EtherCAT VFD Quick Start Guide

Version 1.00

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For more information, please visit the product web page:

www.vitalsystem.com/ec01

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Update Firmware and Software

VFD Support on Vital Systems EtherCAT motion controllers requires the following minimum versions:

- Firmware: 5.84
- Plugin: 2.50.75
- EC-Link: v1.6.0

Any existing EC-Link projects must be remade and any ESI files must be reimported. This can be done by first clicking the trash symbol to remove the ESI file, then once again importing the ESI file:

| Mitsubishi Electric FR-E800-E 1_01.x | Mitsubishi Electric Corpora | 00000A1E | 🗑 |
| Omron R88D-1SN04H-ECT.xml | OMRON Corporation | 00000083 | 🗑 |

Import ESI   Delete All

It is recommended you create a backup of your ECLink project before remaking it so you have a reference to go back to and avoid losing your old settings.

Configuring Project

In the following example my network has an Omron drive and a Mitsubishi VFD. This guide will demonstrate how to configure the Mitsubishi VFD. The steps may vary if using a different VFD.

When setting up your VFD for the first time, we recommend starting with just the VFD on the network by itself. Once it is working, you can add more drives.

**Note that it is highly recommended your VFDs be located at the end of your EtherCAT network.**

After updating to the latest firmware, plugin, and EC-Link version, and reimporting all your ESI files, we can begin configuring your project. For the VFD RxPDOs, select one with ControlWord and Target Velocity. For the TxPDOs, select one with Statusword and Actual Velocity.
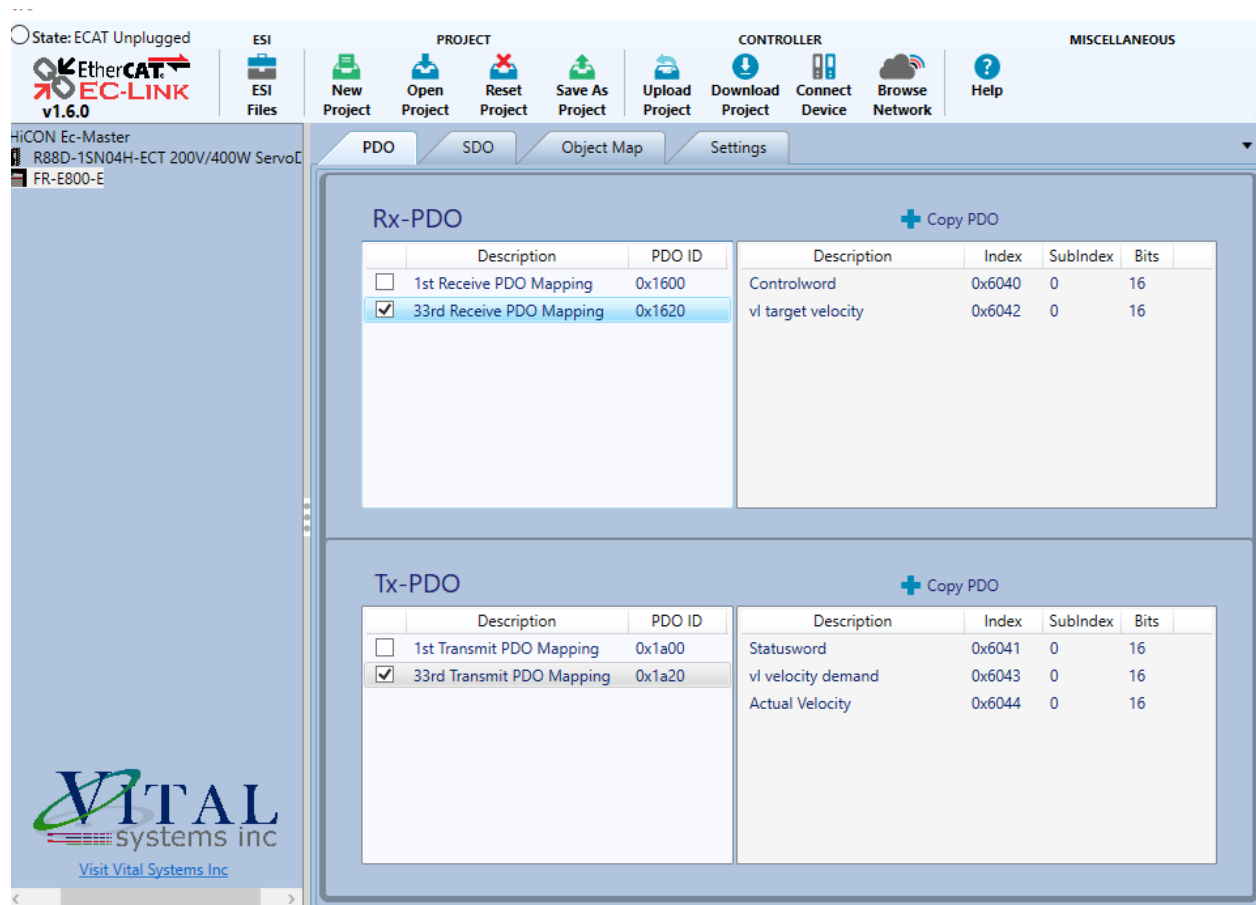

