



# EC01 Quick Start Guide

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Atlanta, GA USA

For more information, please visit the product web page:

[www.vitalsystem.com/ec01](http://www.vitalsystem.com/ec01)

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## License Agreement

Before using the HICON and accompanying software tools, please take a moment to go thru this License agreement. Any use of this hardware and software indicates your acceptance to this agreement.

It is the nature of all machine tools that they are dangerous devices. In order to be permitted to use HICON on any machine you must agree to the following license:

I agree that no-one other than the owner of this machine, will, under any circumstances be responsible, for the operation, safety, and use of this machine. I agree there is no situation under which I would consider Vital Systems, or any of its distributors to be responsible for any losses, damages, or other misfortunes suffered through the use of the HICON board and its software. I understand that the HICON board is very complex, and though the engineers make every effort to achieve a bug free environment, that I will hold no-one other than myself responsible for mistakes, errors, material loss, personal damages, secondary damages, faults or errors of any kind, caused by any circumstance, any bugs, or any undesired response by the board and its software while running my machine or device.

I fully accept all responsibility for the operation of this machine while under the control of HICON, and for its operation by others who may use the machine. It is my responsibility to warn any others who may operate any device under the control of HICON board of the limitations so imposed.

I fully accept the above statements, and I will comply at all times with standard operating procedures and safety requirements pertinent to my area or country, and will endeavor to ensure the safety of all operators, as well as anyone near or in the area of my machine.

**WARNING:** Machines in motion can be extremely dangerous! It is the responsibility of the user to design effective error handling and safety protection as part of the system. VITAL Systems shall not be liable or responsible for any incidental or consequential damages. By Using the HiCON motion controller, you agree to the license agreement.

## 1. Power Up and Connect to PC

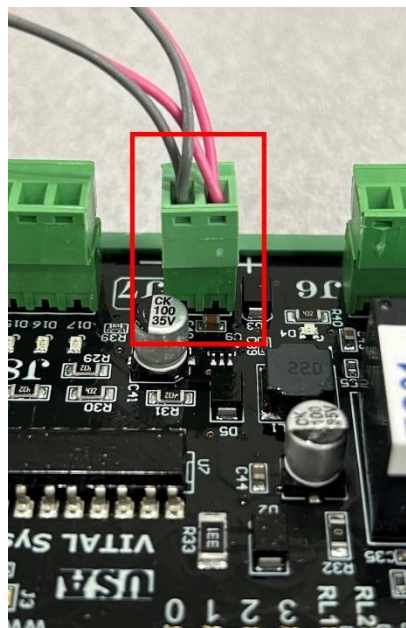
The following guide is intended to give the user a basic step-by-step guide for setting up the EC01 for Motion Control on a target machine. While the EC01 is capable of much more complex configurations, things will be kept simple here as an introduction.

These instructions assume that the user has some knowledge about working with electrical wiring, adequate knowledge about the target machine, and has some experience with building or retrofitting CNC machines. A video QuickStart guide that steps through the software configuration is also available [here](#).

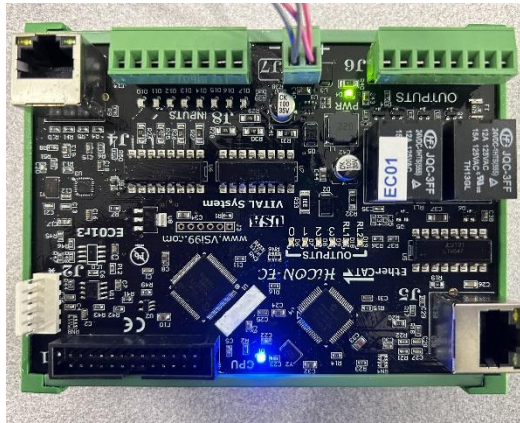
1.1) Download and install the VSI Device Manager application if you haven't already.

- [VSI Device Manager](#)
- [VSI Device Manager manual](#)

1.2) Connect 24V power to the EC01 on J7. The image below shows the necessary wiring connections for this part of the setup. Only turn on the power supply once all the connections below are made.

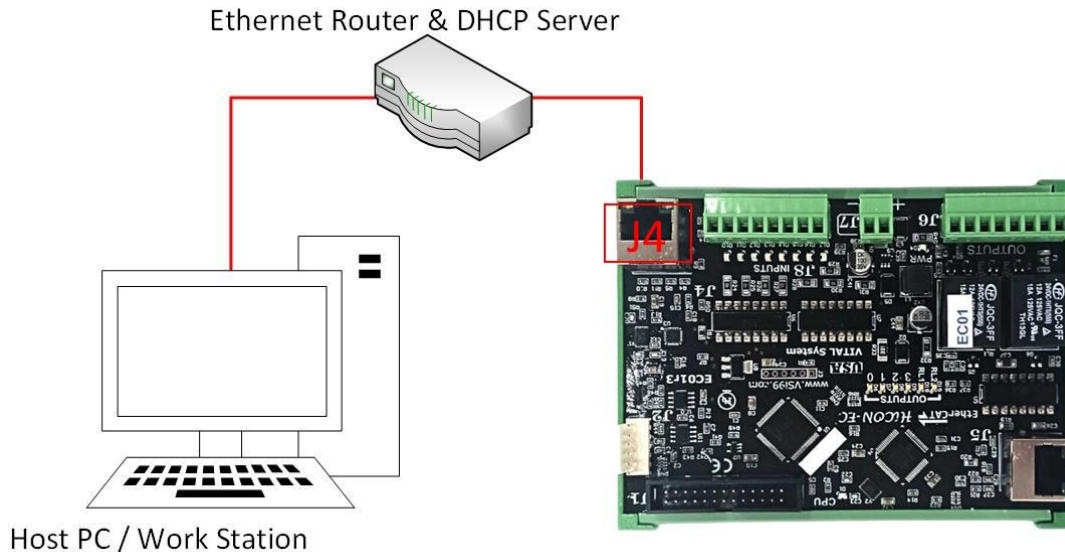


- 1.3) If the EC01 is correctly powered up, the green power LED should be lit and the blue CPU LED will blink in some pattern.

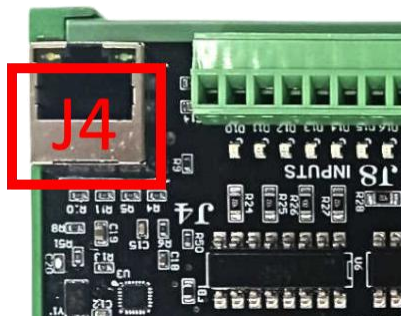


- 1.4) It is now time to establish a network connection to the EC01. You may either connect using an Ethernet Router (easier) or by using a direct connection to the PC (harder).

## 1.1 Option A: Connect using an Ethernet Router (DHCP Server)



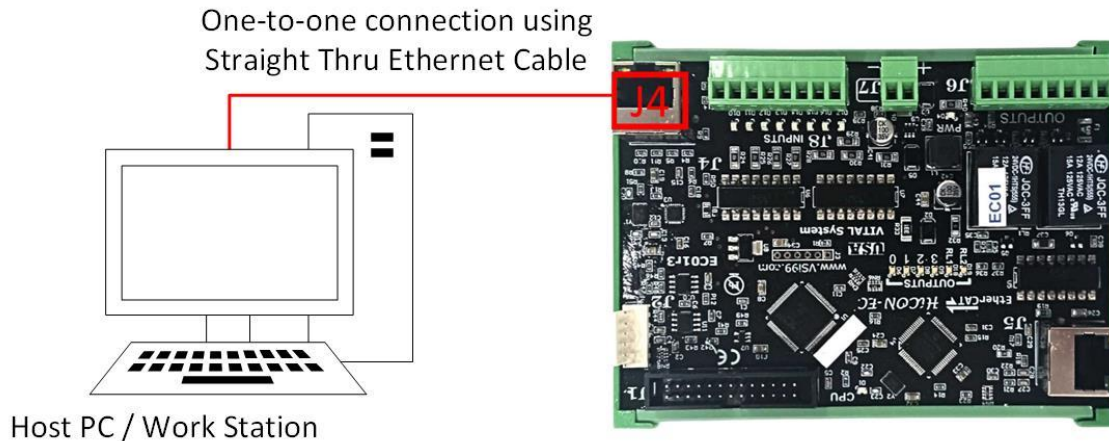
This is the simplest method to connect Mach software to the controller. The figure above shows a basic setup using an Internet router on your network. Connect the Ethernet cable from the J4 Ethernet port of the HiCON to the router.



Connect another Ethernet cable from the router to your PC. The router will dynamically assign a unique IP address to both the PC and the HiCON. This completes the network setup without requiring any intervention from the user.

