

Overview and Identification

Submersible duct temperature transmitters are used for measurement of moisture saturated, stratified air across a duct with a humidifier or outside air intake to give the average mixed air temperature along the length of the sensor. It may also be used as a sump sensor to average the water temperature in a water tank. The flexible probe is made of copper and made in different lengths for a custom duct fit. The 4 to 20mA output transmitters can be ordered with a 1K Ω (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.

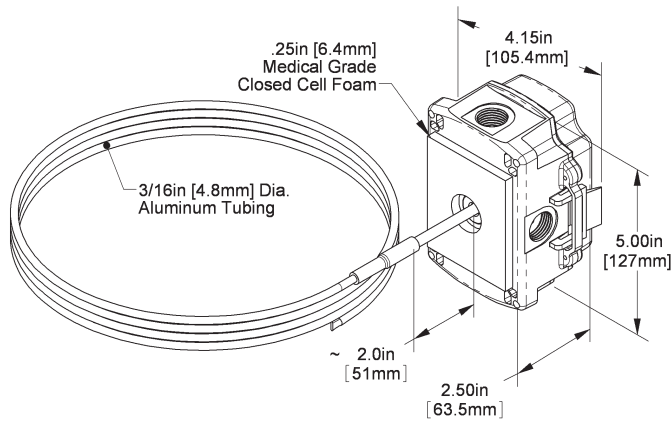


Fig. 1: Duct Averaging Unit with BAPI-Box (**BB**) Enclosure

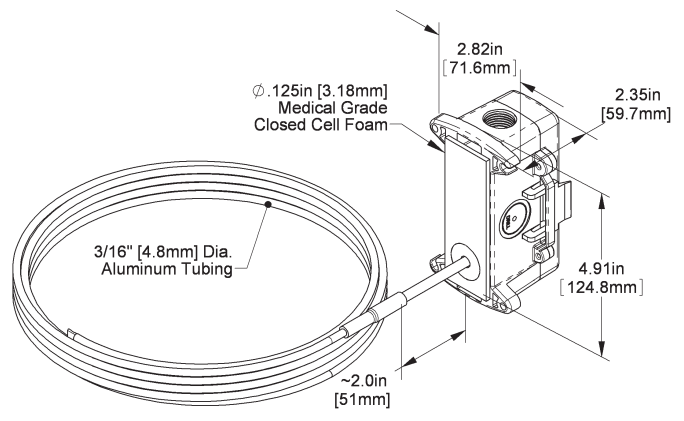


Fig. 2: Duct Averaging Unit with BAPI-Box 2 (**BB2**) Enclosure

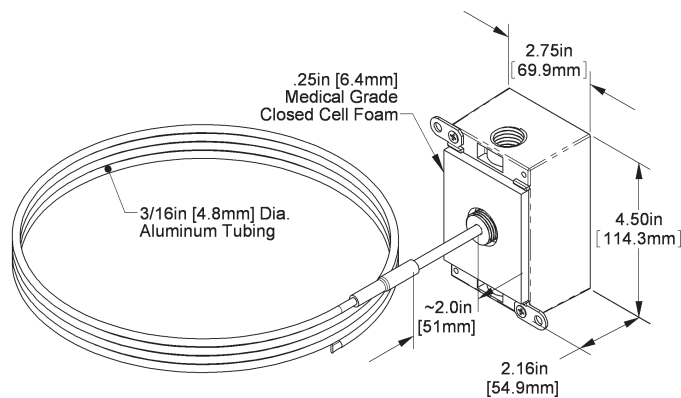


Fig. 3: Duct Averaging Unit with Weatherproof (**WP**) Enclosure

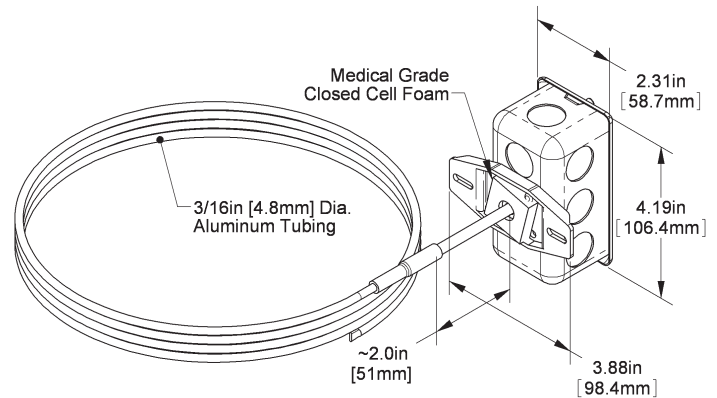


Fig. 4: Duct Averaging Unit with J-Box (Standard)

Specifications subject to change without notice.

