

# **TOXALERT MODEL AIR 2000**

**NOTE:** Toxalert's Model GVU-CO<sub>2</sub>  
Sensor is the same as the Air2000R.

**Microprocessor-based, Infrared  
Environmental CO<sub>2</sub> Sensor**

## **OPERATOR'S MANUAL**

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## Table of Contents

Introduction .....	1
Displays and Indicators .....	1
Specifications .....	2
Installation.....	3
Cover Removal.....	3
Mounting.....	3
Wiring .....	4
Power Supply .....	4
Signal Output .....	5
Verifying Voltage or Current Output Connection .....	6
Cover Replacement .....	6
Field Adjustments .....	7
Altitude Correction.....	7
Calibration.....	8
Verification Procedure .....	8
High CO <sub>2</sub> Limit .....	9
Adjusting the High CO <sub>2</sub> Limit .....	9
Optional High Limit Contact .....	10
Setting High Limit Contact Polarity .....	10
Duct Sampling Option .....	11
Overview .....	11
Duct Kit Contents.....	12
Duct Kit Installation.....	12
Calibration reference chart (Table 1).....	13

## **Introduction**

The Toxalert Model Air 2000 is a non-dispersive infrared analyzer for measuring environmental CO<sub>2</sub> concentration in ventilation systems and indoor living spaces. Its measurement range of 0 – 2000 ppm (parts per million; 1000 ppm = 0.1% by volume) covers the range required to monitor compliance with ASHRAE or other ventilation efficiency standards.

Packaged in a compact, distinctively styled enclosure, the Model Air 2000 can be discreetly installed anywhere from the board room to the boiler room. Standard center wiring access and fully floating outputs make installation a snap.

The Model Air 2000 provides several output alternatives. A voltage (0-10VDC) or 4 – 20 mA current output is standard. An optional LCD readout is available. An optional relay contact can be configured to open or close above a user-adjustable setpoint.

A simple one-point calibration procedure and a built-in calibration port that requires no special fittings or adapters make the Toxalert Model Air 2000 simple to maintain.

## **Displays and Indicators**

The basic Model Air 2000 has a single green LED on the front panel which illuminates whenever the unit is operating. This LED is on steadily when the measured concentration is below the high CO<sub>2</sub> limit setpoint, and blinks whenever the concentration is above the setpoint.

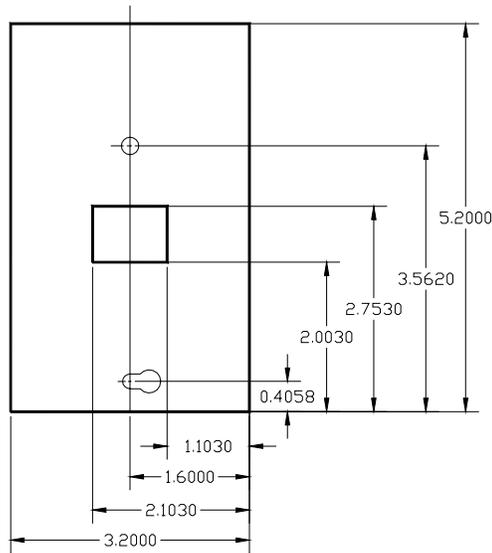
The standard factory setpoint is 1000 ppm, but can be easily adjusted in the field. The procedure for adjusting the high CO<sub>2</sub> limit setpoint is described on page 9.

The display option adds a 4 digit liquid crystal display (LCD) to the front panel. The display shows the measured CO<sub>2</sub> concentration in parts per million (ppm). 1000 parts per million equals 0.1% by volume.

