

# FIELD TESTING AND CALIBRATION OF VOC PROBES

APPLICATION NOTE TSI-156

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## Probe Models

- ⇒ 984 Low Concentration (ppb) VOC and Temperature
- ⇒ 985 High Concentration (ppm) VOC and Temperature
- ⇒ 986 Low Concentration (ppb) VOC, Temperature, CO<sub>2</sub>, and Humidity
- ⇒ 987 High Concentration (ppm) VOC, Temperature, CO<sub>2</sub>, and Humidity

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## Overview

Due to the nature of the PID sensor and the presence of VOCs in air along with other environmental factors such as altitude, temperature and relative humidity, the zero value of the VOC probe will shift over time. **TSI recommends testing the probe performance each time the instrument is used to make measurements.** This is a common practice within the gas measurement community which includes IAQ consultants and industrial hygienists.

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## Probe Verification

Verifying the probe performance can easily be accomplished in the field by comparing it to certified zero and span calibration gases. To do this, attach the probe with the calibration collar to a bottle of Zero Gas and compare to the instrument readings (also referred to as a “Bump Test”). If the probe reads any number other than 0, then the PID sensor has drifted and needs to be re-calibrated.



### NOTE

With probe attached power on the instrument for 10 minutes before verifying performance. This allows the instrument and probe electronics to stabilize to produce best results.



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## TSI Recommended Accessories for Testing or Calibrating PID Probes

- Zero Gas—80% Nitrogen/20% Oxygen
- Span Gas—1 ppm Isobutylene in balance Nitrogen—use with ppb probe
- Span Gas—10 ppm Isobutylene in balance Nitrogen—use with ppb probe
- Span Gas—20 ppm Isobutylene in balance Nitrogen—use with ppm probe
- Span Gas—100 ppm Isobutylene in balance Nitrogen—use with ppm probe
- 0.3 to 0.5 L/min flow rate Continuous Flow Regulator
- Tygon® tubing 0.250 in. (6.35 mm) OD, 0.125 in. (3.175 mm) ID
- VOC probe calibration collar (included with probe)

When spanning with an isobutylene gas, select a concentration value that is closest to the desired measurement range. This will result in maximum accuracy of the PID sensors readings.

### Example 1 (ppb)

If you have a ppb PID probe and wish to measure VOCs in the low ppb range, span calibrating with a 1 ppm isobutylene gas will give more accurate results than span calibrating with a 10 ppm isobutylene gas. If you would like to measure VOCs in the mid to upper range of the PID sensor, calibrating with 10 ppm isobutylene span gas would be appropriate.

### Example 2 (ppm)

If you have a ppm PID probe and wish to measure VOCs in the low ppm range, span calibration with a 20 ppm isobutylene gas will give more accurate results, than span calibrating with 100 ppm isobutylene gas will. If you would like to measure VOCs in the mid to upper range of the PID sensor, calibrating with 100 ppm isobutylene span gas would be appropriate.

Zero, Span gasses and regulators that meet TSI's requirements are available internationally from PortaGas at [www.portagas.com](http://www.portagas.com) in 103 liter bottle configurations.

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## PID Probe Calibration

If the probe reads any number other than 0 when tested against a zero gas, then the PID sensor has drifted and needs to be re-calibrated using the following instructions. These instructions are also applicable if the PID sensor has been replaced in the field.

### NOTES

With probe attached power on the instrument for 10 minutes before calibrating the probe. This allows the instrument and probe electronics to stabilize to produce best results.

Field calibration is required if a new replacement PID sensor is installed on the probe.

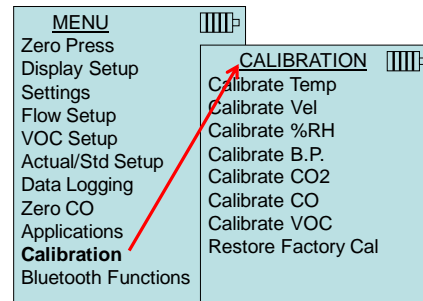
Restore to Factory Calibration before performing field calibration.

(After restoring Factory Calibration, retry the "bump test" at 0 ppm and/or at a known concentration of Isobutylene in balance Nitrogen gas. If readings are still out of tolerance then proceed with field calibration procedure.)

## Accessing the Calibration Menu

To access the CALIBRATION menu, press the **MENU** key and scroll down to CALIBRATION and press **ENTER**. Highlight Calibrate VOC and then press **ENTER**.

**NOTE**  
The measurement capabilities of the instrument and probe will determine what appears in the main MENU and CALIBRATION menu. Instrument models using detachable probes must have the probe attached to perform field calibrations. This screen display at right is from the 9565-P VelociCalc® Multi-Function Ventilation Meter with VOC probe attached.



