Outside Air (OSA) Temperature Transmitters

Installation & Operation

20920_ins_OSA_Active rev. 05/18/26

Overview and Identification

The outside air temperature transmitter is designed to handle the harshest outside environments. The probe and enclosure are made to protect the sensor from impediments such as rain, sleet, snow or bird droppings.

BAPI's Temperature Transmitter can be ordered with a 1KΩ (385) RTD that has a field adjustable 1 to 5, 0 to 5, 2 to 10, 0 to 10VDC or 4 to 20 mA output over a selected temperature range. These adjustable outputs can be set at the factory to order or default set to 4 to 20mA.

This transmitter can also be ordered in three mounting enclosures as shown at right.

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

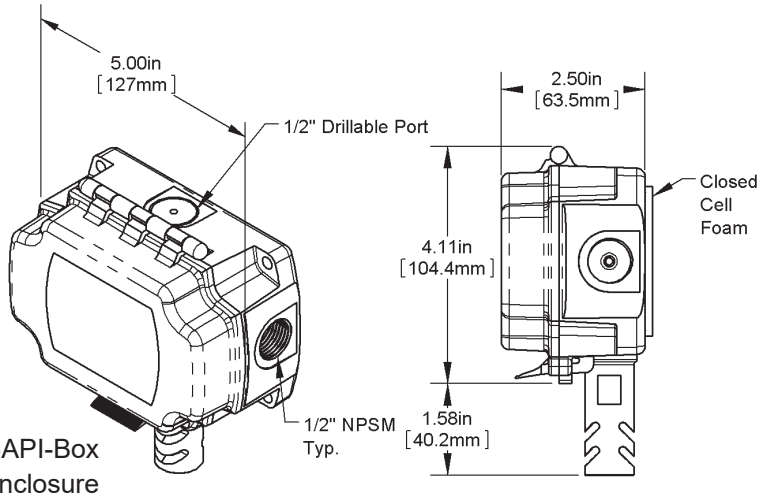

Fig. 1: BAPI-Box **(BB)** Enclosure

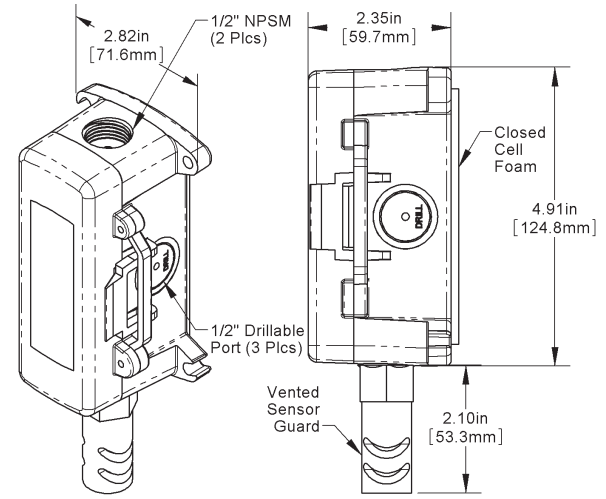

Fig. 2: BAPI-Box 2 **(BB2)** Enclosure

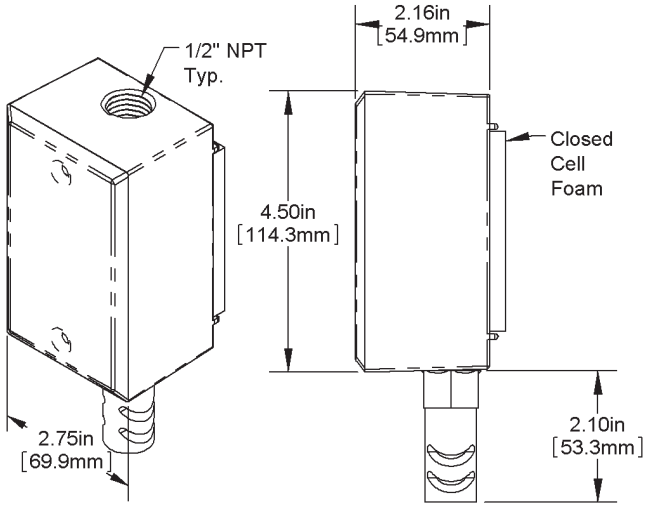

Fig. 3: Weatherproof **(WP)** Enclosure

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Mounting

Outside Air (OSA) sensor placement is critical to good performance. The OSA sensor must be mounted in the shade away from building windows, doors or vents. They should never be in direct sunlight or you will have higher than expected temperature readings by as much as +30%. The ideal shaded location in the Northern hemisphere is on the North side of the building. In the Southern hemisphere the South side of the building is ideal.

