



Advanced Instruments Inc.

Technical Specifications

Accuracy:	< 2% of FS range under constant conditions
Analysis:	0-20, 0-50, 0-100 PPM FS ranges; auto-ranging or manually lock on single range
Application:	Trace PPM H ₂ S in flowing gas streams
Approvals:	ATEX II 2 G Ex ib IIB T4 Gb Tamb -20 °C to +45 °C
Area Classification:	Meets intrinsic safety standards for use in Class 1, Division 1, Group C, D hazardous areas
Calibration:	Span gas 50-80 PPM H ₂ S balance air, Air to cal gas flow ratio 1:1 SCFH
Compensation:	Temperature
Connections:	1/8" Compression Fittings
Controls:	Water resistant keypad; menu driven range selection, calibration and system functions
Display:	Graphical LCD 2.75" x 1.375"; resolution 0.1 PPM; displays real time ambient temperature
Enclosure:	Painted aluminum NEMA 4X, 4x9x3", 8 lbs.
Flow Sensitivity:	Maintain constant flow; air 1 SCFH, sample 1 SCFH
LED Indicators:	LOW BATT Warning; CHARGE mode
Linearity:	±2% of full scale range
Pressure:	Inlet - regulate to 5-30 psig to deliver constant 1 SCFH sample flow rate; vent - atmospheric
Power:	Rechargeable battery, 8 hours day duty cycle
Response Time:	90% of final reading in 35 seconds
Sample System:	Coalescing filter and flow meters; Air to sample gas flow ratio 1:1 SCFH
Sensitivity:	< 0.5% of FS range
Sensor Model:	OSV-72-7HH (standard ranges)
Sensor Life:	24 months at 25 °C and 1 atm
Signal Output:	0-1V
Temp. Range:	-10 °C to 45 °C
Warranty:	12 months analyzer; 12 months sensor
Wetted Parts:	Stainless steel



GPR-7100 Portable PPM H₂S Analyzer

**ATEX Certification
INENRIS 13ATEX0007
Directive 94/9/EC**

- Intrinsically Safe Design
- 3 Standard Analysis Ranges
- Optional High PPM Ranges Available
- Auto-ranging or Manual
- Stainless Steel Wetted Parts
- 0-1V Signal Output
- Water Resistant Enclosure
- Certified ISO 9001-2008 QA System

Optional Equipment

Sample conditioning systems - Contact factory for details
Ranges: 0-500, 0-1000, 0-2000 PPM FS ranges (OSV-72-7H sensor)



GPR-7100

PPM H₂S Portable Analyzer



Owner's Manual

Revised February 2014

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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 hydrogen sulfide analyzer incorporates an advanced electrochemical sensor specific to hydrogen sulfide along with state-of-the-art digital electronics designed to give you years of reliable precise measurements of hydrogen sulfide in a variety of industrial applications. More importantly, it has been constructed as intrinsically safe in accordance with ATEX Directives 94/9/EC for use in hazardous areas in zone 1 Group C and D

Analytical Industries, Inc.
dba Advanced Instruments Inc.
2855 Metropolitan Place, Pomona, CA 91767 USA

GPR-7100



Serial No.:

Year of Manufacture:

INERIS 13ATEX0007



II 2 G

Ex ib IIB T4 Gb

T_{amb} -20 °C to +45 °C



WARNING: POTENTIAL ELECTROSTATIC CHARGING HAZARD – SEE INSTRUCTIONS

To obtain maximum performance from your new hydrogen sulfide 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 transmitter sold.

The serial number of this transmitter 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.

3. General Safety & Installation

This section summarizes the essential precautions applicable to the GPR-7100 H2S analyzer. 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 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 transmitter.

2 Quality Control Certification

See Package slip

Maintenance

Serviceability: Except for replacing the hydrogen sulfide 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.

H₂S 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 transmitter is faulty. Do not attempt to service the transmitter 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 power ON/OFF control, use the control to switch Power to OFF position.

Installation

This analyzer has been constructed in compliance with
EN 60079-0 : 2009
EN 60079-11 : 2012

Sampling Stream: Ensure the gas stream composition of the application is consistent with the specifications and if in doubt, review the application and consult the factory before initiating the installation. **Note:** In natural gas applications such as extraction and transmission, a low voltage current is applied to the pipeline itself to inhibit corrosion of the pipeline. As a result, electronic devices connected to the pipeline can be affected unless they are adequately grounded.

Contaminant Gases/Liquids in Sample Stream: A Sample must be free from any condensable liquid and particulates. Though the analyzer is equipped with an integral coalescing filter, with gas streams containing excessive condensable liquids, an additional coalescing filter must be installed upstream of the analyzer. Consult the factory for recommendations concerning the proper selection and installation of sample conditioning requirements.

Expected Sensor Life: With reference to the publish specification located in Section 4 of this manual, the expected life of all H₂S sensors is predicated on the rate of loss of electrolyte from the sensor at temperature of 77°F/25°C and pressure of 1 atmosphere in "normal" applications. Deviations from standard conditions will affect the life of the sensor (temperature higher than 77°C and pressure less than atmospheric would cause a reduction in the sensor life).

Accuracy and Calibration: Refer to section 5 Operation.

Operating Temperature: The sample must be sufficiently cooled before it enters the analyzer and any optional components. A coiled 10 foot length of ¼" stainless steel tubing is sufficient for cooling sample gases as high as 1,800

°F to ambient. The recommended operating temperature is below 35 °C. However, the analyzer may be operated at temperature up to 45 °C on an intermittent basis but the user is expected to accept a reduction in expected sensor life.

Handling: Do not use force when using the switches, knobs or other 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 and Flow

All electrochemical sensors respond to partial pressure changes in the gas of interest. The sensors are equally capable of analyzing the H₂S content of a flowing sample gas stream or monitoring the H₂S concentration in ambient air (such as a confined space in a control room or an open area around a landfill or bio-pond). The following is applicable to analyzers equipped with electrochemical sensors.

The analyzers requires a sample gas flowing across the sensor. The analyzer is equipped with integral flow meter. For positive sample pressure applications, suitable means must be employed to control the sample pressure to obtain constant flow. For applications where the sample is less than atmospheric pressure, consult factory before initiating installation.

Inlet Pressure: The inlet sample pressure must be regulated between 5-30 psig. Although the rating of the flow meter, SS tubing and tube fittings/valves itself is considerably, a sample pressure of 5-30 psig is recommended for ease of control of sample flow.

The analyzer has a designated SAMPLE and VENT ports. Connect SAMPLE gas to SAMPLE and the vent to the VENT ports only.



Caution: The analyzer is equipped with a coalescing filter. Therefore, the sample inlet pressure must not exceed 30 psig.

Outlet Pressure: In applications where sample pressure is positive, the sample must be vented to an exhaust pipe at a pressure less than the inlet pressure so that the sample gas can flow through the sensor housing. Ideally, the sample must be vented to atmospheric pressure.

Note: If the sample is to be vented to a pipe, use a minimum of ¼ sized tube to connect the analyzer VENT to vent pipe. If the length of tubing from the analyzer to vent line exceeds 10 feet, use 3/8 tube to reduce the “BACK PRESSURE” on the sensor

Note: The sensor may be used at a slight 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 be maintained at all times including during the span calibration. This may be accomplished by using a back-pressure regulator, (set at no greater than 0.2 PSIG) at vent line of the analyzer.

Caution: A sudden change in pressure at the sensor may result in the sensor electrolyte leakage and permanent damage to the sensor.

Sample Flow: Sample flow rate of 1 SCFH is recommended. The sample is continuously blended with air (pumped by the integral pump).

