



INSTRUMENTS

**65-2496RK/65-2499RK
Carbon Monoxide Detector
Operator's Manual**

Part Number: 71-0156RK

Revision: 0

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WARNING

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

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

Product Warranty

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

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

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

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

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

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Overview

This manual describes the 65-2499RK carbon monoxide (CO) detector. This manual also describes how to install, start up, maintain, and calibrate the CO detector when used with a gas monitoring controller. A parts list at the end of this manual lists replacement parts and accessories for the CO detector.

The 65-2499RK CO detector includes the 65-2496K CO detector and a junction box. This manual may also be used for the 65-2496RK CO detector which does not include a junction box and is normally mounted in one of a controller's conduit hubs. If you are using a 65-2496RK CO detector, disregard all references to the junction box and junction box terminal strip.

Specifications

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

Table 1 lists specifications for the 65-2496RK and 65-2499RK CO detectors.

Table 1: Specifications

Target Gas	Carbon Monoxide (CO)
Sampling Method	Diffusion
Detection Range	0 to 300 PPM (parts per million)
Response Time	90% in 30 seconds
Accuracy	± 5% of reading or ± 5 ppm CO (whichever is greater)
Operating Temperature	-4°F to 113°F (-20°C to 45°C)

WARNING: *When using the 65-2496RK/65-2499RK, you must follow the instructions and warnings in this manual to assure proper and safe operation of the 65-2496RK/65-2499RK and to minimize the risk of personal injury. Be sure to maintain and periodically calibrate the 65-2496RK/65-2499RK as described in this manual.*

Description

This section describes the components of the 65-2496RK and 65-2499RK detectors. The 65-2499RK includes the 65-2496RK CO detector and a junction box. A two point terminal strip is provided inside the junction box for detector connections. The 65-2496RK does not include a junction box. Figure 1 below shows the components of the 65-2499RK.

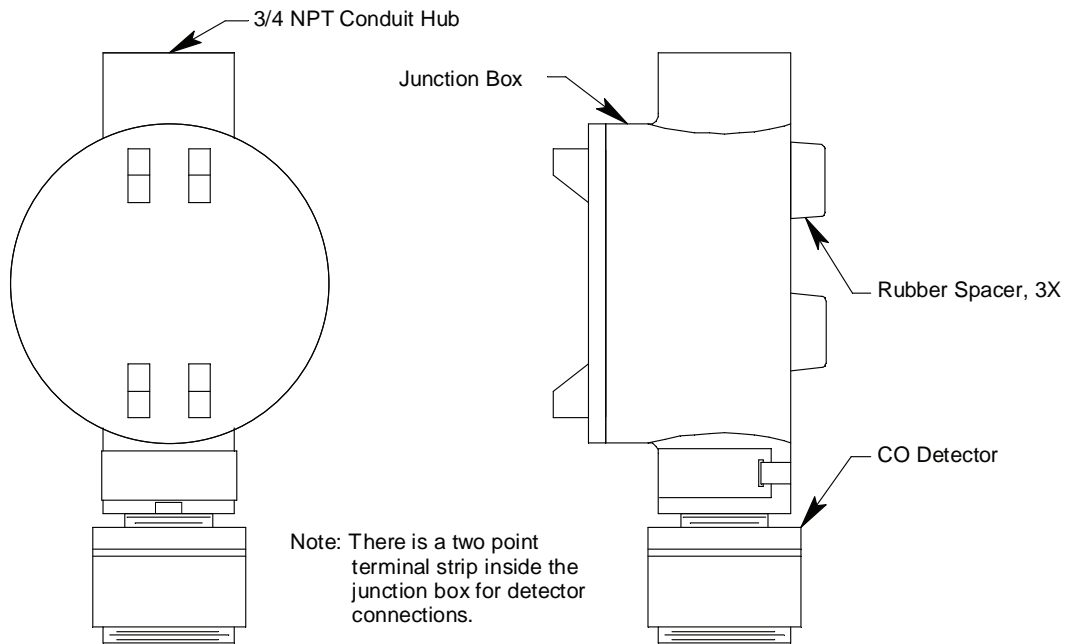


Figure 1: 65-2499RK Component Location

65-2496RK CO Detector

The 65-2496RK CO detector consists of the detector housing body, detector housing cap, cap gasket, plug-in sensor, and the charcoal filter with rubber boot.

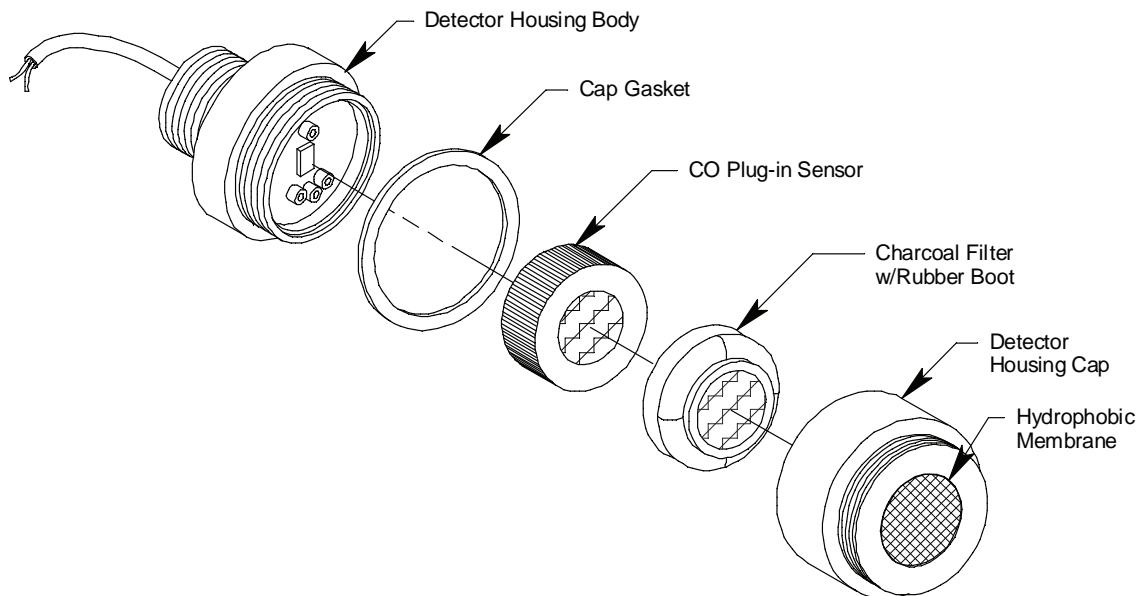


Figure 2: 65-2496RK CO Detector Component Location

Detector Housing Body

The detector housing body protects the electronic components within the housing. Use the mounting threads at the top of the housing to screw the CO detector into a 3/4" NPT hub. Two wires extend from the top of the detector housing body. Use these wires to connect the detector to a controller. One of the wires is black and one of the wires is red.

The housing body includes a four-socket pattern at the bottom of the housing body. The plug-in sensor mates to this socket pattern. A pre-amplifier located between the sockets and the two wires conditions the sensor's signal before the signal reaches the controller.

Housing Cap & Cap Gasket

The housing cap screws onto the detector housing. It retains the sensor and the rubber boot with the charcoal filter and protects them from damage. A hydrophobic membrane on the outside of the cap face keeps water and particulates away from the charcoal filter and sensor face behind the cap. Unscrew the detector cap to access the charcoal filter and sensor for maintenance or replacement. A cap gasket seals the interface between the housing and cap.

Plug-In Sensor

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

Charcoal Filter

The disc-shaped charcoal filter is secured to face of the CO sensor with a rubber boot. The charcoal filter prevents interference gases such as hydrogen sulfide (H₂S) and certain hydrocarbons from producing false CO readings.

Junction Box

The junction box allows you to install the CO detector at a mounting site that is remote from a controller and protects the detector wiring connections. Two conduit hubs allow you to mount the CO detector to the junction box and connect the wiring from the detector to a controller. Three spacers installed on the back of the junction box control the distance of the junction box from a mounting surface and ensure that there is enough room to install a calibration cup on the detector during calibration. A terminal block within the junction box facilitates the wiring connections. A cover on the front of the junction box allows access to the interior of the junction box.

Installation

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

Mounting the CO Detector

NOTE: If you are installing a 65-2496RK, it does not include a junction box and is usually factory installed in one of a controller's conduit hubs or may be field installed using the 3/4" NPT threads on the end with the wires. The 65-2499RK includes a junction box as shown in Figure 3 below.

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 where the target gas is likely to be found first.

NOTE: If your application does not require a specific mounting site, mount the detector at approximately breathing level.

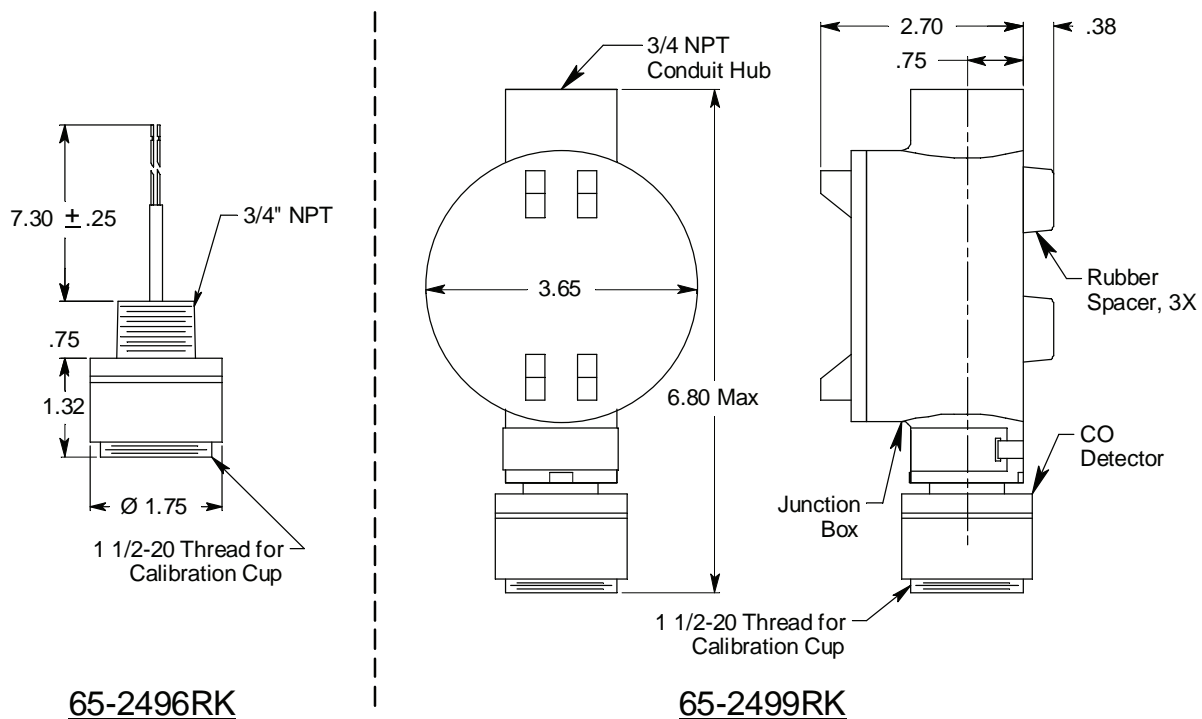


Figure 3: Outline & Mounting Dimensions, 65-2496RK & 65-2499RK

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

Wiring the CO Detector to a Controller

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

1. Turn off the controller.
2. Turn off or unplug power to the controller.
3. If the detector is mounted remotely from a controller using the junction box, proceed to step 4.

If the detector is mounted directly to a controller, it is normally factory wired. Confirm that the detector's black and red wires are connected to the appropriate controller detector terminals and skip to "Start Up" on page 7. See Figure 4, the controller operator's manual, and the controller's detector head specification sheet for the 65-2496RK detector for the wiring connections.

4. Remove the junction box cover.
5. Guide a two-conductor, shielded cable or two wires in conduit through the unused conduit hub of the junction box. Use appropriate conduit fittings and construction technique for the environmental rating of the junction box. The junction box is rated NEMA 4X.
6. Connect the two wires to the detector using the terminal block.

CAUTION: *If using shielded cable, leave the drain wire insulated and disconnected at the detector. You will connect the opposite end of the cable's drain wire at the controller.*

7. Secure the junction box cover to the junction box.
8. Route the cable or wires leading from the CO detector through one of the conduit hubs at the controller housing. Use appropriate conduit fittings and construction technique for the environmental rating of the controller. RKI controllers are typically rated NEMA 4X.

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 controller.*

9. Connect the wires to the applicable controller terminal strip. See the controller operator's manual and the controller's detector head specification sheet for the 65-2499RK detector.

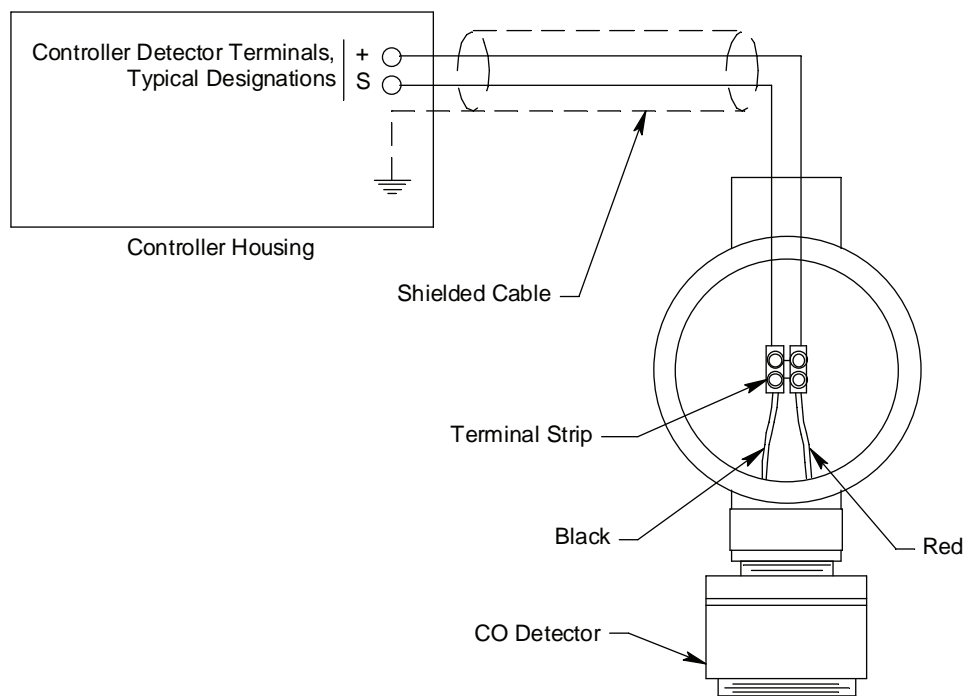


Figure 4: Wiring the CO Detector to a Controller

10. If using shielded cable, connect the cable's drain wire to an available chassis ground at the controller. RKI controllers typically have a ground stud that is a convenient grounding location.

Start Up

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

Introducing Incoming Power

1. Complete the installation procedures described earlier in this manual.
2. Verify that the power wiring to the controller is correct and secure. Refer to the controller operator's manual.
3. Turn on or plug in the incoming power, then turn on the controller.
4. Verify that the controller is on and operating properly. Refer to the controller operator's manual.

CAUTION: *Allow the detector to warm up for 5 minutes before you continue with the next section, "Setting the Zero (Fresh Air) Reading".*

Setting the Zero (Fresh Air) Reading

CAUTION: *If you suspect the presence of CO in the monitoring environment, use the calibration kit and a zero air calibration cylinder to introduce "fresh air" to the CO detector and verify an accurate zero setting. See "Calibration" on page 13 for instructions to introduce zero air to the CO detector.*

1. Verify that the CO detector is in a fresh air environment (environment known to be free of toxic and combustible gases, and of normal oxygen content, 20.9%).
2. Verify a reading of 0 ppm at the controller.
If the display reading is 0 ppm, start up is complete. The CO detector is in normal operation. If the display reading is not 0 ppm, continue with step 3.
3. Perform a zero (fresh air) adjustment operation at the controller. See the controller operator's manual for instructions.

Maintenance

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

Preventive Maintenance

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

Daily

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

Monthly

This procedure describes a test to verify that the CO detector responds properly to the target gas. It describes the test using a calibration kit that includes a calibration cup, calibration gas, sample tubing, and a fixed flow regulator with an on/off knob. RKI Instruments, Inc. recommends using a 0.5 LPM (liters per minute) fixed flow regulator.

WARNING: *Failure to use the recommended calibration gas flow rate will result in an inaccurate reading.*

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

Preparing for the response test

1. Place the controller into its calibration program or disable external alarms.
2. Verify that the controller display reading for the channel you are testing is 0 ppm.
If the display reading is not 0 ppm, set the zero (fresh air) reading of the detector as described in the Start Up section of this manual, then continue this procedure.
3. Screw the regulator into the calibration cylinder. Make sure the regulator is off. It is off when the on/off knob is turned all the way clockwise.
4. Screw the calibration cup onto the bottom of the CO detector.
5. Use the sample tubing to connect the regulator to the calibration cup.

Performing the response test

1. Turn the regulator's on/off knob counterclockwise to open the regulator. Gas will begin to flow.
2. Allow the gas to flow for two minutes, then verify that the reading is within $\pm 20\%$ of the cylinder gas concentration.

NOTE: If the reading is not within $\pm 20\%$ of the correct response reading, calibrate the detector as described in "Calibration" on page 13.

3. Turn the regulator's on/off knob clockwise to close the regulator.
4. Unscrew the regulator from the calibration cylinder.

5. Unscrew the calibration cup from the CO detector. Make sure that you do not loosen the detector housing cap when you unscrew the calibration cup.
6. When the controller display reading falls below the alarm setpoints, return the controller to normal operation.

Quarterly

Calibrate the CO detector as described in “Calibration” on page 13.

Troubleshooting

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

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

Fail Condition

Symptoms

- The controller indicates a fail condition.

Probable causes

- The detector wiring is disconnected or misconnected.
- The plug-in sensor is not properly plugged into the four-socket pattern in the detector housing body.
- The detector’s zero reading is low enough to cause a fail condition.
- The detector is malfunctioning.

Recommended action

- Verify that the detector wiring is correct and secure.
- Confirm that the plug-in sensor is installed properly.
- Perform a zero (fresh air) adjustment. A full calibration is recommended.
- If the fail condition continues, replace the plug-in sensor as described later in this section.
- If the fail condition continues, contact RKI Instruments, Inc. for further instruction.

Slow or No Response/Difficult or Unable to Calibrate

Symptoms

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

NOTE: Under “normal” circumstances, the detector requires calibration once every three months. Some applications may require a more frequent calibration schedule. See “Calibration Frequency” on page 13 for a discussion of the calibration frequency.

Probable causes

- The plug-in sensor has been replaced and the shorting jumper has not been removed.
- The calibration cylinder is low, out-dated, or defective.
- The incorrect calibration cup or regulator is being used.
- The membrane on the detector housing cap is blocked with dirt or some other particulate contamination.
- The detector is malfunctioning.

Recommended action

1. Confirm that the shorting jumper on the plug-in sensor pins has been removed.
2. Verify that the calibration cylinder contains an adequate supply of a fresh test sample.
3. Confirm that you are using the correct calibration cup and regulator. See “Parts List” on page 15 for the required calibration cup and regulator.
4. Check the face of the detector housing cap and remove any particulate contamination from the hydrophobic membrane if necessary. If the membrane appears saturated with contamination or damaged, replace the membrane as described in “Replacing the Hydrophobic Membrane” on page 12.
5. If the calibration/response difficulties continue, replace the plug-in sensor as described later in this section.
6. If the calibration/response difficulties continue, contact RKI Instruments, Inc. for further instruction.

Unexplained Gas Readings

Symptom

- The display indicates a CO reading when CO is known not to be present.

Probable causes

- The detector needs calibration.
- The charcoal filter on the plug-in sensor is saturated and is no longer scrubbing out H₂S or hydrocarbons that cause a response on the CO sensor.

Recommended action

1. Calibrate the detector as described in “Calibration” on page 13.
2. If the difficulties continue, replace the charcoal filter as described later in this section.
3. If the difficulties continue, replace the plug-in sensor as described later in this section.
4. If the difficulties continue, contact RKI Instruments, Inc. for further instruction.

Replacing Components of the CO Detector

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

Replacing The Plug-in CO Sensor

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

1. Turn off the controller.

2. Turn off or unplug power to the controller.
3. Unscrew the detector housing cap from the detector housing body.
4. Unplug and remove the old CO sensor with the boot and charcoal filter attached.
5. Remove the rubber boot and charcoal filter from the old CO sensor.
6. Remove the replacement CO sensor from its packaging and remove the wire jumper that is shorting the WE and RE sensor pins. This wire jumper is installed on the sensor pins for shipment or storage but must be removed for the sensor to operate properly when installed in a detector.

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

7. Install the rubber boot with charcoal filter onto the replacement sensor's face.
8. Carefully plug the replacement sensor into the four-socket pattern that is located in the detector housing body.

WARNING: *You must replace the plug-in sensor with the same type of sensor that is installed. A detector cannot be converted from one type of detector to another by using a different plug-in sensor. For example, if you are replacing an CO sensor, you must replace it with a CO sensor.*

9. Make sure the cap gasket is in place and screw the detector housing cap back onto the detector housing body.
10. Turn on power to the controller.
11. Turn on the controller.

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

12. Calibrate the detector as described in "Calibration" on page 13.

Replacing the Charcoal Filter

1. Turn off the controller.
2. Turn off or unplug power to the controller.
3. Unscrew the detector housing cap from the detector housing body.
4. Unplug and remove the CO sensor with the boot and charcoal filter attached.
5. Remove the rubber boot that secures the charcoal filter to the CO sensor.
6. Remove the charcoal filter from the rubber boot.
7. Place the replacement filter in the rubber boot in the same position as the filter you removed in the previous step.
8. Reinstall the rubber boot with charcoal filter on the CO sensor.
9. Carefully plug the replacement sensor into the socket pattern that is located in the detector housing body.
10. Make sure the cap gasket is in place and screw the detector housing cap back onto the detector housing body.
11. Turn on power to the controller.

12. Turn on the controller.

Replacing the Hydrophobic Membrane

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

Replacing the CO Detector

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

1. Turn off the controller.
2. Turn off or unplug incoming power to the controller.
3. If the detector is installed directly on a controller, open the controller door.
If the detector is installed remotely from a controller in a junction box, remove the junction box cover.
4. If the detector is installed directly on a controller, disconnect the detector leads from the detector terminal strip in the controller. Note the position of the color-coded leads as you remove them.
If the detector is installed remotely from a controller in a junction box, disconnect the detector leads from the terminal block in the junction box. Note the position of the color-coded leads as you remove them.
5. Unscrew the detector from the controller conduit hub or junction box conduit hub.
6. Guide the detector leads of the replacement detector through the controller conduit hub or junction box conduit hub, then screw the mounting threads of the detector into the hub. If necessary for environmental conditions, apply thread sealant or teflon tape to the hub and/or detector threads to seal them.
7. If the detector is installed directly on a controller, connect the detector leads to the appropriate detector terminal strip terminals. See Figure 4 on page 6 for wiring to a generic controller. See the controller operator's manual and the controller's detector head specification sheet for the 65-2496RK detector for wiring specific to your controller.
If the detector is installed remotely from a controller in a junction box, connect the detector leads to the terminal block the same way the old detector was wired (see Figure 4 on page 6). See the controller operator's manual and the controller's detector head specification sheet for the 65-2499RK detector to verify the connections to the controller are correct.

8. If the detector is installed remotely from a controller in a junction box, reinstall the junction box cover.
9. Turn on or plug in power to the controller.
10. Turn on the controller.

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

11. Calibrate the replacement detector as described in “Calibration” on page 13.

Calibration Frequency

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

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

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

Calibration

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

WARNING: *Not using the recommended calibration cup and sample flowrate will result in an inaccurate calibration. See “Parts List” on page 15 for the required calibration cup and regulator.*

Preparing for Calibration

1. Screw the calibration cup onto the bottom of the CO detector.
2. Screw the regulator into the zero air calibration cylinder. Make sure the regulator is off. It is off when the on/off knob is turned all the way clockwise.
3. Use the sample tubing to connect the regulator to the calibration cup.

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

4. Put the controller into its calibration program. See the controller operator’s manual for instructions to enter the calibration program.

Setting the Zero (Fresh Air) Reading

1. Follow the instructions in the controller operator's manual for setting the zero reading.
2. When the instructions call for applying zero air to the detector, turn the regulator's on/off knob counterclockwise to open it. Gas will begin to flow.
3. Allow the gas to flow for two minutes.
4. Set the fresh air reading according to the controller operator's manual.
5. Turn the regulator's on/off knob clockwise to close it.
6. Unscrew the regulator from the zero air calibration cylinder. Leave the sample tubing connected to the regulator and the calibration cup.

NOTE: Depending on the size of your zero air cylinder, it is possible that you will have a different regulator for the zero air cylinder and the CO gas cylinder. If necessary to fit the CO calibration gas cylinder, change the regulator.

Setting the Response Reading (Span)

1. Screw the regulator into the calibration gas cylinder. Make sure the regulator is off. It is off when the on/off knob is turned all the way clockwise.
2. Follow the directions in the controller operator's manual for setting the response (span) reading.
3. When the instructions call for exposing the detector to gas, turn the regulator's on/off knob counterclockwise to open it. Gas will begin to flow.
4. Allow the gas to flow to the detector for 2 minutes.
5. Set the response reading according to the controller operator's manual.
6. After setting the response reading, turn the regulator's on/off knob clockwise to turn it off.
7. Unscrew the regulator from the cylinder.
8. Unscrew the calibration cup from the CO detector. Make sure that you do not loosen the detector housing cap when you unscrew the calibration cup.

NOTE: For convenience, leave the regulator and calibration cup connected by the sample tubing.

Returning to Normal Operation

1. Allow about 45 seconds for the gas reading to decrease below the alarm points and then return the controller to normal operation.

NOTE: If you do not allow the gas reading to decrease below the alarm points, then unwanted alarms may occur.

2. Verify that the controller display reading decreases and stabilizes at 0 ppm.
3. Store the components of the calibration kit in a safe and convenient place.

Parts List

Table 2 lists replacement parts and accessories for the CO detector.

Table 2: Parts List

Part Number	Description
06-1248RK-03	3 foot length of sample tubing for calibration kit
07-0039RK	Detector housing cap gasket
07-0203RK	Rubber retaining boot (for charcoal filter)
33-0157RK	Hydrophobic membrane, adhesive backed, for detector housing cap
33-7101RK	Charcoal Filter Disk
65-2496RK	CO replacement detector assembly (includes plug-in sensor)
71-0156RK	<i>65-2496RK/65-2499RK CO Detector Operator's Manual</i> (this document)
81-0064RK	Calibration cylinder, 50 PPM CO in air; 17 liter steel
81-0064RK-01	Calibration cylinder, 50 PPM CO in air; 34 liter steel
81-0064RK-03	Calibration cylinder, 50 PPM CO in air; 103 liter steel
81-0076RK	Zero air calibration cylinder, 17 liter steel
81-0076RK-01	Zero air calibration cylinder, 34 liter steel
81-0076RK-03	Zero air calibration cylinder, 103 liter steel
81-1050RK	Regulator with gauge and knob, 0.5 LPM, for 17 liter and 34 liter steel calibration cylinders
81-1051RK	Regulator with gauge and knob, 0.5 LPM, for 34AL/58/103 liter calibration cylinders
81-1117RK	Calibration cup
ES-1531-CO	CO replacement sensor