

CRP500 Retrofit Guide

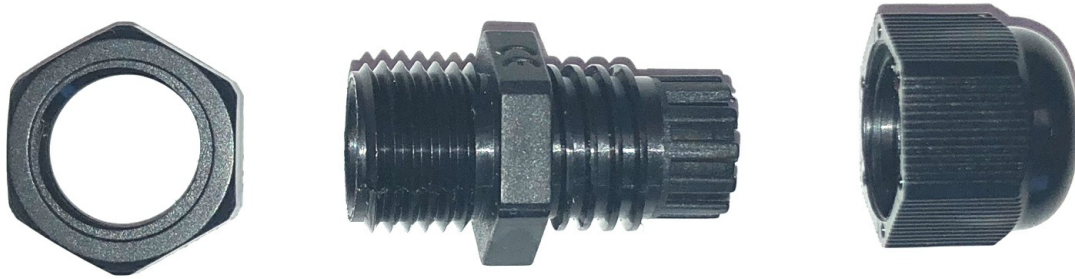
**Congratulations on your purchase of the CNC Router Parts
2.2 kW Plug and Play Spindle / VFD System!**

Step 1

The first step in setting up your Spindle will be to upgrade your current CRP500 Control Unit with VFD compatibility. You should have received an SP/THC Cable and strain relief fitting with your Retrofit Kit.



The strain relief will be used to attach the provided SP/THC Cable to your control unit. There should be an unused hole in your control unit's gland plate, this will be where the strain relief is installed.

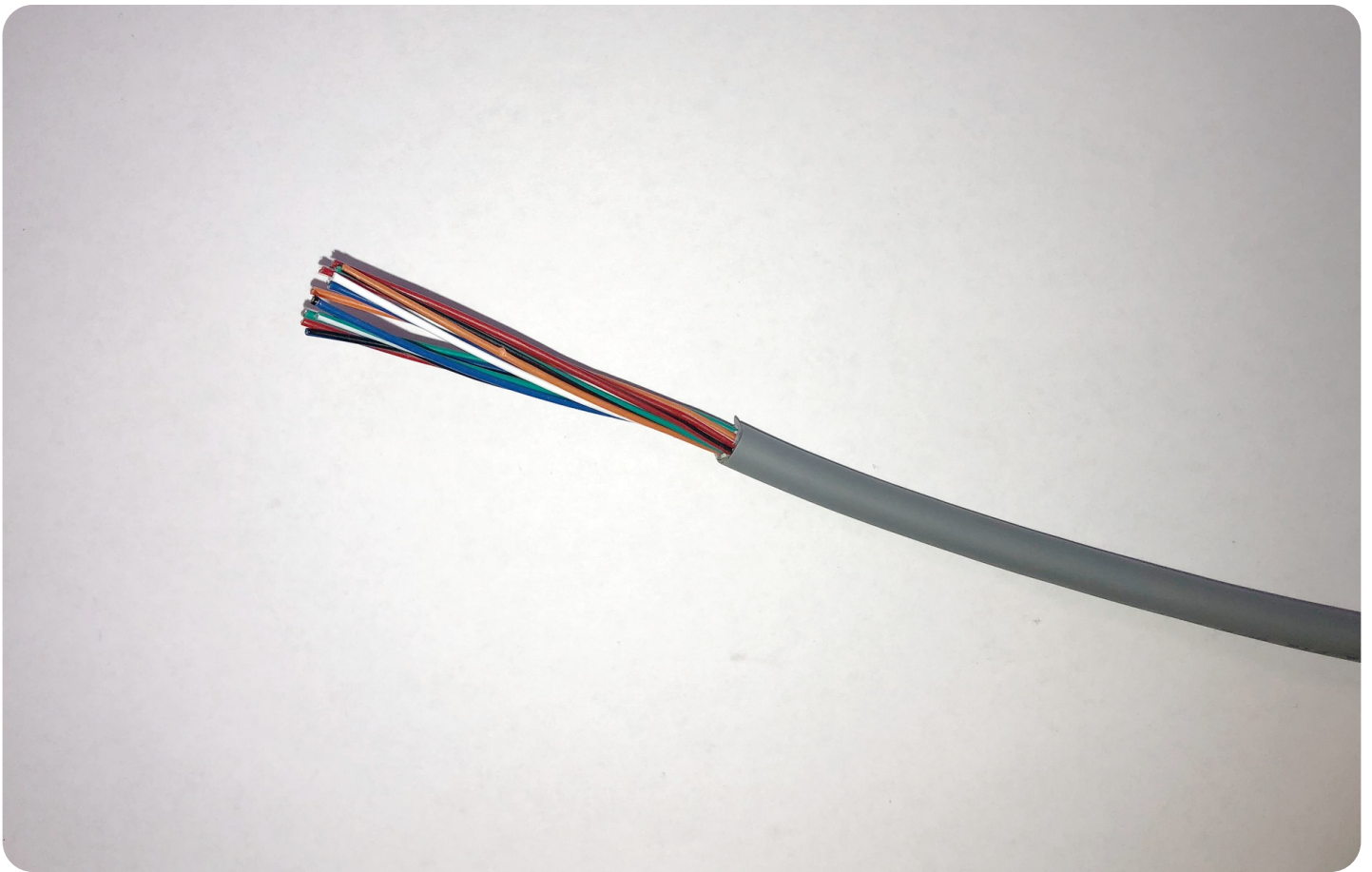


The left (as shown) threaded end of the strain relief should be installed into the gland plate of the control unit, from the exterior. The clamping collar (at left in photo) should then be threaded onto the strain relief, from the interior, to hold it in place on the gland plate.

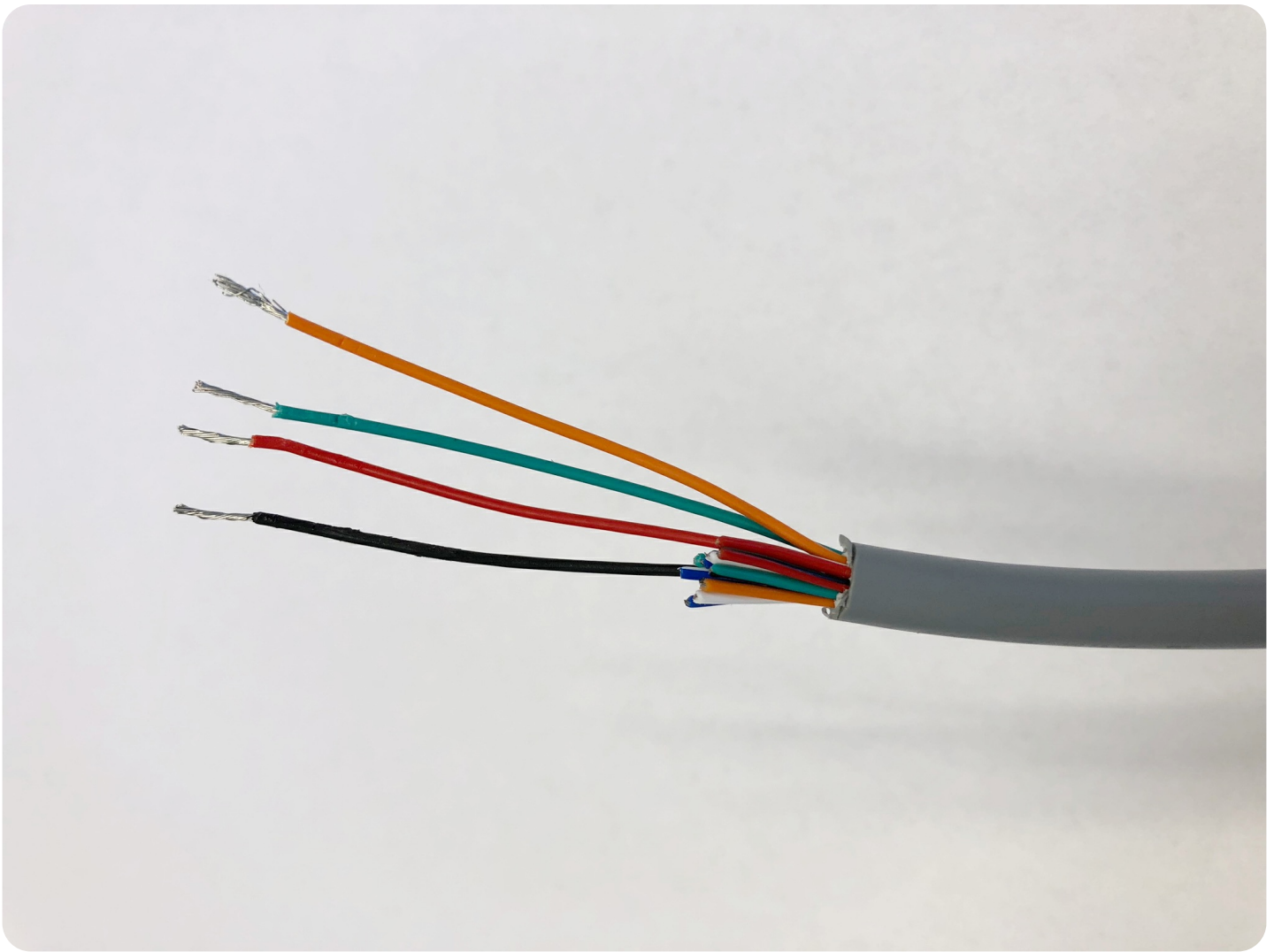
At this point, one end of the SP/THC Cable should have the 14-pin connector removed with the wires stripped to bare leads as shown in the photo series below.



Clip one end of the SP/THC Cable as shown above.



Strip the sheathing on the cable back at least 1.5" (it is easier to work with if you strip 1.5 - 3").



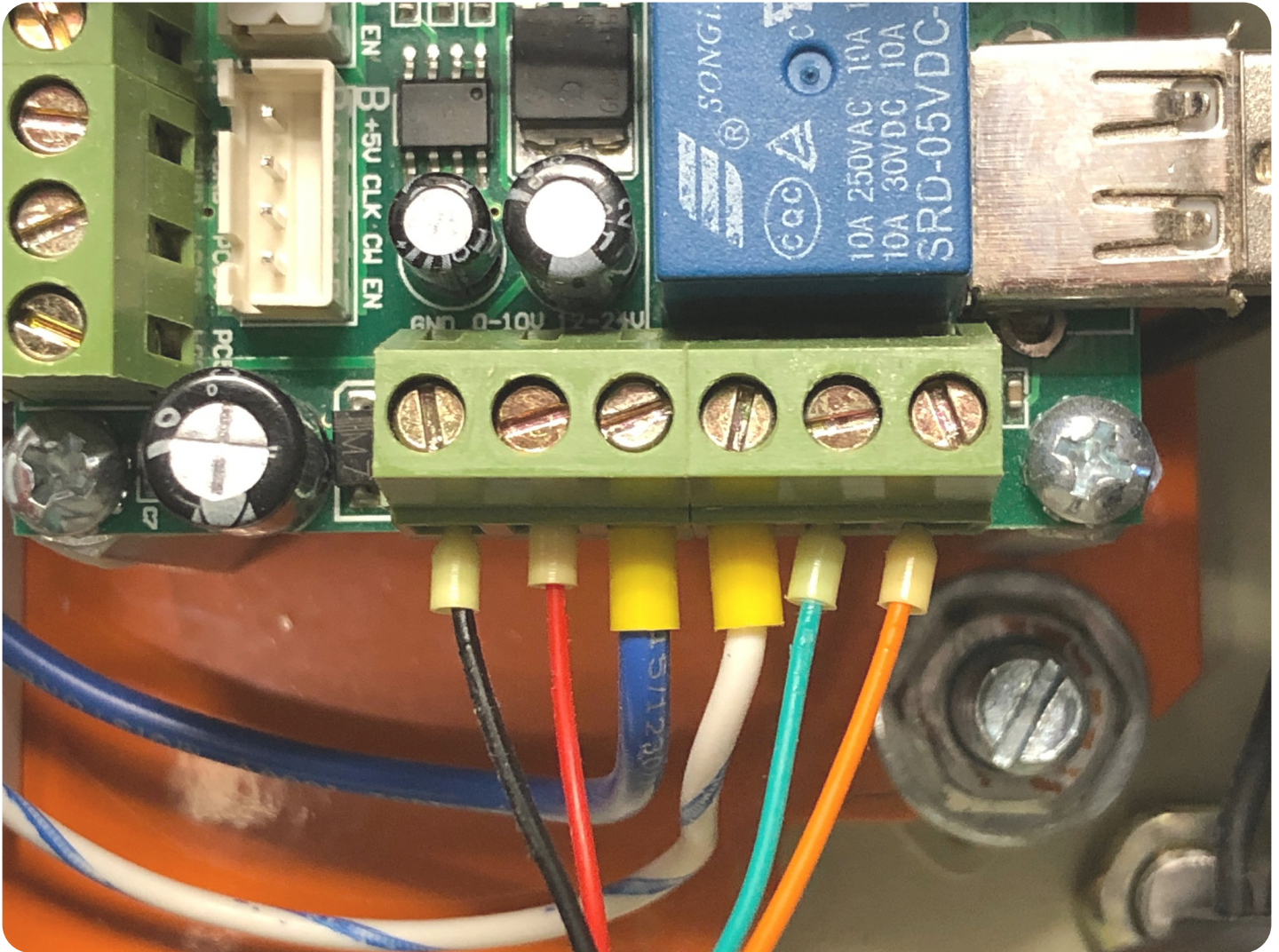
Separate out and strip the Black, Red, Orange, and Green wires. They may now be ferruled or tinned if you desire, although they will function as bare wires. The remaining wires are not used and can be cut back.