Air Flow: The air flow (from the integral pump) is set at 1 SCFH and is constantly blended with the sample gas. Sample flow rate of 1 SCFH is recommended and must be maintained during analysis. The air to sample flow ratio of 1:1 must be maintained at all times (during calibration as well as during analysis).



Caution: Failure in maintaining the sample to air flow ratio will cause an error in the H₂S reading (as a percent of the reading) equivalent to the new sample to air flow ratio (see Section 5 page 25-26 for details).

NOTE: After a sample reading is taken, always flush the analyzer sample system with ambient air by keeping the integral PUMP ON for 2-3 minutes.

Moisture & Particulates: Though a coalescing filter is installed, for excessive liquid condensate/particulates, additional coalescing or particulate filter may be necessary to remove excessive condensation, moisture and/or particulates from the sample gas.

Moisture and/or particulates do not necessarily damage the sensor. However, collection of moisture/particulate on the sensing surface can block or inhibit the diffusion of sample gas into the sensor resulting in a reduction of sensor signal output and the appearance of a sensor failure. Consult factory for recommendations concerning the proper selection and installation of optional components.

Mounting of the Analyzer: The analyzer is approved for indoor as well as outdoor use. The analyzer is intended for use as a "portable device", however, it can be used as a continuous measuring device by keeping the wall charger plugged to the analyzer to keep the battery from draining.



CAUTION: The intrinsic safety rating is voided when analyzer is plugged into a wall charger

Gas Connections: The Inlet and outlet vent gas lines require 1/8" or 1/4" stainless steel compression type tube fittings. The sample inlet tubing must be metallic, preferably SS. The sample vent line may be of SS or hard plastic tubing with low gas permeability.

Power Requirement: Power to the analyzer is provided by the integral Pb-acid rechargeable battery. The analyzer would continually run for 8 hours on a single charge.

NOTE: Once the low battery LED lights up, battery must be recharged by connecting the battery charger to the analyzer and a properly rated power outlet. Failure to do so will drain the battery to a level that would prevent "recharging of battery". If this occurs, replace the battery.

Power Consumption: The maximum power the analyzer consumes is no more than 40-60 mA (from the integral battery) with the pump ON.

A fully charged battery will run for approximately 8 hours.

4. Features & Specifications



Technical Specifications

Accuracy:	< 2% of FS range under constant conditions
Analysis:	0-20, 0-50, 0-100 PPM FS ranges; auto-ranging or manually lock on single range
Application:	Trace PPM H ₂ S in flowing gas streams
Approvals:	ATEX II 2 G Ex ib IIB T4 Gb Tamb -20 °C to +45 °C
Area Classification:	Meets intrinsic safety standards for use in CSA/UL Class 1, Division 1, Group C, D hazardous areas
Alarms:	None
Calibration:	Span gas 50-80 PPM H ₂ S balance air, Air to cal gas flow ratio 1:1 SCFH
Compensation:	temperature compensated
Connections:	1/8" Compression Type Fittings
Controls:	Water resistant keypad; menu driven range selection, calibration and system functions
Display:	Graphical LCD 2.75" x 1.375"; resolution 0.1 PPM; displays real time ambient temperature
Enclosure:	Painted aluminum NEMA 4X, 4x9x3", 8 lbs.
Flow Sensitivity:	Maintain constant flow; air 1 SCFH, sample 1 SCFH
LED Indicators:	LOW BATT Warning; CHARGE mode
Linearity:	±2% of full scale range
Pressure:	Inlet - regulate to 5-30 psig to deliver constant 1 SCFH sample flow rate; vent - atmospheric
Power:	Rechargeable battery, 8 hours day duty cycle
Response Time:	90% of final reading in 35 seconds
Sample System:	Coalescing filter and flow meters; Air to sample gas flow ratio 1:1 SCFH
Sensitivity:	< 0.5% of FS range
Sensor Model:	OSV-72-7HH-LM (standard ranges)
Sensor Life:	24 months at 25 °C and 1 atm
Signal Output:	0-1V
Temp. Range:	-20 °C to 45 °C
Warranty:	12 months analyzer; 12 months sensor
Wetted Parts:	Stainless steel



GPR-7100 Portable PPM H₂S Analyzer

**ATEX Certification
ENRIS 13ATEX0007
Directive 94/9/EC**

- > **Intrinsically Safe Design**
- > **3 Standard Analysis Ranges**
- > **Optional High PPM Ranges Available**
- > **Auto-ranging or Manual**
- > **Stainless Steel Wetted Parts**
- > **0-1V Signal Output**
- > **Water Resistant Enclosure**
- > **Certified ISO 9001-2008 QA System**

Optional Equipment

Sample conditioning systems - Contact factory for details
 Ranges: 0-500, 0-1000, 0-2000 PPM FS ranges (OSV-72-7H-LM sensor)



5. Operation

Principle of Operation

The GPR-7100 H₂S analyzer incorporates a variety of advanced electrochemical sensors. These sensors are very specific to H₂S and generate an electrical signal proportional to the amount of H₂S present in a gas stream. The selection of a particular type of sensor depends on the maximum concentration of H₂S contents in the sample stream. Consult the factory for recommendation.

The analyzer is powered by an integral Pb-Acid rechargeable battery. The battery, signal processing electronics and sensor are housed in a general purpose NEMA 4X rated enclosure. The charging jack and the signal output jack are mounted at the bottom of the enclosure.

The analyzer is equipped with an integral AIR PUMP that blends air with the SAMPLE. This is to ensure a constant supply of air to the H₂S sensor to prevent it from "DECAYING".

The analyzer design conforms to the ATEX directive 94/9/CE for equipment as intrinsically safe.

The analyzer also meets the intrinsic safety standards required for use in Class I, Division 1, Group C, D hazardous areas.

NOTE: After a sample reading is taken, always flush the analyzer sample system with ambient air by keeping the integral PUMP ON for 2-3 minutes.

Advanced Electrochemical Sensor Technology

All electrochemical sensors driven by a bias potential (three electrode configuration) function on the same principle and are specific to a certain gas. They measure the partial pressure of the target gas from low PPM to up to 1% levels in air, inert gases and gaseous hydrocarbons.

The target gas, in this case, Hydrogen Sulfide, diffuses into the sensor through a diffusion limiting membrane, reacts electrochemically at the sensing electrode and produces an electrical current output proportional to the H_2S 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 the design and chemistry of the sensor's components add significant advantages to this extremely versatile H_2S sensing technology. The sensor maintains its sensitivity to within $\pm 5\%$ of its span (it does not sleep during continuous use; a typical symptom seen with conventional electrochemical H_2S sensors) over a 1-3 months period. To maintain accuracy over the useful life of the sensor, calibrate the sensor every 1-3 months. Under normal use, the sensor is expected to last from 18-24 months.

The H_2S sensor recovers from an upset condition (exposure to very high H_2S) to low PPM level in a matter of few minutes.

Electronic

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. The result is a very stable signal that reflects H_2S concentration in the sample very accurately. Response time of 90% of full scale is less than 60 seconds on all ranges (actual experience may vary due to the integrity of sample line connections, dead volume and flow rate selected) under ambient analysis conditions. Sensitivity is typically 0.5% of full scale of the low range. The display has the resolution of 0.1 PPM H_2S (on 0-10 or 0-20 PPM Full scale range). The analog output signal may be recorded by an external device via the 0-1 V output signal.

Sample System

The standard GPR-7100 is supplied with a sample conditioning system that includes a coalescing filter, a flow meter and a sample pump. See Packing slip for any additional optional equipment ordered. Whatever the choice, the sample must be properly conditioned before introducing it to the analyzer sampling system to ensure accurate measurements.

