

STPDRV-1 Stepper Motor Driver Data Sheet (R1.0)

BFF Design Ltd



1. Introduction

The BFF STPDRV-1 card is a **bi-polar** stepper motor driver. It is designed to drive the BFF Motorised Trim Wheel or other user-designed stepper driven trim wheel applications.

The card employs the Texas Instruments DRV8432 driver chip with a PICAXE 28X2 micro-controller to provide a sinusoidal voltage, continuous drive for smooth stepper motor response. The card also provides ancillary connections for trim wheel applications, these are:

- Position feedback potentiometer
- Electric trim buttons
- Position indicator RC Servo output

The card requires a separate 24V regulated power supply or sufficient current capacity to drive the stepper motor. For small steppers a 1 amp supply is usually adequate.

A separate 5V supply is also required for the indicator servo drive. For small servos a 1 amp supply is usually adequate.

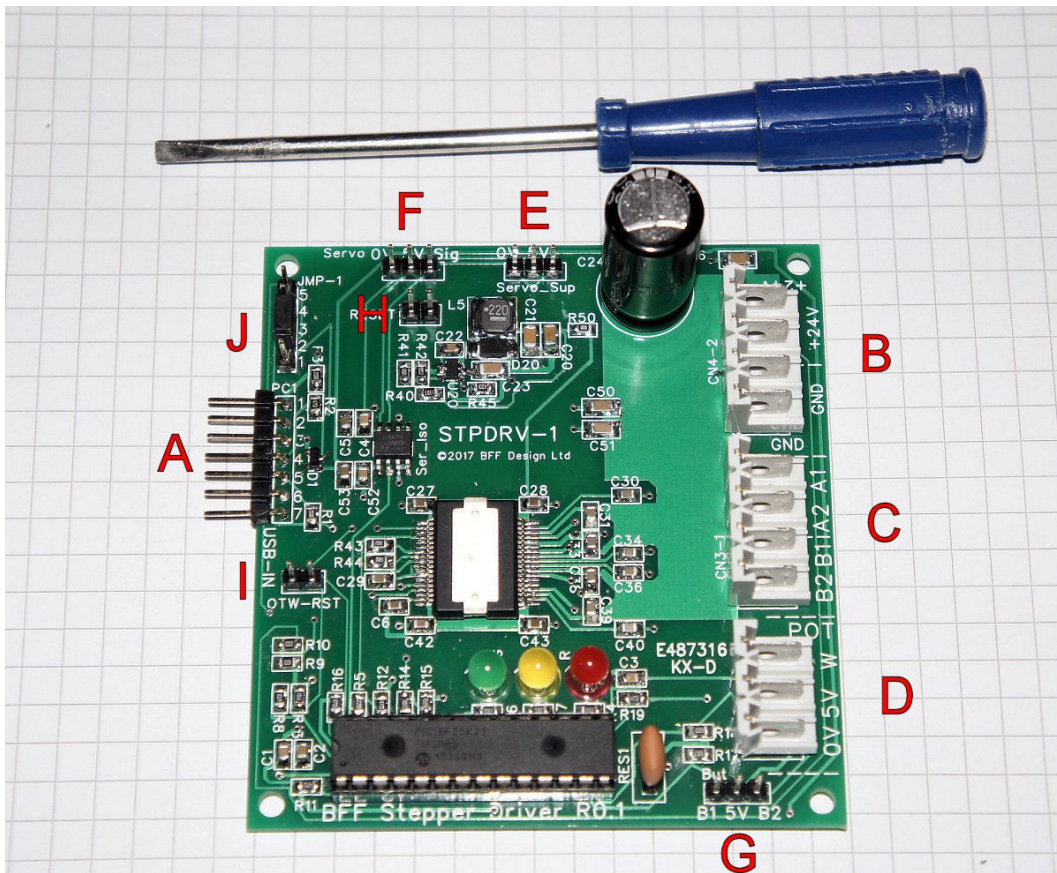
The servo drive is electrically isolated from the other logic and stepper drive circuits. To protect this isolation the servo 5V and stepper 24V supplies should not normally share a common ground.

The logic side of the card is powered directly from USB via the included FTDI USB/TTL cable.

Connection via a powered USB hub is recommended.

2. Card Connections

Refer to the lettered photo below –



- A. 7 Pin right-angled Header for FTDI USB/TTL cable (PC1). Note orientation of cable connection (pin 1 at top – see image on front page).

The USB/TTL cable provides the virtual COM port connection for the BFF Trim Wheel Software. This provides card control and status monitoring and pot position comms to the flight sim.

- B. 24V DC Power Input (CN4-2 upper 2 terminals). Do not exceed 30V.

