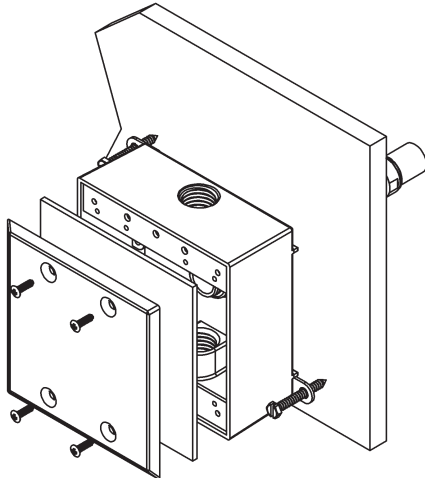
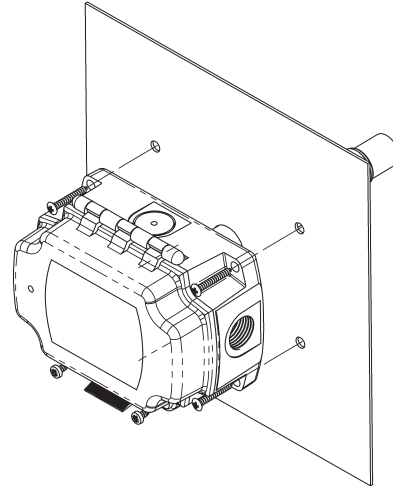


**Overview**

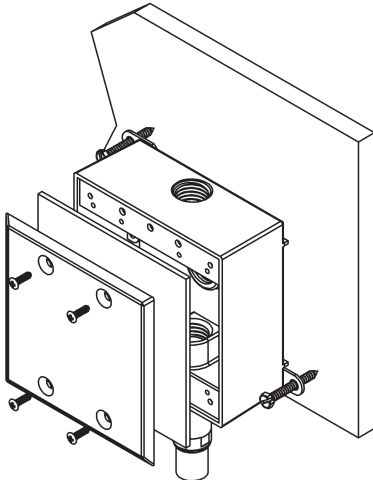
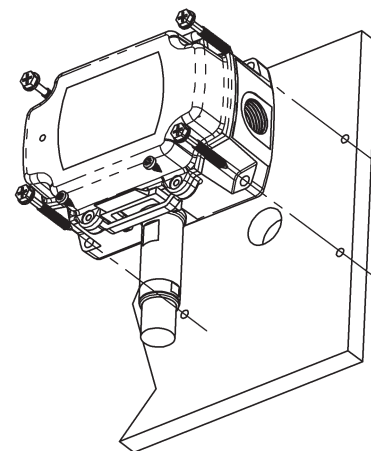
BAPI's Duct and Outside Air Humidity Transmitters come in  $\pm 2\%RH$  or  $\pm 3\%RH$  accuracies. The humidity transmitter can be wired for 0 to 5, 1 to 5, 0 to 10 or 2 to 10 VDC output or a loop powered 4 to 20mA output.

BAPI's Temperature Transmitter can be ordered with a  $1K\Omega$  (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. The units come with a doublegang Weatherproof Enclosure (NEMA 3R) or a BAPI-Box Enclosure (NEMA 4, IP66).

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

**Duct Unit Mounting****Fig. 1:** Duct Unit in a Weatherproof (WP) Enclosure**Fig. 2:** Duct Unit in a BAPI-Box (BB) Enclosure

Mount in the center of the duct wall at least 3 duct diameters from humidifiers. Drill a 1 inch hole in the duct for the probe and use two number 8 sheet metal screws to attach the sensor to the duct. Center the probe in its mounting hole. Be sure that the foam seals the hole, but do not over tighten the screws.

