

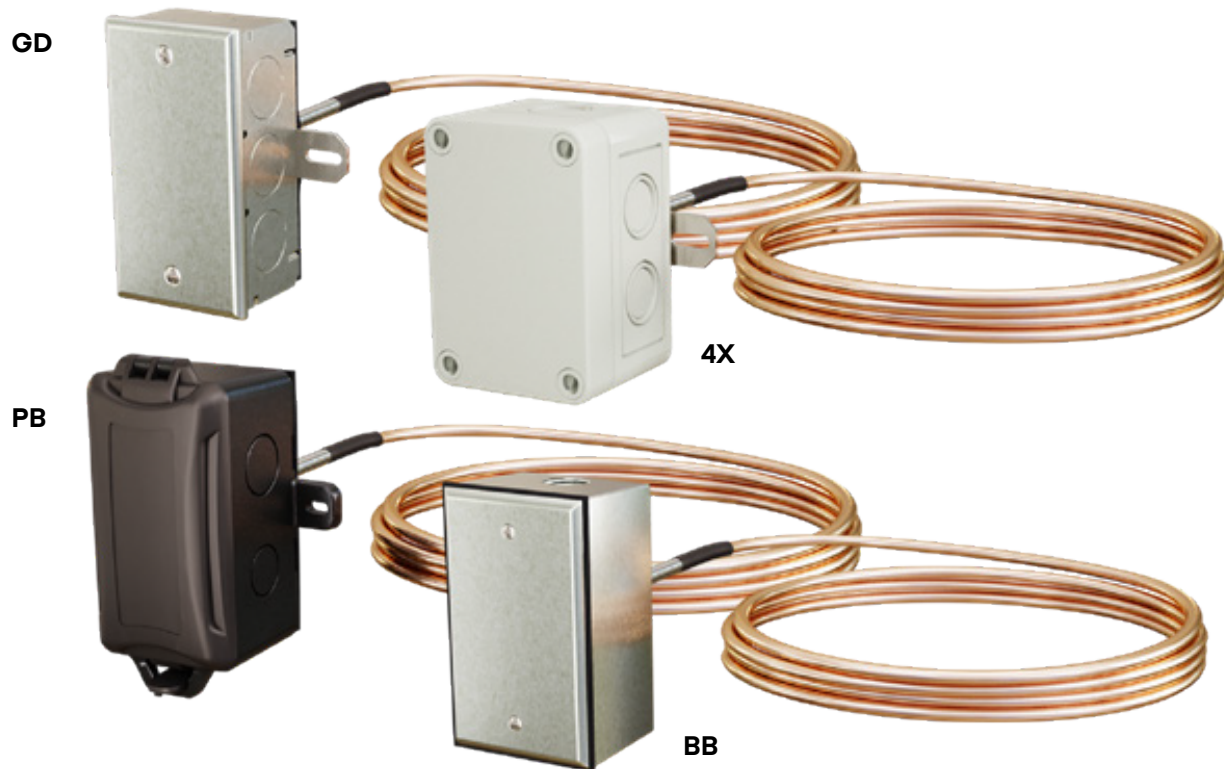


Automation Components, Inc.  
a DwyerOmega brand

## USER'S GUIDE

# Averaging Series Temperature Transmitter

## Installation & Operation Instructions



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The information contained in this document is believed to be correct, but ACI accepts no liability for any errors it contains, and reserves the right to alter specifications without notice.



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## 1. General Information

The ACI Averaging Series sensors and transmitters are continuous sensors that output 4 mA to 20 mA with an optional voltage signal output of 1 Vdc to 5 Vdc or 2 Vdc to 10 Vdc signal to BAS or controller. All ACI/TT and TTM temperature transmitters can be powered from either an unregulated or regulated 8.5 Vdc to 32 Vdc power supply.

## 2. Mounting Instructions

ACI's Averaging Series Temperature Transmitter comes with an averaging element and an enclosure for the transmitter. The transmitter needs to be mounted in environments with ambient temperatures between -40 °C to 85 °C (-40 °F to 185 °F) - see **Specifications**. The averaging element operates between -40 °C to 135 °C (-40 °F to 275 °F).

**For optimal temperature measurement, follow these tips:**

- Mount coil horizontal for vertical stratification.
- Mount coil vertical for horizontal stratification.
- The sensor must be spread evenly over the full duct.
- The entire length of the sensor coil must be installed completely inside the duct. Do not have any part of the sensor exposed to exterior air.
- When installing the sensor near air-handling units, place the sensor downstream from the fan discharge. The stratified airstream will be more uniform across the duct cross-section. If the air is not well-mixed, the reading may be inaccurate.
- If UV Lights are installed in duct, do not use Flexible Averaging. There is no UV protectant on outer cable jacket. Copper averaging must be used in this situation.

### 2.1. Transmitter Mounting

Drill pilot holes for the mounting screws. Use the enclosure flange as a guide, or use the dimensions listed in **Figure 1** and **Figure 2**. Now fasten and insert screws through the mounting holes in the flange and tighten until the unit is held firmly to the duct.

