Introduction

The **GE Telaire Ventostat® 8001/ 8002** carbon dioxide (CO_2) sensors and controllers are designed for *Demand Controlled Ventilation (DCV)* in buildings. This approach, using CO_2 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 A below.

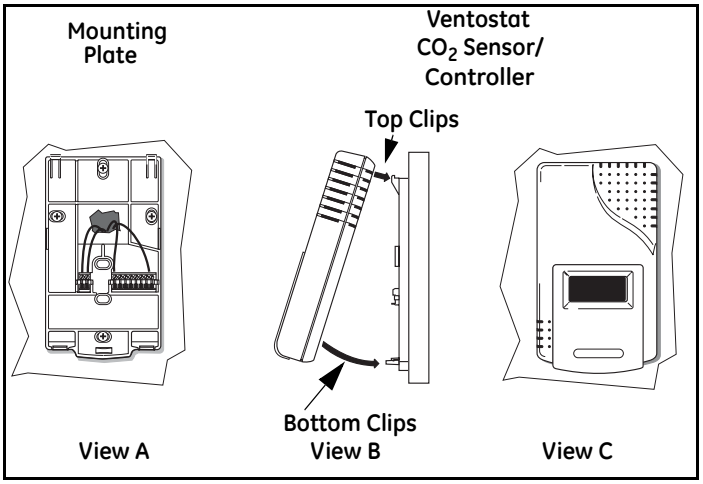

Figure 1: Ventostat® CO_2 Controller - Mounting

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 CO_2 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.

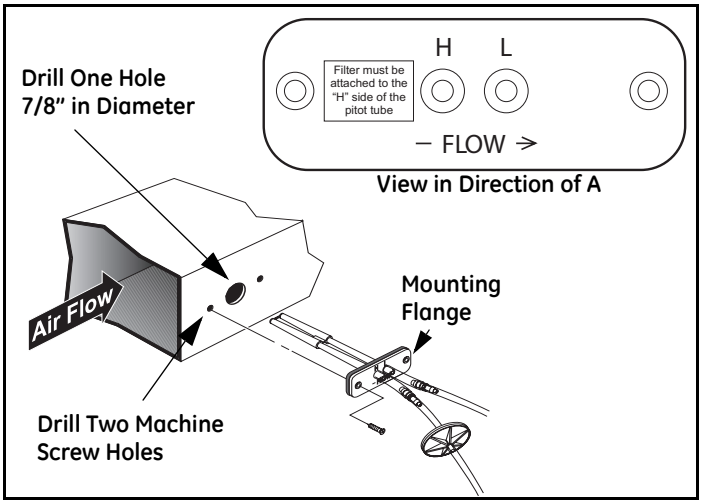

Figure 2: Pitot Tube - Installation

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 sensor and cut the tubing to the required length.
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 CO_2 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.

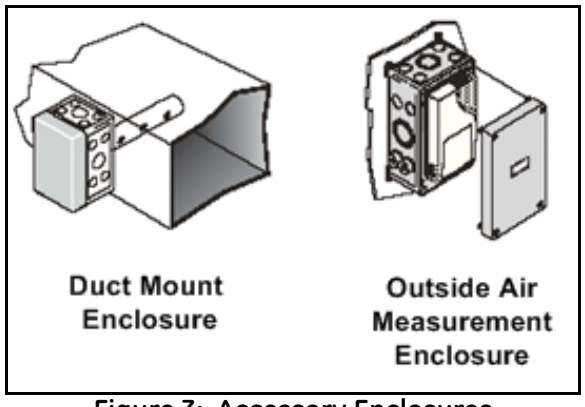

Figure 3: Accessory Enclosures

Typical Wiring Diagrams

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

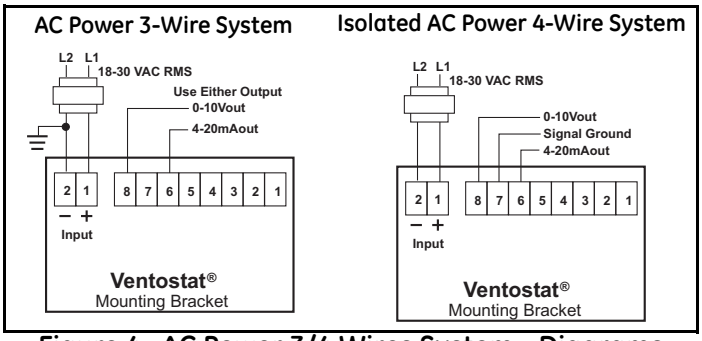

Figure 4: AC Power 3/4 Wires System - Diagrams

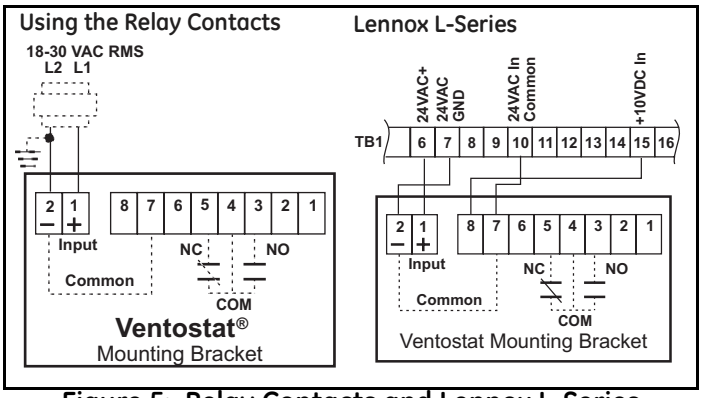

Figure 5: Relay Contacts and Lennox L-Series Diagrams

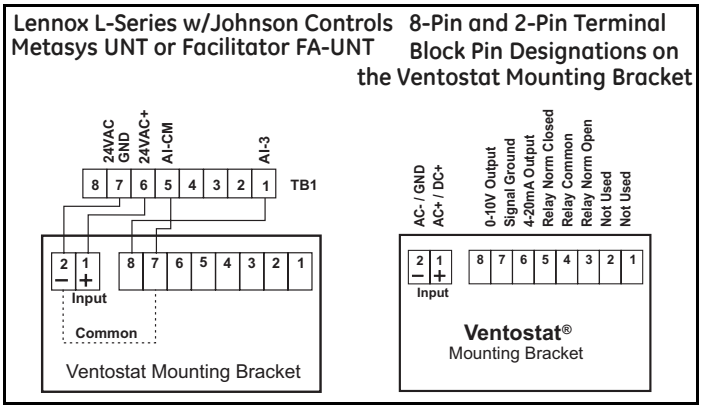

Figure 6: Lennox L-Series/Mounting Bracket Diagrams

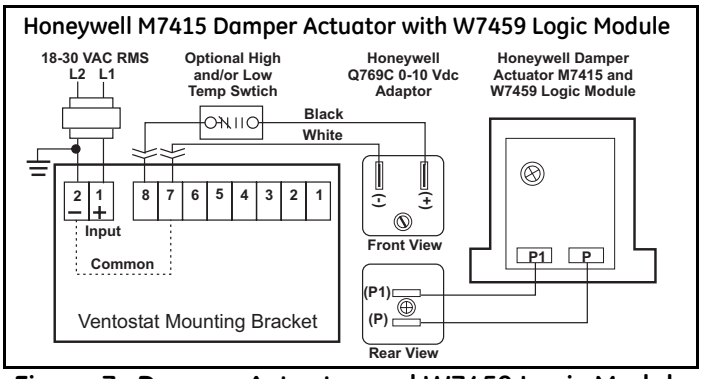

Figure 7: Damper Actuator and W7459 Logic Module Diagrams

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 CO_2 level) at the design load. The CO_2 sensor should use "STDSET#1."

