# PROGRAMMABLE STEPPER MOTOR DRIVER

www.vikingmachinery.co.nz

Version 1.0 – October 2022

# 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

- Programmable stepper motor drive
- 9x pre-programmed functions
- Board supply voltage: 5-24V DC (24V is preferred, as it allows the most power to the motor)
- Maximum motor current: 4A
- Microstepping:  1 to 32 microsteps
- Mounting cut out size: 39 x 71.5mm
- Physical Size: 79mm wide x 43mm Tall x 41mm Deep

# 2.0 Scope of Document

This document is designed to give an overview of the wiring and control options for the programmable stepper motor driver.

This manual assumes that the user has a basic understanding of electronics, and is confident working with electronics devices that require programming.

The documentation here covers the standard uses of the device, and there is a section covering the advanced options for hacking this device for greater interfacing options.

PLEASE DO NOT ATTRMPT THESE ADVANCED OPTIONS UNLESS YOU ARE COMPETENT WITH CIRCUIT BOARD LEVEL MODIFICATIONS OF ELECTRICAL EQUIPMENT.

# 3.0 Conenctions

For standard operation, the connections shown below are all that is required.

Please ensure proper polarity of the power supply! Incorrect connection will damaged the board. The correct polarity is marked on the back of the unit to assist with this.

When connecting the stepper motor, make sure that the correct coils are connected to the corerct terminals. If you are unsure of how to identify the coils f your motor, please refer to our stepper motor user manual.

NOTE: If your motor is spinning in the wrong direction reletive to your controller commands, you will need to reverse the A coil wires. Do this with the power off!
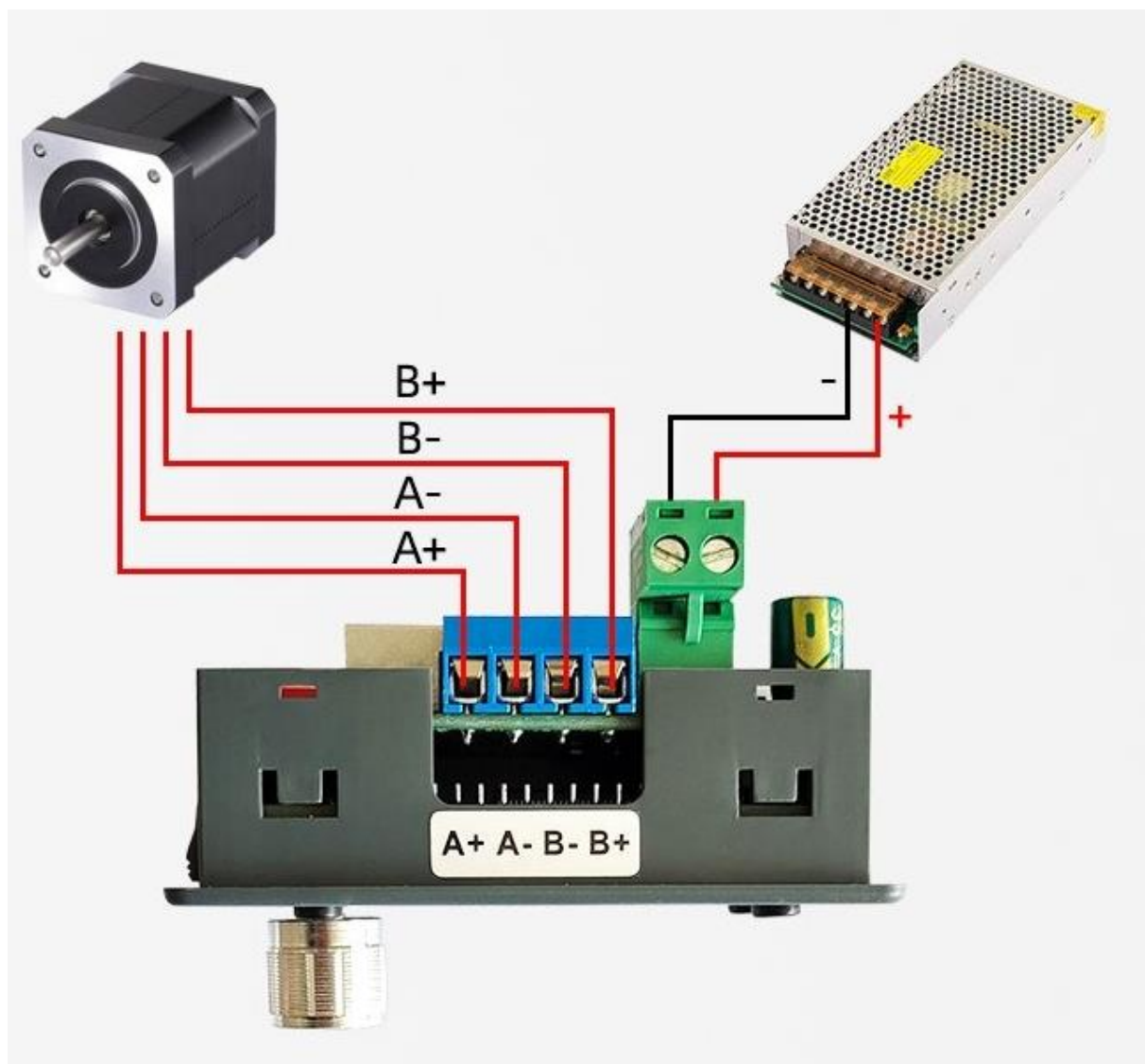
# 4.0 Onboard Hardware Setup

The board has two hardware set up options available. These are;

DIP switches – use these to set the microstepping amount required. Use the table below to configure your setting appropriately.

Potentiometer – use this to set the maximum curernt that can flow to your motor. It is important to limit the current to the nameplete current rating of your motor, or else it will overheat and be damaged.
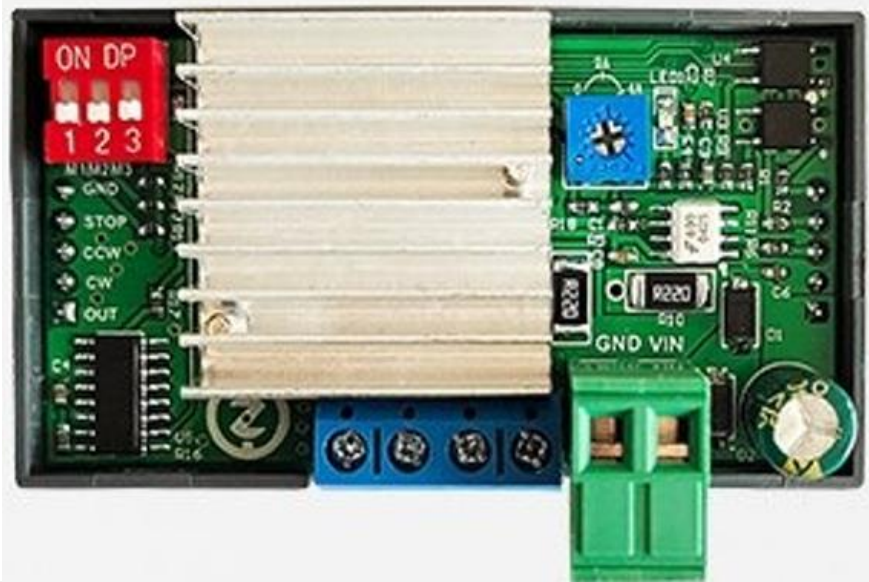


| S3 | S2 | S1 | M-SET |
|---|---|---|---|
| ON | ON | ON | NC |
| OFF | ON | ON | 1 |
| ON | OFF | ON | 2/A |
| ON | ON | OFF | 2/B |
| OFF | OFF | ON | 4 |
| OFF | ON | OFF | 8 |
| ON | OFF | OFF | 16 |
| OFF | OFF | OFF | 32 |

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# 5.0 Control Panel Overview

The front panel of the unit houses the standard operating controls for the device. These controls are also used to program the device.

