



Aircooled ER20 Spindle & H100 VFD 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.

IMPORTANT: Incorrect VFD configuration can and will cause serious damage to the hardware, and can result in dangerous situations such as overheating. As the motor cooling for this unit relies on the spindle coupled fan, the minimum RPM limits **MUST** be adhered to, or else the motor will overheat and fail.

1.0 Product Overview

- Spindle Power – 2.2kW
- Spindle Maximum Speed – 18,000 rpm
- Spindle Minimum Speed – 6,000 rpm
- VFD Supply Voltage – 230V AC
- VFD Maximum Current – 9.5A

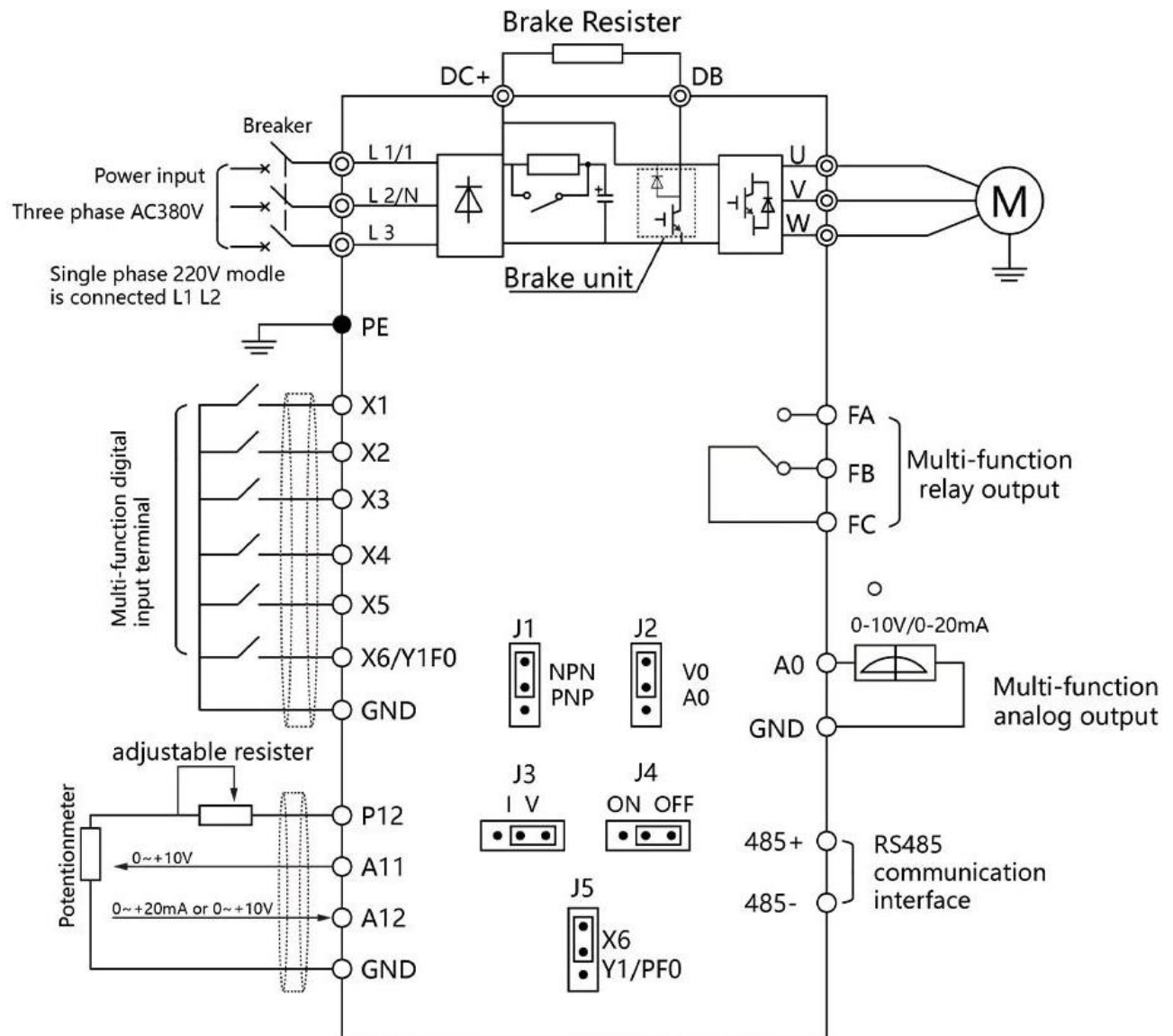
2.0 Scope of Document

This document is designed to give an overview of the wiring options for the aircooled ER20 spindle and H100 VFD products. The H100 VFD accepts several input / control wiring set ups, but only those commonly used in CNC applications will be discussed here.

