INSTRUMENTS

61-1020/61-0230
Molecular Property Spectrometer™
Combustible Gas Detector

Operator's Manual

Part Number: 71-0592

Revision: A

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RKI Instruments, Inc.
www.rkiinstruments.com

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. For most applications, typical calibration frequencies are between 6 and 12 months but can be 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 two years 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:

- Absorbent cartridges
- Pump diaphragms and valves
- Fuses
- Batteries
- 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 61-1020 combustible gas detector. This manual also describes how to install, start up, maintain, and calibrate the detector when used with a gas monitoring controller. A parts list at the end of this manual lists replacement parts and accessories for the combustible gas detector.

The 61-1020 combustible gas detector includes a junction box. This manual may also be used for the 61-0230 combustible gas 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 61-0230 combustible gas detector, disregard all references to the junction box and junction box terminal block.

Specifications

Table 1 specifies the detection range and accuracy for the 14 gases that the MPS sensor can reliably detect at the same time.

Table 1: Detection Ranges and Accuracy

Target Gas	Formula	Detection Range	Accuracy (0 to 50% LEL)
Butane	C_4H_{10}	0 - 100% LEL	± 5% LEL
Ethane	C_2H_6	0 - 100% LEL	± 5% LEL
Hydrogen	H_2	0 - 100% LEL	± 5% LEL
Isobutane	$HC(CH_3)_3$	0 - 100% LEL	± 5% LEL
Isobutylene	C_4H_8	0 - 100% LEL	± 5% LEL
Isopropanol	C_3H_8O	0 - 100% LEL	± 10% LEL
Methane	CH_4	0 - 100% LEL	± 3% LEL
Methyl Ethyl Ketone	C_4H_8O	0 - 100% LEL	± 5% LEL
Octane	C_8H_{18}	0 - 100% LEL	± 5% LEL
Pentane	C_5H_{12}	0 - 100% LEL	± 5% LEL
Propane	C_3H_8	0 - 100% LEL	± 6% LEL
Propylene	C_3H_6	0 - 100% LEL	± 5% LEL
Toluene	C_7H_8	0 - 100% LEL	± 12% LEL
Xylene	C_8H_{10}	0 - 100% LEL	± 12% LEL

NOTE: *The MPS sensor will respond to other combustible gases, but the accuracy has only been determined for these 14 gases.*

Table 2: Specifications

Calibration Gas	61-1020 (With Junction Box) • Methane (CH_4)* 61-0230 Without Junction Box • Methane (CH_4)* * *The detector **must** be calibrated using the methane-in-real-air calibration cylinder, 81-9070RK-03.*
Area Classification	Explosion-proof for Class I, Groups B, C, and D
Operating Temperature Range	-20ºC to +50ºC (-4ºF to +122ºF)
Humidity Range	0 - 100% RH (non-condensing)
Pressure Range	80 to 120 kPa
Sampling Method	Diffusion
Detection Range	0 to 100% LEL
Response Time	90% in 45 seconds
Dead Bands	• Methane (CH_4): 3% LEL • All other gases: 5% LEL ***NOTE:** If the connected controller's dead band setting is 2% LEL for an MPS channel, a reading will not be displayed until it has exceeded the MPS sensor's internal dead band.*

WARNING: ***When using the 61-1020/61-0230, you must follow the instructions and warnings in this manual to assure proper and safe operation of the 61-1020/61-0230 and to minimize the risk of personal injury. Be sure to maintain and periodically calibrate the 61-1020/61-0230 as described in this manual.***

Applications

The MPS combustible detector is most effective in the following applications:

- High concentrations of hydrogen sulfide (H_2S) or silicones present where sensor poisoning is a common problem
- High-humidity environments where catalytic or IR sensors may not hold up
- Environments more likely to have mixtures of hydrocarbons present

Description

The 61-1020 is a Molecular Property Spectrometer (MPS™) type of detector which has some advantages over a catalytic or IR type of combustible detector. The explosion-proof MPS detector is immune to poisons, can be used in high humidity, can detect multiple gases simultaneously (see Table 1), and does not require calibration as often as catalytic combustible sensors.

This section describes the components of the 61-1020: the MPS LEL detector and the junction box.

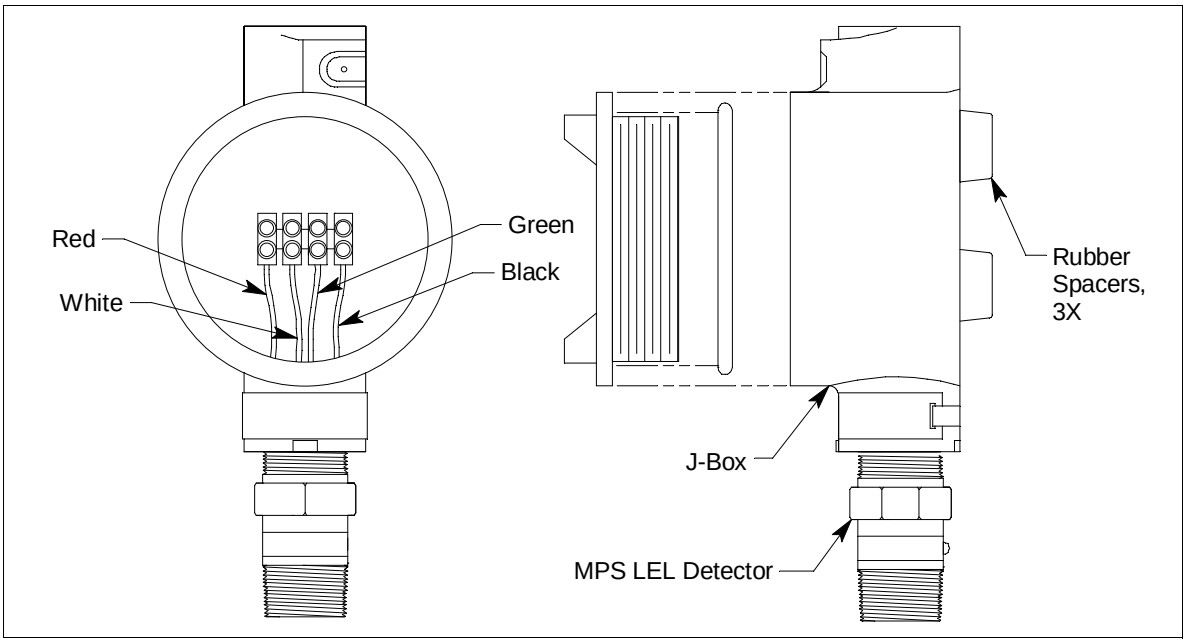

Figure 1: Component Location

MPS Detector

The MPS LEL detector is made up of the MPS combustible gas LEL detector housed and encapsulated in a pipe nipple. The pipe nipple has 3/4 NPT threads on each end and a 1-1/4 inch hex that allows removal or installation of the detector with a wrench. A porous flame arrestor coated with a hydrophobic film that repels liquids is on one end of the detector and allows sample gas to enter the detector. Four color coded leads, red, white, green, and black, extend from the other end of the detector. Use the leads when connecting the detector to the terminal block in the junction box.

Junction Box

The junction box allows installation of the detector at a mounting site that is remote from the controller while protecting the detector wiring connections. Two 3/4 NPT conduit hubs allow you to mount the detector to the junction box and connect the wiring from the detector to a controller. The terminal block within the junction box facilitates the wiring to the detector. A cover on the front of the junction box allows access to the interior of the junction box. Three spacers installed on the back of the junction box control the distance of the junction box from a mounting surface and insure that there is enough room to install a calibration cup on the detector during calibration.

Installation

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

If you purchased a 61-0230 detector that is factory installed and wired to a controller, detector installation is not necessary, but the detector wiring can be confirmed as described in “Wiring the Combustible Gas Detector to a Controller” on page 9.

Mounting the Combustible Gas Detector

1. Select a mounting site that is representative of the monitoring environment. Consider the following when selecting 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. For lighter gases, mount the detector near the ceiling. For heavier gases, mount the detector near the floor.

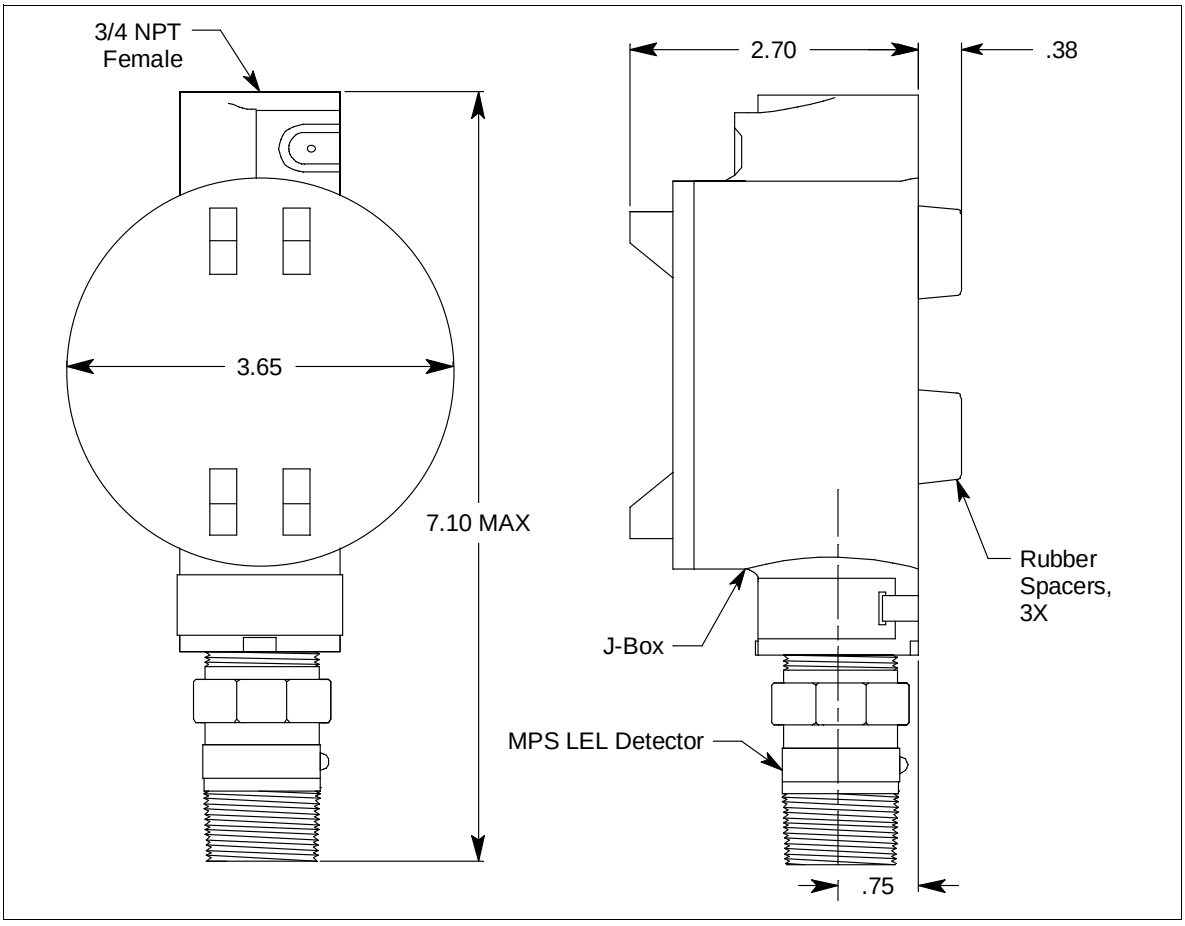

Figure 2: Mounting the Combustible Gas Detector

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

Wiring the Combustible Gas Detector to a Controller

WARNING: Always verify that the 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 wires are connected to the appropriate controller detector terminals and skip to "Start Up" on page 11. See Figure 3, the controller operator's manual, and the controller's detector head specification sheet for the 61-0230 detector for the wiring connections.
4. Remove the cover from the junction box.

   WARNING: To maintain the explosion proof classification of the 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. Adhere to your local electrical code when installing the conduit seal.
5. Guide a four-conductor, shielded cable or four wires in conduit through the unused conduit hub of the junction box. Use appropriate conduit fittings and construction technique for the environmental rating and hazardous location classification of the junction box. The junction box is rated NEMA 4X and classified explosion proof for Class I, Groups B, C, and D.
6. Connect the wires to the terminal block in the junction box.

   CAUTION: *Leave the shield drain wire insulated and disconnected at the 61-1020. 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 in conduit leading from the detector through one of the conduit hubs at the controller. Use appropriate conduit fittings and construction technique for the environmental rating of the controller. RKI controllers are typically rated NEMA 4X, are not explosion-proof, and must be installed in a non-hazardous location.

   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 61-1020 detector.

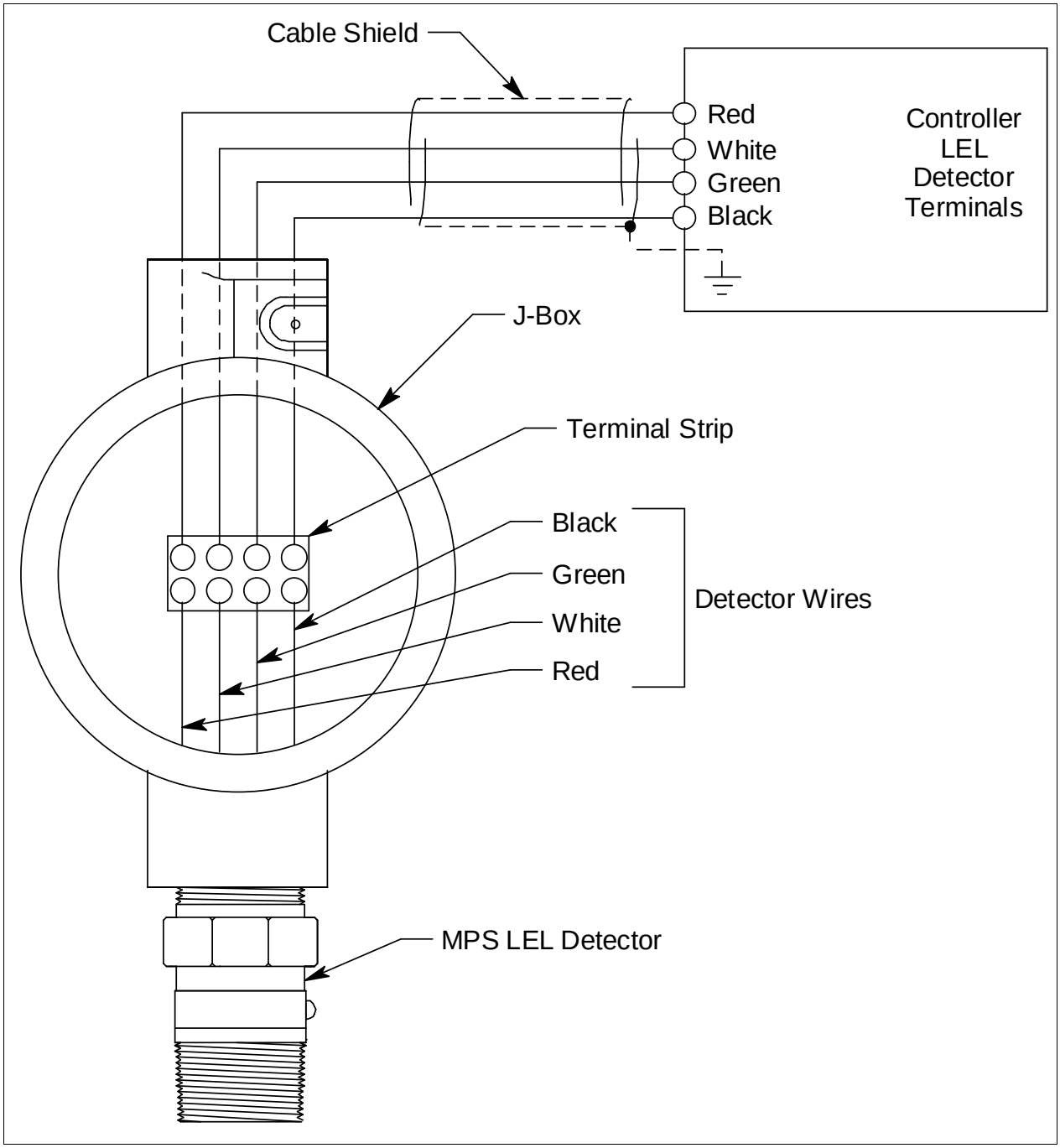

Figure 3: Wiring the Combustible Gas Detector to a Controller

10. If using a 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 combustible gas detector and place the detector into normal operation.

NOTE: Ensure the detector starts up in the background gas it will operate in (e.g. fresh air or N_2).

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 turn on the controller.
4. Verify that the controller is on and operating properly. Refer to the controller operator's manual.
5. Allow the combustible detector to warm up for at least 2 minutes before proceeding to the next section, "Setting the Zero Reading".

CAUTION: ***Do not expose the sensor to combustible gas during the 2-minute warmup period.*** *Exposing the sensor to gas during this period will result in a failure condition.*

Setting the Zero Reading

WARNING: ***Do not remove the junction box cover while the circuits are energized unless the area is determined to be non-hazardous. Keep the junction box cover tightly closed during operation.***

WARNING: ***This manual assumes the MPS sensor is operating in a background of fresh air. If the MPS sensor is not operating in a fresh air background (e.g. a monitoring background of nitrogen or argon), consult RKI Instruments Inc. before calibrating the sensor.***

1. Screw the calibration cup onto the bottom of the MPS LEL detector.
2. Screw the zero air cylinder onto the regulator.

NOTE: If you can verify that the combustible gas transmitter is operating in a fresh air environment (environment with a normal oxygen content of 20.9% and free of combustible and toxic gases), you do not need to apply zero air before adjusting the zero reading.

3. Use sample tubing to connect the regulator to the calibration cup.
4. Turn the regulator's on/off knob counterclockwise to open it.
5. Allow gas to flow for 1 minute.
6. Perform a zeroing operation at the controller. See the controller operator's manual for directions.
7. Turn the regulator's on/off knob clockwise to close it.
8. Unscrew the calibration cup from the detector.
9. Unscrew the regulator from the zero air calibration cylinder. For convenience, leave the sample tubing connected to the regulator and the calibration cup.
10. Store the components of the calibration kit in a safe and convenient place.

Maintenance

This section describes maintenance procedures. It includes details on 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 detector. It includes daily and biannual procedures.

Daily

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

Biannually

Calibrate the detector every six months as described in "Calibration" on page 15.

Troubleshooting

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

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

Table 3: Troubleshooting the Combustible Gas Detector

Condition	Symptom(s)	Probable Causes	Recommended Actions
Fail Condition	• Controller indicates a fail condition.	• The detector wiring is disconnected or misconnected. • The detector zero signal is low enough to cause a fail condition. • The detector was exposed to gas during its 2-minute warmup period. • The detector is malfunctioning.	1. Verify that the detector wiring is correct and secure. 2. Calibrate the detector. 3. Restart the controller and ensure that the detector's environment is free of combustible gas during the warmup period.* 4. If the fail condition continues, replace the detector. 5. If the fail condition continues, contact RKI for further instruction.
Slow or No Response/Difficult or Unable to Calibrate	• Unable to accurately set the zero or response reading during calibration. • Detector requires frequent calibration. ***NOTE:*** *Under "normal" circumstances, the detector requires calibration once every six months.* ***NOTE:*** *Some applications may require a more frequent calibration schedule.*	• The calibration cylinder is low, outdated, or defective. • The detector is malfunctioning.	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. 3. If the calibration/response difficulties continue, contact RKI for further instruction.

* *If a fresh air environment cannot be guaranteed, apply zero air during the warmup period.*

Replacing the Detector

1. Turn off the controller.
2. Turn off power to the controller.
3. If the detector is installed in a junction box that is remote from a controller, remove the junction box cover.

   If the detector is installed directly on a controller, open the controller door.
4. For remote installations, disconnect the detector leads from the terminal block in the junction box. Before removal, note the position of the color coded leads.

   For direct installations, disconnect the detector leads from the detector terminal strip in the controller. Before removal, note the position of the color coded leads.
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.
7. If the detector is installed remotely from the controller in a junction box, use a sealant that is designed for explosion proof installations.

   If the detector is installed directly on the controller, apply any thread sealant appropriate for the application's environmental rating to the hub and/or detector head.
8. 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 3). See the controller operator's manual and the controller's detector head specification sheet for the 61-1020 detector to verify the connections to the controller are correct.

   If the detector is installed directly on a controller, connect the detector leads to the appropriate detector terminal strip terminals. See Figure 3 for wiring to a generic controller. See the controller operator's manual and the controller's detector head specification sheet for the 61-0230 detector for wiring specific to your controller.
9. For remote installations, reinstall the junction box cover.

   For detectors connected directly on a controller, close the controller door.
10. Turn on power to the controller.
11. Turn on the controller.

CAUTION: *Allow the replacement detector to warm up for at least 2 minutes before you continue with the next step.*

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12. Calibrate the replacement detector as described in"Calibration" on page 15.

