

# **65-2400RK Combustible Gas Transmitter Operator's Manual**

*Part Number: 71-0060RK*

*Revision: C*

*Released: 1/31/13*

## **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.

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## 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.

*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 65-2400RK combustible gas transmitter. This manual also describes how to install, start up, configure, maintain, and calibrate the transmitter 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 combustible gas transmitter.

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## Specifications

Table 1 lists specifications for the combustible gas transmitter.

**Table 1: Specifications**

Description	Specification
Target Gas	Combustible gas
Area Classification	Explosionproof for Class I, Groups B, C, and D
Sampling Method	Diffusion
Signal Output	4 to 20 mA
Detection Range	0 to 100% LEL
Accuracy	± 5% of reading or ± 2% LEL (whichever is greater)
Response Time	90% in 45 seconds

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**WARNING:** *When using the 65-2400RK, you must follow the instructions and warnings in this manual to assure proper and safe operation of the 65-2400RK and to minimize the risk of personal injury. Be sure to maintain and periodically calibrate the 65-2400RK as described in this manual.*

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## Description

This section describes the components of the combustible gas transmitter. The transmitter is a 4 - 20 mA type detector head. It consists of the combustible gas detector, amplifier, and junction box.

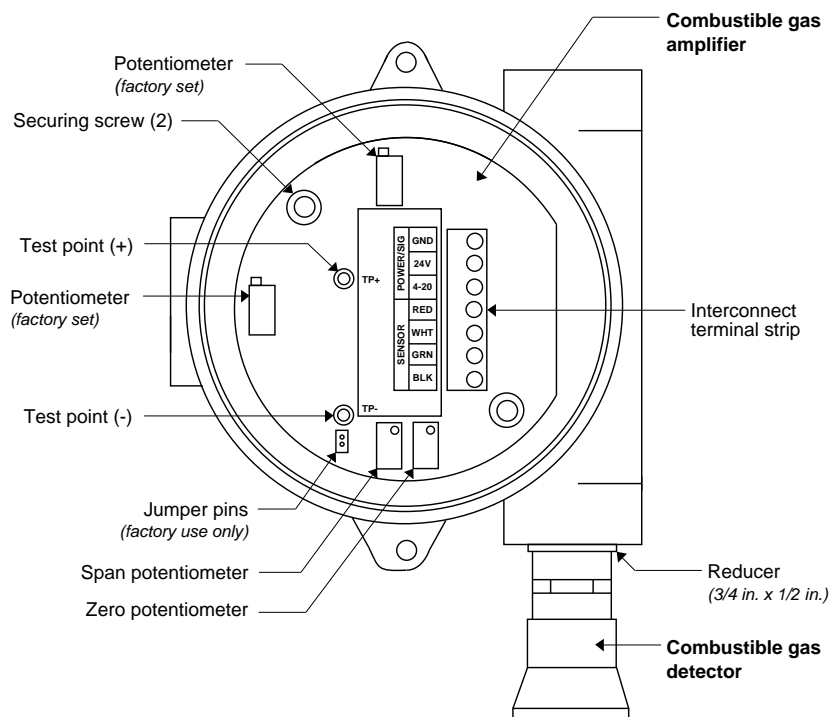


Figure 1: Combustible Gas Transmitter Component Location

### Combustible Gas Detector

The combustible gas detector includes the sensing elements, flame arrestor, detector housing, and detector leads.

#### *Sensing Elements*

Two sensing elements are protected within the detector assembly. Through a series of thermal and electronic reactions, these elements produce an electrical output that is proportional to the detection range of the transmitter.

#### *Flame Arrestor*

The porous flame arrestor allows the target gas to diffuse into the detector assembly and contact the sensing elements. The flame arrestor also contains sparks within the detector.

### ***Detector Housing***

The sensing elements and flame arrestor are installed within the detector housing. Mounting threads (1/2 in. NPT) at the top of the detector allow you to mount the combustible gas detector into the bottom conduit hub of the junction box. A rainshield screws onto the bottom of the detector. The rainshield helps protect the detector from debris in the monitoring environment.

### ***Detector Leads***

Four color-coded leads extend from the top of the detector. The leads allow you to connect the combustible gas detector to the amplifier.

### **Amplifier**

The amplifier converts the electrical output from the detector to a 4 to 20 mA signal that is proportional to the detection range and transmits the signal to a gas monitoring controller. The amplifier includes the interconnect terminal strip, span pot, zero pot, and test points (see Figure 1).

### ***Interconnect Terminal Strip***

The interconnect terminal strip is a seven-point terminal strip. Use the interconnect terminal strip to connect the combustible gas detector to the amplifier and the amplifier to a controller.

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**NOTE:** The combustible gas detector is factory-wired to the amplifier. See the Installation section of this manual for all wiring procedures related to the transmitter.

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### ***Span Pot***

The span pot is near the bottom of the amplifier (see Figure 1). Use the span pot to adjust the transmitter's response output during the calibration procedure.

### ***Zero Pot***

The zero pot is to the right of the span pot (see Figure 1). Use the zero pot to adjust the transmitter's target gas-free output during the start-up and calibration procedures.

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

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### ***Test Points***

The test points (labeled **TP+** and **TP-**) are to the left of the interconnect terminal strip (see Figure 1). The test points produce a 100 to 500 mV output that is proportional to the transmitter's 4 to 20 mA output. Use the test points and a voltmeter to measure the transmitter's output during the start-up and calibration procedures.

## Junction Box

Use the junction box to install the combustible gas transmitter at a mounting site that is remote from the controller. The junction box also protects the amplifier and wiring connections made to the amplifier. Use the two 3/4 in. conduit hubs to mount the detector to the junction box (bottom hub) and connect wiring from the amplifier to the controller (top hub). The detector has 1/2 in. NPT mounting threads, so a 3/4 in NPT. x 1/2 in. NPT reducer is used to mount it.

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**NOTE:** The combustible gas detector and amplifier are factory-mounted to the junction box.

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Use the junction box's two mounting holes to mount the combustible gas transmitter to a vertical surface at the monitoring site. Use the cover on the front of the junction box to access the interior of the junction box.



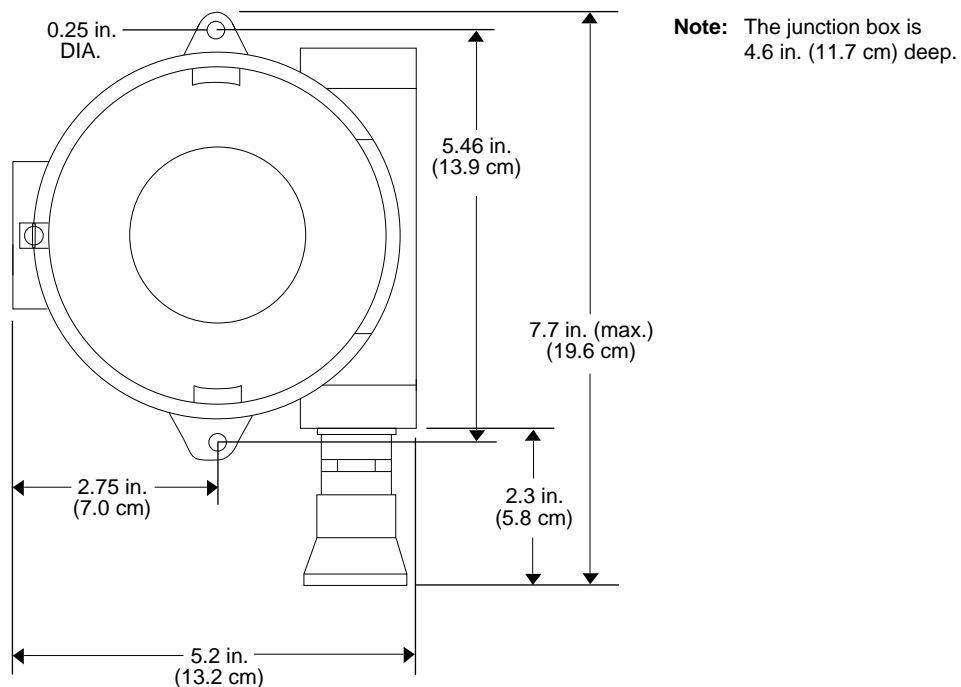
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## Installation

This section describes procedures to mount the combustible gas transmitter in the monitoring environment and wire the transmitter to the controller.

### Mounting the Combustible Gas Transmitter

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 transmitter 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. For lighter gases, mount the detector near the ceiling; for heavier gases, mount the detector near the floor.



**Figure 2: Mounting the Combustible Gas Transmitter**

If the combustible gas detector is mounted to the junction box, skip to step 5. If not, continue with step 2.

2. Remove the junction box cover.
3. Guide the four wires that extend from the top of the combustible gas detector through the bottom conduit hub of the junction box.
4. Screw the combustible gas detector into the bottom conduit hub of the junction box.
5. At the monitoring site, use #10 screws through the junction box's two mounting holes to secure the junction box to a vertical surface.

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**CAUTION:** Mount the combustible gas transmitter with the detector facing down (see Figure 2).

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## Wiring the Combustible Gas Transmitter to a Controller

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

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1. Turn off power to the controller.
2. Place the controller's power switch in the OFF position.
3. Remove the junction box cover.
4. Verify that the detector leads are wired to the amplifier's interconnect terminal strip. If necessary, connect the detector leads to the interconnect terminal strip as shown in Figure 3.
5. Guide a three-conductor, shielded cable or three wires in conduit through the top conduit hub of the junction box.
6. Connect the three wires to the interconnect terminal strip as follows (see Figure 3).
  - Connect the positive wire to the **24VDC** terminal.
  - Connect the feedback wire to the **4-20 (FB)** terminal.
  - Connect the negative wire to the **DC -** terminal.

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**CAUTION:** *If shielded cable is used, leave the cable shield's drain wire insulated and disconnected at the transmitter. You will connect the opposite end of the cable's drain wire at the controller to chassis ground.*

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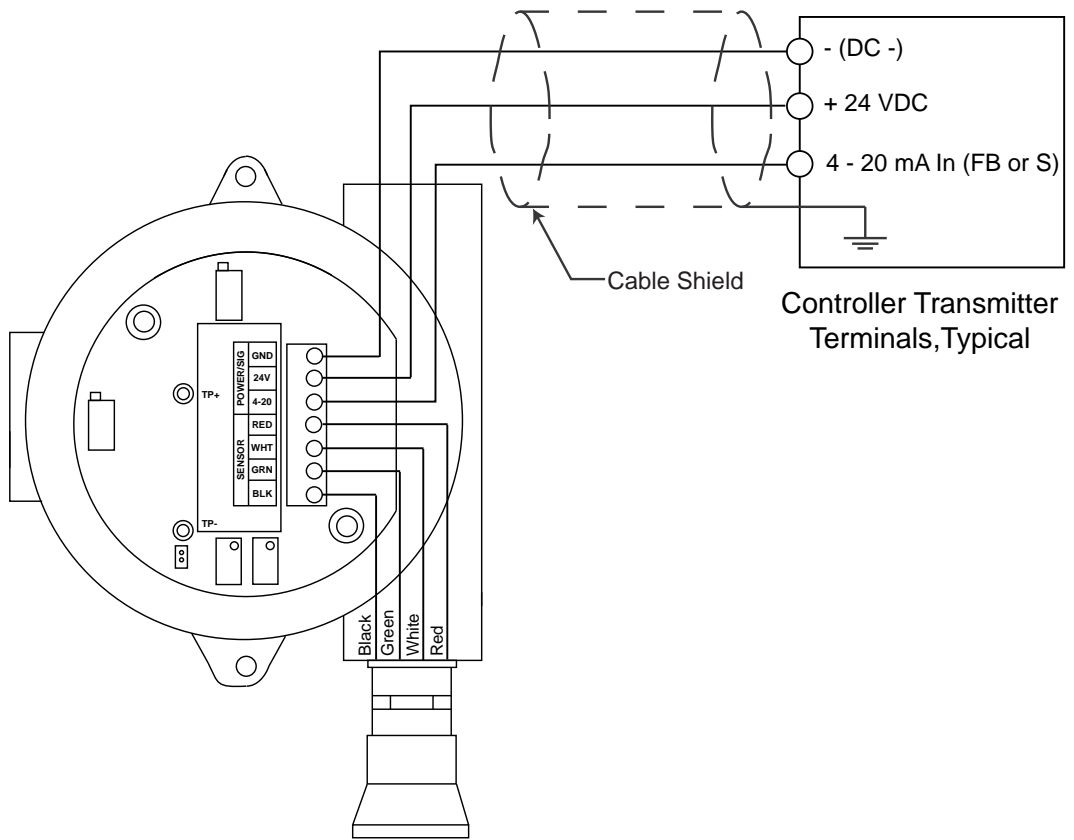
7. Secure the junction box cover to the junction box.
8. Route the cable or wires leading from the combustible gas transmitter through one of the conduit hubs at the controller housing.

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

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9. Connect the wires to the applicable transmitter terminal strip at the controller as shown in Figure 3 below.



**Figure 3: Wiring the Combustible Gas Transmitter to a Controller**

10. If shielded cable is used, connect the cable's drain wire to an available chassis ground at the controller. RKI controllers typically have a ground stud that can be used to ground the cable's drain wire.

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## Start Up

This section describes procedures to start up the combustible gas transmitter and place the transmitter 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 power to the controller, then place the controller's power switch in the ON position.
4. Verify that the controller is on and operating properly. Refer to the controller operator's manual.

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**CAUTION:** Allow the detector to warm up for 5 minutes before you continue with the next section, "Setting the Zero Signal".

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### Setting the Zero Signal

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**NOTE:** If you can verify that the detector is in a fresh air environment (environment known to be of normal oxygen content and free of toxic and combustible gases), it is not necessary to apply zero air when verifying or setting the fresh air reading.

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The procedure below describes applying zero emission air, usually called zero air, 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.

1. Unscrew and remove the junction box cover from the junction box.
2. Set a voltmeter to measure in the millivolt (mV) range.
3. Plug the voltmeter leads into the test points on the amplifier. Plug the positive lead into the test point labeled **TP+**; plug the negative lead into the test point labeled **TP-**.
4. Screw the calibration cup onto the bottom of the detector.
5. Screw the regulator into the zero air calibration cylinder.
6. Use the sample tubing to connect the regulator to the calibration cup.
7. Turn the regulator's on/off knob counterclockwise to open it.
8. Verify a voltmeter reading of 100 mV ( $\pm 2$  mV).
9. If necessary, use a flat-blade screwdriver to adjust the zero pot until the voltmeter reading is 100 mV ( $\pm 2$  mV).
10. Turn the regulator's on/off knob clockwise to close it.
11. Unscrew the calibration cup from the detector. For convenience, leave the sample tubing connected to the regulator and the calibration cup.
12. Store the components of the calibration kit in a safe and convenient place.
13. Remove the voltmeter leads from the test points.
14. Secure the junction box cover to the junction box.

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## 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 combustible gas transmitter. It includes daily, monthly, and quarterly procedures.

#### *Daily*

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

#### *Monthly*

This procedure describes a test to verify that the combustible gas transmitter 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.

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

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#### *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 %LEL.  
If the display reading is not zero, set the zero reading of the transmitter as described in “Start Up” on page 8 of this manual, then continue this procedure.
3. Screw the calibration cup onto the bottom of the combustible detector.
4. Screw the regulator into the calibration cylinder.
5. Use the calibration kit sample tubing to connect the regulator to the calibration cup.
6. Set a voltmeter to measure in the millivolt (mV) range.
7. Remove the junction box cover, then plug the voltmeter leads into the test points on the amplifier.

Plug the positive lead into the test point labeled **TP+**; plug the negative lead into the test point labeled **TP-**.

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

$$\text{Output (mV)} = (\text{calibrating sample/fullscale}) \times 400 + 100$$

For example, with a test sample of 50% LEL and a fullscale setting of 100% LEL, the correct output is 300 mV.

$$300 \text{ (mV)} = (50/100) \times 400 + 100$$

#### *Performing the response test*

1. Turn the regulator’s on/off knob counterclockwise to open it. The sample 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 response reading you determined earlier.

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**NOTE:** If the reading is not within  $\pm 20\%$  of the correct response reading, calibrate the transmitter as described in “Calibration” on page 14 of this manual.

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3. Turn the regulator’s on/off knob clockwise to close it.
4. Unscrew the regulator from the calibration cylinder.
5. Unscrew the calibration cup from the detector.
6. Remove the voltmeter leads from the amplifier test points.
7. Reinstall the junction box cover.
8. When the controller display reading falls below the alarm setpoints, return the controller to normal operation.

***Quarterly***

Calibrate the combustible gas transmitter as described in “Calibration” on page 14 of this manual.

## Troubleshooting

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

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

**Table 2: Troubleshooting the Combustible Gas Transmitter**

Condition	Symptom(s)	Probable Causes	Recommended Action
Fail Condition	<ul style="list-style-type: none"> <li>Controller indicates a fail condition.</li> </ul>	<ul style="list-style-type: none"> <li>The transmitter wiring is disconnected or misconnected.</li> <li>The transmitters zero reading is low enough to cause a fail condition.</li> <li>The transmitter is malfunctioning.</li> </ul>	<ol style="list-style-type: none"> <li>Verify that the transmitter wiring is correct and secure.</li> <li>Calibrate the transmitter.</li> <li>If the fail condition continues, replace the detector.</li> <li>If the fail condition continues, contact RKI for further instruction.</li> </ol>
Slow or No Response/ Difficult or Unable to Calibrate	<ul style="list-style-type: none"> <li>Transmitter responds slowly or does not respond to response test.</li> <li>Unable to accurately set the zero or response reading during calibration.</li> <li>Transmitter requires frequent calibration.</li> </ul> <p><i>Note: Under "normal" circumstances, the transmitter requires calibration once every three months. Some applications may require a more frequent calibration schedule.</i></p>	<ul style="list-style-type: none"> <li>The calibration cylinder is low, out-dated, or defective.</li> <li>The transmitter is malfunctioning.</li> </ul>	<ol style="list-style-type: none"> <li>Verify that the calibration cylinder contains an adequate supply of a fresh test sample.</li> <li>Verify that the regulator used for calibration is a 0.5 LPM regulator.</li> <li>If the calibration/response difficulties continue, replace the detector.</li> <li>If the calibration/response difficulties continue, contact RKI for further instruction.</li> </ol>

## Replacing Components of the Combustible Gas Transmitter

This section includes procedures to replace the combustible gas detector and amplifier.

### ***Replacing the Combustible Gas Detector***

1. Turn off power to the controller.
2. Place the controller's power switch in the OFF position.
3. Remove the junction box cover.
4. Disconnect the detector leads from the interconnect terminal strip. Note the position of the color-coded leads as you remove them.
5. Unscrew the detector from the junction box.
6. 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.
7. Connect the detector leads to the interconnect terminal strip as shown in Table 3 below and Figure 3 on page 7 of this manual.

**Table 3: Reconnecting the Combustible Gas Detector to the Amplifier**

<b>Detector Lead</b>	<b>Amplifier Interconnect Terminal Strip</b>
Red	RED
White	WHT
Green	GRN
Black	BLK

8. Turn on power to the controller.
9. Place the controller's power switch in the ON position.

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

---

10. Calibrate the replacement detector as described in "Calibration" on page 14 of this manual.

### ***Replacing the Amplifier***

1. Turn off power to the controller
2. Place the controller's power switch in the OFF position.
3. Remove the junction box cover.
4. Disconnect the detector leads from the interconnect terminal strip.
5. Disconnect the wiring that connects the combustible gas transmitter to the controller from the amplifier's interconnect terminal strip.
6. Unscrew and remove the two screws that secure the amplifier to the junction box. The screws are at the top left and bottom right of the amplifier.
7. Remove the amplifier.



8. Place the new amplifier in the same position as the amplifier you removed in the previous step.
9. Use the two screws you removed in step 5 to secure the amplifier to the junction box.
10. Reconnect the wiring that connects the controller to the combustible gas transmitter at the amplifier's interconnect terminal strip as shown in Table 4 below and Figure 3 on page 7 of this manual.

**Table 4: Reconnecting the Combustible Gas Amplifier to the Controller**

Amplifier Interconnect Terminal Strip	Controller Transmitter Terminal Strip (typical)
GND	- (DC -)
4-20	4 - 20 mA (FB or S)
24V	+ 24V

11. Reconnect the detector leads to the amplifier's interconnect terminal strip as shown in Table 5 below and Figure 3 on page 7 of this manual.

**Table 5: Reconnecting the Combustible Gas Detector to the Amplifier**

Detector Lead	Amplifier Interconnect Terminal Strip
Red	RED
White	WHT
Green	GRN
Black	BLK

12. Turn on power to the controller.
13. Turn on the controller and place it into normal operation.

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

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14. Calibrate the combustible gas transmitter as described in "Calibration" on page 14 of this manual.

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## Calibration Frequency

Although there is no particular calibration frequency that is correct for all applications, a calibration frequency of every 3 to 6 months is adequate for most combustible gas transmitter applications. Unless experience in a particular application dictates otherwise, RKI Instruments, Inc. recommends a calibration frequency of every 3 months.

If an application is not very demanding, for example detection in a clean, temperature controlled environment where combustible gas 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 combustible gas is present often and in significant concentrations or the environment is not well controlled, then more frequent calibration than every 3 months may be necessary. If potential catalyst poisons are known or likely to be present, more frequent calibration than every 3 months will be necessary.

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## Calibration

This section describes how to calibrate the combustible gas transmitter. It includes procedures to prepare for calibration, set the zero reading, set the response reading, and return to normal operation. 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.

### Preparing for Calibration

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**NOTE:** Calibrating the combustible transmitter may cause alarms. Be sure to put the controller into its calibration program or disable external alarms before continuing.

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1. Screw the calibration cup onto the bottom of the combustible gas detector.
2. Screw the regulator into the zero air calibration cylinder.
3. Use the sample tubing to connect the regulator to the calibration cup.
4. Set a voltmeter to measure in the millivolt (mV) range.
5. Remove the junction box cover, then plug the voltmeter leads into the test points on the amplifier.

Plug the positive lead into the test point labeled **TP+**; plug the negative lead into the test point labeled **TP-**.

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

$$\text{Output (mV)} = (\text{calibrating sample}/\text{fullscale}) \times 400 + 100$$

For example, with a calibrating sample of 50% LEL and a fullscale setting of 100% LEL, the correct output is 300 mV.

$$300 \text{ (mV)} = (50/100) \times 400 + 100$$

### Setting the Zero Reading

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

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1. Turn the regulator's on/off knob counterclockwise to open it. The sample will begin to flow.
2. Allow the gas to flow for two minutes.
3. Verify a reading of 100 mV ( $\pm 2$  mV).

4. If necessary, use the zero pot on the amplifier to adjust the reading to 100 mV ( $\pm 2$  mV).
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.

### **Setting the Response Reading**

1. Screw the regulator into the calibration cylinder. Verify that the calibrating gas is representative of the transmitter's target gas.
2. Turn the regulator's on/off knob counterclockwise to open it.
3. Allow the sample gas to flow for two minutes.
4. Verify that the reading matches the response reading ( $\pm 2$  mV) you determined earlier.
5. If necessary, use the span pot on the amplifier to adjust the reading to match the correct response reading.
6. Turn the regulator's on/off knob clockwise to close it.
7. Unscrew the regulator from the calibration cylinder.
8. Unscrew the calibration cup from the detector.

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

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### **Returning to Normal Operation**

1. Remove the voltmeter leads from the amplifier test points.
2. Secure the junction box cover to the junction box.
3. When the display reading falls below the alarm setpoints, return the controller to normal operation.
4. Verify that the controller display reading decreases and stabilizes at 0% LEL.
5. Store the components of the calibration kit in a safe and convenient place.

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## Parts List

Table 6 lists replacement parts and accessories for the combustible gas transmitter.

**Table 6:Parts List**

<b>Part Number</b>	<b>Description</b>
06-1248RK	Sample tubing (3/16 in. x 5/16 in.; specify length when ordering)
18-0001RK	Reducer, 3/4 in. NPT x 1/2 in. NPT
18-0405RK-01	Junction box (without cover; pre-drilled for amplifier)
18-0406RK	Junction box cover (cover only)
57-1050RK	Amplifier (specify target gas when ordering)
61-0140RK	Combustible gas detector
65-2400RK	Combustible gas transmitter (includes detector and amplifier; specify target gas when ordering)
71-0060RK	<i>65-2400RK Combustible Gas Transmitter Operator's Manual</i> (this document)
81-0007RK-01	Calibration cylinder (15% LEL Hexane; 34-liter)
81-0012RK-01	Calibration cylinder (50% LEL Methane; 34-liter)
81-0076RK-01	Zero air calibration cylinder (34-liter)
81-1050RK	Regulator with gauge and knob, 0.5 LPM, for 17 liter and 34 liter steel calibration cylinders
81-1117RK	Calibration cup