Introduction

The GE Telaire Ventostat® 8001/8002 carbon dioxide (CO₂) sensors and controllers are designed for Demand Controlled Ventilation (DCV) in buildings. This approach, using CO₂ as an indicator of occupancy, allows ventilation based on actual occupancy while still maintaining ASHARE recommended per-person ventilation rates. Over ventilation of buildings can be reduced, energy can be saved, and quality can be optimized.

The optional black case (PN 8001B and PN 8002B) is UL94-V5 rated, making these models suitable for mounting directly inside the ductwork. Typical applications for Ventostat® 8001/8002 series include office buildings, conference rooms, schools, retail stores, restaurants, gymnasiums, and movie theatres.

Installing the Sensor

NOTICE!
Use of cellular telephones or radio transceivers within two (2) feet of the sensor during calibration process could cause sensor interference, calibration errors and affect sensor accuracy. Please refrain from using these devices during sensor calibration.

Install the mounting plate and sensor as follows:

1. Prepare for installation by using the mounting holes configured for US or European junction boxes.
2. Use the mounting plate as a template to mark the mounting holes. See Figure 1, View B below.
3. Secure the mounting plate to the wall or junction box and make necessary wire connections.
4. Mount the controller on the base by aligning the top clips and then securing to the bottom clips, as shown in Figure 1, View B above. A “snap” sound will indicate that the sensor is secure. The sensor will now have power. A 2 minute warm-up will take place. After 2 minutes, the sensor will stabilize and display the “Normal Mode” (current CO₂ readings).
5. At this point one of nine preset programs or one custom channel can be selected for operation. See the section “Configuring the Sensor” on page 3.
6. Finish installation by sliding the cover over the menu keys and secure with the supplied screw.

Mounting the Sensor into the Duct

The 8001B and 8002B have the UL94-V5 rated black case and are specifically designed for mounting inside the return air ductwork. When mounting these products inside the ductwork, seal the hole around the wires and leave the duct insulation in place to prevent condensation which may damage the sensor.

Pitot Tube Installation for the 8001 and 8002

Install the mounting bracket, then install the pitot tube assembly as follows:

Note: The length of the Tygon® tubing is three feet. In order to maintain optimum accuracy, the tubing should not be lengthened. If the sensor is mounted closer than three feet, the excess tubing should be shortened to avoid interference with mechanical or moving devices.

1. To mount the pitot tube, drill one 7/8” hole through the duct as shown in Figure 2 below.

Figure 1: Ventostat® CO₂ Controller - Mounting

Figure 2: Pitot Tube - Installation
2. Insert the pitot tube and mark the two remaining holes for the mounting screws.
3. Punch or drill the two marked holes.
4. Note the direction of airflow in the duct (see View in Direction of A) above.
5. Note the marking on the pitot tube flange and insert the tube so that it is properly aligned with the airflow.
6. To ensure an airtight seal, make sure the mounting surface of the duct is clear of dirt or obstructions. Then, attach the pitot tube to the duct with sheet metal screws or rivets.
7. On top of the sensor, unscrew the protective caps from the tube connectors.
8. Check the length of the tubing before attaching to the sensor. The tubing should connect without stretching or pulling. If the length is long enough to create a loop or bind in the tubing, it should be shortened.
9. To shorten the tubing, remove the connectors that attach to the input ports on the sensor. The tubing connectors can be attached to either input port. It will not affect the performance of the sensor.
10. Replace the tubing connectors by using a twisting or screwing motion. Verify the connection is secure.

Note: If the tubing length has been shortened, be sure the in-line filter is replaced on the pitot tube connector marked with an “H” as shown in Figure 2, View in Direction of A (on the previous page).

11. Complete the installation by screwing the tube connectors to the input ports on the sensor. The tubing connectors can be attached to either input port. It will not affect the performance of the sensor.

Accessory Enclosures

Three kinds of accessory enclosures are listed below, and two are shown in Figure 3 below.

- **Model 1508 Duct Mount Enclosure (Aspiration Box)** - Any 8000 product can be installed inside this enclosure.
- **Model 1551 Outside Air Measurement Enclosure** - This NEMA-3R enclosure is weatherproof for measuring outside air CO₂ concentrations. It also includes heat stabilizers.
- **Model 1505 Harsh Environment Enclosure** - For extreme environments where the sensor might be subjected to condensation or water spray such as those found in greenhouses or breweries-NEMA-3R rated.

