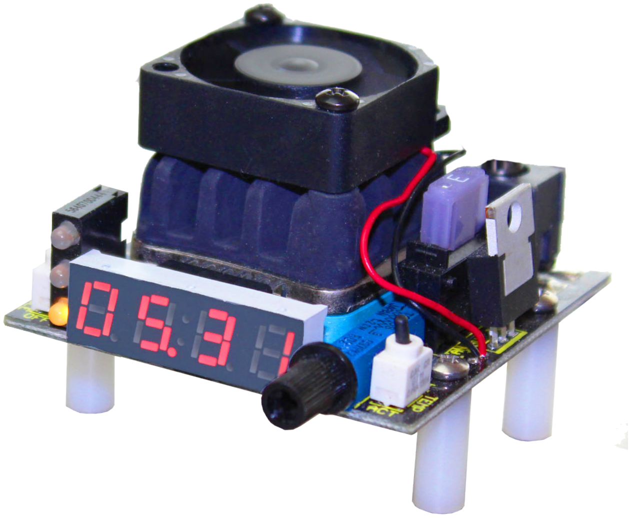
DATASHEET AND OPERATING GUIDE
WTC32ND-14

Thermoelectric Temperature Controller Board with Display



FEATURES

- ±2.2 A Drive Current
- Temperature Display in ºC
- LED indicator for over/under/on setpoint
- Single Supply Operation: +7, +9, or +12 V
- Current limits (cooling & heating)
- Configured for 10 kΩ thermistor
- Temperature Setpoint, Proportional Gain, and Integrator Term are user adjustable
- WTC32ND Included
- WEV301 Cable Included
- Heatsink and Fan Included

PRECISION, STABILITY & VERSATILITY

The WTC32ND-14 is a mini-instrument temperature controller with a temperature display and onboard adjustments.

Wrapped around the precision WTC32ND temperature controller, it is configured for use with a TCS610 10 kΩ thermistor. Wire your thermoelectric cooler and thermistor to the board with the cable provided. Add the appropriate DC power supply and indicate the input 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 temperature 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.

The WTC32ND-14 has been designed to work with various thermoelectrics driving up to ±2.2 Amps. It operates with +7 V, +9 V, or +12 V input voltage.

The controller is particularly suited to applications such as electro-optical systems, LIDAR, Raman spectroscopy, and medical diagnostic equipment or any application where temperature is scanned across ambient.

CONTENTS

ORDERING INFORMATION

PART NO	DESCRIPTION
WTC32ND-14	2.2 A Temperature Controller with Display
PWRPAK-7V	Switching Power Supply 3 A, 7.2 V
PWRPAK-9V	Switching Power Supply 3 A, 9 V
PWRPAK-12V	Switching Power Supply 2.5 A, 12 V
TCS610	TCS610 10 kΩ Thermistor - 10 pack

RoHS Compliant

QUICK CONNECT GUIDE

TO ENSURE SAFE OPERATION OF THE WTC32ND-14 TEMPERATURE CONTROLLER, IT IS IMPERATIVE THAT YOU DETERMINE THAT THE UNIT WILL BE OPERATING WITHIN THE INTERNAL HEAT DISSIPATION SAFE OPERATING AREA (SOA).

Visit the Wavelength Electronics website for the most accurate, up-to-date, and easy to use SOA calculator:

www.teamwavelength.com/support/design-tools/soa-tc-calculator/

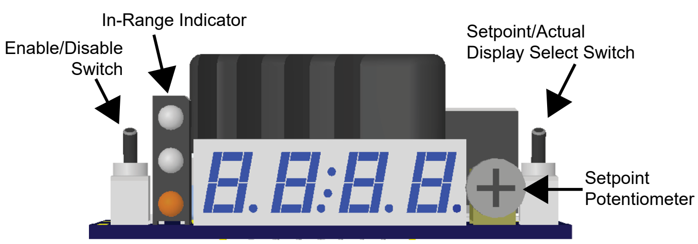


Figure 1. WTC32ND-14 Display, Side View

Figure 1 shows the side view of the WTC32ND-14 Temperature Controller. **Figure 2** shows the Quick Connect schematic for the WTC32ND-14.