#### Plastic Box (-PB)

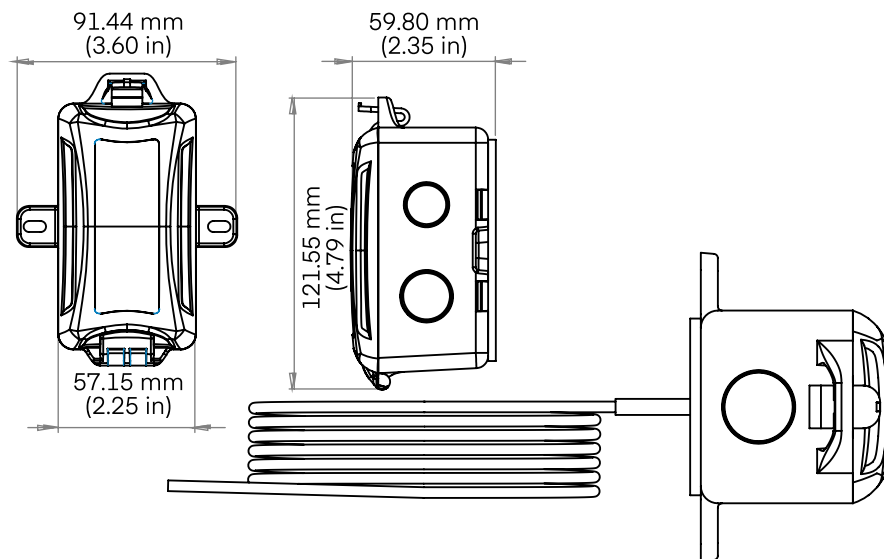
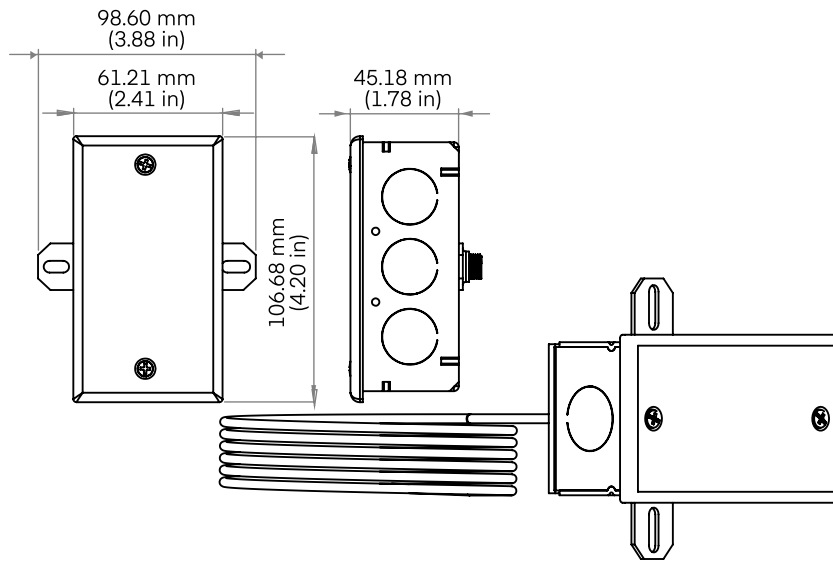
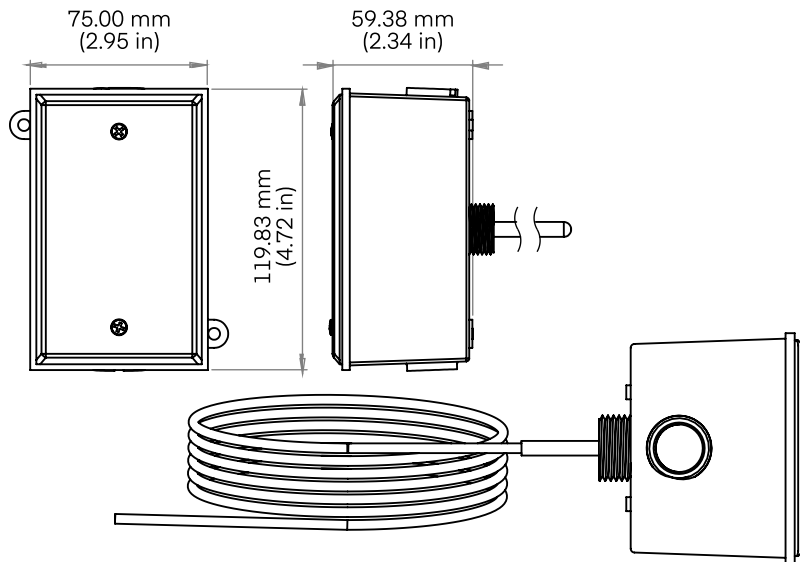