The typical wiring diagrams appear in Figure 4 through Figure 8 below.

**Figure 4: AC Power 3/4 Wires System - Diagrams**

**Figure 5: Relay Contacts and Lennox L-Series Diagrams**

**Figure 6: Lennox L-Series/Mounting Bracket Diagrams**

**Figure 7: Damper Actuator and W7459 Logic Module Diagrams**

**Figure 3: Accessory Enclosures**

**Typical Wiring Diagrams**
Set minimum position potentiometer to twice the design load. For example, if the space is designed for 30 people at 15 cfm/person, adjust the minimum position potentiometer at the economizer logic to 900 cfm. This will allow the economizer to introduce 450 cfm (1000 ppm CO₂ level) at the design load. The CO₂ sensor should use “STDSET#1.”

**Note:** For 24V, do not use a HVAC unit transformer. Provide 24 V by using a non-grounding transformer.

**Table 1: 8000 Series Adjustment Parameters and Factory Settings**

<table>
<thead>
<tr>
<th>Adjustment</th>
<th>Range</th>
<th>Factory Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Altitude Above Sea Level</td>
<td>0 - 10,000 ft.</td>
<td>0 ft.</td>
</tr>
<tr>
<td>ABC Logic™</td>
<td>ON/OFF</td>
<td>ON</td>
</tr>
<tr>
<td>Select Standard Setting</td>
<td>1 to 9</td>
<td>1</td>
</tr>
<tr>
<td>Customize Setting:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PPM Range</td>
<td>0 - 10,000</td>
<td>0-2,000</td>
</tr>
<tr>
<td>Output Range</td>
<td>4-20 mA / 0 - 10 V</td>
<td>4 - 20 mA / 0-10 V</td>
</tr>
<tr>
<td>Proportional/Exponential Output</td>
<td>Select One</td>
<td>Proportional</td>
</tr>
<tr>
<td>Relay Setpoint</td>
<td>0 - 10,000 PPM</td>
<td>1000 PPM</td>
</tr>
<tr>
<td>Relay Hysteresis</td>
<td>0 - 10,000 PPM</td>
<td>50 PPM</td>
</tr>
</tbody>
</table>

All GE Telaire 8000 series products are calibrated at sea level. As altitude increases, the accuracy of this sensor, as of all gas sensors, introduces an error of approximately -3% of the reading per 1,000 ft of elevation. Users that are in elevations significantly higher than sea level, such as Denver, Colorado, should consider adjusting the altitude to have the most accurate reading. The altitude setting can be adjusted on the unit in 500 ft increments.

**ABC Logic™ Self Calibration System**

All GE Telaire 8000 series sensors are factory set with the ABC Logic (Automatic Background Calibration) self-calibration feature ON. This feature allows the sensor to continually re-calibrate itself when the indoor concentrations drop to outside levels while the building is unoccupied. Generally a building must be regularly unoccupied for 4 hours or more for this self-calibration system to operate properly. Under these conditions, the ABC Logic feature should maintain sensor calibration over the lifetime of the sensor. The ABC Logic feature should be turned OFF where a building is continuously occupied 24 hours per day, or where there could be significant sources of non-occupant related CO₂ such as greenhouses, breweries and other industrial and food processing applications.

**Pre-Programmed Settings**

In addition to the factory setting for the 8000 series sensors, nine standard settings can easily be selected using the keypad (display units only) or the PC based UIP Program. Table 2 on the next page describes each of the settings. The definitions for some of the terms used in the table are described in more detail as part of the custom settings outline in the “Custom Settings” section on the next page.

Settings 1, 2 and 3 are applicable for automated or computerized building control systems.

Settings 4 to 7 are specifically designed for operation with economizer controls and actuators where a 0-10 VDC signal will provide 0-100% outside air modulation. These control settings provide different modulation ranges, depending on the target cfm-per-person ventilation rate desired. As described below, the exponential setting is best used in applications that have large volumes of air and people, such as auditoriums, gyms and large conference areas.

Setting 8 is for use in occupational health and safety applications where users want to measure concentrations in relation to the 5000 ppm, 8 hour exposure levels established by OSHA (Occupation Safety and Health Administration).
Setting 9 is intended for use in parking garages where \( \text{CO}_2 \) can be used as an indicator of the presence of combustion fumes. As part of most types of combustion, \( \text{CO}_2 \) is generated at a rate that is 50 times or more than other, more harmful contaminants. This is particularly the case with the extensive use of catalytic converters that tend to remove most of the carbon monoxide from vehicle exhaust. The 700 ppm setting should maintain levels of other exhaust contaminants well below levels of concern.