## 1.2 Option B: Direct Connection to the PC

In a direct connection setup, the Ethernet cable is connected from the J4 Ethernet port of the EC01 directly to the PC as shown below:



When this configuration is used, the network address of the EC01 must match that of the PC's ethernet adapter. The default IP address of the HiCON board is 192.168.0.95. This means that we must change the PC's adapter IP to a static IP with the form 192.168.0.xxx. The following steps will demonstrate how to accomplish this.

(Note that you can change the EC01's IP address using the VSI Device Manager Software. However, this should only be done if you know exactly what you are doing. Network setup can be a simple task, but incorrect settings can get you stuck for many hours.)

### Primary Method:

To connect your PC directly to the HiCON, begin by clicking on the "Scan Network" option. The HiCON board should appear in the Network Devices list. If the device does not appear, click the "Auto-Assign IP" button. Afterward, cycle the power of the HiCON board to ensure the new IP address takes effect. This method will automatically assign an IP address to the HiCON board, facilitating a seamless connection.

VSI Device Manager (v6.10)

Network Devices

IP Address	Firmware	Serial Number	FPGA	Boot Loader	Hardware	Adapter IP	Mode

Scan Network

Auto-Assign IP

Terminal

Boot Loader
Activation

Load File

No File Loaded

Switch To Loader

Program Flash

Reboot Device

Verify Flash

0.0.0.0

FPGA Fast Prog

FPGA Slow Prog

Enable Standalone

Set New IP Addr

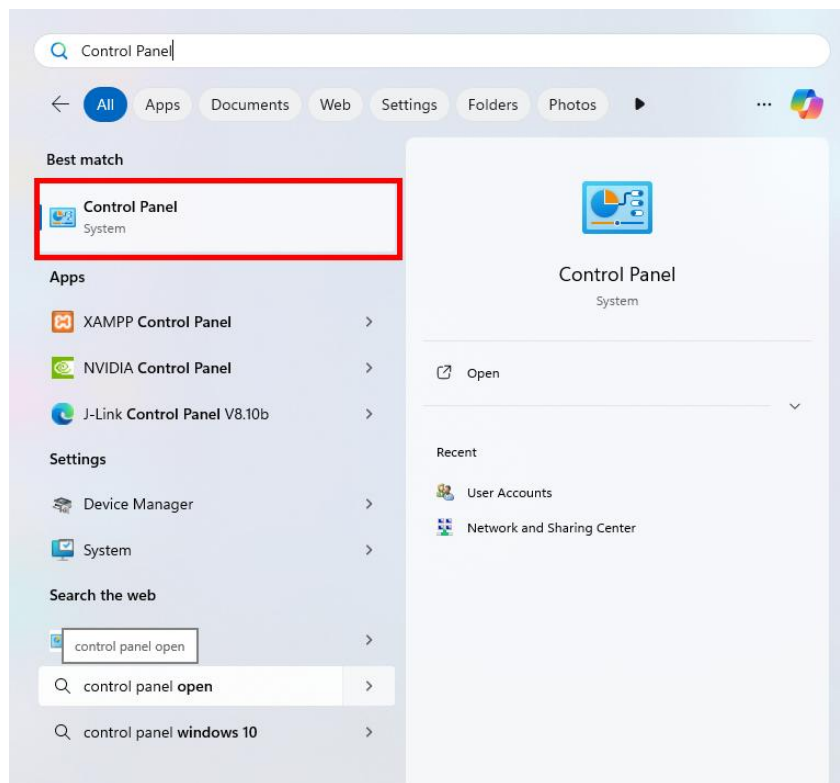
Close



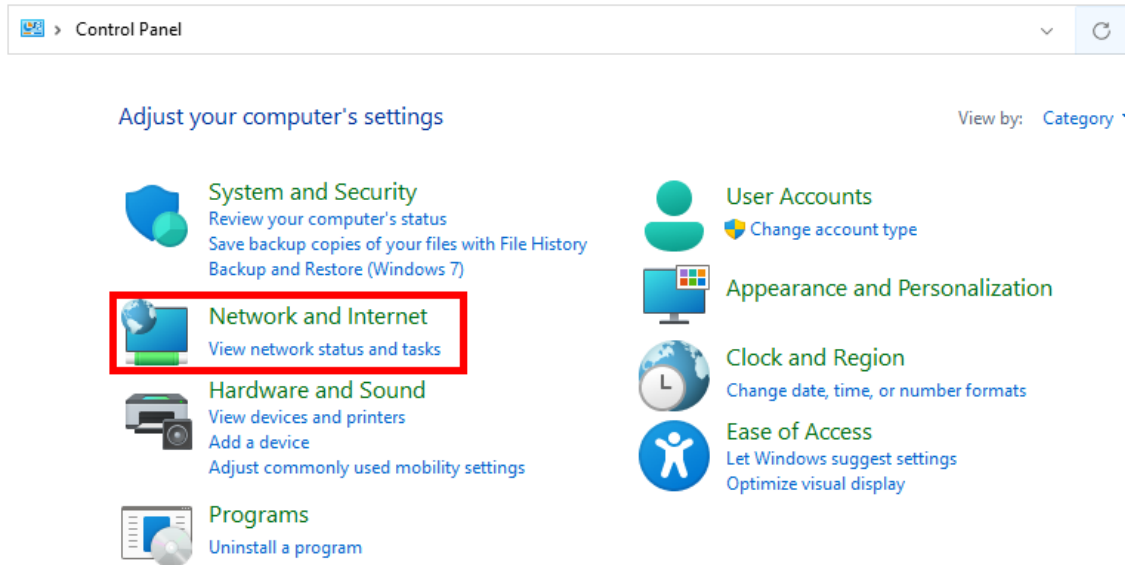
### Secondary Method:

If the device does not appear after clicking “Auto-Assign IP”, you will need to change the PC’s adapter IP to a static IP with the form 192.168.0.xxx. Follow the steps below to do that:

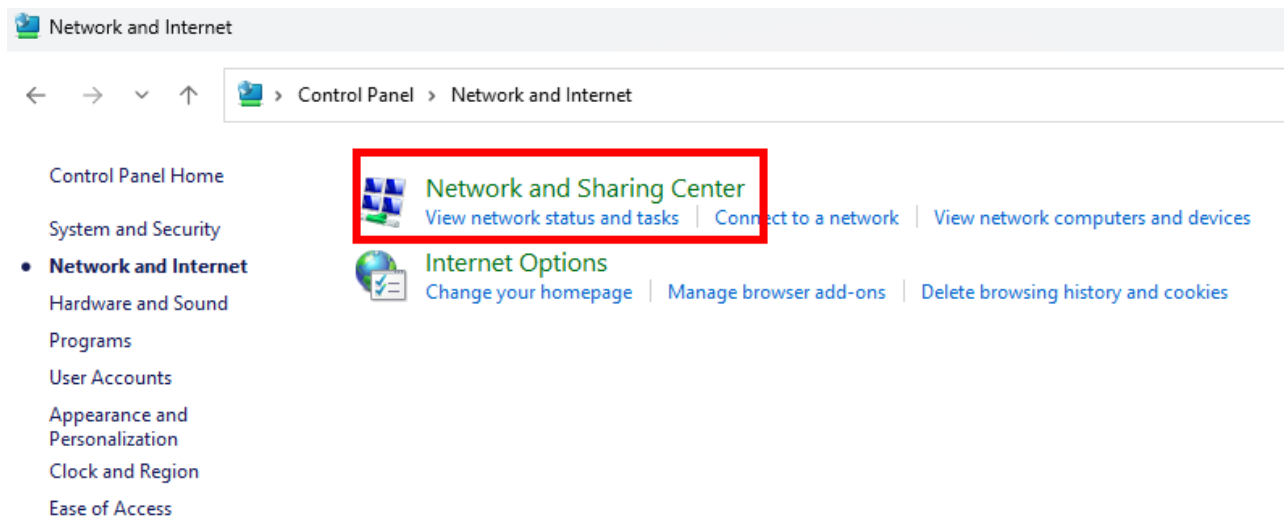
Click the **Start** menu. Next, click on the **Control Panel** option.