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

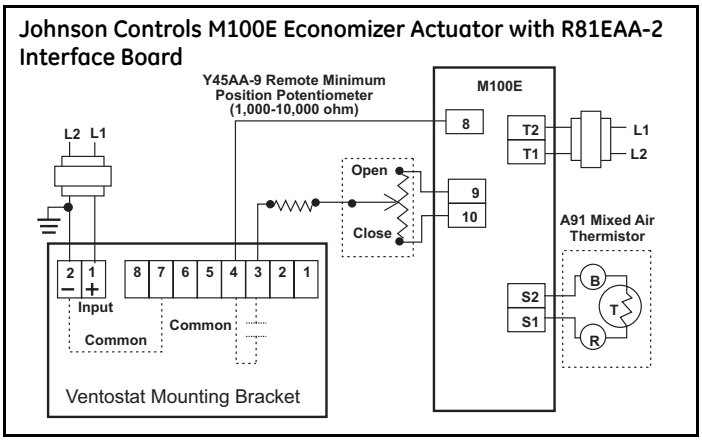

Figure 8: Economizer Actuator and Interface Board - Diagrams

Configuring the Sensor

The sensor has two different settings:

- User Adjustable Sensor Settings
- Factory Settings

User Adjustable Sensor Settings

The **GE Telaire 8000** series includes features which are user adjustable. These adjustments can be made using the keypad on display units, or by the PC based *UIP* program that communicates to the sensor via a custom RS232 interface cable.

Factory Settings

The default settings are the typical settings used by a building control system.

If the installation requires changes to the sensor, the user can customize certain characteristics of the sensor. For example, non-factory settings may be applicable when the sensor is being connected to equipment that has a fixed input range (e.g., actuators used with economizer systems).

Sensor Programming Features

Outlined below in Table 1 are the adjustable parameters of the sensor and the factory setting. In addition to offering these adjustable features, the programming interface allows for a fast and simple adjustment of sensor calibration.

Table 1: 8000 Series Adjustment Parameters and Factory Settings

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

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 CO_2 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 CO_2 can be used as an indicator of the presence of combustion fumes. As part of most types of combustion, 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

Setting No.	Type of Equipment	Type of Output	Ventilation Rate (cfm/ Person)	Analog Output	CO2 Control Range (ppm)	Optional Relay Setpoint (ppm)	Relay Hysteresis (ppm)
1	Interface w/Standard Building Control System	Proportional	Any	0 - 10V 4 - 20 mA	0 - 2000	1000	50
2	Interface w/Standard Building Control System	Proportional	Any	2 - 10V 7 - 20 mA	0 - 2000	1000	50
3	Interface w/Standard Building Control System	Exponential	Any	0 - 10V 4 - 20 mA	0 - 2000	1100	50
4	Economizer (Hvac)	Proportional	15	0 - 10V 4 - 20 mA	0 - 1100	1100	50
5	Economizer (Hvac)	Proportional	20	0 - 10V 4 - 20 mA	0 - 900	900	50
6	Economizer (Hvac)	Exponential	15	0 - 10V 4 - 20 mA	0 - 1100	1100	50
7	Economizer (Hvac)	Exponential	20	0 - 10V 4 - 20 mA	0 - 900	900	50
8	Health & Safety	Proportional	NA	0 - 10V 4 - 20 mA	0 - 9999	5000	500
9	Parking/Air Intakes/ Loading Docks	Proportional	NA	0 - 10V 4 - 20 mA	0 - 2000	700	50

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 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 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 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**.

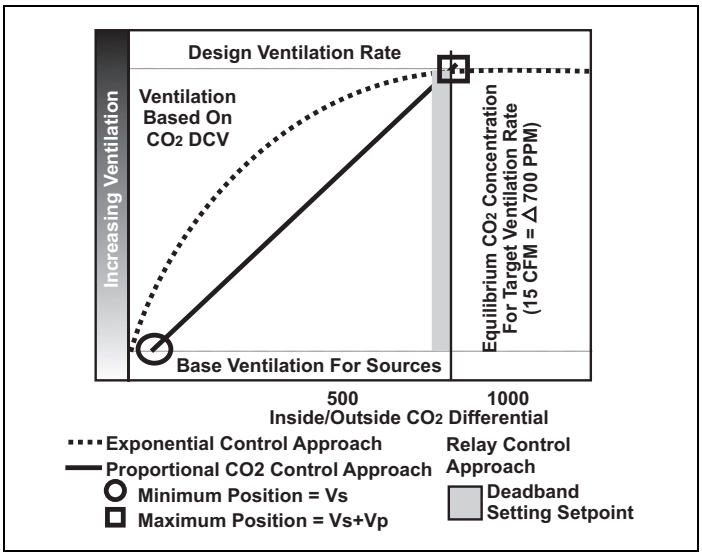

Figure 9: Design Ventilation Rate

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 select the desired pre-programmed number. See the section "Configuring the Sensor" on page 3, for the appropriate setting number.
4. Press **[ENTER]** to lock selection; press **[MODE]** to return to Normal Mode.

