

Technical Note

TDL JOLTER DT PV Motor Starter with differential temperature control



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1.0 General

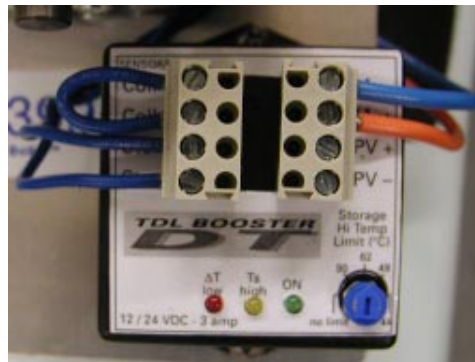
The TDL Jolter DT™ is an electronic device that acts as a DC-DC transformer in a direct drive PV powered DC motor system. As well, the TDL Jolter DT™ is equipped with jolting capability and a differential control function.

2.0 TDL Jolter™ and TDL Booster™

Thermo Dynamics Ltd. (TDL) manufactures various solar-powered drivers for DC motors, or DC-DC transformers, under the trade names *Booster™* and *Jolter™*. A *Booster™* or *Jolter™* is used to drive the TDL Solar Pump™, a solar-powered pump with a DC motor. The *Booster™* maintains the voltage of the photovoltaic (PV) module at 15 VDC in a “12-V nominal” system, or 30 VDC in a “24-V nominal” system. If motor voltage rises above 15 V, then the *Booster™* allows PV voltage to rise with motor voltage. PV voltage should be 15 V, except in the early hours of the morning as the sun rises above the horizon, and in the late hours of the day as the sun sets. The *Jolter™* is an advanced booster. At low sunlight, when the PV module does not produce sufficient power to drive the Solar Pump™ continuously, the *Jolter™* stores the electrical energy from the PV module, and then releases it in bursts of power to cause rotation of the pump. This feature also serves to start the pump earlier in the day, when it might remain at rest due to stickiness after resting over night.

3.0 TDL Jolter DT™

In 2004 TDL introduced an advanced version of the *Booster™* and *Jolter™*. The new solar DC-DC transformer is sold under the trade name **Jolter DT™**. The “DT” stands for “differential temperature” control. The **Jolter DT™** (i) boost PV current, (ii) provides a jolting function to start the motor, (iii) controls the motor according to a differential temperature, and (iv) provides a high storage temperature limit.



Specifications

Voltage (nominal):	12 VDC or 24 VDC (shipped in 12 VDC operation)
Voltage (maximum):	42 VDC
Voltage (operating):	15 VDC or 30 VDC
Current (maximum):	3.0 amperes

LED's

RED = ΔT low - collector temperature is less than storage temperature. System will not operate
YELLOW = T_s high - Storage tank temperature has met high limit. System will not operate
GREEN = System in operation

Blue Potentiometer (available on some models) = The storage high limit can be set from 44°C to “no limit”.



Collector Sensor well. This is used with Solar Boiler systems and is located on the “B” collector. Insert the collector sensor in the copper tube.



Collector Sensor. Supplied with Solar Boiler systems.

All TDL Jolter DT™'s are shipped with a jumper between the 2 collector screw terminals. This disables the differential temperature function.

To enable the differential temperature function, remove the jumper, and connect the wire leading to the collector temperature sensor

The LED's are supplied with power from the PV module, therefore, they will only be illuminated during the daylight hours.

3.1 Differential Control

The **Jolter DT™** uses 10-kohm thermistors to measure collector temperature (T_c) and storage temperature (T_s). When T_c exceeds T_s by a DT of 1-2°C the boosting/jolting function is enabled. The “DT-on” is low relative to conventional DT controllers because the power source is a photovoltaic module and there is no concern that the electrical power consumption of the pump exceeds the thermal power delivered by the solar collectors. If T_s exceeds T_c then the **Jolter DT™** will not supply power to the pump.