An integral air pump mounted inside of the enclosure provides air for blending it with the sample/span gas. The air flow is set at the factory at 1 SCFH and must be maintained during calibration as well as during analysis.

Advanced Instruments Inc. offers a full range of sample handling, conditioning and expertise to meet your application requirements. Contact us at 909-392-6900 or e-mail us at info@a11.com for recommendation.

Calibration and Accuracy Overview

Single Point Calibration: As previously described, the electrochemical H_2S sensor generates an electrical current proportional to the H_2S concentration in the sample gas. In the absence of H_2S the sensor exhibits an absolute zero, e.g. the sensor does not generate a current output in the absence of H_2S . Given these linearity and absolute zero properties, single point calibration is possible.

Sample Pressure: Since the sensor is sensitive to the partial pressure of H_2S in the sample gas, the sensor's signal output is a function of the number of molecules of H_2S per unit volume. When sample is vented to the atmosphere the sensor essentially remains at atmospheric pressure. However, a positive or negative pressure on the

VENT line may cause a positive or negative pressure on the sensor that will alter the output of the sensor and unless the sensor is calibrated under the same analysis conditions, a significant error in measurements will occur.

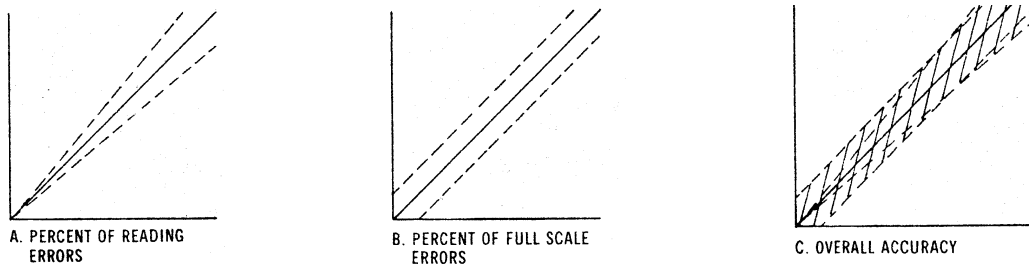
The sample pressure must be regulated by using a pressure regulator. The sample pressure between 5-30 PSIG offers a good compromise between delivering a reasonable gas flow and the ease of controlling the sample flow by using the integral flow control valve. Any blockage of the sample vent line will cause a "Back Pressure" at the sensor thus causing erroneous readings. If sample is to be vented into a pipe above atmospheric pressure, a pressure regulator set at 0.2 PSIG must be installed on the vent line to maintain a constant pressure on the sensor. For vent pressure above 0.2 PSIG, consult factory for proper selection of electronics.

NOTE: After a sample reading is taken, always flush the analyzer sample system with ambient air by keeping the integral PUMP ON for 2-3 minutes.

Ambient Temperature: The rate at which H₂S molecules diffuse into the sensor is controlled by a Teflon membrane otherwise known as an 'H₂S 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 range of temperature. The accuracy of $\pm 5\%$ or better over an operating temperature range e.g., 5-45°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 °C may produce an error of $> \pm 2\%$ 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 $< 1\%$ of full scale at constant temperature or $< 5\%$ over the operating temperature range. The QC testing error at the factory is typically $< 0.5\%$ of full scale.



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, e.g., when span calibration is done by 20 PPM span gas on a 100 PPM full scale range, any error at 20 PPM span gas would be multiplied by a factor of 5 (100/20) when making measurements close to 100 PPM. Conversely, an error during a span adjustment close to the top end of the range, e.g., at 100 PPM 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.

Gas Connections

The GPR-7100 analyzer with its standard flow through configuration is designed for positive pressure samples and requires connections for an incoming sample and an outgoing vent line. The user is responsible for calibration gases and other required components, see below.

Procedure

Caution: Do not change the factory setting until instructed to do in this manual.

1. Connect the sample gas in to SAMPLE IN and sample vent to the VENT line.
2. Regulate the sample pressure as described in "Pressure and Flow" section above.
3. If equipped with a separate SPAN port, connect span gas to SPAN port
4. Set the SAMPLE and SPAN gas pressure between 5-30 psig, keep the sample and span gas pressure within 5 PSIG of each other for a better control of SAMPLE/SPAN flow rate.
5. Select sample gas and allow it to flow through the analyzer and set the flow rate at 1 SCFH.
6. Turn the PUMP ON and set the **AIR flow at 1 SCFH**
7. **Note:** The analyzer is equipped with a coalescing filter, therefore, the SAMPLE pressure must be regulated equal to or less than 30 psig.
8. Keep the SAMPLE and AIR flow constant to maintain a ratio of 1:1. If the ratio of the SAMPLE to AIR is not maintained during analysis, H₂S reading will be affected based on the changes in the sample/air flow ratio (due to variance in dilution of sample gas). For example, with SAMPLE flow of 1 SCFH and air flow of 0.5 SCFH, the dilution ratio is $1.5/0.5 = 3$ but with a SAMPLE flow of 2 SCFH and air flow of 0.5 SCFH, the sample/air dilution will be $2.5/0.5 = 5$, therefore, an error of 66% of the reading will be observed. This is explained below.