### Table 2: Standard Settings Adjustable via Keypad UIP Interface

<table>
<thead>
<tr>
<th>Setting No.</th>
<th>Type of Equipment</th>
<th>Type of Output</th>
<th>Ventilation Rate (cfm/Person)</th>
<th>Analog Output</th>
<th>CO(_2) Control Range (ppm)</th>
<th>Optional Relay Setpoint (ppm)</th>
<th>Relay Hysteresis (ppm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Interface w/Standard Building Control System</td>
<td>Proportional</td>
<td>Any</td>
<td>0 - 10V 4 - 20 mA</td>
<td>0 - 2000</td>
<td>1000</td>
<td>50</td>
</tr>
<tr>
<td>2</td>
<td>Interface w/Standard Building Control System</td>
<td>Proportional</td>
<td>Any</td>
<td>2 - 10V 7 - 20 mA</td>
<td>0 - 2000</td>
<td>1000</td>
<td>50</td>
</tr>
<tr>
<td>3</td>
<td>Interface w/Standard Building Control System</td>
<td>Exponential</td>
<td>Any</td>
<td>0 - 10V 4 - 20 mA</td>
<td>0 - 2000</td>
<td>1100</td>
<td>50</td>
</tr>
<tr>
<td>4</td>
<td>Economizer (Hvac)</td>
<td>Proportional</td>
<td>15</td>
<td>0 - 10V 4 - 20 mA</td>
<td>0 - 1100</td>
<td>1100</td>
<td>50</td>
</tr>
<tr>
<td>5</td>
<td>Economizer (Hvac)</td>
<td>Proportional</td>
<td>20</td>
<td>0 - 10V 4 - 20 mA</td>
<td>0 - 900</td>
<td>900</td>
<td>50</td>
</tr>
<tr>
<td>6</td>
<td>Economizer (Hvac)</td>
<td>Exponential</td>
<td>15</td>
<td>0 - 10V 4 - 20 mA</td>
<td>0 - 1100</td>
<td>1100</td>
<td>50</td>
</tr>
<tr>
<td>7</td>
<td>Economizer (Hvac)</td>
<td>Exponential</td>
<td>20</td>
<td>0 - 10V 4 - 20 mA</td>
<td>0 - 900</td>
<td>900</td>
<td>50</td>
</tr>
<tr>
<td>8</td>
<td>Health &amp; Safety</td>
<td>Proportional</td>
<td>NA</td>
<td>0 - 10V 4 - 20 mA</td>
<td>0 - 9999</td>
<td>5000</td>
<td>500</td>
</tr>
<tr>
<td>9</td>
<td>Parking/Air Intakes/Loading Docks</td>
<td>Proportional</td>
<td>NA</td>
<td>0 - 10V 4 - 20 mA</td>
<td>0 - 2000</td>
<td>700</td>
<td>50</td>
</tr>
</tbody>
</table>

### Custom Settings

In addition to the nine standard settings programmed into the 8000 series (see Table 2 above), users can also custom program the sensor for their own application.

Outlined below is a brief description of each of the adjustable custom settings:

**Control Range** - The range that will correspond to the analog signal output range. The range consists of a low level and a high level in ppm. Setting this range does not limit the actual measurement or display range.

**Analog Output Range** - Can be expressed in V or mA. This range will correspond to the range of \( \text{CO}_2 \) concentrations established in the measurement range. The output in V or mA is selected based on the wiring terminals. It is possible to simultaneously connect to both the V and mA outputs.

**Proportional or Exponential Control** - Proportional (linear) control increases the signal output in proportion to the increase in \( \text{CO}_2 \) concentrations for the measurement range and analog output range selected. Exponential control provides an output function that is exponential over the selected range of the sensor. The effect of the exponential output is to initially introduce more ventilation to the space as concentrations are at the lower level of the control range. The exponential output is particularly useful for areas of potential high occupancy and high air volume where significant time may be required for \( \text{CO}_2 \) levels to build up. Potential applications include arenas, gyms, auditoriums and large conference areas. Examples of both types of outputs appear in Figure 9 on the next page.