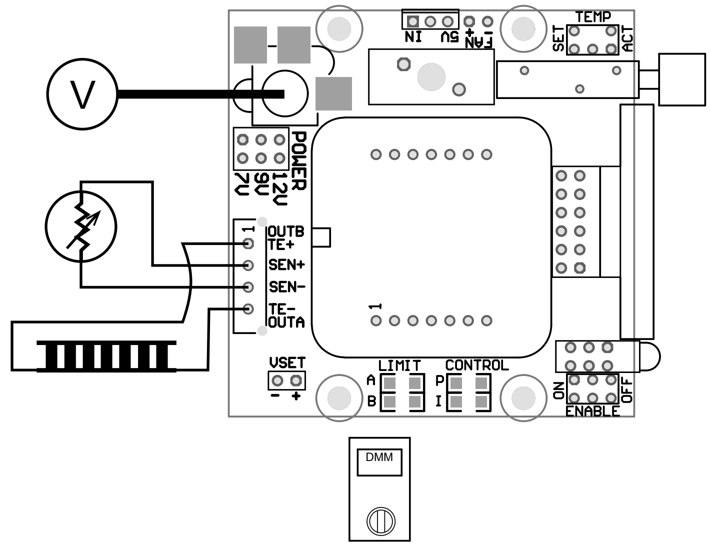


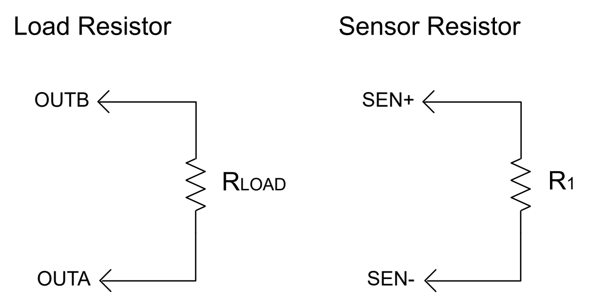
Figure 2. WTC32ND-14 Quick Connect

RECOMMENDED TEST LOAD

A test load can be used for initial configuration of the WTC32ND-14. The following guidelines should be considered.

Load Resistor - Connect a power resistor between OUTB (TE+) and OUTA (TE-) as shown in **Figure 3**. Use the online Safe Operating Area (SOA) Calculator at: www.teamwavelength.com/support/design-tools/soa-tc-calculator/ to ensure that the value of the resistor allows for safe operation of the WTC32ND-14. The maximum achievable current through the resistor is (V+ - 2V) / R_{LOAD}. The power rating on the resistor should be sufficient to handle the maximum current.

Sensor Resistor - Connect a resistor between SEN+ and SEN-. The circuit in **Figure 3** simulates a 10 kΩ thermistor.



R_{LOAD} = 1 Ω, Rated >25 W R_1 = 10k Ω, 1/4 W resistor

Figure 3. Test Load Configurations

BOARD CONNECTION DESCRIPTIONS

Table 1. WTC32ND-14 Temperature Controller Board Descriptions

PIN	PIN	NAME	PIN DESCRIPTION
1	**OUTB TE+**	Output B TEC +	This pin connects to the positive TEC wire. If the polarity is reversed, the system will only heat.
2	**SEN+**	Sensor Out Positive	This pin is used to source reference current through the temperature sensor. The temperature display is calibrated for a specific 10 kΩ 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: 100µA Control temperature range for the 10 kΩ sensor is 10ºC to 50ºC.
3	**SEN-**	Sensor In Ground	This pin is used as the bias current source return pin, and should not be used for anything other than the sensor current source return.
4	**TE- OUTA**	Output A TEC -	This pin connects to the negative TEC wire. If the polarity is reversed, the system will only heat.
	POWER 7V, 9V, 12V	Power Supply Input and Power Select Jumper	Install a jumper indicating which power supply you have selected (7V, 9V, or 12V) on the header near the DC input plug. NOTE: The Enable Switch should be set to OFF when plugging in the power supply. Do not operate with a voltage less than 7V.
	VSET	External Voltage Setpoint	The temperature setpoint can be set using an external voltage. It can also be adjusted using the setpoint potentiometer.
	LIMIT	Current Limits	Metal film resistors can set the cooling (A) and heating (B) current limits.
	CONTROL	Proportion Gain & Integrator Term	Fixed resistors can adjust the P Gain and I Term values of the system.
	ENABLE	Enable/Disable Switch	The switch next to the In-Range LED indicator enables and disables current through the thermoelectric.
	LED	LED In-Range Indicator	The green LED on the In-Range indicator lights when the actual temperature is within 0.05ºC 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.
	POTENTIOMETER	Setpoint Potentiometer	The setpoint temperature can be adjusted from 10 to 65ºC by using the onboard 12-turn potentiometer. It can also be adjusted using an external voltage source.
	TEMP	Setpoint/Actual Display Select Switch	The display switch next to the setpoint potentiometer determines whether Setpoint or Actual temperature is displayed.

