H₂S Analyzer Manual

Model 3010BR

AMI, Costa Mesa, CA

Contents

Preface

Thank you!

We would like to thank you for purchasing the most cost-effective hydrogen sulfide analyzer available. We have gone to great lengths to make this analyzer as simple, user-friendly, and complete, as possible. It includes our revolutionary cell block design that integrates all sample handling components necessary and a very sophisticated set of electronics. With the optional liquid rejection probe accessory and demister it provides a complete system for monitoring natural gas gathering systems and many other hydrogen sulfide applications.

Please verify that the analyzer was not damaged in transit. If so please contact the shipper as well as AMI.

WARNING!

HYDROGEN SULFIDE IS EXTREMELY TOXIC AND CAN BE LETHAL! Read this manual carefully before using this instrument.

Caution

Read and understand this manual fully before attempting to use the instrument. In particular understand the hazards associated with using flammable or poisonous gases, and associated with the contents of the sensor used.

Address

Advanced Micro Instruments.

Costa Mesa, CA 92626

(714) 848-5533

www.*amio2*.com

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Model 3010BR Hydrogen sulfide Analyzer

Introduction

Using the same advanced engineering perfected in the 2010BR trace oxygen analyzer, AMI has produced an equally effective hydrogen sulfide analyzer. Instead of having to use clumsy, unreliable lead acetate tape, or alternatively very expensive and delicate laser diode analyzers, AMI has applied a unique electrochemical sensor to a modified version of the proven platform of the 2010BR to produce an equally effective hydrogen sulfide analyzer. It provides all the features that the industry has come to expect – fully programmable alarms, standard isolated voltage or current outputs, and data logging, and the most user-friendly controls available, together with a fully integrated sample handling system and optional heating, all in a small weather-proof package that meets all applicable safety standards for hazardous area operation with flammable gas samples.

The analyzer is designed to be responsive primarily to hydrogen sulfide, but it will also respond to mercaptans and sulfur dioxide. It should not be used if percent levels of carbon monoxide or hydrogen are present.

Features:

- Compact size
- Unique cell block
- Front panel sensor access
- Built-in span gas selection valve
- Integrated sample system
- Metering valve flow control
- Integrated flow meter
- Optional heater for cold weather operation
- High accuracy and fast response
- Large liquid crystal display
- User selectable output ranges 0-50, 0-100ppm
- Choice of analog outputs: a current output of 4-20mA or a voltage output of 1-5V, both isolated

- Two fully adjustable alarm relay contact closures 24VDC/110VAC 5A.
- Alarm delay-on activation with programmable delay
- Front panel alarm hold off/bypass with programmable delay
- Pulse drivers for latching-type solenoid valves
- Built-in data logging with real time clock
- Bi-directional serial output with simple protocol
- Three levels of security access settable via the RS232 interface: no front panel settings allowed, span only allowed and complete access allowed.
- Optional 117 VAC or 24VDC operation
- Backed by a two year warranty (excluding sensor)
- Designed for Class 1 Div 1 Group BCD

Analyzer description:

Gas analyzers are divided into two main sections – the sample handling section, and the electronics, including the software/user interface.

In any analyzer, the sample control is as important as the electronics. It selects the source of the gas to be measured, controls its flow rate, and brings it to the sensor without allowing leaks or exposing it to excessive tubing length (which slows the response of this kind of analyzer). AMI uses a version of the patented "Cell block", a machined block of nickel-plated aluminum that integrates all of these functions in one compact, and reliable package. The sample enters the cell block through either the sample inlet, or else the span inlet, with the selection made by a three-way valve. This valve is integrated with a needle valve that controls the flow rate of either sample or span gas. Since the two valves are mounted together, there are no opportunities for leaks or mis-assembly. The sample gas then passes through a flow meter, and then across the face of the sensor via a defined flow path, exhausting through the vent. The sensor is installed in a pocket accessible from the front of the unit behind a screw-in "Cell cap", thus allowing sensor replacement without tools or any sort of disassembly of the analyzer. All of these functions occur within a single small block.

The electronics are divided into two sections. All of the user controls, the sensor and the display are mounted in an easily-accessible NEMA box on the right of the assembly, while the power supply and the safety components, along with the output circuitry are mounted in the small explosion-proof box to the left. This allows complete control and maintenance when needed without declassifying the area or having to open an explosion-proof enclosure. The analytical circuit is an "intrinsically safe" circuit that is absolutely incapable of igniting an explosive mixture of gases even in the presence of two worst-case faults.

The NEMA 4 enclosure contains:
- The measuring circuit board and the cell block.
- A keypad that allows the user to perform all the normal adjustments required, such as alarm set points, span, alarm bypass and output range selection.
- A large LCD display that shows the H2S reading.
- The circuit that measures the output of the sensor, and also measures the temperature of the cell block, and calculates the H2S level.
  - It sends this information digitally into the explosion-proof section on the left.
  - It displays the alarm set points, and allows the user to adjust them.
  - It displays the output range, which is also selectable.
  - It can also display the cell block temperature.
  - It displays the "span factor". This is a useful number that gives an idea of how the sensor is aging. You could think of it as the setting of the calibration dial on an old-fashioned analog analyzer.
  - The control panel also includes an "Alarm hold off" button. When calibrating the sensor you normally do not want alarms to shut down the process or pipeline, and so you can press this button to hold them off for a programmable delay time.
  - In addition, it is possible to set up the analyzer so that casual users are not able to make any adjustments, even though they can see what the alarm settings and the output range are – they can be locked out of changing them.

The explosion proof box contains:
- The safety barriers.
- The output/relay PC board.

- The RS-232 connection.
- The power supplies. The unit can be powered optionally either by AC or DC.
- It can also contain the optional explosion-proof heater that controls the cell block temperature, so that the unit can remain operational down to –20 °F, while using minimal power.

All the output connections, such as the alarm relays, the output voltage or current (which are user-selectable and also can be locally calibrated), and the computer interface are available in this enclosure. The alarms are fully configurable through a special PC program that communicates to the analyzer. You can select hold-off (delay-ON) times for each alarm, and configure whether the relays open or close, either above or below the set point. The relays can be set so that they can control a motorized solenoid valve. You can calibrate the voltage or current output to your monitoring device. The unit stores up to three months of readings, and this file can be downloaded into a PC. All of these features are described below in detail.

The sensor:

The analyzer is received with the sensor installed and ready to operate, already calibrated. Unlike trace oxygen sensors, the sensor is not affected by being exposed to air. So you don't need to worry about back diffusion of air into this analyzer, and you also don't need to worry about leaks allowing hydrogen sulfide from the air compromising the reading. Instead, hydrogen sulfide presents its own set of issues. These are mainly due to the fact that hydrogen sulfide sticks to surfaces, and so the walls of the sample tubing act as a sort of filter – they have to be filled up with hydrogen sulfide before the gas that comes out has the same amount of hydrogen sulfide in it as it did when it entered the tubing. If you use plastic tubing or components this problem will get worse. It is possible to get special tubing ("Sulfinert") that has been treated to avoid this problem, but in practice simply allowing the gas to flow for long enough usually is adequate.

Sensor Warranty:

The sensor has an expected life of three years, and it is warranted to operate for a period of one year on a pro-rated basis. If the sensor ceases to operate correctly before this time has elapsed, contact AMI for a return authorization for evaluation.

Instrument Warranty:

Any failure of material or workmanship will be repaired free of charge for a period of two years from the original purchase (shipping date) of the instrument. AMI will also pay for one way ground shipment (back to the user).

This warranty does not cover the sensor, which is covered by its own warranty (see above).

Any indication of abuse or tampering will void the warranty.

Hydrogen sulfide toxicity:

From Wikipedia, under hydrogen sulfide, as of 7/1/2009:

- 0.0047 ppm is the recognition threshold, the concentration at which 50% of humans can detect the characteristic odor of hydrogen sulfide [1], normally described as resembling "a rotten egg".

- Less than 10 ppm has an exposure limit of 8 hours per day.

- 10-20 ppm is the borderline concentration for eye irritation.

- 50-100 ppm leads to eye damage.

- At 150-250 ppm the olfactory nerve is paralyzed after a few inhalations, and the sense of smell disappears, often together with awareness of danger,

- 320-530 ppm leads to pulmonary edema with the possibility of death.

- 530-1000 ppm causes strong stimulation of the central nervous system and rapid breathing, leading to loss of breathing;

  - 800 ppm is the lethal concentration for 50% of humans for 5 minutes exposure(LC50).

- Concentrations over 1000 ppm cause immediate collapse with loss of breathing, even after inhalation of a single breath.

Important:

This section contains important information to do with safety and installation. Please don't skip it!

Points to consider first!

Environment – what is the temperature range going to be where the analyzer will be installed? If the temperature is going to go below freezing, you either need a heated version, a heated version in an extreme weather enclosure, or to place it in a temperature controlled meter building. Also, make sure it won't get too hot in the summer – you may need to ventilate or even air condition a building. Use a solar panel as a sunshield if one is to be used. The standard (non-heated) temperature specification is 25°F to 115°F; with a heater it can go to -20°F; in the optional extreme weather enclosure it can go to -40°F.

Sample conditions – if your sample is hot and wet, you will need to keep water from condensing in the sample line or analyzer. The AMI demister brings hot and wet gases back to ambient temperature and allows the condensation and entrained liquids to fall back into the pipeline (no draining is necessary, unlike a coalescing filter which requires routine maintenance). The Liquid rejection probe stops occasional slugs of water from contaminating the analyzer, and acts as a check valve, so that if a compressor goes down drawing a vacuum on the line, air is not drawn back into the analyzer through its vent. It is available with a built-in pressure regulator for high pressure lines (up to 1200psig).

Power supply – if you are going to run the unit off solar power, using a battery, you need to size both the battery and the solar panel correctly. The analyzer draws about 30mA at 14.4 volts, but if you select the 4-20mA output option this will go up to about 60mA. A heater draws up to 1.67A when the temperature is at its coldest. We suggest that you use the solar panel as the sunshield for the analyzer by mounting it right over the analyzer.

Electrical connections – make sure you use conduit seal-offs on the two conduit entrances located on the bottom of the explosion proof housing, and we suggest you also use universal couplers so you can disconnect the analyzer without cutting wires (if the unit has to be moved or removed for service). Following best electrical practices, run the analog output connections separately from the power and alarm connections. Modbus communications if used should be run with the analog output wiring, using twisted pair wires for both circuits. Run the alarm wires in the same conduit as the power wires.

Solenoid valves – if the analyzer is going to be used to control gas flow (such as to shut in contaminated gas) using solenoid valves, consider using latching type valves and the analyzer pulse feature so as to minimize power consumption, particularly if you are using a battery as the power supply. Standard solenoid valves require power to remain open (or closed), whereas latching valves require power only when changing their position. This conserves a lot of power.

Installation and Operation

Installation.

Location:

Attach solar panel to top of pipe as sun shade

Vent to outside

Span gas (capped)

1/4" sample tubing (stainless steel)

Liquid rejection probe

Use seal offs and universal couplings

2" mouting pipe

Demister
Mounted vertically!
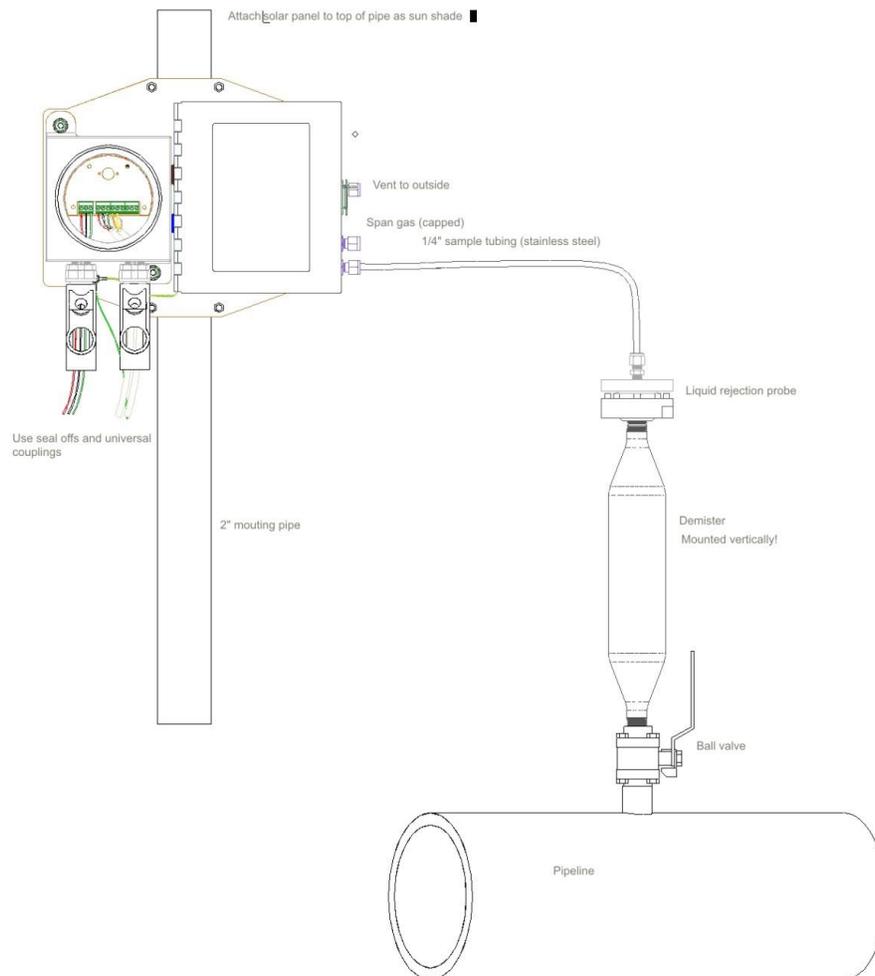
Ball valve

Pipeline

Figure 1. Typical installation showing LRP and demister

The unit is designed to be mounted on a wall or on a 2 inch pipe in a general purpose, Class 1 Division 1 or Class 1 division 2 Group B,C,D area, with a flammable gas sample allowed. When equipped with the optional heater it may be mounted outdoors in severe environments, though it should be given a sun shield if in direct sunlight. It should be mounted at a suitable viewing level. Refer to the drawing (figure 1) showing the analyzer dimensions. **EXPLOSION-PROOF SEALS ARE REQUIRED ON THE POWER AND SIGNAL CONDULET ENTRIES, whether the area classification is Division 1 or Division 2.**

Apply the usual good-practice rules of mounting a piece of analytical equipment. For example do not to mount it close to sources of electrical interference such as large transformers, motor start contactors, relays etc. or in places where it will get a lot of vibration.

