



INSTRUMENTS

65-2330RK
Hydrogen Sulfide Transmitter
Operator's Manual

Part Number: 71-0197RK

Revision: A

Released: 6/11/20

WARNING

Read and understand this instruction manual before operating transmitter. Improper use of the transmitter could result in bodily harm or death.

Periodic calibration and maintenance of the transmitter is essential for proper operation and correct readings. Please calibrate and maintain this transmitter regularly! Frequency of calibration depends upon the type of use you have and the sensor types. Typical calibration frequencies for most applications are between 3 and 6 months, but can be required more often or less often based on your usage.

Product Warranty

RKI Instruments, Inc. warrants gas alarm equipment sold by us to be free from defects in materials, workmanship, and performance for a period of one year from date of shipment from RKI Instruments, Inc. Any parts found defective within that period will be repaired or replaced, at our option, free of charge. This warranty does not apply to those items which by their nature are subject to deterioration or consumption in normal service, and which must be cleaned, repaired, or replaced on a routine basis. Examples of such items are:

- a) Absorbent cartridges
- b) Pump diaphragms and valves
- c) Fuses
- d) Batteries
- e) Filter elements

Warranty is voided by abuse including mechanical damage, alteration, rough handling, or repair procedures not in accordance with the operator's manual. This warranty indicates the full extent of our liability, and we are not responsible for removal or replacement costs, local repair costs, transportation costs, or contingent expenses incurred without our prior approval.

THIS WARRANTY IS EXPRESSLY IN LIEU OF ANY AND ALL OTHER WARRANTIES AND REPRESENTATIONS, EXPRESSED OR IMPLIED, AND ALL OTHER OBLIGATIONS OR LIABILITIES ON THE PART OF RKI INSTRUMENTS, INC. INCLUDING BUT NOT LIMITED TO, THE WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. IN NO EVENT SHALL RKI INSTRUMENTS, INC. BE LIABLE FOR INDIRECT, INCIDENTAL, OR CONSEQUENTIAL LOSS OR DAMAGE OF ANY KIND CONNECTED WITH THE USE OF ITS PRODUCTS OR FAILURE OF ITS PRODUCTS TO FUNCTION OR OPERATE PROPERLY.

This warranty covers instruments and parts sold to users by authorized distributors, dealers, and representatives as appointed by RKI Instruments, Inc.

We do not assume indemnification for any accident or damage caused by the operation of this gas monitor, and our warranty is limited to the replacement of parts or our complete goods.

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Overview

This manual describes the 65-2330RK hydrogen sulfide (H₂S) transmitter. This manual also describes how to install, start up, maintain, and calibrate the transmitter when using it with a gas monitoring controller. A parts list at the end of this manual lists replacement parts and accessories for the H₂S transmitter. See the controller operator's manual for information specific to the controller.

Specifications

WARNING: Do not use this product in a manner not specified in this instruction manual.

Table 1 lists specifications for the H₂S transmitter.

Table 1: Specifications

Target Gas	Hydrogen sulfide (H ₂ S)
Sampling Method	Diffusion
Signal Output	4 to 20 mA
Detection Range	0 to 100 ppm (parts per million)
Accuracy	± 5% of reading or ± 2 ppm H ₂ S (whichever is greater)
Response Time	90% in 30 seconds
Operating Temperature	-40°F to 104°F (-40°C to 40°C)

WARNING: When using the 65-2330RK, you must follow the instructions and warnings in this manual to assure proper and safe operation of the 65-2330RK and to minimize the risk of personal injury. Be sure to maintain and periodically calibrate the 65-2330RK as described in this manual.

Description

This section describes the components of the H₂S transmitter. The H₂S transmitter is a 4-20 mA type detector head. It consists of the H₂S detector, amplifier, and junction box.

