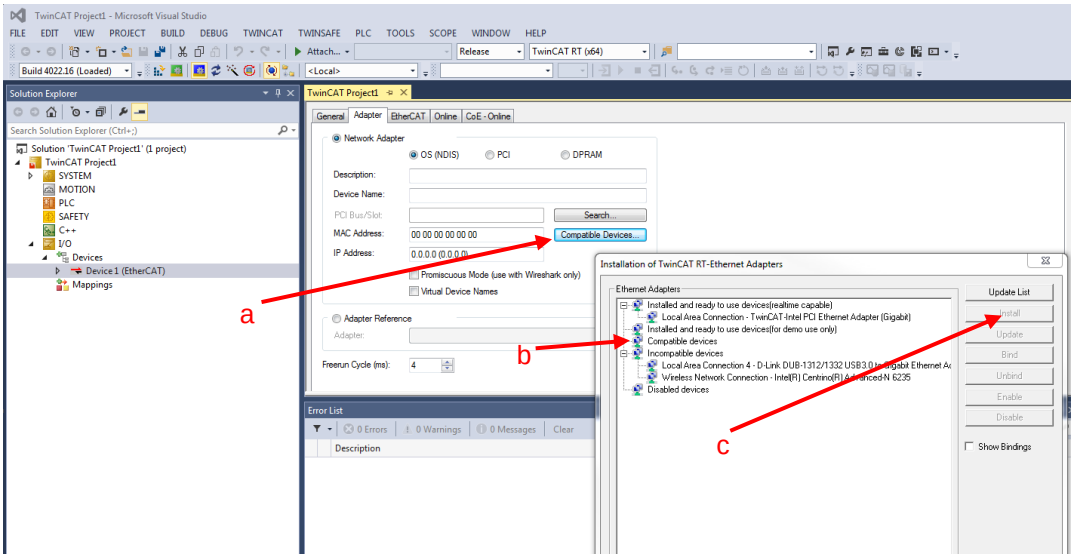
2. Select EtherCAT™ master



3. Double left-click the Device 1 (EtherCAT™) selection that appears. Select the Adapter tab on the window that appears in the middle pane (a).



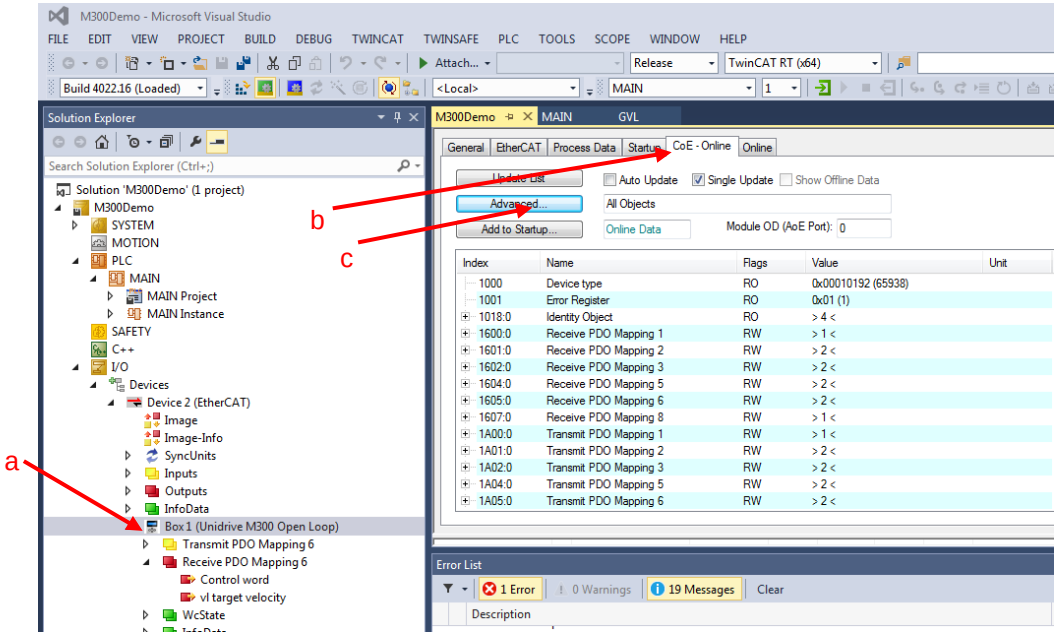
4. Select Compatible Devices (a), a window will appear showing a list of available Ethernet adapters. Click on a device (b) under the “Compatible devices” section, then hit the Install button (c) on the right. If no compatible devices appear, you may need to add additional hardware or find a different machine to operate as a TwinCAT™ master.