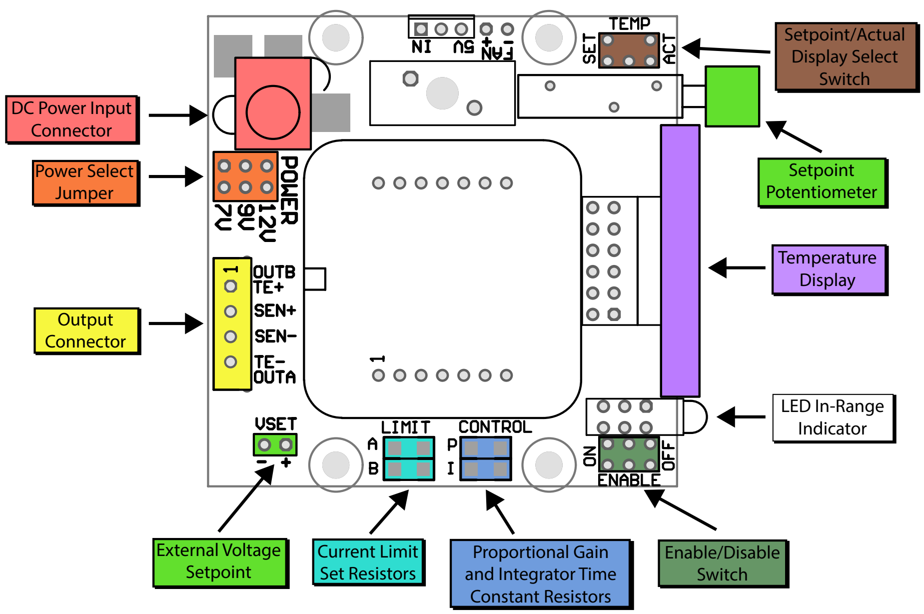


Figure 4. WTC32ND-14 Components Locations

SAFETY INFORMATION

SAFE OPERATING AREA — DO NOT EXCEED INTERNAL POWER DISSIPATION LIMITS

To ensure safe operation of the WTC32ND-14 Thermoelectric Controller, it is imperative that you determine that the unit will be operating within the internal heat dissipation Safe Operating Area (SOA).

Visit the Wavelength Electronics website for the most accurate, up-to-date, and easy to use SOA calculator:
www.teamwavelength.com/support/design-tools/soa-tc-calculator/

For more information on Safe Operating Area, see our Application Note *AN-LDTC01: The Principle of the Safe Operating Area* and our SOA video: How to use the Safe Operating Area (SOA) Calculator.

PREVENT DAMAGE FROM ELECTROSTATIC DISCHARGE

Before proceeding, it is critical that you take precautions to prevent electrostatic discharge (ESD) damage to the controller and your load. ESD damage can result from improper handling of sensitive electronics, and is easily preventable with simple precautions.

For more information regarding ESD, see Application Note *AN-LDTC06: Electrostatic Discharge (ESD) Basics.*

We recommend that you always observe ESD precautions when handing the WTC32ND-14 controller.

FUSE NOTE: For safety, a 3 A fuse is included on the board. Replacement part number is Littelfuse 0297003 (ATO MINI 3A).

Power supply input jack accepts a 2.5 mm diameter plug.

NOTE: It is normal for the voltage regulator to get hot (~60ºC). This regulator is located on the right side of the unit shown in **Figure 5**.

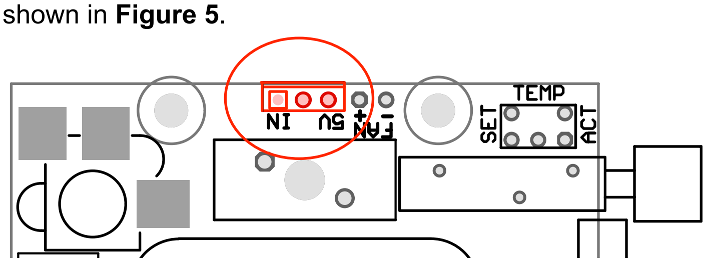


Figure 5. Voltage Regulator Location

THEORY OF OPERATION

The WTC32ND-14 uses the WTC32ND which is a linear temperature controller that delivers bidirectional current to Peltier Effect thermoelectric coolers (TEC), or unidirectional current to resistive heaters.

The fundamental operating principle is that the controller adjusts the TEC drive current in order to change the temperature of the sensor that is connected to the thermal load. The goal is to make the voltage across the sensor match the setpoint voltage, and then keep them equal in spite of changes to ambient conditions and variations in thermal load.

The controller measures the load temperature by driving a current through the temperature sensor and measuring the voltage drop across it. It may be useful to remember that you do not directly adjust the setpoint temperature. Rather, you adjust a voltage signal that represents the sensor voltage at the desired temperature setpoint.

While the output is enabled the controller continuously compares the setpoint voltage and the actual sensor voltage. If there is a difference between the two signals the controller adjusts the output current—thereby driving the TEC or heater to change temperature—until the difference is zero.

Once the actual sensor voltage equals the setpoint voltage, the controller makes minor adjustments to the output current in order to keep the difference at zero. If the ambient temperature changes, for example, the controller will adjust the drive current accordingly.

The controller board (WTC32ND-14) includes features that help protect the load from damage. These features are explained in detail in **Operating Instructions on page 5**.

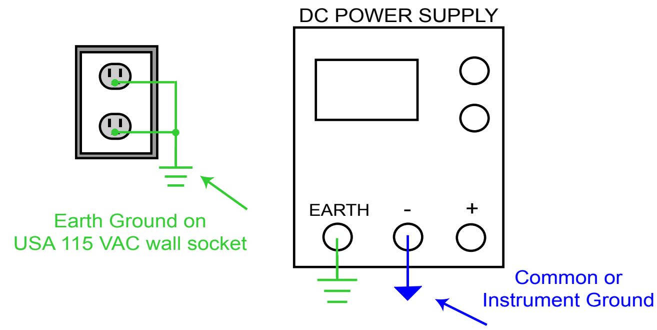
- **Current limits:** Heating or cooling current limits avoid over-driving and damaging the TEC or heater.
- **External or Onboard temperature setpoint control:** for prototyping and benchtop applications the temperature setpoint can be adjusted with the onboard potentiometer. The temperature setpoint can also be adjusted by an external voltage signal.
- **Control loop:** the controller employs a Proportional-Integrating control loop to adjust the drive current. The proportional term and integrator time constant are user-adjustable, and when properly configured will quickly settle the load to temperature with minimal overshoot and ringing.
- **Local Enable / Disable:** The controller can be configured so that the output is always on whenever power is applied to the unit or disabled when needed.

