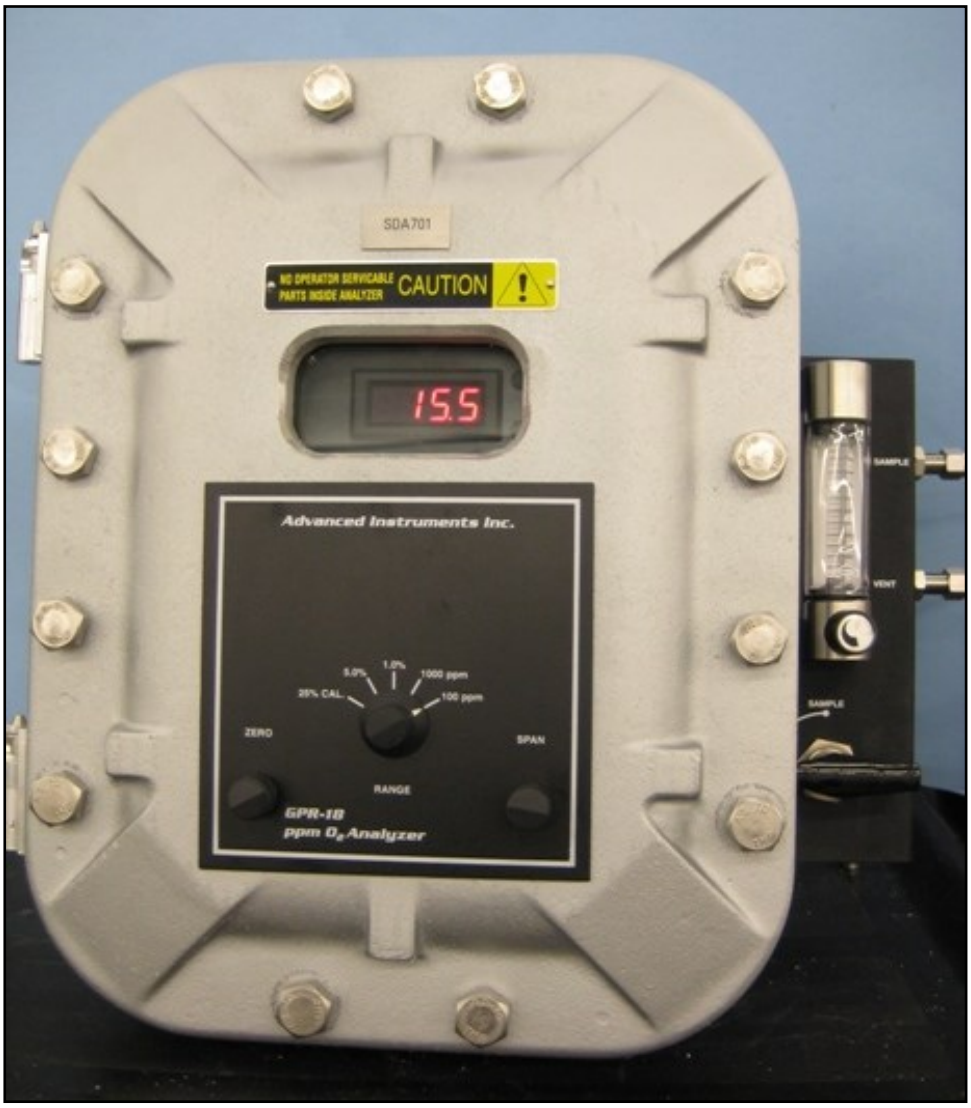
GPR-x8 Explosion-Proof Oxygen Analyzers

User Manual PST-UM-3014-EN-3.1



Issue No.	Description	Date	Author Initials
01	Original document issued	01/2016	PP
02	Re-brand template Hazardous area information	09/2023	FR
03	Updated GPR-28: specifications	12/2023	FR
3.1	Updated specifications	01/2024	NSF

GPR-x8 Oxygen Analyzers

For contact information, visit

ProcessSensing.com

Contents

1. Introduction

Your new oxygen analyzer is a precision device designed to give you years of measuring a wide range of oxygen concentrations. This analyzer features sensor technology developed exclusively by Analytical Industries Inc.
For a discussion of the various analyzer's performance see section 11 Specifications of this Instructions for Use.
The analyzers are designed to measure the oxygen concentration in inert gases, gaseous hydrocarbons, hydrogen and a variety of gas mixtures. To obtain maximum performance from your new oxygen analyzer, please read and follow the guidelines provided in this Instructions for Use.
Every effort has been made to select the most reliable state of the art materials and components; and, to design the analyzer for superior performance and minimal cost of ownership. This analyzer was tested thoroughly by the manufacturer prior to shipment for best performance.
However, these devices do require service from time to time. The warranty included herein plus a staff of trained professional technicians to quickly service your analyzer is your assurance that we stand behind every analyzer sold.
The serial number of this analyzer may be found on the side the analyzer. You should note the serial number in the space provided and retains this Owner's Manual as a permanent record of your purchase, for future reference and for warranty considerations.

Serial Number: _____

Analytical Industries Inc. appreciates your business and pledges to make every effort to maintain the highest possible quality standards with respect to product design, manufacturing and service.

Intended Use

The Explosion Proof Series of Oxygen Analyzers are designed with an explosion proof enclosure, flame arrestors, breather device, actuators and certified for use in hazardous areas as noted at the right.

*The equipment shall not have an internal source of release of oxygen or any other oxidizers in concentrations greater than that found in normal air (21%).

GPR-18 MS:

10 PPB to 1000 PPM oxygen contamination in inert gases streams.

GPR-18:

50 PPB to 1% oxygen contamination in inert, hydrocarbon, He, H2, mixed, and acid (CO2) gas streams.

GPR-28:

0.05% to 21% oxygen measurements in inert, hydrocarbon, He, H2, mixed and acid (CO2) gas streams.

Technical Description

Oxygen Analyzer

Manufacturer: Analytical Industries Inc.
Types: GPR-18 MS, GPR-18, GPR-28
ATEX: Certificate: CML 23ATEX1357X
Standards: EN IEC 60079-0:2018
EN 60079-1:2014
Marking: Ⓔx II 2 G
Ex db IIB or IIB+H2 T6 Gb
IECEx: Certificate: IECEx CML 23.0122X
Standards: IEC 60079-0:2017
IEC 60079-1:2014
Marking: Ex db IIB or IIB+H2 T6 Gb
Tamb = -20°C to +60°C
UKEX: Certificate: CML 23 UKEX1358X
Standards: EN IEC 60079-0:2018
EN 60079-1:2014
Marking: Ⓔx II 2 G
Ex db IIB or IIB+H2 T6 Gb

Flameproof Enclosure

Manufacturer: Killark
Type: EXB N34 cover, window and three buttons
EXB N34 box, 3 holes ½"NPT, 2 holes ¾"NPT
ATEX: Certificate: QPS 21ATEX0001U
Standards: EN IEC 60079-0: 2018
EN 60079-1:2014
EN 60079-31: 2014
EN 60529:1992+A2:2013
Marking: Ⓔx II 2G Ex db IIB+H2 Gb
II 2D Ex tb IIIC Db IP66
Ta= -50°C.. +70°C

UKEX: Certificate: 3CT UKEX1002U
Standards: EN IEC 60079-0: 2018
EN 60079-1:2014
EN IEC 60079-31: 2014
Marking: Ⓔx II 2G Ex db IIB+H2 Gb
II 2D Ex tb IIIC Db IP66
Ta= -50°C.. +70°C

IECEx: Certificate: IECEx QPS 17.0013U
Standards: IEC 60079-0:2017 Edition: 7.0
IEC 60079-1:2014-06 Edition: 7.0
IEC 60079-31:2013 Edition: 2.0
Marking: Ex db IIB+H2 T6 Gb
Ex tb IIIC Db IP66
Tamb = -20°C to +60°C
Volume : 13L
Maximum power dissipated: 93W

1. Introduction

Flame Arrestors and Breather

Manufacturer: Michell Instruments
Type: FA-2-A Flame Arrestors and BR-2-A Breathers
ATEX: Certificate: CML 20ATEX1302U
Standard: EN IEC 60079-0:2018
EN 60079-1:2014
EN 60079-31:2014
Marking: Ex II 2 G D
Ex db IIB+H2 T6 Gb
Ex tb IIIC T85°C Db
Ts= -40°C to +60°C
IP6X

UKEX: Certificate: CML 21UKEX1086U
Standard: EN 60079-0:2018
EN 60079-1:2014
EN 60079-31:2014
Marking: Group II 2 G D
Ex db IIB+H2 T6 Gb
Ex tb IIC T85°C Db
Tamb -40°C to +60°C
IP6X

IECEx: Certificate: IECEx CML 20.0168U
Standards: EC 60079-0:2017 Edition: 7.0
IEC 60079-1:2014-06 Edition: 7.0
IEC 60079-31:2013 Edition 2
Marking: Ex db IIB+H2 T6 Gb
Ex tb IIIC T85°C Db
Tamb -40°C to +60°C
IP6X

The flame arrestors do not include any polymeric or elastomeric materials.

Containment system with limited release (presence of fittings)

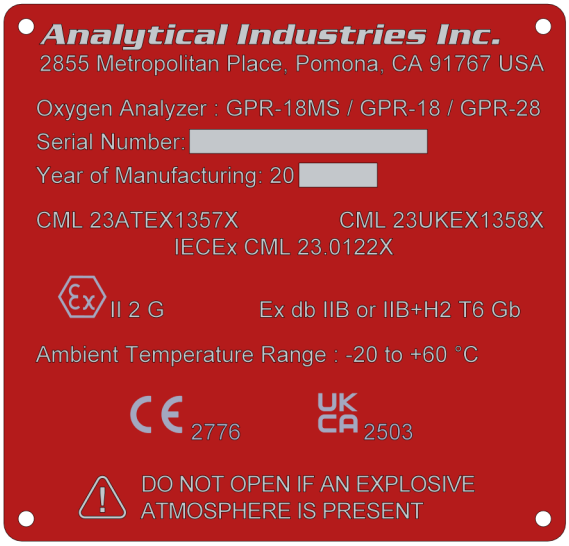
Description: The sample gas is completely confined inside 1/8" stainless steel tubing with Swagelok type ferrule and ring compression fittings and tightened to Swagelok's instructions, until exiting the enclosure.

Inlet pressure: specified regulated to 5-30 psig.
Flowrate: sample gas entering the enclosure: 1-2 SCFH
Test realized according to annex G of EN 60079-0:2018 / IEC 60079-0:2017 for certification.

Cable gland

Analytical Industries does not supply the cable gland. It is the responsibility of the user to install a cable gland that complies with local regulations.

A unique label reflecting the sample above is permanently affixed to the enclosure to identify every analyzer.



The analyzer must be installed in accordance with:

EN 60079-14:2014; IEC 60079-14:2013
EN 60079-17:2014; IEC 60079-17:2013

1. Introduction

Theory of Operation

These analyzers consist of two PCB assemblies, sample system including sample flow control valve and flow meter, sensor housing, and, incorporate a variety of advanced electrochemical galvanic fuel cell type sensors for PPB, PPM and % range oxygen measurements.

An optional temperature controlled heater system is available that enhances the stability of the oxygen reading and is recommended for outdoor installations or when ambient temperatures vary regularly.

In standard configuration the alarm controls are integral to the main PCB and cannot accessed from the outside of analyzer (to prevent tampering with alarm set points)

* The analyzer shall not have an internal source of release of oxygen or any other oxidizers in concentrations greater than 21%.

Sensor Technology

Oxygen enters the sensor, simultaneously oxidizes the anode and reduces the cathode to produce a linear electrical current signal output proportional to the oxygen concentration in the gas phase.

Advanced sensor technology permeates the range of oxygen sensors which are:

- specific to oxygen with superior accuracy
- generate a signal output that is both linear over all ranges and virtually constant over its life time
- exhibits superior stability and fast response time
- requires no maintenance or electrolyte additions
- easily replaced in the field like a battery
- offer the best warranty and service in the industry

GPR-18 MS: Measures 10 PPB to 1000 PPM oxygen contamination in inert, hydrocarbon, He, H2 and mixed gases streams. It is based on a proprietary design, the Pico-Ion™ oxygen sensor which is specific to oxygen and produces a current signal output 80x greater than conventional electrochemical fuel cells and equal to Coulometric wet cells.

The Pico-Ion sensor features a proprietary sensing electrode that generates the 80x increase in signal output and a unique gas delivery path that minimizes the amount of unreacted oxygen that can dissolve into the electrolyte and slow offline recovery time.

Sensitivity, stability and recovery time are improved while significantly reducing the temperature dependence of the sensor's signal output which contributes to excellent long term stability.

GPR-18: Measures 50 PPB to 1% oxygen contamination in inert, hydrocarbon, He, H_2, mixed, and acid (CO_2) gas streams. Proprietary advancements in design and chemistry add significant advantages to an extremely versatile oxygen sensing technology.

These PPM oxygen sensors exhibit superior accuracy and stability, recover from exposure to air to PPM levels in minutes with a longer life and warranty period. The XLT version offers an extended operating range of -20°C to 50° C and excellent compatibility for measuring PPM oxygen levels in applications involving natural gas and beverage grade CO2 containing up to 100% CO_2.

GPR-28: 0.05% to 21% oxygen measurements in inert, hydrocarbon, He, H_2, mixed and acid (CO_2) gas streams. Proprietary advancements aid in the transition from PPM to low percentage range measurements to 21% oxygen.

In addition to superior accuracy and stability, the percent oxygen sensor offer the longest life and extended temperature range in the industry. The XLT version also offer an extended operating range of -20°C to 50°C and excellent compatibility for measuring oxygen levels in applications containing varying concentrations of CO_2.

Signal Processing Electronics

The signal generated by the sensor is processed by an integrated electronic circuit. The first stage amplifies the signal. The second stage eliminates the low frequency noise. The third stage employs a high frequency filter and compensates for signal output variations caused by ambient temperature changes.

The result is a very stable signal. Sample oxygen is analyzed very accurately. Response time of 90% of full scale is less than 30 seconds (actual experience may vary due to the integrity of sample line connections, dead volume and flow rate selected) on all ranges under ambient monitoring conditions. Sensitivity is typically 0.5% of full scale low range. The measured Oxygen value can be transmitted for external use via an isolated 4-20mA and 0-1V signal output.

Overall performance is enhanced by an optional temperature controlled heater system that controls the temperature around the sensor at a pre-set temperature.

Connections of the appropriate AC line voltage should be hard wired to screw type terminal blocks. Power requirement related to the optional heater system is specific to 100/110VAC or 220/230VAC, supply power as indicated near the power input terminal.

2. Essential Information

This section summarizes the general precautions and operating information for the Explosion Proof Series Oxygen Analyzers that must be observed to prevent damage to the analyzer and injury to the operator.
The remaining sections provide specific additional instructions for optimizing the analyzer's performance in inert sample gases. Analytical Industries Inc. will not be responsible for damages resulting from the installation or operation of the analyzer in a manner not consistent with these Instructions for Use.

* The analyzer shall not have an internal source of release of oxygen or any other oxidizers in concentrations greater than 21%.

	Review Instructions for Use.
	Alerts the user to important information.
	Danger: Hazardous conditions to personnel.
	Caution: Possible damage to equipment.
	Caution: Caustic liquid present (section 10).
	Caution: High voltage hazard present.
	DO NOT attempt this action.

	Read the Instructions for Use before operating the analyzer and retain for future reference.
	The sensor contains caustic liquid, DO NOT open.

	Avoid erratic or erroneous O2 readings by: ▶ Calibrate at the sample gas temperature and pressure. ▶ Set flow rate at lowest pressure expected (section 11). ▶ Mounting the analyzer indoors under stable conditions as near to 25°C and 1 atm as possible. ▶ A pump upstream of the sensor should be be tested for air leaks before finalizing the sample system. ▶ Preventing excessive power line voltage variations. ▶ Bundling the signal output wires with power cable. ▶ Confirm span gas O2 value with air calibrated portable.
	Avoid damaging the O2 sensor or analyzer components by: ▶ Opening the sensor's shipping package before instructed. ▶ The sudden removal of a restriction in the vent line draws a vacuum on the sensor damaging the sensing area and causing electrolyte leakage which in turn damages the electrical contacts and clogs the gas line. ▶ Exceeding the specified inlet pressure or venting to a line above atmospheric pressure (section 11). ▶ Disconnecting power to the analyzer for over 24 hours without flowing zero gas. ▶ Operating outside the temperature range (section 11). ▶ Sample pump downstream of the sensor requires the manual flow control valve upstream of the sensor to be wide open to avoid drawing a vacuum on the sensor as noted above.
	▶ Hazardous AC voltage is present within the analyzer. ▶ Supply power as specified by markings on analyzer. ▶ Contact factory for cleaning and service instructions.

Troubleshooting: Consult the guidelines in section 8 for advice on the common operating errors before concluding that your analyzer is faulty. Do not attempt to service the analyzer beyond those means described in the Instructions for Use.

Serviceability: See section 6 Maintenance. While none of the components are serviceable in themselves, see Section 7 Spare Parts is provided in the unlikely event a component fails and has to be replaced.