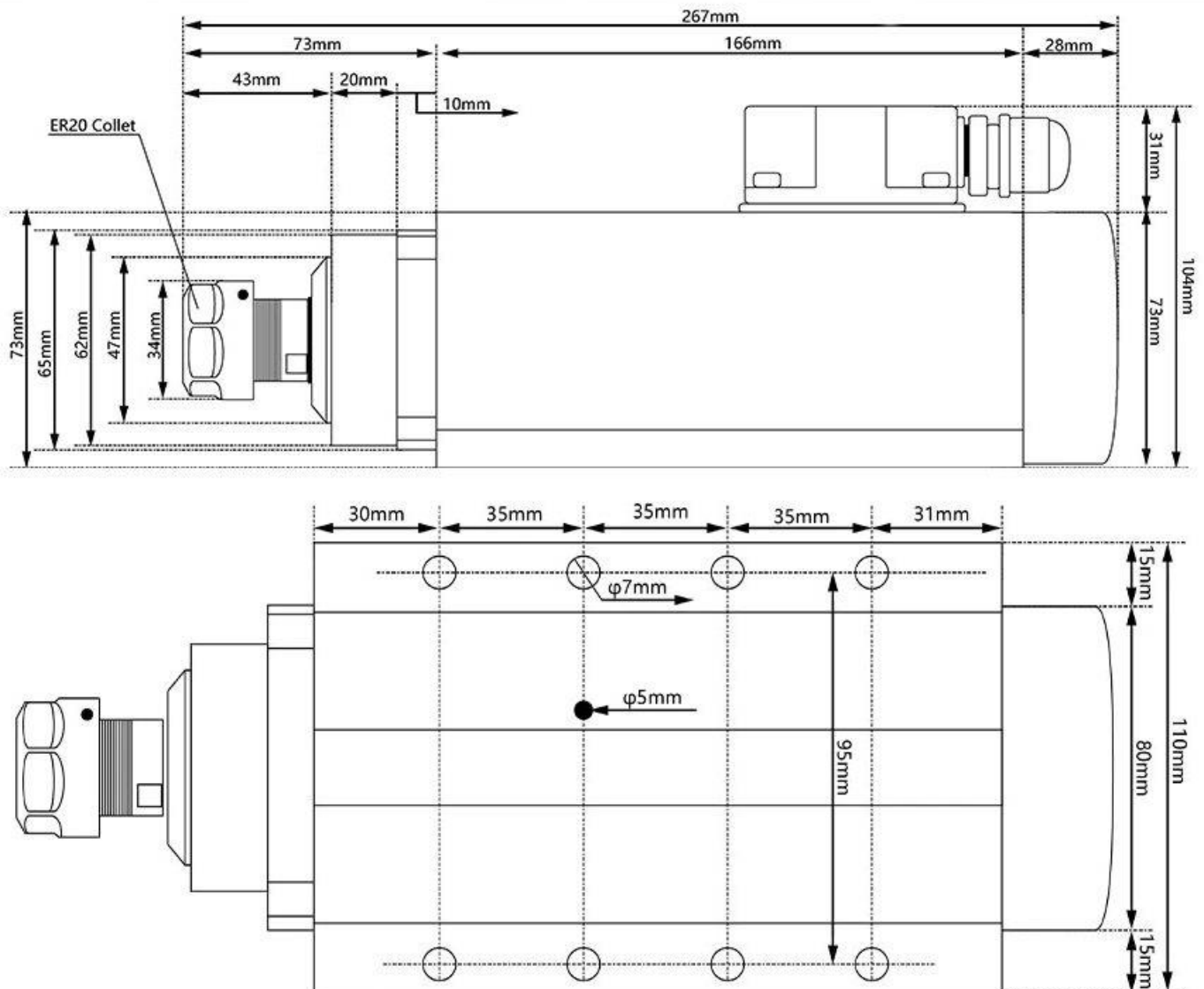
There is a factory supplied user manual for the H100 VFD. It is available for download [HERE](#). Please familiarise yourself with this document as it contains much technical information that will not be covered in this document.

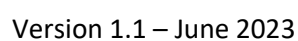
Software setting examples are given for Mach 3 only, but other CNC software such as the Centroid CNC12 program will also work with the board. The principle of operation is the same.