The clipped and stripped end of the SP/THC Cable can now pass through the strain relief installed in your gland plate.

Ensure the cable nut (shown at the right in the strain relief image) is partially threaded onto the strain relief prior to inserting the cable.

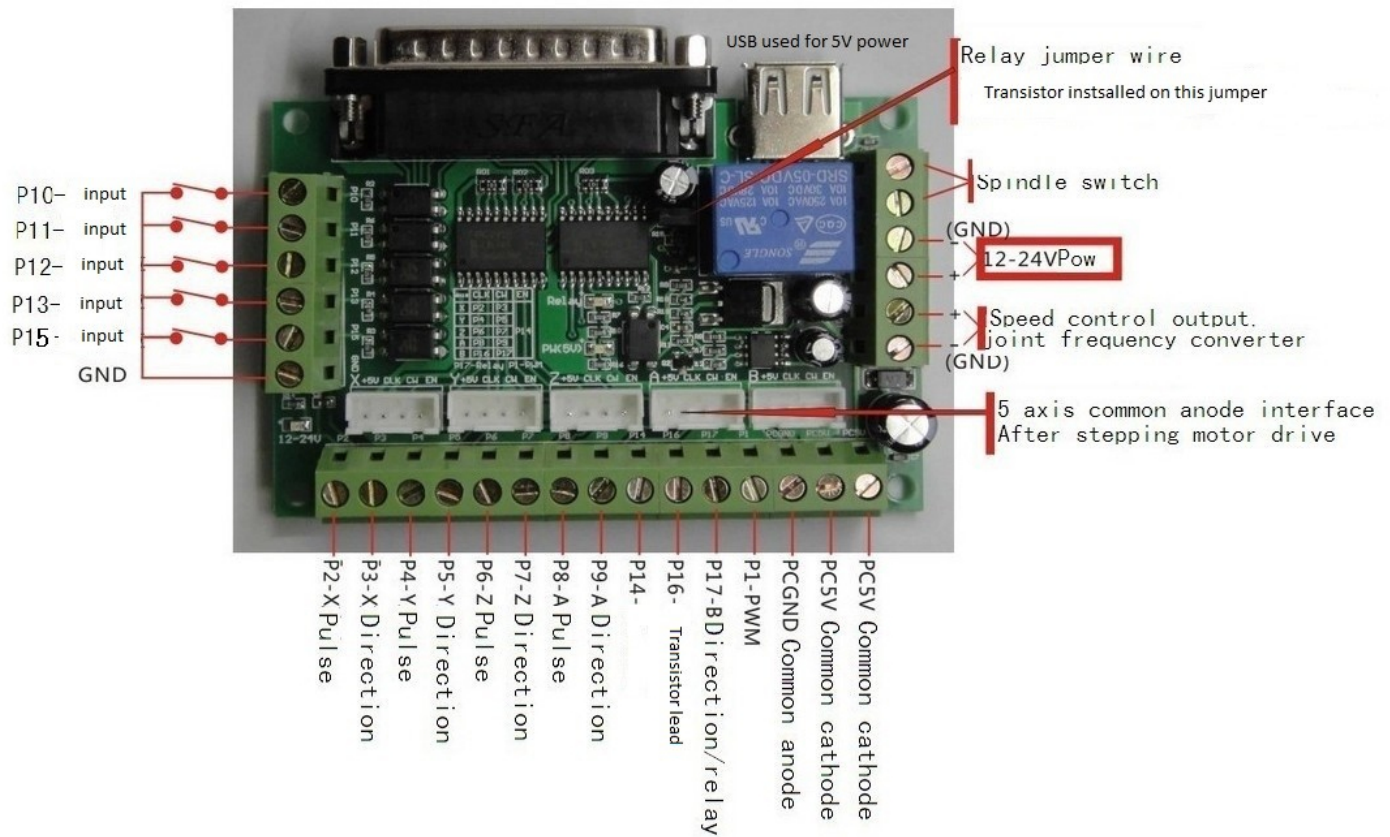
Once there is a sufficient length of cable inside your control box to reach your break out board, the cable nut can be tightened down onto the strain relief. This will secure the cable to the control unit.

The stripped and ferruled wires from the SP/THC Cable can now be connected to your break out board (BOB). The image above shows which screw terminals correspond to which screw terminal on the BOB. When looking at the BOB in the depicted orientation, the connections should be as follows:



- PWM signal ground to VFD (**Black**)
- PWM signal 0-10v output to VFD (**Red**)
- 10V from discrete power supply required for PWM output (**Existing Connection**)
- Ground to discrete power supply required for PWM output (**Existing Connection**)
- Spindle relay ground (**Green**)
- Spindle relay signal (**Orange**)

Note: The middle two screw terminals should already be connected to 12V power and should not be changed or modified.



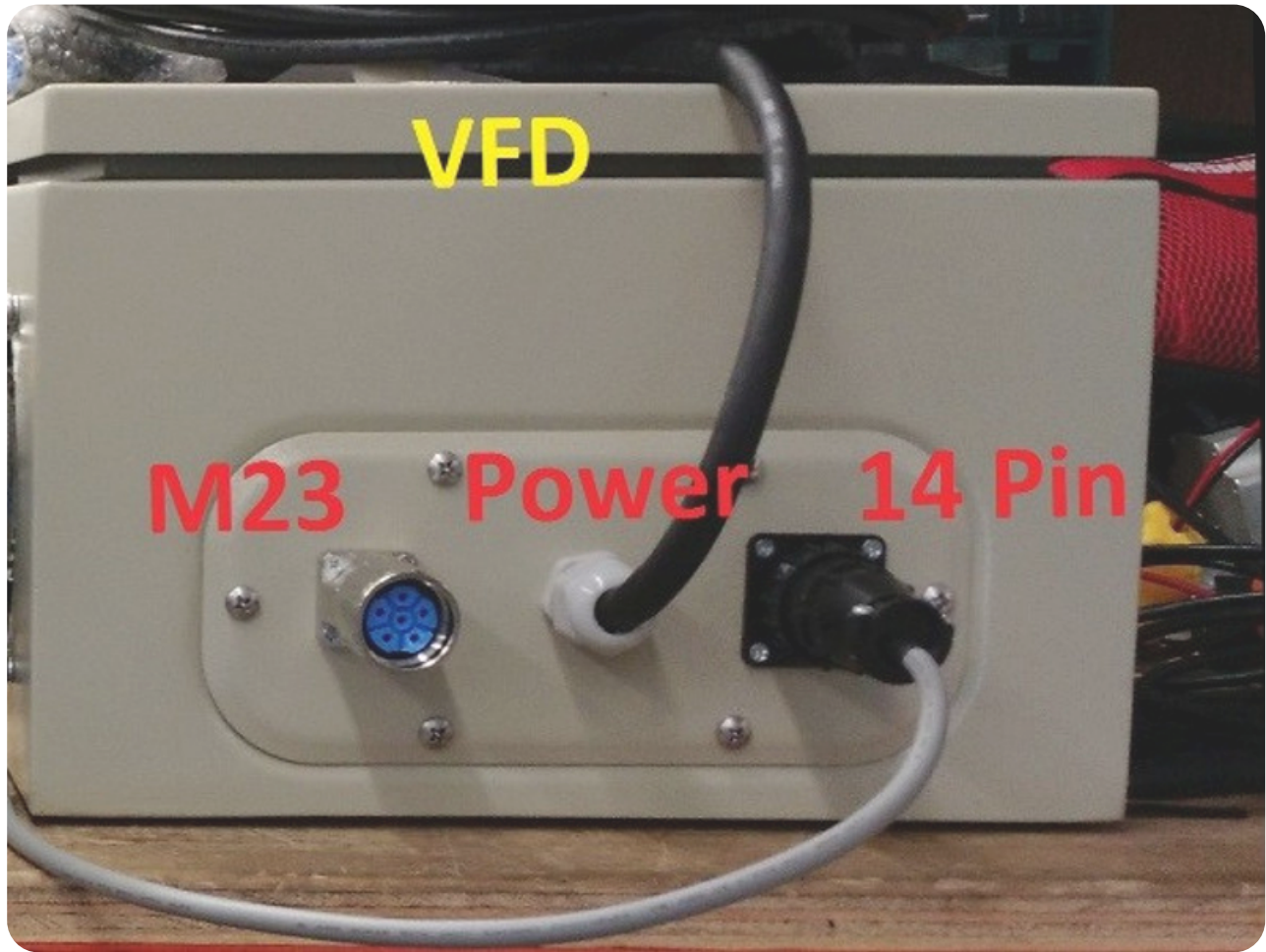
The above image should further clarify how to connect the SP/THC Cable to the BOB.

