Strap-On Sensors Transmitters
BA/Txx-(S, STP) Temperature Sensor
Installation & Operating Instructions

Overview

The BA/Txx#-(S, STP) Strap on Sensors are made for direct pipe mounting and temperature measurement of water pipe applications. The BA/Txx#-S is for mounting before any insulation is on the pipe and the BA/Txx#-STP is for mounting to pipes with up to 2" of insulation using a unique spring sensor extension. The 4 to 20mA transmitter can be ordered with 100Ω (385), 1KΩ (385) RTDs or 10KΩ type 2 thermistor sensor. A 0 to 5VDC or 0 to 10VDC transmitter is also available with the 10KΩ type 2 thermistor sensor. Special high accuracy RTD matched transmitters (M) are available which match the sensor to the transmitter for improved accuracy. Enclosure mounting styles come in plastic or metal for both NEMA 1 and NEMA 4 applications and are all plenum rated.

Identification

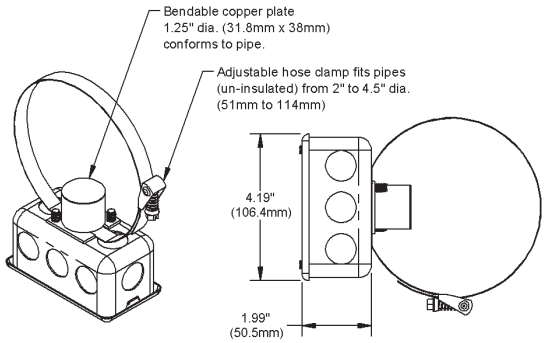

Fig. 1: Clamp-On Strap Unit with Junction Box (Standard)

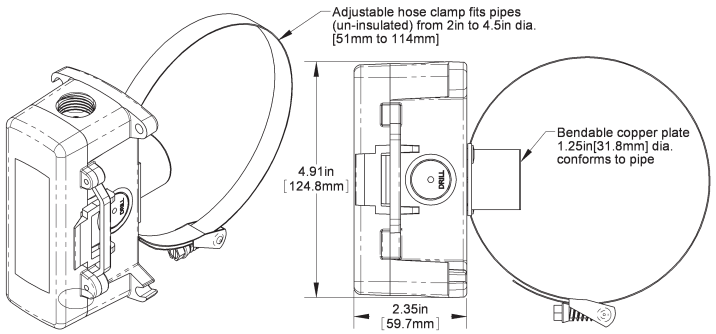

Fig. 2: Clamp-On Strap Unit in BAPI-Box 2 (BB2) Enclosure

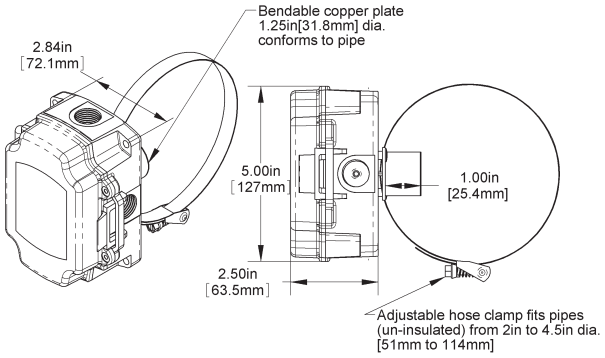

Fig. 3: Clamp-On Strap Unit in BAPI-Box (BB) Enclosure

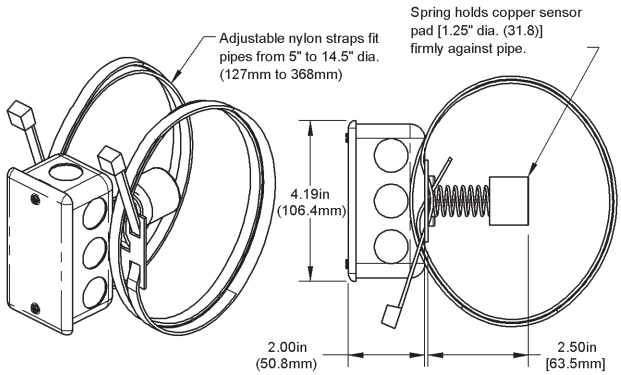

Fig. 4: Spring Loaded Strap Unit in a Junction Box (Standard)

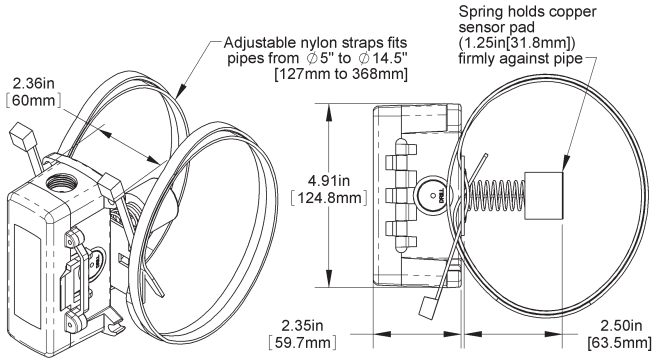

Fig. 5: Spring Loaded Strap Unit in a BAPI-Box 2 (BB2) Enclosure

Specifications subject to change without notice.