The sensor shield and probe should always point down and mounted between four feet above the ground/roof and one foot minimum below the eave. (Note: Four feet keeps the sensor above the ground or roof top radiation and one foot under the eave prevents measurement of trapped heat from under the eave.)

Drill the mounting holes and mount as shown in the figs 4-6. Snug up the mounting screws to ensure that the foam backing compresses to about 50% of its thickness to make a gasket type seal against the wall surface.

Route the wires into the box and terminate with sealant filled connectors to prevent water from attacking the connection, thereby preventing costly callbacks. Best practice is to caulk the wiring hole after the wiring is installed. Close the cover of the enclosures and secure with provided cover security screws.

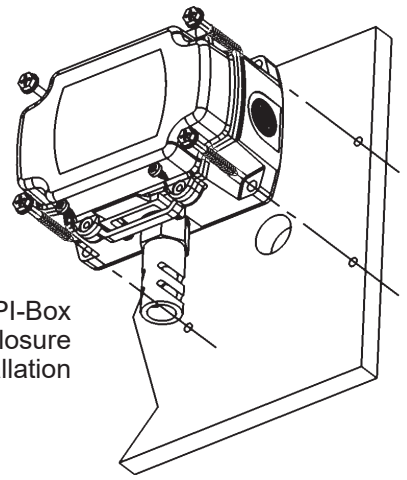


Fig. 4: BAPI-Box **(BB)** Enclosure Installation

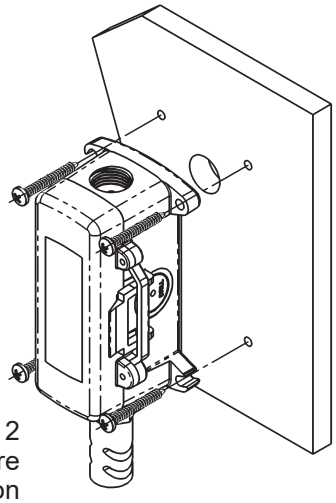


Fig. 5: BAPI-Box 2 **(BB2)** Enclosure Installation

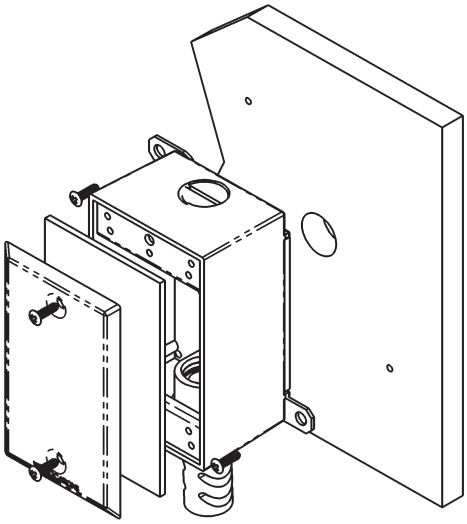


Fig. 6: Weatherproof **(WP)** Enclosure Installation

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 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.

TERMINATION OF 4 TO 20mA UNITS

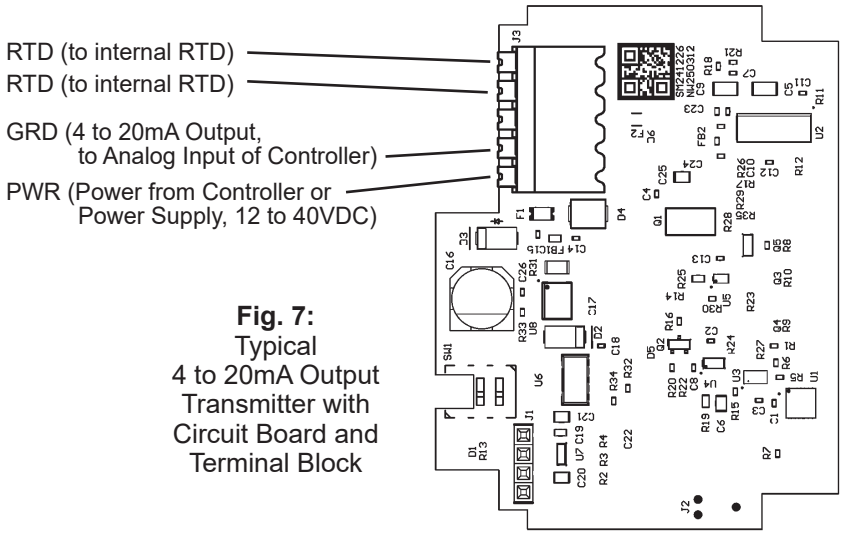


Fig. 7: Typical 4 to 20mA Output Transmitter with Circuit Board and Terminal Block

