

# e-Mag Solar Pump™

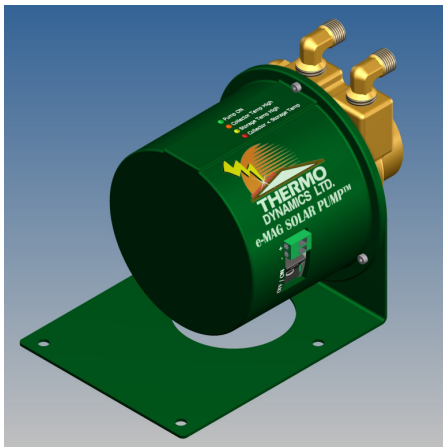
## 12 VDC Pump/Motor with Solar Controller

### Technical Specifications

Models: P24070EM & P50140EM



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### 1.0 General Information

The Thermo Dynamics Electronic Mag-Drive Solar Pump™ (e-Mag Solar Pump™) is an advanced solar powered pump. The unit is equipped with a brushless DC (BLDC) motor, positive displacement vane pump, and integral motor controller with differential temperature controls. About the size of a large grapefruit, the e-Mag Solar Pump™ is the latest advancement in solar pump technology and is unparalleled in efficiency and reliability. Designed specifically for solar thermal applications, the e-Mag Solar Pump™ includes all the electronics and control functionality necessary for a typical solar water heater. The e-Mag Solar Pump™ is also suitable for a variety of other applications where low pumping power is required.

### 2.0 Background

Thermo Dynamics Ltd. (TDL) manufactures a line of pumps under the tradename Solar Pump™. The Solar Pump™ is designed for operation with photovoltaic (PV) modules, or another source of DC power (e.g., batteries, DC power supply). The e-Mag Solar Pump™ is the latest evolution of TDL's Solar Pump™ family, occupying less than one half the footprint of its predecessor while maintaining all of the functionality and efficiency. The compact size has been achieved by replacing the brushed motor and magnetic pump-to-motor coupler with a substantially smaller BLDC motor. The BLDC motor couples directly to the pump via a rotating electro-magnetic field that interacts with a magnet secured to the shaft of the pump rotor. As the electro-magnetic field rotates, so does the pump rotor, thus causing the pump to circulate. All motor control functions are handled by the integral motor control circuit with built-in solar controller.

TDL has conducted extensive research and development on solar powered pumps in order to design a 100% solar powered solar water heater and overcome the inefficiencies of AC powered circulator pumps.

In 1992 TDL introduced the very first Solar Pump™. Since then, TDL has continued to develop increasingly compact and efficient Solar Pump™ models. In 2002, after extensive development and testing in the laboratory and in the field, TDL introduced the Mag-Drive Solar Pump™. After several more years of research and development with brushless DC motors, TDL is proud to introduce the e-Mag Solar Pump™ as the successor to the Mag-Drive Solar Pump™.

The following e-Mag Solar Pump™ models replace the former Mag-Drive Solar Pump™:

- P24070EM replaces P24070M
- P50140EM replaces P50140M

Currently there is no Mag-Drive or e-Mag model of the P118330 Direct-Drive Solar Pump™.

### 3.0 Description of Electro-Mag-Drive

There is a powerful magnet on the shaft of the pump rotor. The rotor magnet, and the entire pump rotor, is sealed inside the pump housing. There is no rotating shaft to penetrate the pump housing, and therefore, no need for a mechanical seal.

When power is applied to the e-Mag control circuit (assuming the differential temperature parameters are satisfied) a powerful electro-magnetic field is generated at three poles of the 9-pole BLDC motor. The resulting electro-magnetic force will cause the pump rotor to turn 120°, a rotation that will successively be detected by sensors on the e-Mag control circuit. Power will then be diverted by the control circuit to the next three poles of the BLDC motor, causing the pump rotor to turn once more. As the pump rotor continues to turn, the e-Mag controller continues to track the rotor position, energizing the respective poles of the 9-pole BLDC motor, and thus enabling continuous rotation of the pump rotor.

### 4.0 Advantages of the Solar Pump™

- 100% solar powered
- built-in differential temperature controller with fail-safe functionality and high-temperature limits
- built-in linear current booster
- high head & pressure (up to 35 m / 115 ft)
- self-priming
- no air separator required
- no charging pump required
- smaller diameter tube may be used
- reduced installation time
- life expectancy of over twenty years
- ten-year limited warranty
- no high-voltage electrical connections
- no certified electrician to install pump
- no electrical permit required
- no high-voltage electromagnetic fields

### 5.0 BLDC Motor Driver

Developed by TDL, the e-Mag Solar Pump™ on-board motor control circuit utilizes electronic commutation and hall effect sensors for driving the BLDC motor. The motor control circuit also integrates the full functionality of the TDL Delta-T Booster™ solar controller, featuring a linear current booster (LCB), and differential temperature controller, making it ideal for solar thermal applications.

Since 2000, TDL has developed an evolving line of linear current boosters (LCB). The LCB is a motor driver recommended for PV powered applications and functions by matching the DC motor load to the PV power supply, thus optimizing performance. Over several years of experimentation and trials, TDL has introduced three LCB's - the Jolter™, the Booster™, and the Delta-T Booster™. The Delta-T Booster™ is the most recent iteration of TDL's LCBs and incorporates differential temperature control with fail-safe functionality, high-temperature limits, and an electronic jolting function to overcome static friction and/or minor pump blockages. It is included as a standard component with the Solar Pump™ and the Solar Boiler™, and it now comes fully integrated into the new e-Mag Solar Pump™.

### 6.0 Power Requirements

Voltage (nominal)	12 VDC
Minimum voltage, $V_{MIN}$	15 VDC
Maximum voltage, $V_{MAX}$	30 VDC
Minimum current, $I_{MIN}$	0.08 A
Maximum current, $I_{MAX}$	2.00 A
PV Module size	10 to 50 $W_p$

### 7.0 Flow Rates

#### Solar Pump™ P24070EM

12 VDC (nominal):  
 0.3 - 2.4 L/min (0.1 - 0.6 USGPM)

#### Solar Pump™ P50140EM

12 VDC (nominal):  
 0.8 - 5.0 L/min (0.2 - 1.4 USGPM)

### 8.0 Pressure Ratings

These ratings indicate the maximum pressure increases produced by the e-Mag Solar Pump™. Operating line pressures can be as high as 150 psi (10 bar)

#### Solar Pump™ P24070EM

12 VDC (nominal): 50 psi (3.4 bar)

#### Solar Pump™ P50140EM

12 VDC (nominal): 50 psi (3.4 bar)

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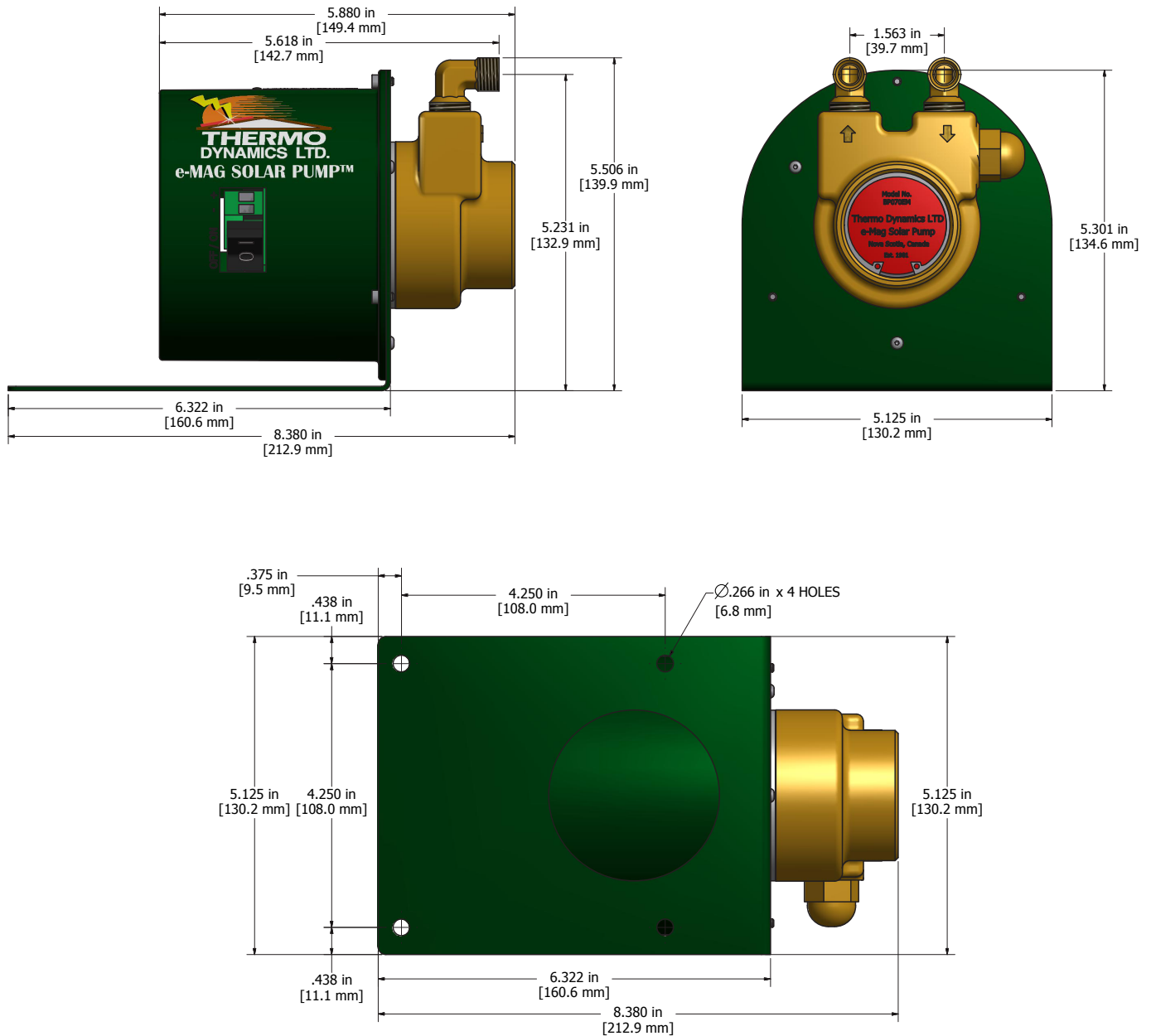


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## e-Mag Solar Pump™ - Dimensions

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Weight: 3.4 kg (7.5 lbs)