OPERATING INSTRUCTIONS

NECESSARY EQUIPMENT

The following equipment is required to configure the WTC32ND-14 for basic operation.

- WTC32ND-14 Temperature Controller
- 10kΩ thermistor (TCS610)
- Peltier-type thermoelectric cooler or resistive heater
- Optional: test load
- Minimum 22 gauge wiring to TEC
- Power Supply (see below)



Unless Earth and Instrument Ground are connected via the power supply, Instrument Ground is floating with respect to Earth Ground

SYSTEM DESIGN DECISIONS

Before the WTC32ND-14 can be configured, several decisions must be made:

- What is the operating maximum current and maximum voltage?
- Will the controller be heating or cooling? Or both?
- Will the system, as designed, fit within the Safe Operating Area (SOA)?

POWER SUPPLY REQUIREMENTS

The WTC32ND-14 has been designed to operate at one of three discrete voltages: 7V, 9V, 12V. The POWER jumper must be installed for the chosen voltage.

To choose the appropriate voltage for your application, use Wavelength's online Safe Operating Area (SOA) calculator for Temperature Controllers:
www.teamwavelength.com/support/design-tools/soa-tc-calculator/

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 7 V. See **Figure 4** for jumper location.

The WTC32ND-14 uses the WTC32ND temperature controller, which is designed to drive currents as high as 2.2 A. 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 WTC32ND will equal the power supply voltage minus the thermoelectric voltage. If the power dissipated by the WTC32ND is too high (Power = Voltage x Current), the WTC32ND will overheat and be destroyed.

GROUNDING

Special attention to grounding will ensure safe operation. Some manufacturers package devices with one lead of the sensor or thermoelectric connected to the metal enclosure or in the case of laser diodes, the laser anode or cathode.

OPERATION INSTRUCTIONS

STEP 1 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 2.00 kΩ resistors for 0.5 A cooling and heating limits.** Resistors should be 5% metal film and size 1206. Carbon resistors will introduce noise and instabilities.

Resistor A (R_A) sets the cooling limit.
Resistor B (R_B) sets the heating limit.

Table 2. Current Limit Set Resistor vs. Maximum Output Current

MAXIMUM OUTPUT CURRENT (A)	CURRENT LIMIT RESISTOR (kΩ) R_A OR R_B
0.0	1.58
0.1	1.66
0.2	1.74
0.3	1.83
0.4	1.92
0.5	2.01
0.6	2.11
0.7	2.22
0.8	2.33
0.9	2.45
1.0	2.58
1.1	2.71
1.2	2.86
1.3	3.01
1.4	3.18
1.5	3.36
1.6	3.55
1.7	3.76
1.8	3.98
1.9	4.23
2.0	4.50
2.1	4.79
2.2	5.11

Figure 6 shows the current limit resistor locations.

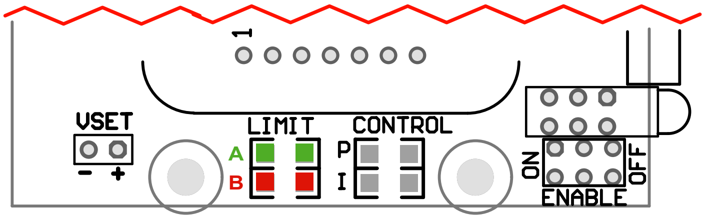


Figure 6. Current Limit Set Resistor Locations (R_A & R_B)

NOTE: For easy resistor value calculations, use the online WTC32ND design calculator. This can be found at: https://www.teamwavelength.com/support/design-tools/wtc-calculator/

STEP 2 Adjust the Proportional Gain

To optimize the control loop (minimize overshoot, settling time, avoid cycling, etc.) change the control parameters as described below. Resistors should be 5% metal film and size 1206. Carbon resistors will introduce noise and instabilities.

The control loop proportional gain can be adjusted by inserting an appropriate resistor, R_P, into Control P location to set P from 1 to 100. (Shown in green in **Figure 7**.)