NOTE the card is NOT reverse polarity protected – ENSURE CORRECT SUPPLY POLARITY.

Ensure the power supply has adequate current capacity for the driven stepper motor. The **Mercury Motor SM-42BYG011-25** stepper motor used in the BFF Motorised Trim Wheel is rated at 0.3 Amps, so a 1 amp supply will normally be adequate for the motor and card requirements.

The power supply capacity may need to be increased if larger bi-polar steppers are driven. The DRV8432 drive chip will drive currents up to 8 amps but will require additional heat sinking to do so. Space is available for an adhesive heat sink to be attached to the exposed heat plate on the top surface of the DRV8432 chip. Currents less than 1 to 2 Amps usually do not require additional heatsinking.

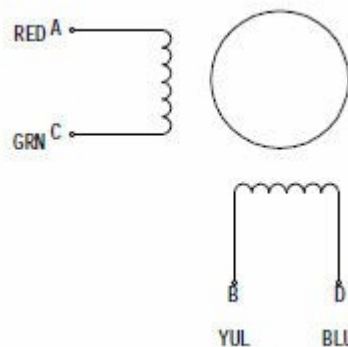
Power Supply GND (CN4-2 lower 2 terminals).

Always ensure the GND line to your power supply is connected and secure before powering-up the card. Otherwise the return current may try to get back to GND via the USB cable.

C. Stepper Motor Phase Connections (CN3-1) marked A1, A2, B1 & B2

Connections to the [Mercury Motor SM-42BYG011-25](#) are:

- A1: Red (A on diag)
- A2: Green (C on diag)
- B1: Yellow (B on Diag)
- B2: Blue (D on diag)

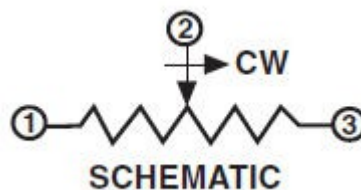


IMPORTANT: Outputs C are BTL outputs (bridge-tied load). Do not connect them to ground

D. Trim Wheel Position Potentiometer (POT) - 0V, 5V and Wiper connections for the position feedback pot.

A Vishay Spectrol Model 534 (10 turn, 10KOhm, Linear) is used in the BFF Motorised Trim Wheel.

See - <http://www.vishay.com/ppg?57065>



Connections:

- 0V → 1 on Diag
- 5V → 3 on Diag
- Wiper → 2 on diag

E. Servo Power Supply (Servo_Sup) – 0.1” 3 pin header for separate 5V supply for the position indicator servo drive.

NOTE only the two left-most pins are connected (0V & 5V).

A 1 amp supply will be adequate for the 9g servo used in the BFF Motorised Trim Wheel. If a larger servo is to be driven the supply may require to be increased to suit.

NOTE the card is NOT reverse polarity protected – ENSURE CORRECT SUPPLY POLARITY.

Full electrical isolation of the servo circuit from the rest of the card can be achieved by ensuring that the 5V servo supply and the 24V main card supply do NOT share a common ground. This will ensure that any electrical noise from the servo will not affect the rest of the stepper drive operation.

If the driven servo is electrically quiet then the card may be able to operate normally if the grounds are shared. In this case a standard BEC may be used to generate the servo 5V supply from the 24V card supply. The BEC supply can be taken from the spare 24V / 0V connectors at B.

- F. Indicator Servo output (Servo) – a 0.1” 3 pin header for the indicator servo.

Please note the orientation of the pins and connection, and ensure the servo is connected correctly.

The 5V supply for this servo connection is passed-through from connection E above. The output servo position pulse is in the range 0.8ms to 2.2ms with 1.5ms mid position.

Check your servo can handle this pulse length range.

- G. Electric Trim Buttons (But) – a 0.1” 3 pin header for connection of up/down electric trim buttons.

Pulling B1 or B2 high to 5V will activate electric trim wheel movement. Separate normally-closed momentary switches could be used, or a single pole double throw (SPDT) rocker switch (ON/OFF/ON).

Note: the trim wheel controller software can also allow electric trim button assignments from a standard USB joystick controller.

- H. Power Reset (RESET).

Momentarily closing this jumper will restart the power side of the card without stopping and starting the external power supply.

- I. Over Temperature Warning reset (OTW-RST). Close to reset a latched over-temperature warning fault condition.

If the main drive chip approaches overheat the card will automatically stop the output. The output will be restored when the drive chip cools to below the trigger temperature.

In extreme cases over temperature may trigger a full over-temperature latched error. This can be reset by power-cycling the card, or by closing this jumper momentarily. This should not be attempted until the drive chip has been able to cool to below its trip temperature.