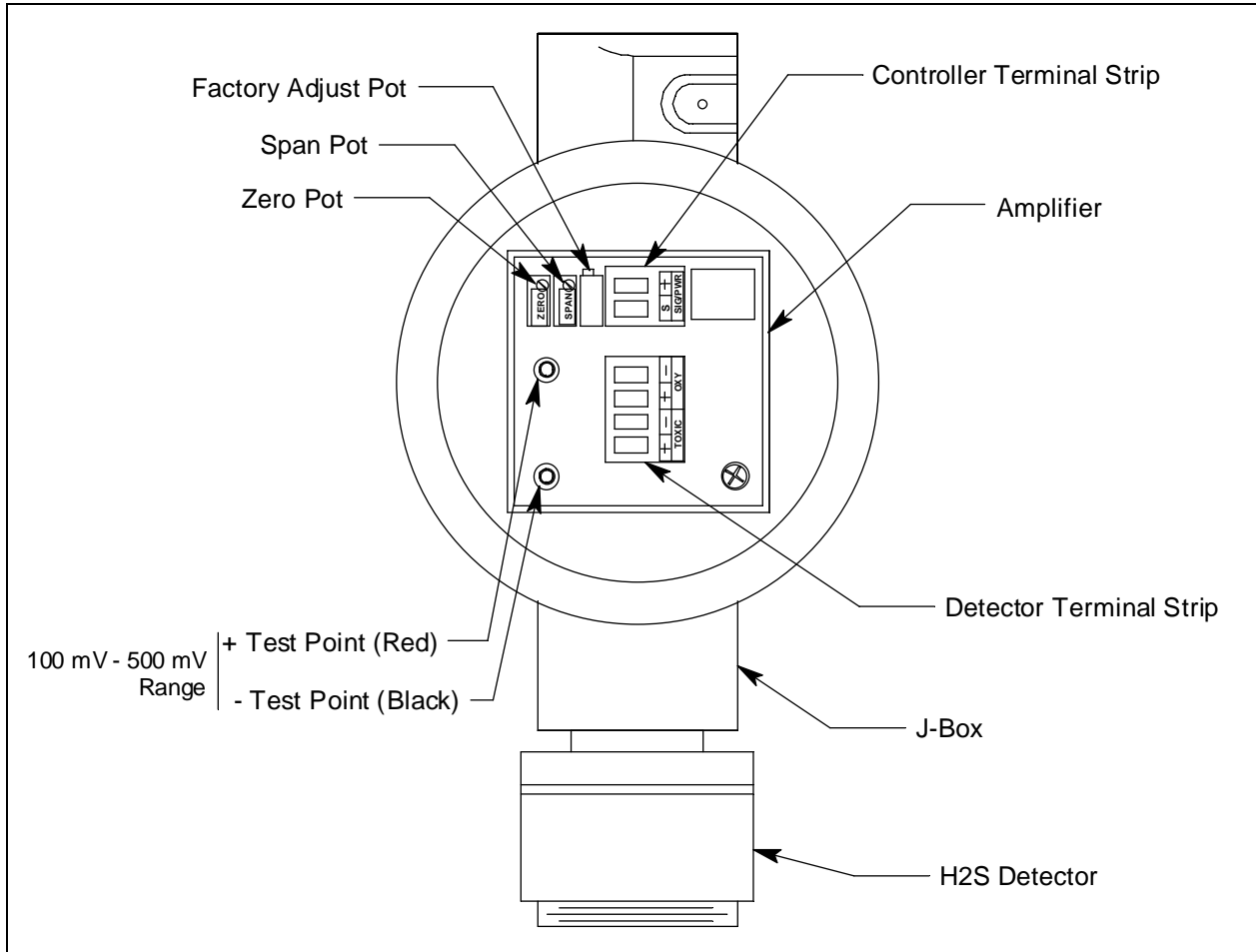


Figure 1: H₂S Transmitter Component Location

H₂S Detector

The H₂S detector consists of the detector housing body, detector housing cap, cap gasket, and the plug-in sensor.

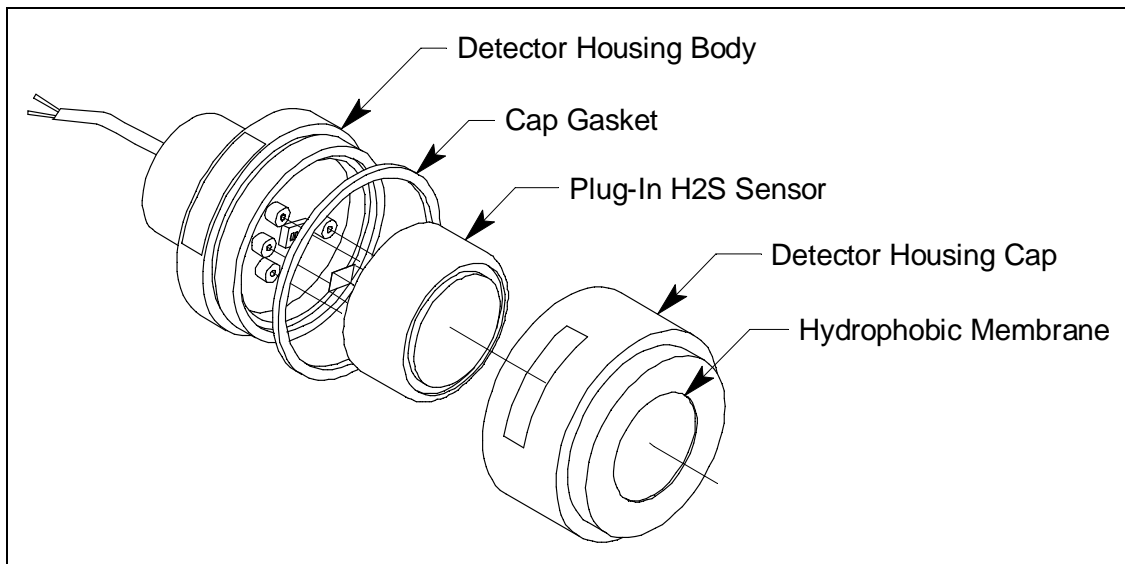


Figure 2: H₂S Detector Component Location

Detector Housing Body

The detector housing body protects the electronic components within the housing. Use the mounting threads at the top of the housing to screw the H₂S detector into the 3/4 NPT hub on the bottom of the junction box. Two wires extend from the top of the detector housing body. Use these wires to connect the H₂S detector to the amplifier. One of the wires is red and one of the wires is black.

