Duct Temperature Transmitters

Installation & Operations

20913_ins_Duct_Active

rev. 03/11/24

Overview and Identification

BAPI's Duct Temperature Transmitters come with a 1KΩ (385) RTD sensor element with a field adjustable output of 4 to 20 mA or 1 to 5, 0 to 5, 2 to 10, 0 to 10 VDC over a selected temperature range.

This transmitter can also be ordered in a variety of probe lengths and mounting enclosures as shown in the figures at right.

These transmitters are available with a wired connection via flying leads or a pluggable terminal block (-TS).

Special high accuracy RTD matched transmitters (**M**) are available which match the sensor to the transmitter for improved accuracy.

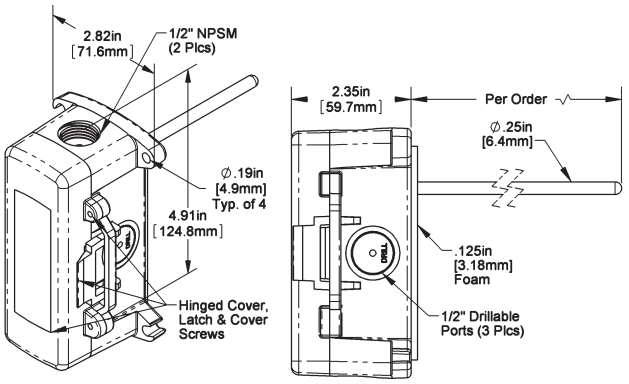


Fig. 1: Duct Unit with BAPI-Box 2 **(BB2)** Enclosure

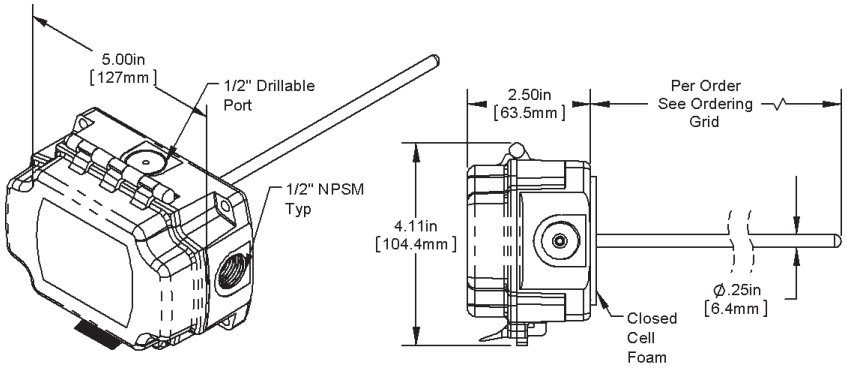


Fig. 2: Duct Unit with BAPI-Box **(BB)** Enclosure

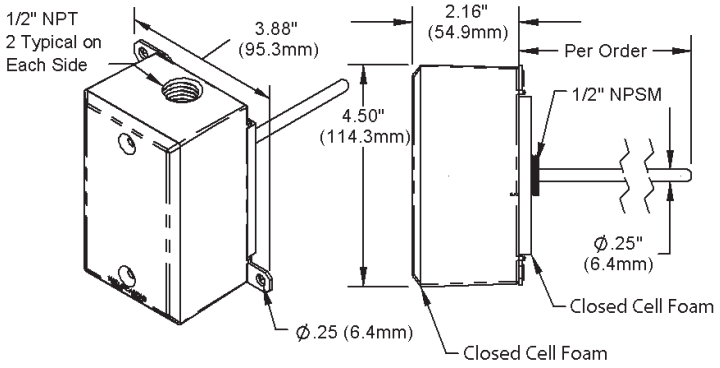


Fig. 3: Duct Unit with Weatherproof **(WP)** Enclosure

Mounting

1. Place the sensor in the middle of the duct away from temperature stratified air, coils or humidifiers to achieve the best temperature reading.
2. Drill the probe hole as depicted on this page for the enclosure being used. Insert the probe into the duct.
3. Mount the enclosure to the duct using BAPI recommended #8 screws through a minimum of two opposing mounting tabs. Weatherproof **(WP)** enclosures 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:
Do not drill into the water tight enclosures **(BB, BB2, WP)** which will violate the NEMA and/or IP rating.

Note 2:
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.

