



WTC3293-14000 Series

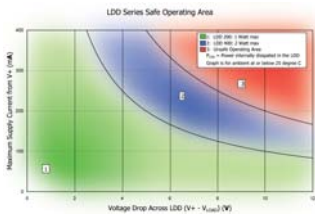
WTC3243 Thermoelectric Temperature Controller Board with Display



GENERAL DESCRIPTION:

Simply stable temperature control. Wire your thermoelectric cooler and thermistor to the board with the cable provided. Add the appropriate DC power supply and indicate the expected voltage on the jumper. With the output disabled, adjust the on-board 12-turn trimpot and watch the setpoint temperature change on the 4-digit display. Switch to Actual and display your thermistor temperature. Watch the LED tree to see “over / under temperature” or “stable at setpoint” status. Enable the output current and watch the temperature quickly lock in on the setpoint.

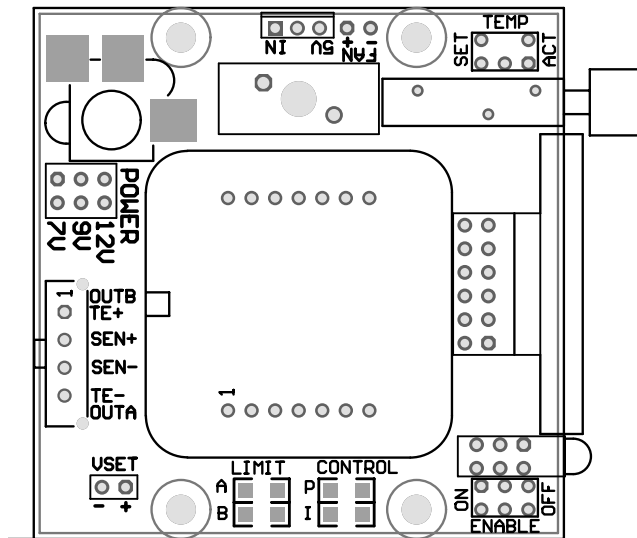
Online Design Tools at
www.teamwavelength.com



FEATURES:

- Low noise, maximum temperature stability commercially available
- Display thermistor temperature directly - no tables to convert resistance to temperature
- LED indicator shows over temperature, stable at setpoint, or under temperature status
- Adjust setpoint with a 12-turn potentiometer or an external voltage
- Control temperature using a 10kΩ thermistor
- Fixed resistors set Proportional Gain, Integrator Time Constant, and thermoelectric current limits
- Enable/Disable Output Current Switch
- Includes Output Cable & DC Power Supply
- Works with a wide range of thermoelectrics

Figure 1
 Top View



WTC3293-14000 BOARD WITH DISPLAY

Quick Reference: CONFIGURATION

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The display is calibrated for a specific 10 kohm thermistor, the TCS610:

$$1/T = A + B(\ln R) + C(\ln R)^3$$

where T is in Kelvin; R is in ohms,

A = 1.1279E-3; B=2.3429E-4; C=8.7298E-8

Bias Current is also chosen for this thermistor: **100 μ A**

Fuse: For safety, a 3A fuse is included on the board. Replacement part number is Littelfuse 297 003 (ATO MINI 3A).

Power supply input jack accepts a 2.5mm diameter plug.

ORDERING INFORMATION:

The boards are configured for the power supply you intend to use.

	+7V or +9V	+12V
Order WEI part number: [WTC3243 & thermal solution kit included]	WTC3293-14001	WTC3293-14002
Power Supply: Order WEI part numbers:	7V DC supply: PWRPAK-7V 9V DC supply: PWRPAK-9V	12VDC supply: PWRPAK-12V

Note: Control temperature range for the 10k Ω sensor is 10°C to 50°C.

WTC3293-14000 BOARD WITH DISPLAY

OPERATING THE WTC3293-14000

STEP 1: SELECT POWER SUPPLY VOLTAGE and INSTALL JUMPER

This board has been designed to work with various thermoelectrics. The power supply voltage must be tailored to the resistance of the thermoelectric to keep the WTC3243 intact. You need a power supply voltage high enough to drive the thermoelectric, but not too high to overdrive the WTC3243.

1. Determine your maximum thermoelectric voltage and current: V_{max}, I_{max} .
2. The WTC3243 drops about 1.7V, so the minimum power supply voltage is $V_{max} + 1.7V$.
3. Choose from available power supplies. For example, if your thermoelectric will need 5V, the minimum supply voltage is 6.7V. WEI offers a 7V power supply.
4. Calculate the actual power dissipated in the WTC3243: $Power = I_{max} \times [V_{supply} - V_{max}]$. For example, if you need 1.5Amps and plan to use a 7V supply, $Power = 1.5 \times [7-5]$ or 3 Watts. The maximum power dissipation of the WTC3243 is 9 Watts (with fan & heatsink).