Mounting

1. Place the sensor in the middle or top of the duct as shown in Fig. 5 or Fig. 6 so the flexible probe can enter the duct in a convenient place. Drill the probe and mounting holes as depicted for the enclosure being used.
2. Insert the probe by unrolling the sensor into the duct carefully to avoid kinking the sensor. Serpentine the duct with the sensor at least twice across the stratified air in the duct to achieve the best average temperature reading. At the sensor reversing points, a BAPI Flexible Probe Bracket (Fig 12) can be used to support the sensor and to avoid kinking the sensor.
3. Mount the enclosure to the duct using BAPI recommended #8 screws through a minimum of two opposing mounting tabs provided. Weatherproof (WP) enclosures will require assembly of the mounting tabs on opposite corners. A 1/8 inch pilot screw hole in the duct makes mounting easier through the mounting tabs. Use the enclosure tabs to mark the pilot hole locations.
4. Snug up the sensors so that the foam backing is depressed to prevent air leakage but do not over-tighten or strip the screw threads.

Note 1: Be sure not to drill into the weatherproof enclosures (**BB**, **BB2** & **WP**) which will violate the NEMA and/or the IP rating.

Note 2: Be sure to use caulk or Teflon tape for your conduit entries to maintain the appropriate NEMA or IP rating for your application.

Note 3: Conduit entry for outdoor or wet applications should be from the bottom of the enclosure.

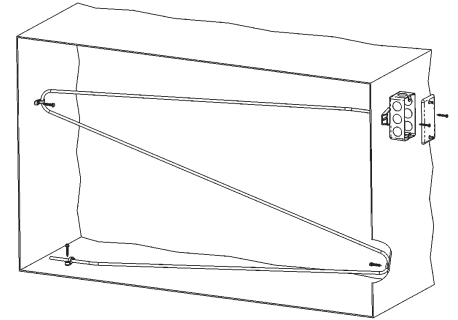


Fig. 5: Averaging Sensor Horizontal Mount. Best for Vertical Stratification.

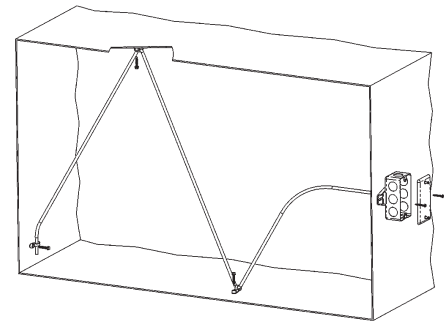


Fig. 6: Averaging Sensor Vertical Mount. Best for Horizontal Stratification.

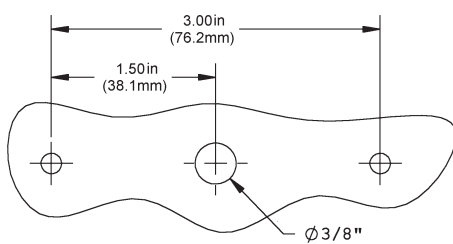


Fig. 7: Junction Box or No Box (**NB**) Mounting Holes and installation

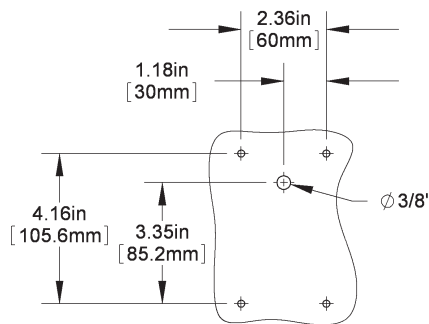
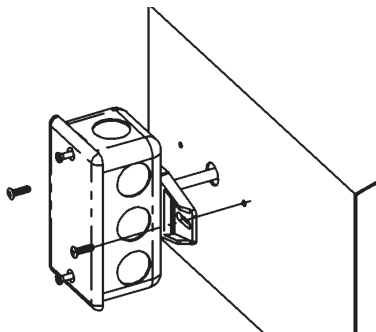


Fig. 8: BAPI-Box 2 (**BB2**) Mounting Holes and installation.

