CO_2 Room Sensor in the BAPI-Stat "Quantum Prime" Style Enclosure

Installation and Operating Instructions

40696_ins_BSQPrime_CO2 rev. 05/06/21

Identification and Overview

The BAPI CO_2 Sensor is an accurate and reliable way of incorporating demand controlled ventilation into a building's HVAC strategy. It measures the CO_2 in a range of 0 to 2,000 ppm with a field selectable output of 0 to 5 or 0 to 10 VDC.

The Single Beam (ACD) unit has been optimized for periodically unoccupied areas and features automatic background calibration over a long time period to reduce drift. The Dual Channel (DCD) "24/7" unit has been optimized for continuously occupied areas and features a three-point calibration process for enhanced stability, accuracy and reliability.

Barometric pressure changes from altitude or weather patterns can affect CO_2 sensors, even putting them outside of their specified accuracy. The BAPI unit has a built-in Barometric pressure sensor that continuously compensates the output for accurate readings despite the weather or altitude of the installation.

The BAPI-Stat "Quantum Prime" unit can be ordered as CO_2 alone, or as a combination temperature and humidity sensor. The CO_2 level is indicated as "Good, Fair or Poor" by three discrete green, yellow and red LEDs on the front of the unit.

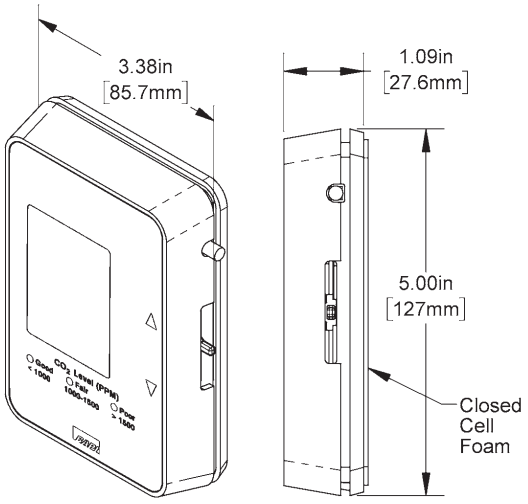
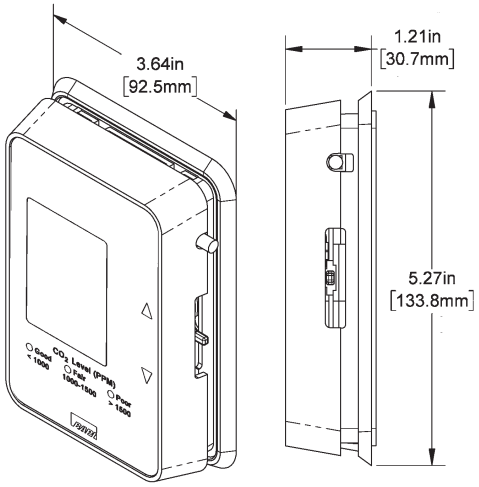


Fig. 1: BAPI-Stat "Quantum Prime" CO_2 Sensor

(standard mounting base at left and 60mm mounting base for European wall boxes with 60mm mounting centers at right)

Included Screw Pack



Specifications

Power for 0 to 5 VDC Outputs:
9 to 35 VDC @ 240 mA (9 to 24 VDC recomm.)

Power for 0 to 10 VDC Outputs:
15 to 35 VDC @ 240 mA (15 to 24 VDC recomm.)

CO_2 Sensor:
Single or Dual Channel Non-Dispersive Infrared (NDIR)

Humidity Sensor: Capacitive Polymer ±2% RH Accuracy

Temperature Sensor: Thermistor or RTD

Operating Environment:
32 to 122°F (0 to 50°C) • 0 to 95%RH non-condensing

Material: ABS Plastic, Material Rated UL94V-O

CO_2 Detection Range: 0 to 2,000 ppm

Start-Up Time:
<2 Minutes

Response Time:
<2 Minutes for 90% step change typical (after start-up)

CO_2 Accuracy (Single Channel Units):
400 to 1,250 ppm: ±30ppm or 3% of reading, whichever is greater
1,250 to 2,000 ppm: ±5% of reading + 30ppm

CO_2 Accuracy (Dual Channel "24/7" Units):
400 to 1,000 ppm: ±75 ppm
>1,000 ppm: ±10% of reading

CO_2 Drift Stability (Dual Channel "24/7" Units):
<5% of full scale over life of product.

