

35-3000RK-OXY

Oxygen Sample-Draw Detector

Operator's Manual

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

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Overview

This instruction manual describes the 35-3000RK-OXY sample-draw oxygen detector. This manual also describes how to install, start up, maintain, and calibrate the sample-draw detector when using it with a gas monitoring controller. A parts list at the end of this manual lists replacement parts and accessories for the sample-draw oxygen detector. See the operator's manual for the controller for information specific to the controller

Specifications

Table 1 lists specifications for the sample-draw oxygen detector.

Table 1: Specifications

Target Gas	Oxygen (O ₂)
Input Power	24 VDC Nominal (23 VDC - 28 VDC)
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 25.0% (by volume)
Response Time	90% in 30 seconds

Description

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

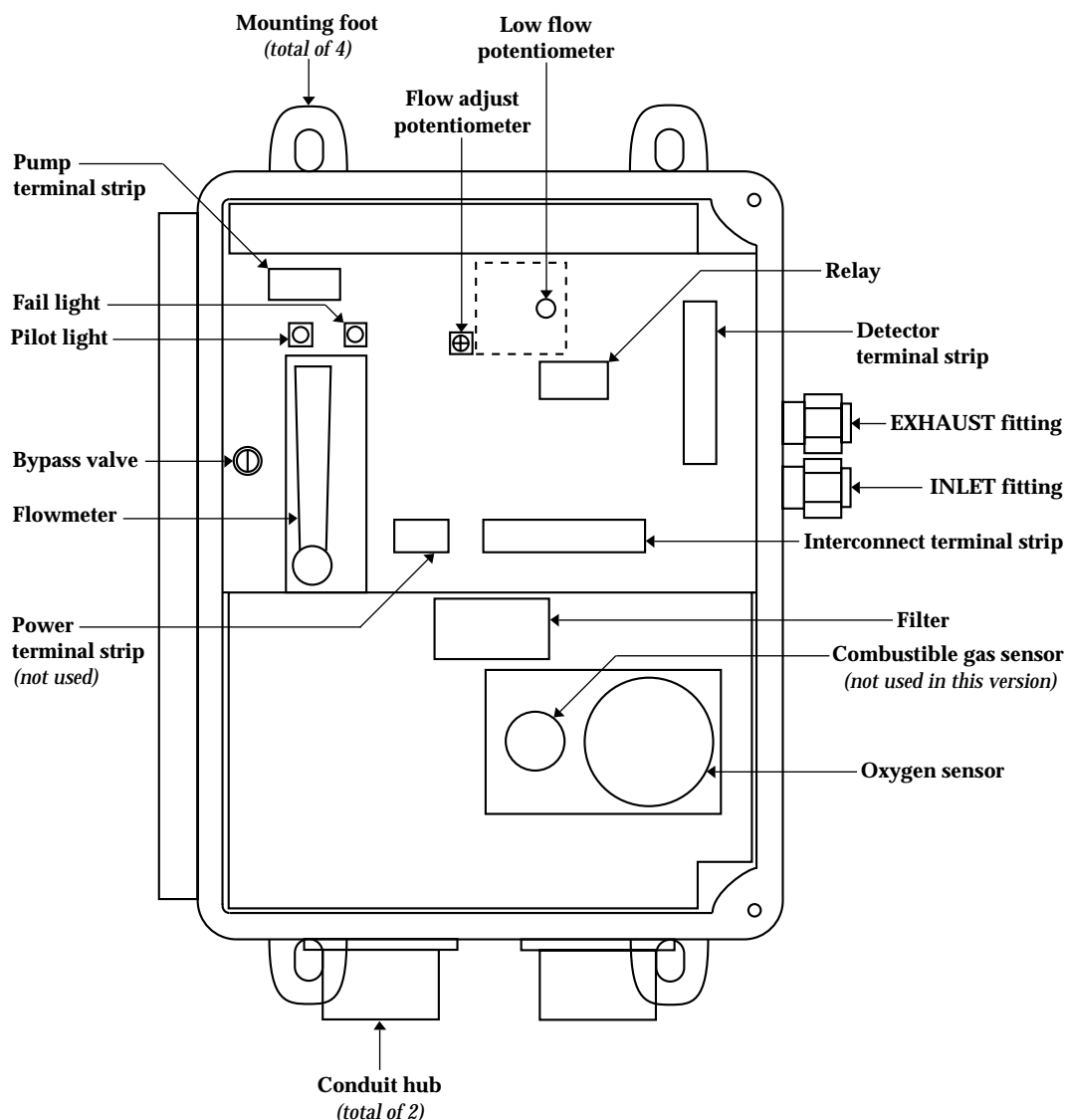


Figure 1: Sample-draw Oxygen Detector Component Location

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.

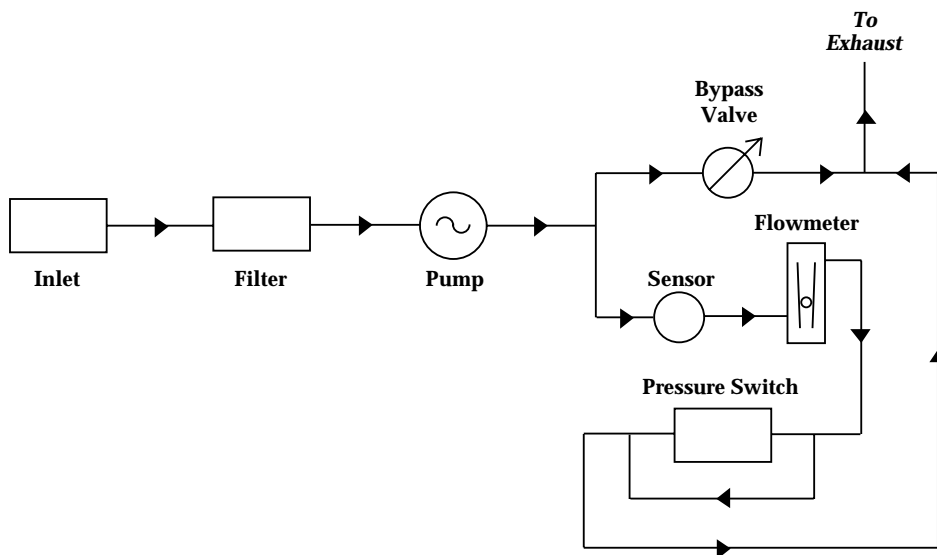


Figure 2: Sample-draw Oxygen Detector Flow Diagram

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 9 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 Controller.

Fail light

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

NOTE: The factory set low flow level is 0.6 SCFH (± 0.2). See “Adjusting the Low Flow Setting” on page 16 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 from the sensor. The interrupted sensor signal causes a fail condition at the controller. 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 9 to connect tubing to the exhaust fitting.

Detection System

The detection system consists of the oxygen sensor and the main circuit board.

Oxygen sensor

The oxygen sensor is installed in a cavity block. The cavity block is mounted to the aluminum subpanel near the bottom of the sample-draw detector. The oxygen sensor includes the oxygen cell, connector, and sensor leads.

NOTE: The cavity block includes a cavity for a combustible gas sensor. This version of the sample-draw detector does not include the combustible gas sensor.

Oxygen cell

The oxygen cell is protected within the sensor assembly. Through a series of chemical and electronic reactions, the cell produces a millivolt output that is proportional to the detection range of the sample-draw detector.

Connector

The cable that extends from the sensor terminates in a 7-position socket that connects to a mating 7-pin male connector. The socket and connector allow you to replace the sensor without disconnecting the wiring. The sensor leads are soldered to the male connector.

Sensor leads

Two color-coded leads extend from the connector. The leads allow you to connect the oxygen sensor to the main circuit board.

Main Circuit Board

The main circuit board includes the interconnect terminal strip, detector 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 a controller.

Detector terminal strip

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

NOTE: The oxygen sensor is factory-wired to the circuit board. See the “Installation” section on page 9 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.

Relay

The relay is to the left of the detector terminal strip. The relay is single-pole, double-throw (SPDT) 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 controller.

NOTE: No relay contacts are available for use in controlling an external device.

Installation

This section describes procedures to mount the sample-draw oxygen 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 lights visible?

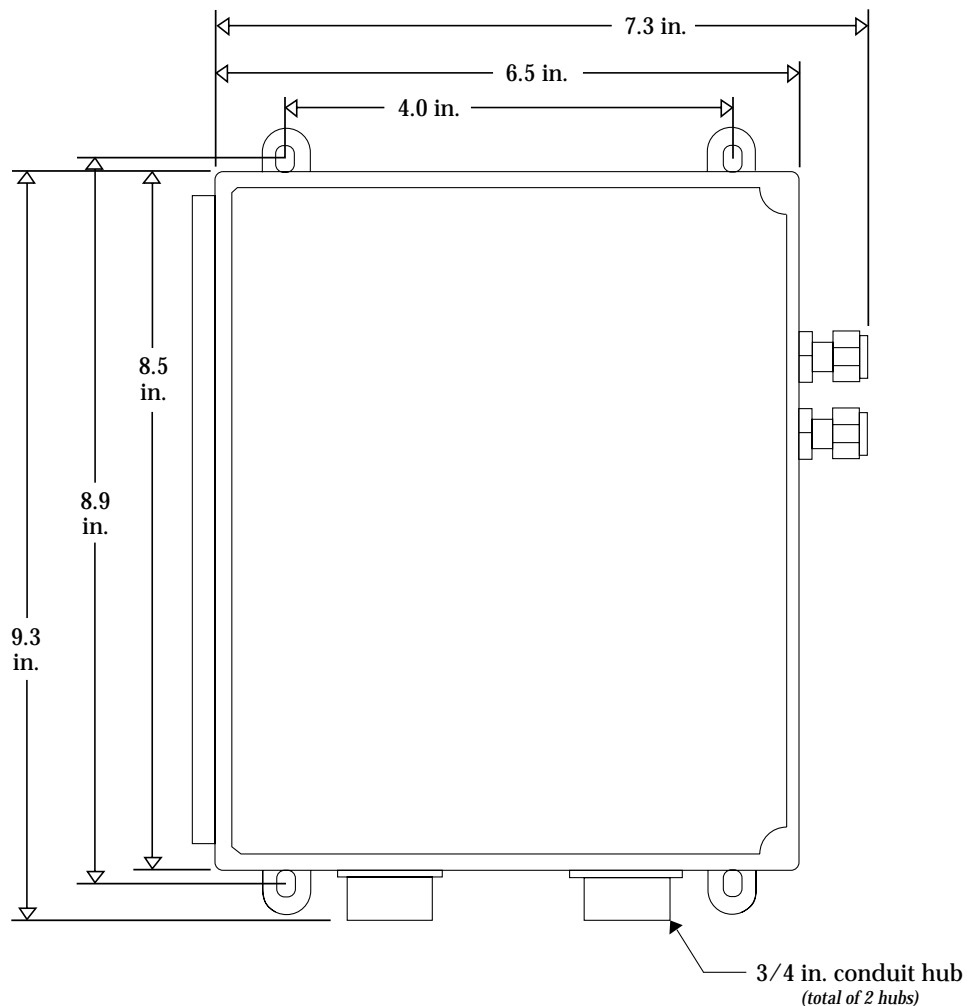


Figure 3: Mounting the Sample-Draw Oxygen Detector

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.

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 Detector

1. Attach 1/4 in. metal or plastic rigid sample tubing to the inlet fitting.

CAUTION: If you use **flexible** sample tubing (vinyl or polyurethane for example), use an appropriate metal insert to seal the connection between the tubing and the inlet fitting. See the Parts List at the end of this manual for an example of an appropriate metal insert.

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.

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 Detector to a Controller

WARNING: Always verify that the controller is off and 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. Unlatch and open the housing door of the sample-draw detector.
4. Guide a four-conductor, shielded cable or four wires in conduit through one of the conduit hubs at the bottom of the sample-draw housing.
5. Connect the cable 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.

Start Up

This section describes procedures to start up the sample-draw oxygen 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 wiring is correct and secure. Refer to the controller instruction manual for connections at the controller.
3. Turn on or plug in the incoming power at the power source end, then turn on the controller.
4. Verify that the sample-draw detector's PILOT light is on.
5. Verify that the controller is on and operating properly. Refer to the controller instruction manual.
6. 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 will cause a low flow condition at the sample-draw detector and a fail condition at the controller. Be sure to put the controller into its calibration program or disable external alarms before performing this test.

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 that the flowmeter returns to a normal flow rate.
9. If alarms were disabled at the controller, enable them.

Setting the Fresh Air Reading

CAUTION: *If you suspect the monitoring environment is not of normal oxygen content (20.9%), use the calibration kit and zero air calibration cylinder to introduce "fresh air" to the detector and verify an accurate normal setting.*

1. Verify that the sample-draw detector is sampling a fresh air environment (environment known to be of normal oxygen content).
2. Verify a reading of 20.9% at the controller.

If the display reading is 20.9%, start up is complete. The sample-draw oxygen detector is in normal operation. If the display reading is not 20.9%, continue with step 3.
3. Perform a zeroing operation at the controller. See the controller instruction manual for directions.

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, 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 20.9% at the controller. Investigate significant changes in the reading.

Monthly

This procedure describes a test to verify that the sample-draw detector responds properly to oxygen deficiency.

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

Performing the response test

1. Exhale into the sample-draw detector's incoming sample line.
2. Stop exhaling into the sample line, then verify that the readings at the controller decreased.

NOTE: If the reading does not decrease, calibrate the sample draw detector as described in the "Calibration" section on page 17.

Quarterly

Calibrate the sample-draw detector as described in the "Calibration" section on page 17.

Troubleshooting

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

NOTE: This troubleshooting guide describes sample-draw detector problems only. See the controller instruction manual for problems you may encounter with the controller.

Fail condition

Symptoms

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

Probable causes

- The detector wiring is disconnected or misconnected.
- 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. 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 wiring is correct and secure. The Installation section on page 9 describes detector wiring connections.
4. Calibrate the sample-draw detector as described in the Calibration section on page 17.
5. If the fail condition continues, replace the oxygen 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 fresh air or zero reading during the calibration procedure.
- The detector requires frequent calibration.

NOTE: Under "normal" circumstances, the detector requires calibration once every three months. 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 oxygen 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 Oxygen Sample-draw Detector

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

Replacing the oxygen sensor

1. Turn off the controller.
2. Turn off power to the controller.
3. Open the housing door of the sample-draw detector.
4. Unscrew and remove the two screws that secure the sensor retraining plate, then lift the plate, connector, and sensor out of the housing.
5. Unplug the connector from the sensor cable socket.
6. Plug the socket of the replacement sensor into the connector.
7. Place the sensor in the oxygen sensor cavity, 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. Turn on power to the controller.
10. Turn on the controller.
11. Calibrate the replacement sensor as described in the "Calibration" section on page 17.

Replacing the 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 the direction of the arrow on the filter. The arrow indicates the direction of the sample flow.
5. Disconnect the filter from the elbows on each end of the filter, then remove the filter from the sample-draw detector.
6. 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.
7. Verify that the flow rate is approximately 1.5 SCFH, then close the housing door.
8. Turn on power to the controller.
9. Turn on the controller.

Replacing the ferrules

Both the inlet and exhaust fittings include two ferrules that seal the inlet 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 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.

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

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 performing this test

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 oxygen detector. It includes procedures to assemble the calibration kit, set the fresh air reading, set the zero reading, and return to normal operation.

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

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

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 fresh air reading at the controller.

1. Screw the dispensing valve onto the zero air calibration cylinder.
2. Connect the calibration kit sample tubing to the fitting on the gas collection bag.
3. Disconnect the incoming sample line from the sample-draw detector's inlet fitting, then connect the sample tubing from the gas collection bag to the inlet fitting.
Allow the sample-draw pump to draw out any residual gas in the gas collection bag.
4. Close the tubing clamp. The tubing clamp is attached to the calibration kit sample tubing.
5. Disconnect the calibration kit sample tubing from the inlet fitting.
6. Connect the tubing from the gas collection bag to the dispensing valve, then open the clamp.
7. Open the dispensing valve. The gas collection bag begins to fill.
8. Close the dispensing valve when the gas collection bag appears full.
9. Close the tubing clamp, then disconnect the sample tubing from the dispensing valve.

Setting the Fresh Air Reading

1. Open the clamp, then connect the sample tubing from the gas collection bag to the sample-draw detector's inlet fitting.
2. Allow the sample draw detector to draw sample for one minute.
3. Follow the directions in the controller's instruction manual for setting the fresh air reading.
4. Allow the sample-draw detector to draw out any residual gas in the gas collection bag.
5. Disconnect the gas bag sample tubing from the inlet fitting, then close the tubing clamp.
6. Unscrew the dispensing valve from the zero air calibration cylinder.

Setting the Zero Reading

1. Screw the dispensing valve onto the 100% N₂ calibration cylinder.
2. Connect the sample tubing from the gas collection bag to the dispensing valve, then open the tubing clamp.
3. Open the dispensing valve. The gas collection bag begins to fill.
4. Close the dispensing valve when the gas collection bag appears full.
5. Close the tubing clamp, then disconnect the sample tubing from the dispensing valve. Open the tubing clamp, then connect the sample tubing from the gas collection bag to the sample-draw detector's inlet fitting.
6. Allow the sample-draw detector to draw the calibrating sample for 1 minute.
7. Follow the directions in the controller's instruction manual for setting the zero (oxygen free) reading.
8. Allow the sample-draw detector to draw out any residual gas in the gas collection bag.
9. Disconnect the sample tubing from the sample-draw detector's inlet fitting.
10. Reconnect the incoming sample line to the inlet fitting.
11. Unscrew the dispensing valve from the calibration cylinder.
12. Wait 1 to 2 minutes to allow the oxygen reading at the controller to return to normal, then return the controller to normal operation.

NOTE: If you do not allow the oxygen reading to return to normal, then unwanted alarms may occur.

13. Verify that the controller display reading stabilizes at 20.9%.
14. Store the components of the calibration kit in a safe and convenient place.

Parts List

Table 3 lists replacement parts and accessories for the sample-draw oxygen 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 (Balston DFU9933-05-DQ)
65-0601RK	Oxygen sensor (plug-in type)
71-0071RK	<i>Operator's Manual, 35-3000RK-OXY Oxygen Sample-Draw Detector</i>
81-0076RK-01	Zero air calibration cylinder (34 liter)
81-0076RK-03	Zero air calibration cylinder (103 liter)
81-0078RK	Calibration cylinder (100% Nitrogen; 17 liter)
81-0078RK-01	Calibration cylinder (100% Nitrogen; 34 liter)
81-0078RK-03	Calibration cylinder (100% Nitrogen; 103 liter)
81-1001RK	Dispensing valve with knob, for 17 liter & 34 liter cylinders
81-1054RK	Demand flow regulator, for 103 liter cylinder
81-1126RK	Gas collection bag (2 liter)
81-F301RKS-LV	Calibration kit (includes gas collection bag, 100% Nitrogen and zero air calibration cylinders)
81-F302RKS-LV	Calibration kit (includes gas collection bag and 100% Nitrogen calibration cylinder)