



# Air Check✓ EX *LEL Gas Monitor*

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## Instruction Manual

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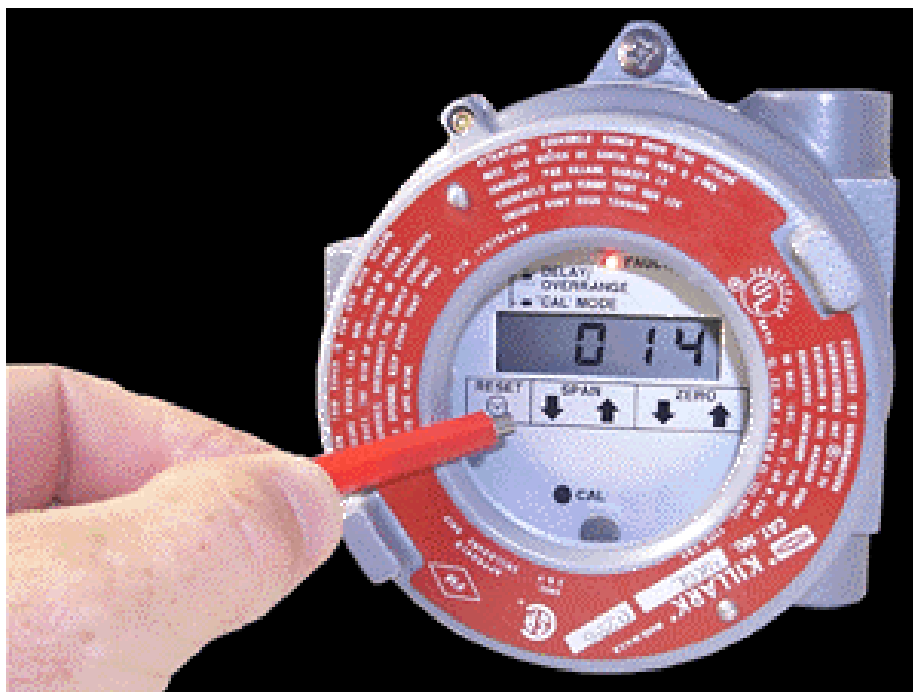
# 1: Introduction

The *Air Check ✓ EX* is an explosion-proof toxic gas monitoring system designed for the continuous detection and measurement of toxic gas leaks. It is a single point monitoring system housed in an explosion-proof enclosure. The enclosure is suitable for use in Class 1, Group B, C, D and Class 2, Group E, F, and G hazardous areas.

➔ **NOTE:** Acetylene monitor enclosure is special rated for Group A

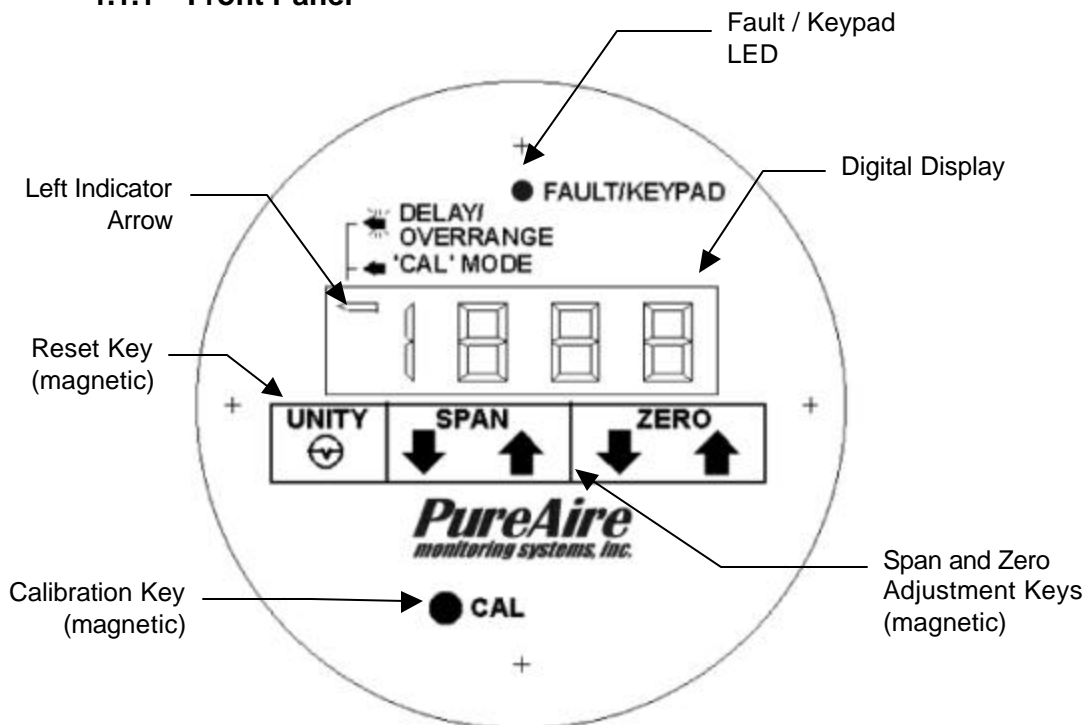
The system has the following features:

- Explosion-proof transmitter enclosure
- Non-intrusive, one-man calibration
- Local digital display
- 4-20 mA output
- Supervised sensor cell
- 24 VDC operation
- A variety of output options (isolated analog output, Modbus, alarm relays)



## 1.1 Component Identification

### 1.1.1 Front Panel



**Digital Display** — A 3 1/2 digit LCD which continuously displays the measured gas concentration value when in the normal monitoring mode. Displays zero and span values when in the Calibration mode. Target gas and unit of measure appear adjacent to the digital display.