The interface options for normal operation are;

CW – the clockwise rotation button

CCW – the counter clockwise rotation button

Run / Stop – used to start or stop the motor (in the appropriate mode – not all modes use this)

Encoder Knob – Used to change settings, and directly move the stepper motor in certain modes

The CW & CCW LED's indicate the current motion direction of the motor.

The LCD display shows mode specific variables such as speed, delay, etc.

# 6.0 Operating Modes

This controller supports 9 modes of operation. The mode is changed in the Function 1 menu (discussed later) and are described as "P01 Functions".  Changing the variables for each operation mode will also be discussed later in this manual.

These operating modes are;

## P01 = 1 - Tracking Mode

The stepper motor tracks the input potentiometer position. Rotating the potentiometer X degrees results in a corresponding movement of X degrees at the motor.

This mode is useful for adjusting the position of a motor remotely with a fine degree of precision.

## P01 = 2 - Manual Jog Mode

Pressing and holding the CW or CCW button causes the motor to rotate in the specified direction continuously until the button is released. When the button is released, the motor stops.

This mode is useful as a jog function where a motor needs to run while the button is pressed.

## P01 = 3 - Latching Jog Mode

Press and release either the CW or CCW button, and the motor will run in that direction until the button is pressed a second time.

This mode is useful where a continuous motion is required, such as running a conveyor belt or auger.

## P01 = 4 - Incremental Jog Mode

Pressing either the CW or CCW button will cause the motor to rotate a programmed set distance and then stop. There is a sub option in this mode that lets you program an optional dwell and repeat number, where the motor moves one increment, waits, and then repeats as many times as programmed (including infinite).

This mode is useful for applications where a single button press requires an exact movement. E.g moving a screw drive by a predetermined distance per button push.

## P01 = 5 - Incremental Jog, Return to Home Mode

This function works the same was as function 4, but when the motor reaches its final position, it will pause for a programmed period of time, and then return to the starting position.

This mode is useful for shuttling a motor between two positions – for example as an escapement for a feeder system.

## P01 = 6 - Incremental Jog, Offset Home Mode

This mode works the same way as mode 5, but instead of moving back to home, it will move back a programmed distance. E.g. move forward one rotation, move backwards half a revolution per button press.

This mode is used to move a load to a position with a mechanical latch, and then back the motor tension off.

### PO1 = 7 – Unlimited Jog, Return to Home Mode

This mode works in the same manner as mode 5, but allows free jogging of the motor. E.g. hold the button down and the motor will move until you release the button, and then the motor will return to home.

This mode is useful for applications like remote steering where you want the ability to offset the motor by a variable amount, but still have the return to home option.

### PO1 = 8 – Time Jog Mode

This option is similar to mode 4, but instead of jogging a prespecified distance, the motor will run for a pre specified amount of time.

This mode is used when the run time is more important than the distance moved.

### PO1 = 9 – Windscreen Wiper Mode

This mode makes the motor run a pre programmed distance forward, then a pre programmed distance backwards, for a pre programmed number of times (including infinite repeats). This mode starts as soon as the device is powered on, or the Start button is pressed.

This mode is used when a repetitive forward and reverse function is required such as a wiper or sweeper.

# 7.0 Programming

Programming this unit is very easy. We will address the initial set up steps first, and then the function calibration options last. We recommend setting your functions in the order they are presented here. These options are called "F Functions".

To enter the programming mode, long press the encoder button until you see the F function displayed on the LCD screen.

From the programming menu, use the encode to change the F-0X number to the function you are going to adjust. Once you have the correct F-0X selected, short press the encoder button again to drop to the second line with the setting variable. Use the encoder rotation to change these numbers, and short press the encoder button to shift the cursor across the digits.