Calibration Frequency

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

If an application is not very demanding, for example detection in a clean, temperature controlled environment where calibration adjustments are minimal at calibration, then a calibration frequency of every 9 to 12 months is adequate.

If an application is very demanding, for example if the environment is not well-controlled, then more frequent calibration than every 6 months may be necessary.

Calibration

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

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

NOTE: During calibration, the detector must be calibrated with a cylinder of methane in a background of real air containing argon and CO_2. **Only use the RKI-provided calibration cylinder 81-9070RK-03.**

Materials

The following items are required for detector calibration:

- a CH_4 calibration cylinder (in a background of **real air** which contains argon and CO_2)
- a 0.5 LPM fixed flow regulator with an on/off knob
- a calibration cup for the detector
- a short piece of sample tubing to connect the regulator to the calibration cup
- a zero air cylinder provided (required for fresh air environments where there may be a temporary presence of combustible or toxic gas)

Preparing for Calibration

1. Connect the calibration kit sample tubing to the calibration cup hose barb.
2. Screw the calibration cup onto the detector.
3. Use the sample tubing to connect the regulator to the calibration cup.

4. Place the controller into its calibration program or disable external alarms.

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

5. Allow the combustible detector to warm up for at least 2 minutes before proceeding to the next section, “Setting the Zero Reading”.

CAUTION: ***Do not expose the sensor to combustible gas during the 2-minute warmup period.*** *Exposing the sensor to gas during this period will result in a failure condition.*

Setting the Zero Reading

WARNING: ***This manual assumes the MPS sensor is operating in a background of fresh air. If the MPS sensor is not operating in a fresh air background (e.g. a monitoring background of nitrogen or argon), consult RKI Instruments Inc. before calibrating the sensor.***

WARNING: ***Do not remove the junction box cover while the circuits are energized unless the area is determined to be non-hazardous. Keep the junction box cover tightly closed during operation.***

1. Screw the regulator onto the zero air calibration cylinder.

NOTE: If you can verify that the combustible gas transmitter is operating in a fresh air environment (environment with a normal oxygen content of 20.9% and free of combustible and toxic gases), you do not need to apply zero air before adjusting the zero reading.

2. Turn the regulator’s on/off knob counterclockwise to open the regulator.
3. Verify a reading of 0% LEL at the controller. If the display reading is 0% LEL, start up is complete. The combustible detector is in normal operation.

   If the display reading is not 0% LEL, continue to the next step.
4. Perform a zeroing operation at the controller. See the controller operator’s manual for directions.
5. Turn the regulator’s on/off knob clockwise to close the regulator.
6. Unscrew the regulator from the zero air calibration cylinder.
7. Leave the sample tubing connected to the regulator and the calibration cup.

Setting the Response Reading

1. Follow the directions in the controller's operator's manual for setting the response reading (span).
2. When the directions call for exposing the detector to gas, screw the regulator into the **methane in real air** cylinder provided by RKI Instruments Inc.
3. Turn the regulator's on/off knob counterclockwise to open the regulator.
4. Allow the gas to flow for 1 minute.
5. After setting the response reading, turn the on/off knob clockwise to close the regulator, unscrew the regulator from the cylinder and remove the calibration cup from the detector.
6. Allow the reading at the controller to decrease below the alarm points before returning the controller to normal operation or enabling external alarms.

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

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7. Verify that the controller display reading decreases and stabilizes at 0% LEL.
8. Store the components of the calibration kit in a safe and convenient place.

Parts List

Table 4 lists replacement parts and accessories for the 61-1020 combustible gas detector.

Table 4: Parts List

Part Number	Description
18-0400RK-01	Junction box with spacers
61-0230	MPS LEL detector
71-0592	*61-1020/61-0230 Combustible Gas Detector Operator's Manual* (this document)
81-1050RK	Regulator, with gauge and knob, 0.5 liter/minute continuous flow, for 17 liter and 34 liter steel calibration cylinders (cylinders with external threads)
81-1051RK	Regulator, with gauge and knob, 0.5 liter/minute continuous flow, for 34 liter aluminum/58 liter/103 liter calibration cylinders (cylinders with internal threads)
81-1103RK	Calibration cup
81-9070RK-03	Calibration cylinder, 50% LEL methane in air, 103 liter
81-F076RK	Cal kit: 103 liter cylinder of 50% LEL CH4 in air, 0.5 LPM fixed flow regulator with gauge and knob, calibration cup, and 3 feet of calibration tubing