**Left Indicator Arrow** — Unlit during normal operation. Lit continuously when in the Calibration mode, flashes (slow) during power up and calibration delay periods, flashes (fast) when an over-range condition is detected.

**Fault/Keypad LED** — This key is used as a dual-purpose indicator. It momentarily lights to provide visual feedback that the magnetic key is being activated. It also flashes once per second, without a magnet near the keypad, to signal a Fault condition.

**Cal Key** — A magnetic key used to place the instrument in the Calibration mode.

**Span Adjustment Keys** — Magnetic keys used to adjust the instrument's span (gain) up/down when in the Calibration mode. Display current gain setting when touched with a magnet during normal operation.

**Zero Adjustment Keys** — Magnetic keys used to adjust the instruments zero up/down when in the Calibration mode. Display current span adjustment when touched with a magnet during normal operation.

**Unity Key** — Used for calibration when a new LEL sensor is installed. When a new LEL sensor is replaced, selecting the Unity key will center both the zero and span pots. For more information consult PureAire.

**1.1.2 Overall**

**Explosion-Proof Housing** — Meets requirements for installation in Class 1, Group B, C, and D and Class 2, Group E, F, and G hazardous areas. Magnetic keypad permits calibration without declassifying area.

**Front Panel** — Incorporates local digital display, magnetic keys, etc. See 1.1.1 above for front panel component details.

**Sensor / Sensor Cover** — Renewable, plug-in electrochemical sensor with threaded cover.

**1.1.3 Gas Sensor**

**LEL Sensor** — This is a disposable cell that has an operational life of approximately 4 to 5 years.

## 2: Specifications

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### 2.1 Performance Specifications

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Sensor Type:	Disposable, LEL catalytic bead
Response Time:	Within 30 seconds to T90.
Repeatability:	±10% of full scale.
Operating Temperature:	14° to 113°F (0° to +40°C); consult PureAire for lower operating temperatures.
Humidity:	Typically 5 to 95% RH.

### 2.2 Gas Detection System

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Type:	Proprietary catalytic bead.
Sensor Life:	4 to 5 years under normal conditions.
Detectable Gases:	Combustible Gases: Acetylene Methane (CH <sub>4</sub> ) Gasoline Hexane Propane Hydrogen IPA

### 2.3 Signal Outputs

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Local Display:	3-1/2 digit LCD
Analog Output:	4-20 mA; isolated 4-20 mA output optional
Serial Output:	Optional Modbus RS-485 serial interface
Alarm Relays:	Optional SPDT High, Warning, and Fault alarm relays

### 2.4 Electrical Requirements

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Power: 19-48 VDC; less than 4 watts. (200mA)

### 2.5 Physical Characteristics

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Dimensions:	5.50 (W) x 10.6 (H) x 4.55 (D) inches.
Weight:	Approximately 6 pounds.

### 2.6 Safety Characteristics

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Transmitter enclosure suitable for Class 1, Group B, C, D and Class 2, Group E, F, and G hazardous areas. Also meets NEMA 4 with included O-ring.

## 3: Installation

### 3.1 Mounting

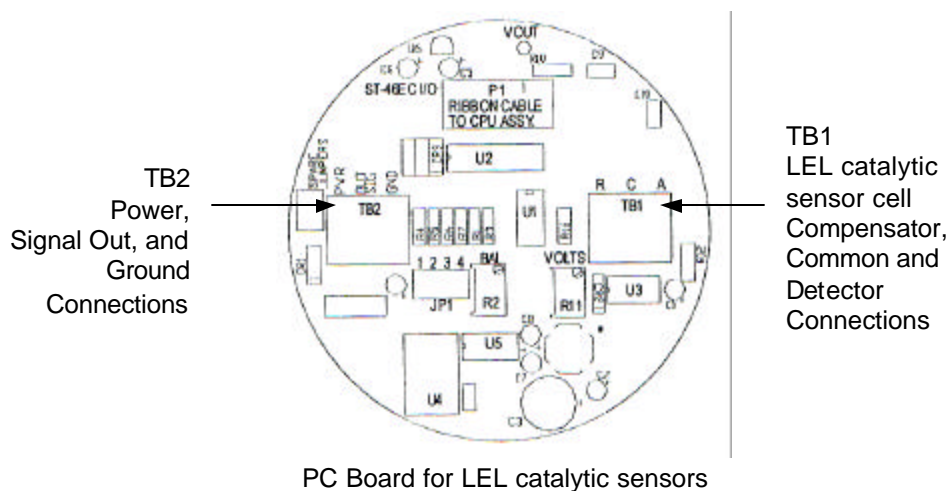
The *Air Check ✓ EX* monitoring system is packaged in an explosion-proof housing with three  $\frac{3}{4}$  inch NPT conduit hubs.

