TINY CONTROLS

Tstep- 484, TWO PHASE BIPOLAR STEPPER MOTOR DRIVER USER MANUAL

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

GENERAL DESCRIPTION

- **The Tiny Controls Tstep – 484 is a high resolution step motor drive operating on fixed 10 micro stepping.**
- **The Tstep-484 operates on an unregulated positive supply voltage of 18-48V DC. Drive output current ranges from 0.7A to 4.2 A per phase. With suitably sized motors, over 200 watt peak can be delivered to user's application.**
- **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-484 is programmed to provide excellent stability at all speeds overcoming a limitation 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 s low level while the 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 drive. When any of these conditions occurs, the T-step 484 shuts down and turns on a faulty LED red in color; to indicate the presence of fault condition.**
- **The driver is compact, measuring approx. 82mm x 65mm x 20mm. 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- 48 V DC

Phase Current: 0.7 A – 4.2 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 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 2us.

Direction input: Stay 500ns unchanged before and after a step pulse.

Minimum operating Temperature: 70 degree Celsius (158 F).

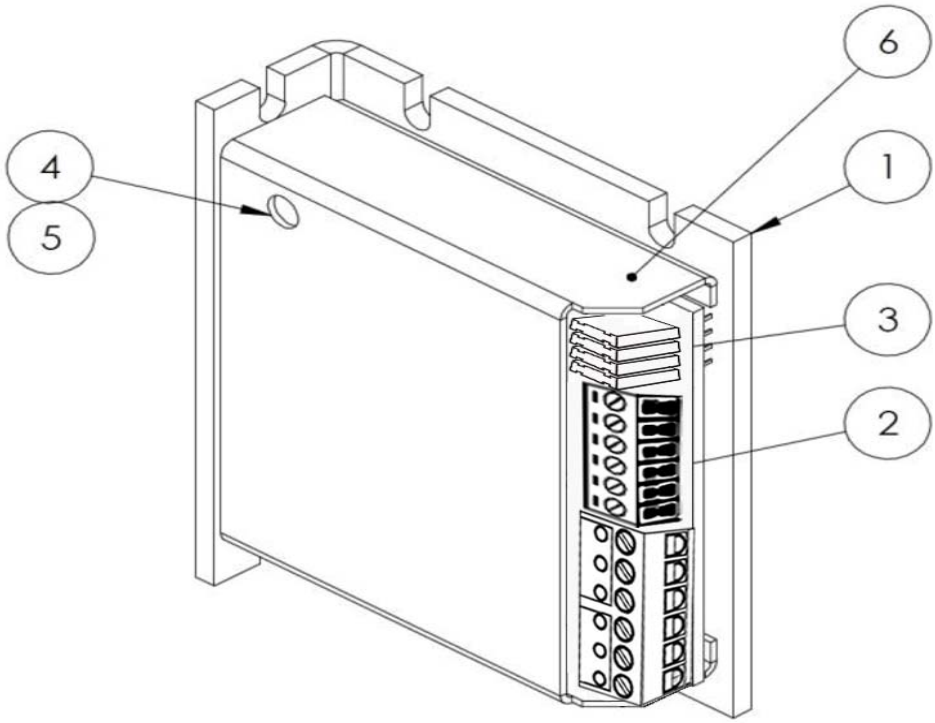
Storage temperature: 0 – 50 degree Celsius.

Humidity: 90%

Overall Size: 82mm x 65mm x 20mm.

Weight: 0.50 kg.

COMPONENT DESCRIPTION



1. **MOUNTING PLATE:** **This plate serves as a heat sink for the drive; heat generating components are thermally coupled/ attached to this plate.**

2. **CONNECTOR:** **2 different removable power terminal strips located on the front edge of the Tstep- 484 each 6 pin. The first connector gives connections for control interface i.e. Step, Direction and Disable connections. The 2nd connector is for the power supply and motor windings.**