## Calibrate VOC

A probe calibration collar (included with probe), zero calibration gas, span calibration gas, gas regulator and tubing are required to perform the calibration. The gas regulator used to control the flow should be capable of providing 0.3 L/min. Follow the on-screen instructions to complete the calibration.

Refer to the section above entitled "[TSI Recommended Accessories for Testing or Calibrating PID Probes](#)" for recommended gases and accessories.

<p><b>Step 1</b>—Grasp probe handle and pull PID sensor protective cap off.</p>	
<p><b>Step 2</b>—Slide calibration collar onto probe and attach to gas cylinder using tubing.</p>	
<p><b>Step 3—Zero Calibration.</b> After pressing <b>ENTER</b> with the zero calibration gas connected, the instrument begins to take data. A bar graph will appear showing the time remaining. <i>The time allocated by the instruments firmware for zero is sufficient for zeroing.</i></p>	<div style="display: flex; justify-content: space-around;"> <div> <p>CALIBRATE VOC <span style="float: right;">▣▣▣▣▣</span></p> <p>Connect zero gas then press ENTER</p> </div> <div> <p>CALIBRATE VOC <span style="float: right;">▣▣▣▣▣</span></p> <p style="font-size: 24pt; text-align: center;">0.00 ppm</p> <div style="text-align: center;"> </div> </div> </div>

<p><b>Step 4—Span Calibration.</b></p> <p>For best results, <i>run the span gas with the probe attached for 60 seconds before pressing the <b>ENTER</b> button to conduct the span calibration.</i></p> <p>After pressing <b>ENTER</b> with the span calibration gas connected, the instrument begins to take data. A bar graph will appear showing the time remaining.</p>	<div style="display: flex; justify-content: space-around;"> <div style="border: 1px solid black; padding: 5px; width: 45%;"> <p>CALIBRATE VOC <span style="float: right;">     </span></p> <p>Connect span gas then press ENTER</p> </div> <div style="border: 1px solid black; padding: 5px; width: 45%;"> <p>CALIBRATE VOC <span style="float: right;">     </span></p> <p style="text-align: center; font-size: 1.2em;">9.41 ppm</p> <div style="text-align: center;"> <div style="width: 100px; height: 10px; background: linear-gradient(to right, black 80%, white 20%);"></div> </div> </div> </div>
<p><b>Step 5—Span Adjustment</b></p> <p>Once the countdown is complete, the VOC concentration as measured by the probe is displayed along with the percent of adjustment.</p> <p>In this example, the span gas is rated at 10 ppm. Use the UP or DOWN arrow keys to adjust offset to match the span gas concentration. Press <b>ENTER</b> to accept and to return to the CALIBRATION menu.</p>	<div style="display: flex; justify-content: space-around;"> <div style="border: 1px solid black; padding: 5px; width: 45%;"> <p>CALIBRATE VOC <span style="float: right;">     </span></p> <p>9.41 ppm 0.0 % Adjustment</p> </div> <div style="border: 1px solid black; padding: 5px; width: 45%;"> <p>CALIBRATE VOC <span style="float: right;">     </span></p> <p>10.00 ppm 6.3 % Adjustment</p> </div> </div>

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## Calibrate CO<sub>2</sub>

This calibration option applies to meters and probes capable of measuring CO<sub>2</sub>. A probe calibration collar, zero calibration gas, span calibration gas, gas regulator and tubing are required to perform the calibration. The gas regulator used to control the flow should be capable of providing 0.3 L/min. Follow the on-screen instructions to complete the calibration.

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## Requirements

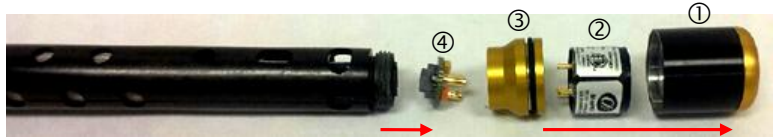
- Probe calibration collar (included with IAQ and VOC probes)
- Span calibration gas, 5000 ppm maximum
- Zero Gas – 80% Nitrogen/20% Oxygen
- 0.3 L/min flow rate Continuous Flow Regulator
- Tygon tubing 0.250 in. (6.35 mm) OD, 0.125 in. (3.175 mm) ID



**NOTE**

If probe measures VOC gasses, remove VOC sensor first.