The system should be mounted on a vibration-free surface and out of direct sunlight. The sensor should facing toward the ground.

### 3.2 Electrical

The *Air Check ✓ EX* is a 3-wire device. There is a positive 24 VDC power wire and a positive output signal wire, which is typically 4-20 mA. The third wire is system common and serves as power supply and signal returns. These connect to the three point terminal block labels TB2. An earth ground lug inside the enclosure is provided for earth grounding of shield wires.

PureAire recommends the use of a General Cable #E2203S.30.86 or equivalent for analog output and 24 VDC power input. The maximum permissible cable length is 0.62 miles (1 km).

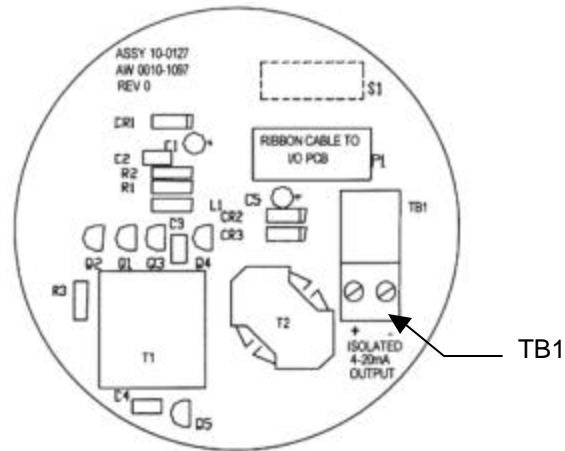


### 3.3 Optional Outputs

➔ **NOTE:** *The Air Check ✓ EX may be configured with one of the following optional outputs isolated 4-20 mA, Modbus serial output, SPDT alarm relays. Optional outputs are provided using an auxiliary, factory-installed electronics board. The instrument can only accommodate one optional output.*

#### 3.3.1 Isolated 4-20 mA

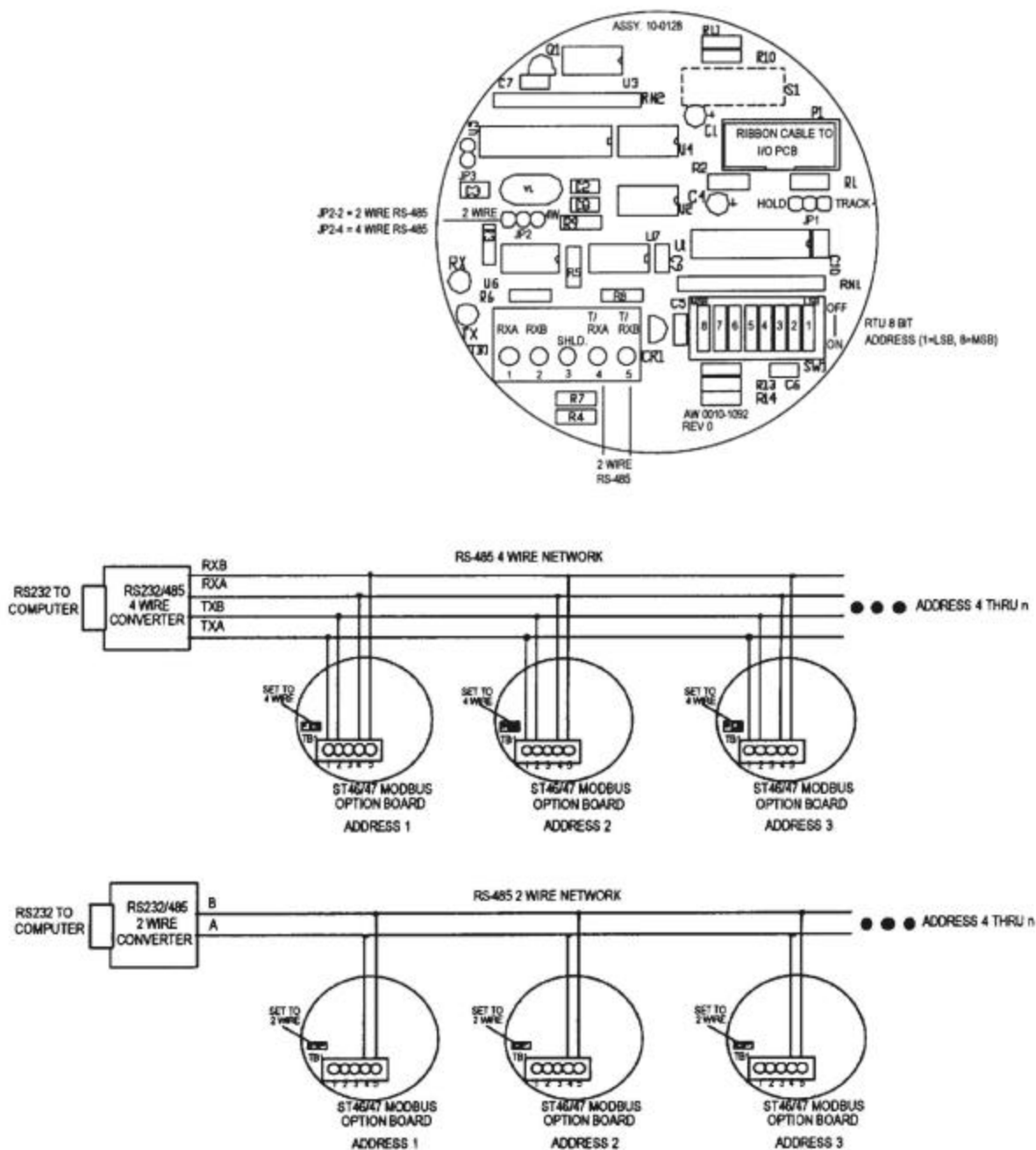
An optional isolated 420 mA output board is available. A 2-point terminal strip (TB1) provides the 1500 V isolated 4-20 mA output signal.