Let's assume that with

Air flow = 0.5 SCFH

Sample flow = 1 SCFH

Dilution = $1.5/0.5 = 3$

On LCD, H₂S reading = 10 PPM

With

Air flow = 0.5 SCFH

Sample flow = 2 SCFH

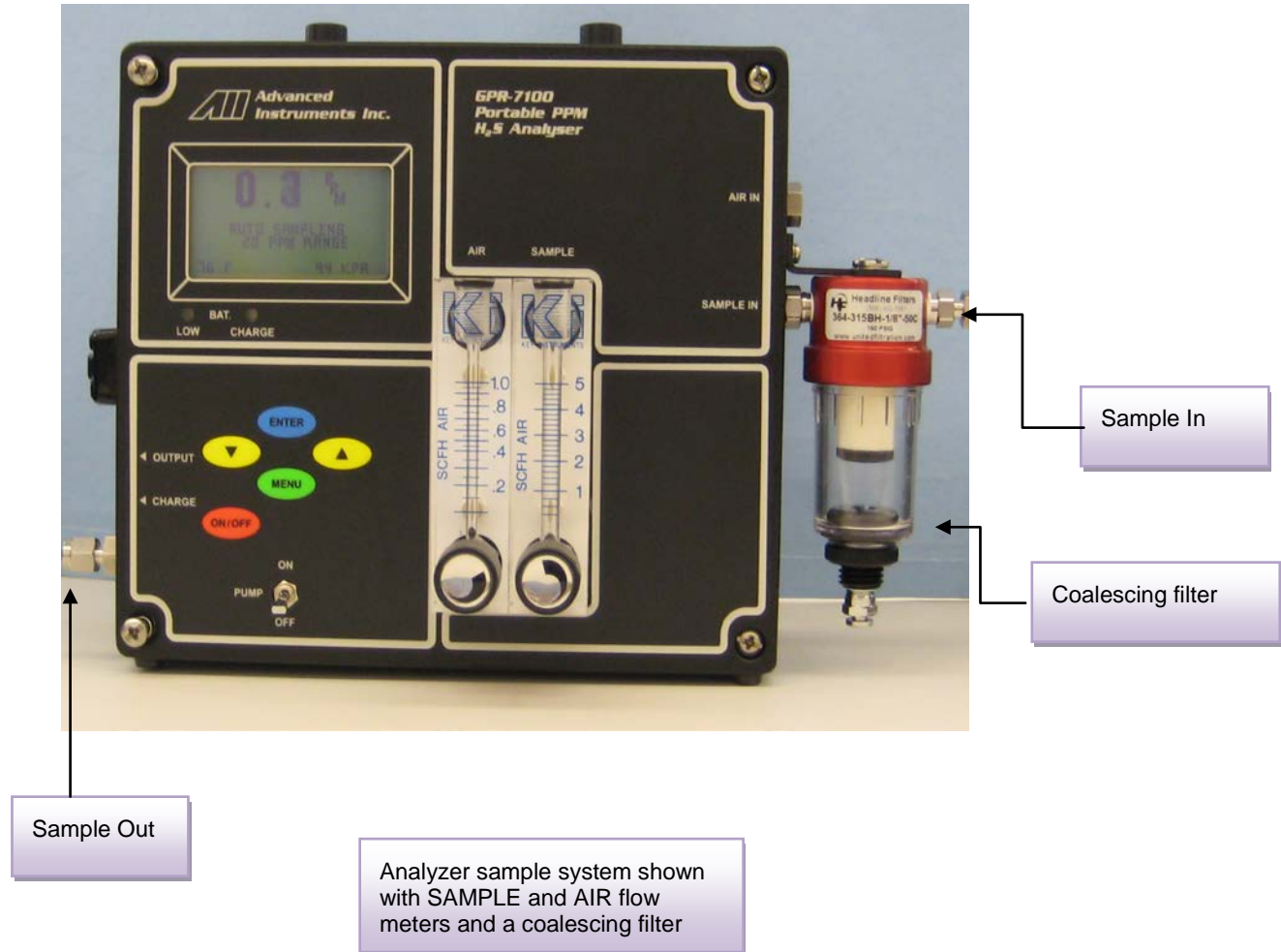
Dilution = $2.5/0.5 = 5$

Difference in Dilution = $5-3 = 2$ or $2/3 \times 100 = 66\%$ increase in sample concentration

On LCD, H₂S reading would be 66% higher (66% of 10 PPM = 6.66 PPM)

Therefore, the new H₂S reading will be

$10 \text{ PPM} + 6.66 \text{ PPM} = 16.6 \text{ PPM}$



Note: If equipped with optional H₂S scrubber on the sample vent line, the H₂S from the sample gas will be removed by the scrubbing material. The scrubbing material will change its color from purple to light pale. Replace scrubbing material when 2/3 of the material had changed its color from purple to pale.



As a safety, connect the vent line of analyzer to a vent pipe for safe venting of sample gas that might contain un-scrubbed H₂S

Keep the drain valve on coalescing filter closed during normal operation. To drain liquid, open the drain valve. After draining the liquid, turn the drain valve off.

NOTE: After a sample reading is taken, always flush the analyzer sample system with ambient air by keeping the integral PUMP ON for 2-3 minutes.

Installation of H2S Sensor

The GPR-7100 is equipped with SS sensor housing. This housing offers ease of replacement of sensor and at the same time prevents any leakage into the system. The sensor is screwed in and it makes the seal against the flat surface of the sensor housing via the integral O-ring on the sensor's threaded front end.



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 transmitter come without sensor installed or need to install a new sensor, follow the guidelines give below.

Procedure

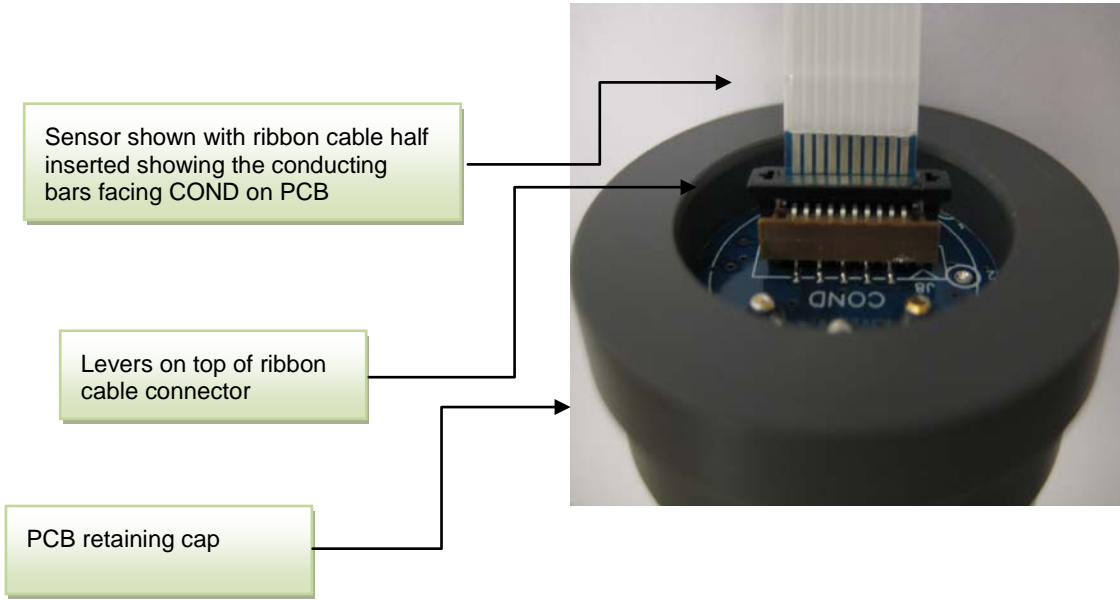
1. Access the interior of the analyzer by removing the top of the analyzer enclosure (removing the four screws holding two sections of the analyzer enclosure).



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

2. Remove the ribbon cable from the top of the sensor by first pulling gently the locking lever on the top of the ribbon cable connector and then pulling the ribbon cable off of the ribbon cable connector.
3. Remove the grey cap from the sensor (the cap is to secure the PCB on the sensor)
4. Remove the PCB from the top of the sensor by gently pulling the PCB.
5. Pull the two small levers of the ribbon cable connector to loosen the ribbon cable.
6. Turn the sensor anti clockwise until loosen and then pull it off the housing.
7. Remove the new sensor from the original sealed shipping bag.
8. Screw the new sensor in to the sensor housing until finger tight.
9. Align 4 pins of the sensor PCB with 4 pins of the sensor and gently push the PCB on to the sensor until it is firmly seated.
10. Insert the ribbon cable into the connector with “bare conducting bars” facing COND on the PCB
11. Push the two side levers on the connector locking the ribbon cable.





Sensor shown with PCB retainer cap



Sensor shown without PCB retainer cap

Span Gas Preparation

The GPR-7100 can be calibrated by using a certified span gas, preferably 50-80% of the full scale of the range of interest or one range above the range of interest.



Caution: Do not inhale the H₂S span gas. If the analyzer is installed in an enclosed area, when using a span gas, ensure the area is being ventilated by circulating air to flush out H₂S.

Required Components

1. Certified span gas cylinder with an H₂S concentration, balance nitrogen or air, approximating 50-80% of the full scale of the measuring range or one range above the intended measuring range. For example, for analysis on 0-100 PPM range, use a span gas with H₂S concentration ranging from 50-80 PPM
2. A pressure regulator to set the span gas pressure between 5 and 30 psig.
3. Suitable tube fittings and a 4-6 ft. length of 1/8" dia. metal tubing.

