

## OXY-SEN OXYGEN MONITOR



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## **WARRANTY**

Alpha Omega Instruments Corp. warrants the OXY-SEN Oxygen Monitor delivered to be free from defects in material and workmanship at the time of delivery to the FOB point specified in the purchase order, its liability under this warranty being limited to repairing or replacing, at Alpha Omega Instruments option, items which are returned to it **prepaid** within one year from the date of shipment and found to Seller's satisfaction to be defective.

Alpha Omega Instruments one (1) year sensor warranty offers protection for one full year from the date of shipment of the OXY-SEN Oxygen Monitor. Any sensor from an OXY-SEN Oxygen Monitor that fails under normal use must be returned to Seller prepaid and, if such sensor is determined by Seller to be defective, Seller shall provide Buyer a replacement sensor. Buyer must provide the serial number of the monitor from which the sensor has been removed. If a sensor is found to be defective and a new one issued, the warranty of the replacement sensor (s) is for a period of one year from the date of shipment. At times, it may be necessary to ship a replacement sensor in advance of receiving one returned for warranty claim. In such cases, if the returned sensor is not covered under warranty, the user will be charged the full price of a replacement sensor. **In no event shall Alpha Omega Instruments Corp. be liable for consequential damages. NO PRODUCT IS WARRANTED AS BEING FIT FOR A PARTICULAR PURPOSE AND THERE IS NO WARRANTY OF MERCHANTABILITY.**

This warranty applies only if:

- (i) the items are used solely under the operating conditions and manner recommended in this manual, specifications, or other literature;
- (ii) the items have not been misused or abused in any manner or repairs attempted thereon;
- (iii) written notice of the failure within the warranty period is forwarded to Alpha Omega Instruments Corp. and, the directions received for properly identifying items returned under warranty are followed;
- (iv) the return notice authorizes Alpha Omega Instruments Corp. to examine and disassemble returned products to the extent the Company deems necessary to ascertain the cause of failure.

The warranties stated herein are exclusive. THERE ARE NO OTHER WARRANTIES, EITHER EXPRESSED OR IMPLIED, BEYOND THOSE SET FORTH HEREIN, and Alpha Omega Instruments Corp. does not assume any other obligation or liability in connection with the sale or use of said products.

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**SECTION 1.0  
SPECIFICATIONS**

**PERFORMANCE**

<b>Measurement Range:</b>	0-100% oxygen (gas phase)
<b>Measurement Error:</b>	±1% of full scale (at 77°F and 29.92" Hg)
<b>Linearity:</b>	±1% of full scale
<b>Response Time:</b>	90% of full scale in under 30 seconds
<b>Sensor Type:</b>	Long-life ambient temperature electrochemical
<b>Temperature Compensation:</b>	Standard
<b>Operating Temperature Range:</b>	40° to 104°F (5° to 40°C)
<b>Warranty:</b>	12 months (both sensor and electronics)

**ELECTRICAL**

<b>Display:</b>	3-1/2 digit liquid crystal
<b>Input Power:</b>	115/230 VAC, 50-60Hz or 24 VDC
<b>Analog Output (Optional):</b>	4-20 mADC scaled over 0-100% O <sub>2</sub> and 0-25% O <sub>2</sub> (selectable by connector position).

**SAMPLE GAS CHARACTERISTICS**

<b>Storage Temperature Range:</b>	40° to 104°F (5° to 40°C)
<b>Sample Gas Pressure Limits:</b>	< 2 psig (0.14 kg/cm <sup>2</sup> )

**CONSTRUCTION**

<b>Dimensions of Electronics Enclosure:</b>	5-3/4 in.(146.05 mm) Width 5-1/2 in.(139.70 mm) Height 1-1/4 in.(31.75 mm) Depth
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Note: All dimensions are without optional equipment

<b>Dimensions of Sensor:</b>	1.85 in.(47 mm) Height 0.9 in.(22.86 mm) Depth
<b>Thread depth:</b>	0.29 in.(7.34 mm) (exclusive of O-ring)
<b>Thread size:</b>	M16 X 1
<b>Weight (with 10' of sensor cable):</b>	< 2 pounds (<0.907 kg)

