For boards purchased after 10/12/09.

B1-Variable Speed Control V1 (B1-VSC-V1)

http://www.cncdoctor.co.uk

1. Overview

A Variable frequency drive or inverter works by modifying the frequency of AC motors. You can control many of these with an external analogue signal (0-10V DC). If this board (B1-VSC-V1) outputs 5v the motor will run at 50% of the full speed, if it outputs 10v the motor will run at 100% of full speed. If there is no input signal the analogue output will go to 0v and the motor will stop.

2. Features

- *A step input is converted in to a 0-10V analogue output.*
- ***Opto-isolated step input signal.***
- *An input frequency from 0-25 KHz with a Minimum on-state pulse width of 3uS (5uS is recommended) will deliver an analogue 0-10V output for controlling a VFD (variable frequency drive).*
- *An on board Isolated supply.* ***This board can share a grounded power supply*** *even on VFD's (Variable Frequency Drives), DCMSC (DC Motor speed controllers) or inverters that have a 0-10V input signal at mains potential (e.g. non isolated input signal).*
- *A precision potentiometer for fine-tuning the output voltage.*

3. Safety notice

Be careful when wiring up any device that is 110V or greater. Always disconnect the device and wait 60 seconds or greater before touching the terminals. Please don't rely on this unit to stop the VFD, Inverter drive etc. use other means of isolating the drive by the use of a relay/contactor on it's power supply or run signal.

4. Tips

I recommend that you first get the drive and motor working with a potentiometer before you connect this board, you may need to tune your drive to suit the motor being driven. It is much better to do this before you install the B1-VSC unit to avoid confusion when setting up.

5. Configuring Mach

Step 1.

Go into “Mach 3” ->” Config”->”Engine Configuration…. Ports & Pins”->”Spindle Setup”

In the Motor Control column

- Tick Use Spindle Motor Output
- Tick Step/Dir Motor
- Apply these changes

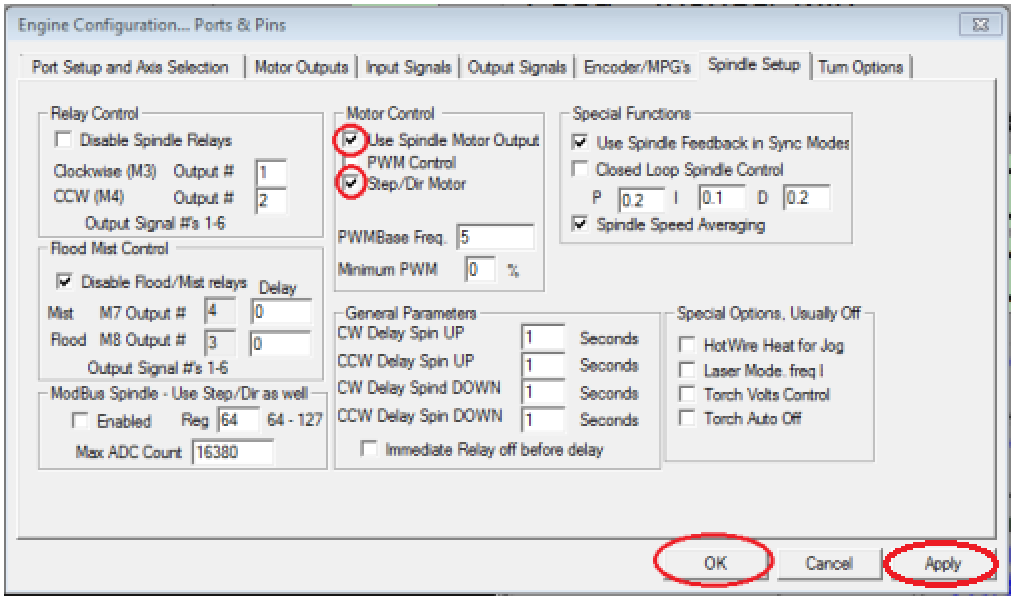


Fig. 1. Spindle Setup screen shot.

Step 2.

Go into “Mach 3” ->” Config”->”Engine Configuration…. Ports & Pins”->”Motor Outputs”.