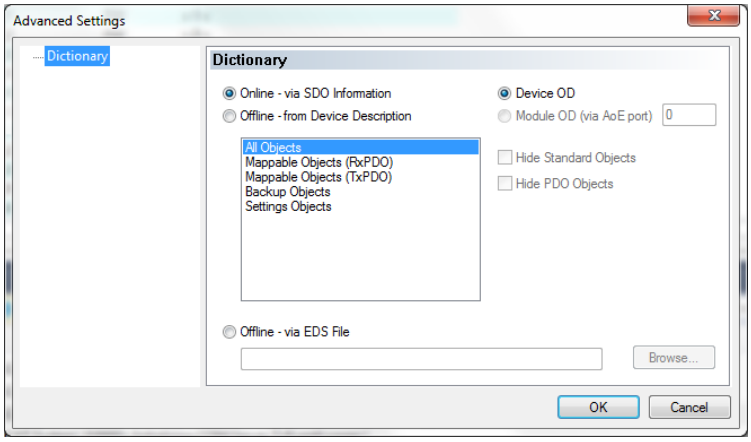
5. Once installation is complete, the compatible adapter will become a TwinCAT™ Ethernet adapter and the “Installed and ready to use devices” will update with this device. It is recommended that the user close TwinCAT™ 3 and power cycle their machine.

Appendix B: Example of adding parameters to a PDO

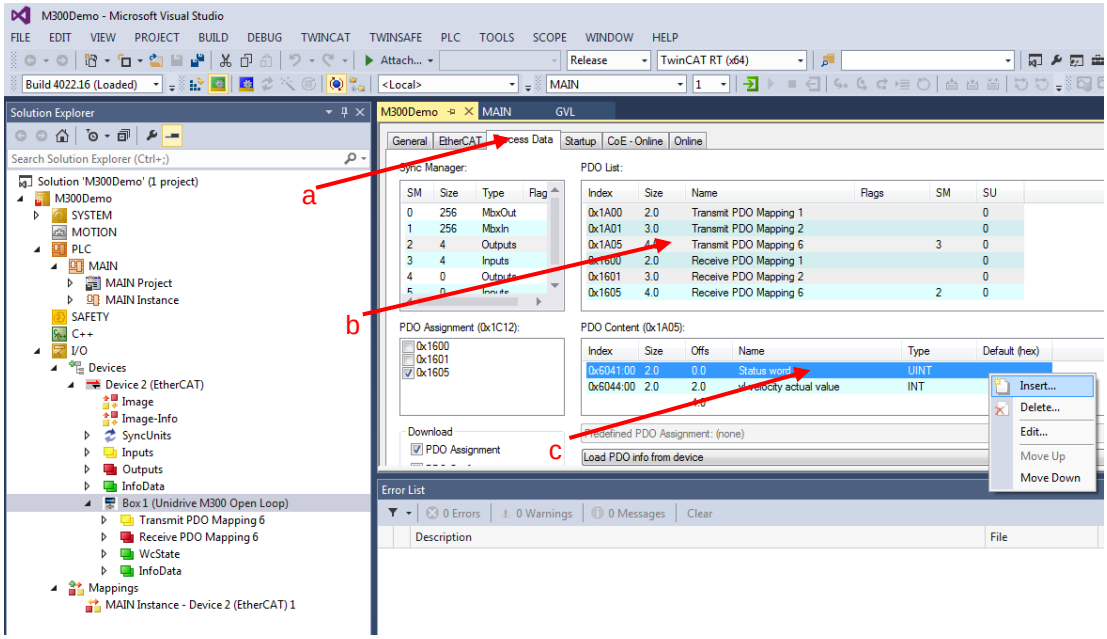
1. Click on the drive icon (a) under Devices. Click on the CoE - Online tab (b). Click on the Advanced button (c) to open advanced settings.