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.

Adjusting the Sensor with the UIP Program

The *UIP 8000* program (Model 2072) is a Windows based interface program designed to work with Ventostat ventilation controllers. It allows quick, easy adjustments to the output, elevation, relay setpoint, hysteresis and can be used with calibration for calibration. This program is ideal for units without display but can also be used with display. The *UIP* accessory package comes with the program and cables for connecting the sensor to a laptop computer equipped with a serial communications port. The main *UIP* screen (easy-to-use-program) is shown in Figure 10 below.

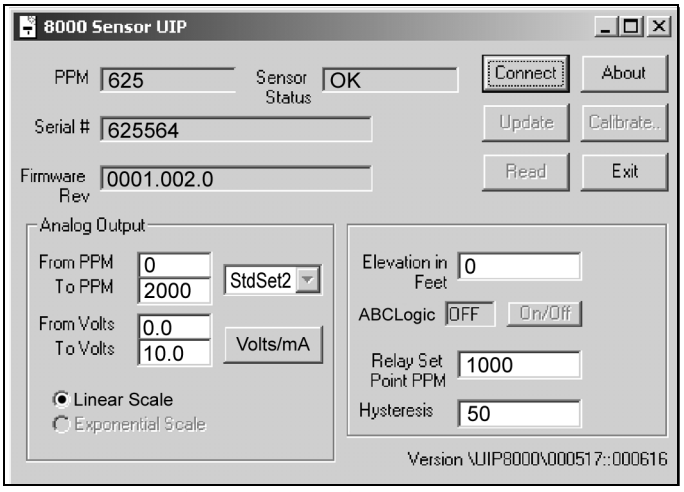

Figure 10: Main UIP Screen

Troubleshooting

See Table 3 below for symptoms and remedies.

Table 3: Symptoms and Remedies

Symptom	Remedy
LCD Display is blank after the 2 minute warmup period (8002 and 8008 models)	**Note:** *Follow the Remedy Steps in numerical order.* **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 **2.** Ensure that the sensor pins that connect to the 2-pin terminal block are not broken, bent, or damaged. **3.** If the LCD display is still blank after replacing the sensor on the mounting plate, call **GE Telaire** or your distributor/dealer for a return authorization number.
Green light is not illuminated (8001 and 8008 models) after the two minute warmup period.	**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. **2.** Ensure that the two pins on the sensor that connect to the 2-pin terminal block are not broken, bent, or damaged. **3.** If the green light is still not illuminated after replacing the sensor on the mounting plate, try verifying the sensor operation using the *UIP* 8000 computer interface or checking the output signal on the building automation system. **4.** If there is no output signal, call **GE Telaire** or your distributor/dealer for a return authorization number.

Table 3: Symptoms and Remedies (cont.)

Symptom	Remedy
Suspect the sensor is out of calibration.	**1.** Compare the sensor reading to a **GE Telaire** 7001 hand-held CO_2 monitor. **2.** Take another sensor from the building and replace the suspect sensor to see if the readings are similar. **3.** Connect the sensor outdoors (if possible). The readings should be between **350 and 450 ppm**. **4.** Connect the sensor to nitrogen gas from a Model 2075 calibration kit. The reading should be close to zero. **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 **GE Telaire** for factory calibration.
Relay does not actuate at the proper setpoint.	**1.** Using the LCD menu or the *UIP 8000* computer interface, verify that the relay setpoint is correct. **2.** Return the sensor to normal operating mode, and breathe into the sensor to raise the **ppm** value above the relay setpoint. **3.** If the relay does not actuate at the proper setpoint, call **GE Telaire** or your distributor/dealer for a Return Authorization (RA) number.

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/
5,691,704/5,767,776/5,966,077/6,107,925/5,798,700/5,945,924/
5,592,147/6,255,653/6,250,133/6,285,290

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