



Tstep-087, Two Phase Bipolar Stepper Driver



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THIS MANUAL CONTAINS INFORMATION FOR INSTALLING AND OPERATING THE FOLLOWING PRODUCT:

▪ TSTEP-087, TWO PHASE BIPOLAR STEPPER MOTOR DRIVER

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In the following pages, "Drive(r)" may refer to Tstep-087.

GENERAL DESCRIPTION

The Tiny Controls' Tstep-087 is a high resolution stepper motor driver operating on fixed 10 micro stepping.

Tstep-087 operates on an unregulated positive supply voltage range of +18 V to +80 V DC. The Drive output current ranges from 1.2 A to 7.0 A per phase. With suitably sized motors, over 560 watt peak can be delivered to the user's application.

The control interface for the drive is optoisolated for maximum noise immunity. The inputs are compatible with TTL drivers and require no additional components.

The Tstep-087 is programmed to provide excellent stability at all speeds overcoming limitations of other drives to perform in certain low speed conditions, full power operations at speed normally prohibited when use other drives.

The H-bridge output utilizes MOSFET designs to minimize heating due to switching losses. To improve poor motor efficiency, automatic current standby reduces phase current to a low level while motor is at rest to keep heating of drive and motor to a minimum.

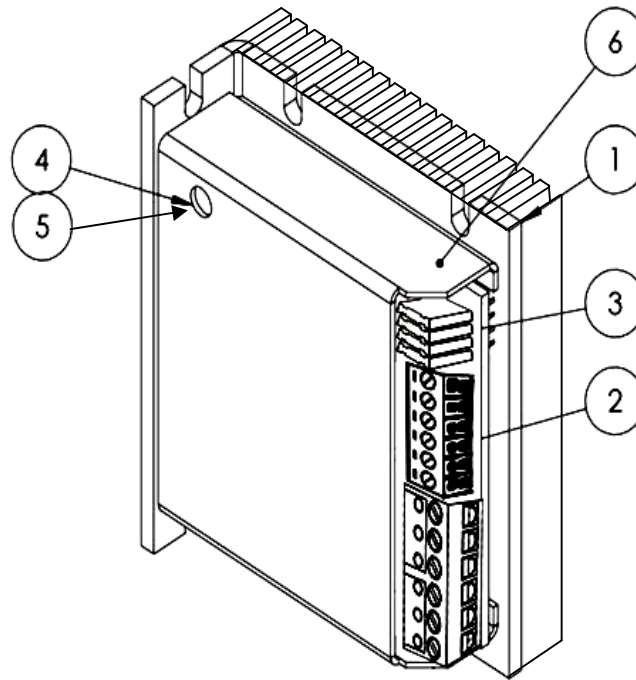
Over current (windings short) and under voltage are automatically sensed by the drive. When any of these conditions occur, the T-step 087 shuts down and turns on 'Fault LED' which is red in color, to indicate the presence of a fault condition.

The driver is compact, measuring approx. 82mm x 72mm x 36mm. It comes encased in an anodized powder coated enclosure, small enough to be assembled with ease into compact control boxes.

PHYSICAL AND ELECTRICAL CHARACTERISTICS

- **Supply Voltages:** 18 - 80 V DC
- **Phase Current:** 1.2 - 7.0 A
- **Chopping Frequency:** 20 KHz
- **Auto Current Reduction:** 70% of set current after approx 1 second of inactivity.
- **Inputs:** Step and Direction opto coupled (3.3 V or 5 V compatible).
- **Short Circuit Protection:** Motor windings and motor outputs to ground.
- **Step Frequency:** 0 to 200 KHz.
- **Step pulse:** Step on rising edge, minimum low/high time 2 μ s.
- **Direction input:** Stay 500ns unchanged before and after a step pulse.
- **Maximum operating Temperature:** 70 degree Celsius (158 F).
- **Overall Size:** 82mm x 72mm x 36mm
- **Weight:** 700 g

COMPONENT DESCRIPTION



1. HEAT SINK: Heat sink serves as a mounting plate for the drive; heat generating components are thermally coupled to this heat sink.

2. CONNECTOR: Two different removable power terminal strips are located on the front edge of the Tstep-087 each of 6 pin. The first connector gives connections for control interface i.e. Step, Direction and Disable connections. The 2nd connector is used for the motor windings and power supply.

