Sample-Draw Hydrogen Sulfide Gas Detector for Use With Generic Device

Specifications

Table 1 lists specifications for the sample-draw hydrogen sulfide detector. .

Table 1: Specifications

Target Gas	Hydrogen Sulfide
Input Power	24 VDC
Output Signal	4-20 mA
Construction (housing)	Fiberglass / polyester (NEMA 4X)
Dimensions	8.5 in. H x 6.5 in. W x 4.25 in. D
Weight	4.5 lbs.
Sampling Method	Sample-draw
Sample Flow	1.5 SCFH (nominal)
Detection Range	0 to 100 ppm
Response Time	90% in 30 seconds
Accuracy	±5% of detection range
Repeatability	±2% of detection range

Description

This section describes the components of the sample-draw hydrogen sulfide gas detector. The sample-draw detector consists of the housing, flow system, and detection system.

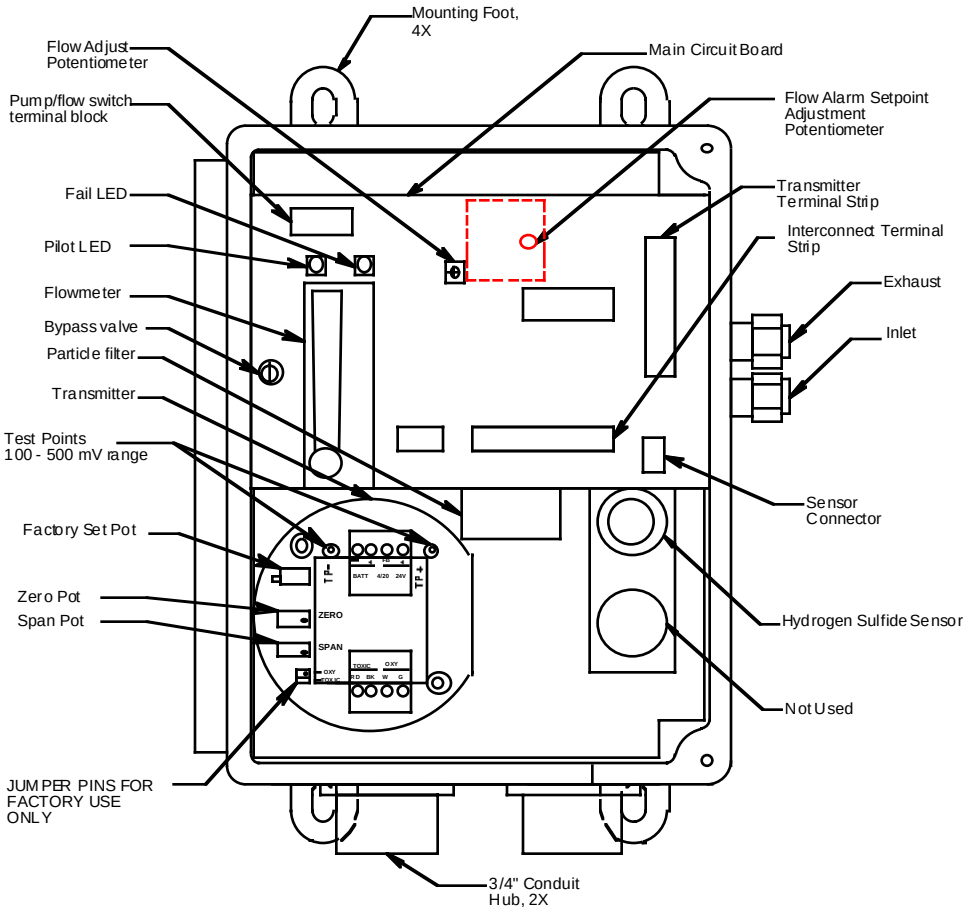


Figure 1: Sample-draw Hydrogen Sulfide Gas Detector Component Location

Housing

The sample-draw detector's fiberglass housing is weather- and corrosion-resistant. It is suitable for installation where general purpose equipment is in use.

The housing door is hinged on the left side and is secured by two latches on the right side. The flowmeter and status lights are visible through a window in the housing door.

Four mounting feet are attached to the back of the housing (one at each corner). Use the mounting feet to install the housing to a vertical surface. Use the two conduit hubs on the bottom of the housing to make wiring connections.