3.0 Inverter Schematic



4.0 Spindle Dimensions

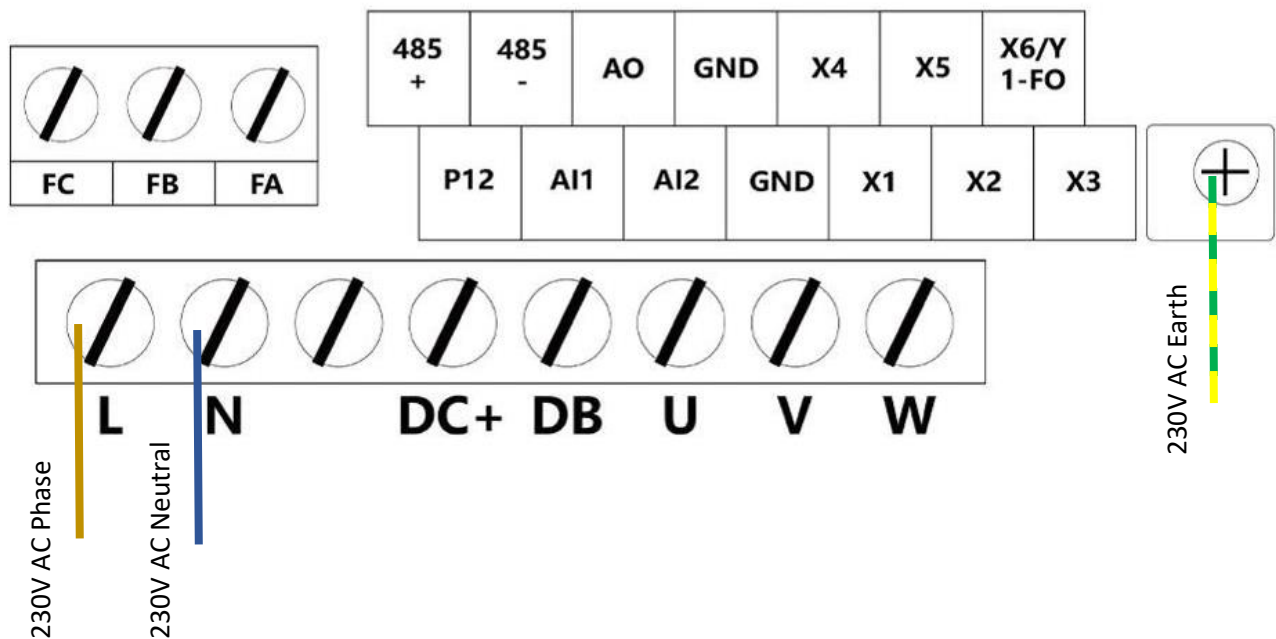




6.0 Power Wiring

Start by wiring the drive for 230V power supply. Note that the protective earth (PE) is located away from the input terminals to the right of the control terminal group. The diagrams below show both the actual 'as photographed' VFD connection area, and also the labelled schematic view.

NOTE THAT THIS IS A MAINS ELECTRICITY CONNECTION, AND SHOULD ONLY BE DONE BY A QUALIFIED AND COMPETENT ELECTRICAL WORKER

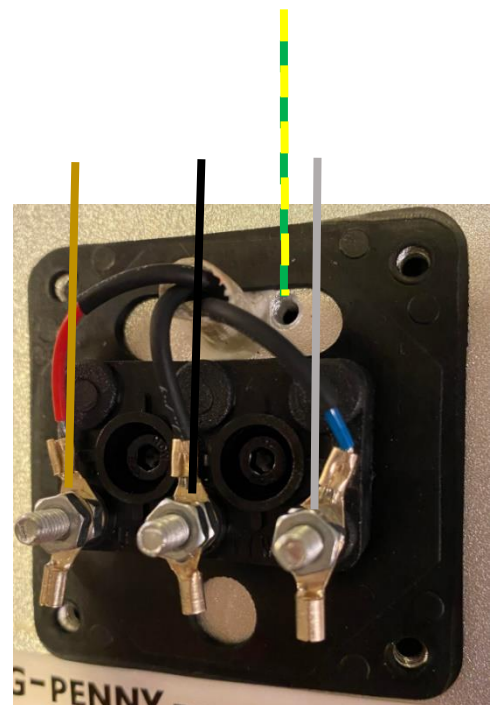
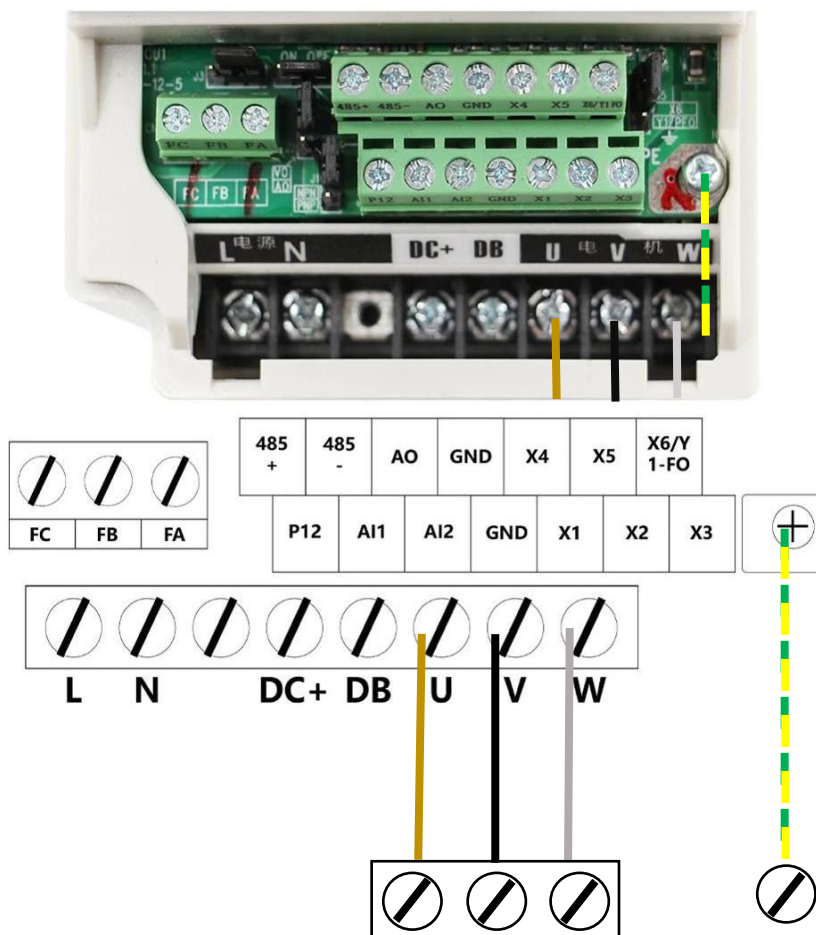