Procedure

1. With the span gas cylinder valve closed, install the pressure regulator on the cylinder.
2. Keep the regulator's exit valve closed and open the cylinder's control knob slowly.
3. Set the pressure between 5-30 psig using the pressure regulator's control knob.
4. Open the regulator's exit valve
5. Set the span gas flow at 1 SCFH

Caution: Do not exceed the recommended flow rate. Excessive flow rate may cause "backpressure" on the sensor and may result in erroneous readings and damage to the sensor

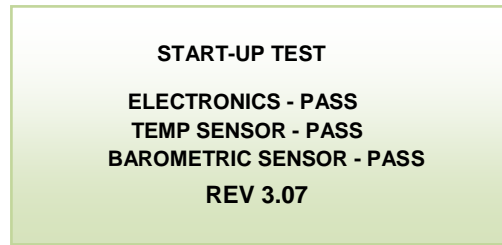
During calibration, maintain the AIR flow at 1 SCFH. Failure to do so will cause an error in SPAN calibration and eventually in SAMPLE readings.

The air flow is set at the factory at 1 SCFH and must be maintained during calibration as well as during analysis

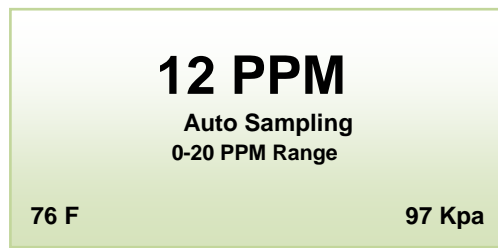
NOTE: After span calibration or a sample reading is taken, always flush the analyzer sample system with ambient air by keeping the integral PUMP ON for 2-3 minutes.

Establishing Power to Electronics

Once the power ON/OFF KEY is pressed, 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 H₂S contents the sensor is exposed to, the analysis range, the ambient temperature and pressure



NOTE: At power up, the analyzer may first display a higher H₂S reading which will slowly decrease and eventually stabilize close to zero reading. The stabilizing may take up to 5-10 minutes.

While taking measurements at different sample points, you may turn the PUMP OFF but keep the analyzer electronics at ON position all the time.

Manu Navigation

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

Blue ENTER (select)

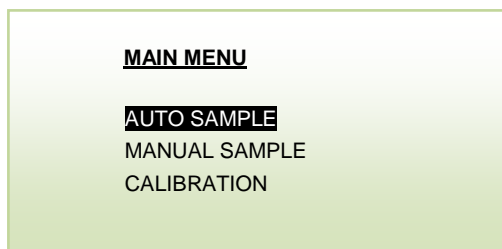
Yellow UP ARROW

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

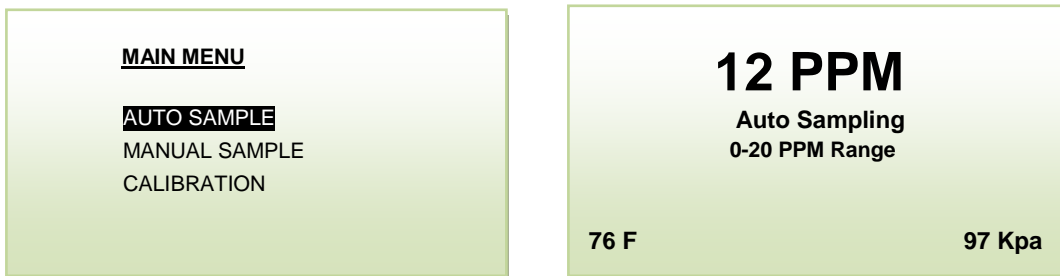
The GPR-7100 analyzer is equipped with three (3) standard measuring ranges (see specification) and provides users with a choice of sampling modes. By accessing the MAIN MENU, users may select either the AUTO SAMPLING (ranging) or MANUAL SAMPLING (to lock on a single range) mode.

Note: For calibration purposes, use of the AUTO SAMPLE mode is recommended. However, the user can also select the MANUAL SAMPLE mode for calibration but the span gas must not exceed the full scale of the manual range selected – for example, a span gas with 15 PPM H₂S concentration would dictate the use of the 0-20 PPM full scale range for calibration.

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 H₂S reading exceeds 99.9% of the upper limit of the current range. The display will shift to the next lower range when the H₂S reading drops to 85% of the next lower range. For example, if the transmitter is reading 2 PPM on the 0-20 PPM range and an upset occurs, the display will shift to the 0-50 PPM range when the H₂S reading exceeds 19.99 PPM. Conversely, once the upset condition is corrected, the display will shift back to the 0-20 PPM range when the H₂S reading drops to 17 PPM (85% of 20 PPM).

Manual Sampling

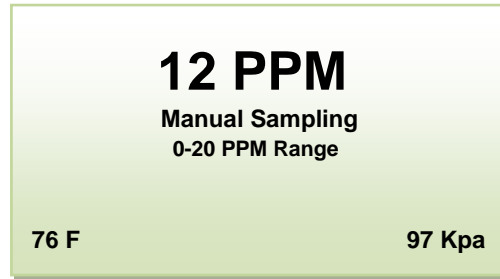
1. Access the MAIN MENU by pressing the MENU key.
2. Advance the reverse shade cursor using the ARROW keys to highlight MANUAL SAMPLE.
3. Press the ENTER key to select the highlighted menu option.

The following display appears:

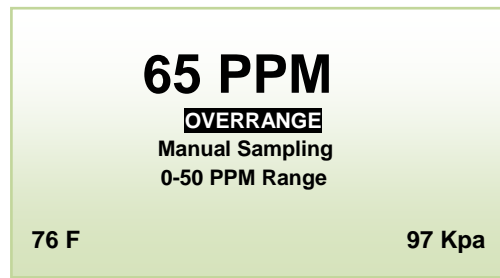


4. Advance the reverse shade cursor using the ARROW keys to highlight the desired MANUAL RANGE.
5. Press the ENTER key to select the highlighted menu option.

The following display appears with the range selected and oxygen concentration of the sample gas:



6. If the value of H₂S goes above the full scale range selected, display will not shift to the next higher range. Instead, when the H₂S 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 transmitter to the next higher range.
8. **NOTE:** With H₂S reading above 125% of the selected range, the voltage signal output will increase but will freeze at a maximum value of 1.25V. After the sample reading falls below the full scale range, the voltage signal will become normal.

Calibration of Analyzer

The electrochemical H₂S sensors generate an electrical current that is **linear** or proportional to the H₂S concentration in a sample gas. In the absence of H₂S the sensor exhibits an **absolute zero**, i.e., the sensor does not generate a current output in the absence of H₂S. Given the properties of linearity and an absolute zero, a single point calibration is possible.

As described below, zero calibration is recommended only when the application (or user) demands optimum accuracy of below 5% of the most sensitive.

Span calibration, as described below, is necessary to adjust the analyzer sensitivity for accurate measurements of H₂S. As a rule of thumb, zero calibration should be carried out before span calibration.

Zero Calibration

Despite the absolute zero inherent to the electrochemical H₂S sensors, the reality is that analyzers may display H₂S reading even when sampling a zero gas (H₂S free gas) due to:

1. Contamination or questionable quality of the zero gas
2. Minor leakage in the sample line connections
3. Residual electrical current generated by the sensor
4. Tolerances in the electronic components

Therefore, it may be necessary to perform a zero calibration to remove any zero offset.

Typical offset seen is less than 0.5-1 PPM (with 10 or 20 PPM low range or 1-5 PPM with 500 PPM low range). Therefore, for most applications, a Zero calibration is not required. However, ZERO calibration option has been

provided to allow the user to precisely measure H₂S concentration at the very low levels (less than 0.5 PPM). As described below, accomplishing either objective places a degree of responsibility on the user.

Determining the true offset requires the user to wait until the analyzer reading is no longer trending downward (best evidenced by a constant horizontal trend on an external recording device).

The zero offset adjustment is limited to 5-20% of the most sensitive range of the analyzer. At factory, analyzer is QC tested to confirm that the maximum offset is less than 20% of the most sensitive range available. Should you observe a zero offset more than 20% of the lowest range, check sample system for any possible leaks, integrity of the zero gas and assure that the analyzer has been given enough time to stabilize on zero gas before initiating the "ZERO CALIBRATION".

NOTE: Use ambient air for ZERO calibration by turning the integral PUMP ON and drawing the ambient air IN.

Caution: If adequate time is not allowed for the analyzer to establish the true baseline and a ZERO calibration is performed, the analyzer will, in all probability, display a negative reading in the sample mode after a certain period of time. If a negative reading is seen, perform ZERO calibration again

Span Calibration

Involves periodically, see Intervals section below, checking and/or adjusting the electronics to the sensor's signal output at a given H₂S 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 one (1) month.

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

Factors to Consider when calibrating

1. When it comes to the calibration of transmitter, circumstances vary widely from the ideal conditions that exist at the factory to a variety of differing circumstances users encounter in the field. The following describes the most common factors and reasons that influence the calibration procedures.
2. All electrochemical sensor based devices require periodic calibration, e.g. weekly intervals to a 3 month maximum, to ensure accuracy and ascertain the integrity of the sensor
3. For optimum accuracy, calibrate the analyzer at or close to the temperature and pressure of the sample gas
4. The priority users place on getting or keeping an analyzer online is "the" most significant factor involved in calibration and troubleshooting issues" the time it takes an analyzer/transmitter to come down to a specific level after installation or calibration. A new sensor would require 30-60 minute settling time after installation before commencing calibration. If a sensor has been in service, calibration can be performed any selected time.
5. For optimum accuracy, the H₂S concentration of a span gas should be approximate 50-90% of the full scale range of analysis or one range above the analysis range, e.g. 50-80 PPM on the 0-100 PPM range.
6. Use of span gas less than 50% of the full scale range of measurements will introduce an "expanding error" as illustrated by Graph A in Example 1 in the Accuracy section above, close to the top end of the range.
7. Prematurely initiating the SPAN CALIBRATION function (before the analyzer reading has stabilized) can result in erroneous readings as follows:

NOTE: After span calibration or a sample reading is taken, always flush the analyzer sample system with ambient air by keeping the integral PUMP ON for 2-3 minutes.

Zero Calibration Procedure

Normally, zero calibrations are performed when a new sensor is installed or when the analyzer has been turned off for several days.

To perform ZERO calibration, ambient is sufficient. To allow AIR to go through the sampling system, turn the PUMP ON.

NOTE: Set the AIR flow as close to the recommended AIR flow as possible.

Before performing a ZERO calibration, it is highly recommended to perform a factory default zero. This will eliminate previous zero offset adjustment that might have been made. With factory default zero setting, a zero offset that does not exceed 10% of the lowest range ensures that the integrity of the sensor/analyzer is maintained.

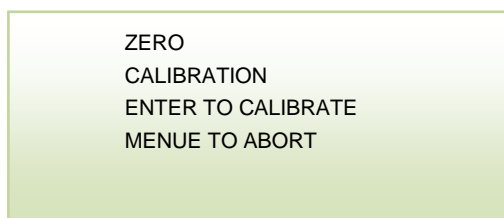
1. Access the MAIN MENU by pressing the MENU key.
2. Advance the reverse shade cursor using the ARROW keys to highlight CALIBRATION.
3. Press the ENTER key to select the highlighted menu option.

The following displays appear:



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

The following displays appear:



6. Press the ENTER key to calibrate or MENU key to abort and return to SAMPLING mode.
7. Allow approximately 1-2 minutes or wait until the H₂S reading has stabilized. If the offset is less than 20% of the lowest range, by pressing ENTER, message PASSED CALIBRATION will appear and the analyzer will return to the Sample mode. On the other hand, if the offset is above 20% of the lowest range, by pressing ENTER, a message FAILED CALIBRATION will appear and the analyzer will return to Sample mode without completing the Zero calibration.

Both the Zero Calibrate and Span Calibrate functions result in the following displays:

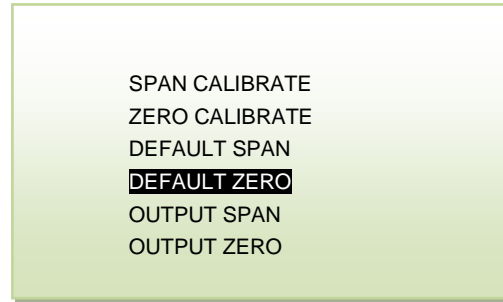
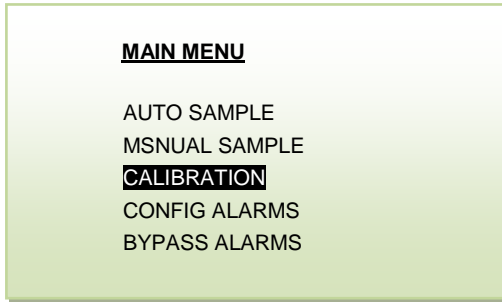


Factory Default Zero Calibration

The factory default zero eliminates any previous zero calibration adjustment and display the actual signal output of the sensor in the absence of H₂S. This feature allows the user to ensure that the accumulative zero offset never exceeds 20% of the lowest range limit. To perform Default Zero,

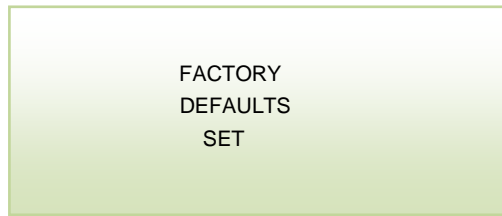
1. Access the MAIN MENU by pressing the MENU key.
2. Advance the reverse shade cursor using the ARROW keys to highlight CALIBRATION.
3. Press the ENTER key to select the highlighted menu option.

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 Procedure

This procedure assumes the span gas is under a positive pressure.

To assure an accurate calibration, the temperature and pressure of the span gas must closely match with the sample gas.

For calibration purposes, use of the AUTO SAMPLE mode is recommended.

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 following displays appear:

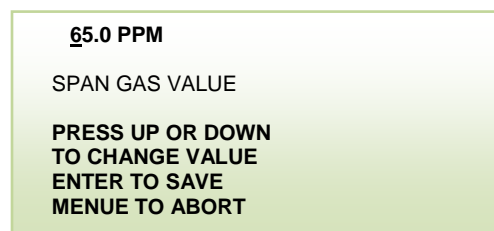


4. Return to the MAIN MENU by pressing the MENU key.
5. Advance the reverse shade cursor using the ARROW keys to highlight CALIBRATION.
6. Press the ENTER key to select the highlighted menu option.
7. Repeat to select SPAN CALIBRATE

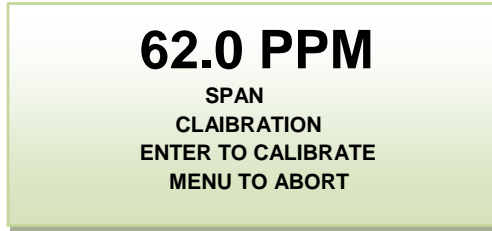
The following displays appear:



8. After selecting the SPAN CALIBRATION, the following displays appear:

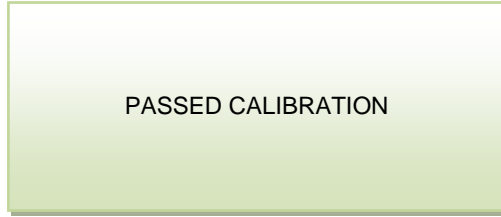
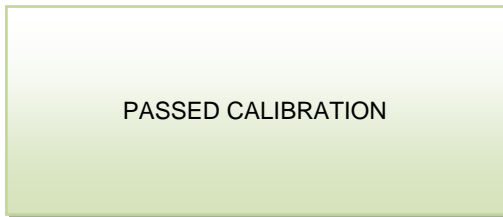


9. Use UP or DOWN key to change the digit with underline cursor. Press the ENTER key to advance the underline cursor right or press the MENU key to advance the underline cursor left to reach to the desired digit of the alarm value.
10. Repeat until complete span value has been entered and press ENTER. The following display will appear showing the current H₂S concentration before calibration. This value should be within +/- 30 of the span gas value (with factory default span setting).



