USER GUIDE

LAB MONITOR FOR TRACE OXYGEN

LM-O_2-A, Part Number 103570 (110 VAC)
LM-O_2, Part Number 103569 (110 VAC)
LM-O_2-A, Part Number 103601 (220 VAC)
LM-O_2, Part Number 103600 (220 VAC)

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1 INTRODUCTION

1.1 GENERAL

The Vacuum Atmospheres Lab Monitor accurately measures and displays trace oxygen levels in inert gas systems. Using an industry standard electrochemical sensor with oxygen specific chemistry, the analyzer generates an output current in proportion to the amount of oxygen present in the sampled gas stream. The sensor is linear throughout its range, and because the sensor has zero output in the absence of oxygen, there is no need to zero the analyzer. Calibration of the unit is performed using ambient air.

Two models are available:

LM-O_2-A	Lab Monitor for Trace Oxygen, with alarm, form C relay contacts and 0-1 VDC output
LM-O_2	Lab Monitor for Trace Oxygen, basic model

Both oxygen analyzer models feature an autoranging 3 1/2 digit LCD display, front panel sensor access, and a manual isolation valve for air calibration using the front panel potentiometer.

Housed in a compact enclosure, the analyzer is easy to set up and operate. The small footprint allows mounting in various convenient locations on or near the glove box. Two ports are required in the glove box, one to be plumbed for sample in to the analyzer, and the other for the sample return. A small sample pump is provided, to be placed anywhere in the glove box and connected to the analyzer sample in port. All installation hardware is provided. The analyzer requires 24 VDC power from a supplied adapter, and the sample pump requires one 110 or 220 VAC receptacle inside the glove box.

Vacuum Atmospheres Company also manufactures a Lab Monitor for Trace Moisture in the same form factor as the oxygen analyzer. If both trace oxygen and moisture measurement are to be added to your system, the units may then be stacked, placed side by side, or kept in separate locations as the need dictates. See the separate *Lab Monitor for Trace Moisture User Guide* for full information.

1.2 LAB MONITOR CONFIGURATION

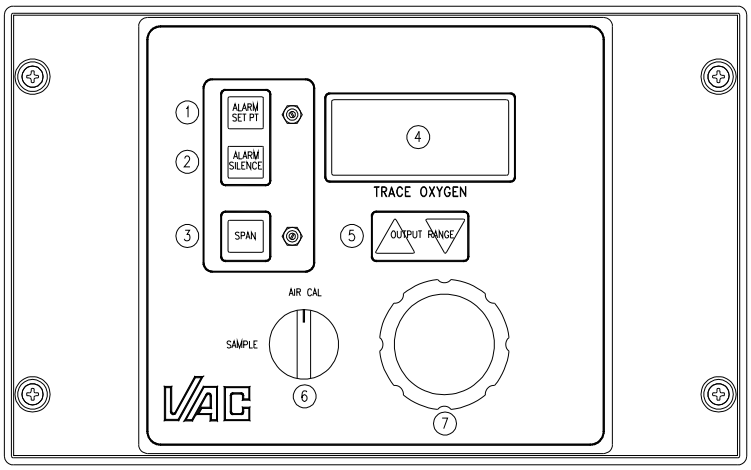


Figure 1-1
Front View, LM-O_2-A

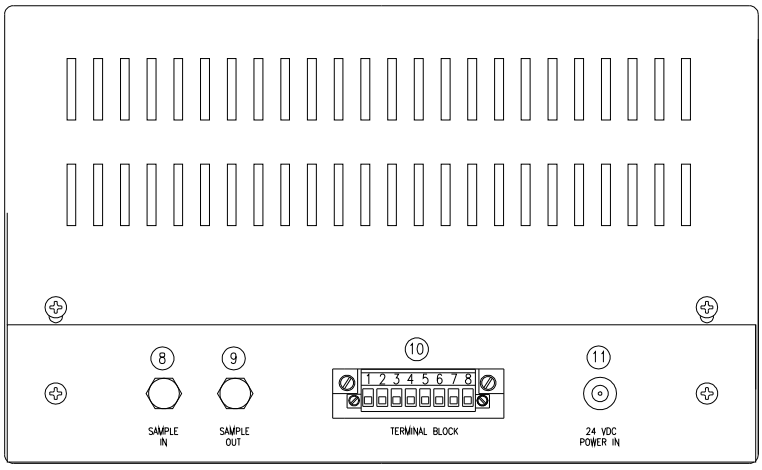


Figure 1-2
Rear View, LM-O_2-A

1. Alarm Set Point Button and Adjustment Potentiometer
2. Alarm Silence Button
3. Span Button and Adjustment Potentiometer
4. LCD Display
5. Output Range Selection Button
6. Sample/Air Cal Gas Selection Valve
7. Sensor Cell Cap
8. Sample Gas In Port
9. Sample Gas Out Port
10. Analog Output and Alarm Relay Contacts
11. 24 VDC Power In (from power adapter)