Install a jumper indicating which power supply you have selected on the header near the DC input plug. **NOTE: When you plug in the supply, make sure the Enable Switch is OFF. Do not operate with a voltage less than 7V.**

WHY? The WTC3243 is designed to drive currents as high as 2.0 Amps. The resistance of the thermoelectric will create a voltage drop across the thermoelectric proportional to the current (Voltage = Current x Resistance). The voltage drop across the WTC3243 will equal the power supply voltage minus the thermoelectric voltage. If the power dissipated by the WTC3243 is too high (Power = Voltage x Current), the WTC3243 will overheat and be destroyed.

Online, SOA calculators are at <http://www.teamwavelength.com/tools/calculator/soa/defaulttc.htm>. You can vary heatsink temperature, power supply voltage, etc. to design a system that will not dissipate too much power in the WTC3243.

STEP 2: SELECT HEAT AND COOL CURRENT LIMITS

To protect the thermoelectric from over current damage, set the heat and cool current limits as follows. **The standard product is shipped with 2.00kΩ resistors for 0.5A cooling and heating limits.** Resistors should be 5% metal film. Carbon resistors will introduce noise and instabilities.

Table 1

Current Limit Set Resistor vs
Maximum Output Current

Maximum Output Currents (Amps)	Current Limit Set Resistor, (kΩ) R_A, R_B	Maximum Output Current (Amps)	Current Limit Set Resistor, (kΩ) R_A, R_B
0.0	1.60	1.2	3.05
0.1	1.69	1.3	3.23
0.2	1.78	1.4	3.43
0.3	1.87	1.5	3.65
0.4	1.97	1.6	3.88
0.5	2.08	1.7	4.13
0.6	2.19	1.8	4.42
0.7	2.31	1.9	4.72
0.8	2.44	2.0	5.07
0.9	2.58	2.1	5.45
1.0	2.72	2.2	5.88
1.1	2.88	2.3	6.36

OPERATING THE WTC3293-14000

STEP 3: SELECT PROPORTIONAL GAIN AND INTEGRAL TIME CONSTANT

To optimize the control loop (minimize overshoot, settling time, avoid cycling, etc.) change the control parameters as shown below. If the load doesn't stabilize, contact the factory for troubleshooting advice. Resistors should be 5% metal film. Carbon resistors will introduce noise and instabilities.

Table 3 Proportional Gain and Integral Time Constant settings

Load Size	P value; Resistance	I value; Resistance
Small (~0.25 oz)*	P = 10 A / V R = 10k Ω	3 seconds R = 31.6k Ω
Medium	P = 10 A / V R = 10k Ω	3.75 seconds R = 24.9k Ω
Large	P = 20 A / V R = 24.9k Ω	4.5 seconds R = 20k Ω

*Default

Note: If you want to use values not listed, use the web based WTC3243 design calculator to determine resistance values.

STEP 4: WIRE OUTPUT CONNECTOR

Connect the Thermoelectric wires to the Red and Black cable wires as shown. If the polarity is reversed, the system will only heat. Connect the thermistor wires to the Green and White cable wires (polarity is not important).

Table 4 - OUTPUT CABLE wiring for Thermoelectric

PIN #	Wire Color	Function
1	RED	OUTPUT B - Positive TE wire
2	GREEN	SENSOR +
3	WHITE	SENSOR -
4	BLACK	OUTPUT A - Negative TE wire

Table 5 - OUTPUT CABLE wiring for Resistive Heater

PIN #	Wire Color	Function
1	RED	OUTPUT B - One side of RH
2	GREEN	SENSOR +
3	WHITE	SENSOR -
4	BLACK	OUTPUT A - NO CONNECT

Connect other side of RH to V+

Change RLIM A to 1.5k Ω to limit the cooling current to ZERO.

Resistive Heater operation assumes NTC sensor.

Note: If you want a wiring diagram with values, use the online WTC3243 design calculator.

OPERATING THE WTC3293-14000

STEP 5: VIEW THE SETPOINT and ACTUAL TEMPERATURE

The switch next to the setpoint potentiometer determines whether Setpoint or Actual temperature is displayed. When the setpoint is displayed, the rightmost decimal point is lit. The resistance to temperature conversion software assumes the thermistor bias current is 100 μ A and the thermistor is characterized by the Steinhart-Hart relationship:

$$1/T = A + B(\ln R) + C(\ln R)^3$$

where T is in Kelvin; R is in ohms, A = 1.1279E-3; B=2.3429E-4; C=8.7298E-8 (TCS-610)

If another thermistor or bias current is used, the temperature display will not be properly calibrated. To use another sensor or change the calibration, contact the factory.