Mounting:
Standard 2"x4" junction box, European junction box or drywall mount (screws provided)

LED CO_2 Level Indicator:
Good, Green < 1,000 PPM (1,100 PPM when option "N" chosen)

Fair, Yellow = 1,000 to 1,500 PPM
(1,100 to 1,500 PPM when option "N" chosen)

Poor, Red > 1,500 PPM

Agency: RoHS, California Title 24 and AB 841

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Mounting

Mounting hardware is provided for both junction box and drywall installation (junction box installation shown).

Note: Screw the 1/16" Allen lock-down screw into the base to open the case. Back out the lock-down screw to secure the cover.

Junction Box

1. Pull the wire through the wall and out of the junction box, leaving about six inches free.
2. Pull the wire through the hole in the base plate.
3. Secure the plate to the box using the #6-32 x 5/8 inch mounting screws provided.
4. Terminate the unit according to the guidelines in the Termination section. (page 3)
5. Mold the foam on the unit's base to the wire bundle to prevent drafts. (see note below)
6. Attach Cover by latching it to the top of the base, rotating the cover down and snapping it into place.
7. Secure the cover by backing out the lock-down screw using a 1/16" Allen wrench until it is flush with the bottom of the cover.

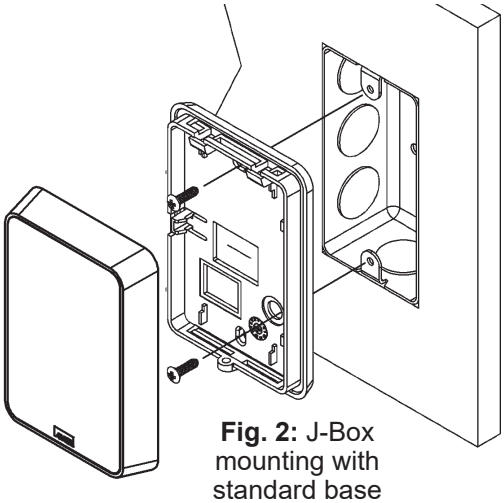

Fig. 2: J-Box mounting with standard base

Drywall Mounting

1. Place the base plate against the wall where you want to mount the sensor. Mark out the two mounting holes and the area where the wires will come through the wall.
2. Drill two 3/16" (4.75mm) holes in the center of each marked mounting hole, DO NOT punch the holes or the drywall anchors will not hold. Insert a drywall anchor into each hole.
3. Drill one 1/2" (13mm) hole in the middle of the marked wiring area.
4. Pull the wire through the wall and out of the 1/2" (13mm) hole, leaving about six inches free. Pull the wire through the hole in the base plate.
5. Secure the base to the drywall anchors using the #6 x 1 inch mounting screws provided.
6. Terminate the unit according to the guidelines in the Termination section. (page 3)
7. Mold the foam on the unit's base to the wire bundle to prevent drafts. (see note below)
8. Attach cover by latching it to the top of the base, rotating the cover down and snapping it into place.
9. Secure the cover by backing out the lock-down screw using a 1/16" Allen wrench until it is flush with the bottom of the cover.

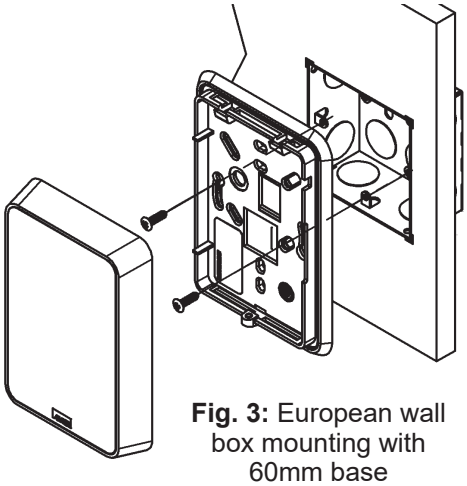

Fig. 3: European wall box mounting with 60mm base

NOTE: In any wall-mount application, the wall temperature and the temperature of the air within the wall cavity can cause erroneous readings. The mixing of room air and air from within the wall cavity can lead to condensation, erroneous readings and sensor failure. To prevent these conditions, BAPI recommends sealing the conduit leading to the junction box, filling the junction box with fiberglass insulation or sealing the wall cavity.

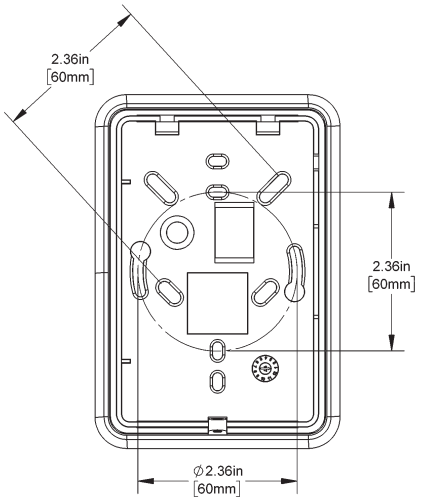

Fig. 4: 60mm mounting base dimensions

Specifications subject to change without notice.

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. BAPI's tests show fluctuating and inaccurate signals are possible when AC power wiring is in the same conduit as the signal lines. If you are experiencing any of these difficulties, please contact your BAPI representative.

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 void the warranty.

Note: For proper operation, the jumper on PRG connector of J19 must not be installed on both legs.

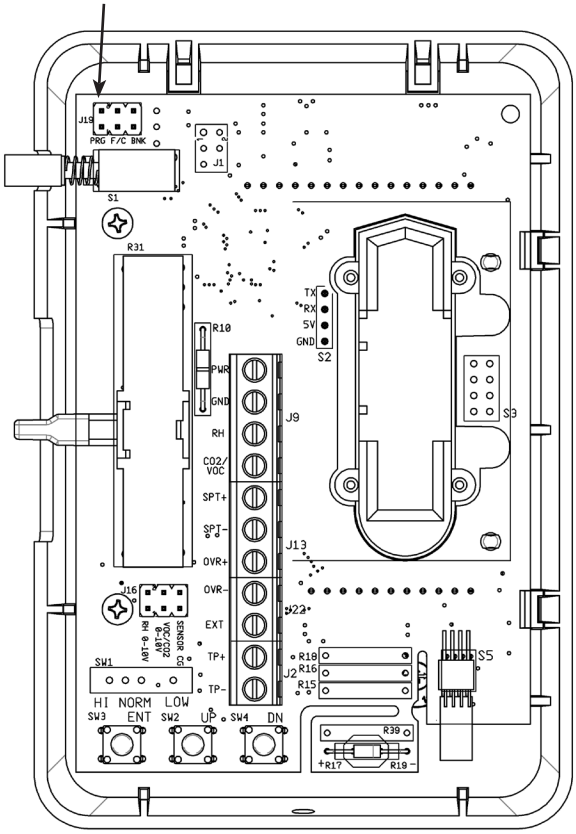

Fig. 5: Circuit Board

Terminal	Function
PWR	Power, referenced to GND (Ground). See Voltage Specifications above.
GND	To controller Ground (GND or Common).
RH	Voltage Output Humidity Signal referenced to the GND terminal.
CO2/VOC	Voltage Output CO2 Signal (0 to 2,000ppm) referenced to the GND terminal.
SPT+ & SPT-	Temperature Setpoint Output per order (resistive or voltage). Voltage output requires Common Ground, SPT- is referenced to the GND terminal.
OVR+ & OVR-	Override output (Dry contact). The contact can be ordered as a momentary shunt across the sensor, momentary shunt across the setpoint, or as a separate momentary contact. If the unit is Common Ground, OVR- is referenced to the GND terminal.
EXT	External occupied LCD indicator is activated by logic LOW or ground at this terminal, referenced to the GND terminal.
TP+ & TP-	Temperature Sensor Output (Resistive Only). When jumper is installed on J16 Sensor CG, TP- is connected to the GND terminal. It is recommended to wire TP+ and TP- as differential to prevent interference on GND from pulse readings on the CO2 Sensor.