Strap Mount Application

Application: This sensor technique is for reading the fluid temperature in a pipe by reading the temperature of the pipe. Properly installed Strap-On sensors with insulation around the local strap-on sight will offer a very accurate temperature of the water inside the pipe to within .5 °F or better of the inside pipe water temperature.

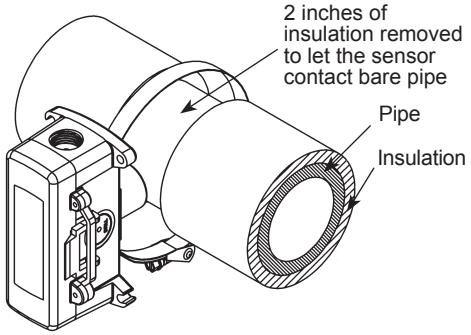

Fig. 6: Clamp-On Strap Unit Mounting (BAPI-Box 2 Enclosure shown but mounting is similar for all BAPI-Boxes.)

Clamp-On Strap Unit Installation: BA/#-S

1. Figure 6 show a typical direct pipe installation for pipes from 2” to 4.5”. Stripping away insulation is OK.
2. Larger pipes can be accommodated by adding another, customer supplied, stainless steel hose clamp extending the possible pipe diameter.
3. If there is insulation, clean away a section of the pipe insulation a minimum of 2” all around the pipe. The copper sensor pad and SS strap must be in direct contact with the metal or plastic pipe. Note: Nothing should be between the copper plate sensor and the bare pipe.
4. Tighten the strap-so that the sensor does not rotate around the pipe and so that the foam is compressed not more than 50% allowing the copper sensor plate to form (bend) to the pipe curvature for maximum temperature conduction. BAPI recommends pre-forming the copper plate by bending it around the pipe with your fingers.
5. After the strap-on sensor is securely mounted, add insulation a minimum of 1” thick and a minimum of 4 pipe diameters on each side of the copper sensor pad. (EXPL. A 2” pipe should have 8” of insulation on each side of the sensor). Only cover the sensor box to the top of the metal cover plate or to the BB door hinge so termination and servicing can be completed.
6. Terminate per the following Wiring and Termination Section.

String-Loaded Strap Unit Installation: BA/#-STP

1. Figure 7 shows a typical direct pipe installation for insulated pipes from 5” to 14”. Insulation thickness accommodated is 0.5” to 2.5”.
2. Larger pipes can be accommodated by adding another, customer supplied, tie rap strap extending the possible pipe diameter.
3. Make a 1.5 inch diameter hole in the insulation where the sensor is to be placed and clean the pipe from debris. Extend the spring so the copper sensor pad is in direct contact with the metal or plastic pipe. ***Note:*** *No debris should be between the copper plate sensor and the bare pipe.* The spring can retract to a minimum insulation thickness of ~.5” compressed to ~2.5” extended.
4. Position the box and sensor over the hole.
5. Tighten the strap so that the sensor spring is compressed no more than 50% allowing the copper sensor plate to form (bend) to the pipe curvature for maximum temperature conduction. BAPI recommends pre-forming the copper plate by bending it around the pipe with your fingers. Extend the spring further by turning it clockwise if the copper sensor plate contact is questionable. The copper sensor plate must be in direct contact with the pipe.
6. After the strap on sensor is securely mounted, add insulation back in (backfill) around the spring extension, using the removed insulation, so that no heat or cold from the pipe can escape.
7. If more insulation is desired, only cover the sensor box to the top of the metal cover plate or to the BB door hinge so termination and servicing can be completed.
8. Terminate per the following Wiring and Termination Section.

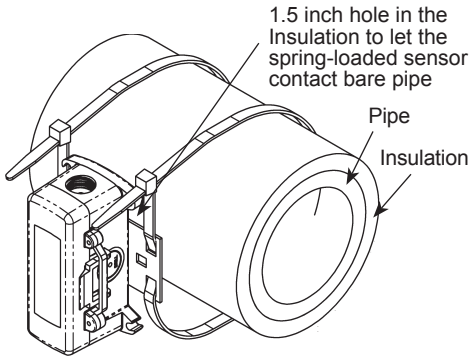

Fig. 7: Spring Loaded Strap Unit Mounting (BAPI-Box 2 Enclosure shown but mounting is similar for all BAPI-Boxes.)

