Advanced Instruments Inc.

Technical Specifications *

Accuracy:	< 2% of FS range under constant conditions
Analysis:	0-25% O2 FS ranges
Application:	Oxygen analysis in hazardous ambient areas and confined spaces
Approvals:	Certified for use in hazardous areas - see lower right UL: United States: UL 1203, UL 913, UL 508 Canada: CAN/CSA C22.2 No. 30-M1986, CAN/CSA C22.2 No. 157-92, CAN/CSA C22.2 No. 14-10 ATEX: Directive 94/9/EC
Area Classification:	Certified for use in hazardous areas - see lower right
Alarms:	Two user configurable alarms: magnetic coil relays rated 3A at 100 VAC, programmable alarm delays, alarm bypass for calibration and system fail alarm
Calibration:	Max interval—3 months. Air calibrate with clean source of certified span gas, compressed, or ambient (20.9% O2) air on 0-25% range.
Compensation:	Barometric pressure and temperature
Connections:	None
Controls:	Water resistant keypad; menu driven range selection, calibration and system functions
Display:	Graphical LCD 2.75" x 1.375"; resolution 0.001%; displays real time ambient temperature and pressure
Enclosure:	NEMA Type 3R for rain in outdoor applications (UL) NEMA 4X (ATEX)
Flow:	N/A, Ambient air monitoring only
Linearity:	±2% of full scale
Pressure:	Atmospheric
Power:	12-28 VDC (UL, ATEX Certified) 110-220 VAC (ATEX Certified)
Response Time:	90% of final reading in 10 seconds
Sample System:	None
Sensitivity:	< 0.5% of FS range
Sensor Model:	GPR-11-32-4
Sensor Life:	32 months
Signal Output:	4-20mA non-isolated or 1-5VDC
Operating Range:	5ºC to 45ºC
Warranty:	12 months analyzer; 12 months sensor
Wetted Parts:	N/A

Optional Equipment

Modbus RTU Communication

* Specifications subject to change without notice

UL or ATEX Certified for Hazardous Areas

GPR-2800 AIS S
Ambient Oxygen Analyzer

Full Featured Ambient Oxygen Analyzer

Optional Modbus RTU Communication

Advanced Galvanic Sensor Technology

Exia

UL Certified

File E343386

Class I, Division 1, Groups C and D

T4 T_{amb} -20ºC to +50ºC

ATEX Certified - Directive 94/9/EC

Examination Cert: INERIS 08ATEX0036

II 2 G

Ex d [ib] ib IIB GbT4

T_{amb} -20ºC to +45ºC

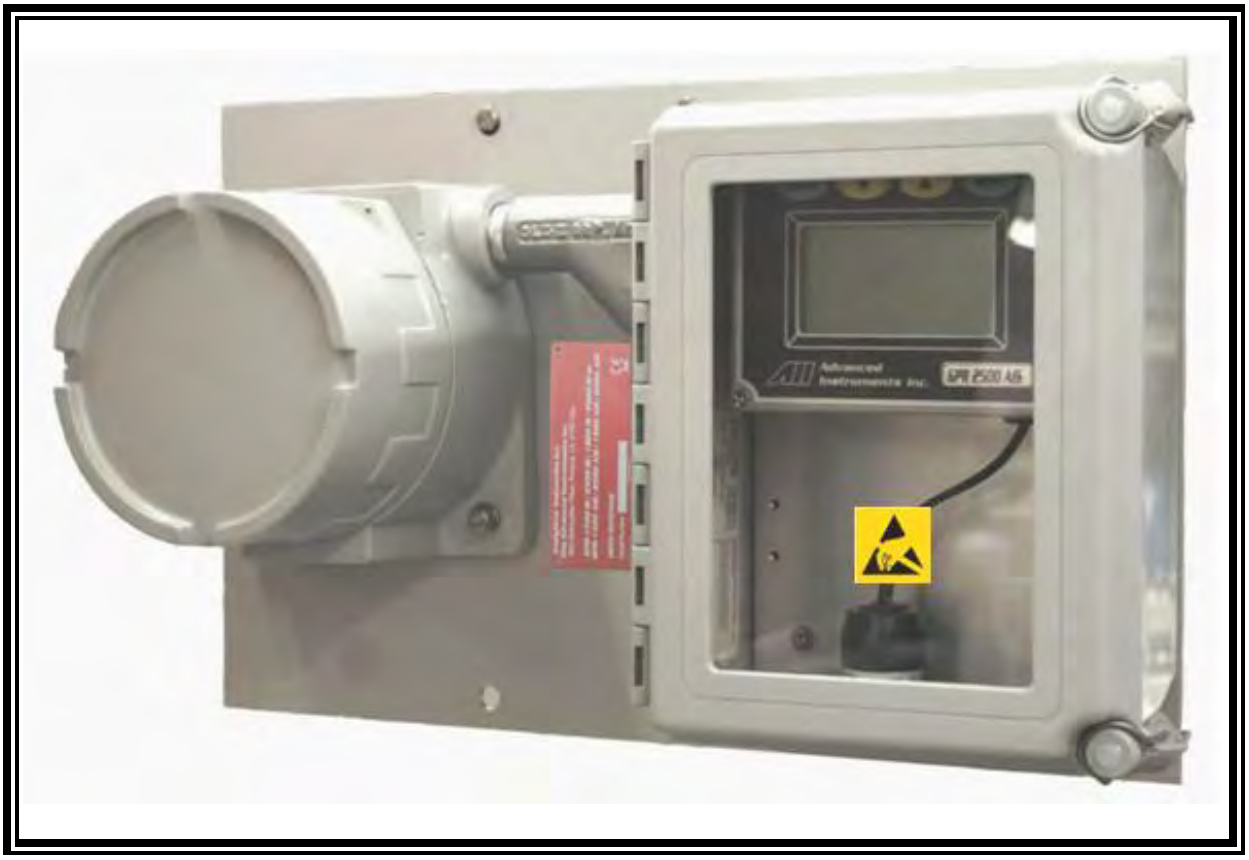
0080

ISO 9001:2008 Certified

INTERTEK Certificate No. 485

2855 Metropolitan Place, Pomona, CA 91767 USA ♦ Tel: 909-392-6900, Fax: 909-392-3665, www.aii1.com, e-mail: info@aii1.com Rev 10/15

GPR-2800 AIS-S ATEX Ambient Oxygen Analyzer



Owner's Manual

2855 Metropolitan Place, Pomona, California 91767 USA ♦ Tel: 909-392-6900, e-mail: info@aii1.com Rev 11/14

Table of Contents

The appendices referenced above are an integral part of the documentation, installation and maintenance of this analyzer to comply with all applicable directives. It is important that users review these documents before proceeding.

1. Introduction

Your new Ambient Oxygen Analyzer incorporates an advanced electrochemical sensor specific to Oxygen along with state-of-the-art digital electronics designed to give you years of reliable precise measurements of Oxygen in ambient environment or confined spaces.

More importantly, it has been constructed as explosion proof/intrinsically safe in accordance with:

ATEX Directives 94/9/EC, INERIS 08ATEX0036, for use in hazardous areas in zone 1 Group C and D

 II 2 G

EX d [ib] ib IIB T4

T amb -20°C to +50°C

WARNING: Potential electrostatic charging hazard - see instructions.

Safety Standards: EN 60079-0:2009

EN 60079-1:2007

EN 60079-11:2012

UL 913 Seventh Edition and CSA C22.2 No. 157-92 Third Edition, for use in Class I, Div 1, Groups C and D hazardous locations.

Please refer to Appendix A for information on making electrical connections that maintain the desired level of protection.

To obtain maximum performance from your new Oxygen Analyzer, please read and follow the guidelines provided in this Owner's Manual.

Every effort has been made to select the most reliable state of the art materials and components, 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, modern electronic 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 inside the Analyzer enclosure. 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: _____

Advanced Instruments 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.

2. General Safety & Installation

This section summarizes the essential precautions applicable to the GPR-2800 AIS-S Ambient Oxygen Analyzer. Additional precautions specific to individual Analyzer are contained in the following sections of this manual. To operate the Analyzer safely and obtain maximum performance follow the basic guidelines outlined in this Owner's Manual.

Caution: This symbol is used throughout the Owner's Manual to **Caution** and alert the user to recommended safety and/or operating guidelines.

Warning: This symbol is used throughout the Owner's Manual to **Warn** and alert the user of the presence of electrostatic discharge.

Danger: This symbol is used throughout the Owner's Manual to identify sources of immediate **Danger** such as the presence of hazardous voltages.

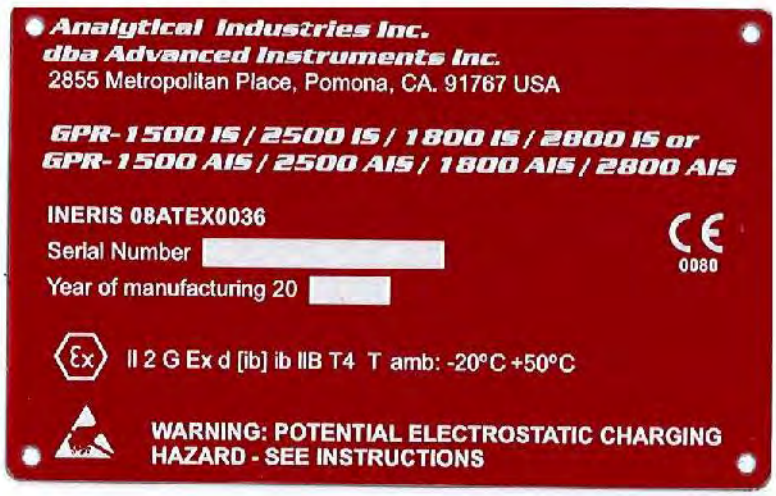
Read Instructions: Before operating the Analyzer read the instructions.

Retain Instructions: The safety precautions and operating instructions found in the Owner's Manual should be retained for future reference.

Heed Warnings: Follow all warnings on the Analyzer, accessories (if any) and in this Owner's Manual.

Follow Instructions: Observe all precautions and operating instructions. Failure to do so may result in personal injury or damage to the Analyzer.

Analyzer Label



Potential Explosion Hazard: The devices are not intended for use in atmospheres or with sample gas streams containing oxygen concentration greater than 21 percent by volume (ambient air) and are only intended for use in gases or gas mixtures classified as Class I, Div 1, Groups C and D hazardous locations, when used in the United States or Canada.

2. Quality Control & Calibration Certification

Attached as separate page following indices.

3. Maintenance

Serviceability: Except for replacing the Oxygen sensor, there are no parts inside the Analyzer for the operator to service.

WARNING- Substitution of Components May Impair Intrinsic Safety

Only trained personnel with the authorization of their supervisor should conduct maintenance.

Oxygen Sensor: DO NOT open the sensor. The sensor contains a corrosive liquid electrolyte that could be harmful if touched or ingested, refer to the Material Safety Data Sheet contained in the Owner's Manual appendix. 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. Leaking sensors should be disposed of in accordance with local regulations.

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 this Owner's Manual.

Do not attempt to make repairs by yourself as this will void the warranty as per Section 10 and may result in electrical shock, injury or damage. All other servicing should be referred to qualified service personnel.

Cleaning: The analyzer should be cleaned only as recommended by the manufacturer. Wipe off dust and dirt from the outside of the unit with a soft damp cloth then dry immediately. Do not use solvents or chemicals.

Non-use Period: If the analyzer is equipped with a range switch advance the switch to the OFF position and disconnect the power when the Analyzer is left unused for a long period of time.

Installation

This analyzer has been constructed in compliance with:

ATEX Directive 94/9/EC
EN 60079-0 : 2006
EN 60079-1 : 2004
EN 60079-11 : 2007

It must be installed in accordance with: EN 60079-14

Potential Explosion Hazard: The devices are not intended for use in atmospheres or with sample gas streams containing oxygen concentration greater than 21 percent by volume (ambient air) and are only intended for use in gases or gas mixtures classified as Class I, Div 1, Groups C and D hazardous locations, when used in the United States or Canada.

Sampling Stream: The analyzer is designed to measure Oxygen in ambient air and hence has no sample stream requirement.

Expected Sensor Life: With reference to the publish specification included as a separate page following the appendices of this manual, the expected life of all Oxygen sensors is predicated on the rate at which the sensor's anode is consumed at: temperature of 77°F/25°C; pressure of 1 atmosphere in ambient air (20.9% oxygen).

Deviations from these conditions will affect the life of the sensor (temperature higher than 77^0C and pressure less than atmospheric would cause a reduction in the sensor life).

Accuracy and Calibration: Refer to section 5 Operation.

Material and Gases: A certified span gas is required for routine calibration (see details in Operation).

Operating Temperature: The recommended operating temperature is below 35 ºC. However, the analyzer may be operated at temperature up to 45 ºC on an intermittent basis but the user is expected to accept a reduction in expected sensor life –as a rule of thumb, for every degree ºC increase in temperature (above 25 ºC), the sensor life is reduced by approximately 2.5%.

Heat: Install the analyzer away from direct sun and from any source of heat. Situate and store the analyzer away from direct sources of heat.

Liquid and Solid Object Entry: The analyzer should not be immersed in any liquid. Care should be taken so that liquids are not spilled into and objects do not fall on or inside of the analyzer.

Handling: Do not use force when using/operating mechanical components. Before moving your analyzer be sure to disconnect the wiring/power cord and any cables connected to the output terminals of the analyzer.

Sample Pressure

All electrochemical sensors respond to partial pressure changes in the gas of interest. The sensors are capable of analyzing the Oxygen in ambient air (such as a confined space in a control room or an open area around a landfill or bio-pond). The following conditions are applicable to analyzers equipped with electrochemical sensors.

Analyzers designed for in-situ ambient or area monitoring have no real sample inlet and vent. The sensor is intended to operate at atmospheric pressure and is exposed directly to the ambient measuring environment. The analyzer has a built-in barometric pressure sensor and the sensor output is automatically compensated for any atmospheric pressure changes.

Mounting of the Analyzer: The analyzer is approved for indoor as well as outdoor use. However, avoid mounting in an area where direct sun might heat up the analyzer beyond the recommended operating temperature range. If possible, install a small hood over the analyzer for rain water drain and to prevent over-heating of analyzer.

Gas Connections: None for normal operation. For calibration, a flow-through adapter with gas Inlet and outlet is provided. A flow control valve is recommended to bring the span gas to sensor within the recommended flow rate (1-2 SCFH)

Power Requirement: Supply power to the analyzer only as rated by the specification or markings on the analyzer enclosure. The GPR-2800AIS-S is powered by 12-28 VDC. The wiring that connects the analyzer to the power source should be installed in accordance with recognized electrical standards. Ensure that the analyzer case is properly grounded and meets the requirements for area classification where the analyzer is installed. Never yank wiring to remove it from a terminal connection.

Power Consumption: The maximum power consumption is less than 7 Watts.

4. Features & Specifications

Attached as separate page following indices.

Potential Explosion Hazard: The devices are not intended for use in atmospheres or with sample gas streams containing Oxygen concentration greater than 21% percent by volume (ambient air) and are only intended for use in gases or gas mixtures classified as Class I, Div 1, Groups C and D hazardous locations, when used in the United States or Canada.

5. Operation

Principle of Operation

The GPR-2800AIS-S Ambient Oxygen Analyzer incorporates an advanced electrochemical sensor very specific to Oxygen and generates an electrical signal proportional to the amount of Oxygen present in a gas.

The analyzer is configured in two sections. The signal processing electronics and sensor are housed in a general purpose (Type R3) rated enclosure. The terminals of power input, signal output and the intrinsic safety barriers are mounted on a PCB housed in an explosion proof enclosure.

The two sets of electronics are interconnected using an explosion proof Y-fitting, explosion proof packing fiber and sealing cement. Once connected, the intrinsic safety barriers limit the amount of power that flows to and from the signal processing electronics effectively preventing an explosive condition.

The GPR-2800AIS-S meets the ATEX and cUL intrinsic safety standards required for use in Class I, Division 1, Group C, D hazardous areas and carries the following area classification:

II 2 G
Ex d [ib] ib IIB T4 Gb
T_{amb} -20ºC to +50ºC

Advanced Electrochemical Sensor Technology

All galvanic type sensors function on the same principle and are specific to oxygen. They measure the partial pressure of oxygen from low PPM to 100% levels in inert gases, gaseous hydrocarbons, helium, hydrogen and mixed gases.

Oxygen, the fuel for this electrochemical transducer, diffusing into the sensor, reacts electrochemically at the sensing electrode to produce an electrical current output proportional to the oxygen concentration in the gas phase. The sensor's signal output is linear over all measuring ranges and remains virtually constant over its useful life. The sensor requires no maintenance and is easily and safely replaced at the end of its useful life.

Proprietary advancements in design and chemistry add significant advantages to this extremely versatile oxygen sensing technology. Sensors recover from air to low % levels in seconds, exhibit longer life and reliable quality. The expected life of our new generation of percentage range sensors now range from 32 months to ten years with faster response times and greater stability. Another significant development involves expanding the operating temperature range for percentage range sensors from -30°C to 50°C. Contact factory for more specific information about your application.

Electronics

The signal generated by the sensor is processed by state of the art low power micro-processor based digital circuitry. 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 10 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 of the low range. Oxygen readings may be recorded by an external device via the 4-20 mA or 1-5V signal output.

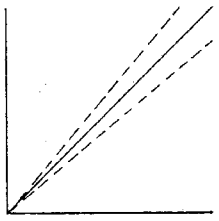
Calibration and Accuracy Overview

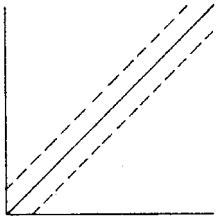
Single Point Calibration: As previously described, the electrochemical Oxygen sensor generates an electrical current proportional to the Oxygen concentration in the sample gas. In the absence of Oxygen the sensor exhibits an absolute zero, e.g. the sensor does not generate a current output in the absence of Oxygen. Given these linearity and absolute zero properties, single point calibration is possible.