4 to 20mA Output with Circuit Board and Push Button Terminal Block

Note on Push Button Terminal Block:
Use a small screwdriver to press the white release button while inserting the wire into the terminal. Release the button once the wire is fully seated to secure the connection. Gently pull on the wire to confirm it is properly secured.

4 to 20mA Output with Potted Shell and Flying Leads

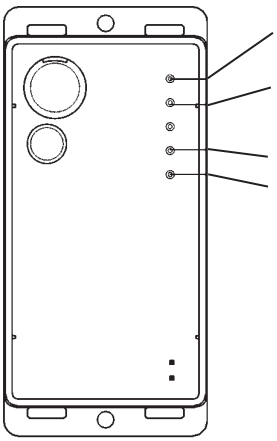


Fig. 8: Typical 4 to 20mA Output Transmitter with Potted Shell and Flying Leads

4 to 20mA Output with Potted Shell and Screw Terminal Block

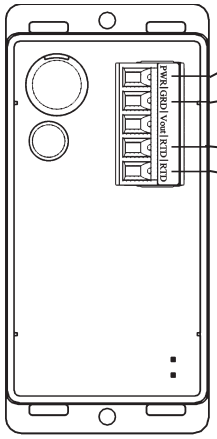


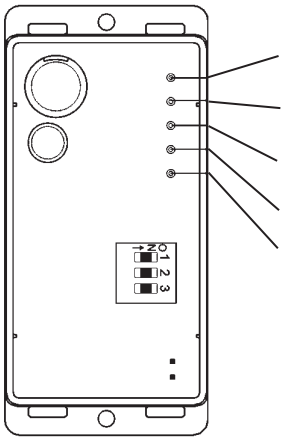
Fig. 9: Typical 4 to 20mA Output Transmitter with Potted Shell and Terminal Block

Termination continued on next page...

Termination continued...

TERMINATION OF FIELD-SELECTABLE VOLTAGE OUTPUT UNITS

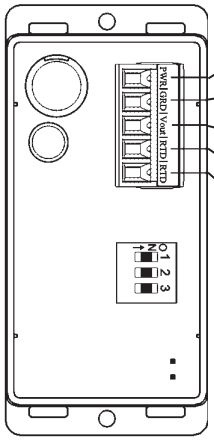
Voltage Output with Potted Shell & Flying Leads



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. 10:
Typical Voltage Output Transmitter with Potted Shell and Flying Leads

Voltage Output with Potted Shell & Screw Terminal Block

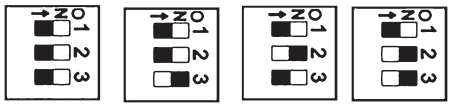


PWR (Power from Controller or Power Supply, 12 to 40VDC)
GRD (Ground for Power and Voltage Signal)
Vout (Voltage Output to Analog Input of Controller)
RTD (to internal RTD)
RTD (to internal RTD)

Fig. 11:
Typical Voltage Output Transmitter with Potted Shell and Terminal Block

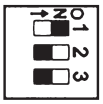
DIP Switch Settings for Field-Selectable Voltage Output Units (Figs 10 & 11 above)

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 8 and 9 on the previous page.



4 to 20mA

Diagnostics

Possible Problems:

Unit will not operate.

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 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

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 x T-20ºC)/100

RTD Sensor:.....2 wire Platinum, 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:
Vented polycarbonate shield, ½" (13mm) OD

Probe Length:
2.1" (53mm) with ½" (13mm) NPT threads

Wall Gasket:
0.25" (6.35mm) Closed cell foam (impervious to mold)

Enclosure Ratings:
Weatherproof **(WP)**: NEMA 3R, IP14
BAPI-Boxes **(BB, BB2)**: NEMA 4, IP66, UV Rated

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

Environmental Operating Range
Weatherproof **(WP)**: -40 to 212ºF (-40 to 100ºC)
BAPI-Boxes **(BB, BB2)**: -40 to 185ºF (-40 to 85ºC)
0 to 100%RH, Non-condensing

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

Specifications subject to change without notice.