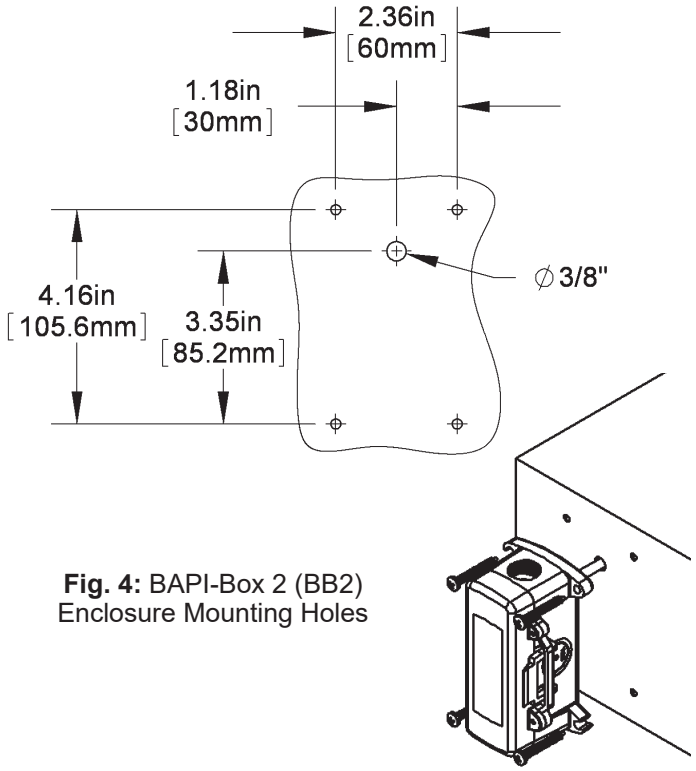


Fig. 4: BAPI-Box 2 (BB2) Enclosure Mounting Holes

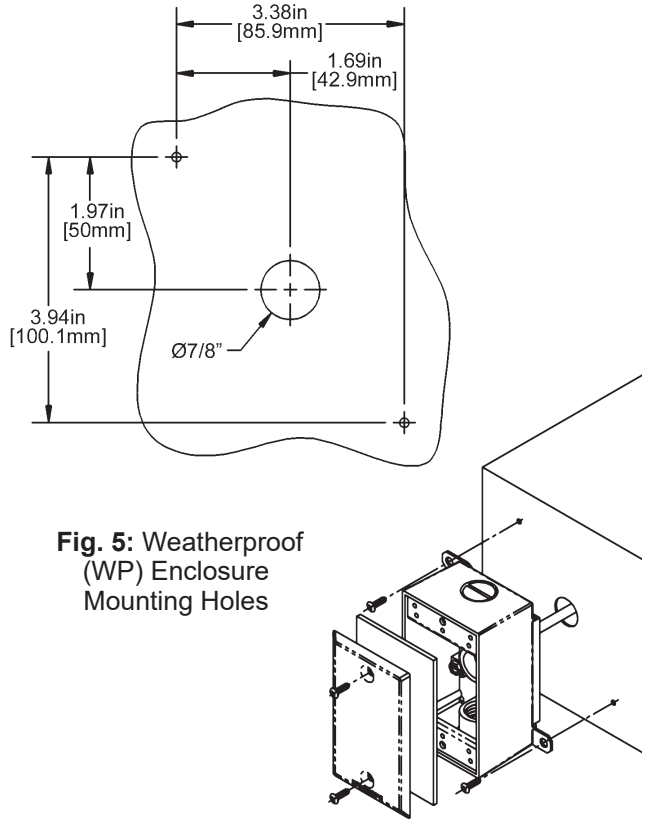


Fig. 5: Weatherproof (WP) Enclosure Mounting Holes

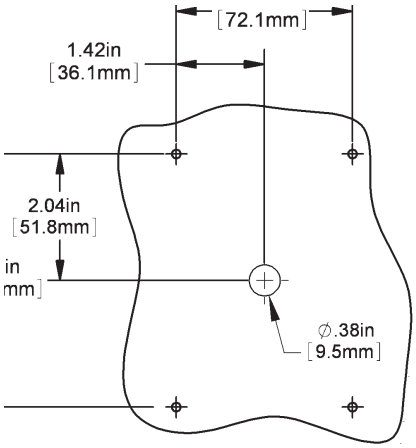


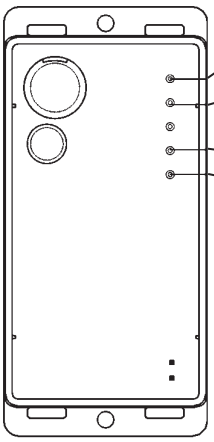
Fig. 6: BAPI-Box (BB) Enclosure Mounting Holes, Rotate 90° for Horizontal Mounting

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 AC power wiring of NEC class1 or NEC class 2, NEC class 3 or with wiring used to supply highly inductive loads such as motors, contactors and relays. BAPI's tests show that fluctuating and inaccurate signal levels are possible when AC power wiring is present in the same conduit as the signal lines. *Note: Keep transmitter at least 5 feet from any radio wave-emitting device (ie: 2 way radio). Transmitters that are less than 5 feet from a radio wave-emitting device can cause unwanted interference*.

STOP BAPI recommends wiring the product with power disconnected. Proper supply voltage, polarity, and wiring connections are important to a successful installation. Not observing these recommendations may damage the product and will void the warranty.

