VOC Room Sensor in a BAPI-Stat Quantum Enclosure

Installation & Operating Instructions

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Overview and Identification

Humans respirate Volatile Organic Compounds (VOCs) as well as CO_2. The BAPI sensor measures these VOCs and indicates when a space is occupied just as well as a CO_2 sensor.

The advantage of the VOC sensor is that it measures air contaminants from other sources besides respiration, such as building materials, cleaners, perfumes, furniture and carpet. Using this sensor for Demand Controlled Ventilation then is a way of achieving true indoor air quality, rather than just CO_2 dilution.

A further benefit is that it requires no additional work on your part. That's because the sensor converts the VOC reading to a CO_2 equivalent level. This lets you use ASHRAE's CO_2-based VRP schedule to ventilate.

The BAPI-Stat "Quantum" VOC Room Sensor features 0 to 5 VDC or 0 to 10 VDC output. The VOC level is indicated as "Good, Fair or Poor" by three discrete green, yellow and red LED's on the front of the unit. If the output reaches 2,000 PPM, the red LED will begin to flash because it has hit its maximum output.

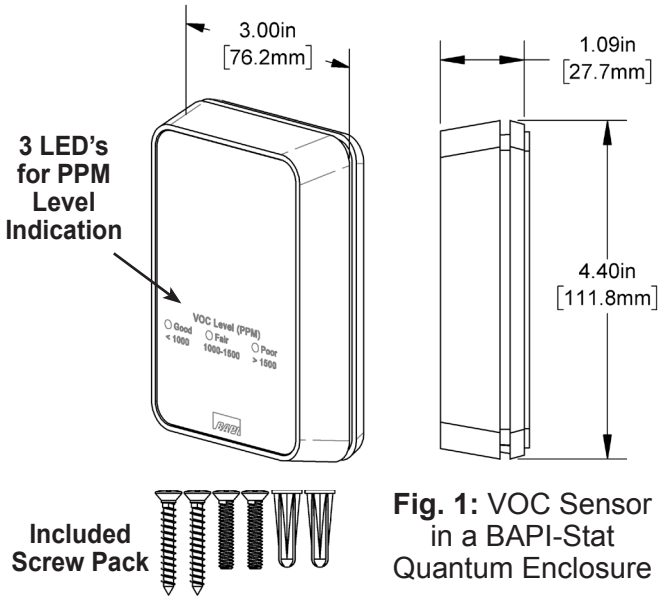

Fig. 1: VOC Sensor in a BAPI-Stat Quantum Enclosure

Mounting

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 base to the box using the #6-32 x 1/2 inch mounting screw provided.
4. Terminate the unit according to the guidelines in the **Termination** section.
5. Attach Cover by latching it to the top of the base, rotating the cover down and snapping it into place.
6. Secure the cover by backing out the lock-down screws using a 1/16" Allen wrench until they are flush with the bottom of the cover.