An aluminum subpanel is mounted to the interior of the housing. The sample-draw detector's internal components are mounted to the subpanel.

Flow System

The sample-draw detector's flow system consists of the INLET fitting, filter, pump, flowmeter, bypass valve, status lights, pressure switch, and EXHAUST fitting (see Figure 1). Figure 2 illustrates how the gas sample moves through the flow system.

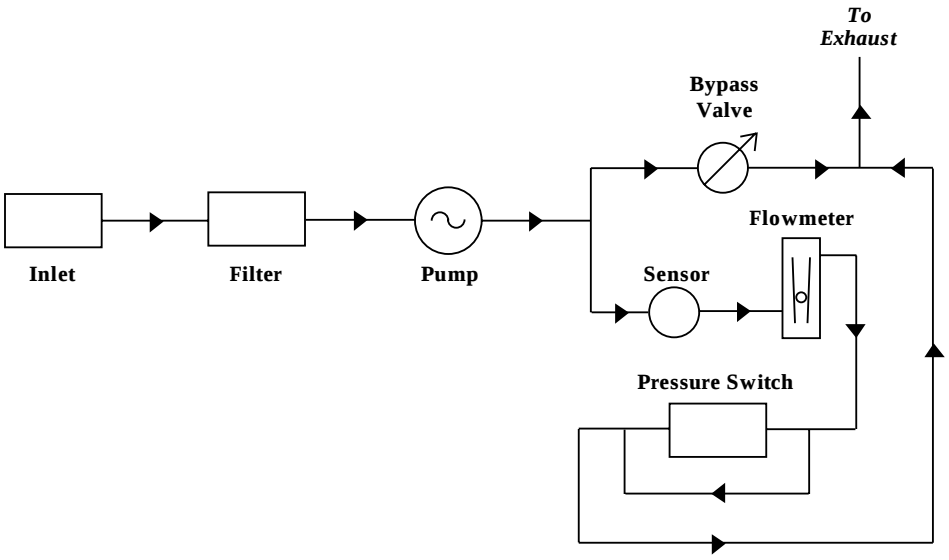


Figure 2: Sample-draw Hydrogen Sulfide Gas Detector Flow Diagram

INLET fitting

The INLET fitting on the right side of the housing allows the gas sample to enter the sample-draw detector. The INLET fitting accepts 1/4 in. rigid tubing. See the Installation section on page 6 to connect tubing to the INLET fitting.

Filter

The dust filter is below the main circuit board. The filter prevents particulates in the incoming gas sample from damaging the flow and detection systems. Replace the filter when it appears dirty, discolored, or clogged.

Pump

The pump is behind the main circuit board near the top of the sample-draw detector. The pump pulls the gas sample into the sample-draw detector. The pump operates on 24 VAC, which is generated from the 24 VDC supplied to the sample draw detector.

Flowmeter

The flowmeter is attached to the main circuit board near the top left corner (see Figure 1.) You can see it through the window in the door. A ball in the flowmeter column indicates the flow rate of the sample-draw detector. The flowmeter measures the flow in the range 0.2 to 2.0 SCFH (Standard Cubic Feet per Hour). The optimum flow rate is 1.5 SCFH.

Bypass valve

The bypass valve is to the left of the flowmeter. The bypass valve adjusts the flow rate to the sensor. Use a flat-blade screwdriver to adjust the bypass valve.

NOTE: The bypass valve allows fine adjustments of the flow rate. For a wider range of adjustment, use the flow adjust potentiometer (see Figure 1.)

Status lights

Two status lights are above the flowmeter. They are also visible through the window in the housing door.

Pilot light

The green Pilot light is on when the sample-draw detector is receiving power from the Pioneer.

Fail light

The red Fail light is on when the sample flow rate is below the low flow level.

NOTE: The default low flow level is 0.6 SCFH (±0.2). See "Adjusting the Low Flow Setting" on page 13 to adjust this setting.

Pressure switch

The pressure switch is mounted to the opposite side of the main circuit board. The pressure switch monitors the flow rate of the incoming gas sample.

If the flow rate falls below the preset low flow level, the pressure switch causes the fail relay to interrupt the signal in the 4-20 mA line. This causes a downscale reading at the monitor. The low flow level is factory-set at 0.6 SCFH (±0.2 SCFH).

EXHAUST fitting

The EXHAUST fitting on the right side of the housing allows the gas sample to exit the sample-draw detector. The EXHAUST fitting accepts 1/4 in. rigid tubing. See the Installation section on page 6 to connect tubing to the EXHAUST fitting.

Detection System

The detection system consists of the hydrogen sulfide gas sensor, the hydrogen sulfide transmitter, and the main circuit board.

Hydrogen sulfide gas sensor

The hydrogen sulfide gas sensor is installed in a cavity block. The cavity block is mounted to the aluminum subpanel on the right of the sample-draw detector. The hydrogen sulfide gas sensor includes the sensor and the cable with connector.

NOTE: The cavity block includes a cavity for a second hydrogen sulfide or a carbon monoxide sensor. This version of the sample-draw detector does not include the second sensor.

Sensor

The sensor is pushed into the cavity block and held in place by two o-rings. Through a series of chemical and electrical reactions, the sensor produces an electrical output that is proportional to the detector range of the transmitter.

Cable w/Connector

The sensor has a two wire cable with a 4-pin connector soldered to it. The connector is plugged into the sensor connector in the lower right of the Main Circuit Board.

Hydrogen Sulfide Transmitter

The hydrogen sulfide transmitter is mounted to the left of the hydrogen sensor. It consists of the span pot, zero pot, two internally wired terminal strips, and the test points.

Span/zero pots

The span and zero pots are located at the left edge of the transmitter and are used for calibration. Use the span pot to make adjustments to gas response readings and the zero pot to make adjustments to the zero reading

Termainal Strips

There are two terminal strips which are used for internal factory wiring.

Test points

The test points are located at the top of the transmitter and are labeled **TP+** and **TP-**. A 100 mV - 500 mV output is available at these testpoints for use during calibration.

Main Circuit Board

The main circuit board includes the interconnect terminal strip, transmitter terminal strip, pump terminal strip, and relay (see Figure 1).

NOTE: The flowmeter and status lights are mounted to the main circuit board but are considered part of the flow system.

Interconnect terminal strip

The interconnect terminal strip is the nine-point terminal strip near the bottom edge of the main circuit board. Use the interconnect terminal strip to connect the sample-draw detector to power and an external device.

Transmitter terminal strip

The transmitter terminal strip is the nine-point terminal strip near the right edge of the circuit board. Use the transmitter terminal strip to connect the transmitter to the main circuit board.

NOTE: The transmitter is factory-wired to the circuit board. See the “Installation” section on page 6 for all wiring procedures related to the sample-draw detector.

Pump terminal strip

The pump terminal strip is the four-point terminal strip near the top edge of the circuit board. Use the pump terminal strip to connect the pump and pressure switch to the main circuit board.

NOTE: The pump and pressure switch are factory-wired to the circuit board. See the “Installation” on page 6 for all wiring procedures related to the sample-draw detector.

Relay

The relay is to the left of the detector terminal strip. The relay is double pole, double-throw (DPDT) and is rated for 2 amps at 25 VDC (resistive). If the pressure switch senses a low flow condition, the relay interrupts the signal from the sensor. The interrupted sensor signal causes a fail condition at the Pioneer.