Please review section 9 Warranty, DO NOT attempt to service the analyzer or replace component parts on your own, consult the factory or a factory trained service technician.

3. Installation

Unpack & Inspect

1.Examine the condition of the packaging, remove the contents identified below and inspect.
- ▶Oxygen Analyzer
- ▶Instructions for Use (e-copy on thumb drive)
- ▶Quality Control & Calibration Certification (sec 12)
- ▶Chart Recording of Qualification Test

2.Verify the contents against the packing slip.
3.Open the analyzer door, remove any shipping materials and inspect with particular attention to components that may have come loose during transport.
4.Report any apparent damage or missing items to the carrier and factory immediately (+1 909-392-6900 or info@aii1.com). DO NOT proceed if damage is noted.

Overview

The following sections provide key information about the sensors, influence of operating conditions, sample system requirements, mounting the analyzer, electrical connections, gas connections, establishing power to the analyzer and installing the oxygen sensor.

Install in accordance with ATEX Directives and IECEx Scheme:

EN 60079-14:2014; IEC 60079-14:2013
EN 60079-17:2014; IEC 60079-17:2013

Sensors

The GPR series sensor is available with all analyzers and recommended for all inert and hydrocarbon gas streams, whereas, the XLT series sensor is available only with the GPR-18 and GPR-28 analyzers and is recommended for background gases with more than 0.5% CO_2 on a continual basis.

Avoid prolonged exposure to air or high O2 levels.

GPR-12-2000 MS2 PPB oxygen sensors are susceptible to damage from prolonged exposure to > 1000 PPM O2.

GPR-12-333 PPM sensors last 4-6 months in prolonged exposure to air but generate a > 1-2 PPM O2 offset in the reading on zero gas. **XLT-12-333 PPM** sensors expire after 5-7 days in air.

GPR-11-32 and **XLT-11-24** % sensors are not adversely affected by exposure to ambient air.

See section 11 Specifications for the expected life of an oxygen sensor which is inversely proportional to changes in the oxygen concentration and pressure and exponential (2.54%/° C) to sample temperature, e.g. if an analyzer is continuously operated at 35 ° C, expect the sensor life to be reduced by ~30%.

Operating Conditions

Temperature of the sample gas must be within the recommended operating range specified in section 11 before it enters the analyzer.

Hot sample gases can easily be cooled to ambient temperature by using a coiled 10 foot (3m) length of ¼" stainless steel tubing. On an intermittent basis, the analyzer may be operated at 122°F (50 °C).

Sample Inlet Pressure

The analyzers are designed for flowing samples under positive pressure as standard. An optional Sample pump can be specified for negative pressure applications. See section 11 Specifications.

If the analyzer is equipped with an optional H2S scrubber and or a coalescing filter, inlet sample pressure must not exceed 30 PSIG.

For sampling gases at near atmospheric pressure or under slight vacuum an external sample pump can be used to either push or draw the sample gas from the process, move it through the analyzer for analysis and to vent.

The positioning of the sample pump either upstream or downstream of the analyzer requires making an informed decision:

1. The rate at which air (oxygen) leaks into the pump should be empirically determined.
2. The user's accuracy requirements must be assessed in light of the actual leak rate of the sample pump.
3. If the sample pump has a low enough leak rate to meet the user's accuracy requirements (a) position the pump upstream of the analyzer to draw the sample and push it through the analyzer, (b) the analyzer's flow control device upstream of the sensor regulates the flowrate of the sample, a point that is critical to the GPR-18 MS, (c) the possibility of damaging the oxygen sensor is minimized, (d) this approach is the exception rather than the rule.
4. To meet the user's accuracy requirements or inability to confirm the actual leak rate of the sample pump position the pump downstream of the analyzer as the safest approach to obtaining reliable measurements.

DO NOT use a sample pump downstream of the GPR-18 MS. Using a sample pump downstream of the GPR-18 MS will damage the sensor. If a sample pump is used it must be suitable for the application and the area of installation.

GPR-18 and GPR-28 use an adjustable valve to control the flow rate. When a pump is positioned downstream of the analyzer, the adjustable valve MUST BE COMPLETELY OPEN to avoid drawing a vacuum directly on and permanently damaging the oxygen sensor.

3. Installation

Sample Vent Pressure

In positive sample pressure applications, the sample must be vented to ambient or in a vent line with pressure less than the sample inlet pressure.

If the sample is vented to a line at a pressure above or below ambient, a back-pressure regulator must be installed downstream of the oxygen sensor and set at least 1 PSIG higher that the line pressure of the vent to ensure a constant pressure on the sensor.

When employing a back-pressure regulator to overcome a higher vent line pressure, e.g. venting a sample to a flare line, (a) set the back-pressure gradually to avoid drawing a vacuum on the sensor and (b) calibrate the analyzer after the back-pressure regulator has been set.

Sample System

Sample Gas Stream: Ensure that the sample gas composition and application conditions are consistent with the specifications of the analyzer. If in doubt, consult factory to ensure the analyzer is suitable for specific gas analysis.

Material and Components

The analyzers can be specified and supplied with a sample handling system. However, if the analyzer was purchased without a sample handling system, the user may be required to install the necessary sample handling components.

When designing a sample system, use of stainless steel tubing, fittings and valves is essential for maintaining the integrity of the sample gas stream.

Removal of Contaminant Gases: In certain application, it may be necessary to remove any contaminants that may interfere with measurements. Typically, a gas-specific scrubber is used to remove interfering gases such as oxides of sulfur and nitrogen or hydrogen sulfide.

The presence of such interfering gases can result in false oxygen readings and reduction in the expected life of the sensor. Consult factory for recommendations concerning the proper selection and installation of scrubber or filter components.

Mounting

The analyzers are packaged in an aluminum wall mount enclosure with dimensions of 13.25" x 17.25" x 10.75" which carries ATEX / IECEx certifications and IP66 rating.

Only authorized trained personnel should install this analyzer. Installation must comply with local, state, country regulations and the ATEX standards identified above.

DO NOT connect electrical power until the analyzer is properly mounted.

The analyzer is designed for mounting on a flat vertical surface (mount approximately 5 feet above the floor) by bolting the mounting feet attached to the rear of the enclosure the mounting surface using 1/2" or M12 diameter steel bolt and washers

Inspect and clean the machined surfaces of both the bottom base and the hinged cover of the enclosure. The sealing surfaces must be inspected and free of nicks, dirt or any foreign particle build-up that would prevent a proper seal.

Closing the enclosure:

1. Wipe the sealing surfaces with a clean lint-free cloth.
2. Apply a light coating of Killark "LUBG" lubricant to the sealing surfaces.
3. Close the hinged cover and mate to enclosure base.
4. Install the bolts thru the cover into enclosure base.
5. Finger tighten bolts.
6. Torque all bolts to 30 ft/lbs.

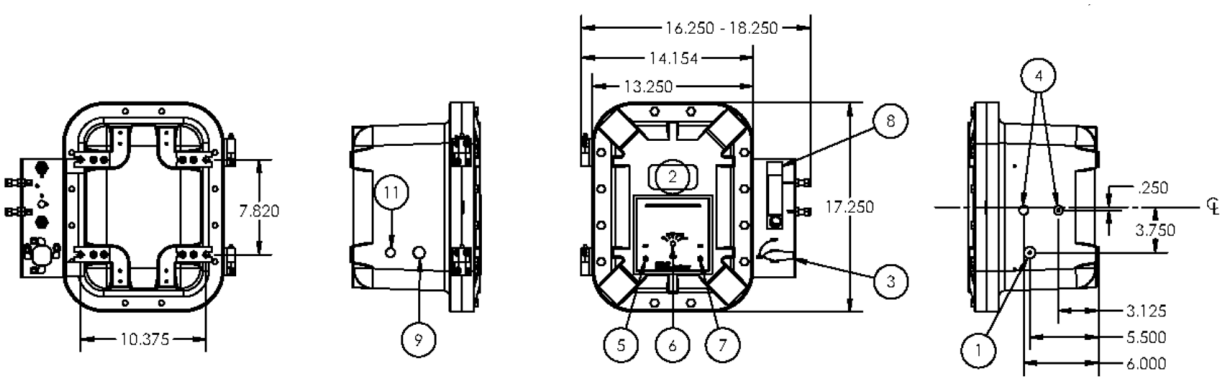
After installation, the unit must be inspected regularly to verify the enclosure mounting bolts are tight and in good condition, the cover bolts are torqued to 30 ft/lbs., conduit/cable gland connections are intact and free of corrosion.

Should the flange surface be damaged, NEVER attempt to rework the surface of flange in the field. Consult the analyzer or enclosure manufacturer identified by one of the red metal labels affixed to the enclosure.

See enclosure diagram on following page.

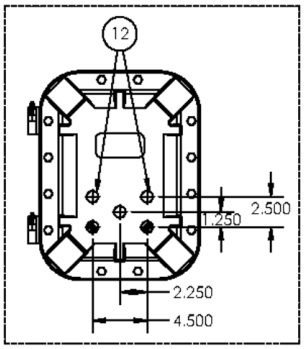
3. Installation

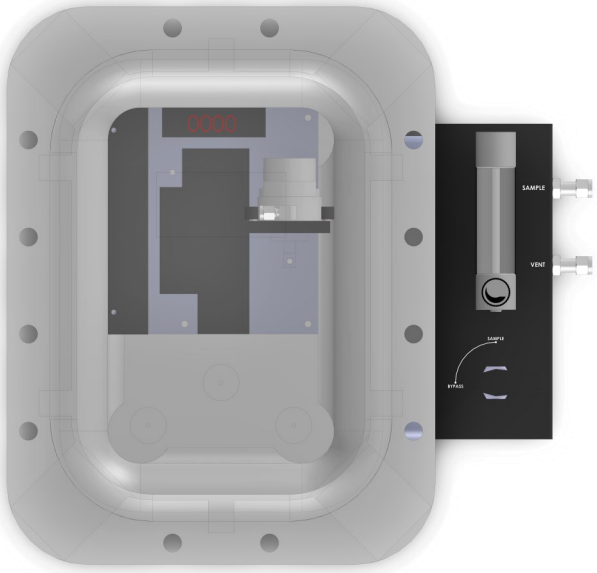
Mounting - Enclosure Diagram



REF	DESCRIPTION	PART NO.
1	3/4" NPT-F POWER INPUT	-
2	LCD DISPLAY 3.5 DIGITS; MODE & ALARM LED'S	MTR-1002
3	BYPASS VALVE	VALV-1031
4	FLAME ARRESTORS	FITN-1262
5	ACTUATOR CONTROL ZERO POTENTIOMETER	A-3152
6	ACTUATOR CONTROL RANGE SWITCHING	A-2610 (GPR-18) A-2745 (GPR-18MS) A-2774 (GPR-28)
7	ACTUATOR CONTROL SPAN POTENTIOMETER	A-3152
8	FLOW INDICATOR WITH VALVE	FMTR-1002
9	3/4" NPT-F OUTPUT & ALARMS INPUT	-
10	ENCLOSURE ALUM. EX-PROOF (ATEX)	ENCL-1012
11	BREATHER DEVICE	ENCL-1146
12	ENCLOSURE ALUM. EX-PROOF (ATEX) WITH OPTIONAL ACTUATOR CONTROLS - ALARM 1, ALARM 2 DRILL AND TAP 3/4"-14 NPSM THRU, SPOT FACE 2" DIAMETER (INSIDE COVER), MIN. SPOT FACE DEPTH - 360° CLEAN-UP, MIN. COVER THICKNESS REMAINING - 27/32", 2 PLACES	ENCL-1012-1

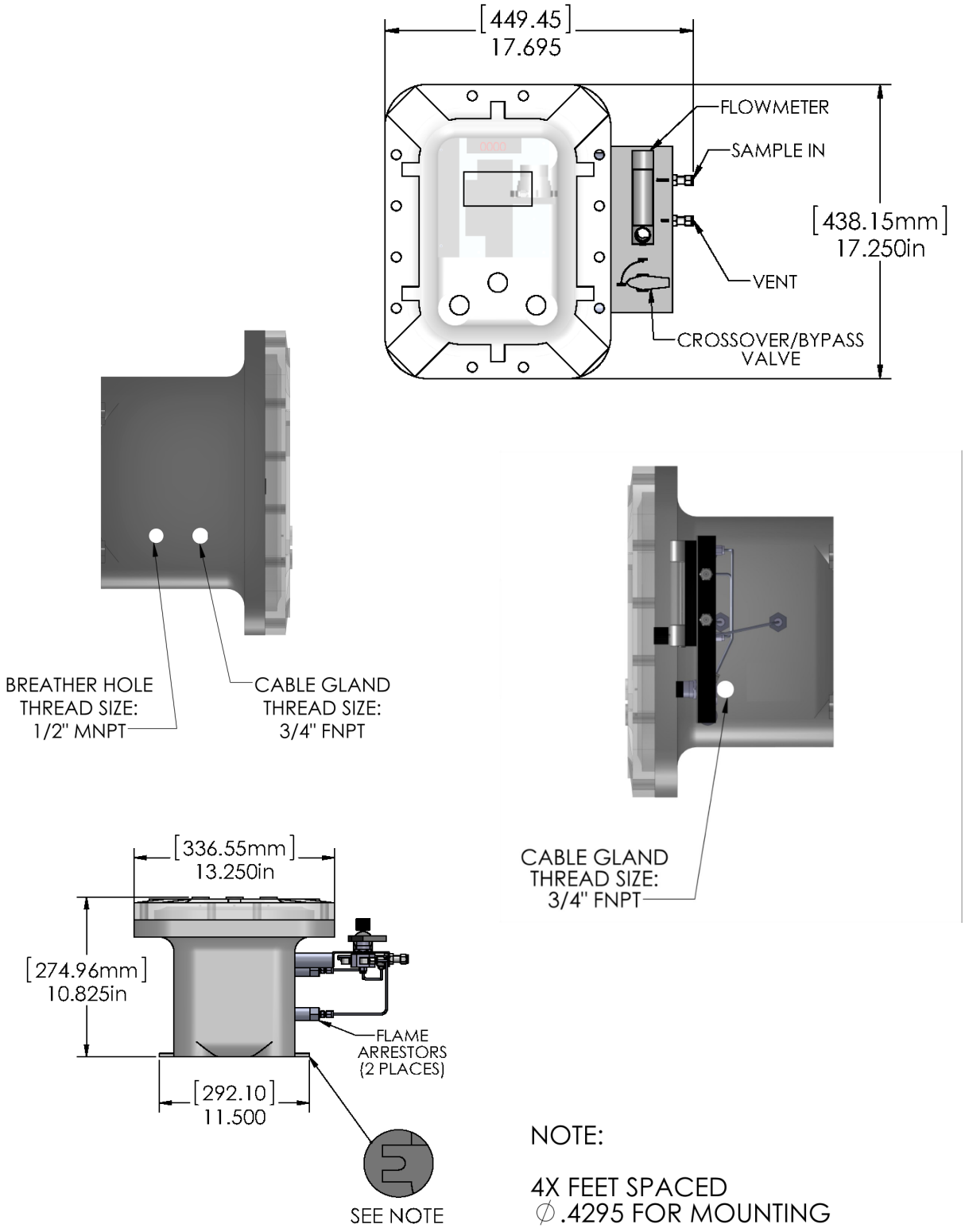
OPTIONAL





3. Installation

Mounting - Enclosure Diagram



3. Installation

Electrical Connections

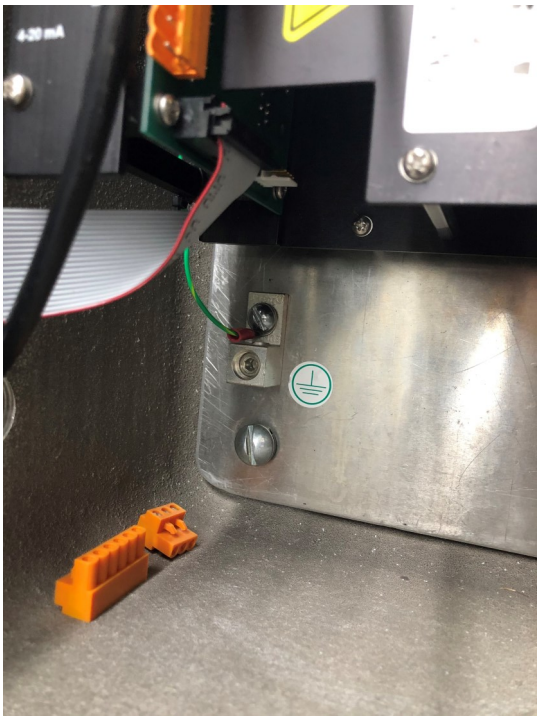
The analyzer electronics including the optional integral heater system are powered by 110 or 220 VAC power which must be specified at order entry. The analyzer's power rating is located near the power input terminal.

Install cable glands, size 3/4"-14 NPT-M, or conduit using an approved electrical conducting type lubricant on the threads. The glands and conduit must be either a tapered type thread conforming to ANSI/ASME B1.20.1 standard or an ISO metric thread standard.

Supply power to the analyzer only as rated by the specification and markings on the analyzer enclosure.

The accessories used for cable gland entry, size 3/4"-14 NPT-M, must be covered by a separate ATEX certificate and must be suitable to be used with the enclosure, see **Appendix A**.