**SECTION 2.0  
SYSTEM DESCRIPTION**

**General Description**

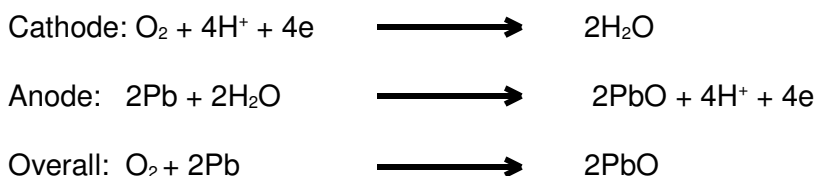
The OXY-SEN Oxygen Monitor is a percent oxygen monitor designed to provide accurate and dependable percent oxygen measurements in a variety of gases. The monitor enclosure is made from aluminum, and is rated for general purpose service. The monitor is powered from 115 VAC, 208/240 VAC (auto-adjusts to input voltage) or 24 VDC (must be selected at time of order).

**Ambient Temperature Electrochemical Sensor with EES**

The OXY-SEN Oxygen Monitor features an extended life oxygen sensor with EES (enhanced electrolyte system) a weak acid electrolyte system. The weak acid electrolyte system retards passivation of the sensor anode by allowing the products of oxidation to dissolve in the acid electrolyte. In effect, the sensor is renewed continuously as the weak acid electrolyte tolerates over 20 times the lead oxide (PbO) than potassium hydroxide (KOH) based sensors. The result is a sensor with a greatly extended useful life.

The extended life sensor is a lead-oxygen battery comprised of a lead anode, a gold cathode, and a weak acid electrolyte. A gold electrode is bonded onto a non-porous Teflon (FEP) membrane. A small amount of oxygen permeating through the membrane is reduced electrochemically at the gold electrode. A resistor and a thermistor (for temperature compensation) are connected between the cathode and anode. As a result, the lead-oxygen battery is always discharged.

Current flowing through the resistor and thermistor is proportional to the oxygen concentration of the gas in contact with the Teflon membrane. By measuring the voltage between the resistor and the thermistor, oxygen concentration can be accurately determined. The two electrode reactions are depicted below:



If PbO generated at the anode remains on the anode, the anode's potential will change and the output voltage of the sensor would become extremely low. However, in actuality the surface of the lead anode is continuously renewed because PbO is dissolved back into the electrolyte. There is a maximum level to the solubility of PbO in the weak acid electrolyte. As a result, when the electrolyte becomes saturated with PbO, the sensitivity of the sensor will begin to drop signaling time for replacement of the sensor. When the extended life oxygen sensor is used in ambient air monitoring applications, carbon dioxide (CO<sub>2</sub>) that is present will not adversely affect the sensor's performance. Due to the weak acid electrolyte, CO<sub>2</sub> will not react with the electrolyte to form potassium carbonate as it does with KOH based sensors. As a result, there is no loss in output due to the presence of CO<sub>2</sub>.

**SECTION 3.0  
INSTALLATION PROCEDURES**

**Unpacking the Instrument**

Upon opening the shipping container, carefully unpack the monitor to check if the outer surfaces have been damaged. If so, report the findings immediately to Alpha Omega Instruments who will provide further instructions. If there is no apparent damage, check the contents to ensure all items were shipped. In some cases, items may be back-ordered.



**All damage and shortage claims must be made known to Alpha Omega Instruments within 10 days after receipt of shipment.**

**Mounting the OXY-SEN Oxygen Monitor**

The mounting slots for the monitor electronics are 2-5/8" apart vertically, and 5-3/8" apart horizontally. The slots can accommodate # 6 through #8 screws.

**Powering the OXY-SEN Oxygen Monitor A/C Power Source Version**

The OXY-SEN Oxygen Monitor is powered from 115 VAC/60 HZ. or 208/240 VAC, Hz., at 10 ma. MAX. The Oxy-Sen Oxygen Monitor senses the input voltage and adjusts automatically for proper operation.

