

TStep-087/TStep-484, Two Phase Micro-stepping Bipolar Stepper Motor Drivers



Document: Operation Manual
Document # : T15
Document Rev: 1.03

Product: Tstep-087 / Tstep-484
Product Rev: V3.0

Created: -----
Updated: 30-July-2012

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

- TSTEP-087 MICRO-STEPPING STEPPER MOTOR DRIVER
- TSTEP-484 MICRO-STEPPING STEPPER MOTOR DRIVER

“TINY CONTROLS” AND THE TINY CONTROLS COMPANY LOGO ARE TRADEMARKS OF TINY CONTROLS COMPANY. OTHER TRADEMARKS, TRADE NAMES, AND SERVICE MARKS OWNED OR REGISTERED BY ANY OTHER COMPANY AND USED IN THIS MANUAL ARE THE PROPERTY OF THEIR RESPECTIVE COMPANIES.

B-17, NISHAT PARK, KAKROLA MOR, NEW DELHI, INDIA – 110078

WEB: [HTTP://WWW.TINYCONTROLS.COM](http://www.tinycontrols.com)

PHONE: +91-11-2533-1567, +91-991-119-3210

CONTENTS

<i>Item</i>	<i>Page #</i>
GENERAL DESCRIPTION	3
LOCATION OF COMPONENTS	4
INSTALLATION	5
TERMINALS	6
CURRENT SETTING TABLES	8
NOTES	9
CONNECTING 4, 6 and 8 LEAD MOTORS	10
USER NOTES	11

In the following pages Tstep-087 and Tstep-484 may be called Tstep-xxx or simply 'Drive(er)' when the option or function applies to both models.

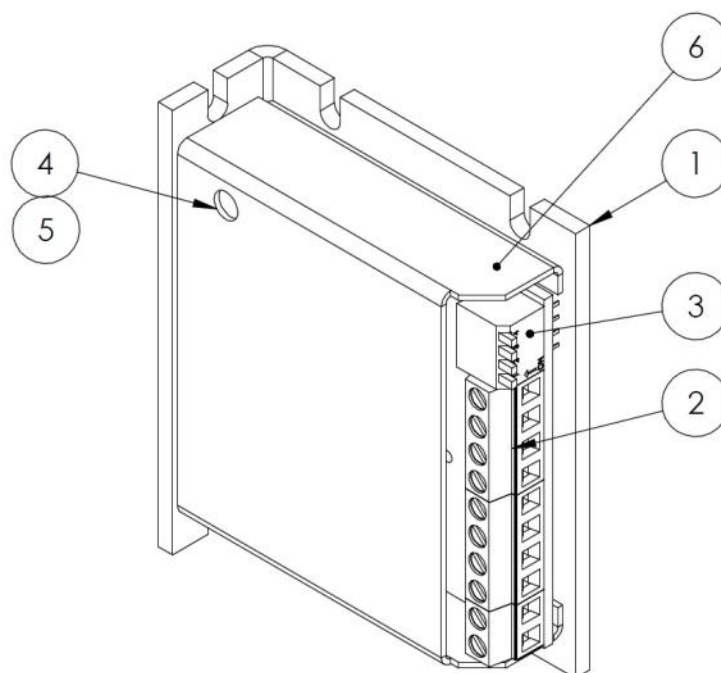
GENERAL DESCRIPTION

- *The TINY CONTROLS Tstep-xxx is a high resolution step motor drive operating on a fixed 10 micro stepping.*
- *The Tstep-087 operates on an unregulated positive supply voltage of 18-80 VDC. Drive output current ranges from 1.2A to 7 amps per phase. With suitably sized motors, over half kilowatt (560 watts - peak) can be delivered to the user's application (Note: Tstep-484 is limited to 48V and 4A).*
- *The control interface for the drive is opto-isolated 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 a limitation of other drives to perform in certain low speed conditions .This allows continuous, full power operation at speeds normally prohibited when use other drives.*
- *The 'H' bridge output utilizes MOSFET design to minimize heating due to switching losses. To improve motor efficiency, automatic current standby reduces phase current to a low level while the motor is at rest to keep heating of the drive and motor to a minimum.*
- *Over-current (winding shorts etc.), and under-voltage are automatically sensed by the Driver. When any of these conditions occur the Tstep-xxx shuts down and turns on a 'fault' LED to indicate the presence of the fault condition.*
- *The drive is compact, measuring approximately 3.5" x 3" x 1". It comes encased in an anodized / powder coated enclosure, small enough to be assembled with ease into compact control boxes.*