Ensure that the analyzer is properly grounded, see illustration below, and meets the requirements of recommended local electrical standards.



Power Consumption: The analyzer consumes a maximum 30 watts of power without the optional heater and 93 watts with the built-in optional heater system.

Power must be supplied through a separate conduit on the left side of the enclosure, see drawing previous page.

Use a shielded power cord with minimum of 18 gauge wires. If equipped with the optional integral heater system, the required internal wiring to the heater and controller has been installed at the factory.

The user simply connects an appropriate source of AC power to the power terminal as illustrated below. Bring the output and alarm connections through an approved 3/4"-14 NPT-M conduit fitting on the right side of the enclosure, see drawing previous page.

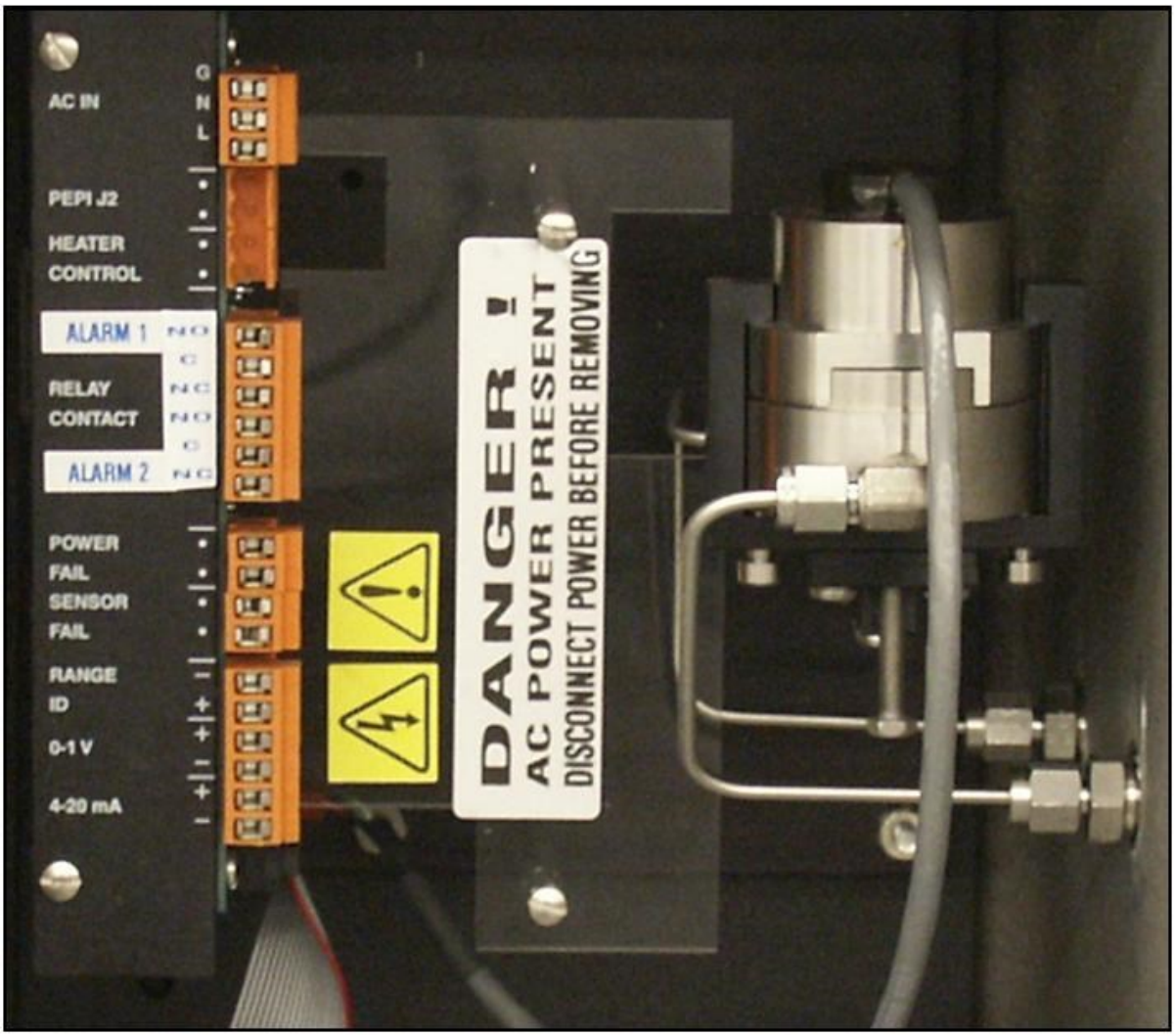
The electronics are rated for 110 or 220 VAC. Supply appropriate AC power of the power. An improper voltage could permanently damage the heating system. Do not remove the protective Plexi-glass panel that covers the PCB. The cover prevents the user from touching any of the **LIVE** circuitry on the PCB.

If authorized by the factory to replacement failed components in the analyzer, disconnect the AC power source to avoid electric shock. There is no AC power present on the circuit board assemblies mounted on inside of analyzer door.

See power and electrical feature connections, interconnection wiring and optional heater wiring diagrams along with installation procedures on the following pages.

3. Installation

Electrical Connections

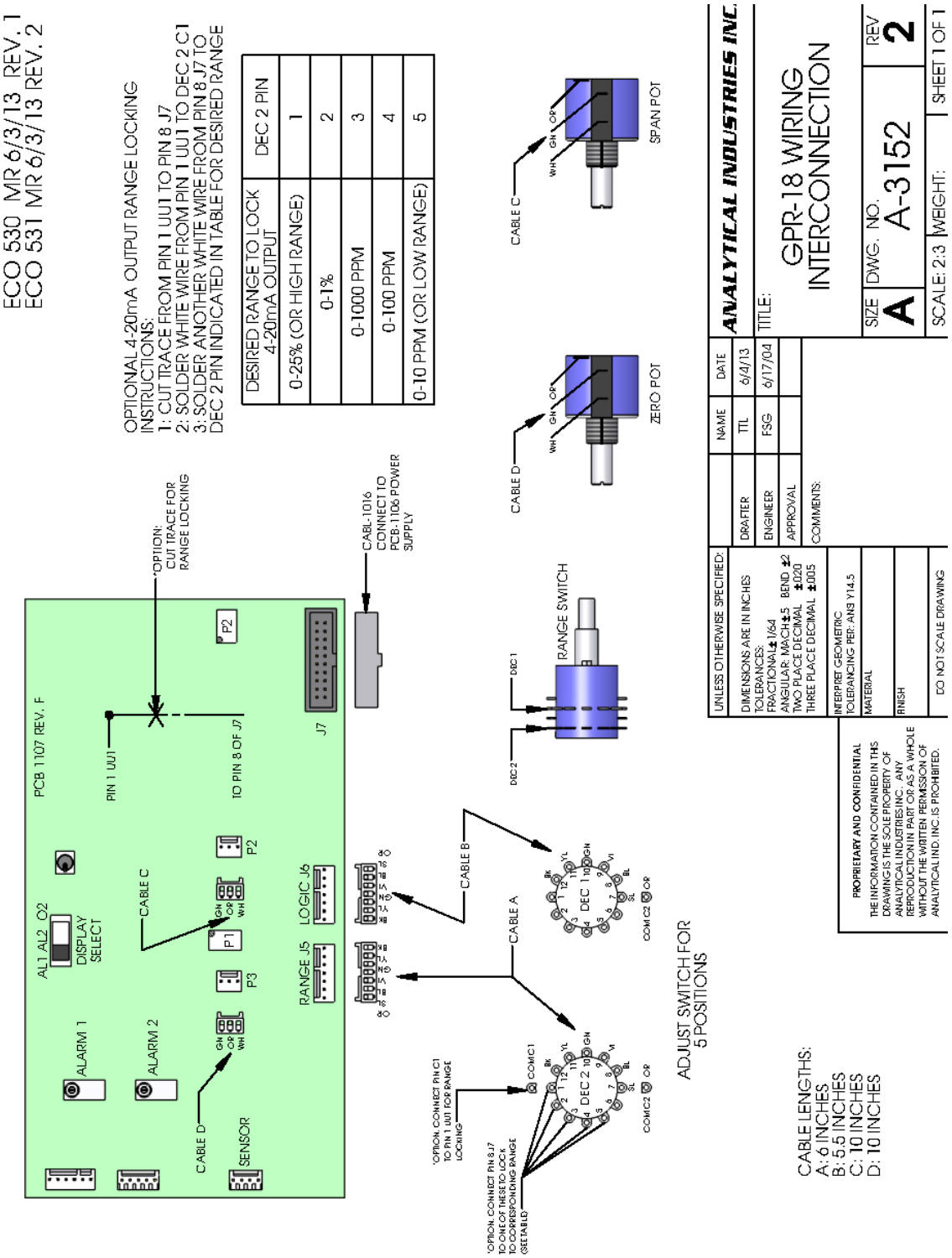


Procedure:

1. Insert the power cable through the user supplied ATEX approved conduit fitting on the left side of the analyzer.
2. Insert the signal output cable(s) through the user supplied ATEX approved conduit fittings on the right side of the analyzer.
3. Strip the ends of the wires approximately ¼ inch.
4. Loosen the terminal screws, insert the bare wire into the appropriate terminals and re-tighten with a small bladed screwdriver.
5. **Note:** If equipped with the optional temperature-controlled heater system, the necessary wiring to the heater and controller has been installed at the factory and no additional connections are required. The power connection services both the analyzer electronics and temperature-controlled heater system.
6. Connect the power ground directly to the ground terminal on the inside of the analyzer case, see previous page.
7. Pack and seal the seal fittings bringing power to and taking analog outputs and alarm interconnection wiring from the analyzer as recommended in Appendix A.
8. Establish power to the analyzer after making gas connections as below once installation is complete.

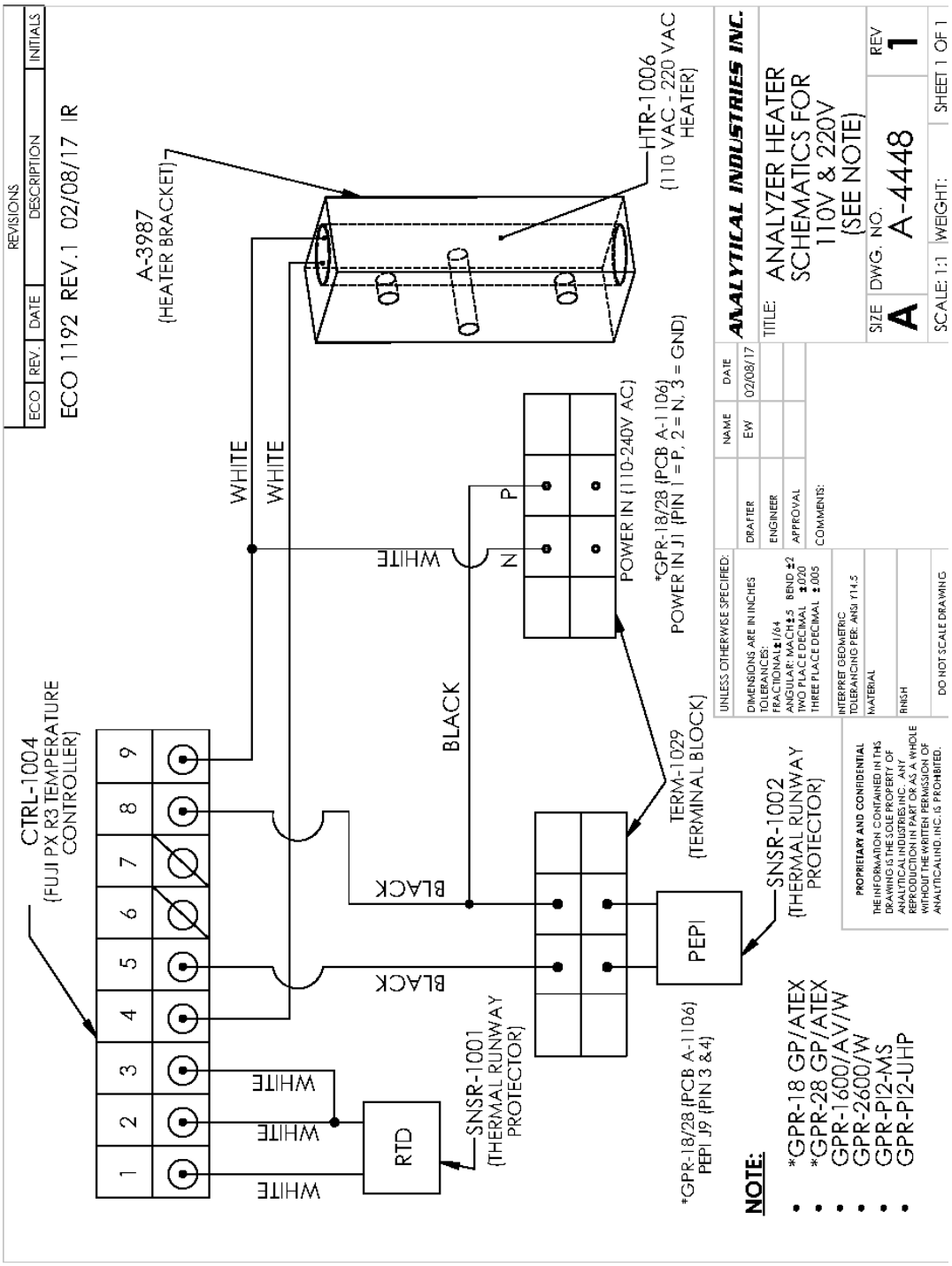
3. Installation

Electrical Connections - Analyzer Interconnection Diagram



3. Installation

Electrical Connections - Optional Heater Wiring Diagram



3. Installation

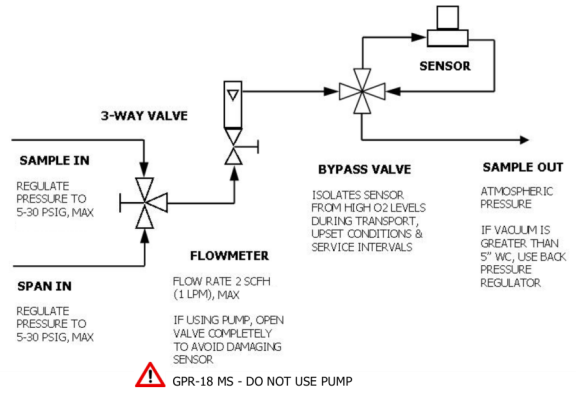
Gas Connections

The analyzer's flow through configuration is designed for positive pressure samples and requires connection to 1/4'" diameter compression tube fittings. Addressing different sample conditions was discussed previously.

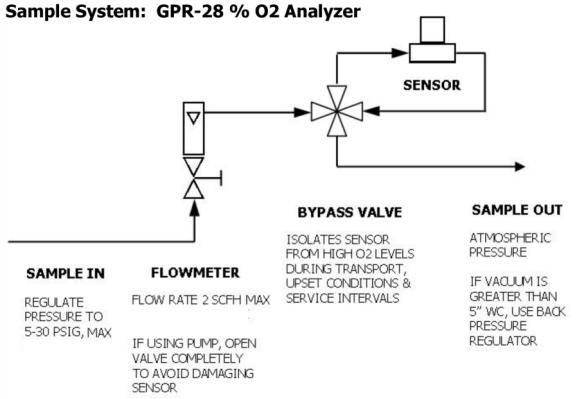
Complementing the performance capabilities of the PPB (GPR-18 MS) and PPM (GPR-18) oxygen sensor is a sample system consisting of stainless steel and glass wetted parts, a unique proven leak-tight sensor housing design and a sample/bypass system.

The bypass system isolates the sensor from exposure to high oxygen concentration during transport, upset conditions and routine maintenance and bring the analyzer on-line at PPB and PPM levels very quickly. The sample/bypass valve is not required for the GPR-28.

Sample System: GPR-18 MS PPB O2 Analyzer / GPR-18 PPM O2 Analyzer



Sample System: GPR-28 % O2 Analyzer

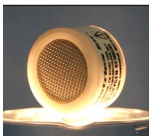


Establish Power to Electronics

Connect a power cable to analyzer's power terminal block. The electronics are rated for a power input of 100 or 230 VAC 50-60 Hz. With optional temperature-controlled heater system, however, supply only the voltage noted near the power terminal.

The LCD display will light up when power is applied to the analyzer. Assuming the analyzer has been installed as directed above, and the sensor has been installed at the factory, the reading displayed when the analyzer is turned on, reflects the oxygen value under static condition (i.e. the axiom that all valves and fittings leak, the sensor is looking at equilibrium point of oxygen diffusing into the sample system and oxygen consumed by the sensor).

Installing the Oxygen Sensor



Analyzers are shipped with the oxygen sensor that the analyzer was calibrated, qualified and tested with at the factory as documented by the Quality Control & Calibration Certification and chart recordings in section 12.

Circumstances vary but normally the oxygen sensor is installed prior to shipment and the analyzer is fully operational out of the box.

If the oxygen sensor was shipped separately or if a new oxygen sensor must be installed in the field, it will be necessary to install a new sensor.

The sensor is sealed in a special bag under application conditions. DO NOT open the bag until ready to install the sensor.