Note: Unit is not ready for operation until the 10 minute start-up time has elapsed.

POWERING WITH A BAPI VC350A VOLTAGE CONVERTER

The CO_2 unit requires 240mA of current to operate correctly. If this is more current than can be provided by the controller power output, then the unit can be powered by a BAPI VC350A or VC350A-EZ Voltage Converter.

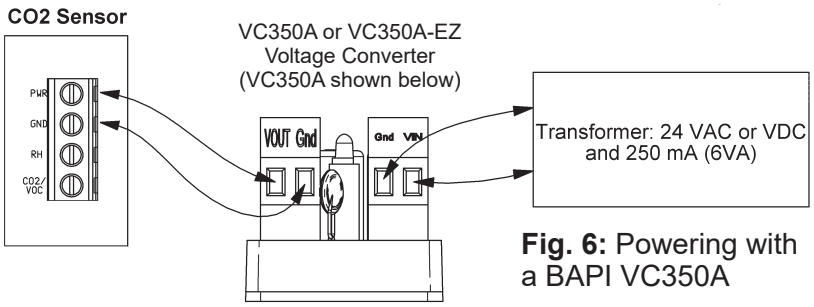

Fig. 6: Powering with a BAPI VC350A

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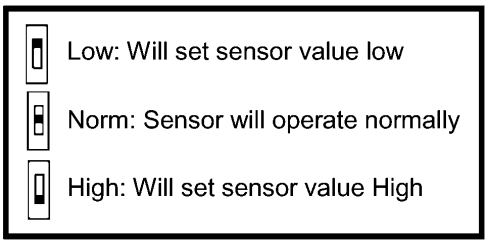
Installation and Operating Instructions

Optional Test and Balance Switch (SW1)



Sensor Type	Low Temp	High Temp
1K RTD	1.02KΩ = 41.2°F (5.1°C)	1.15KΩ = 101.5°F (38.6°C)
3K Thermistor	7.87KΩ = 39.8°F (4.3°C)	1.50KΩ = 106.8°F (41.5°C)
10K-2 Thermistor	30.1KΩ = 34.9°F (1.6°C)	4.75KΩ = 109.1°F (42.8°C)
10K-3 Thermistor	26.7KΩ = 35.9°F (2.2°C)	5.11KΩ = 108.4°F (42.4°C)
10K-3(11K) Thermistor	7.32KΩ = 43.7°F (6.5°C)	3.65KΩ = 105.2°F (41.7°C)

Optional Communications Jack Wiring

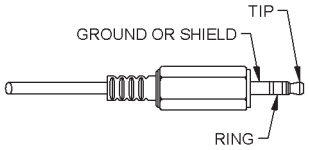


Table 1: C35 Wiring	
	Wire Color
Ground	Black
Tip	White
Ring	Red

C35 Communication Jack
(Male jack shown for clarity)

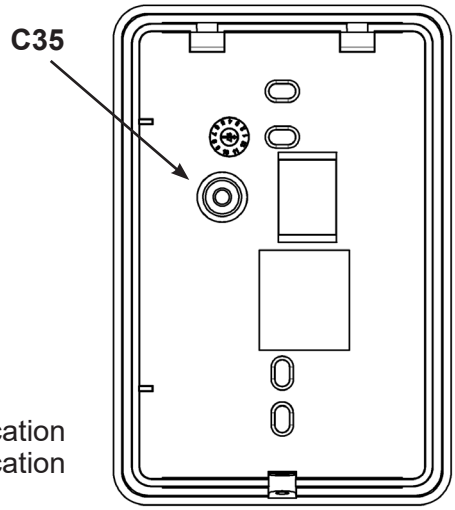


Fig. 7: Communication Jack Location

User Operation

The display indicates CO_2 in PPM, temperature in °F or °C, %RH, temperature setpoint in degrees °F or °C and override using the Human icon.

The major display indicates the CO_2 in PPM. The minor display indicates the temperature in °F or °C, %RH, and temperature setpoint in degrees °F or °C when present.

Temperature Setpoint Slidepot: Moving the slidepot enough to change the setpoint will display the setpoint on the minor LCD display if equipped with display. The setpoint temperature display will flash the digits indicating that setpoint is being changed.