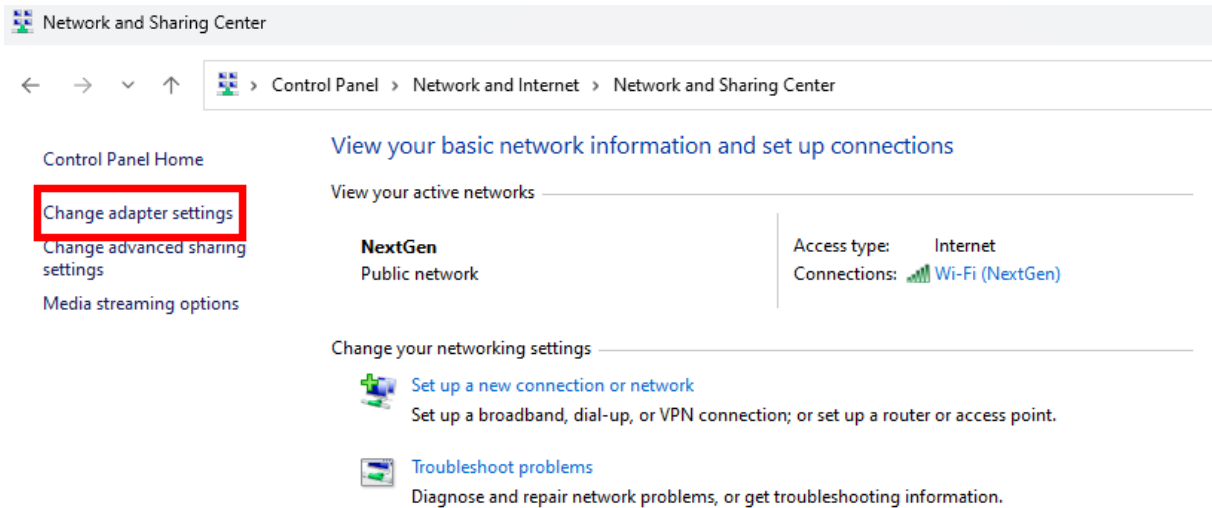
Click on the **Network and Internet** option.



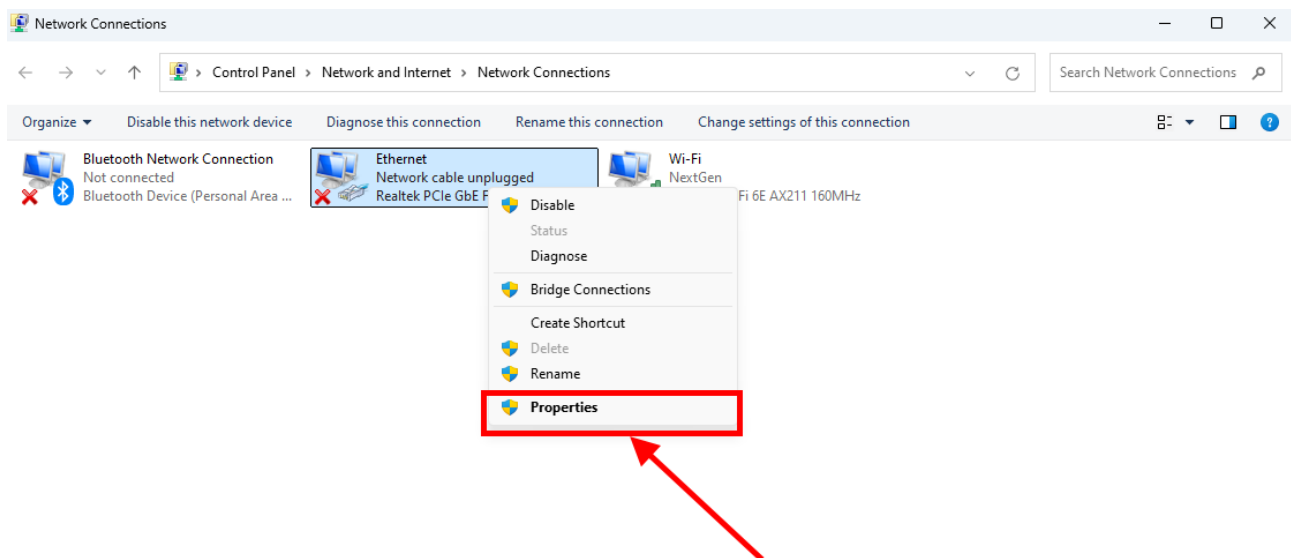
Click on the **Network and Sharing Center** option.



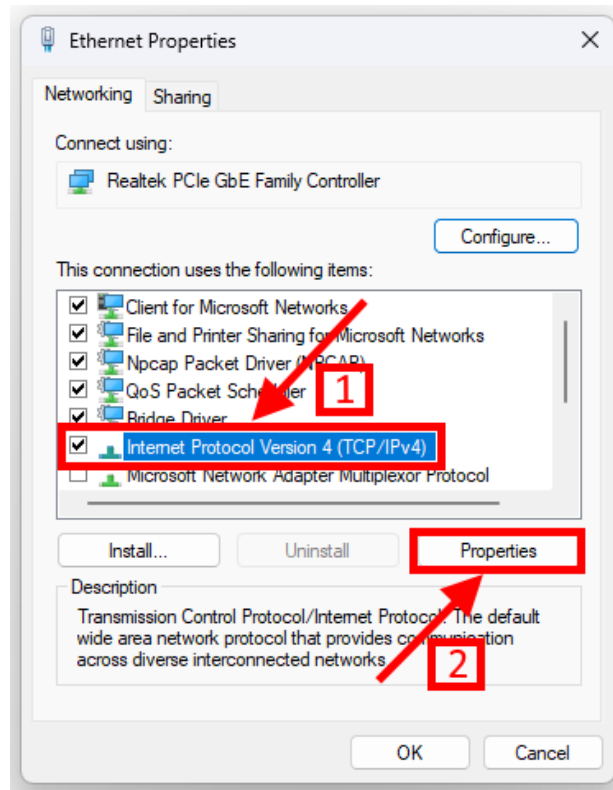
Click on **Change adapter settings** from the left side menu.



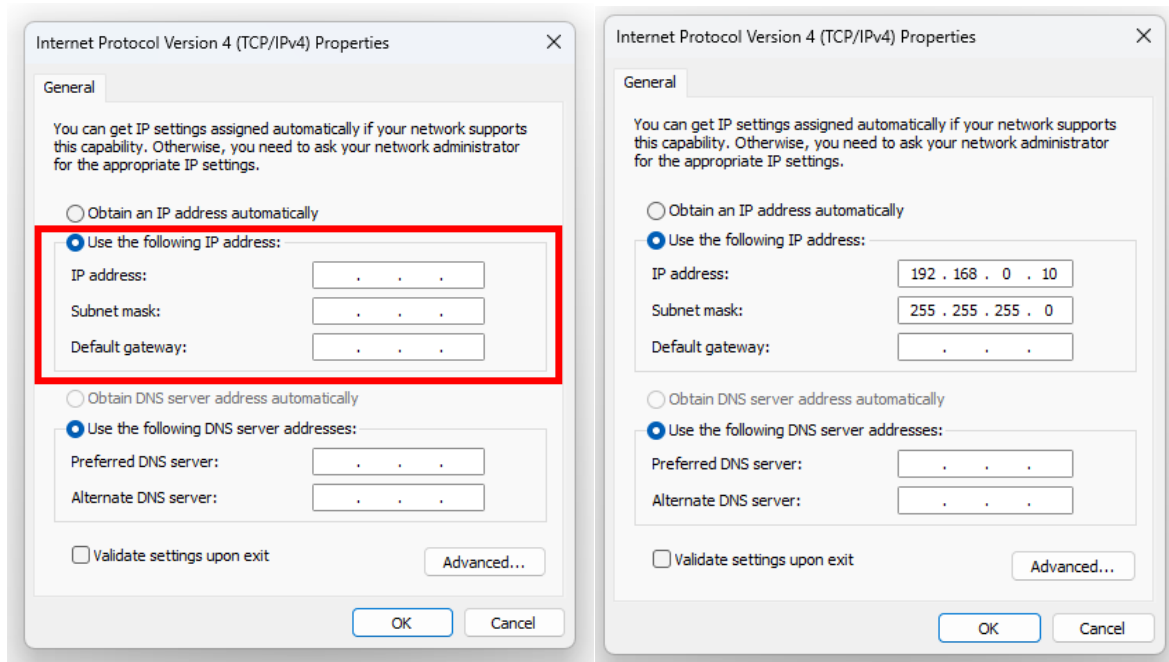
Right-click on the **Ethernet** icon, then select **Properties**.