### 3.3.2 Modbus RS-485 Serial Interface

The Modbus RS-485 Serial Interface board allows up to 128 *Air Check ✓ EX* gas monitors to communicate to a Modbus master device on a single cable. The gas detector functions as a slave device; a PLC or PC running MMI or BUI software equipped with a Modbus driver functions as the master.

The RS-485 standard allows cable lengths up to 4000 feet between the Modbus master and slave. Both 4-wire full duplex and 2-wire half duplex connections are supported by the Modbus RS-485 serial interface option.



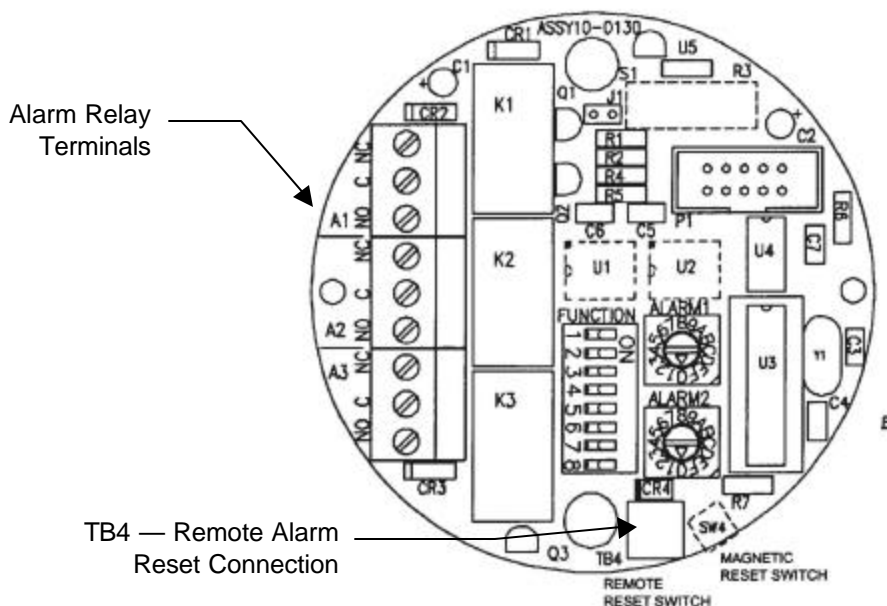
➔ **NOTE:** See Appendix for RTU address, Registers, and Function Code information.

### 3.3.3 Alarm Relays

The alarm option provides 5-amp resistive form C relays for Alarm 1, Alarm 2, and Alarm 3 conditions. They may be wired for either normally open or normally closed operation.

- ➔ **IMPORTANT:** *The relay contacts are rated for 5 amp resistive loads. Appropriate surge suppressors should be installed across loads to prevent arcing on the contacts. Arcing generates high levels of RFI that may interfere with measurement signals.*

The alarm relay PCB also incorporates a remote reset switch (TB4) for use if the alarm relays are configured for latching operation (see Appendix).



These alarms are factory-set as follows:

**Alarm 1** — One times TLV, non-latching.

**Alarm 2** — Two times TLV, latching.

**Alarm 3** — This is a fail-safe Fault relay and is activated when a sensor fault, such as a missing sensor, is detected. It also indicates loss of power conditions.

- ➔ **NOTE:** *Alarm 1 and 2 setpoints and operation (latching/non-latching/fail-safe) are user-adjustable. See the Appendix for more information.*

## 4: Normal Operation

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The **Air Check ✓ EX** is a single point monitoring system designed for the continuous detection and measurement of toxic gas leaks.

### 4.1 Power Up Delay

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The **Air Check ✓ EX** incorporates a power up delay that holds the analog output at 4 mA for one minute after power is applied. This allows the sensor to stabilize and reduces the possibility of triggering an erroneous alarm.

### 4.2 Concentration Display

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This is a real time display of the measured concentration of the target gas. The concentration value appears on the LCD; the target gas and unit of measure (PPM, PPB, etc.) are indicated adjacent to the digital display.

When the instrument is in the normal monitoring mode, the left arrow indicator on the LCD will be “off.” Should the measured concentration exceed the range of the instrument however, the left arrow indicator will flash rapidly and three horizontal dashes (- - -) will appear on the LCD.

