Overview and Identification

The Immersion Sensor is made for thermowell mounting and temperature measurement in water pipes, water tanks or cooling tower sump applications. The stainless steel probe comes in different lengths and mounting enclosures as shown below. The 4 to 20mA output transmitter comes with a 1KΩ (385) RTD or 10K-2 thermistor sensor. A 0 to 5VDC or 0 to 10VDC output is also available with the 10K-2 thermistor sensor. Special high accuracy RTD matched transmitters (**M**) are available which match the sensor to the transmitter for improved accuracy.

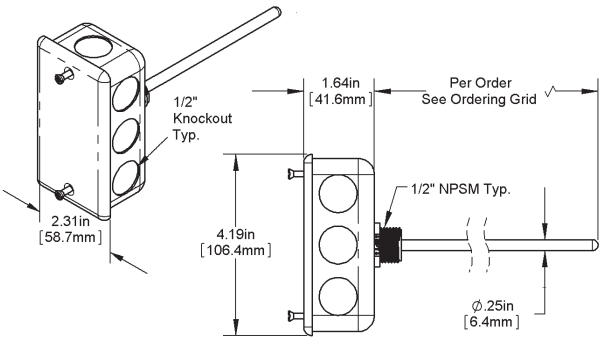

Fig. 1: J-Box Immersion (Standard)

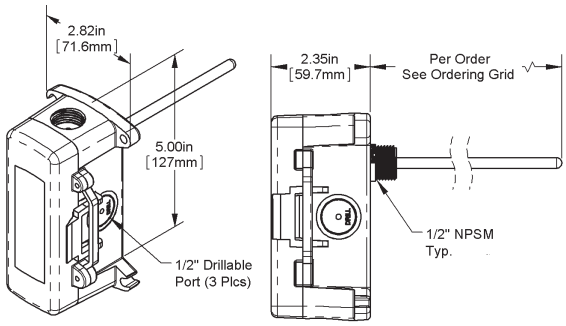

Fig. 2: BAPI-Box 2 **(BB2)** Immersion

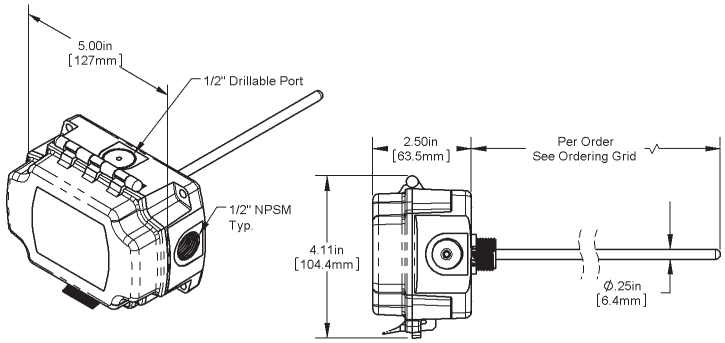

Fig. 3: BAPI-Box **(BB)** Immersion

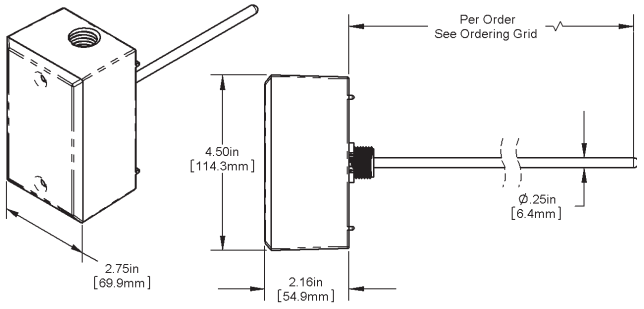

Fig. 4: Weatherproof **(WP)** Immersion

Mounting

• **Application:** Fig 7 shows a typical four-inch thermowell and four-inch immersion probe installed into an eight inch pipe. In a properly insulated pipe with liquid or steam, the temperature is essentially the same across the entire cross section of the pipe. Usually thermowells are sized to extend to the center of the pipe; however, shorter thermowells will give proper temperature readings if properly insulated. The shorter thermowells are used in pipes with high flow velocities. See Application notes “Thermowells Explained” on our website at www.bapihvac.com.

