



# LOW/HIGH TEMPERATURE IMMERSION TRANSMITTER SERIES SENSOR

Installation & Operation Instructions

Phone: 1-888-967-5224  
Website: workaci.com

## GENERAL INFORMATION

The ACI Low/High Temperature Immersion Series sensors and transmitters are single point sensors that output 4-20 mA with an optional voltage signal output of 1-5VDC or 2-10VDC signal to BAS or controller. All ACI/TT and TTM temperature transmitters can be powered from either an unregulated or regulated 8.5 to 32 VDC power supply.

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

- Apply thermal grease to the end of the probe before installation into thermowell (ACI Item #102595).
- The tip of the thermowell should be located in the middle of the pipe.
- The sensor thermowell should be installed against the flow of the water, where water temperature is well mixed (no stratification).
- Be sure the entire thermowell is immersed. If the thermowell is longer than the pipe diameter, the thermowell should be installed in an elbow or Tee.

## MOUNTING INSTRUCTIONS

ACI's Low/High Temperature Series comes with two enclosures: one for transmitter and a second for the immersion sensor. The transmitter needs to be mounted in environments with ambient temperatures between -40 to 85 °C (-40 to 185 °F) - see **SPECIFICATIONS** (p. 4). The immersion high temperature probe operates between -40 to 395 °C (-40 to 743 °F). The low temperature probe operates between -198 °C and 200 °C (-324 to 392 °F).

### TRANSMITTER ENCLOSURE

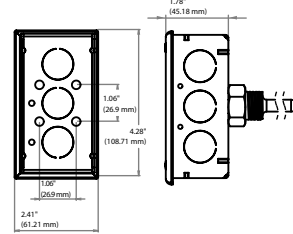
Attach the base directly to the wall by first drilling pilot holes for the mounting screws. Alternatively, you may refer to the dimensions listed (**FIGURE 1**) to measure out.

### SENSOR ENCLOSURE

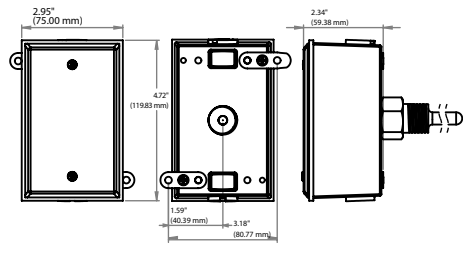
ACI's standard Immersion sensors are made to install into a 1/2" NPT female thread. Typically a Threadolet or Tee is installed into the pipe (**FIGURE 2, 3, and 4**), but a hole can also be drilled and tapped. The pipe/system will need to be drained, unless a Hot Tap is being used.

**FIGURE 1: ENCLOSURE DIMENSIONS**

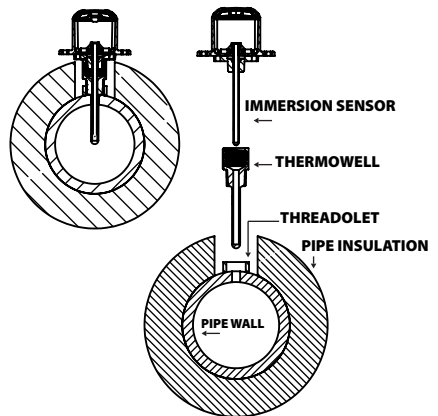
### GALVANIZED (-GD)



### BELL BOX (-BB)



**FIGURE 2: THREADOLET ASSEMBLY**



## MOUNTING INSTRUCTIONS

(Continued)

### SENSOR ENCLOSURE (Continued)

The recommended drill size is 23/32 in. (18 mm). Drill the hole, and tap the hole with 1/2"-14NPT. Always use proper thread sealants on tapered pipe threads of the thermowell. Screw the thermowell into the Threadolet, Tee, or tapped hole, using a wrench to tighten it firmly. Refill the system and check for leaks.

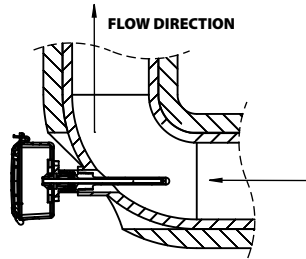
Best practice is to apply thermal grease to the end of the probe, but not required. Insert and push the sensor probe into the thermowell. Turn the sensor probe assembly clockwise to tighten down completely. Refer to the **Wiring Instructions (p. 3)** to make necessary connections.

### PROBE INSERTION

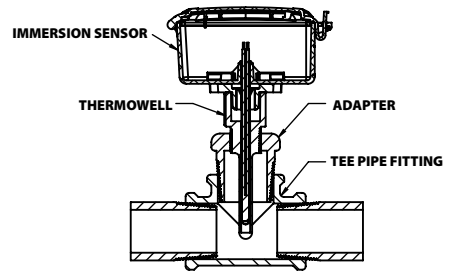
The "INW" includes a standard 1/2" NPS process thread to be used with a machined thermowell or previously installed thermowell. Verify the existing thermowell insertion length of the pipe is suitable for your selected Immersion. If the length of the probe is too large, the probe may be pressed into its enclosure - up to an inch of clearance.

**Note:** \*Fabricated (welded) thermowells (-I) are not intended for moving water or high pressure service. Fluid velocity and wake frequency are primary factors in well failure. Machined thermowells (-IM) should be used in these types of applications. Fabricated thermowells are intended for tank, or low to no flow, applications.

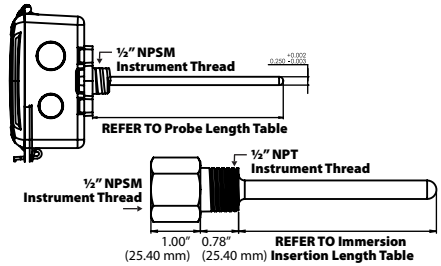
**FIGURE 3: ELBOW ASSEMBLY**



**FIGURE 4: TEE MOUNT ASSEMBLY**



**FIGURE 5: PROBE and IMMERSION**



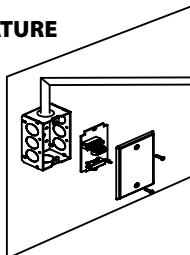
**TABLE 1: PROBE and INSERTION LENGTH**

ACI PART #	IMMERSION LENGTH	PROBE LENGTH
A/TTxx-HT-2.5"-yy-zz	2.5" (63.50 mm)	4.31" (109.47 mm) +/- 0.13" (3.30 mm)
A/TTxx-HT-4"-yy-zz	4.0" (101.60 mm)	5.81" (147.57 mm) +/- 0.13" (3.30 mm)
A/TTxx-HT-6"-yy-zz	6.25" (158.75 mm)	7.81" (198.37 mm) +/- 0.13" (3.30 mm)

## FIGURE 6: INSTALLATION

### AMBIENT TEMPERATURE ENVIRONMENT

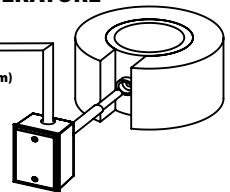
1st ENCLOSURE:  
TEMPERATURE TRANSMITTER  
ELECTRONICS BOARD



### LOW/HIGH TEMPERATURE ENVIRONMENT

↑ CONDUIT  
MAX WIRE LENGTH: 8' (2.43 m)

2nd ENCLOSURE:  
SENSOR ONLY



# WIRING INSTRUCTIONS (Continued)



## 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 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 7** (right) 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 to 32VDC 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.

**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.

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

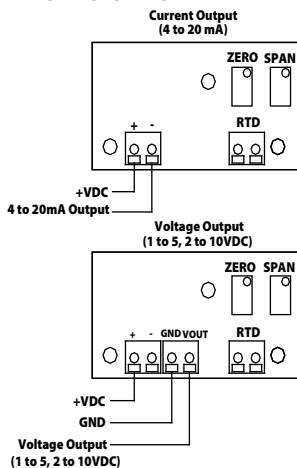
- 249Ω load resistor (1-5 VDC output) = 13.5 V min supply voltage
- 499 Ω load resistor (2-10 VDC output) = 18.5 V min supply voltage

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

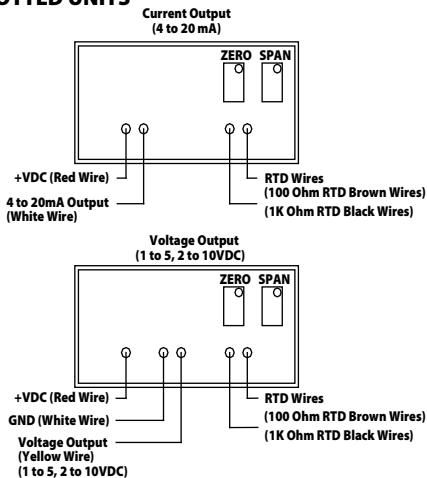
## FORMULA FOR NUMBER OF TRANSMITTERS

Several transmitters may be powered from the same supply as shown in **FIGURE 8** (p. 4). Each transmitter draws 25mA; refer to the following equation to obtain the number of permissible transmitters:  $[ \# \text{ Transmitters} ] = [ \text{Current} ] / ( 25 \text{ mA} )$ .

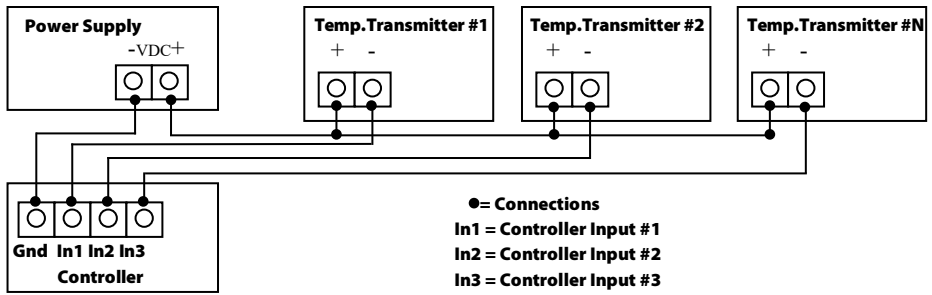
**FIGURE 7: WIRING DIAGRAMS**  
**STANDARD UNITS**



## POTTED UNITS



**FIGURE 8: MULTIPLE TRANSMITTER CONNECTIONS**



## TROUBLESHOOTING

PROBLEM	
<b>No Reading</b>	<ul style="list-style-type: none"> <li>No power to board - check voltage at power terminal - should be between +8.5 and 32 VDC.</li> </ul>
<b>Reading too Low</b>	<ul style="list-style-type: none"> <li>RTD wires shorted. Disconnect sensor wires from terminal block and check with ohmmeter. Reading should be close to either 100 Ω or 1000 Ω.</li> <li>RTD Improper range of transmitter (too low). Check current or voltage (model dependent) - should be between 4-20 mA, 1-5 V, or 2-10 V.</li> </ul>
<b>Reading too High</b>	<ul style="list-style-type: none"> <li>RTD opened. Disconnect sensor wires from terminal block and check with ohmmeter. Reading should be close to either 100 Ω or 1000 Ω.</li> <li>Improper range of transmitter (too high). Check current or voltage (model dependent) - should be between 4-20 mA, 1-5 V, or 2-10 V.</li> </ul>
<b>Reading is Inaccurate</b>	<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>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>Enter the low end of the span</li> <li>Enter the high end of the span</li> <li>Click on the output of the transmitter. This will generate a span to output chart.</li> <li>Measure output of transmitter.</li> <li>Compare measured output to calculated output</li> </ol> </li> </ul>
<b>RF Interference</b>	<ul style="list-style-type: none"> <li>Input power must be clean. Use twisted wires or shielded cable. RF resistant power supply. Use a shielded cable to connect the sensor - connect the shield to ground. Encase the board in a RF shielded enclosure.</li> </ul>

## WARRANTY

The ACI Immersion Series sensors and transmitters 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).

# PRODUCT SPECIFICATIONS

SENSOR NON-SPECIFIC	
<b>Storage Temperature Range:</b>	-40 to 85 °C (-40 to 185 °F)
<b>Operating Humidity Range:</b>	10 to 90% RH, non-condensing
<b>Lead Length   Conductor Size:</b>	<b>HIGHTT:</b> 8'(2.44 m)   24 AWG (0.20 mm <sup>2</sup> )   <b>LOWTT:</b> 8'(2.44 m)   22 AWG (0.25 mm <sup>2</sup> )
<b>Lead Wire Insulation   Conductor Material:</b>	<b>HIGHTT:</b> Fiberglass Braided Insulation with Mica Tape   27% Nickel Plated Copper <b>LOWTT:</b> Etched Teflon (PTFE)   Silver Plated Copper
<b>Probe Material   Probe Diameter:</b>	316 Stainless Steel   0.250" (6.35 mm)
<b>Compression Fitting Material   Thread Size:</b>	316 Stainless Steel   1/2" NPT
<b>Thermowell Material (HIGH TT):</b>	304 Series Stainless Steel
<b>Thermowell Thread   Process Thread (HIGH TT):</b>	1/2" NPS (National Pipe Straight - Female)   1/2" NPT (National Pipe Tapered - Male)
<b>Enclosure Specifications:</b>	"-GD" Enclosure: -40 to 199 °C (-40 to 390 °F); Galvanized Steel; NEMA 1 (IP 10) "-BB" Enclosure: -40 to 85 °C (-40 to 185 °F); Aluminum; NEMA 3R (IP 14)
TRANSMITTER	
<b>Transmitter Supply Voltage   Supply Current:</b>	+8.5 to 32 VDC (Reverse Polarity Protected)   25 mA minimum <b>250 Ω Load (1-5 VDC):</b> +13.5 to 32 VDC   <b>500 Ω Load (2-10 VDC):</b> +18.5 to 32 VDC
<b>Output Signals:</b>	<b>Current:</b> 4-20 mA (2-Wire Loop Powered)   <b>Voltage:</b> 1-5 VDC or 2-10 VDC (3-Wires)
<b>Calibrated Transmitter Accuracy   Linearity:</b>	<b>T. Spans &lt; 260 °C (500 °F):</b> +/- 0.2%   <b>T. Spans &gt; 260 °C (500 °F):</b> +/- 0.5%
<b>Transmitter Operating Temperature Range:</b>	-40 to 85 °C (-40 to 185 °F)
<b>Operating Humidity Range:</b>	0 to 90%, non-condensing
<b>Calibrated Temperature Spans:</b>	<b>Min. T. Span:</b> 28 °C (50 °F)   <b>Max T. Span:</b> 426 °C (800 °F)
<b>Temp Drift:</b>	<b>T. Span &lt; 38 °C (100 °F):</b> +/- 0.04%   <b>T. Span &gt; 38 °C (100 °F):</b> +/- 0.02%
<b>Warm Up Time   Drift:</b>	10 Minutes   +/- 0.1%
<b>Connections   Wire Size:</b>	Screw Terminal Blocks (Non-Polarity Sensitive)   16 (1.31 mm <sup>2</sup> ) to 26 AWG (0.129 mm <sup>2</sup> )
<b>Terminal Block Torque Rating:</b>	0.5 Nm nominal
PROBE	
<b>Sensor Type   Sensor Curve   Sensing Points:</b>	Platinum RTD   PTC (Positive Temperature Coefficient)   One
<b>DIN Standard   Temp Coefficient:</b>	DIN EN 60751 (IEC 751)   3850 ppm / °C
<b>Response Time:</b>	15 Seconds nominal
<b>Sensor Output @ 0°C (32°F):</b>	<b>A/100-3W-HT-D-xx:</b> 100 Ω nominal   <b>A/1K-3W-HT-D-xx":</b> 1 KΩ nominal
<b>Sensor Tolerance Class   Accuracy:</b>	+/- 0.12% Class B   <b>Class B Tolerance Formula:</b> +/- °C = (0.30 °C + (0.005 *  t ))
<b>Sensor Operating Temperature Range:</b>	<b>HIGHTT:</b> -40 to 395 °C (-40 to 743 °F)   <b>LOWTT:</b> -198 to 200 °C (-324 to 392 °F)

## 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.



## NOTES

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## **Automation Components, Inc.**

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