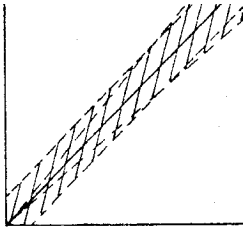
Ambient Temperature: The rate at which Oxygen molecules diffuse into the sensor is controlled by a Teflon membrane otherwise known as an 'Oxygen diffusion limiting barrier'. All diffusion processes are temperature sensitive, therefore, the fact that the sensor's electrical output will vary with temperature is normal. Under typical applications, this variation is relatively constant and the measurement accuracy remains within the published specifications over the recommended operating rage of temperature. The accuracy of $\pm$5% or better over an operating temperature range e.g., 5-45^{o}C can be obtained. The measurement accuracy will be the highest if the calibration and sampling are performed at similar temperatures (a temperature variation of 10 ºC may produce an error of >+/-2% of full scale).

Accuracy: In light of the above parameters, the overall accuracy of an analyzer is affected by two types of errors, 'percent of reading errors', illustrated by Graph A below and the 'percent of full scale errors', illustrated by Graph B. The percent of reading error is contributed by incorrect calibration procedure whereas the percent of full scale error is contributed by tolerance in components and the measurement device. These errors are 'spanned out' during calibration, especially when span calibration is done close to the top end of the measuring range followed by a zero calibration.

Graph C illustrates these 'worse case' specifications that are typically used to develop an overall accuracy statement of < 2% of full scale at constant temperature or < 5% over the operating temperature range. The QC testing error at the factory is typically < 1% of full scale.


A. PERCENT OF READING ERRORS


B. PERCENT OF FULL SCALE ERRORS


C. OVERALL ACCURACY

Example 1: Graph A, percent of reading error, this error is more pronounced when a span adjustment is carried out at the lower end of the scale. Conversely, an error during a span adjustment close to the top end of the range would reduce the error proportionately for measurements near the bottom end of the range.

Graph B represents a constant error over the entire measuring range. This error is generally associated with the measuring e.g., LCD and or calibrating devices, e.g., current simulator or current/voltage measuring devices.

Graph C shows the overall accuracy of the measurement.

Mounting of the Analyzer

The GPR-2800AIS-S consists of two interconnected enclosures. This configuration is designed to be mounted directly to any flat vertical surface, wall or bulkhead plate by using eight (4) of the appropriate screws.

To facilitate servicing the interior of the Analyzers, secure the back plate to a vertical surface approximately 5 feet from the floor or a level accessible to service personnel. This requires the user to supply four (4) additional proper size screws and anchors.

Caution: Do not remove or discard the gaskets from either the Ex enclosure or the fiberglass enclosure. Failure to reinstall either of the gaskets will void the UL Type 3R rating and the immunity to RFI/EMI.

The Analyzer's design provides immunity from RFI/EMI by maintaining a good conductive contact between the two halves of the enclosures via a conductive gasket (the smaller enclosure containing signal processing electronics). The surfaces contacting the conductive gasket are unpainted. Do not paint these areas. Painting will negate the RFI/EMI protection

See Section 4 – Specifications, for exclusions

Gas Connections

The GPR-2800AIS-S measures Oxygen in ambient air thus it does not require sample gas connections.

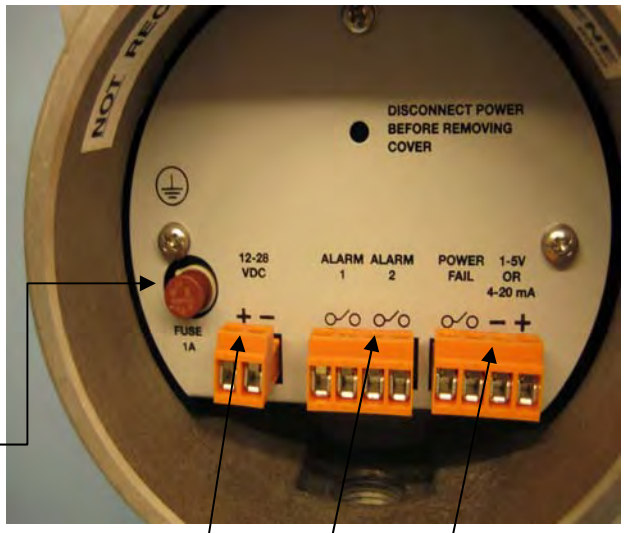
For calibration a flow through housing with gas inlet and vent is provided that mounts directly to the sensor. Use supplies the flow control device to regulate span gas flow within the recommended range (1-2 SCFH). The user is responsible for calibration gases and other required components, see below.

Electrical Connections

The Incoming power, alarm relays, and signal output connections are made to terminal blocks mounted on a PCB located in the explosion proof enclosure.

Do not supply voltage above the noted value in this manual and noted near the power input terminal of the analyzer.

The PCB in the explosion proof enclosure contains a power limiting intrinsic safety barrier that limit the total power available at the PCB electronics mounted in the general purpose enclosure.



200 mA Fuse

Power In Alarms Signal Out

The GPR-2800 AIS-S meets the intrinsic safety standards required for use in Class I, Division 1, Group C, D hazardous areas.
ATEX Directive 94/9/EC

II 2 G
Ex d ib IIB T4 Gb
T_{amb} -20ºC to +50ºC

For USA and Canada, it conforms to: UL 913, 7th Edition and CSA C22.2 No. 157-92

The A-1166 AIS PCB in the Ex enclosure contains five fuses, one plug-in (brown color) rated at 200 mA and the rest are mounted on the PCB (after the DC voltage is regulated to lower safe value, these fuse meet barrier network standard EN 50020).

Avoid electrostatic discharge – Clean all surfaces with a damp cloth only.

Analyzer ground terminal must be connected to ground.

Hazardous Area Installation

The GPR-2800AIS-S may be installed in a hazardous area when adhered to the recommended installation procedure delineated above mentioned directives; see Installation section beginning on page 5.

Power Input

A 12-28 VDC power supply with a shielded power cable is recommended. The power cable to the Ex enclosure must be supplied through a conduit approved for use in hazardous area. Secure the wires to the power input terminal block by using the integral screws of the terminal block.

CAUTION: Check the Quality Control & Calibration Certification, Section 2, attached as a separate page following the appendices for the proper power requirement. Incorrect power will severely damage the analyzer

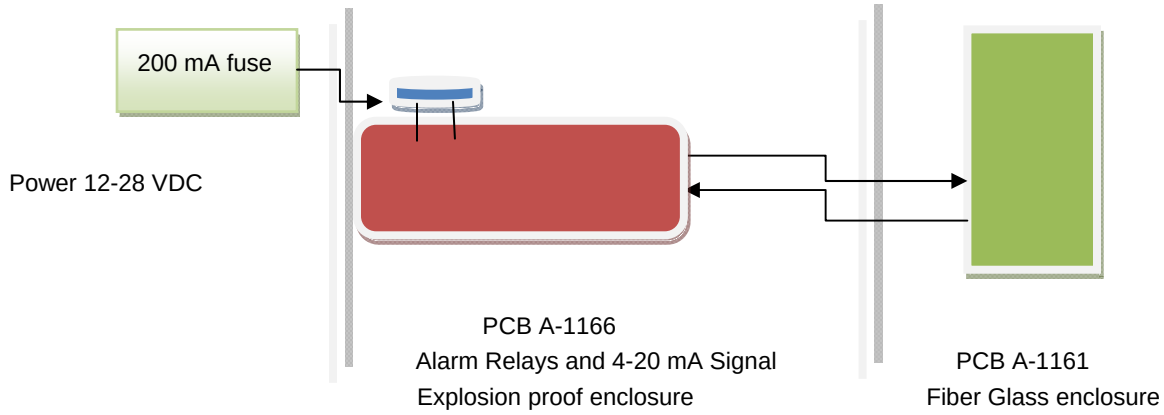
Output Connections

The Analyzer has two adjustable alarms, one power fail alarm and 4-20 mA or 1-5 VDC signal output connections.

CAUTION: The 4-20mA circuit does not require external power. Supplying external power to the 4-20 mA signal output connector will permanently damage the PCB.

The HI and LOW alarms are user configurable. The relays are rated at 1A @ 230 VAC.

CAUTION: Do not exceed the recommended rating of the relays. Excessive power through the relays can severely damage the relays and the PCB.



There are total five wire connections between the Ex enclosure and the fiber glass enclosure but for simplicity, only two connections are shown.

Procedure

1. Unscrew the cone shaped cover from the EX enclosure.
2. Separate the shielding from the wires of the cables.
3. Strip the end of wires no greater than 1/4"
4. Insert the stripped end of wires into the appropriate slots of the terminal block
5. Ensure the positive and negative terminals of the power supply are connected to the appropriate terminals of the terminal block as marked.
6. Tighten the screws and ensure the wires are properly secured.
7. Connect the shielding of the cable to the ground screw inside of the enclosure.

8. Follow the same procedure and establish alarm relays and 4-20 mA signal connections with appropriate terminals
9. Replace the cover.

Note**:** The male and female power terminals snap together, making it difficult to detach them when connecting the shield to the ground. However, after connecting the shield, ensure that the male terminal is fully inserted and secured into the female terminal block.

Installation of Oxygen Sensor

The sensor housing is threaded and screws directly into the bottom section of the fiber glass enclosure.

Caution: DO NOT dissect the sensor. The sensor contains a corrosive liquid electrolyte that could be harmful if touched or ingested, refer to the Material Safety Data Sheet contained in the Owner's Manual appendix. 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. Leaking sensors should be disposed off in a manner similar to that of a common battery in accordance with local regulations.

Should the Analyzer come without sensor installed or need to install a new sensor, follow the procedure below.

1. Turn the power to analyzer OFF.
2. Remove the two (2) clamps securing the right side corners and open the door of the fiber glass enclosure.
3. Remove the connector cable from the top of the sensor by gently squeezing the tab attached to the connector toward the connector itself, pulling the connector up and away from the jack.

Avoid electrostatic discharge – touch a metal surface with your bare hand before contacting the sensor. Clean all surfaces with a damp cloth only

4. Unscrew the sensor by turn the sensor anti clockwise.
5. Remove the new sensor from the bag.
6. Screw the new sensor in to the sensor housing until finger tight.
7. Align the tab on the connector with the registration slot of the jack and push into the sensor until firmly seated. .

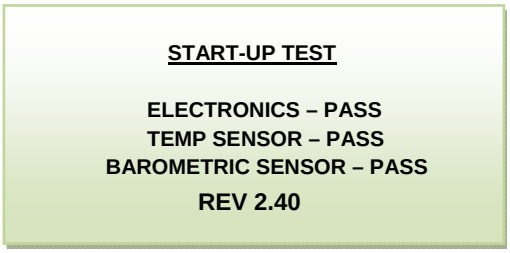
Sensor shown with connector cable half inserted into mating jack

Span Gas Requirement

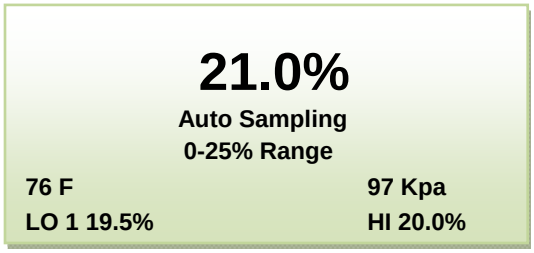
The GPR-2800AIS-S must be calibrated with a mixture of Oxygen approximating 20.9% and the balance Nitrogen from either a known clean source of air (ambient or compressed) or a certified span gas balance air or nitrogen. User is responsible to provide means of calibration gas.

Establishing Power to Electronics

Once the two power input wires of the shielded cable are properly connected to the terminals inside the Ex enclosure as described above, connect the other end of the two wires to a suitable 12-28 VDC power source such as a battery, PLC, DCS, etc. The digital display responds instantaneously. The Analyzer performs several self-diagnostic system status checks termed as “START-UP TEST” as illustrated below:



After self diagnostic tests, the analyzer turns itself into the sampling mode and displays the Oxygen concentration the sensor is exposed to, the analysis range, the ambient temperature and pressure, High and Low alarm set points.



Menu Navigation

The four (4) pushbuttons located on the front of the Analyzer control the micro-processor functions:

Blue ENTER (select)

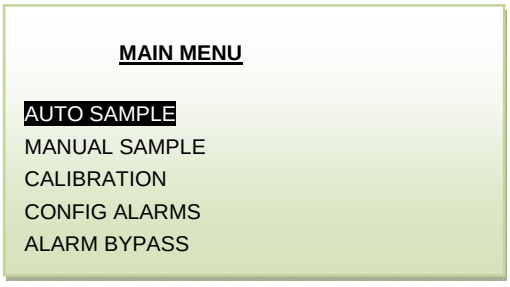
Yellow UP ARROW

Yellow DOWN ARROW

Green MENU (escape)

Main Menu

To access the MAIN MENU, press the MENU (ESC) key and the following screen will appear.



This screen shows various options available. You can use the UP and DOWN arrow key to move the cursor and highlight the desired function. After moving the cursor to the desired function, press ENTER to access that function.

Range Selection

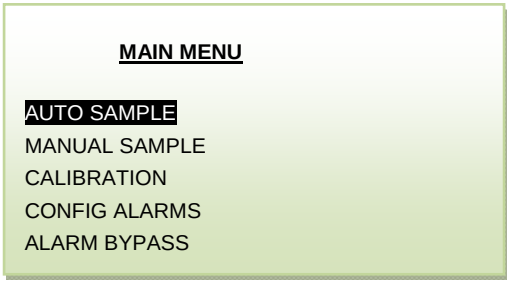
The GPR-2800 AIS-S is equipped with four (4) standard measuring ranges. By accessing the MAIN MENU, users may select either the AUTO SAMPLING (ranging) or MANUAL SAMPLING (to lock on a single range) mode.

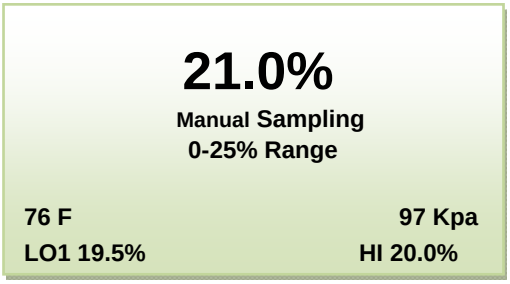
Note: The GPR-2800 AIS-S is shipped with the range manually locked on the 0-25% range.

Auto Sampling

1. Access the MAIN MENU by pressing the MENU key.
2. Advance the reverse shade cursor using the ARROW keys to highlight AUTO SAMPLE.
3. Press the ENTER key to select the highlighted menu option.

The display returns to the sampling mode:

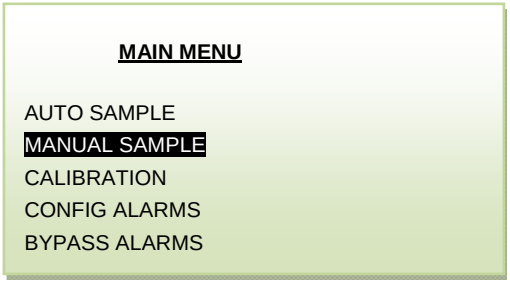


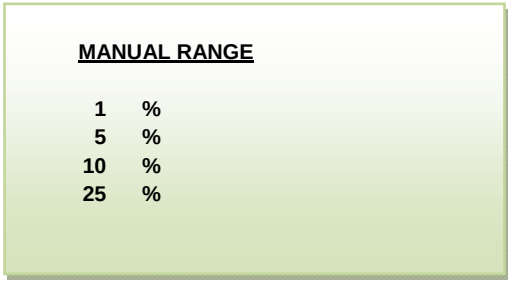


4. The display will shift to the next higher range when the Oxygen reading exceeds 99.9% of the upper limit of the current range. The display will shift to the next lower range when the Oxygen reading drops to 85% of the next lower range.

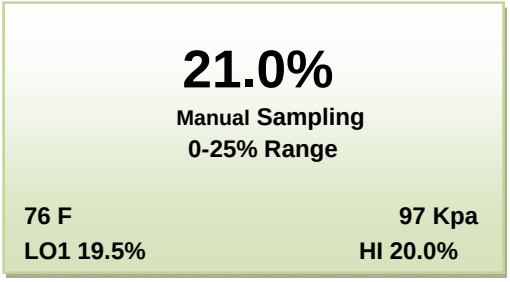
Manual Sampling

1. Access the MAIN MENU by pressing the MENU key.
2. Advance the reverse shade cursor using the ARROW keys to highlight MANUAL SAMPLE.
3. Press the ENTER key to select the highlighted menu option and the following display appears:





4. Advance the reverse shade cursor using the ARROW keys to highlight the desired MANUAL RANGE.
5. Press the ENTER key to select the highlighted menu option and the following display appears with the range selected and oxygen concentration of the sample gas:



6. If the value of Oxygen goes above the full scale range selected, the display will not shift to the next higher range. Instead, when the Oxygen reading exceeds 125% of the upper limit of the current range, an **OVER RANGE** warning will be displayed.
7. Once the OVER RANGE warning appears the user must advance the Analyzer to the next higher range.
8. **NOTE:** With Oxygen reading above 125% of the selected range, the mA signal output will increase but will freeze at a maximum value of 24 mA. After the sample reading falls below the full scale range, the mA signal will become normal.

Calibration

The electrochemical Oxygen sensors generate an electrical current that is **linear** or proportional to the Oxygen concentration in a sample gas. In the absence of Oxygen the sensor exhibits an **absolute zero**, i.e., the sensor does not generate a current output in the absence of Oxygen. Given the properties of linearity and an absolute zero, a single point calibration is possible.

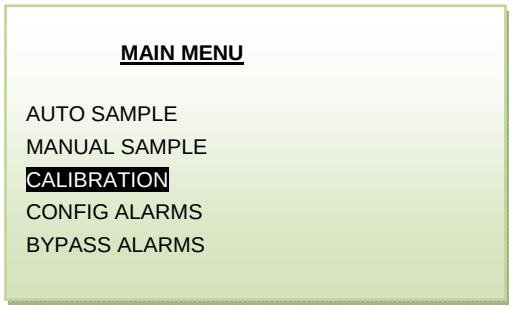
Zero Calibration is recommended only when the application (or user) demands optimum accuracy of below 5% of the most sensitive or lowest range available. Inasmuch as the GPR-2800 AIS-S is designed for ambient Oxygen measurements the zero calibration section of the software is not applicable, except for one function, has been omitted from this manual.