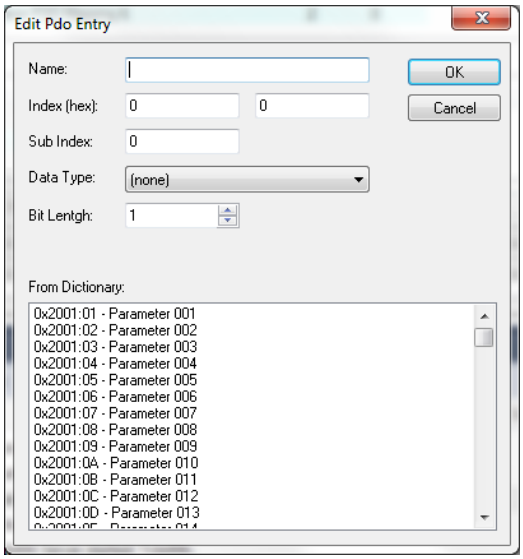
2. In the advanced settings window, select Online – via SDO Infromation and click OK. Wait for TwinCAT™ to load the dictionary (may take a few minutes).



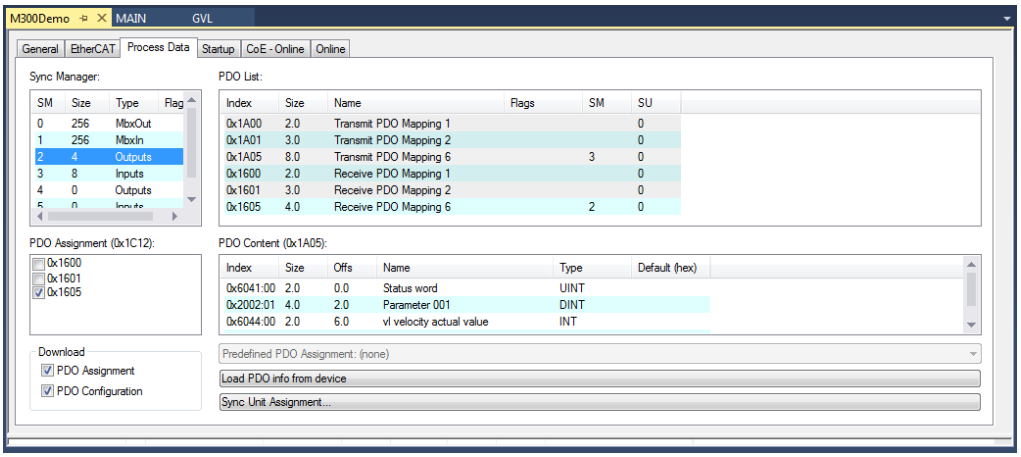
3. When it is complete, click on the Process Data tab (a). Click on Transmit PDO Mapping 6 (b). Right click on an object (c) inside the PDO, select Insert.



4. In the dictionary, select the drive parameter that will be added to Transmit PDO 6. Use the following to decode the objects in the dicitonary from drive parameters: 0x200**A** : **65** where **A** indicates the menu number in hex (10 in decimal) and **65** indicates parameter number in hex (101 in decimal). Select and click OK.



5. The selected drive parameter object will appear inside of Transmit PDO Mapping 6. The example below shows object 0x2002 : 01, which is Pr. 02.001 Post-ramp Reference for a C300 drive.



6. Clicking on the new object in the Solutions Explorer will show the online trace of the parameter. Below shows the Post-ramp Reference of 15.00Hz, indicating that the motor is running. For any issues with this parameter updating, try re-activating configuration.