Equation 1 demonstrates how to calculate a value for R_P given a desired proportional gain.

$$R_P = \left(\frac{100{,}000}{\frac{100}{P} - 1} \right) \; [\Omega] \qquad (1)$$

Equation 2 demonstrates how to calculate the proportional gain, P, given a value for R_P.

$$P = \left(\frac{100}{\frac{100{,}000}{R_P} + 1} \right) \; [\text{Amps / Volts}] \qquad (2)$$

Figure 7. Control P and Control I Resistor Locations

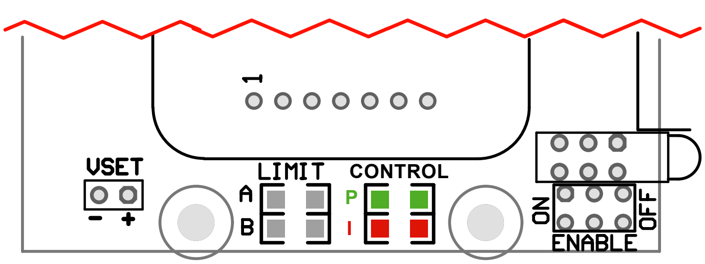


Table 3 lists the suggested resistor values for R_P versus sensor type and the ability of the thermal load to change temperature rapidly.

Table 3. Proportional Gain Resistor R_P vs Sensor Type and Thermal Load Speed

PROPORTIONAL GAIN RESISTOR, R_P	PROPORTIONAL GAIN, [A / V]	SENSOR TYPE/ THERMAL LOAD SPEED
4.99 kΩ	5	Thermistor/Fast
24.9 kΩ	20	Thermistor/Slow
100 kΩ	50	RTD/Fast
Open	100	RTD/Slow
24.9 kΩ	20	AD590 or LM335/ Fast
100 kΩ	50	AD590 or LM335/ Slow

STEP 3 Adjust the Integrator Time Constant

The control loop integrator time constant can be adjusted by inserting an appropriate resistor, R_I, into Control I location to set I_{TC} from 0.53 to 4.5 seconds. (Shown in red in **Figure 7**.)

Equation 3 demonstrates how to calculate a value for R_I given a desired integrator time constant. The integrator time constant, I_{TC}, is measured in seconds.

$$R_I = \left(\frac{100{,}000}{(1.89)\, I_{TC} - 1} \right) \; [\Omega] \qquad (3)$$

Equation 4 demonstrates how to calculate the integrator time constant, I_{TC}, given a value for R_I.

$$I_{TC} = (0.53) \left(\frac{100{,}000}{R_I} + 1 \right) \; [\text{Seconds}] \qquad (4)$$

Table 4 lists the suggested resistor values for R_I versus sensor type and the ability of the thermal load to change temperature rapidly.

Overshoot with Small Loads

When using the WTC with small, fast loads, the unit has a tendency to overshoot by up to 10ºC. This problem is caused by overcompensation by the integrator and can be solved by taking the integrator term out of the system. This can be done by placing a shorting jumper or 0 Ω resistor in the Control I location.

Table 4. Integrator Time Constant vs Sensor Type and Thermal Load Speed

INTEGRATOR RESISTOR, R_I	INTEGRATOR TIME CONSTANT, [SECONDS]	SENSOR TYPE/ THERMAL LOAD SPEED
21.4 kΩ	3	Thermistor/Fast
13.3 kΩ	4.5	Thermistor/Slow
Open	0.53	RTD/Fast
112 kΩ	1	RTD/Slow
112 kΩ	1	AD590 or LM335/ Fast
13.3 kΩ	4.5	AD590 or LM335/ Slow

STEP 4 Wire Output Connector

Connect the Thermoelectric wires to the Red and Black cable wires as directed in **Table 5**. 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). A diagram of the cable can be seen on **page 11**.

Table 5. OUTPUT CABLE wiring for Thermoelectric

PIN #	WIRE COLOR	FUNCTION
1	RED	OUTPUT B - Positive TEC Wire
2	GREEN	SENSOR +
3	WHITE	SENSOR -
4	BLACK	OUTPUT A - Negative TEC Wire

Table 6 shows wiring for Resistive Heater (RH) operation.

Table 6. OUTPUT CABLE wiring for Resistive Heater

PIN #	WIRE COLOR	FUNCTION
1	RED	OUTPUT B - One side of RH (Connect other side of RH to V+)
2	GREEN	SENSOR + (Change RLIM A to 1.5 kΩ to limit the cooling current to ZERO)
3	WHITE	SENSOR - (RH operation assumes thermistor)
4	BLACK	OUTPUT A - No Contact

STEP 5 Monitor Setpoint & Actual Temperature

The switch next to the setpoint potentiometer (**Figure 1**) determines whether Setpoint or Actual temperature is displayed. When the setpoint is displayed, the right-most decimal point is lit. The resistance to temperature conversion software assumes the thermistor bias current is 100 µA 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 65ºC either by using the onboard 12-turn potentiometer or an external voltage source.

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 1.5 V). The input voltage range is 0 to 2.5 V which corresponds to 0 to 25 kΩ of thermistor resistance. [Transfer function is 10 kΩ / V.]

STEP 7 Enable/Disable the Output Current

The switch next to the In-Range indicator enables and disables current through the thermoelectric. The switch must be in the “disable” position when connecting the power supply to the controller.

STEP 8 Monitor In-Range Status

The green LED on the In-Range indicator is lit when the actual temperature is within 0.05ºC 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.

SAFE OPERATING AREA

The Safe Operating Area of the WTC32ND-14 controller is determined by the amount of power that can be dissipated within the output stage of the controller. If that power limit is exceeded permanent damage can result.