When the DT is low, indicating there is insufficient heat in the solar collectors, the red LED on the **Jolter DT™** is illuminated. A high storage temperature limit is also provided with the **Jolter DT™**. The storage high limit can be set with the potentiometer dial on the top of the **Jolter DT™**. The high limit can be set from 44°C to “no limit”. When T_s exceeds the high limit setpoint, the yellow LED is illuminated.

Note: Adjustable high limit is only available on some models.

Technical Note

TDL JOLTER DT

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During daylight hours, if T_c exceeds T_s , and T_s is less than the storage high limit, the green LED should be illuminated. The LED's are supplied with power from the PV module, therefore, they will only be illuminated during the daylight hours.

All TDL Jolter DT™ are shipped with a jumper between the 2 collector sensor terminals. This disables the differential temperature function.

To enable the differential temperature function, remove the jumper and connect the wires leading to the collector temperature sensor.

3.2 Jolting Capabilities

At low levels of sunlight, while:

1. the current from the PV modules is less than 0.3 amperes AND
2. $T_c > T_s$ AND
3. $T_s <$ high limit AND the motor has not started -

the motor will be given small jolts of power. When the motor turns continuously, the power will be supplied in a steady manner to the motor. The current required to start a motor is greater than the current required to keep a motor running. It may require 0.20 amps of PV current to start a motor, but the motor, once started, may continue to run until the PV current falls to 0.12 amps. The minimum current required to maintain a motor running, and the current required to start a motor varies from motor to motor, and pump to pump. If the motor will not start with 0.30 amps of PV current, then there may be a problem with the motor/pump.

4.0 Installation

The connections to the **Jolter DT™** are made using the terminal blocks on top of the Jolter DT™. Light gauge wire can be used for the thermistors. The thermistor current is very small. The thermistors have no polarity. Connect the motor to the **Jolter DT™** prior to connecting the PV module to the **Jolter DT™**. Observe polarity when connecting the PV module leads to the terminal block.

The only power source that is to be connected to the **Jolter DT™** is a PV module, or modules, with a rating not exceeding 3 amperes at full sun. A high-quality DC power supply, with current control, can be used to test the **Jolter DT™**. The DC power supply should be set at 20 VDC (40 VDC with a 24 V Jolter DT™), and connected to the **Jolter DT™** while the current control is turned to the zero current position. The current can be increased gradually to simulate the rising of the sun and the increase in current from a PV module as the sun arises.

4.1 Jumper positions and Operation

The **Jolter DT™** operates with a single PV module, or several PV modules wired in parallel, in a "12-V nominal" PV system. The **Jolter DT™** can also be used with a "24-V nominal" PV system, which consists of two PV modules wired in series. A jumper is located inside the **Jolter DT™** at location H1. Removing the jumper from the header sets the **Jolter DT™** for 24-V operation. If the jumper is set for 24-V operation, replace the jumper on a single pin of the header H1. The jumper is black, with a small handle to allow for removal using a small pair of needle-nose pliers.

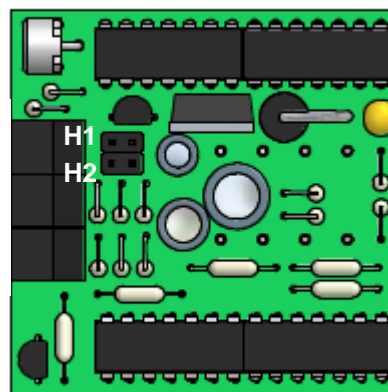
The jolting function can be disabled by installing the jumper on the pins of header H2. When the jumper is on both pins, the jolting function is disabled.

Do not install a jumper between headers H1 and H2.

CAUTION: Do not connect any battery or battery charger directly to the Jolter DT™.

TDL Jolter DT circuit board

(remove bottom cover of Jolter DT to view)



Jumper Positions

H1
Jumpered = nominal 12 VDC operation
Not Jumpered = nominal 24 VDC operation

H2
Jumpered = jolting DISABLED
Not Jumpered = jolting ENABLED

CAUTION: Do NOT install a jumper between H1 and H2