- Enable the spindle signal with the check box
- In the step box select the pin you want to use (this will be the pin that supplies the step signal to the B1-VSC).
- Set the step port (parallel port selection)
- Apply the changes

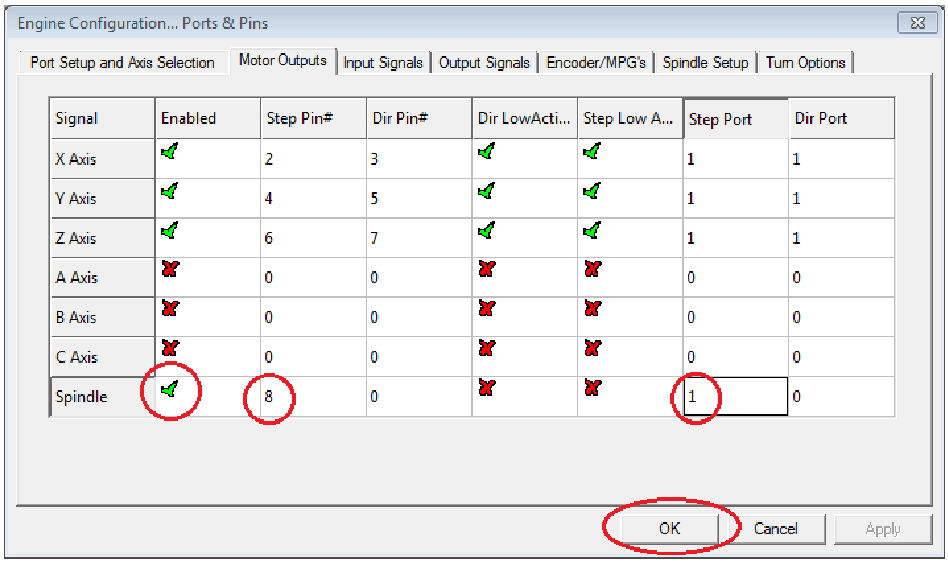


Fig. 2. Motor Outputs screen shot.

Step 3.

Go into “Mach 3” ->” Config”->” Motor Tuning and Setup”

- Select spindle.
- Enter 1000 in the steps per box (left hand side).
- Under Step pulse length set to 5. This number is directly proportional to the final voltage you will get from the analogue output. Note: Use this number and fine-tune pot (VR1) to adjust the voltage you want to get at max speed.
- Move the velocity slider to its maximum (to the top).
- For acceleration, choose the acceleration that you feel comfortable with.
- Save Axis Settings.

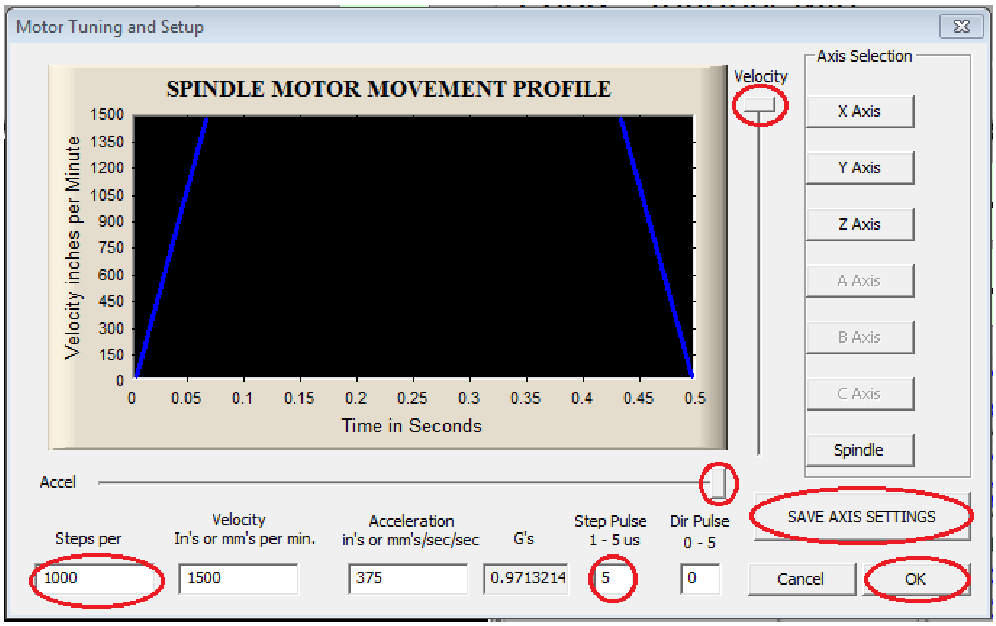


Fig. 3. Motor tuning screen shot

Step 4.

Spindle pulley setup

The final step is to tell Mach how fast the machine can go- so it knows what speed to associate with the step pulses. You do this in the pulley configuration dialog.

- Go into “Mach 3” ->” Config”->”Spindle pulleys”
- Enter the minimum and maximum speeds.
- Press OK.

