

GPR-x500 GB Oxygen Transmitters (GP)

User Manual AII-UG-2002-EN Rev0



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GPR-x500 GB Oxygen Transmitters

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Before using your GPR-x500 GB

Safety information

Please read this manual, ensuring that you fully understand the content before attempting to setup, maintain or use the GPR-x500 GB. Important safety information is highlighted throughout this document as follows:



The electrical warning symbol indicates instructions that must be followed to avoid serious or fatal injury from hazardous voltages and electric shock.



The warning symbol indicates instructions that must be followed to avoid minor, serious or even fatal injury to personnel.



The **electrostatic discharge (ESD) warning** symbol indicates the user must take precautions and follow the necessary steps to avoid generating electrostatic discharge.



The **caution** symbol indicates instructions that must be followed to avoid damage to equipment (hardware and/or software) or the occurrence of a system failure.

NOTE: Highlights an essential operating procedure, condition, or statement.

Abbreviations

AC	Alternating Current
DC	Direct Current
°C	Degrees celcius
°F	Degrees fahrenheit
EC	Electrochemical
ELV	Extra Low Voltage
ESD	Electrostatic Discharge
FSD	Full-scale Deflection
g	Grams
GND	Ground
IS	Intrinsically Safe
kg	Kilograms
lb	Pounds
LDL	Lower Detection Limit
LED	Light Emitting Diode
LPM	Liters Per Minute
mA	Milliampere
OEM	Original Equipment Manufacturer
oz	Ounces
PC	Personal Computer
PCB	Printed Circuit Board
PLC	Programmable Logic Controller
ppb	Parts Per Billion
ppm	Parts Per Million
SCFH	Standard Cubic Feet per Hour
SS	Stainless Steel

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1 Introduction

This user manual is applicable to the GPR-1500 GB and GPR-2500 GB oxygen transmitters.

⚠ These products are for indoor use. If they are used in a manner not specified by the manufacturer, the protection provided by this equipment may be impaired.

This document contains the following information for your transmitter:

- Installation
- Connection
- Operation
- Maintenance and troubleshooting.

To ensure that the latest manual is being used please visit the Aii website www.aii1.com. Access the latest datasheets, user manuals, certificates and more at the product page **Downloads** tab.



GPR-1500 GB & GPR-2500 GB

1.1 Overview

GPR oxygen transmitters are reliable, compact, robust, and designed to perform verification measurements in a variety of industrial oxygen applications.

Features of GPR-1500 GB and GPR-2500 GB transmitters include:

- Loop-powered configuration
- Sensors avail
- Choice of process connection – flow through or KF-40
- User selectable
- Simple intuitive
- Gas temperature

1.2 Models

The GPR range of oxygen transmitters covered in this manual are detailed as follows:

- GPR-1500 GB - ppm oxygen online transmitter
- GPR-2500 GB - % oxygen online transmitter

1.3 Applications

- Monitor oxygen in inert environments
- Monitor gas purity during generation and distribution
- Pure gas quality on feed gases for food & beverage packaging and production, and N2 generators
- This transmitter is for general purpose location applications only

1.4 Sensors

Our maintenance-free electrochemical sensors are galvanic cells capable of superior performance, accuracy and stability; designed to be unaffected by the presence of background gases. As a consumptive sensor type, it is disposable and requires only periodic calibration.



Each sensor has a different operational life, and the replacement frequency is dependent on the individual application.

If contaminants are present in the sample gas, the sensor can be affected, and the validity of the measurement impacted. Please ensure that the sensor is protected, and any contamination is prevented from reaching the transmitter's pipework and the sensor.

Consult the Aii sales team about our cost-effective standard sample conditioning systems.

NOTE: Calibration is required each time your sensor is replaced. Ideally, your sensor should be replaced before reaching the end of its operational life.

Table 1: Available sensor types:

		
Transmitter model	GPR-1500 GB	GPR-2500 GB
Sensor number	GPR-12-333 GPR-12-333-H XLT-12-333	GPR-11-60 XLT-11-24
Recommended O₂ Measurement Range	0...1000 ppm _v	0...25 %
Minimum Range	0...10 ppm _v	0...1 %
Sensitivity	0.01 ppm _v	0.005 %

For full sensor technical specifications, please refer to "Appendix A - Technical Specifications" on page 33.

1.4.1 GPR-12-333 Sensor

Our standard ppm sensor can be used to measure oxygen in a wide variety of gases.

Operational life for this sensor is up to 24 months however; replacement frequency is dependent on the individual application.

1.4.2 XLT-12-333 Sensor

For measurement applications with ppm levels of oxygen in a background gas containing more than 0.5 % CO₂, the specially designed XLT sensor should be selected.

With most standard electrochemical sensors, an alkaline electrolyte is used; this is neutralized over time when exposed to acidic gases, such as CO₂. To overcome this, Aii has developed the XLT sensor with a special electrolyte formula.

Operational life for this sensor is up to 24 months however; replacement frequency is dependent on the individual application.

1.4.3 GPR-12-333-H Sensor

In applications with a background gas of helium or hydrogen, we recommend using the -H sensor.

This sensor has the same construction as the standard sensor, but a different electrolyte formula enables a quick measurement response with He and H₂ background gases.

Operational life for this sensor is up to 24 months however; replacement frequency is dependent on the individual application.

1.4.4 GPR-11-60 Sensor

Our standard % sensor can be used to measure oxygen in a wide variety of gases, including helium and hydrogen.

Operational life for this sensor is up to 60 months however; replacement frequency is dependent on the individual application.

1.4.5 XLT-11-24 Sensor

For measurement applications with % levels of oxygen in a background gas containing more than 0.5 % CO₂, the specially designed XLT sensor should be selected.

Operational life for this sensor is up to 24 months however; replacement frequency is dependent on the individual application.

1.5 Further general considerations

When your GPR-x500 GB transmitter is used with or inside other equipment please consider the following:

- The transmitter should not be submerged in any liquid. Care should be taken to ensure liquids are not spilled and objects do not fall into the unit.
- Avoid force when using connectors, switches and knobs. Before moving your transmitter, be sure to disconnect the wiring/power cord and any cables connected to the output terminals.
- Ensure the sensor selected and supplied is suitable for the gas composition to which it will be presented; if in doubt, review the application and consult the Aii Factory before initiating the installation.
- The products covered in this manual should be evaluated to the environmental conditions up to 2000m altitude and within the temperature range applicable to your sensor; refer to "Appendix A - Technical Specifications" for details.
- The products covered by this manual should be installed using the manufacturer's instructions.
- Only the sensor provided by the manufacturer is to be used with the transmitter.

1.6 Specific conditions of use



The enclosure of this equipment contains aluminum which may present an ignition hazard if subjected to impact or friction in the hazardous area. Ensure that the equipment is only used in applications where this will not occur.

Intrinsically safe circuits are not insulated from the equipment enclosure.

The enclosure of this equipment may present an electrostatic charging hazard. To minimize the risk, consider the following:

- Control environmental humidity to appropriate levels to reduce the generation of static electricity.
- Protect equipment from direct airflow that could cause charge transfer.
- Ensure that any contact with the enclosure is made using insulating objects.
- Implement a continuous method to safely dissipate electrostatic charges.
- Connect indicated terminal to earth (ground).

1.7 Understanding equipment labels

 <p>Analytical Industries Inc 2855 METROPOLITAN PLACE, POMONA, CA 91766 USA TEL: 909 392 6900, FAX: 909 392 3665, E-MAIL: info@aii1.com GPR- 1500 GB ppm O2 Transmitter S/N: 308860688</p>	<ul style="list-style-type: none"> • Product Identification: Model Specifies the product type and functionality. • S/N (Serial Number): Unique identifier for this specific unit. Use for warranty or support inquiries. • CE Mark: Demonstrate compliance with European safety, health, and environmental protection standards. • USA Flag Icon: Indicates that the product is made or assembled in the USA. • Manufacture and Date: Location of manufacturer and date manufactured (YYMMDD).
	<ul style="list-style-type: none"> • Ground symbol marks a terminal that should be connected to the Earth (ground) for safety. • Always ensure device is properly grounded, otherwise can result in malfunction or pose a serious safety hazard.

1.8 Safety approvals and directives






The CE marking indicates GPR-x500 GB oxygen transmitter conformity to European health, safety, and environmental protection directives.


Please ensure your transmitter is compliant with site or location requirements. This user manual details installation, operation and support for all our portable transmitters for all certifications.

2 Installation

NOTE: Installation, operation and maintenance of this equipment should be carried out only by appropriately trained and suitably qualified technicians in accordance with the instructions in this user manual, and any applicable standards/certificates associated with the country, industry and application.


 Failure to correctly adhere to these instructions may result in serious or even fatal injury. In this regard, the manufacturer will not be held liable.


NOTE: The operator may only perform modifications and repairs to the equipment or system with approval from the manufacturer.

 Do not operate damaged equipment. If faults cannot be rectified, the equipment must be taken out of service and secured against unintentional commissioning.

Before using your GPR-x500 GB, ensure that its specifications are suitable for the process in which it will be installed.

2.1 Unpack your transmitter

The GPR-x500 GB will be supplied in a custom box which should be retained for future use (such as a service return).

Your GPR-x500 GB transmitter pack is comprised of the following equipment (pack contents may vary depending on your specification):

1. GPR-x500 GB transmitter
2. Sensor (in double-foil pack)
3. Aii Factory calibration certificate
4. Quick Start Guides (ref: AII-QS-2001, span calibration, AII-QS-2002, air calibration)
5. User Manual, this document (ref: AII-UG-2002) on a USB stick.



Figure 1. Contents of GPR-x500 GB pack

2.2 Transmitter features

The GPR-x500 GB transmitter consists of an enclosure with an integrated display and sensor housing with a choice of flow through or KF-40 process connection. Both configurations are shown below. For details of physical dimensions please see Appendix E on page 45 in this manual or refer to the product page on website where a STEP model is available.