**Outside Air Mounting****Fig. 3:** Outside Air Unit in a Weatherproof (WP) Enclosure**Fig. 4:** Outside Air Unit in a BAPI-Box (BB) Enclosure

Mount in a permanently shaded area away from windows and doors. Do not mount in direct sunlight. Mount with the sensor probe pointed down. Drill a hole large enough for your sensor cable through your mounting surface. Mount the unit to the surface with the wiring knock-out centered over the wiring hole. Pull the wiring into the unit and terminate using sealant filled connectors. Best practice is to seal the wiring hole with caulk after the wiring is installed. Be sure that the foam on the back of the unit makes a good weather tight seal.

## 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 class 1 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.



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.

## WIRING FOR UNITS WITH 4 TO 20mA TEMPERATURE OUTPUT

Wire Color	Purpose	Note
White	Not Used	Not Used
Black	Humidity Output	4 to 20mA, To Analog Input of Controller
Red	Power	7 to 40VDC

Wire Color	Purpose	Note
White	Humidity Output	0 to 5 or 1 to 5 VDC, To Analog Input of Controller
Black	GND (Common)	Ground for Power and Humidity Output
Red	Power	7 to 40 VDC or 18 to 32 VAC

Wire Color	Purpose	Note
White	Humidity Output	0 to 10 or 2 to 10VDC, To Analog Input of Controller
Black	GND (Common)	Ground for Power and Humidity Output
Red	Power	13 to 40 VDC or 18 to 32 VAC

**NOTE:** BAPI's  $\pm 2\%$  and  $\pm 3\%$  humidity transmitters **ARE** polarity sensitive as well as reverse polarity protected.

