Technical Note:

Delta-T Booster II

PV Powered Motor Starter with Differential Temperature Control

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1.0 General:

The Delta-T Booster II (DTBII or "Booster™") is a differential temperature (ΔT) controller with current boosting functionality. It is for solar pumps that utilize a photovoltaic (PV) solar module as the power source.

The Booster™ holds the voltage of the PV module at approximately 15 VDC in a "12-V nominal" system, or approximately 30 VDC in a "24-V nominal" system. If the motor voltage rises above 15 V (or 30 C), the Booster™ allows the PV voltage to rise with motor voltage. The PV voltage should be 15 V (or 30 V), except in the early hours of the morning as the sun rises above the horizon, and in the late hours of the day when the sun sets.

During low sunlight conditions when the PV module does not produce sufficient power to drive the Solar Pump™ continuously, the Booster™ stores the electrical energy from the PV module, and then releases it in a sudden burst of power to cause rotation of the pump. This "jolting" feature also serves to start the pump earlier in the day, when it might remain at rest due to static friction after resting overnight.

The DTBII uses two temperature sensors (10,000 ohm thermistor) for differential temperature control. By comparing the two temperatures, the DTBII ensures that the Solar Pump is only activated when there is energy to be gained, that is, when the solar collector is hotter than the storage tank. The DTBII has high and low temperature limits, and failsafe protection in the event of an open or short circuits. The DTBII provides all the control functionality necessary for a solar thermal system powered 100% by the sun.

2.0 Connections:

PV+ Positive from the PV module
PV- Negative from the PV module
M+ Positive to the DC motor
M- Negative to the DC motor
Tc Collector temperature sensor (no polarity)
Ts Storage temperature sensor (no polarity)

3.0 Operation:

The Delta-T Booster II will turn ON (energize the M+ terminal) when the collector sensor measures 3°C (5ºF) higher than the storage sensor.

The Delta-T Booster II will turn OFF (de-energize the M+ terminal) when:

- The collector sensor temperature drops 1ºC (2ºF), or less, above the storage sensor temperature.
- The "Storage Temp High" set point is reached. This set point is factory set to 70°C (158°F) and can be adjusted between 32°C - 90ºC (90°F – 194ºF) using the potentiometer next to the power switch. Fully clockwise equals 90ºC (194ºF).
- The "Collector Temp High" set point is reached (112°C or 234°F).
- The "storage temperature low" set point is reached (-3°C or 27°F).

There is 3°C (5°F) of hysteresis for all set points. Once a set point has been reached the temperature must fall (or rise) by 3°C before the controller will turn ON (or OFF) again.

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3.1 LEDS:

The following conditions are required to illuminate each LED.

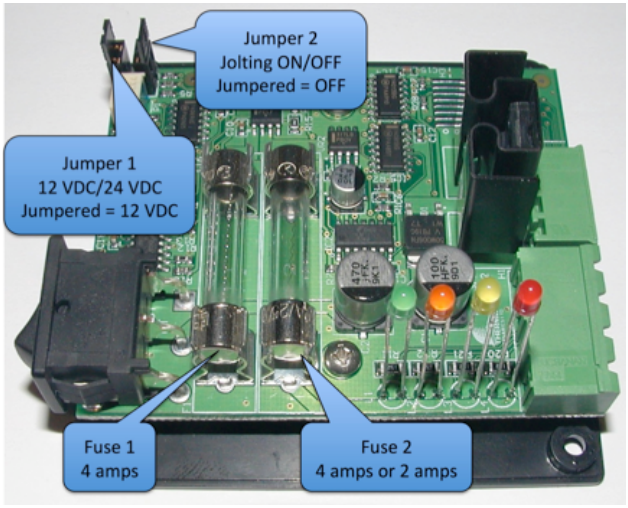
- GREEN – Pump ON
  The collector temperature is higher than the storage temperature. The pump should be running. If there is little sunlight, the green LED may be "ON" but the pump may not be turning. If so, wait for more sunlight.
- AMBER – Collector Temp HIGH
  Collector temperature HIGH (>112°C or 234°F) or collector sensor short circuit.
- YELLOW – Storage Temp High
  Storage temperature HIGH or storage sensor short circuit.
- RED – Coll Temp < Stor Temp
  Low ΔT (collector temperature < storage temperature) or collector sensor open circuit.
- No LEDs illuminated
  The power switch is OFF, or there is no power from the PV module (no sunlight), or the storage sensor is open circuited, or the storage sensor measures -3°C or less.

4.0 Fuses

The Delta T Booster II has two fuses, F1 and F2. Both fuses are fast acting, size 3AG.

- F1 is rated at 4 A, 250 VDC and is used to protect the controller circuit.
- F2 is used to protect the motor from overheating. F2 is rated at 2 A, 250 VDC for Solar Boiler™ systems (SB32-9PV, SB64-9PV). F2 is rated at 4 A, 250 VDC for other systems

  Should a fuse need replacement, it must be replaced with an equivalent rated fuse.



5.0 Service Plug

The "Service Plug" is used to override the Delta-T Booster II's differential temperature controls. Plug the service plug into the Ts and Tc terminal block to force the Delta-T Booster II into a "Pump ON" state when power is available from the PV module. This is useful for commissioning and/or servicing.

6.0 Troubleshooting

Problem: The green LED is ON when the sun is shining but the pump is not turning.
Diagnosis: Fuse F2 has blown.
Solution: Replace fuse F2 with equivalent rated fuse (see above for fuse ratings).

7.0 Jumper positions

Jumper 1 is used to set the DTB II for 12 V or 24 V operation.
Jumper 2 is used to disable the "jolting" function of the controller.

8.0 Electrical specifications

Voltage (nominal): 12 or 24 VDC*
Voltage (maximum): 22 or 44 VDC
Voltage (typical): 15 or 30 VDC
PV current (maximum): 4 amps

9.0 Caution

The DTB II is only to be connected to a 12 V or 24 V PV module. For servicing purposes a current controlled DC power supply (set at 20 or 40 VDC) can be employed.

Service Plug