When you have made your changes, short press the Run / Stop button to save and exit. Long pressing the encoder button will return you to the main run screen.



Run stop exit

## F09 – Pulses Per Revolution / mm

To calibrate the movements of the motor to real world units, we need to enter the motor, microstepping and mechanical linking ratios relative to the pulse numbers.

The formula for the correct number here is;

Value = (360 ÷ Motor degrees per step) x microstepping number ÷ mechanical gearing

Check your stepper motor for the degrees per step (It's usually 1.8 degrees), and use the value for microstepping you have set on the board. If you are using a mechanical drive (e.g driving a screw) and want your variables to relate to the output position rather than the motor position, you need to scale by the mechanical gearing of the system. E.g. if one rotation of the motor moves your screw by 3mm, you will need to divide by 3 as your mechanical gearing number.

## F12 – Acceleration Levels

The acceleration number controls the how quickly the motor gets up to / slows down from top speed. Slower is gentler on the system and makes the motor less likely to stall.
Choose a number between 1 and 100. 1 being the slowest acceleration, 100 being the fastest. By default this is set to 20.

## F11 - Stop Mode

When the stop button is pressed, the motor can either slow to stop at the deceleration rate (setting = 0) or immediately come to a dead stop (setting = 1).

Dead stop can be safer, but often results in lost position due to mechanical slippages. Unless you require a dead stop for safety reasons, use decelerating stop.

## F09 - Pulses Per Revolution / mm

To calibrate the movements of the motor to real world units, we need to enter the motor, microstepping and mechanical linking ratios relative to the pulse numbers.

## F10 - Display Preferences

The LCD shows two lines of data in run mode. The top line is the speed setting in units per minute (as per your F09 settings), the bottom line can either show the delay time (setting = 00) or the number of cycle repeats (setting = 01).

Choice of setting here is user preference.

## F01 - Operating Mode

Use the F01 function to select the P01 mode of operation. Choose from 1 – 9 as per the list in the previous section.

## F03 - Forward Rotation Speed (Units / min)

This setting is used to specify the operating speed for the forward rotation of the motor. The acceptable range here is from 0.1 to 999. Note that your hardware may not support the top speed! Going too fast for your motor will result in stalling.

## F05 - Reverse Rotation Speed (Units / min)

This setting is used to specify the operating speed for the forward rotation of the motor. The acceptable range here is from 0.1 to 999. Note that your hardware may not support the top speed! Going too fast for your motor will result in stalling.

## F02 - Forward Rotation Pulses

Sets the number of pulses to move for a forward distance move in a pre-programmed distance mode. Use the calculations from F09 to work out the number of pulses you need to achieve your mechanical outcome.

## F04 - Reverse Rotation Pulses

Sets the number of pulses to move for a reverse distance move in a pre-programmed distance mode. Use the calculations from F09 to work out the number of pulses you need to achieve your mechanical outcome.

## FO6 - Cycle Repeat Number

Sets the number of repeats for a function that requires repeats. For infinite, tab to the first digit and encode UP until your display reads "----". For any other number of repeats, choose a number from 1 to 9999.

## FO7 - Forward End Position Delay

Sets a delay period in seconds for the motor to wait at its move end position. The accuracy of this delay is approximately +/- 0.25 seconds. Choose a value from 0 to 999.9

## FO8 - Reverse End Position Delay

Sets a delay period in seconds for the motor to wait at its move end position. The accuracy of this delay is approximately +/- 0.25 seconds. Choose a value from 0 to 999.9

## F13 - Port Address

We have no idea how this works…
There is a hack mode to establish coms with this board, but we haven't figured out how this works yet. Leave this alone unless you know what you are doing!

Choose a number from 1 to 255 (default 1) to set a port address for coms.