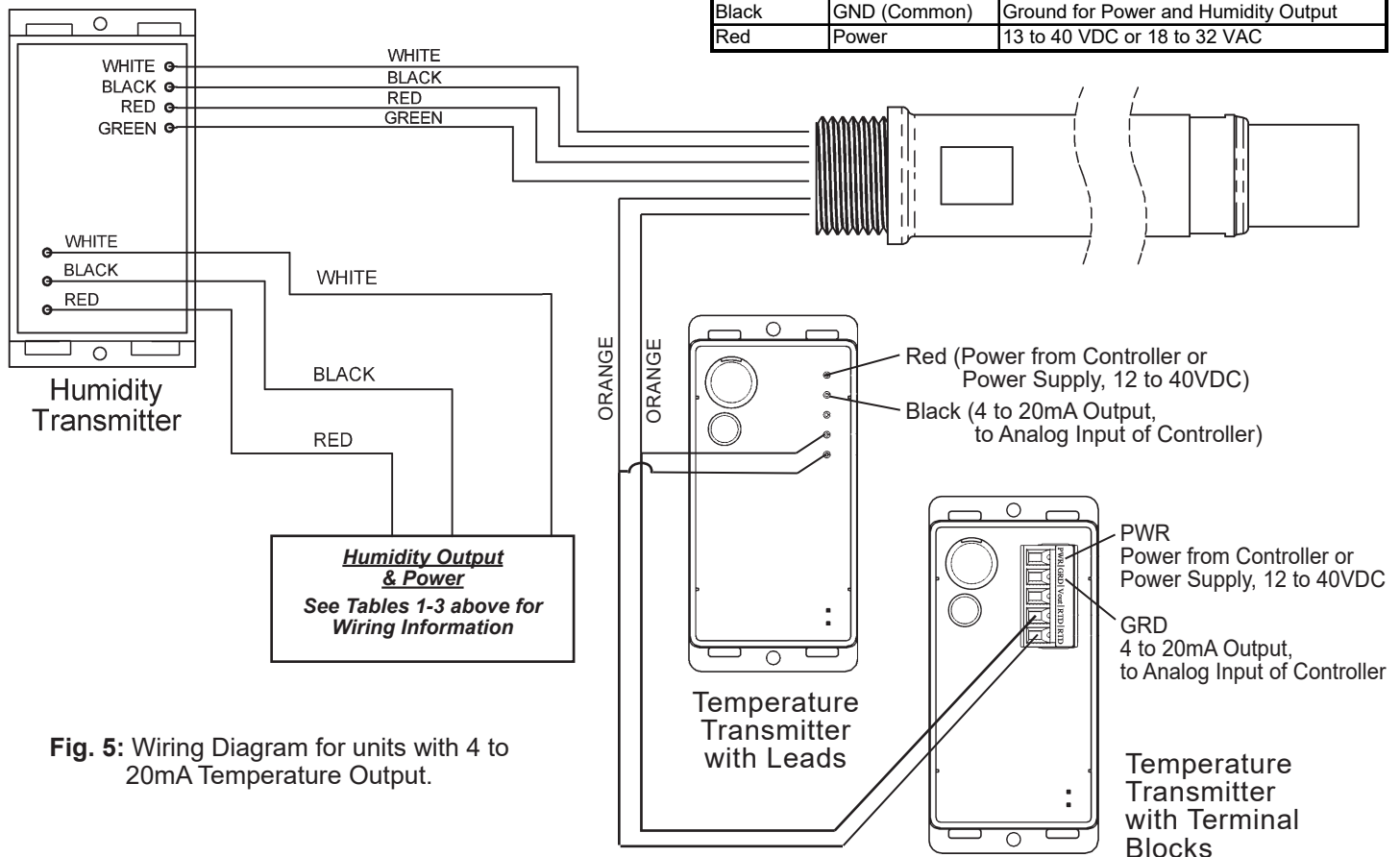


Fig. 5: Wiring Diagram for units with 4 to 20mA Temperature Output.

**Termination continued...**

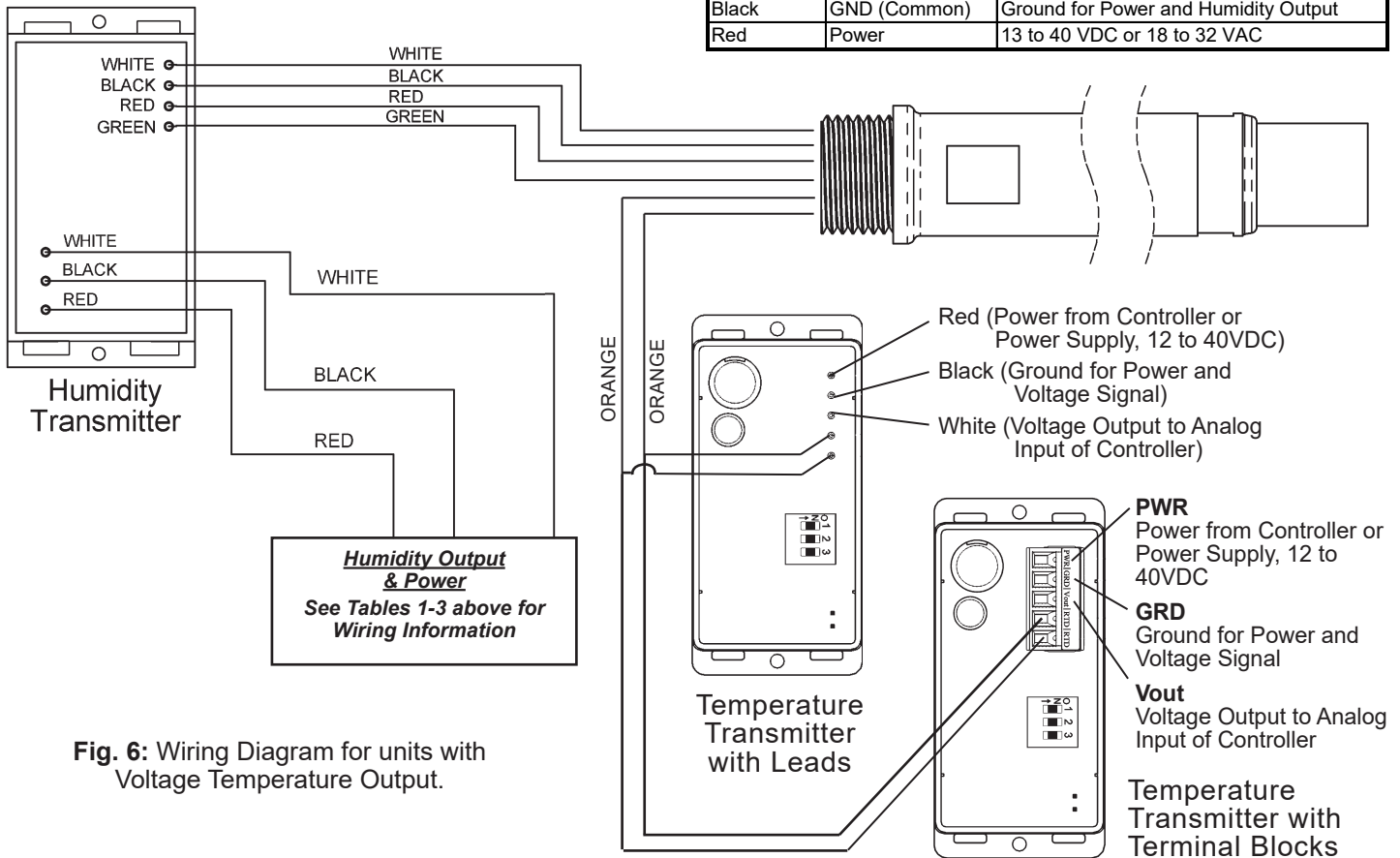
## WIRING FOR UNITS WITH VOLTAGE TEMPERATURE OUTPUT