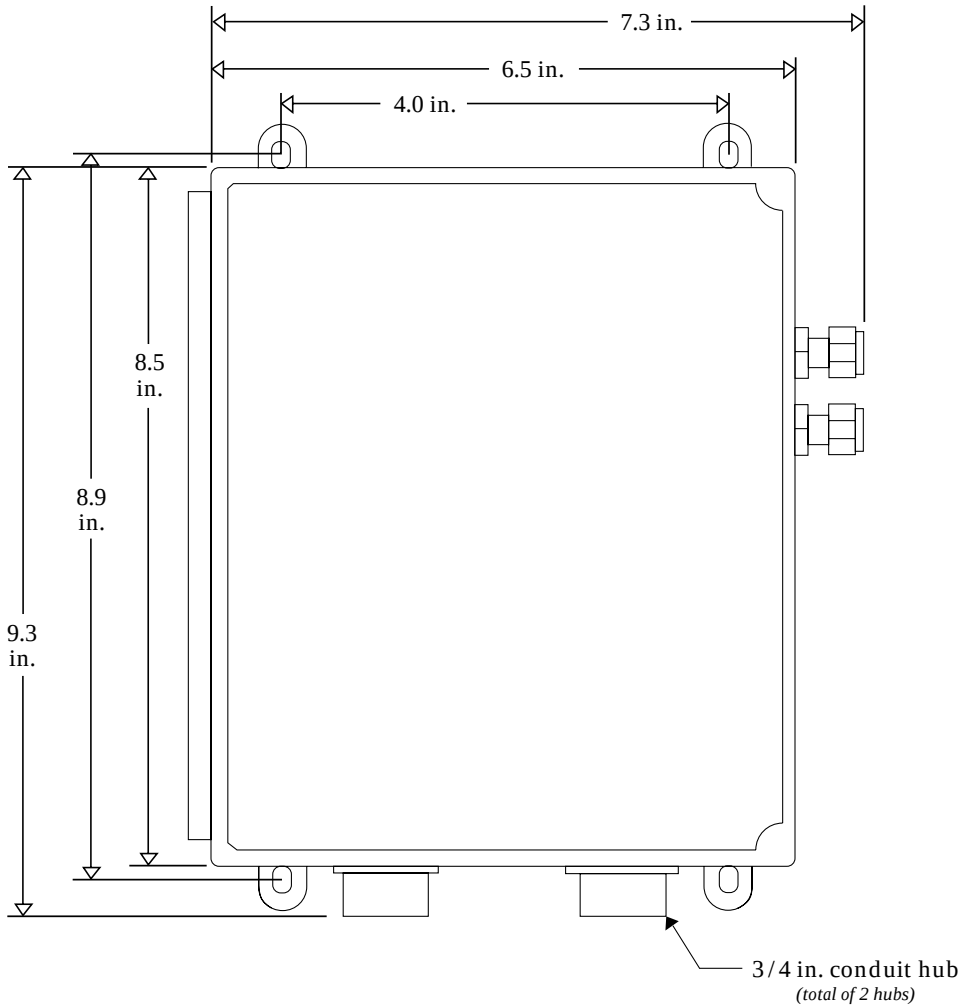
Installation

This section describes procedures to mount the sample-draw hydrogen sulfide gas detector in the monitoring environment and wire the sample-draw detector to power and an external device.

Mounting the Sample-Draw Combustible Gas Detector

1. Select the mounting site. Consider the following when you select the mounting site.
   - Is there enough room to open the housing door and make wiring connections at the bottom of the housing and tubing connections at the right of the housing?

     Make sure there is sufficient room to perform start-up, maintenance, and calibration procedures.
   - Are the flowmeter and status lights visible?



Note: The housing is 4.25 in. deep.

Figure 3: Mounting the Sample-Draw Hydrogen Sulfide Gas Detector

2. Close and latch the housing door.

NOTE: The sample-draw detector is shipped with the mounting feet "tucked under" the housing to protect the mounting feet during shipment.

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3. Slightly loosen the screw that secures the mounting foot to the housing, then rotate the mounting foot 180 degrees (see Figure 3).
4. Tighten the screw that secures the mounting foot to the housing.
5. Repeat steps 3 and 4 for the remaining three mounting feet.
6. Position the sample-draw housing on a vertical surface at eye level (4 1/2 to 5 feet from the floor).
7. Insert 1/4 in. or 5/16 screws through the slots in the mounting feet to secure the housing to the mounting surface.

Connecting the Sample Lines to the Sample-Draw Hydrogen Sulfide Gas Detector

1. Attach 1/4 in. O.D. stainless steel, rigid teflon, or rigid polypropylene sample tubing to the INLET fitting.

CAUTION: *If you use **flexible** sample tubing (polyurethane is acceptable), use an appropriate metal insert to seal the connection between the tubing and the INLET fitting. See Appendix A, Parts List, for an example of an appropriate metal insert.*

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2. Place the opposite end of the tubing at the sampling area.

CAUTION: *Avoid loops or slumps in the incoming sample line. To reduce response time, keep the incoming sample line as short as possible.*

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3. Attach rigid sample tubing to the EXHAUST fitting.
4. Route the opposite end of the tubing to an open area where the sample can safely disperse.

Wiring the Sample-Draw Hydrogen Sulfide Gas Detector

WARNING: ***Always verify that the power source is OFF before you make wiring connections.***

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1. Unlatch and open the housing door of the sample-draw detector.
2. Guide a three-conductor, shielded cable or three wires in conduit through one of the conduit hubs at the bottom of the sample-draw housing.
3. Connect the cable to the sample-draw detector's interconnect terminal strip as shown in Figure 4.
4. Close and latch the housing door of the sample-draw detector.

CAUTION: *Leave the shield cable insulated and disconnected at the sample-draw detector. You will connect the opposite end of the shield cable at the device.*

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5. Route the cable or wires in conduit leading from the sample-draw detector to the monitoring device and power.
6. Connect the cable shield to an available chassis ground at the device end.

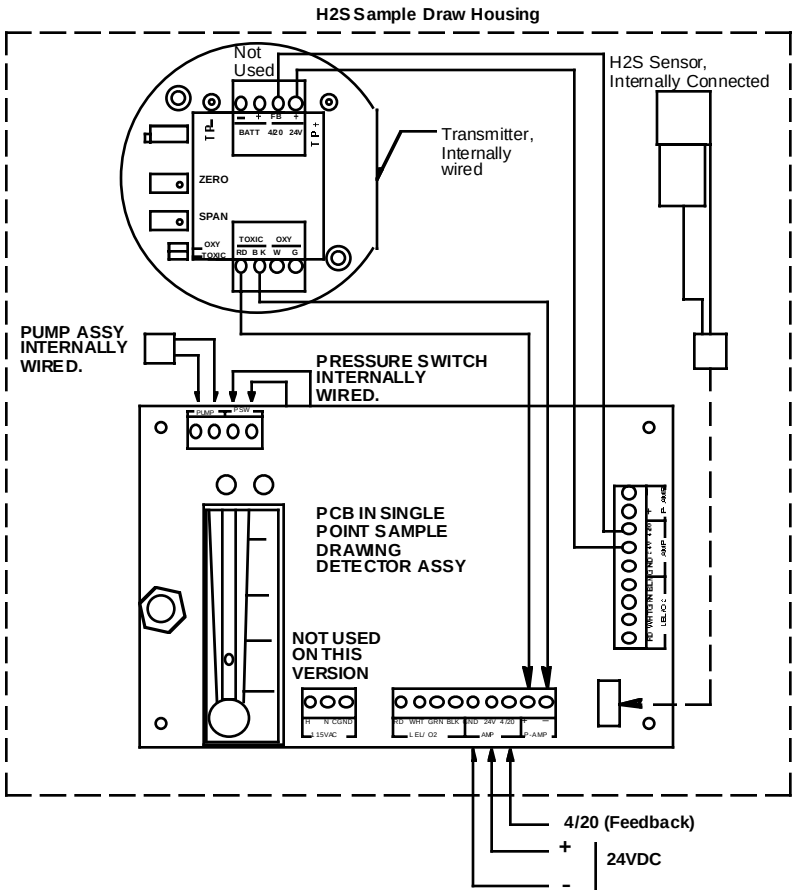

Figure 4: Wiring the Sample-Draw Hydrogen Sulfide Gas Detector

Start Up

This section describes procedures to start up the sample-draw hydrogen sulfide gas detector and place the sample-draw detector into normal operation.

Introducing Incoming Power

1. Complete the installation procedures described earlier in this manual.
2. Verify that the power / device wiring is correct and secure.
3. Turn on or plug in the incoming power at the power source end.
4. Verify that the Pilot light is on.
5. Verify that the flowmeter indicates a flow rate of approximately 1.5 SCFH. If necessary, use the bypass valve or flow adjust potentiometer to adjust the flow rate.

NOTE: The following step tests for leaks in the sample line. This test may cause a low flow condition at the sample-draw detector.

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6. Verify that the incoming sample line is not leaking. To test the sample line, plug the open end of the sample line with your thumb. If the flowmeter ball drops to the bottom of the flowmeter, the incoming sample line is not leaking.
7. Remove your thumb from the sample line, verify the flowmeter returns to a normal flow rate.