**Relay Set Point** - Establishes the level at which the on-board relay will activate. The relay is a double pole single throw (DPST) relay that allows the user to operate the relay normally open or normally closed based on the selection of wiring terminals connected on the sub-base.

**Relay Hysteresis (Deadband)** - Is the point at which the relay will deactivate. It is entered as a ppm value below the setpoint. A sensor with a relay setting of 1000 and a hysteresis of 50 would activate at 1000 ppm and deactivate at 950 ppm.
Adjusting Sensor Using Display

The four buttons listed below perform the following functions:

- **[CLEAR]** - Resets Menu / Returns to Normal Mode
- **[MODE]** - Toggles to Next Menu Item
- **[ENTER]** - Press to Lock Menu
- **[UP/DOWN]** - Increase/Decrease Selection Value

Altitude Correction and ABC Logic™ (ON/OFF)

1. After 2 minute warm-up period, press [CLEAR] + [MODE]. Hold at least 5 seconds until the sensor enters the edit mode.
2. The first menu is Altitude Correction. Use the [UP/DOWN] button to adjust to the proper altitude in 500 ft. increments.
3. Press [ENTER] to lock in value, then press [MODE] to proceed to ABC Logic.
4. Use the [UP/DOWN] button to switch to ON or OFF.
5. Press [ENTER] to lock value then press [MODE] to proceed to Normal Mode. It is recommended that the ABC Logic feature is left ON for the best sensor operation.

Selecting a Pre-Programmed Setting:

The pre-programmed settings shown in Table 2 are factory set and cannot be changed. These settings can be selected from the Standard Settings (STDSET) menu. The Altitude and ABC Logic features can be changed without entering the Standard Settings (STDSET) menu.

1. After a 2 minute warmup period, press [CLEAR] + [MODE] and hold (at least 5 seconds) until the sensor enters the edit mode.
2. Press [MODE] 2 times. You will enter the STDSET menu.
3. Use the [UP/DOWN] button to toggle to the NONSTD menu.
4. Press [MODE] to move through the variables. Use the [UP/DOWN] button to toggle to the desired setting.
5. Press [ENTER] to lock in the selection; press [MODE] for the next variable.

For Non-Standard (Custom) Settings

The non-standard (custom) settings can be changed at any time after the sensor is powered up. The seven settings (variables) are:

- PPM Range
- Scale (proportional or exponential)
- Output (V or mA)
- Output Range V
- Output Range mA
- Relay Setpoint
- Relay Hysteresis.

The Altitude and ABC Logic™ features can be changed without entering into the Non-Standard (NONSTD) menu.

1. After 2 minute warmup period, press [CLEAR] + [MODE] and hold (at least 5 seconds) until the sensor enters the edit mode.
2. Press [MODE] 2 times. You will enter the STDSET menu.
3. Use the [UP/DOWN] button to toggle to the NONSTD menu.
4. Press [MODE] to move through the variables. Use the [UP/DOWN] button to toggle to the desired setting.
5. Press [ENTER] to lock in the selection; press [MODE] for the next variable.
Troubleshooting

See Table 3 below for symptoms and remedies.

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>LCD Display is blank after the 2 minute warmup period (8002 and 8008 models)</td>
<td><strong>Note:</strong> Follow the Remedy Steps in numerical order.</td>
</tr>
<tr>
<td></td>
<td>1. Remove the sensor from the wiring plate and check the voltage on pins 1 and 2 of the 2-pin terminal block. The voltage should be: 18-30 VAC RMS or 18 - 42 VDC</td>
</tr>
<tr>
<td></td>
<td>2. Ensure that the sensor pins that connect to the 2-pin terminal block are not broken, bent, or damaged.</td>
</tr>
<tr>
<td></td>
<td>3. If the LCD display is still blank after replacing the sensor on the mounting plate, call <strong>GE Telaire</strong> or your distributor/dealer for a return authorization number.</td>
</tr>
<tr>
<td>Green light is not illuminated (8001 and 8008 models) after the two minute warmup period.</td>
<td>1. Remove the sensor from the wiring plate and check the voltage on pins 1 and 2 of the 2-pin terminal block. The voltage should be: 18-30 VAC RMS or 18 - 42 VDC.</td>
</tr>
<tr>
<td></td>
<td>2. Ensure that the two pins on the sensor that connect to the 2-pin terminal block are not broken, bent, or damaged.</td>
</tr>
<tr>
<td></td>
<td>3. If the green light is still not illuminated after replacing the sensor on the mounting plate, try verifying the sensor operation using the <strong>UIP 8000</strong> computer interface or checking the output signal on the building automation system.</td>
</tr>
<tr>
<td></td>
<td>4. If there is no output signal, call <strong>GE Telaire</strong> or your distributor/dealer for a return authorization number.</td>
</tr>
<tr>
<td>Relay does not actuate at the proper setpoint.</td>
<td>1. Using the LCD menu or the <strong>UIP 8000</strong> computer interface, verify that the relay setpoint is correct.</td>
</tr>
<tr>
<td></td>
<td>2. Return the sensor to normal operating mode, and breathe into the sensor to raise the ppm value above the relay setpoint.</td>
</tr>
<tr>
<td></td>
<td>3. If the relay does not actuate at the proper setpoint, call <strong>GE Telaire</strong> or your distributor/dealer for a Return Authorization (RA) number.</td>
</tr>
</tbody>
</table>

