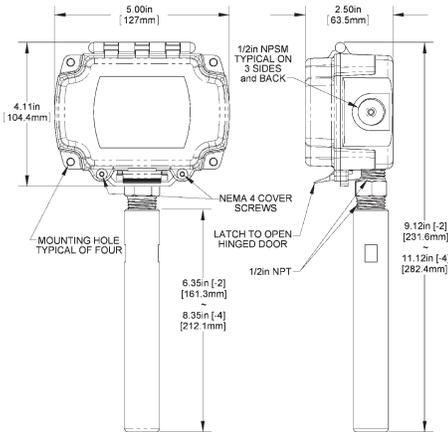


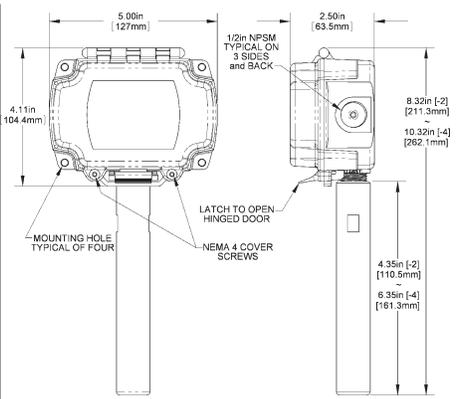
### Overview

The BA/T#-TB is for measuring the temperature in walk-in-freezers or refrigerators with a wall or hanging bracket sensor. The buffers are made in different lengths and are made to be filled with food grade glycol to slow down the temperature response to more closely simulate the contents of the freezer or refrigerator. The BA/T#-TB transmitter is available in common temperature ranges and 2-wire, 4-20mA or voltage signaling as shown in the specifications. The mounting enclosure styles come in NEMA 4 plastic or hanging bracket with the buffers available in stainless steel or aluminum to fit any application.

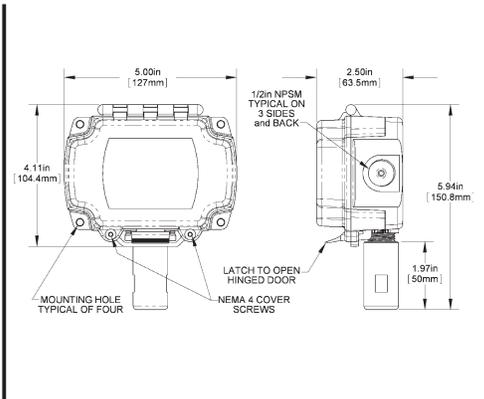
### Identification



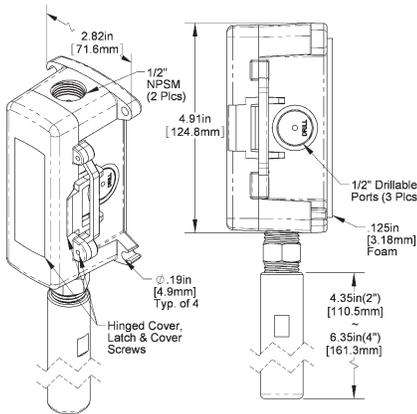
**Fig 1: BB, 2" & 4" Buffer w/SS Threaded Fitting**



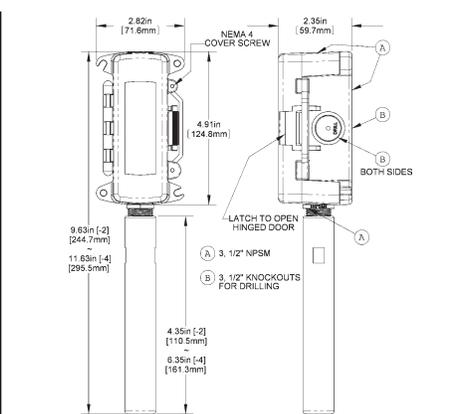
**Fig 2: BB, 2" & 4" Buffer w/plastic Threaded Fitting**



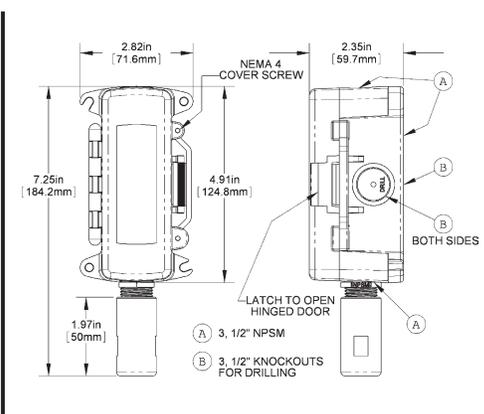
**Fig 3: BB, 1" Buffer w/plastic Threaded Fitting**