There are a few caveats specific to the Mitsubishi VFD to note here:

- It does not have Actual Velocity in its TxPDOs by default. We will have to add this manually by editing the PDO 0x1a20. I will demonstrate this in the below section.
- PDOs 0x1600 and 0x1a00 are fixed and cannot be edited. Any additions and edits you would like to make must use either 0x1620 or 0x1a20.
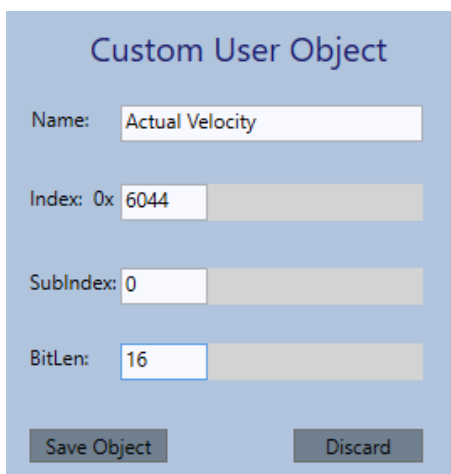
Right click the PDO we want to edit, and select Edit:
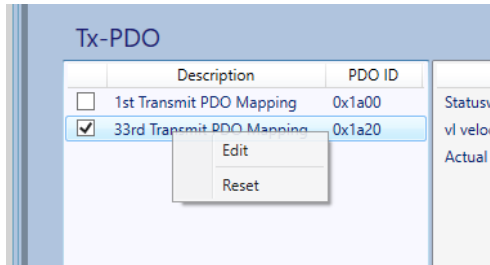
Usually common objects such as Actual Velocity will be easily available and added in the top right box. In the case of this VFD however, we must manually add the object. Select New in the bottom right.
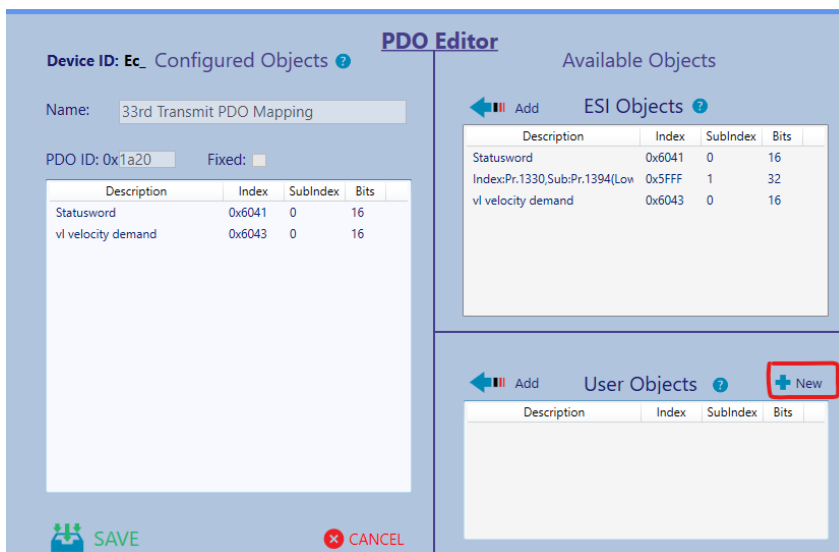
Fill the box with the following information and select Save:

Note that the information entered here may vary from slave to slave. For Example, the Actual Velocity object for the Omron slave I have on my network uses Index 0x606c and is 32 bits. You will need to check your VFD's documentation for this information if it is not in the Available Objects list.

Then select actual velocity and press Add, and then Save:

Now the Actual Velocity PDO has been successfully added:

We do not need to configure any SDOs for this VFD, so that tab will be skipped. On the Object Map tab, we will want to assign the objects to their function. Auto Select should correctly do the mapping for you, but if not you can manually set them through the dropdowns.

There are a few more configuration settings available on the Settings tab. These are used as workarounds for slaves with unique requirements. In most cases these can be ignored, but in the case of our Mitsubishi VFD I will need to select the DC Override – ForceNoDC. The Mitsubishi drive will incorrectly be flagged as using a distributed clock and be unable to arm if we do not choose this setting.
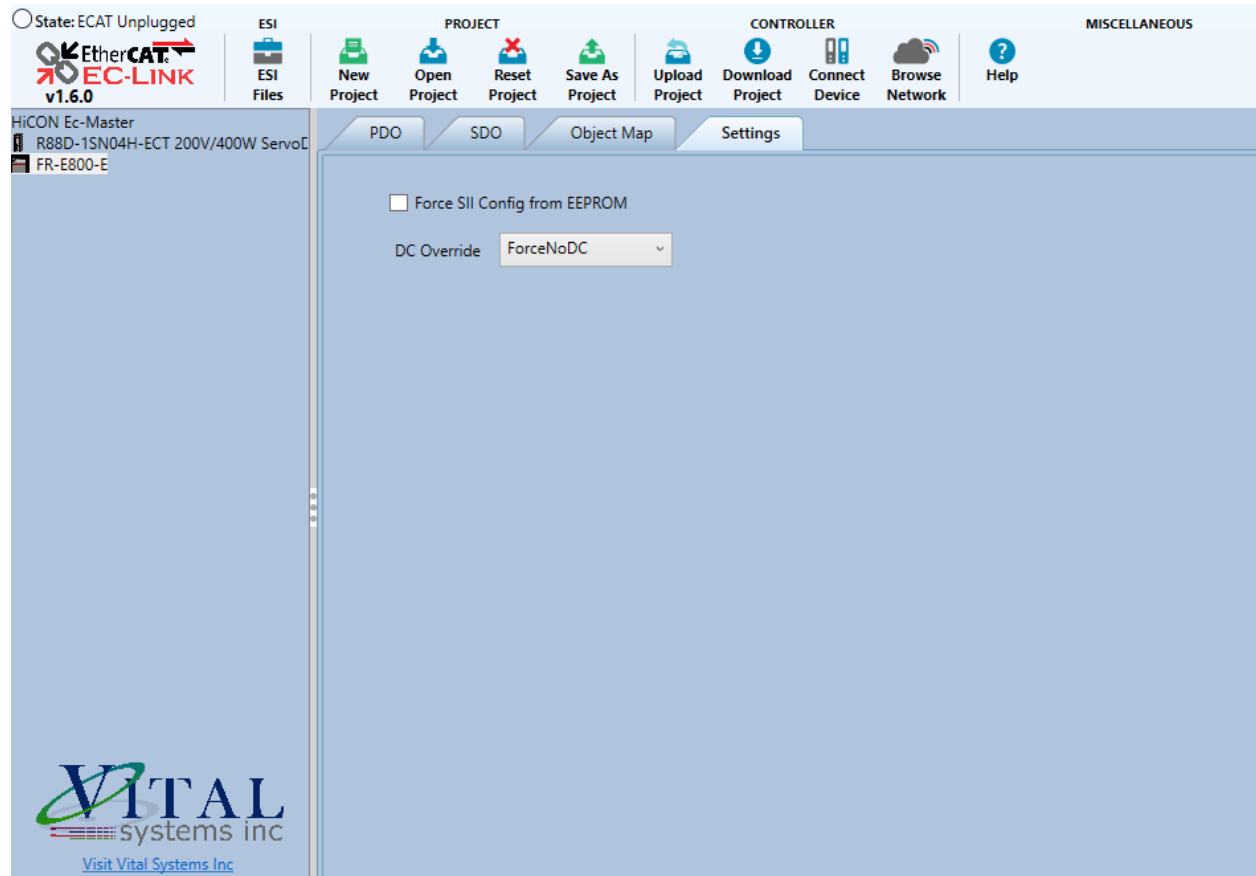
Now our project is configured and we can Connect and Download to our EtherCAT Master. If the steps have been followed correctly, the status indicator in the top left of EtherCAT should switch from:

Init->PreOp->SafeOp->Operational

This concludes the necessary steps in EC-Link.

Mach4 Configuration

In the System Tab of the HiCON plugin, there will now be two different options for ECAT Spindle Type:

- ECAT RPM – The VFD will transmit the selected RPM directly to the VFD. No further configuration on this tab is needed. This mode is used by the Mitsubishi VFD.
- ECAT Counts – The VFD expects its velocity in terms of Counts/Second. Selecting this option will enable the Motor Counts/Rev text box below, where you will need to specify the counts per/rev for your EtherCAT VFD. For example, this is the mode the Omron Drive's Velocity Mode requires, and it uses 20000 counts/Rev.
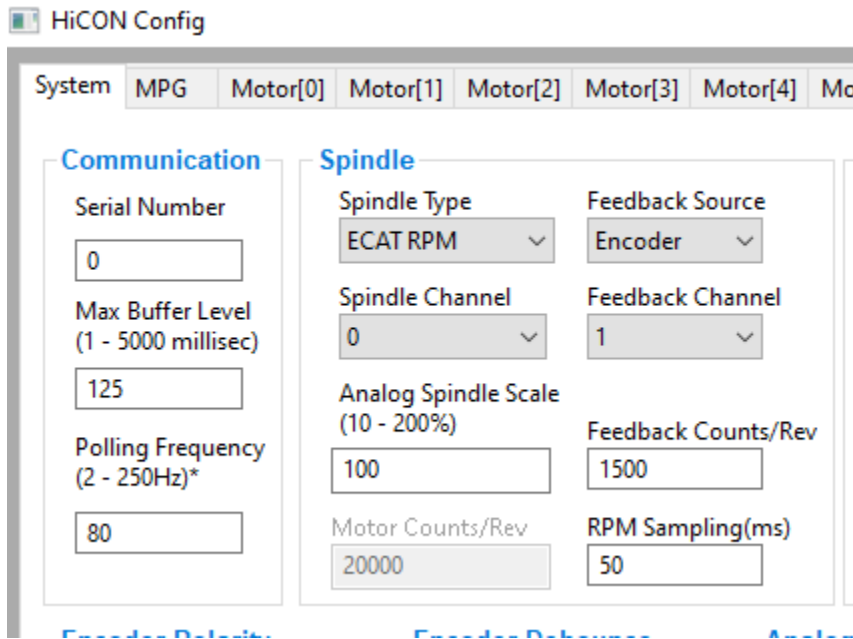
You will also need to set the Feedback Source as Encoder. Otherwise you will not get Actual Velocity back from the drive to the Mach4 UI.