Wire Color	Purpose	Note
White	Not Used	Not Used
Black	Humidity Output	4 to 20mA, To Analog Input of Controller
Red	Power	7 to 40VDC

Wire Color	Purpose	Note
White	Humidity Output	0 to 5 or 1 to 5 VDC, To Analog Input of Controller
Black	GND (Common)	Ground for Power and Humidity Output
Red	Power	7 to 40 VDC or 18 to 32 VAC

Wire Color	Purpose	Note
White	Humidity Output	0 to 10 or 2 to 10VDC, To Analog Input of Controller
Black	GND (Common)	Ground for Power and Humidity Output
Red	Power	13 to 40 VDC or 18 to 32 VAC

**NOTE:** BAPI's  $\pm 2\%$  and  $\pm 3\%$  humidity transmitters **ARE** polarity sensitive as well as reverse polarity protected.



**Fig. 6:** Wiring Diagram for units with Voltage Temperature Output.

### DIP Switch Settings for Field-Selectable Output

#### TEMPERATURE TRANSMITTER:

The transmitter circuit board has a three-position DIP switch that controls the temperature output value. This switch is set at the factory at the time of the order. The settings of the switch are shown below in case you want to change them in the field.



**Fig. 7:** DIP Switch Settings for Temperature Transmitters and Humidity Transmitters with the DIP Switches

#### HUMIDITY TRANSMITTER:

The transmitter circuit board may have a three-position DIP switch that controls the humidity output value. This switch is set at the factory at the time of the order. The settings of the switch are shown at right in case you want to change them in the field. Be aware that the power requirements for the unit change depending on the humidity output value. See the tables 1-3 above for power requirements.



# Duct & Outside Air Humidity with Temperature Transmitter

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## Filter Care

A filter protects the humidity sensor from various airborne particles that might reduce the sensor's accuracy. Depending on the sensor's location and environment, this filter may need periodic cleaning. To do this, gently unscrew the filter from the probe. Rinse the filter under warm water until clean. Warm soapy water may be used if necessary. Gently replace the filter by screwing it back into the probe. The filter should screw all the way into the probe. Hand tighten only. If a replacement filter or replacement probe is needed, call BAPI.

