**WARNING**

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

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

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

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

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

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

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

This manual describes the 65-2438 carbon monoxide (CO) detector. This manual also describes how to install, start up, maintain, and calibrate the 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 CO detector.

Specifications

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

Table 1 lists specifications for the CO Detector.

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Target Gas</td>
<td>Carbon monoxide (CO)</td>
</tr>
<tr>
<td>Area Classification*</td>
<td>Explosionproof for Class I, Groups B, C, and D</td>
</tr>
<tr>
<td>Temperature Code</td>
<td>T6</td>
</tr>
<tr>
<td>Installation Category</td>
<td>Installation Category 1. Signal level, special equipment or parts of equipment, telecommunication, electronic, etc., with smaller transient overvoltages than Installation Category (Overvoltage Category) II (ref. IEC 664).</td>
</tr>
<tr>
<td>Sampling Method</td>
<td>Diffusion</td>
</tr>
<tr>
<td>Signal Output</td>
<td>4 to 20 mA</td>
</tr>
<tr>
<td>Detection Range</td>
<td>0 to 100 ppm (parts per million)</td>
</tr>
<tr>
<td>CO Detector Signal Output</td>
<td>0.3 mA at 0 ppm CO nominal, 2.5 mA at 300 ppm CO nominal</td>
</tr>
<tr>
<td>Response Time</td>
<td>90% in 30 seconds</td>
</tr>
<tr>
<td>Accuracy</td>
<td>± 5% of reading or ± 5 ppm CO (whichever is greater)</td>
</tr>
<tr>
<td>Operating Temperature</td>
<td>23°F to 104°F (5°C to 40°C)</td>
</tr>
<tr>
<td></td>
<td>* This area classification only applies if the detector is installed using a Killark HKB junction box and a Killark HFC, HK2D, or HK4D cover.</td>
</tr>
</tbody>
</table>

NOTE: The following symbol on the detector label is a caution to the user to refer to this documentation for installation and operation instructions:

WARNING: When using the 65-2438, you must follow the instructions and warnings in this manual to assure proper and safe operation of the 65-2438 and to minimize the risk of personal injury. Be sure to maintain and periodically calibrate the 65-2438 as described in this manual.
This section describes the components of the CO detector. The detector consists of the CO sensor, charcoal filter with rubber boot, detector housing body, detector housing cap, and cap gasket.

**Detector Housing, Housing Cap, & Cap Gasket**

The detector housing body protects the sensing components within the housing. Use the 3/4” NPT mounting threads at the top of the housing to screw the CO detector into the bottom conduit hubs of the junction box. Use the removable cap near the bottom of the housing to access the sensor for maintenance or replacement. The cap protects the sensor from damage and includes a flame arrestor which contains any sparks which may occur within the detector housing. A cap gasket seals the interface between the housing and cap. A flame arrestor guard is permanently bonded to the cap.

Two wires extend from the top of the detector housing body. Use these wires to connect the CO detector to a controller. The housing includes a four-socket pattern. This socket pattern accepts the sensor’s four pins to secure the sensor within the detector housing. A pre-amplifier, located between the sockets and two interconnect wires, conditions the sensor’s signal before the signal reaches the controller.

**Plug-In Sensor**

The sensor is secured within the sensor housing by four pins. 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 the face of the CO sensor with a rubber boot. The charcoal filter prevents interference gases (hydrogen sulfide \([H_2S]\) and certain hydrocarbons) from producing false CO readings.
This section describes procedures to mount the CO detector in the monitoring environment and wire the detector to a controller.

**Mounting the CO 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 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.

2. At the monitoring site, install the detector in the bottom conduit hub of a junction box:

**CAUTION:** Mount the CO detector with the detector facing down (see Figure 2).
NOTE: If the mounting site requires the detector installation to be explosion proof, you must install the detector in a Killark HKB junction box with a Killark HFC, HK2D, or HK4D cover.

Wiring the CO Detector to a Controller

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

1. Turn off the controller.
2. Turn off or unplug power to the controller.
3. Remove the junction box cover.

WARNING: To maintain the explosion proof classification of the CO detector/junction box combination, a conduit seal must be used within 18 inches of the junction box conduit hub used for wiring to the controller.

