

# Oxygen Detection

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## Overview

This detection insert describes the oxygen detector (internal amplifier type). This insert also describes how to install, start up, maintain, and calibrate the detector. A parts list at the end of this insert lists replacement parts and accessories for the oxygen detector.

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## Specifications

Table 1 lists specifications for the oxygen detector. See the specifications in Chapter 1, Introduction, for specifications that apply to the Beacon 100 Gas Monitor.

**Table 1: Specifications**

Target Gas	Oxygen (O <sub>2</sub> )
Sampling Method	Diffusion
Signal Output	Milivolt (mV)
Detection Range	0 to 25.0% VOL (by volume)
Alarm 1 Setpoint	19.5% VOL <sup>1</sup> (decreasing)
Alarm 2 Setpoint	17.0% VOL <sup>1</sup> (decreasing)
Alarm 3 Setpoint	23.5% VOL <sup>1</sup> (increasing)
Response Time	90% in 30 seconds

<sup>1</sup> Represents RKI standard setting; however, you can adjust the setting in the Instrument Setup Program..

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## Description

This section describes the components of the oxygen detector head. The detector head includes the oxygen detector, the detector terminal strip, and the junction box.

### Oxygen Detector

An oxygen cell is protected within an aluminum detector housing. Mounting threads (3/4 in. pipe) at the top of the detector allow you to mount the detector to the junction box. Through a series of chemical and electronic reactions, the cell produces a milivolt output that is proportional to the detection range. The Beacon 100 converts the cell's output and displays the oxygen reading on the display screen.

### Detector Terminal Strip

Two color-coded leads extend from the top of the detector. The leads allow you to connect the detector to the detector terminal strip in the Beacon 100 through the terminal block in the junction box.

### Junction Box

The junction box allows you to install the oxygen detector at a mounting site that is remote from the Beacon 100, and it protects the detector wiring connections.

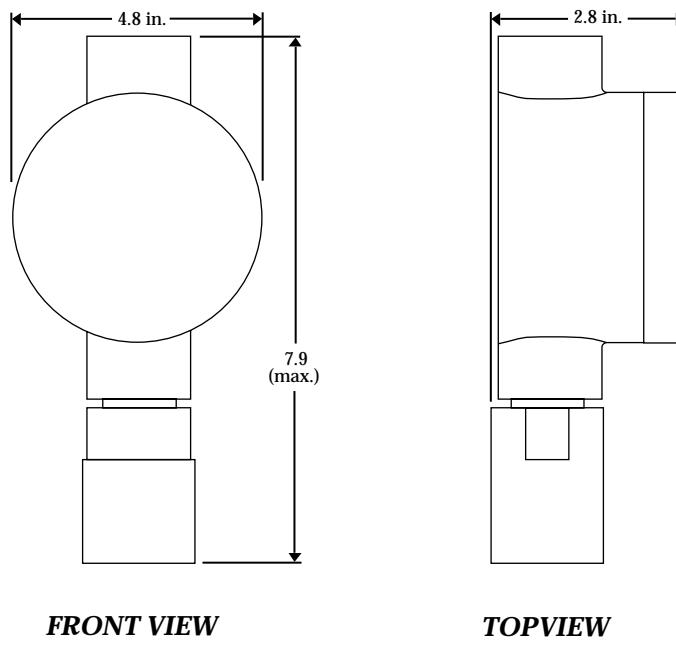
Two conduit hubs allow you to mount the oxygen detector to the junction box and connect the wiring from the detector to the Beacon 100. A terminal block within the junction box facilitates the wiring process. A cover on the front of the junction box allows access to the interior of the junction box.

## Installation

This section describes the procedure to mount the oxygen detector in the monitoring environment and wire the detector to the Beacon 100.

### Mounting the Detector

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 detector 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.
2. At the mounting site you select, hang or mount the junction box with the detector facing down (see Figure 1).



**FRONT VIEW**                            **TOPVIEW**  
**Figure 1: Mounting the Oxygen Detector**

### Wiring the Detector to the Beacon 100

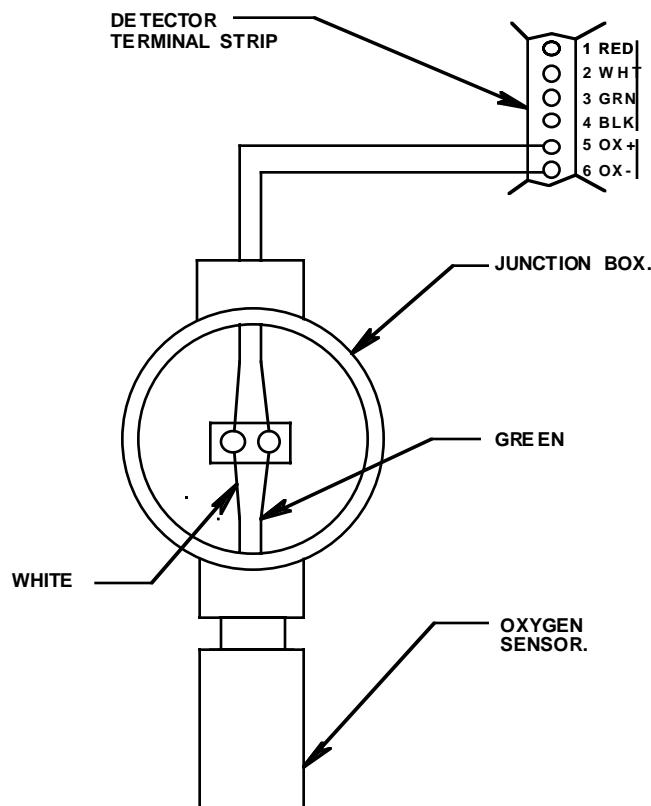
**WARNING:** *Always verify that power to the Beacon 100 is off before you make wiring connections.*

1. Turn off power to the Beacon 100.
2. Remove the cover from the junction box. If the detector is already installed in the junction box, go to step 5.
3. Guide the detector leads through the bottom conduit hub of the junction box, then screw the mounting threads of the detector into the conduit hub.
4. Connect the detector leads to the terminal block in the junction box.

5. Guide a two-conductor, shielded cable or two wires in conduit through the top conduit hub of the junction box. Connect the wires to the terminals opposite the detector leads.
6. Secure the junction box cover to the junction box.
7. Route the cable or wires in conduit leading from the detector through one of the conduit hubs on the bottom of the Beacon 100 housing.

**CAUTION:** Do not route power and detector wiring through the same conduit hub. The power cable may disrupt the transmission of the detector signal to the Beacon 100.

8. Connect the wires to the detector terminal strip as shown in Figure 2. The detector terminal strip is at the bottom of the main PCB.



**Figure 2: Wiring the Oxygen Detector to the Beacon 100 Gas Monitor**

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## Start Up

This section describes procedures to start up the oxygen detector and place the detector into normal operation.

### Introducing Incoming Power

1. Complete the installation procedures described earlier in this insert.
2. Verify that the power wiring is correct and secure (see Chapter 3, Installation and Start Up).
3. Turn on or plug in the incoming power at the power source end.
4. Verify that the PILOT light is on.

### Setting the Normal Reading

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**CAUTION:** If you suspect the monitoring environment is not of normal oxygen content (20.9%), use the calibration kit and 100% nitrogen calibration cylinder to introduce “fresh air” to the detector and verify an accurate normal setting.

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1. Verify that the detector is in a fresh air environment (environment known to be of normal oxygen content).
2. Verify a reading of 20.9 %VOL on the display screen.  
If the display reading is 20.9 %VOL, start up is complete. The oxygen detector is in normal operation. If the display reading is not 20.9 %VOL, continue with step 3.
3. Open the housing door, and locate the program buttons below the display screen.
4. Press ESCAPE and DOWN buttons simultaneously and hold for 3 seconds.  
The display screen changes from the gas reading to a screen that gives you a choice of CALIB or ALARMS & MISC.

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**NOTE:** Once leave normal operation and enter this screen, if any alarm conditions were occurring when you left normal operation, they will be retained by the Beacon 100 until you return to normal operation. If an alarm condition no longer exists when you return to normal operation, press the reset switch to reset alarms.

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5. Press the UP or DOWN button to make the cursor blink in front of CALIB, then press the ENTER button to proceed
6. You can now choose between ZERO or SPAN. Use the UP button to make the cursor blink in front of SPAN. Press ENTER
7. The screen will display the concentration of oxygen that it expects when you perform the span operation. It will show CAL GAS = 20.9.

Usually fresh air is used and the default concentration is 20.9%. If you are using a cylinder to span the sensor, make sure the reading matches the oxygen concentration in your cylinder.

Use the UP or DOWN button to set the concentration to the correct level, then press the ENTER button to accept it.

8. The screen will display the current reading. Press the ENTER button to perform a span adjust. The screen will momentarily show WAIT and then indicate SPAN COMPLETE.
9. Press the ESCAPE button 4 times to return to normal operation.

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## Maintenance

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

### Preventive Maintenance

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

#### **Daily**

Verify a display reading of 20.9 %VOL. Investigate significant changes in the display reading.

#### **Monthly**

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

1. Verify that the display reading is 20.9 %VOL.

If the display reading(s) is not 20.9, set the fresh air reading as described in the Start Up section of this insert then continue this procedure.

2. Open the housing door, and locate the program buttons below the display screen.
3. Press ESCAPE and DOWN buttons simultaneously and hold for 3 seconds.

The display screen changes from the gas reading to a screen that gives you a choice of CALIB or ALARMS & MISC.

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**NOTE:** Once leave normal operation and enter this screen, if any alarm conditions were occurring when you left normal operation, they will be retained by the Beacon 100 until you return to normal operation. If an alarm condition no longer exists when you return to normal operation, press the reset switch to reset alarms.

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4. Press the UP or DOWN button to make the cursor blink in front of CALIB, then press the ENTER button to proceed
5. You can now choose between ZERO or SPAN. Use the UP button to make the cursor blink in front of SPAN. Press ENTER
6. The screen will display the concentration of oxygen that it expects when you perform the span operation. It will show CAL GAS = 20.9.

For the purposes of this test it doesn't matter what contration the unit expects.

Press ENTER to proceed.

7. The screen will display the current reading. Breathe over the sensor or apply some 100 % nitrogen to the sensor and verify that the reading decreased.
8. **Press the ESCAPE button to exit this screen without saving.** Since the purpose of this test is only to determine that the reading decreases with oxygen deficiency, a span operation does not need to be performed.

9. Press the ESCAPE button four times to return to normal operation.

#### ***Quarterly***

Calibrate the detector as described in the Calibration section of this insert.

#### **Troubleshooting**

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

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**NOTE:** This troubleshooting guide describes detector problems only. See the Troubleshooting guide in Chapter 5, Maintenance, for problems you may encounter with the Beacon 100 Gas Monitor.

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#### ***Fail condition***

##### Symptoms

- The FAIL light is on.
- The buzzer is sounding a steady tone.
- The fail relay is de-energized.
- The display reading is flashing.

##### Probable causes

- The detector wiring is disconnected or misconnected.
- The detector is malfunctioning.

##### Recommended action

1. Verify that the detector wiring is correct and secure. The Installation section of this insert describes detector wiring connections.
2. Calibrate the detector as described in the Calibration section of this insert.
3. If the fail condition continues, replace the detector as described later in this section.
4. 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.

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**NOTE:** Under “normal” circumstances, the detector requires calibration once every three months. Some applications may require a more frequent calibration schedule.

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##### Probable causes

- The calibration cylinder is low, out-dated, or defective.
- The detector is malfunctioning.

*Recommended action*

1. Verify that the calibration cylinder contains an adequate supply of a fresh test sample.
2. If the calibration/response difficulties continue, replace the detector as described later in this section.
3. If the calibration/response difficulties continue, contact RKI Instruments, Inc., for further instruction.

## Replacing the Oxygen Detector

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NOTE: This procedure applies if the detector is installed in a junction box. If the sensor is mounted directly to the Beacon 100, the procedure is the same but the sensor is mounted in the right conduit hub and wired directly to the detector terminal strip.

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1. Turn off power to the Beacon 100 at the power source end.
2. Remove the junction box cover.
3. Disconnect the detector leads from the terminal block inside the junction box. Note the position of the color-coded leads as you remove them.
4. Unscrew the detector from the junction box.
5. 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.
6. Connect the detector leads of the terminal block in the same position as the leads you removed in step 3.
7. Turn on power to the Beacon 100.
8. Secure the junction box cover to the junction box.
9. Calibrate the replacement detector as described in the Calibration section of this insert.

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## Calibration

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

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***WARNING: The Beacon 100 is not an active gas monitoring device during the calibration procedure.***

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### Setting the Fresh Air Reading

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***CAUTION: If you suspect the monitoring environment is not of normal oxygen content (20.9%), use the calibration kit and 100% nitrogen calibration cylinder to introduce "fresh air" to the detector and verify an accurate normal setting.***

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1. Verify that the detector is in a fresh air environment (environment known to be of normal oxygen content).
2. Open the housing door, and locate the program buttons below the display screen.
3. Press ESCAPE and DOWN buttons simultaneously and hold for 3 seconds.  
The display screen changes from the gas reading to a screen that gives you a choice of CALIB or ALARMS & MISC.

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**NOTE:** Once leave normal operation and enter this screen, if any alarm conditions were occurring when you left normal operation, they will be retained by the Beacon 100 until you return to normal operation. If an alarm condition no longer exists when you return to normal operation, press the reset switch to reset alarms.

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4. Press the UP or DOWN button to make the cursor blink in front of CALIB, then press the ENTER button to proceed.
5. You can now choose between ZERO or SPAN. Use the UP button to make the cursor blink in front of SPAN. Press ENTER
6. The screen will display the concentration of oxygen that it expects when you perform the span operation. It will show CAL GAS = 20.9.  
Usually fresh air is used and the default concentration is 20.9%. If you are using a cylinder to span the sensor, make sure the reading matches the oxygen concentration in your cylinder.  
Use the UP or DOWN button to set the concentration to the correct level, then press the ENTER button to accept it.
7. The screen will display the current reading. Press the ENTER button to perform a span adjust. The screen will momentarily show WAIT and then indicate SPAN COMPLETE.
8. Press the ESCAPE button twice to return to the screen that allows you to choose between ZERO and SPAN.

## **Assembling the Calibration Kit**

1. Slide the calibration cup over the bottom of the oxygen detector, then secure the calibration cup to the detector with the thumb screw.
2. Use the sample tubing to connect the regulator to the calibration cup.

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**NOTE:** Do not screw the regulator into the calibration cylinder at this time.

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## **Setting the Zero Reading**

1. If necessary, press the DOWN button to make the cursor blink in front of ZERO. Press ENTER. The screen will indicate the current reading.
2. Screw the regulator onto the cylinder to allow the gas to flow over the sensor. Allow 2 minutes for the reading to stabilize.
3. Press the ENTER button to perform a zero adjust. The screen will momentarily show WAIT and then indicate ZERO COMPLETE.
4. Unscrew the regulator from the cylinder and remove the calibration cup from the sensor.
5. Allow about 15 seconds for the gas reading to return to normal and then press ESCAPE four times to return to normal operation.

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

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## Parts List

Table 3 lists replacement parts and accessories for the oxygen detector (internal amplifier type).

**Table 2: Parts List**

Part Number	Description
18-0400RK	Junction boxx
65-2510RK	Oxygen detector (conduit-mounting)
71-0035RK-03	<i>Oxygen Detection Manual Insert</i> (this document)
81-F301RK-LV	Calibration kit (34 liter)
81-0076RK-01	Zero air calibration cylinder (34 liter)
81-0078RK	Calibration cylinder (100% nitrogen; 17 liter)
81-0078RK-01	Calibration cylinder (100% nitrogen; 34 liter)
81-1003RK	Regulator; fixed flow, 0.5 LPM (for 17-liter and 34-liter calibration cylinders)
81-1117RK	Calibration cup