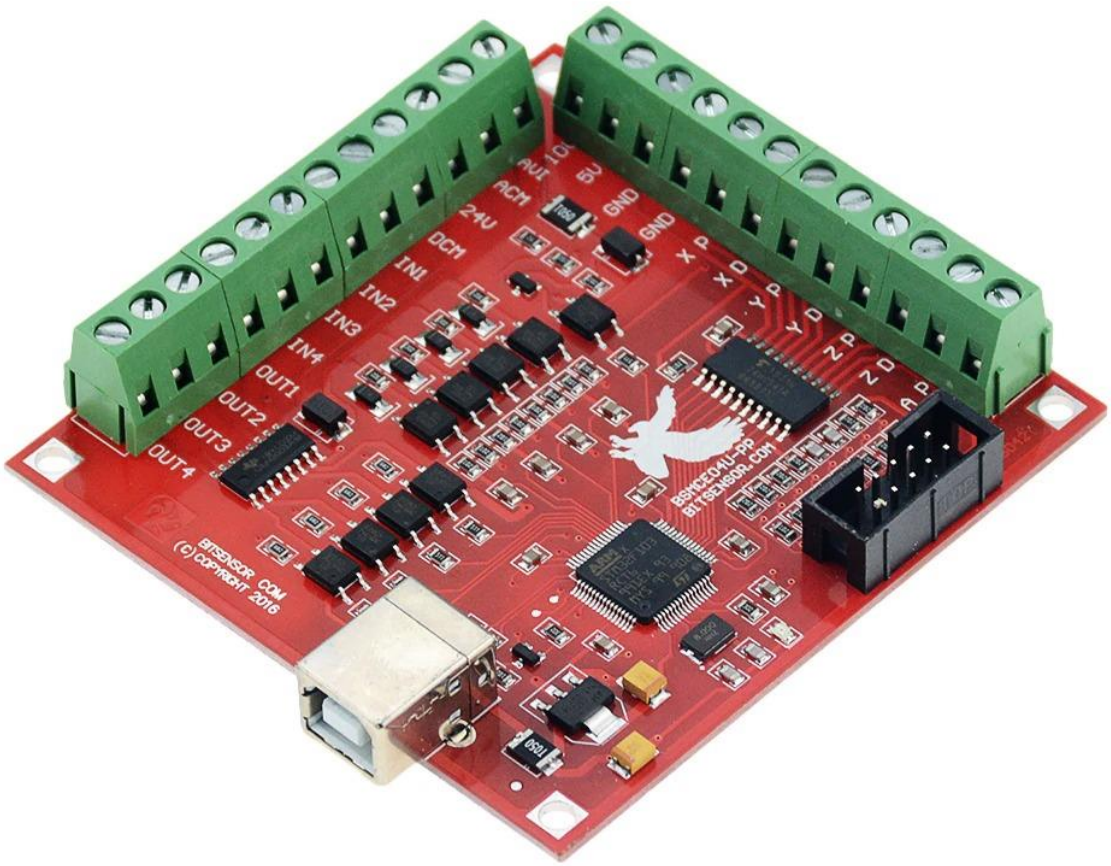
VIKING

4 Axis CNC USB Breakout Board Wiring & Set Up Guide



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0.0 Safety Statement

All machinery, especially CNC machinery, has inherent dangers and risks. It is the responsibility of the system designer to ensure that any systems built using any Viking Machinery Ltd. products are safe for use. Any technical information is provided as a reference only, and does not constitute a recommendation as to the fitness of use in any particular application.

Viking Machinery Ltd. strongly urges customers to seek expert advice when dealing with potentially dangerous electrical voltages and sources of mechanical energy. Information contained in this document does not constitute a substitute for expert advice.

1.0 Product Overview

- Controller interface: USB. USB A Male – USB B Male Cable Required
- Board supply voltage: 24V DC (Must be connected for full board function)
- Number of inputs: 4 (Preconfigured with pullup resistors)
- Dedicated spindle speed control options: 0-10V DC Analog
- Number of outputs: 4
- Board dimensions: 82mm x 78mm x 20mm approximate
- Mounting hole spacing: 70mm x 73.5mm – M3 screws & 6mm stand offs required for gear plate mounting
- Compatible with Mach3

2.0 Scope of Document

This document is designed to give an overview of the wiring options for the 4 axis USB breakout board product. It is assumed that your PC based software is installed as per it's instructions and is fully licensed.

Software setting examples are given for Mach 3 only.

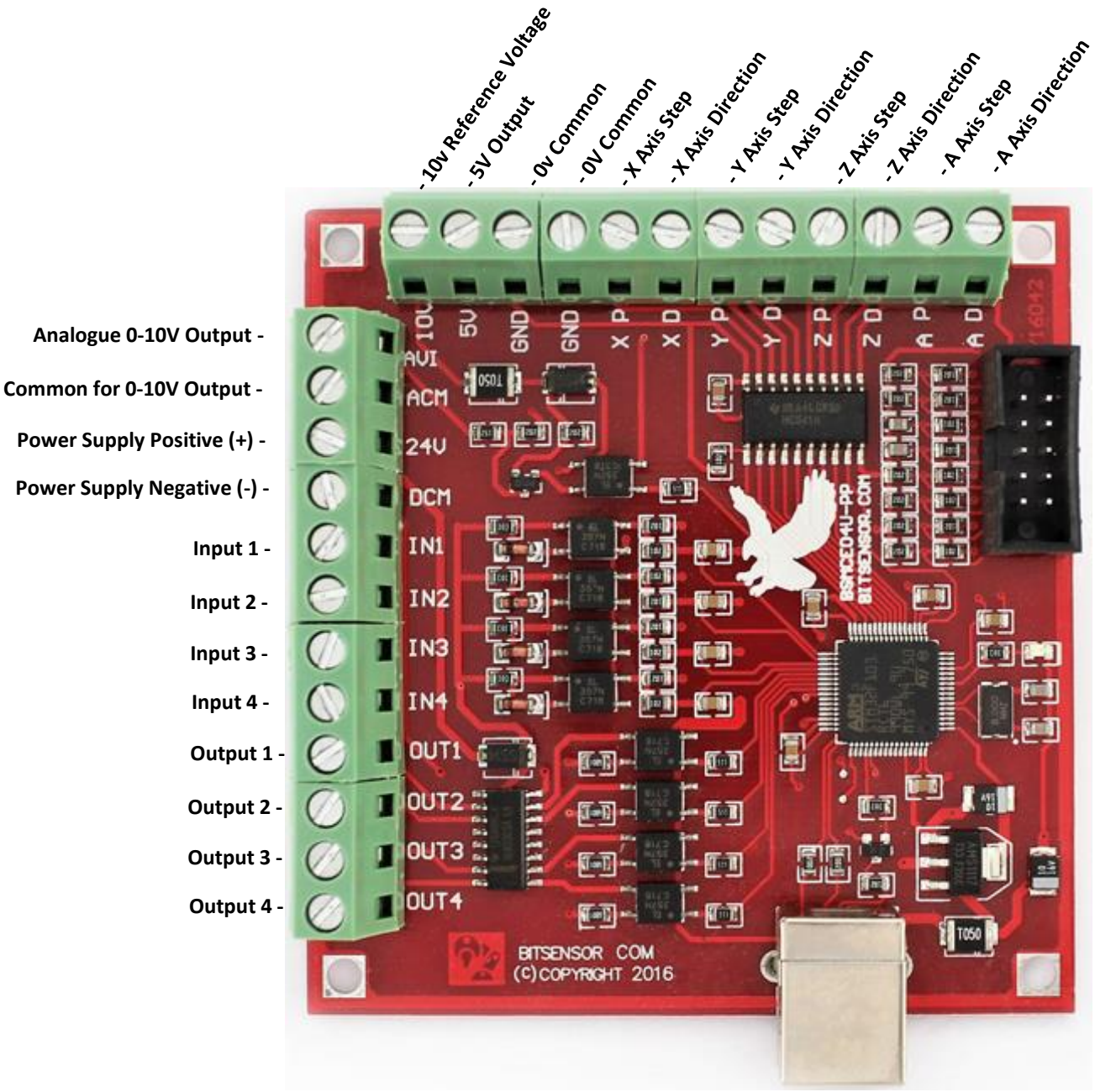
Only basic physical settings are covered. The Mach 3 user manual (which is linked to in this document) covers these settings and the relevant calculations in detail.

3.0 Pin Map & Conenctions

The output terminals below are called directly from the plugin. They are not set in “Ports & Pins” like you normally would expect in a typical Mach 3 set up.

It is essential that the 24V DC supply is connected, or else the inputs and 0-10V output will not function.

The MPG connection socket (the black one on the board) has not been referenced here as it deserves it’s own section.



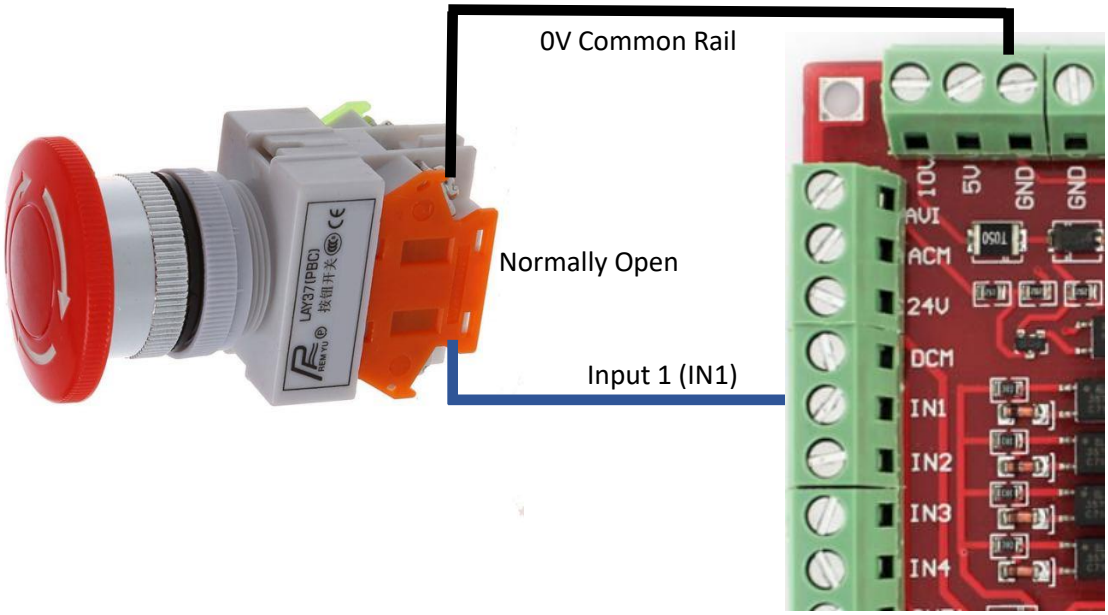
4.0 Input Wiring

4.1 E-Stop Wiring

The emergency stop is an essential safety component in the CNC control system. We strongly recommend that this is the first component connected in any project. Spare contact sets on the E-Stop button can be used to cut power to motor drives or other sub systems as required.

We recommend connecting the E-Stop in its normally open setting as this is the configuration that the board is configured to run in out of the box.