The housing includes a four-socket pattern. This socket pattern accepts the sensor's four pins to secure the sensor within the detector housing. A pre-amplifier, located between the sockets and two interconnect wires, conditions the sensor's signal before the signal reaches the controller.

Housing Cap & Cap Gasket

The housing cap screws onto the detector housing. It retains the plug-in sensor and protects it from damage. A foam gasket inside the housing cap seals against the face of the sensor when the cap is screwed onto the housing body. A hydrophobic membrane on the outside of the cap face keeps water and particulates away from the sensor face behind the cap. Unscrew the detector cap to access the plug-in sensor for maintenance or replacement. A cap gasket seals the interface between the housing and cap.

Plug-In H₂S Sensor

The sensor is secured within the detector assembly by the housing cap. Through a series of chemical and electrical reactions, the sensor produces an electrical output that corresponds to the detection range of the transmitter.

Amplifier

The amplifier converts the electrical output from the sensor to a 4 to 20 mA signal that corresponds to the detection range and transmits the signal to a gas monitoring controller. A foam gasket that orients the amplifier and keeps it from rotating is installed on the bottom of the amplifier. The amplifier includes the controller terminal strip, detector terminal strip, zero pot, span pot, and test points (Figure 1).

Controller Terminal Strip

The interconnect terminal strip is a two position plug-in style terminal strip located at the top edge of the amplifier. Use the controller terminal strip to connect the amplifier to a controller.

Detector Terminal Strip

The detector terminal strip is a four-point plug-in style terminal strip near the bottom of the amplifier. Use the detector terminal strip to connect the H₂S detector to the amplifier.

NOTE: The H₂S detector is factory-wired to the detector terminal strip. See the Installation section of this manual for all wiring procedures related to the transmitter.

Zero Pot

The zero pot is located in the upper left corner of the amplifier (see Figure 1). Use a small flat blade screwdriver to turn the zero pot's adjustment screw and adjust the amplifier's zero (H₂S free) output during the start-up and calibration procedures. Turn the adjustment screw clockwise to increase the zero output and counterclockwise to decrease the zero output.

Span Pot

The span pot is located to the right of the zero pot (see Figure 1). Use a small flat blade screwdriver to turn the span pot's adjustment screw and adjust the amplifier's response output during the calibration procedure. Turn the adjustment screw clockwise to increase the output and counterclockwise to decrease the output.

CAUTION: *The third potentiometer is factory-set. Do not adjust it.*

Test Points

The test points (red and black) are on the left side of the amplifier (see Figure 1). The test points produce a 100 mV to 500 mV output that corresponds to the transmitter's 4 to 20 mA output. Use the test points and a voltmeter to measure the transmitter's output during the start-up and calibration procedures. The black test point in the lower left corner is the negative (-) test point and the red test point below the zero pot is the positive (+) test point.

Junction Box

Use the junction box to install the H₂S transmitter at a mounting site that is remote from the controller. The junction box protects the amplifier and wiring connections made to the amplifier. Use the top 3/4 NPT conduit hub to connect wiring from the amplifier to the controller. Use the cover on the front of the junction box to access the interior of the junction

box. Three spacers installed on the back of the junction box control the distance of the junction box from a mounting surface and ensure that there is enough room to install a calibration cup on the detector during calibration.

Installation

This section describes procedures to mount the H₂S transmitter in the monitoring environment and wire the transmitter to a controller.

Mounting the H₂S Transmitter

1. Select a mounting site that is representative of the monitoring environment. Consider the following when you select the mounting site.
 - Select a site where the transmitter is not likely to be bumped or disturbed. Make sure there is sufficient room to perform start-up, maintenance, and calibration procedures.
 - Select a site that is at normal breathing level.