Mount the unit at a suitable eye level (so you can easily read the LCD and adjust the controls), not so close to a wall on the right side that you will have a hard time connecting the gas lines.

Safety Considerations:

The unit is designed for installation in either a general purpose or a Class 1 Div 1 or Div 2 Group B,C,D area, but it is also designed so that a hazardous gas may be introduced into its NEMA compartment. This gas may be any group B,C or D gas.
The unit consists of two enclosures mounted on a back panel. The smaller enclosure on the left is explosion-proof and contains the electrical connections for the user, and also the power supply and safety components for the NEMA 4 enclosure.
The NEMA 4 enclosure contains the analytical circuitry, the sample handling components and the hydrogen sulfide sensor. This circuitry is designed for intrinsic safety and meets requirements for Class 1 Div 1 Group B,C,D.

There is an RS485 connection running ModBus available from the explosion-proof section. This may be wired up permanently. There is also a USB port in the explosion-proof section that may be used occasionally by removing the explosion-proof cap. If so, the area MUST be declassified first.
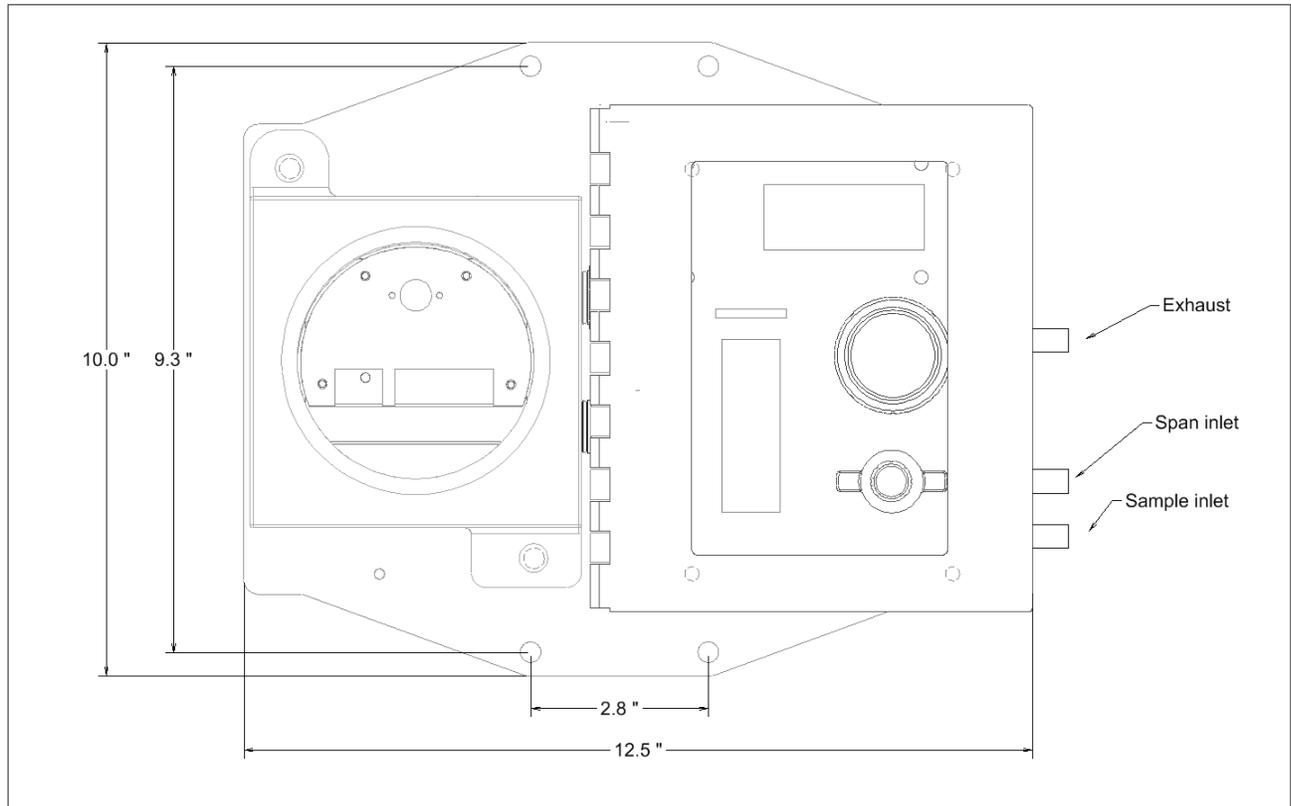
Figure 2. Outline Drawing

Installation Procedure

1. Mount analyzer in a shelter if convenient, at a convenient eye level, not too close to the right wall (so as not to interfere with the gas connections).
2. Make the gas connections
   a. Connect the sample line with ¼" ss tubing.
   b. Make sure that the sample gas line has a pressure no greater than 150 psig.
   c. If so, use a pressure reducing regulator and adjust the inlet pressure to 25 psig.
   d. Connect the exhaust to a line that goes outside the building, or to a suitable purge system. Make sure it runs downhill so no condensation from a wet sample forms ice or water and blocks it up in it in winter.
   e. Turn the sample valve to SAMPLE.
   f. Adjust sample flow to 1 SCFH with the flow control valve.

We recommend that you use an "Analyzer Guardian" (a liquid rejection device) on the sample line if there is any possibility of water or entrained liquids in the sample. **Don't allow liquid water to enter the analyzer! This may mean that you have to cool the sample and drop out water before it gets into the analyzer**.

Figure 3. Interconnections (AC unit shown)

3. Make the electrical connections:
   a. Connect the analyzer ground lug located on the panel under the explosion-proof housing to an 8 ft ground rod (or similar high quality ground).
   b. Install explosion-proof electrical seals using suitable ½" NPT nipples close to the explosion-proof housing.
   c. Connect power and other electrical connections through suitable conduit. The power and alarm connections should be run through one conduit separately from the analog signal wiring. The connectors unplug for convenience and can handle up to AWG 12 gauge wire.
   d. Connect the power wires to the terminals marked "Power Input". If using DC, the positive supply line connects to the terminal marked "+", and the negative line to the terminal marked "-". If using AC, the hot line is connected to the terminal marked "H", and the neutral to the terminal marked "N". In either case, the ground terminal marked with the ground symbol MUST be connected to a low impedance ground connection. (Note that the cover is black for the AC unit, white for the DC one).
   e. Connect the alarm relays as desired. The two relays provide a single contact that can either make or break to indicate an alarm. They are by default programmed to close on alarm above set point (though this can be changed with the user interface). They can handle 5A at 24DC or 117VAC.

f. Connect the analog output if desired. Make sure that the system is set up correctly for voltage or current output (you can change it if necessary) and wire it with a shielded twisted pair. Connect the shield to the ground connection shown by the ground symbol next to the analog output. Note that the output type is defined on the label on the side of the analyzer.

4. Verify all electrical connections.
5. Power up analyzer.
6. If using the analyzer controls available on the front panel only:
    a. Select the desired output range by pressing the "Output Range" button, then scrolling with the UP or Down buttons.
    b. Set the two alarm set points by pressing "Alarm 1" (or "Alarm 2") and scrolling to the desired set point.
    c. For details on the front panel controls see the chapter in this manual called "Operation".
7. If it is desired to use the advanced functions available, purchase the AMI user interface program and the custom RS-232 cable, and refer to the chapter in the manual called "Advanced Features and Communications".
8. Confirm all electrical connections are correct, and the remote devices connected to the analyzer all work.
9. Seal the electrical seals installed in step 3b above.
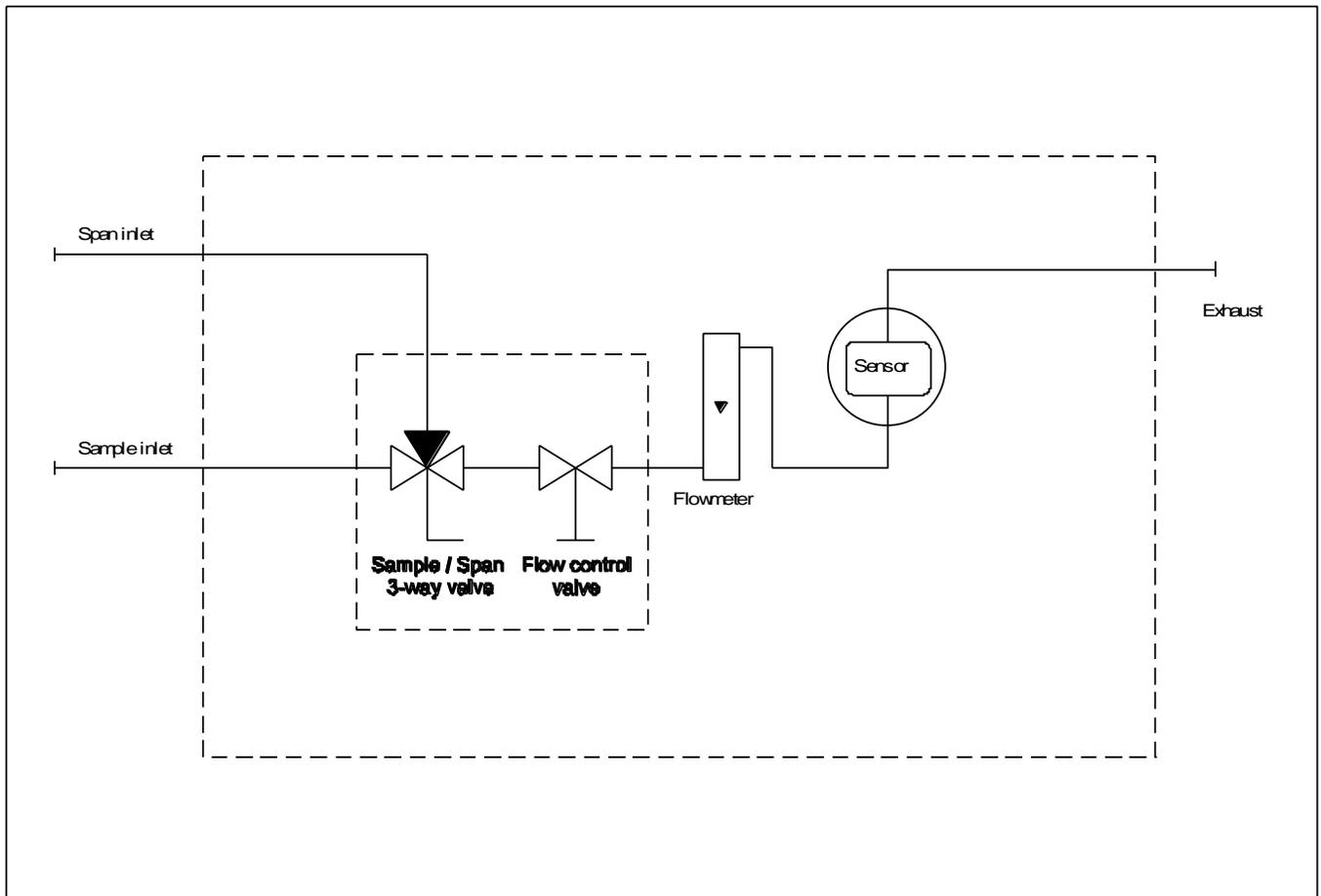10. Screw on the explosion-proof cap.

Figure 4 Flow Schematic

Initial Calibration:

The sensor has already been installed, and it is ready for operation. The analyzer has been calibrated at the factory, but changes in altitude will affect the calibration, so it is best to start off with an initial calibration. Use this procedure:

1. Connect a stainless steel regulator (with Stainless Steel diaphragm ONLY) to span gas tank.
2. Connect the output of the regulator to the span inlet of the analyzer located on the right side of the NEMA 4 box.
3. Set the regulator pressure to 10psig.
4. We recommend using the special AMI supplied span gas tubing with O ring sealed fittings so as to prevent fitting damage to the span port.
5. Confirm all fittings are tight.
6. Press the ALARM HOLD OFF button, and adjust the time displayed suitably (typically 30 minutes). This prevents unintentionally setting off alarms if the gas value is higher than the alarm set points.
7. Turn the analyzer flow valve on the front of the NEMA 4 box to the SPAN position.

8. Set flow rate for 1 SCFH and flow the gas for a minimum of 25 minutes.
9. Perform a calibration by adjusting the analyzer span until it reads the span gas value.
    a. Press the "SPAN" button until the "SPAN" flag appears on the display.
    b. Release the span button and immediately press and hold the UP or DOWN button until the display reads the correct span gas value.
    c. Once you release the UP or DOWN button, after a few seconds, the unit will return to normal mode.
    d. If you made some kind of mistake, let go for five seconds, and then try again.
10. Once it is back in normal operation, press the UP arrow and note the number displayed on the display (called the "Calibration factor"). When new this number is about 500, but as the sensor ages the number will increase. When it gets up to 1000 the sensor will have to be replaced.
11. Rotate the valve back to the Sample position.
12. Readjust the flow rate to 1 SCFH if necessary.

If the span gas reads more than 25% wrong, something is wrong either with the gas, or with the plumbing. Also, changes in altitude will affect the calibration. See the troubleshooting section for some ideas about curing this. Alternatively you simply haven't let the span gas flow long enough. Hydrogen sulfide is "sticky" – that is, it collects on the walls of the tubing and it can take a long time until the gas being delivered has the same level of H2S in it as the gas in the bottle.
 Do not leave the gas cylinder on when you are not spanning the analyzer, as not only may you drain the cylinder but any leak will contaminate the area and can be dangerous. Turn the bottle off with the cylinder valve.

Front Panel Settings and Adjustments

General Description:

This analyzer is designed to be as simple to operate as possible. The analyzer displays the Hydrogen sulfide level in ppms on the LCD. Meanwhile the analog output and the alarms are set on a single (user selectable) range.

For example, you can set the analog output to correspond to 0-100ppm, and the alarms to be, for example, 40ppm for Alarm 1 and 50ppm for Alarm 2 (i.e. 40% of range and 50% of range), activating above set point. Be aware that if you then change the output range to 50ppm, the alarm set points will automatically change to 20ppm and 25ppm respectively. For this reason, set the output range first and then set the alarm set points.

The unit provides the basic controls through the front panel, and more advanced controls are available through the user interface program (see below in the Advanced Features and Communications section. If you are going to set up the analyzer using the advanced computer interface, you can skip this section.

Security:

Through the user interface, three levels of security can be set. These are: No security (all front panel controls work), Span (only the span control and the alarm hold off button are allowed to operate), and Full security (only the Alarm hold off button performs a function, though other buttons will show settings but won't allow them to be changed). If the front panel controls don't seem to work, use the AMI User Interface to change the security settings.

Front Panel Controls:

The controls all work the same way. You press the function you want for a second, and let go, and the display will show the value corresponding to that function, for about 3 seconds. For example, if you press the OUTPUT RANGE button for a second, the display will show the full scale output range. You can change this value (if the security setting allows) by then pressing the UP or DOWN arrow button. You can either press this once for a small change, or you can hold it down , in which case the number will change slowly at first, and then faster. If you overshoot your target, press the other button to go back, and the display will again start moving slowly.

Output Ranges

The output range is the range to which the analog output signal and the alarm settings correspond.

Output ranges for Low Range 0-200ppm:	0-10ppm, 0-50ppm, 0-100ppm,0-200ppm.
Output Ranges for High Range 0-2000ppm:	0-100ppm, 0-500ppm, 0-1000ppm, 0-2000ppm

View Output Range

Press the OUTPUT RANGE button on the front panel for a second, and let go. The display will show the full scale value of the output range for about three seconds, and then change back to the Hydrogen sulfide reading.

Change Output Range

Press the OUTPUT RANGE button for a second and let go. While the output range value is displayed, press the UP or DOWN arrow buttons until the desired range appears. Simply leave it or select another function and the range will be stored and the system updated.

Note: if this results in an alarm set point change, the alarms will change as soon as the unit starts showing the reading again.

If the range changes back again after you let go, the security level must be set to full or span only security. In this case change the security level with the laptop and the AMI User Interface program.

Alarm Set Points

The alarm set points can be viewed and changed (if security allows) from the front panel. All the other alarm configuration settings can only be changed with the AMI User Interface program. See "Advanced Features and Communications " below.

View Alarm Set Points

Press either of the ALARM SET POINT buttons and let go. The alarm set point will be displayed for about 3 seconds, and the then the display will revert to the Hydrogen sulfide reading and the "ALARM" flag disappears.

Change Alarm Set Points

Press one or the other ALARM SET POINT buttons for a second, and let go. While the alarm set point and "ALARM" flag are showing, press either the UP or DOWN arrow button and hold it until the desired value is reached and then let go. The numbers will scroll slowly at first and then speed up: if you press the other button, or release and re-press the one you are using, the number will start going slowly again. Once you let go, the system will store the new alarm set point and revert to showing the hydrogen sulfide reading, and the "ALARM" flag will disappear.

If security is set, nothing will happen. In this case use the AMI User Interface program to change the security level, or directly change the alarm set point.

Alarm Hold Off

Press the ALARM HOLD OFF button and release it. The display will show the alarm hold off time in minutes (from 0 to 120 minutes), and if any alarms are fired, they will be turned off and held off for the period of the alarm hold off time. If the relays are programmed to latch, pressing this button will also unlatch them (and stop them from alarming again for the hold off period). This is particularly useful during calibration, so that you don't cause alarms to trigger when you flow the calibration gas. For example, if the span gas is 40ppm, and the alarms are set to 10ppm and 20ppm, the span gas would set off the alarms with whatever consequences that would cause. Pressing this button will temporarily bypass triggering the alarms.

If the security setting allows it, the alarm hold off time can be adjusted by pressing the UP or DOWN arrow buttons.

Span (Calibration)

When the span gas has been flowing for 25 minutes and the reading is stable, press the SPAN button for one second until the "SPAN" flag appears, and let go, and then quickly push the Up or DOWN button until the display reads the same as the label on the span gas cylinder. Release the button, and after three seconds (if security does not forbid it), the new span factor is stored, the "SPAN" flag disappears and the analyzer drops back to normal operating mode.

View the Span Factor:

The model 3010BR has a "Span Factor" feature. It can be displayed on the LCD by pressing the UP arrow by itself (when the analyzer is in normal operation, meaning not in a function such as spanning or setting the alarms). It helps you determine the life of the sensor. As the sensor ages, its output decreases gradually, and therefore the span factor has to be turned up during calibration to compensate.
The span factor should be between 400 and 600 for a new sensor. When you calibrate the analyzer, check this value before and after the calibration. You should see that the value goes up slowly over the life of the sensor. When the value has reached 1000, the sensor has reached the end of its life and should be replaced.

Cell Block Temperature:

Press the DOWN arrow button only and the display will show the temperature of the cell block in degrees Fahrenheit. This is useful for troubleshooting and to see if the heater (if present) is operating properly. The temperature reading is limited to 25°F at the lowest, and about 120°F at the highest. If the unit is equipped with a heater, the temperature will be higher than ambient once the ambient temperature has dropped below 50°F.

Default Settings

The analyzer is tested and shipped with the following default settings, unless otherwise requested by the customer at the time of purchase.

Output Range	0-100ppm

Analog output configuration (voltage/current)	Per purchase order, noted on Analyzer ID tag
Alarm 1 set point	80ppm
Alarm 2 set point	90ppm
Alarm 1 delay	0 minutes
Alarm 2 delay	0 minutes
Alarm hold off time	1 minute
Alarm 1 logic	High, non-latching, closed above set point
Alarm 2 logic	High, non-latching, closed above set point
Pulse time	0 (disabled)
Security	All front panel adjustments allowed
Data log time	1 minute interval

Changing the output from 1-5 VDC to 4-20mA (or vice versa)

This unit is equipped with a selectable output. It may be either 1-5V or 4-20mA, selectable via a set of jumpers on the output PCB (the board directly under the cover plate in the explosion proof housing – see Fig. 3 above). The positioning of the switch is indicated on the PCB itself – put switch on the left-hand position for 4-20mA, and put it on the right hand position for 1-5V. The 4-20mA option will increase the current draw to some degree, if the unit is powered from DC and the heater is not used.

The output 4-20mA circuit is capable of driving a 600 Ohm load, while the voltage output needs at least a 10,000 Ohm load. Either will saturate at more than 125% of the nominal full scale range.

Using AMI software you can set the output to 4mA, 12mA and 20mA(or 1V, 3V and 5V), and adjust the internal settings to calibrate these values so as to get the most accurate possible transfer of information to a recording or computing device. If you forget to reset them the unit will automatically return to its normal operation after ten minutes.
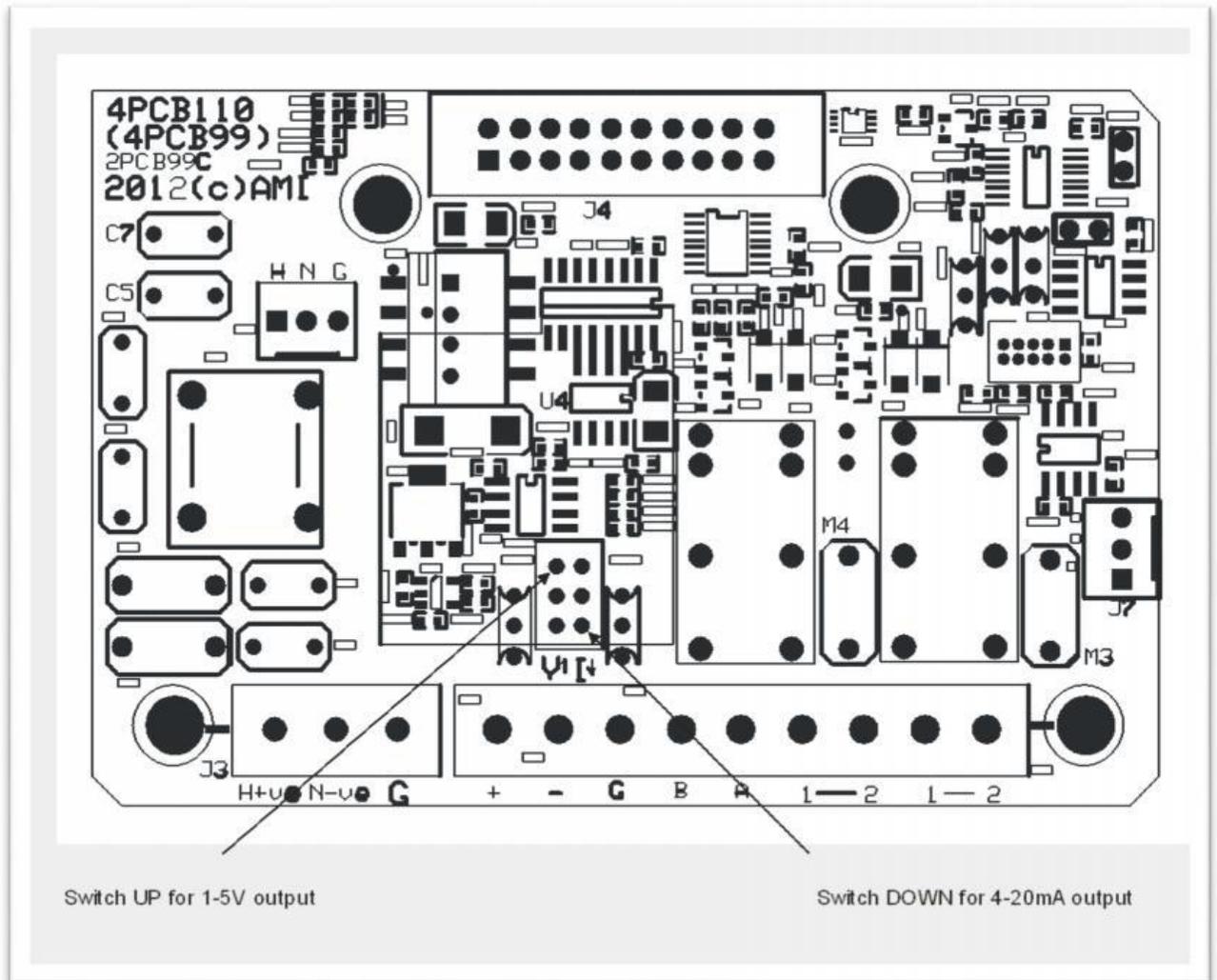
Figure 5. Output selection switch positions

Output Selection:

To change from 4-20mA to 1-5V output, or vice versa, swap around the switch as shown in the figure above. It is in the left hand position for 4-20mA, and the right hand position for 1-5V. If you switch between the two options the internal calibration will be fairly close but not perfect, so it may be necessary to use the AMI User Interface to make the output exact.

Flow Control

Figure 6 Front panel controls

3 way Selector Valve – Located right beneath the cell cap on the lower right side of the front panel of the NEMA 4 enclosure. It selects either sample or span gas to flow past the sensor. It can be turned off, to prevent gas from flowing past the sensor, useful when replacing the sensor. Rotate the valve until the groove in one side of the valve corresponds with the position marking, and the detent clicks into place.

Flow Control valve – Located in the center of the 3 way selector valve. This provides flow control of the sample or span gas flowing past the sensor as indicated in the flowmeter.

Flow meter – Shows the sample or span flow rate in the range of 0 to 2 SCFH. The flow should generally be set at 1 SCFH.

Sample and Span and Exhaust gas connections – Located on the right side of the NEMA 4 box. They all use ¼" Swagelok™ fittings, though if the span connection if likely to be made and broken may times, it is best to use the AMI provided sample tubing with O ring style fittings.

Advanced Features and Communications

Communication Program:

The analyzer supports both the industry-standard ModBus protocol running on an RS485 loop, and the AMI User Interface software connected via a USB port. If the USB connection is detected the ModBus connection will be disabled.

Details of these protocols can be found in the "AMI Communications Manual" provided upon request or downloaded from the AMI website at www.amio2.com.

Maintenance and troubleshooting

Maintenance:

The model 3010BR is virtually maintenance free other than for periodic calibration and occasional sensor replacement.

Periodic Calibration:

The analyzer should be calibrated about once every month to obtain the best accuracy. The sensor typically declines in sensitivity by less than 1% of full scale per month, so a monthly calibration is usually satisfactory. Use in a particularly aggressive environment may degrade the sensor faster: in this case calibrate more often.

If you are calibrating the high range MODEL 3010BR Analyzer (0 – 2000 ppm) with a Span Gas, the Span Gas needs to be >200 ppm.

Sensor Replacement:

This should be done based on the Span Factor feature, rather than as a response to a dead sensor. See the Front Panel Settings and Adjustments section earlier in this manual.

Sensor replacement cautions:

CAUTION: The sensor contains an acid. If there is any sign of a liquid in the

cell compartment, do not allow it to come into contact with your skin. If it does, immediately flush the affected area with water for a period of at least 15 minutes. Refer to the Material Safety Data Sheet provided.