**Powering the OXY-SEN Oxygen Monitor 24 VDC Power Source Version**

The OXY-SEN Oxygen Monitor is powered from a 24 volt DC power source. The unit is internally fused for 500 mA. All manual references to AC power input do not apply. **DO NOT CONNECT THE 24VDC POWER SOURCE VERSION TO ANY AC (115/220 VAC) POWER SOURCE!**

**Mounting the Oxy-Sen Oxygen Sensor**

The pre-cabled sensor mounts into a tapped hole with a M16X1 thread. Insure that only finger tight pressure is applied to the sensor when mounting, as the o-ring supplied with the sensor will supply a good seal with finger tight torque to the sensor.

The sensor connects to the monitor's electronics with a pre-wired cable connector, installed into the connector labeled "Sensor" (use the dimple on the connector for alignment).

**Connecting the Optional Analog Output Cable**

When ordered with the optional analog output, the monitor is equipped with a 10 foot (3 meter) cable. This cable can be used to access either the 0-25% or 0-100% oxygen output range. The location of these connections is shown in Figure 1.0 on page 7.

**SECTION 4.0  
OPERATING PROCEDURES**

**Power On:**

Power to the OXY-SEN is applied whenever the instrument is plugged into an AC outlet.

**Gas System Pressure Limits**

It is imperative that the sample gas pressure to the sensor be kept to under **1 pound per square inch**. There is no automatic pressure correction so operation at a constant pressure will provide optimum measuring conditions. Vacuums to 12.5 psia are permissible. Any vacuum level greater than that should be avoided as it will cause irreparable damage to the sensor.

**Range Operation**

The OXY-SEN Oxygen Monitor operates with two (2) different analog signal output ranges 0-25% and 0-100%. Selection of the range of operation is done by plugging the monitor's output cable into one of the two connectors. The connector on the far right labeled "100%" automatically selects the 0-100% range; selecting the connector to the immediate left labeled "25%" will provide the 4-20 mADC output over 0-25%. **If the 25% output range is selected, the OXY-SEN will still measure and display oxygen values up to 100%**

**Sample Connections**

The standard OXY-SEN oxygen sensor is designed to be threaded into a hole prepared to accept a M16X1 thread. As such, there are no conventional gas connections to be made. Typical applications for the OXY-SEN include glove boxes, reactor vessels, chambers, etc., where such threaded holes can be made quite easily. Once the sensor has been properly installed and the "O" ring properly seated, then the other end of the sensor cable, may be connected to the bottom of the electronics labeled "Sensor". Alpha Omega Instruments does offer an optional "T" like flow through gas housing for the OXY-SEN. If this option has been ordered, the housing will be equipped with quick connect fittings on both the gas inlet and outlet. These fittings are designed for use with 1/4" OD plastic tubing. The housing may also be ordered with compression fittings.

**Analog Outputs**

The OXY-SEN Oxygen Monitor may be equipped with optional analog outputs for use with a recorder, datalogger, etc., which is a powered 4-20 ma loop output. This output scale is determined by the range connection selected. The interface cable supplied with the Monitor can be plugged into the connector labeled "25%" or "100%" on the bottom of the electronics enclosure. The cable connector location information can be found in Figure 1.0, and the cable pin-outs in Figure 2.0.

**Storage of the Monitor**

When the OXY-SEN Oxygen Monitor is not in use, it may be stored in any position. If stored in an atmosphere where the temperature is greatly different from the temperature where it will be used, the instrument should be allowed to come into equilibrium with the operating ambient temperature before use. Under **no circumstances** should the OXY-SEN Oxygen Monitor or its sensor be exposed to temperatures below 40°F (5° C) or above 104 °F (40° C). Doing so will damage the sensor and void the warranty.

**SECTION 5.0  
CALIBRATION PROCEDURES**

**Routine Span Gas Calibration Checks**

The OXY-SEN Oxygen Monitor **has been calibrated** at the factory prior to shipment. However, due to the rigors of shipping, it is advisable to check the calibration of the OXY-SEN upon receipt (see below). This can easily be accomplished by powering up the instrument and placing the sensor in a source of fresh air. The reading on the meter should be approximately 20.9%. If an adjustment needs to be made, use the span adjustment screw located on the side of the instrument. The measurement error associated with the OXY-SEN is  $\pm 1\%$  of full scale which translates into  $\pm 1\%$ . This specification does not differ if the optional 25% analog output is used. The oxygen sensor used in the OXY-SEN is very stable and will provide exceptional performance over long periods. It is advisable to check the calibration of any gas phase instrument. Alpha Omega Instruments recommends checking the calibration of the OXY-SEN every 2-3 months.

