



How to Modify PTC Failsafe Setpoint Temperature Circuit Defaults

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OVERVIEW

The PTC Temperature Controllers have a feature that is meant to protect a laser diode (or other hardware you're trying to temperature stabilize) in the event that the remote setpoint signal is lost. With NTC sensors, a 0 V setpoint equates to a hot temperature. If the setpoint signal is lost, the controller will drive heating current (at current limit) to match the sensor voltage to the 0 V setpoint. This can potentially cause excessive temperatures at the laser diode.

The failsafe circuit substitutes a "safe" default setpoint voltage when the setpoint voltage drops below a limit.

In the factory default configuration the minimum setpoint is approximately 0.3 Volts. The substitute setpoint is approximately 1.0 V. This correlates to a setpoint of about 25°C, assuming the system is using a 10 kΩ thermistor and a 100 μA bias current through the thermistor. Since room temperature is usually around 25°C, this is usually a "safe" temperature setpoint default.

Both the trip point and the substitute setpoint can be modified to meet the specific requirements of your application. This Application Note describes how to configure these parameters.

NOTES

Please be aware that circuit modifications implemented by the customer will void the Wavelength Electronics warranty. Only factory implemented modifications are warranted. For factory service please contact Wavelength or an authorized distributor.

MODIFY DEFAULT SETPOINT TEMPERATURE

Two resistors on the PTC printed circuit board determine the default temperature setpoint value. These resistors are R_2 and R_6 . Both are sized 0805 surface mount, 1%, 1/10 Watt resistors. From a reference voltage of 3.3 V, R_2 and R_6 form a voltage divider that sets the temperature setpoint for this circuit. From the factory R_2 is 49.9 k Ω and R_6 is 9.76 k Ω . This sets up a voltage of approximately 0.54 V that is subsequently multiplied by two to yield a default setpoint of 1.0 V when the failsafe circuit is tripped.

$$V_{\text{SETPOINT}} = 2 * V_{\text{REF}} \left(\frac{R_6}{R_2 + R_6} \right)$$

Change either R_2 or R_6 (or both) to change the default setpoint voltage to a desired value other than the factory default.

EXAMPLE:

Let's use an example where we want a default setpoint of 30°C using a 10 k Ω thermistor as the sensor and a 100 μ A bias current through the sensor. From the datasheet, the TCS-610 thermistor is 8056 Ohms at 30°C. Using a 100 μ A bias current we would want to establish a default setpoint voltage of 0.805 V.

$$V_{\text{SETPOINT}} = R_{\text{Thermistor at } 30^\circ\text{C}} * I_{\text{BIAS}} = 8056 \Omega * 100 \mu\text{A} = 0.805 \text{ V}$$

Assuming that we only wish to change one resistor in the divider string, we choose to modify R_6 to achieve the new default setpoint voltage. Use the following equation to determine what the value of R_6 should be for a setpoint of 0.805 V.

$$R_6 = \frac{(V_{\text{SETPOINT}} * R_2)}{(2 * V_{\text{REF}} - V_{\text{SETPOINT}})}$$

$$V_{\text{REF}} = 3.3 \text{ V}$$

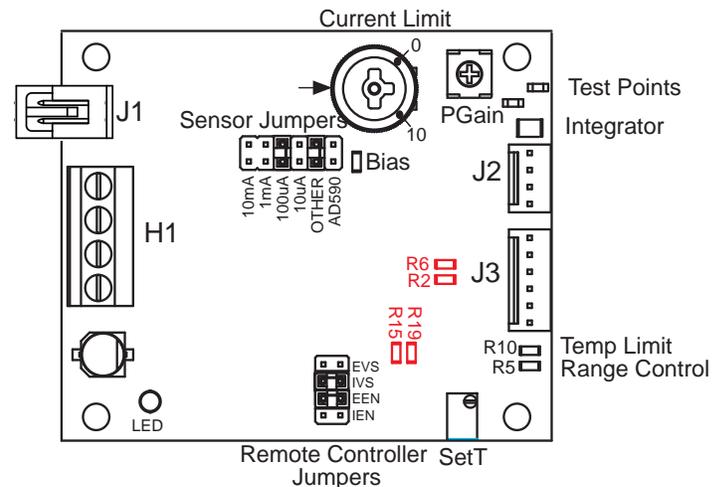
$$V_{\text{SETPOINT}} = 0.805 \text{ V}$$

$$R_2 = 49.9 \text{ k}\Omega$$

$$R_6 = \frac{(0.805 * 49900)}{(2 * 3.3 - 0.805)}$$

$$R_6 = 6.93 \text{ k}\Omega \text{ or approximately } 6.9 \text{ k}\Omega$$

Replacing R_6 with a 6.9 k Ω resistor would achieve a new default setpoint temperature of approximately 30°C for the TCS-610 10 k Ω thermistor at 100 μ A bias current.



MODIFY DEFAULT TRIP POINT

The point at which the failsafe setpoint voltage will be tripped is controlled by the voltage divider string established by resistors R_{15} (factory default – 100 k Ω , 1%, 1/10 W, 0805 sized) and R_{19} (factory default – 4.99 k Ω , 1%, 1/10 W, 0805 sized) from the reference voltage of 3.3 V. The default voltage divider string implements a voltage of approximately 0.157 V that is then multiplied by two to achieve the trip point of about 0.3 V.

$$V_{TRIP} = 2 * V_{REF} \left(\frac{R_{19}}{R_{15} + R_{19}} \right)$$

Change either the value of R_{15} or R_{19} (or both) to modify the point at which the failsafe setpoint voltage will be used.

EXAMPLE:

As an example, consider the case where we want a trip point of 0.25 V. Assuming that we only wish to change one resistor in the divider string, we choose to modify R_{19} to achieve the new trip point voltage. Use the following equation to determine what the value of R_{19} should be for a trip point of 0.25 V.

$$R_{19} = \frac{(V_{TRIP} * R_{15})}{(2 * V_{REF} - V_{TRIP})}$$

$V_{REF} = 3.3$ V
 $V_{TRIP} = 0.25$ V
 $R_{15} = 100$ k Ω

$$\frac{(0.25 * 100000)}{(2 * 3.3 - 0.25)}$$

$R_{19} = 3.937$ k Ω or approximately 3.9 k Ω

Replacing R_{19} with a 3.9 k Ω resistor would achieve a new default trip point of 0.25 V.

KEYWORDS

PTC, temperature control, failsafe setpoint default, modify setpoint temperature, modify setpoint default

DISABLE FAILSAFE CIRCUITRY

To generally disable the Failsafe Circuitry, remove R_{15} . Because of offsets, the failsafe will now trigger when the setpoint is below approximately 50 mV.



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