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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.

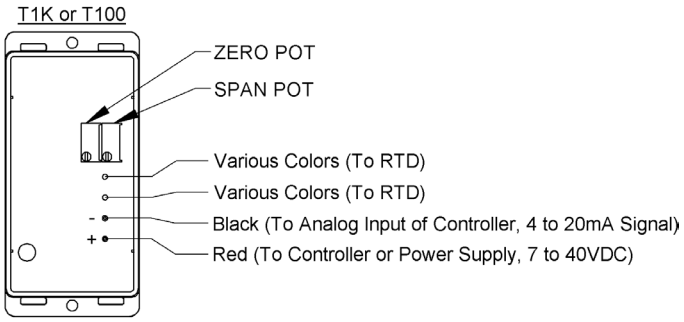

Fig. 8: Typical RTD 4 to 20 mA Transmitter with Flying Leads

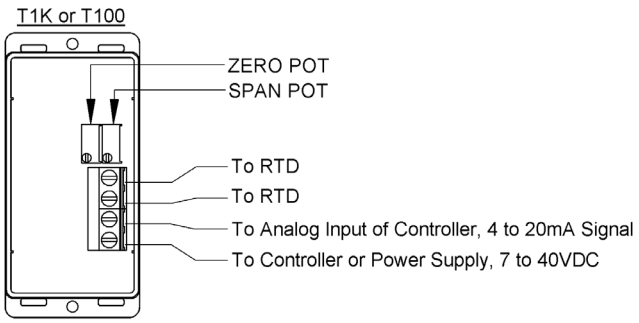

Fig. 9: Typical RTD 4 to 20mA Transmitter with Terminals

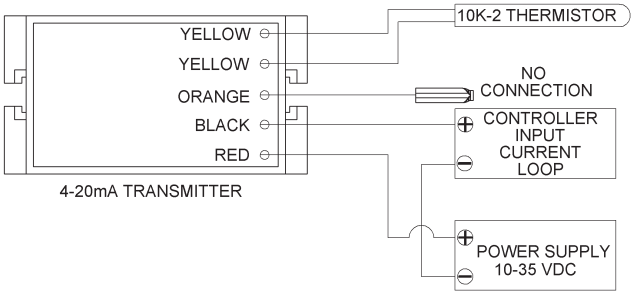

Fig. 10: Typical Thermistor 4 to 20mA Transmitter

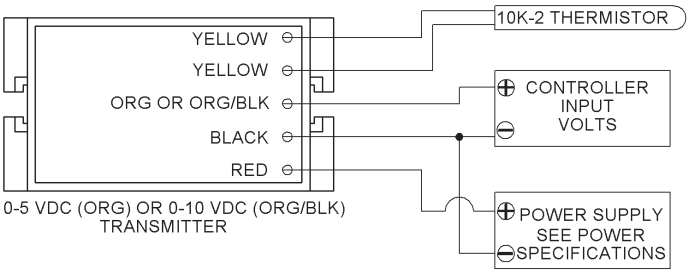

Fig. 11: Typical Thermistor Voltage Transmitter

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.
- 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.

• The reading is incorrect in the controller.

- 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 "4-20mA 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. 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 5 & 0 to 10VDC, 10KΩ min
Output Wiring:	2 & 3 wire (See wiring detail on pg. 3)
Transmitter Limits:	-40 to 185ºF, (-40 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 (Bare Sensor)
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 (Bare Sensor)
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 (See www.bapihvac.com, click “Sensor Specs”)
RTD (Pt):	3.85Ω/ºC for 1KΩ RTD 0.385Ω/ºC for 100Ω RTD
Lead Wire:	22awg stranded
Insulation:	Etched Teflon, Plenum rated
Probe:	Copper Sensor Plate, 24awg, 1.25” dia.
Mounting:	**-S**, ½” Stainless steel worm gear hose clamp **-STP**, 48” Nylon tie strap, ½” wide

Enclosure Types: (Part number designator in bold)

2”x4” J-Box:	Standard w/ eight ½” knock-outs
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)

2x4 J-Box:	Standard, NEMA 1
BAPI-Box:	**-BB,** NEMA 4, IP66, UV Rated
BAPI-Box 2:	**-BB2,** NEMA 4, IP66, UV Rated

Enclosure Material: (Part number designator in bold)

2x4 J-Box:	Galvanized steel, UL94H-B
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

BB, BB2:	-40ºF to 185ºF, (-40º to 85ºC)
J-Box, WP:	-40ºF to 212ºF, (-40º to 100ºC)

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

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