DO NOT EXCEED THE SAFE OPERATING AREA (SOA). EXCEEDING THE SOA VOIDS THE WARRANTY.

Refer to the Wavelength Electronics website for the most up-to-date SOA calculator for our products. The online tool is fast and easy to use, and also takes into consideration operating temperature.

www.teamwavelength.com/support/design-tools/soa-tc-calculator/

SOA charts are included in this datasheet for quick reference, however we recommend you use the online tools instead. See our SOA video: How to use the Safe Operating Area (SOA) Calculator.

Follow these steps to determine if the controller will be operating within the SOA.

- Refer to the thermoelectric datasheet to find the maximum voltage (V_{LOAD}) and current (I_{LOAD}) specifications
- Calculate the voltage drop across the controller: V_{DROP} = V+ - V_{LOAD} (V+ is the power supply voltage)
- Mark V_{DROP} on the X-axis, and extend a line upward
- Mark I_{LOAD} on the Y-axis, and extend a line (Line BB) to the right until it intersects the V_{DROP} line
- On the X-axis, mark the value of V+
- Extend a diagonal line from V+ to the intersection of the V_{DROP} and I_{LOAD} lines; this is the Load Line
- If the Load Line crosses the Safe Operating Area line at any point, the configuration is not safe

If the SOA Calculator indicates the WTC32ND-14 will be outside of the Safe Operating Area, the system must be changed so that less power is dissipated within the controller. See Wavelength Electronics Application Note *AN-LDTC01: The Principle of the Safe Operating Area* for information on shifting the Load Line.

An example SOA calculation for the WTC32ND-14 with heatsink and fan is shown in **Figure 8** where:

V+= 7 Volts (Point C)	V_{LOAD} = 4 Volts
I_{LOAD} = 1.5 Amp (Point B)	V_{DROP} = 7V - 4V = 3 V (Point A)

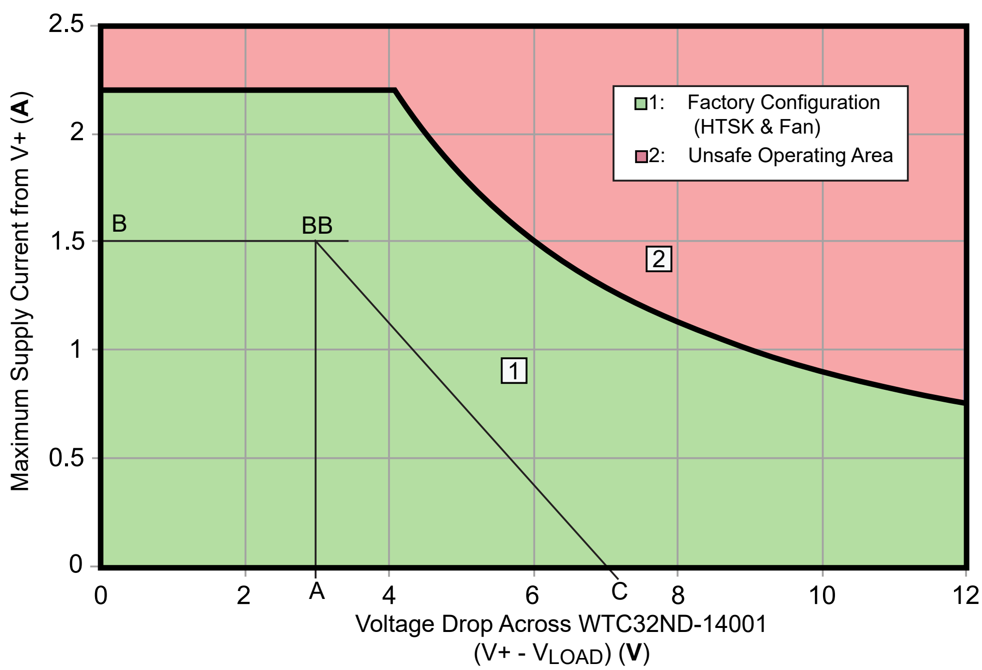
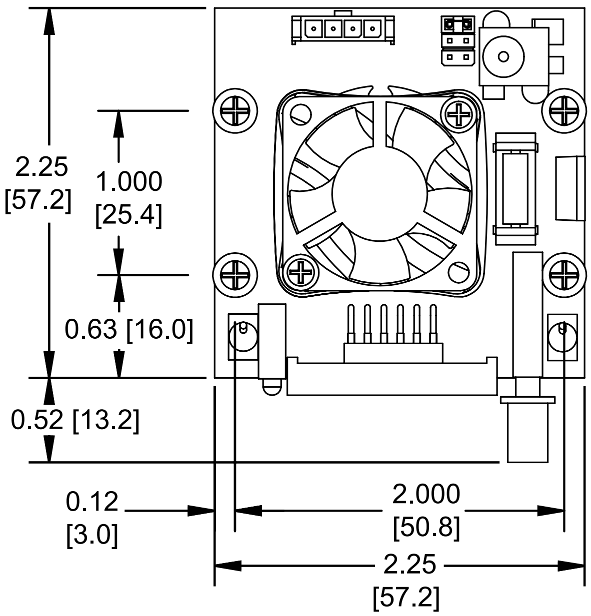