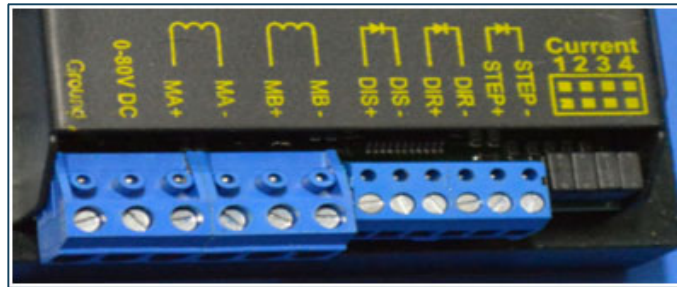
3. MOTOR CURRENT OPTION HEADERS: A jumper block is provided for setting motor current.

4. FAULT LED RED: This LED indicates that Tstep-087 has auto-triggered its protective shutdown circuit. Cycling the power supply after correcting fault condition resets the driver and turn off the LED.

5. POWER LED GREEN: It indicates that the power is connected to the drive and that it is in working condition.

6. DRIVE COVER: This powder-coated cover protects the driver from external elements which come in contact with the drive electronics. It also works as shield that can interfere in the internal electronic workings.

TERMINAL DESCRIPTION



Terminals described below follow right to left in the picture given above:

CONTROL INTERFACE: The control interface is optoisolated from the power section of drive and described below:

TERMINAL 1 & 2: Step is the (active signal) signal input; the motor rotates one step from each low to high going edge. Though there are no minimum requirements for timing, it is suggested to keep the signal high for a minimum of three microseconds to fully saturate the output transistor inside the opto coupler.

TERMINAL 3 & 4: With direction signal, the motor runs clockwise on high signal and counterclockwise on low signal on each step pulse. If motor is stepping in opposite direction to the desired direction, it can be corrected by simply interchanging the wires of one phase keeping the other phase coil connection same.

TERMINAL 5 & 6: Disable Signal, as the name suggests, it is given to disable the drive.

PHASE TERMINAL INTERFACE: These are phase winding outputs attached to the stepper. One motor winding coil goes to +MA/-MA and other winding coil connects to +MB/-MB. No power is applied to the phase outputs until the initial one second approx after power up of the Tstep-087 (power on reset).

Motor wires not connected to the drive should not be left exposed. Cut off the striped ends and insulate them with electrical tape or heat shrink tube. The Tstep-087 drives 4, 6 and 8 wire motor. With 6 motors, the user has the option to connect the winding in a

high or low performance configuration. Refer to page 13 for connecting 4, 6 and 8 wire motor.

POWER SUPPLY TERMINAL INTERFACE:

TERMINAL 11: It is positive DC voltage input for the motor power supply. The power supply voltage range is +18 V DC to +80 V DC for Tstep-087.

The power supply may be unregulated. For unregulated supplies, it is recommended that ripple voltage should be limited to a maximum of 10% of the DC output voltage. The power supply should have a sufficient smoothing capacitance. If a switch mode power supply is used a capacitor (470 uf/100 V) connected across the power terminal is suggested, since SMPS usually have little output capacitance. This capacitor should be located as close as possible to motor power terminals.

Because of an electrical noise generated by these drives, it is recommended that the supply should not be shared with low level logic circuitry. During rapid deceleration of large inertial loads from high speeds, the step motors become generators of considerable electrical power. This is returned to supply by the step motor drive. If the supply cannot absorb this power, voltage generated may exceed the limit of the Tstep-087 i.e. 80 volts and damage the drive and power supply. To prevent this problem, make sure that the ripple voltage does not exceed the rated supply voltage of drive.

The current requirement for Power supply depends on the motor to be used and whether it is wired for high performance (parallel) or low performance (series) operation. If the motor is wired for high performance (parallel) the current required from the supply should not exceed 2/3 rated per phase current of motor. Low performance (series) operation requires a maximum of 1/3 the motor's rated current.

Use the manufacturer's phase current rating of the motor in conjunction with the motor wiring option to estimate the size of power supply required. Page 13 explains in more detail the various configurations for connecting the motor to the driver.

More than one Tstep-087 can be run from a common power supply only if the filter capacitor is sized large enough to account for the combined load. Each Tstep-087 must have separate power supply that leads back to the power supply.

TERMINAL 12: It is the ground connection for motor power supply.

TERMINAL WIRING DESCRIPTION

The Tstep-087 comprises 2 blocks of connector. The first connector block has 1 to 6 terminals for control interface and the other connector block has terminals 7 to 12 for motor leads and power supply connections. Each can be removed separately by pulling the connectors upwards.