DO NOT open the oxygen sensor. The sensor contains a corrosive liquid electrolyte that could be harmful if touched or ingested, refer to section 10 Safety Data Sheet. Avoid contact with any liquid or crystal type powder in or around the sensor or sensor housing, as either could be a form of electrolyte. Spent sensor or a leaking sensor should be disposed of in accordance with local regulations.

After sensor installation, the analyzer must be calibrated to ensure correct sample analysis. Review section 4 Calibration to determine whether the next step is Zero or Span Calibration.

Depending on the circumstances and type of oxygen sensor, there are several procedures with different requirements as described on next page.

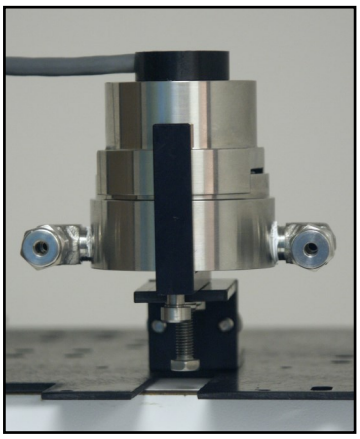
3. Installation

Procedure Applicable to GPR-18 MS and GPR-18 if Zero Calibration is to follow (section 4 Calibration):

1. Select the analyzer's highest range available range, adjust as the reading trends downward.
2. Initiate the flow of a high purity N2 zero gas, regulate the pressure to the lowest value expected in the sample gas and then set the flow rate, see section 11 Specification.
3. Place the Sample/Bypass valve in the Sample position before installing the oxygen sensor.
4. Use the 5/16 wrench supplied to loosen the clamp bolt under the sensor housing.
5. With the bolt loose, rotate the upper sensor housing 90° to disengage it from the clamp.
6. Remove the oxygen sensor from the bag (**if replacing an existing sensor see section 6**).
7. Place the oxygen sensor in the bottom section of the sensor housing, PCB facing up.
8. Remove the two red shorting strips (including the gold ribbon) from the sensor's PCB.
9. Place the upper section of the sensor housing over the oxygen sensor, gently push downward and rotate 90° to engage the clamp.
10. Use the 5/16 wrench to re-tighten the clamp bolt.
11. The analyzer will display the O2 content of the gas.
12. Confirm the downward trend of the O2 concentration with an external recording device.
13. Proceed to section 4 Calibration to complete Zero Calibration

Procedure Applicable to GPR-18 MS, GPR-18 and GPR-28 if Span Calibration is to follow:

1. Select the range that accommodates the O2 content of the span gas, see section 11 Specification.
2. Initiate the flow of span gas, regulate the pressure to the lowest value expected in the sample gas and then set the flow rate, see section 11 Specification.
3. Place the Sample/Bypass valve in the Sample position before installing the oxygen sensor.
4. Use the 5/16 wrench supplied to loosen the clamp bolt under the sensor housing.
5. With the bolt loose, rotate the upper sensor housing 90° to disengage it from the clamp.
6. Remove the oxygen sensor from the bag (**if replacing an existing sensor, see section 6**).
7. Immediately place the oxygen sensor in the bottom section of the sensor housing, PCB facing up.
8. Remove the two red shorting strips (including the gold ribbon) from the sensor's PCB.
9. Place the upper section of the sensor housing over the oxygen sensor, gently push downward
10. and rotate 90° to engage the clamp.
11. Use the 5/16 wrench to re-tighten the clamp bolt.
12. The analyzer will immediately display oxygen content of the gas.
13. Confirm the downward trend of the O2 concentration with an external recording device.
14. Proceed to section 4 Calibration.



Procedure Applicable to GPR-18 and GPR-28 if Air Calibration is to follow:

1. Select the range of the analyzer to the 0-25% range.
2. Initiate the flow of sample gas, regulate the pressure to lowest value expected in the sample
3. Gas and then set the flow rate, see section 11 Specification.
4. Place the Sample/Bypass valve in the Sample position before installing the oxygen sensor.
5. Use the 5/16 wrench supplied to loosen the clamp bolt under the sensor housing.
6. After loosening the bolt, rotate the upper sensor housing 90° to disengage it from the clamp.
7. Remove the oxygen sensor from the bag (**if replacing an existing sensor, see section 6**).
8. Remove the two red shorting strips (including the gold ribbon) from the sensor PCB.
9. **Proceed to section 4 Calibration and follow the Air Calibration procedure.**
10. Upon completion of the Air Calibration procedure, immediately place the new sensor in the bottom section, PCB facing up.
11. Place the upper section of the sensor housing over the sensor, gently push downward and rotate 90° to engage the clamp.
12. Use the 5/16 wrench to re-tighten the clamp bolt.
13. The analyzer will immediately display the O2 content of the gas.
14. Confirm the downward trend of the O2 concentration with an external recording device.

4. Calibration

In order to accurately measure the oxygen concentration in a sample gas stream, it is necessary to calibrate (adjust the accuracy) the analyzer electronics to the oxygen sensor's signal output when exposed to certified gas standard. Calibration can involve one or both Zero and Span Calibrations.

The user is responsible for making provision for calibration gases and regulating the sample and span gas pressure and flow as described below.

Recommendation: Consider installing 3-way valves before the sample inlet to provide a permanent connection for Zero gas (if required) and/or Span gas and a means of switching from SAMPLE to ZERO or SPAN gas and vice versa without breaking gas line connections. This arrangement eliminates the possibility of exposing the sensor to high oxygen when changing gas lines to switch gas sources.

Accuracy

Single Point Calibration: The galvanic oxygen sensor generates an electrical current that is both linear and proportional to the oxygen concentration in the sample gas.

In the absence of oxygen, the sensor exhibits an absolute zero, e.g. the oxygen sensor **does not** generate a current signal output in the absence of oxygen. Given the specificity, linearity and absolute zero properties, a single point calibration of the analyzer is possible.

Pressure: Galvanic oxygen sensors are accurate at any pressure provided the pressure is constant. Oxygen sensors are sensitive to the partial pressure of oxygen in the sample gas and their output is a function of the number of oxygen molecules 'per unit volume' of the sample gas. The number of oxygen molecules per unit volume will increase proportionally with pressure.

Expected sensor life is inversely proportional to pressure.

Because pressure varies in real world applications, a flow control device is positioned between the pressure regulator and the oxygen sensor to reduce and stabilize the pressure at the oxygen sensor. The type of flow control valve or fixed restrictor varies with the flow sensitivity of the oxygen sensor.

The GPR-18 MS oxygen sensor is more flow sensitive and requires the precision of a flow restrictor, whereas, the membrane clad oxygen sensors found in the GPR-18 and GPR-28 are not flow sensitive and use a metering valve to maintain the pressure.

Flow devices can minimize the influence of increasing pressure but drops in pressure actually change the partial pressure at the oxygen sensor.

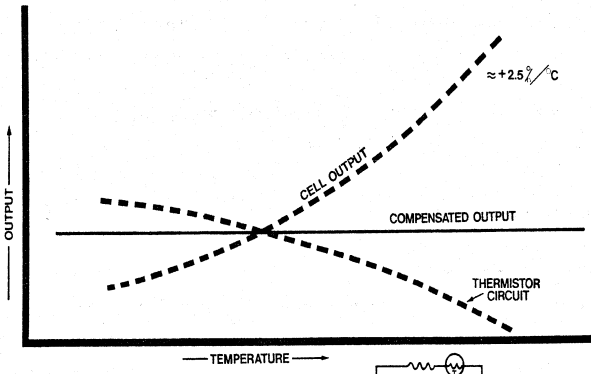
To prevent erratic oxygen readings, set the flow rate only after the pressure is regulated, see section 11 Specifications, at the lowest pressure anticipated under sampling conditions.

Temperature: The rate at which oxygen molecules diffuse into the sensor is controlled by a Teflon membrane otherwise known as an 'oxygen diffusion limiting barrier. All diffusion processes are temperature sensitive, the sensor's electrical signal output also varies with temperature.

Changes in temperature result in a 2.54%/ºC variation in the sensor's signal output which inversely affects expected sensor life.

With reference to Dalton's Law of partial pressure, the oxygen diffusion limiting barrier allows and requires a small amount of the actual sample to permeate into the sensor to make the oxygen measurement. This provides several performance advantages:

1. Unaffected by changes in flow rate, 0.1 to 10 SCFH.
2. Unaffected by changes in background gases (except GPR-12-2000 MS2 Pico Ion PPB oxygen sensor).
3. Unaffected by moisture and particulates.



A temperature compensation circuit offsets the 2.54%/ºC variation in the sensor's signal output once the electronics and sensor's diffusion barrier and electrolyte reach equilibrium. Accuracy is ±5% full scale range over the operating temperature range, see section 11 Specifications.

A variation of ~10º F produces < 2% FS error in the O2 reading until equilibrium is reached.

To prevent erratic oxygen readings, calibrate the analyzer at the temperature nearest the temperature anticipated under sampling conditions

4. Calibration

Calibration Gas Preparation

It is essential that when using a certified standard zero or span gas to adjust the analyzer sensitivity that the integrity of the gas is maintained during installation of a pressure regulator (on the gas cylinder) to regulate the gas pressure when making
gas connection to the analyzer.

Required Components:

1. Certified zero or span (as recommended in section 11 Specifications) gas cylinder.
2. Regulator to set gas pressure to 5-30 psig.
3. Suitable fittings and 1/8" or 1/4" dia. metal tubing to connect the regulator to the flow meter/analyzer SAMPLE IN inlet
4. Suitable fitting and 1/8" or 1/4" metal tubing to connect from the flow meter vent to the analyzer tube fitting designated as SAMPLE OUT.
   Use additional flow meter only if the analyzer is not equipped with an integral flow meter.

Procedure:

1. With the span gas cylinder valve closed, install the regulator on the cylinder.
2. Open the regulator's exit valve and partially open the pressure regulator's control knob.
3. Open slightly the cylinder valve.
4. Loosen the nut connecting the regulator to the cylinder and bleed the pressure regulator.
5. Retighten the nut connecting the regulator to the cylinder.
6. Adjust the regulator exit valve and slowly bleed the pressure regulator.
7. Open the cylinder valve completely and then close the regulator exit valve.
8. Set the pressure as specified in section 11 using the pressure regulator's control knob.
9. **Caution:** Do not exceed the recommended flow rate. Excessive flow rate could cause backpressure on sensor and may result in erroneous readings and permanent damage to sensor.

Zero Calibration

Zero Calibration (preceding Span Calibration) is required for optimum accuracy only when analyzing a sample with an expected value of less than 5% to 10% of the most sensitive range available. Perform a Zero Calibration when initially installing the analyzer, the customer's sample system is interrupted, and a new sensor is installed.

Zero Calibration produces an adjustment that is too small to affect the accuracy and thus is not recommended for the following measurements :

1. Above 10% of the most sensitive ranges on the GPR-18 MS and GPR-18.
2. 99% of percent range applications involving the GPR-28, which has no Zero Calibration capability.

In theory, the galvanic fuel cell type oxygen sensor has an absolute zero meaning it does generate a signal output when exposed to an oxygen free zero gas.

In reality, the sensor generates a signal output or positive oxygen reading when sampling a zero gas due to:

1. Minor leakage in the sample line connections.
2. Impurities in the zero gas, e.g. accuracy % tag.
3. Tolerances of the electronic components.
4. Lack of quality control during manufacturing of the sensor that results in residual oxygen dissolved inside the sensor.

The term **ZERO OFFSET** is applied to the fully stabilized oxygen reading evidenced by a flat horizontal trend on an external recording device after 12-30 hours of continuous exposure to flowing high purity zero gas.

This horizontal trend indicates:

1. The sensor has consumed all the oxygen that dissolved into the sensor's electrolyte during installation or exposure to high levels of oxygen,
2. The remaining oxygen value represents the sum total of elements 1-4 listed above,
3. The ZERO OFFSET value the analyzer electronics will deduct from all subsequent readings including Span Calibration for optimum accuracy.

The manufacturer's Quality Control testing prior to shipment confirms the zero offset, above, is within acceptable limits. However, owing to the differences in the user's sample system leakage and zero gas accuracy, no Zero Calibration adjustment is made by the factory.

The following Zero Calibration procedure assumes the user is installing the analyzer for the first time.

Procedure for Zero Calibration:

1. Connect the zero gas to either the sample inlet or Zero/Span valve if present.
2. Connect an external recording device to monitor the trend of the reading to the 0-1V or 4-20 mA analog signal outputs.
3. Refer to section 11 Specifications and set the pressure and flow rate as specified.
4. Initiate the flow of ultra-high purity nitrogen zero gas to the analyzer.
5. Allow 12-30 hours for the O2 trend to stabilize parallel to the X axis on the external recording device.

The time required for stabilization, clean-up, recovery, purge down depends on:

i)If the gas lines were adequately purged.
ii)Quality of the zero gas,
iii)Length of time the sensor was exposed to ambient air during installation, e.g. red shorting devices removed (unshorted) before being connected (shorted) to the upper section of the sensor housing.

4. Calibration

6. If after 2 hours, the oxygen value displayed is not below 5 PPM, perform a complete check of all external sample system connections and allow the zero gas to flow overnight before concluding the sensor is defective and notifying the factory.
7. Once the analyzer reading stabilizes, the reading should be well below 50% of the most sensitive range, the limit of the ZERO OFFSET adjustment.

Prematurely adjusting the ZERO control knob will result in erroneous low or even negative oxygen readings when sampling gases with very low O2 concentrations.

6. Turn the ZERO knob on the analyzer's front panel ½ turn at a time until the analyzer display reads 0.00 to complete the Zero Calibration and activate the ZERO OFFSET.
7. Place the Sample/Bypass valve in the Bypass position before disconnecting the zero gas line.
8. Connect the span gas line as described previously and allow the span gas to flow for 30 seconds to purge the ambient air through the gas lines.
9. Proceed to SPAN CALIBRATION

Subsequent Zero Calibration requires eliminating the previous ZERO OFFSET

Changes such as:

- Replacing the oxygen sensor
- Servicing the user's sample system
- Replacing an electronic PCB or other component
- Correcting for zero drift as determined by repeating the Zero Calibration procedure above.

require eliminating the prior ZERO OFFSET and performing a new Zero Calibration to establish a new ZERO OFFSET.

Procedure for Eliminating the Zero Offset:

1. Loosen the top section of the sensor housing, twist it 90 degrees and pull it up until it disengages from the sensor.
2. The resulting reading represents the ZERO OFFSET stored in the analyzer electronics.
3. Allow the reading to stabilize.
4. Adjust the ZERO knob on the analyzer's front panel until the analyzer reads 0.00.
5. After eliminating the ZERO OFFSET, the reading on all ranges should be zero with +/- one digit of the range.

Install the oxygen sensor and perform a new Zero Calibration as described above.

Span Calibration

Involves periodically adjusting the analyzer electronics to the sensor's signal output when it is exposed to a gas with a known oxygen content, see below or section 11.

Recommended Calibration Gases:

- **GPR-18 MS**: certified span gas of 7.5-9 PPM oxygen balance nitrogen.
- **GPR-18**: certified span gas of 75-90 PPM oxygen balance nitrogen or clean source ambient air 20.9% oxygen.
- **GPR-28**: clean source of ambient air 20.9% oxygen or a certified span gas oxygen balance with the oxygen content approximating 75–90% of FS.

The frequency of calibration varies with the application conditions, the degree of accuracy required and the Quality Assurance requirements of the user.

Ensure accuracy, allow the oxygen reading to stabilize on the certified span gas standard before making the Span Calibration adjustment.

The Span Calibration process itself only takes 15-30 minutes. However, the time required to bring the analyzer back on-line can vary depending on the span gas used, exposure time and purging the sensor after Span Calibration with the lowest oxygen concentration gas available.

Recommendations to minimize downtime (see Recovery section 11 Specifications)**:**

GPR-18 MS PPB Oxygen Analyzer:

1. Minimize exposure of the sensor to air when installing new sensor,
2. DO NOT calibrate with span gas containing more than 900 PPM oxygen balance nitrogen.
3. Change the gas line immediately upon completion of Span Calibration to lowest oxygen concentration gas available and purge:
   - i) place the Sample/Bypass valve in the Bypass position,
   - ii) change the gas lines from Span to lowest oxygen concentration gas available,
   - iii) initiate the flow of low oxygen concentration gas and purge the gas lines for 30 seconds,
   - iv) place the Sample/Bypass valve in the Sample position, allow the analyzer reading to stabilize,
1. If the lowest oxygen concentration gas was not the sample gas, repeat (3) above with the sample gas.

GPR-18: As above, except #2 is not applicable.

GPR-28: No special requirements.

4. Calibration

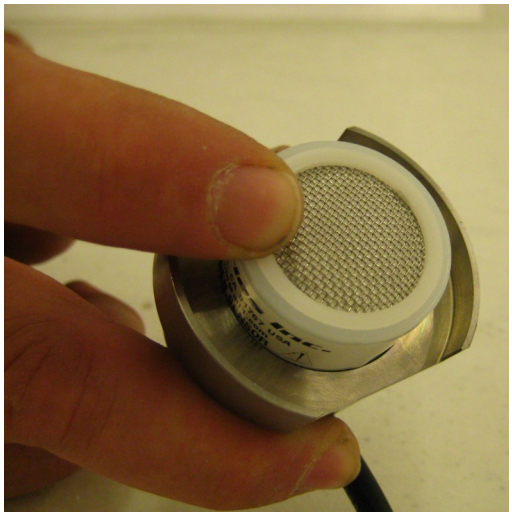
Procedure Span Gas Calibration:

1. Place the Sample/Bypass valve in the Bypass position.
2. Connect the span gas line to either the SAMPLE INLET or Zero/Span valve if present.
3. Connect a metal vent line to the fitting designated SAMPLE OUT or VENT.
4. **Optional:** Connect an external recording device to monitor the trend of the reading to the 0-1V or 4-20 mA analog signal outputs.
5. Assure there are no restrictions in the vent line.
6. Initiate the flow of the span gas to the analyzer.
7. Set the pressure and flow rate as described in the preceding **sub-section titled Accuracy**.
8. Purge the gas lines with span gas for 30 seconds.
9. Place the Sample/Bypass valve in the Sample position.
10. The sensor will detect the oxygen content in the span gas and the analyzer's reading will move toward it.
11. Ensure accuracy, allow the oxygen reading to stabilize (15-30 minutes) on the certified span gas standard before making the Span Calibration adjustment.
12. Turn the SPAN knob on the analyzer's front panel ½ turn at a time until the analyzer displays the oxygen content of the certified span gas standard.
13. Place the Sample/Bypass valve in the Bypass position before disconnecting the span gas line.
14. Connect the sample gas line as described previously and allow the sample gas to flow for 30 seconds to purge the ambient air through the gas lines.
15. Proceed to SAMPLING.

Procedure Ambient Air Calibration:

DO NOT calibrate the GPR-18 MS with a span gas containing more than 900 PPM oxygen balance nitrogen.

1. Place the analyzer in the OXYGEN mode and select the CAL (0-25%) range.
2. Access the interior of the analyzer by removing the bolts securing the front door.
3. Using the 5/16 wrench supplied, loosen but do not remove the clamp bolt holding the two sections of the sensor housing.
4. Rotate the upper section of the sensor housing 90º to disengage from the clamp.
5. Remove the upper section by pulling it straight up and let it rest on your 1st and 2nd fingers.
6. With your other hand, remove the oxygen sensor from the bottom section of the housing.
7. Place the sensor in the upper section of the sensor housing ensuring the PCB contacts the two gold pins.
7. Use your thumb (see photo right) to hold the sensor and upper section of the sensor housing together.
8. With the sensor exposed to ambient air – allow the reading to stabilize for 1-2 minutes.
9. After the reading stabilizes, turn the SPAN knob until the LED display reads the 20.9%.



10. After air calibration, reinstall the sensor as previously described.
11. With sample gas flowing, the oxygen reading will start trending down.
12. Manually turn the RANGE selector switch to lower ranges and follow the progress of the sensor's recovery, see section 11 Specifications.
13. Proceed to SAMPLING.

Sampling

After ZERO and SPAN calibration, the analyzer is ready to analyze the sample gas stream. Select the appropriate range of interest by turning the RANGE selector switch to the desired range.

If the oxygen concentration is higher than the selected range, the display will show 1-- indicating over-range condition. If this occurs, select a higher range until the display show oxygen reading.

Adjust the flow rate if necessary as specified in section 11.

5. Operation

As detailed in section 1 Introduction, the Explosion Proof Series of Oxygen Analyzers are designed with an explosion proof enclosure, flame arrestors, breather device, actuators and ATEX certified for use in hazardous areas.

The preceding sections 2, 3, 4 detail the basic do's and don'ts, setup and calibration information, review them.

* The analyzer shall not have an internal source of release of oxygen or any other oxidizers in concentrations greater than 21%.

Analyzer Features

Oxygen Display

The analyzers are equipped with a 3-1/2 digit LED display that shows oxygen concentration from PPB to % level depending on the range of analysis selected.

Display Mode Selection

The DISPLAY SELECT slide switch (circled in red in photo at right) is located on the main signal processing PCB mounted on the inside of analyzer front door. The slide switch has been set to the O2 position at the factory. Advance this slide switch to select one of the three available DISPLAY modes:

OXYGEN to display the oxygen reading
ALARM 1 to set Alarm 1 Set point
ALARM 2 to set Alarm 2 Set point

Oxygen Alarms

The analyzers are equipped with two user adjustable alarms that when activated trigger SPDT Form C, normally closed, non-latching relays rated @ 5A, 30VDC or 240VAC resistive.

The alarm set point represents a value. When the oxygen reading exceeds ALARM 2 (high alarm) or falls below ALARM 1 (low alarm) set point, the corresponding relay is activated.

The alarms are fully adjustable by the two potentiometers accessible from the auxiliary panel (circled in yellow in the photo at right) on the inside of the door with a small bladed screwdriver. Optionally, the alarm controls might have been installed external to the analyzer by using actuators.

To configure alarms as "Fail safe" (inactive when energized) - connect positive lead to NO and negative to the C, common or neutral.

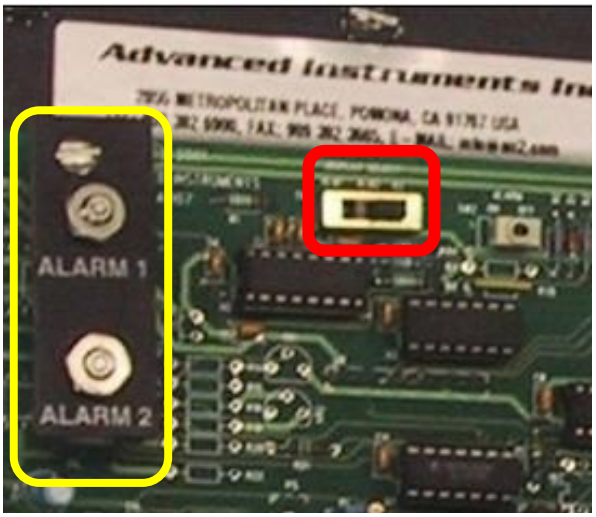
To connect to an active relay, connect the live cable to the common terminal C and the secondary cable to the normally open NO terminal.

To break the connection upon relay activation, connect the secondary cable to the normally closed NC terminal.

To prevent chattering of the relays, the alarm will remain active until the oxygen reading has fallen 2% below the alarm set point (high alarm) or risen 2% above the alarm set point (low alarm) after the alarm was activated.

Procedure (see photo below):

1. Open the front door to access the DISPLAY SELECT slide switch (highlighted in red) located on the A-1107 PCB Assembly Main/Display.
2. Slide the switch to the ALM1 (high) or ALM2 (low).
3. The LED display indicates the current alarm set point.
4. The set point is displayed as a value on a given range.
5. Use a small bladed screwdriver to adjust the potentiometer slowly, a ½ a turn at a time to allow the electronic processing to catch up . . . until the display reads the desired alarm set point value.
6. Once the alarm values are set, slide the DISPLAY SELECT switch back to OXYGEN position.



Power Fail Alarm

A dry contact rated at 1A @ 30 VDC is provided as a power failure alarm. The contact is normally open but closes when the power to the analyzer is switched off or interrupted.

Sensor Fail Alarm

A relay contact rated at 1A @ 30 VDC is provided for sensor fail alarm. The contact is normally open but closes when oxygen signal goes to zero or falls below zero.

Adjusting the ZERO OFFSET to 00.00 activates the Sensor Failure Alarm possibly causing a spike in the trend analysis. To avoid the momentary spike, set the ZERO OFFSET to 0.01 PPM. The sensor failure alarm becomes active when the display indicates '000' on any range of the analyzer.

5. Operation

Signal Outputs

The analyzer provides an isolated 4-20mA signal output and a 0-1V full scale signal output for external recording devices. The integral IC on the main PCB converts the 0-1V signal with negative ground to a 4-20mA fully isolated signal. A finer adjustment of the zero offset of the 4-20mA converter can be provided by a potentiometer, R99, mounted on the main PCB Assembly. Consult factory for instructions.

DO NOT supply any voltage to either of the two terminals of the 4-20mA converter. Supplying power to 4-20 mA IC will permanently damage the IC. The integral 4-20mA converter is internally powered and does not require external power.

Range ID

A voltage output corresponding to each range is provided. The output of the highest range (normally CAL) is 5V. The range ID voltage will change by 1V with each remaining range.

Temperature Controlled Heater System

If the optional temperature controlled heater system is installed, the temp controller is accessible only by opening the front door of the enclosure. The controller is PID and is set at the factory to maintain the analyzer interior temperature at 85°F (30°C)

DO NOT change this setting. A higher temperature setting may drastically reduce sensor life and possibly cause damage to the electronic circuitry of both the controller and the analyzer. When power is applied to the temperature controller, the controller initially tunes itself and then maintains the temperature at the set point.

It is recommended that at initial start-up, or when replacing oxygen sensor or when trouble shooting, set the set point around 60°F (15°C) to turn heater off (to prevent overheating of heater element).

Keep the analyzer front door closed and securely fastened when the temperature controller is ON.

Heater Runaway Protection

As part of the optional temperature controlled heater system, the analyzer is protected in the event the temperature controller should fail and thereby allowing the heater to runaway damaging the interior of the analysis unit.

The protection is provided by a J2 type device positioned between the temperature controller and the heater. This device cuts off power to the heater if temperature inside the enclosure exceeds 158°F (70°C). Should the F2 device fail, correct the problem and replace J2.

Range Selection

See section 11 Specifications: the analyzers are equipped with four (4) standard measuring ranges. The GPR-18 is equipped with a 5th range of 0-25% for air calibration only. The ranges available are indicated around the RANGE selector knob located in the center of the control panel of the analyzer. Simply turn the pointer on the RANGE knob to the desired range.

* The analyzer shall not have an internal source of release of oxygen or any other oxidizers in concentrations greater than 21%.

If the oxygen concentration is higher than the selected range, the display will show 1---- indicating over-range condition. Select a higher range until the oxygen reading is displayed.

Before concluding the sensor is not "coming down to expected ppb or PPM levels" or "is not responding to sample gas":

1. Confirm that the display selector switch (highlighted in red in photo on previous page) inside of the enclosure door is positioned to the far right in the OXYGEN DISPLAY.
2. Perform a flow test as described in section 8 Troubleshooting to check for leaks in the sample system connections.
3. Perform a Span Calibration, as this condition could result from not allowing the oxygen reading to stabilize before making the adjustment.

Standby

- The analyzer has no special storage requirements.
- The sensor should remain installed in the sensor housing during storage periods – place the 4-way SAMPLE/ BYPASS crossover valve in the BYPASS position.
- Store the analyzer with power OFF.

6. Maintenance

The extent of the maintenance requirements of this analyzer involves periodically replacing the oxygen sensor, cleaning and lubricating the o-ring in the sensor housing and the machined surfaces of the analyzer cover and bottom section.

While none of the components are serviceable in themselves, the section 7 Spare Parts is provided in the unlikely event a component fails and has to be replaced.

DO NOT attempt to service the analyzer or replace component parts on your own, consult the factory or a factory trained service technician. Please review section 9 Warranty.

Sensor Replacement

Periodically, the oxygen sensor will require replacement. Section 11 Specifications defines the normal operating conditions and expected life of the various sensors employed by the various analyzers.

Section 4 Calibration, Accuracy defines the factors that can influence the expected life of an oxygen. In reality, expected sensor life is determined by a number of factors that are influenced by the user and therefore virtually impossible to predict.

DO NOT open the oxygen sensor. The sensor contains a corrosive liquid electrolyte that could be harmful if touched or ingested, refer to section 10 Safety Data Sheet for information.

Install the replacement oxygen sensor as outlined in section 3 Installation, Installing the Oxygen Sensor.

Remove the existing sensor and dispose of in accordance with local regulations.

Analyzer Enclosure

Inspect and clean the machined surfaces of both the bottom base and the hinged cover of the enclosure.

The sealing surfaces must be inspected and free of nicks, dirt or any foreign particle build-up that would prevent a proper seal.

Cleaning & Closing the enclosure:

1. Wipe the sealing surfaces with a clean lint-free cloth.
2. Apply a light coating of Killark "LUBG" lubricant to the sealing surfaces.
3. Close the hinged cover and mate to enclosure base.
4. Install the bolts thru the cover into enclosure base.
5. Finger tighten bolts.
6. Torque all bolts to 30 ft/lbs.

After installation, the unit must be inspected regularly to verify the enclosure mounting bolts are tight and in good condition, the cover bolts are torqued to 30ft/lbs., conduit/cable gland connections are intact and free of corrosion.

DO NOT attempt to repair the flange sealing surfaces should they appear to be damaged, they are not intended to be repaired. Contact the analyzer or enclosure manufacturer identified by one of the red metal labels affixed to the enclosure.

Troubleshooting: Consult the guidelines in section 8 for advice on the common operating errors before concluding that your analyzer is faulty. Do not attempt to service the analyzer beyond those means described in the Instructions for Use.

7. Spare Parts

Description	GPR-18 MS	GPR-18	GPR-28
Oxygen Sensor(s)	GPR-12-2000 MS2	GPR-12-333	GPR-11-32
		XLT-12-333 (CO2 Background)	XLT-12-333 (CO2 Background)
PCB Assy Power / Interconnection	A-1107-MS2	A-1107-M	A-1107-C
Sample Panel Assy	A-4753		A-4565
Sensor Housing Assy SS	A-1004-4-3-14	A-1004-4-3-5	
Sensor Housing SS Upper Assy w/Cable	B-2762-B-2-32	B-2762-A-2-32	
Valve 4-way Sample/Bypass	VALV-1031		Not Applicable
Amplifier E/I converter	IC-1007		
Breather Device 1/2" NPT	ENCL-1146		
Controller Temperature	CTRL-1004		
Flame Arrestor 1/2" NPT	FITN-1262		
Flowmeter Assy	A-4565		
Flowmeter SS, Max Inlet 200 psig, 1/8" FNPT, Scale 5	FMTR-1002		
Fuse Holder for TR5 Fuse	FUSE-1003		
Fuse 3A TR5 Series 250VAC	FUSE-1010		
Heater Rod 75W 240VAC	HTR-1006		
LCD 3.5 DGT 2VFS (29 / 19)	MTR-1002		
O-Ring Viton Black Size -126	ORNG-1007		
PCB Assy Main / Display	A-1106-C		
Sensor Housing SS Bottom Assy	A-4541-4		
Sensor Temperature Pepi J2 Runaway Protector	SNSR-1002		
Temperature Sensor RTD	SNSR-1006		

8. Troubleshooting

Symptom	Possible Cause	Recommended Action
Slow recovery or response time	At installation, defective sensor	Replace sensor if recovery unacceptable or O_2 reading fails to reach 10% of lowest range
	Failure to purge gas lines with Bypass, air leak in connections, dead legs, distance of sample line, low flow rate, volume of optional filters and scrubbers	Leak test the entire sample system: Vary the flow rate, if the O_2 reading changes inversely with the change in flow rate indicates an air leak - correct source of leak
	Abnormality in zero gas	Qualify zero gas (using portable analyzer)
	Damaged in service - prolonged exposure to air, electrolyte leak	Replace sensor
	Sensor nearing end of life	Replace sensor
High O_2 reading after installing or replacing sensor	Analyzer calibrated before sensor stabilized caused by: 1) Prolonged exposure to ambient air, worse if sensor was **unshorted** 2) Air leak in sample system connection(s) 3) Abnormality in zero gas	Allow O_2 reading to stabilize before making the span/calibration adjustment Continue purge with zero gas Leak test the entire sample system (above) Qualify zero gas (using portable analyzer)
High O_2 reading Sampling	Flow rate exceeds limits	Correct pressure and flow rate
	Pressurized sensor	Remove restriction on vent line, replace sensor
	Improper sensor - $CO_{2\ affects}$ GPR sensor	Use XLT sensor when CO_2 or acid gases are present
	Abnormality in gas	Qualify the gas (use a portable analyzer)
Reading doesn't agree to expected O_2 values	Pressure and temperature of the sample is different than span gas	Calibrate the analyzer (calibrate at pressure and temperature of sample)
	Abnormality in gas	Qualify the gas (use a portable analyzer)
	Failure to allow reading to stabilize before zero and/or span calibration adjustments	Repeat calibration procedure and allow reading (sensor) to stabilize
	Calibration error caused by turning the zero and/or span potentiometer more than ½ turn at a time (electronics need time to keep up	Repeat calibration, allow reading to stabilize and make adjustments ½ turn at a time

8. Troubleshooting

Symptom	Possible Cause	Recommended Action
Erratic O_2 reading	Change in sample pressure	Repeat calibration at the temperature and pressure of sample
	Dirty electrical contacts in upper section of sensor housing	Clean contacts with alcohol (minimize exposure time of MS sensor to ambient air to extent possible)
	Corroded solder joints on sensor PCB from corrosive sample or electrolyte leakage from sensor	Replace sensor and return sensor to the factory for warranty determination
	Corroded spring loaded contact in upper section of sensor housing from liquid in sample or electrolyte leakage from sensor	**Upper section of sensor housing:** Clean contacts with alcohol, flow sample or zero gas for 2-3 hours to flush sample system and sensor housing **Sensor:** Replace if leaking and return it to the factory for warranty determination
	Liquid covering sensing area	Wipe with alcohol and lint free towel or flow sample or zero gas for 2-3 hours to flush
	Presence of interference gases	Consult factory
	Presence of sulfur gases and/or CO_2	Replace sensor and install scrubber, contact factory
	Unauthorized maintenance	Replace sensor, obtain authorized service
No O_2 reading Negative O_2 reading	Failure of an electronic component or power surge that sends a charge to the sensor	Service the analyzer, check the power source and THEN replace the sensor
	Pressurizing the sensor by: a) Flowing gas to the sensor with the vent restricted or SHUT OFF valve closed and suddenly removing the restriction draws a vacuum and can damage the sensor and/or cause electrolyte leakage b) Drawing a vacuum on the sensor by partially opening the FLOW valve upstream of the sensor when using a pump downstream to draw sample from a process at atmospheric pressure or a slight vacuum can damage the sensor and cause it to leak electrolyte	Introduce span gas to determine if the sensor responds. If successful calibrate the analyzer and resume sampling If not successful, inspect for electrolyte leakage, check and clean the contacts in the upper section of the sensor housing, flow a little warm water followed by air or clean sample through the analyzer for 2-3 hours to push the electrolyte through the sample system and THEN replace the sensor

9. Warranty

The design and manufacture of Analytical Industries Inc. oxygen analyzers and oxygen sensors are performed under a certified Quality Assurance System that conforms to established standards and incorporates state of the art materials and components for superior performance and minimal cost of ownership. Prior to shipment every analyzer is thoroughly tested by the manufacturer and documented in the form of a Quality Control Certification that is included in the Owner's Manual accompanying every analyzer. When operated and maintained in accordance with the Owner's Manual, the units will provide many years of reliable service.