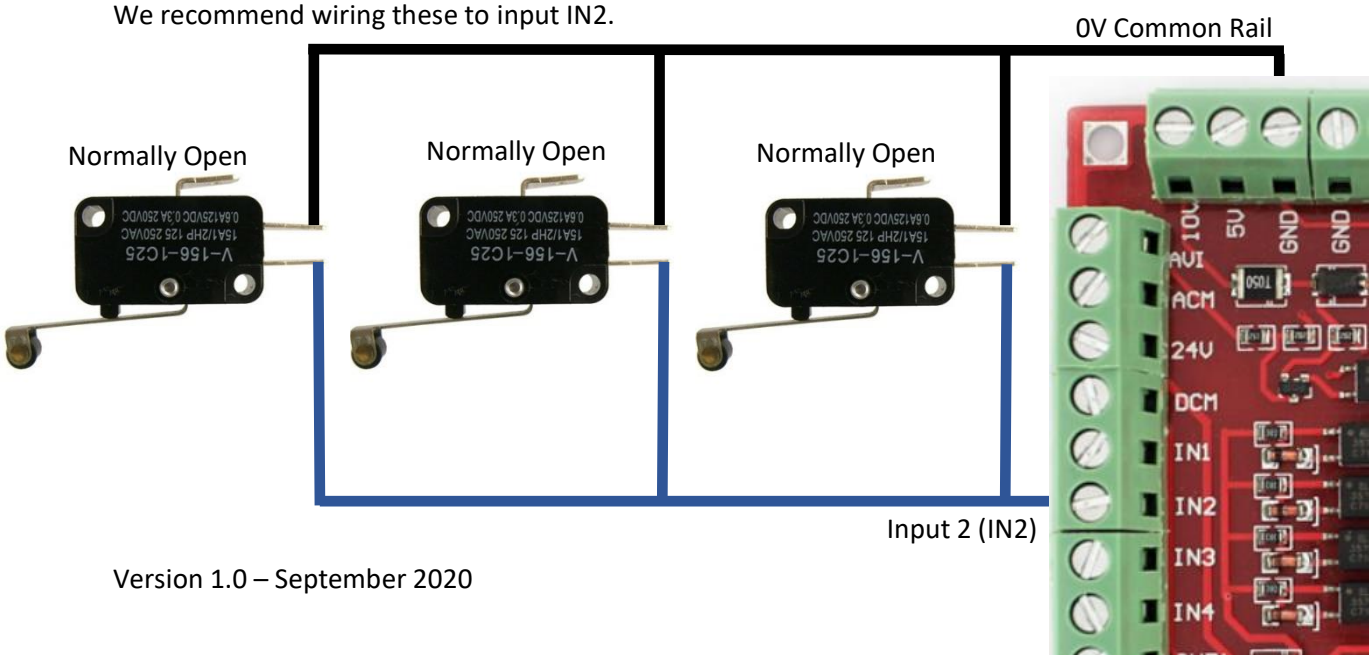
The E-Stop needs to be wired between IN1 and 0v to operate successfully.



4.2 Mechanical Limit Wiring (Parallel)

Parallel wired limit switches are a great way to protect your machine without using too many of your limited input pins. Using the normally open contacts on your limit switches you can connect any number of mechanical switches in parallel. We recommend using high quality switches such as the Omron V-156-1C25.

We recommend wiring these to input IN2.



4.3 Proximity Home Switch Wiring

Proximity sensors are a robust and accurate way to home your machine. We use Fotek PL-05N NPN proximity sensors wherever possible due to their ease of use and longevity. A sample circuit drawing is provided below using this particular sensor complete with colour coded wiring. Note that the wire colouring convention for proximity sensors is typically Brown for supply voltage, Blue for 0v common, and then black for signal. This can cause some confusion!

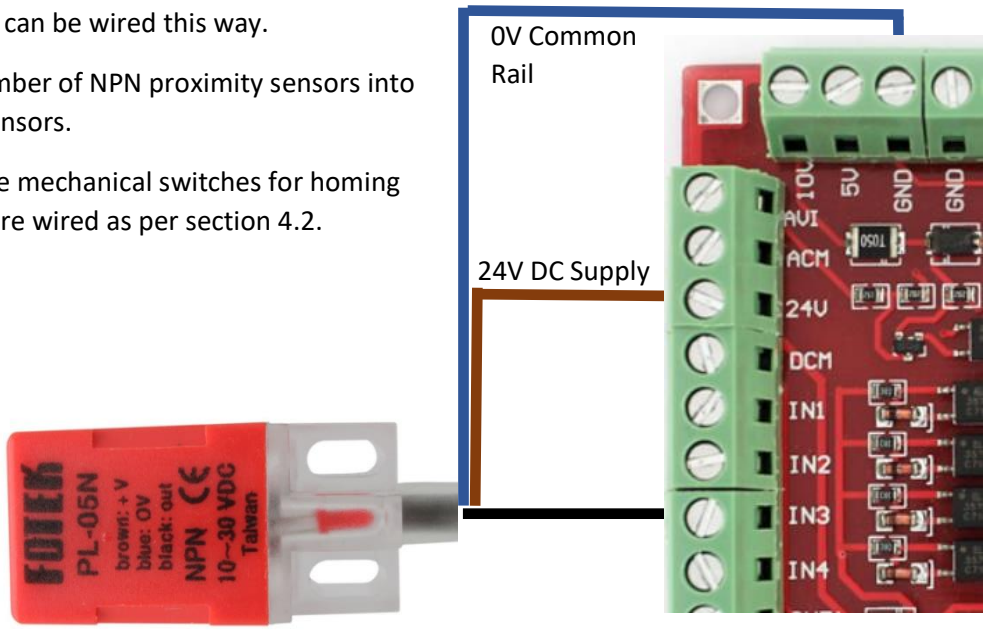
It is possible to use other makes and models of proximity sensor. You will need to refer to the manufacturers specifications for wire colouring, but the principle is the same.

To avoid damaging your breakout board it is essential to power your proximity sensors from the same power supply as the board.

Any of the input pins can be wired this way.

You can wire any number of NPN proximity sensors into Input IN3 as home sensors.

Note that you can use mechanical switches for homing if you prefer. These are wired as per section 4.2.



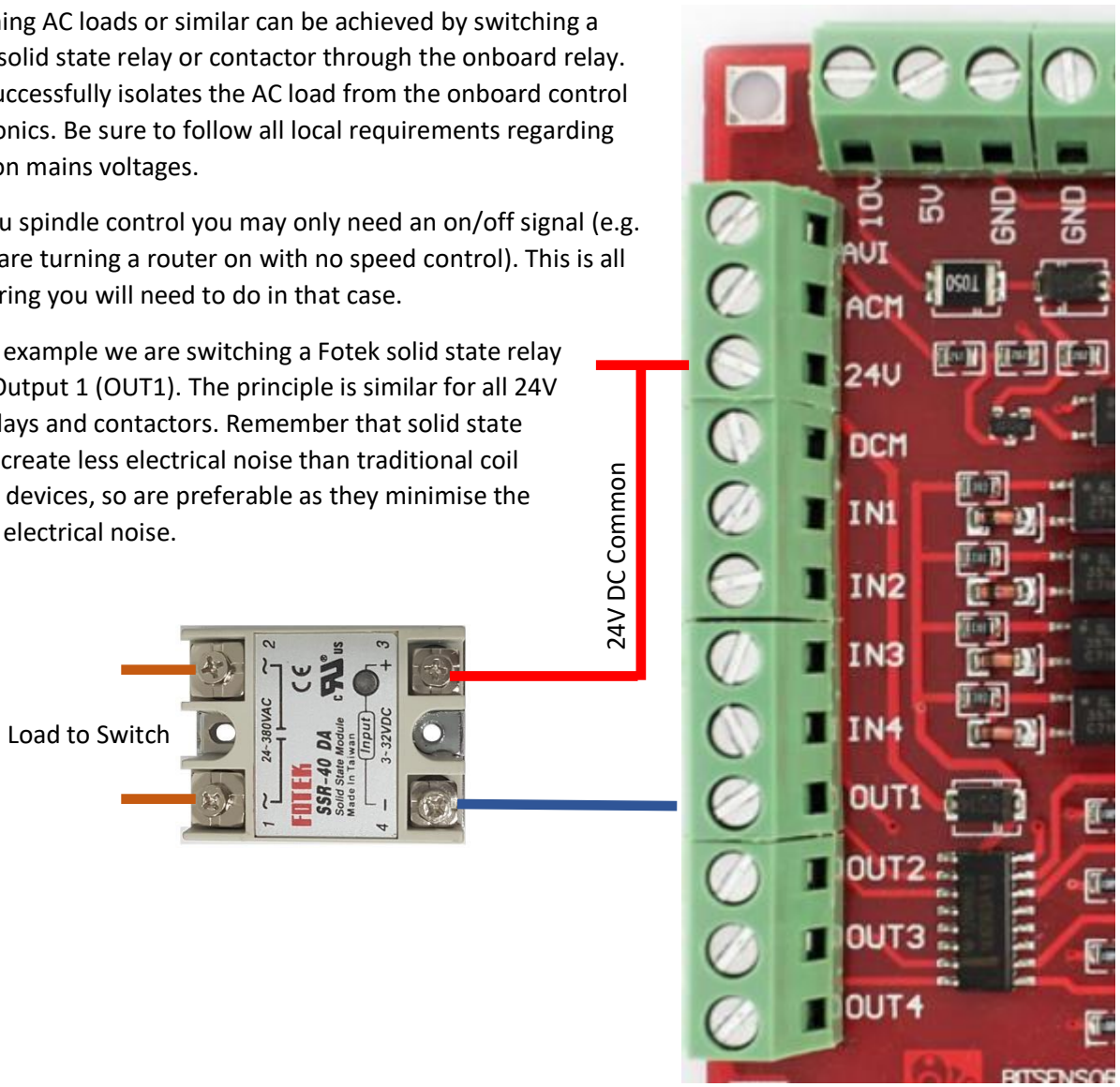
5.0 Output Wiring

5.1 Spindle Relay Wiring

Switching AC loads or similar can be achieved by switching a relay, solid state relay or contactor through the onboard relay. This successfully isolates the AC load from the onboard control electronics. Be sure to follow all local requirements regarding work on mains voltages.

For you spindle control you may only need an on/off signal (e.g. if you are turning a router on with no speed control). This is all the wiring you will need to do in that case.