**BA/HDOFS3**..... Stainless Steel Sintered Filter Replacement

## Specifications

### Humidity Transmitter Power:

Units with RH Output of 4 to 20mA, 0 to 5 or 1 to 5 VDC:  
10 to 35VDC, 22mA max

Units with RH Output of 0 to 5 or 1 to 5VDC:  
12 to 27VAC, 0.53VA max

Units with RH Output of 0 to 10 or 2 to 10VDC:  
15 to 35VDC, 6mA max or 15 to 27VAC, 0.14VA max

### Humidity Sensor:

Sensor Type: .....Capacitive Polymer  
Drift .....0.5% per year  
Response time..... < 5 seconds in moving air  
RH Linearity.....Negligible, factory corrected linier  
from 10 to 80%  
RH Hysteresis.....Factory corrected to <1%

### Humidity Output Impedance:

Voltage: 10KΩ  
Current: 700Ω@ 24VDC, Voltage drop is 10VDC

$$\frac{(\text{Supply VDC} - 10\text{VDC})}{0.02 \text{ Amps}} = \frac{\text{Max load}}{\text{Impedance}}$$

### Humidity System Accuracy:

2% RH: ±2% (10 to 80% RH @ 25°C), Non-condensing  
±3% (80 to 90% RH @ 25°C), Non-condensing  
3% RH: ±3% (10 to 90% RH @ 25°C), Non-condensing

**Humidity Filter:** 80 micron sintered stainless steel filter

**Humidity Output:** Selectable via wiring detail

0 to 5, 1 to 5, 0 to 10 or 2 to 10VDC  
or 4 to 20mA at 0 to 100% RH

**Humidity Output Wiring:**

2 wire current loop, or 3 wire voltage

**Environmental Operation Range:** -40° to 158°F (-40° to 70°C) • 0% to 100% RH

**Enclosure Material:** Weatherproof (WP): Cast Aluminum (doublegang) • BAPI-Box (BB): Polycarbonate, UV-resistant

**Enclosures Ratings:** Weatherproof (WP): NEMA-3R (doublegang) • BAPI-Box (BB): NEMA-4, IP66, UL94V-0

**Dimensions:** W x H x D

Doublegang Weatherproof (WP): 4.5 x 4.5 x 2.2" (114 x 114 x 55 mm)  
BAPI-Box (BB): 4.15 x 5 x 2.5" (105.4 x 127 x 63.5 mm)

**Termination:** Open wire

Crimp: 18 to 26 AWG with Sealant Filled Crimp Connector (BA/SFC1000-x00)  
Wire Nut: 26 to 16 AWG with Sealant Filled Wire Nut (BA/SFC2000-x00)

**Probe Length:** Duct: 5.3" (13.5cm) Duct Insertion, 1" diameter • Outside Air: 2.4" (6.1cm) Below Enclosure, 1" diameter

**Approvals:** RoHs

### Temperature 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. 30°F (17°C), Max 1000°F, (555°C)  
Zero: ..... Min. -148°F (-100°C), Max 900°F (482°C)  
System Accuracy: .....±0.065% of span  
Linearity: .....±(0.125 \* T-20°C)/100  
RTD Sensor:.....2 wire Platinum (Pt), 385 curve  
Transmitter Ambient: .-4 to 158°F(-20 to 70°C)  
0 to 95% RH, Non-condensing

**RTD Sensor:** Resistance Temp Device (Bare Sensor)

Platinum RTD: ..... 1KΩ @ 0°C, 385 curve  
Sensitivity: .....3.85Ω/°C, Approximate @ 32°F (0°C)  
Accuracy (Standard):. 0.12% @Ref, or ±0.55°F, (±0.3°C)  
Accuracy (High):..... 0.06% @Ref, or ±0.277°F, (±0.15°C),  
[A]option

Stability:.....±0.25°F, (±0.14°C)  
Self Heating:.....0.4 °C/mW @0°C  
Probe Range: .....-40 to 221°F, (-40 to 105°C)



## Specifications continued...

### Temperature 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 30°F (17°C), Max 1000°F, (555°C)  
Zero: ..... Min -148°F (-100°C), Max 900°F (482°C)  
System Accuracy: ±0.065% of span  
Linearity: ..... ±(0.125 \* T-20°C)/100  
RTD Sensor: ..... 2 wire Platinum (Pt), 385 curve  
Transmitter Ambient -4 to 158°F(-20 to 70°C)  
0 to 95% RH, Non-condensing