Override Button: When the override button is pressed on display units, the Human icon will display. A dry resistance of less than 1 ohm appears from the override output. Latching the Icon to show that the system is in override requires that a dry contact on your controller be used to connect terminal EXT to ground.

CO_2 Level LEDs: 3 discrete LEDs indicate the CO_2 level with green for Good, yellow for Fair and red for Poor. For units with the California AB 841 option, the logo plate and setpoint between Good and Fair is 1,100 ppm. The red LED will begin to flash when the unit exceeds 2,000 ppm.

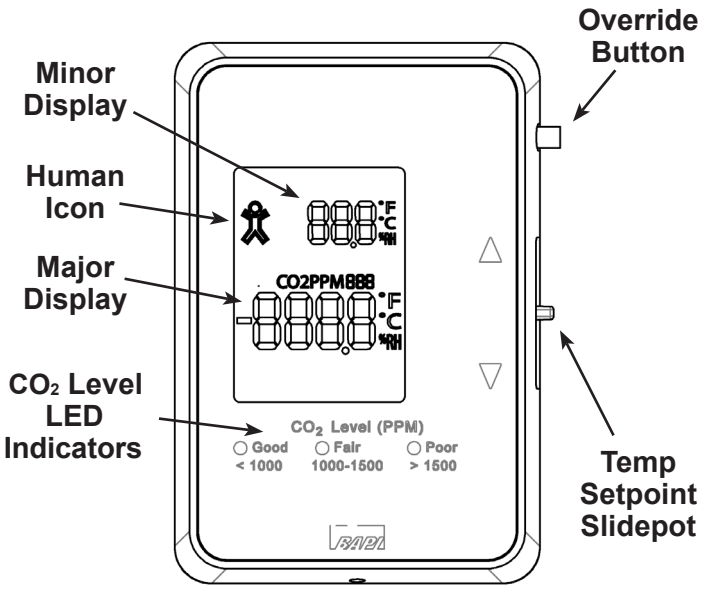


Fig. 8: CO_2 Unit Indicators
(Shown above with all optional indicators)

Specifications subject to change without notice.

Optional Technician Adjustments

BAPI's CO_2 room sensor comes calibrated and ready to operate. In some installations the sensor may not match local instrumentation. The technician adjustment procedure allows °F or °C display units, temperature or humidity offsets or display information to be changed at any time.

Removing Ground from Temperature Sensor
Some installations may experience erratic temperature readings due to increased power consumption when the CO_2 sensor element takes a reading. A possible remedy may be to float the temperature sensor as shown in Figs 9 and 10. Run wires directly from TP+ and TP- to the controller's analog input. The VOC/CO2 and RH jumpers are omitted for clarity.

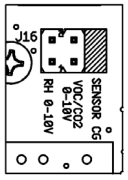


Fig. 9: Temp. Sensor Grounded

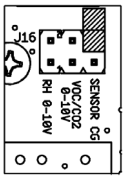


Fig. 10: Temp. Sensor Floating

°F or °C Display Units
Figs 11 and 12 show the jumper positions for displayed values of Celsius or Fahrenheit degrees. The jumpers on pins PRG and BNK are omitted for clarity.

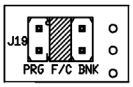


Fig. 11: °F

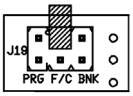


Fig. 12: °C

Parameter Offsets & Display Information
Figs 13 and 14 show how to place the unit into field setup mode. Take the jumper from the BNK terminals and place it on the PRG terminals. The F/C jumper is omitted for clarity.

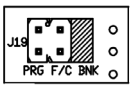


Fig. 13: Normal Operation

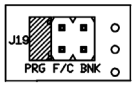


Fig. 14: Programming Setup

The major display should read P1.

Use the UP/DN buttons (See Fig 15) to select the desired page.

Press and release the ENT button to select the desired page.

Use the UP/DN buttons to adjust the desired value

Press and release the ENT button to save the change and return to the page display.

Adjust another page or place the jumper into normal operation.