Technical Specifications:

- **Supply Voltage:** 18V to 80V DC for tstep-087, 18V to 48V DC for tstep-484
- **Phase Current:** 1.2A-7.0A for tstep-087, 0.7A-4.0A for tstep-484
- **Chopping Freq:** 20 KHz for tstep-087, 35 KHz for tstep-484
- **Auto Current Reduction:** 70% of set current after approx 1 second of inactivity
- **Overall Size:** 85mm x 70mm x 22 mm
- **Mounting:** See installation on page 6
- **Inputs:** Step and Direction opto-coupled (3.3V or 5V compatible)
- **Inputs Common terminal:** Can be configured as either +ve or -ve terminal
- **Short-circuit protection:** Motor windings and Motor outputs to MGND
- **Step Frequency:** 0 to 200 kHz
- **Step Pulse:** Step on rising edge, minimum low/high time 2uS
- **Direction Input:** Stay 500nS unchanged before and after a step pulse
- **Max Operating Temperature:** 70 deg C

LOCATION OF COMPONENTS: Major components of the Tstep-xxx



The following is a description of these components.

1. MOUNTING PLATE

This plate also serves as a heat-sink for the drive, heat generating components are thermally coupled/attached to this plate.

2. CONNECTOR

A 9 position removable power terminal strip located on the front edge of the Tstep-087 provides the connections for power supply, motor windings and controller interface. The function of each contact is printed on the case adjacent to the terminal strip.

3. OPTION HEADERS

2 Jumper blocks are provided: 1) for setting motor current and 2) for setting COM terminal polarity.

4. FAULT LED - RED

This LED indicates that the Tstep-087 has triggered its protective shutdown circuit. Cycling the power supply after correcting the fault condition will reset the driver and turn off the LED.

5. POWER LED – GREEN

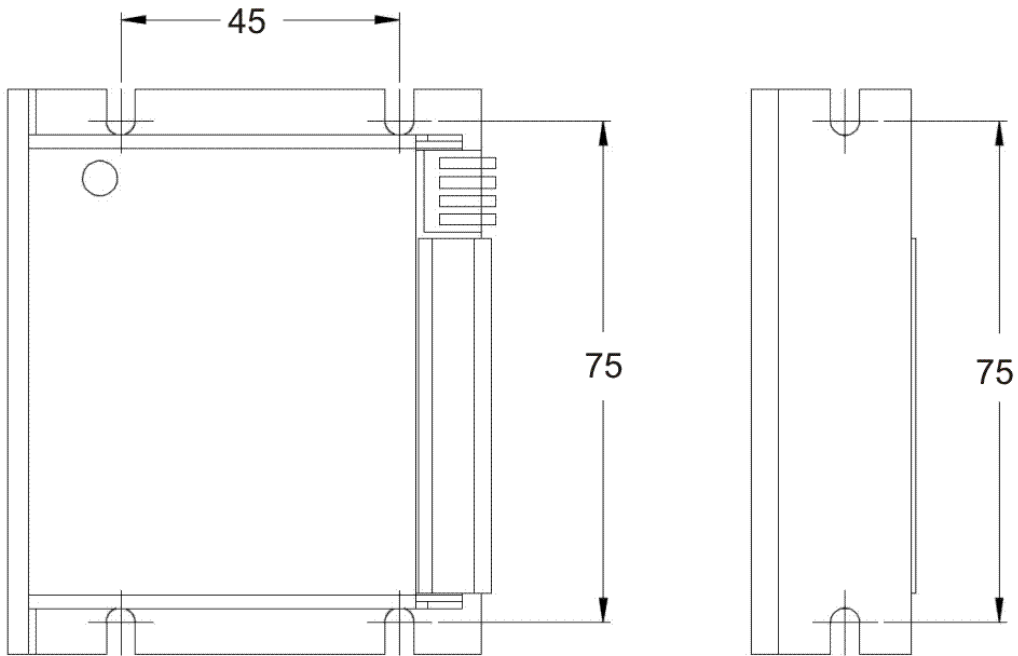
This LED indicates the power is connected to the drive and it's in working condition.