### **RTD Temperature Sensor:** Resistance Temp Device (Bare Sensor)

Platinum (Pt): ..... 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 B..... Orange/Orange (no polarity)  
1KΩ, Class A..... Orange/White (no polarity)

### **RTD Temperature Sensor Sensitivity:**

3.85Ω/°C, Approximate @ 32°F (0°C)

### **Lead Wire:**

22awg stranded

### **Insulation:**

Etched Teflon, Plenum rated

### **Probe Length:**

1.2" with ½" NPT threads

### **Wall Gasket:**

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

### **Agency**

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



# Duct & Outside Air Humidity with Temperature Transmitter

Installation and Operating Instructions

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## Diagnostics - Humidity

### Possible Problems:

Unit will not operate

Humidity output is at its maximum value of 10V

Humidity output is at its minimum value of 0V or 2V

Humidity reading in controller's software appears to be off by more than the specified accuracy

Output	Humidity Formula
4 to 20mA	%RH = (mA-4)/0.16
0 to 5VDC	%RH = V/0.05
0 to 10VDC	%RH = V/0.1
2 to 10VDC	%RH = (V-2)/0.08

### Possible Solutions:

- Check for proper supply power. (See the wiring diagram and power specifications)
- Make sure the humidity sensor is wired properly.
- Verify humidity with a reference sensor. If humidity drops to 5% or below in the environment, the output will go to the maximum value.
- Make sure the humidity sensor is wired properly.
- Check all software parameters
- Determine if the sensor is exposed to an external air source different from the measured environment, such as air infiltration through the wiring conduit.
- Check the Humidity transmitter output against a calibrated reference such as a 2% accurate hygrometer. Measure the humidity at the sensor's location using the reference meter, then calculate the humidity transmitter output using the humidity formula at left. Compare the calculated output to the actual humidity transmitter output (see the wiring diagram for the humidity transmitter output wire colors). If the calculated output differs from the humidity transmitter output by more than 5%, contact BAPI technical support.

## Diagnostics - Temperature

### Possible Problems:

Unit will not operate

Temperature sensor reading is inaccurate at the controller software

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	

### Possible Solutions:

- Check for proper supply power (7 to 40VDC) to the temperature transmitter. (See pages 2 for wiring diagram and power specifications.)
- Determine if the input is set up correctly in the controller's front end software.
- Check if the RTD sensor wires are physically open or shorted.
- Determine if the sensor is exposed to an external air source different from the measured environment, such as air infiltration through the wiring conduit.
- Check the resistance of the temperature sensor (located inside the unit's probe) against an accurate temperature standard. Measure the temperature at the sensor's location using a reference meter. Disconnect the temperature sensor wires (2 Red Wires for a 100 Ohm Platinum RTD sensor or 2 Orange Wires for a 1,000 Ohm Platinum RTD sensor) and measure the temperature sensor's resistance with an ohmmeter. Compare this resistance to the appropriate temperature sensor's Output Table on the BAPI website. (Go to [www.bapivac.com](http://www.bapivac.com); click on "Resource Library" and "Sensor Specs" and then on the 100 Ohm Plat. RTD or the 1,000 Ohm Plat. RTD.) If the measured resistance is different from the Output Table by more than 5%, contact BAPI technical support.
- Check the output current of the temperature transmitter (located inside the unit's enclosure) against an accurate temperature standard. Measure the temperature at the sensor's location using a reference meter. Measure the transmitter current by placing an ammeter in series with the controller input (the black wire on the temperature transmitter). The current should read according to the equation at left. If the measured output is different from the calculated output, call BAPI technical support. If the measured output is the same as the calculated output, then check the wiring between the unit and the controller.

### Note:

The temperature surrounding the transmitter must be between -4 and 158°F (-20 and 70°C).

Specifications subject to change without notice.