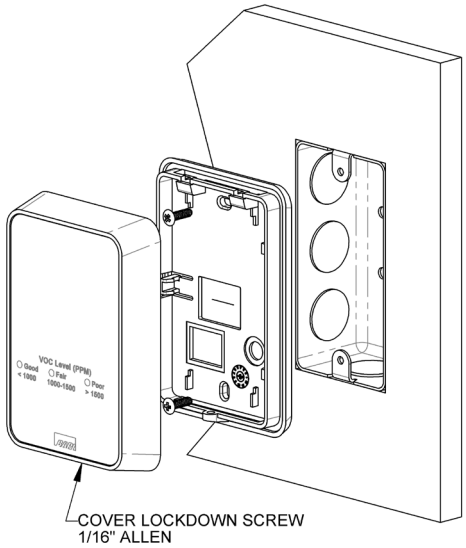

Fig. 2: Mounting to a Junction Box

DRYWALL MOUNTING

1. Place the base plate against the wall where you will mount the sensor.
2. Using a pencil, mark out the two mounting holes and the area where the wires will come through the wall.
3. Drill two 3/16" holes in the center of each marked mounting hole. Insert a drywall anchor into each hole.
4. Drill one 1/2" hole in the middle of the marked wiring area.
5. Pull the wire through the wall and out of the 1/2" hole, leaving about six inches free.
6. Pull the wire through the hole in the base plate.
7. Secure the base to the drywall anchors using the #6 x 1 inch mounting screws provided.
8. Terminate the unit according to the guidelines in the **Termination** section.
9. Attach Cover by latching it to the top of the base, rotating the cover down and snapping it into place.
10. Secure the cover by backing out the lock-down screws using a 1/16" Allen wrench until they are flush with the bottom of the cover.

NOTE: *In a wall-mount application, the mixing of room air and air from within the wall cavity can lead to erroneous readings, condensation, and premature failure of the sensor. To prevent this condition, plug the conduit hole with insulation in the junction box.*

Specifications subject to change without notice.

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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.

> **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.

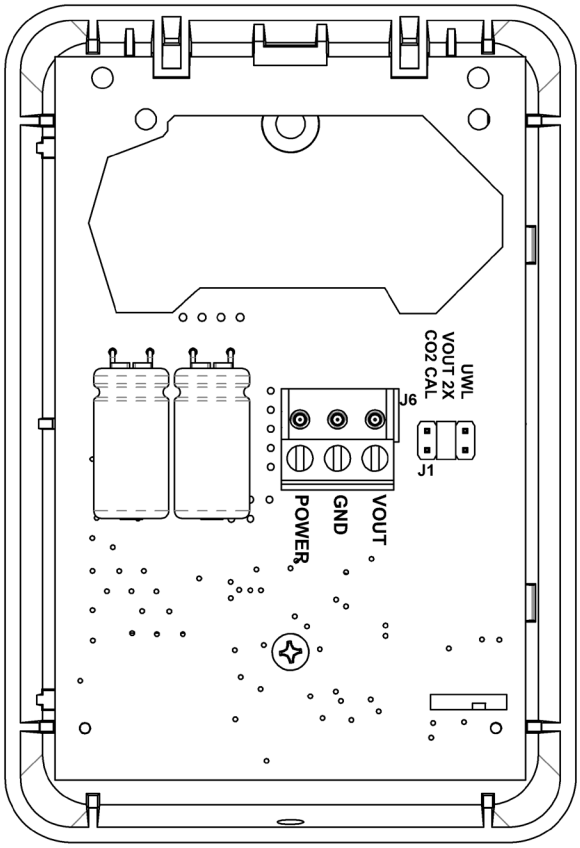

Fig. 3: Circuit Board

Terminal	Description
PWR	Power, referenced to GND 12 to 24 VDC, 35 mA Peak 18 to 24 VAC, 4 VA Peak
GND	To controller Ground [GND or Common]
OUT	Voltage Output, VOC Signal (0 to 2,000 ppm), referenced to GND

The VOC outputs may be field configured for 0 to 5 VDC or 0 to 10 VDC outputs at any time. Set the jumpers on J1 as shown in Figures 4 and 5.

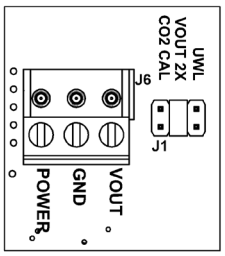

Fig. 4: J1 set for 0 to 10 VDC output

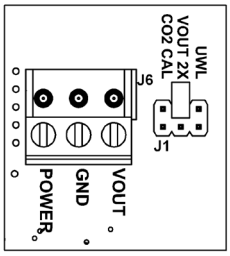

Fig. 5: J1 set for 0 to 5 VDC output

Specifications

Power:
12 to 24 VDC, 35 mA Peak
18 to 24 VAC, 4 VA Peak

Sensing Elements: Micro-machined Metal Oxide

Mounting: 2”x4” J-Box or drywall mount - screws provided

VOC Detection Range:
0 to 2,000ppm CO_2 Equivalent, Analog Output

Response Time: Less Than 60 Seconds (after start-up)