7.0 Spindle Wiring

Next wire the spindle to the VFD. Again, note that the protective earth (PE) is located away from the input terminals to the right of the control terminal group. The diagrams below show both the actual 'as photographed' VFD connection area, and also the labelled schematic view.

Use appropriate shielded 3C+E VFD rated flexible cord for this connection. The shielding should be connected to chassis ground at the control cabinet end only.

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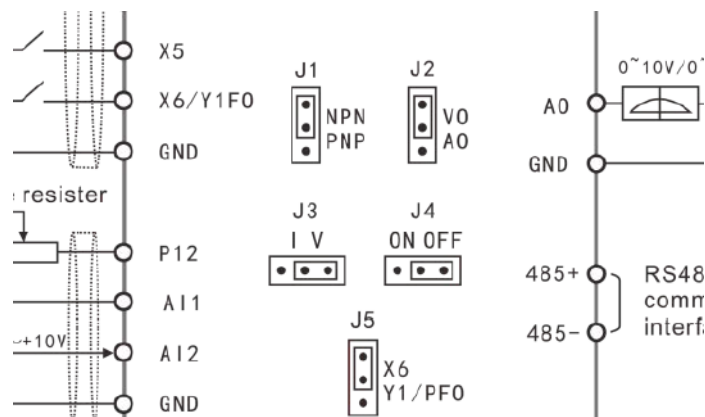
8.0 Jumper Setting

Only change the jumper settings of the drive with the power off! Changing with power connected can damage the drive.

The H100 VFD comes with a series of PCB mounted jumpers. These are used to set various functional parameters on the board. If they are not set correctly, you may not get the behaviour from the inverter you expect! For the wiring set up we will cover below, you will want to set the jumpers as per the schematic.

If you need any further information on jumper settings, please refer to page 13 (section 3.5) of the H100 user manual.

No.	Function
J1	Selection of X1-X6 wiring mode: NPN PNP
J2	Selection of AO output: VO, voltage AO, current
J3	Selection of AI2 input: V, voltage A, current
J4	RS485 communication interface terminator enabled: ON OFF
J5	Selection of X6 terminal function reuse: X6 Y1_PFO



9.0 Input Terminals Overview

The green screw terminals of the inverter are used for the logic level input / output control between this device and your machine controller. Note that each terminal is labelled, and a description and default setting can be found in the table below.

Please make sure to connect both “GND” terminals back into the common DC bus of your machine controller, or else you will not get proper communication between devices.

For the parameters required to change these default settings, please see page 22 of the H100 user manual.