Dispose of leaking or used sensors in accordance with local regulations. Sensors should generally not be thrown into ordinary trash. Refer to the MSDS to learn about potential hazards and corrective actions in case of any accident.
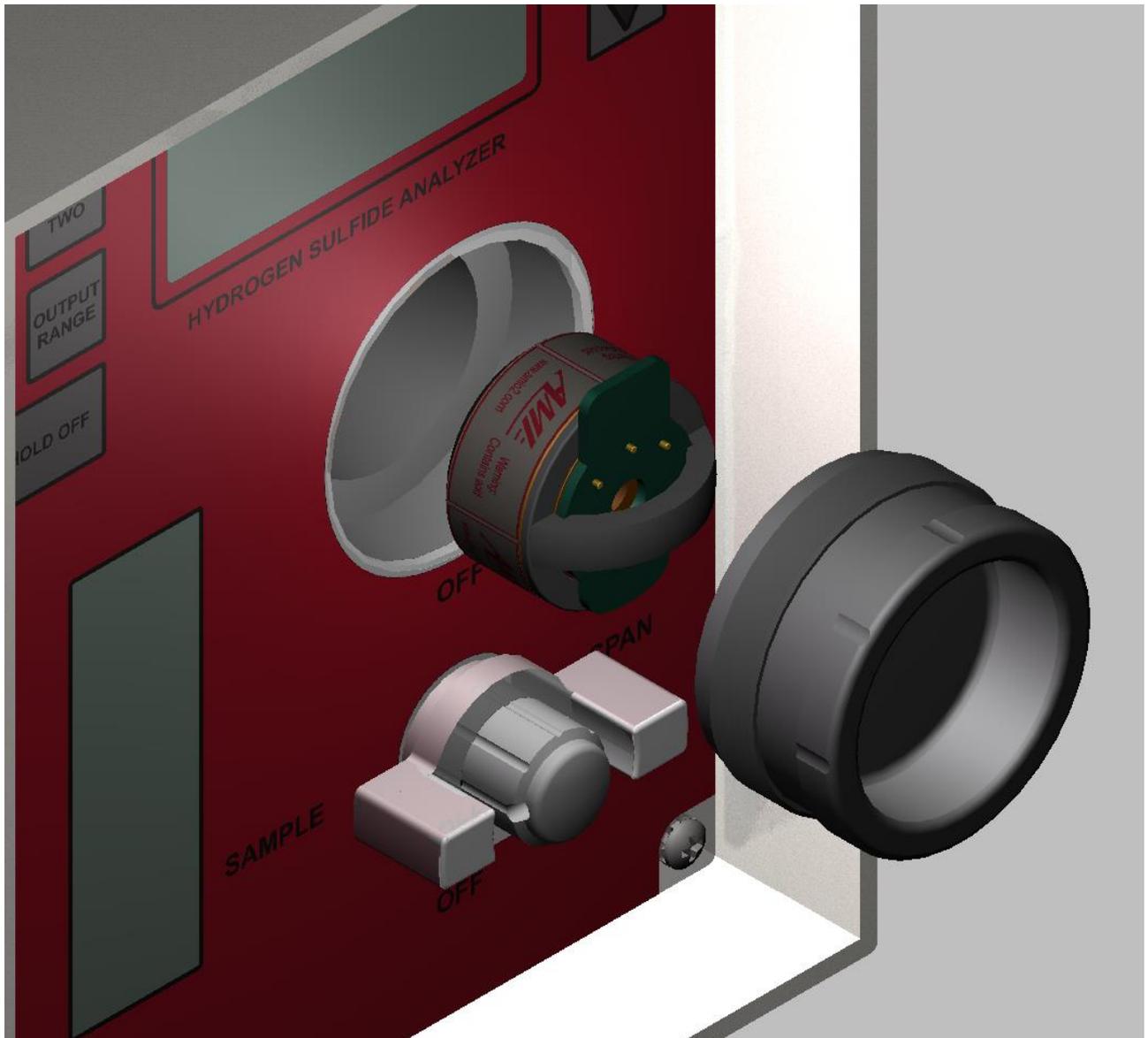
Figure 7. Inserting sensor in cell block

Sensor replacement procedure:

The sensor is provided in a special sealed bag.

1. Turn the three-way valve to the OFF position, in order to prevent gas flowing into the sensor compartment.

2. Unscrew the cell block cap.

3. Carefully remove old cell by pulling the little black handle.

4. Inspect the cell block cavity, and if any sign of moisture clean it out with a Q tip or similar. Make sure that the contact springs inside the block are intact. Be careful not to snag them with the Q tip.

5. Carefully open the bag using a pair of scissors or a knife. Make sure you don't cut yourself or stab the sensor! In the rare event that the sensor has leaked there will be liquid in the bag. If so do not proceed - you need a new sensor.

6. Verify that the O ring is in place on the face of the sensor (white membrane side) before installing.

7. Holding the sensor by the little black handle, gently slide it into the cavity with the circuit board extension mating into the little machined slot, located at the top of the cavity. You really cannot put it in any other way.

8. Carefully replace the cap, making sure that you do not cross thread it, and tighten firmly by hand. Do not over-tighten.

9. Press the ALARM HOLD OFF button, and adjust the time displayed suitably (typically 30 minutes). This prevents unintentionally setting off alarms if the gas value is higher than the alarm set points.

10. Turn the analyzer flow valve on the front of the NEMA 4 box to the SPAN position.

11. Set flow rate for 1 SCFH and flow the gas for a minimum of 25 minutes.

12. Perform a calibration by adjust the analyzer span until it reads the span gas value.

13. Press the "SPAN" button until the "SPAN" flag appears on the display.

14. Release the span button and immediately press and hold the UP or DOWN button until the display reads correctly.

15. Once you release the UP or DOWN button, after a few seconds, the unit will return to normal mode.

16. If you made some kind of mistake, let go for five seconds, and then try again.

17. Once it is back in normal operation, press the UP arrow and note the number displayed on the display (called the "Calibration factor"). When new this number is about 500, but as the sensor ages the number will increase. When it gets up to 1000 the sensor will have to be replaced.

18. Rotate the valve back to the Sample position.

19. Readjust the flow rate to 1 SCFH if necessary.

Specifications and Disclaimer

Specifications

- **4 standard user selectable output ranges to choose from:** 0-10ppm, 0-50ppm, 0-100ppm, 0–200ppm
- **Optional output ranges available:** 0-500ppm, 0-1000ppm and 2000ppm
  - The selection of an output range simultaneously controls the two alarms, the analog output and the data logger so that all 4 functions operate on the same range
- **Digital display:** High resolution 3 ½ digit LCD. Reads full scale from 0.00ppm to 100ppm independently of output range selection and 0.00ppm to 2000ppm when using high range sensor.
- **Alarms:** 2 fully adjustable Hydrogen Sulfide (H2S) concentration alarms Dry contacts 5A. @24VDC/115VAC
- **Alarm delays:** Programmable from 0-300 minutes
- **Alarm hold off:** Programmable from 0-120 minutes• Isolated analog output signal: 1-5VDC or 4-20mARepresents the output range selected: 0-10ppm, 0-50ppm, 0-100ppm, 0-200ppm
- **Data logger:** Logs data for 15 days @ 1 minute intervals, 30 days @ 2 minute intervals, etc. Represents the output range selected: 0-10ppm, 0-50ppm,0-100ppm,0-200ppm
- **Power requirements:** 10-28VDC/ 115VAC<70mA. @ 12VDC non heated<24W @12VDC with heated option