If you have not tightened your strain relief, you can do that now.

Your control unit is now ready to communicate with your Spindle and VFD package.

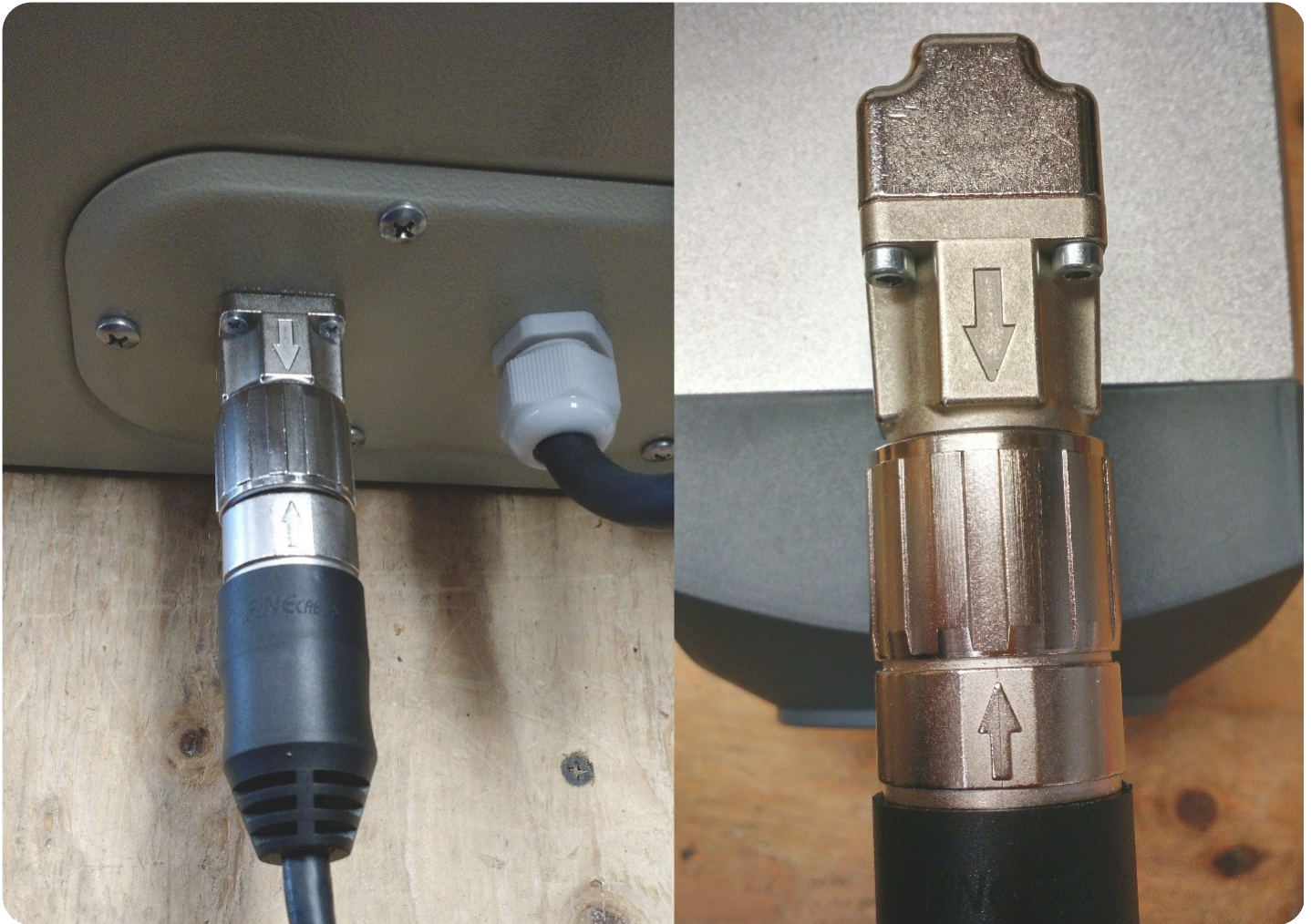
Step 2

You may now physically connect your VFD to your CRP500 Controller. The 14-pin connector on the cable you just connected to your CRP500 BOB will plug into the female 14-pin receptacle on the VFD unit.



The included M23 cable should be used to connect your VFD to your spindle and the VFD power cable should be plugged into an appropriate L6-30 240 volt outlet.

The arrows on the M23 cable ends should align with the panel mount M23 receptacles on both the spindle and VFD enclosure. If these arrows do not align, the cable will not make a functional connection. (see below)



Step 3

Now that all the physical connections are complete, you must modify the Mach3 settings on your PC to ensure proper spindle operation.

General Config

Controller Frequency: 1 kHz. The Controller Frequency controls how many times per second the velocity is updated when outputting pulses.

At 250 Hz, up to 4 seconds of data can be queued up. Each doubling of frequency halves the buffer length, so at 500 Hz, 2 seconds can be buffered, 1 kHz, 1 second, etc.