**Calibration Gas**

The oxygen sensor used in the OXY-SEN Oxygen Monitor has a linear output. As a result, it can be calibrated using a source of fresh air, which contains 20.9 % O<sub>2</sub>. For gas measurement expected to be over 20.9%, a calibration gas at or above the anticipated measurements may improve calibration accuracy.

An optional calibration fixture (P/N OS-1CAL) is available to enable use of bottled calibration gases.

**Procedure for Checking Calibration**

Insure that the sensor input is exposed to a source of fresh air, or to a flowing gas from a calibration gas bottle (must have optional flow through gas housing). Insure that pressure does not exceed 1.0 PSIG and flow does not exceed 0.5 to 1.0 liters/min when utilizing the optional flow through gas housing. If the reading on the meter differs markedly from the calibration source, an adjustment to the instrument should be made. To accomplish this, locate the span calibration potentiometer located on the right side of the electronics enclosure. With a small blade screw driver, adjust the front panel reading of the instrument until it matches that of the calibration medium.

**Zero Adjustment**

No zero calibration is required.



**SECTION 6.0  
REPLACEMENT OF THE OXYGEN SENSOR**

Alpha Omega Instruments oxygen sensor is designed to operate for prolonged periods of time without needing replacement. However, in time the sensor's output will drop to a level where replacement becomes the prudent course of action. A good indication of this is a marked increase in calibration frequency. When this happens, a replacement sensor should be ordered directly from the factory.

To install a new sensor follow the directions below:

1.0 **Remove AC/DC power from the instrument.**



2.0 Locate the sensor cable located on the bottom of the enclosure and unplug the sensor.

3.0 Locate the oxygen sensor where it is mounted and remove the sensor by unscrewing the sensor by rotating in a counterclockwise motion. Discard the old sensor (see precautionary note below) and install the replacement sensor being careful not to over-tighten the sensor. The sensor has an "O" ring seal that when **finger tightened**, will provide therequired seal. Reattach the sensor's electrical connector.