Start-up Time: 15 minutes

Operating Environment:
32 to 122°F (0 to 50°C) • 5 to 95%RH non-condensing

Analog Outputs:
0 to 5 or 0 to 10VDC >4KΩ impedance

LED VOC CO2 Equivalent Indicator:
Good, Green < 1,000 ppm
Fair, Yellow = 1,000 to 1,500 ppm
Poor, Red > 1,500 ppm

Dimensions: See image on page 1

Material: ABS Plastic, Material Rated UL94V-0

Certifications: RoHS

Warranty Period: 5 years from manufacture date

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Sensor Start-Up

Do not set the control parameter to a VOC limit until the VOC sensor has been installed for a week. The first few days of install may provide different readings compared to several days later.

At each power up, the sensor enters the start-up period for 15 minutes. The VOC output will follow the timing shown in Figure 6. During the start-up period, an optional verification/commissioning test, described below, may be performed. This test is not mandatory. It is necessary only if building commissioning requires sensor verification or if verification of VOC output is required for later troubleshooting.

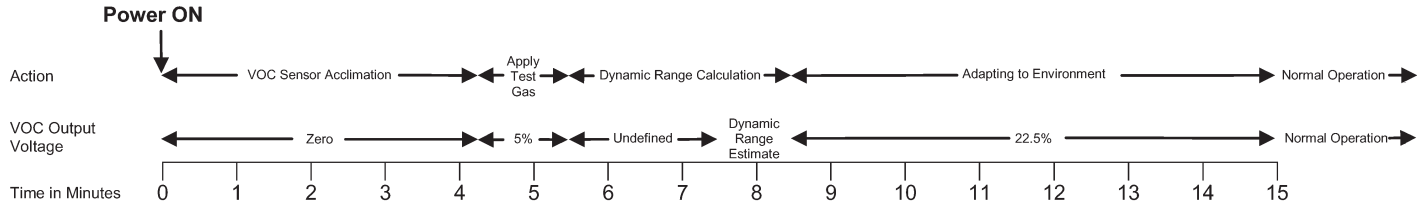

Fig. 6: Sensor Start-up Timeline

Optional Sensor Performance Verification and Commissioning

BAPI's VOC sensor contains an adaptive, self adjusting, VOC sensor element that provides a CO_2 equivalent control signal output. When incorporated into a control strategy based on ASHRAE's Demand Control Ventilation algorithm, ventilation with this sensor will achieve true indoor air quality, not just CO_2 dilution.

The fundamental performance criterion of the VOC sensor element is its dynamic sensing range. The VOC sensor element requires a minimum dynamic range of 30% for proper operation. During BAPI's verification/commissioning test, the dynamic range is tested.

BAPI recommends installing the sensor and powering it for at least 48 hours before the first verification test is performed. BAPI further recommends ventilating the space such that the sensor reads 750 ppm or less CO_2 equivalent before any verification test is performed. Wait at least one hour before repeating the test.

1. Start Automatic Verification/Commissioning Test

A. Remove sensor power for at least one minute and reapply. The VOC sensor will set the VOC output to zero volts. (Power ON in Fig. 6)

B. Wait four minutes fifteen seconds.

C. The VOC sensor will set the VOC output voltage to 5% of full scale (0.25 VDC for 0 to 5 VDC, 0.5 VDC or 0 to 10 VDC outputs).

D. The 5% output voltage confirms that the VOC sensor is in its verification/commissioning test. (Apply Test Gas in Fig. 6)

2. Apply Verification Stimulus

A. Apply the stimulus gas during the first minute after the output voltage is set to 5% (See Stimulus Preparation and Application).

B. Read and record the VOC output voltage approximately 2 to 4 minutes following the stimulus gas application to determine the dynamic range measurement. (Dynamic Range Estimate period in Fig. 6)

C. Use the graph in Fig. 8 to determine dynamic range.

3. Termination of Verification Mode

A. For the last 7 minutes of the start-up period the sensor adapts to its ambient environment. The VOC sensor will maintain its output voltage at 450 ppm CO_2 equivalent.