Max Step Frequency:

- X-axis: 256 kHz
- Y-axis: 256 kHz
- Z-axis: 256 kHz
- A-axis: 256 kHz
- B-axis: 256 kHz
- C-axis: 256 kHz
- Spindle: 32 kHz

Output Mode:

| Step and Direction | CW/CCW | Quadrature |
|---------------------------------------|--------------------------|--------------------------|
| X <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Y <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Z <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| A <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| B <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| C <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

Watchdog: 2.0. If the PlugIn fails to communicate with the device within the amount of time listed below, an EStop will be triggered in the device. The time is in seconds and is rounded to the nearest tenth of a second. Max value is 3.1 seconds.

Port 2 Pins 2 through 9 Direction: Out

Port 3 Pins 2 through 9 Direction: In

Noise Filtering of Inputs:

An input must be stable for the specified amount of time in microseconds before it will be considered valid. Values will be assigned to groups of similar signals. The specified values will be rounded to the nearest multiple of about 1.43 microseconds. To disable filtering for a given groups of inputs, use a value of 0.0 microseconds.

Encoders/MPGs: 0.00 (includes A, B, Index, and timing)

Miscellaneous: 0.00 (Miscellaneous covers all other inputs)

Probe: 0.00

EStop: 0.00

Jog: 0.00

Limits: 0.00

Home: 0.00

Feed Hold:

- ☒ Controlled By Mach
- ☐ Controlled By SmoothStepper

IsMoving: Output Number for the IsMoving signal

Spindle:

Relay or None: ☐ PWM: ☒ Step and Dir: ☐ CW / CCW: ☐ Quadrature: ☐

Base Hz: 25

Pulse Width (us): 4.0

Spindle Index Prescale: 1. Max of 4096. Set to 1 for no prescale (default)

M11Px/M10Px Commands:

Output Mode: ☒ Output Mode (normal default mode)

M11Px/M10Px Gates Spindle Output: ☐

Output Number to use for M11P#/M10P#: 0

Input Mode:

M10 OEM Trigger #:

M11 OEM Trigger #:

Dwell time associated with M11/M10 Commands:

M11:

Dwell selected in this config: ☒ Delay: 0 milliseconds

Dwell selected Via User DRO: ☐ User DRO #: 0

M10:

Dwell selected in this config: ☒ Delay: 0 milliseconds

Dwell selected Via User DRO: ☐ User DRO #: 0

Miscellaneous:

- ☐ De-Reference Axes in EStop
- ☐ THC Mode
- ☐ Don't Report Port and Pin Warnings
- 1023 Number of Data Points Mach Should Pre-Calculate

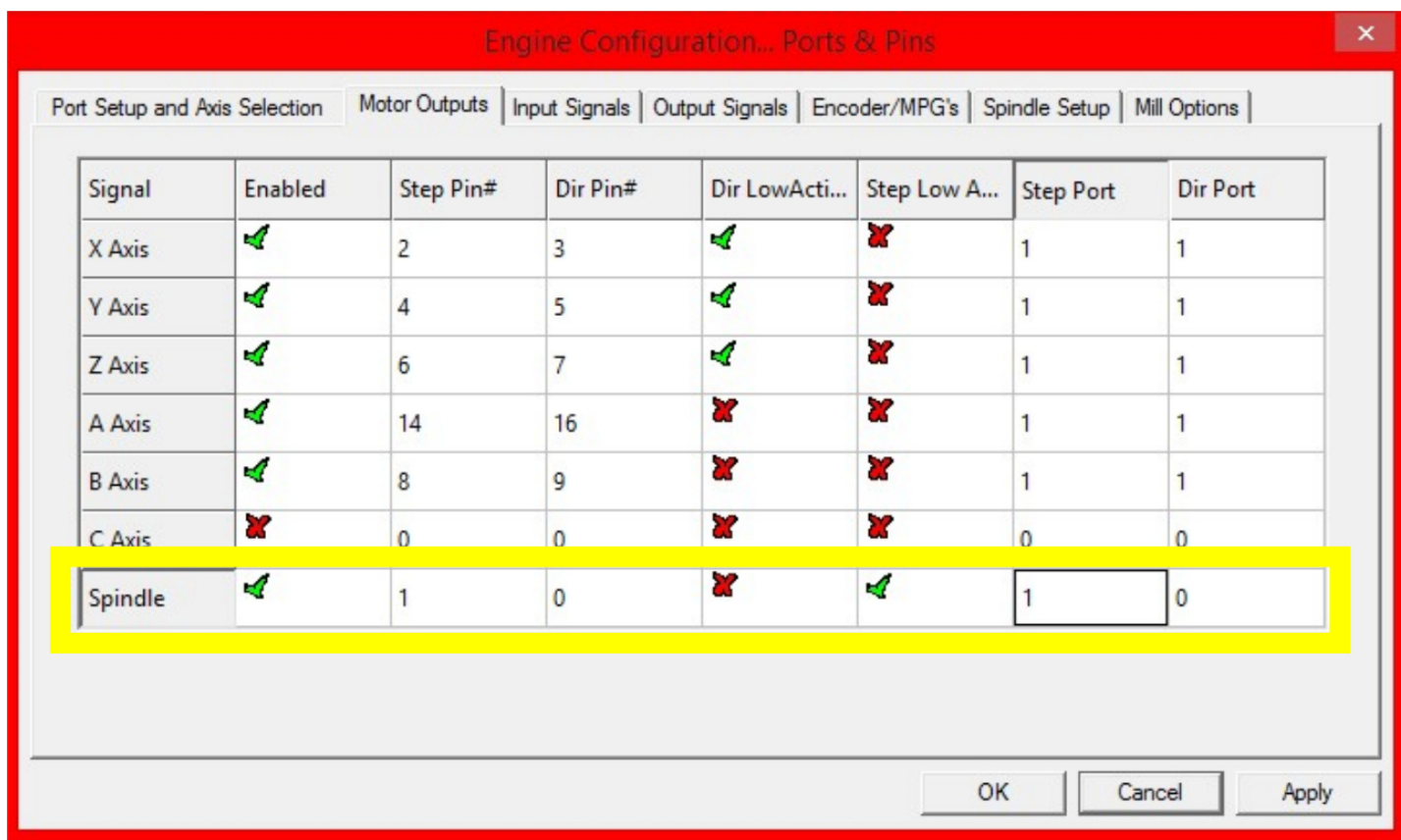
Homing:

- ☐ Support Multi-Axis (but G28.1 will not work right)
- ☒ Single Axis at a time

Enable: ☐ Spindle PWM Proportional to XY Feed Rate. When enabled, the spindle PWM is a function of the XY Feed Rate. The mapping function is a table in the specified file located in the Plugins folder of the Mach directory.

Mapping Function Filename:

Under the Plugin Control drop down menu, select ESS-General Config and then make sure the PWM box is checked and the Base Hz is set to 25. Now Restart Mach3.