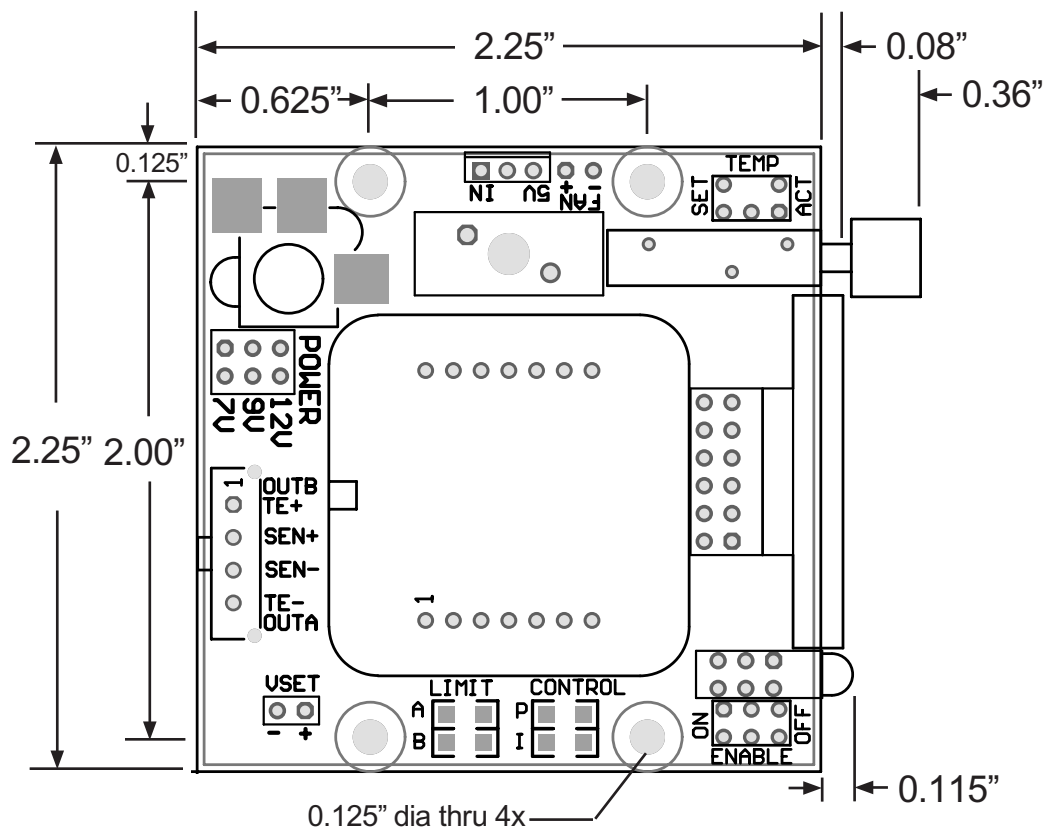
STEP 6: ADJUST THE SETPOINT TEMPERATURE

The setpoint temperature can be adjusted from 10 to 65°C either by using the onboard 12-turn potentiometer.

The VSET wire pads can be used as test points to monitor the potentiometer setting or for connecting an external voltage source (such as a function generator). If an external voltage source is used, set the setpoint potentiometer approximately mid-range (1 to 1.5V). The input voltage range is 0 to 2.5V which corresponds to 0 to 25k Ω of thermistor resistance. [Transfer function is 10k Ω / V.]

STEP 7: ENABLE THE OUTPUT CURRENT & MONITOR IN-RANGE STATUS

The switch next to the In-Range indicator enables and disables current through the thermoelectric. The green LED on the In-Range indicator lights when the actual temperature is within 0.05°C of the setpoint. If the actual temperature exceeds the setpoint, the upper LED will light. If it is below the setpoint temperature, the lower LED will light.



Max height from top side of PCB to fan is 1.5"
 Standoffs are 0.625" tall
 Board thickness is 0.60"

Allow 0.375" clearance from bottom side of PCB for airflow.

CERTIFICATION AND WARRANTY**CERTIFICATION:**

Wavelength Electronics (WEI) certifies that this product met it's published specifications at the time of shipment. Wavelength further certifies that its calibration measurements are traceable to the United States National Institute of Standard and Technology, to the extent allowed by that organization's calibration facilities, and to the calibration facilities of other International Standards Organization members.

WARRANTY:

This Wavelength product is warranted against defects in materials and workmanship for a period of 90 days from date of shipment. During the warranty period, Wavelength, will, at it's option, either repair or replace products which prove to be defective.

WARRANTY SERVICE:

For warranty service or repair, this product must be returned to the factory. For products returned to Wavelength for warranty service, the Buyer shall prepay shipping charges to Wavelength and Wavelength shall pay shipping charges to return the product to the Buyer. However, the Buyer shall pay all shipping charges, duties, and taxes for products returned to Wavelength from another country.

LIMITATIONS OF WARRANTY:

The warranty shall not apply to defects resulting from improper use or misuse of the instrument outside published specifications.

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EXCLUSIVE REMEDIES:

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SAFETY:

There are no user serviceability parts inside this product. Return the product to Wavelength Electronics for service and repair to assure that safety features are maintained.

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WAVELENGTH ELECTRONICS, INC.
51 Evergreen Drive
Bozeman, Montana, 59715

phone :(406) 587-4910 Sales and Technical Support
(406) 587-4183 Accounting
fax: (406) 587-4911
e-mail: sales@teamwavelength.com
web: www.teamwavelength.com