We will also need to set one of the motor tabs as an EtherCAT VFD, and select the appropriate EtherCAT Drive. EtherCAT VFDs require more internal processing than a traditional VFD, so are piggybacking off of the pre-existing axis system in the HiCON plugin. Note that any motors set as VFD will not count towards your Activated Motor count (an EC01 with 4 activated motors can use 4 drives and any number of VFDs.)

Here in this example, we are assigning VFD to HiCON Motor 6 and then make sure Motor 6 is also enabled in Mach Control (and make sure it is not mapped to any axis in mach, see below for more detail)
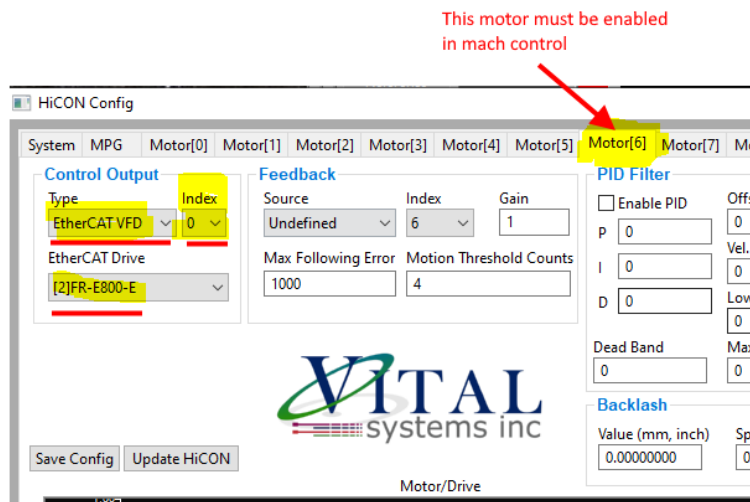
One quirk is that the Feedback from the ECAT VFD will be in terms of velocity; either RPM or Counts/Sec. You will need to set the Max Following Error sufficiently high that the Max Following Error will not be hit when the Targeted RPM jumps instantly when commanded. This should be at least twice as the Max Velocity, but may also just be an arbitrarily high number to avoid this.

One final thing to do is confirm that the selected motor is enabled in the Mach4 Motor tab (configuration here is unnecessary, it simply must be enabled) and should **NOT** be mapped in the Axis Mapping tab. This is essentially a dummy axis and shouldn't be under Mach's control.
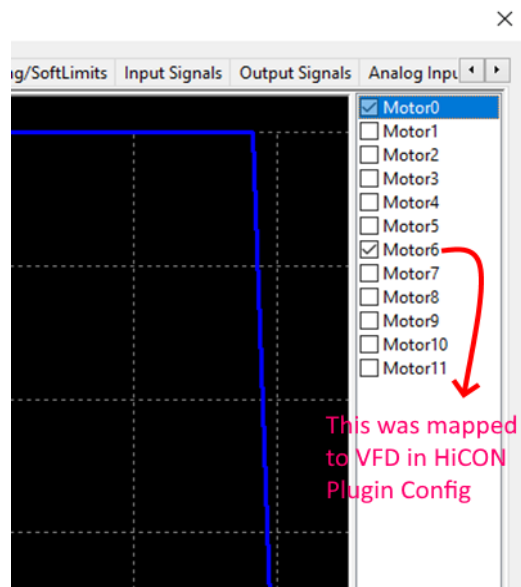
Control Configuration Mach4Mill:0

	Enabled	Master	Slave 1	Slave 2	Slave 3
X (0)	✔	Motor0			
Y (1)	✘				
Z (2)	✘				
A (3)	✘				
B (4)	✘				
C (5)	✘				
OB1 (6)	✘				
OB2 (7)	✘				

Motor 6 is not mapped to any Axis here.

Configuration Complete

Now the Configuration in both ECLink and Mach4 has been complete. Enable Mach4, set the RPM with the S command, and enable the spindle with M3. The VFD should properly enable and move at the selected speed.