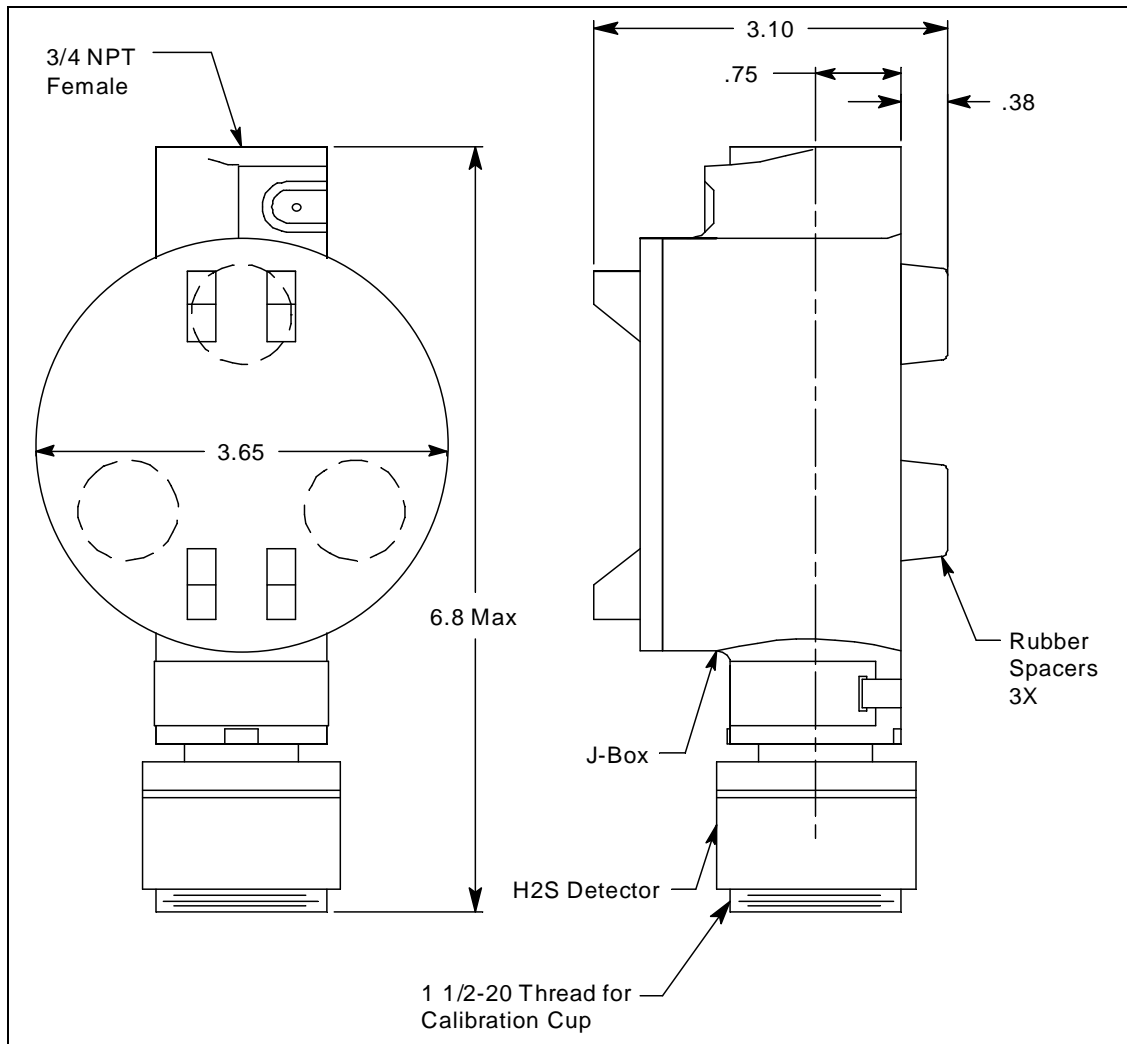


Figure 3: Mounting the H₂S Transmitter

2. At the monitoring site you select, hang or mount the junction box with the detector facing down (see Figure 3).

Wiring the H₂S Transmitter to a Controller

WARNING: Always verify that power to the controller is OFF before you make wiring connections.

1. Turn off the controller.
2. Turn off power to the controller.
3. Remove the junction box cover.
4. The detector leads are factory wired. Verify that the detector leads are wired to the amplifier's detector terminal strip as shown in Figure 4.
5. To gain access to a plug-in terminal strip for wiring, pull it out of its socket by grasping the terminal strip and pulling. The detector terminal strip is keyed so that the controller and detector terminal strips cannot be reversed inadvertently.
6. Guide a two-conductor, shielded cable, or two wires in conduit through the top conduit hub of the junction box.
7. Pull out the controller terminal strip and connect the two wires to the terminal strip as follows (see Figure 4).
 - Connect the positive wire to the terminal labeled **SIG/PWR “+”** terminal.
 - Connect the signal wire to the terminal labeled **SIG/PWR “S”** terminal.

CAUTION: If shielded cable is used, leave the cable shield's drain wire insulated and disconnected at the transmitter. You will connect the opposite end of the cable's drain wire to the controller's chassis (earth) ground.

8. Reinstall the controller terminal strip into its socket.
9. Secure the junction box cover to the junction box.
10. Route the cable or wires leading from the H₂S transmitter through one of the conduit hubs at the controller housing.

CAUTION: Do not route power and transmitter wiring through the same controller conduit hub. The power cable may disrupt the transmission of the transmitter signal to the controller.

11. Connect the wires to the applicable detector/transmitter terminal strip at the controller as shown in Figure 4.

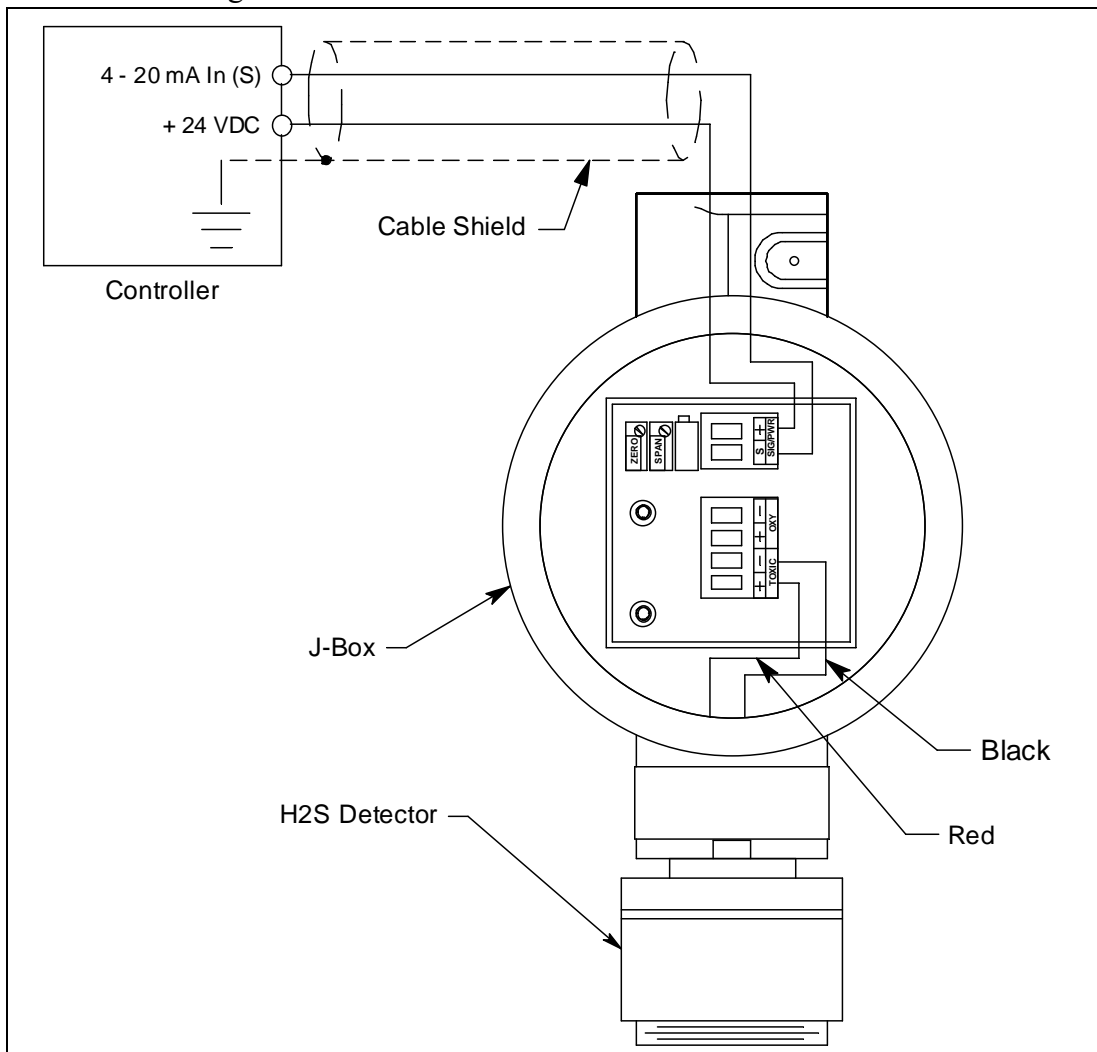


Figure 4: Wiring the H₂S Transmitter to a Controller

12. If shielded cable is used, connect the cable's drain wire to an available chassis (earth) ground at the controller. RKI controllers typically have a ground stud that can be used to ground the cable's drain wire.

Start Up

This section describes procedures to start up the H₂S transmitter and place the transmitter into normal operation.

Introducing Incoming Power

1. Complete the installation procedures described earlier in this manual.
2. Verify that the power wiring to the controller is correct and secure. Refer to the controller operator's manual.

3. Turn on power to the controller.
4. Turn on the controller.
5. Verify that the controller is on and operating properly. Refer to the controller operator's manual.

CAUTION: Allow the transmitter to warm up for 5 minutes before you continue with the next section, "Setting the Zero Signal".

Setting the Zero Signal

NOTE: If you can verify that the detector is in a fresh air environment (environment known to be of normal oxygen content and free of toxic and combustible gases), it is not necessary to apply zero air when verifying or setting the fresh air reading.

The procedure below describes applying zero emission air, usually called zero air, using a calibration kit that includes a calibration cup, calibration gas, sample tubing, and a fixed flow regulator with an on/off knob. RKI Instruments, Inc. recommends using a 0.5 LPM (liters per minute) fixed flow regulator.

1. Unscrew and remove the junction box cover from the junction box.
2. Set a voltmeter to measure in the millivolt (mV) range.
3. Plug the voltmeter leads into the test points on the amplifier. Plug the positive lead into the red (+) test point; plug the negative lead into the black (-) test point.
4. Screw the calibration cup onto the bottom of the H₂S detector.
5. Screw the regulator into the zero air calibration cylinder.
6. Use the sample tubing to connect the regulator to the calibration cup.
7. Turn the regulator's on/off knob counterclockwise to open it. Gas will begin to flow.
8. Allow the gas to flow for two minutes.
9. Verify a voltmeter reading of 100 mV (± 2 mV).
10. If necessary, use a small flat-blade screwdriver to adjust the zero pot until the voltmeter reading is 100 mV (± 2 mV).
11. Turn the regulator's on/off knob clockwise to close it.
12. Unscrew the calibration cup from the detector.
13. Unscrew the regulator from the zero air calibration cylinder. For convenience, leave the sample tubing connected to the regulator and the calibration cup.
14. Store the components of the calibration kit in a safe and convenient place.
15. Remove the voltmeter leads from the test points.
16. Secure the junction box cover to the junction box.

Maintenance

This section describes maintenance procedures. It includes preventive maintenance, troubleshooting, and component replacement procedures.

Preventive Maintenance

This section describes a preventive maintenance schedule to ensure the optimum performance of the H₂S transmitter. It includes daily and quarterly procedures.

Daily

Verify a display reading of 0 ppm H₂S at the controller. Investigate significant changes in the display reading.

Quarterly

Calibrate the H₂S transmitter as described in “Calibration” on page 18. See the calibration frequency discussion in “Calibration Frequency” on page 17 to determine if a quarterly calibration schedule fits your needs.

Troubleshooting

The troubleshooting guide describes symptoms, probable causes, and recommended action for problems you may encounter with the H₂S transmitter.

NOTE: This troubleshooting guide describes transmitter problems only. See the controller operator’s manual for problems you may encounter with the controller.

Table 2: Troubleshooting H₂S Transmitter

Condition	Symptom(s)	Probable Causes	Recommended Action
Fail Condition	<ul style="list-style-type: none">Controller indicates a fail condition.	<ul style="list-style-type: none">The transmitter wiring to the controller is disconnected or misconnected.The plug-in sensor is not properly plugged into the sockets in the detector housing body.The wiring from the detector to the amplifier is disconnected or misconnected.The transmitter’s zero reading is low enough to cause a fail condition.The transmitter is malfunctioning.	<ol style="list-style-type: none">Verify that the transmitter wiring to the controller is correct and secure.Confirm that the plug-in sensor is installed properly.Verify that the wiring from the detector to the amplifier is correct and secure.Perform a fresh air adjustment. A full calibration is recommended.If the fail condition continues, replace the plug-in sensor as described later in this section.If the fail condition continues, contact RKI for further instruction.

Condition	Symptom(s)	Probable Causes	Recommended Action
Slow or No Response/ Difficult or Unable to Calibrate	<ul style="list-style-type: none"> Unable to accurately set the zero or response reading during calibration. Transmitter requires frequent calibration. <p><i>Note: Under "normal" circumstances, the transmitter requires calibration once every 3 months. Some applications may require a more frequent calibration schedule.</i></p>	<ul style="list-style-type: none"> The calibration cylinder is low, out-dated, or defective. The hydrophobic membrane in the detector housing cap is wet or clogged with dirt or other particulates. The calibration gas is not an appropriate concentration. The transmitter is malfunctioning. 	<ol style="list-style-type: none"> Verify that the calibration cylinder contains an adequate supply of a fresh test sample. Check the face of the detector housing cap and remove any particulate contamination from the hydrophobic membrane if necessary. If the membrane appears saturated with contamination or damaged, replace the membrane as described in the next section. Verify that the calibration gas concentration is appropriate for the transmitter. Zero emission air (20.9% oxygen) is normally used for a zero adjustment if the environment is suspect and 25 PPM H₂S in nitrogen is normally used for a response test. If the calibration/response difficulties continue, replace the plug-in sensor as described later in this section. If the calibration/response difficulties continue, contact RKI for further instruction.

Replacing Components of the H₂S Transmitter

This section includes a procedure to replace the H₂S plug-in sensor, the entire detector assembly, the hydrophobic membrane, and the amplifier. In most cases, it is not necessary to replace the entire detector assembly.

