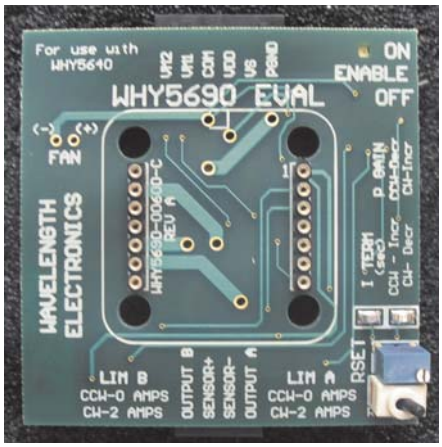
April, 2008

WAVELENGTH ELECTRONICS

WHY5690

WHY5640 Thermoelectric Temperature Controller Evaluation Board



GENERAL DESCRIPTION:

Quickly interface a WHY5640 temperature controller to your thermoelectric or resistive heater load without having to design a printed circuit board. Connect a WHY5640 Thermoelectric Temperature Controller to the easy-to-configure evaluation board to control temperature using thermistor temperature sensors. Adjust temperature using the onboard trimpot. Other adjustable trimpots configure heat and cool current limits, proportional gain, and integrator time constant. The removable input cable set allows easy connection to your power supply and monitoring equipment while the output cable set quickly connects to your thermal load and temperature sensor. For higher current and/or voltage operation use the onboard fan connector to power a WXC303 or WXC304 (+5 V or +12 V) DC fan attached to a WHS302 heatsink.

FEATURES:

- Control temperature using thermistors
- Adjustable Heat and Cool Current Limits
- Adjustable Proportional Gain
- Adjustable Integrator Time Constant
- Enable/Disable Switch and LED
- Includes Input/Output Cable Set
- Includes Fan Connections