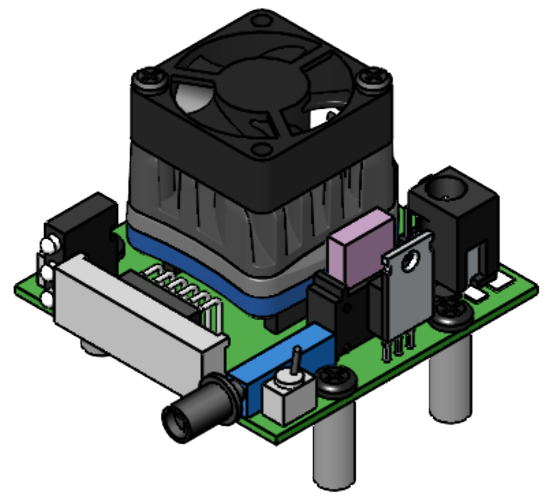
Figure 8. WTC32ND-14 SOA

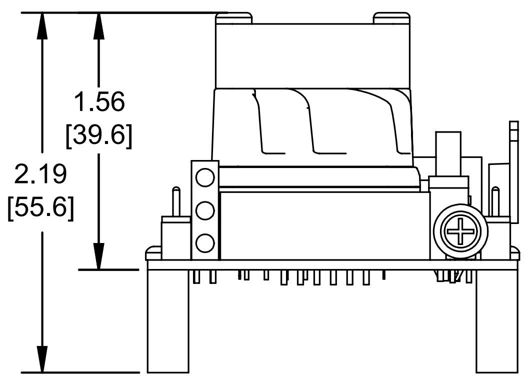
TROUBLESHOOTING

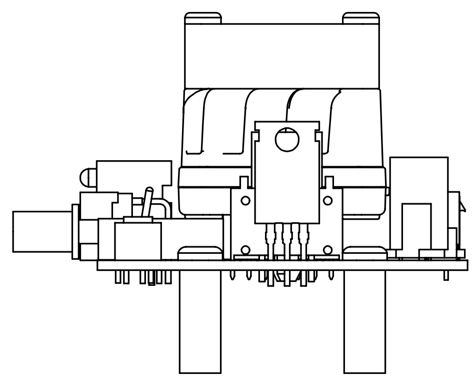
PROBLEM	POTENTIAL CAUSES	SOLUTIONS
Temperature is decreasing when it should be increasing -OR- Temperature is increasing when it should be decreasing	The TEC may be connected backwards to the WTC32ND-14	The convention is that the red wire on the TEC module connects to TEC+ (OUTB) and the black wire to TEC- (OUTA). If your TEC is connected in this manner and the problem persists, the TEC module itself may be wired in reverse. Switch off power to the system, reverse the connections to the WTC32ND-14, and then try again to operate the system.
Temperature increases beyond setpoint and will not come down	The heatsink may be inadequately sized to dissipate the heat from the load and the TEC module, and now the system is in **thermal runaway**	Increase the size of the heatsink, add a fan to blow air over the heatsink, and/or reduce the ambient air temperature around the heatsink.
	The TEC and heatsink are not adequately sized for the thermal load	The heat being generated by the load may be too great for the TEC to pump to the heatsink; a larger TEC may be needed. Consult our Technical Note *TN-TC01: Optimizing Thermoelectric Temperature Control Systems* and Application Note *AN-TC09: Specifying Thermoelectric Coolers*.
Temperature does not stabilize very well at the setpoint	There may be poor thermal contact between components of the thermal load	Use thermal paste or washers between the load / TEC and the TEC / heatsink interfaces. Ensure the temperature sensor is in good thermal contact with the load.
	Proportional control term may be set too high	Reduce the value of the proportional term. For more information, reference our Technical Note *TN-TC01: Optimizing Thermoelectric Temperature Control Systems*.
	Heatsink may not be sized correctly or may not have adequate airflow	Ambient temperature disturbances can pass through the heatsink and thermoelectric and affect the device temperature stability. Choosing a heatsink with a larger mass and lower thermal resistance will improve temperature stability. Adding a fan across the thermoelectric's heatsink may be required.
Temperature does not reach the setpoint	Current driven to the TEC or heater may be insufficient	Increase the current limit – but DO NOT exceed the specifications of the TEC or heater.
	The controller may not have sufficient compliance voltage to drive the TEC or heater	Increase the power supply voltage; be certain to verify that the controller is within the Safe Operating Area with Wavelength's Temperature Controller SOA calculator: www.teamwavelength.com/support/design-tools/soa-tc-calculator/
	The sensor may not have good contact with the heatsink and load	Use thermal paste or washers between the load / TEC and the TEC / heatsink interfaces. Contact the thermoelectric manufacturer for their recommended mounting methods.
Temperature is slow to stabilize and is not within the specifications with Resistive Heaters	Setpoint temperature is set close to the ambient temperature	Set the temperature at least 10ºC above ambient when using a resistive heater. A resistive heater is unable to precisely maintain temperatures near ambient. Once the temperature overshoots the setpoint, the controller turns off and relies on ambient temperature to cool the load.
Output will not enable	Enable/Disable switch is not in proper orientation	The Enable/Disable switch must be in the ON position for current to be enabled to the TEC. The switch must be in the "disable" position when connecting the power supply to the controller.
	The Power Jumper is in the wrong location	Ensure that the Power Jumper is installed indicating the correct power supply voltage you have provided.
Voltage regulator gets really hot	It is normal for the voltage regulator to reach high temperatures (~60ºC)	Caution should be used when handling the WTC32ND-14 controller, not just for ESD safety, but also for high temperatures from the voltage regulator.
Temperature is not calibrated	The firmware is only designed for 10 kΩ thermistors with curves matching the TCS610	Use the TCS610 10 kΩ thermistor with the WTC32ND-14 controller for optimized and calibrated temperature control. For use with other thermistors or sensors, contact the factory.
	Supply Voltage is too low	Ensure that the power supply is the approved 7, 9, or 12 V supplies with the appropriate Power Jumper installation.