1. STEP:

TERMINAL 1 & 2: Connect the step pulse signal here. On each positive edge of step pulse, the motor rotates one step.

2. DIR:

TERMINAL 3 & 4: Connect the Direction signal here. The motor runs clockwise on high DIR signal (+5V) and anticlockwise on low DIR signal (Ground) on each step pulse.

3. DISABLE:

TERMINAL 5 & 6: This terminal disables the stepper motor drive.

All the signals above are optoisolated. Do not connect the GND signal and Terminal 1, 3 and 5 to ground. Terminal 2, 4 and 6 are driven with +5V signals without needing any external signals or resistor and driver is able to supply a minimum of 10 mA to the opto coupled STEP/DIR signals for best results.

If motor is stepping in opposite direction to what is desired, it can be corrected by simply interchanging the wires of one phase keeping the other phase's coil connection same.

4. PHASE TERMINALS: Motor leads connections.

TERMINAL 7: MOTOR PHASE MB- Connect one end of phase B motor windings here.

TERMINAL 8: MOTOR PHASE MB+ Connect other end of phase B motor windings here.

TERMINAL 9: MOTOR PHASE MA- Connect one end of phase A motor windings here.

TERMINAL 10: MOTOR PHASE MA+ Connect other end of phase A motor windings here.

5. POWER TERMINALS:

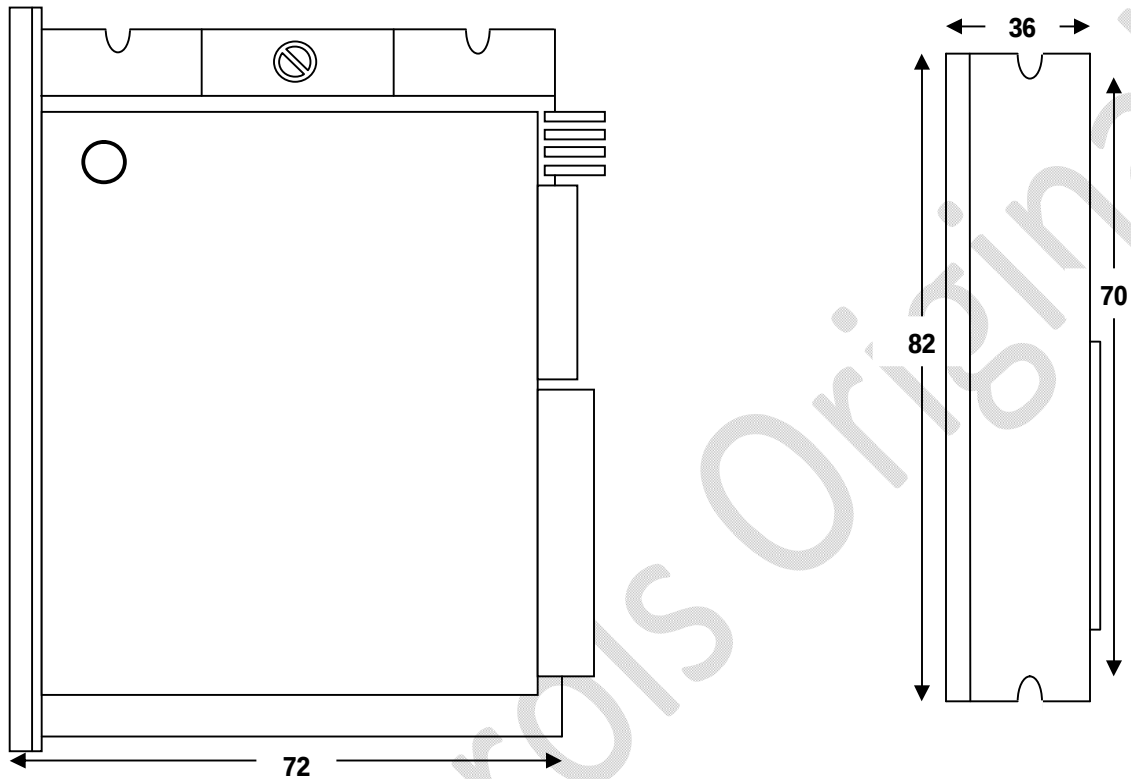
TERMINAL 11: Connect the positive lead of power supply to this terminal. It must be between +18V DC to +80 V DC.

TERMINAL 12: Connect the negative lead of power supply to this terminal.

The Drive can be reset back to normal operation (after removing the fault condition like short at output) by recycling the power.