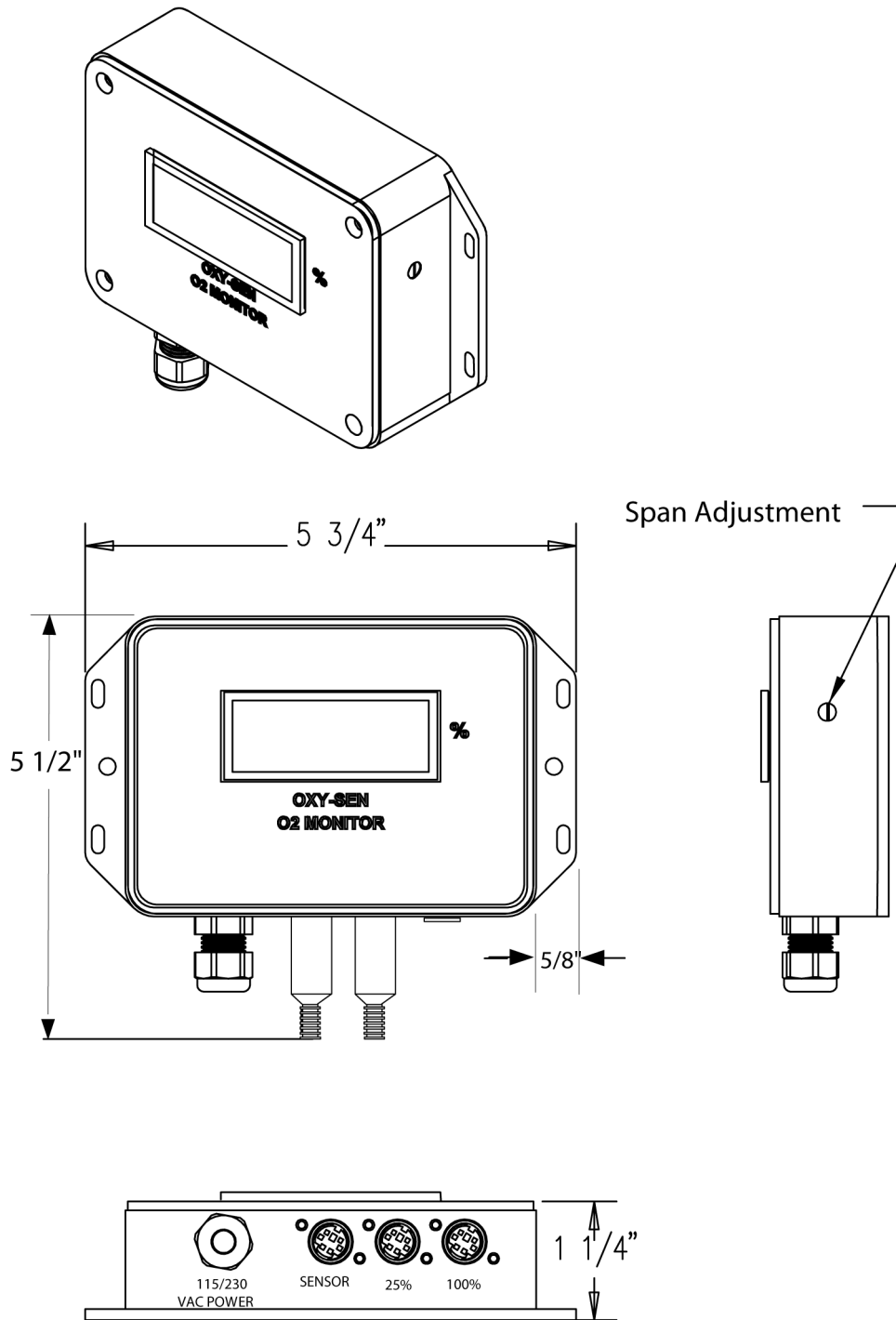


**THE SENSOR CONTAINS A SMALL AMOUNT OF WEAK ACID. WHEN DISCARDING SPENT SENSORS, CARE SHOULD BE GIVEN NOT TO PUNCTURE THE SENSOR OR TO TAKE IT APART. DISPOSE OF THE SPENT SENSOR ACCORDING TO LOCAL, COUNTY, OR STATE GUIDELINES.**

4.0 Apply AC/DC power and calibrate according to Section 5.0.

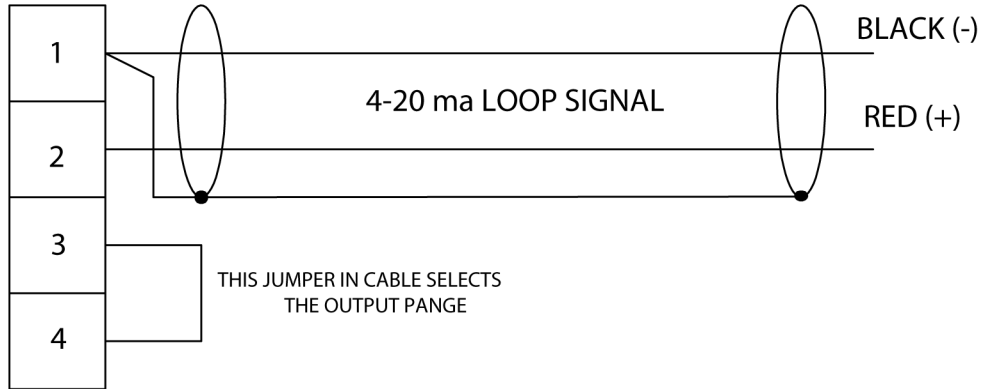
Figure 1.0

Dimensional Drawing



**Figure 2.0**

**Analogue Output Cable**



The cable connector is a 4 Pin mini-DIN Connector, AMP P/N 171-2604

**Appendix A**  
**Material Safety Data Sheet for the 2SEN Oxygen Sensor**

**SECTION I - PRODUCT IDENTIFICATION**

**Manufacturer's Name:** Alpha Omega Instruments Corp  
**Address** 40 Albion Road, Suite 100  
**Telephone** 401-333-8580  
**Date Prepared** September 3, 1998  
**Date Revised** April 12, 2001  
**Trade Name** OXY-SEN-2SN  
**Description** Weak acidic solution encapsulated in plastic housing.