## Specifications

Operating principle	Non-dispersive infrared (NDIR)	
Gas sampling method	Diffusion or sample draw	
Measurement range	0-2000 ppm CO <sub>2</sub>	
Typical drift (per year)	±75 ppm (@ 1200 ppm)	
Accuracy	±5% of reading or ±75 ppm, whichever is greater	
Repeatability	±20 ppm	
Recommended calibration interval	Five years	
Response time	Less than 1 minute	
Operating temperature range	0 to 50◊ C (32◊F to 122◊F)	
Operating humidity range	0 – 90% RH (non-condensing)	
Storage temperature	-30 to +60◊ C (-22◊F to 140◊F)	
Power requirements	20 – 28 Vrms AC, 18 – 30 VDC	
Power consumption	Less than 2 W @ 24VAC	
Calibration adjustments	Span only (offset electronically nulled)	
Calibration verification time	10 minutes typical	
Dimensions	5.2” x 3.2” x 1.4”	
Voltage output (linear)	0 – 10 volts DC standard	
Current output (linear)	4 – 20 mA (RL ≤ 500 Ohms)	
Warm-up time	3 minutes	
Weight	6.5 Oz. (.35 Kg)	
Optional digital display	4 digit, .35” LCD	
Optional high limit contact	setpoint range	0 to full scale
	contact polarity	jumper selectable
	contact rating	2A @ 24VAC
Operating life expectancy	10 years typical	
Warranty	1 year	

## **Installation**



**Figure 1:** *Toxalert Model Air 2000 Mounting Dimensions*

## **Cover Removal**

To open the Model Air 2000 use a coin in the slot on the bottom to release the snap. Lift the cover up slightly to disengage the closure and remove cover with a downward motion to clear the catch at the top of the unit.

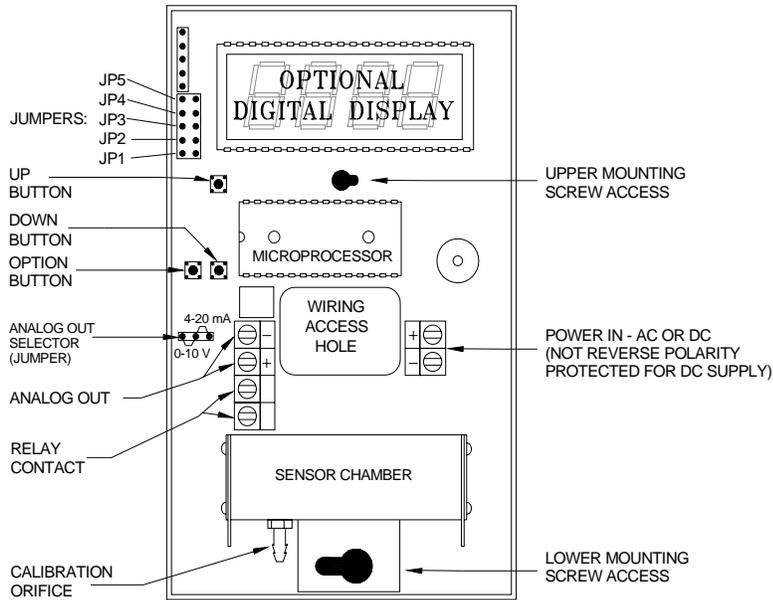
The locations of controls and terminals on the main circuit board are shown in Figure 2 on page 4.

## **Mounting**

The Model Air 2000 is designed for flush mounting with two fasteners. The locations of the mounting points (shown in Figure 1) allow direct mounting on a standard simplex (single circuit) junction box. There is a wiring cutout in the center of the unit near the terminal strips.

## Wiring

This section describes the external connections to the Model Air 2000. Wiring enters the chassis through the cutout in the center of the unit.



**Figure 2:** Model AIR 2000 Component Locations

## Power Supply

The Model Air 2000 will operate from an AC or DC input voltage between the values called out in the specifications on page 2. The power supply leads are connected to the two-terminal power connector shown in Figure 2.

**The Model Air 2000 must never be connected directly to line power.** Operation at voltages higher than specified will damage the unit and void the warranty.

When operating from DC power, the polarity of the power leads must be as shown in Figure 2. Reversed polarity connection will not damage the unit, but will make it inoperable until the connection is reversed.

## **Signal Output**

The Toxalert Model Air 2000 provides either a 0 – 10 volt or a 4 – 20 mA current loop output at the two terminals of the analog output connector shown in Figure 2.

The type of analog output is determined by the setting of the analog output selector shown in Figure 2.

The analog output of the Model Air 2000 is completely isolated from the power supply. The common outputs of multiple units can be connected together with no interaction regardless of power supply hook-up.

## **Voltage**

When the outboard and middle pins of the analog output selector are connected with the shorting block, a voltage output appears between the two terminals marked ANALOG OUTPUT. The output voltage increases linearly from 0 volts at the low output threshold to 10 volts at the high output threshold. The unit is shipped from the factory with the low output threshold at 0 ppm and the high output threshold at 2000 ppm.

## **Current**

When the inboard and middle pins of the analog output selector are connected with the shorting block, a current output appears between the two terminals marked ANALOG OUTPUT. The output current increases linearly from 4 mA at the low output threshold to 20 mA at the high output threshold. The unit is shipped from the factory with the low output threshold at 0 ppm and the high output threshold at 2000 ppm.

If the total resistance between the two terminals exceeds the specified maximum loop resistance, the output current may be erroneously low at high concentrations.

## Verifying Voltage or Current Output Connection

After the voltage or current output of the Model AIR 2000 is connected to a controller or indicator, the following check should be performed to ensure that the connection has been properly established and the Model 2000 is transmitting the correct value:

1. **Be sure that the output select jumper is set correctly for voltage or current output. If this is not done first, the following check may produce incorrect results.**  
**Note whether the shorting block at jumper JP5 is covering both pins or only a single pin**, then borrow the shorting block and slide it over the two pins of jumper JP4 (see Figure 2). The display (if present) will show 'SEL' to indicate selection of voltage calibration mode.
2. Momentarily closing JP5 will set the unit to full scale output (10V or 20 mA). **Do not** press the buttons on the unit as this will affect the output calibration. If the receiving device does not indicate a full scale reading after JP5 is closed, verify that the wiring is correct.
3. Remove the shorting block from JP4 and restore it to its original position at jumper JP5. The Model Air 2000 will reset and it's output now corresponds to the actual detected CO<sub>2</sub> concentration.

## Cover Replacement

Engage the top center of the cover under the latch at the top of the base, then press the bottom of the cover onto the bottom of the case until it latches.

## Field Adjustments

### Altitude Correction

The Model AIR 2000 is factory calibrated for operation at sea level. When operated at higher elevations, the calibration must be adjusted by the amount shown in the altitude correction table at the bottom of the page.

#### Altitude Correction Procedure

To adjust the calibration of a unit currently calibrated for sea level operation to a new altitude proceed as follows:

1. Let the Model AIR 2000 stabilize to the ambient CO<sub>2</sub> concentration and record the reading in ppm.
2. Multiply the reading by the scale factor corresponding to the operating altitude in the altitude correction table. For instance, if the unit is operating at an altitude of 4000 feet, the scale factor from the table is 1.14. If the concentration reads 420ppm, multiply 420 times 1.14 giving 478 ppm. Adjust the display to read 480 ppm.
3. Remove the AIR 2000's cover.
4. **Note whether the shorting block at jumper JP5 is covering both pins or only a single pin**, then borrow the shorting block and slide it over the two pins of jumper JP2 (see figure 2 on page 4). Use the 'UP' and 'DOWN' buttons to change the concentration to the value just calculated.
5. Remove the shorting block from jumper JP2 and return it to its previous position over on or both pins of jumper JP5.
6. Replace the cover.

**ALTITUDE CORRECTION TABLE**

Altitude (feet)	Multiplication Factor	Altitude (feet)	Multiplication Factor
0	1.0	3000	1.10
500	1.02	3500	1.12
1000	1.03	4000	1.14
1500	1.05	4500	1.16
2000	1.07	5000	1.18
2500	1.08	5500	1.20

## Calibration

The following section describes the calibration verification procedure and calibration adjustment procedures.

### Verification Procedure

A quick but approximate verification can be done by supplying the unit with outside air and letting the reading stabilize. CO<sub>2</sub> concentrations in outside air are typically between 350 ppm and 450 ppm.

A more accurate calibration check requires the use of a calibration gas of known concentration. A calibration kit is available from the factory.