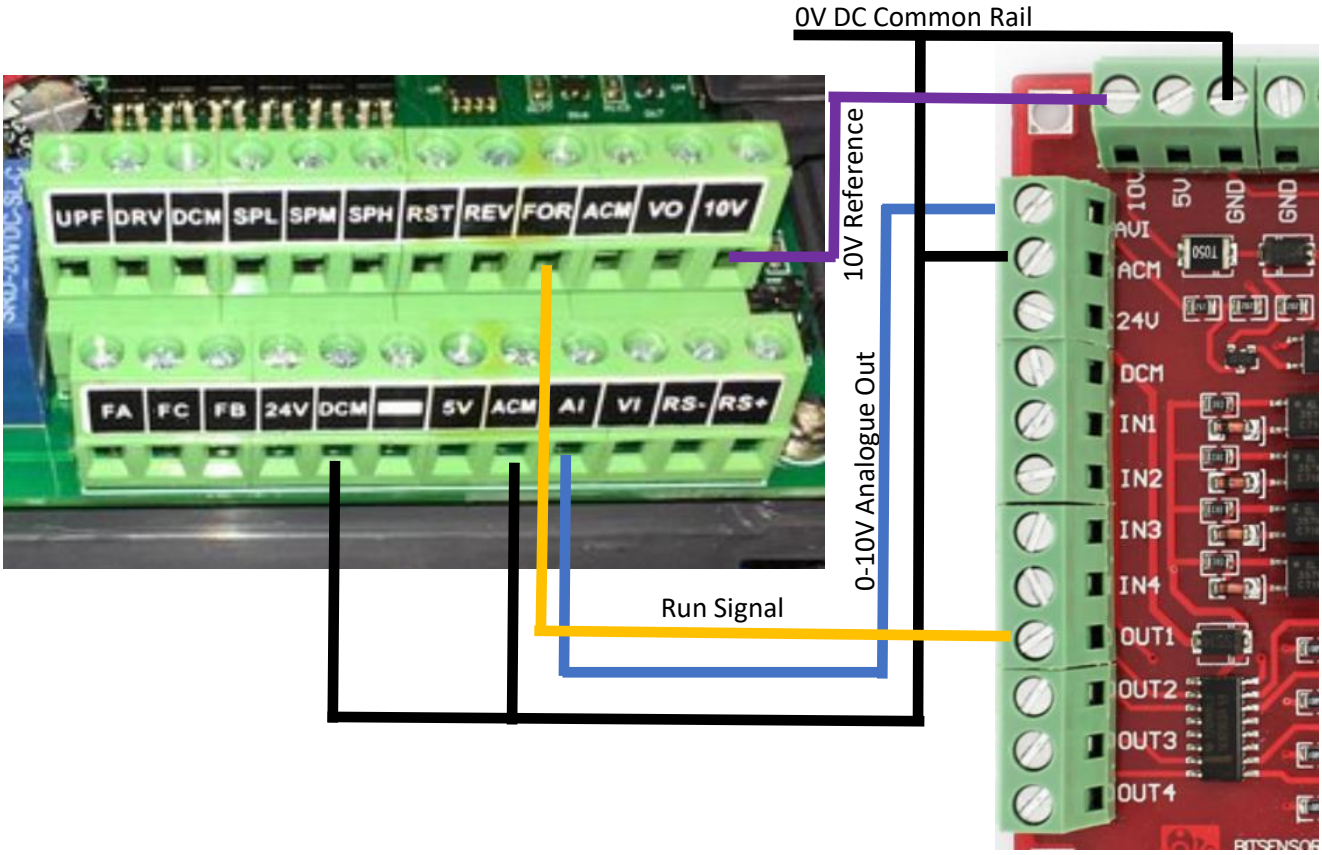
In this example we are switching a Fotek solid state relay from Output 1 (OUT1). The principle is similar for all 24V coil relays and contactors. Remember that solid state relays create less electrical noise than traditional coil driven devices, so are preferable as they minimise the risk of electrical noise.



5.2 Spindle Speed Control Wiring

The breakout board supports a 0-10V analogue output signal allowing you to deliver a speed control command to an external device such as a VFD. Typically, you will need to send a run signal AND a 0-10V speed signal. The diagram below shows how this is achieved, using the common Huanyang VFD as an example. You will need to follow the specific instructions for your VFD to ensure that it is correctly configured to accept external signals.

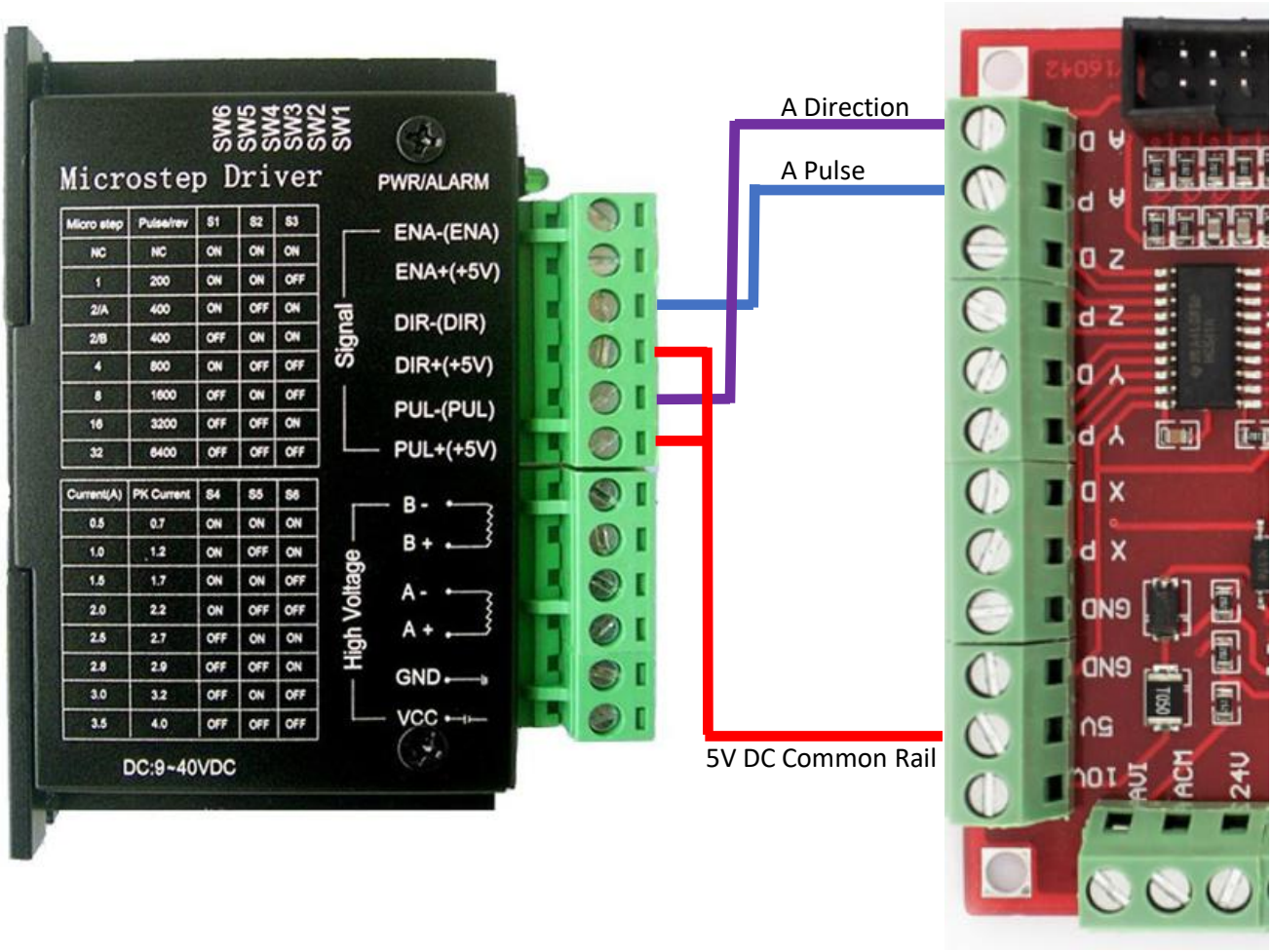
The diagram below shows the typical wiring for a Huanyang VFD using the 0-10V analogue method. For specific wiring details you will need to refer to your specific drive's user manual. It is essential that the 0V rail from the motor control drive and the breakout board are wired in common.



5.3 Stepper Motor Drive Wiring

This board will drive up to four stepper motor drivers. The example below shows the connection for the signal wiring to the TB6600 motor driver, specifically the connection of the A axis. Note that the wiring of the power and stepper motor are not shown in this diagram.

As you can see, the PUL+(+5V) & DIR+(+5V) pins on the driver are connected back to the 5V supply on the breakout board. The pulse (also called “Step”) pin on the stepper driver (PUL) is connected to the “A P” pin on the breakout board. The direction pin on the stepper driver (DIR) is connected to the “A D” pin on the breakout board.



6.0 Software Settings

6.1 Software Installation

Download and install Mach 3 as per the manufacturer's instructions. Software can be downloaded using the following link:

http://www.machsupport.com/wp-content/uploads/2013/04/Mach3Version3.043.066.exe

Note that Mach 3 will only run in demo mode until it is licensed. This will restrict functionality and limit the G code to 50 lines.

Viking machinery is a registered agent for Mach licenses – please contact us via email to purchase these if you do not already have one.

The user manual for Mach 3 can be found using the following link. Please read it carefully before proceeding.

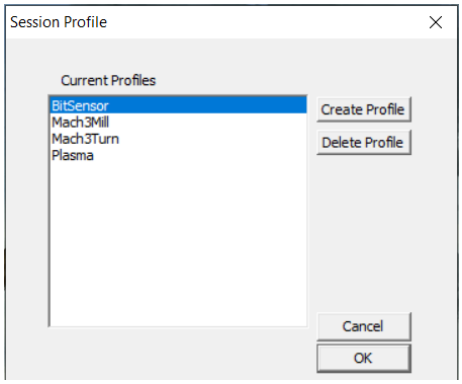
http://www.machsupport.com/wp-content/uploads/2013/02/Mach3Mill_Install_Config.pdf

After installation, you will need to move the plugin to the Mach 3 plugins folder. The plugin file "RnRMotion.dll" and preconfigured "Mach3Mill.xml" settings file both need to be downloaded from the link here:

https://github.com/Viking-Machinery/Software

Copy the "RnRMotion.dll" file to your Mach 3 plugins folder. Typically this is found under the directory; Windows(C:) > Mach3 > PlugIns

Before you copy the "Mach3Mill.xml" file to your Mach 3 folder, you want to rename it. We usually call it "BitSensor.XML". Copy this to the directory Windows(C:) > Mach3 . This is a preconfigured profile which has all of the ports and pins set up ready for you.



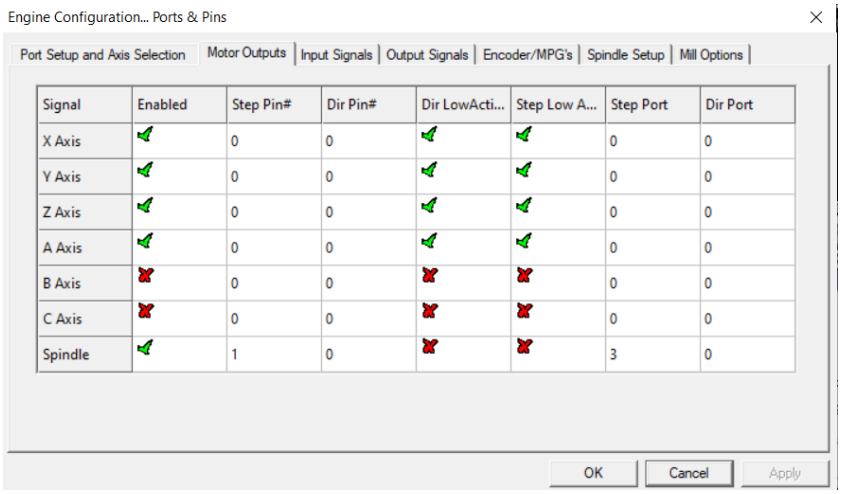
Now plug the control board in to your PC's USB port. Windows will automatically take some time to set up the drivers.

Run the Mach 3 loader. You will now have the option to choose the Mach 3 profile you want to use. Select the profile for the XML file you have just copied (in this case it is the "BitSensor" one) and then click OK.

Mach 3 is now generally configured for use. You will just need to set your real-world variables to match your hardware. We will cover this in the next section.

6.2 Motor Variable Set Up (Manual)

Mach 3 does not by default know how your machine is physically configured. We need to tell it how we want it to behave.

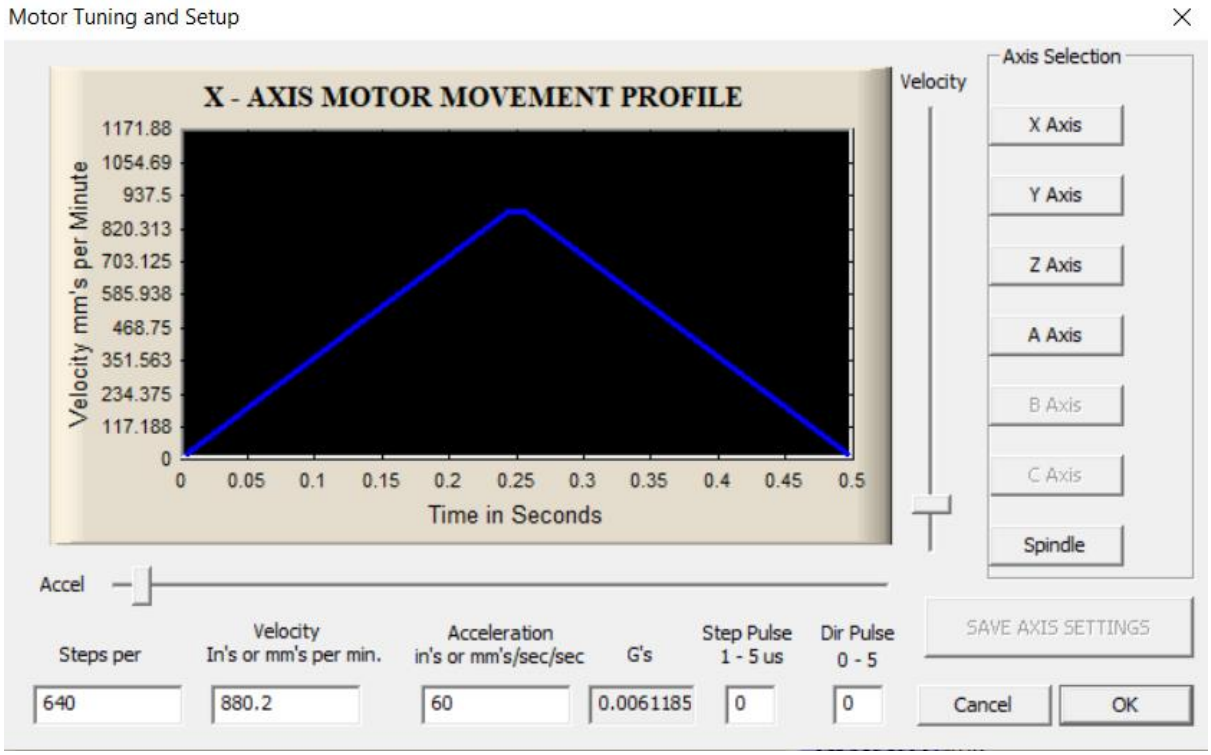


The ports and pins are already set for you as part of the XML file. You will notice that the ports and pins are not all alocated to non-zero intigers. This is because the USB plugin is taking care of this for you already.

With Mach 3 opened, click "Config" > "Motor Tuning". You will be taken to the motor tuning window that is shown below. You need to select the axis you want to tune from the buttons on the right.

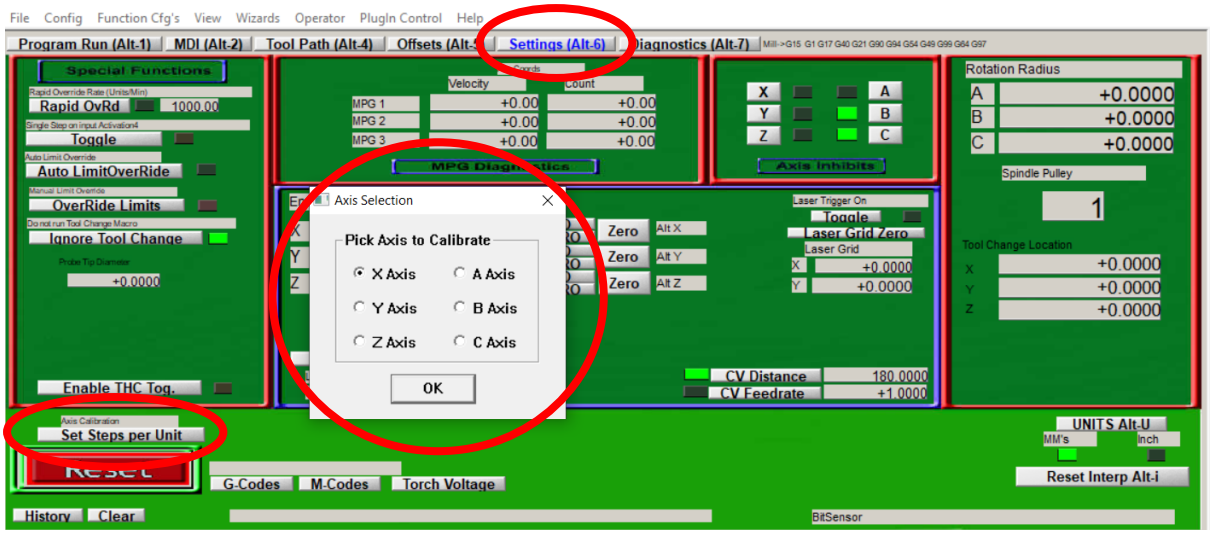
You need to set your variables in the bottom text boxes on this window. The "Steps Per" box sets the number of pulses the computer needs to send to move the axis by one unit. This will be a product of your motors, drive settings and mechanical configurations. The "Velocity" box is the maximum axis speed that you want to limit the axis to. The "Acceleration" box sets the acceleration (how quickly the machine will change it's speed) – generally a high acceleration gives better performance, but is harder on the machine and can result in lost steps.

Once you have set your axis profile, make sure to click the "SAVE AXIS SETTINGS" button in the bottom right corner before changing to another axis or closing the window.



6.3 Motor Variable Set Up (Automatic)

Mach 3 has a utility that will help you to set your Steps per Unit. Click to the Settings tab, then click the “Set Steps per Unit” button in the bottom left. The “Axis Selection” window will pop up. Choose the axis you want to calibrate, then click OK. Follow the instructions that pop up on screen.



6.4 MPG Set Up

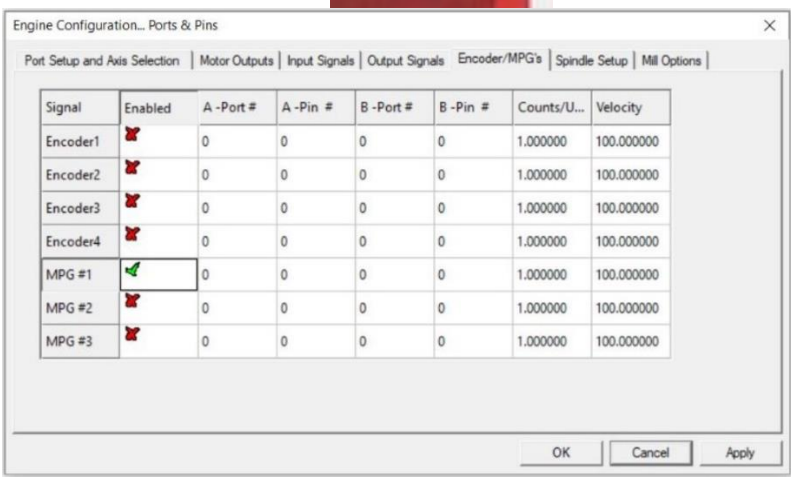
This board supports inputs from an MPG (Manual Pulse Generator) via the black socket on the board. The pins are labelled in the diagram to the right.

The 5V supply pins can be used to power your pulse generator.

The Pulse A & B channels are held high at 5V, and need to be switched down to 0V to transmit a signal.

All the other pins are held high at 3.3V, and need to be switched down to 0V to transmit a signal.

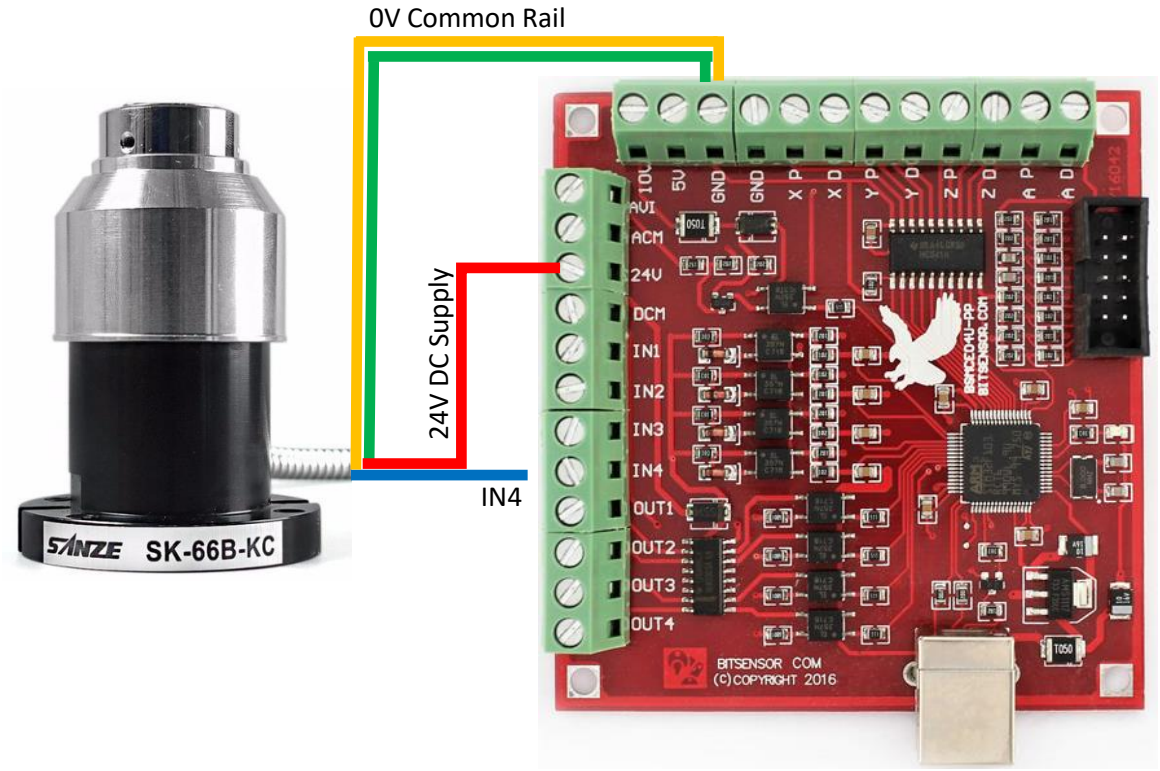
The MPG settings are already enabled in the provided XML file. Notice that there are no ports and pins allocated. This is because the USB plugin is taking care of the ports and pins.



6.5 Probing

The XML provided has input 4 set up as a probing input. Mach 3 has various options and methods. As a general rule, you need to switch Input 4 (IN4) to 0V common to create a signal. Our CNC tool setter (CNC-TS-01) manual covers this in some detail. The wiring diagram for this set up is shown below.

The above-mentioned manual contains some detail on writing your own probing macro.



7.0 Reference Links

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Viking Machinery - TradeMe Store

https://www.trademe.co.nz/Members/Listings.aspx?member=4906214

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https://www.thingiverse.com/VikingNZ/about

https://www.youtube.com/channel/UCgnl_7dUO9MeNOyI_jWO5QQ?view_as=subscriber

https://grabcad.com/james.hussey-3

Mach3 Useful Links

http://www.machsupport.com/wp-content/uploads/2013/04/Mach3Version3.043.066.exe

http://www.machsupport.com/wp-content/uploads/2013/02/Mach3Mill_Install_Config.pdf