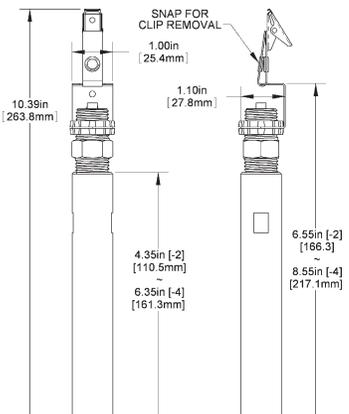
**Fig 4: BB2, 2" & 4" Buffer w/SS Threaded Fitting**



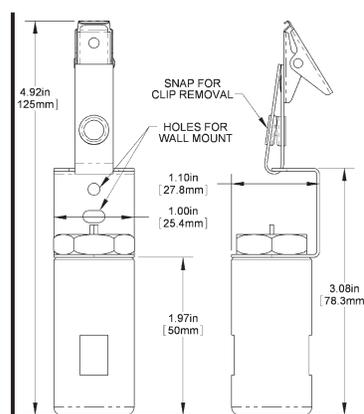
**Fig 5: BB2, 2" & 4" Buffer w/Plastic Threaded Fitting**



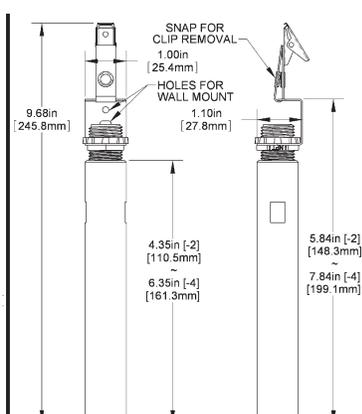
**Fig 6: BB2, 1" Buffer w/plastic Threaded Fitting**



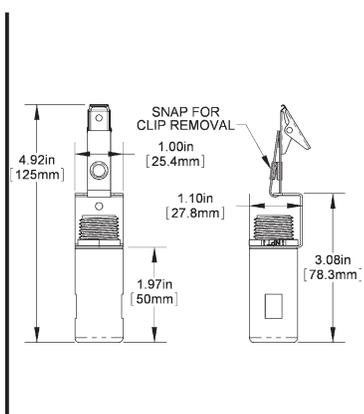
**Fig 7: Hanging Bracket, 2" & 4" Buffer w/SS Threaded Fitting**



**Fig 8: Hanging Bracket, 1" Buffer w/SS Threaded Fitting**



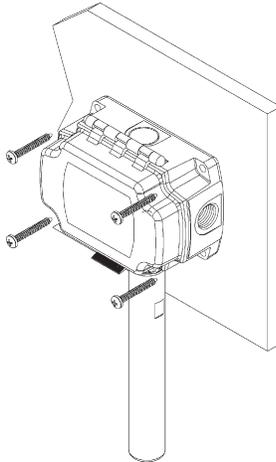
**Fig 9: Hanging Bracket, 2" & 4" Buffer w/Plastic Threaded Fitting**



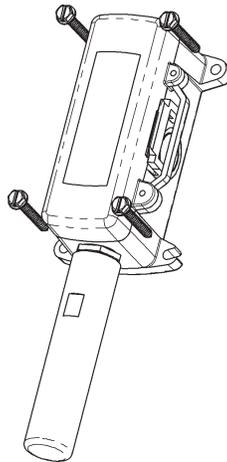
**Fig 10: Hanging Bracket, 1" Buffer w/Plastic Threaded Fitting**

Specifications subject to change without notice.