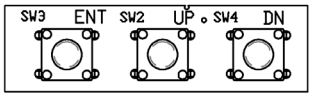


Fig. 15: Calibration Buttons

Programming Pages			
Parameter	Page	Adjustment	
Display Options	P1	Item	Display Action - CO2 always shown in major display
		0	CO2 Only
		1	CO2 and Temperature
		2	CO2 and %RH
		3	CO2, Temperature, and %RH (5 second rotation in minor display)
		4	CO2, Temperature Setpoint when active
		5	CO2, Temperature, and Temperature Setpoint when active
		6	CO2, %RH, and Temperature Setpoint when active
		7	CO2, Temperature, %RH, and Temperature Setpoint when active (5 second rotation in minor display)
Temperature Offset	P2	±5° in 0.1° increments	
Humidity Offset	P3	±5%RH in 0.1%RH increments	
CO2 Offset	P4	±100ppm in 1ppm increments	

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Output Selection

The CO_2 outputs may be field configured for 0 to 5 VDC or 0 to 10 VDC outputs at any time. Set the jumpers on J16 as shown in Figs 16 and 17.

The humidity outputs may be field configured for 0 to 5 or 0 to 10 VDC outputs at any time (or 1 to 5 or 2 to 10 VDC if that option was chosen when ordering). Set the jumpers on J16 as shown in Figs 18 and 19.

Note: The jumpers on the pins not being described are omitted for clarity on the figures at right.

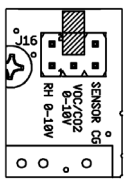

Fig. 16: CO_2 Output 0 to 5 VDC

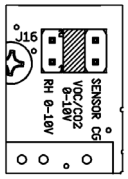

Fig. 17: CO_2 Output 0 to 10 VDC

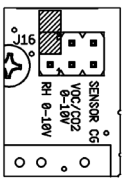

Fig. 18: %RH Output 0 to 5 or 1 to 5 VDC

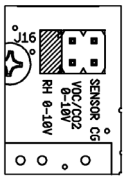

Fig. 19: %RH Output 0 to 10 or 2 to 10 VDC

Diagnostics

Possible Problems:	**Possible Solutions:**
General troubleshooting	Determine that the input is set up correctly in the controller's and building automation software.
	Check wiring at the sensor and controller for proper connections. If there is corrosion, clean off the corrosion, re-strip the interconnecting wire and reapply the connection. In extreme cases, replace the controller, interconnecting wire and/or sensor.
	Label the terminals that the interconnecting wires are connected to at the sensor end and the controller end. Disconnect the interconnecting wires from the controller and the sensor. With the interconnecting wires separated at both ends measure the resistance from wire-to-wire with a multimeter. The meter should read greater than 10 Meg-ohms, open or OL depending on the meter you have. Short the interconnecting wires together at one end. Go to the other end and measure the resistance from wire-to-wire with a multimeter. The meter should read less than 10 ohms — 22 gauge or larger, 250 feet (76m) or less. If either test fails, replace the wire.
	Check power supply/controller voltage supply for proper voltage (see specifications)
Incorrect CO_2	Wait 15 minutes after a power interruption.
	Check all software parameters
	Determine if the sensor is exposed to an external environment different from the room (conduit draft)
	If the sensor is reading consistently high, make sure that the power supply to the unit can provide 240mA. A low power situation will cause high CO_2 readings.
	Note: If the CO_2 sensor has consistently given high PPM readings for over 5 days, it will take up to 14 days for the readings to return to normal.
Incorrect Humidity	Check all software parameters
	If available, check the sensor against a calibrated instrument such as a hygrometer
	Determine if the sensor is exposed to an external environment different from the room (conduit draft)
Incorrect Temperature	Check the wires at the sensor and controller for proper connections.
	Check the Temperature Output of the unit. Disconnect the temperature sensor's wire (Terminals TP+ & TP-) and measure the temperature sensor's resistance across the sensor output pins with an ohmmeter. Put the ohmmeter's black lead on Terminal TP- and the red lead on Terminal TP+. Compare the temperature sensor's resistance to the appropriate temperature sensor table on the BAPI website. (Go to www.bapihvac.com; click on "Resource Library" and "Sensor Specs", then click on the sensor type you have.) If the measured resistance differs from the temperature table by more than 5%, call BAPI technical support.
	Determine if the sensor is exposed to an external environment different from the room (conduit or wall cavity draft)