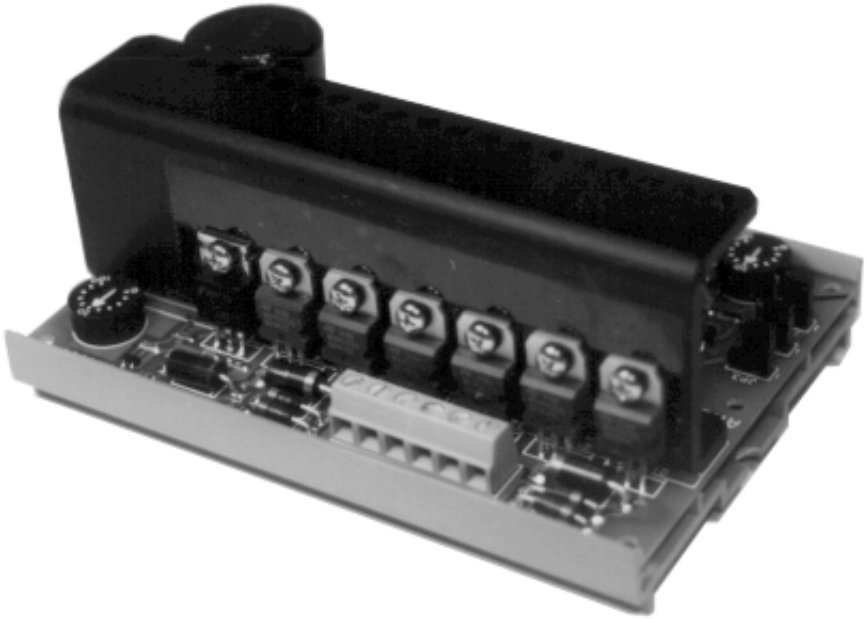
TM4000
Track Mounted Step Motor Driver

User's Guide



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TM4000 Driver Features

- 1.0-4.5 Amperes/Phase Operating Current
- Higher Torque/Speed Output
- Improved Start-Stop Speeds
- Short Circuit Protection
- Open Motor Wire Detection
- No RFI or EMI Problems
- Requires 7-28 VAC or 10-40 VDC
- TTL-CMOS Compatible Inputs
- Receives Positive or Negative Going Clocks
- Full Step or Half Step Operation
- Motor Turn Off Provisions
- Open Frame Circuit Board Mounts on Snaptrack

General Description

The TM4000 driver is a low cost, unipolar step motor driver designed for 4-phase step motors. The TM4000 can be mounted on easy to use snaptrack, available in lengths of up to 6 feet.

Bi-level Drive

The basic function of a step motor driver is to control the motor winding currents. Motor performance is determined by how fast the driver can increase and decrease the winding currents. A rapid rise in winding current is achieved by applying a high voltage directly to a motor winding. This rapid rise of current is also referred to as the “kick” or operating current. When a desired current level is reached, the high voltage is turned off and a low voltage is applied to maintain a suitable holding current level. When a motor winding is turned off, a rapid decrease in winding current is achieved by routing the energy in the collapsing field back to the power supply through a high voltage path. The high voltage supply furnishes the energy necessary to maintain motor output torque at high step rates thus providing high mechanical power output. The low voltage supply provides much of the current needed at low step rates and all of the holding current. Bi-level drivers do not use high frequency switching techniques as chopper drivers do. Consequently, they do not create the EMI, RFI, and motor heating problems that are associated with chopper drivers.

Half Step/Full Step

The TM4000 has two modes of operation full-step or half-step operation. Full-step operation occurs by energizing two phases at a time, rotating a typical motor 1.8 degrees per step. Half-step operation occurs by alternately energizing one, and then two, phases at a time, rotating the motor 0.9 degrees per step. Full-step operation is only for applications that specifically require that mode, such as when retrofitting existing full-step systems.

Phase Inputs

The TM4000 has the ability to accept phase inputs to control each of the 4 motor phases. For example, a micro controller can be used to control the motor phases. Terminals 1, 2, 3, and 4 of TB2, are used as the inputs for phase 1, phase 2, phase 3, and phase 4 respectively. Either positive true phase inputs or negative true phase inputs may be used. (See Jumper Functions/Locations)

Clock, CCW, and Direction

Pulses applied to the clock input cause the motor to move in the clockwise direction if the direction control input is a logic “1” (no connection), or in the counterclockwise direction if the direction control input is logic “0”. Pulses applied to the CCW input cause the motor to move in the counter clockwise direction. Either positive or negative going pulses may be used by setting jumpers in the appropriate position. To determine which setting to use, first consider the type of clock pulse output on the pulse generator or indexer (controller). If the clock output on the controller is open-collector type (sinking), then use the negative going jumper setting. If the clock output on the controller is a pnp or p-channel (sourcing) type, then use the positive going jumper setting. If the clock output on the controller is a TTL/CMOS type (totem pole), then either setting will work; but the jumper setting should be chosen based on the level of the clock output when the controller is not pulsing. If the clock is low when not pulsing, then use the positive going jumper setting. If the clock is high when not pulsing, then use the negative going jumper setting. (See Jumper Functions/Locations)

Current Adjust Setting (CUR. ADJ.)

The potentiometer R9 is used to set the motor current. The pot should be set according to the motor’s rated current. This will produce a kick current of 1.4 times the rated motor current. (Refer to Wiring Diagram for location of current adjust potentiometer R9)

Pot Setting	Rated Motor Current	Kick Current
0%	1.00A	1.40A
10%	1.35A	1.89A
20%	1.70A	2.38A
30%	2.05A	2.87A
40%	2.40A	3.36A
50%	2.75A	3.85A
60%	3.10A	4.34A
70%	3.45A	4.83A
80%	3.80A	5.32A
90%	4.15A	5.81A
100%	4.50A	6.30A

Motor Connection

Refer to the hookup diagram for typical driver applications. Wiring connected to inputs must be separated from motor connections and all other possible sources of interference. **Important Note:** When connecting the driver to the step motor, consult the factory if more than 25 feet of cable will be used to extend between the motor and driver.

Low Voltage Adjust (VLV ADJ.)

The potentiometer R24 is used to set the motor low voltage (VLV) supply which furnishes the current necessary for holding (standstill) torque and low-speed running torque. Higher values for the low voltage will produce more holding and low-speed torque. A proper VLV will produce a standstill current that is 65 to 100% of the rated motor current (i.e. for a motor rated at 1 amp, VLV should be set so that the standstill current is 0.65 to 1 amps).

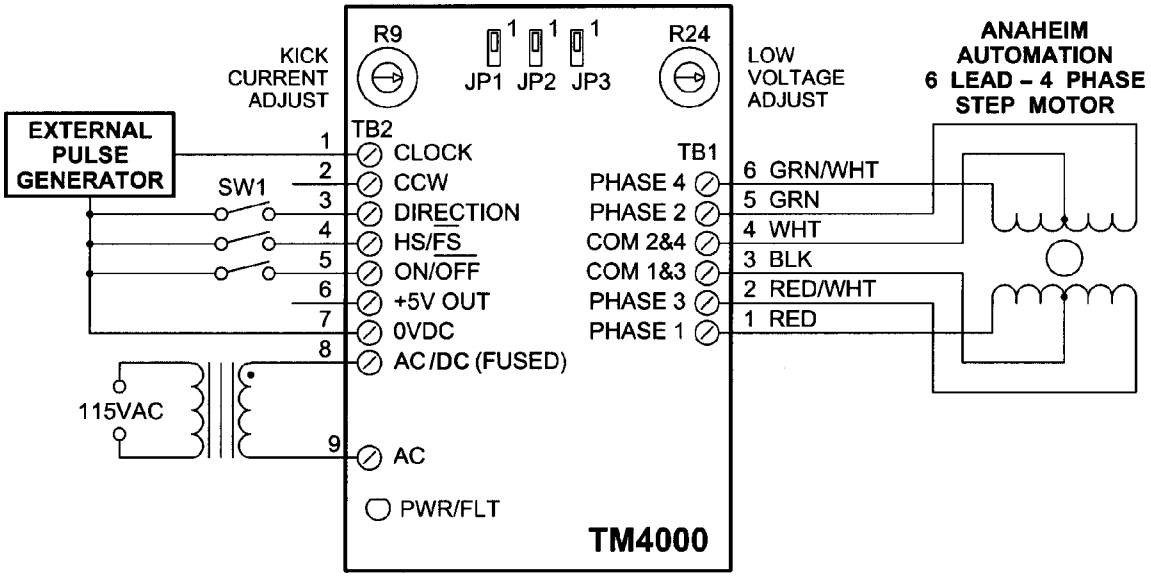
Motor	Standstill Current (Amps/Phase)	VLV ADJ. Pot Setting	Motor	Standstill Current (Amps/Phase)	VLV ADJ. Pot Setting
17L002_*-LW8	.7	0%	23D204_*	1.26	35%
17L102_*-LW8	.7	45%	23D306_*	2.03	30%
17L202_*-LW8	.7	55%	34D106_*	2.1	20%
17L203_*-LW8	1.05	20%	34D209_*	3.22	0%
23L002_*-LW8	.7	45%	34D207_*	2.45	25%
23L102_*-LW8	.7	80%	34D307_*	2.45	30%
23L104_*-LW8	1.4	20%	34N104_*-LW8	1.4	65%
23L106_*-LW8	2.1	0%	34N108_*-LW8	2.73	30%
23L204_*-LW8	1.4	35%	34K104_*-LW8	1.4	65%
23L206_*-LW8	2.1	30%	34K108_*-LW8	2.73	30%
23L303_*-LW8	1.05	35%	34N207_*-LW8	2.45	40%
23L306_*-LW8	2.1	55%	34K207_*-LW8	2.45	40%
23D102_*	.7	45%	34N307_*-LW8	2.45	40%
23D104_*	1.4	20%	34K307_*-LW8	2.45	40%

* Substitute S or D for Single or Dual Shaft Motor

Jumper Functions/ Locations

Function	JP1	JP2	JP3
Negative Going Clock Input	1-2	1-2	1-2
Positive Going Clock Input	1-2	2-3	1-2
Negative True Phase Inputs	1-2	1-2	2-3
Positive True Phase Inputs	2-3	2-3	2-3
Standard Product (Ready to Ship)	1-2	1-2	1-2

Wiring Diagram



Heating Considerations

The temperature of the heatsink should never be allowed to rise above 60 degrees Celsius. If necessary, air should be blown across the heatsink to maintain suitable temperatures.

Power Requirements

The TM4000 can be powered by an AC or DC voltage (see specifications). For AC operation, the driver may be purchased with a recommended step down transformer. A single transformer may be used to power up several drivers based on power consumption.

Terminal Descriptions

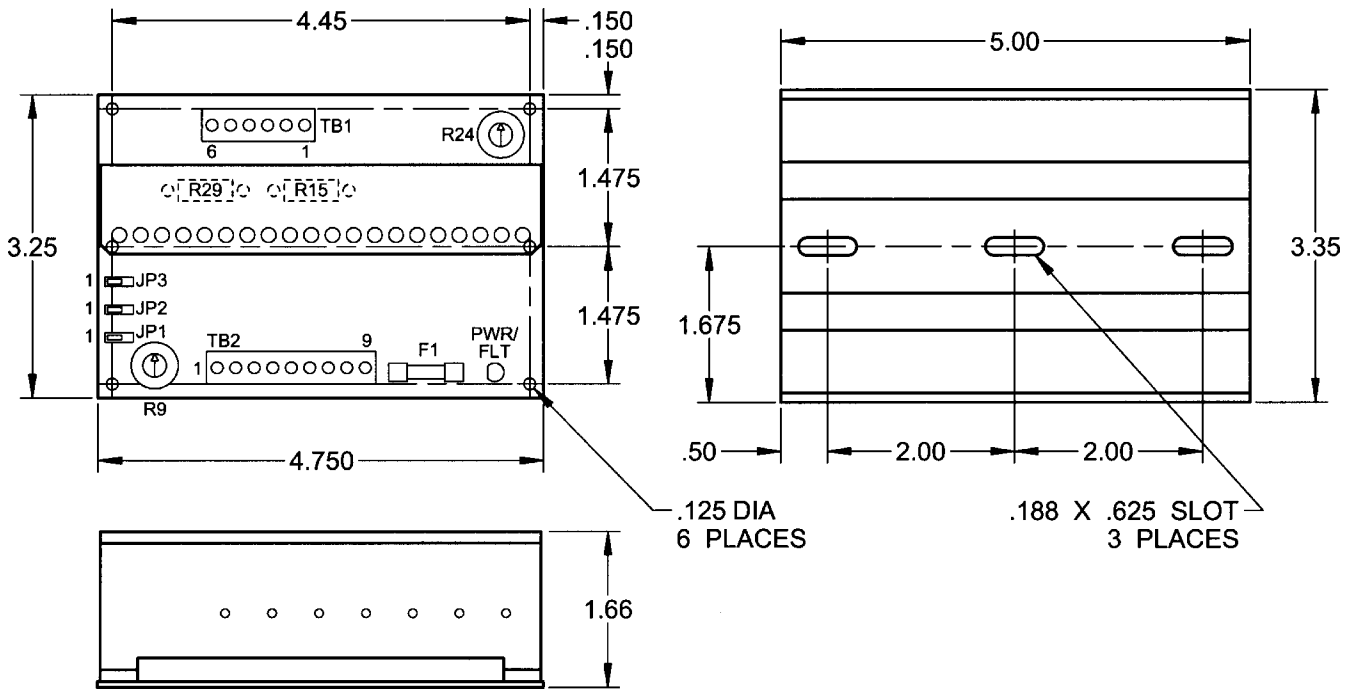
TB1:

Pin	Description
1	Clock Input (Phase 1)
2	CCW Input (Phase 2)
3	Direction Control (Phase 3)
4	Halfstep/Fullstep (Phase 4)
5	Motor On/Off
6	+5VDC Output
7	0VDC
8	AC/DC Power Input (Fused)
9	AC Power Input

TB2:

Pin	Description
1	Phase 1 (Red)
2	Phase 3 (Red/White)
3	COM Phase 1 & 3 (Black)
4	COM Phase 2 & 4 (White)
5	Phase 2 (Green)
6	Phase 4 (Green/White)

Dimensions



Motor On/Off

The motor On/Off feature allows the de-energizing of a motor without disturbing the positioning logic. After reenergizing the motor, a routine can continue. This reduces motor heating and conserves power, especially in applications where motors are stopped for long periods.

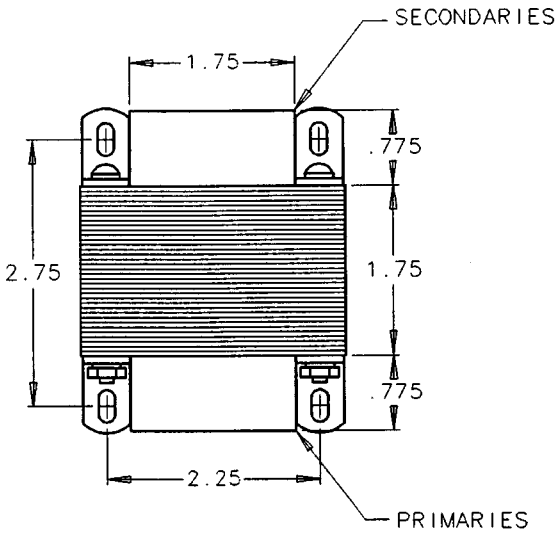
Fault Protection

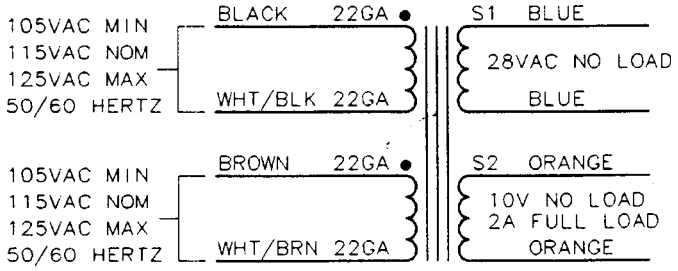
There are 2 types of fault detection. When a fault is detected, the driver turns off the motor current and the LED indicates which type of fault occurred. The LED is solid red during normal operation.

LED - Two Blinks	Shorted wire in the motor or cable.
LED - One Blinks	Open wire in the motor or cable.

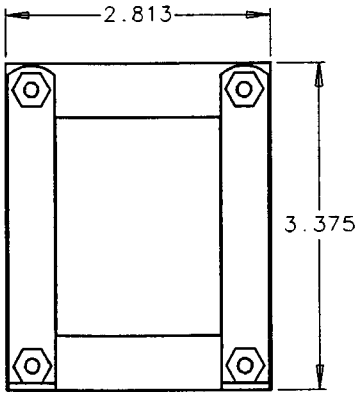
If the driver goes into a fault condition, the fault may be reset by turning the power off for at least 20 seconds.

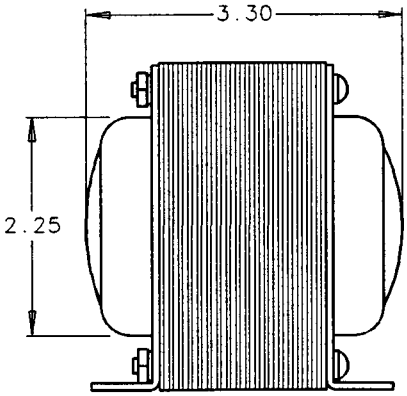
Transformer Drawings (AA2784)



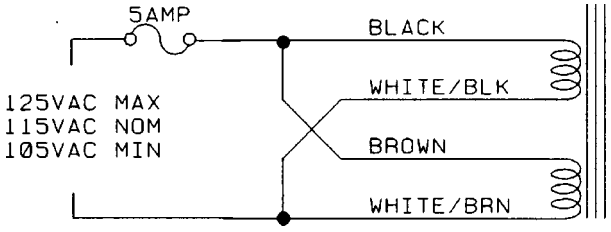


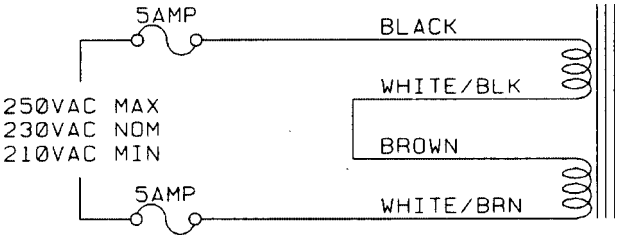
Note: Blue wires go to TB2, pins 8 & 9 on the driver.





Transformer Wiring Diagrams (Primary Input)





Specifications

Control Inputs: (TB2, Pins 1-5)
TTL-CMOS Compatible
Logic “0” = 0-0.8VDC
Logic “1” = 3.5-5.0VDC
Pins 1-4 are pulled up or down (depending on the jumpers) through 10k ohm resistors. Pin 5 is pulled up through a 10k ohm resistor.

Clock, CCW: (TB2, Pins 1 and 2)
15 microseconds minimum pulse width, positive or negative going.

Direction Control: (TB2, Pin 3)
Logic “1” (open) - Clockwise
Logic “0” - Counterclockwise

Mode Select: (TB2, Pin 4)
Logic “1” (open) - Half-step
Logic “0” - Full-step

Motor On/Off: (TB2, Pin 5)
Logic “1” (open) - Motor energized
Logic “0” - Motor de-energized

Output Current Rating: (TB1)
4.5 amperes per phase maximum operating current; 3.0 amperes per phase maximum standstill current. Motor phase ratings of 1 ampere minimum are required to meet the minimum kick level.

+5VDC Output: (TB2, Pin 6)
100mA maximum

Power Requirements: (TB2, Pins 8 and 9)
7VAC (min) - 28VAC (max) or
10VDC (min) - 40VDC (max)

Operating Temperature:
Heatsink: 0°-60° C

Fuse:
5 Amp Fast Blow
5 x 20mm

Power Supply Ordering Information

DC Supply	Description	AC Transformer	Description
PSA40V4A	40VDC at 4 Amps	AA2295	100 Watt
PSA24V2.7A	24VDC at 2 Amps	AA2784	200 Watt
PSA40V8A	40VDC at 8 Amps	AA2785	300 Watt

The AA2784 is the recommended transformer. For additional info on other transformers please contact the factory.

Troubleshooting

If a fault occurs, reset the fault by cycling power OFF for at least 20 seconds. After resetting, try to run the motor again. If the driver faults again then check the conditions listed below.

Is the LED blinking twice?
This indicates that the motor has a phase shorted or there is a short in the motor cable or wiring. Check the motor and the wiring for shorts. If the driver continues to sense “shorts” after the motor and wiring are determined to be accurate, then the output transistor should be checked (see below).

Is the LED blinking once?
This indicates that there is an open or intermittent connection in one of the motor wires. Check the motor and the wiring for opens. Another condition that may cause this type of fault, is when a large motor is ramped down too quickly so that it loses it’s positioning.

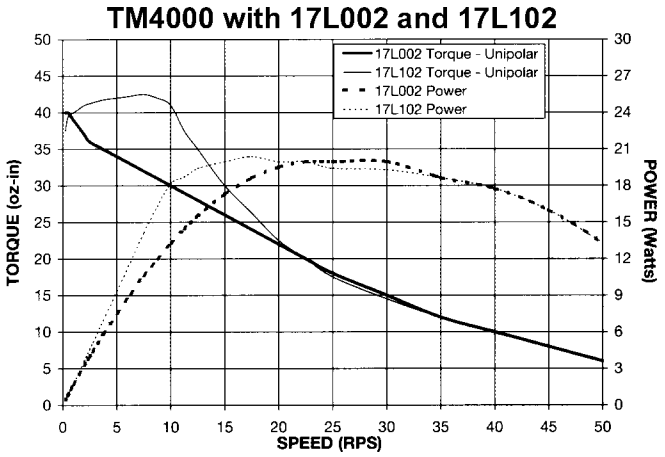
Checking Output Transistors

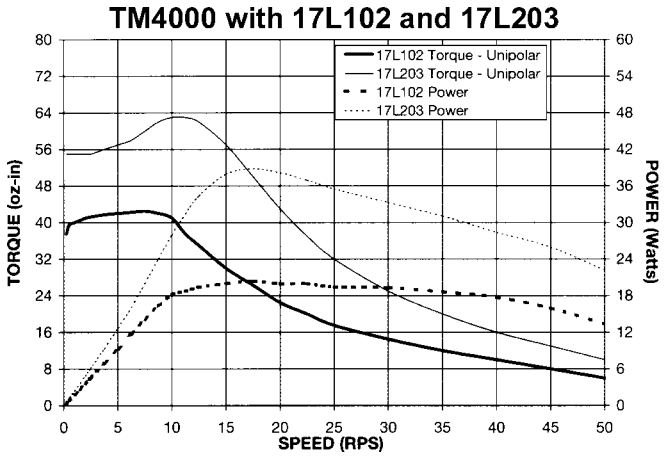
1. Set the multimeter to “diode test”.
2. Place the red meter lead on (between) the sense resistors (labeled as R15 and R29 in Jumper Functions/Locations).
3. Touch the black meter lead to each phase (TB1, Pins 1,2,5 and 6).
4. Readings should be between 0.450 VDC and 0.550 VDC.
5. If any readings are significantly less than 0.450 VDC, then the unit has been damaged.

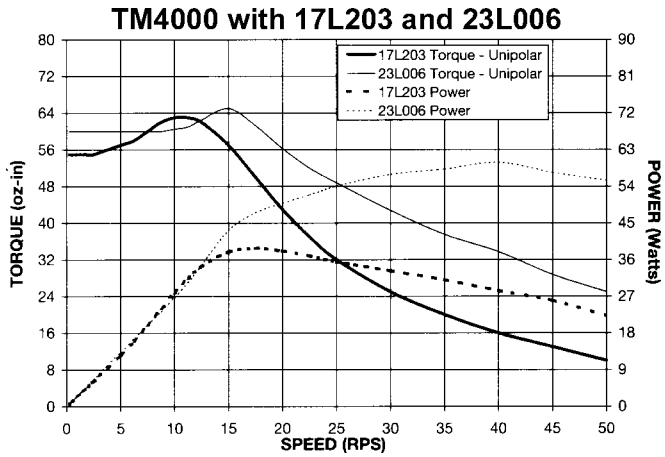
If a factory repair is required, please contact Anaheim Automation for an RMA# at:

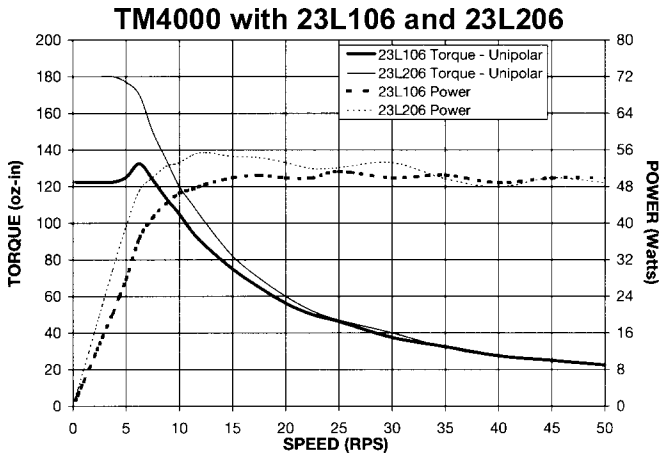
(800) 345-9401 or (714) 922-6990

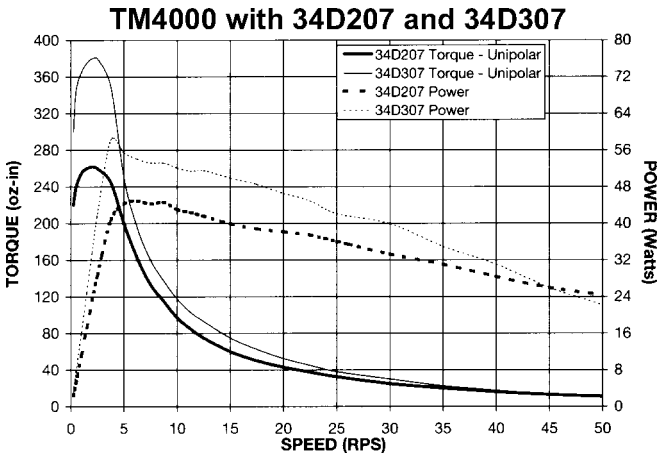
Torque Speed Curves

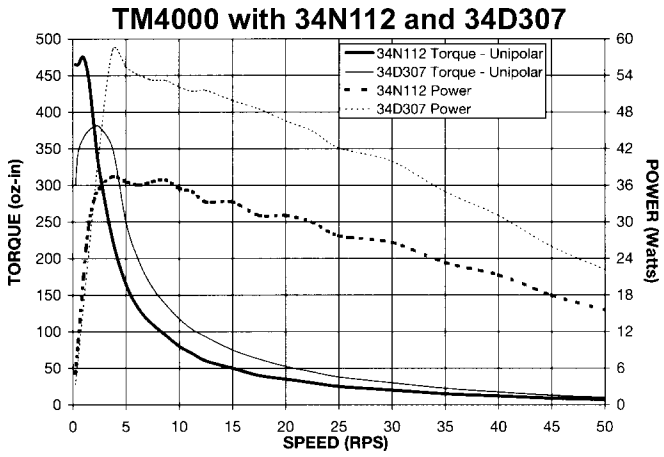












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LIMITED WARRANTY

All Anaheim Automation products are warranted against defects in workmanship, materials and construction, when used under Normal Operating Conditions and when used in accordance with specifications. This warranty shall be in effect for a period of twelve months from the date of purchase or eighteen months from the date of manufacture, whichever comes first. **Warranty provisions may be voided if products are subjected to physical modifications, damage, abuse, or misuse.**

Anaheim Automation will repair or replace at its' option, any product which has been found to be defective and is within the warranty period, provided that the item is shipped freight prepaid, with previous authorization (RMA#) to Anaheim Automation's plant in Anaheim, California.

TECHNICAL SUPPORT

If you should require technical support or if you have problems using any of the equipment covered by this manual, please read the manual completely to see if it will answer the questions you have. If you need assistance beyond what this manual can provide, contact your Local Distributor where you purchased the unit, or contact the factory direct.

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