**SECTION II - HAZARDOUS INGREDIENTS OF SOLUTION**

**Lead Acetate, Trihydrate** CAS # 6080-56-4  
OSHA/PEL 0.05 mg/m3  
ACGIH/TLV 0.15 mg/m3

TLV and PEL are for lead, inorganic dusts and fumes, as Pb

Note: Lead has been reported as causing cancer in laboratory animals, exercise due care.

**Acetic Acid, Glacial** CAS # 64-19-7  
OSHA/PEL 10 PPM  
ACGIH/TLV 10 PPM

NOTE: TLV and PEL are for concentrated (90% - 100%) Acetic Acid, actual solution is less than 50%.

**Lead** CAS # 7439-92-1  
OSHA/PEL 0.03mg/m3

**SECTION III - PHYSICAL & CHEMICAL CHARACTERISTICS**

Boiling Point: Not Available Specific Gravity: Not Available

Vapor Pressure: Not Available Vapor Density: Not Available

Evaporation Rate: Not Available Physical State: Liquid

Melting Point: Not Available pH: 3.5 - 7.0 Flash Point: > 100 degrees C

Appearance & Odor: Colorless Liquid: Vinegar like odor

Extinguisher Media: Use water spray, alcohol foam, dry chemical or carbon dioxide

Special Fire Fighting Procedures: Respiratory protection should be used to avoid breathing fumes.

**Unusual Fire & Explosion Hazards:**

Lead acetate decomposes at boiling point and toxic gases are produced. Acetic acid vapors may flow along surfaces to distant ignition sources and flash back. Closed containers exposed to heat may explode.

**Appendix A**  
**Material Safety Data Sheet for the 2SEN Oxygen Sensor**

**SECTION IV - REACTIVITY DATA OF SOLUTION**

<b>Stability</b>	Stable
<b>Hazardous Polymerization:</b>	Will not occur
<b>Conditions to Avoid:</b>	Heat, flame, other sources of ignition
<b>Incompatibles:</b>	Strong acids, strong bases, strong oxidizing agents.
<b>Decomposition Products:</b>	Lead fumes, carbon monoxide, carbon dioxide.

**SECTION V - HEALTH HAZARD DATA OF SOLUTION**

<b>Lead Acetate Component</b>	Data is for lead, inorganic dusts and fumes as Pb
<b>(TLV/TWA):</b>	0.15 mg/m <sup>3</sup>
<b>STEL:</b>	Not Established
<b>PEL:</b>	0.05 mg/m <sup>3</sup>
<b>Toxicity:</b>	Intraperitoneal Rate LD50 for Lead Acetate Trihydrate is 200 mg/Kg
<b>Carcinogenicity:</b>	This substance is listed as a NTP anticipated human carcinogen and an IARC animal carcinogen.
<b>Reproductive Effects:</b>	None identified
<b>Effects of Overexposure:</b>	
<b>INHALATION:</b>	Tightness and pain in chest, coughing, difficult breathing.
<b>SKIN CONTACT:</b>	Irritation.
<b>EYE CONTACT:</b>	Irritation.
<b>SKIN ABSORPTION:</b>	May be harmful.
<b>INGESTION:</b>	Is harmful and may be fatal, headache, nausea, vomiting, dizziness, gastrointestinal irritation.
<b>CHRONIC EFFECTS:</b>	Anemia, kidney damage, blurred vision, lead build-up in the central nervous system.
<b>Target Organs:</b>	GI tract, central nervous system, kidneys, blood, gingival tissue.
<b>Medical Conditions Generally Aggravated by Exposure:</b>	None identified.
<b>Primary Routes of Entry:</b>	Ingestion, inhalation, eye contact, skin contact, absorption.
<b>Emergency and First Aid Procedures:</b>	
<b>INGESTION:</b>	<b>CALL A PHYSICIAN.</b> Give large amounts of water.
<b>INHALATION:</b>	If inhaled, remove to fresh air.
<b>SKIN CONTACT:</b>	In case of contact, flush with water for at least 15 minutes.
<b>EYE CONTACT:</b>	In case of contact, flush with water for at least 15 minutes.