MECHANICAL SPECIFICATIONS









Max height from top side of PCB to fan is 1.60” [40.6 mm].
Factory configuration does include 7-Pin SIP sockets.
Socket manufacturer is Sullins PPPC071LFBN-RC Socket.

Standoffs are 0.625” [15.88 mm] tall

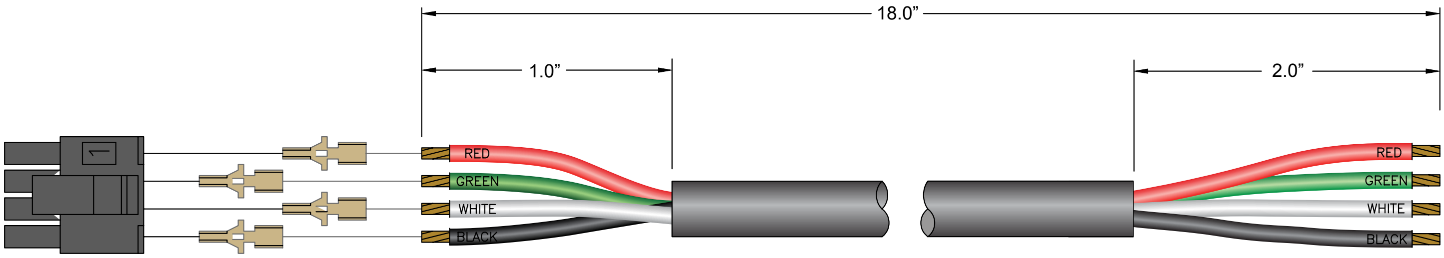
Allow 0.375” [9.53 mm] clearance from bottom side of PCB for airflow

All Tolerances are ±5%
Dimensions are in Inches [mm]

CABLING SPECIFICATIONS

The following cable is included as an accessory to facilitate WTC32ND-14 connection and integration.

WTC3293-00102 4-WIRE CONDUCTOR OUTPUT CABLE



CERTIFICATION AND WARRANTY

CERTIFICATION

Wavelength Electronics, Inc. (Wavelength) certifies that this product met its published specifications at the time of shipment. Wavelength further certifies that its calibration measurements are traceable to the United States National Institute of Standards 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 one (1) year from date of shipment. During the warranty period, Wavelength will, at its 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. An RMA is required 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 upon determination of defective materials or workmanship. 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 product or operation outside published specifications. No other warranty is expressed or implied. Wavelength specifically disclaims the implied warranties of merchantability and fitness for a particular purpose.

EXCLUSIVE REMEDIES

The remedies provided herein are the Buyer's sole and exclusive remedies. Wavelength shall not be liable for any direct, indirect, special, incidental, or consequential damages, whether based on contract, tort, or any other legal theory.

REVERSE ENGINEERING PROHIBITED

Buyer, End-User, or Third-Party Reseller are expressly prohibited from reverse engineering, decompiling, or disassembling this product.

NOTICE

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SAFETY

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

LIFE SUPPORT POLICY

This important safety information applies to all Wavelength electrical and electronic products and accessories:

As a general policy, Wavelength Electronics, Inc. does not recommend the use of any of its products in life support applications where the failure or malfunction of the Wavelength product can be reasonably expected to cause failure of the life support device or to significantly affect its safety or effectiveness. Wavelength will not knowingly sell its products for use in such applications unless it receives written assurances satisfactory to Wavelength that the risks of injury or damage have been minimized, the customer assumes all such risks, and there is no product liability for Wavelength. Examples of devices considered to be life support devices are neonatal oxygen analyzers, nerve stimulators (for any use), auto-transfusion devices, blood pumps, defibrillators, arrhythmia detectors and alarms, pacemakers, hemodialysis systems, peritoneal dialysis systems, ventilators of all types, and infusion pumps as well as other devices designated as "critical" by the FDA. The above are representative examples only and are not intended to be conclusive or exclusive of any other life support device.

REVISION HISTORY

DOCUMENT NUMBER: WTC32ND-14400

REV.	DATE	CHANGE
A	April 2022	Initial Release

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