• **Thermowell Installer:** Typically a Pipe Fitter drills a ¾-inch hole into the pipe where the thermowell is needed. A customer provided fitting, called a Threadolet or Weldolet, is welded to the pipe over the hole. The Threadolet has a ½” NPT thread in the center. Thread sealant such as Teflon tape or pipe dope is applied to the ½” NPT threads of the thermowell. The thermowell is then inserted into the Threadolet and tightened. Estimates on insertion depths can be seen in our Application note “Thermowells Explained” on our website at www.bapihvac.com.

• **Sensor Installation:** Insert the immersion sensor into the well with the plastic screw fitting into the opening on the well. Hand tighten the immersion sensor snugly without too much torque. Make sure that the tip of the immersion sensor is in contact with the bottom of the well by pushing on the top of the probe, without damaging the wires, to bottom out the probe in the thermowell. The unit is designed so that the temperature probe slides in the junction box as the sensor hits the bottom of the thermowell.

Specifications subject to change without notice.

Mounting continued...

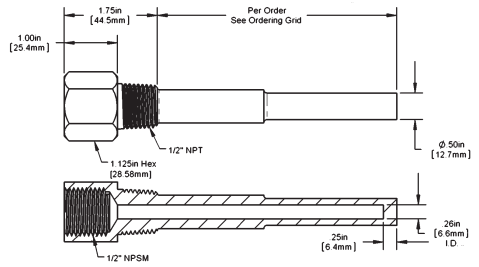

Fig. 5: Machined Bar Stock Thermowell