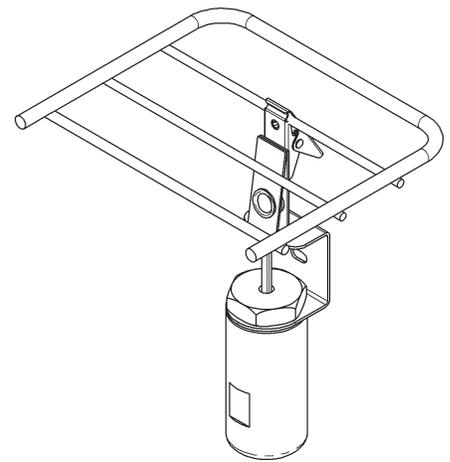
#### Assembly & Installation



**Fig 11: BB, 2" & 4" Installation**  
(Transmitter Mounted Internally)

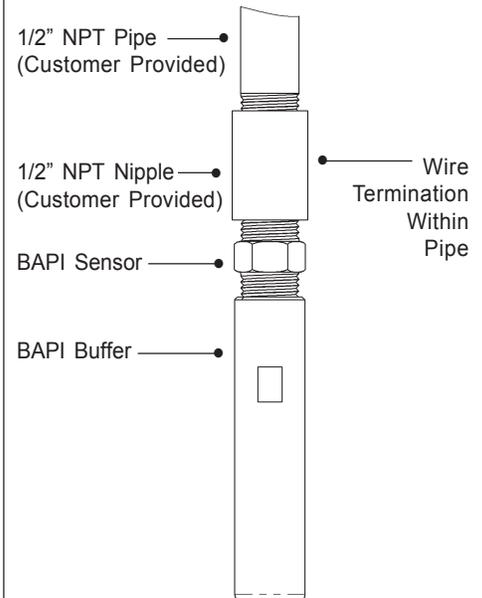


**Fig 12: BB2, 2" & 4" Installation**  
(Transmitter Mounted Internally)



**Fig 13: HB, Hanging Bracket 1" Installation**  
(Transmitter Mounted Externally)

| Table 1:    |                        |
|-------------|------------------------|
| Buffer Size | Recommended Fluid Fill |
| 1" Buffer   | 0.17 Fluid oz (5mL)    |
| 2" Buffer   | 0.67 Fluid oz (20mL)   |
| 4" Buffer   | 1.00 Fluid oz (30mL)   |



**Fig 14: NB, Direct Pipe Buffer Mount Installation**  
(Transmitter Mounted Externally)

- 1 Fill the buffer with the appropriate amount of customer provided glycol to the amount as dictated by table 1.
- 2 Wrap the probe threads with Teflon tape with at least 4 wraps so a water tight seal is established.
- 3 Insert the probe into the buffer and screw in for a secure tight fit.
- 4 Towel off excess fluid which may leak out during assembly and check for leaking. If the assembly leaks, a 15/16ths wrench may be used to snug up the probe to the buffer. More tape may also be needed. The use of food safe silicon may also be used.
- 5 Select a location on a wall or hanging from a wire rack near the contents you wish to monitor.
- 6 Mount the Thermo Buffer with the buffer facing down (Probe on top). Any other orientation is not recommended due to leaking concerns.
- 7 We recommend BAPI Box surface mounting be positioned over the refrigerator wire way hole using the rear BAPI Box drill-out. Pull the wiring into the unit and terminate using sealant filled connectors. Best practice is to caulk the wiring hole after the wiring is installed. Secure with mounting screws and ensure that the foam backing compresses to about 50% of its thickness to make a gasket type seal against the surface.

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 15: Typical RTD 4-20 mA Transmitter W/Flying Leads

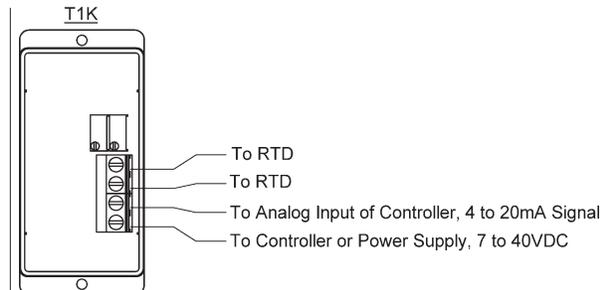


Fig 16: Typical RTD 4-20mA Transmitter W/Terminals

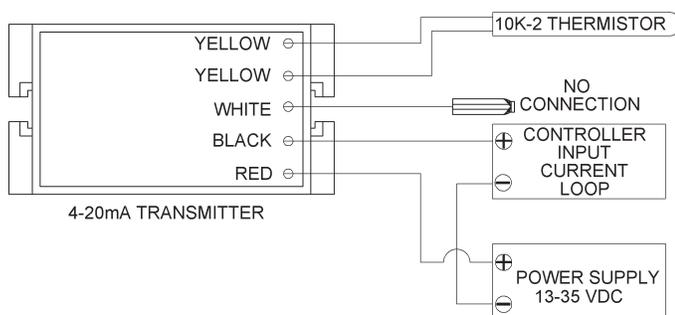


Fig 17: Typical Thermistor 4-20mA Transmitter

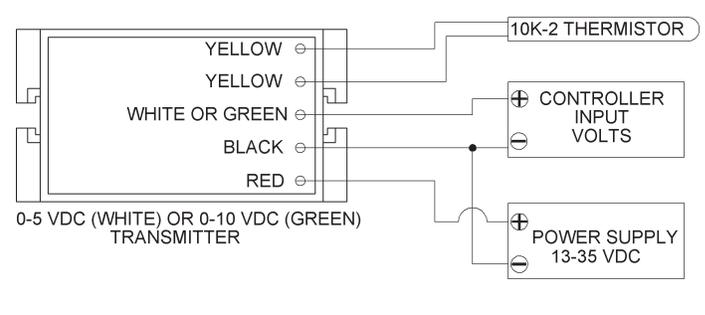


Fig 18: Typical Thermistor Voltage Transmitter

#### Diagnostics

##### Problems:

- Unit will not operate.