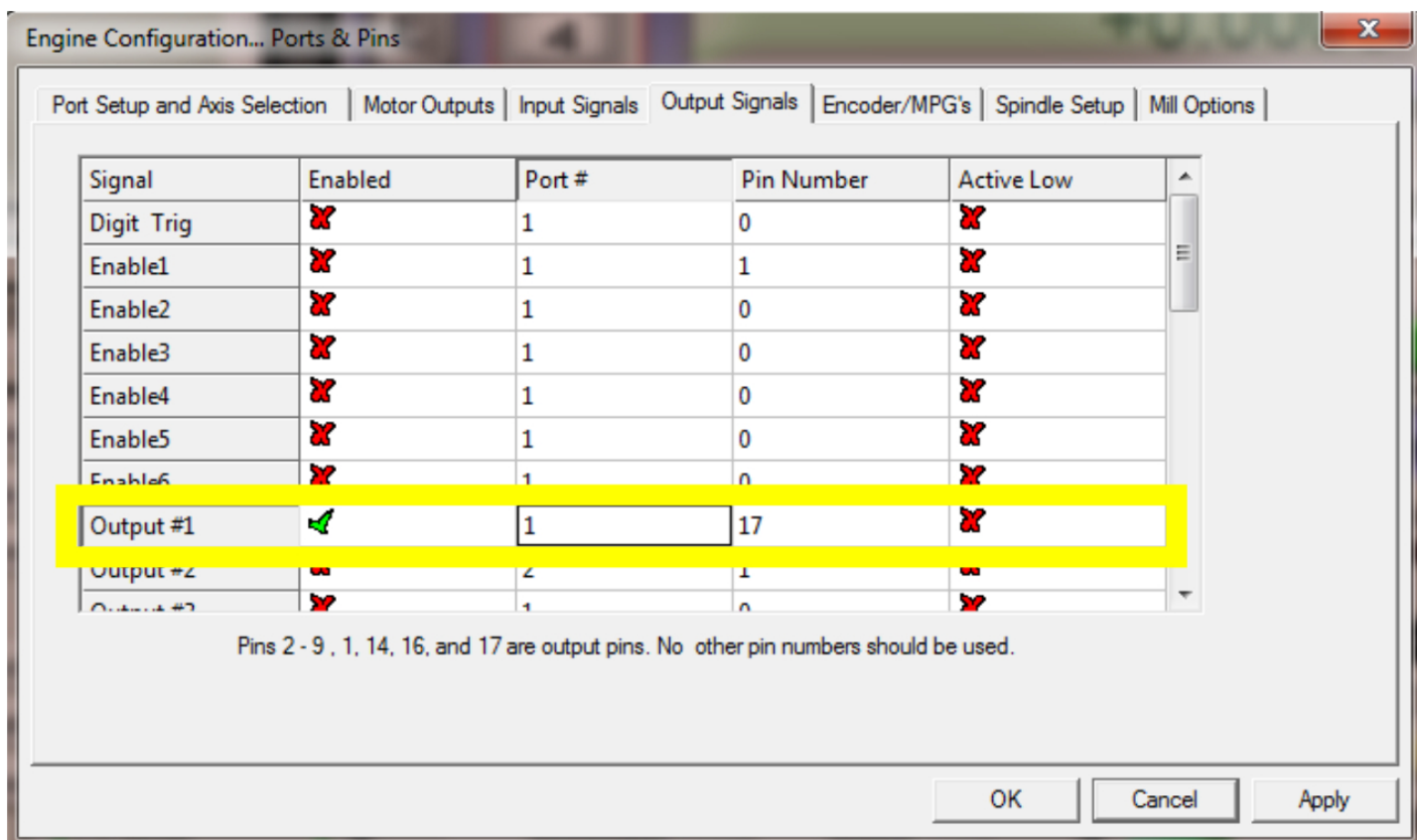
Select "Ports and Pins" from the "Config" drop down menu then navigate to the "Motor Outputs" tab.

Make sure the Enabled column shows a green check mark next to Spindle and the Step and Dir pins are 1 and 0, respectively.

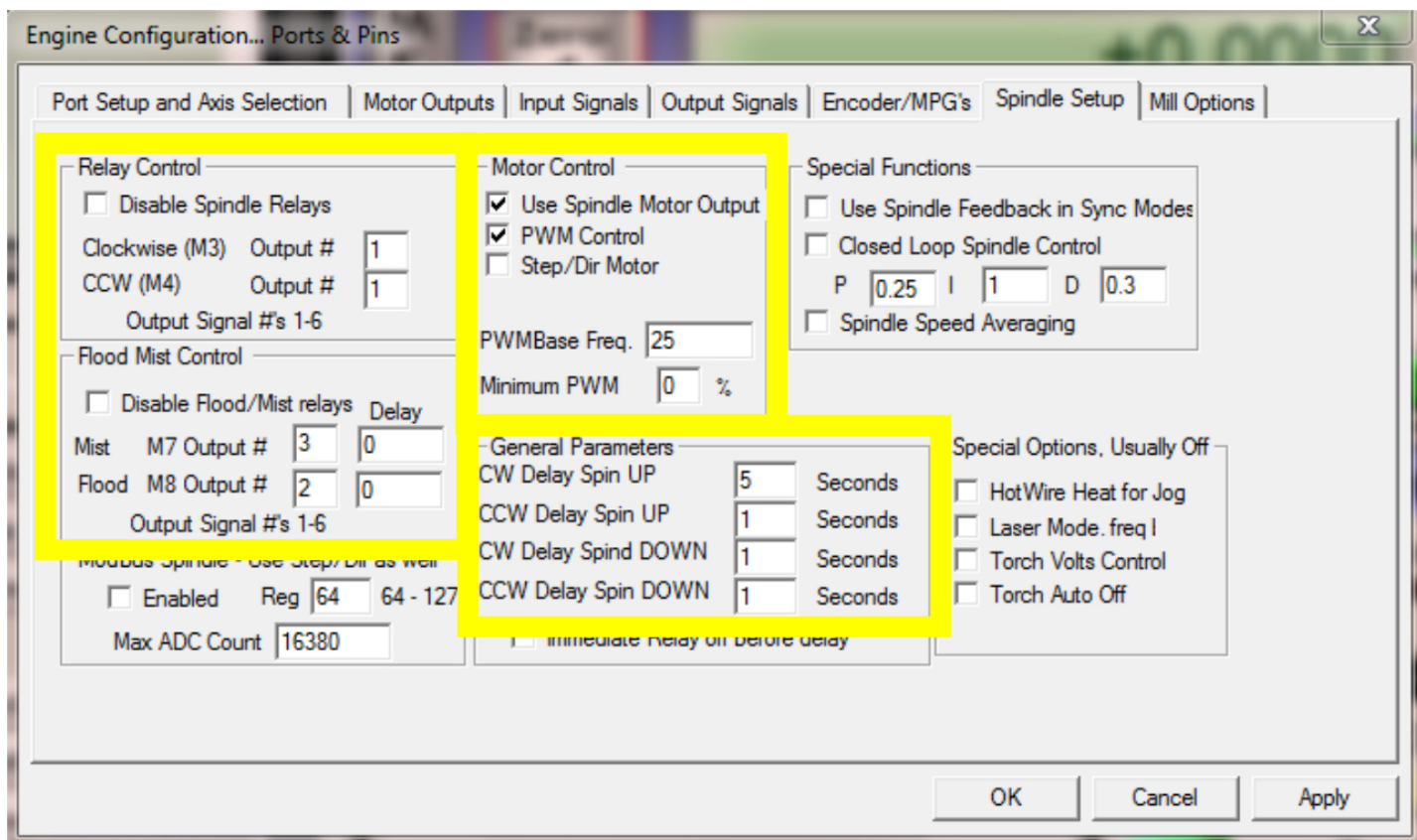
The Step Low Active must be enabled.