**Appendix A**  
**Material Safety Data Sheet for the 2SEN Oxygen Sensor**

**SECTION V - HEALTH HAZARD DATA OF SOLUTION cont'd**

**Acetic Acid** Data is for concentrated acid.

Threshold Limit value (TLV/TWA) 25 mg/m3  
 Short term exposure limit (STEL) 37 mg/m3  
 Permissible exposure limit (PEL) 25 mg/m3

**Toxicity:**

Oral rate LD50 for acetic acid: 3310 mg/kg  
 Intravenous mouse LD50 for acetic acid: 525 mg/kg  
 Skin rabbit LD50 for acetic acid: 1060 mg/kg  
 Inhalation mouse LD50 for acetic acid: 5620 mg/kg  
 Carcinogenicity NTP: No  
 IARC: No  
 Z List: No  
 OSHA Reg: No

**Carcinogenicity:** None identified

**Reproductive Effects:** None identified

**Effects of Overexposure:**

**INHALATION:** Severe irritation or burns of respiratory system  
**SKIN CONTACT:** Severe burns, may cause dermatitis  
**EYE CONTACT:** Severe burns, permanent eye damage.  
**SKIN ABSORPTION:** None identified  
**INGESTION:** Burns to mouth and throat, nausea, vomiting, gastrointestinal irritation, diarrhea, shock, may be fatal  
**CHRONIC EFFECTS:** Lung damage, teeth damage

**Target Organs:** Respiratory system, eyes, skin, teeth, lungs.

**Medical Conditions Generally Aggravated by Exposure:** Respiratory system disease, skin disorders.

**Primary Routes of Entry:** Inhalation, ingestion, skin contact, eye contact.

**Emergency and First Aid Procedures:**

**INGESTION:** **CALL A PHYSICIAN.** Give large amounts of water.  
**INHALATION:** If inhaled, remove to fresh air.  
**SKIN CONTACT:** Immediately flush skin with plenty of water for at least 15 minutes.  
**EYE CONTACT:** Immediately flush with plenty of water for at least 15 minutes.

**Appendix A**  
**Material Safety Data Sheet for the 2SEN Oxygen Sensor**

**SECTION VI - SPILL AND DISPOSAL PROCEDURES**

**NOTE:** The sensors are sealed, and under normal circumstances, the contents of the sensors do not present a health hazard. The following information is given as a guide in the event that a cell leaks.

**Steps to be taken in the event of a spill or discharge:**

- Wear respiratory protection and full protective clothing
- Neutralize spill with soda ash or lime
- Carefully place material into clean, dry container and cover.
- Flush spill area with water.

**Disposal Procedure:**

Dispose in accordance with all applicable federal, state and local environmental regulations, with regards to lead or lead acetate.

**EPA Hazardous Waste Numbers:**

Lead	D008
Lead Acetate	U144 (Toxic Waste)
Acetic Acid, Glacial	D001, D002 (Ignitable, Waste)

**SECTION VII - ENGINEERING AND WORK PRACTICES CONTROLS**

**VENTILATION:** Use general or local exhaust ventilation to meet TLV requirements.

**RESPIRATORY PROTECTION:** Respiratory protection required if airborne concentration exceeds TLV.

**EYE/SKIN PROTECTION:** Safety goggles, uniform, apron, neoprene gloves are recommended.

**Protective measures during cell replacement:**

Before opening the packaging containing the sensor cell, check the sensor cell for leakage. If the sensor cell leaks, do not open the container. If there is liquid around the cell while in the instrument, use the protection listed above in this section.

**SECTION VIII - STORAGE AND HANDLING PRECAUTIONS**

**Storage Requirements:** Store in a cool, well-ventilated area.

NOTE: The above data is based on tests and experience which Alpha Omega Instruments, Inc. believes reliable and are supplied for information purposes only. Alpha Omega Instruments Corp. disclaims any liability for damage or injury which results for the use of the data and nothing contained there in shall constitute a guarantee, warranty (including warranty of merchant ability) or representation (including freedom from patent liability) by Alpha Omega Instruments Corp. with respect to the data, the product described, or their use for any specific purpose, even if that purpose is known to Alpha Omega Instruments Corp.