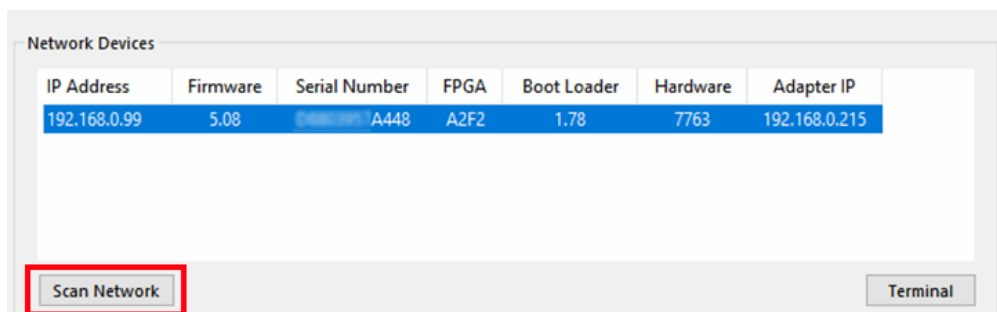
In the window that opens, click on the **Internet Protocol Version 4 (TCP/IPv4)** (you may need to scroll down to find it). Next, click on the **Properties** button.



In the window that opens, click the Use the following IP address: radio button. In the IP address:, type **192.168.0.10**, Subnet mask: **255.255.255.0**, and Default gateway: leave blank. For the DNS server settings, leave both of them blank



Click OK to save the settings. If all instructions were followed correctly, the EC01 should appear when you click Scan in the “VSI Device Manager” application.

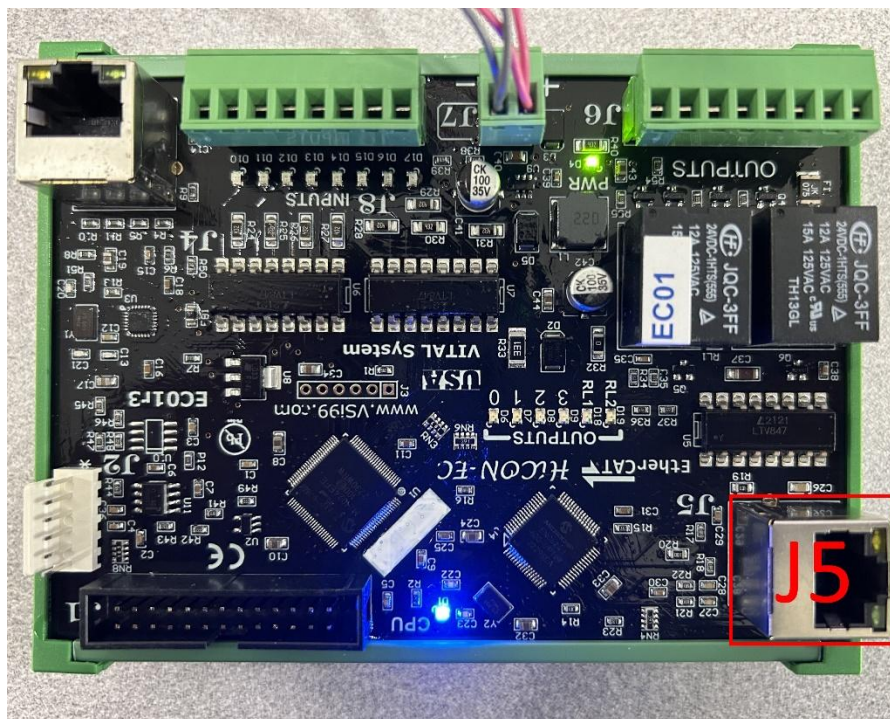


## 2. Setup EC-Link Software

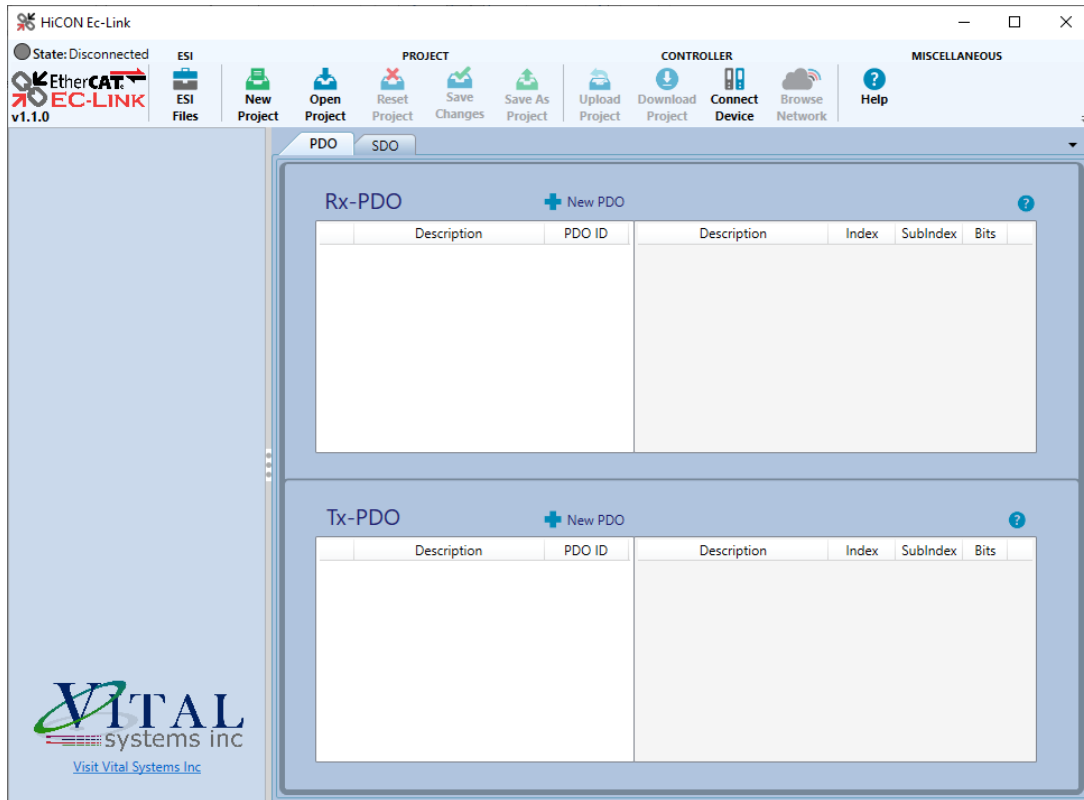
You should have the User Manual for your EtherCAT slave device on-hand while following along the below steps, as you will need to reference it at times.

**Note that you should perform the following steps at first with only **one** slave device connected for testing purposes. Once you have the **one** slave device operational, you may repeat the steps to add the rest of the slave devices.**

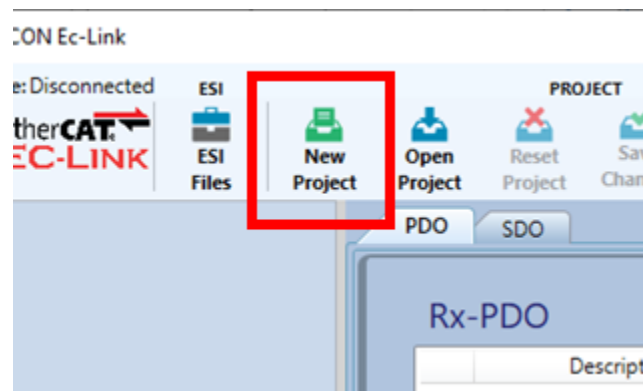
- 2.1) Download and install [EC-Link](#) Software.
- 2.2) Follow along the manual of your EtherCAT slave device to get it set up. Connect it to the EC01 using the **J5** Ethernet port on the EC01 and the IN port on the EtherCAT slave (also sometimes labeled A or X1).



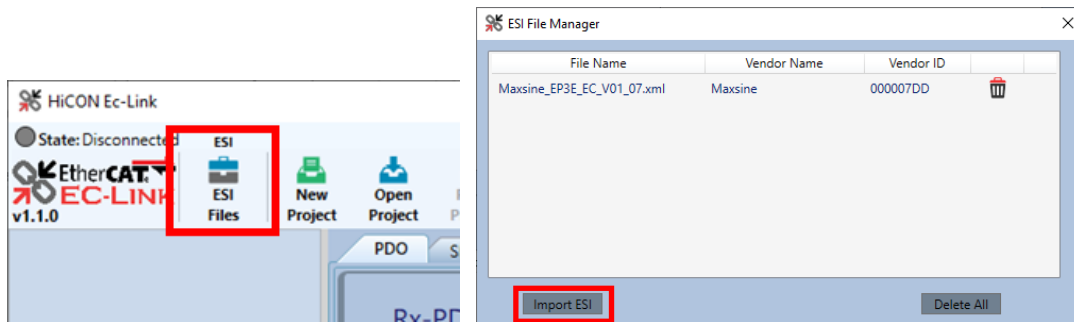
- 2.3) Open the VSI EC-Link configuration software. You will be greeted with the following menu:



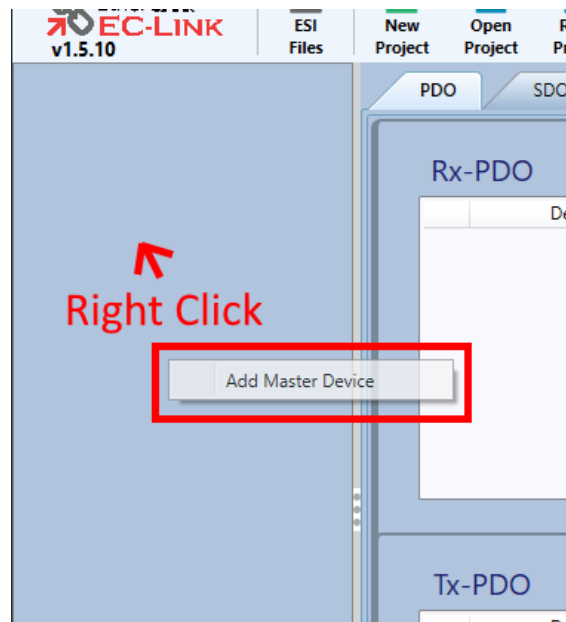
- 2.4) Create a new project by clicking on “New Project”



- 2.5) Click ESI Files->Import ESI, and import the ESI file (XML) for your drive  
(Available from your drive distributor.)