Replacing the Plug-In H₂S Sensor

CAUTION: *The sensor contains electrolyte which is a dilute acid. Do not disassemble the sensor when replacing it with a new one. If sensor electrolyte comes in contact with your skin, wash affected area thoroughly with soap and water.*

- Turn off the controller.
- Turn off or unplug power to the controller.
- Unscrew the detector housing cap from the detector housing body. Make sure not to lose the cap gasket.
- Unplug and remove the H₂S sensor.
- Remove the replacement sensor from its packaging and remove the wire jumper. This wire jumper is installed on the sensor pins for shipment or storage but must be removed for the sensor to operate properly when installed in a detector.

WARNING: *The H₂S sensor will not operate properly if the wire jumper is not removed.*

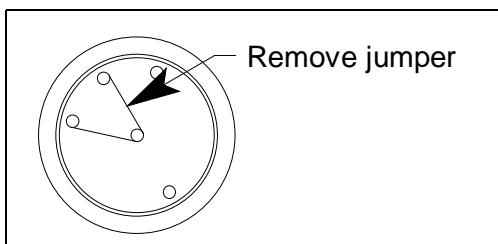


Figure 5: Plug-In Sensor Jumper Removal

6. Carefully plug the replacement sensor into the four-socket pattern that is located in the detector housing.
7. Make sure the cap gasket is in place and screw the detector housing cap back onto the detector housing body.
8. Turn on or plug in power to the controller.
9. Turn on the controller and place into normal operation.

CAUTION: *Allow the replacement sensor to warm up for 5 minutes before you continue with the next step.*

10. Calibrate the transmitter as described in “Calibration” on page 18.

Replacing the H₂S Detector

NOTE: In most cases, it is only necessary to replace the plug-in H₂S sensor.

1. Turn off the controller.
2. Turn off or unplug power to the controller.
3. Remove the junction box cover.
4. Remove the detector terminal strip from its socket.
5. Disconnect the detector leads from the detector terminal strip. Note the position of the color-coded leads as you remove them.
6. Unscrew the detector from the junction box conduit hub.
7. Guide the detector leads of the replacement detector through the bottom conduit hub of the junction box, then screw the mounting threads of the detector into the conduit hub. If necessary for environmental conditions, apply thread sealant or Teflon tape to the hub and/or detector threads to seal them.
8. Connect the detector leads to the appropriate detector terminal strip terminals. Connect the red wire to the terminal labeled TOXIC + and the black wire to the terminal labeled TOXIC -. See Figure 4 for the detector wiring connections to the amplifier.

9. Reinstall the detector terminal strip into its socket.
10. Turn on or plug in power to the controller.
11. Turn on the controller and place it into normal operation.

CAUTION: Allow the replacement detector to warm up for 5 minutes before you continue with the next step.

12. Calibrate the replacement detector as described in “Calibration” on page 18.
13. Secure the junction box cover to the junction box.

Replacing the Hydrophobic Membrane

1. Turn off the controller.
2. Turn off or unplug incoming power to the controller.
3. Unscrew the detector housing cap from the detector housing body.
4. Gently pry up the edge of the white hydrophobic membrane with a small flat blade screwdriver or a similar tool.
5. Peel off the hydrophobic membrane. It may be necessary to clean off the detector housing cap face to remove any residue left from the adhesive backed membrane.
6. Install the new membrane in the recess on the face of the detector housing cap.
7. Make sure the cap gasket is in place and screw the detector housing cap back onto the detector housing body.
8. Turn on power to the controller.
9. Turn on the controller.

Replacing the Amplifier

1. Turn off the controller.
2. Turn off or unplug power to the controller.
3. Remove the junction box cover.
4. Unplug the detector terminal strip and controller terminal strip from their sockets. You may leave the wires connected to the terminal strips.
5. Unscrew and remove the screw with the flat and lock washers that secures the amplifier to the junction box. The screw is at the bottom right of the amplifier.
6. Remove the old amplifier.
7. Place the new amplifier in the same position as the old amplifier. A foam gasket that orients the amplifier and keeps it from rotating is installed on the bottom of the amplifier. Make sure the amplifier is seated flat in the junction box.
8. Install the new amplifier into the junction box with the screw, lock washer, and flat washer you removed in Step 5.

9. Install the detector and controller terminals strips into their sockets on the new amplifier as shown in Figure 4. If controller leads or detector leads were removed during this procedure, refer to Figure 4 for the detector and amplifier connections.

NOTE: When a transmitter is first powered up with a new amplifier, the initial output may be either high or below zero depending on the setting of the zero pot. Be sure to make arrangements so that this does not cause unwanted alarms.

10. Turn on or plug in power to the controller.
11. Turn on the controller and place it into normal operation.
12. Allow the transmitter to warm up for 5 minutes.
13. Calibrate the H₂S transmitter as described in “Calibration” on page 18.

Calibration Frequency

Although there is no particular calibration frequency that is correct for all applications, a calibration frequency of every 3 months is adequate for most H₂S transmitter applications. Unless experience in a particular application dictates otherwise, RKI Instruments, Inc. recommends a calibration frequency of every 3 months for the H₂S transmitter.

If an application is not very demanding, for example detection in a clean, temperature controlled environment, and calibration adjustments are minimal at calibration, then a calibration frequency of every 6 months is adequate.

If the application is very demanding, for example if the environment is not well controlled, then more frequent calibration than every 3 months may be necessary.

Calibration

This section describes how to calibrate the H₂S transmitter. It includes procedures to prepare for calibration, set the zero reading, set the response reading, and return to normal operation. It describes the test using a calibration kit that includes a calibration cup, calibration gas, sample tubing, and a fixed flow regulator with an on/off knob. RKI Instruments, Inc. recommends using a 0.5 LPM (liters per minute) fixed flow regulator.

Preparing for Calibration

NOTE: Calibrating the H₂S transmitter may cause alarms. Be sure to put the controller into its calibration program or disable external alarms before calibration.

WARNING: Do not remove the detector housing cap or junction box cover while the circuits are energized unless the area is determined to be non-hazardous. Keep the detector housing cap and junction box cover tightly closed during operation.

1. Unscrew and remove the junction box cover.
2. Set a voltmeter to measure in the millivolt (mV) range.
3. Plug the voltmeter leads into the test points on the amplifier. Plug the positive lead into the red (+) test point; plug the negative lead into the black (-) test point.
4. Use the following formula to determine the correct test points output for the calibrating sample.

$$\text{Output (mV)} = (\text{calibrating sample/fullscale}) \times 400 + 100$$

For example, with a calibrating sample of 25 ppm H₂S and a fullscale setting of 100 ppm, the correct output is 200 mV.

$$200 \text{ (mV)} = (25/100) \times 400 + 100$$

5. Screw the calibration cup onto the detector housing.

Setting the Zero Reading

NOTE: If you can verify that the H₂S transmitter is in a fresh air environment, you do not need to apply zero air to the detector before adjusting the zero reading.

1. Screw the regulator into the zero air calibration cylinder.
2. Use the sample tubing to connect the regulator to the calibration cup.
3. Turn the regulator knob counterclockwise to open the regulator.
4. Allow the gas to flow for two minutes, then verify a reading of 100 mV (± 2 mV). If necessary, use the zero pot on the amplifier to adjust the reading to 100 mV (± 2 mV).

5. Turn the regulator knob clockwise to close the regulator.
6. Unscrew the regulator from the zero air calibration cylinder.
7. Leave the sample tubing connected to the regulator and the calibration cup.

Setting the Response Reading

1. Verify that the calibration gas is representative of the transmitter's target gas.
2. For toxic gas cylinders (like H₂S), it is important to vent the regulator while installing it onto the cylinder. Venting the regulator during installation helps prevent air from getting into the cylinder and degrading the gas. Open the regulator by turning the knob counterclockwise and then install it onto the cylinder.
3. Allow the gas to flow for two minutes, then verify that the reading matches the response reading ($\pm 2\text{mV}$) you determined earlier. If necessary, use the span pot on the amplifier to adjust the reading to match the correct response reading.
4. Turn the regulator knob clockwise to close the regulator.
5. Unscrew the regulator from the calibration cylinder.

Returning to Normal Operation

1. Remove the voltmeter leads from the amplifier test points.
2. Unscrew the calibration cup from the detector.

NOTE: For convenience, leave the components of the calibration kit connected by the sample tubing.

3. Secure the junction box cover to the junction box.
4. When the display reading falls below the alarm setpoints, return the controller to normal operation.
5. Verify that the controller display reading decreases and stabilizes at 0 ppm.
6. Store the components of the calibration kit in a safe and convenient place.

Parts List

Table 5 lists replacement parts and accessories for the H₂S transmitter.

Table 3: Parts List

Part Number	Description
06-1248RK	Sample tubing (order by the foot)
07-0033RK	Detector housing cap gasket
18-0400RK-01	Junction box with rubber spacers
57-1064RK-03	Amplifier (specify target gas when ordering)
65-2330RK	H ₂ S transmitter (includes detector and amplifier)
65-2495RK	H ₂ S replacement detector assembly (includes sensor)
71-0176RK	65-2330RK H ₂ S Transmitter Operator's Manual (this document)
81-0151RK-04	Calibration cylinder, 25 ppm H ₂ S in nitrogen, 34 liter aluminum
81-0076RK-01	Zero air calibration cylinder, 34 liter steel
81-1050RK	Regulator with gauge and knob, 0.5 LPM, for 17 liter and 34 liter steel calibration cylinders (cylinders with external threads)
81-1051RK	Regulator with gauge and knob, 0.5 LPM, for 34 liter aluminum, 58 liter, and 103 liter calibration cylinders (cylinders with internal threads)
81-1117RK	Calibration cup
ES-1537-H2S	H ₂ S replacement sensor