Figure 1: Bullet Probe Dimensions

### Galvanized (-GD)



### Bell Box (-BB)



### NEMA 4X (-4X)

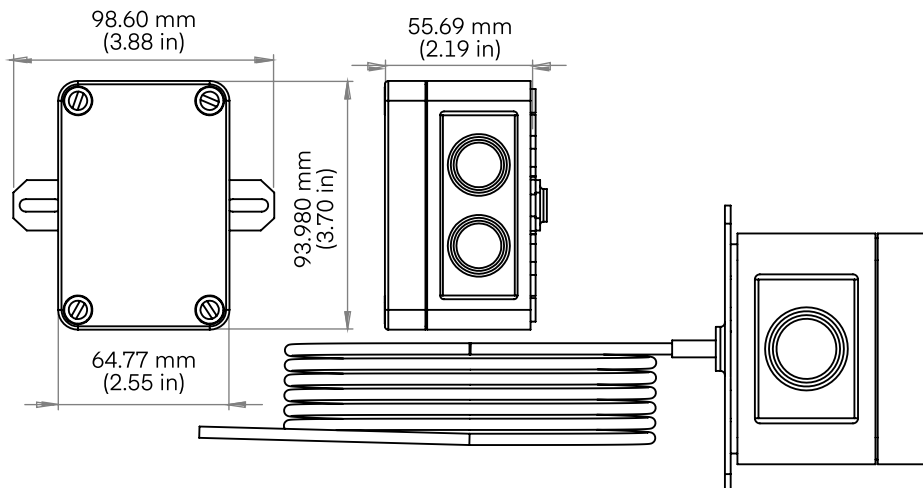
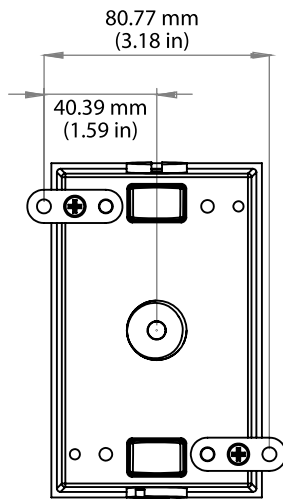
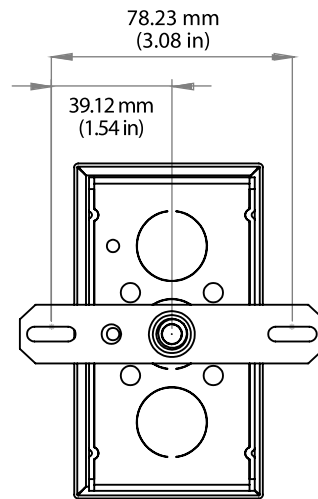


Figure 1 (continued): Bullet Probe Dimensions

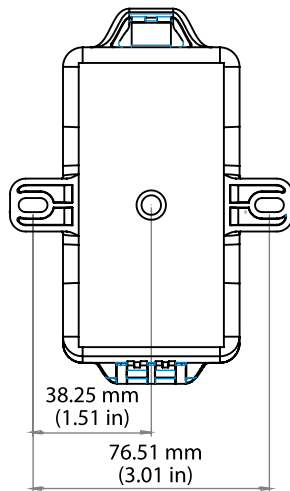
### -BB Enclosure



### -GD Enclosure



### -PB Enclosure



### -PB Enclosure

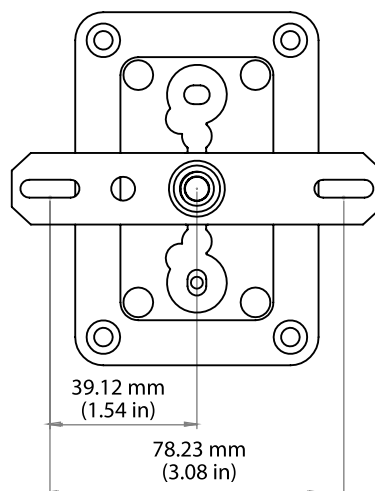


Figure 2: Mounting dimensions

## 2.2. Sensor Mounting

Drill a 9.53 mm (3/8 in) hole in the duct. Gently uncoil the copper tubing and insert the averaging element through the hole until the foam pad is tight to the duct. The sensor should then be strung in a criss-cross pattern throughout the duct using the mounting clips provided - see **Figure 4**.

Use a pattern that covers the greatest surface area of the duct to ensure that there is no stratification. When bending the copper tubing, be careful that you use a gradual bend and that you **DO NOT** kink the copper tubing. Bends should be a minimum of 50.8 mm (2 in). Each unit includes nylon wire ties and mounts for mounting. Optional copper capillary (ACI Item #130525) or universal plastic mounting clips (ACI Item #128248) can be ordered - see **Figure 3**. Plastic mounting clips will help insulate the copper sensing element from the metal duct. The capillary clips help avoid kinks when bending. When using Flexible averaging, do not cover the heatshrink that is located throughout the sensor (sensing points).