GPR-2500 GB pictured

Figure 2. The GPR-x500 GB oxygen transmitter set-up with flow through connection



GPR-2500 GB pictured

Figure 3. The GPR-x500 GB oxygen transmitter set-up with flow through and KF-40 connection

2.3 Mount your transmitter

The transmitter is approved for indoor use only. However, avoid mounting in an area where the transmitter may be exposed to direct sunlight. This can cause the transmitter to heat up beyond the recommended operating temperature range.

- Find the appropriate location to install the transmitter.
- Ensure that the mounting and operation is only on a horizontal plane.

NOTE: For installations where temperature can be expected to fall below +5 °C (0 °F) please consult Aii Sales to discuss heated enclosure options.

This GPR-x500 GB configuration is designed to be mounted directly to any flat horizontal surface, bulkhead plate. Please see "Appendix E- Mounting Information" on page 45.

3 Connection

Connect the transmitter to a powered 4...20mA loop according to the specification or markings on the transmitter enclosure. The wiring that connects the transmitter to the power source should be installed in accordance with recognized electrical standards.

Ensure that the transmitter case is properly grounded and meets the requirements for area classification where the transmitter is installed. Never use force when removing wiring from a terminal connection.

3.1 Ground your transmitter

Use a secure, appropriately sized grounding wire and attach to the earth terminal and a suitable grounding point.

! Do not operate without grounding. Running the transmitter without proper grounding may cause inaccurate readings or potential damage to the equipment.

3.2 Connect your power supply

This configuration is **loop-powered**; it requires an 18...24 V DC power supply on a 4...20 mA loop.

Loop power is connected via a cable plug.

! Do not apply line-power to the GPR-1500 GB or the GPR-2500 GB. If line- power is applied to a loop-powered transmitter, it will result in damage to the main PCB.



Figure 4. Wiring and connections

The maximum power consumption for GPR-x500 GB transmitters is 1.8 W.

4 Sensor installation

NOTE: Please read through this procedure and "5 Before connecting gas" on page 12 before attempting to install your sensor.

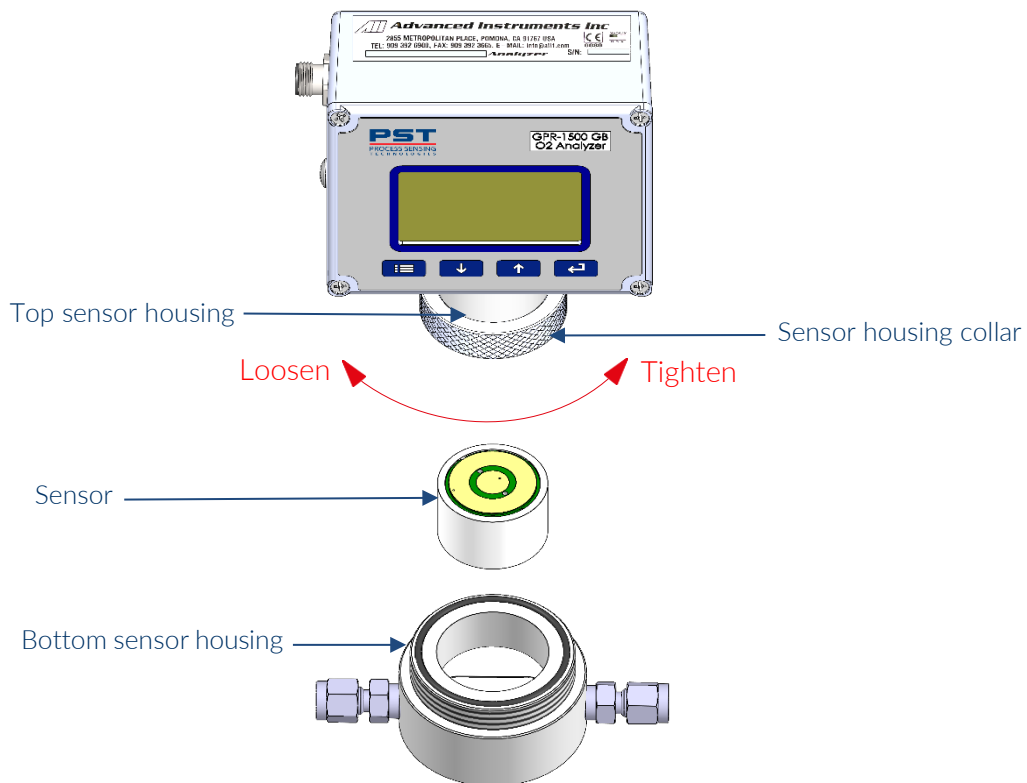
4.1 GPR-x500 GB - with flow through housing

The GPR-x500 GB oxygen analyzer is equipped with stainless steel sensor flow through housing. This housing offers ease of replacement of sensor whilst preventing any sample gas leakage into the system. The two sections of the sensor housing are held together by a stainless steel collar.

The integrity of the sensor housing has been tested at the Aii Factory prior to shipment.

The transmitter must be calibrated once the installation has been completed and periodically thereafter. To install or replace an oxygen sensor:

1. Apply power to your transmitter (refer to Figure 4 on page 9 for guidance).
2. Loosen the collar on the top sensor housing by turning in counter-clockwise direction.
3. Open the sensor housing (refer to [Figure 5](#) below for guidance).
4. If replacing your sensor, remove the old sensor from the sensor housing, otherwise continue to the next step.



Sensor appearance may vary depending on your configuration
Figure 5. Installing and uninstalling your sensor (GPR-x500 GB)

! Always minimize the time that the sensor is exposed to ambient air.

- Remove the sensor from its packaging, remove the shorting flags and immediately place in the bottom sensor housing with the gold contact plate facing upwards as shown in [Figure 6](#).

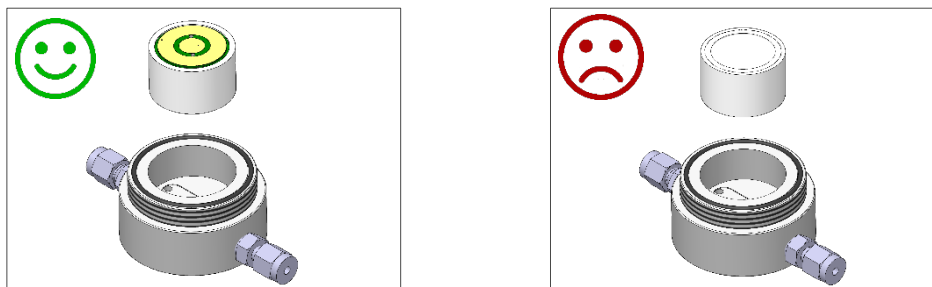


Figure 6. Aligning your sensor

- You may perform a zero and span calibration or an air calibration to confirm that the sensor output is within the recommended limits. "Zero and span vs span calibration" on page 21 for guidance.
- Place the top sensor housing over the sensor and bring down the sensor collar. Lock the sensor housing together by turning the sensor collar in the clockwise direction.
- Quickly connect your process sample gas or zero oxygen gas immediately, following the procedure in "5.2 Connect your gas" on page 13.

4.2 GPR-x500 GB – with KF-40 process connection

The GPR-x500 GB oxygen analyzer with the KF-40 process connection is designed for compatibility with a stainless steel KF-40 flange, allowing for easy integration into existing vacuum systems. The analyzer can be purchased with a separate KF-40 stainless steel sensor housing if required, ensuring secure sensor placement while preventing any sample gas leakage into the system.

The integrity of the sensor housing has been tested at the Aii Factory prior to shipment.

The analyzer must be calibrated once the installation has been completed and periodically thereafter.

To install or replace an oxygen sensor:

- Apply power to your analyzer (refer to [Figure 4](#) on page 9 for guidance).
- Loosen wing nut and open the KF-40 flange (refer to [Figure 8](#) on page 12 below for guidance).
- If replacing the sensor, remove the old sensor from the sensor holder or bottom housing, otherwise continue to the next step.

! Always minimize the time that the sensor is exposed to ambient air.

- Remove the sensor from its packaging, remove the shorting flags and immediately place in the sensor holder or bottom housing with the gold contact plate facing upwards (orientation shown in [Figure 6](#)).
- A flow through sensor housing is required to perform a span calibration to confirm the sensor output is within the recommendation limits. See "Span calibration with KF-40 flange" on page 23 for guidance.
- Place the top sensor housing over the sensor and secure connections with the KF-40 flange, by closing and tightening the wing nut.

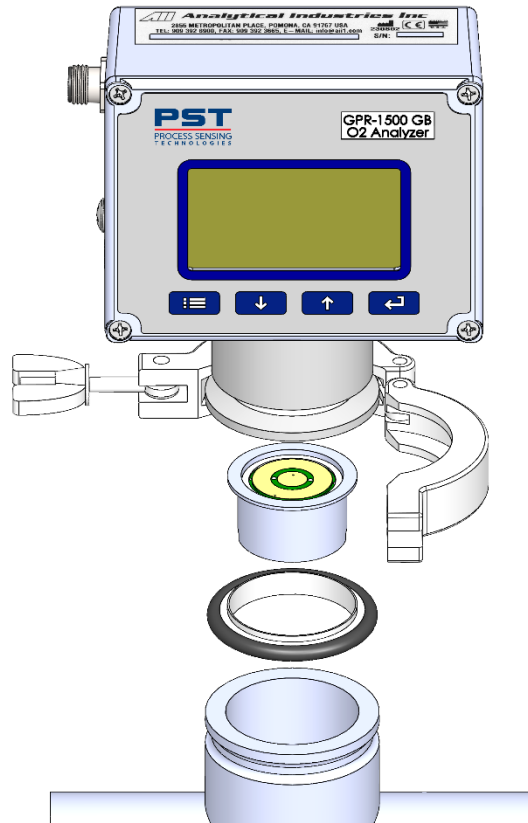


Figure 7. Aligning your sensor

5 Before connecting gas

5.1 Necessary considerations before gas connection

With standard flow-through configuration, the GPR-x500 GB transmitters are designed for positive pressure samples and require connections for incoming sample and outgoing vent lines.