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# 8.0 Advanced Options / Hacks

There are points on the board that wires can be soldered to expand the usage of this board. They allow expansion in three ways;
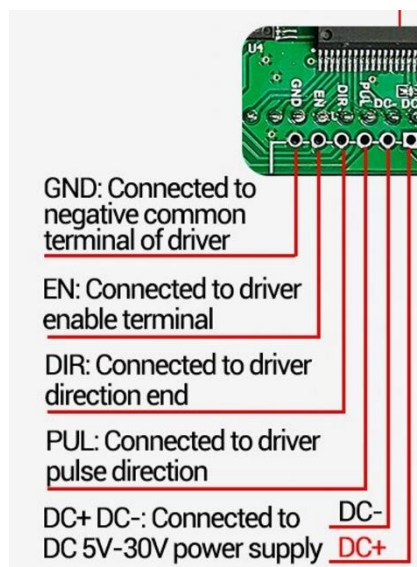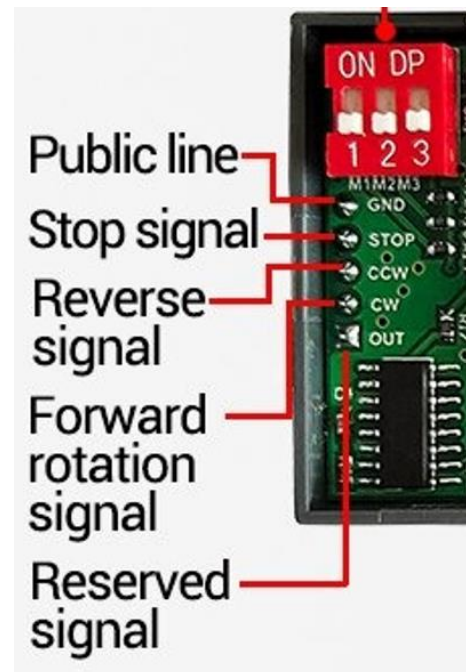
## 8.1 - Remote Inputs

If you want to control this unit from remote inputs (e.g. from a sensor or push button) you can solder a connection to the relevant input and the GND pin (labelled "public line" in the photo for some reason..).

Leave the OUT pin alone here!

## 8.2 - Remote Outputs

If you want to run a bigger stepper motor drive (so you can control a stepper motor that needs more current than this board can drive) you can tap off the step and direction pins from the board. The power connections are optional and can be left empty if you have connected power to the module through the green terminals.

Make sure to power your stepper motor driver independently from this board! i.e. don't take the power OFF the DC+ / DC- terminals here!



Public line
Stop signal
Reverse signal
Forward rotation signal
Reserved signal



GND: Connected to negative common terminal of driver

EN: Connected to driver enable terminal

DIR: Connected to driver direction end

PUL: Connected to driver pulse direction

DC+ DC-: Connected to DC 5V-30V power supply

## 8.3 - Serial Coms

Apparently, there is the option to control this board over serial. We haven't done this yet! If you are reading this in the manual, we still don't know how to do this! If you figure it out and let us know how you did it, we'll refund you the purchase price of the unit 😊



+3.3V
TX
RX
GND

Serial communication
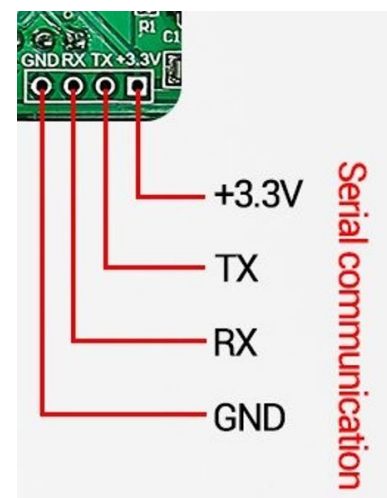
# 9.0 Reference Links

## Viking Machinery – Home Page
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## Viking Machinery – TradeMe Store
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