##### 4-20mA Temperature Equation

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

- T = Temperature at sensor
- T<sub>Low</sub> = Low temperature of span
- T<sub>High</sub> = High temperature of span
- T<sub>Span</sub> = T<sub>High</sub> - T<sub>Low</sub>
- A = Ammeter reading in mA

- The reading is incorrect in the controller.

##### Voltage Temperature Equation

$$T = T_{Low} + \frac{(V \times T_{Span})}{16}$$

- T = Temperature at sensor
- T<sub>Low</sub> = Low temperature of span
- T<sub>High</sub> = High temperature of span
- T<sub>Span</sub> = T<sub>High</sub> - T<sub>Low</sub>
- V<sub>Low</sub> = Low transmitter voltage usually = (0.1 or 2v)
- V<sub>High</sub> = High transmitter voltage usually = (5 or 10v)
- V<sub>Span</sub> = V<sub>High</sub> - V<sub>Low</sub>
- V = Voltage reading in volts

##### Possible Solutions:

- Measure the power supply voltage by placing a voltmeter across the transmitter's (+) and (-) terminals. The voltage reading should be between 7 to 40 VDC.
- Check if the RTD wires are physically open or shorted together and are terminated to the transmitter.
- Measure the physical temperature at the temperature sensor's location using an accurate temperature standard. Disconnect the temperature sensor wires and measure the temperature sensor's resistance with an ohmmeter. Compare the temperature sensor's resistance to the appropriate temperature sensor table on the BAPI web site.
- Determine if the input is set up correctly in the controllers and BAS software.
- For a 4-20mA current transmitter measure the transmitter current by placing an ammeter in series with the controller input. The current should read according to the equation shown at left.
- For a voltage transmitter, measure the signal with a volt meter (Green to Black). The signal should read according to the voltage equation shown at left.

Specifications subject to change without notice.



# Thermobuffer Temperature Transmitters

## BA/T#- TB Temperature Transmitter

### Installation and Operation Instructions

20898\_ins\_Thermobuffer\_Active

rev. 8/25/09

#### Specifications

##### RTD Transmitter

|                     |  |
|---------------------|--|
| Power Required      | 7 to 40VDC   |
| Transmitter Output  | 4-20mA, 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. -328°F (-200°C), Max 900°F (482°C)                    |
| Accuracy            | ±0.065% of span  |
| Linearity           | ±0.125% of span  |
| Power Output Shift  | ±0.009% of span  |
| RTD Sensor          | 2 wire Platinum, 385 curve                                 |
| Transmitter Ambient | 0 to 95% RH, Non-condensing<br>-4 to 158°F, (-20° to 70°C) |

##### Thermistor Transmitter

|                     |   |
|---------------------|---|
| Power Required      | 8 to 35VDC  |
| Transmitter Output  | 4-20mA, 800Ω@24VDC<br>0-5/0-10VDC, 10KΩmin                |
| Output wiring       | 2 and 3 wire, (See wiring detail)                         |
| Transmitter Limits  | -50°F to 150°F, (-45°C to 65°C)                           |
| Accuracy            | ±0.1015°C, (0 to 65°C)                                    |
| Linearity           | ±0.065°C, (0 to 65°C)                                     |
| Resolution          | Span/1024   |
| Thermistor Sensor   | 10K-2 Thermistor, 10kΩ @77°F (25°C)                       |
| Transmitter Ambient | 0 to 95% RH, Non-condensing<br>32° to 158°F, (0° to 70°C) |

##### Sensor

|                  |                                 |
|------------------|---------------------------------|
| Thermistor       | Passive                         |
| RTD              | NTC, 2 wire<br>PTC, 2 or 3 wire |
| Thermistor       | Thermal resistor (NTC)          |
| Temp. Output     | Resistance                      |
| Accuracy (std)   | ±0.36°F, (±0.2°C)               |
| Accuracy (Hi)    | ±0.18°F, (±0.1°C), [XP] option  |
| Stability        | < 0.036°F/Year, (<0.02°C/Year)  |
| Heat dissipation | 2.7 mW/°C                       |
| Temp. Drift      | <0.02°C per year                |
| Probe range      | -40° to 221°F (-40° to 105°C)   |