For connecting +12 V to Step or DIR signal, connect a resistance of 1.2K Ohm in series with signals and for connecting +24 V, connect a resistance of 2.2K Ohm in series with signals.

PRODUCT DIMENSIONS AND INSTALLATION



- When operating Tstep-087 at high power (more than 3.0 A) levels, make suitable arrangements to keep the drive cool.
- The mounting plate dimensions are as given above. These dimensions are in mm. The Tstep-087 can be mounted in any mounting position for example horizontally or vertically. All connections are available on the front side of the drive for easy access and clean routing of wire harness.

Note: Don't run Signal and motor/power cables parallel in the same conduit as the high frequency power as switching generated noise can get into signal interfering the working of the driver. Use shielded cables for signal lines for better noise immunity. A wire size of 16-22 AWG (around 1 sq mm) is recommended. Either stranded or solid conductor wire can be used. The insulation should be stripped back 5 mm (around quarter of an inch) and the wire left un-tinned.

CURRENT SETTING USING “CSET” JUMPER BLOCK

The following table shows the jumper settings for the corresponding currents (in A):

Jumpers				Current (A) for Tstep-087
J1	J2	J3	J4	
1	1	1	1	1.2
0	1	1	1	1.8
1	0	1	1	2.2
0	0	1	1	2.8
1	1	0	1	3.2
1	1	1	0	3.4
0	1	0	1	3.8
0	1	1	0	4.0
1	0	0	1	4.2
1	0	1	0	4.4
0	0	0	1	4.8
0	0	1	0	5.0
1	1	0	0	5.4
0	1	0	0	6.0
1	0	0	0	6.4
0	0	0	0	7.0

However, 1 means jumper mounted and 0 means jumper removed.

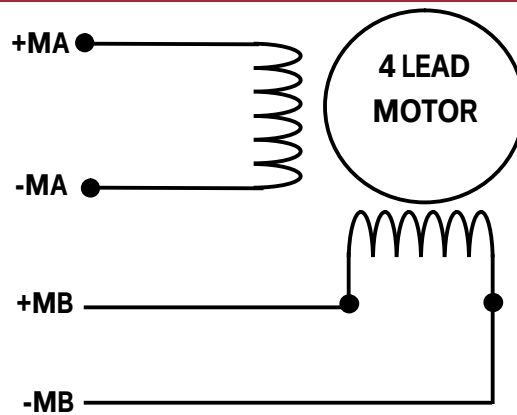
NOTES:

The Tstep-087 is a high frequency switching type drive. Because of the rapid rate of voltage and current change inherent with this type of drive, considerable RFI is generated. The following precautions should be taken to prevent noise from coupling back to the inputs and causing erratic operation.

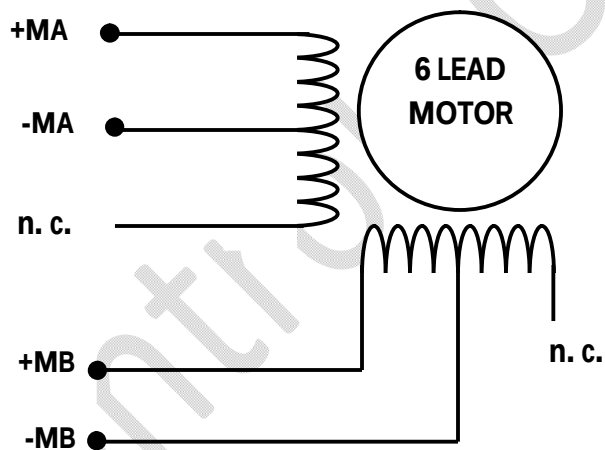
- 1.** Never run the motor leads in the same cable or wiring harness as the STEP, DIR or COM (GND or 5 V) lines.
- 2.** Keep power supply leads as short as possible. If the power supply lead length exceeds 12 inches, use a 100 μ F capacitor across Terminals 11 & 12 at the drive.
- 3.** Never wire capacitors, inductors or any other components to the motor output terminals.
- 4.** Ground the Tstep-087 case.
- 5.** The metal casing of Tstep-087 acts as an electrical noise filter and it is recommended that the drive should not be used without the cover (casing).
- 6.** The Drive is protected from over current and short circuits but not from reverse polarity on POWER Terminals and doing so blows the internal fuse and may destroy the driver.
- 7.** The current set "CSET" jumpers are treated as "1" when they are mounted on pins and "0" when they are not mounted. (Removed/un-mounted jumpers should be kept safe for future use).
- 8.** Never put a switch on the DC side of the Drive power supply, always the switch should be located on the AC side of the power supply. Loose power wires to the Drive also equivalent to a switch on DC side and can trigger the error inside drive; in an extreme case, it may blow the internal fuse.
- 9.** Note that terminal "ground" is power GND and "0-80 V DC" is +ve supply terminal, its printed on drive cover but the user needs to ensure that the power is not connected wrong way.