**Table 3: Symptoms and Remedies**

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Suspect the sensor is out of calibration.</td>
<td>1. Compare the sensor reading to a <strong>GE Telaire</strong> 7001 hand-held CO₂ monitor.</td>
</tr>
<tr>
<td></td>
<td>2. Take another sensor from the building and replace the suspect sensor to see if the readings are similar.</td>
</tr>
<tr>
<td></td>
<td>3. Connect the sensor outdoors (if possible). The readings should be between 350 and 450 ppm.</td>
</tr>
<tr>
<td></td>
<td>4. Connect the sensor to nitrogen gas from a Model 2075 calibration kit. The reading should be close to zero.</td>
</tr>
<tr>
<td></td>
<td>5. If the sensor still proves to be out of calibration, calibrate the sensor according to the instructions included in your calibration kit, or call for a Return Authorization (RA) number before returning the sensor to <strong>GE Telaire</strong> for factory calibration.</td>
</tr>
</tbody>
</table>
**Specifications**

**Method**
- Single Beam Absorption Infrared™
- Diffusion sample method (8001, 8001B, 8002, 8002B)
- Flow-Through sample method (70-120 ml/min) (8007, 8008)

**Performance**

**Measurement Range**
- 0-2000 ppm factory default
- Adjustable to 10,000 ppm with UIP software kit

**Accuracy**
±100 ppm or 7%, whichever is greater

**Elevation (Pressure) Correction**
Add 0.13% of reading per mm Hg decrease from 760 mm Hg (On-board correction, user set with UIP software)

**Response Time 0-90%**
<1 minute

**Warm-Up Time @ 25°C**
<2 minutes

**Operating Conditions**
- 15 to 32°C (60 to 90°F)
- 0 – 95% RH, non-condensing

**Storage Temperature**
-40° to 70°C (-40 to 158°F)

**Agency Certification**
FCC Part 15 Class B, CE, California Energy Commission

**Input/Output**

**Power**
- 18-30 VAC RMS, 50/60 Hz – half-wave rectified
- 18-42 VDC polarity protected
- 1.75 VA maximum average power
- 2.75 VA peak power

**Analog Output (Simultaneous)**
- 0 - 10 VDC (100 Ohms output impedance)
- 4 - 20 mA (RLmax = 500 Ohms)

**Relay Output**
Normally Open and Normally Closed (wire either way), gold bifurcated, 2A max. @ 24VAC. Adjustable setpoint, factory set at 1000 ppm, 50 ppm hysteresis.

**Wiring**
18-28 AWG stranded copper wire only. 2 wires each for power, analog output, relay

**Digital I/O**
RS-232 interface for use with optional PC software and cable in UIP kit 2072

**Warranty Repairs**
GE Sensing will repair Telaire product that fails to meet the terms provided for in the Return and Warranty Policy Statement (See, http://www.gesensing.com/service/brochures.htm). Warranty period shall start from date of manufacture and be based on product category and type of equipment as specified in Table 1: Product Warranty Periods. For all warranty repairs, GE Sensing will bear all product repair parts, labor, and standard ground shipping charges.

This product is covered by one or more of the following patents:

5,650,624/5,721,430/5,444,249/5,747,808/5,834,777/5,163,332/
5,340,986/5,502,308/6,344,798/6,023,069/5,370,114/5,601,079/
5,966,077/6,107,925/5,798,700/5,945,924/
5,945,924/6,255,653/6,250,133/6,285,290

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