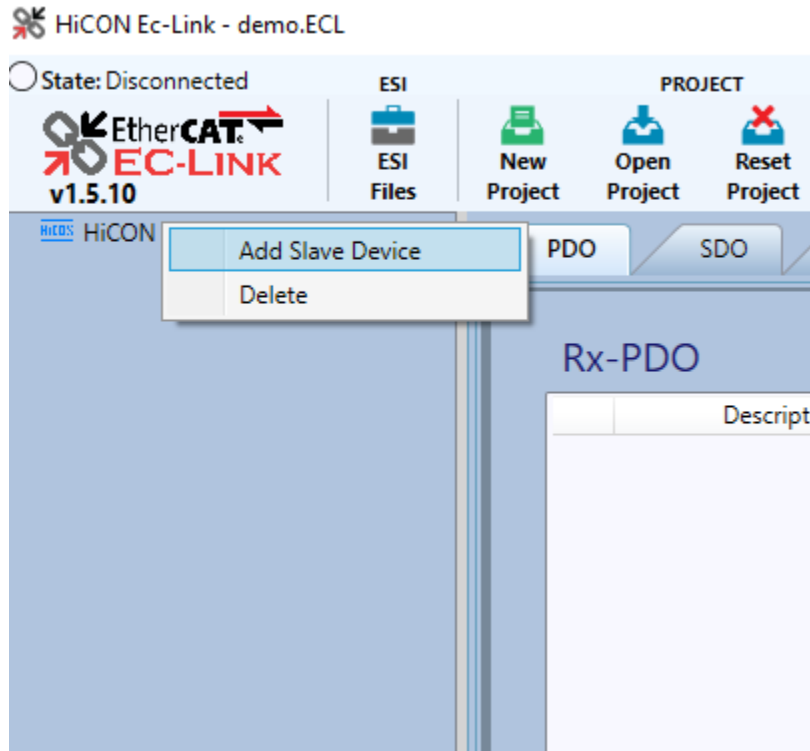


- 2.6) Then right click in the leftmost area and select “Add Master Device.”

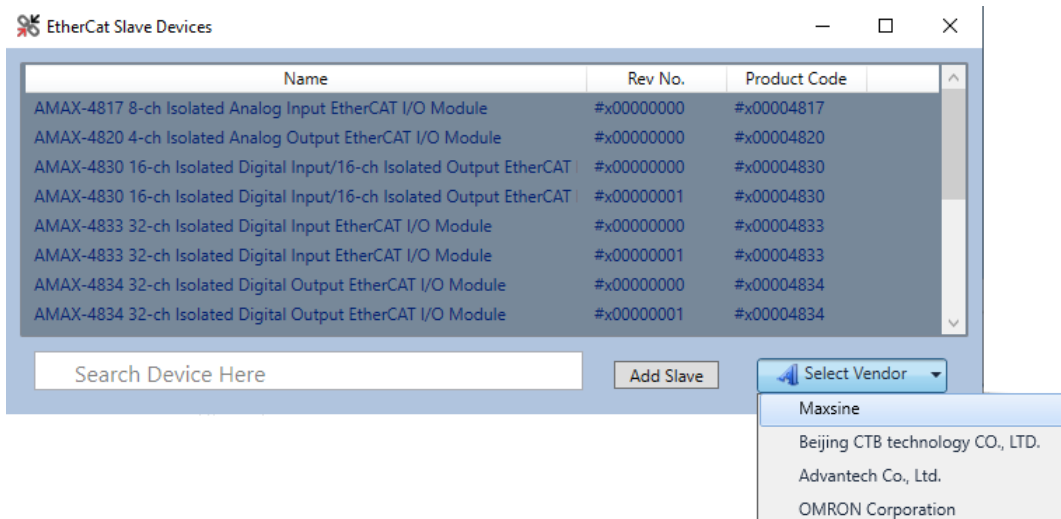




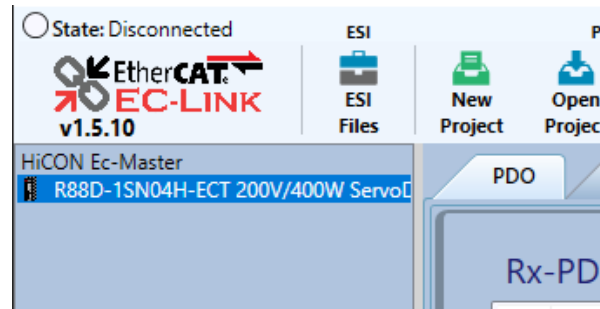
2.7) Right click the master and click “Add Slave Device”.



2.8) In the window that appears, select the vendor of your drive from the Vendor dropdown. Then select the item in the list whose revision and product code matches your drive, then press “Add Slave”. This will add the selected slave device to the device list under the selected master. Close the window.

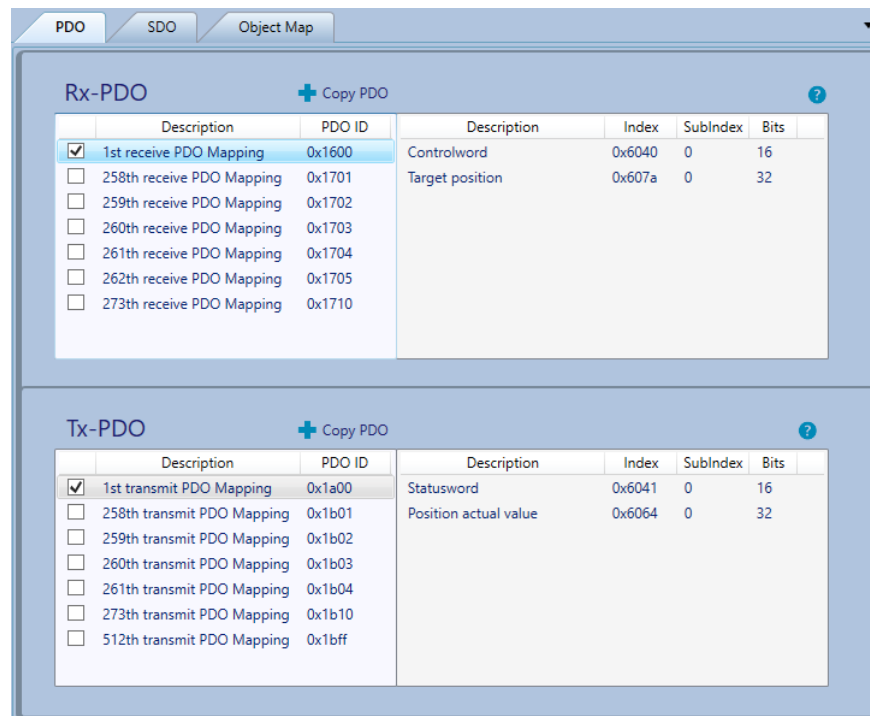


2.9) Click the added slave to select it.



Once a slave is selected, you should see a number of PDO mappings appear in the Rx and Tx PDO sections. Here you can choose which PDOs to use by clicking the checkbox next to the PDO.