CONNECTING 4, 6 AND 8 WIRE MOTOR

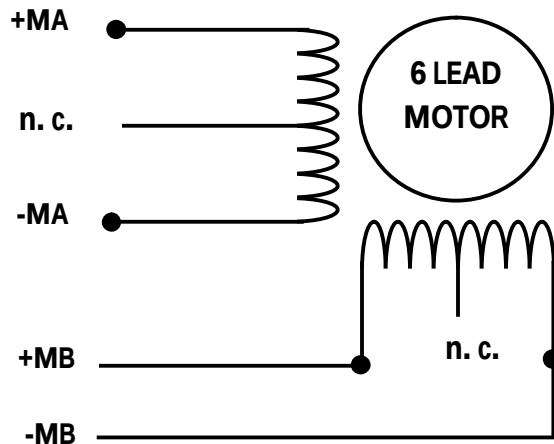
4 Lead: Only One Way (Set rated Current)



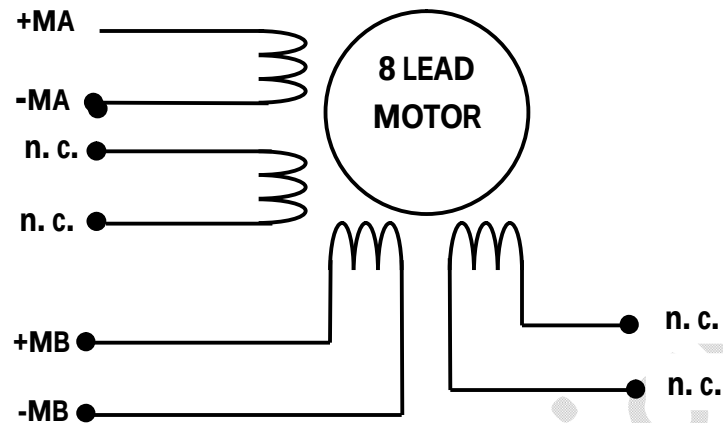
6 Lead: Half Coil (Set 2/3 rated Current)



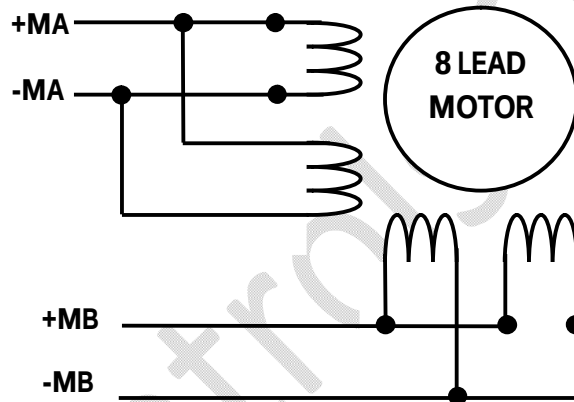
6 Lead: Series Coil (Set 1/3 rated Current)



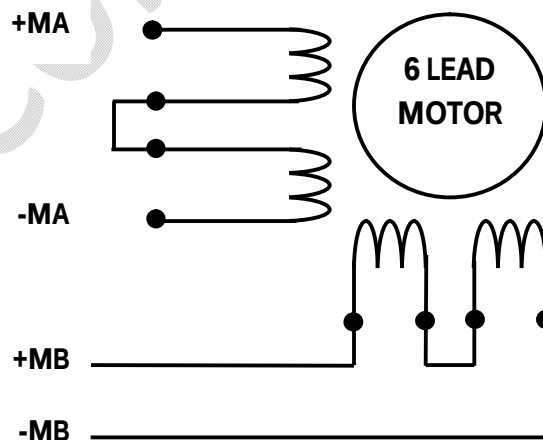
8 Lead: Half Coil (Set 2/3 rated Current)



8 Lead: Parallel Coil (Set 2/3 rated Current)



8 Lead: Series Coil (Set 1/3 rated Current)



NOTE: It is recommended to set the drive output current as equal to the above values described to avoid the excessive heating of motor.

USER NOTES:

Tiny Controls Original