

DIY KIT 187: STEPPER MOTOR CHOPPER DRIVER

The Stepper Motor Chopper Driver is a Bipolar Stepper Motor Drive with easily adjustable current control up to 2A, based on the SGS-Thompson L297 and L298 stepper motor controller and driver IC's.

Stepper motors are rated by current and not by voltage. A chopper driver because it is switching on and off current allows a set current to be fed to the coils and not be dependent on the voltage of the power supply. The Chopper Driver also allows for the use of higher voltage power supplies (up to 36V) to overcome the effects of the inductance of the coils giving better performance and a higher top speed.

Features Include:

- Easily adjustable motor current (0.A to 2A)
- Full and Half stepping modes
- Step and Direction inputs
- Synchroniseable when using multiple drivers
- Enable input can be connected to ground to disable motor
- Connections via screw terminals

Initial Setup:

The Stepper Motor Chopper Driver can be used with a power supply up to 36V, however, if the power supply voltage is above 25V a second power supply less than 26V is required to produce 5V for the logic.

Connect the motor power supply negative wire to a COM terminal and positive wire to the Vs terminal. When using a motor voltage above 26V link LK1 must be removed and a power supply between 8V and 26V must be connected to the Vss terminal.

Control signals are connected to the STEP and DIR terminals. Connect a COM terminal to the COM terminal of the source of the signals as well.

The EN terminal is pulled high internally, when a connection is made to ground through this terminal current is removed from the motor coils, allowing it to turn freely. This can be used as a kill switch input.

The SYNC terminal is only required when more than one Chopper Driver is being used. See the section on using multiple drivers for details.

Setting the Bipolar Stepper Current:

The current that will be passed through the motors coils is set using the single turn trimpot P1 and a Multi-meter. The voltage in volts at the test point labeled REF will be half the current in the motors coils in amps. That means 1V will give 2A, 0.5V will give 1A and so on.

Full and Half Stepping:

When the DIP switch labeled FULL is in the ON position the motor will move one step for each pulse on the STEP input if the switch is set to OFF the motor will move half a step for each pulse on the STEP input. This switch should be set before power is applied to the circuit. Half step produces a much smoother performance and less motor resonance.

Multiple Drivers:

When using multiple drivers in the same system (eg 3 or 4 axis controller) the drivers should be synchronized to avoid ground noise problems. This is done by setting the DIP switch labeled SYNC on all but one of the the drivers to the ON position and connecting the SYNC terminals of all the drivers. **WARNING: Unless another Driver is attached via the SYNC terminal with its SYNC switch in the OFF position, the Driver should NEVER be powered with the SYNC switch in the ON Position. Doing so will cause CATASTROPHIC FAILURE to the board.**

Heat:

The Stepper Motor Chopper Driver is provided with a Heatsink. Care should be taken when using the driver to ensure that the L298 IC does not overheat. When the driver is first used monitor the temperature of the heatsink. If it begins to get too hot to touch a fan or larger heatsink will be required. This is quite important if the motor is turning slowly or is stopped for long periods.

Noise:

The switching of currents to the motor can radiate electromagnetic interference. To reduce radiated noise the motor leads should be shielded and as short as possible. The motor body should be grounded and a grounded metal housing for the PCB can be used.

Assembly:

Assembly of the driver PCB is relatively simple. If the power supply will be over 26V the link LK1 can be left out. The 1 ohm resistors R1-R4 need to have the leads bent as close to the resistor body as possible so that they can fit into the PCB.

Leave the L298 and 7805 IC's until last. Attach the two IC's to the heatsink using screws first and then mount and solder the IC's in the PCB. This will avoid mounting the IC's unevenly and preventing the heatsink from being mounted.

Parts List:

Semiconductors

| | | | |
|---|-----------|-------|-----------------------------|
| 1 | L297 | L297 | Stepper motor controller IC |
| 1 | L298N | L298 | Stepper motor driver IC |
| 1 | 7805 | 7805 | 5V Regulator |
| 8 | FR302/304 | D1-D8 | Fast Recovery Diode |
| 1 | 1N4004 | D9 | Power Diode |

Resistors

| | | | |
|---|---------|--------------|------------------------|
| 4 | 1 ohm | R1-R4 | 1W Resisitors |
| 4 | 10 k | R6,R7,R9,R10 | 1/4W or 0.5W Metal |
| 1 | 18 k | R8 | 1/4W or 0.5W Metal |
| 1 | 22 k | R5 | 1/4W or 0.5W Metal |
| 1 | 5 k pot | P1 | Single turn top adjust |

Capacitors

| | | | |
|---|--------|------------|------------------|
| 6 | 0.1 uF | C1-C5, C10 | monolythic |
| 1 | 100 uF | C3 | electrolytic 35V |
| 1 | 3.3 uF | C6 | greencap |
| 2 | 220 pF | C8, C9 | ceramic |

Miscellaneous

| | | | |
|---|------------------------|--------|------------|
| 1 | PCB | | KIT187 PCB |
| 2 | 2 way Terminal | X4, X5 | |
| 3 | 3 way Terminal | X1-X3 | |
| 1 | 2 way DIL Switch | S1-S2 | |
| 1 | Heatsink | | |
| 2 | 10mm M3 Bolts (2 sets) | | |