Figure 1
Top View

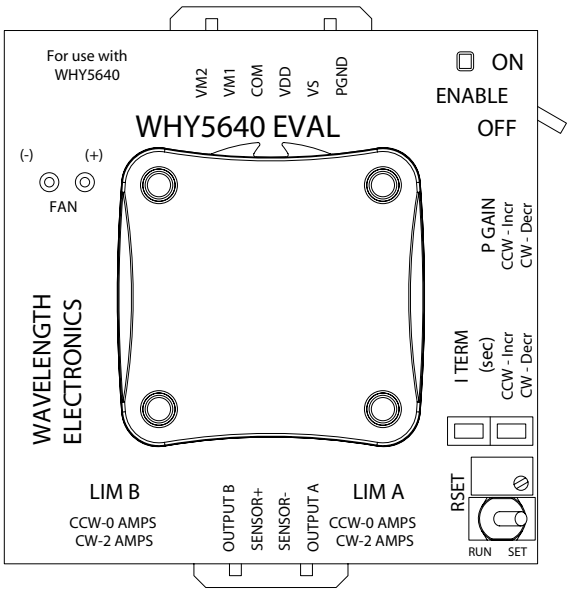


Figure 2
WHY5690 Schematic

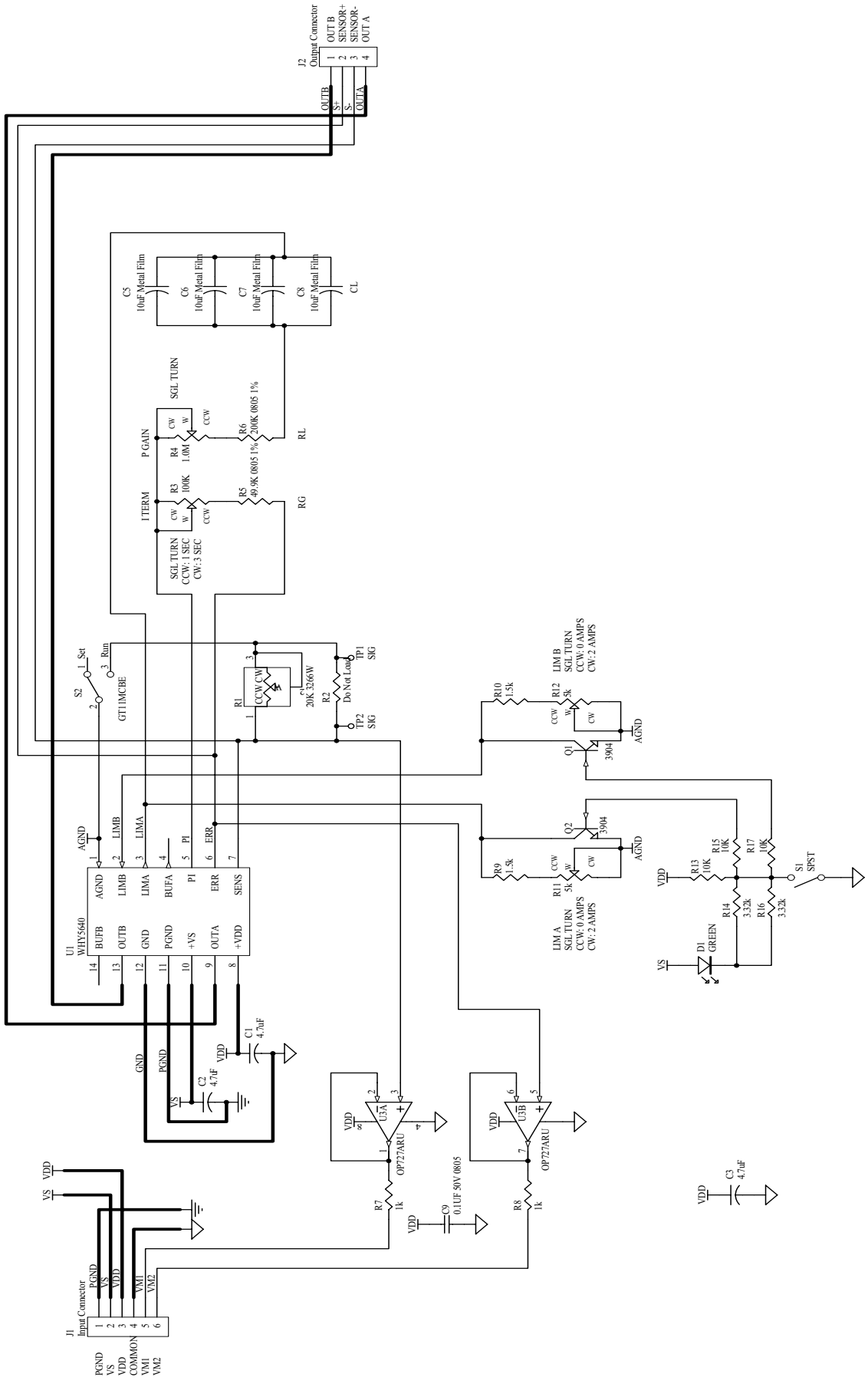
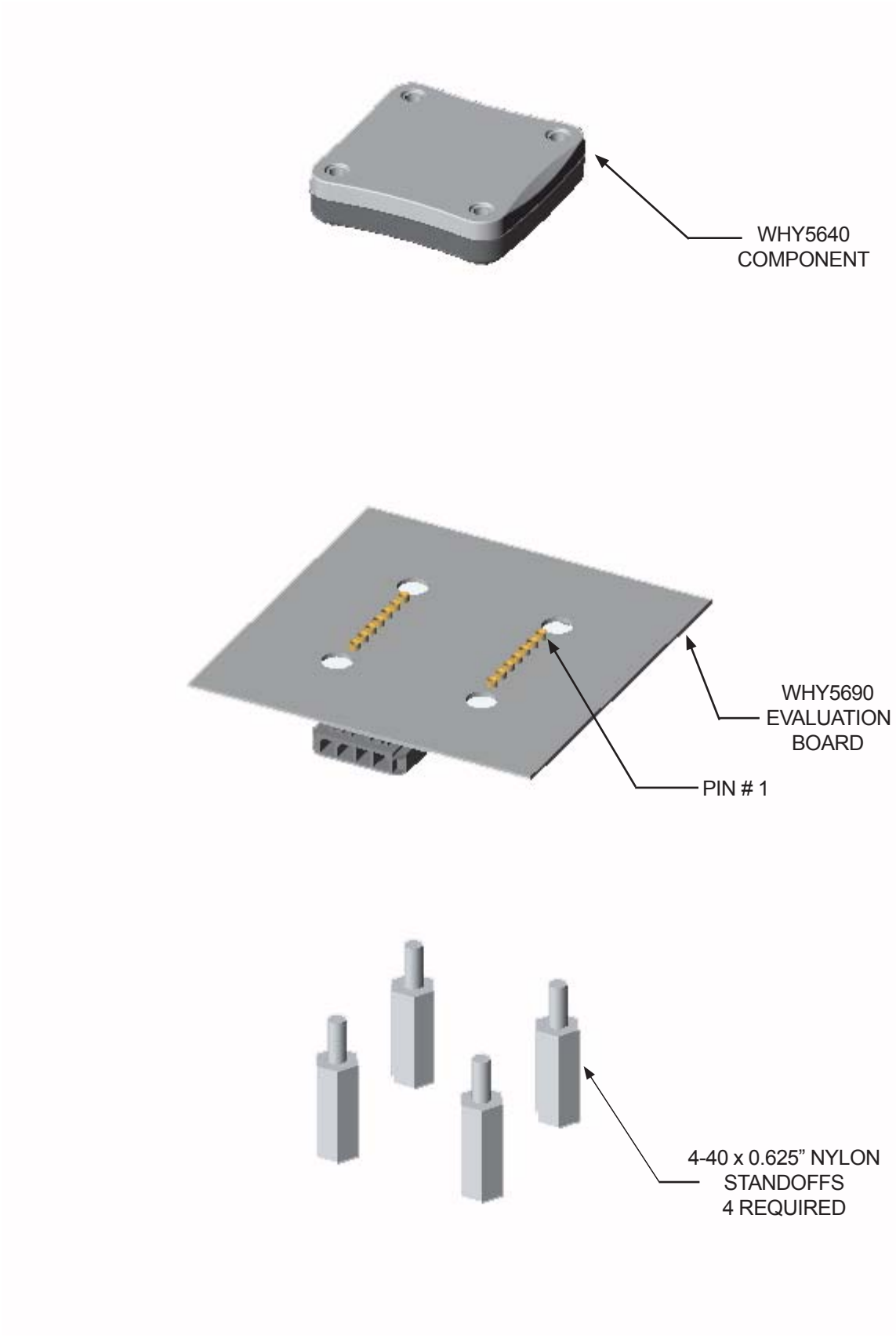