**You should only select one PDO in each section.**



Your EtherCAT Drive should have **just** these objects enabled:

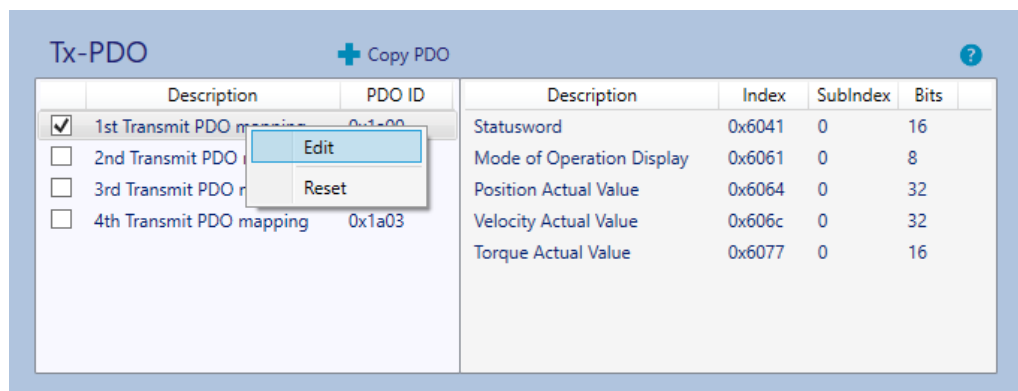
**Rx-PDO:** Control word (0x6040), Target Position (0x607a).

**Tx-PDO:** Statusword (0x6041), Position Actual (0x6064).

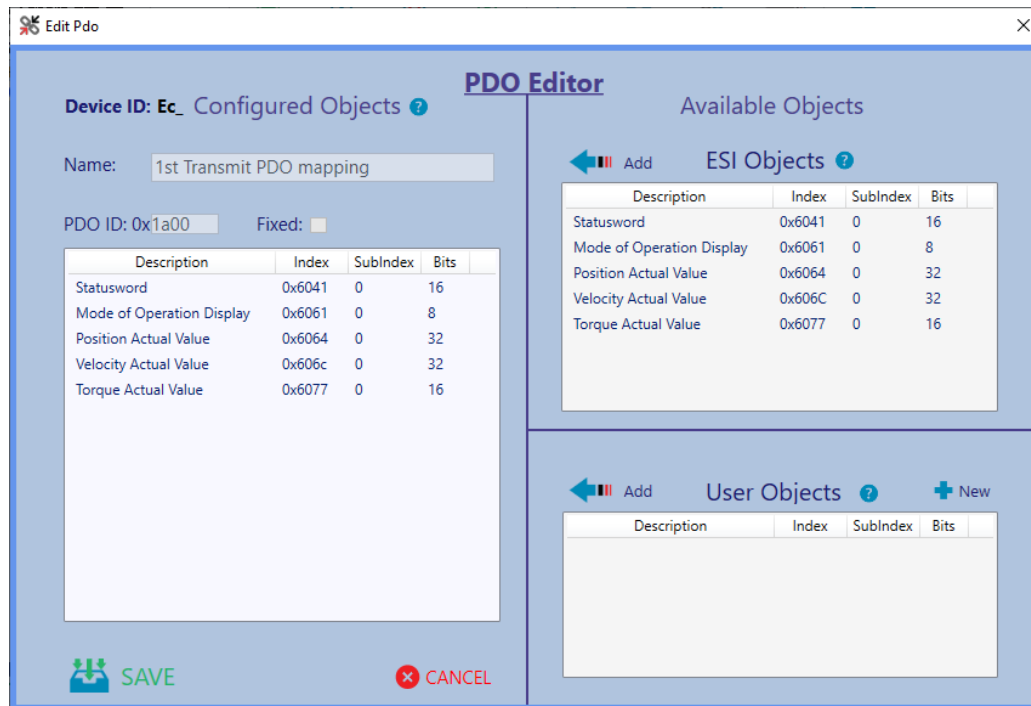
Usually, the first or second PDO will have just the above required objects. If one does, then you may enable it and move onto the next step. However, if one does not exist, you will have to manually edit your PDOs to create one.

For example, in the below image, there are extra objects in this TX-PDO that we do not need.

Right click a PDO in the list that contains the required objects, then select Edit.



This will open the PDO editor:

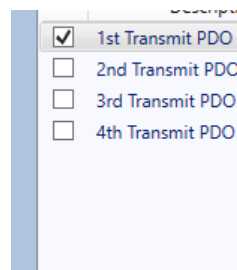


This window will allow you to add or remove objects from PDOs. The list on the left shows objects that are currently present in the PDO.

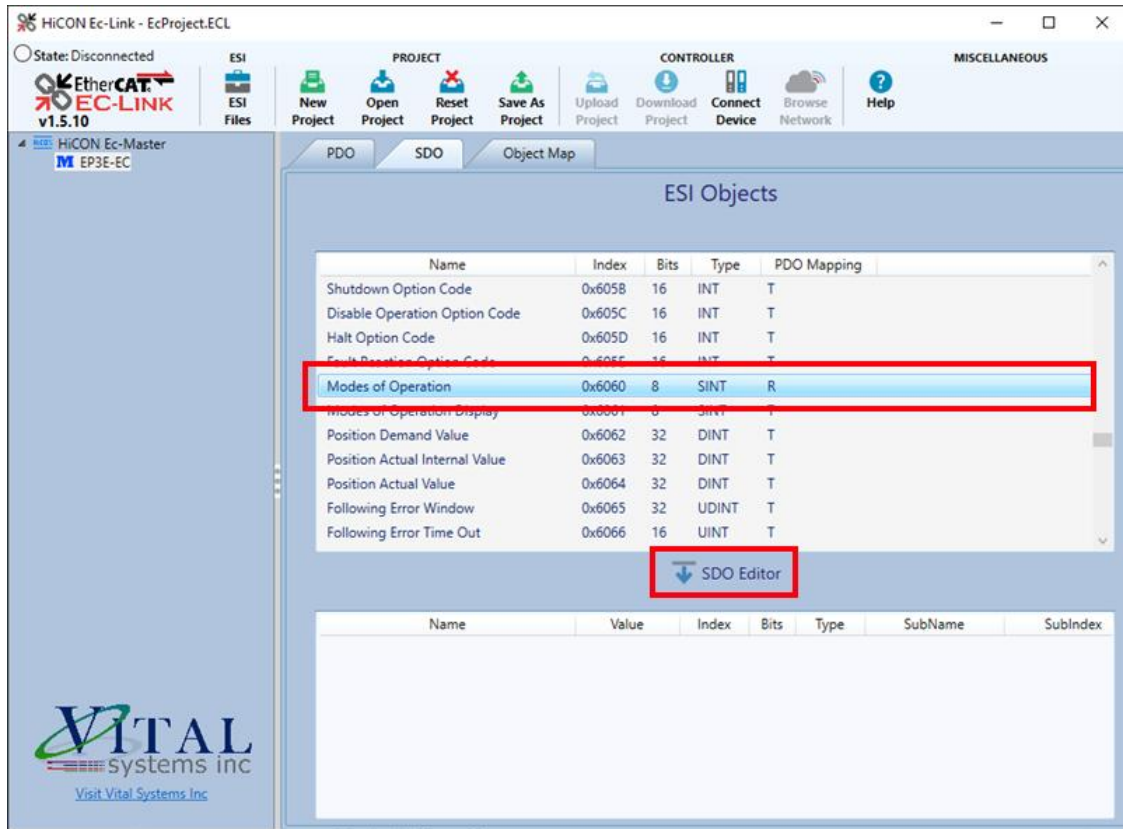
You will need to remove the extra objects from the PDO that you do not need. In my TX-PDO I only need Status Word and Position Actual Value, so I'm going to right click the other objects and select 'Remove'.



Once this is done and only the required objects are left, I can click Save. Make sure to select the checkbox next to our corrected PDO.



2.10) Next, you will need to set the Mode of Operation for the drive. Navigate to the SDO tab.



Find and select Modes of Operation (0x6060) in the list, select it, and click SDO Editor. This will open the SDO Editor.

**SDO Editor**

Device ID: 1 Configured Object ?

Name: Modes of Operation

Index 0x: 0x6060

Type: SINT

BitSize: 8

Sub Name:

Sub Index: 0

Sub Type: 0

Sub BitSize: 0

**SDO Value**

8

SAVE CANCEL

**Available SubItems**

Load ESI Objects ?

Name	SubIndex	BitSize	Offset	Type
------	----------	---------	--------	------

Load User Objects ? + New

Name	Index	BitSize	Type
------	-------	---------	------

Near the bottom left, enter 8 as the SDO Value, then click Save.