Setting the Zero Reading

CAUTION: *If you suspect the presence of hydrogen sulfide gas in the monitoring environment, use the calibration kit and the zero air calibration cylinder to introduce "fresh air" to the sensor and verify an accurate zero setting.*

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1. Verify that the sample-draw detector is sampling a fresh air environment (environment known to be free of combustible gas).
2. Open the housing door.
3. Set a voltmeter to measure in the milivolt (mV) range.
4. Plug the voltmeter leads into the test points on the amplifier. Plug the positive lead into the test point labeled **TP+**; plug the negative lead into the test point labeled **TP-**.
5. Verify a voltmeter reading of 100 mV (± 2 mV).
6. If necessary, use a small flat-blade screwdriver to adjust the zero potentiometer until the voltmeter reading is 100 mV (± 2 mV).
7. Close the housing door.

Maintenance

This section describes maintenance procedures. It includes preventive maintenance procedures. This section also includes procedures to troubleshoot the sample-draw detector, replace components of the sample-draw hydrogen sulfide gas detector, and adjust the low flow setting.

Preventive Maintenance

This section describes a preventive maintenance schedule to ensure the optimum performance of the sample-draw detector. It includes daily, monthly, and quarterly procedures.

Daily

1. Verify that the pilot light is on.
2. Verify that the flowmeter indicates a flow rate of approximately 1.5 SCFH. If necessary use the bypass valve or flow adjust potentiometer to adjust the flow rate to 1.5 SCFH.
3. Verify a reading of 0 ppm (4 mA) at the monitoring device or a reading of 100 mV at the transmitter test points. Investigate significant changes in the reading.

Monthly

This procedure describes a test to verify that the sample-draw hydrogen sulfide gas detector responds properly to the target gas.

Preparing for the response test

1. Verify that the monitoring device is reading 0 ppm (4 mA).

   If the reading is not 0, set the zero reading as described in the “Start Up” section on page 9, then continue this procedure.
2. Assemble the calibration kit as described in the Calibration section of this insert.

Performing the response test

NOTE: This procedure describes the RKI calibration kit that includes a gas collection bag. A calibration kit that uses a demand flow regulator is also available.

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1. Connect the calibration tubing from the gas collection bag to the inlet line at or near the INLET fitting.

   The sample-draw detector’s pump automatically begins pulling the test sample from the gas collection bag when you connect the tubing to the inlet line.
2. After approximately one minute, verify that the reading at the monitoring device stabalizes within ± 10% of the concentration of the test sample. If the reading is not within ± 10% of the test sample, calibrate the sample-draw detector as described in the Calibration section of this manual.
3. Remove the calibration tubing from the inlet line, then reconnect the inlet line.

Quarterly

Calibrate the sample-draw detector as described in the “Calibration” section on page 14 .

Troubleshooting

The troubleshooting guide describes symptoms, probable causes, and recommended action for problems you may encounter with the sample-draw hydrogen sulfide gas detector.

NOTE: This troubleshooting guide describes sample-draw detector problems only. See the instruction manual for the monitoring device if it exhibits any problems.

Fail condition

Symptoms

- The sample-draw detector's Fail light is on.
- The monitoring device is operating properly but indicates a reading well below zero.

Probable causes

- The sample-draw detector's flow rate is too low because of an obstructed sample line, failed pump, etc.
- The sample-draw detector is malfunctioning.
- The sensor or transmitter wiring is disconnected or misconnected.

Recommended action

1. At the sample-draw detector, set the correct flow rate with the bypass valve or flow adjust potentiometer.
2. If you cannot set the correct flow rate, check the sample lines for obstructions or kinks.
3. Verify that the detector and transmitter wiring are correct and secure. The Installation section on page 6 describes detector wiring connections.
4. Calibrate the sample-draw detector as described in the Calibration section on page 14.
5. If the fail condition continues, replace the sensor as described later in this section.
6. If the fail condition continues, contact RKI Instruments, Inc., for further instruction.

Slow or no response/difficult or unable to calibrate

Symptoms

- The detector responds slowly or does not respond during the monthly response test.
- Unable to accurately set the zero or response reading during the calibration procedure.
- The detector requires frequent calibration.

NOTE: Under "normal" circumstances, the detector requires calibration once a quarter. Some applications may require a more frequent calibration schedule.