##### RTD

|                   |  |
|-------------------|--|
| Platinum (PT)     | Resistance Temperature Device, (PTC) knockout        |
| Platinum (PT)     | 100Ω and 1KΩ @0°C, 385 curve, 1KΩ @0°C, 375 curve    |
| PT Accuracy (Std) | 0.12% @Ref, or ±0.55°F, (±0.3°C)                     |
| PT Accuracy (Hi)  | 0.06% Ref, or ±0.277°F (±0.15°C), ±0.25°F, (±0.14°C) |
| 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)                        |

##### Sensitivity

|            |  |
|------------|--|
| Thermistor | Go to bapihvac.com "Sensor Specs"  |
| RTD (PT)   | Non-linear<br>3.85Ω/°C for 1KΩ RTD, @0°C<br>0.385Ω/°C for 100Ω RTD, @0°C |

##### Sensor Lead wire

|            |   |
|------------|---|
| Insulation | 22awg stranded<br>Etched Teflon, Plenum rated |
| Probe      | 304 Stainless Steel (SS), 0.25"OD             |

##### Probe Process Connection

|              |   |
|--------------|---|
| -TB          | 304 SS Double threaded ½" NPT                     |
| -TBP         | Plastic Double threaded ½" NPT, & NPSM, 100°C max |
| Probe Length | Probe tip to thread start                         |
| 1"           | 0.75"   |
| 2"           | 3.5"  |
| 4"           | 5.5"  |

##### Buffer Dimensions:

|           |                |
|-----------|----------------|
| 1" Buffer | 2.75"H x 1"Dia |
| 2" Buffer | 5.1H x 1"Dia   |
| 4" Buffer | 7.1"H x 1"Dia  |

##### Mounting

|                 |                                       |
|-----------------|---------------------------------------|
| Plastic Box     | 4 extension tabs (ears), 7/16" hole,  |
| Hanging Bracket | SS bracket w/ 1/8" holes or 3/8" clip |

##### Enclosure Types

|                 |   |
|-----------------|---|
| No box          | -NB, direct ½" NPT pipe mount           |
| BAPI-Box        | -BB, w/four ½" NPSM & one 1/2" drillout |
| BAPI-Box 2      | -BB2, w/three ½" NPSM & three 1/2"      |
| Hanging Bracket | -HB, Intended to hang from shelving     |

##### Enclosure ratings

|                 |                     |
|-----------------|---------------------|
| No box          | -NB, No rating      |
| BAPI-Box        | -BB, NEMA 4X, IP66  |
| BAPI-Box 2      | -BB2, NEMA 4X, IP66 |
| Hanging Bracket | -HB, No rating      |

##### Enclosure materials

|                 |   |
|-----------------|---|
| No box          | -NP, See Buffer material                  |
| BAPI-Box        | -BB, Polycarbonate, UL94V-0, UV rated     |
| BAPI-Box 2      | -BB2, Polycarbonate, UL94V-0, UV rated    |
| Hanging Bracket | -HB, 304 Satinless Steel bracket and clip |

##### Buffer Well Construction

|              |   |
|--------------|---|
| M-304        | Machined 304 Stainless Steel, 0.7" core |
| MAL          | Machined Aluminum, 0.7" core            |
| Liquid Fill: | Food Grade Glycol (Customer provided)   |
| 1" Buffer    | 5 mL                                    |
| 2" Buffer    | 20 mL                                   |
| 4" Buffer    | 30 mL                                   |

##### Color:

|                 |                          |
|-----------------|--------------------------|
| Box             | Warm White (beige)       |
| SS Buffer       | Polished Stainless Steel |
| Aluminum Buffer | Wire Brushed Aluminum    |

##### Ambient (Encl.)

|                 |                                 |
|-----------------|---------------------------------|
| BB, BB2         | 0 to 100% RH, Non-condensing    |
| NB, w/TB sensor | -40°F to 185°F, (-40° to 85°C)  |
| HB              | -40°F to 212°F, (-40° to 100°C) |
|                 | -40°F to 122°F, (-40° to 50°C)  |

##### Agency

|  |  |
|--|--|
|  | RoHS, CE (Thermistors (10KΩ)                   |
|  | PT= DIN43760, IEC Pub 751-1983, JIS C1604-1989 |

Specifications subject to change without notice.