Coverage
Under normal operating conditions, the analyzers and sensors are warranted to be free of defects in materials and workmanship for the period specified in accordance with the most recent published specifications, said period begins with the date of shipment by the manufacturer. The manufacturer information and serial number of this analyzer are located on the rear of the analyzer. Analytical Industries Inc. reserves the right in its sole discretion to invalidate this warranty if the serial number does not appear on the analyzer.

If your Analytical Industries Inc. analyzer and/or oxygen sensor is determined to be defective with respect to material and/or workmanship, we will repair it or, at our option, replace it at no charge to you. If we choose to repair your purchase, we may use new or reconditioned replacement parts. If we choose to replace your Analytical Industries Inc. analyzer, we may replace it with a new or reconditioned one of the same or upgraded design. This warranty applies to all monitors, analyzers and sensors purchased worldwide. It is the only one we will give, and it sets forth all our responsibilities.

There are no other express warranties. This warranty is limited to the first customer who submits a claim for a given serial number and/or the above warranty period. Under no circumstances will the warranty extend to more than one customer or beyond the warranty period.

Limitations
Analytical Industries Inc. will not pay for: loss of time; inconvenience; loss of use of your Analytical Industries Inc. analyzer or property damage caused by your Analytical Industries Inc. analyzer or its failure to work; any special, incidental or consequential damages; or any damage resulting from alterations, misuse or abuse; lack of proper maintenance; unauthorized repair or modification of the analyzer; affixing of any attachment not provided with the analyzer or other failure to follow the Owner's Manual. Some states and provinces do not allow limitations on how an implied warranty lasts or the exclusion of incidental or consequential damages, these exclusions may not apply.

Exclusions
This warranty does not cover installation; defects resulting from accidents; damage while in transit to our service location; damage resulting from alterations, misuse or abuse; lack of proper maintenance; unauthorized repair or modification of the analyzer; affixing of any label or attachment not provided with the analyzer; fire, flood, or acts of God; or other failure to follow the Owner's Manual.

Service
Call Analytical Industries Inc. at 909-392-6900 (or e-mail info@aii1.com) between:

7:30 AM and 5:00 PM PST . . . Monday thru Thursday
8:00 AM and 12:00 PM PST . . . Friday.

Trained technicians will assist you in diagnosing the problem and arrange to supply you with the required parts. You may obtain warranty service by returning you analyzer, postage prepaid to:

Analytical Industries Inc.
2855 Metropolitan Place
Pomona, Ca 91767 USA

Be sure to pack the analyzer securely. Include your name, address, telephone number, and a description of the operating problem. After repairing or, at our option, replacing your Analytical Industries Inc. analyzer, we will ship it to you at no cost for parts and labor.

10. Safety Data Sheet

GPR Series Oxygen Sensors

PST PROCESS SENSING TECHNOLOGIES

Analytical Industries Inc.
A PST Brand

Safety Data Sheet (KOH)

I. Product Identification

Product Name:	Oxygen Sensor (Series AII, GPR, PSR, Private Label derivations)
Product Use:	Oxygen Sensors
Manufacturer:	Analytical Industries Inc.
Address:	2855 Metropolitan Place, Pomona, CA 92767 USA
Contact Information:	Tel: 909-392-6900, Fax: 909-392-3665, email: info@aii1.com
Emergency Number:	
Date Prepared:	January 1, 1995
Date Revised:	January 31, 2023

II. Hazardou(s) Identification

GHS Classification:

Lead (Pb)	**Health**	**Environmental**	**Physical**
	Acute Toxicity- Category (Inhalation) Acute Toxicity- Category 4 (oral/dermal) Carcinogenic- Category 2ty Reproductive/Developmental- Category 2 Target organ Toxicity (Repeated) Category 2	Acute Aquatic Toxicity-Category 1 Chronic Aquatic Toxicity-Category 1	NA
Potassium Hydroxide (KOH)	**Health**	**Environmental**	**Physical**
	Corrosive to Metal- Category 1 Acute Toxicity- Category 4 (oral) Skin Corrosion-Category 1A Serious Eye Damage-Category 1	Acute Aquatic Toxicity-Category 3	NA

GHS Labels:
Potassium Hydroxide (KOH)
Symbols:

Hazardous Statements

- Danger
- May be corrosive to metal
- Harmful if swallowed
- Causes severe skin burns and eye damage
- Harmful to aquatic life

Precautionary Statements

- Wash skin thoroughly after handling.
- Do not eat, drink or smoke when using this product.
- Avoid release to the environment.
- Wear protective gloves/ protective clothing/ eye protection/ face protection.
- IF SWALLOWED: Call a POISON CENTER or doctor/ physician if you feel unwell.
- IF SWALLOWED: Rinse mouth. Do NOT induce vomiting.
- IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/ shower.
- IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
- IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISON CENTER for doctor/ physician.
- Wash contaminated clothing before reuse.
- Absorb spillage to prevent material damage.
- Store in corrosive resistant stainless steel container with a resistant inner liner.
- Dispose of contents/ container to an approved waste disposal plant.

GHS Labels:
Lead (Pb)
Symbols:

Hazardous Statements ***Precautionary Statements***

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Analytical Industries Inc.
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- Warning !
- Harmful if swallowed
- Suspected of causing cancer.
- Suspected of damaging fertility or the unborn child.
- May cause damage to organs through prolonged or repeated exposure.
- Very toxic to aquatic life with long lasting effects.

- If breathed in, move person into fresh air. In not breathing, give artificial respiration. Consult a physician.
- In case of skin contact, wash off with soap and plenty of water.
- In case of eye contact, flush eyes with water as a precaution.
- If swallowed, rinse mouth with water.

III. Composition /Information on Ingredients

Material	C.A.S. #	Weight %	GHS Classification	Notes
Lead (Pb)	7439-92-1	50-75	Carc 1A;H350 Aquatic Acute 1:H400	Substance classified with a health & Environmental hazard. Substance with a work place limit
Potassium Hydroxide (KOH)	1310-58-3	1.0-10	Acute Tox. 4; H302 Skin Corr.1A; H314	Substance classified with a health & Environmental hazard. Substance with a work place limit.

IV. First Aid Measures

4.1. Description of aid measures

General:
- In all cases of doubt, or when symptoms persist, seek medical attention. Never give anything by mouth to an unconscious person.

Inhalation:
- Remove to fresh air, keep patient warm and at rest. If breathing is irregular or stopped, give artificial respiration. If unconscious place in the recovery position and obtain immediate

Eyes:
- Irrigate copiously with clean water for at least 15 minutes, holding the eyelids apart and seek medical attention.

Skin:
- Remove contaminated clothing. Wash skin thoroughly with soap and water or use a recognized skin cleanser.

Ingestion:
- Do NOT induce vomiting. Rinse mouth and slowly drink several glasses of water. Call a physician. Do NOT give anything by mouth to an unconscious or convulsing person.

4.2. Most important symptoms and effects, both acute and delayed
- The most important known symptoms and effects are described in the labelling (see section II) and/or in section XI

V. Fire -Fighting Measures

5.1. Extinguishing media
- Use standard fire fighting media on surrounding materials including water spray, foam, and carbon dioxide. (Do not use dry chemical extinguisher containing ammonium

5.2. Special hazards arising from the substance or mixture
- Lead Oxides.

5.3. Advice for fire-fighters
- Wear self-contained breathing apparatus for firefighting if necessary.

5.4. Further Information
- Gives off hydrogen by reaction with metals.

VI. Accidental release measures

Note: The Oxygen sensor contains a strong basic solution encapsulated in a plastic housing. Under normal operating conditions the solution (electrolyte) is never exposed. In case of a leak please observe the following instructions:

6.1. Personal precautions, protective equipment and emergency procedures
- Use appropriate personal protective equipment. Avoid dust formation. Avoid breathing vapors, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas.

10. Safety Data Sheet

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Analytical Industries Inc.
A PST Brand

Safety Data Sheet (KOH)

Avoid breathing dust. For personal protection see section VII.

6.2. Environmental precautions

• Do not allow spills to enter drains or waterways. Use good personal hygiene practices. Wash hands before eating, drinking, smoking or using toilet. Promptly remove soiled clothing and wash thoroughly before reuse.

6.3.Methods and material for containment and cleaning up

• Contain spillage. Neutralize spill with soda ash or lime. Carefully place material into clean dry contain and cover. Flush spill area with water. Avoid creating dust.

VII. Handling and storage

7.1. Precautions for safe handling

• Under normal circumstances the lead anode and potassium hydroxide electrolyte are sealed inside the oxygen sensor which is then\ sealed in a polyethylene bag and placed in a cardboard box for shipment) and do not present a health hazard. The following guidelines are provided in the event an oxygen sensor leaks electrolyte.
• Before opening the bag containing the sensor cell, check the sensor cell for leakage. If the sensor cell leaks, do not open the bag. If there is liquid around the cell while in the instrument, put on gloves and eye protection before removing the sensor cell.

7.2. Conditions for safe storage, including any incompatibilities

• Store sensors in a cool ,dry and well-ventilated places. Exercise due caution to prevent damage to or leakage from the container. Keep containers closed when not in use.

7.3. Specific end use(s)

• Apart from the uses mentioned in section I no other specifies are stipulated.

VIII. Exposure Controls/Personal Protection

8.1. Control parameters

Exposure

CAS No.	Ingredient	Source	Value
0001310-58-3	Potassium hydroxide	OSHA	No Establish Limits
		ACGIH	Ceiling: 2mg/m3
		NIOSH	Ceiling: 2mg/m3
		Supplier	No Establish Limits
007439-92-1	Lead (Pb)	OSHA	(1910.1025)TWA 0.050mg/m3
		ACGIH	TWA:0.05 mg/m3R,2B,2A
		NIOSH	TWA (8 Hour)0.050 mg/m3
		Supplier	No Establish Limits

Carcinogen Data

CAS No.	Ingredient	Source	Value
0001310-58-3	Potassium hydroxide	OSHA	Select Carcinogen: No
		NTP	Known: No; Suspected: No
		IARC	Group 1: No; Group 2a: No; Group 2b: No; Group 3: No; Group 4: No;
007439-92-1	Lead (Pb)	OSHA	Select Carcinogen: Yes
		NTP	Known: No; Suspected: Yes
		IARC	Group 1: No; Group 2a: No; Group 2b: Yes; Group 3: No; Group 4: No;

8.2. Exposure controls

Respiratory

• If workers are exposed to concentrations above the exposure limit they must use the appropriate, certified respirators.

Eyes

• Chemical splash goggles

Skin

• Apron, face shield Wear gloves. Gloves must be resistant to corrosive materials. Nitrile

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A PST Brand

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	or PVC gloves are suitable. Do not use cotton or leather gloves.
Engineering Controls	• Provide adequate ventilation. Where reasonably practicable this should be achieved by the use of local exhaust ventilation and good general extraction. If these are not sufficient to maintain concentrations of particulates and any vapor below occupational exposure limits suitable respiratory protection must be worn.
Other Work Practices	• Use good personal hygiene practices. Wash hands before eating, drinking, smoking or using toilet. Promptly remove soiled clothing and wash thoroughly before reuse.

IX. Physical / Chemical Characteristics

9.1 Information on basic physical and chemical properties

Material / Component:	**Lead (Pb) - Anode**	**Potassium Hydroxide (KOH) - Electrolyte**
Appearance	Article Solid	**Form:** Liquid; **Color:** Clear Translucent
Odor	None	None
Odor threshold	Not Measured	Not Measured
pH	Not Measured	>13
Melting point / freezing point	>328° C	Not Measured
Initial boiling point and boiling range	>1320° C	Not Measured
Flash Point	Not Measured	>100° C
Evaporation rate (Ether = 1)	Not Measured	Not Measured
Flammability (solid, gas)	Not Applicable	Not Measured
Upper/lower flammability or explosive limits	Not Measured	Not Measured
Vapor pressure	Not Measured	Not Measured
Vapor Density	Not Measured	Not Measured
Specific Gravity	Not Measured	Not Measured
Solubility in Water	Insoluble	100% (Water based solution)
Partition coefficient n-octanol/water (Log Kow)	Not Measured	Not Measured
Auto-ignition temperature	Not Measured	Not Measured
Decomposition temperature	Not Measured	Not Measured
Viscosity (cSt)	Not Measured	Not Measured

9.2. Other information
No other relevant information.

X. Stability and Reactivity

10.1. Reactivity	• Hazardous Polymerization will not occur
10.2. Chemical stability	• Stable under normal circumstances
10.3. Possibility of hazardous reactions	• Incompatible with strong oxidizers, leather and halogenated compounds. Product will react with 'soft' metals such as aluminum, tin, magnesium, and zinc releasing flammable hydrogen gas.
10.4. Conditions to avoid	• Excessive heat and open flame.
10.5. Incompatible materials	• Aluminum, organic materials, acid chlorides, acid anhydrides, magnesium, copper. Avoid contact with acids and hydrogen peroxide >52%
10.6. Hazardous decomposition products	• Toxic fumes.

XI. Toxicological Information

11.1 Information on toxicological effects (Potassium Hydroxide)

Acute toxicity	• LD50 Oral - Rat- 333mg/kg • Inhalation : no data available

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	• Dermal: no data available
Skin Corrosion/irritation	• Skin Rabbit- Severe skin irritation 24 h
Serious eye damage/eye irritation	• Eyes Rabbit- Corrosive to eyes (OECD Test Guideline 405
Respiratory or skin sensitization	• No Data Available
Germ cell mutagenicity	• No Data Available
Carcinogenicity	**IARC** • No component of this product presents at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC. **ACGIH** • No component of this product presents at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by ACGIH. **NTP** • No component of this product presents at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP **OSHA** • No component of this product presents at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA
Reproductive toxicity	• No Data Available
Specific target organ toxicity-single exposure	• No Data Available
Specific target organ toxicity-repeated exposure	• No Data Available
Additional information	• RTECS:TT2100000
11.2 Information on toxicological effects (Lead) **Acute toxicity**	• Inhalation : no data available • Dermal: no data available
Skin Corrosion/irritation	• No Data Available
Serious eye damage/eye irritation	• No Data Available
Respiratory or skin sensitization	• No Data Available
Germ cell mutagenicity	• Rat - Cytogenetic analysis
Carcinogenicity	• Limited evidence of carcinogenicity in animal studies **IARC** • 2B-Group 2B. Possibly carcinogenic to humans (Lead) **NTP** • Reasonably anticipated to be a human carcinogen (Lead) **OSHA** • 1910.1025 (Lead)
Reproductive toxicity	• Suspected human reproductive toxicant • Rat-Inhalation: Effects on Newborn; Biochemical metabolic • Rat-Oral: Effects on Newborn; Behavioral • Mouse-Oral: Effect on Fertility: Female fertility index (e.g., # females pregnant per # sperm positive females; # females pregnant per # females mated). Effects on Fertility: Pre-implantation mortality (e.g., reduction in number of implants per female; total number of implants per corpora lutea).
Development Toxicity	• Rat-Inhalation: Effects on Embryo or Fetus: Fetotoxicity (except death, e.g., stunted fetus). Specific Developmental Abnormalities: Blood and lymphatic system (including spleen and marrow). • Rat-Oral: Specific Developmental Abnormalities: Blood and lymphatic system (including sleep and marrow). Effects on Newborn: Growth statistics (e.g., reduced weight gain)

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• Rat-Oral: Effects on Embryo or Fetus: Fetotoxicity (except death, e.g., stunted fetus). Effects on Embryo or Fetus: Fetal death.
• Mouse-Oral: Effects on Embryo or Fetus: Fetotoxicity (except death, e.g., stunted fetus). Effects on Embryo or Fetus: Fetal death.

Specific target organ toxicity – single exposure • No Data Available

Specific target organ toxicity – repeated exposure • May cause damage to organs through prolonged or repeated exposure.

Aspiration hazard • No Data Available

Additional Information • RTECS: OF7525000

XII. Ecological Information

12.1. Toxicity
Very toxic to aquatic life
Aquatic Ecotoxicity

Ingredient	96 hr. LC50 fish, mg/l	48 hr. EC50 crustacea, mg/l	ErC50 algae, mg/l
Lead Compounds (as Pb) - (7439-92-1)	0.44, Cyprinus carpio	4.40, Daphnia magna	0.25 (72 hr.), Scenedesmus subspicatus
Potassium hydroxide. - (1310-58-3)	Not Available	Not Available	Not Available

12.1. Persistence and degradability • There is no data available on the preparation itself.

12.3. Bioaccumulative potential • Not Measured

12.4. Mobility in soil • No Data Available

12.5. Result of PBT and vPvB assessment • This Product contains no PBT and vPvB chemicals.

12.6. Other adverse effects • Lead is bioaccumulative in most aquatic life and mammals. It is highly mobile as lead dust or fume, yet forms complexes with organic material which limits its mobility.

XIII. Disposal Considerations

13.1. Waste treatment methods • Do not allow into drains or water courses. Wastes and emptied containers should be disposed of in accordance with regulations made under the Control of Pollution Act and the Environmental Protection Act.
• Using information provided in this data sheet advice should be obtained from the Waste Regulation Authority, whether the special waste regulations apply.

XIV. Transport Information

DOT: • Regulated. Refer to Small Quantity Exceptions: 49 CFR 173.4
• UN3266, Corrosive liquid, basic, inorganic, n.o.s., (potassium hydroxide, lead), 8, II NOTE: This description is used for shipping purposes when not using Analytical Industries Inc. US DOT Approval.
• UN3363, Dangerous Goods in Machinery or Dangerous Goods in Apparatus, 9. NOTE: This description is used when shipping under the US DOT Approval.

IATA: • Regulated. Meets criteria for IATA Dangerous Goods in Excepted Quantities, Section 2.7

Environmental hazards
IMDG • Marine Pollutant: Yes (Lead Compounds (as Pb))

XV. Regulatory Information

10. Safety Data Sheet

GPR Series Oxygen Sensors

PST PROCESS SENSING TECHNOLOGIES

Analytical Industries Inc.
A PST Brand

Safety Data Sheet (KOH)

Regulatory Overview	• The regulatory data in Section 15 is not intended to be all-inclusive, only selected regulations are represented.
Toxic Substance Control Act (TSCA)	• All components of this material are either listed or exempt from listing on the TSCA Inventory
WHMIS Classification	• D2A E
US EPA Tier II Hazards	**Fire:** No **Sudden Release of Pressure:** No **Reactive:** No **Immediate (Acute):** Yes **Delayed (Chronic):** Yes
EPCRA 311/312 Chemicals and RQs (lbs.):	• Lead Compounds (as Pb) (10.00) • Potassium hydroxide. (1,000.00)
EPCRA 302 Extremely Hazardous :	•(No Product Ingredients Listed)
EPCRA 313 Toxic Chemicals:	• Lead Compounds (as Pb)
Proposition 65 - Carcinogens (>0.0%):	• Lead Compounds (as Pb)
Proposition 65 - Developmental Toxins (>0.0%):	• Lead Compounds (as Pb)
Proposition 65 - Female Repro Toxins (>0.0%):	• Lead Compounds (as Pb)
Proposition 65 - Male Repro Toxins (>0.0%):	• Lead Compounds (as Pb)
N.J. RTK Substances (>1%):	• Lead Compounds (as Pb) • Potassium hydroxide.

XVI. Other Information

The information and recommendations contained herein are based upon data believed to be correct. However, no guarantee or warranty of any kind, expressed or implied, is made with respect to the information contained herein. We accept no responsibility and disclaim all liability for any harmful effects which may be caused by exposure to our products. Customers/users of this product must comply with all applicable health and safety laws, regulations, and orders.

H302 Harmful if swallowed.
H314 Causes severe skin burns and eye damage.
H350 May cause cancer.
H400 Very toxic to aquatic life.

This is the first version in the GHS SDS format. Listings of changes from previous versions in other formats are not applicable.

All chemicals may pose unknown hazards and should be used with caution. While the information contained in this Material Safety Data Sheet is believed to be correct and is offered for your information, consideration and investigation, Analytical Industries Inc assumes no responsibility of the completeness or accuracy of the information contained herein.

End of Document

10. Safety Data Sheet

XLT Series Oxygen Sensors

PST PROCESS SENSING TECHNOLOGIES

Analytical Industries Inc.

A PST Brand

Safety Data Sheet (Acid)

I. Product Identification

Product Name:	Oxygen Sensor (Series XLT, Private Label derivations)
Product Use:	Oxygen Sensors
Manufacturer:	Analytical Industries Inc.
Address:	2855 Metropolitan Place, Pomona, CA 92767 USA
Contact Information:	Tel: 909-392-6900, Fax: 909-392-3665, email: info@aii1.com
Emergency Number:	
Date Prepared:	January 1, 1995
Date Revised:	January 31, 2023

II. Hazardou(s) Identification

GHS Classification:

Lead (Pb)	**Health**	**Environmental**	**Physical**
	Acute Toxicity - Category (inhalation) Acute Toxicity - Category 4 (oral/dermal) Carcinogenicity - Category 2 Reproductive/Developmental - Category 2 Target organ Toxicity (Repeated) - Category 2	Acute Aquatic Toxicity - Category 1 Chronic Aquatic Toxicity - Category 1	Not Available
Acetic Acid, Glacial*	**Health**	**Environmental**	**Physical**
	Eye Corrosion - Category 1 Skin Corrosion - Category 1A	Not Available	
*Data pertains to concentrations >80%, actual solution >10% but not >80%			
Lead Acetate, Trihydrate	**Health**	**Environmental**	**Physical**
	Reproductive/Developmental - Category 1A	Acute Aquatic Toxicity - Category 1 Chronic Aquatic Toxicity - Category	
Potassium Acetate	**Health**	**Environmental**	**Physical**
	Not a hazardous substance or mixture		

GHS Labels:
Lead (Pb)

Symbols:

Hazard Statements
- Warning!
- Harmful if swallowed.
- Suspected of causing cancer.
- Suspected of damaging fertility or the unborn child.
- May cause damage to organs through prolonged or repeated exposure.
- Very toxic to aquatic life with long lasting effects

Precautionary Statements
- If breathed in, move person into fresh air. In not breathing, give artificial respiration. Consult a physician.
- In case of skin contact, wash off with soap and plenty of water.
- In case of eye contact, flush eyes with water as a precaution.
- If swallowed, rinse mouth with water

GHS Labels:
Acetic Acid, Glacial*

Symbols:

Hazard Statements
- Danger
- Causes severe skin burns and eye damage

Precautionary Statements
- Wash skin thoroughly after handling.

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A PST Brand

Safety Data Sheet (Acid)

- Wear protective gloves/ protective clothing/ eye protection/ face protection.
- IF SWALLOWED: Rinse moth. Do not induce vomiting.
- IF ON SKIN (or hair): Remove/ Take off immediately all contaminated clothing. Rinse skin with water/ shower.
- IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
- IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue to rinse.
- Immediately call a POISON CENTER or doctor/ physician
- Wash contaminated clothing before reuse.
- Store locked up.
- Dispose of contents/container to an approved waste disposal plant

GHS Labels:
Lead Acetate, Trihydrate

Symbols:
Hazard Statements
- Danger!
- May damage fertility or the
- unborn child.
- Very toxic to aquatic life with
- long lasting effects

Precautionary Statements
- Obtain special instructions before use.
- Do not handle until all safety precautions have been read and understood.
- Avoid release to the environment.
- Use personal protective equipment as required.
- If exposed or concerned: Get medical advice/ attention.
- Dispose of contents/container to an approved waste disposal plant.

GHS Labels:
Potassium Acetate
Symbols:
Hazard Statements
- Not a hazardous substance or mixture

None

Precautionary Statements
- If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.
- In case of skin contact, wash off with soap and plenty of water.
- In case of eye contact, flush eyes with water as a precaution.
- If swallowed, rinse mouth with water.

III. Composition /Information on Ingredients

Material	C.A.S. #	Weight %	GHS Classification	Notes
Lead (Pb)	7439-92-1	25 - 50	Carc. 1A;H350 Aquatic Acute 1;H400	• Substance classified with a health or environmental hazard • Substance with a workplace exposure limit
Acetic Acid, Glacial	64-19-7	1.0 - 10	Flam. Liq. 3;H226 Skin Corr. 1A;H314 Eye Irrit. 2;H319	• Substance classified with a health or environmental hazard • Substance with a workplace exposure limit
Lead Acetate, Trihydrate	6080-56-4			
Potassium Acetate	127-08-2	1.0 - 10	Not Classified	• Substance classified with a health or environmental hazard

IV. First Aid Measures

4.1. Description of aid measures

General Description:

The oxygen sensors contain a weak acidic solution encapsulated in a plastic housing. Under normal operating conditions the solution is never exposed. In case of a leak please observe the following instructions:

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General Advice

Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled

If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact

Take off contaminated clothing and shoes immediately. Wash off with soap and plenty of water. Consult a physician

In case of eye contact

Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician. Continue rinsing eyes during transport to hospital

If swallowed

Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed

The most important known symptoms and effects are described in the labelling (see section 2) and/or in section 11.

4.3 Indication of any immediate medical attention and special treatment needed

No data available

V. Fire -Fighting Measures

5.1. Extinguishing media

Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide

5.2. Special hazards arising from the substance or mixture

Carbon oxides, Lead oxides, Potassium Oxides

5.3. Advice for fire-fighters

Wear self-contained breathing apparatus for the firefighting if necessary.

5.4. Further Information

No data available.

VI. Accidental release measures

Note: The Oxygen sensor contains a strong basic solution encapsulated in a plastic housing. Under normal operating conditions the solution (electrolyte) is never exposed. In case of a leak please observe the following instructions:

6.1. Personal precautions, protective equipment, and emergency procedures

Use appropriate personal protective equipment. Avoid dust formation. Avoid breathing vapors, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust. For personal protection see section VII.

6.2. Environmental precautions

Do not allow spills to enter drains or waterways. Use good personal hygiene practices. Wash hands before eating, drinking, smoking or using toilet. Promptly remove soiled clothing and wash thoroughly before reuse.

6.3. Methods and material for containment and cleaning up

Contain spillage. Neutralize spill with soda ash or lime. Carefully place material into clean dry contain and cover. Flush spill area with water. Avoid creating dust.

VII. Handling and storage

7.1. Precautions for safe handling

Avoid rough handling.
Avoid exposing sensor(s) to rapid changes in pressure.
Avoid puncturing or damaging sensor membrane(s).
In case of sensor leakage see section 6

7.2. Conditions for safe storage, including any incompatibilities

Store sensors in a cool, dry and well-ventilated place

7.3. Specific end use(s)

Apart from the uses mentioned in section 1 no other specifics uses are stipulated

VIII. Exposure Controls/Personal Protection

8.1. Control parameters

CAS No.	Exposure Ingredient	Source	Value
7439-92-1	Lead (Pb)	OSHA	[1910.1025] TWA 0.050 mg/m3

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		ACGIH	TWA: 0.05 mg/m3R, 2B, 2A
		NIOSH	TWA (8-hour) 0.050 mg/m3
		Supplier	No Established Limit
64-19-7	Acetic Acid, Glacial*	OSHA	TWA 10 ppm (25 mg/m3)
		ACGIH	TWA: 10 ppm STEL: 15 ppm
		NIOSH	TWA 10 ppm (25 mg/m3) ST 15 ppm (37 mg/m3)
		Supplier	No Established Limit
6080-56-4	Lead Acetate, Trihydrate	OSHA	
		ACGIH	WTA 0.05 mg/m3
		NIOSH	TWA 0.05 mg/m3
		Supplier	
127-08-2	Potassium Acetate	OSHA	No Established Limit
		ACGIH	No Established Limit
		NIOSH	No Established Limit
		Supplier	No Established Limit

Carcinogen Data

CAS No.	Ingredient	Source	Value
007439-92-1	Lead (Pb)	OSHA	Select Carcinogen: Yes
		NTP	Known: No; Suspected: Yes
		IARC	Group 1: No; Group 2a: No; Group 2b: Yes; Group 3: No; Group 4: No;
64-19-7	Acetic Acid, Glacial*	OSHA	Select Carcinogen: No
		NTP	Known: No; Suspected: No
		IARC	Group 1: No; Group 2a: No; Group 2b: No; Group 3: No; Group 4: No;
6080-56-4	Lead Acetate, Trihydrate	OSHA	
		NTP	
		IARC	
127-08-2	Potassium acetate	OSHA	Select Carcinogen: No
		NTP	Known: No; Suspected: No
		IARC	Group 1: No; Group 2a: No; Group 2b: No; Group 3: No; Group 4: No;

8.2. Exposure controls

Respiratory If workers are exposed to concentrations above the exposure limit they must use the appropriate, certified respirators.

Eyes Protective safety glasses recommended

Skin Wear protective clothing to keep skin contact to a minimum. Chemical impervious gloves recommended

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Engineering Controls	Provide adequate ventilation. Where reasonably practicable this should be achieved by the use of local exhaust ventilation and good general extraction. If these are not sufficient to maintain concentrations of particulates and any vapor below occupational exposure limits suitable respiratory protection must be worn
Other Work Practices	Use good personal hygiene practices. Wash hands before eating, drinking, smoking or using toilet. Promptly remove soiled clothing and wash thoroughly before reuse.

IX. Physical / Chemical Characteristics

9.1 Information on basic physical and chemical properties

Material / Component:

	Lead (Pb) - Anode	Acetic Acid	Lead Acetate, Trihydrate	Potassium Acetate
Appearance	Article Solid			
Odor	None			
Odor threshold	Not Measured			
pH	Not Measured			
Melting point / freezing point	>328° C			
Initial boiling point and boiling range	>1320° C			
Flash Point	Not Measured			
Evaporation rate (Ether = 1)	Not Measured			
Flammability (solid, gas)	Not Applicable			
Upper/lower flammability or explosive limits	Not Measured			
Vapor pressure	Not Measured			
Vapor Density	Not Measured			
Specific Gravity	Not Measured			
Solubility in Water	Insoluble			
Partition coefficient n-octanol/water (Log Kow)	Not Measured			
Auto-ignition temperature	Not Measured			
Decomposition temperature	Not Measured			
Viscosity (cSt)	Not Measured			

X. Stability and Reactivity

10.1. Reactivity	Hazardous Polymerization will not occur
10.2. Chemical stability	Stable under normal circumstances
10.3. Possibility of hazardous reactions	Incompatible with strong oxidizers, leather and halogenated compounds. Product will react with 'soft' metals such as aluminum, tin, magnesium, and zinc releasing flammable hydrogen gas.
10.4. Conditions to avoid	Excessive heat and open flame.
10.5. Incompatible materials	Aluminum, organic materials, acid chlorides, acid anhydrides, magnesium, copper. Avoid contact with acids and hydrogen peroxide >52%
10.6. Hazardous decomposition products	Toxic fumes.

XI. Toxicological Information

11.1 Information on toxicological effects (Lead)

Acute toxicity	• Inhalation: no data available • Dermal: no data available
Skin Corrosion/irritation	• No data available
Serious eye damage/eye irritation	• No data available
Respiratory or skin sensitization	• No data available
Germ cell mutagenicity	• Rat • Cytogenetic analysis

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Carcinogenicity	• Limited evidence of carcinogenicity in animal studies • IARC: 2B – Group 2B: Possibly carcinogenic to humans (Lead) • NTP: Reasonably anticipated to be a human carcinogen (Lead) Reasonably anticipated to be a human carcinogen. The reference note have been added by TD based on the background information of NTP. (Lead) • OSHA: 1910.1025 (Lead)
Reproductive toxicity	• Suspected human reproductive toxicant • Reproductive toxicity – rat – Inhalation • Effects on Newborn: Biochemical metabolic. • Reproductive toxicity – rat – Oral Effects on Newborn: Behavioral. • Reproductive toxicity – mouse – Oral • Effect on Fertility: Female fertility index (e.g., # females pregnant per # sperm positive females; # females pregnant per # females mated). Effects on Fertility: Pre-implantation mortality (e.g., reduction in number of implants per female; total number of implants per corpora lutea). • Development Toxicity – rat – Inhalation • Effects on Embryo or Fetus: Fetotoxicity (except death, e.g., stunted fetus). Specific Developmental Abnormalities: Blood and lymphatic system (including spleen and marrow). • Developmental Toxicity – rat – Oral • Specific Developmental Abnormalities: Blood and lymphatic system (including sleep and marrow). Effects on Newborn: Growth statistics (e.g., reduced weight gain) • Developmental Toxicity – rat – Oral • Effects on Embryo or Fetus: Fetotoxicity (except death, e.g., stunted fetus). Effects on Embryo or Fetus: Fetal death. • Developmental Toxicity – mouse – Oral • Effects on Embryo or Fetus: Fetotoxicity (except death, e.g., stunted fetus). Effects on Embryo or Fetus: Fetal death.
Specific target organ toxicity-single exposure	No data available
Specific target organ toxicity-repeated exposure	• May cause damage to organs through prolonged or repeated exposure.
Aspiration hazard	• No data available
Additional information	• RTECS: OF7525000 • Anemia • Stomach – Irregularities – Based on Human Evidence

11.2 Information on toxicological effects (Acetic Acid, Glacial)

Acute toxicity	• LD50 Oral – rat – 3,310 mg/kg • LC50 Inhalation – mouse – 1 h – 5620 ppm • Remarks: Sense Organs and Special Senses (Hose, Eye, Ear, and Taste): Eye: Conjunctive irritation. Sense Organs and Special Senses (Nose, Eye, Ear, and Taste): Eye: Other. Blood: Other changes.
Skin Corrosion/irritation	• No data available
Serious eye damage/eye irritation	• Eyes – rabbit • Result – Corrosive to eyes
Respiratory or skin sensitization	• No data available
Germ cell mutagenicity	• No data available
Carcinogenicity	• IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC • ACGIH: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by ACGIH.