- **Minimum detection:** 50ppb of Hydrogen Sulfide (H2S)
- Repeatability: +/- 1% of range or +/- 0.2ppm of H2S,whichever is greater
- **Operating temperature range:** 25 to 115˚ F non-heated; -20 to 115˚ F heated option
- **Diurnal temperature specification:**< +/- 2 % of scale over temperature range
- **90% full scale response times for specified range:** 0-100ppm < 120 seconds @ 1.5SCFH0-2000ppm < 120 seconds @ 1.5SCFH
- **Response to Methyl Mercaptan:** 40% of actual concentration
- **Response to Sulfur Dioxide:** 18% of actual concentration
- **Area Classification:** Designed to meet UL-913 and UL-1203 Class 1, Div. 1, Groups B,C,D with a flammable gas sample
- **Inlet gas pressure:** 0.5 to 150psig
- **Gas connections:** ¼" 316 S.S. compression fittings
- **Wetted parts:** 316 S.S. fittings, electroless nickel plated cellblock, gold plated contacts, acrylic flow meter and Viton O-rings
- **Recommended flow rate:** from 1.0 to 1.5 SCFH
- **Mounting:** Wall mount or 2.0" pipe
- **Dimensions:** 13.0"W x 9.5"H x 5.0"D
- **Weight:** 16 lbs.

117VAC version is to be installed only in installation (overvoltage) category I or II.

Disclaimer

Although every effort has been made to assure that the AMI analyzers meet all their performance specifications, AMI takes no responsibility for any losses incurred by reason of the failure of its analyzers or associated components. AMI's obligation is expressly limited to the analyzer itself.

CSA GROUP™

Certificate of Compliance

Certificate: 1905645   **Master Contract:** 227773

Project: 80023753   **Date Issued:** 2019-11-05

Issued To: **Advanced Micro Instruments, Inc.**
225 Paularino Ave
Costa Mesa, California, 92626
United States

Attention: Charles Schacht

The products listed below are eligible to bear the CSA Mark shown with adjacent indicators 'C' and 'US' for Canada and US or with adjacent indicator 'US' for US only or without either indicator for Canada only.

Issued by: Joshua Burdeshaw

C ⊗ US

PRODUCTS
CLASS - C482802 - SIGNAL APPLIANCES Toxic Gas Detection Instruments - For Hazardous Locations
CLASS - C482882 - SIGNAL APPLIANCES-Toxic Gas Detection Instruments For Hazardous Locations.
Certified to U.S. Standards

Class I, Division 1, Groups B, C and D:

Series 2010BR and 210BR Oxygen Analyzers and series 3010BR Hydrogen Sulfide Analyzers, input rated 117Vac, 0.5A max, 50/60Hz or 12-24VDC, 1.7A max or 12-24VDC, 0.1A max; with output rated 1-5V or 4-20mA; with or without built-in heater; provides intrinsically safe output to attached external measurement section (also located in Class I, Div 1, Groups B, C and D); Alarm relay contacts rated 117VAC/5A, 28VDC/5A and Resistive; Temperature Code T3A.

APPLICABLE REQUIREMENTS

CSA C22.2 No 0-10	General Requirements – Canadian Electrical Code, Part II – Tenth Edition
CSA C22.2 No 30-M1986 *(R 2007)*	Explosion-Proof Enclosures for Use in Class I Hazardous Locations Industrial Products – Third Edition
CSA C22.2 No 142-M1987 *(R 2009)*	Process Control Equipment Industrial Products – Third Edition
CSA C22.2 No 157-92 *(R 2006)*	Intrinsically Safe and Non-Incendive Equipment for Use in Hazardous Locations – Third Edition
UL 913	Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, and III, Division 1, Hazardous (Classified) Locations - Seventh Edition
UL 916	Energy Management Equipment – Fourth Edition
UL 1203	Explosion-Proof and Dust-Ignition-Proof Electrical Equipment for Use in Hazardous (Classified) Locations – Fourth Edition

MARKINGS

The manufacturer is required to apply the following markings:
- Products shall be marked with the markings specified by the particular product standard.
- Products certified for Canada shall have all Caution and Warning markings in both English and French.

Additional bilingual markings not covered by the product standard(s) may be required by the Authorities Having Jurisdiction. It is the responsibility of the manufacturer to provide and apply these additional markings, where applicable, in accordance with the requirements of those authorities.

The products listed are eligible to bear the CSA Mark shown with adjacent indicators 'C' and 'US' for Canada and US (indicating that products have been manufactured to the requirements of both Canadian and U.S. Standards) or with adjacent indicator 'US' for US only or without either indicator for Canada only.

The following markings are permanently embossed, die-stamped or etched on a metallic nameplate, have a minimum thickness of 0.5mm, which is secured to flow-meter enclosure by two screws.

- Manufacturer's name: "Advanced Micro Instruments", or CSA Master Contract Number "227773", adjacent to the CSA Mark in lieu of manufacturer's name.
- Model number: As specified in the PRODUCTS section, above.
- Electrical ratings: As specified in the PRODUCTS section, above.
- Relay contacts rating: As specified in the PRODUCTS section, above.
- Manufacturing date in MMYY format, or serial number, traceable to month of manufacture.
- The CSA Mark with or without "C" and "US" indicators, as shown on the Certificate of Conformity.
- Hazardous Location designation: As specified in the PRODUCTS section, above (may be abbreviated).
- Temperature code: As specified in the PRODUCTS section, above.
- The following words:

- o Caution: "Warning – Explosion Hazard – Keep explosion-proof cover tight while circuits are alive. Substitution of components may impair intrinsic safety"

Supplement to Certificate of Compliance

Certificate: 1905645   **Master Contract:** 227773

The products listed, including the latest revision described below,
are eligible to be marked in accordance with the referenced Certificate.

Product Certification History

Project	Date	Description
80023753	2019-11-05	Update report 1905645 and reissue CofC 1905645 to reflect Submitor's new address. Advanced Micro Instruments 225 Paularino Av Costa Mesa, CA 92626
000070159520	2017-11-28	Variation to REPORT: 1905645 Review drawing pack supplied with application form and analyse effect changes upon compliance. CSA CAN and US Standards marking: Unchanged
0002591862	2013-01-25	Update to report 1905645 to include revised drawings. This update includes component designator changes in the intrinsic safety section and component and drawing number changes in the Explosion proof enclosure section.
0002550588	2012-09-25	Update to report 1905645 to include revised drawings. This update includes three physical changes and six documentation revisions
0002424143	2011-06-10	Update to report 1905645 to include revised drawings.
0002354641	2011-01-18	Update to report 1905645 to include change to electrical rating, replacing a fuse, add a new model variation, and update drawings.
0002225238	2009-10-23	Update to Report 1905645 to include minor electrical and mechanical construction change
0001905645	2007-09-06	Continuation of project 1783712 - I.S. and Explosion-Proof to C/US Division requirements