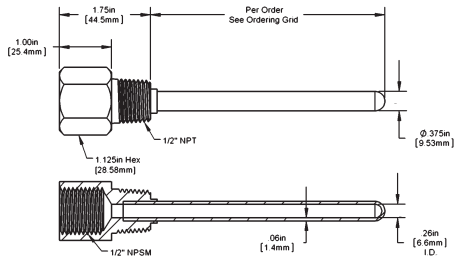

Fig. 6: Two Part Welded Thermowell

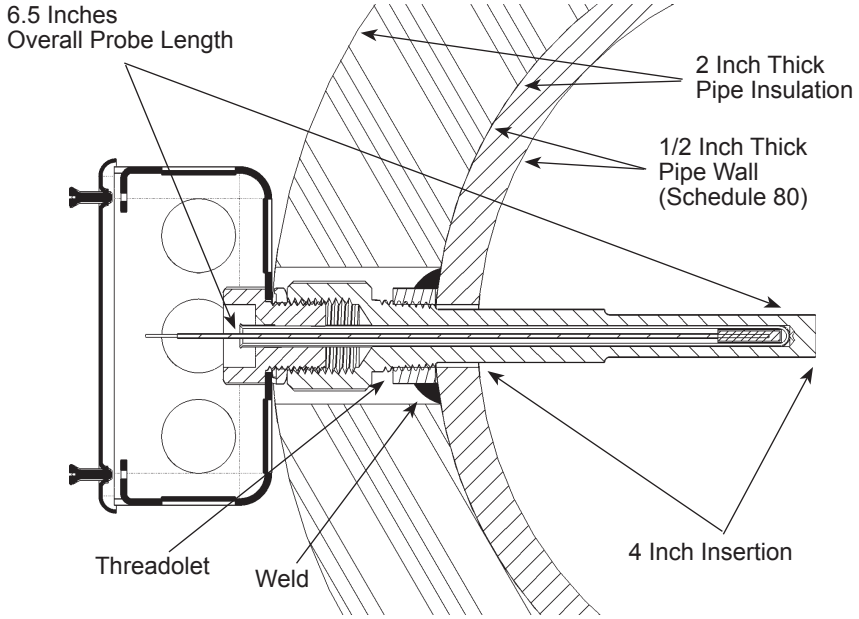

Fig. 7: Typical Installation Identification and Dimensions

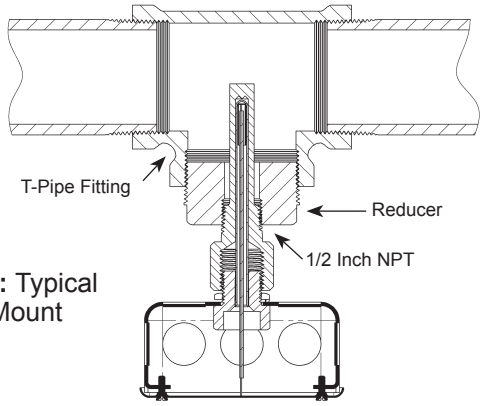

Fig. 8: Typical T-Mount

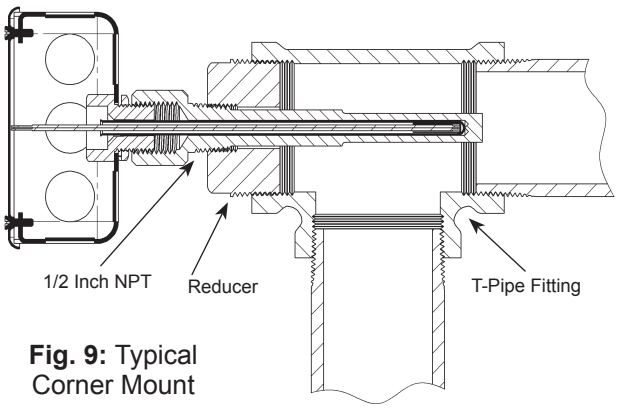

Fig. 9: Typical Corner Mount

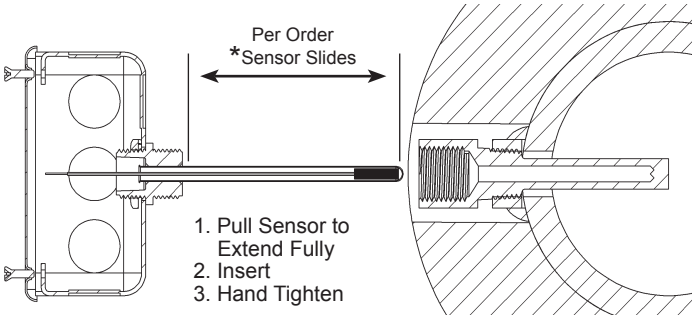

Fig. 10: Standard J-Box Before Insertion
(J-Box shown but process is the same for all enclosures)

*As the enclosure is hand screwed, the probe will push back into the enclosure as the probe tip bottoms out in the thermowell. The probe can slide up to 1.6 inches.

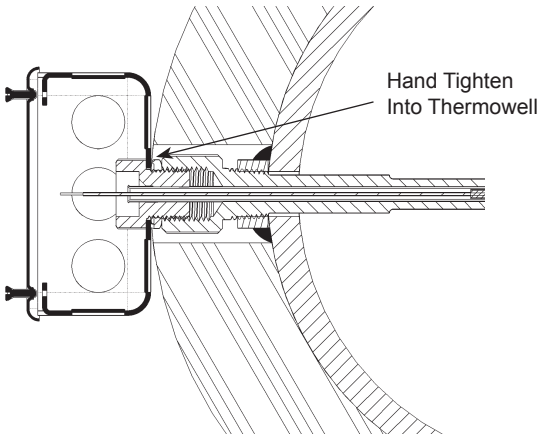

Fig. 11: Typical Sensor Inserted

Specifications subject to change without notice.

Wiring & Termination

BAPI recommends using twisted pair of at least 22AWG and sealant filled connectors for all wire connections. Larger gauge wire may be required for long runs. All wiring must comply with the National Electric Code (NEC) and local codes. Do NOT run this device's wiring in the same conduit as high or low voltage AC power wiring. BAPI's tests show that inaccurate signal levels are possible when AC power wiring is present in the same conduit as the sensor wires.