Probable causes

- The calibration cylinder is low, out-dated, or defective.
- The sample-draw detector's flow rate is too low because of an obstructed sample line, failed pump, etc.
- The sample-draw detector is malfunctioning.

Recommended action

1. Verify that the calibration cylinder contains an adequate supply of a fresh test sample.
2. If necessary, set the correct flow rate with the bypass valve or flow adjust potentiometer.
3. If you cannot set the correct flow rate, check the sample line for obstructions or kinks.
4. If the calibration / response difficulties continue, replace the sensor as described later in this section.
5. If the calibration / response difficulties continue, contact RKI Instruments, Inc., for further instruction.

Replacing Components of the Hydrogen Sulfide Gas Sample-draw Detector

This section includes procedures to replace the sensor, filter, and ferrules.

Replacing the hydrogen sulfide gas sensor

1. Turn off incomming power.
2. Open the housing door of the sample-draw detector.
3. Unplug the sensor connector from the main circuit board.
4. Grasp the sensor firmly and pull it out of the flow chamber.
5. Install the new sensor in the flow chamber. Make sure it is pushed all the way down.
6. Connect the sensor connector to the main circuit board.
7. Turn on incomming power.

CAUTION: *Allow the replacement sensor to warm up for 15 minutes before you continue.*

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8. Calibrate the replacement sensor as described in the "Calibration" section on page 14.

Replacing the filter

1. Open the housing door of the sample-draw detector.
2. Note the direction of the arrow on the filter. The arrow indicates the direction of the sample flow.
3. Disconnect the filter from the elbows on each end of the filter, then remove the filter from the sample-draw detector.
4. Make sure the arrow is pointing in the same direction as the arrow on the filter you removed, then connect each end of the replacement filter to the elbows.
5. Verify that the flow rate is approximately 1.5 SCFH, then close the housing door.

Replacing the ferrules

The INLET and EXHAUST fittings each includes two ferrules that seal the incoming or exhaust tubing to the fitting. Replace the ferrules if the seal is bad or if you replace the sample tubing. Always replace the ferrules as a pair.

1. Disconnect the sample tubing from the fitting, then unscrew the nut from the fitting.
2. Verify that the ferrules did not remain in the nut. If necessary, remove the ferrules from the nut.
3. Position the nut so the threaded end is facing you, then insert the back (smaller)

ferrule into the nut. Insert the ferrule so the flat side is facing down.

NOTE: Make sure the bottom ferrule is laying flat in the nut.

4. Insert the cone-shaped front ferrule on top of the bottom ferrule. Insert the ferrule so the smaller end of the cone is facing up.
5. Screw the nut onto the fitting, then connect the sample tubing to the fitting. Make sure you firmly tighten the tubing to the fitting.

Adjusting the Low Flow Setting

The factory-set low flow setting is 0.6 SCFH (±0.2). To adjust the low flow setting:

1. Use the flow adjust potentiometer (VR1) to set the flow to 0.6 SCFH.

   If the sample-draw detector goes into low flow alarm before you can adjust the flow down to 0.6 SCFH, adjust the low flow potentiometer 1/4 turn clockwise, then attempt to set the flow again. Repeat this step until you are able to adjust the flow to 0.6 SCFH.
2. Slowly turn the low flow potentiometer counterclockwise just until the sample-draw detector goes into low flow alarm.

NOTE: The low flow potentiometer is accessible through a circular cutout in the main circuit board. The cutout is labeled PS1.

3. Increase the flow using VR1 until the unit is out of low flow alarm.
4. Decrease the flow very slowly and verify that the low flow alarm is 0.6 SCFH (±0.2).

   If the low flow alarm is set too low, turn the low flow potentiometer slightly clockwise. Repeat steps 3 and 4 if necessary.
5. Use the flow adjust potentiometer (VR1) to set the flow to 1.5 SCFH.
6. Make sure the sample draw detector's Fail light is off.

Calibration

This section describes how to calibrate the sample-draw combustible gas detector. It includes procedures to assemble the calibration kit, set the zero reading, set the response reading, and return to normal operation.

NOTE: This procedure describes calibration using a gas collection bag. A demand-flow calibration kit is also available for calibrating the hydrogen sulfide gas sample-draw detector.