- Pull PID sensor protective cap off ①
- Remove PID sensor ②
- Unscrew collar ③
- Gently remove small PCB ④



**Step 1**—Slide calibration collar onto probe and attach to gas cylinder using tubing.

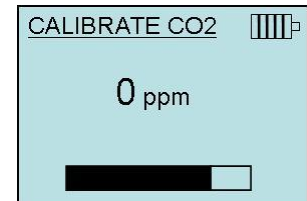
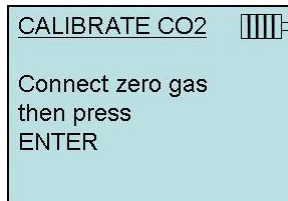


**Step 2— Bump Test**

Measure concentration with 0 ppm calibration gas flowing through the calibration collar. Do the same with the Span Gas. If readings are out of tolerance then Restore CO<sub>2</sub> Factory Calibration (see the very end of this Application Note) and then perform the Bump Test again at 0 ppm and Span. If readings are still OOT then proceed with Field Calibration.

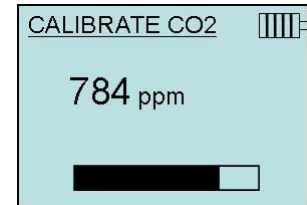
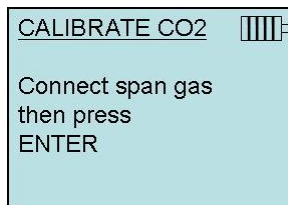
**Step 3—Zero Calibration.**

After pressing **ENTER** with the zero calibration gas connected, the instrument will begin to take data. A bar graph will appear showing the time remaining.



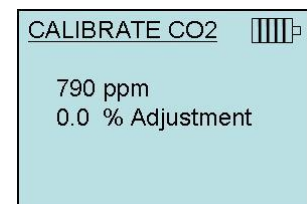
**Step 4—Span Calibration.**

After pressing **ENTER** with the span calibration gas connected, the instrument will begin to take data. A bar graph will appear showing the time remaining.

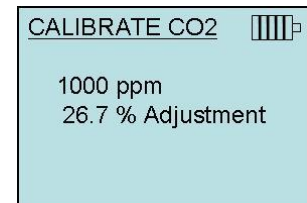


**Step 5—Span Adjustment.**

Once the countdown is complete, the CO<sub>2</sub> concentration as measured by the probe is displayed along with the percent of adjustment.



In this example, the span gas is rated at 1000 ppm. Use the UP or DOWN arrow keys to adjust offset to match the span gas concentration. Press **ENTER** to accept and to return to the CALIBRATION menu.




## Calibrate Temp

This calibration option applies to all meters and probes capable of measuring temperature. The temperature calibration can be adjusted  $\pm 6.0^{\circ}\text{F}$  ( $\pm 3.3^{\circ}\text{C}$ ). Compare the instruments temperature reading to a reference standard and make changes as required.

**Step 1**—Use the UP or DOWN arrow keys to adjust offset.

**Step 2**—Press **ENTER** to accept and to return to CALIBRATION menu.

In this example, the temperature measured by the probe is  $75.3^{\circ}\text{F}$  and the reference temperature is  $73.6^{\circ}\text{F}$ . Adjusting the offset by  $-1.7^{\circ}\text{F}$  allows the probe match the reference standard.

CALIBRATE TEMP   
 $75.3^{\circ}\text{F}$   
 $0.0^{\circ}\text{F}$  Offset

CALIBRATE TEMP   
 $73.6^{\circ}\text{F}$   
 $-1.7^{\circ}\text{F}$  Offset


## Calibrate %RH

This calibration option applies to meters and probes capable of measuring relative humidity. Compare the instruments relative humidity reading to a reference standard and make changes as required. The Offset can be adjusted  $\pm 12.0\%$  RH.

**Step 1**—Use the UP or DOWN arrow keys to adjust offset.

**Step 2**—Press **ENTER** to accept and to return to CALIBRATION menu.

In this example, the relative humidity measured by the probe is  $30.5\%$  RH and the reference humidity is  $31.6\%$  RH. Adjusting the offset by  $1.1\%$  allows the probe match the reference standard.


CALIBRATE %RH   
 $30.5\%$  RH  
 $0.0\%$  RH Offset

CALIBRATE %RH   
 $31.6\%$  RH  
 $1.1\%$  RH Offset

## RESTORE FACTORY CAL

This option resets the field calibration for any measurement parameter back to the last factory calibration. To restore the last factory calibration for any measurement parameter, the probe must be attached to the meter on models with detachable probe.

RESTORE FACTORY CAL   
Restore Temp  
Restore Vel  
Restore %RH  
Restore Press  
Restore B.P.  
Restore CO2  
Restore CO  
Restore VOC

RESTORE VOC   
  
Are you Sure?  
  
YES NO



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USA Tel: +1 800 874 2811  
UK Tel: +44 149 4 459200  
France Tel: +33 4 91 11 87 64  
Germany Tel: +49 241 523030

India Tel: +91 80 67877200  
China Tel: +86 10 8219 7688  
Singapore Tel: +65 6595 6388