Figure 3
Assembling the WHY5640 Thermoelectric Controller to the WHY5690 Evaluation Board



INPUT / OUTPUT CONNECTOR CONFIGURATION

Table 1 - INPUT CABLE

PIN #	Color	Function
1	BLUE	PGND
2	ORANGE	VS
3	RED	VDD
4	BLACK	COM
5	WHITE	VM1
6	GREEN	VM2

Table 2 - OUTPUT CABLE

PIN #	Color	Function
1	RED	OUTPUT B
2	GREEN	SENSOR +
3	WHITE	SENSOR -
4	BLACK	OUTPUT A

WHY5690 SETUP AND OPERATION

Follow the next nine steps sequentially to safely operate the WHY5690. Complete steps 1 through 4 before applying power to the board. For online Safe Operating Area Calculators (SOA) see: http://www.teamwavelength.com/tools/calculator/soa/defaulttc.htm.

STEP 1: ATTACHING HEATSINK AND FAN

The WHY5640 is designed to handle currents as high as 2.0 Amps. Refer to the WHY5640 data sheet to determine the SOA and proper thermal solution for your application. Refer to the WHS302 and WXC303/WXC304 data sheets for proper assembly instructions. (WEV300, WEV301, and WEV302 Thermal Solutions Kits include: heatsink, thermal washer, fan, and screw fasteners).

STEP 2: CONFIGURING THE HEAT AND COOL CURRENT LIMITS

The evaluation board's LIMA and LIMB trimpots independently adjust the heat and cool current limits from zero to a full 2.0 Amps. Use Table 3 to adjust the heat and cool current limits. Do not exceed SOA limits.

Table 3 - LIMA and LIMB Current Limit Trimpot Configuration

Sensor Type	Load Type	LIMA Trimpot	LIMB Trimpot
Thermistor	Thermoelectric	Cool Current Limit	Heat Current Limit
Thermistor	Resistive Heater	Turn Fully CCW	Heat Current Limit

OPERATING THE EVALUATION BOARD

STEP 3: CONNECTING YOUR THERMAL LOAD

Use Table 4 to determine how to connect the WHY5640 outputs (OUTA or OUTB) to your thermoelectric or resistive heater.