The Step Port must be 1 and the Dir Port must be 0.

Note: All of the other port and pin assignments in the above image should not be used as a reference.



Again under "Ports and Pins" navigate to the "Output Signals" tab. Enable Output 1. The Output 1 Port and Pin numbers should be changed to 1 and 17, respectively.



Again under "Ports and Pins" navigate to the "Spindle Setup" tab.

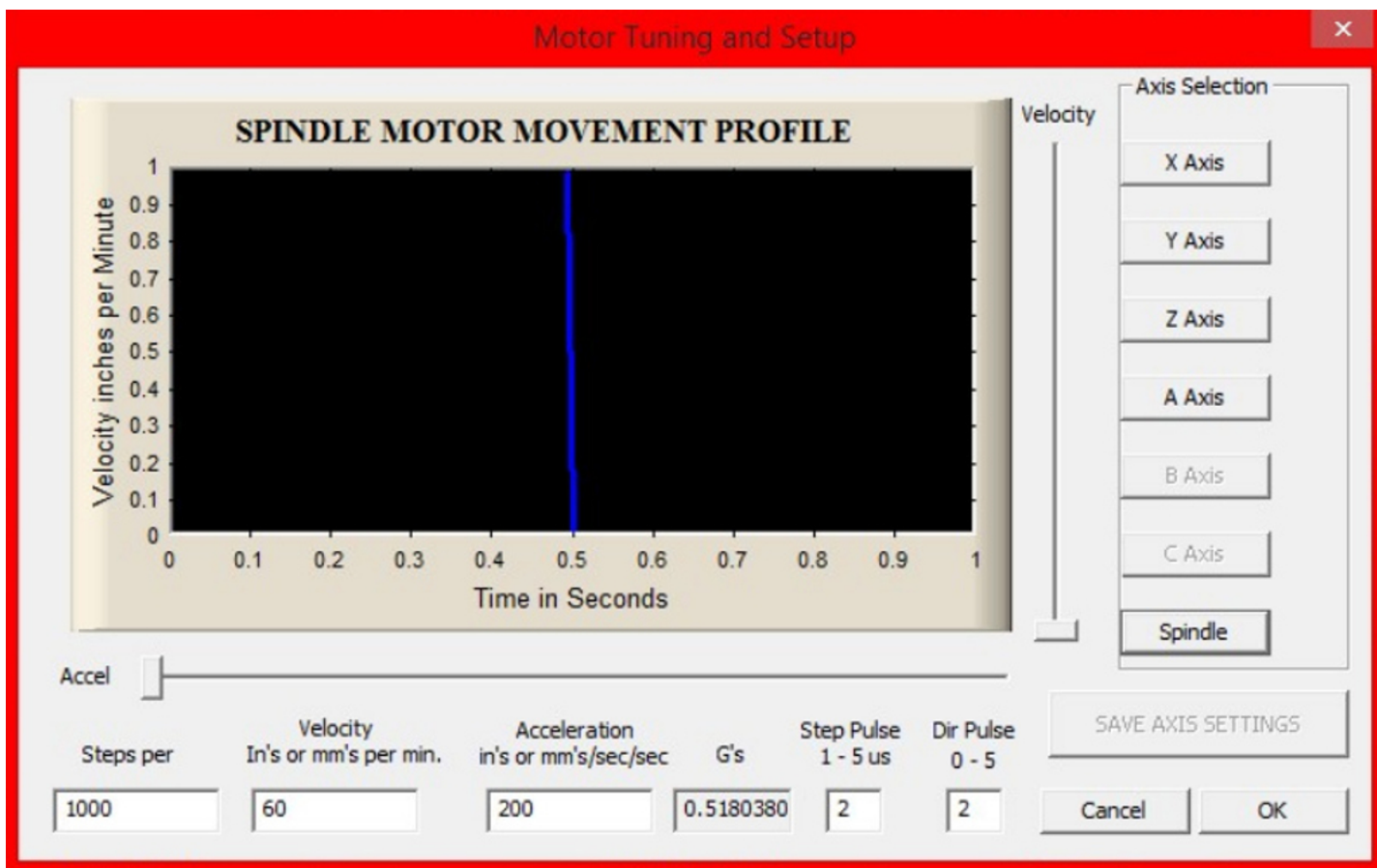
Under "Relay Control" un-check the box which says "Disable Spindle Relay."

Make sure "Clockwise (M3)" and "CCW (M4)" are both set to 1.

Under "General Parameters," **"CW Delay Spin UP" should be set to 5**. This ensures the spindle has time to get up to speed before starting a cutting operation. If you would prefer there is no delay before starting your program, leave this as 0.

Under "Motor Control" in the Spindle Setup tab, ensure the "Use Spindle Motor Output" and "PWM Control" boxes are both checked, while "Step/Dir Motor" is unchecked.

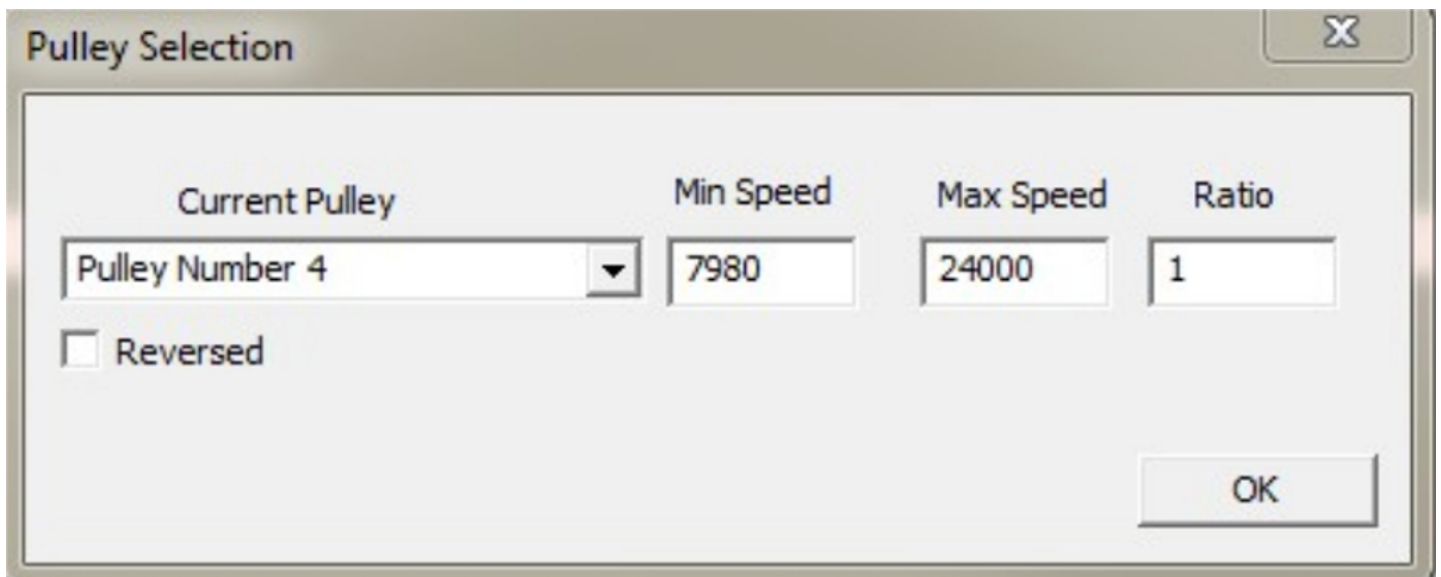
Set PWM Base Frequency to 25 and **Minimum PWM to 0%**.