2.11) Navigate to the Object Map tab and click Auto Select:

PDO SDO Object Map

**Rx-PDO**

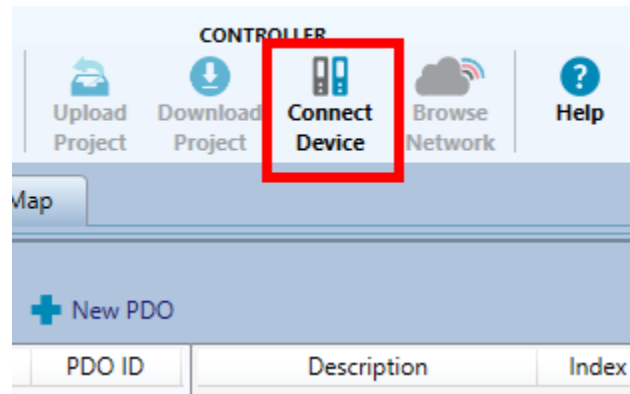
Description	Index	SubIndex	Bits	Object Type
Controlword	0x6040	0	16	Controlword
Target Position	0x607A	0	32	Target Position

**Auto Select**

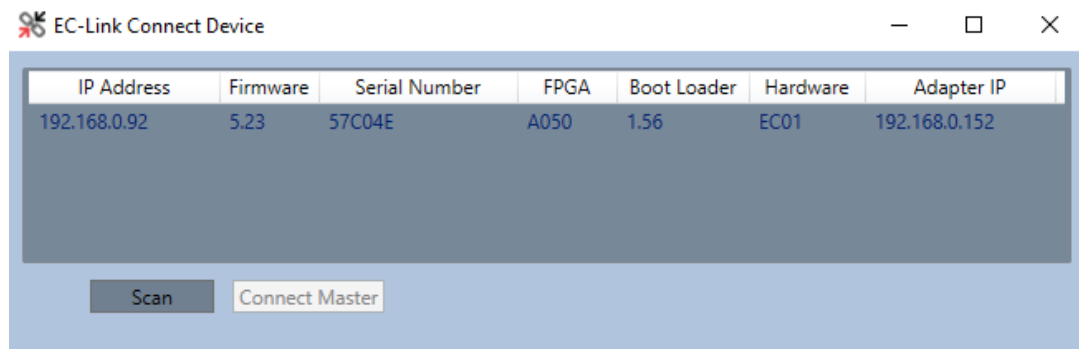
**Tx-PDO**

Description	Index	SubIndex	Bits	Object Type
Statusword	0x6041	0	16	Statusword
Position Actual Value	0x6064	0	32	Actual Position

- 2.12) If you have not yet, follow along [Section 1](#) to connect your EC01 to the PC. Click on “Connect Device” in the toolbar to bring up the Connection window.

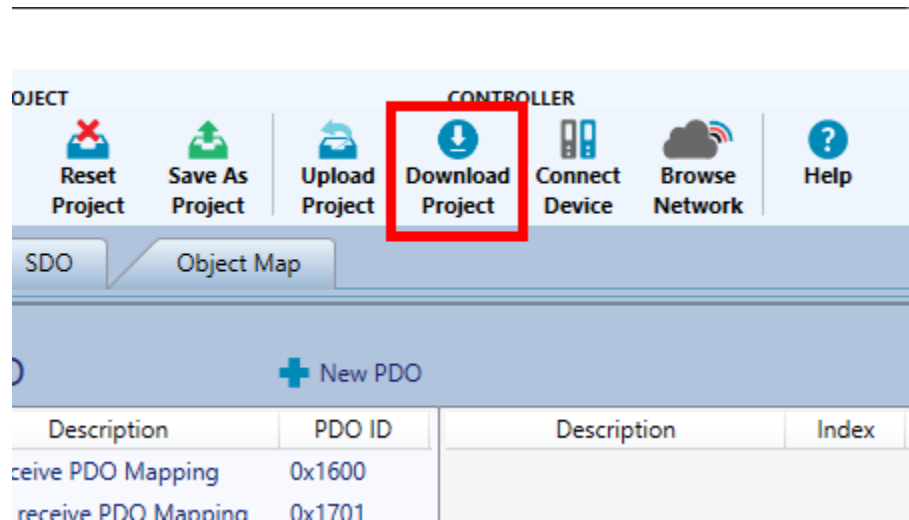


- 2.13) Click “Scan”, select your master from the list, and then press “Connect Master”. Close this menu.



- 2.14) Select “Download Project” in the toolbar to download the configuration to the device. Note that Mach must be closed when downloading the project to the EC01. This concludes the configuration necessary from the EC-Link software.



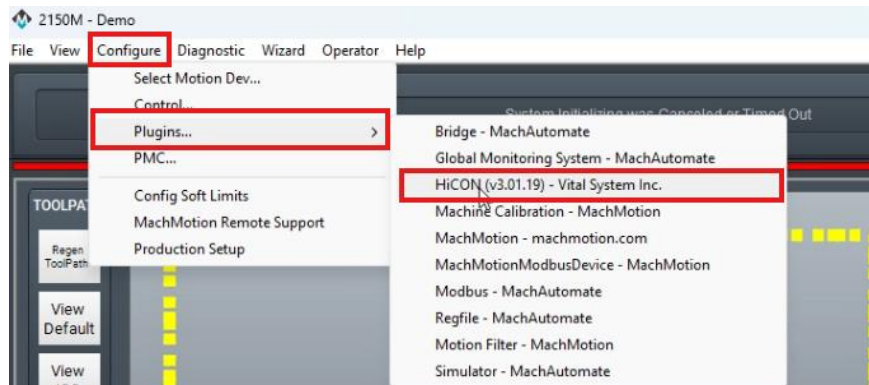


2.15) Refer to the [EC-Link manual](#) for any additional information on this software.

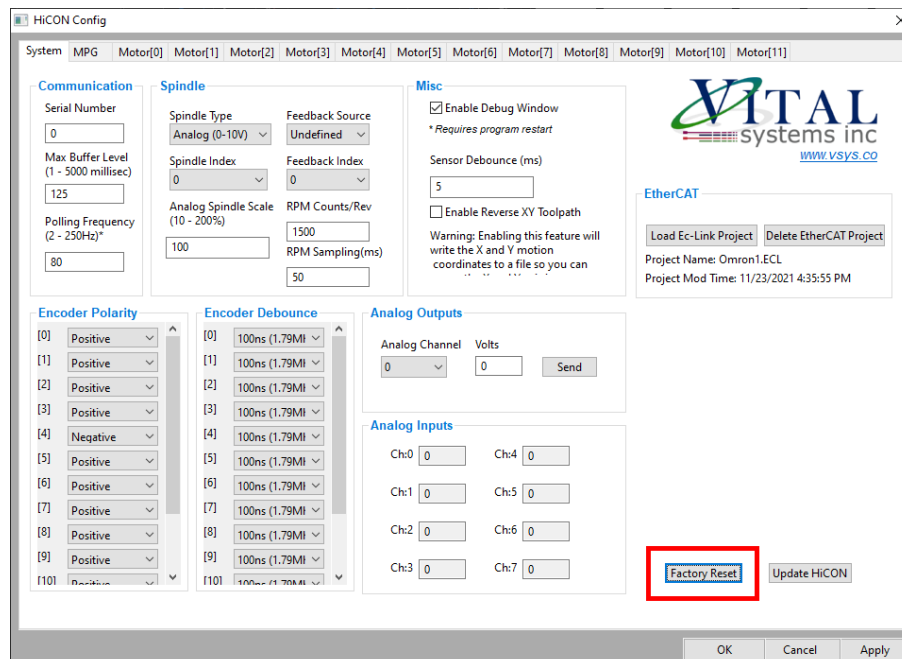
### 3. Setup Mach4/MachPro and Install Plugin

3.1) Refer to the [Mach Software Integration Manual](#) to setup the plugin.

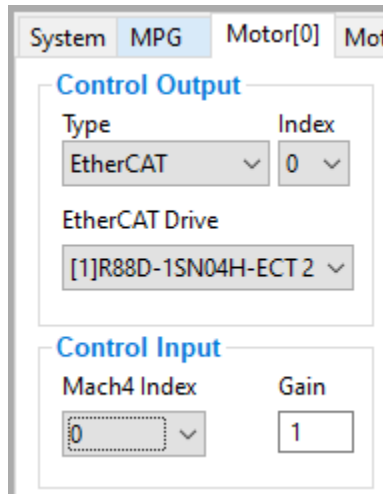
3.2) After the plugin is setup, open the HiCON Plugin window at: Configure->Plugins->HiCON.



3.3) On the System Tab, Click “Factory Reset” available on the bottom right. Apply and click Ok. Note that this step is only necessary the first time you setup the plugin and should not be done for additional motors.