6. METAL COVER

This powder coated cover protects the drive from external elements coming in contact with the drive electronics and also works as shield that can interfere the internal electronic working.

INSTALLATION

Note: When operating the Tstep-087 at high power (more than 3.0 A) levels an external heat sink must be attached to the mounting plate.



The mounting plate dimension are as given above, the dimensions are in millimeter. Tstep-xxx can be mounted on any of the mounting position, 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 switching generated noise can get into signal interfering the working of the driver. Use shielded cables for the Signal lines for better noise immunity.

No connectors are required on the wiring to the drive. A wire size of 16-22 AWG (around 1 sq mm) is recommended. Either stranded or solid conductor wire may be used. The insulation should be stripped back 5 mm (around quarter of an inch) and the wire left un-tinned.

The following section describes each connector terminal in detail.

TERMINALS (1 to 9, as seen from Left to right in below picture)



POWER SUPPLY TERMINAL (1 & 2)

Terminal 1 is the ground connection for motor power supply.

Terminal 2 is the positive dc voltage input for the motor power supply.

- The power supply voltage range is +18 to +80 VDC for Tstep-087.
- The power supply voltage range is +18 to +48 VDC for Tstep-484.

The power supply may be unregulated. For unregulated supplies it is recommended that the ripple voltage be limited to a maximum of 10% of the DC output voltage.

The power supply should have a sufficient smoothing capacitor, if a Switch mode power supply is used a capacitor (470uf / 100V) connected across the power terminals is suggested, since SMPS usually have little output capacitance. This capacitor should be located as close as possible to the motor power terminals.

Because of the electrical noise generated by these drives, it is not recommended that the supply be shared with low level logic circuitry.

During rapid deceleration of large inertial loads from high speeds, step motors become generators of considerable electrical power. This is returned to the supply by the step motor drive. If the supply cannot absorb this power, the voltage generated may exceed the (80 volts for tstep-087, 48 volts for tstep-484) limit of the Tstep-XXX and damage the drive and power supply. To prevent this problem make sure the ripple voltage does not exceed the rated supply voltage of drive.

Power supply current requirements depend on the motor being 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 will not exceed 2/3 of the motor's rated per phase current. 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 11 explains in more details, the various configurations for connecting motor to the driver.

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

PHASE OUTPUTS TERMINALS (3 to 6)

These are the phase winding outputs to the step motor. One motor winding coil goes to +MA/-MA and the other motor 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).

The Tstep-087 will drive 4, 6 and 8 wire motors. With 6 wire and 8 wire motors, the user has the option of connecting the windings in a high or low performance configuration. Reference the relevant info to determine the best configuration for your application.

Motor wires not connected to the Drive should not be left exposed. Cut off the stripped ends and insulate them with electrical tape or heat-shrink tubing.

CONTROL SIGNAL TERMINALS (7 – 9)

Control signals are opto-isolated from the power section of drive, terminal '9' being Common for both step/dir signals.

COM can be configured as -ve or +ve terminals for step/dir signals.

Note: Even if COM is set as -ve common it should not be connected to Motor supply -ve terminal (MGND) for best performance.

Terminal 7 is DIR signal, Motor will step clockwise on high signal and counter clockwise on low signal on each step pulse. If the motor is stepping in opposite direction to what is desired, it can be corrected by interchanging the wires of one phase keeping the other phase coil connection same.