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 O2 reading is within 50% of the span gas value. If the O2 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 the calibration is unsuccessful, return to the SAMPLING mode with span gas flowing through the transmitter, make sure the reading stabilizes, reaches within 30-40% (see below) of the span gas value (after factory default span setting) and repeat the calibration before concluding the equipment is defective.

NOTE: If with Factory Default Span Calibration, the span gas reading is above the acceptable range of calibration, you may increase the AIR flow to a slightly higher level until the Span gas reading falls within the acceptable range of calibration. The ratio of sample to air used during calibration must be maintained during sampling.

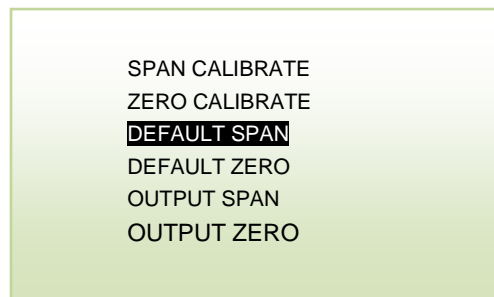
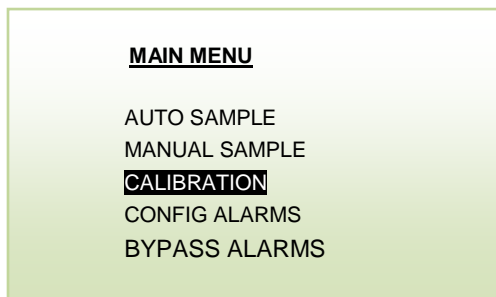
After SPAN calibration or a sample reading has been taken, always flush the analyzer sample system with ambient air by keeping the integral PUMP ON for 2-3 minutes.

Factory Default Span

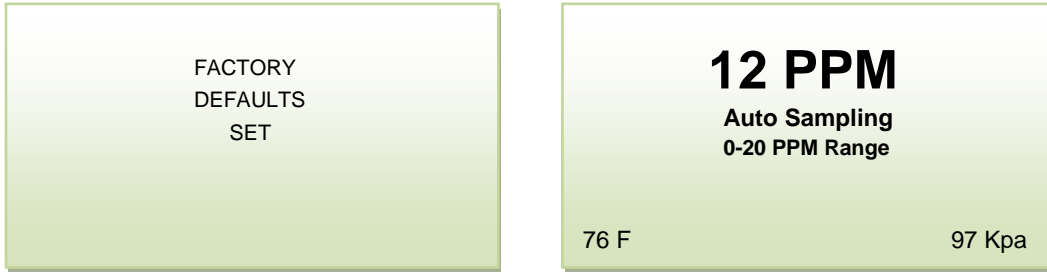
With factory default span, previous calibration data stored in the memory is removed and the sensitivity of the analyzer is reset to the value based on the average output of the H2S sensor. For example, with factory default settings, when a span gas is introduced, the micro-processor will display H2S reading within 30-40% of the span gas value, indicating that the sensor output is within the specified limits. This feature allows the user to check the sensor's signal output without removing it from the sensor housing.

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.

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.
- The following displays appear and after 3 seconds the system returns to the SAMPLING mode:



Adjustment of 0-1V Analog Output

In rare instances the 0-1V signal output may not agree to the reading displayed by the LCD. This feature enables the user to adjust the analog signal output should the LCD display not agree.

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

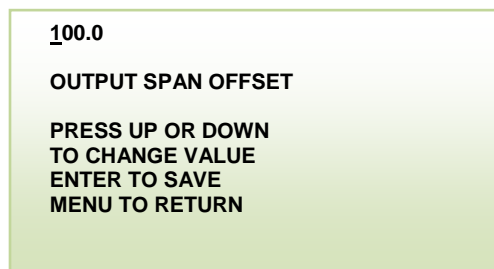
1. Access the MAIN MENU by pressing the MENU key.
2. Advance the reverse shade cursor using the ARROW keys to highlight CALIBRATION.
3. Press the ENTER key to select the highlighted menu option.

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.

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 1V analog signal value or decrease it below 100 to decrease the 1V 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 voltage signal will adjust to the new value.
9. If the 1V signal still does not match with display, repeat steps 7 through 8 until the voltage signal matches with the display.
10. Save the adjustment value by pressing the ENTER key or abort by pressing the MENU key.

The system returns to the SAMPLING mode.

Sampling

GPR-7100 H2S analyzer requires a positive pressure to flow the sample gas across the sensor to measure the H2S concentration in a sample gas. If the sample pressure is atmospheric or at a slight negative pressure (no greater than 10 inches of water column pressure), use an external pump to push the sample through the analyzer.

Procedure

Depending on the H2S concentration, the 90 % response time would vary from 60 seconds to 3 minutes. Similarly, the recovery time would vary from 2 minutes to 5 minutes. As a rule of thumb, higher is the H2S concentration slower is the response and longer recovery.

Following calibration, the analyzer automatically returns to the SAMPLE mode.

1. Select the desired sampling mode - auto or if manual, the range that provides maximum resolution – as described above.
2. Preferably, use metal tubing to transport the sample gas to the analyzer.
3. Ensure the sample gas tubing connections fit tightly into the sample input port.
4. For sample gases under positive pressure, the user must provide a means of controlling the inlet pressure between 5-30 psig and set the flow at 1 SCFH.
5. For sample gases under atmospheric or slightly negative pressure, an external sampling pump must be used to push the sample through the analyzer. Set the sample flow at 1 SCFH.
6. Turn the integral PUMP ON and set the AIR flow at 1 SCFH.
7. Keep the SAMPLE to AIR flow ratio at 1:1 at all times
8. Assure the sample is adequately vented for optimum response and recovery – and safety.
9. Allow the H2S reading to stabilize for approximately 10-15 minutes at each sample point.

Depending on the H2S concentration, the 90 % response time would vary from 60 seconds to 3 minutes. Similarly, the recovery time would vary from 2 minutes to 5 minutes. Higher is the H2S concentration slower is the response and recovery.

Standby

The analyzer has no special storage requirements.

The sensor should remain inside of the sensor housing and connected to the electronics during storage periods. Before turning the analyzer OFF, ensure that sample system is purged with clean air. This will keep the sample system clean and would be ready to use again when required with very short down time.

Store the analyzer with the 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 or replacing filter element of the coalescing filter is the extent of the maintenance requirements of this transmitter.

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.

NOTE: In some cases, you may receive a replacement sensor with A-1196 sensor PCB. If you receive the sensor with A-1196 PCB, you must install the new sensor along with the A-1196 PCB.