Under the drop down menu "Config" choose "Motor Tuning."

In the Motor Tuning and Setup window, select "Spindle." Set "Steps Per" to 1000, "Velocity" to 60 and "Acceleration" to 200.

Click **Save Axis Settings** and then hit "OK." If you do not press "Save Axis Settings" the changes will not be retained.



| Current Pulley | Min Speed | Max Speed | Ratio |
|-----------------|-----------|-----------|-------|
| Pulley Number 4 | 7980 | 24000 | 1 |

☐ Reversed

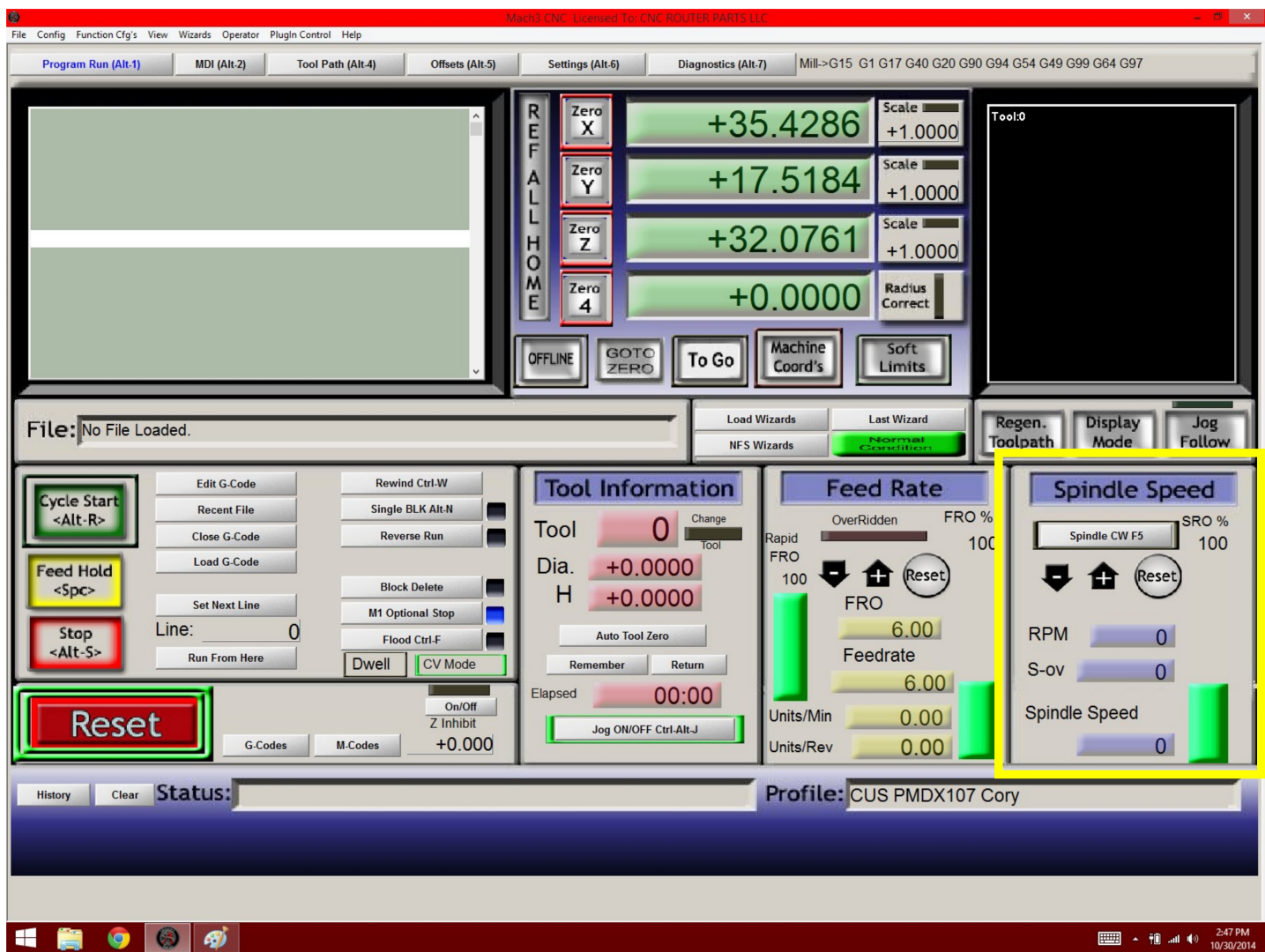
OK

Under the drop down menu "Config" choose "Spindle Pulleys."

In the Pulley Selection window, enter 7980 as the "Min Speed" and 24000 as the "Max Speed."

Do not alter "Ratio" and use Pulley Number 4 as that is the default.

Click "OK."



Mach3 is now configured properly for spindle relay and speed control.

Under the "Config" drop down menu, select "Save Settings" to lock in all the changes that you just made.

To prepare for testing the spindle, connect the control unit to the VFD unit, connect the VFD unit to the spindle, then power on the VFD unit.

Make sure to clear space around the spindle shaft and either remove or tighten the collet nut on the spindle shaft before testing.

To test the spindle, enter a speed between 8000 and 24000 into the "Spindle Speed" box. If you enter a value too low it will bump to 7980, too high and it will bump to 24000. If you accidentally enter a value too low or high, hit reset twice to clear the error code which appears in the "Status" bar.

Once you have input a valid Spindle Speed (not RPM or S-OV), click the "Spindle CW F5" button to turn the spindle on and run it at that speed.

Check that you can adjust the speed while the spindle is on by entering various speeds between 8000 and 24000 into "Spindle Speed."

If the spindle responds to these speed commands, your VFD and Spindle package is ready to use!

If your spindle does not function properly, please **Contact us**.