Preparing for Calibration

1. Open the housing door.
2. Set a voltmeter to measure in the millivolt (mV) range.
3. Plug the positive lead into the transmitter test point labeled **TP+**; plug the negative lead into the transmitter test point labeled **TP-**.
4. Use the following formula to determine the correct test points output for the calibrating sample.

   Output (mV) = (calibrating sample/fullscale) X 400 + 100

   For example, with a calibrating sample of 25 ppm hydrogen and a fullscale setting of 100 ppm hydrogen, the correct output is 200 mV.

   200 (mV) = (25/100) X 400 +100

Assembling the Calibration Kit

NOTE: If you can verify a fresh air environment, it is not necessary to use a zero air calibration cylinder to set the zero reading. Go to the next section, “Setting the Zero Reading.”

1. Connect the calibration kit sample tubing to the fitting on the gas collection bag.
2. Connect the sample tubing from the gas collection bag to the inlet line at or near the INLET fitting.

   Allow the sample-draw pump to draw out any residual gas in the gas collection bag.
3. Disconnect the calibration kit sample tubing from the inlet line.
4. Close the clamp right away. The clamp is attached to the calibration kit sample tubing.
5. Connect the tubing from the gas collection bag to the fixed flow regulator, then open the clamp.
6. Screw the fixed flow regulator onto the zero air calibration cylinder. The gas collection bag begins to fill.
7. When the bag is full, unscrew the fixed flow regulator form the cylinder.
8. Close the clamp, then disconnect the sample tubing from the fixed flow regulator.

Setting the Zero Reading

1. Open the clamp, then connect the sample tubing from the gas collection bag to the sample-draw detector's inlet line. **This step is not necessary if you verified a fresh air environment earlier in this procedure.**
2. Allow the reading to stabilize for approximately 1 minute.
3. Verify a voltmeter reading of 100 mV (± 2 mV).
4. If necessary, use a small flat-blade screwdriver to adjust the zero potentiometer until the voltmeter reading is 100 mV (± 2 mV).
5. Allow the sample-draw pump to draw out any residual gas in the gas collection bag. **Steps 6 through 8 are not necessary if you verified a fresh air environment earlier in this procedure. Go to step 9.**
6. Disconnect the sample tubing from the inlet line, then close the clamp.
7. Connect the sample tubing from the gas collection bag to the fixed flow regulator, then open the clamp.
8. Screw the fixed flow regulator onto the calibration gas cylinder. The gas collection bag begins to fill.
9. Unscrew the fixed flow regulator from the cylinder when the gas collection bag appears full.
10. Close the clamp, then disconnect the sample tubing from the fixed flow regulator.

Setting the Response Reading

1. Open the clamp, then connect the sample tubing from the gas collection bag to the inlet line at or near the sample-draw detector's INLET fitting.
2. Allow the sample-draw detector to respond to the calibrating sample for approximately 1 minute.
3. When the reading on the voltmeter stabilizes, verify that the reading matches the response reading (±2 mV) you determined earlier.
4. If necessary, use the span potentiometer on the amplifier to adjust the reading to match the correct response reading.
5. Allow the sample-draw pump to draw out any residual gas in the gas collection bag.
6. Disconnect the sample tubing from the sample-draw detector's inlet line, then close the clamp.
7. Reconnect the incoming sample line.
8. Wait 1 to 2 minutes to allow the hydrogen gas reading to decrease and stabilize.
9. Store the components of the calibration kit in a safe and convenient place.

Parts List

Table 4 lists replacement parts and accessories for the sample-draw hydrogen sulfide gas detector.

Table 2: Parts List

Part Number	Description
06-1248RK	Sample tubing, 3/16 x 5/16, specify length, (for calibration kit)
17-2593RK	Brass insert (for INLET and EXHAUST fittings)
17-2683RK	Front ferrule (for INLET and EXHAUST fittings)
17-2688RK	Back ferrule (for INLET and EXHAUST fittings)
30-0610RK	Pump
33-0163RK	Filter (Boston DFU9933-05-DQ)
65-2037RK	Hydrogen sulfide sensor w/cable and 4-pin connector
81-0151RK-02	Calibration cylinder, 25 ppm H2S in nitrogen, 58 liters
81-0076RK-03	Zero air calibration cylinder (103 liter)
81-1005RK	Regulator, fixed flow, 6 LPM
81-1126RK	Gas collection bag (2 liter)