Table 4 - Output Configuration

Sensor Type	Load Type	Output A	Output B
Thermistor	Thermoelectric	Negative TE Terminal	Positive TE Terminal
Thermistor	Resistive Heater	**Quick Connection**: Simply connect the resistive heater to OUTA and OUTB. Adjust the cooling current limit to zero by turning the LIMA trimpot fully counterclockwise. **Maximum Voltage Connection**: Connect one side of the resistive heater to OUTB and the other side to the voltage source V_S.	
RTD	Resistive Heater	**Maximum Voltage Connection**: Connect one side of the resistive heater to OUTA and the other side to the voltage source V_S. NOTE: Adjust the cooling current limit to zero by turning the LIMB trimpot fully counterclockwise.	

STEP 4: CONNECTING YOUR TEMPERATURE SENSOR

The default configuration of the WHY5690 allows for operation of the board with NTC thermistiors in the range of 0-20kΩ. Connect the temperature sensor to the Sensor+ and Sensor- leads on the 4-wire output cable.

Contact Wavelength Electronics to use the WHY5690 with other sensors or ranges.

STEP 5: ATTACHING THE V_{DD} AND V_S POWER SUPPLIES

The V_{DD} power supply is used to power the WHY5640 internal control electronics and must be capable of supplying 100 mA of current. The V_S power supply is used to power the WHY5640 output H-Bridge and must be capable of supplying a current greater than the LIMA and LIMB current limit settings. For simple operation tie V_{DD} to V_S. A separate V_S power supply allows the H-Bridge to operate at a voltage different from the 4.5 volts required by the V_{DD} supply. Select V_S approximately 2.5 volts above the maximum voltage drop across OUTA and OUTB to reduce the power dissipation in the WHY5640 component and minimize your heatsinking requirements. Connect both power supplies via the PGND line in the input connector. For high impedance resistance loads, a higher voltage V_S power supply may be required.

STEP 6: ADJUSTING THE LOOP COMPENSATION PROPORTIONAL GAIN AND INTEGRATOR TIME CONSTANT

These two trimpots adjust the proportional gain and integrator time constant for the control loop and can be adjusted to optimize the control parameters of your system. The "I Term" adjustment affects both the proportional and integrator parameters while the proportional setting affects only the proportional gain.

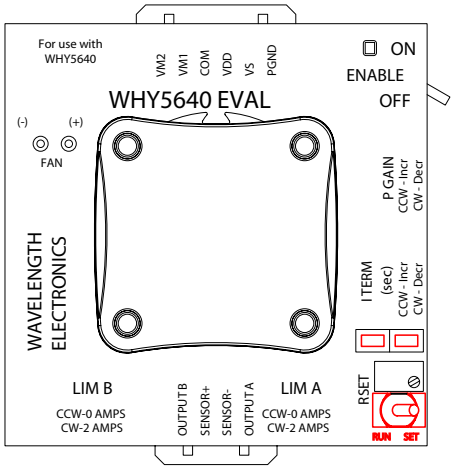
For a better explanation of how the I Term and P Term trimpots affect the parameters of the control system see page 12 of the WHY5640 manual. The I Term adjusts R_G in the equations on page 12, while P Term adjusts R_L.

OPERATING THE EVALUATION BOARD

STEP 7: ADJUSTING THE SETPOINT TEMPERATURE

With the Run/Set switch in the “Set” position, measure the resistance between the two test points next to the RSET trimpot. Adust the RSET trimpot to change this resistance to the resistance value of the thermistor at the desired operating temperature. Once the RSET resistance is set to the desired level, return the Run/Set switch to the “Run” position. Figure 3 shows the location of the Run/Set switch and test points.

Figure 3
Run / Set Switch and Test Points



STEP 8: ENABLING AND DISABLING THE OUTPUT CURRENT

The WHY5640 output current can be enabled and disabled using the onboard toggle switch. The output is enabled when the green ON LED indicator is lit.