7. Spare Parts

Recommended spare parts for the GPR-7100:

Item No.	Description
GPR-11-72-7H-LM	H2S sensor for measuring up to 2000 PPM H2S
GPR-11-72-7HH-LM	H2S Sensor for measuring up to 100 PPM H2S

Other spare parts:

Item No.	Description
MTR-1010	Meter Digital Panel LCD (Standard)
A-1161-H2S-B-100	PCB Assembly Main signal processing and display with 100 PPM Max Range
A-1161-H2S-B-2000	PCB Assembly Main signal processing and display with 2000 PPM Max Range
A-1196-H2S-C3	PCB H2S sensor
B-3652	Battery Intrinsically safe

8. Troubleshooting

Symptom	Possible Cause	Recommended Action
Slow recovery	At installation, defective sensor	Replace sensor if recovery unacceptable or H ₂ S reading fails to reach within 20% of the lowest range
	Air leak in sample system connection(s)	Leak test the entire sample system:
	Abnormality in zero gas	Qualify zero gas or use clean ambient air
	Damaged in service - electrolyte leakage Sensor nearing end of life	Replace sensor Replace sensor
High H ₂ S reading after installing or replacing sensor	Analyzer calibrated before sensor has been stabilized	Allow H ₂ S reading to stabilize before making the span/calibration adjustment
High H ₂ S reading Sampling	Flow rate exceeds limits	Correct sample pressure and flow rate
	Pressurized sensor	Remove restriction on vent line
	Improper sensor selection	Install proper sensor
Response time slow	Air leak, dead legs, distance of sample line, high volume of optional filters and scrubbers	Reduce dead volume or increase flow rate
H ₂ S reading doesn't agree to expected values	Sample flow, ambient pressure and temperature is different than that during span calibration	Calibrate the analyzer (calibrate at pressure and temperature similar to that of sample)
	Error in span calibration	Repeat span calibration
	Abnormality in sample gas	Qualify the integrity of the sample gas (use another portable analyzer as a secondary check)
Erratic H ₂ S reading	Sudden Changes in sample pressure or flow	Keep the sample pressure/flow constant

<p>or No H₂S reading</p>	<p>Loose sensor cable and or sensor PCB</p>	<p>Maintain sample flow to within the recommended range Secure ribbon cable firmly by fully inserting the ribbon cable into its mating socket on the sensor PCB Ensure that sensor PCB is firmly secured on sensor</p>
	<p>Incorrect polarity of ribbon cable</p>	<p>Ensure that the conductors of ribbon cable align with COND on sensor PCB</p>
	<p>Corroded sensor PCB</p>	<p>Replace sensor PCB</p>
	<p>Liquid covering sensing area</p>	<p>Replace sensor</p>
	<p>Sensor nearing end of life</p>	<p>Replace sensor</p>
<p>Cannot span calibrate the analyzer</p>	<p>Incorrect span gas concentration Span gas pressure/flow too high or too low</p>	<p>Check span gas with a secondary analyzer</p>
	<p>Incorrect sensor model Sensor nearing end of life</p>	<p>Set span gas pressure/flow within recommended range</p>
<p>Cannot zero calibrate the analyzer</p>	<p>Zero offset outside of recommended range</p>	<p>Use correct sensor Model Replace sensor</p>
	<p>High sample/zero gas flow causing back pressure on sensor</p>	<p>Allow enough time for sensor to settle with zero gas/air</p>
	<p>Defective sensor</p>	<p>Set sample/zero gas flow within recommended range</p>
		<p>Replace sensor</p>

9. Warranty

The design and manufacture of GPR Series H2S analyzers, monitors 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 monitor, 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. monitor, analyzer and/or H2S 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 monitors, analyzers and sensors purchased worldwide. It is the only one we will give and it sets forth all our responsibilities. There are no other express warranties. This warranty is limited to the first customer who submits a claim for a given serial number and/or the above warranty period. Under no circumstances will the warranty extend to more than one customer or beyond the warranty period.

Limitations

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

Product Identification

Product Name	H2S sensor Series
Synonyms	Electrochemical Sensor
Manufacturer	Advanced Instruments Inc., 2855 Metropolitan Place, Pomona, CA 91767 USA
Emergency Phone Number	909-392-6900
Preparation / Revision Date	January 1, 1995
Notes	H2S sensors are sealed, contain protective coverings and in normal conditions do not present a health hazard. Information applies to electrolyte unless otherwise noted.

Specific Generic Ingredients

Carcinogens at levels > 0.1%	None
Others at levels > 1.0%	Acetic Acid or sulfuric acid
CAS Number	Acetic Acid = 64-19-7

General Requirements

Use	Acid - as electrolyte
Handling	Rubber or latex gloves, safety glasses
Storage	Indefinitely

Physical Properties

Boiling Point Range	Acetic Acid = 100 to 117° C
Melting Point Range	Acetic Acid – NA, Lead 327° C
Freezing Point	Acetic Acid = -40 to -10° C
Molecular Weight	Acetic Acid – NA, Lead = 207
Specific Gravity	Acetic Acid = 1.05 @ 20° C
Vapor Pressure	Acetic Acid = 11.4 @ 20° C
Vapor Density	Acetic Acid = 2.07
pH	Acetic Acid = 2-3
Solubility in H ₂ O	Complete
% Volatiles by Volume	None
Evaporation Rate	Similar to water
Appearance and Odor	Aqueous solutions Colorless, vinegar-like odor, sulfuric acid, no odor

Fire and Explosion Data

Flash and Fire Points	Not applicable
Flammable Limits	Not flammable
Extinguishing Method	Not applicable
Special Fire Fighting Procedures	Not applicable



Unusual Fire and Explosion Hazards

Not applicable

Reactivity Data

Stability

Stable

Conditions Contributing to Instability

None

Incompatibility

Acid = Avoid contact with strong bases

Hazardous Decomposition Products

Acid = Emits toxic fumes when heated

Conditions to Avoid

Heat above 70 degree C

Spill or Leak

Steps if material is released

Sensor is packaged in a sealed plastic bag, check the sensor inside for electrolyte leakage. If the sensor leaks inside the plastic bag or inside analyzer sensor housing do not remove it without rubber or latex gloves and safety glasses and a source of water. Flush or wipe all surfaces repeatedly with water or wet paper towel (fresh each time).

Disposal

In accordance with federal, state and local regulations.

Health Hazard Information

Primary Route(s) of Entry

Ingestion, eye and skin contact

Exposure Limits

Acetic Acid - ACGIH TLV / OSHA PEL 10 % (TWA)

Ingestion

Acetic Acid = Oral LD50 (RAT) = 6620 mg/kg

Eye

Electrolyte is corrosive and eye contact could result in permanent loss of vision.

Skin

Electrolyte is corrosive and skin contact could result in a chemical burn.

Inhalation

Liquid inhalation is unlikely.

Symptoms

Eye contact - burning sensation. Skin contact - soapy slick feeling.

Medical Conditions Aggravated

None

Carcinogenic Reference Data

Acetic Acid = NTP Annual Report on Carcinogens - not listed; LARC Monographs - not listed; OSHA - not listed

Other

none.

Special Protection Information

Ventilation Requirements

None

Eye

Safety glasses

Hand

Rubber or latex gloves

Respirator Type

Not applicable

Other Special Protection

None

Special Precautions

Precautions

Do not remove the sensor's protective Teflon and PCB coverings. Do not probe the sensor with sharp objects. Wash hands thoroughly after handling. Avoid contact with eyes, skin and clothing.

Transportation

Empty sensor body may contain hazardous residue.

Not applicable