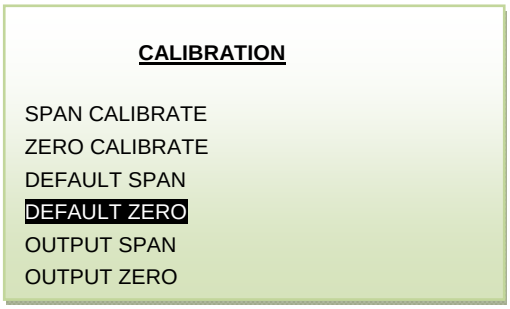
Span Calibration, as described below, is necessary to adjust the analyzer sensitivity for accurate measurements of Oxygen.

Zero Calibration - Default Zero

This function eliminates any previous zero calibration and displays the actual signal output of the sensor and should be performed prior to Span Calibration. To perform Default Zero,

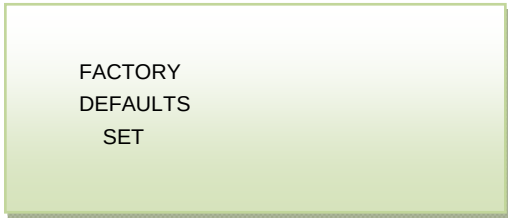
1. Access the MAIN MENU by pressing the MENU key.
2. Advance the reverse shade cursor using the ARROW keys to highlight CALIBRATION.
3. Press the ENTER key to select the highlighted menu option and the following displays appear:





4. Advance the reverse shade cursor using the ARROW keys to highlight DEFAULT ZERO.
5. Press the ENTER key to select the highlighted menu option.

The following display appears and after 3 seconds the system returns to the SAMPLING mode:



Span Calibration

Involves periodically checking and/or adjusting the electronics to the sensor's signal output at a given Oxygen standard. The frequency of calibration varies with the application, e.g., the degree of accuracy required by the application and the quality assurance protocol of the user. However, the interval between span calibrations should not exceed 1 month.

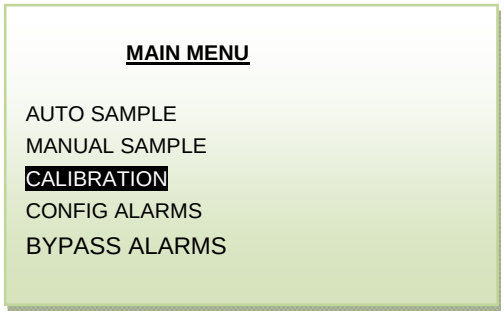
Note: Regardless of the value of the standard used, the span calibration process takes approximately 10-15 minutes.

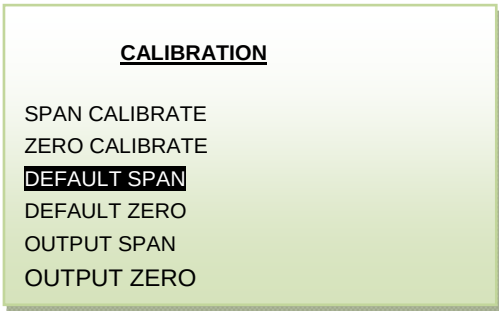
Span Calibration - Default Span

This function should be performed immediately following the Zero Calibration - Default Zero (described above) and prior to the actual Span Calibration, see menu below right.

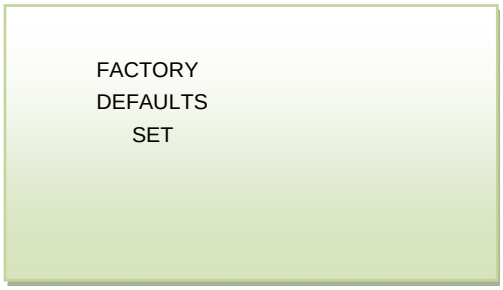
This function eliminates all previous calibration data stored in the memory and the sensitivity of the sensor is reset to the value based on the average output of the sensor at a specific Oxygen concentration. For example, with factory default settings, when a span gas is introduced, the micro-processor will display an Oxygen reading within 30-50% of the span gas value, indicating that the sensor output is within the specified limit.

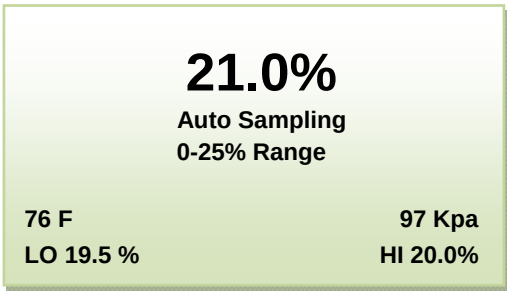
1. Access the MAIN MENU by pressing the MENU key.
2. Advance the reverse shade cursor using the ARROW keys to highlight CALIBRATION.
3. Press the ENTER key to select the highlighted menu option and the following display appears:





4. Advance the reverse shade cursor using the ARROW keys to highlight DEFAULT SPAN.
5. Press the ENTER key to select the highlighted menu option and the following displays appear and after 3 seconds the system returns to the SAMPLING mode:

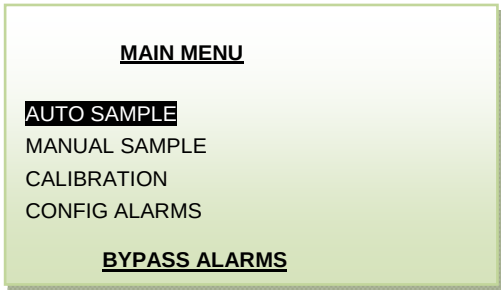


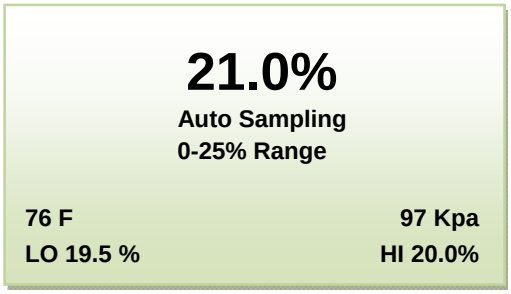


Span Calibration

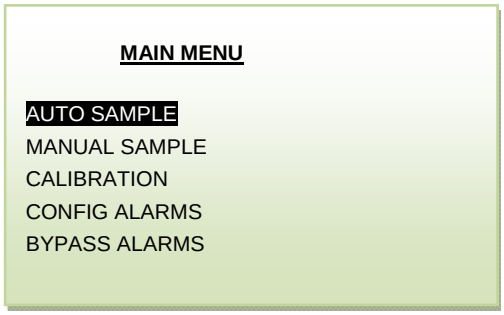
This procedure assumes a span gas under positive pressure.

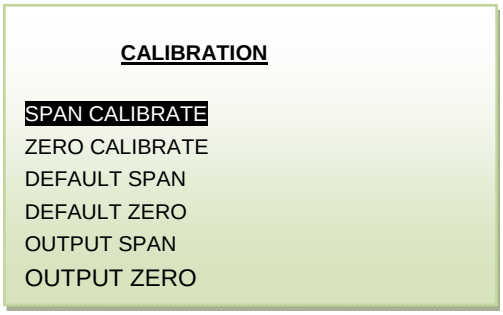
1. Attach the flow-through sensor housing to the sensor.
2. Connect 1/4" tubing from the span gas to the inlet of the flow-through sensor housing.
3. Connect a 1/4" tubing to vent of the sensor housing to vent the span gas to a safe location.
4. Set the span gas flow 1-2 SCFH.
5. For calibration purposes, use AUTO SAMPLE mode.
    1. Access the MAIN MENU by pressing the MENU key.
    2. Advance the reverse shade cursor using the ARROW keys to highlight AUTO SAMPLE.
    3. Press the ENTER key to select the highlighted menu option and the following displays appear:



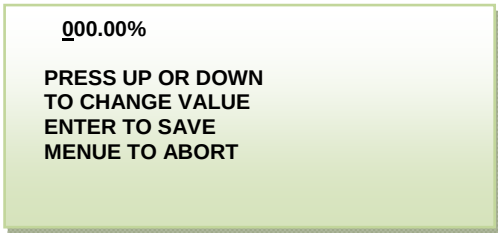


    4. Return to the MAIN MENU by pressing the MENU key.
    5. Advance the reverse shade cursor using the ARROW keys to highlight CALIBRATION.
    6. Press the ENTER key to select the highlighted menu option.
    7. Repeat to select SPAN CALIBRATE and the following displays appear:



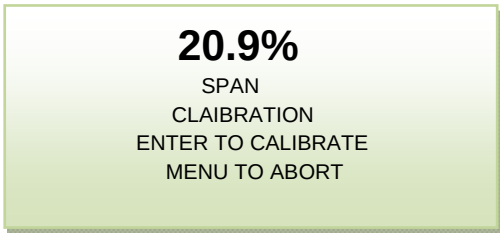


    8. After selecting the SPAN CALIBRATION, the following display appears:



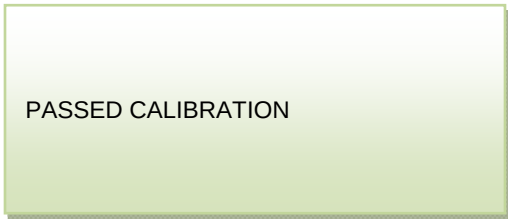
    9. Press the ENTER key to advance the underline cursor right or press the MENU key to advance the underline cursor left to reach to the desired digit of the alarm value.

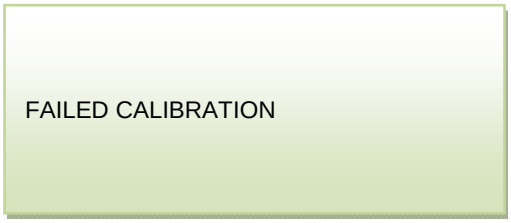
10. Repeat until the complete span value has been entered and press ENTER. The following display will appear showing the real time Oxygen concentration..



11. Press the ENTER key to accept SPAN CALIBRATION. After successful calibration, the analyzer will display a message “PASSED CALIBRATION” and return to the Sample mode.

NOTE: The analyzer is allowed to accept calibration only when the Oxygen reading is within 50% of the span gas value. If the Oxygen reading is outside of this limit, by pressing ENTER to accept calibration will result in “FAILED CALIBRATION” and the analyzer will return to the Sample mode without completing Span calibration.





If span calibration is unsuccessful, repeat calibration, make sure the reading stabilizes and reaches within 30-50% of the span gas value (after factory default span setting) before pressing ENTER to accept calibration.

Setting Alarms

The analyzer is equipped with two programmable alarm relays. The two alarms set points are user adjustable and can be set either as LOW/HIGH, LOW/LOW or HIGH/HIGH.

Setting Alarm Delays

Alarm delay option allows the user to ignore the alarm should a sudden short spike in the oxygen reading occurs.

Setting Alarm Bypass

The alarms bypass feature allows the user to bypass the alarm during trouble shooting/repair or test run. However, once the alarm bypass is selected, alarm will remain disabled even if the oxygen reading is over/under the alarm set point. The alarm will re-arm itself only after the fault condition has been reverted.

The alarms are automatically disabled during SPAN/ZERO calibration.

The relays are rated at 1A @ 230V.

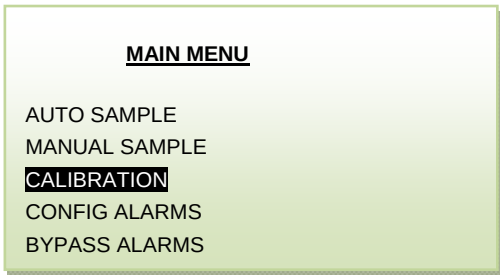
CAUTION; When using these relays, do not exceed the recommended rating.

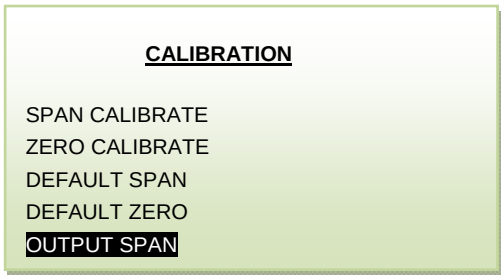
Adjustment of 20 mA Analog Output

In rare instances the 4-20mA signal output may not agree to the reading displayed by the LCD. This feature enables the user to adjust the 4-20mA signal output should the LCD display and signal output does not match.

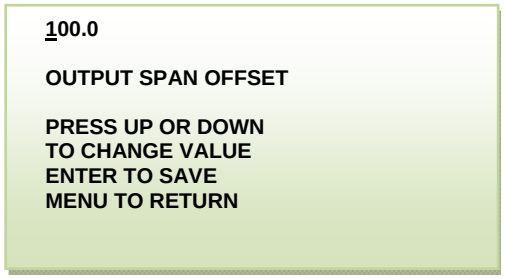
Note: Adjust the 4mA signal output with the OUTPUT ZERO option described above.

1. Access the MAIN MENU by pressing the MENU key.
2. Advance the reverse shade cursor using the ARROW keys to highlight CALIBRATION.
3. Press the ENTER key to select the highlighted menu option and the following displays appear:





4. Advance the reverse shade cursor using the ARROW keys to highlight DEFAULT SPAN.
5. Press the ENTER key to select the highlighted menu option and the following display appears



6. The default setting of 100 illustrates no adjustment to the analog output signal. Adjust the initial value to above 100 to increase the 20 mA analog signal value or decrease it below 100 to decrease the 20 mA analog signal.
7. Press the ENTER key to advance the underline cursor right or press the MENU key to advance the underline cursor left to reach to the desired digit of the OUTPUT SPAN OFFSET value.
8. Press the ARROW keys to enter the desired digit. After entering the digit press ENTER and the 20 mA signal will adjust to the new value.
9. If the 20 mA signal still does not match with 20 mA signal, repeat steps 7 through 8 the 20 mA matches with the display..
10. **Save the adjustment value by pressing the ENTER key or abort by pressing the MENU key and the system returns to the SAMPLING mode.**

Sampling

GPR-2800 AIS-S Ambient Oxygen Analyzer is design to measure Oxygen concentration in ambient air and hence does not require any sampling system. When powered, the analyzer will immediately start to analyze the ambient air and will display the real time Oxygen concentration in air.

Standby

The analyzer has no special storage requirements. The sensor should remain connected to the electronics during storage periods.

Store the analyzer with power OFF at a safe location and away from a direct heating source. If storing for an extended period of time, protect the analyzer from dust, heat and moisture.

6. Maintenance

Generally, replacing the sensor periodically is the extent of the maintenance requirements of this analyzer.

Serviceability: Except for replacing the sensor, there are no parts inside the Analyzer for the operator to service. Only trained personnel with the authorization of their supervisor should conduct maintenance.

7. Spare Parts

Recommended spare parts for the GPR-2800 AIS-S Ambient Oxygen Analyzer:

Item No.	Description
GPR-11-32-4	Oxygen Sensor (inert gas atmospheres)

Other spare parts:

The Factory must be consulted for any other spare parts and questions related to maintenance

8. Troubleshooting

Symptom	Possible Cause	Recommended Action
Slow settling	♦ At Installation, defective sensor	Replace sensor
	♦ Damaged in service - electrolyte leakage	Replace sensor
	♦ Sensor nearing end of useful life	Replace sensor
High Oxygen reading after installing or replacing sensor	♦ Calibrated before sensor stabilized	Allow Oxygen reading to stabilize before performing calibration
Slow response time	♦ Sensor surface clogged by liquid/moisture condensation	Clean front end of sensor with blowing air
Oxygen reading doesn't agree to expected values	♦ Varying ambient temperature and pressure	Calibrate at pressure and temperature that is average of temperature and pressure cycle in 24 hours
	♦ Error in calibration	Repeat calibration
Erratic or no Oxygen reading	♦ Sudden Changes in ambient temperature and/or pressure	Calibrate at mean temperature and pressure during a 24 hours period
	♦ Loose sensor cable	Secure connector firmly by fully inserting the jack into its mating socket on the sensor
	♦ Liquid covering sensing area	Clean frond end of sensor with blowing air .
	♦ Sensor nearing end of life	Replace sensor
Cannot span calibrate	♦ Incorrect span gas	Check span gas with a secondary analyzer
	♦ Span flow rate too high	Set span gas flow within recommended range
	♦ Incorrect sensor	Replace sensor
	♦ Sensor nearing end of life	Replace sensor

9. Warranty

The design and manufacture of GPR Series Analyzers and 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 Analyzer, analyzers and sensor 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. Advanced Instruments Inc. reserves the right in its sole discretion to invalidate this warranty if the serial number does not appear on the analyzer.

If your Advanced Instruments Inc. Analyzer, 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 Advanced Instruments Inc. analyzer, we may replace it with a new or reconditioned one of the same or upgraded design. This warranty applies to all Analyzers, 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

Advanced Instruments Inc. will not pay for: loss of time; inconvenience; loss of use of your Advanced Instruments Inc. analyzer or property damage caused by your Advanced Instruments 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 Advanced Instruments Inc. at 909-392-6900 (or e-mail info@aii1.com) between 7:30 AM and 5:00 PM Pacific Time Monday thru Thursday or 8:00 AM to 12:00 pm on 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:

Advanced Instruments 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 Advanced Instruments Inc. analyzer, we will ship it to you at no cost for parts and labor.