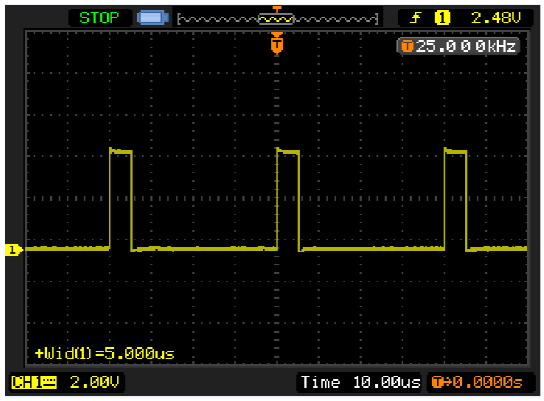


Fig. 3.1. Oscilloscope screen shot (input).

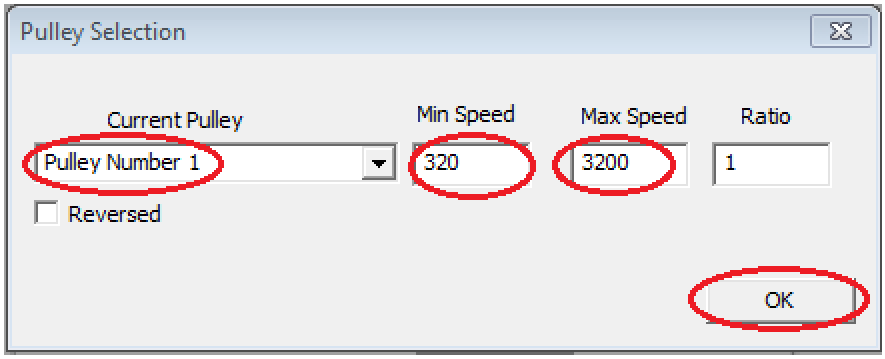


Fig. 4. Spindle Pulleys screen shot

6. Wiring/ connections

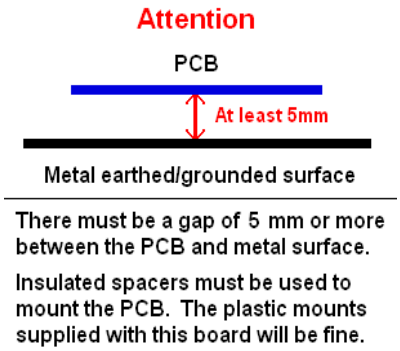
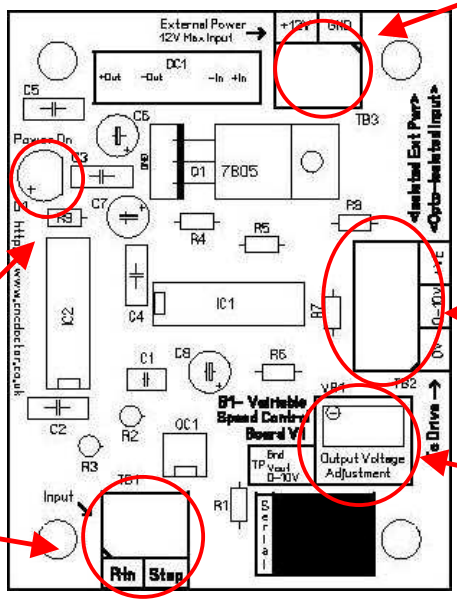


Fig. 6. B1-VSC-V1 connections.



Power on LED

(**TB1**)
Step input signal.
Opto-isolated.
0-25KHz.
Minimum on-state pulse width 3uS.

(**TB3**)
Power connectors. The supply to this board does not need to be isolated.

(**TB2**)
Analogue output connections (these connections replace a potentiometer). On some drives you may need to connect the +VE. **Do not** connect 0V to any other circuit or common ground.

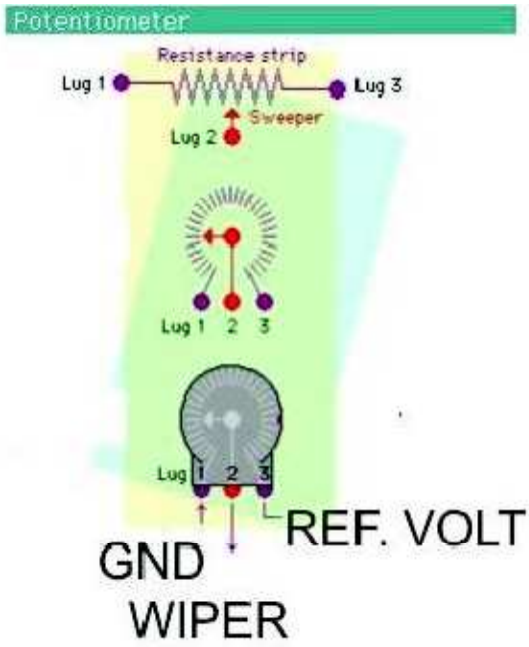
(**VR1**)
Analogue output voltage. Fine-tune potentiometer

7. Replacing a potentiometer with our 0-10V VSC.

Note: Please see page 5 section 8 (Calibration) before connecting to your VFD/Inverter drive.