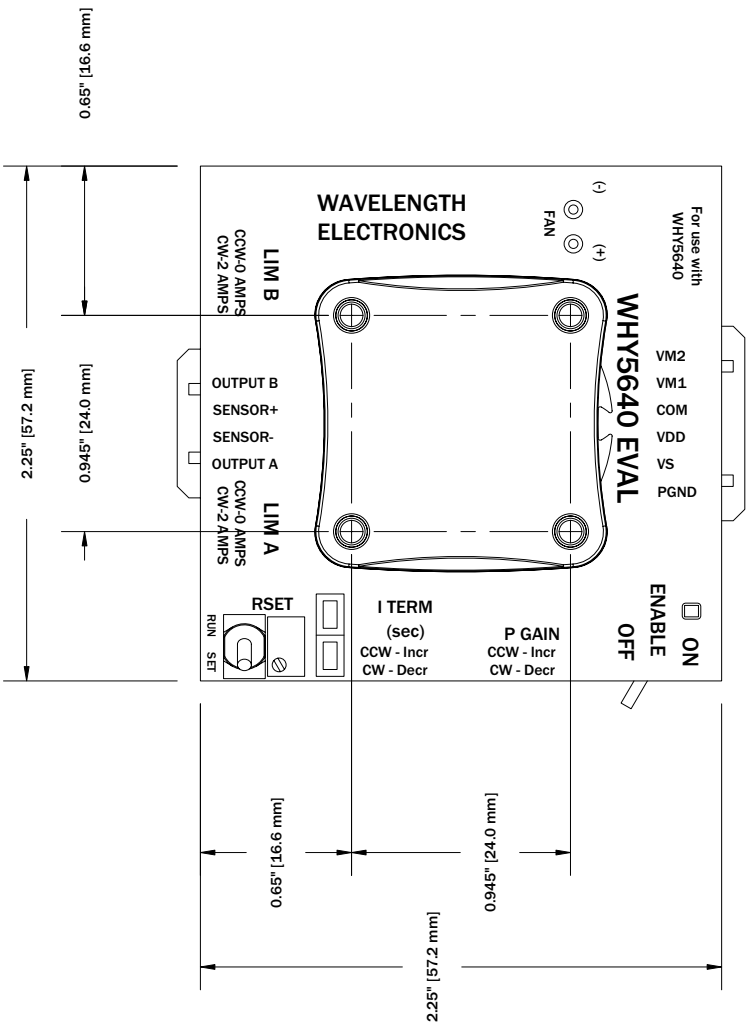
CAUTION: Before enabling the output make sure the Run/Set switch is set to the “Run” position. When enabled with this switch in the “set” position the controller will run at the cooling current limit regardless of the temperature setpoint, which can cause damage to the controller or your thermal load.

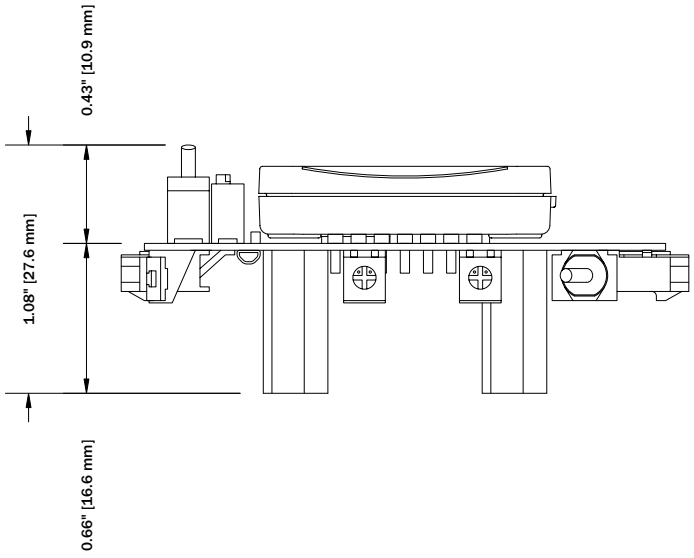
STEP 9: MONITORING THE TEMPERATURE SETPOINT VOLTAGE AND ACTUAL TEMPERATURE SENSOR VOLTAGE

The input connector includes three lines for externally monitoring the WHY5640 setpoint resistance and the actual temperature sensor resistance levels by monitoring voltages produced by the sensor bridge circuit. Both the VM1 and VM2 monitor voltages are referenced to the COMMON terminal. By monitoring VM1 and VM2 you can calculate the thermistor resistance using the following equation.

$$R_T = \left(\frac{VM2-VM1}{VM1}\right) R_{SET}$$

MECHANICAL SPECIFICATIONS*





*All Tolerances are +/- 5%

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

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