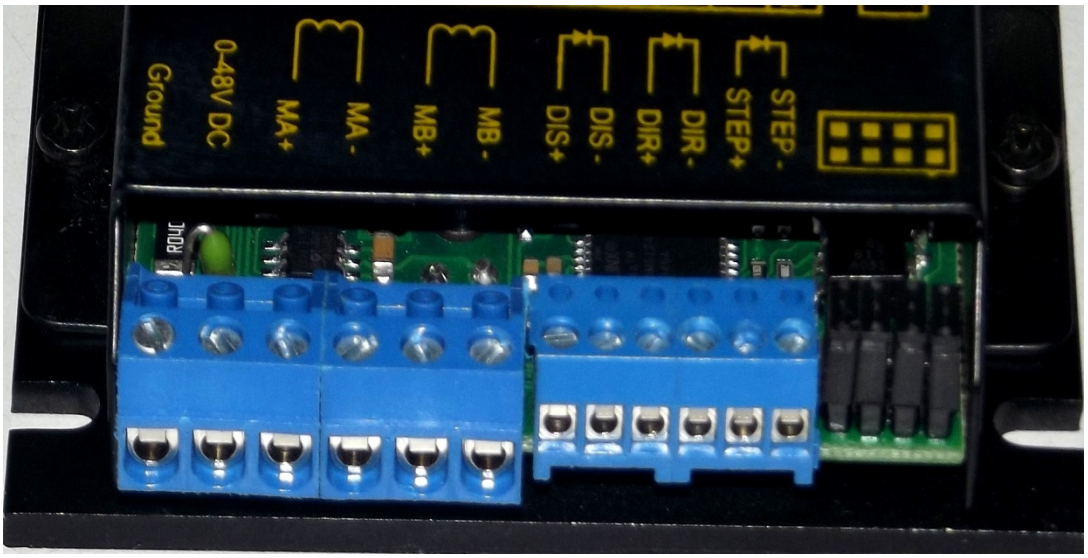
3. **MOTOR CURRENT OPTION HEADERS: A jumper block is provided for setting motor current.**

4. **FAULT LED RED: This LED indicates that tstep-484 has auto-triggered its protective shutdown circuit cycling the power supply after correcting fault condition. Will reset the driver and turn off the LED.**

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

6. **MOTOR COVER: This powder coated cover protects the driver from external elements in contact with the drive electronics and also works as shield that can interfere the internal electronic workings.**

TERMINAL DESCRIPTION



Terminals are described from left to right in picture:

THE CONTROL INTERFACE:

Control interface are opto-isolated from the power section of drive and described below:

TERMINAL 1 &2: Step is the (active signal) signal input, the motor will rotate one step 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 optocoupler.

TERMINAL 3 &4: Direction signal, Motor will step clockwise on high signals and counterclockwise on low signals on each step pulse. 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 coil connection same.

TERMINAL 5 &6: **Disable Signal. These are simply disabling signal. As the name suggests, it is provided to disable the drive.**

PHASE TERMINAL INTERFACE:

These are the phase winding outputs to the stepper. One motor winding coil goes to +MA/-MA and the 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-484 (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 tubing.

The Tstep-484 will drive 4, 6 and 8 wire motor. With 6 motors, the user has the option of connecting the winding in a high or low performance configuration. Reference the relevant information from page 15 showing the connections of 4, 6 and 8 wired motor connections.

POWER SUPPLY TERMINAL INTERFACE:

TERMINAL 11*:* **It is the positive dc voltage input for the motor power supply. 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 limit of the Tstep-484 i.e. 48 volts 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 15 explains in more details, the various configurations for connecting motor to the driver.

More than one Tstep-484 can be run from a common power supply if the filter capacitor is sized large enough to account for the combined load. Each Tstep-484 must have separate power supply leads back to the power supply.

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

TERMINAL WIRING DESCRIPTION

The Tstep-484 comprises a 2- piece main connector. The first connector has 1 to 6 terminals for control interface and the other connectors have terminals 7 to 12 for motor leads and power supply connections. Each can be removed separately by pulling the connectors upwards.

STEP: Connect the STEP signal to these terminals.

TERMINAL 1 & 2: Step pulse. Connect the step signal to Step- (terminal 1) or Step+ (terminal 2) as per your requirement. Terminal 1 is for signal ground and Terminal 2 is for controller +5V DC signal.

DIR: Connect the DIR signal to these terminals.

TERMINAL 3 & 4: Dir pulse. Connect the Direction signal here. Terminal 3 is for signal Ground and Terminal 4 is for controller +5V DC signal. Direction pulse provides the clockwise or anticlockwise direction from step controller. If the motor turns in opposite direction, then reverse the connections of motor windings. Put the connections from Terminal 9 to 10 and remain terminal 7 and 8 as it is.

DISABLE: to disable the stepper drive.

TERMINAL 5 & 6: This Terminal disables the stepper motor drive. Terminal 5, Dis- is for signal ground and terminal 6, Dis+ is for controller +5V DC signal.

This Terminal disables the stepper motor drive. Terminal 5, Dis- is for signal ground and terminal 6, Dis+ is for controller +5V DC signal. All the signals above are opto-isolated from each other. Don't connect the signal ground and Terminal 1, 3 and 5 to MGND. Terminal 2, 4 and 6 are driven

with +5V signals without needing any external signals or resistor and the driver must be able to supply a minimum of 10mA to the opto coupled STEP/DIR signals for best results.

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.

POWER TERMINALS:

TERMINAL 11: Connect the red lead of power supply to this terminal. It must be between +18V DC to +48 V DC.

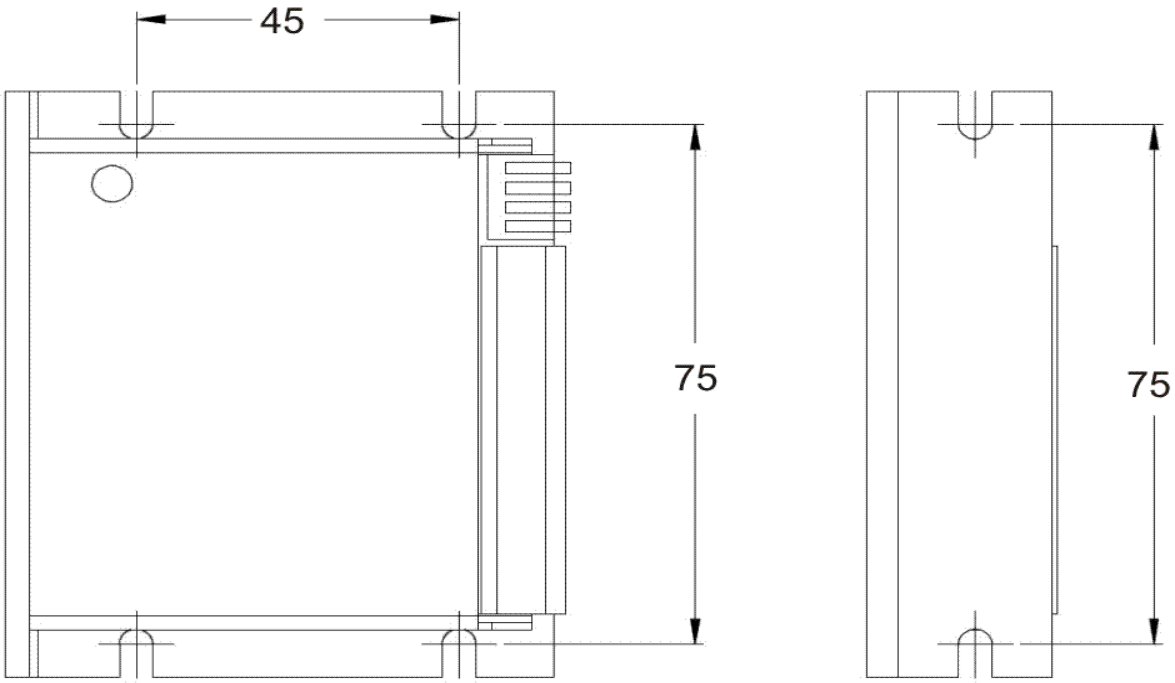
TERMINAL 12: Connect the negative (black) lead of power supply to this terminal.

Don't short the motor leads to each other or the drive will go into short circuit error. Drive can be reset back to normal operation (after removing the fault condition like short at output) by recycling the power.

The power supply must be between 18V DC to 48 V DC. Power supply excess of 48 V DC will damage the drive. The choice i.e. what should be the power supply voltage depends on the inductance of the motor.

The power supply voltage should not be less than 4 times of rated voltage of motor.

Product Dimensions and Installation



When operating the Tstep-484 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-484 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.

CURRENT SETTING USING "CSET" JUMPER BLOCK

Following Table shows the jumper settings for the corresponding currents (in A):

JUMPERS				CURRENT (A)
J1	J2	J3	J4	
1	1	1	1	0.7
0	1	1	1	1.0
1	0	1	1	1.4
0	0	1	1	1.7
1	1	0	1	1.9
0	1	1	0	2.1
1	1	0	1	2.2
0	1	1	0	2.4
1	0	0	1	2.6
0	0	1	0	2.7
1	0	0	1	2.8
0	0	1	0	3.0
1	1	0	0	3.2
0	1	0	0	3.6
1	0	0	0	3.9
0	0	0	0	4.2

When using above table: '1' means Jumper mounted and '0' means jumper removed.

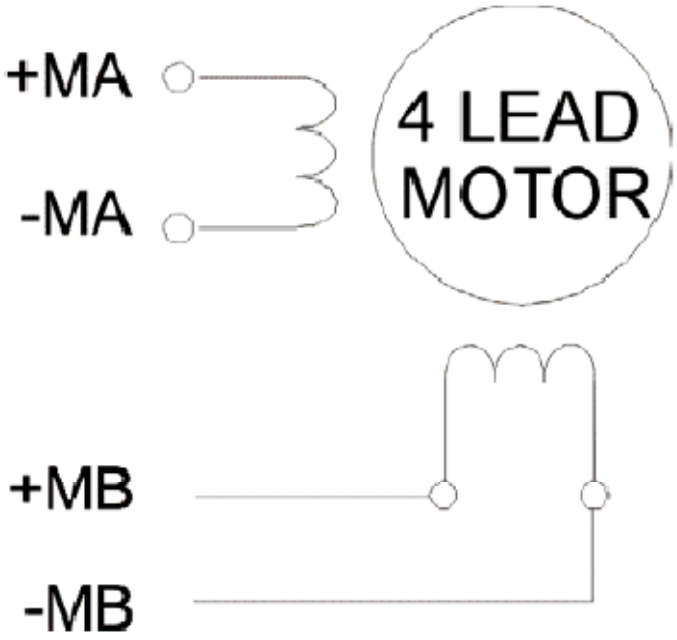
Notes:

The Tstep-484 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.

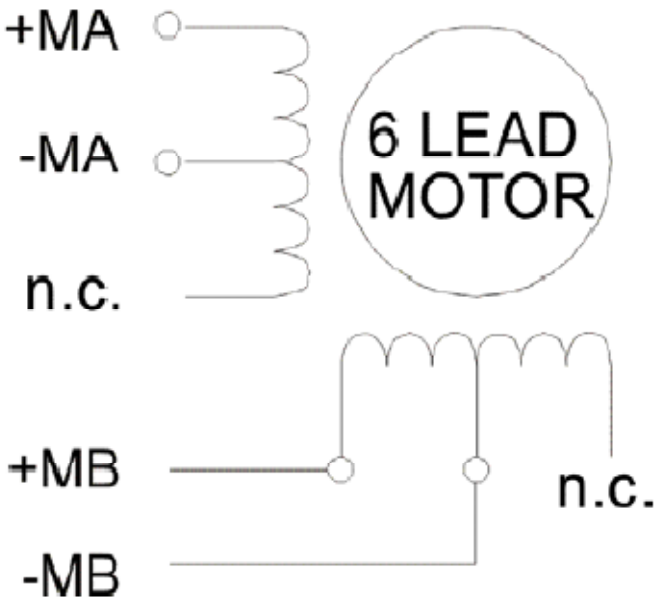
1. **Never run the motor leads in the same cable or wiring harness as the STEP, DIR or COM (GND or 5 V) lines.**
2. **Keep power supply leads as short as possible. If the power supply lead length exceeds 12 inches, use a 100 µf /100V capacitor across Terminals 1 & 2 at the drive (please ensure correct polarity).**
3. **Never wire capacitors, inductors or any other components to the motor output terminals.**
4. **Ground the Tstep-484 case.**
5. **The metal casing of Tstep-484 acts as an electrical noise filter and it is recommended 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 nest 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.**

CONNECTING 4, 6 AND 8 WIRES MOTOR

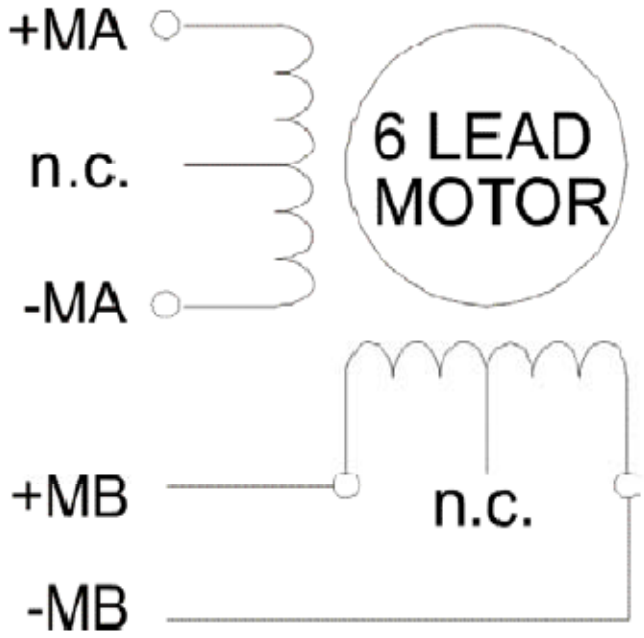
4 Lead: Only One Way (Set rated Current).



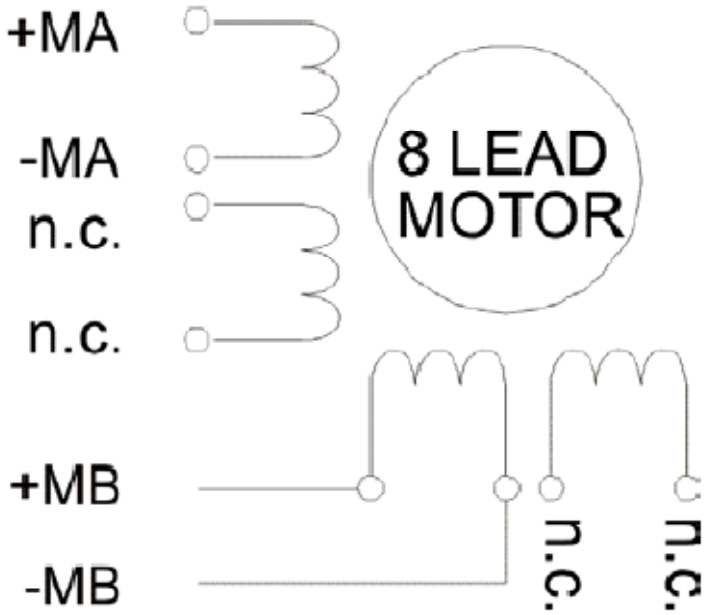
6 Lead: Half Coil (Set 2/3 rated Current).



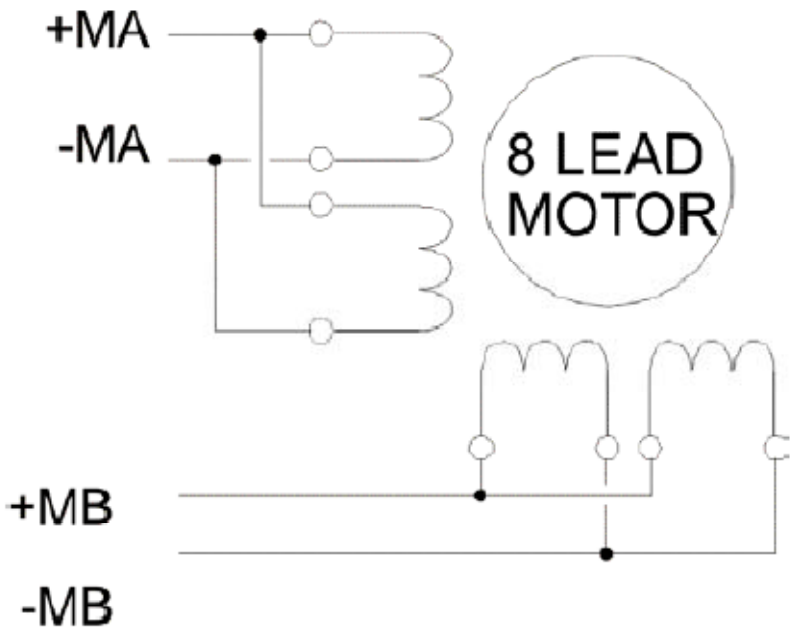
6 Lead: Series Coil (Set 1/3 rated Current).



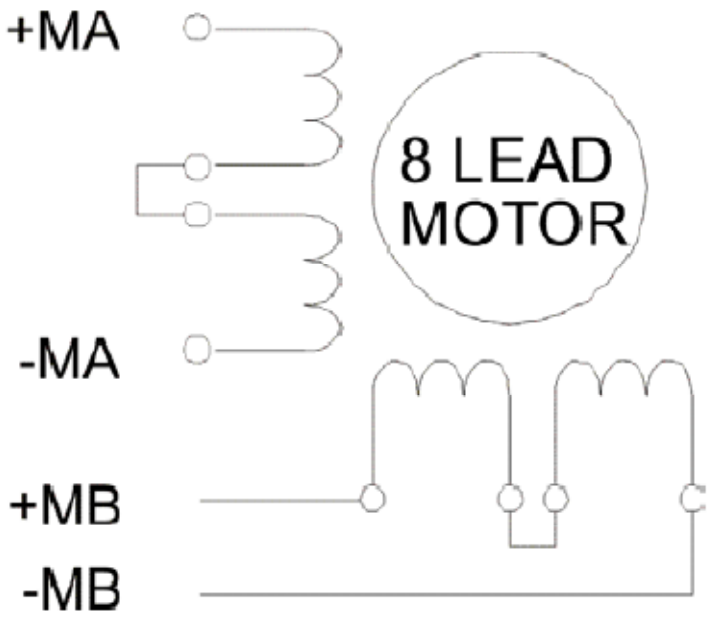
8 Lead: Half Coil (Set 2/3 rated Current).



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 equal to above values, this will result in minimum heating from the motor.

User Notes: