35-3000RKA-10
PPM Hexane Sample Draw Detector Operator's Manual

Part Number: 71-0151RK

Revision P1

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RKI Instruments, Inc.
www.rkiinstruments.com

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 the 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. Parts must be returned to RKI Instruments, Inc. for repair or replacement. 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) Pump diaphragms and valves

b) Fuses

c) Batteries

d) Filter elements

Warranty is voided by abuse including mechanical damage, alteration, rough handling, or repair procedures not in accordance with instruction manual. This warranty indicates the full extend 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.

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This warranty covers instruments and parts sold to users only 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. Warranty covers parts and labor performed at RKI Instruments, Inc. only, and does not cover field labor or shipment of parts back to RKI.

Table of Contents

Overview

This manual describes the 35-3000RKA-10 ppm hexane sample draw detector. This manual also describes how to install, start up, configure, maintain, and calibrate the sample draw detector when it is used with a gas monitoring controller. A parts list at the end of this manual lists replacement parts and accessories for the sample draw detector.

Specifications

Table 1 lists specifications for the sample draw detector.

Table 1:Specifications

Description	Specification
Input Power	18 - 30 VDC
Target Gas	Combustible Gas, Calibrated to Hexane
Detection Range	0-500 ppm Hexane
Construction	Fiberglass/polyester NEMA 4X Housing
Dimensions	8.5 in. H x 6.5 in W x 4.25 in. D
Weight	4.5 pounds
Sampling Method	Sample Draw
Sample Flow	1.5 SCFH nominal
Signal Output	4 to 20 mA, 500 ohm impedance max.
Response Time	90% in 30 seconds
Accuracy	± 5% of detection range

Description

This section describes the components of the sample draw detector. It is a 4 to 20 mA type detector head. The sample draw detector consists of the housing, flow system, and detection system.

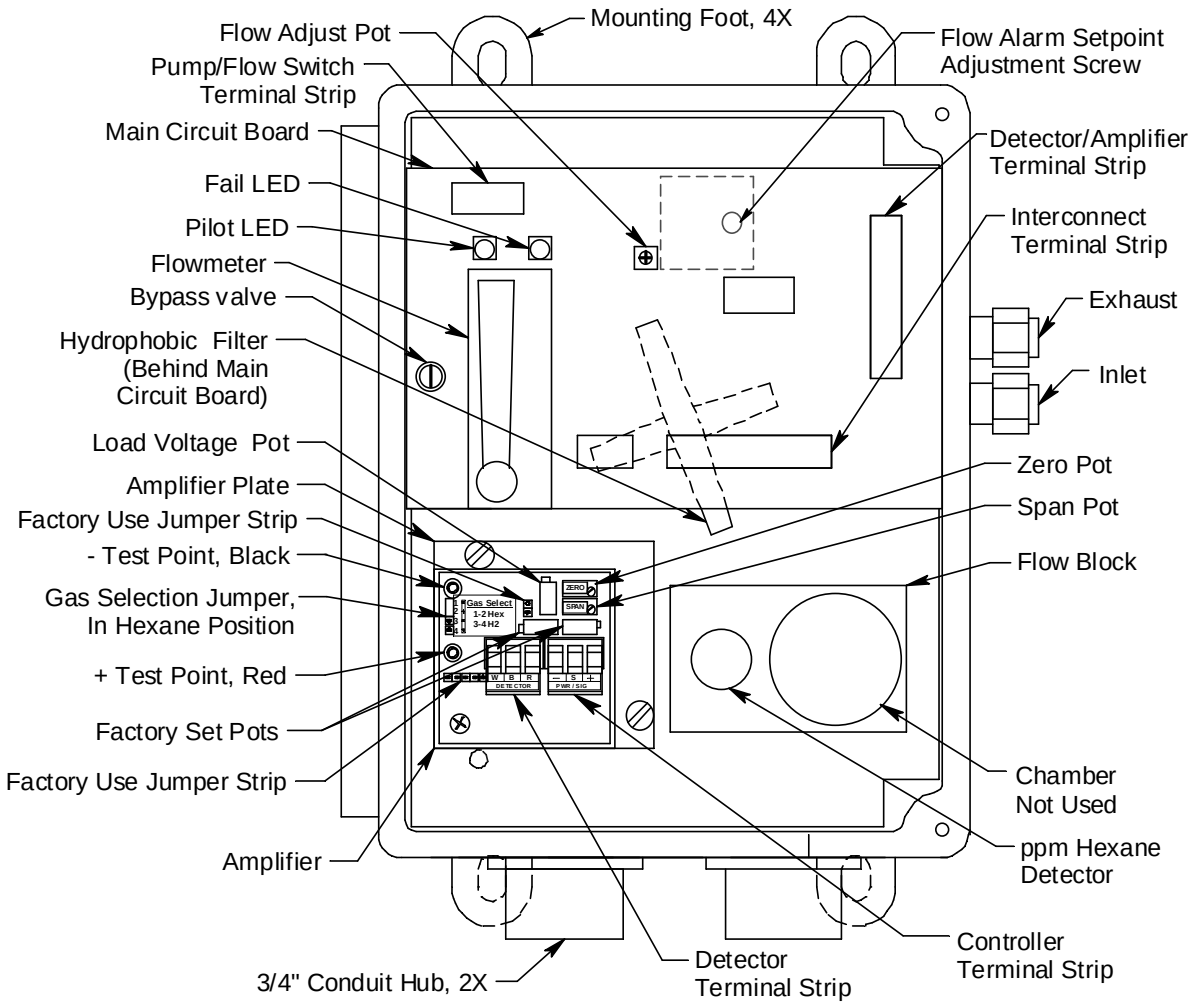


Figure 1: Component Location

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 LEDs 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, exhaust fitting, pump, flowmeter, bypass valve, flow block, status LEDs, and pressure switch (see Figure 1). Figure 2 below illustrates how the gas sample moves through the flow system.

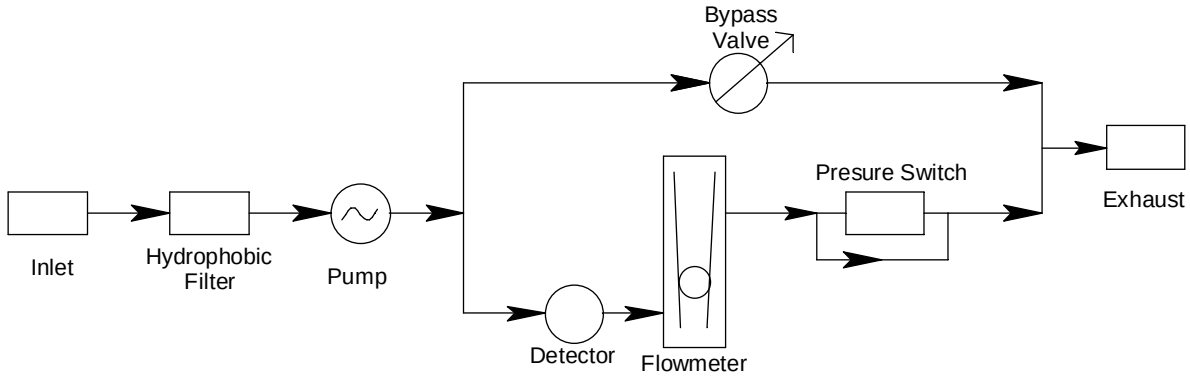


Figure 2: Flow Diagram

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 "Connecting the Sample Lines to the Sample Draw Detector" on page 11 to connect tubing to the inlet fitting.

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 "Connecting the Sample Lines to the Sample Draw Detector" on page 11 to connect tubing to the exhaust fitting.

Hydrophobic Filter

The hydrophobic filter is behind the main circuit board near the bottom edge of the board. The filter prevents particulates and water 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 detector. Use a flat-blade screwdriver to adjust the bypass valve.

NOTE: The bypass valve allows fine adjustments of the flow rate to the detector. To adjust the total flow and for a wider range of adjustment, use the flow adjust pot (see Figure 1).

Flow Block

The flow block is an aluminum block with a chamber for the detector and passages that route the sample to and from the detector. It is located in the lower right corner of the sample draw detector. The flow block has an unused chamber that is used for an oxygen detector in other versions of the 35-3000RK.

Status LEDs

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

Pilot LED

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

Fail LED

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

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 SC FH). See “Adjusting the Low Flow Setting” on page 20 to adjust this setting if necessary.

Detection System

The detection system consists of the ppm hexane detector, the amplifier, and the main circuit board.

PPM Hexane Detector

The ppm hexane detector is a MOS type (metal oxide semiconductor) detector packaged in a 5 pin plug-in detector housing with a sintered metal flame arrestor on one end allowing ambient air to diffuse into the detector. The flame arrestor also contains any sparks which may occur within the detector. The 5 pins allow you to connect the detector to the detector cable which has a mating 5 pin connector. The three color-coded leads of the detector cable allow you to connect the detector to the amplifier. The output of the detector is non-linear and is linearized by the amplifier (see below).

The detector is installed in an aluminum flow block. The flow block is mounted to the aluminum subpanel near the bottom right corner of the sample draw detector.

NOTE: The flow block includes a chamber for an oxygen sensor. This version of the sample draw detector does not include the oxygen sensor.

Amplifier

The amplifier is mounted to the left of the detector. It is installed on a small plate with adhesive foam and the plate is mounted to two standoffs. The amplifier converts the non-linear electrical output from the detector to a linear 4 to 20 mA signal that corresponds to the detection range and transmits the signal to a gas monitoring controller. The amplifier consists of the span pot, zero pot, load voltage pot, gas select jumper strip, controller terminal strip, detector terminal strip and test points.

Zero Pot

The zero pot is located in the upper right 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 (fresh air) output during the start-up and calibration procedures.

Span Pot

The span pot is located below 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 gas response output during the calibration procedure.

Load voltage pot

The load voltage pot is located to the left of the zero and span pots (see Figure 1). The load voltage pot is not needed for normal scheduled maintenance, so it is a right angle pot that is not accessible unless the amplifier is lifted out of the sample draw detector enough to access the adjustment screw. Use a small flat blade screwdriver to turn the load voltage pot's adjustment screw and adjust the amplifier's detector load voltage when the detector or amplifier is replaced.

CAUTION: *The amplifier includes additional pots. They are factory-set. Do not adjust them.*

Gas Select Jumper Strip

The gas select jumper strip is a three position pin style terminal strip located in the upper left corner of the amplifier. A label next to the jumper strip indicates which pins must be shorted to select hexane or hydrogen. A jumper block is installed at the factory over pins 1 & 2 to select hexane as the gas type. The gas type defines the linearizing curve used by the amplifier to linearize the detector output.

Controller and Detector Terminal Strips

The controller terminal strip and detector terminal strip are three position terminal strips. The controller terminal strip is located on the right side of the amplifier and the detector terminal strip is to the right of it. Both terminal strips are factory wired to the sensor and main circuit board.

Test points

The test points are located on the left side of the amplifier. The black - test point is in the upper left corner and the red + test point is located below it on the other side of the gas select jumper strip. A 100 mV - 500 mV output is available at these test points for use during calibration.

Main Circuit Board

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

NOTE: The flowmeter and status LEDs 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 a controller.

Detector/Amplifier Terminal Strip

The detector / amplifier terminal strip is the nine-point terminal strip near the right edge of the circuit board. Use the detector / amplifier terminal strip to connect the amplifier to the main circuit board. In this version of the 35-3000RK the detector is not wired to the detector / amplifier terminal strip but is wired to the amplifier's detector terminal strip.

NOTE: The amplifier is factory wired to the sample draw detector's detector / amplifier terminal strip. See "Wiring the Sample Draw Detector" on page 11 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 pump terminal strip. See "Wiring the Sample Draw Detector" on page 11 for all wiring procedures related to the sample draw detector.

Relay

The relay is to the left of the detector / amplifier terminal strip. The amplifier output to the controller is routed through the relay contacts and if the pressure switch senses a low flow condition, the relay interrupts the output from the amplifier. The interrupted amplifier output causes a fail condition at the controller.

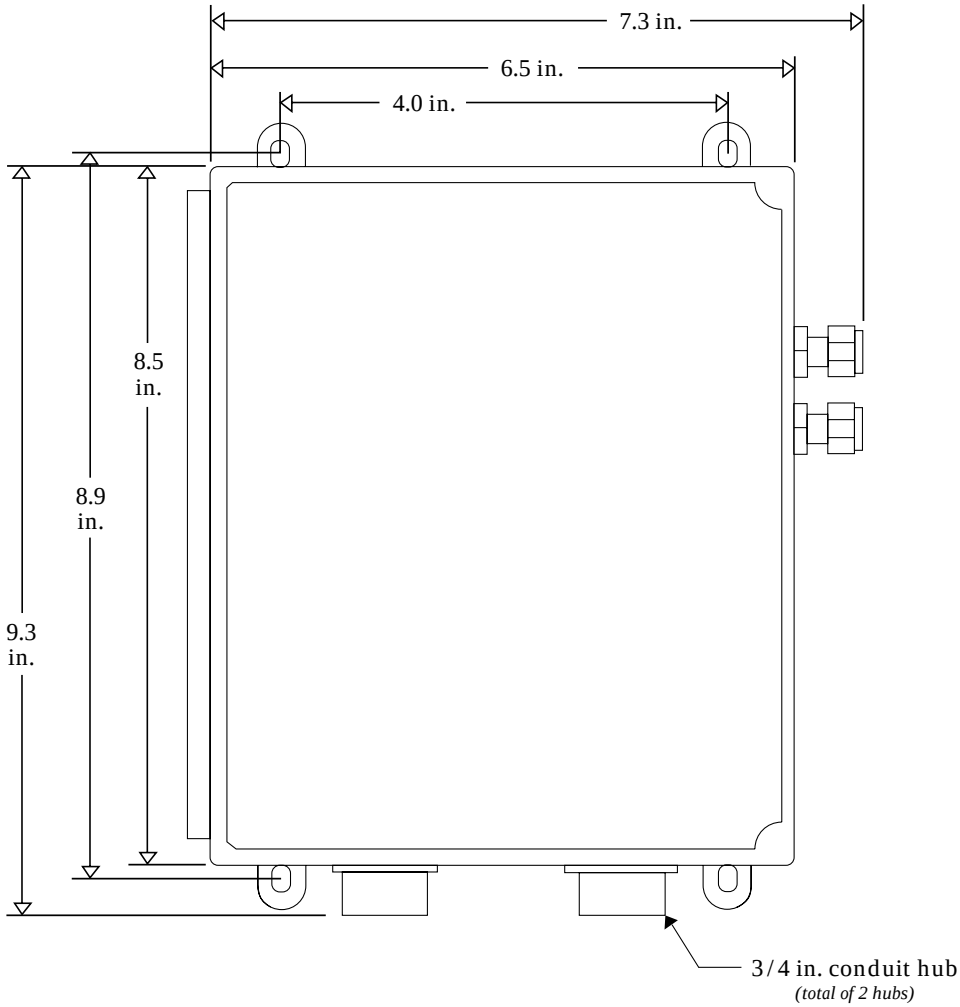
Installation

This section describes procedures to mount the sample draw detector in the monitoring environment and wire the sample draw detector to a controller.

Mounting the Sample Draw 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 LEDs visible?



Note: The housing is 4.25 in. deep.

Figure 3: Outline & Mounting Dimensions

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.

3. Slightly loosen the screw that secures one of the mounting feet 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 Detector

It is important to use the appropriate tubing material for the 0 - 500 ppm hexane sample draw detector. To avoid the possibility of losing sample in the inlet tubing, use either stainless steel, rigid polypropylene, or flexible polyurethane tubing.

1. Attach 1/4 inch O.D. stainless steel, polypropylene, or polyurethane sample tubing to the inlet fitting.

CAUTION: *If you use **flexible** sample tubing (polyurethane for example), use an appropriate metal insert to seal the connection between the tubing and the INLET fitting. See "Parts List" on page 26 for an example of an appropriate metal insert.*

2. Place the opposite end of the tubing in 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.*

3. Attach rigid sample tubing or flexible tubing with an appropriate insert 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 Detector

WARNING: Always verify that all power is off before making any wiring connections

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

CAUTION: ***If using shielded cable, leave the cable's drain wire disconnected and insulated at the sample draw detector. You will connect it to an available chassis ground at the controller.***

7. Route the shielded cable or wires in conduit leading from the sample draw detector to the controller.
8. Connect the cable's drain wire to an available chassis ground at the controller. A ground stud is typically a convenient location to connect to chassis ground in an RKI controller.

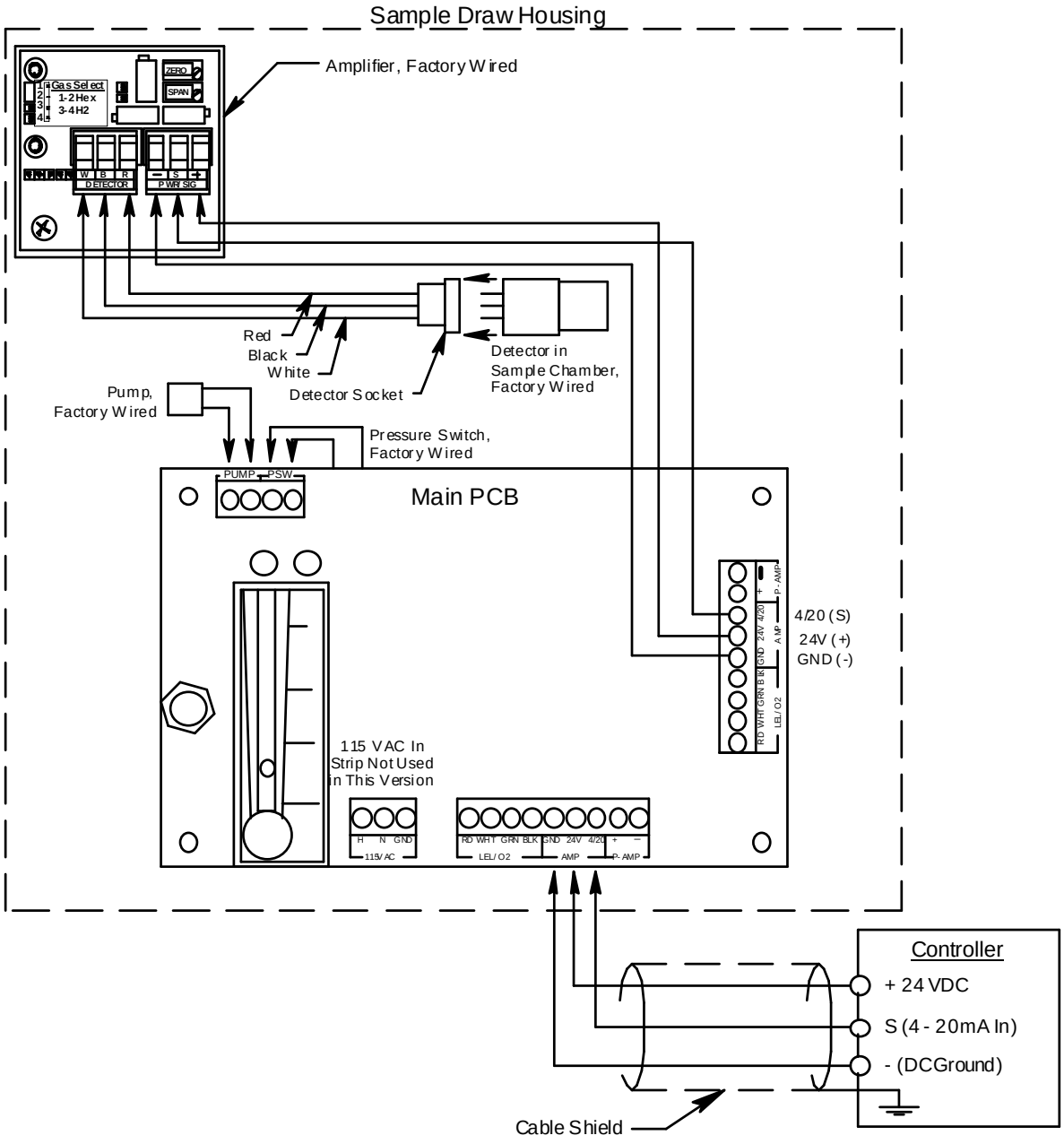


Figure 4: Internal and Field Wiring Diagram

Start Up

This section describes procedures to start up the sample draw 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 wiring to the controller is correct and secure.
3. Turn on or plug in the power to the controller.
4. Turn on the controller.
5. Verify that the Pilot LED is on.
6. Verify that the flowmeter indicates a flow rate of approximately 1.5 SCFH. If necessary, use the bypass valve or flow adjust pot 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 and a fail condition at the controller.

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7. 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.
8. Remove your thumb from the sample line, verify the flowmeter returns to a normal flow rate.

Sample Draw Detector Burn-In Period

Once power has been applied to the sample draw detector, it will take several days for the signal to the controller to stabilize completely. This is the burn-in period. The zero reading may be slightly above zero after startup and will stabilize in about 5 to 7 days. The sample draw detector is calibrated at the factory before shipment, so it is not necessary to calibrate the sample draw detector after startup. If calibration of the sample draw detector after startup is desired, wait at least 5 days after startup before calibrating the sample draw detector. A burn-in period of 7 days is recommended. See “Calibration” on page 23 for calibration instructions.

After the burn-in period, set the zero reading if needed as described in “Calibration” on page 23.

CAUTION: *Do not adjust the zero or span pots for at least 5 days after startup. If the fresh air reading is high enough to cause unwanted alarms during the burn-in period, adjust the zero pot only enough to bring the reading below the alarm point.*

Setting the Zero Reading

CAUTION: *If you suspect the presence of the target gas in the monitoring environment, see “Calibration” on page 23 for instructions to use the calibration kit and the zero air calibration cylinder to introduce “fresh air” to the sample draw detector 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 millivolt (mV) range.
4. 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.
5. Verify a voltmeter reading of 100 mV (± 2 mV).
6. If necessary, use a small flat-blade screwdriver to adjust the zero pot until the voltmeter reading is 100 mV (± 2 mV).
7. Remove the voltmeter leads from the test points.
8. 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 detector, adjust the low flow setting, and set the load voltage.

Preventive Maintenance

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

Daily

1. Verify that the pilot LED 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 pot 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 detector responds properly to the target gas.

NOTE: To reduce the response time of this test, use a short incoming sample line. If the sample draw detector's sample line is long, connect a shorter line for this test. Make sure you reconnect the sample line after you complete this procedure.

NOTE: Performing a response test on the sample draw detector may cause alarms. Be sure to put the controller into its calibration program or disable external alarms before performing this test.

NOTE: The following procedure assumes the use of a calibration kit that includes a calibration gas cylinder, a dispensing valve with an on / off knob, a gas bag, and a humidifier tube to connect the gas bag to the dispensing valve and to the sample draw detector inlet fitting. A demand flow regulator calibration kit is also available.

WARNING: The controller is not an active gas monitoring device during the response test.

Preparing for the response test

1. Verify that the display reading at the controller is 0 ppm.

   If the display reading is not 0, set the zero reading as described in "Calibration" on page 23, then continue this procedure.

2. Follow the instructions in the controller's operator's manual for entering calibration mode.
3. Set a voltmeter to measure in the millivolt (mV) range.
4. Open the housing door, then 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.

5. Use the following formula to determine the correct test points output for the test sample.

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

   For example, with a test sample of 250 ppm hexane and a fullscale setting of 500 ppm hexane, the correct output is 300 mV.

   300 (mV) = (250/500) X 400 +100

6. Run one end of the humidifier tube through the tubing clamp provided with the calibration kit and connect this end to the fitting on the gas collection bag.

WARNING: The humidifier tube used with this calibration kit includes polyurethane tubing on each end of the humidifier tube to facilitate making connections to hose barbs. Do not clamp on the middle braided tube section of the humidifier tube. Only clamp on the polyurethane tube on either end of the humidifier tube.

7. Connect the humidifier tube from the gas collection bag to the inlet sample line.

   Allow the sample-draw pump to draw out any residual gas in the gas collection bag.

8. Close the tubing clamp.

NOTE: This step will cause a low flow alarm.

9. Disconnect the humidifier tube from the inlet sample line.
10. Screw the dispensing valve onto the test gas cylinder.

11. Connect the humidifier tube from the gas collection bag to the dispensing valve, then open the clamp.
12. Turn the dispensing valve's on / off knob counterclockwise to open it. The gas collection bag begins to fill.
13. Turn the dispensing valve's on / off knob clockwise to close it when the gas collection bag appears full.
14. Close the tubing clamp, then disconnect the humidifier tube from the dispensing valve.
15. Remove the dispensing valve from the gas cylinder.

Performing the response test

1. Connect the humidifier tube from the gas collection bag to the inlet sample line.

   The sample draw detector's pump begins pulling the test sample from the gas collection bag when you connect the tubing to the inlet sample line.
2. After one minute, verify that the test points output stabilizes within ± 20% of the mV reading you determined earlier for the test sample. If the mV reading is not within ± 20% of the test sample, calibrate the sample draw detector as described in "Calibration" on page 23.
3. Remove the humidifier tube from the inlet sample line.
4. Remove the voltmeter leads from the amplifier test points.
5. Close the housing door.
6. Unscrew the dispensing valve from the gas cylinder.
7. Return the controller to normal operation.
8. Store the components of the calibration kit in a save place

Biannually

Calibrate the sample draw detector as described in the "Calibration" on page 23.

Troubleshooting

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

NOTE: This troubleshooting guide describes sample draw detector problems only. See the controller operator's manual if it exhibits any problems.

Fail condition

Symptoms

- The sample draw detector's Fail LED is on.
- The controller 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, clogged filter, failed pump, etc.
- The sample draw detector is malfunctioning.
- The detector or amplifier wiring is disconnected or misconnected.

Recommended action

1. Set the correct flow rate with the bypass valve or flow adjust pot.
2. If you cannot set the correct flow rate, check the sample lines for obstructions or kinks.
3. Inspect the hydrophobic filter to see if it is dirty or clogged with particulate matter or liquid.
4. Verify that the detector and amplifier wiring are correct and secure. “Installation” on page 10 describes sample draw detector wiring connections.
5. Calibrate the sample draw detector as described in “Calibration” on page 23.
6. If the fail condition continues, replace the detector as described later in this section.
7. 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 twice a year. Some applications may require a more frequent calibration schedule. See “Calibration Frequency” on page 23 for a discussion of the calibration requirements.

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 a demand flow regulator calibration kit is used, use a different demand flow regulator to determine if the original one if functioning properly.
3. If necessary, set the correct flow rate with the bypass valve or flow adjust pot.
4. If you cannot set the correct flow rate, check the sample line for obstructions or kinks.
5. If the calibration / response difficulties continue, replace the sensor as described later in this section.
6. If the calibration / response difficulties continue, contact RKI Instruments, Inc., for further instruction.

Replacing Components of the Sample Draw Detector

This section includes procedures to replace the detector, amplifier, hydrophobic filter, and ferrules.

Replacing the Detector

1. Turn off the controller

2. Turn off power to the controller.
3. Open the sample draw detector's housing door.
4. Unscrew and remove the two screws that secure the sensor retraining plate, then lift the plate, connector, and detector out of the housing.
5. Unplug the connector from the detector.
6. Verify that you are using the correct replacement sensor (SG-8521 is printed on the sensor), then plug the sensor into the connector.
7. Place the detector in the detector chamber, then position the retaining plate on the two standoffs.
8. Secure the retaining plate to the standoffs with the two screws you removed in Step 4.
9. Close and latch the housing door.
10. Turn on power to the controller.
11. Turn on the controller and place it into normal operation.
12. Allow the sample draw detector to run for 3 hours.
13. Make a preliminary setting of the detector load voltage. See "Setting the Detector Load Voltage" on page 21. This will be a temporary load voltage setting since the load voltage will need to be set again after the burn-in period as described below.
14. Perform a preliminary calibration. See "Calibration" on page 23. This will be a temporary calibration since the new detector must burn-in before it can be properly calibrated.
15. Allow the replacement detector to burn-in for at least 5 days before you continue with the next step. A burn-in period of 7 days is recommended.
16. After the burn-in period, set the load voltage as described in "Setting the Detector Load Voltage" on page 21.
17. After setting the load voltage, calibrate the as described in "Calibration" on page 23.

Replacing the Amplifier

If you are replacing the amplifier, it is likely that the sample draw detector has been off power for an extended period. Make sure to follow the preliminary load voltage and preliminary calibration recommendations and the burn-in period recommendation before making the final load voltage setting and calibration. The replacement amplifier is supplied already installed to a small mounting plate like the amplifier that is being replaced. All references to the amplifier below refer to an amplifier already installed on the amplifier mounting plate.

1. Turn off the controller.
2. Turn off power to the controller.
3. Open the housing door
4. Unplug the detector terminal strip and controller terminal strip from their sockets on the amplifier. You may leave the wires connected to the terminal strips.
5. Unscrew and remove the two screws, flat washers, and split lock washers that secure the old amplifier on its mounting plate to the mounting standoffs.
6. Remove the old amplifier with its mounting plate.
7. Install the detector and controller terminals strips into their sockets on the new amplifier. See Figure 1 on page 5 or Figure 5 on page 22 for the location of these terminal strips If controller leads or detector leads were removed during this procedure, refer to Figure 4 on page 12 for wiring connections.

8. Lay the new amplifier (already installed on its mounting plate) on the mounting standoffs and install the retaining screws with the flat washers and split lock washers but do not tighten them down because you will need to pull out the amplifier for access to the load voltage adjust pot below.

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

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9. Turn on power to the controller.
10. Turn on the controller and place it into normal operation.
11. Allow the sample draw detector to run for 3 hours.
12. Remove mounting screws, flat washers, and lock washers that retain the amplifier plate to pull out the amplifier enough to gain access to the load voltage pot and make a preliminary setting of the detector load voltage. See “Setting the Detector Load Voltage” on page 21. This will be a temporary load voltage setting since the load voltage will need to be set again after the burn-in period as described below.
13. Install the amplifier with its mounting plate using the retaining screws, flat washers, and lock washers.
14. Perform a preliminary calibration. See “Calibration” on page 23. This will be a temporary calibration since the detector must burn-in before it can be properly calibrated.
15. Allow the sample draw detector to burn-in for at least 5 days before you continue with the next step. A burn-in period of 7 days is recommended.
16. After the burn-in period, set the load voltage as described in “Setting the Detector Load Voltage” on page 21.
17. After setting the load voltage, calibrate the transmitter as described in “Calibration” on page 23 of this manual.

Replacing the Hydrophobic Filter

1. Turn off the controller
2. Turn off power to the controller.
3. Open the housing door of the sample draw detector.
4. Note which side of the replacement filter’s body has the “INLET” marking. The barb on this side must be connected to the line coming from the inlet fitting when it is installed.
5. If necessary, remove the mounting screws flat washers, and lock washers that secure the main circuit board and list the board enough to gain access to the hydrophobic filter.
6. Disconnect the old filter from the rubber elbows on each end of the filter, then remove the filter from the sample-draw detector.
7. Connect the rubber elbow on the tube from the inlet fitting to the side of the replacement filter with the “INLET” marking, then connect the other rubber elbow to the other side of the filter.
8. Lay the replacement filter below the main PCB like the old one.
9. If necessary, reinstall the main circuit board.

10. Place the controller and sample draw detector into operation
11. Verify that the flow rate is approximately 1.5 SCFH. If necessary, adjust the flow rate with the bypass valve and/or the flow adjust pot.
12. Close the sample draw detector's 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 set.

1. Unscrew the nut that holds the tubing to the fitting from the fitting.
2. Slide the nut away from the end of the tubing.
3. Cut off the end of the sample tube with the old ferrules off about one inch from the end
4. Slide the nut off the sample tubing.
5. Position the nut so the threaded end is facing you, then insert the bottom (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.

6. 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.
7. Screw the nut onto the fitting by hand just until it stops turning.
8. Insert the sample tubing into the fitting until it bottoms out.
9. Firmly tighten the nut so the ferrules crimp onto the sample tubing and make a seal.

Adjusting the Low Flow Setting

NOTE: Adjusting the low flow setting will cause a low flow alarm at the sample draw detector and a fail alarm at the controller. Be sure to put the controller into its calibration program or disable external alarms before making this adjustment

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

1. Use the flow adjust pot (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 adjustment screw 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.
   The low flow adjustment screw is accessible through a circular cutout in the main circuit board. See "Component Location" on page 5.
2. Slowly turn the low flow adjustment screw in very small increments counterclockwise just until the sample draw detector goes into low flow alarm.
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 adjustment screw slightly clockwise. Repeat Step 3 and Step 4 if necessary.

5. Use the flow adjust pot (VR1) to set the flow to 1.5 SCFH.
6. Make sure the sample draw detector's Fail LED is off.

Setting the Detector Load Voltage

The detector load voltage must be set when the detector or amplifier is replaced or if you suspect that it has been changed from the factory setting for your detection range. This procedure involves setting a voltage while applying calibration gas to the sample draw detector that matches the full-scale concentration for the sample draw detector. After replacing the detector or amplifier as described earlier in this manual, the following procedure must be completed before calibrating the sample draw detector. Be sure to follow the timing recommendations in "Replacing the Detector" on page 17 and "Replacing the Amplifier" on page 18 for setting the load voltage.

NOTE: Setting the load voltage may cause alarms. Be sure to put the controller into calibration mode or disable external alarms before performing this test.

WARNING: ***The controller is not an active gas monitoring device during the load voltage setting procedure***

NOTE: The following procedure assumes the use of a calibration kit that includes a calibration gas cylinder equal to the transmitter's full scale gas concentration, a dispensing valve with an on/off knob, a gas bag, and a humidifier tube to connect the gas bag to the regulator and to the sample draw detector inlet line.

NOTE: For best accuracy, RKI Instruments, Inc. recommends introducing the gas at the end of the inlet sample line when making a load voltage adjustment instead of using a temporary short sample line.

1. Put the controller into calibration mode or disable external alarms.
2. Open the sample draw detector housing door.
3. Set a voltmeter to measure in the DC millivolt range.
4. Remove the screw, flat washer, and lock washer retaining the amplifier plate to each of the two mounting standoffs, then carefully lift the amplifier plate to gain access to the amplifier's load voltage adjustment pot. See Figure 5 below for the pot location.
5. Screw the dispensing valve onto the calibration gas cylinder. It must have a gas concentration equal to the sample draw detector's full scale.
6. Run one end of the humidifier tube through the tubing clamp provided with the calibration kit and connect this end to the fitting on the gas collection bag.

WARNING: ***The humidifier tube used with this calibration kit includes polyurethane tubing on each end of the humidifier tube to facilitate making connections to hose barbs. Do not clamp on the middle braided tube section of the humidifier tube. Only clamp on the polyurethane tube on either end of the braided humidifier tube.***

7. Connect the humidifier tube from the gas collection bag to the inlet line.

   Allow the sample draw pump to draw out any residual gas in the gas collection bag.

8. Close the tubing clamp.

NOTE: This step will cause a low flow alarm.

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9. Disconnect the humidifier tube from the inlet line.
10. Connect the humidifier tube from the gas collection bag to the dispensing valve, then open the clamp.
11. Turn the dispensing valve's on / off knob counterclockwise to open it. The gas collection bag begins to fill.
12. Turn the dispensing valve's on / off knob clockwise to close it when the gas collection bag appears full.
13. Close the clamp, then disconnect the humidifier tube from the regulator.
14. Open the clamp, then connect the humidifier tube from the gas collection bag to the sample draw detector's inlet line.
15. Allow the sample draw detector to draw sample for one minute.
16. Measure the voltage between the **B** terminal on the detector terminal strip and the **-** (negative) terminal on the controller terminal strip as shown below in Figure 5.

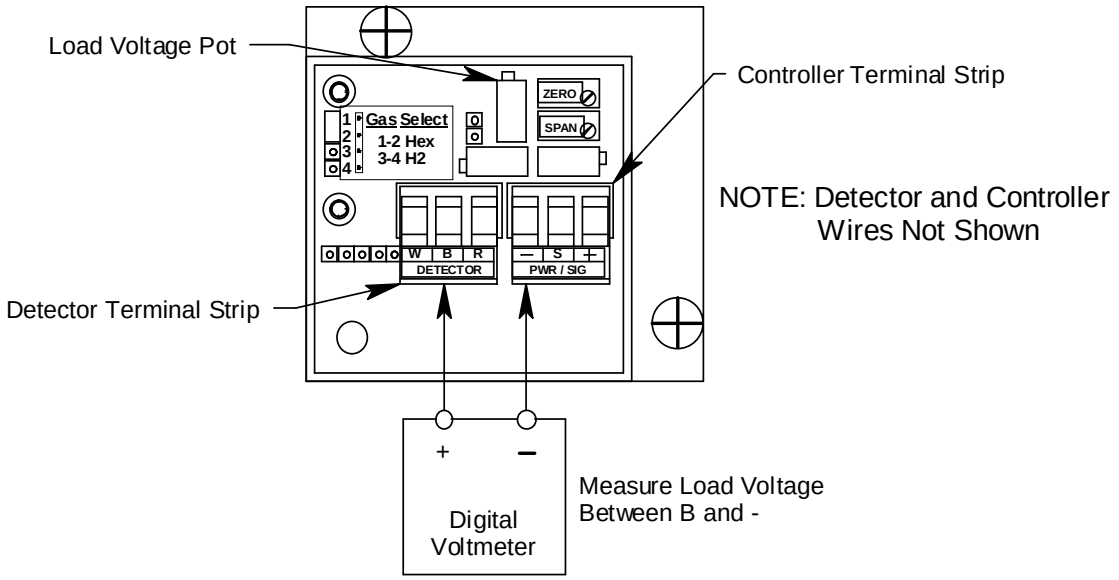

Figure 5: Load Voltage Measurement

17. Adjust the load voltage adjust pot until the load voltage is 4.0 V ± 0.1 V.
18. Allow the sample draw detector to draw out any residual gas in the gas collection bag.
19. Disconnect the humidifier tube from the sample draw detector's inlet line.
20. If necessary, remove the short inlet line used for this adjustment and re-install the inlet line.
21. Unscrew the dispensing valve from the calibration cylinder.

22. Wait 1 to 2 minutes to allow the combustible gas reading to decrease and stabilize.
23. Re-install the amplifier using the screws, flat washers, and lock washers removed in Step 4 above.
24. Calibrate the sample draw detector as described in “Calibration” on page 23
25. Verify that the controller display reading decreases and stabilizes at 0 ppm.
26. Store the components of the calibration kit in a safe and convenient place.

Calibration Frequency

Although there is no particular calibration frequency that is correct for all sample draw detector applications, a calibration frequency of every 6 to 12 months is adequate for most applications. Unless experience in a particular application dictates otherwise, RKI Instruments, Inc. recommends a calibration frequency of every 6 months.

If an application is not very demanding, for example detection in a clean, temperature controlled environment where hexane or other combustible gasses are not normally present and calibration adjustments are minimal at calibration, then a calibration frequency of every 12 months is adequate.

If an application is very demanding, for example if hexane or other combustible gasses are present often and in significant concentrations or the environment is not well controlled, then more frequent calibration than every 6 months may be necessary.

Calibration

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

NOTE: The following procedure assumes the use of a calibration kit that includes a calibration gas cylinder, a dispensing valve with an on / off knob, a gas bag, and a humidifier tube to connect the gas bag to the dispensing valve and to the sample draw detector inlet line. A demand flow regulator calibration kit is also available.

Calibration Kit Humidifier Tube

The sample draw detector requires normal atmospheric humidity levels to respond properly to hexane because of the low ppm levels involved. Normal atmospheric humidity variations do not affect the detector’s response to hexane in ambient air, but the ultra low humidity level of gas from a calibration cylinder requires that the calibration sample be humidified for the detector to respond properly. The calibration kit for the sample draw detector includes a humidifier tube with flexible polyurethane on each end that is not normally included in other calibration kits. This humidifier tube humidifies the calibration sample flowing through it by absorbing humidity from the ambient air and adding it to the sample. The humidifier tube is included in Table 2 on page 26.

WARNING: ***A humidifier tube must be used when calibrating the sample draw detector for the detector to respond properly to the calibration gas. Failure to use a humidifier tube will result in an inaccurate calibration.***

Preparing for Calibration

NOTE: Calibrating the sample draw detector may cause alarms. Be sure to put the controller into calibration mode or disable external alarms before continuing.

1. Put the controller into calibration mode or disable external alarms.
2. Open the sample draw detector's housing door.
3. Set a voltmeter to measure in the DC millivolt (mV) range.
4. Plug the positive lead into the red + test point; plug the negative lead into the black - test point.
5. 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 250 ppm hexane and a fullscale setting of 500 ppm hexane, the correct output is 300 mV.

   300 (mV) = (250/500) 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 calibrating sample to set the zero reading. Screw the dispensing valve onto the hexane calibration cylinder and go to the next section, "Setting the Zero Reading."

1. Screw the dispensing valve onto the zero air calibration cylinder.
2. Run one end of the humidifier tube through the tubing clamp provided with the calibration kit and connect this end to the fitting on the gas collection bag.

WARNING: ***The humidifier tube used with this calibration kit includes polyurethane tubing on each end of the humidifier tube to facilitate making connections to hose barbs. Do not clamp on the middle braided tube section of the humidifier tube. Only clamp on the polyurethane tube on either end of the braided humidifier tube.***

NOTE: For best accuracy, RKI Instruments, Inc. recommends calibrating the sample draw detector by introducing the calibration gas at the end of the inlet sample line and not using a shorter temporary inlet line.

3. Connect the humidifier tube from the gas collection bag to the inlet sample line.

   Allow the sample draw pump to draw out any residual gas in the gas collection bag.
4. Close the tubing clamp.

NOTE: This step will cause a low flow alarm.

5. Disconnect the humidifier tube from the inlet sample line.

6. Connect the humidifier tube from the gas collection bag to the dispensing valve, then open the clamp.
7. Turn the dispensing valve's on / off knob counterclockwise to open the dispensing valve. The gas collection bag begins to fill.
8. Turn the dispensing valve's on / off knob clockwise to close the dispensing valve when the gas collection bag appears full.
9. Close the tubing clamp, then disconnect the humidifier tube from the dispensing valve.

Setting the Zero Reading

1. Open the tubing clamp, then connect the humidifier tube from the gas collection bag to the sample draw detector's inlet sample line. **This step is not necessary if you verified a fresh air environment earlier in this procedure.**
2. Allow the sample draw detector to sample the gas for one minute. If the inlet line is long, allow time for the sample to reach the detector, about 1 second per foot of sample line.
3. Verify a voltmeter reading of 100 mV (± 2 mV).
4. If necessary, use a small flat-blade screwdriver to adjust the zero pot until the voltmeter reading is 100 mV (± 2 mV).
5. Allow the sample draw detector to draw out any residual gas in the gas collection bag, then close the clamp. **Step 5 through Step 7 are not necessary if you verified a fresh air environment earlier in this procedure. If you verified a fresh air environment, go to step Step 1 in the next section, Setting the Response Reading.**

NOTE: This step will cause a low flow alarm.

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6. Disconnect the humidifier tube from the inlet sample line.
7. Unscrew the dispensing valve from the zero air calibration cylinder, then screw the dispensing valve onto the hexane calibration cylinder.

Setting the Response Reading

1. Connect the humidifier tube from the gas collection bag to the dispensing valve (installed on the hexane calibration cylinder), then open the tubing clamp.
2. Turn the dispensing valve's on / off knob counterclockwise to open the dispensing valve. The gas collection bag begins to fill.
3. Turn the dispensing valve's on / off knob clockwise to close the dispensing valve when the gas collection bag appears full.
4. Close the tubing clamp, then disconnect the humidifier tube from the dispensing valve.
5. Open the tubing clamp, then connect the humidifier tube from the gas collection bag to the sample draw detector's inlet sample line.
6. Allow the sample draw detector to draw calibration gas for one minute. If the sample line is long, allow time for the sample to reach the detector, about 1 minute per foot of sample line.
7. Verify that the test points output matches the response output (±2 mV) you determined earlier.

8. If necessary, use the span pot on the amplifier to adjust the reading to match the correct mV output.
9. Allow the sample draw detector to draw out any residual gas in the gas collection bag.
10. Disconnect the sample tubing from the sample-draw detector's inlet sample line.
11. Remove the test jacks from the test points.
12. Close the housing door.
13. Unscrew the dispensing valve from the calibration cylinder.
14. Wait 1 to 2 minutes to allow the combustible gas reading to decrease.
15. Store the components of the calibration kit in a safe and convenient place.

Parts List

Table 2 lists replacement parts and accessories for the sample draw detector.

Table 2: Parts List

Part Number	Description
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)
33-2001RK-01	6 inch humidifier tube for fixed system calibration kit
71-0151RK	35-3000RKA-10 Operator's Manual (this document)
81-0023RK-21	Calibration cylinder (500 ppm hexane in air, 34 liter)
81-0083RK-23	Calibration cylinder (500 ppm hexane in air, 103 liter)
81-0076RK-01	Zero air calibration cylinder (34 liter)
81-0076RK-03	Zero air calibration cylinder (103 liter)
81-1001RK	Dispensing valve (with knob)
81-1054RK	Demand flow regulator
81-1126RK	Gas collection bag (2 liter)
SG-8521	MOS combustible detector for hexane