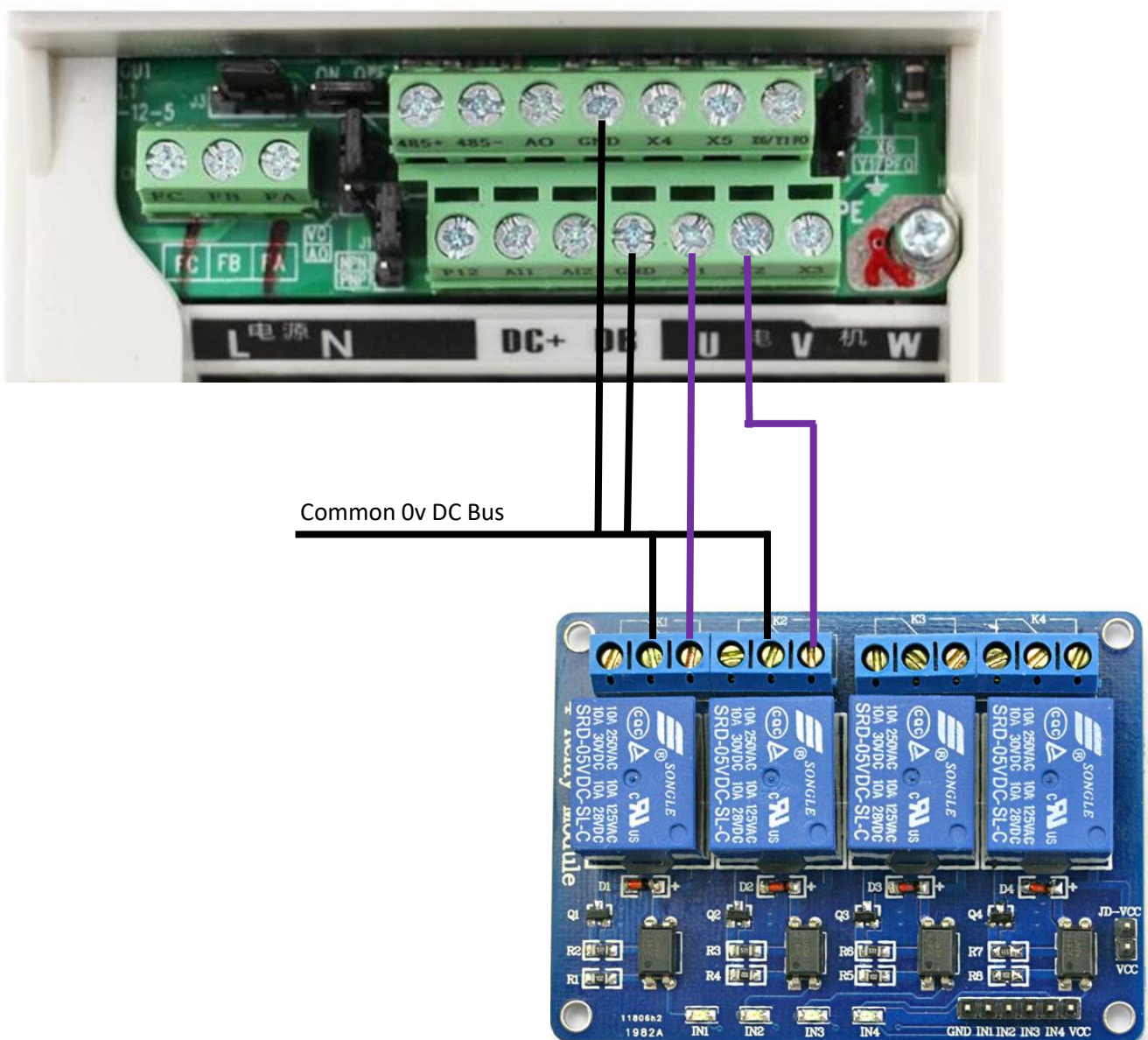


Description	Description	Description
X1	Multi-function digital input terminals 1-6	Set as forward during delivery
X2		Set as reverse during delivery
X3		Set as reset during delivery
X4		Set as high speed during delivery
X5		Set as medium speed during delivery
X6/Y1_FO		Set as low speed during delivery
GND	Digital/analog/communication and power earthing terminals	Isolation of GND inside from PE
P12	+12V power supply	Maximum output current: 150mA
AI1	Analog voltage input	Input voltage range: 0~+10V
AI2	Analog current/voltage input, selecting via jumper J3, default to current input	Input current range: 0~+20mA Input voltage range: 0~+10V
AO	Analog voltage output, can choose voltage or current	Output voltage range: 0~+10V Input current range: 0/4~+20mA
FA, FB, FC	Multi-function relay output	FA-FC: normally open, FB-FC: normally close Contact specification: 250VAC/3A, 30VDC/3A
485+ , 485-	RS485 communication interface	Available connection of 1-32 RS485 sites

10.0 Start/Stop Control Wiring

Terminals X1 (Forward) and X2 (Reverse) need to be wired to be switched remotely if you wish them to be controlled by Mach 3 and your CNC controller. The example below shows these terminals being switched via our 5V relay module, but any other relay or 12-24v DC transistor based control will work.

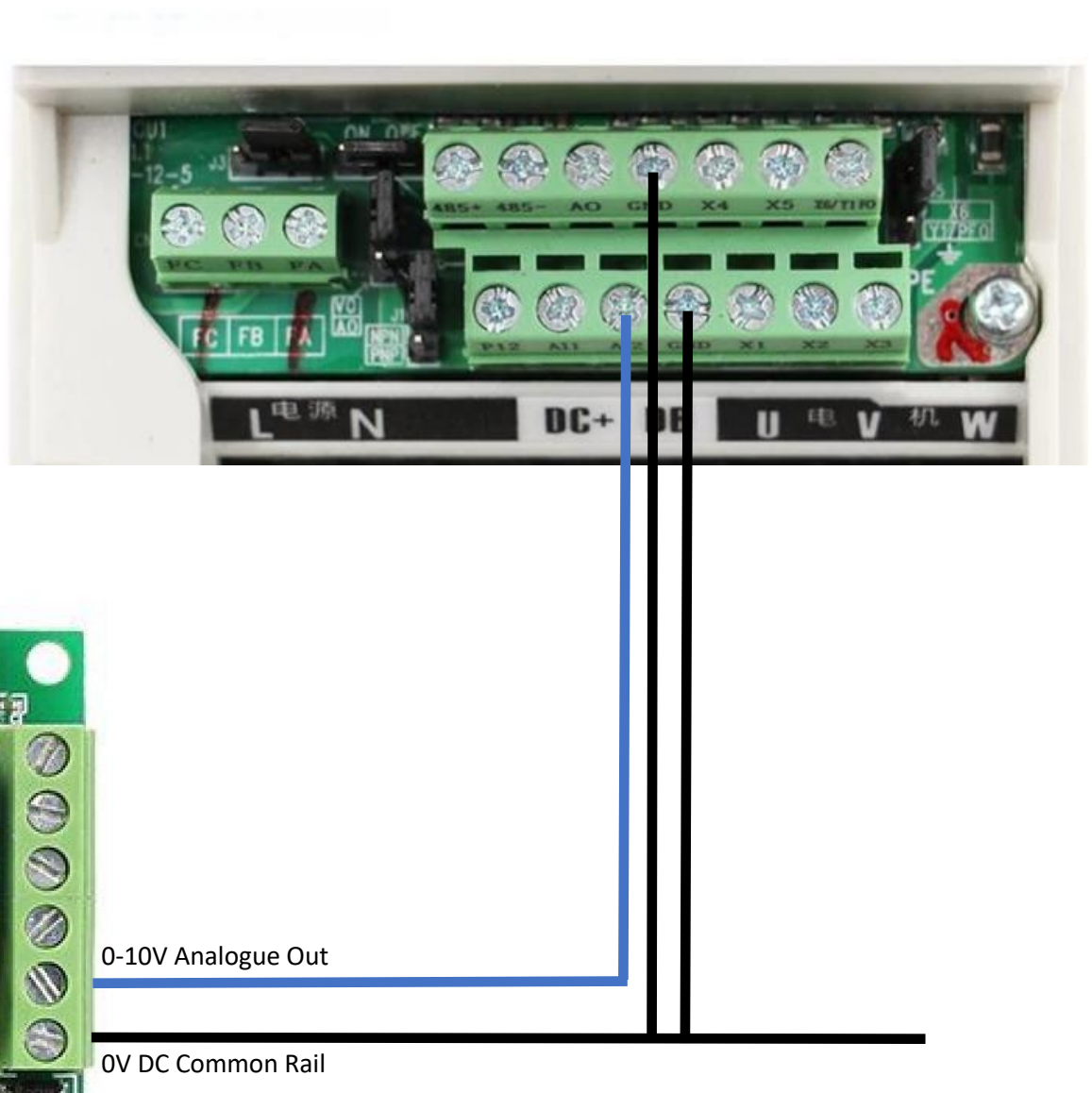
The controlling relay module is normally open. When it is activated via the CNC control, it connects the input to the 0V DC common bus, thus activating the relevant input on the VFD. Releasing the relay will stop sending the function signal to the VFD. This is an NPN wiring configuration as we are pulling the VFD terminals down to 0v to send an activation signal to them.



11.0 Spindle Speed Control Wiring

The breakout board supports two options for supplying spindle speed information to your spindle drive. We will use the 0-10V DC analogue signal as it is the most common method for speed control.

The diagram below shows the typical wiring for the H100 VFD using the 0-10V analogue method. It is essential that the 0V rail from the VFD and the breakout board are both wired back to the common DC bus. The 0-10V DC output from your CNC controller is connected into terminal A12. No other connections are needed.