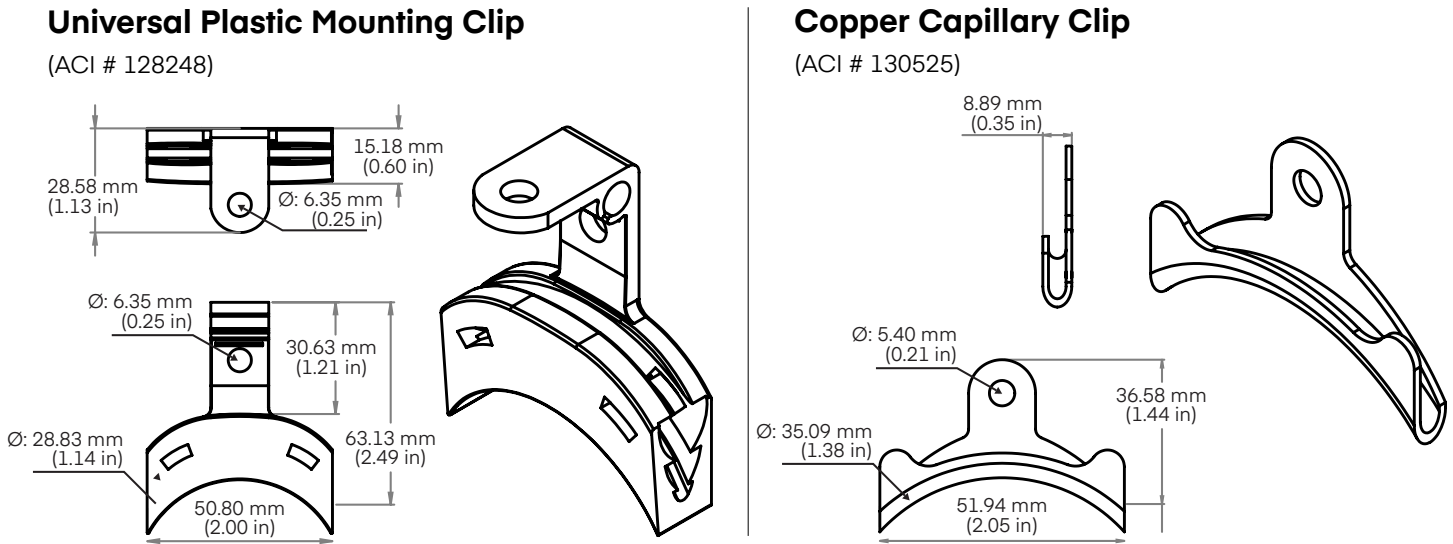
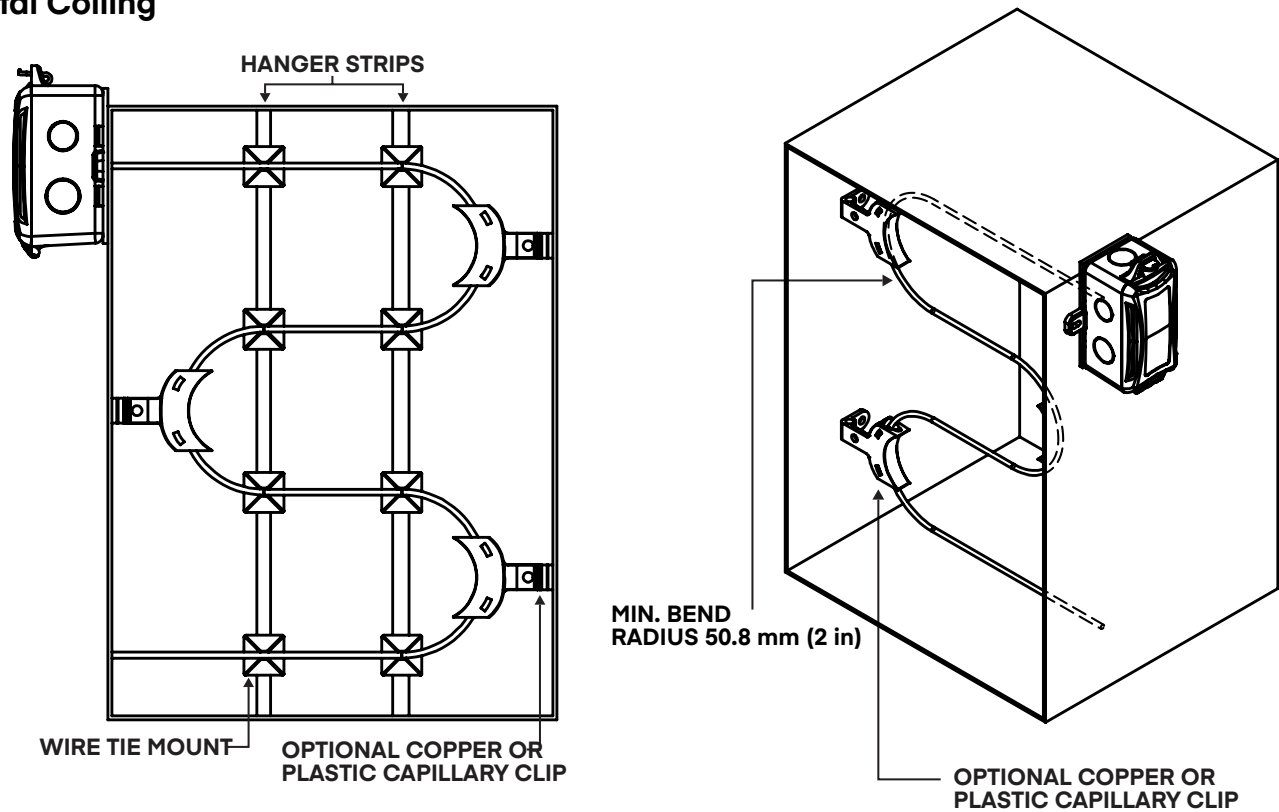


Figure 3: Mounting clip dimensions

Horizontal Coiling



Vertical Coiling

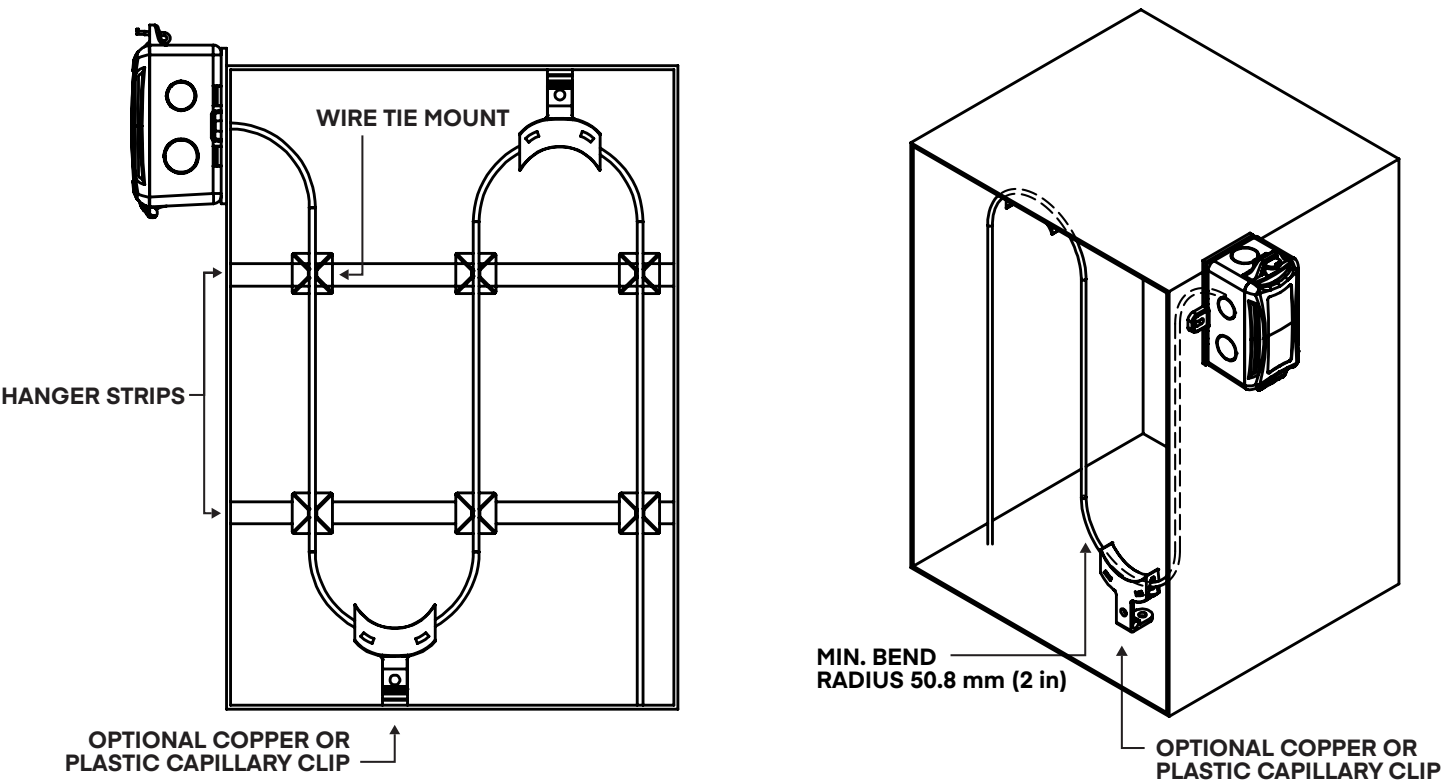


Figure 4: Horizontal and vertical coiling



### 3. Wiring Instructions

#### Precautions

- Transmitter is powered by 24 Vdc only.
- Remove power before wiring. NEVER connect or disconnect wiring with power applied.
- When removing the shield from the sensor end, make sure to properly trim the shield to prevent any chance of shorting.
- When using a shielded cable, ground the shield ONLY at the controller end. Grounding both ends can cause a ground loop.
- If the 24 Vdc power is shared with devices that have coils such as relays, solenoids, or other inductors, each coil must have an MOV, DC Transorb, Transient Voltage Suppressor (ACI Part: 142583), or diode placed across the coil or inductor. The cathode, or banded side of the DC Transorb or diode, connects to the positive side of the power supply. Without these snubbers, coils produce very large voltage spikes when de-energizing that can cause malfunction or destruction of electronic circuits.

Open the cover of the enclosure. ACI recommends 16 AWG to 26 AWG twisted pair wires or shielded cable for all transmitters. Twisted pair may be used for 2-wire current output transmitters or 3-wire for voltage output. Refer to Figure 4 for wiring diagrams. All wiring must comply with local and National Electric Codes. All ACI TT and TTM temperature transmitters can be powered from either an unregulated or regulated 8.5 Vdc to 32 Vdc power supply. The TT and TTM DO NOT support an AC input. All TT and TTM temperature transmitters are reverse polarity protected. After wiring, attach the cover to the enclosure.

The minimum voltage at the transmitter power terminal is 8.5 V after load resistor voltage drop.

- 249  $\Omega$  load resistor (1 Vdc to 5 Vdc output) = 13.5 V min supply voltage
- 499  $\Omega$  load resistor (2 Vdc to 10 Vdc output) = 18.5 V min supply voltage

#### Note

Adding extra wire length between the sensor and transmitter board may affect accuracy.

#### Note

All RTD's are supplied with (2) or (3) flying lead wires. ACI's transmitters are supplied with a 2 pole terminal block for RTD sensor connections. When wiring a 3 wire RTD, connect the (2) common wires (same color) together into the same terminal block.

### Standard Units

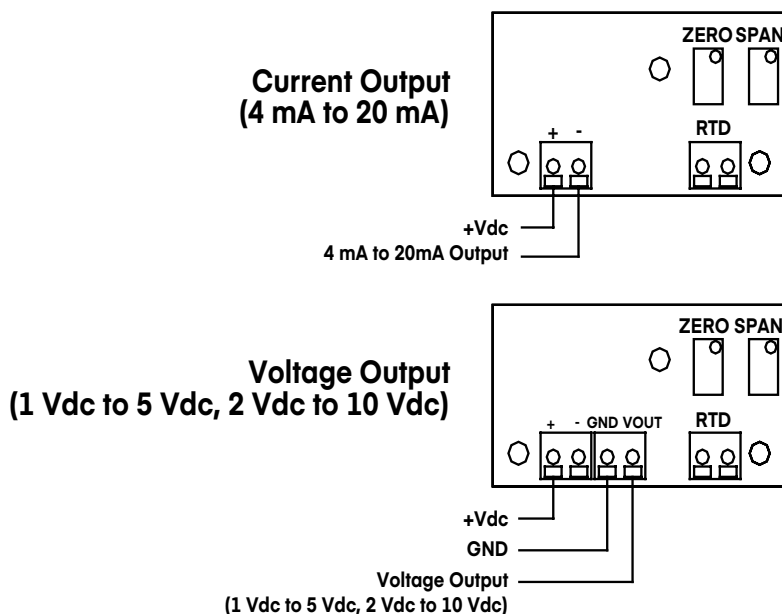


Figure 4: Wiring diagrams

## Potted Units

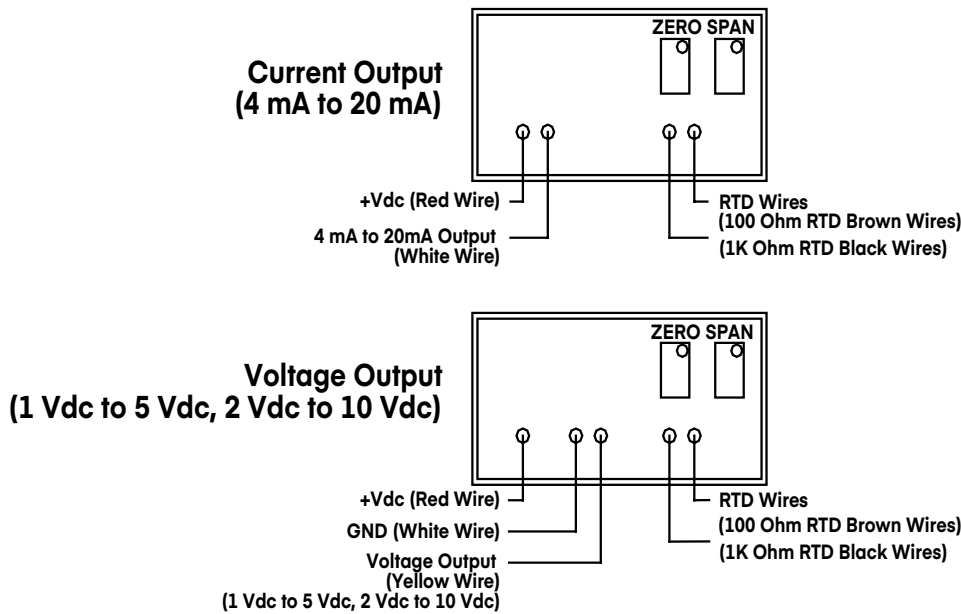


Figure 4 (continued): Wiring diagrams

### 3.1. Formula for Number of Transmitters

Several transmitters may be powered from the same supply as shown in **Figure 5**. Each transmitter draws 25 mA; refer to the following equation to obtain the number of permissible transmitters:

$$[\# \text{ Transmitters}] = [\text{Current}] / (25 \text{ mA}).$$

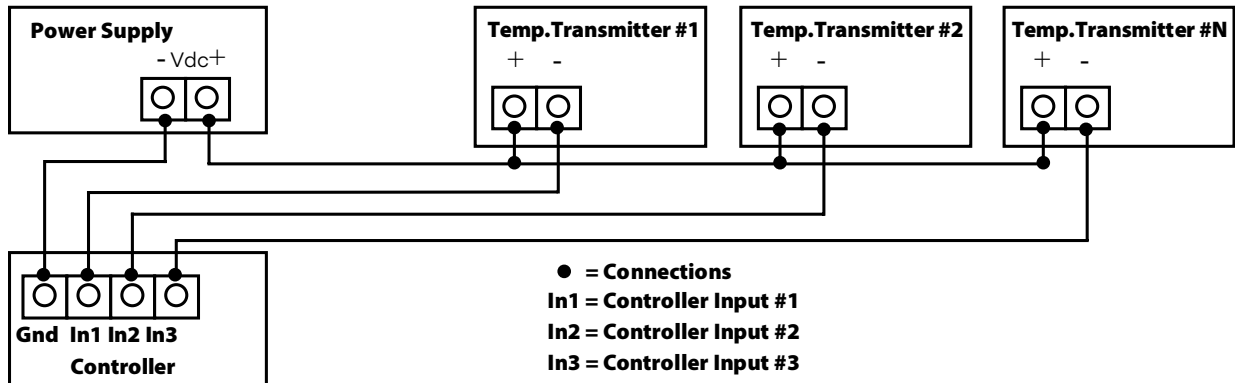


Figure 5: Multiple transmitter connections

## 4. Troubleshooting

Problem	Solution(s)
<b>Temperature Reading Problem</b>	
No reading	<ul style="list-style-type: none"> <li>No power to board - check voltage at power terminal - should be between +8.5 Vdc and 32 Vdc.</li> </ul>
Reading too low	<ul style="list-style-type: none"> <li>RTD wires shorted. Disconnect wires from terminal block and check with ohmmeter. Reading should be close to 100 <math>\Omega</math> or 1K <math>\Omega</math>.</li> <li>RTD Improper range of transmitter (too low). Check current or voltage - should be between 4 mA to 20 mA, 1 V to 5 V, or 2 V to 10 V.</li> </ul>
Reading too high	<ul style="list-style-type: none"> <li>RTD opened. Disconnect sensor wires from terminal block and check with ohmmeter. Reading should be close to 100 <math>\Omega</math> or 1 K<math>\Omega</math>.</li> <li>Improper range of transmitter (too high). Check current or voltage - should be between 4 mA to 20 mA, 1 V to 5 V, or 2 V to 10 V.</li> </ul>

Reading is inaccurate	<ul style="list-style-type: none"> <li>• <b>Sensor check:</b> Disconnect sensor wires from terminal block and check with ohmmeter. Compare the resistance reading to the Temperature vs Resistance curves located on ACI's website.</li> <li>• <b>Transmitter check:</b> Make sure sensor wires are connected to terminal block. Determine that the proper output is being transmitted based on predetermined span: <ol style="list-style-type: none"> <li>1. Go to ACI Website, Span to Output Page: <a href="http://www.workaci.com/content/span-output">http://www.workaci.com/content/span-output</a></li> <li>2. Enter the low end of the span</li> <li>3. Enter the high end of the span</li> <li>4. Click on the output of the transmitter. This will generate a span to output chart.</li> <li>5. Measure output of transmitter.</li> <li>6. Compare measured output to calculated output</li> </ol> </li> </ul>
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## 7. Product Specifications

### General

<b>Storage Temperature Range:</b>	-40 °C to 80 °C (-40 °F to 176 °F)
<b>Operating Humidity Range:</b>	5 % to 90 % RH, non-condensing
<b>Lead Length   Conductor Size:</b>	30.5 cm (12 in)   0.65 mm (22 AWG)
<b>Lead Wire Insulation   Wire Rating:</b>	Etched Teflon (PTFE) Colored Leads   Mil Spec 16878/4 Type E
<b>Conductor Material:</b>	Silver Plated Copper
<b>Enclosure Specifications: (Operating Temperature, Material, Flammability, NEMA/IP Ratings):</b>	<b>"-GD"</b> : Galvanized Steel, -40 °C to 115 °C (-40 °F to 239 °F), NEMA 1 (IP10) <b>"-PB"</b> : ABS Plastic, -30 °C to 100 °C (-22 °F to 212 °F), UL94 5VB, Plenum Rated <b>"-BB"</b> : Aluminum, -40 °C to 115 °C (-40 °F to 239 °F), NEMA 3R (IP 14) <b>"-4X"</b> : Polystyrene Plastic, -40 °C to 70 °C (-40 °F to 158 °F), UL94-V2, NEMA 4X (IP 66)

### Sensor

<b>Sensor Type   Sensor Curve   Sensing Points:</b>	Platinum RTD   PTC (Positive Temperature Coefficient)   Continuous
<b>Sensor Output @ 0 °C (32 °F):</b>	1000 Ohms nominal
<b>Sensor Accuracy:</b>	+/- 0.1 % @ 0 °C (32 °F)   +/- 0.25 % @ 21 °C (70 °F)   +/- 1.0 % @ 130 °C (266 °F)
<b>Temperature Coefficient:</b>	3850 ppm / °C
<b>Response Time (63 % Step Change):</b>	15 Seconds nominal
<b>Sensor Operating Temperature Range:</b>	-40 °C to 135 °C (-40 °F to 275 °F)
<b>Sensing Element Material   Sensor Diameter:</b>	Copper   5.34 mm (0.210 in) nominal
<b>Probe Diameter   Probe Material:</b>	6.35 mm (0.250 in)   304 Stainless Steel
<b>Fitting Material   Flammability Rating:</b>	Polyamide 66 (High Performance Nylon 66)   UL94-HB
<b>Fitting Thread Size:</b>	1/8 in-27 NPSM

### Transmitter

<b>Transmitter Supply Voltage   Supply Current:</b>	+8.5 Vdc to 32 Vdc (Reverse Polarity Protected)   25 mA minimum <b>250 Ω Load:</b> +13.5 Vdc to 32 Vdc   <b>500 Ω Load:</b> +18.5 Vdc to 32 Vdc
<b>Maximum Load Resistance:</b>	(Terminal Voltage - 8.5 V)   0.020 A
<b>Output Signals:</b>	<b>Current:</b> 4 mA to 20 mA (2-Wire)   <b>Voltage:</b> 1 Vdc to 5 Vdc or 2 Vdc to 10 Vdc (3-Wires)
<b>Calibrated Accuracy   Linearity<sup>1</sup>:</b>	<b>T. Spans &lt; 260 °C (500 °F):</b> +/- 0.2 %

<b>Thermal Drift<sup>2</sup>:</b>	<b>T. Spans &lt; 38 °C (100 °F):</b> +/- 0.04%/ °F   <b>T. Spans &gt; 38 °C (100 °F):</b> +/- 0.02%
<b>Min./Max. Calibrated Temperature Spans:</b>	<b>Min. T. Span:</b> 28 °C (50 °F)   <b>Max T. Span:</b> 204 °C (400 °F)
<b>TTM100/TTM1K Certification Points:</b>	<b>3 Pt. NIST:</b> 20 %, 50 %, & 80 % of span   <b>5 Pt. NIST:</b> 20 %, 35 %, 50 %, 65 %, & 80 % of span
<b>Warm Up Time   Warm Up Drift:</b>	10 Minutes   +/- 0.1 %
<b>Transmitter Operating Temperature Range:</b>	-40 °C to 85 °C (-40 °F to 185 °F)
<b>Transmitter Operating Humidity Range:</b>	0 % to 90 %, non-condensing
<b>Connections   Wire Size:</b>	Screw Terminal Blocks   1.31 mm <sup>2</sup> (16 AWG) to 0.129 mm <sup>2</sup> (26 AWG)
<b>Terminal Block Torque Rating:</b>	0.5 Nm (0.37 ft-lb) nominal
<b>Agency Approvals:</b>	CE <sup>3</sup> , UKCA, RoHS2, WEEE, China RoHS 20

**Note<sup>1</sup>:** A Transmitter is calibrated at 22 °C (71 °F) Nominal. | **Note<sup>2</sup>:** Temperature Drift is referenced to 22 °C (71 °F) nominal calibration temperature. | **Note<sup>3</sup>:** Model may not maintain criterion A when subjected to conducted emissions between 28.5 MHz and 29.3 MHz.

## **WARRANTY**

The ACI Averaging Series RH sensors are covered by ACI's Five (5) Year Limited Warranty, which is located in the front of ACI'S SENSORS & TRANSMITTERS CATALOG or can be found on ACI's website: [www.workaci.com](http://www.workaci.com).

## **W.E.E.E. DIRECTIVE**

At the end of their useful life the packaging and product should be disposed of via a suitable recycling centre. Do not dispose of with household waste. Do not burn.



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Version 3.0

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