SCPVD-1 Stepper-Controlled Proportional Valve Driver

INSTALLATION & OPERATIONS MANUAL

The **Stepper-Controlled Proportional Valve Driver** takes power and control signals (step and direction), and produces the signals necessary to step a 0A to 2A bipolar stepper motor.

Hook-Up

The SCPVD-1 has 3.5 mm screw terminals. To run an SCPV, the minimum number of connections to the driver is nine—four stepper wires, power, two GNDs, direction and step. All others are optional. Note that there are two ground connections, one next to the power input and one next to the step input. Typically these will connect to the power supply ground and the signal ground (from controller), respectively. For full stepping mode, MS1, MS2 & MS3 must be connected to ground.

Top Edge Connections

Motor: Connect the four wires from the motor to the four motor connections on the driver. The two "A" connections should connect to one coil (red and black wires) and the "B" connections to the other coil (green and blue wires). **Do not connect or disconnect the motor when driver is powered.**

Power: Connect the power input (+7 to +35V filtered DC) to the M+ connection and GND from the power supply to the GND connection.

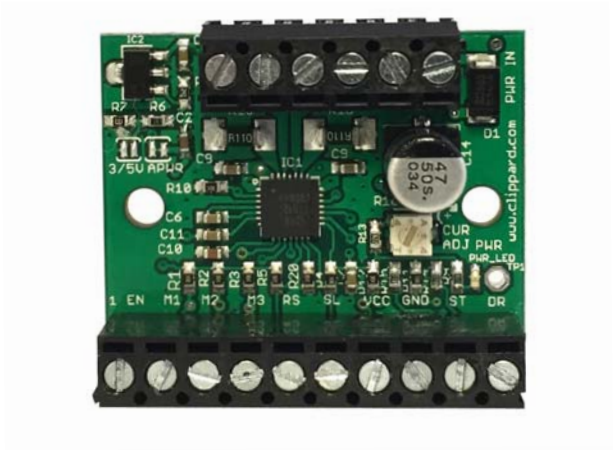
Bottom Edge Connections

Enable: This input is pulled down on the board with a 20K Ohm resistor. It can be left disconnected, or driven from a controller. When low, the driver chip is enabled and the motor is energized. When high, the driver chip is still enabled, but all of the final motor drive circuits are disabled and no current will flow to the motor.

MS1, MS2 & MS3: These inputs are all tied high with 20K Ohm resistors which set the microstep setting. Use the following table to control the microstep settings. (Note: Default setting is 1/16 step. For full step operation, connect as shown in table).

MS1	MS2	MS3	Microstep Resolution	Excitation Mode
L	L	L	Full Step	2 Phase
H	L	L	1/2 Step	1-2 Phase
L	H	L	1/4 Step	W1-2 Phase
H	H	L	1/8 Step	2W1-2 Phase
H	H	H	1/16 Step*	4W1-2 Phase

**Default*



RST (Reset): This input is tied high with a 20K Ohm resistor on the driver. If this signal is pulled low, the motor driver circuits are shut off and the driver is reset. Only when this input is high will the driver chip enable the motor driver circuits and react to the step input.

Sleep: This input is tied high with a 20K Ohm resistor on the driver. To switch the driver chip to a lower power mode (motor driver circuits shut off, charge pump shutdown, etc.), pull this input low. When coming out of Sleep, allow at least 1 millisecond before sending step pulses.

VCC: This is an output from the driver's voltage regulator. The voltage regulator takes the motor input voltage and provides 5V (or 3.3V) for the logic inputs of the driver chip. Maximum output is approximately 85 mA from the pin, although the higher the motor input voltage is, the hotter the voltage regulator chip will get as more current is pulled from the pin. See the Jumper Configuration Section to switch this to 3.3V output.

GND: This is one of two ground connections on the driver; the other is on the top next to the M+ power input. Both grounds are internally tied together. This is a ideal place to tie the ground of the micro-controller.

Step: This input is tied high with a 20K Ohm resistor on the driver. Each rising edge of this input will cause the stepper driver to advance one step in the direction specified by the DIR input. The step input must be high for at least 1 microsecond, and low for at least 1 microsecond.

DIR: This input is tied high with a 20K Ohm resistor on the driver. When a step pulse is received, the driver chip references this input to determine which direction to take the step. When high, the motor will turn counter-clockwise, and when low, the motor will turn clockwise.