Terminal 8 is the STEP pulse (active high) signal input, the motor will rotate one step on 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 3 microseconds to fully saturate the output transistor inside the opto coupler.

Terminal 9 is the common (negative or positive) terminal for the STEP and DIR signals, see relevant section for configuring the COM terminal.

STEP and DIR signal are to be driven with 5V signals without needing any external resistor, the driver must be able to supply a minimum of 10 mA to the opto coupled STEP/DIR signal for best performance. IF the driver is not capable of sourcing full current it is advisable to buffer these signals with TTL buffers like 74244 types of drivers.

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

CURRENT SETTING USING "CSET" JUMPER BLOCK

JUMPERS				Current (Amp) For Tstep-087	Current (Amp) For Tstep-484
J1	J2	J3	J4		
1	1	1	1	1.2	0.7
0	1	1	1	1.8	1.0
1	0	1	1	2.2	1.3
0	0	1	1	2.8	1.6
1	1	0	1	3.2	1.8
1	1	1	0	3.4	2.0
0	1	0	1	3.8	2.1
0	1	1	0	4.0	2.3
1	0	0	1	4.2	2.4
1	0	1	0	4.4	2.6
0	0	0	1	4.8	2.7
0	0	1	0	5.0	2.9
1	1	0	0	5.4	3.1
0	1	0	0	6.0	3.4
1	0	0	0	6.4	3.7
0	0	0	0	7.0	4.0

When using above table: '1' means Jumper mounted, '0' means Jumper removed

SIGNAL COMMON TERMINAL POLARITY SETTING USING "POL" JUMPER BLOCK



Default setting for this jumper block is COM configured as -ve (GND) for Step/Dir signals, all the 4 Jumpers should be in parallel to each other side by side as shown in the picture on the left.



To configure COM as +ve terminal for Step/Dir signals, rotate the jumpers 90 deg as depicted on the drive cover, In this case jumpers will look like 2 pair of 2 jumper each side by side as shown in picture on the left.

NOTE: You may need to remove the cover to change this jumper setting as the whole jumper block is not exposed from the front side of drive.

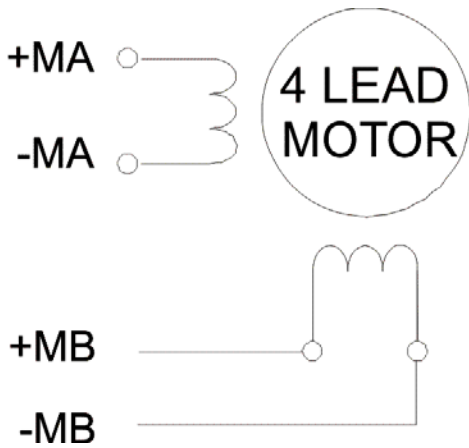
NOTES:

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.

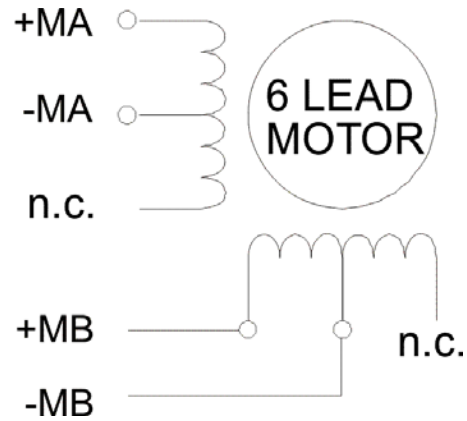
- 1. Never run the motor leads in the same cable or wiring harness as the STEP, DIR or COM (GND or 5 V) lines.*
- 2. Keep power supply leads as short as possible. If the power supply lead length exceeds 12 inches, use a 100 μ f capacitor across Terminals 1 & 2 at the drive.*
- 3. Never wire capacitors, inductors or any other components to the motor output terminals.*
- 4. Ground the Tstep-087 / Tstep-484 case.*
- 5. The metal casing of Tstep-xxx acts as an electrical noise filter and it is advisable not to run the drive without the cover (casing).*
- 6. Drive is protected from over current and short circuits but not from reverse polarity on POWER Terminals and connecting the power wrongly will destroy the drive.*
- 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 worst case it may blow the internal fuse.*
- 9. Note that the extreme left terminal "MGND" is power GND and the next right to it "MPWR" is +Ve supply terminal, its printed on drive cover but just making sure by mistake the power is not connected wrong way.*
- 10. Drive is not protected from reverse polarity on power terminals and doing so will blow the internal fuse and may destroy the driver.*