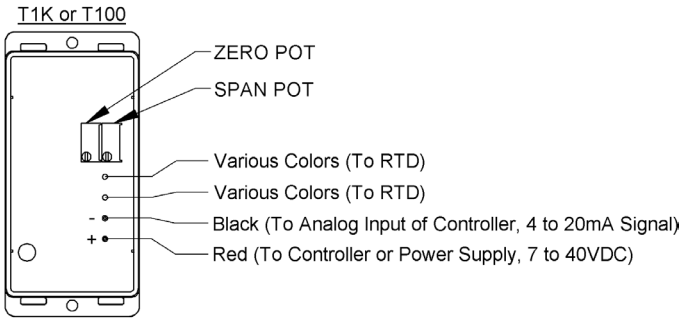

Fig. 12: Typical RTD 4 to 20mA Transmitter with Flying Leads

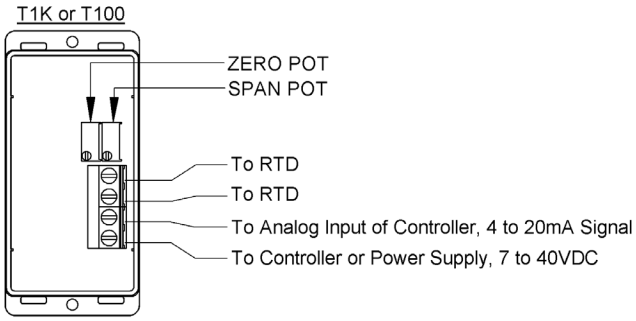

Fig. 13: Typical RTD 4 to 20mA Transmitter with Terminals

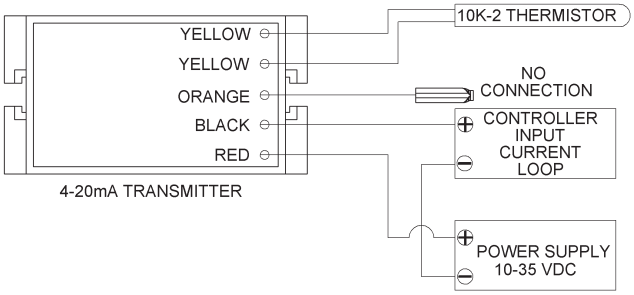

Fig. 14: Typical Thermistor 4 to 20mA Transmitter

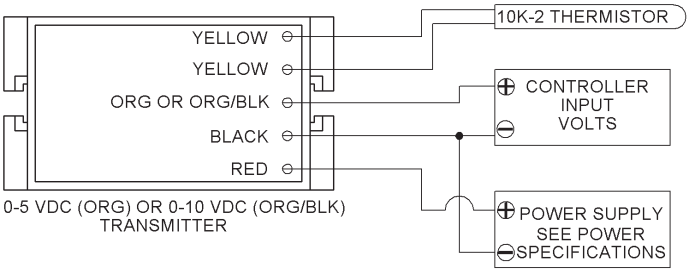

Fig. 15: Typical Thermistor Voltage Transmitter

Diagnostics

Possible Problems:

• Unit will not operate.

Possible Solutions:

- Measure the power supply voltage by placing a voltmeter across the transmitter's (+) and (-) terminal. Make sure that it matches the drawings above and power requirements in the specifications.
- Check if the RTD wires are physically open or shorted together and are terminated to the transmitter.

• The reading is incorrect in the controller.

- Determine if the input is set up correctly in the controllers and BAS software.
- For a 4 to 20mA current transmitter measure the transmitter current by placing an ammeter in series with the controller input. The current should read according to the "4 to 20mA Temperature Equation" shown below.
- For a voltage transmitter, measure the signal with a volt meter (Orange or Orange/Black to Black). The signal should read according to the "Voltage Temperature Equation" shown below.

Voltage Temperature Equation

$$T = T_{Low} + \frac{(V \times T_{Span})}{V_{Span}}$$

T	= Temperature at sensor
T_{Low}	= Low temperature of span
T_{High}	= High temperature of span
T_{Span}	= T_{High} - T_{Low}
V_{Low}	= Low transmitter voltage usually=(0, 1 or 2v)
V_{High}	= High transmitter voltage usually=(5 or 10v)
V_{Span}	= V_{High} - V_{Low}
V	= Signal reading in volts

4 to 20mA Temperature Equation

$$T = T_{Low} + \frac{(A - 4) \times (T_{Span})}{16}$$

T	= Temperature at sensor
T_{Low}	= Low temperature of span
T_{High}	= High temperature of span
T_{Span}	= T_{High} - T_{Low}
A	= Signal reading in mA

Specifications subject to change without notice.

Specifications

RTD Transmitter

Power Required: ....7 to 40VDC
Transmitter Output: 4 to 20mA, 850Ω@24VDC
Output Wiring: .....2 wire loop
Output Limits: .....<1mA (short), <22.35mA (open)
Span: .....Min. 30ºF (17ºC), Max 1000ºF, (555ºC)
Zero: .....Min. -148°F (-100°C), Max 900ºF (482ºC)
Zero & Span Adjust: 10% of span
Accuracy: .....±0.065% of span
Linearity: .....±0.125% of span
Power Output Shift: ±0.009% of span
RTD Sensor: .....2 wire Platinum (Pt), 385 curve
Transmitter Ambient: -4 to 158ºF(-20 to 70ºC)
0 to 95% RH, Non-condensing