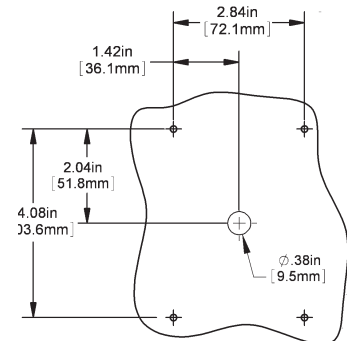
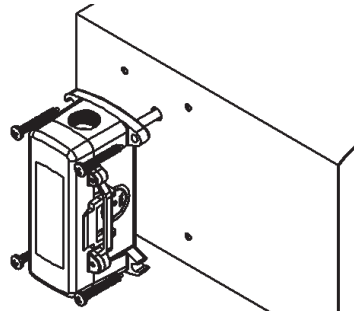
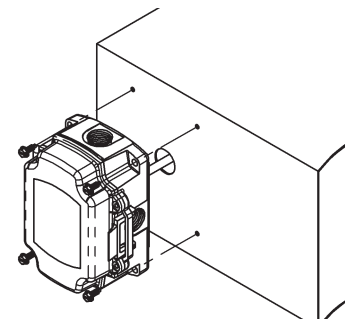


Fig. 9: BAPI-Box (**BB**) Enclosure Mounting and installation Holes (Rotate 90° for Horizontal Mounting)



Specifications subject to change without notice.

Mounting Continued...

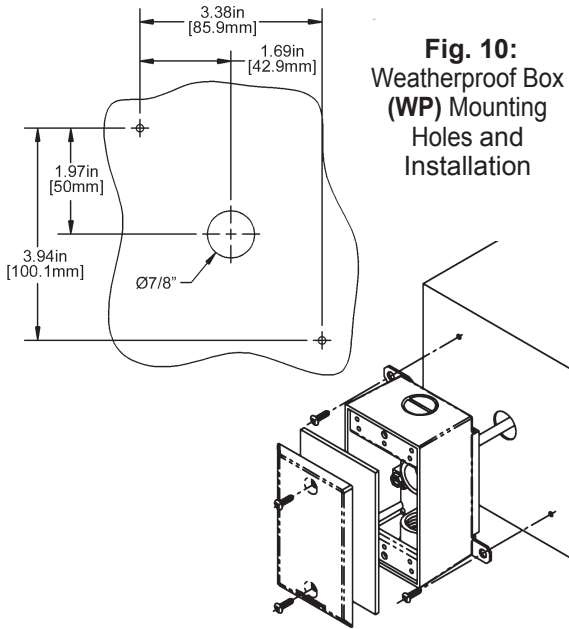


Fig. 10:
Weatherproof Box
(WP) Mounting
Holes and
Installation

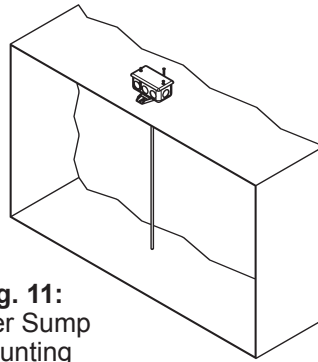


Fig. 11:
Water Sump
Mounting

Notes:

1. Straighten out Flexible Probe to the water depth needed.
2. Place box 5" from the water surface.
3. A weight or fastener may be needed at the bottom of the sensor.

Flexible Probe Bracket

The BAPI Flexible Probe Bracket (Fig. 12) is used to mount averaging sensors. It makes a smooth arc at direction changes to eliminate the risk of kinking.

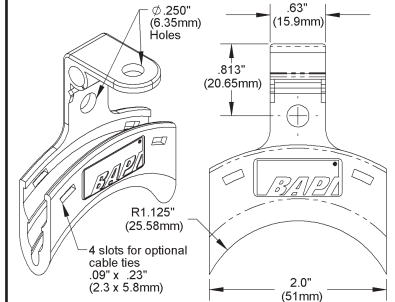


Fig. 12: Flexible Probe Bracket for mounting averaging sensors (Part #: BA/FPB)

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.