10. MSDS – Material Safety Data Sheet

I. Product Identification

Product Name:	Oxygen Sensor (Series AII, GPR, PSR, Private Label derivations)
Manufacturer:	Analytical Industries Inc. 2855 Metropolitan Place, Pomona, CA 92767 USA
Contact Information:	Tel: 909-392-6900, Fax: 909-392-3665, email: info@aii1.com
Date Prepared:	January 1, 1995
Date Revised:	January 1, 2013

II. Hazardous Ingredients / Composition

Material	C.A.S. #	Quantity	OSHA PEL	ACGIH
Lead (Pb)	7439-92-1	5-25 gms	0.05 mg/m^3	0.15 mg/m^3
Potassium Hydroxide (KOH)	1310-58-3	1-10 ml	2 mg/m^3	2 mg/m^3

III. Health Hazard Data

		Lead (Pb) - Anode	Potassium Hydroxide (KOH) - Electrolyte
Routes of Entry:	Inhalation:	Very unlikely.	Very unlikely.
	Ingestion:	May be harmful or fatal if swallowed.	May be harmful or fatal if swallowed.
	Skin:	NA	Contact may cause irritation or chemical burns.
	Eyes:	NA	Contact may cause irritation or chemical burns.
Acute Effects:		NA	Corrosive, harmful if swallowed, inhaled or absorbed through the skin. Very destructive to tissue of the mucous membranes, stomach, mouth, upper respiratory tract, eyes and skin.
Chronic Effects:		Very unlikely due to product content. May cause disease of blood and blood organs, kidneys, liver, a decrease in fertility, damage to the reproductive system and damage to the fetus of a pregnant woman.	Prolonged exposure is destructive to tissue.
Symptoms of Exposure:		Loss of sleep and appetite, metallic taste and fatigue. For detail information refer to 29 CFR 1910.1025, Appendix A	Slippery to touch, burning sensation to skin and eyes.
Carcinogenicity:		IARC class 2B (lead is possibly carcinogenic to human beings)	NA
OSHA:		If airborne exposure exceed action level refer to OSHA Lead Standard 1910.1025	NA
NTP:		NA	NA
Medical Conditions Generally Aggravated by Exposure:		Disease of the blood and blood forming organs, hypertension, kidneys, nervous and possibly reproductive systems.	Preexisting skin or eye disorders may be more susceptible to the effects of the electrolyte.

IV. Emergency First Aid Procedures

Lead (Pb) - Anode	NA	
Potassium Hydroxide (KOH) - Electrolyte	Following any event:	Obtain medical attention immediately.
	Skin or eye contact:	Immediately flush with generous amounts of water. Continue flushing with water for 15 minutes. Remove all contaminated clothing.
	Ingestion:	Drink generous amounts of water. DO NOT INDUCE VOMITING.
	Inhalation:	Relocate to source of clean ambient air.

V. Fire and Explosion Hazard Data

Material	Flash Point	Flammable Limits	LEL	UEL
Lead (Pb)	NA	NA	NA	NA
Potassium Hydroxide (KOH)	NA	NA	NA	NA

Unusual Fire / Explosion Hazards: NA

Extinguishing Media: No specific agents recommended, use media appropriate to fire conditions.

Special Equipment: NIOSH / OSHA approved self-contained breathing apparatus, protective clothing to prevent contact with skin and eyes.

VI. Cleanup Procedures

Saturate a paper towel with tap water and wipe down the area.
Repeat several times with a new paper towel.
Used or contaminated paper towels are considered hazardous waste, refer to section XIII. Disposal Considerations.

VII. Precautions for Safe Handling and Use

Attention: 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.

Protective Measures:

Before installing (initially or replacement) a new oxygen sensor, open the cardboard box and check for electrolyte leakage inside the polyethylene bag. Some bags are clear and easily inspected,

Other bags are not clear and like sensor housings inside analyzers must be opened to be inspected. A clear liquid inside the clear polyethylene bag indicates an electrolyte leak, do not open the bag.

Anytime the oxygen sensor is not readily visible always open slowly and visually inspect for evidence of a clear liquid indicating an electrolyte leak.

Refer to section VIII. Personal Protection recommendations for hand, skin and eye protection when handling oxygen sensors that have leaked electrolyte.

VIII. Personal Protection Exposure Controls

Eye Protection:	Chemical splash goggles.
Hand Protection:	Rubber or latex gloves.
Other Protective Clothing:	Apron, face shield.
Ventilation:	NA

IX. Physical / Chemical Characteristics

Material / Component:	Lead (Pb) - Anode	Potassium Hydroxide (KOH) - Electrolyte
Boiling Point (°C):	1744	1320
Specific Gravity:	11.34	2.04
Vapor Pressure:	NA	NA
Melting Point (°C):	328	360
Density:	NA	NA
Evaporation Rate:	NA	NA
Solubility in Water:	Insoluble	Complete
Odor / Physical Appearance:	Odorless, solid, silver gray	Odorless, crystals, white or slightly yellow (When combined with H2O - odorless, clear liquid)

X. Stability and Reactivity

Material / Component:	Lead (Pb) - Anode	Potassium Hydroxide (KOH) - Electrolyte
Stability:	Stable	Stable
Incompatibilities:	NA	Aluminum, organic materials, acid chlorides, acid anhydrides, magnesium, copper. Avoid contact with acids and hydrogen peroxide >52%.
Hazardous Decomposition:	NA	Toxic fumes.
Hazardous Polymerization:	NA	Will not occur.

XI. Toxicological Information

Toxicity to Animals:	Calculated value for KOH electrolyte solution - acute oral toxicity (LD50): 2730 mg/kg (Rat)
Mutagenicity:	Lead tested positive as a mutagen in the Ames test.

XII. Ecological Information

Ecotoxicity:	The LC50 of lead for the daphnia magna is 3.6 mg/l, and 5.1 mg/l for the daphnia pulex.
Environmental Fate:	Lead is bioaccumulative in most aquatic life and mammals. It is highly mobile as dust or fumes (30 mesh is the smallest particle size found inside the oxygen sensor), yet forms complexes with organic material which limits its mobility.

XIII. Disposal Considerations

Waste must be disposed of in accordance with Federal, State and Local environmental control regulations. If discarded in its purchased form, this product is hazardous by its characteristics of toxicity and corrosivity under RCRA.

EPA Waste Number: D008, D002

DOT Information: Corrosive liquid, basic, inorganic, n.o.s. (potassium hydroxide, lead), 8, UN 3266, II.
Follow all Federal, State and Local regulations.

XIV. Transport Information

DOT: Regulated. Meets criteria for Small Quantity Exceptions of 49 CFR 173.4

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

XV. Regulatory Information

U.S. Federal Regulations

1) OSHA: Hazardous by definition of Haz Com Std. 29 CFR 1910.1200

2) SARA TITLE III:

Sec 302 (40 CFR Part 365): **Not Applicable** as to chemical name, CAS#, %, TPQ lbs., RQ

Sec 311 & 312: **YES** as to Acute and Chronic Health Hazard;
NO as to Fire and Sudden Release of Pressure Hazard, Reactive

Sec 313 (40 CFR Part 372): This product contains the following toxic chemicals subject to the reporting requirements of Section 313, of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR Part 372

Chemical Name	CAS #	Lead Content
Lead	7439-92-1	5-25 gms

3) TSCA (Toxic Substances Control Act): Components of this product are listed on the TSCA inventory.

4) CERCLA Section 102(A) (40 CFR Part 302) - Hazardous Substances and Reportable Quantities

Chemical Name	CAS #	RQ
Lead	7439-92-1	10 lbs.
Potassium Hydroxide (solid)	1310-58-3	1,000 lbs.

5) State Regulations:

California Proposition 65: WARNING: This product contains lead, a chemical known to the State of California to cause cancer, birth defects or other reproductive harm.

Massachusetts: Potassium Hydroxide is a listed chemical.

Pennsylvania: Potassium Hydroxide is a listed chemical.

International Regulations

Canada:	Canadian Environmental Protection Act (CEPA)	Potassium Hydroxide, liquid, is on the Domestic Substances List (DSL) and is acceptable for use under the provisions of CEPA.	
	WHMIS:	Chemical Name	Class
		Potassium Hydroxide	D-2A: Material causing other VERY TOXIC effects. E: Corrosive liquid
		Lead	D-2A: Material causing other VERY TOXIC effects.
European Community:	Potassium Hydroxide (liquid)	R35 - Causes severe burns. R42 - May cause sensitization by inhalation. R36/37/38 - Irritating to eyes, respiratory system and skin.	

XVI. Other Information

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 for the completeness or accuracy of the information contained herein.

Appendix A

Explosion Proofing Electrical Connections

Electrical connections require an approved explosion proof sealing fitting and packing around wires and cables (for incoming power for the analyzer electronics and 4-20mA signal output) coming into and out of the explosion proof enclosure that houses the power supply/signal output PCB.

Compliance with hazardous area electrical code requires the user to supply glands, fittings and/or conduit commensurate with the level of protection or classification desired.

To maintain the ATEX certification of this unit, the user must install ATEX approved components according to ATEX directives. To meet US and Canada requirements for use in Class I, Division 1, Groups C, D hazardous areas, the user must install the appropriate components according to the NEC standards (US) or CEC standards (Canada).

Note: The following instruction is supplied from information and data supplied by a reputable enclosure manufacturer which we believe is reliable and is given in good faith. Since the methods of application and conditions under which our products are put to use are beyond our control, we are not able to guarantee the application and/or use of same. The user assumes all risks and liability in connection with the application and use of our products.

Directions for use of Explosion Proof Packing Fiber (non-asbestos)

For use as packing at the hub of sealing fittings, tamp packing fiber between and around conductors where they enter fitting to prevent leakage of the liquid cement. Leave enough space in the fitting for length equivalent to the inside diameter of the conduit but, not less than 5/8".

Caution: Avoid contact may cause lung, eye or skin irritation. Use adequate ventilation, prolonged breathing or ingestion may cause internal obstruction, seek medical care. Use protective gloves, long sleeve and mask if dust or fiber is irritating. Contact with eyes or skin may cause skin burn, flush with water for 15 minutes.

Directions for use of Explosion Proof Sealing Cement:

1. Water-mix sealing compound **should not** be poured or installed at temperature below 40F (4C).
2. Maintain temperature at or above 40F for at least 72 hours after pouring.
3. CSA certified when used with any CSA certified sealing fitting.
4. Adaco No. 1 sealing cement must be used as a part of any Adalet UL listed fitting.
5. Tamp packing fiber between and around conductors at entry to the sealing fitting to prevent leakage of liquid cement.
6. Make sure conductors are not in contact with each other or with the wall of fitting.
7. Leave space in the fitting for a sealing length equivalent to the thread size of the conduit seal but not less than 5/8".
8. Fill the marked shipping container with clean cold water to the "water line" [35 ml to be precise].
9. Do not exceed the required amount of water.
10. Gradually pour cement from the plastic bag into the water and stir thoroughly for proper mixture.
11. Fill fitting completely within five (5) minutes after mixing, then tamp with blunt stick to expel any air bubbles.
12. Close up any opening in the fitting to insure integrity of the seal.
13. Fittings requiring more than 10 oz. of cement must be filled from a single mixture of cement and water.
    DO NOT POUR IN STAGES.
14. Allow cement at least 72 hours to cure.
15. **Caution:** At least five threads must engage on all fill plugs.

To reorder sealing cement kit, specify P/N ENCL-1071-KIT

Appendix B

Matching - LCD Display with 4-20mA Output

In rare instances the 4-20mA signal output may not agree with the reading displayed on the LCD. The Output Zero and Output Span features enable the user to adjust the 4mA and 20 mA signal output matching with the reading displayed by the LCD.

For optimum accuracy make two separate adjustments as follows:

1. OUTPUT ZERO feature: To adjust the 4mA signal output and requires zero gas.
2. OUTPUT SPAN feature: To adjust the 20mA signal output and requires span gas near full range.

Note: In the field or in the absence of the preferred gases, use the OUTPUT SPAN feature and adjust the 20mA signal output using the span gas available.

Procedure – regardless of type of adjustment:

1. When you select OUTPUT ZERO OR OUTPUT SPAN, the microprocessor defaults to 100% to start.
2. The “actual” 4-20mA signal output will be adjusted to the “theoretical” value of the LCD display.
3. Adjustment general rule:
   a) If the actual 4-20mA value < the theoretical LCD value, the adjustment value will be > 100%.
   b) If the actual 4-20mA value > the theoretical LCD value, the adjustment value will be < 100%.
4. Convert the “actual” reading of the LCD display to the “theoretical” 4-20mA as follows:
   a) Divide the “actual” (% or percent) LCD reading by the value of the span gas available.
   b) Multiply 16mA (20mA – 4mA) times the “result of a.”
   c) Add 4mA plus the “result of b.” to obtain the “theoretical” 4-20mA signal output value.
5. Adjustment value: Divide the theoretical by the actual 4-20mA values and multiply by 100.
6. Enter the adjustment value via OUTPUT ZERO or OUTPUT SPAN routines described below.

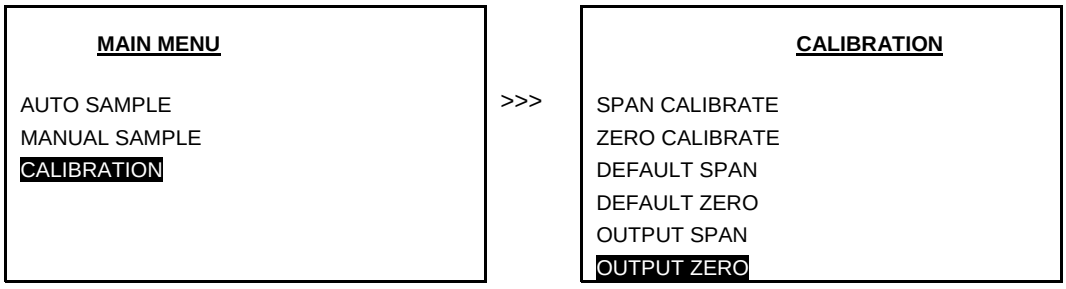
Adjust 4 mA with Zero O_2

Access the MAIN MENU by pressing the MENU key.

Advance the reverse shade cursor using the ARROW keys to highlight CALIBRATION.

Press the ENTER key to select the highlighted menu option.

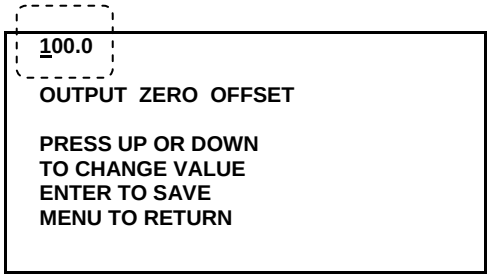
The following displays appear:



Advance the reverse shade cursor using the ARROW keys to highlight DEFAULT ZERO.

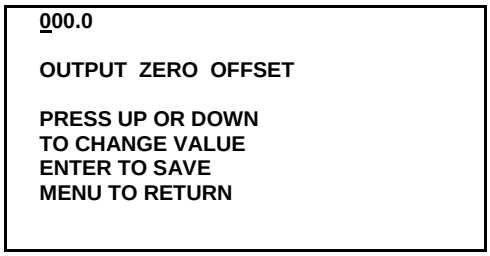
Press the ENTER key to select the highlighted menu option.

The following display appears:



Enter the calculated adjustment value

NOTE: Once the initial adjustment is made and checked at the PLC it may be necessary to fine tune the initial adjustment by repeating. Any additional percent error must be added or subtracted from the initial adjustment value



Press the ENTER key to advance the underline cursor right or press the MENU key to advance the underline cursor left to reach to the desired digit of the adjustment OUTPUT ZERO OFFSET value.

Press the ARROW keys to enter each the numerical value of each digit of the adjustment OUTPUT ZERO OFFSET value.

Repeat until the complete OUTPUT ZERO OFFSET value has been entered.

Save the adjustment value by pressing the ENTER key or abort by pressing the MENU key.

The system returns to the SAMPLING mode.

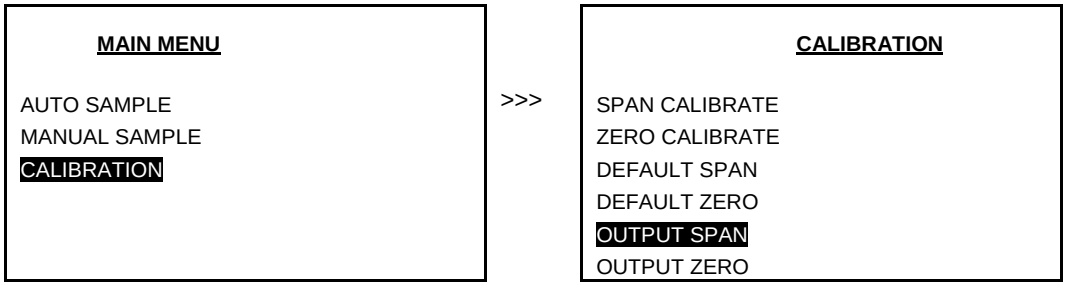
Adjust 20 mA at known Oxygen Concentration

Access the MAIN MENU by pressing the MENU key.

Advance the reverse shade cursor using the ARROW keys to highlight CALIBRATION.

Press the ENTER key to select the highlighted menu option.

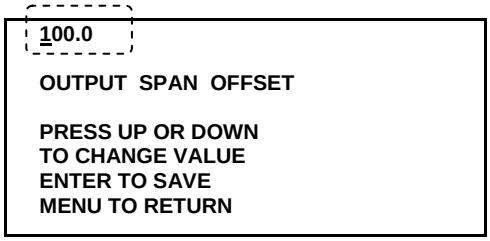
The following displays appear:



Advance the reverse shade cursor using the ARROW keys to highlight OUTPUT SPAN.

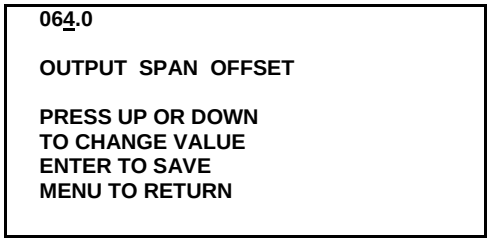
Press the ENTER key to select the highlighted menu option.

The following display appears:



Enter the calculated adjustment value, refer to example described above.

Note: Once the initial adjustment is made and checked at the PLC it may be necessary to fine tune the initial adjustment by repeating. Any additional percent error must be added or subtracted from the initial adjustment value



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Press the ENTER key to advance the underline cursor right or press the MENU key to advance the underline cursor left to reach to the desired digit of the adjustment OUTPUT SPAN OFFSET value.

Press the ARROW keys to enter the numerical value of each digit of the OUTPUT SPAN OFFSET value.

Repeat until the complete OUTPUT SPAN OFFSET value has been entered.

Save the adjustment value by pressing the ENTER key or abort by pressing the MENU key.

The system returns to the SAMPLING mode.