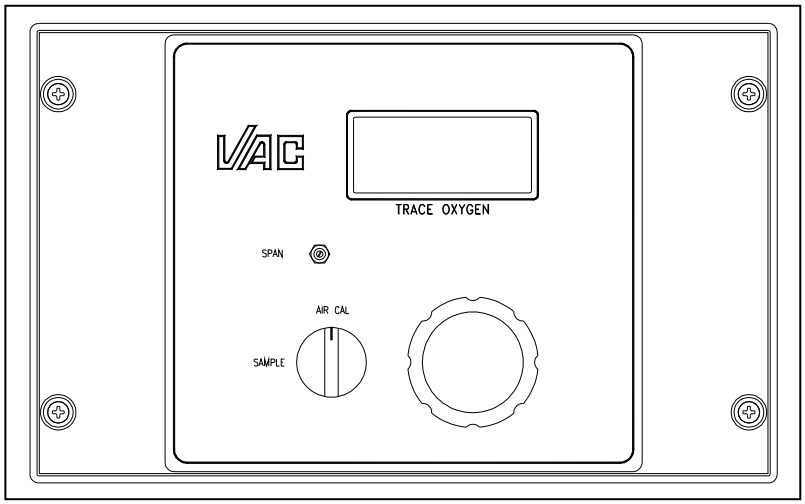


Figure 1-3
Front View, LM-O_2

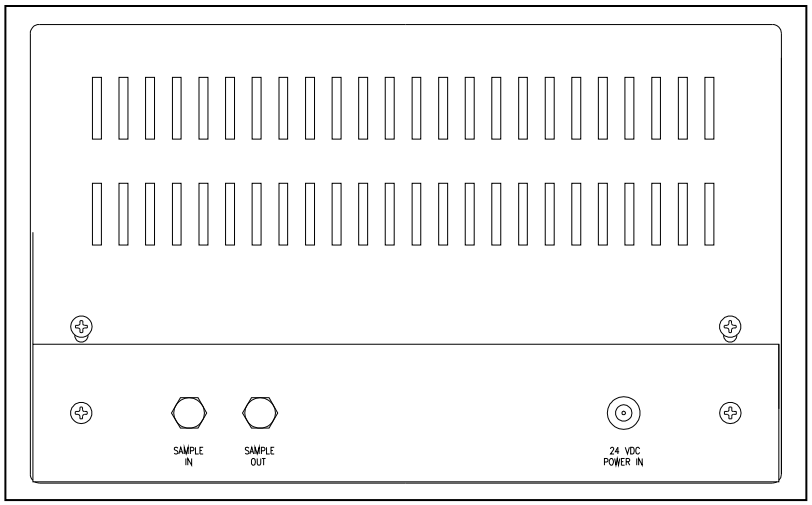


Figure 1-4
Rear View, LM-O_2

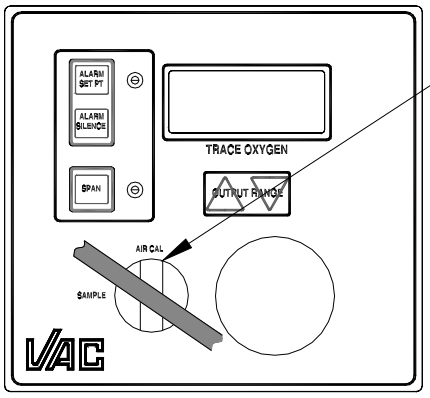
1. Span Potentiometer
2. LCD Display
3. Sample/Air Cal Gas Selection Valve
4. Sensor Cell Cap
5. Sample Gas In Port
6. Sample Gas Out Port
7. 24 VDC Power In (from power adapter)

2 INSTALLATION

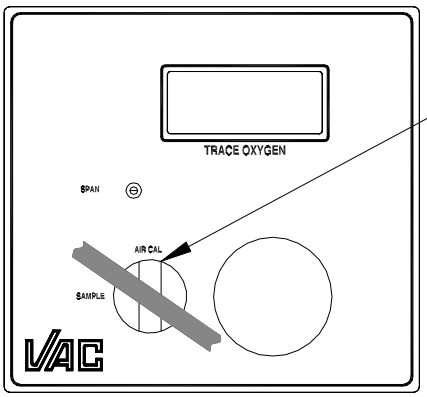
2.1 UNPACKING AND INSPECTION

Remove all the plastic wrapping from the unit. Carefully inspect for any sign of shipping damage. Call VAC immediately if any damage is noted.

NOTE: Leave the SAMPLE/AIR CAL gas selector valve in the AIR CAL position. There is red tape on this valve as a reminder. Rotating the oxygen analyzer SAMPLE/AIR CAL gas selector to the SAMPLE position will expose the sensor cell to air, which will quickly destroy its ability to detect trace oxygen levels later.



! DO NOT rotate valve to SAMPLE position prior to installation



! DO NOT rotate valve to SAMPLE position prior to installation

2.2 ELECTRICAL UTILITIES

The analyzer requires 24 VDC power, provided by the supplied power adapter. Depending on your model, the adapter plugs into 110 or 220 VAC, 50/60 Hz power.

2.3 ANALYZER PLACEMENT

Find a secure, level location for the analyzer, on or near the glove box. Do not plug in the power adapter at this point.

2.4 CONNECTION OF GAS SAMPLE LINES

The inlet and outlet gas sample lines should be connected to the glove box using the supplied 1/8" diameter copper tubing. Figure 2-1 shows a typical connection configuration using the hardware supplied with the analyzer. An appropriate thread sealant (such as teflon tape) should be used when installing fittings. The analyzer sample inlet port should be fitted with the supplied 1/8" hose barb fitting on the inside of the glove box. The return line to the glove box should ideally be located at some distance from the other port to allow proper sampling of the atmosphere.

When plumbing the analyzer, the tube length should be kept as short as is practically possible, with a minimum amount of bends. A flowmeter may be installed in the sample inlet line if desired. There is a flow adjustment on the sample pump, but it should not be necessary to change it . The analyzer needs a very minimal flow rate to operate properly, typically around 0.1 SCFH.

Before proceeding, make sure the tubing connections are tight and leak free. Any leaks in the system will contaminate the glove box atmosphere and reduce the quality of the inert atmosphere.

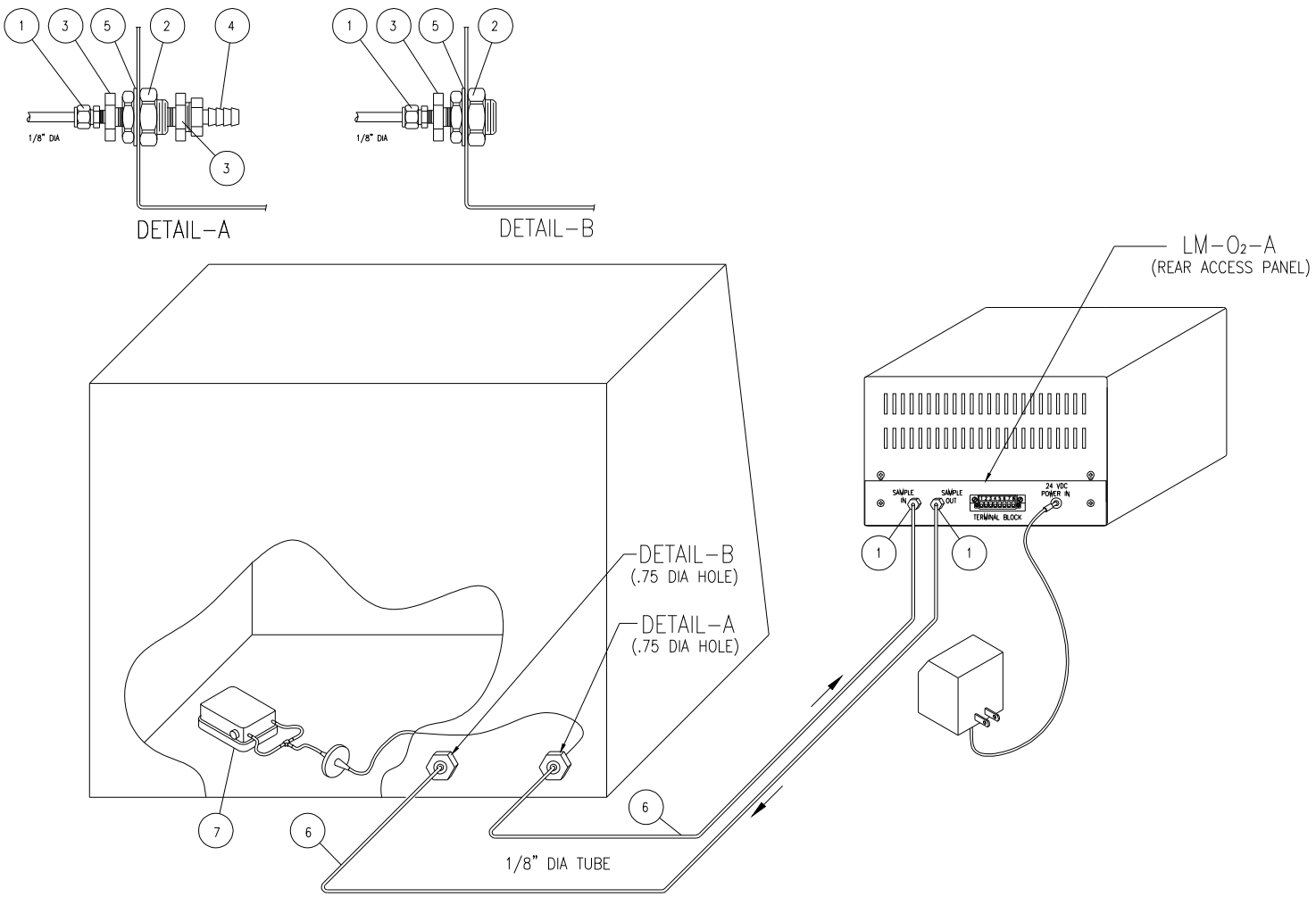
2.5 INSTALLATION OF SAMPLE PUMP

The supplied sample pump may be placed at a convenient location inside the glove box. See Fig. 2-1. Depending on your model, the pump requires 110 or 220 VAC, 50/60 Hz power. Don't plug in the pump at this point. The outlets of the pump have been teed together. Attach a piece of the supplied tubing to the tee, and install the filter. Use another piece of the tubing to connect the filter to the hose barb fitting on the glove box.

2.6 CONNECTIONS TO TERMINAL STRIP

The LM-O_2-A has a terminal strip connector on the rear panel. A mating connector is supplied with screw connections for 0-1 volt analog output and form C relay contacts.

Pin	Function
1	Analog Out +
2	Analog Out -
3	Shield
4	Spare
5	Spare
6	Relay COM
7	Relay N.C.
8	Relay N.O.



Item	Description
1	Connector, 1/8” Tube O.D. x 1/8” NPT, VAC 3138
2	Adapter, ¼” NPT, Bulkhead, VAC 2117
3	Bushing, ¼” NPT – 1/8” NPT, VAC 2027
4	Adapter, Hose Barb, 1/8” NPT, VAC 2691-5
5	Washer, Stat-O-Seal, VAC 4288
6	Tube, Copper 1/8” O.D., VAC 82
7	Sample Pump Assy, VAC 900072 (110 VAC) or VAC 103641 (220 VAC)

Figure 2-1
Connection of Sample Lines to Glove Box

2.7 INSTALLATION CONCLUSION

Before applying power and opening the sensor to the inert atmosphere, make sure the glove box is at a relatively low ppm level (<200 ppm or so), either by purging the box or by some other method. Remember that prolonged exposure to high levels of oxygen will shorten the life of the sensor.

3 START UP

3.1 START UP PROCEDURE

If the sample lines are tight and leak free, and the glove box is at approximately 200 ppm or below, you may apply power to the analyzer and the sample pump. Remove the red tape from the SAMPLE/AIR CAL valve, and rotate the valve to the SAMPLE position. After a short initialization period, the display should indicate the approximate oxygen level.

3.2 INITIAL CHECKS

Monitor the oxygen level after the reading stabilizes – if the level continues to climb you may have a leak. If you suspect a leak, turn the SAMPLE/AIR CAL valve back to the AIR CAL position and try to isolate the leak.

Note: DO NOT pressurize or pull a vacuum on the sensor while troubleshooting a leak problem! The AIR CAL valve position will isolate the sensor from the sample lines (as long as the cap is screwed down tightly)

If the oxygen level stabilizes or decreases and you are satisfied the gas connections are leak free, at that point the analyzer should be calibrated on air (see the Calibration section).

4 CALIBRATION

The calibration procedure differs depending on the model.

4.1 CALIBRATION – LM-O_2-A (WITH ALARM)

NOTE: The oxygen analyzer should be calibrated approximately every 30 days. If the glove box atmosphere is known to have been consistently in the low ppm range, the calibration interval may be increased to approximately 60 days, which will prolong the cell life. Exposure to air rapidly depletes the fuel cell, so do not calibrate the unit on air for more time than is absolutely necessary.

1. Rotate the SAMPLE/AIR CAL gas selector valve to the AIR CAL position. This will seal off the sample in/out gas ports between the analyzer and glove box and therefore will not allow ambient air to diffuse in.
2. Unscrew the cell cap from the front panel of the analyzer. This will expose the oxygen sensor to ambient air which consistently contains 20.9% oxygen. QUICKLY start fanning air towards the exposed oxygen sensor. This will bring the level of oxygen inside the sensor compartment to 20.9% from previous low levels. After 30 to 45 seconds the oxygen reading will start to stabilize.
3. Once the reading has stabilized, you must gain security access into the analyzer. Press the UP and DOWN arrows simultaneously and hold them down until the LCD shows 3 dashes followed by a display of the output range setting. DO NOT RELEASE THE ARROW BUTTONS UNTIL THE OUTPUT RANGE IS DISPLAYED. Release the arrow buttons and within 3 seconds press and continue holding down the SPAN button while adjusting the SPAN potentiometer with a small screwdriver. Adjust it until the LCD reads 20.9%, then release the span button. After a few seconds, the unit will save the new calibration data and return to normal operating mode. Please note, for optimum results, this entire calibration procedure should take less than 90 seconds. If you make a mistake at any point, let go of the buttons for 5 seconds and allow the analyzer to cycle out of the security mode and then regain access, and repeat above steps.

Calibration is now complete. Verify that the sealing o-ring is in place in the cell cap groove, and clean and free of any particulate. **Immediately** reinstall the cell cap, being careful not to cross thread it, and tighten firmly by hand. Do not over tighten. Rotate selector valve back to SAMPLE which will allow low oxygen level gas from the glove box to flow past the sensor.

4.2 CALIBRATION – LM-O_2 (WITHOUT ALARM)

NOTE: The oxygen analyzer should be calibrated approximately every 30 days. If the glove box atmosphere is known to have been consistently in the low ppm range, the calibration interval may be increased to approximately 60 days, which will prolong the cell life. Exposure to air rapidly depletes the fuel cell, so do not calibrate the unit on air for more time than is absolutely necessary.

1. Rotate the SAMPLE/AIR CAL gas selector valve to the AIR CAL position. This will seal off the sample in/out gas ports between the analyzer and glove box and therefore will not allow ambient air to diffuse in.
2. Unscrew the cell cap from the front panel of the analyzer. This will expose the oxygen sensor to ambient air which consistently contains 20.9% oxygen. QUICKLY start fanning air towards the exposed oxygen sensor. This will bring the level of oxygen inside the sensor compartment to 20.9% from previous low levels. After 30 to 45 seconds the oxygen reading will start to stabilize.
3. Once the reading has stabilized, adjust the SPAN potentiometer with a small screwdriver until the LCD reads 20.9%. Please note, for optimum results, this entire calibration procedure should take less than 90 seconds.

Calibration is now complete. Verify that the sealing o-ring is in place in the cell cap groove, and clean and free of any particulate. **Immediately** reinstall the cell cap, being careful not to cross thread it, and tighten firmly by hand. Do not over tighten. Rotate selector valve back to SAMPLE which will allow low oxygen level gas from the glove box to flow past the sensor.

5 LM-0_2-A OPERATION

5.1 ALARM CONFIGURATION

An internal audio alarm will sound when the oxygen level exceeds a user defined set point. The display also indicates ALARM in the lower left corner when this occurs. The normally open relay contact will close at this point also. The user can silence the alarm by pressing ALARM SILENCE, but the N.O. relay contact will remain closed and the ALARM display will remain until the oxygen level is once again below the set point.

5.2 SETTING THE ALARM LEVEL

1. Press the UP and DOWN arrows simultaneously and hold them down until the LCD shows 3 dashes followed by a display of the output range setting. DO NOT RELEASE THE ARROW BUTTONS UNTIL THE OUTPUT RANGE IS DISPLAYED.

2. Release the UP and DOWN arrows, then quickly select the range using the UP or DOWN arrow. If the range is correct, go to the next step. Note that the range is the maximum value of the alarm setpoint, so for example, if the intended alarm set point is 5 ppm, choose the 10 ppm range, and if the intended alarm set point is 12 ppm, choose the 50 ppm range.

3. Immediately press ALARM SET PT. The display will indicate ALARM in the lower left corner, and the current alarm set point will be displayed. Hold ALARM SET PT down and adjust the adjacent potentiometer until the desired setpoint is reached.

4. Release ALARM SET PT and after 3 seconds the normal display returns.

5. If at any point during this procedure, more than 5 seconds elapse between the time a key is released and the time the next key is pressed, the display reverts to normal and you will need to start again. DO NOT adjust the potentiometer while the display is in the normal mode - it will have no effect on the alarm setpoint until you re-enter the alarm setpoint procedure.

5.3 CHECKING THE ALARM LEVEL

Press ALARM SET PT while the normal display is on.

5.4 0-1 VDC OUTPUT

This output may be used for a strip chart recorder or a similar device. The voltage range corresponds to the range selected in 5.2 step 1 above. For example, 500 mV represents 5 ppm when the selected range is 0-10 ppm.

6 OXYGEN SENSOR

6.1 OXYGEN SENSOR LIFE

Typical useful life of the sensor cell is 6 months to more than 1 year, depending on the levels of oxygen to which the cell has been exposed. The LM-O_2-A analyzer has a feature whereby the user may monitor the approximate life left in the cell by pressing the SPAN button. A number is displayed between 1 and 1000, which indicates the position of the SPAN potentiometer. A reading that approaches 1000 means the sensor cell is near the end of its useful life.

Noting the difference in readings between consecutive calibrations is the best predictor of remaining cell life. Assuming regular calibration intervals, this difference should remain fairly constant until near the end of the cell life, at which point the difference will increase substantially. The user should be prepared to replace the cell at the next calibration interval if this occurs.

6.2 OXYGEN SENSOR REPLACEMENT

The sensor is provided in a special sealed bag. Do not open this until you are immediately ready to install the sensor.

Note: Before installing sensor, turn OFF analyzer power by unplugging power cord to the wall mount power adapter.

1. With oxygen analyzer power off, rotate the SAMPLE/AIR CAL gas selector valve to the AIR CAL position.
2. Unscrew the cell block cap, being careful not to lose the O-ring.
3. Carefully remove old cell by pulling the tab on the sensor label.
4. Inspect the cell block cavity, and if there is any sign of moisture, clean it out with a Q-tip or similar. Make sure that the contact springs inside the block are intact. Be careful not to snag them with the Q-tip.
5. Carefully open the bag using a pair of scissors or a knife. Make sure you don't cut yourself or stab the sensor! Make sure that there is no sign of any liquid in the bag, if so, do not proceed - you need a new sensor.
6. Remove the plug or other device that acts as a shorting clip. This may be found on the contact plate on the top of the sensor.
7. Holding the sensor by its tab, membrane side down, slide it into the cell block (gold plated contact side of sensor should be facing up touching the cell block contacts). The membrane side is covered by a convex gold plated mesh.
8. Immediately re-apply power and perform air calibration (see previous section).

7 SPECIFICATIONS

Both Models

Standard ranges: 0 - 10 ppm, 0 - 100 ppm, 0 -1000 ppm, 0 – 10,000 ppm, 0 -25%

Sensitivity: 0.5% of full scale

Repeatability: +/- 1% of full scale at constant temperature, all scales except
+/- 3% of full scale at constant temperature, 0-10 ppm scale

Operating temperature: 5 – 45 °C

Humidity: < 85%, non-condensing

Operational conditions: Pollution degree 2, Installation category I I.

Drift: +/- 1% of full scale in 4 weeks at constant temperature (dependent on sensor)

Expected cell life: 6 months.

Response times:

Trace: 90% of full scale in less than:

0 - 10 ppm - 25 sec

Other ranges -10 sec

Power requirements: 500mA @24VDC, adapter supplied for 110 VAC or 220 VAC, 50/60 Hz.

LM-O_2-A (Oxygen Analyzer with Alarm)

Analog Output: 0 - 1 VDC, output depends on range selection.

Oxygen Alarm Relay Contacts: Form C contacts rated at 1 A, 120 VAC/30 VDC.

Dimensions

10.5” W x 5.9” D x 6.5” H

Revision Record

Rev	Description	Date	Approved
A	E.O. 15395	04/09/04	WCM
B	E.O. 15443	05/10/04	WCM