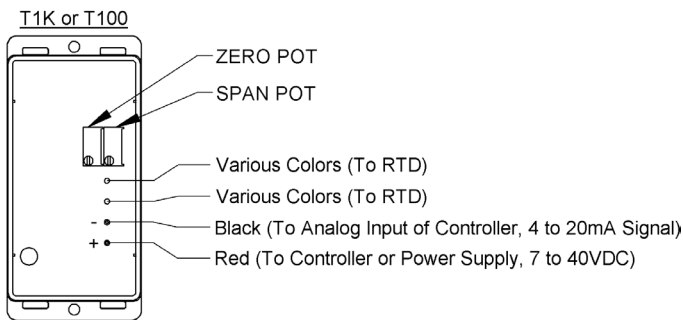


Fig. 13: Typical RTD 4 to 20mA Transmitter with Flying Leads

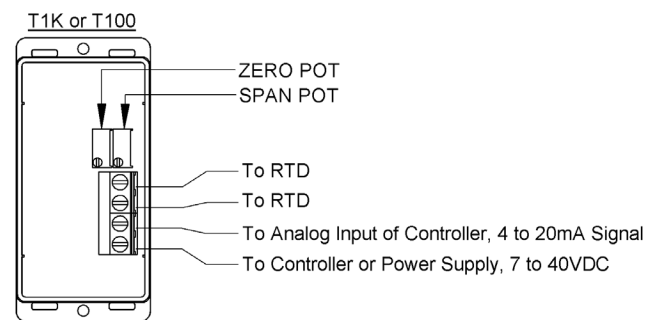


Fig. 14: Typical RTD 4 to 20mA Transmitter with Terminals

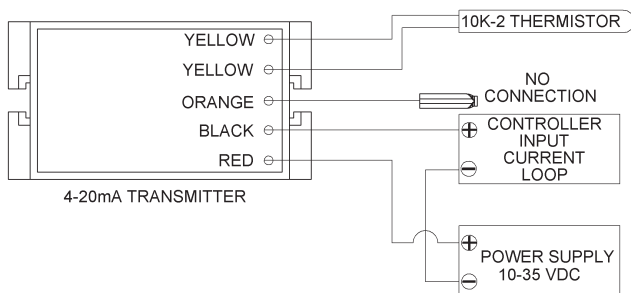


Fig. 15: Typical Thermistor 4 to 20mA Transmitter

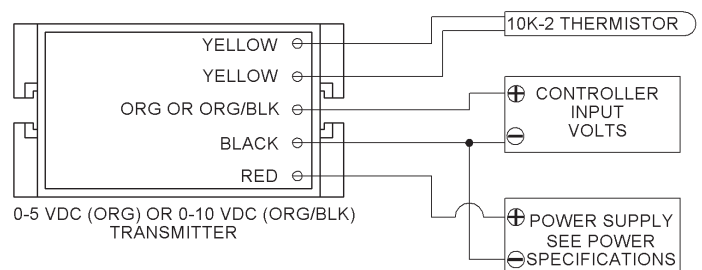


Fig. 16: Typical Thermistor Voltage Transmitter

Specifications subject to change without notice.



Diagnosics

Possible Problems:

- Unit will not operate.
- The reading is incorrect in the controller.

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.
- 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

4-20mA 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. 30°F (17°C), Max 1000°F, (555°C)
 Zero:Min. -148°F (-100°C), Max 900°F (482°C)
 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 158°F(-20 to 70°C)
 0 to 95% RH, Non-condensing

Thermistor Transmitter

Supply Voltage:
 10 to 35 VDC0 to 5 VDC or 4 to 20 mA Outputs
 15 to 35 VDC0 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 wiring2 & 3 wire (see Wiring detail)
 Transmitter Limits ...-40°F to 185°F,(-40°C to 85°C)
 Accuracy±1.015°C, from (0 to 65°C)
 Linearity±0.065°C, from (0 to 65°C)
 Resolution.....Span/1024
 Thermistor Sensor ..10K-2 Thermistor,10KΩ @77°F
 Transmitter Ambient 32 to 158°F, (0° to 70°C)
 0 to 95% RH, Noncondensing

Thermistor: 10K-2, Thermal resistor

Sensor Probe:
 8 feet4 Thermistors
 12 feet4 Thermistors
 24 feet9 Thermistors
 Accuracy(Std) ±0.36°F, (±0.2°C)
 Accuracy(High) ±0.18°F, (±0.1°C), [XP] option
 Stability< 0.036°F/Year, (<0.02°C/Year)
 Heat Dissipation2.7 mW/°C
 Probe Range-40° to 221°F (-40° to 105°C)
 Wire Colors:
 Standard:Yellow/Yellow (no polarity)
 High Acc. [XP]:Yellow/Yellow (no polarity)

RTD: Resistance Temp Device (Continuous)

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

Sensitivity: Approximate @ 32°F (0°C)

Thermistor Non-linear – Go to bapihvac.com
 click “Resources” and “BAPI
 Sensors Overview”

RTD (Pt)3.85Ω/°C for 1KΩ RTD
 0.385Ω/°C for 100Ω RTD

Lead Wire: 22awg stranded

Insulation: Etched Teflon, Plenum rated

Probe: Flexible Copper Tube, 0.19”OD

Probe Length: 2', 4', 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 1/2” knock-outs
 Weatherproof: ..**-WP**, w/ two 1/2” FNPT entries, (Bell box)
 BAPI-Box:**-BB**, w/ four 1/2” NPSM & one 1/2” drill-out
 BAPI-Box 2:.....**-BB2**, w/ three 1/2” NPSM & three 1/2” 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**, -40°F to 212°F, (-40° to 100°C)
 Weatherproof ...**-WP**, -40°F to 212°F, (-40° to 100°C)
 BAPI-Box**-BB**, -40°F to 185°F, (-40° to 85°C)
 BAPI-Box 2**-BB2**, -40°F to 185°F, (-40° to 85°C)

Agency

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

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