To verify the AIR 2000's calibration, proceed as follows:

1. Carefully remove the front cover of the unit.
2. If there is no display on the unit being calibrated, connect a current or a voltmeter to the analog output terminals. Check the setting of the analog output selector (see Figure 2 on page 4) to determine whether the unit is set for voltage or current output.
3. **Note whether the shorting block at jumper JP5 is covering both pins or only a single pin**, then borrow the shorting block and slide it over both pins of jumper JP2 (see figure 2 on page 4).
4. Remove the dust cover from the calibration nipple, attach a flexible tube and establish a flow of between 50 and 100cc/min (0.1 to 0.2 SCFM) of calibration gas through the sensor. Allow approximately two minutes for the reading to stabilize.
5. **(Refer to Table 1, page 13)**. If the reading differs by more than  $\pm 75$ ppm from the known concentration of calibration gas, use the 'UP' and 'DOWN' buttons (see figure 2 on page 4) to adjust the reading.
6. When the reading agrees with the concentration of the calibration gas, remove the shorting block on jumper JP2, and replace it in its original position at jumper JP5.
7. Turn off the calibration gas flow, disconnect the tubing from the calibration nipple and replace its dust cover. Remove the meter leads from the terminal strip and replace the front cover.

## **High CO<sub>2</sub> Limit**

An adjustable high CO<sub>2</sub> limit is a standard feature of the model AIR 2000. The front panel LED changes from steady to blinking when the indicated concentration is above the high CO<sub>2</sub> limit value. An optional contact closure is available which opens or closes when the high limit is exceeded.

### **Adjusting the High CO<sub>2</sub> Limit**

The setpoint value is adjusted by closing jumper JP3 (see figure 2 on page 4). If the display is present when JP3 is closed it will show the current high limit setpoint in ppm of CO<sub>2</sub>.

If there is no display this setting can be adjusted by using a meter connected to the output. In this calibration mode the analog output is 2000 ppm at full scale (i.e. 10.0 volts or 20.0 mA). If the voltage output is selected, this scaling corresponds to 1 ppm per 5 millivolts or 1 volt per 200 ppm. (Factory default setting is 1000 ppm which equals 5 volts or 12 mA at the analog output.)

The setpoint is adjusted with the 'UP' and 'DOWN' buttons while JP3 is closed. When JP3 is opened, the new relay setpoint takes effect and is stored in non-volatile memory.

The setpoint hysteresis is approximately 40 ppm.

## **Optional High Limit Contact**

The high CO<sub>2</sub> limit option provides a dry (i.e. unpowered) contact closure that activates when the detected concentration rises above the high CO<sub>2</sub> limit. The high limit is adjustable from 0 to 2000 ppm, full scale of the unit.

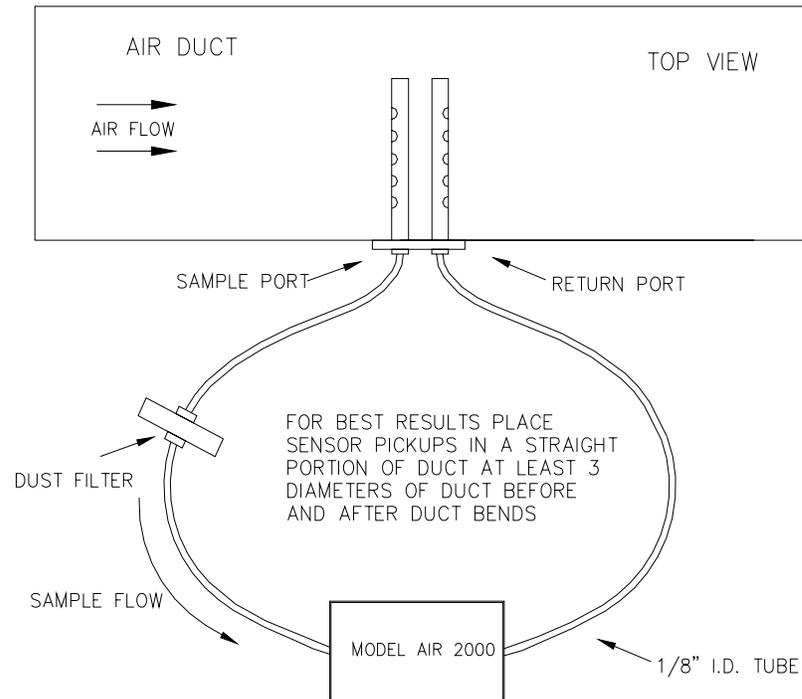
### **Setting High Limit Contact Polarity**

The polarity of the high limit contact is set with jumper JP5 as shown in the table below.

