

ProboStepVX

Uni-polar Microstepping Chopper Driver



Model: ProboStepVX

Stepper Motor Microstepping Driver Specs:

- ◆ Chopper Current Driver
- ◆ 0.5 - 3 Amp Current Limiting
- ◆ Short-circuit & Open-circuit Protection
- ◆ Full, Half, Quarter, Eighth & Sixteenth Microstepping
- ◆ Buffered Step & Direction Lines
- ◆ 10V - 44V Supply
- ◆ For 5-, 6-, and 8-wire Stepper Motors

Description:

The ProboStep is a complete microstepping motor driver and control system with a built-in translator. It is designed to operate uni-polar stepper motors in full-, half-, quarter-, eighth-, and sixteenth-step modes with output drive capability of 44V and 3.0 A. This driver utilizes the Sanken SLA7078MPR chip which includes built-in sense current detection and load circuit short or open protection provide lower loss and lower thermal resistance.

Features:

- ▶ Hardware or software selectable step and direction signals
- ▶ Current limit adjustable by potentiometer
- ▶ Wide range of motor power (10-42V)
- ▶ Power (for logic) indicator LED
- ▶ 3 A, 44 V Output Rating
- ▶ Fixed-offtime PWM blanking circuit reduces ringing
- ▶ 3.0-5.5 V Logic Supply Voltage Range
- ▶ Synchronous Rectification for Low Power Dissipation
- ▶ Internal UVLO and Short & Open Circuit Protection
- ▶ Crossover Current Protection

Flexible Design:

The ProboStep was designed with flexibility in mind with features including:

- ▶ Internal synchronous-rectification control circuitry is provided to improve power dissipation during PWM operation.
- ▶ Internal circuit protection includes short-circuit and open-circuit protection. Special power-up sequencing is not required.
- ▶ The logic signals are brought out to a .1" pin header on one side, allowing for use of an IDC cable to connect your boards. Every other pin on the IDC header is connected to ground, which acts to shield the control signals from noise. Noise in a stepper control system can cause miss stepping, which can damage your equipment, cause injury, and ruin your work piece.
- ▶ A schmitt trigger IC buffers the high voltage driver from your sensitive parallel port, and filters noise.
- ▶ Unlike the SideStep, the driver chip, the ProboStep does not have thermal protection, so a heatsink must be used when driving motors at greater than 1 amps.
- ▶ An under-voltage lockout circuit protects the A3977 from potential shoot-through currents when the motor supply voltage is applied before the logic supply voltage. All outputs are disabled until the logic supply voltage is above 2.7V; the control logic is then able to correctly control the state of the outputs.
- ▶ Patented short and open circuit protection.

Unipolar Chopper Drivers:

Unipolar chopper drivers are the simplest form of stepper motor control. A set of four sink drivers control the current to each of the four half-phases of a stepper motor. The circuit includes recirculating diodes and a sense resistor that maintains a feedback voltage proportional to the motor current. The high side of the supply is split out to one side of each half-coil, and the other end of each half-coil is routed to the low-side transistor switches. Motor windings, using a chopper driver, are energized to the full supply level by turning on one set the switching transistors. The sense resistor monitors the linear rise in current until the required level is reached. At this point the switch opens and the current decays until a preset position is reached and the process starts over. This "chopping" effect of the supply is what maintains the correct current voltage to the motor at all times.

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VREF = .145 x amps

VREF (Volts)	Current (amps)
0.07	0.5
0.15	1
0.22	1.5
0.29	2
0.36	2.5
0.44	3

WARNING: Use a heatsink and fan when running higher than 1 amp.

Full Step (Mode 8 fixed)