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Safety Data Sheet (Acid)

	• NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP. • OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.
Reproductive toxicity	• No data available
Specific target organ toxicity-single exposure	• No data available
Specific target organ toxicity-repeated exposure	• No data available
Additional information	• RTECS: AF1225000 • Material is extremely destructive to tissue of the mucous membranes and upper respiratory tract, eyes, and skin., spasm, inflammation and edema of the larynx, spasm, inflammation and edema of the bronchi, pneumonitis, pulmonary edema, burning sensation, cough, wheezing, laryngitis, shortness of breath, headache, nausea, vomiting, ingestion or inhalation of concentrated acetic acid causes damage to tissues of the respiratory and digestive tracts. Symptoms include: hematemesis, bloody diarrhea, edema and/or perforation of the esophagus and pylorus, pancreatitis, hematuria, anuria, uremia, albuminuria, hemolysis, convulsions, bronchitis, pulmonary edema, pneumonia, cardiovascular collapse, shock, and death. Direct contact or exposure to high concentrations of vapor with skin or eyes can cause: erythema, blisters, tissue destruction with slow healing, skin blackening, hyperkeratosis, fissures, corneal erosion, opacification, iritis, conjunctivitis, and possible blindness., To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated. • Stomach – Irregularities – Based on Human Evidence
11.3 Information on toxicological effects (Lead (II) Acetate, Trihydrate)	
Acute toxicity	• LD50 Oral – rat – 4,665 mg/kg • Inhalation: no data available • Dermal: no data available
Skin Corrosion/irritation	• No data available
Serious eye damage/eye irritation	• No data available
Respiratory or skin sensitization	• No data Available
Germ cell mutagenicity	• May alter genetic material
Carcinogenicity	• This is or contains a component that has been reported to be carcinogenic based on its IARC, OSHA, ACGIH, NTP, or EPA classification • IARC - 2A – group 2A: Probably carcinogenic to humans (Lead di(acetate) trihydrate) • NTP - Reasonably anticipated to be a human carcinogen. The reference note has been added by TD based on the background information of the NTP. (lead di(acetate) trihydrate) • OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA
Reproductive toxicity	• Known human reproductive toxicant • May cause reproductive disorder
Specific target organ toxicity-single exposure	• No data Available
Specific target organ toxicity-repeated exposure	• No data Available
Additional information	• RTECS: OF8050000

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Safety Data Sheet (Acid)

- Lead salts have been reported to cross the placenta and to induce embryo- and feto-mortality. They also have teratogenic effect in some animal species. No teratogenic effects have been reported with exposure to organometallic lead compounds. Adverse effect of lead on human reproduction, embryonic and fetal development, and postnatal (e.g., mental) development have been reported. Excessive exposure can affect blood, nervous, and digestive systems. The synthesis of hemoglobin is inhibited and results in anemia. If left untreated, neuromuscular dysfunction, possible paralysis, and encephalopathy can result. Additional symptoms of overexposure include joint and muscle pain, weakness of the extensor muscles (frequently the hand and wrist), headache, dizziness, abdominal pain, diarrhea, constipation, nausea, vomiting, blue line on the gums, insomnia, and metallic taste. High body levels produce increased cerebrospinal pressure, brain damage, and stupor leading to coma and often death., May cause convulsions.
- Stomach – Irregularities – Based on Human Evidence

11.4 Information on toxicological effects (Potassium Acetate)

Acute toxicity	• LD50 Oral – rat – 3,250 mg/kg
Skin Corrosion/irritation	• Skin – rat • Results: no skin irritation • (OECD Test Guideline 404)
Serious eye damage/eye irritation	• Eyes – rabbit • Result – no eye irritation • (OECD Test Guideline 405
Respiratory or skin sensitization	• Information given is based on data obtained from similar substances.
Germ cell mutagenicity	• No data available
Carcinogenicity	• IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible, or confirmed human carcinogen by IARC • ACGIH: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by ACGIH. • NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP • OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.
Reproductive toxicity	• No data available
Specific target organ toxicity-single exposure	• No data available
Specific target organ toxicity-repeated exposure	• No data available
Aspiration hazard	• No data available
Additional information	• RTECS: AJ33225000 • To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

XII. Ecological Information

12.1. Toxicity

Lead (II) Acetate, Trihydrate

No data available

Acetic Acid, Glacial

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	Toxic to fish	semi-static test LC50 – Oncorhynchus mykiss (rainbow trout) - > 1,000 mg/L – 96 h (OECD Test Guideline 203)
	Toxicity to daphnia and other aquatic invertebrates	EC50 – Daphnia mgna (water flea) - > 300.82 mg/L – 48 h (OECD Test Guideline 202)
Potassium Acetate		
	Toxic to fish	LC50 – Danio rerio (zebra fish) - > 992 mg/L – 96 h (OECD Test Guideline 203)
	Toxicity to daphnia and other aquatic invertebrates	EC50 – Daphnia - > 919 mg/L – 48 h (OECD Test Guideline 202)
	Toxic to algae	EC50 – Skeletonema costatum - > 1,000 mg/L – 72 h (ISO 10253)
Lead		
	Toxic to fish	mortality LOEC – Oncorhynchus mykiss (rainbow trout) – 1.19 mg/L – 96 h LC50 – Micropterus dolomieui – 2.2 mg/L – 96 h Mortality NOEC – Salvelinus fontinalis – 1.7 mg/L – 10 d
	Toxicity to daphnia and other aquatic invertebrates	mortality LOEC – Daphnia – 0.17 mg/L – 24 h mortality NOEC – Daphnia – 0.099 mg/L – 24 h
	Toxic to algae	mortality EC50 – Skeletonema costatum – 7.94 mg/L – 10

12.2 Persistence and degradability

Lead (II) Acetate, Trihydrate

No data available

Acetic Acid, Glacial

Biodegradability	Aerobic – Exposure time 30 d Result: 99% - Readily biodegradable. Remarks: Expected to be biodegradable
Biochemical Oxygen Demand (BOD)	880 mg/g

Potassium Acetate

Biodegradability	Results: Readily biodegradable

Lead

No data available

12.3 Bio accumulative potential

Lead (II) Acetate, Trihydrate

No data available

Acetic Acid, Glacial

No data available

Potassium Acetate

Does not accumulate in organisms.

Lead

Bioaccumulation	Oncorhynchus kisutch – 2 Weeks – 150 µg/L Bioconcentration factor (BCF): 12

12.4 Mobility in soil

No data available

12.5 Results of PBT and vPvB assessment

PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects

An environmental hazard cannot be excluded in the event of unprofessional handling or disposal. Very toxic to aquatic life.

XIII. Disposal Considerations

13.1. Waste treatment methods

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Offer used or surplus oxygen sensors to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material. Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber.

XIV. Transport Information

IATA: Regulated. Refer to IATA dangerous goods in excepted quantities, Sec 2.6, if applicable.
U.S. Department of Transportation (DOT)
Proper Shipping Name: Corrosive liquid, toxic, n.o.s. (Acetic acid solution, Lead acetate) **Hazard Class:** 8(6.1)
UN Number: UN2922
Packaging Group: III
International Maritime Organization (IMDG)
Proper Shipping Name: Corrosive liquid, toxic, n.o.s. (Acetic acid solution, Lead acetate) **Hazard Class:** 8(6.1)
UN Number: UN2922
Packaging Group: III
IATA
Proper Shipping Name: Corrosive liquid, toxic, n.o.s. (Acetic acid solution, Lead acetate) **Hazard Class:** 8(6.1)
UN Number: UN2922
Packaging Group: III

XV. Regulatory Information

SARA 302 Components
SARA 302: No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.
SARA 313 Components
The following components are subject to reporting levels established by SARA Title III, Section 313:

	CAS-No	Revision Date
Lead	7439-92-1	1994-04-01

SARA 311/312 Components
Acute Health Hazard, Chronic Health Hazard
Massachusetts Right to Know Components

	CAS-No	Revision Date
Lead (II) Acetate, Trihydrate	6080-56-4	1993-04-24
Acetic Acid, Glacial	64-19-7	1993-04-24
Lead	7439-92-1	1994-04-01

Pennsylvania Right To Know Components

	CAS-No	Revision Date
Lead (II) Acetate, Trihydrate	6080-56-4	1993-04-24
Acetic Acid, Glacial	64-19-7	1993-04-24
Potassium Acetate	127-08-2	
Lead	7439-92-1	1994-04-01

New Jersey Right To Know Components

	CAS-No	Revision Date
Lead (II) Acetate, Trihydrate	6080-56-4	1993-04-24
Acetic Acid, Glacial	64-19-7	1993-04-24
Potassium Acetate	127-08-2	
Lead	7439-92-1	1994-04-01

California Prop. 65 Components
WARNING! This product contains a chemical know to the State of California to cause cancer.

	CAS-No	Revision Date
Lead (II) Acetate, Trihydrate	6080-56-4	1993-04-24
Lead	7439-92-1	1994-04-01

WARNING! This product contains a chemical know to the State of California to cause birth defects or other reproductive harm.

XVI. Other Information

HMIS Rating

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Health Hazard:	3
Chronic Health Hazard:	*
Flammability:	0
Physical Hazard:	0
NFPA Rating	
Health Hazard:	3
Fire Hazard:	0
Reactivity Hazard:	0

The information and recommendations contained herein are based upon data believed to be correct. However, no guarantee or warranty of any kind, expressed or implied, is made with respect to the information contained herein. We accept no responsibility and disclaim all liability for any harmful effects which may be caused by exposure to our products. Customers/users of this product must comply with all applicable health and safety laws, regulations, and orders
H302 Harmful if swallowed.
H314 Causes severe skin burns and eye damage.
H350 May cause cancer.

H400 Very toxic to aquatic life.
This is the first version in the GHS SDS format. Listings of changes from previous versions in other formats are not applicable.

All chemicals may pose unknown hazards and should be used with caution. While the information contained in this Material Safety Data Sheet is believed to be correct and is offered for your information, consideration and investigation, Analytical Industries Inc assumes no responsibility of the completeness or accuracy of the information contained herein.

11. Specifications

	GPR-18 MS	***GPR-18***	***GPR-28***
Analysis Ranges:	0-1 , 0-10, 0-100, 0-1000 PPM FS	0-10, 0-100, 0-1000 PPM, 0-1% FS 0-25% (Cal Only)	0-1, 0-5, 0-10, 0-25% FS
Application:	10 PPB to 1000 PPM oxygen in inert gases streams	50 PPB to 1% oxygen in hydrocarbon, He, H_2, mixed and acid (CO_2) gas streams (a)	0.05% to 21% oxygen in hydrocarbon, He, H_2, mixed and acid (CO_2) gas streams (a)
Accuracy:	± 1% of FS range under constant conditions		
Sensitivity:	< 0.5% of FS range		
Linearity:	< 1% over all ranges		
Display:	3-1/2 digit bright red LCD; resolution 0.001 PPM		
Alarms:	2 adjustable form C relay contacts non-latching; sensor and power failure		
Signal Output:	0-1V and 4-20mA		
Sample Pressure:	5-30 psig		
Flow Rate:	1.5-2 SCFH (700-950ml/min)		
Sensor Model:	GPR-12-2000-MSE	GPR-12-333 (a)	GPR-11-60 (b)
Response Time:	< 20 seconds 90% of final FS reading	< 10 seconds 90% of final FS reading	
Recovery Time:	O_2 Level / Duration / O2 Target / Recovery on N2 Air / 30 sec / 1 PPM / 45 min 9 PPB / 2 min / 10 PPB / 10 min 1 PPM / 5 min / 10 PPB / 15 min	O2 Level / Duration / O2 Target / Recovery on N2 Air / 2 min / 10 PPM / 60 min * Air / 2 min / 1 PPM / 20 min * Installation ** In service for 2 weeks at 1 PPM	O2 Level / Duration / O2 Target / Recovery on N2 Air / 2 min / 0.1% / < 30 sec
Calibration:	1 month interval using certified gas of 7.5 - 9 PPM O_2 balance N_2	1 month interval using certified gas of 75 - 90 PPM O_2 balance N_2 or 20.9% air	1 month interval using 20.9% air
Sensor Life:	12-18 months in < 100 PPM O2 at 25ºC and 1 atm	24 months in < 1000 PPM O2 at 25ºC and 1 atm	60 months in Air at 25ºC and 1 atm
Compensation:	Temperature		
Sample System:	Flow control and bypass valves; flow indicator		Flowmeter with integral valve
Connections:	1/4" compression tube fittings		
Controls:	Explosion proof actuators for range selection, zero and span calibration adjustments		
Wetted Parts:	300 series stainless steel		
Operating Temp. Range:	Sensor 0...45ºC (32...90°F)	Sensor GPR 0...45ºC (32...90°F), XLT -10...+45ºC (14...90°F)	
	Enclosure –20...+60ºC (-4…+140°F)		
Enclosure:	16 x 18 x 11" (406 x 457 x 280mm) Wall mount, 70lbs (31.8 Kg) Unpainted aluminum		
Power:	Specify 100/120 or 220/240 VAC		
ATEX & UKEX/IECEx Classification:	Ex II 2 G Ex db IIB or IIB+H2 T6 Gb // Ex db IIB or IIB+H2 T6 Gb		
Build Options:	Sample conditioning systems Temperature controlled heater system		
		(a) use XLT-12-333 for gases with > 0.5% CO_2 present	(b) use XLT-11-24 for gases with > 0.5% CO_2 present

Appendix A

Regulations regarding equipment certified for use in hazardous areas require electrical connections be protected by conduit and/or cable gland entry. Analytical Industries Inc. recognizes the need of safe operation of this analyzer and **strongly recommends** the user to adhere to all local safety related directives during installation and operation.

The accessories used for cable gland entry, size 3/4"-14 NPT-M, must be covered by a separate certificate in accordance with the standards:

EN 60079-14:2014; IEC 60079-14:2013
EN 60079-17:2014; IEC 60079-17:2013

And they must be suitable to be used with the enclosure and the type of hazardous location:

Ex II 2 G
Ex db IIB or IIB+H_2 T6 Gb

Electrical connections require approved explosion proof sealing fittings and packing around wires and cables coming into or going out of the enclosure. Conduit seals and fittings must be certified "Ex d" components per EN60079-1 whose design and installation comply with ATEX standards for hazardous locations

Sealing fittings must be installed within 18" of this enclosure for IIB + H_2 locations.

All unused openings must be closed with a Killark CUP, CUPX, PLUG, GO-8177 series close=up plug or an Ex d certified close-up plug or sealing plug.

Explosion Proof Packing Fiber (non-asbestos)

For use as packing at the hub of sealing fittings. Use only ATEX approved packing fiber.

These instructions are supplied in good faith from information which we believe to be reliable. However, since users and not Analytical Industries Inc. control the application, installation and operation of our products, users therefore assume all associated risk and liability.

Contact and/or exposure may cause skin, lung or eye irritation. Use gloves and long sleeve coveralls to protect skin. Use a mask or respirator to prevent inhalation or eye contact during application.

Directions:

1. To prevent leakage of the liquid cement, tamp packing fiber between and around conductors where they enter fitting
2. Ensure conductors DO NOT contact each other or the fitting wall.
3. Leave enough space inside the fitting - space/ length equivalent to the inside diameter of the conduit but not less than 5/8".

Explosion Proof Sealing Cement

Directions:

1. After tamping packing fiber between and around conductors, prepare the sealing resin.
2. Use only ATEX approved sealant.
3. Prepare the sealant by mixing the resin catalyzing agent as recommended by the manufacturer.
4. Apply the resin as recommended by the manufacturer.

The following sealant for sealing fittings is ATEX approved.

ELFIT RESIN (Part A) CRV420
ELFIT CATHALIZING AGENT (Part B) CRV420H72

5. Mixture ratio: 100 grams Part A to 25 grams Part B
6. Blend mixture to obtain a homogeneous compound.
7. Immediately fill the sealing connection.
8. Cure 72 hours for the mixture to setup.

Consult manufacturer instructions for complete details related to mixing two components and pouring the resulting resin in the sealing fittings.

Engage at least five threads on all fill plugs.

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