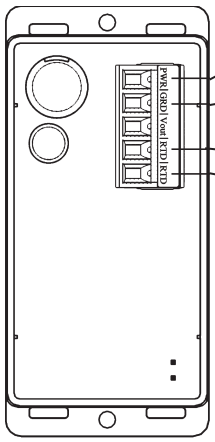
4 to 20mA Output with Flying Leads



Red (Power from Controller or Power Supply, 12 to 40VDC)
Black (4 to 20mA Output, to Analog Input of Controller)
Orange (to internal RTD)
Orange (to internal RTD)

Fig. 7: Typical 4 to 20mA Output Transmitter with Flying Leads

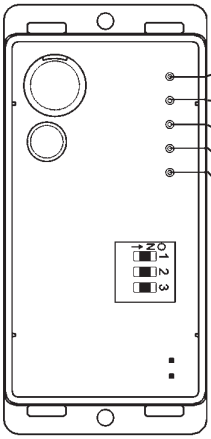
4 to 20mA Output with Terminals



PWR (Power from Controller or Power Supply, 12 to 40VDC)
GRD (4 to 20mA Output, to Analog Input of Controller)
RTD (to internal RTD)
RTD (to internal RTD)

Fig. 8: Typical 4 to 20mA Output Transmitter with Terminals

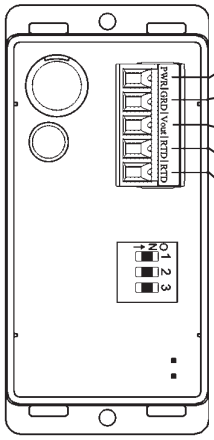
Voltage Output with Flying Leads



Red (Power from Controller or Power Supply, 12 to 40VDC)
Black (Ground for Power and Voltage Signal)
White (Voltage Output to Analog Input of Controller)
Orange (to internal RTD)
Orange (to internal RTD)

Fig. 9: Typical Voltage Output Transmitter with Flying Leads

Voltage Output with Terminals

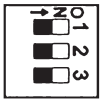


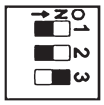
PWR (Power from Controller or Power Supply, 12 to 40VDC)
GRD (Ground for Power and Voltage Signal)
Vout (Voltage Output to Analog Input of Controller)
RTD (to internal RTD)
RTD (to internal RTD)

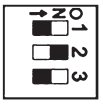
Fig. 10: Typical Voltage Output Transmitter with Terminals

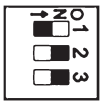
DIP Switch Settings for Field-Selectable Voltage Output Units

The circuit board for voltage output units has a 3-position DIP switch that controls the output value. This switch is set at the factory at the time of the order but may be changed in the field.

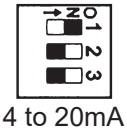

0 to 5V


0 to 10V


1 to 5V


2 to 10V

Note: Units ordered with Voltage Output can be switched to 4 to 20mA output with the DIP switch setting shown at right. The middle flying lead or middle terminal would not be used in that case and the unit would be wired similar to Figs 7 and 8 above.


4 to 20mA

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.

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

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

Specifications

Transmitter Circuit

Power Required:.....12 to 40VDC
Transmitter Output:.....4 to 20mA, 0 to 5, 1 to 5, 0 to 10 or 2 to 10VDC, 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)
System Accuracy: .....±0.065% of span
Linearity:.....±(0.125 * T-20ºC)/100
RTD Sensor:.....2 wire Platinum (Pt), 385 curve
Transmitter Ambient: ...-4 to 158ºF(-20 to 70ºC) 0 to 95% RH, Non-condensing

RTD Sensor: Resistance Temp Device (Bare Sensor)
Platinum RTD: .....1KΩ @ 0ºC, 385 curve
Sensitivity: .....3.85Ω/ºC, Approximate @ 32ºF (0ºC)
Accuracy (Standard):...0.12% @Ref, or ±0.55ºF, (±0.3ºC)
Accuracy (High):.....0.06% @Ref, or ±0.277ºF, (±0.15ºC), **[A]**option
Stability:.....±0.25ºF, (±0.14ºC)
Self Heating:.....0.4 ºC/mW @0ºC
Probe Range: .....-40 to 221ºF, (-40 to 105ºC)

Lead Wire: 22awg stranded

Insulation: Etched Teflon, Plenum rated

Probe: 304 Stainless steel, 0.25" OD

Probe Length: 2", 4", 8", 12" or 18" or per order

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

Enclosure Types: (Part number designator in bold)
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)
Weatherproof:..... **-WP,** NEMA 3R, IP14
BAPI-Boxes:..... **-BB, BB2,** NEMA 4, IP66, UV Rated

Enclosure Material: (Part number designator in bold)
Weatherproof:..... **-WP,** Cast Aluminum, UV rated
BAPI-Boxes:..... **-BB, BB2** Polycarb., UL94V-0, UV rated

Ambient (Encl.) ... 0 to 100% RH, Non-condensing
BAPI-Boxes:..... **-BB, BB2,** -40ºF to 185ºF, (-40º to 85ºC)
BAPI-Box 2:..... **-BB2,** -40ºF to 185ºF, (-40º to 85ºC)

Agency
CE EN 61326-1:2013 EMC (Industrial Electromagnetic Environment) / RoHS / PT=DIN43760, IEC Pub 751-1983 / JIS C1604-1989

Specifications subject to change without notice.