Full Step (Mode F Fixed)*

Half step

Half Step (Mode F fixed)*

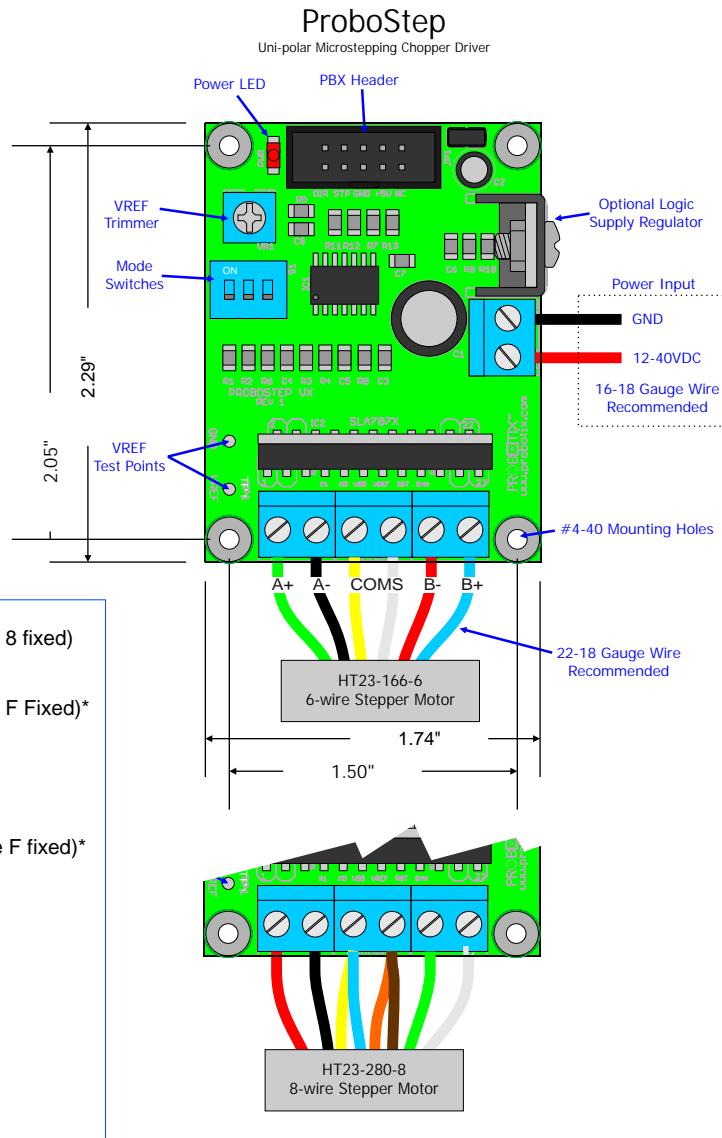
Quarter Step

Eighth Step

Sixteenth Step

Sleep

* Mode 8 uses 70% current ratio between phases, Mode F uses 100% current ratio between phases. Mode F should provide slightly more torque while Mode 8 should give smoother motion.



Setting Current Limit

Measure the DC voltage between the Ref Pin and GND, and adjust the trimmer as follows: $V_{ref} = .145 \times \text{desired motor current}$.

3 A = $V_{ref} .44$ V

2 A = $V_{ref} .29$ V

1 A = $V_{ref} .15$ V

0.5 A = $V_{ref} .07$ V

1. Determine the step resolution you wish to use, and set the dip switches according to Figure 2.

2. If driving your motors at more than 1 Amp, install a heat sink over the driver chip. A fan blowing over the heatsink will extend the life of your drivers. See the thermal warning on page three.

3. Apply power.

4. Connect a voltmeter between the VREF signal and GND and adjust the current trimmer to the desired voltage determined above.

WARNING: If the motor is connected during this adjustment, excessive heating may occur. Most motors can NOT experience temperatures above 100°C. At these temperatures internal melting and seizure may occur. Short-term current overdrive will, in general, not harm most motors.

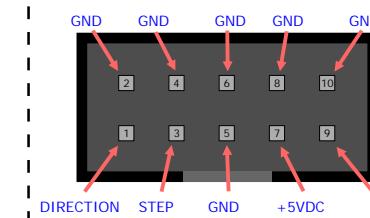
WARNING: Never remove a connection to the stepper motor with power applied. There is a possibility the SLA7078 IC will be damaged. The SLA7078 is rated for 46V DC max. The power supply voltage should be limited to ~42V DC to allow for back EMF generated by the stepper.

Control Software Setup

The ProboStep is negative logic. The STEP lines should be inverted in your software. Please contact us if you need help configuring your software.

Minimum pulse width for the step pulse is 5 uS. Maximum step frequency is 40 kHz. Most steppers torque really drop above 1 kHz at full step, or 8 kHz if you're using the eighth-step mode.

Figure 1: PBX Header Pin Diagram

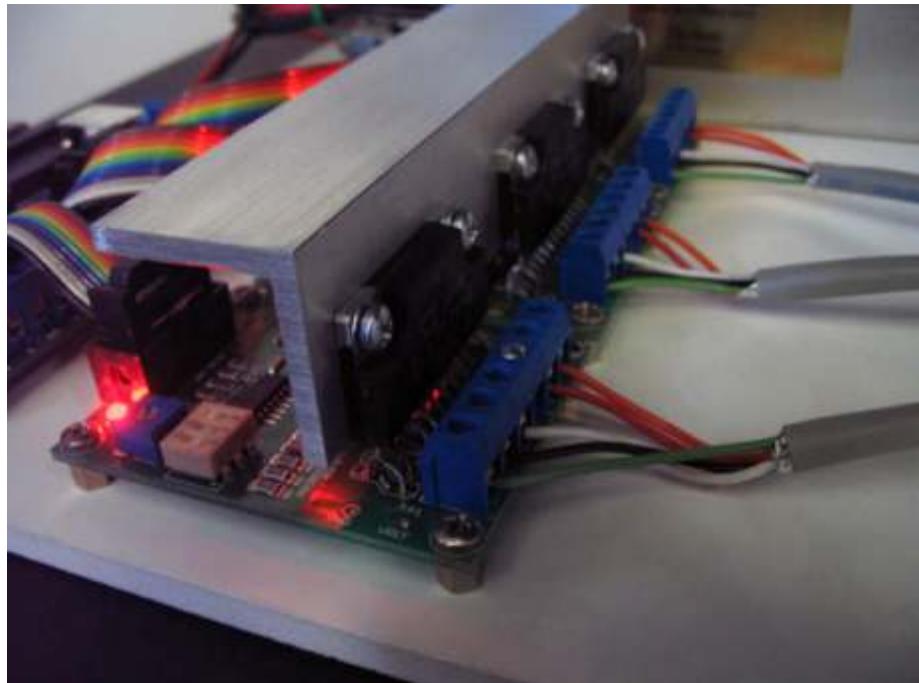


Thermal Warning

The ProboStepVX driver chip is not protected from temperature. Inadequate heatsinking will destroy the chip. Do not ever power the driver without a heatsink and cooling fan for even a few seconds - doing so will void your warranty.

A piece of 1/8" x 1" x 1" Aluminum angle makes a great heat sink if you bolt a 60mm fan to the top to help circulate air away from the heat sink. Use 4-40 Screws to attach the heat sink. Do not ever drill out the mounting holes to accomodate larger screws. Doing so will void your warranty.

Use thermal paste between the heatsink and driver to increase the efficiency. Make sure the heatsink covers the entire metal back plate of the chip. The hottest part of the chip is just above the center pin. The heat sink needs to touch the entire surface in order to properly wick away the heat.



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