<b>Jumper JP5</b>	<b>Relay Operation</b>
OPEN	Normally closed- opens above setpoint
CLOSED (Factory default)	Normally open- Closes above setpoint

To open jumper JP5 remove the shorting block from the two pins, and replace it so that it engages only a single pin of the jumper. The shorting block should not be removed; it is required during the calibration procedure.

## Duct Sampling Option



### **Overview**

The duct sampling option is used to divert a portion of the duct airflow through the AIR 2000. The difference between the total pressure at the upstream sample port and the static pressure at the downstream return port propels the sample stream. Minimum recommended flow rate is 200 feet per minute.

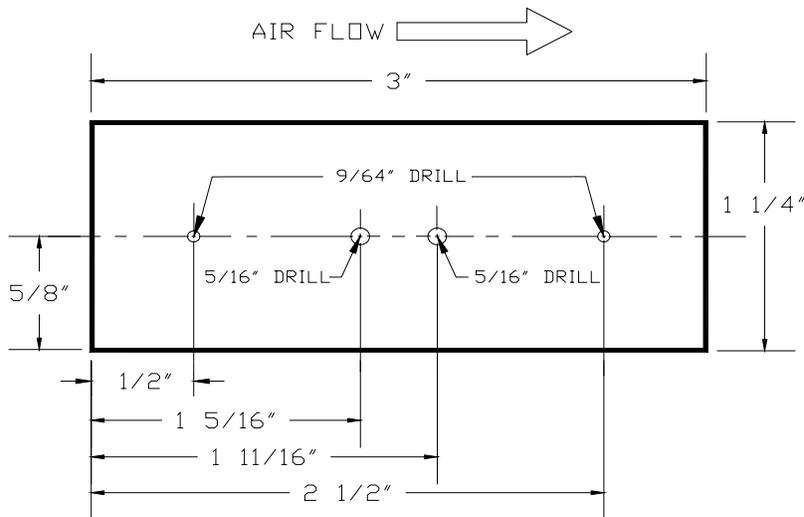
A Model Air 2000 with the duct sample option has a sample draw adapter fitted to the bottom of its enclosure. The duct probe assembly is connected to tubing nipples on the adapter.

## Duct Kit Contents

- |                       |                             |
|-----------------------|-----------------------------|
| 1 Dust filter         | 2 Sheet metal Screws        |
| 1 Duct probe assembly | 2 Lengths of 1/8" ID Tubing |

## Duct Kit Installation

1. Select a point along the duct where the probe assembly can be installed into unrestricted airflow without interfering with any internal duct components such as dampers, radiators, etc.
2. Mark and drill the four holes for the duct probe as shown in figure 4. The centerline must be parallel to the airflow through the duct.
3. Install the duct probe assembly through the holes just drilled. The sample port must be on the upstream side. Secure the probe assembly in place with the two sheet metal screws.
4. Connect the open ends of the two tubes from the probe assembly to the two sample ports on the base of the AIR 2000. It makes no difference which tube is connected to which port on the AIR 2000.



DUCT PROBE INSTALLATION DIMENSIONS

**Table 1.**

CO2 Concentration In PPM	Voltage Output (0 to 10V Range)	Current Output (mA) (4 to 20 mA Range) (250 to 500 ohm load)
0	0	4.0 mA
300	1.5V	6.4 mA
400	2.0V	6.8 mA
450	2.25V	7.2 mA
500	2.5V	7.6 mA
600	3.0V	8.0 mA
700	3.5V	9.6 mA
800	4.0V	10.4 mA
900	4.5V	11.2 mA
1000	5.0V	12.0 mA
1100	5.5V	12.8 mA
1200	6.0V	13.6 mA
1300	6.5V	14.4 mA
1400	7.0V	15.2 mA
1500	7.5V	16.0 mA
1600	8.0V	16.8 mA
1700	8.5V	17.6 mA
1800	9.0V	18.4 mA
1900	9.5V	19.2 mA
2000	10.0V	20.0 mA