4. Guide a two-conductor, shielded cable or two wires in conduit through an unused conduit hub of the junction box.
5. Connect the two wires to the detector using an appropriate 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.

6. Secure the junction box cover to the junction box.
7. Route the cable or wires leading from the CO detector through one of the conduit hubs at the controller 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 controller.

8. Connect the wires to the applicable controller terminal strip. See the controller operator’s manual and the controller’s detector head specification sheet.
9. Connect the cable’s drain wire to an available chassis ground at the controller.

10. Reinstall the junction box cover.
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 power to the controller.
4. Turn on the controller.
5. Verify that the controller is on and operating properly. Refer to the controller operator’s manual.

CAUTION: Allow the 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

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

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 10 for instructions to introduce zero air to the CO detector.

1. Verify that the detector is in a fresh air environment (environment known to be free of carbon monoxide, other toxic and combustible gases, and of normal oxygen content, 20.9%).
2. Verify a reading of 0 ppm CO at the controller.
   If the display reading is 0 ppm CO, start up is complete. The detector is in normal operation. If the display reading is not 0 ppm CO, continue with step 3.
3. Perform a zeroing operation at the controller. See the controller operator’s manual for directions.
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 CO 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 carbon monoxide. It describes a test using a fixed flow regulator with an on/off knob. RKI Instruments, Inc. recommends using a 0.5 LPM (liters per minute) fixed flow regulator.

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 zero, set the zero reading of the detector as described in the Start Up section of this manual, then continue this procedure.

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

3. Screw the calibration cup onto the bottom of the CO detector.
4. Screw the regulator into the calibration cylinder.
5. Use the calibration kit 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 ± 20% of the cylinder gas concentration.

NOTE: If the reading is not within ± 20% of the correct response reading, calibrate the detector as described in the Calibration section of this manual.

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.
6. When the controller display reading falls below the alarm setpoints, return the controller to normal operation.

7. Store the components of the calibration kit in a safe place.

**Quarterly**

Calibrate the CO detector as described in the Calibration section of this manual.

**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.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Symptom(s)</th>
<th>Probable Causes</th>
<th>Recommended Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fail Condition</td>
<td>Controller indicates a fail condition.</td>
<td>• The detector wiring is disconnected or mismatched.</td>
<td>1. Verify that the detector wiring is correct and secure.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• The plug-in sensor is not properly plugged into the sockets in the detector housing body.</td>
<td>2. Confirm that the plug-in sensor is installed properly.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• The detector’s zero reading is low enough to cause a fail condition.</td>
<td>3. Perform a zero adjustment. A full calibration is recommended.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• The detector is malfunctioning.</td>
<td>4. If the fail condition continues, replace the plug-in sensor as described later in this section.</td>
</tr>
<tr>
<td>Slow or No Response/</td>
<td>• Detector responds slowly or does not respond to response test.</td>
<td>• The calibration cylinder is low, out-dated, or defective.</td>
<td>5. If the fail condition continues, contact RKI for further instruction.</td>
</tr>
<tr>
<td>Difficult or Unable to</td>
<td>• Unable to accurately set the zero or response reading during calibration.</td>
<td>• The flame arrestor in the detector housing cap is wet or clogged with dirt or other particulates.</td>
<td></td>
</tr>
<tr>
<td>Calibrate</td>
<td>• Detector requires frequent calibration.</td>
<td>• The calibration gas is not an appropriate concentration.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• The detector is malfunctioning.</td>
<td></td>
</tr>
<tr>
<td>Unexplained Upscale Readings or</td>
<td>• Controller indicates a CO reading that cannot be verified.</td>
<td>• Charcoal filter is saturated and no longer scrubbing out interfering gases.</td>
<td>1. Replace charcoal filter.</td>
</tr>
<tr>
<td>Alarms</td>
<td>• CO alarms occur at the controller that cannot be explained.</td>
<td></td>
<td>2. If difficulties continue, contact RKI for further instructions.</td>
</tr>
</tbody>
</table>

**Table 2: Troubleshooting the CO Detector**

Some applications may require a more frequent calibration schedule.
Replacing Components of the CO Detector

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

Replacing the Plug-In CO Sensor

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

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. Make sure not to lose the cap gasket.
4. Unplug and remove the CO sensor with the boot and charcoal filter attached.
5. Remove the rubber boot and charcoal filter from the old sensor.
6. Install the rubber boot with charcoal filter onto the replacement sensor’s face.
7. Carefully plug the replacement sensor into the four-socket pattern that is located in the detector housing.
8. Make sure the cap gasket is in place and screw the detector housing cap back onto the detector housing body.
9. Turn on or plug in power to the controller.
10. Turn on the controller and place into normal operation.

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

11. Calibrate the replacement sensor as described in the Calibration section of this manual.

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

**Replacing the CO Detector**

**NOTE:** In most cases, it is only necessary to replace the CO sensor.

1. Turn off the controller.
2. Turn off or unplug power to the controller.
3. Remove the junction box cover.
4. 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 junction box hub.
6. Guide the detector leads of the replacement detector through the junction box hub then screw the mounting threads of the detector into the hub.
7. Connect the detector leads to the terminal block the same way the old detector was wired. See the controller operator’s manual and the controller’s detector head specification sheet to verify the connections are correct.
8. Reinstall the junction box cover.
9. Turn on or plug in power to the controller.
10. Turn on the controller and place into normal operation.

**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 the Calibration section of this manual.

**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, 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, 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 zero 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.
Preparing for Calibration

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

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

1. Screw the calibration cup onto the bottom of the CO detector.
2. Screw the regulator into the calibration cylinder.
3. Use the calibration kit sample tubing to connect the fixed flow regulator to the calibration cup.
4. Put the controller into its calibration program.

Setting the Zero Reading

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 zero reading.

1. Follow the directions 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.
3. Allow the gas to flow for two minutes.
4. Set the zero reading according to the controller operator’s manual.
5. Turn the regulator’s on/off knob clockwise to close it.
6. Leave the sample tubing connected to the regulator and the calibration cup.

Setting the Response Reading

1. Follow the directions in the controller operator’s manual for setting the response reading (span).
2. When the directions call for exposing the detector to gas, turn the regulator’s on/off knob counterclockwise to open it.
3. Allow gas to flow for 2 minutes before continuing with the directions.
4. After setting the response reading, turn the regulator’s on/off knob clockwise to close it.
5. Unscrew the regulator from the cylinder.
6. Remove the calibration cup from the detector.

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

7. 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.

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

**Parts List**

Table 5 lists replacement parts and accessories for the CO detector.

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>06-1248RK</td>
<td>Sample tubing (order by the foot)</td>
</tr>
<tr>
<td>07-0033RK</td>
<td>Detector housing cap gasket</td>
</tr>
<tr>
<td>07-0203RK</td>
<td>Rubber retaining boot (for charcoal filter)</td>
</tr>
<tr>
<td>33-7101RK</td>
<td>Charcoal Filter Disk</td>
</tr>
<tr>
<td>65-2438</td>
<td>CO replacement detector assembly (includes sensor)</td>
</tr>
<tr>
<td>71-0343</td>
<td><em>65-2438 CO Detector Operator’s Manual</em> (this document)</td>
</tr>
<tr>
<td>81-0064RK-01</td>
<td>Calibration cylinder, 50 ppm CO in air, 34 liter steel</td>
</tr>
<tr>
<td>81-0064RK-03</td>
<td>Calibration cylinder, 50 ppm CO in air, 103 liter steel</td>
</tr>
<tr>
<td>81-0076RK</td>
<td>Zero air calibration cylinder, 17 liter steel</td>
</tr>
<tr>
<td>81-0076RK-01</td>
<td>Zero air calibration cylinder, 34 liter steel</td>
</tr>
<tr>
<td>81-0076RK-03</td>
<td>Zero air calibration cylinder, 103 liter steel</td>
</tr>
<tr>
<td>81-1050RK</td>
<td>Regulator with gauge and knob, 0.5 LPM, for 17 liter and 34 liter steel calibration cylinders</td>
</tr>
<tr>
<td>81-1051RK</td>
<td>Regulator with gauge and knob, 0.5 LPM, for 34AL/58/103 liter calibration cylinders</td>
</tr>
<tr>
<td>81-1117RK</td>
<td>Calibration cup</td>
</tr>
<tr>
<td>ES-1531-CO</td>
<td>CO replacement sensor</td>
</tr>
</tbody>
</table>