12.0 Software Settings

12.1 Preparation

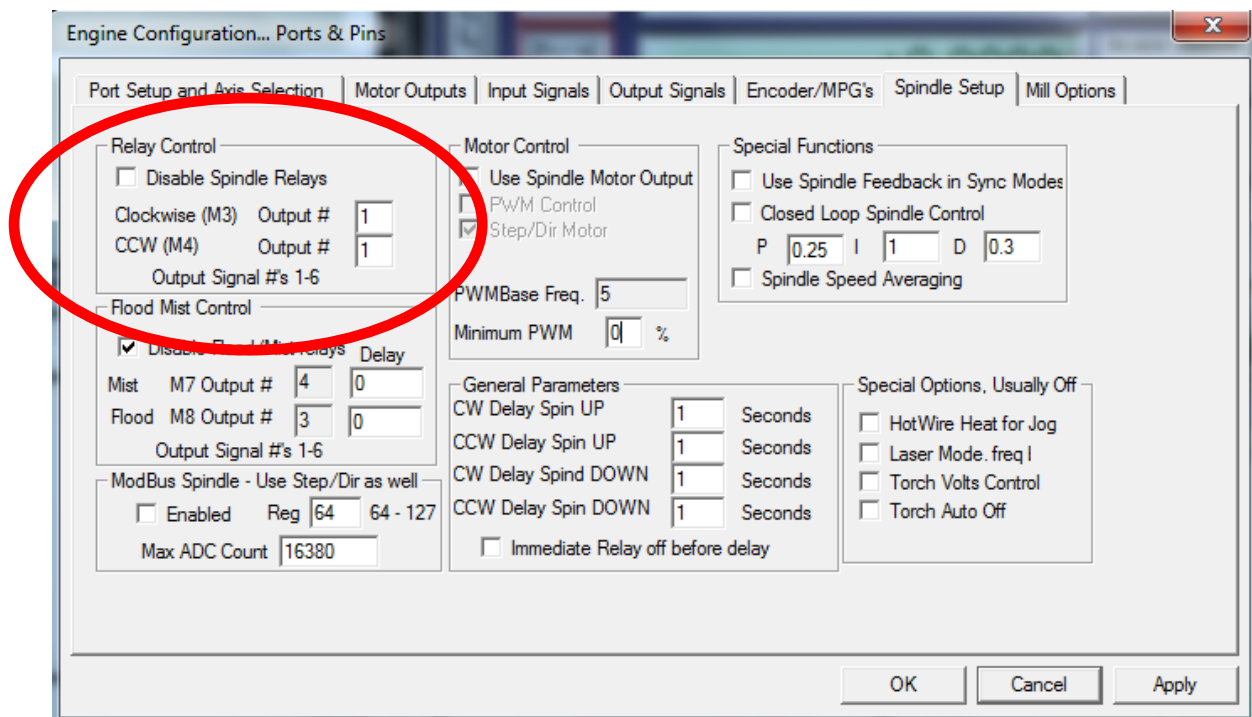
The rest of this manual assumes that you have your CNC controller set up and talking to your PC already. If not, go away now and get this working (see our Breakout Board user manuals for a detailed guide). The spindle control should be the last part of your project.

12.2 Mach 3 Settings

This section picks up from the breakout board user manual at section 6.5.

Now open the “Spindle Setup” tab and make sure that the “Disable Spindle Relays” box is UNCHECKED. You need to set the Clockwise (M3) Output number to #1 (or whichever number output you set just before), and CCW (M4) to output #2 (or whichever output number you set up before).

Mach3 will only allow you to use outputs 1-6 for spindle relay control. We suggest always using #1 for CW, #2 for CCW, and #3 & #4 for mist and flood coolant respectively.



12.3 Spindle Speed Control - 0-10V Analogue

In the Motor Outputs tab, you need to enable the spindle, set the Step Pin#, Dir Pin#, Step Port & Dir Port all to 1. Click on Apply again to save!

Signal	Enabled	Step Pin#	Dir Pin#	Dir LowActi...	Step Low A...	Step Port	Dir Port
X Axis		2	3			1	1
Y Axis		4	5			1	1
Z Axis		6	7			1	1
A Axis		8	9			1	1
B Axis		16	17			0	0
C Axis		0	0			0	0
Spindle		1	1			1	1

Next return to the Spindle Setup tab and enter the details below. If your VFD needs a higher than 0V minimum setting then adjust the minimum PWM setting up by 10% per volt required. For most VFD's however (the H100 included) 0% will be perfect.

Engine Configuration... Ports & Pins

Port Setup and Axis Selection | Motor Outputs | Input Signals | Output Signals | Encoder/MPG's | Spindle Setup | Mill Options

Relay Control

☐ Disable Spindle Relays

Clockwise (M3) Output #

CCW (M4) Output #

Output Signal #'s 1-6

Flood Mist Control

☒ Disable Flood/Mist relays Delay

Mist M7 Output #

Flood M8 Output #

Output Signal #'s 1-6

ModBus Spindle - Use Step/Dir as well

☐ Enabled Reg 64 - 127

Max ADC Count

Motor Control

☒ Use Spindle Motor Output

☒ PWM Control

☐ Step/Dir Motor

PWMBase Freq.