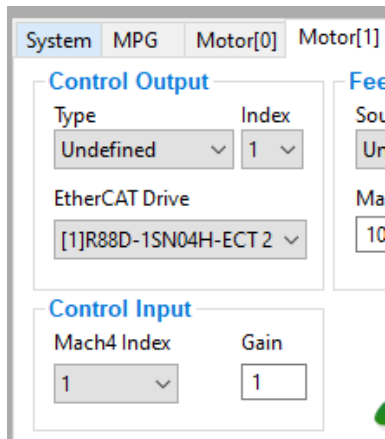


- 3.4) On the Motor0 tab, select EtherCAT as the Output Type and select your EtherCAT Drive. (Refer to the [Mach Integration Manual](#) for full explanations of these settings)



The screenshot shows the 'Motor[0]' tab in a configuration window. Under 'Control Output', the 'Type' is set to 'EtherCAT' and the 'Index' is '0'. The 'EtherCAT Drive' is set to '[1]R88D-1SN04H-ECT 2'. Under 'Control Input', the 'Mach4 Index' is '0' and the 'Gain' is '1'.

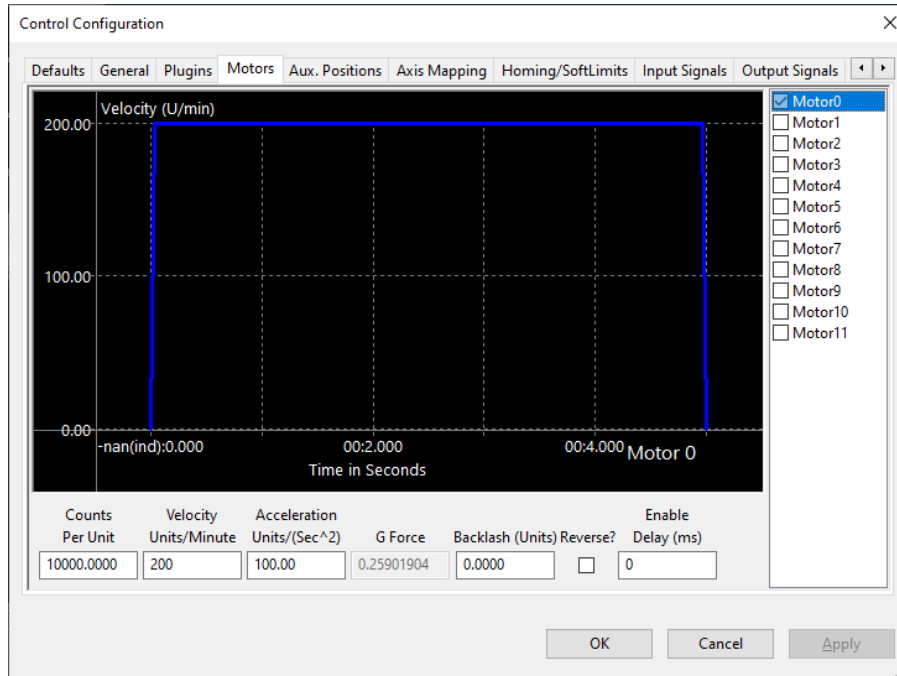
- 3.5) Select Output Type as “Undefined” for motors 1-11. (Later when you set up additional drives, you may define additional motors past Motor0.)



The screenshot shows the 'Motor[1]' tab in a configuration window. Under 'Control Output', the 'Type' is set to 'Undefined' and the 'Index' is '1'. The 'EtherCAT Drive' is set to '[1]R88D-1SN04H-ECT 2'. Under 'Control Input', the 'Mach4 Index' is '1' and the 'Gain' is '1'.

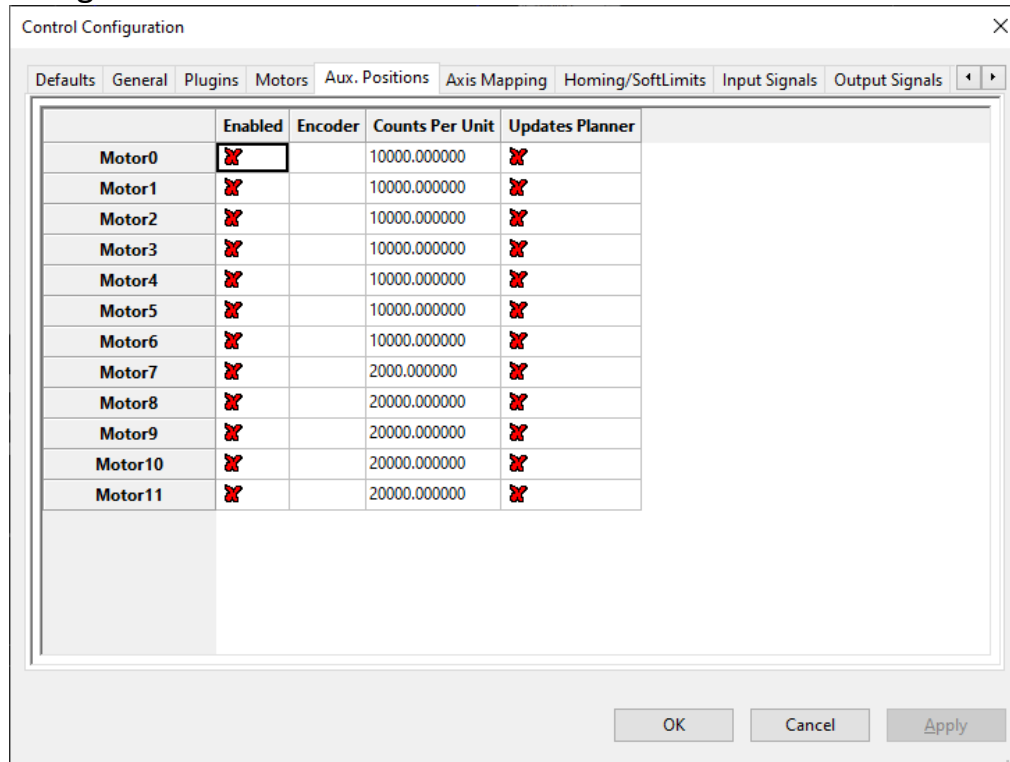
Click Apply and Ok.

### 3.6) Navigate to the Motors tab of the Mach Control Window:



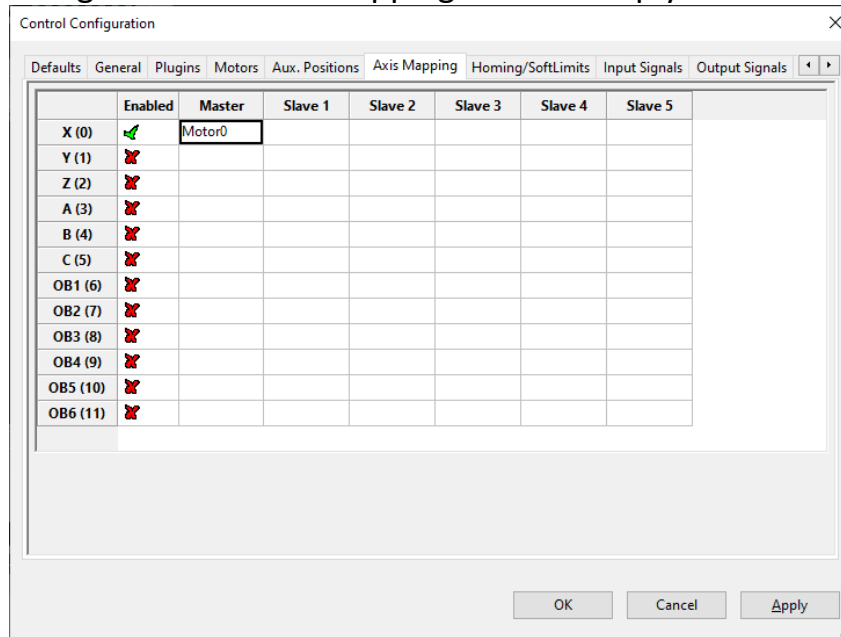
Click the check mark next to Motor0, and set the values for Counts Per Unit, Velocity, and Acceleration (these values will depend on your drive and intended use. You will need to determine these values yourself.

### 3.7) Navigate to the Aux Positions tab:



Set the Counts Per Unit of your Motor to the same value you set in the previous step, but **do not enable aux positions**. If you do not follow this step, the position indicators in Mach will be incorrect.

3.8) Navigate to the Axis Mapping tab and map your Motor0 to the X axis:



3.9) You should now be able to enable Mach and jog the motor.

3.10) Once you have one drive working, you can setup additional drives by repeating the above steps for each additional drive.

**NOTE:** Check the “Activations” tab and ensure that Arm Enable and that some number of motors have been activated. These two features are required for the operation of the motion controller. If either of these activations is missing, please email [support@vitalsystem.com](mailto:support@vitalsystem.com) for assistance.