B. At 15 minutes the VOC sensor will terminate the start-up period and begin normal operation.

C. The VOC output will now report the VOCs present as CO_2 equivalents.

4. Result Analysis and Recommendations

The VOC algorithm requires a dynamic range of greater than 30% for proper operation. Sensors reporting a dynamic range of 30% or less should be considered for replacement. (See Fig. 8)

Stimulus Preparation and Application

Customer supplied – 70% minimum Isopropyl Alcohol.

Place 50ml of the Isopropyl Alcohol into a 200ml bottle (2oz in an 8oz bottle) with stopper and allow to reach room temperature (65° to 80°F, 18° to 27°C), a minimum of 15 minutes.

1. Using a medical grade syringe, remove the stopper from the alcohol bottle, place the tip of the syringe at least half-way into the bottle and withdraw a 60 ml sample of the ALCOHOL VAPOR. (NO LIQUID)
2. Replace the stopper on the alcohol bottle.
3. Place the end of the syringe under, or into the bottom ventilation slot of the VOC monitor's housing.
4. Empty the syringe into the sensor using one continuous motion.

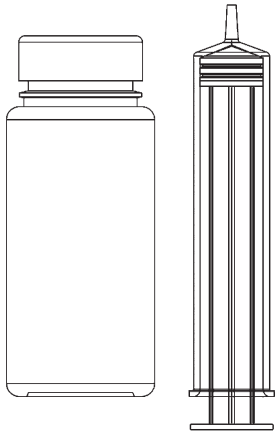

Fig. 7: Alcohol Bottle and Syringe included in the VOC Verification Kit (BA/VOC-KIT)

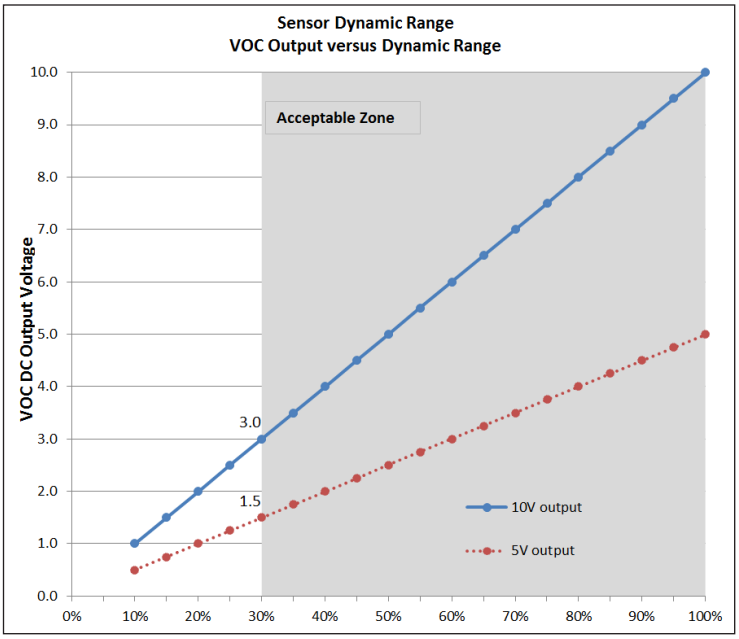

Fig. 8: Acceptable Dynamic Range Output Graph

Diagnostics

Possible Problems:	**Possible Solutions:**
General Troubleshooting	- Determine that the input is set up correctly in the controller and BAS software. - Check wiring at the sensor and controller for proper connections. If there is corrosion on any terminations, 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 VOC sensor wire terminals at the sensor and controller ends. Disconnect the wires and 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. Short the wires at one end and measure the resistance from wire-to-wire at the other end. The meter should read less than 10 ohms (22 gauge or larger, 250 feet or less). If either test fails, replace the wire. - Check the power supply and controller voltage supply. - Disconnect sensor and check power wires for proper voltage (see power specs on pg 2).
Incorrect VOC Reading	- 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).

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