Minimum PWM %

Special Functions

☐ Use Spindle Feedback in Sync Modes

☐ Closed Loop Spindle Control

P I D

☐ Spindle Speed Averaging

General Parameters

CW Delay Spin UP Seconds

CCW Delay Spin UP Seconds

CW Delay Spind DOWN Seconds

CCW Delay Spin DOWN Seconds

☐ Immediate Relay off before delay

Special Options, Usually Off

☐ HotWire Heat for Jog

☐ Laser Mode. freq I

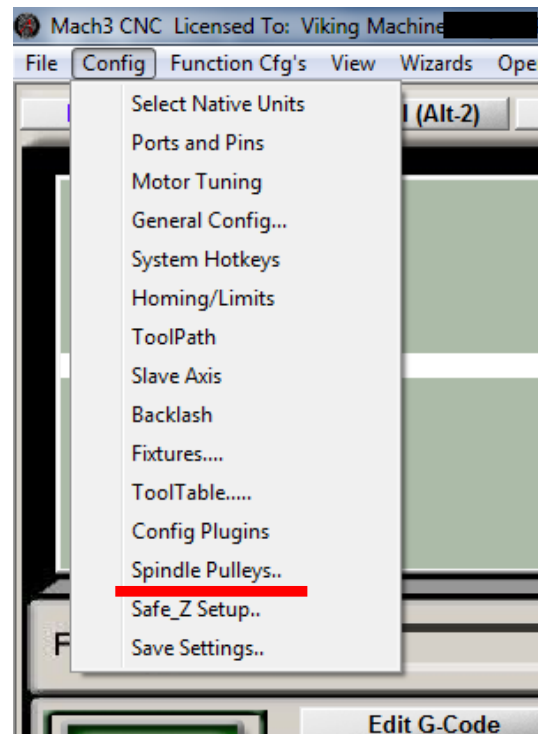
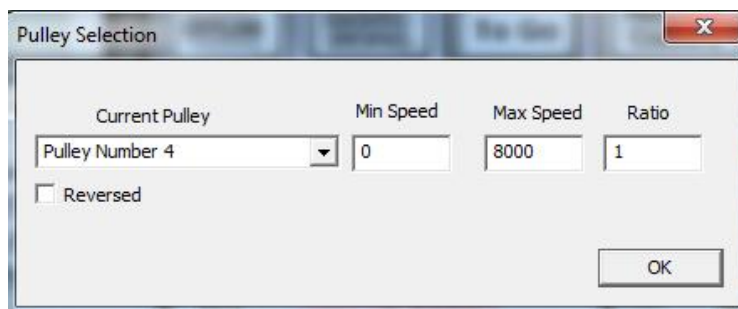
☐ Torch Volts Control

☐ Torch Auto Off

You will now need to configure your spindle pulleys to match the hardware on your machine. Find this via Config -> Spindle Pulleys.. as shown to the right.

Leave the box set as Pulley Number 4 (Mach 3 doesn't like it if you change) and then set the minimum and maximum speeds to match those that your VFD supports. This number is the RPM (Revolutions per minute) that you are limited to. For this example, the H100 will use 4,000 as its minimum and 18,000 as its maximum, as it must be running at least 4,000RPM, but no more than 18,000RPM.

Click OK to save your settings.



13.0 VFD Settings

Finally, we need to set the VFD to work with external control, and with the spindle motor we are using. Below is the manufacturer recommended sequence for doing this. Please note that doing this out of order can cause problems later. If you would like to change any other settings, please refer to the H100 user manual.

We will mostly be using the push buttons on the front of the inverter to change settings. The button functions are:

SET – Used to ‘enter’ a setting for adjustment

ESC – Backs up one level

UP / DOWN arrows – Used to navigate through a menu, or to change a variable up / down

SHIFT arrow – Used to move the cursor to the left so you can change other digits of a parameter



The correct basic parameters for CNC control with this spindle are:

F013=8 – This resets the inverter to factory default

F005=300 – Sets the maximum frequency of the drive. 300Hz is 18kRPM, 400Hz is 24kRPM with this spindle

F004=300 – Sets the reference frequency of the drive. 300Hz is 18kRPM, 400Hz is 24kRPM with this spindle

F003=300 – Sets the main frequency of the drive. 300Hz is 18kRPM, 400Hz is 24kRPM with this spindle

F072=300 – Sets the high-end frequency that corresponds to 10V on the analogue input

F070=000 – Sets the potentiometer input for voltage, 0-10V range

F002=004 – Sets the VFD to look for speed control information from the AI12 terminal

F001=001 – Sets the VFD to look for forward / reverse signals from the X1 & X2 terminals

F007=50 – Sets the VFD minimum start up frequency of the drive. 50Hz is 6,000RPM

F011=50 – Sets the lower frequency limit of the drive during operation. 50Hz is 6,000RPM

Please read through the H100 user manual from page 35 for a detailed description of all the available parameters. There are several cool features that you may wish to make use of that have not been covered here, such as alarm outputs, acceleration and deceleration times

14.0 Reference Links

Viking Machinery - Home Page

www.vikingmachinery.co.nz

Viking Machinery - TradeMe Store

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

Viking Machinery - Email

Sales@vikingmachinery.co.nz

Viking Machinery - Social Media

<https://www.instagram.com/vikingmachinery>

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

https://www.youtube.com/channel/UCgnl_7dUO9MeNOyl_jW05QQ?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

H100 User Manual

<https://github.com/Viking->

[Machinery/Viking_User_Manuals/blob/master/H100%20VFD%20User%20Manual.pdf](https://github.com/Viking-Machinery/Viking_User_Manuals/blob/master/H100%20VFD%20User%20Manual.pdf)