Note this will not reset the driver if an error other than OTW has occurred (eg short-circuit protection or other chip fault).

- J. Operating/Programming mode selection jumper (JMP-1)

To set operating or programming mode. Pins 2 & 3 connected for normal operation. Pins 1 & 2 and 4 & 5 connected to put the card into PICAXE programming mode. In this mode the 28X2 micro-controller firmware can be updated.

3. Specifications

- Bi-polar stepper driver, 2 phase sinusoidal voltage drive. PWM at 20KHz
- Input Voltage: 24V DC (do not exceed 30V), current capacity to suit driven stepper motor. 1 amp is adequate for BFF Motorised Trim Wheel
- Servo power input 5V DC, 1 amp usually adequate for 9g servo in the BFF Motorised Trim Wheel
- Stepper motor voltage output 2.4V to 24V – set in BFF Trim Wheel software.
- Output current 1 to 2 Amps typically without heat sinking (operating temperature dependent). Up to 8 Amps with additional heat sinking.
- USB 5V current draw, typically < 50mA
- Feedback potentiometer: 10K Linear for 5V operation, 10 turn when used with BFF Motorised Trim Wheel.

4. LED Sequences

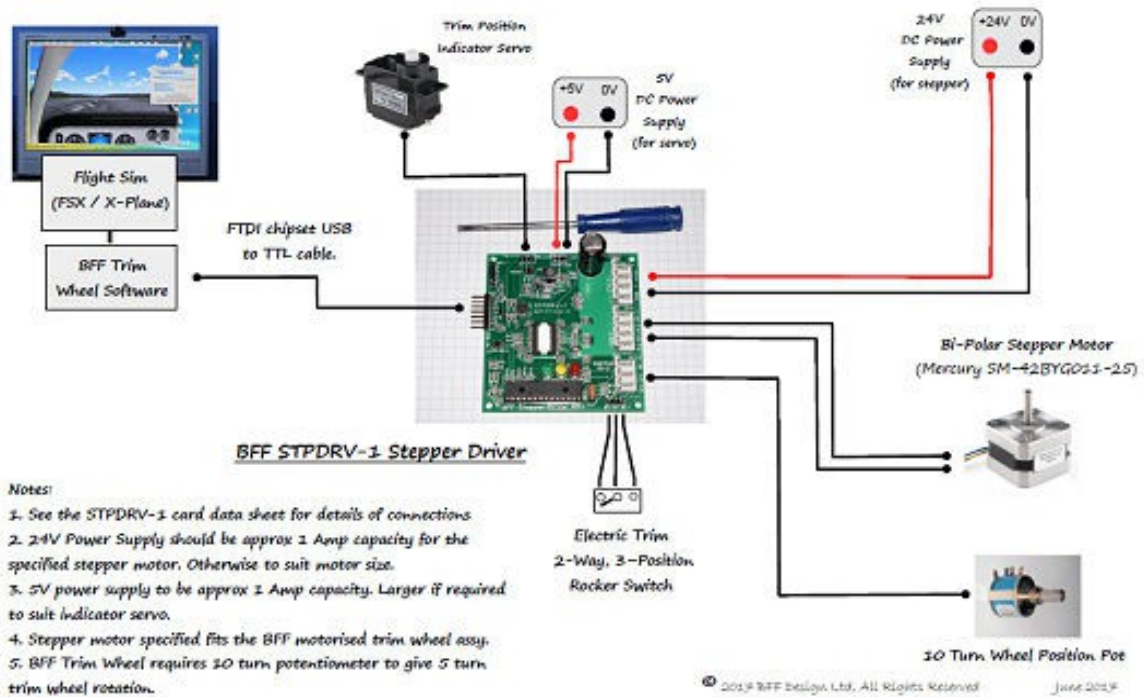
The STPDRV-1 card has three on-board LED's; green, yellow and red.

G	Y	R	CONDITION
Intermittent Blink	OFF	OFF	Logic power present (via USB) but waiting for 24V supply
ON Steady	OFF	OFF	Logic power present and 24V supply present
ON Flickering	OFF	OFF	Logic power present and 24V supply present – also receiving serial data from software via USB/TTL cable
OFF	OFF	ON	Initialisation procedure is active
OFF	ON	ON	Initialisation movements in progress
ON or Flickering	ON	ON	Card error condition – potentiometer out of range (see software status LED's for further information)
ON or Flickering	OFF	ON	Card error condition – DRV8432 chip reports FAULT condition
ON or Flickering	OFF	DIM	Card error condition – DRV8432 chip reports over-temperature condition

5. Typical Wiring Arrangements

Typical system diagram.

BFF Motorised Trim Wheel – System Diagram



Please see Section 2 Connections for further details of each connection.