Thermistor Transmitter

Supply Voltage:
10 to 35 VDC ..... 0 to 5 VDC or 4 to 20 mA Outputs
15 to 35 VDC .....0 to 10 VDC Output
12 to 24 VAC.....0 to 5 VDC Outputs
15 to 24 VAC.....0 to 10 VDC Output
Transmitter Output....4 to 20mA, 700Ω@24VDC
0 to 5VDC, 0 to 10VDC, 10KΩ min
Output wiring .....2 & 3 wire (see Wiring detail)
Transmitter Limits .....-40ºF to 185ºF,(-40ºC to 85ºC)
Accuracy.....±1.015ºC, from (0 to 65ºC)
Linearity.....±0.065ºC, from (0 to 65ºC)
Resolution.....Span/1024
Thermistor Sensor ....10K-2 Thermistor,10KΩ @77ºF
Transmitter Ambient..32 to 158ºF, (0º to 70ºC)
0 to 95% RH, Noncondensing

Thermistor: 10K-2**,** Thermal resistor
Accuracy.....(Std) ±0.36ºF, (±0.2ºC)
Accuracy.....(High) ±0.18ºF, (±0.1ºC), **[XP]** option
Stability.....< 0.036ºF/Year, (<0.02ºC/Year)
Heat Dissipation .....2.7 mW/ºC
Probe Range .....-40º to 221ºF (-40º to 105ºC)
Wire Colors:
Standard: .....Yellow/Yellow (no polarity)
High Acc. [XP]: .....Yellow/Yellow (no polarity)

RTD: Resistance Temp Device (Continuous)
Platinum (Pt).....100Ω and 1KΩ @0ºC, 385 curve,
Pt Accuracy.....(Std) 0.12% @Ref, or ±0.55ºF, (±0.3ºC)
Pt Accuracy.....(High) 0.06% @Ref, or ±0.277ºF,
(±0.15ºC), **[A]**option
Pt Stability.....±0.25ºF, (±0.14ºC)
Pt Self Heating.....0.4 ºC/mW @0ºC
Pt Probe Range.....-40º to 221ºF, (-40 to 105ºC)
Wire Colors:.....General color code (other colors possible)
1KΩ, Class B .....Orange/Orange (no polarity)
1KΩ, Class A .....Orange/White (no polarity)
100Ω, Class B .....Red/Red (no polarity)
100Ω, Class A.....Red/Red-w/black stripe (no polarity)

Sensitivity: Approximate @ 32ºF (0ºC)
Thermistor ..... Non-linier – Go to bapihvac.com click “Resources” and “BAPI Sensors Overview”
RTD (Pt) ..... 3.85Ω/ºC for 1KΩ RTD
0.385Ω/ºC for 100Ω RTD

Lead Wire: 22awg stranded

Insulation: Etched Teflon, Plenum rated

Probe: Rigid, 304 Stainless Steel, 0.25” OD

Probe Length: 2”, 4” or 8” or per order

Duct Gasket: 1/4” Closed cell foam (impervious to mold)

Enclosure Types: (Part number designator in bold)
J-Box: ..... **-JB,** w/ eight ½” knock-outs
Weatherproof: .. **-WP,** w/ two ½” FNPT entries, (Bell box)
BAPI-Box: ..... **-BB,** w/ four ½” NPSM & one ½” drill-out
BAPI-Box 2: ..... **-BB2,** w/ three ½” NPSM & three ½” drill-outs

Enclosure Ratings: (Part number designator in bold)
J-Box: ..... **-JB,** NEMA 1
Weatherproof: .. **-WP,** NEMA 3R, IP14
BAPI-Box: ..... **-BB,** NEMA 4, IP66, UV Rated
BAPI-Box 2: ..... **-BB2,** NEMA 4, IP66, UV Rated

Enclosure Material: (Part number designator in bold)
J-Box: ..... **-JB,** UL94H-B
Weatherproof:... **-WP,** Cast Aluminum, UV rated
BAPI-Box:..... **-BB,** Polycarbonate, UL94V-0, UV rated
BAPI-Box 2: ..... **-BB2,** Polycarbonate, UL94V-0, UV rated

Ambient (Enclosure): 0 to 100% RH, Non-condensing
J-Box ..... **-JB,** -40ºF to 212ºF, (-40º to 100ºC)
Weatherproof ... **-WP,** -40ºF to 212ºF, (-40º to 100ºC)
BAPI-Box..... **-BB,** -40ºF to 185ºF, (-40º to 85ºC)
BAPI-Box 2..... **-BB2,** -40ºF to 185ºF, (-40º to 85ºC)

Agency
RoHS
PT=DIN43760, IEC Pub 751-1983,
JIS C1604-1989

Specifications subject to change without notice.