Jumper Configurations

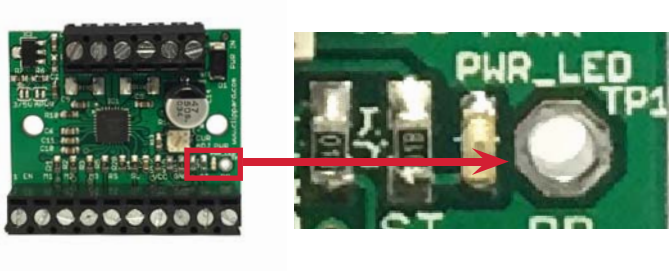
There are two jumpers on the SCPVD-1—APWR (alternate power) and 3/5V. They are located in the upper left corner of the SCPVD-1.

APWR: This jumper is Normally-Closed (connected). If the trace is cut between the two pads, the driver's voltage regulator chip is disconnected from the circuit and the VCC connection to the bottom edge of the board can be used as an input to power the driver with the logic level voltage desired (3.0V to 5.5V is the acceptable range). This option may be chosen to power the driver's logic level circuits with an external power source.

3/5V: This jumper is Normally-Open (disconnected). The SCPVD-1 may be switched to use 3.3V for its logic level circuits by soldering this jumper closed. This would be necessary to interface the SCPVD-1 to a 3.3V controller,
for example.

Current Limit Set Potentiometer

The SCPVD-1 includes a very small potentiometer to allow for adjustment of the maximum current level through the winding of the motor. This potentiometer is labeled CUR ADJ on the board. Turning changes the Vref voltage into the A4988 driver chip, and thus changes the maximum current that the driver chip delivers to the motor coils. Use TP1 to determine maximum current.



A volt meter is used to measure the voltage on TP1 (Vref) with respect to GND as the potentiometer is turned.

The range of the potentiometer produces maximum motor currents from approximately 0 mA (fully clockwise) to 5A (fully counter-clockwise). The driver cannot supply 5A, so the full range of the potentiometer will not be used. A Vref of 1.76V will result in a motor current of 2A. Use the following table
to set Vref:

Model	Vref
SCPV-1	0.4V

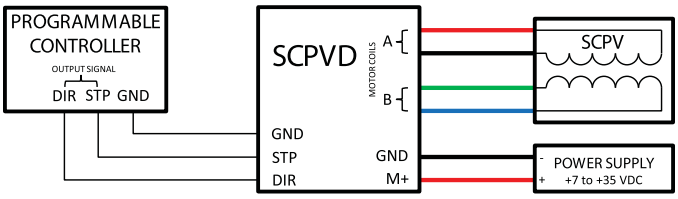
Power LED

A yellow LED light is located near the lower right corner of the driver, labeled PWR. This LED will light when there is 5V or 3.3V supplied to the driver chip. If the LED shuts off while power is being supplied to the M+ and GND power inputs, the voltage regular chip has either become too hot and shut down, or a short from the VCC to GND has been detected and the chip has shut off. If the LED turns on and off, either the M+ power is turning on and off, or the voltage regulator chip is overheating and is power cycling in an attempt to remain cool.

Heat Dissipation

The SCPVD-1 will supply up to approximately 1.4A/phase of current at room temperature. This is due to the four layer construction and design of the board. When driving high current, the entire board will act as a heatsink, including the connectors and other connected devices. The driver chip has excellent over temperature protection, therefore no damage will be done to the driver chip by operating the board too hot. It will simply shut down until the chip temperature returns to normal (less than approximately 302°F/150°C). Adding a small heatsink and/or using a small fan to cool the drive chip can allow currents in excess of 2A/phase.

Motor Wiring



This diagram illustrates a typical connection (the bare minimum connection) for the SCPVD-1 with a Clippard
SCPV Valve and a source for step/direction signals. Additional digital input signals may be connected on the SCPVD-1 for more control (Sleep, MS1, etc.). A typical setup will have MS1, MS2, and MS3 set low (connected to ground) for full stepping mode.

Specifications

- +7 to +35 VDC supply voltage
- Maximum 2A/phase
- 1/16, 1/8, 1/4, 1/2 and full step modes
- 5V or 3.3V logic inputs (jumper selectable)
- LED power supply indicator light
- Crossover current protection
- Thermal shutdown circuitry

For additional specifications, refer to Allegro A4988 documentation (www.allegromicro.com).

The SCPVD-1 is based on the Big Easy Driver which was designed by Brian Schmalz (Schmalz Haus LLC).
http://www.schmalzhaus.com/BigEasyDriver/

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