Your transmitter is equipped with two gas ports as shown in [Figure 8](#). The direction of connection does not matter; either port may be used interchangeably.

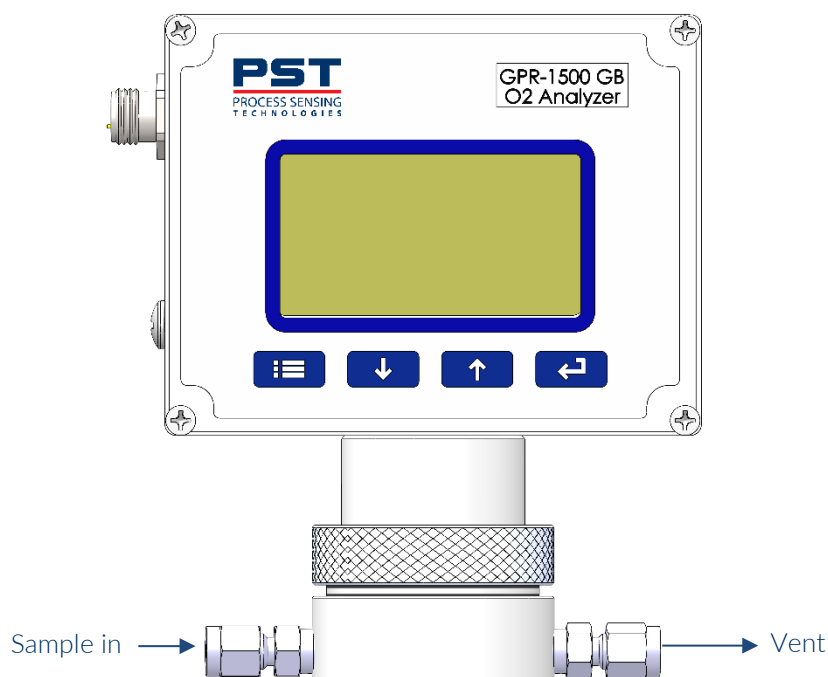


Figure 8. Gas ports

The sample in and vent gas lines require 1/8" stainless steel compression type tube fittings.

The sample inlet tubing must be metallic, preferably stainless steel (SS). The sample vent line may be of SS or hard plastic tubing with low gas permeability.

To ensure the best possible operation, a review of the installation is recommended:

- a. Sample gas quality
 - Is the sensor suitable for gas?
 - Is the sample gas clean and liquid free?
- b. Stainless steel tubing (essential for maintaining the integrity of the gas stream for very low ppm level analysis).

NOTE: If operated in potentially contaminated gases, which can interfere with measurement and reduce the sensor's life expectancy. Consult Aii for recommendations concerning the proper selection and installation of components.

5.2 Connect your gas

To connect your gas:

1. See [Figure 8](#) on page 12 and connect your **Sample** and **Vent** lines.
2. Connect a 1/8" or 1/4" vent line to the compression fitting to be used for venting the sample.
3. Connect a 1/8" or 1/4" sample line to the compression fitting to be used to bring sample gas to the transmitter.
4. Set the **Sample** gas pressure between 2... 5 psi (0.2....0.4 bar).
5. Allow sample gas to flow through the transmitters and set the flow rate to 1 ...2 SCFH (0.5...1 LPM).



Do not place your finger over the vent (it pressurizes the sensor) to test the flow indicator when gas is flowing to the sensor. Removing your finger (the restriction) generates a vacuum on the sensor and may damage the sensor, voiding the sensor warranty.

5.3 Calibration gases

NOTE: It is recommended that you use certified zero and span gases for calibration to ensure the best measurement performance of the GPR-x500 GB transmitter.

Cylinders of the appropriate certified zero and span gases should be made available for installation and commissioning. Calibration gases will need to be set to the same input pressure and flow rate as the sample gas to ensure calibration integrity.

5.4 Sample gas requirements

All gas transmitters utilizing electrochemical oxygen sensors respond to partial pressure changes in oxygen. To ensure accurate measurement of the oxygen sample, gas must be presented to the transmitter at a stable pressure and flow rate.

5.4.1 Inlet pressure

For the transmitters designed to measure oxygen in a flowing gas stream, the inlet sample pressure must be regulated in the range 15 psi (1 SCFH).

5.4.2 Outlet pressure

The sample must be vented at a pressure less than the inlet pressure so that the sample gas can flow through the sensor housing. Ideally, the sample should be vented to the atmosphere or into a flare at atmospheric pressure.

NOTE: The sensor may be used at slightly positive pressure (e.g., when sample is vented to a common exhaust where the pressure might be higher than 1 atmosphere). However, the pressure at the sensor **must remain constant at all times including during the span calibration. This may be accomplished by using a back-pressure regulator on the vent line of the transmitter.**

If assistance is required to configure a measurement at a positive pressure, please contact Aii with full application details for a review.

 A sudden change in pressure at the sensor may result in the sensor electrolyte leakage.

5.5 Prepare your zero/span gas


Avoid contamination of the zero/span gas cylinder when connecting the pressure regulator. Bleed the air-filled regulator for a couple of minutes before closing the vent valve of the pressure regulator (faster and more reliable method of purging the regulator than simply allowing the zero/span gas to flow through the regulator and the span gas line).

The following components/tools are required to set up a zero/span gas cylinder:

- a. Certified zero/span gas cylinder with an oxygen concentration, balance nitrogen, of approximately 50-80 % of the full scale range above the sampling measuring range or 1 range above.
- b. A pressure regulator to enable the reduction of gas pressure to between 5 and 30 psi (0.4 – 2.1 bar).
- c. A flow meter (for use only if the transmitter is not equipped with one) to set the flow rate between 1 and 2 SCFH (0.5 – 1 LPM).
- d. Suitable fittings and 1/8" diameter metal tubing to connect the regulator to the inlet of the transmitter.

Ensure your zero/span gas cylinder valve is closed, then:

1. Install the regulator on the cylinder using good practice.
2. Open the regulator's exit valve and partially open the pressure regulator's control knob.
3. Slightly open the cylinder valve.
4. Loosen the nut connecting the regulator to the cylinder and bleed the pressure regulator.
5. Re-tighten the nut by connecting the regulator to the cylinder.
6. Adjust the regulator exit valve and slowly bleed the pressure regulator.
7. Open the cylinder valve completely.
8. Set the output pressure between 5 and 30 psi using the pressure regulator's control knob.

 **Do not exceed the recommended pressure. Excessive pressure will make flow adjustment more difficult.**

6 Operation

This section details the best practice operation for a correctly installed transmitter. Please refer to "2 Installation" on page 6 for transmitter installation guidance and gas connection.

6.1 User interface

The GPR-x500 GB has a 3.5-inch LCD display and a four-key keypad interface.

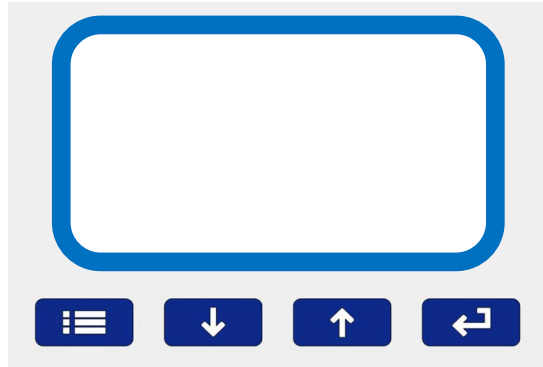






Figure 9. GPR-x500 GB user interface

The interface keys can be used as identified in the table below:

Table 2: Interface key functions

Key	Function
	Menu open/close
	Enter
	Next (increment)
	Previous (decrement)

6.2 Initial start-up and self-test

Once the transmitter is correctly installed and the loop power is applied the transmitter will immediately start up. The digital display responds instantaneously and will display an initial start-up screen:

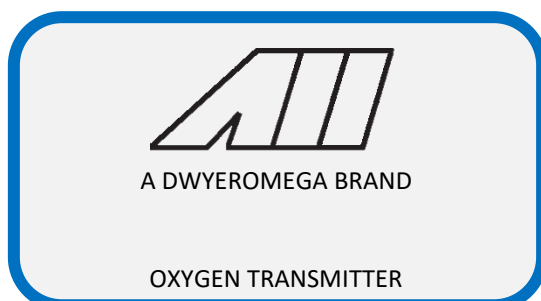


Figure 10. GPR-series transmitter start-up screen

After self-diagnostic tests, the transmitter switches to sampling mode and displays the oxygen reading from the sensor (larger size numeric value) and the measurement range (small size font with units).

Auto indicates that the transmitter is in AUTO mode. In this mode, the measured value affects the range, which will automatically adjust to the next higher level. See **Range** (page 17) in the **Main Menu** to select.

If the **Auto** is not selected, the range display will not show **Auto**. An example of a sampling mode screen is shown below in [Figure 11](#).

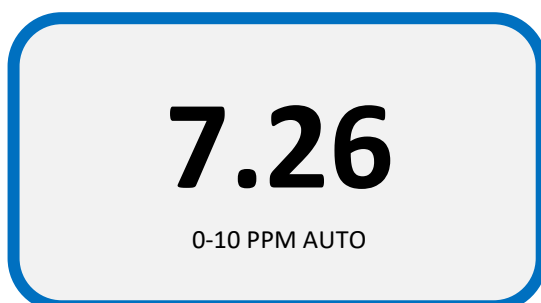


Figure 11. Measurement mode display

6.3 Menus

NOTE: Available menu options and sequences will vary between transmitter model and sensor type.





6.3.1 Main Menu and interface keys

To access the Main Menu, press the **Menu** key and the following Main Menu display will appear:



Figure 12. Main menu display

This screen shows the menu options available.

- Use the  and  keys to move the cursor to the desired menu
- Press  to access the sub menu
- Use the  key to return to the previous screen.

Range

Configure transmitter measurement range (see "6.3.2 Range selection").

Calibration

Perform zero, span or analog calibration functions (see " 6.3.3 Transmitter Calibration" on page 19).

System

Configure system-level settings (see "6.3.4 System" on page 24).

Info

View transmitter information (see "6.3.5 Info" on page 26).

6.3.2 Range selection

Within the Range menu, you can select 6 options. The range is linked to the display and the 4...20 mA analog output of the transmitter.

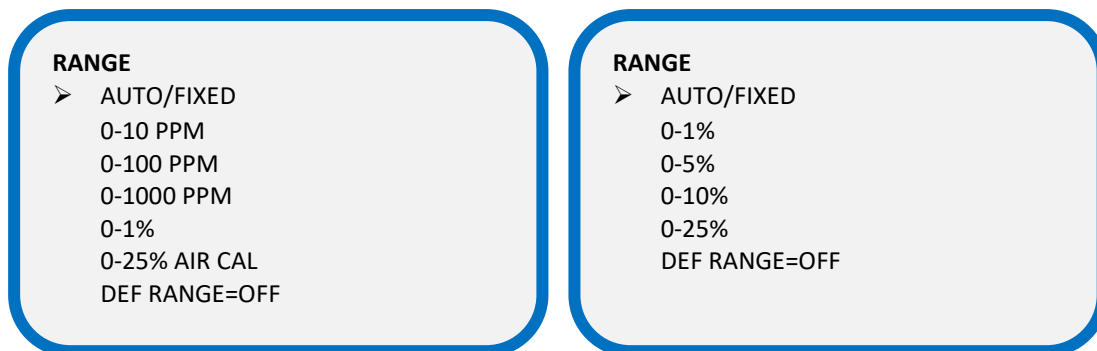







Figure 13. GPR-1500 GB (Left) and GPR-2500 GB (Right) range displays

NOTE: For trace oxygen transmitters, the range 0...25 % is for calibration purposes only. It is not a measurement range of the transmitter (see "Zero and span vs span calibration" on page 21 for calibration). Using this range extensively to perform a process measurement will significantly shorten the sensor life.

Range menu options

In the Range menu:

1. Use  and  to move the cursor to the desired range option.
2. Once the cursor is pointing to your chosen range, press  to select the range.

Selecting a range will cause the **Auto** option to change to **Fixed**. To select Auto, use  to move the cursor to **Fixed**, then press  to toggle between **Auto** and **Fixed**.

Auto/Fixed

Selecting **Auto** will enable automatic adjustment of your measurement range depending on the oxygen levels detected by your oxygen sensor. For example, a 0...10 ppm range will change to 0...100 ppm if the measured oxygen value is higher than 10 ppm.

Default Range

Def Range allows you to set the default range for the transmitter. Within this sub-menu, all standard ranges or **Auto** mode can be selected.

This option will prevent incorrect range-setting if multiple users have access to the transmitter. See Figure 14 on page 19.

If the transmitter range has been changed, for instance for the purpose of checks or maintenance, and a default range has been pre-set, the transmitter will automatically return to the default range after 30 minutes of inactivity.

It is recommended that you set your preferred default range for the transmitter.

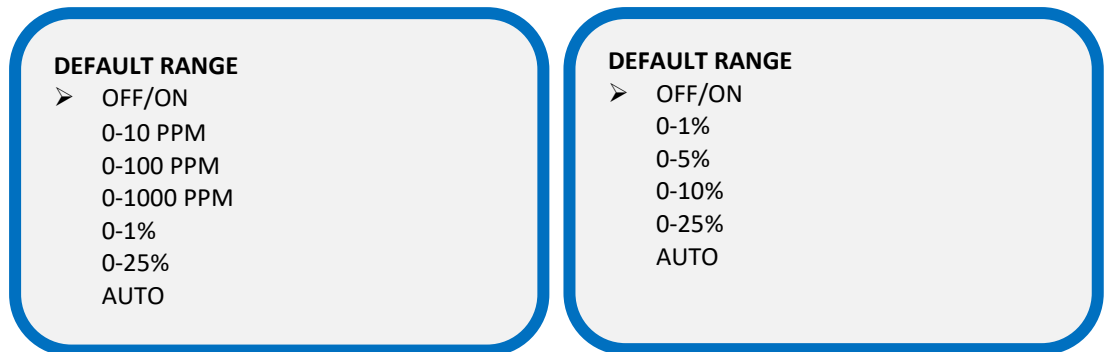


Figure 14. GPR-1500 GB (Left) and GPR-2500 GB (Right) default range displays

Measurements outside manual range

If the oxygen reading goes above the manual or auto range maximum value, the values will be displayed up to 10 % above the maximum range. Beyond this, an OVER RANGE warning will be displayed.

6.3.3 Set sensor serial number

Updating the sensor serial number is critical for the calibration process.

When replacing O₂ sensors it is important to update the sensor serial number. To view the current 9-digit sensor serial number, enter the **Calibration** menu.

The sensor serial number can be seen in the menu as shown below:

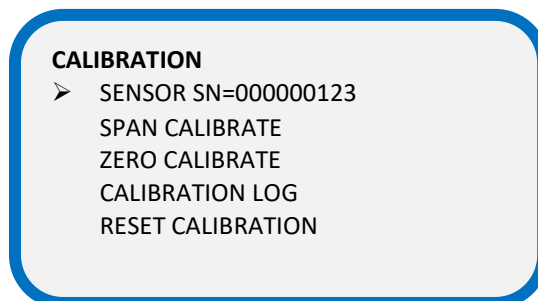


Figure 15. Calibration display

NOTE: Changing the sensor serial number will reset span and zero calibrations to Factory defaults and clear the calibration log. It should only be changed when a new sensor is installed.

To change the sensor serial number:

1. Use  to select **Sensor SN=00000000**.
The display will change as shown below in [Figure 16](#).

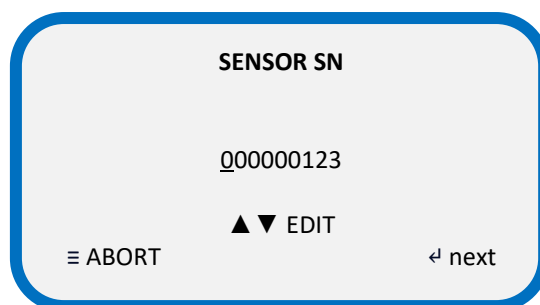







Figure 16. Sensor serial number display

2. Enter your sensor serial number by using  or  to edit the value.
3. Press  to progress to the next digit or  to move to the previous digit.
4. When you have entered your sensor serial number's last digit, press  to **Accept** the new serial number.

Transmitter calibration

All electrochemical sensor-based transmitters require periodic calibration. The electrochemical sensor signal will remain relatively constant throughout its useful life, however, some components in a gas stream, e.g. sulfides, can adversely affect the sensor causing changes in sensitivity with time. As such, regular calibration is recommended to ensure accuracy and ascertain the integrity of the sensor (e.g. weekly intervals to a 3-month maximum). See the Aii Factory calibration certificate supplied with your module for specific calibration gas values.

Always use good calibration practices.

- Calibrate the transmitter at or close to the temperature and pressure of the sample gas.
- Use known reference gases or fresh air.
- Allow suitable stability time, especially when making significant changes in measurement value (e.g. 20.9 % to 0.0 %). Use the table below for guidance.

Table 3: Example stability times

Condition example	Typical stability time
<1 % to air (20.9 %)	<3 minutes
Air (20.9 %) to 0.1 %	<30 seconds
Air (20.9 %) to 0.01 %	<2 minutes
2 minute air exposure to 10 ppm	60 minutes

Zero and span vs span calibration

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 demands optimum accuracy of better than 5 % of the lowest range of the transmitter (e.g. for a transmitter configured for 0...25 % range, we would recommend a zero calibration if measurements below 1.0 % O₂ were required).

Span calibration is required routinely for accurate measurements of oxygen.

NOTE: Zero calibration should always be carried out before a span calibration.

Zero calibration

The zero calibration adjustments are limited to 30 % of the most sensitive range. All transmitters are QC-tested to confirm the zero calibration. Should you observe a zero calibration error of more than 30 % of the lowest range, we recommend first:

- Check the sample system for any possible leaks
- Confirm the integrity of the zero gas
- Ensure the transmitter has been given enough time to stabilize on the zero gas
- Ensure CLIP = OFF, refer to "Clipping" on page 25 for information.

If adequate time is not allowed for the transmitter to establish the true baseline and a ZERO calibration is performed, the transmitter will likely display a negative reading in the sample mode when exposed to zero gas. If a negative reading is observed, we recommend repeating the ZERO calibration. Refer to Table 3 on page 20 for example stability times.

To perform a zero calibration:

1. Enter the **Calibration** menu and select **Zero Calibrate**.
The transmitter will switch to **Zero Cal** mode and display the live readings.

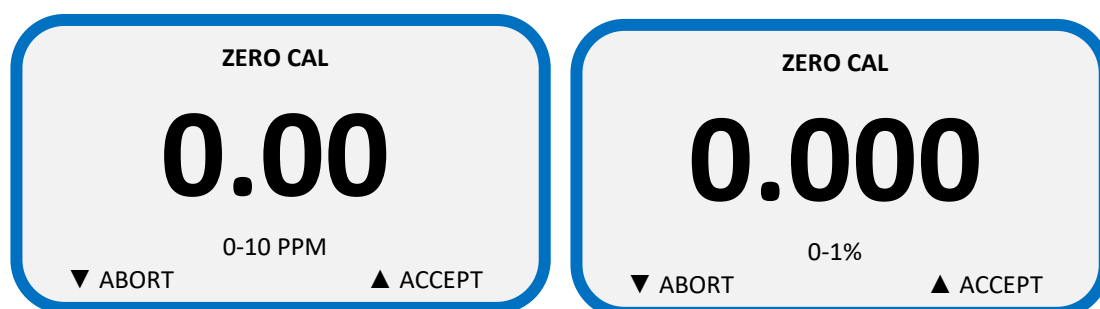


Figure 17. GPR-1500 GB (Left) and GPR-2500 GB (Right) zero calibration display

2. Once gas reading is stable you can **Accept** or **Abort** the calibration.
The calibration will **Pass** or **Fail**, and the transmitter will return to normal operation at the configured range.

During calibration ensure stability of readings, secure gas connections and supply of suitable reference gas.

Span calibration

To perform a Span Calibration, enter the **Calibration** menu and select **Span Calibration**.

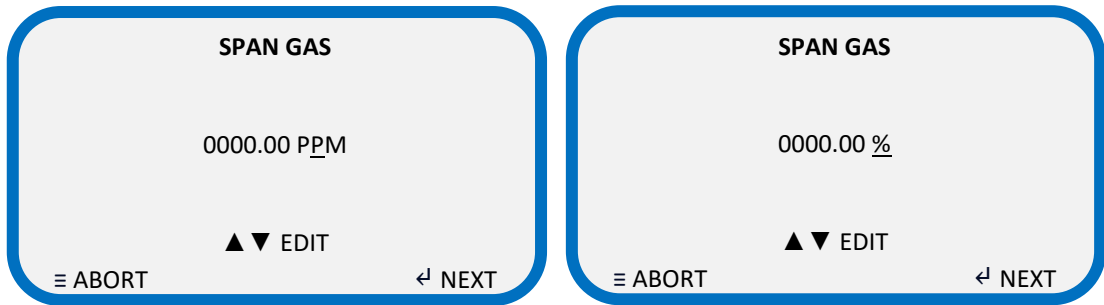


Figure 18. GPR-1500 GB (Left) and GPR-2500 GB (Right) span gas display

In the sub-menu, set the Span Gas value. If using certified cylinder gas, this can be found on the certificate that was supplied with the cylinder:

1. Use to progress to the next digit or to move to the previous digit; use and to edit the values.

NOTE: When a Span or Zero Cal starts, only "Abort" with is shown until the reading is stable, then "Accept" with appears.

2. Now select the unit in use (% or ppm).
3. When you press , the transmitter will switch to the appropriate range and display the live readings.

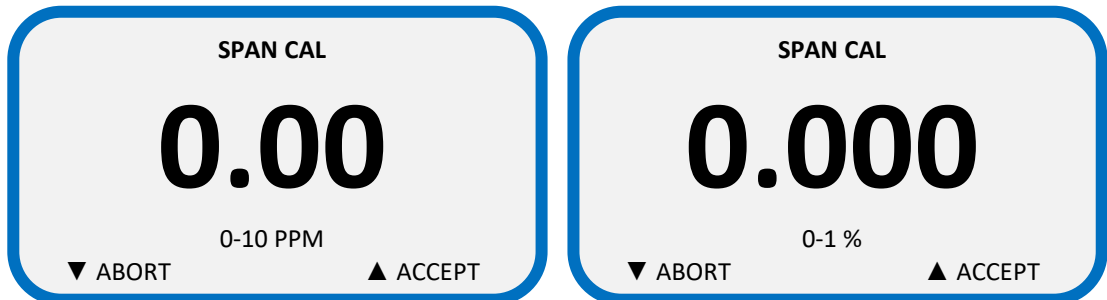


Figure 19. GPR-1500 GB (Left) and GPR-2500 GB (Right) span calibration display

Once gas reading is stable you can **Accept** or **Abort** the calibration. The calibration will **Pass** or **Fail** and the transmitter will return to normal operation at the configured range.

During calibration ensure stability of readings, secure gas connections and supply of suitable reference gas.

NOTE: If using a ppm sensor, we do not recommend exposure of the sensor to ambient air as it will significantly degrade the sensor life.

Span calibration with KF-40 flange

To perform span calibration using span gas, optional **flow-through sensor housing is required**. This housing ensures proper delivery of the calibration gas to the sensor for accurate and reliable calibration results.

The flow-through sensor housing is **not included** with the standard transmitter package and must be purchased separately.

NOTE: Attempting span calibration without the optional housing may result in inaccurate calibration or damage to the sensor.

To perform span calibration with flow through housing:

1. Ensure nitrogen is flowing through the flow-through sensor housing.
2. Loosen the wing nut and open the KF-40 clamp.

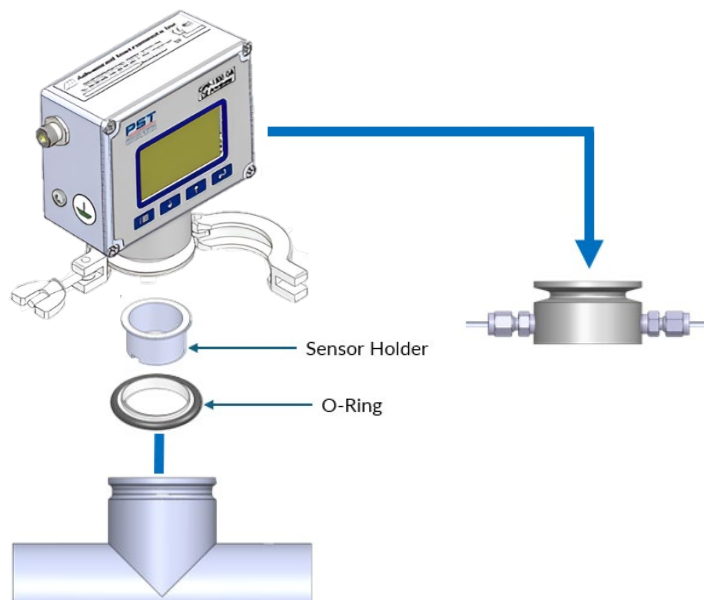


Figure 20. Moving transmitter to flow through sensor housing

3. Carefully lift the transmitter and put aside the sensor holder. Place the sensor and O-ring onto the flow through housing.
4. Place the transmitter on top of the O-ring and use the KF-40 clamp to securely seal the sensor housing.
5. Perform span calibration as described in the calibration section of this manual.

Calibration log

The Cal Log shows a summary of events on the transmitter. A total of 256 records can be recorded. Details included are shown below:

Date	Cal Type	Correction Value	Pass/Fail	
01/01/23	RST			ZRO = Zero calibration
01/01/23	SPN	-0.05	P	SPN = Span calibration
01/01/23	ZRO	-1.00	F	RST = Reset calibration to factory calibration

NOTE: The correction value does not relate to actual readings, it is a proportional value. This value can be used by the Aii Factory for diagnostics.

Reset Calibration

This function clears all stored calibration data (such as span and zero adjustments) and restores it to the factory default calibration values. After resetting, the sensor will operate as if it were newly installed, and you will need to perform a new zero calibration and/or span calibration before use.

6.3.4 System

Use the System menu to make the system adjustments shown in [Figure 21](#).

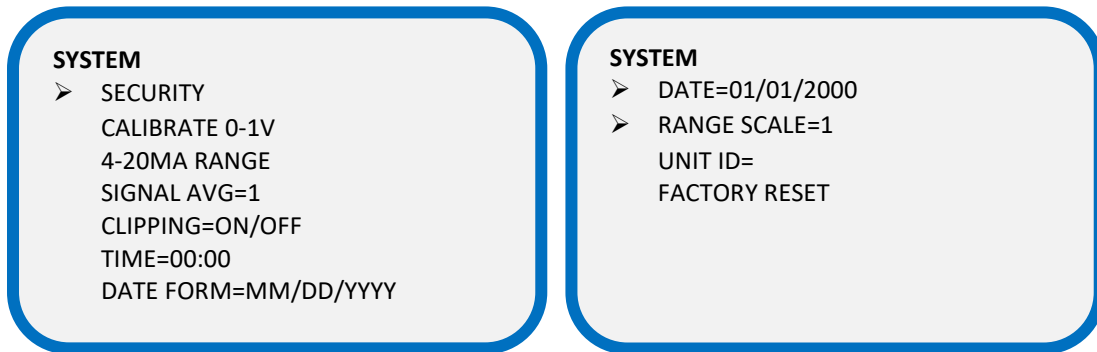


Figure 21. System display

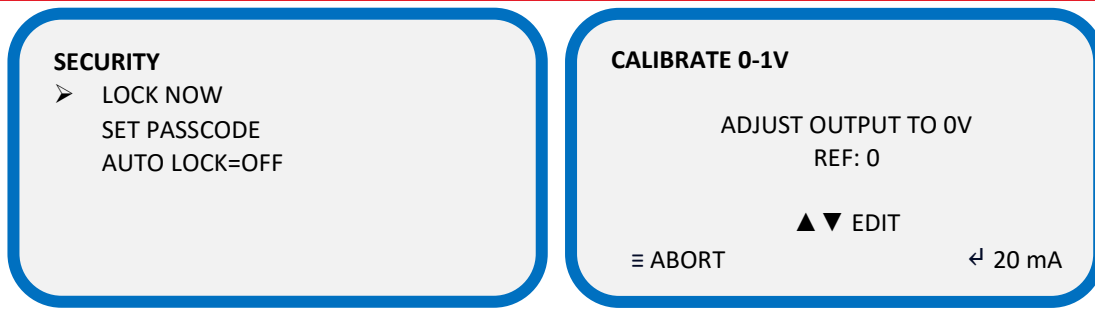


Figure 22. System sub-menu displays

Security

- Enable Screen Lock with a passcode (default code is 0000)
- Set Passcode > Set the 4-digit passcode
- Enable Auto Lock > Locks the screen after 30 minutes.

Calibrate 4...20 mA

This sub-menu allows a direct offset to be applied to the 4...20 mA analog output.

1. Use the keypad to adjust the reference corrections for both 4 and 20 mA output.
2. Select **Accept** to apply the adjustments or **Abort**.

Signal AV - signal average

This function enables the setup of a measurement rolling average. A value between 1...100 readings can be used in a simple average calculation for the display measurements. Measurements are made at 1 Hz so that a value of 60 will give a 1-minute rolling average.

Higher signal average will help remove measurement instability but will reduce measurement response.

Clipping

Enabling Clipping will stop the transmitter displaying below 0 ppm / 0 % readings.

Time

Sets the on board 24-hour clock for event logging.

Date form

These user-configurable functions enables you to set your date format preference. Default is shown as the following:

MM/DD/YYYY

Date

Set the on board device date (after a full power cycle the date time will be 00:00 1 Jan 2000).

Edit ranges

Adjusts the ppm range max values. Your transmitter is supplied as standard with ranges of:

0-10 ppm	OR	0-1 %
0-100 ppm		0-5 %
0-1000 ppm		0-10 %
0-1 %		0-25%

Range editing Rules:

- The lowest range cannot be set lower.
- The highest range cannot be set higher.
- A range cannot be greater than half the next higher range.
- A range cannot be less than twice the next lower range.

Unit ID

Allows an Alpha numeric ID (up to 8 characters) to be given to the transmitter. This value will be stamped on log files and displayed on the INFO SCREEN.

Factory reset

Reverts all settings to Factory Configuration including security settings, sensor calibration and analog calibration.

6.3.5 Info

The **Info** menu displays the device information including:

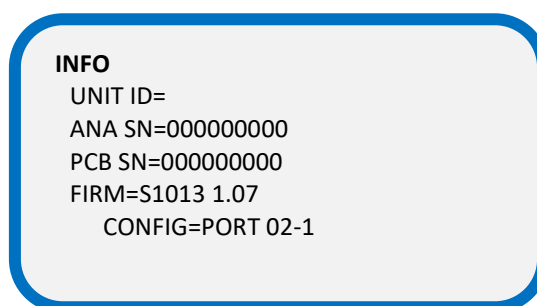


Figure 23. Info display

- **UNIT ID:** User defined (this is left blank for user, usually a location ID or asset number can be changed here)
- **ANA SN:** Serial number of the transmitter (The 9-digit transmitter serial number is also displayed in log files)
- **PCB SN:** Serial number of the circuit board (a 9-digit number)
- **FIRM:** Firmware part number and revision
- **CONFIG:** This number refers to your transmitter's power, gas and Factory group number.

7 Maintenance

The GPR-x500 GB will provide reliable and fault-free service with regular maintenance and calibration.

During periods without use, the sensor should be purged with nitrogen or argon gas to preserve the sensor life as good practice.

 **Do not attempt to make repairs to the transmitter. This will void the warranty and may result in electrical shock, injury, or damage. All servicing should be referred to qualified service personnel.**

7.1 Sensor replacement

To maintain performance, the sensor in your GPR-x500 GB transmitter will require replacement. Sensor life is application dependent.

When your sensor reaches the end of its serviceable life, calibration can no longer be performed, and the sensor must be replaced.


A regular program of calibration will mitigate against sudden sensor failure. It is advisable to establish a program of preventative maintenance to ensure process downtime is kept to a minimum or avoided.

The protective tags on your sensor should only be removed when your GPR-x500 GB is installed and ready to begin gas measurement.

Refer to "5 Before connecting gas" on page 12 for the sensor installation procedure.

7.2 Routine cleaning

During sensor replacement, it is recommended that light cleaning of electrical contacts is carried out.

 **Never use chemical cleaning agents, solvents or high pressure water or steam to clean the equipment. Do not submerge in water.**

To perform routine cleaning:

1. Use a clean cloth that is damp with water to wipe away dust and dirt from the outside of the unit.
2. Dry the transmitter with a clean, dry cloth.

7.3 Routine inspection of sensor housing

The maximum interval between routine inspections should be determined with consideration of the application and importance of the measurement.

The interval should be reassessed on a regular basis and can be extended and reduced as the process control requires.

This can be carried out during sensor replacement. To perform routine inspection:

1. Ensure the gas entry and vent ports on the sensor housing are not obstructed.
2. Inspect the sensor housing seal and replace it if damage is visible.

7.4 Troubleshooting

- Ensure the correct calibration gas is used when performing a validation or calibration of your transmitter. This will prevent unpredictable operation and incorrect readings.
- The calibration gas should be within the range of your GPR-x500 GB, typically 5-8 ppm (or 50-80 ppm) for the 0...1 % range transmitter, and 20.9 % for the 0...25 %.
- A faulty sensor or one that is incorrectly installed will display 'FLT' on your transmitter's display.
- Do not expose the sensor to moisture in an un-powered state. If this happens, allow the sensor to dry out, and if necessary, apply clean dry inert gas.

Table 4: Troubleshooting causes and recommendations

Symptoms	Possible cause	Recommended actions
Slow recovery.	At installation, defective sensor.	Replace sensor if recovery unacceptable or O ₂ reading fails to reach 10 % of lowest range.
	Air leak in sample system connection(s).	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 with zero gas. Replace sensor.
	Damaged in service - prolonged exposure to air, electrolyte leak.	Replace sensor.
	Sensor is nearing the end of life.	Replace sensor.
High O ₂ reading after installing or replacing sensor.	Transmitter calibrated before sensor stabilized caused by: Prolonged exposure to ambient air, worse if sensor was left in air un-shorted.	Allow O ₂ reading to stabilize before making any calibration adjustment, continue purging with zero gas.
	Air leak in sample system connection(s).	Leak test the entire sample system (above).
	Abnormality in zero gas.	Qualify with zero gas.
	High O ₂ reading sampling.	Flow rate exceeds limits Pressurized sensor. Improper sensor selection.
Response time slow.	Abnormality in sample gas measurement.	Validate with portable oxygen transmitter.
	Air leak, dead legs, longer distance of sample line, low flow rate, high volume of optional filters and scrubbers.	Leak test sample system bringing sample gas to transmitter, reduce dead volume and/or increase sample flow rate.
O ₂ reading doesn't agree with expected O ₂ values.	Pressure and temperature of the sample may be different than the span gas used for calibration Abnormality in the sample gas.	Calibrate the transmitter (calibrate close to the pressure and temperature of the sample gas). Qualify sample gas independently.

Symptoms	Possible cause	Recommended actions
Erratic O ₂ reading or No O ₂ reading.	Test sensor signal output independent from transmitter.	Remove sensor from housing. Using a voltmeter set to uA output, apply the (+) lead to the outer ring of the sensor PCB and the (-) lead to the center circle to obtain the sensor's output in air. If there is no current signal, replace the sensor, otherwise contact the Aii Factory.
	Abrupt changes in sample pressure.	Regulate sample gas pressure and flow.
	Dirty electrical contacts in upper section of sensor housing.	Replace sensor.
	Corroded solder joints on sensor PCB from corrosive sample or electrolyte leakage from sensor Corroded Spring loaded contact in upper section of sensor housing from liquid in sample or electrolyte leakage from sensor.	Clean spring loaded contacts in upper section of sensor housing with a damp cloth or cotton swab, water or IPA can be used. If electrolyte leakage from sensor is evident, replace sensor.
	Liquid in sensor housing.	Wipe sensor and sensor housing with a damp cloth or cotton swab. Water or IPA can be used.
	Improper sensor selection.	Replace GPR/PSR series sensor with XLT sensor when CO ₂ or acid gases are present.
	Presence of other interference gases.	Consult Aii Factory.
	Presence of sulfur gases.	Replace the sensor and install the H ₂ S scrubber.
	Unauthorized maintenance.	Replace sensor, obtain authorized service.
	Sensor nearing end of life.	Replace sensor.
Erratic O ₂ reading or Negative O ₂ reading or No O ₂ reading possibly accompanied by electrolyte leakage.	Pressurizing the sensor by flowing gas to the sensor with the vent restricted	Zero the transmitter. If not successful replace the sensor.
	Pressurizing of the sensor by flowing gas to the sensor with SHUT OFF valve closed then suddenly removing the restriction to draw a vacuum on the sensor, or partially opening the valves upstream of the transmitter when using a pump downstream of the transmitter to draw sample from a process at atmospheric pressure or a slight vacuum. A pressurized sensor may not leak but still can produce negative readings. Placing a vacuum on the sensor in excess 40" of water column is strongly discouraged.	Avoid drawing a vacuum on the sensor.
	A premature ZERO OFFSET of transmitter.	From MAIN MENU select DEFAULT ZERO and perform a zero calibration.

8 Warranty information

The design and manufacture of Analytical Industries Inc. oxygen transmitters 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 transmitter 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 transmitter.

When operated and maintained in accordance with the Owner's Manual, the units will provide many years of reliable service.

8.1 Coverage

Under normal operating conditions, the transmitters 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 transmitter are located on the rear of the transmitter. Analytical Industries Inc. reserves the right in its sole discretion to invalidate this warranty if the serial number does not appear on the transmitter.

If your Analytical Industries Inc. monitor, transmitter and/or oxygen sensor is determined to be defective with respect to material and/or workmanship, Aii will repair it or, at our option, replace it at no charge to you.

This warranty applies to all monitors, transmitters and sensors purchased worldwide.

8.2 Limitations

Analytical Industries Inc. will not pay for: loss of time; inconvenience; loss of use of your Analytical Industries Inc. transmitter or property damage caused by your Analytical Industries Inc. transmitter 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 transmitter; affixing of any attachment not provided with the transmitter or other failure to follow the user manual.

US Customers only: Some states and provinces do not allow limitations on the duration of an implied warranty or the exclusion or limitation of special, incidental or consequential damages, in this case, these exclusions may not apply. This warranty gives you specific legal rights. You may have other rights, which vary between states and provinces.

8.3 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 transmitter; affixing of any label or attachment not provided with the transmitter; fire, flood, or acts of God; or other failure to follow the User Manual.

8.4 Service

For queries related to service and warranty, please contact your local Analytical Industries office, sales partner or supplier.

Offices are listed at Aii1.com or email sensors@dwyeromega.com.



9 Appendices

Appendix A - Technical Specifications

Sensor				
Electrochemical	ppm		%	
Model Number	GPR-12-333 GPR-12-333-H	XLT-12-333	GPR-11-60	XLT-11-24
Measuring Range	0...10, 0...100, 0...1000 ppm _v , 0...1 % 0...25 % (calibration only)		0...1, 0...5, 0...10, 0...25 %	
Output Resolution	0.01 ppm _v		0.001 %	
Lower Detection Limit (LDL)	0.05 ppm _v		0.01 %	
Sample Flow Rate (application dependent)	1...2 SCFH (0.5...1 LPM)			
Pressure Range	5...30 psi (0.4...2.1 bar)			
Response Time (T90)	< 2 minutes		< 30 seconds	
Operating Temperature Range	+5 °C...+45 °C (+41 °F...+113 °F)	-10 °C...+45 °C (+14 °F...+113 °F)	+5 °C...+45 °C (+41 °F...+113 °F)	-10 °C...+45 °C (+14 °F...+113 °F)
Humidity	0...80 % rh non-condensing			
Life Expectancy (application dependent)	24 months in 1000 ppm _v		60 months in air	24 months in air
Calibration Interval (application dependent)	30 days			
Transmitter				
Electrical				
Display	LCD			
Output Signal	4...20 mA			
Power Supply	18...24 V DC			
Maximum Power Consumption	0.4 W (18 V), 0.53 W (24 V)			
Mechanical				
Transmitter Housing Material	Painted aluminum			
Mounting	Flat / Horizontal surface			
Compliance				
Complies with EMC Directive: 2014/30/EU				
Electrical Safety: EN 61010-1				

Appendix B – Compliance

Region	Certification details	Standards
Europe		EN 61010-1: 2010

Appendix C - Safety Data Sheet

Analytical Industries Inc.

A DwyerOmega 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@aai1.com
Emergency Number:

Date Prepared: January 1, 1995
Date Revised: January 31, 2023

II. Hazardou(s) Identification

GHS Classification:

Lead (Pb)

Health

Acute Toxicity- Category (Inhalation)
 Acute Toxicity- Category 4 (oral/dermal)
 Carcinogenic- Category 2ty
 Reproductive/Developmental- Category 2
 Target organ Toxicity (Repeated) Category 2

Environmental

Acute Aquatic Toxicity-Cat
 Chronic Aquatic Toxicity-Category 1

Physical

NA

Potassium Hydroxide (KOH)

Health

Corrosive to Metal- Category 1
 Acute Toxicity- Category 4 (oral)
 Skin Corrosion-Category 1A
 Serious Eye Damage-Category 1

Environmental

Acute Aquatic Toxicity-Cat

Physical

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 lens if present and easy to do. Continue rinsing. Immediately call a POISON CENTER f 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)

Analytical Industries Inc.

Safety Data Sheet (KOH)

Symbols:



Hazardous 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.

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

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

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.

*Analytical Industries Inc.***Safety Data Sheet (KOH)****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. Avoid breathing dust. For personal protection see section

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
- 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

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

7.3. Specific end use(s)

- Apart from the uses mentioned in section I no other specifics are stipulated.

VIII. Exposure Controls/Personal Protection**8.1. Control parameters****Exposure**

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

Carcinogen Data

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

*Analytical Industries Inc.***Safety Data Sheet (KOH)**

NTP Known: No; Suspected: Yes
 Group 1: No; Group 2a: No;
 IARC 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 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

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

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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
- 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

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Carcinogenicity	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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 spleen and marrow). Effects on Newborn: Growth statistics (e.g., 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	<ul style="list-style-type: none"> No Data Available
Specific target organ toxicity – repeated exposure	<ul style="list-style-type: none"> May cause damage to organs through prolonged or repeated exposure.
Aspiration hazard	<ul style="list-style-type: none"> No Data Available
Additional Information	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> There is no data available on the preparation itself.
12.3. Bioaccumulative potential	<ul style="list-style-type: none"> Not Measured
12.4. Mobility in soil	<ul style="list-style-type: none"> No Data Available
12.5. Result of PBT and vPvB assessment	<ul style="list-style-type: none"> This Product contains no PBT and vPvB chemicals.
12.6. Other adverse effects	<ul style="list-style-type: none"> Lead is bio accumulative in most aquatic life and mammals. It is highly mobile as lead dust or fume, yet forms complexes with organic material which limits its

XIII. Disposal Considerations

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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, Secti

Environmental hazards IMDG

- Marine Pollutant: Yes (Lead Compounds (as Pb))

XV. Regulatory Information

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

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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.

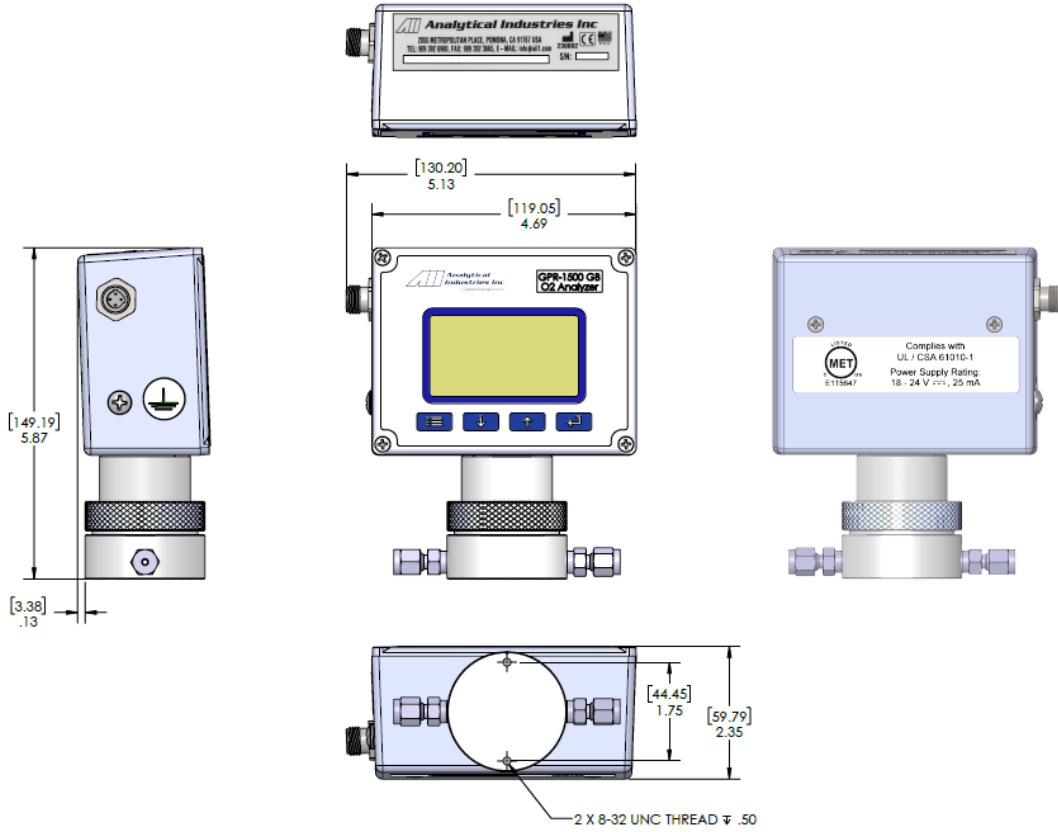
This is the first version in the GHS SDS format. Listings of changes from previous versions in other formats are not

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.

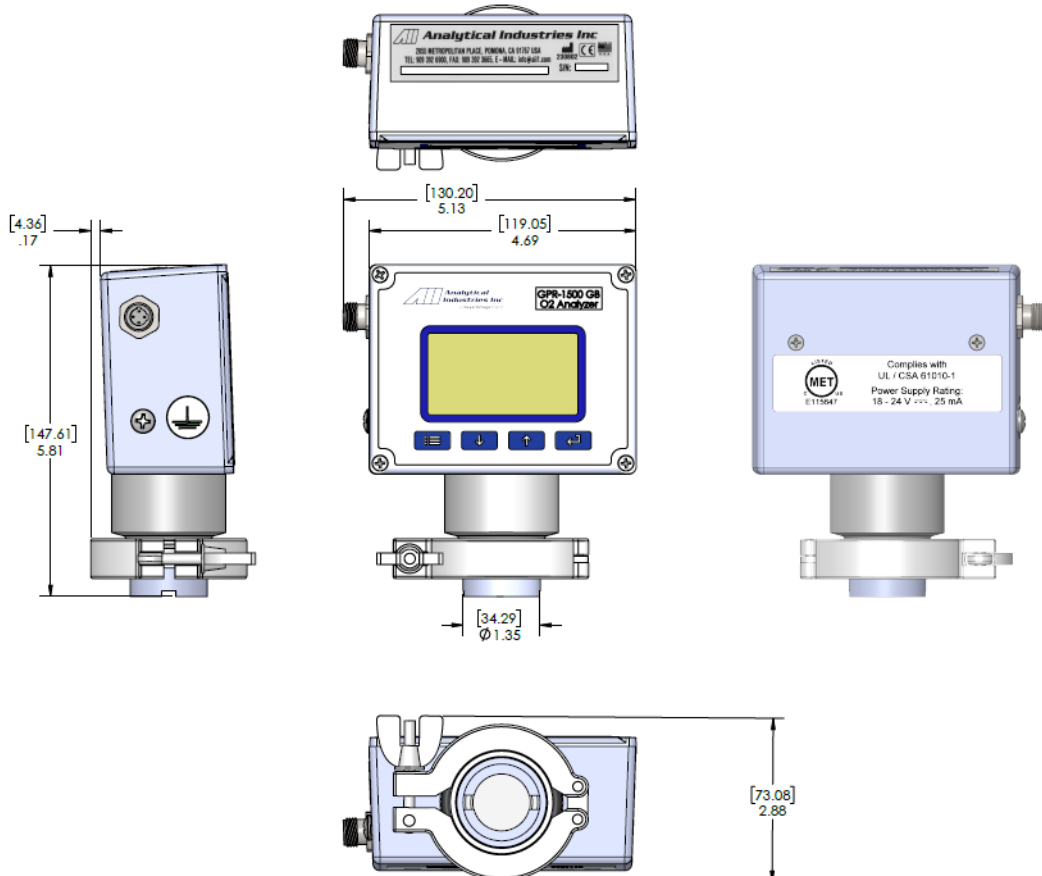
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Appendix D - Mounting Information

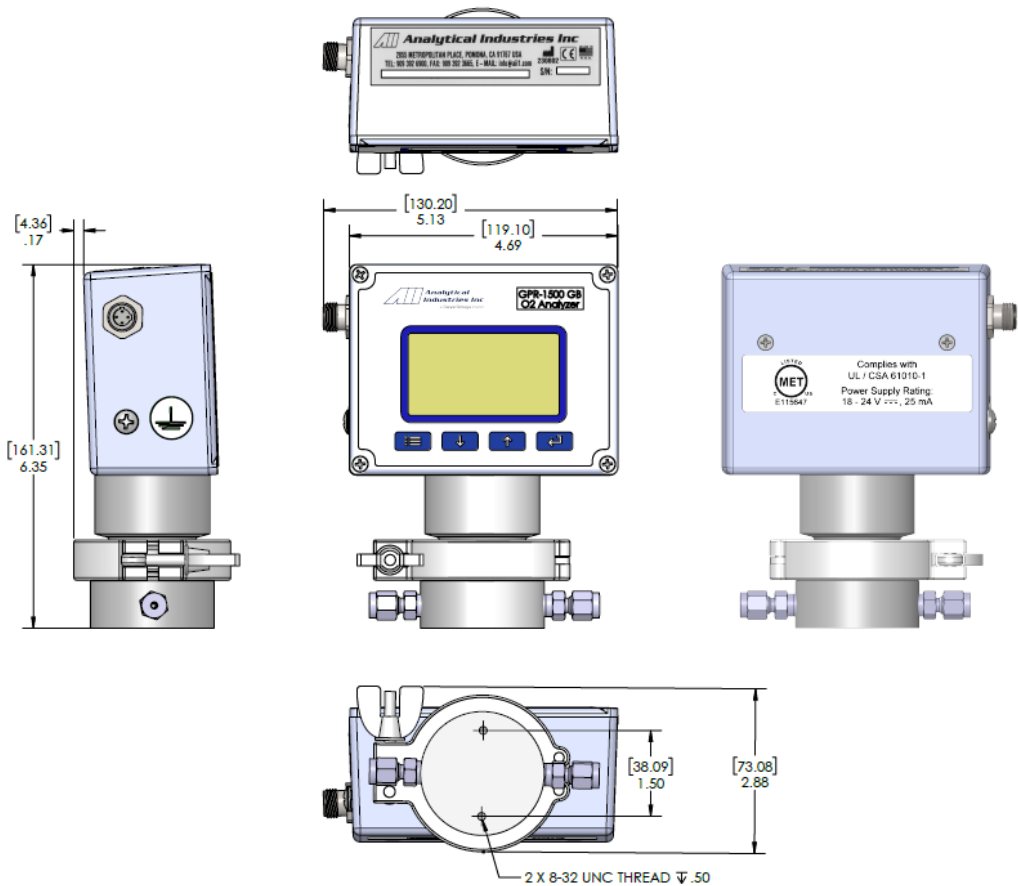
GPR-x500 GB with Flow Through Housing



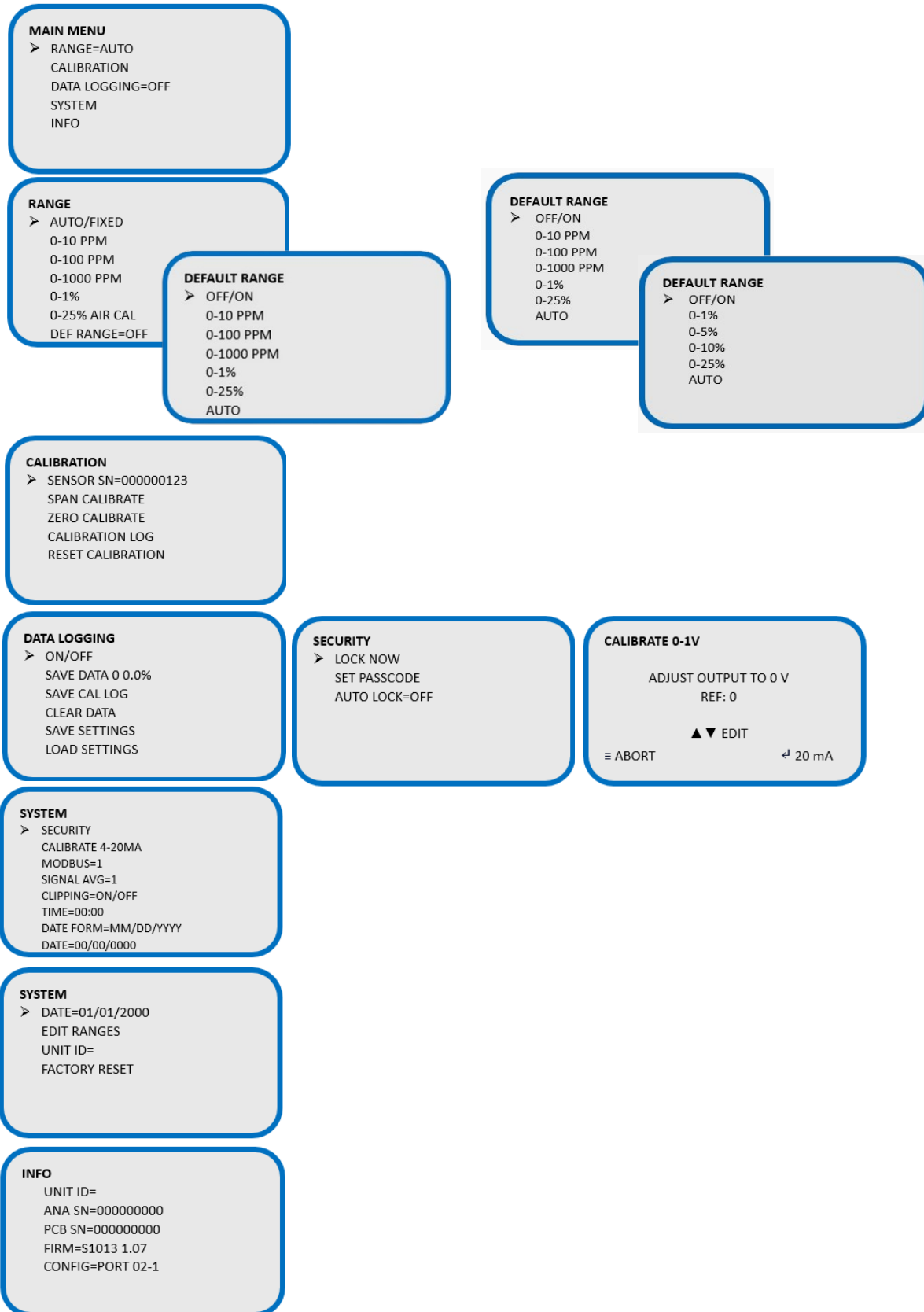
GPR-x500 GB with KF Clamp



GPR-x500 GB with KF Clamp and Flow Through Housing



Appendix E - Menu Displays



NOTE: The menu structure may vary depending on your configuration.

Appendix F - Spare Parts

Sensors	
GPR-12-333	ppm oxygen sensor
GPR-12-333-H	ppm oxygen sensor for He and H ₂ gases
XLT-12-333	ppm oxygen sensor for gases with < 0.5 % CO ₂ presence
GPR-11-60	% oxygen sensor
XLT-11-24	% oxygen sensor for gases with < 0.5 % CO ₂ presence
Operational Spares	
BARR-1002	Intrinsically Safe remote barrier
CONN-1014-6	Transmitter cable molded with lock ring
ORNG-1007	Sensor housing O-Ring Seal – Viton
ORNG-1043	Center stainless steel ring with Viton O-Ring Seal
Transmitter Hardware Spares	
A-5365	Sensor top housing assembly stainless steel
A-5366	Sensor KF top housing assembly stainless steel

Appendix G - Quality, Recycling, and Warranty Information

Aii is part of the DwyerOmega (DO) Group. The DO Oxygen group of companies - Aii, Ntron and SST - comply with applicable national and international standards and directives.

Full information can be found on this website

<https://aii1.com>

The compliance site contains information on the following directives:

- ATEX (equipment for explosive atmosphere, Europe)
- CE
- IECEx
- REACH (Registration, Evaluation, Authorization, and Restriction of Chemicals)
- Recycling policy
- RoHS (Restriction of Hazardous Substances in electrical and electronic equipment)
- UKCA
- WEEE (Waste Electrical and Electronic Equipment recycling).

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