This unit can be used to replace a potentiometer on many types of motor speed control circuits. Measure the voltage between the reference voltage (P3) and GND (P1) on the potentiometer with a DVM (Digital Volt Meter). If this reading is between 10V-12V this will be fine.

Fig. 7. Potentiometer connections.



- Remove the potentiometer.
- Connect +VE from TB2 to Reference Voltage (P3).
- Connect the 0V from TB2 to GND (P1).
- Connect 0-10V from TB2 to the wiper (P2).

P1 = GND
P2 = Wiper
P3 = Reference voltage

8. Calibration.

After configuring Mach these are the following steps that should be followed.

Step 1. Ensure that all external power sources are OFF.

Step 2. Connect a power supply (Max 12v DC) to the power inputs TB3.

Step 3. Connect the input signals to TB1. The step input needs a 25Khz signal to produce a 0-10V analogue output voltage.

Step 4. Connect a DVM (Digital Volt Meter) between the analogue output and 0v.

Step 5. Set Mach3 to use the fastest rpm range (or pulley) for step 7 calibration of the VSC.

Step 6. Turn the external power supplies on.

Step 7. You need =< 1V @ 320 and 10V @ 3200.

Step 8. Ensure that all external power sources are OFF and then connect the VSC to the VFD. **Note:** Read your VDF's/Inverter drive manual thoroughly before connecting this board.

Step 9. Start the spindle by using the MDI line e.g. type S320 and press enter then type M3 and press enter. Slowly ramp up the speed using the radio button (Fig.7.). Adjust the maximum speed with the VFD's on board potentiometer. If you can't slow it down enough on the VFD, then limit the VSC using the fine-tune potentiometer (Fig.8.).

Step 10. When the maximum speed is set, reduce the speed to e.g. 320 and use the Minimum speed potentiometer on the VFD to set the desired minimum speed.

Note: All potentiometers (on VSC & VFD) affect each other.

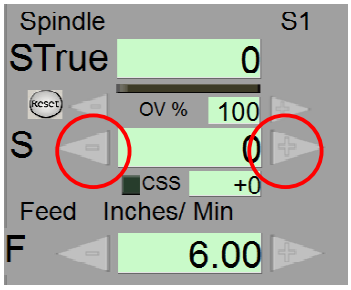


Fig. 7. Radio button.

Make sure when you reach the maximum speed in your control software you get 10V DC out on TB2. The voltage can vary depending on many things, including the electrical properties of your parallel port or breakout board, the length of step pulses that your control software is delivering and the normal hi or low status of the step pin.

Fig. 8. Fine-Tune potentiometer.

Pot for fine-tuning the analogue output voltage.

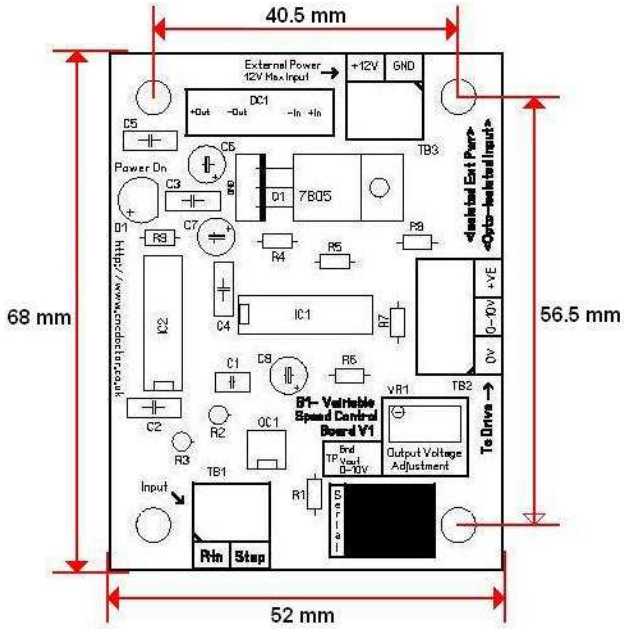
Make sure that the supply is disconnected from your VDF before connecting this unit. If you are connecting this unit to a VDF that has been operated disconnect the supply and wait 60 seconds or greater before touching the terminals.

9.Ratings & dimensions

Maximum Supply (TB3)	Max 12V DC
Operating current	Max <70mA @ 12V DC
Polarity protection	None

Step input specifications (TB1)	
On-state voltage	5V
Minimum on-state current	Aprox 10 mA
Maximum off state voltage	Aprox 0.8 V
Minimum on-state pulse width	3uS
Signal type	Active High

Fig. 8. B1-VSC-V1 Dimensions.



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