### 4.3 Analog Output

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During normal operation, outputs an analog signal directly proportional to the measured gas concentration, with 4 mA being “0” and 20 mA being full scale.

### 4.4 Fault Alarm

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The **Air Check ✓ EX** features a self-supervised gas sensing system which alerts the operator to sensor faults, such as a missing sensor, or negative drift. In the event a sensor fault is detected, the analog output will drop to 0 mA, FLt will appear on the local digital readout, and the red Keypad/Fault LED will flash at one second intervals. If the instrument is configured with the alarm relay option, the Alarm 3 (Fault) relay will also be activated.

### 4.5 Concentration Alarms

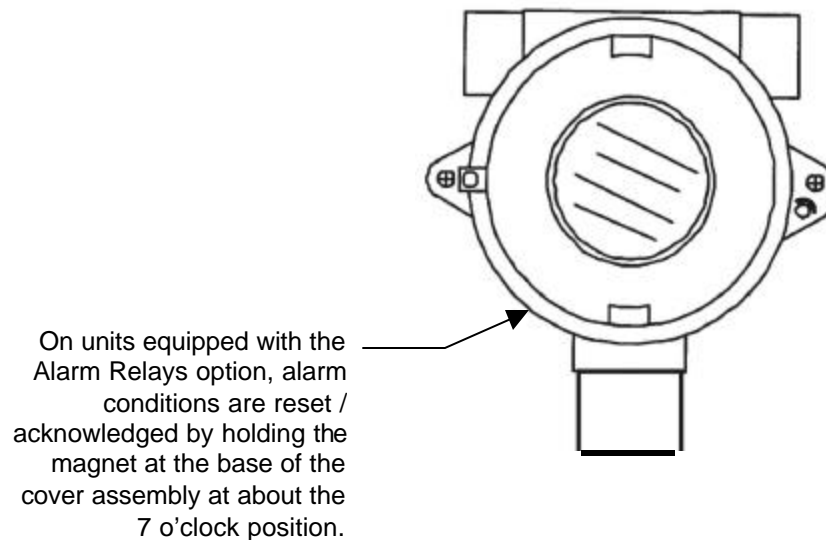
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If the **Air Check ✓ EX** is equipped with the Alarm Relay option, the appropriate Alarm 1 or Alarm 2 relay will activate when the measured gas concentration exceeds the alarm setpoint.

## 4.6 Alarm Reset

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If the instrument is equipped with the Alarm Relays option and one or more alarms are configured for latching operation (see Appendix), alarm conditions must be acknowledged by manually resetting the alarm. This manual alarm reset may be performed remotely via a control room signal or locally by holding the magnet at about the 7 o'clock position on the base of the cover assembly.



## 4.7 Loss of Power Indication

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In the event the **Air Check ✓ EX** loses VDC power, the local display go blank and the 4-20 mA analog output signal will drop to 0. If the instrument is configured with the optional Fault Alarm Relay, that relay will de-energize.

## 4.8 Routine Maintenance Schedule

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Continuous gas detection systems depended upon to measure and detect hazardous gas leaks in the workplace require periodic maintenance to ensure proper operation. The frequency with which this routine maintenance is required depends on the environment, since temperature, humidity, gas concentrations, and dust all affect system operation.

The following tables are intended to serve as general guidelines for routine maintenance. The conditions in your particular application, as well as your organization's maintenance policies, will ultimately determine the best routine maintenance schedule for your equipment.

### 4.8.1 Routine Visual Checks

Item	Status With No Gas Present
Local Display	Display should read "0.0" ("0" for LEL gases)
Fault Keypad LED	Should not be illuminated
4-20 mA Output	Output should be 4 mA
Gas Concentration Alarm Relays (optional)	De-energized
System Fault Relay (optional)	Energized

### 4.8.2 Recommended Routine Maintenance Schedule

Routine Visual Checks	Monthly
Sensor Calibration	Every 6 months

## 5: Maintenance & Calibration

Maintenance and calibration should be performed only by qualified personnel.

### 5.1 Sensor Calibration

The **Air Check ✓ EX** system requires periodic calibration with the appropriate standard gas. Calibration should be performed whenever 6 to 12 months has passed.

#### 5.1.1 Optional Calibration Equipment

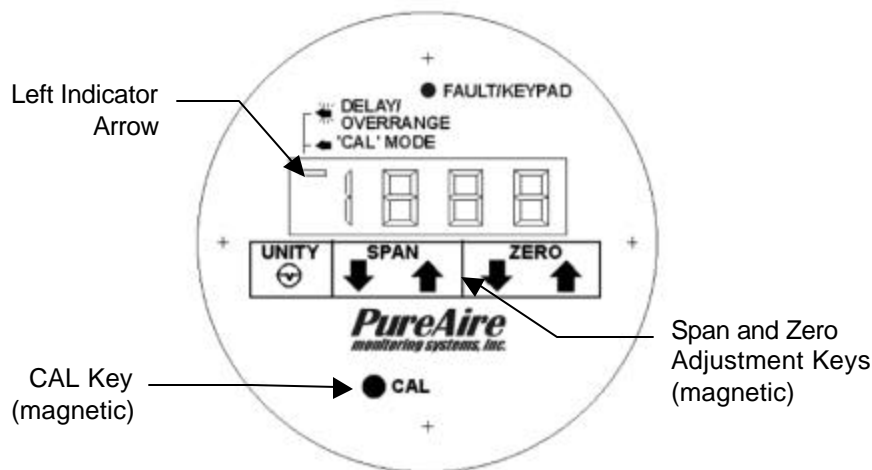
The following equipment is available from PureAire to facilitate gas calibration:

Part Number	Description	Quantity
Contact PureAire	Span Gas, specify gas 50% LEL	1ea
690100	Calibration Cap for LEL Sensor Cell	1ea

#### 5.1.2 Entering the Calibration Mode

The **Air Check ✓ EX** features a magnetic keypad, which permits one-man, non-intrusive calibration. All zero and span adjustments can be made without removing the cover of the enclosure housing.

To place the instrument in the Calibration mode, briefly hold the magnet over the CAL key located on the lower left of the front panel. The left indicator arrow on the upper left side of the LCD will light and the 4-20 mA signal will hold at 1.5 mA, indicating that the instrument is in the Calibration mode.



#### 5.1.3 Zero Calibration

➔ **IMPORTANT:** *This procedure should be performed under normal monitoring conditions, without any of the target gas present.*

1. Check the instrument's gas concentration reading on the local display.
2. If the display does not read a steady "0," hold the magnet over the UP ZERO or DOWN ZERO keys and adjust the reading for the correct zero value.

### 5.1.4 Span Calibration from span gas cylinders

➔ **CAUTION:** *Be sure to observe all safety guidelines when generating and using calibration gases.*

➔ **NOTE:** *Gas generation kits are available through PureAire. These kits include instructions and materials for generating calibration gases and precise methods for accurately measuring the concentration of these gases.*

➔ **NOTE:** *The gas concentration should be close to, but never exceed, full scale.*

1. Recheck the instrument's zero reading; adjust as required.
2. Connect the calibration cap to the LEL sensor.
3. Open the regulator valve on the span gas cylinder and expose the sensor cell to the span gas for 1 to 2 minutes until the gas reading stabilizes.
4. If the correct gas concentration is not displayed; With the left indicator arrow still lit, Hold the magnet over the UP SPAN or DOWN SPAN key and adjust the display reading for the correct value.

**NOTE:** *For calibrating Gasoline using Hexane, hexane has a low vapor pressure and the sensor cell will continuously rise, therefore only expose the cell to a flow rate of 200cc/min for 1-2 minutes and then adjust the span to the calibration standard. If the cell is exposed to higher flow rates the system will rise too quickly and make it difficult to adjust the span.*

5. Close the regulator valve on the span gas cylinder and remove from the inlet of the calibration cap. Remove calibration cap from the sensor cell by gently rocking the cap as you pull downward. Permit the instrument to return to a zero reading.
6. If the instrument has not returned to zero after 3 minutes readjust the zero as required by repeating the procedure outlined in section 5.3.4.
7. Exit the Calibration mode by touching the magnet to the CAL key. The instrument will return to normal operation after a one-minute delay.

➔ **NOTE:** *The left indicator arrow will flash slowly and the 4-20 mA output will be held at 4 mA during the delay period.*

➔ **NOTE:** *If the CAL mode is not exited manually, it will exit automatically after five minutes of inactivity.*

### 5.1.5 Displaying Zero / Gain Settings

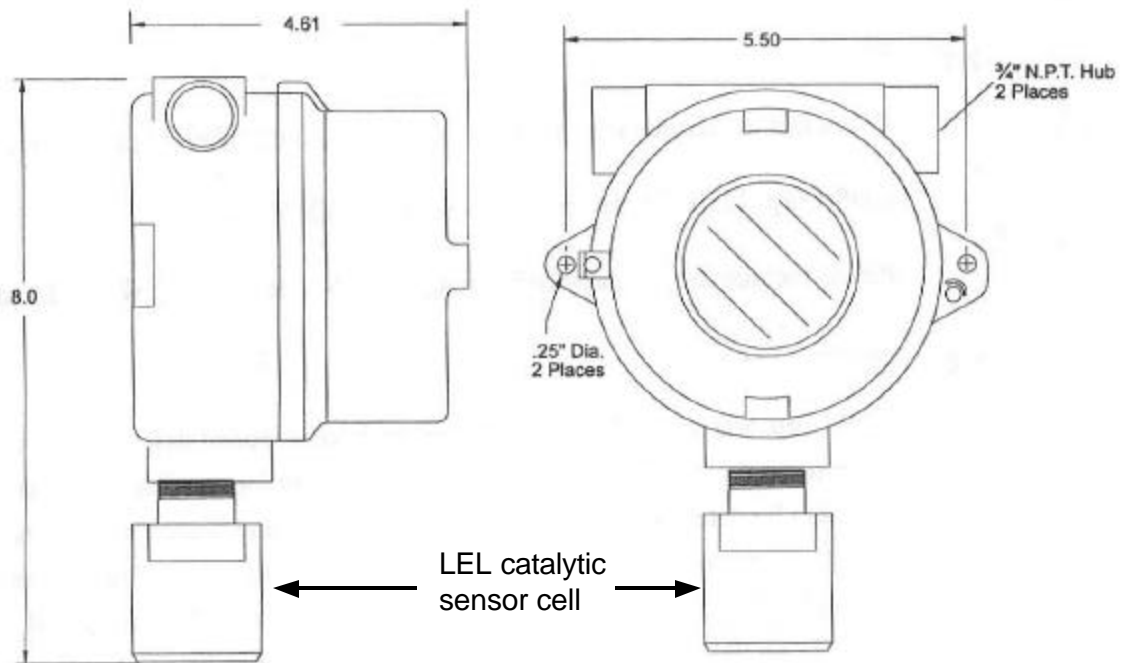
The Zero and Span values applied during calibration may be read on the front panel of the LCD after exiting the Calibration mode. These values provide an indication of how much sensor sensitivity has declined over time — the higher the gain, the greater the degree of sensor sensitivity deterioration.

These values are displayed as follows:

1. Exit the Calibration mode and wait for the one minute delay to end (the left indicator arrow will stop flashing and remain unlit).
2. Hold the magnet over the UP SPAN key. The amount of zero offset, in percent of full-scale, will be displayed.
3. Hold the magnet over the DOWN SPAN key. The amount of gain applied will be displayed. This value will range between 0.5 and 2.0.

## 6: Diagrams & Schematics

### 6.1 Dimensional Drawing



## 7: Appendix

### 7.1 Modbus RS-485 Serial Interface

The optional Modbus RS-485 serial interface board allows up to 128 **Air Check ✓ EX** gas monitors to communicate to a Modbus master device — such as a PLC or PC running MMI or GUI software equipped with a Modbus driver — on a single cable. With this option, the Modbus master can interrogate each connected slave device (i.e., **Air Check ✓ EX**) and retrieve information made available in specific register locations. It supports cable lengths up to 4000 feet and both 4-wire full duplex and 2-wire half duplex connections.

#### 7.1.1 RTU Address

The 8-position DIP switch on the Modbus RS-485 PCB allows different RTU addresses to be assigned to each **Air Check ✓ EX**. The eight DIP switches represent an 8-bit binary number with 1 = LSB and 8 = MSB.

➔ **EXAMPLE:** OFF, ON, ON, OFF, ON, OFF, OFF, OFF = 0110 1000 = RTU address 104.

A unique RTU address must be assigned to each **Air Check ✓ EX** communicating on the same RS-485 port.

#### 7.1.2 Modbus Data Registers and Function Codes

The following table identifies the **Air Check ✓ EX** Modbus register locations and the function codes available:

Variable	Alias	Read Function Code	Write Function Code
<b>FAULT BIT</b>	<b>12000</b>	<b>2</b>	<b>NA</b>
0 = OK			
1 = Fault			
<b>ALARMS</b>	<b>12008</b>	<b>2</b>	<b>NA</b>
Returned as 8 discrete bits packed in the low byte of the response data.			
12008:bit 0 = Fault (tracks 12000)			
12008:bit 1 = Alarm 1			
12008:bit 2 = Alarm 2			
12008:bit 3 = Not used			
12008:bit 4 = Not used			
12008:bit 5 = Not used			
12008:bit 6 = Alarm 2 acknowledge			
12008:bit 7 = Not used			
<b>A2D Raw</b>	<b>33000</b>	<b>3 &amp; 4</b>	<b>NA</b>
10-bit value representing the A2D value of 0 to 1023 for -20 to 103% FS (197=0% and 1003 = 100%).			

Variable	Alias	Read Function Code	Write Function Code
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<b>A2D ASCII</b>	<b>31010 (6 bytes)</b>	<b>3 &amp; 4</b>	<b>NA</b>
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6 bytes of data representing the scaled span value, including the decimal point. The first 5 bytes contain the value; the last byte is a space. They are arranged with the first byte as the MSD with leading zero spacing. For example, with a span value of 1234 with 1 decimal point, the correct value of 123.4 is returned for 100% of full scale as follows:

Byte	0	1	2	3	4	5	6	7	8	9	10
Response	Address	04	06	31	32	33	2E	34	20	Crcl	Crch
ASCII Character	Address	◆	♠	1	2	3	.	4	sp	Crcl	Crch

With the same settings, a 50% of full scale reading of 617 would be:

Byte	0	1	2	3	4	5	6	7	8	9	10
Response	Address	04	06	20	36	31	2E	37	20	Crcl	Crch
ASCII Character	Address	◆	♠	sp	6	1	.	7	sp	Crcl	Crch

<b>EUNITS</b>	<b>40319-40324</b>	<b>3</b>	<b>6</b>
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6 ASCII characters assigned to the engineering units read as bytes.

<b>Measurement Name</b>	<b>40325-40340</b>	<b>3</b>	<b>6</b>
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16 ASCII characters assigned to the unit identifier read as bytes.

<b>Span</b>	<b>40343</b>	<b>3</b>	<b>6</b>
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An integer from 1 to 9999 used to scale the A2D ASCII value.

<b>Alm1Setpoint</b>	<b>40345</b>	<b>3</b>	<b>6</b>
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<b>Alm2Setpoint</b>	<b>40347</b>	<b>3</b>	<b>6</b>
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Integer compared to the A2D Raw value to determine alarm 1 or 2 status. The 0 to 100% set point must be scaled from 197 to 1003. This is done by using (Alarm%\*806) + Offset. Example: A 40% set point would be computed as (.4\*806) + 197.

<b>D.P. Position</b>	<b>40349</b>	<b>3</b>	<b>6</b>
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Determines how many decimal positions return with the A2D ASCII value. Valid range is 0 to 3.

<b>Alm1Trip</b>	<b>40351</b>	<b>3</b>	<b>6</b>
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<b>Alm2Trip</b>	<b>40359</b>	<b>3</b>	<b>6</b>
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Set to 255 alarms on high, set to 0 alarm on low.

<b>Alm1Latch</b>	<b>40353</b>	<b>3</b>	<b>6</b>
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<b>Alm2Latch</b>	<b>40355</b>	<b>3</b>	<b>6</b>
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Set to 0 causes alarm 1 or 2 to auto reset, set to 255 causes alarm 1 or 2 to latch.

<b>AlmZoneWord</b>	<b>40357</b>	<b>3</b>	<b>6</b>
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16 bit value which may be used as a zone alarm mask for the master.

<b>AlarmReset</b>	<b>2000</b>	<b>NA</b>	<b>5</b>
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Setting to 255 causes any latched or acknowledgeable alarms to reset.

<b>InitRtu</b>	<b>2010</b>	<b>NA</b>	<b>5</b>
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Setting to 255 causes a restart which applies updated configuration variables.

### **7.1.3 Modbus Configuration Software**

All of the register values described in 7.1.2 above must be configured via the serial port. This is a one time requirement unless changes within the application necessitate adjustments after the initial installation. This functionality may be built into the Modbus master or may be performed with a portable computer running a simple software application. Consult PureAire for more information on this software.

## 7.2 Alarm Relays

The Alarm option provides 5-amp resistive form C relays for Alarm 1, Alarm 2, and Alarm 3 conditions.

- ➔ **IMPORTANT:** *The relay contacts are rated for 5 amp resistive loads. Appropriate surge suppressors should be installed across loads to prevent arcing on the contacts. Arcing generates high levels of RFI that may interfere with measurement signals.*

### 7.2.1 Alarm 3 (Sensor Fault Alarm)

Alarm 3 is typically a fail-safe Fault relay and is activated by a sensor fault, such as low electrolyte or a missing sensor. Since it is fail-safe, it also indicates loss of power conditions. If a Fault alarm is not needed, this relay can be set to trip with the Alarm 2 relay (see 7.2.3 below).

### 7.2.2 Alarm 1 and Alarm 2 (Concentration Alarms)

Alarms 1 and 2 are intended as low and high concentration alarms. They are factory set at one and two times TLV respectively. Alarm 1 is non-latching; Alarm 2 is latching.

#### Changing the Alarm Setpoint

The alarm setpoints for Alarms 1 and 2 are controlled by 16 position rotary DIP switches. Both alarm setpoints incorporate approximately 1.5% hysteresis; therefore, the signal must drop about 1.5% of the trip level to reset the alarm. This prevents “chatter” when the input signal equals the trip level.

The trip points are various rotary switch positions are as follows:

Switch Position	Trip Level (% full scale)
0	Alarm Inactive
1	5%
2	10%
3	15%
4	20%
5	25%
6	30%
7	35%
8	40%
9	45%
A	50%
B	55%
C	60%
D	65%
E	70%
F	75%

### 7.2.3 Alarm Relay Configuration

Alarms 1, 2, and 3 may be configured in for latching / non-latching operation, fail-safe operation, etc. The exact configuration of these alarms is determined by the positions chosen on the FUNCTION DIP switch.

Switch	ON	OFF
1	Alarm 1 = High Trip	Alarm 1 = Low Trip
2	Alarm 1 = Non-Latching	Alarm 1 = Latching
3	Alarm 1 = Normal	Alarm 1 = Fail-safe
4	Alarm 2 = High Trip	Alarm 2 = Low Trip
5	Alarm 2 = Non-Latching	Alarm 2 = Latching
6	Alarm 2 = Normal	Alarm 2 = Fail-safe
7	Alarm 2 = No acknowledge	Alarm 2 = Acknowledge
8	Alarm 3 = Fault	Alarm 3 = Trips with Alarm 2

➔ **IMPORTANT:** *PureAire recommends that Alarms 1 and 2 always be set for High Trip (activate when measured gas value rises about setpoint) except for instruments monitoring for oxygen deficiency. Setting these alarms for Low Trip will cause them to alarm when the measured gas concentration falls below the setpoint level.*

### 7.2.4 Weatherproof Rain Shield

For LEL monitoring outdoors the use of a weatherproof rain shield is recommended to protect the LEL sensor from being damaged from splashing rain. If water reaches the catalytic bead inside the flame arrestor, it will damage the bead. The use of the rain shield will prevent water from reaching the catalytic bead. Contact PureAire for more information.