MOTOR CONNECTION FOR 4, 6 and 8 LEAD STEPPER MOTORS

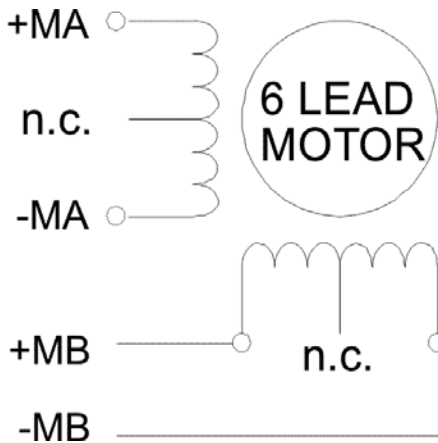
4 Lead: Only one way (set rated current)



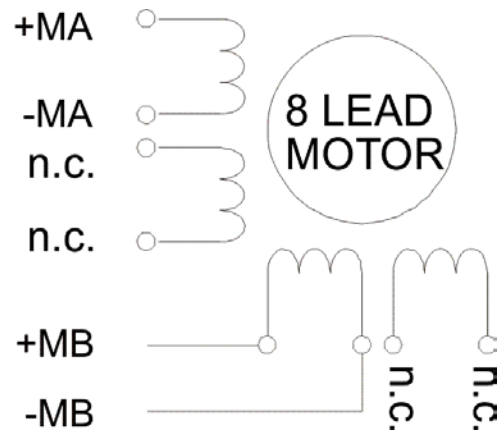
6 Lead: Half coil (set 2/3 rated current)



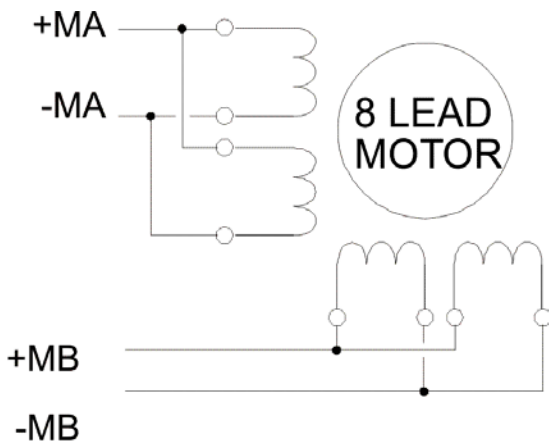
6 Lead: Series coil (set 1/3 rated current)



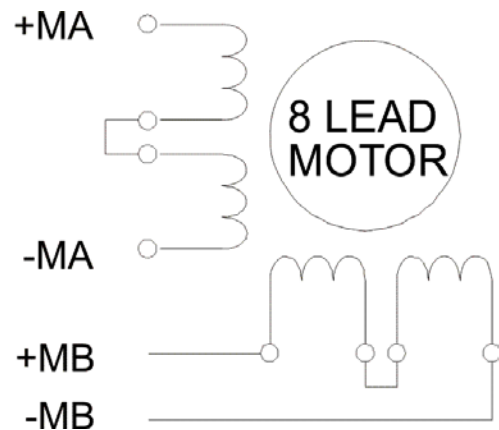
8 Lead: Half coil (set 2/3 rated current)



8 Lead: Parallel coil (set 2/3 rated current)



8 Lead: Series coil (set 1/3 rated current)



Note: It is advisable to set the drive output current equal to above values, this will result in minimum heating from the motor.

USER NOTES: