

# **Model GD-K8A Diffusion Detector Head Operator's Manual**

*Part Number: 71-0081RK*

*Revision: A*

*Released: 3/1/11*

## **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 the 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. Parts must be returned to RKI Instruments, Inc. for repair or replacement. 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) Pump diaphragms and valves | c) Batteries       |
| b) Fuses                      | d) Filter elements |

Warranty is voided by abuse including mechanical damage, alteration, rough handling, or repair procedures not in accordance with instruction 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 only 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. Warranty covers parts and labor performed at RKI Instruments, Inc. only, and does not cover field labor or shipment of parts back to RKI.

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## Overview

This manual describes the Model GD-K8A diffusion 4 - 20 mA transmitter detector head. This manual also describes how to install, start up, maintain, and calibrate the GD-K8A 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 GD-K8A.

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## Specifications

Table 1 lists specifications for the GD-K8A.

**Table 1: Specifications**

Target Gas & Detector Range	Refer to the RKI Instruments Inc. List of Detectable Gasses
Area Classification	Indoor, non-hazardous locations
Sampling Method	Diffusion
Input Power	24 VDC
Signal Output	4 to 20 mA
Response Time	90% in 60 seconds
Accuracy	$\pm 10\%$ of reading or $\pm 5\%$ of full scale (whichever is greater)

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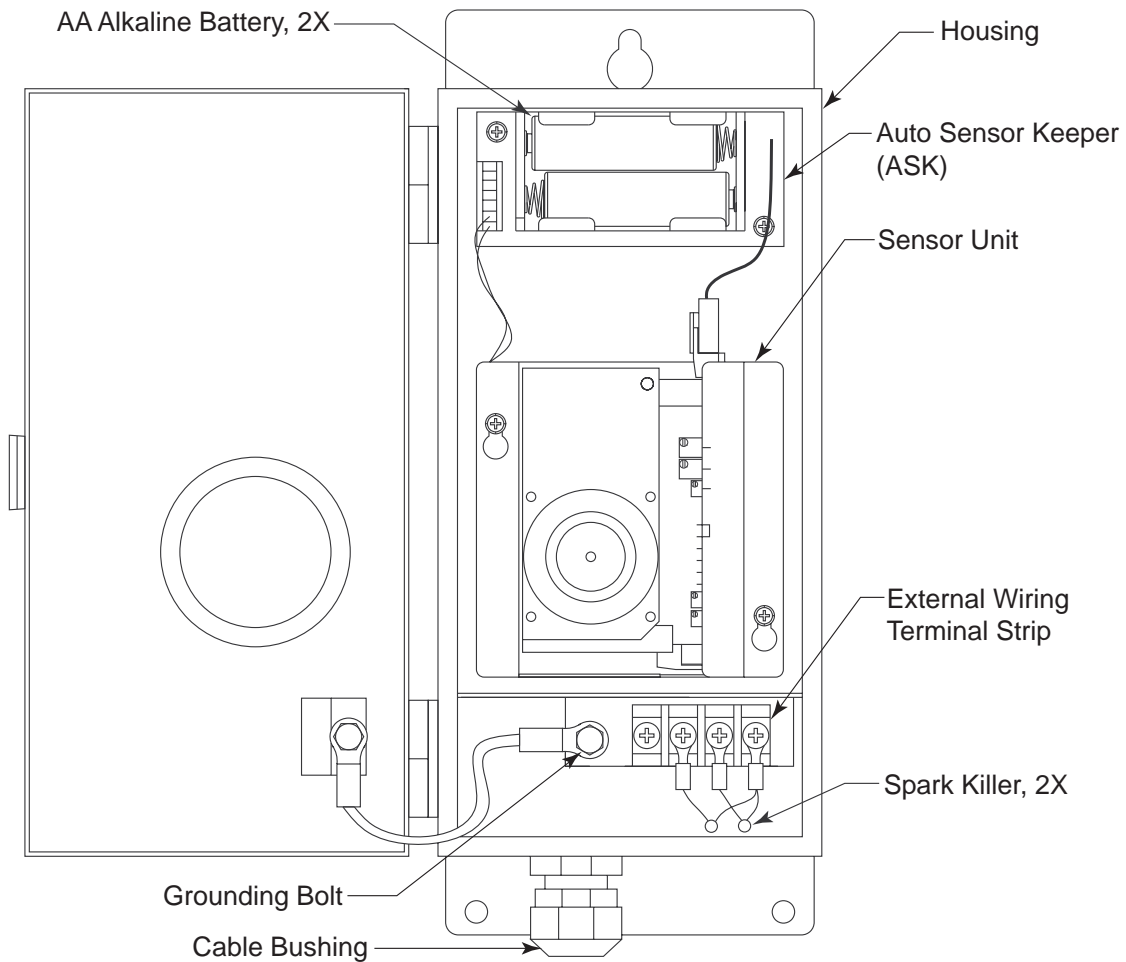
**WARNING:** *When using the GD-K8A, you must follow the instructions and warnings in this manual to assure proper and safe operation of the GD-K8A and to minimize the risk of personal injury. Be sure to maintain and periodically calibrate the GD-K8A as described in this manual.*

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## Description

This section describes the components of the GD-K8A. The GD-K8A consists of three major components: the housing assembly, the sensor unit and the auto sensor keeper (ASK). The sensor unit is secured in the housing by two screws. It can be removed by loosening these two screws for sensor or amplifier replacement. The ASK is also secured in the housing by two screws.



**Figure 1: Model GD-K8A Component Location**

### Housing Assembly

The housing assembly includes the housing, cable bushing and external wiring terminal strip.

#### *Housing*

The painted steel housing is radio frequency (RF) and dust resistant. A gasketed door rotates on two hinge pins on the left side of the housing and is secured in the closed position with a snap latch on the right side of the housing. When the door is closed, a gasketed hole in the door seals against the sensor and allows the sensor to be exposed to the ambient air. An earth ground bolt is provided to the left of the external wiring terminal strip.

The housing has two mounting flanges, one at the top and one at the bottom. The top mounting flange has a slotted hole in the middle and the bottom mounting flange has two holes, one in each corner. These holes are used for mounting the GD-K8A to a vertical surface.

**Cable Bushing**

A cable bushing on the bottom left of the housing allows you to route wiring from a controller to the two point external wiring terminal strip in the housing. The cable bushing accommodates a .35 inch to .43 inch diameter cable.

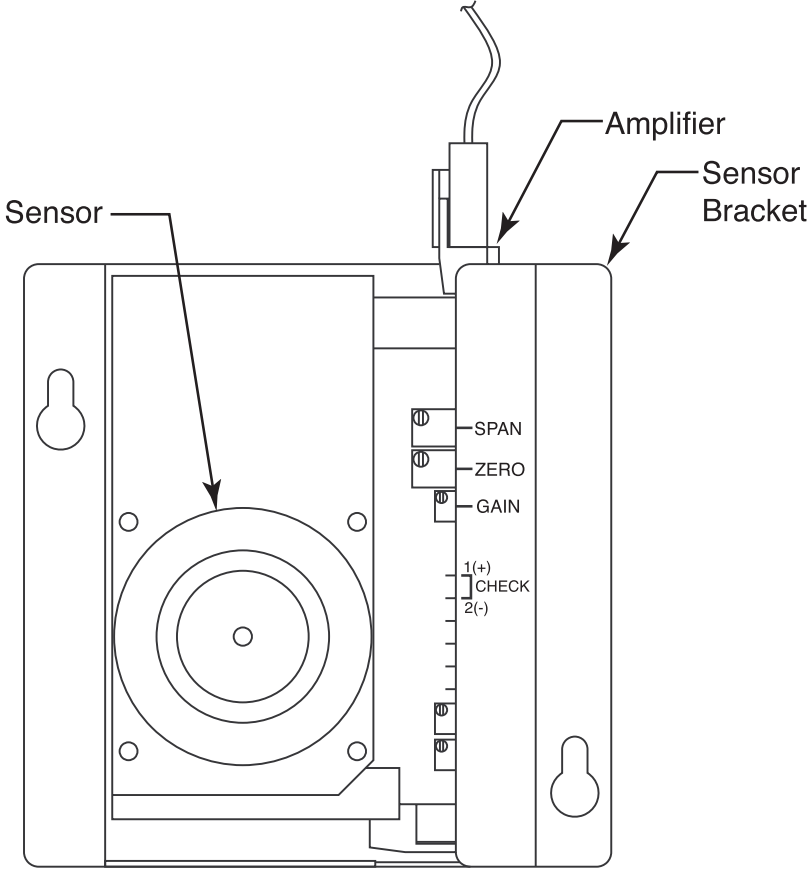
**External Wiring Terminal Strip**

A two point terminal strip in the bottom right part of the housing is provided for making wiring connections from the GD-K8A to a controller. A grounding bolt is located to the left of the terminal strip. This grounding bolt is earth ground and cannot be used to wire the GD-K8A to the controller.

The terminal strip has two spark killers installed in the terminals. These spark killers protect the GD-K8A from noise and spikes in the “+” line and must remain installed when the GD-K8A is installed and wired to a controller.

**Sensor Unit**

The sensor unit consists of the sensor bracket, sensor, and amplifier.



**Figure 2: Sensor Unit**

### ***Sensor Bracket***

The painted steel sensor bracket is used to install the sensor and amplifier into the GD-K8A housing. It is secured to the housing with two screws. The mounting holes in the bracket are slotted allowing removal of the bracket for sensor or amplifier replacement without removing the two mounting screws.

### ***Sensor***

The sensor is mounted in the sensor bracket with two screws through the back of the sensor bracket. The sensor face protrudes slightly through a gasketed opening in the housing door to sample the ambient air by diffusion. Through a series of electrical and chemical reactions, the sensor produces an electrical current that is proportional to the detection range of the target gas. Electrodes within the sensor are surrounded by liquid electrolyte. The chemical and electrical reactions are facilitated by the electrolyte.

### ***Amplifier***

The amplifier is to the right of the sensor (see Figure 2). The amplifier converts the output of the sensor to a 4 to 20 mA signal that is proportional to the detection range of the GD-K8A and transmits the signal to a controller. The amplifier includes the span pot, zero pot, gain pot, and output check pins.

#### *Span pot*

The span pot is near the top of the amplifier. Use the span pot to adjust the GD-K8A's response output during the calibration procedure.

#### *Zero pot*

The zero pot is below the span pot. Use the zero pot to adjust the GD-K8A's fresh air output during start-up and calibration procedures.

#### *Gain pot*

The gain pot is below the zero pot. It is used to make coarse span adjustments. **The gain pot is factory set and for adjustment by a field service technician only.**

Another factory adjust pot may be located below the gain pot. Do not adjust this pot.

#### *Output check pins*

Two output check pins, marked 1 (+) and 2 (-), are below the pots. A 4 - 20 mA signal can be read at the pins using a milliammeter. Use the output check pins to read the signal output of the GD-K8A during the start-up and calibration procedures.

### **Auto Sensor Keeper (ASK)**

The ASK is in the top part of the housing. It consists of a battery compartment which holds two AA size alkaline batteries mounted to a circuit board which maintains a bias voltage on the sensor when the GD-K8A is not receiving incoming power, such as during shipment or storage. If the GD-K8A is off power for an extended period and the batteries in the ASK are dead, the sensor operation will be affected when the GD-K8A is started up. See Storing the GD-K8A in the Maintenance section for battery replacement recommendations.



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## Installation

This section describes how to install the GD-K8A at the monitoring site. This section includes procedures to mount the GD-K8A in the monitoring environment and wire the GD-K8A to a controller.

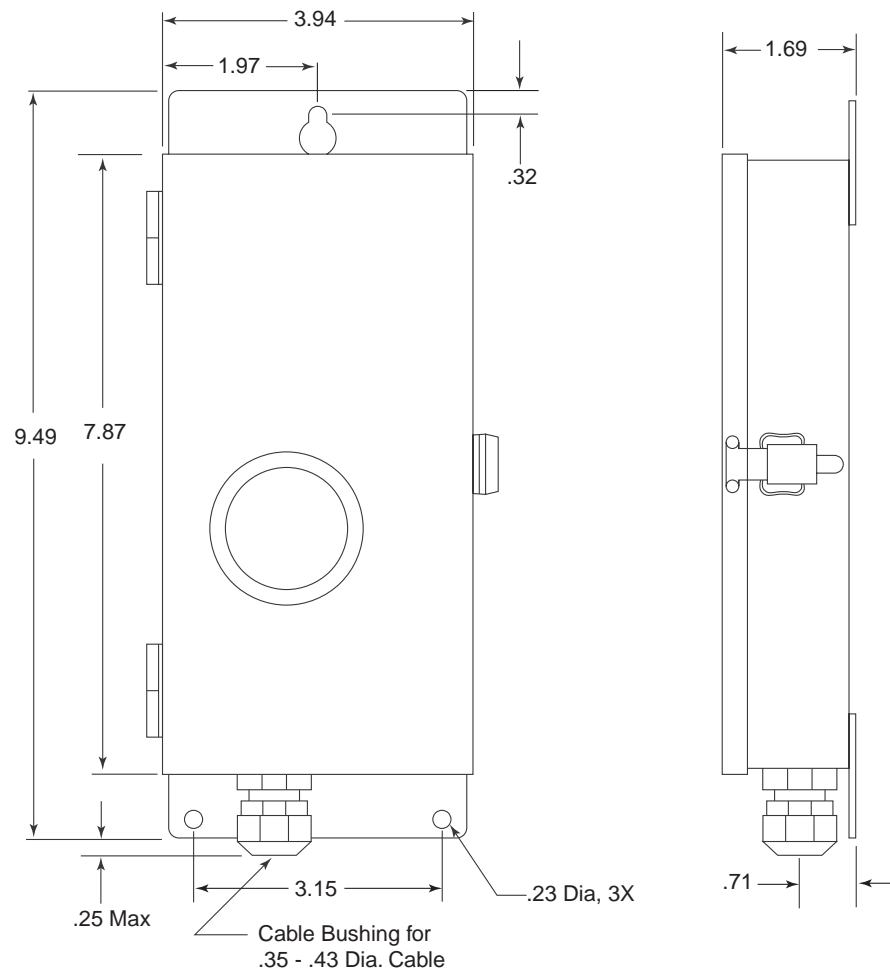
### Mounting the GD-K8A

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**CAUTION:** *The GD-K8A is suitable for installation in indoor areas where general purpose equipment is in use.*

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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 target gas is likely to be found first.
  - Select a site that is easily accessible for servicing. Make sure there is sufficient room to make wiring connections at the bottom of the GD-K8A. Also make sure there is sufficient room to perform start-up, maintenance, and calibration procedures.
  - Select a site where the GD-K8A is not likely to be bumped or disturbed.



**Figure 3: Mounting the GD-K8A**

2. Use three #10 screws through the mounting holes in the mounting flanges at the top and bottom of the housing to mount the GD-K8A to a vertical surface (see Figure 3).

## Wiring the GD-K8A to a Controller

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**WARNING:** Always verify that the power source is off before making wiring connections or adjustments.

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1. Place the controller's power switch in the off position.
2. Turn off power to the controller.
3. Guide a two conductor shielded cable through the cable bushing at the bottom of the GD-K8A.

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**CAUTION:** Leave the cable shield's drain wire insulated and disconnected at the GD-K8A. You will connect the opposite end of the cable shield's drain wire at the controller.

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4. Connect the two wires between the GD-K8A and the controller as shown in Figure 4 below.

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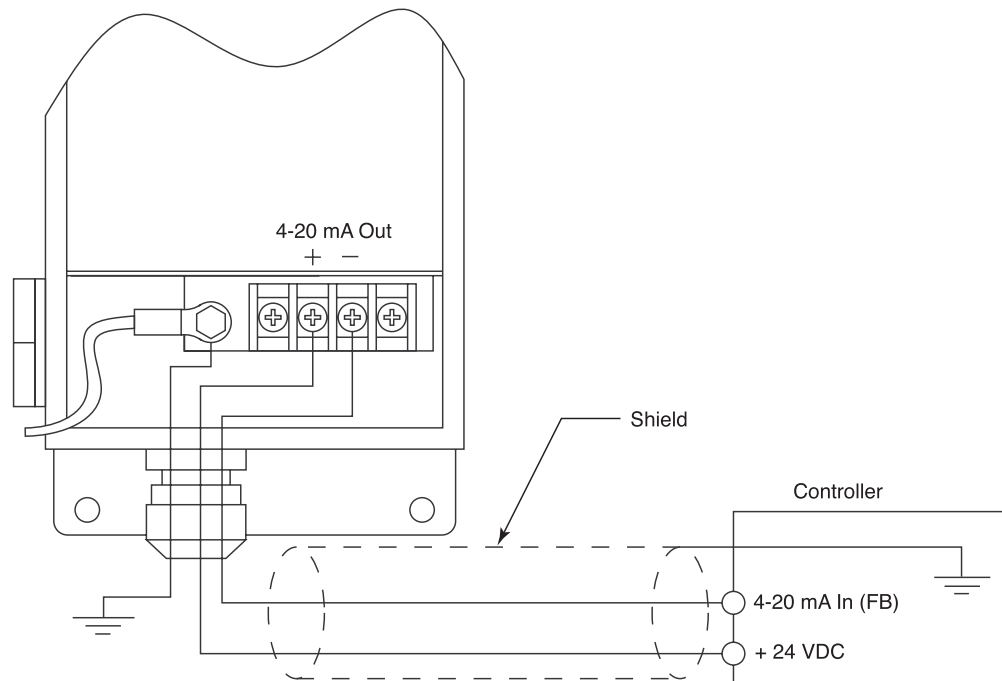
**CAUTION:** At the controller, do not route power and GD-K8A wiring through the same conduit hub. The power cable may disrupt the transmission of the GD-K8A's signal to the controller.

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**NOTE:** The controller connections shown are typical. See the controller Detector Head Specification Sheet for the GD-K8A or a controller specific wiring diagram for the GD-K8A for connections specific to the controller.

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**Figure 4: Wiring the GD-K8A to a Controller**

5. Connect the ground bolt to a locally available earth ground.
6. Connect the cable shield's drain wire to an available earth (chassis) ground at the controller. The grounding screw on each controller conduit hub is an example of an earth (chassis) ground.

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## Start Up

This section describes procedures to start up the GD-K8A and place it 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 instruction manual.
3. Turn on or plug in the incoming power to the controller.
4. Turn on the controller.
5. Verify that the controller is on and operating properly. Refer to the controller instruction manual.

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**CAUTION:** *Allow the GD-K8A to warm-up for at least 1 hour before you continue with the next section. If the batteries in the ASK are dead and the GD-K8A has been off power for an extended period of time, allow the GD-K8A to warm up overnight.*

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### Setting the Zero Signal

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**CAUTION:** *If you suspect the presence of toxic gas in the monitoring environment, use the calibration kit and the zero air calibration cylinder to introduce "fresh air" to the sensor and verify an accurate zero setting.*

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1. Verify that the GD-K8A is in a fresh air environment (environment known to be free of toxic and combustible gas and of normal oxygen content, 20.9%).
2. Release that snap latch on the right side of the housing that secures the door and open the door.
3. Use small test clips to connect a milliampmeter to the output check pins on the amplifier.
4. Verify a reading of 4.0 mA on the milliampmeter. If necessary, use the zero pot to adjust the milliampmeter reading to 4.0 mA.

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**CAUTION:** *Do not adjust the span pot at this time unless a full calibration is performed. The GD-K8A is factory calibrated before shipment. If a calibration is performed at start up, allow at least two hours for warm-up.*

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5. Remove the milliampmeter test clips.
6. Close the door and secure it with the snap latch.
7. The GD-K8A will now monitor the ambient air and send the target gas reading to the controller via a 4 - 20 mA signal.

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## Maintenance

This section describes maintenance procedures for the GD-K8A. It includes preventive maintenance and troubleshooting procedures.

### Preventive Maintenance

This section describes a preventive maintenance schedule to ensure the optimum performance of the GD-K8A. It includes daily, monthly, and quarterly procedures.

#### *Daily*

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

#### *Monthly*

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**NOTE:** Verifying the response of the GD-K8A may cause alarms. Be sure to put the controller into its calibration program or disable external alarms before verification.

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This procedure describes a test to verify that the GD-K8A responds properly to the target gas.

#### *Preparing for the response test*

1. Verify that the display reading for the channel you plan to test is 0.

If the display reading is not 0, set the zero reading of the GD-K8A as described in the Start Up section of this manual, then continue this procedure.

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**NOTE:** This procedure describes a test using a fixed flow regulator with an on/off knob.

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2. Connect the calibration kit sample tubing to the calibration adapter and to the fixed flow regulator.
3. Open the GD-K8A's door and attach the calibration adapter over the face of the sensor.
4. Use small test clips to connect a milliampmeter to the output check pins.
5. Use the following formula to determine the correct GD-K8A response output for the calibrating sample.

$$\text{Response Output (mA)} = (\text{calibrating gas/fullscale}) \times 16 + 4$$

For example, if you have a cylinder of 5 ppm calibration gas with a GD-K8A full scale of 10 ppm:

$$12 \text{ mA} = (5 \text{ ppm}/10 \text{ ppm}) \times 16 + 4$$

#### Performing the response test

1. Screw the calibration cylinder onto the fixed flow regulator.
2. Turn the regulator's on/off knob counterclockwise to open it. Gas will begin to flow.
3. Allow gas to flow for two minutes and verify 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 GD-K8A as described in the Calibration section of this manual.

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4. Turn the regulator's on/off knob clockwise to close it.
5. Unscrew the calibration cylinder from the regulator.
6. Remove the calibration adapter from the sensor face, then disconnect the calibration kit sample tubing from the regulator.
7. Remove the milliampmeter test clips from the output check pins.
8. Close the housing door.
9. Allow time for the gas reading to return to normal and return the controller to normal operation.

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**NOTE:** If the gas reading does not return to normal before returning the controller to normal operation, unwanted alarms may occur.

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#### ***Quarterly/Biannually***

Calibrate the GD-K8A as described in the Calibration section of this manual. The calibration frequency (every 3 to 6 months) depends on your specific application.

### **Troubleshooting**

The troubleshooting guide describes symptoms, probable causes, and recommended action for problems you may encounter with the GD-K8A.

#### ***Fail Condition***

##### Symptoms

- The controller is indicating a fail condition.

##### Probable causes

- The GD-K8A wiring to the controller is disconnected or misconnected.
- The GD-K8A is malfunctioning.

##### Recommended action

1. Verify that the GD-K8A wiring is correct and secure. The Installation section of this manual describes GD-K8A wiring connections.
2. Calibrate the GD-K8A as described in the Calibration section of this manual.
3. If the fail condition continues, replace the sensor as described later in this section.
4. If the fail condition continues, contact RKI Instruments, Inc. for further instruction.

## ***Slow or No Response/Difficult or Unable to Calibrate***

### Symptoms

- The GD-K8A 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 GD-K8A requires frequent calibration.

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**NOTE:** Under “normal” circumstances, the GD-K8A requires calibration every 3 - 6 months. Some applications may require a more frequent calibration schedule.

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### Probable causes

- The calibration cylinder is low, out-dated, or defective.
- The GD-K8A is malfunctioning.

### Recommended action

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

## **Storing the GD-K8A**

The GD-K8A's ASK keeps a bias voltage on the sensor whenever there is no incoming power, such as during shipment, storage, or power outages. This circuit is powered by the alkaline batteries. If the batteries are dead when power to the GD-K8A is turned off or is lost, then the bias voltage normally on the sensor during operation will not be applied to the sensor. If the sensor is without the bias voltage for an extended period, it will take some time to stabilize and be ready for use after power is restored. If the sensor is off bias for too long, it may not be usable when power is restored.

When starting with a full charge, the alkaline batteries will last approximately 8 months. Be sure to replace the batteries periodically to assure that the sensor will always be on bias during power outages.

If the GD-K8A is going to be stored, make sure fresh batteries are installed to maintain a bias on the sensor. See the next section for instructions to change the batteries.

In addition to keeping the sensor on bias during storage, the GD-K8A must be kept upright. If the GD-K8A is stored, it must be oriented so that the sensor is upright.

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**WARNING:** *If the GD-K8A is not stored in an upright position, the sensor membrane which allows gas into the sensor may dry out and the sensor may not recover proper operation.*

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## **Replacing Components of the GD-K8A**

### ***Replacing the Sensor***

1. Turn off the controller.
2. Turn off power to the controller.
3. Open the GD-K8A's housing door.

4. Loosen the two screws that secure the sensor bracket to the housing, then remove the sensor unit from the housing.
5. Remove the two screws on the back of the sensor bracket that secure the sensor to the bracket and remove the sensor with amplifier from the bracket.
6. Disconnect the ASK from the amplifier. A cable leading from the ASK plugs into a connector near the top of the amplifier.
7. Remove the screw near the top of the amplifier that secures the amplifier to the sensor and disconnect the amplifier from the sensor.
8. Connect the amplifier to the new sensor and secure it with the screw you removed in step 7.
9. Reinstall the sensor to the sensor bracket.
10. Reconnect the cable from the ASK to the amplifier.
11. Reinstall the sensor bracket to the housing.
12. Turn on power to the controller and turn on the controller.
13. Allow the new sensor to warm-up for at least 2 hours.
14. Calibrate the GD-K8A as described in the Calibration section.

#### ***Replacing the Alkaline Batteries in the ASK***

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**NOTE: Change the alkaline batteries with the controller on and the GD-K8A on power and operating. If power to the GD-K8A is turned off to change the alkaline batteries, the gas readings may be unstable for a short time when power is restored.**

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1. Open the housing door.
2. Carefully remove the old alkaline batteries from the ASK in the upper part of the housing. Do not touch the ASK circuit board.
3. Carefully install the new alkaline batteries observing the proper battery orientation.
4. Close the housing cover.

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## Calibration

This section describes how to calibrate the GD-K8A. It includes procedures to prepare for calibration, set the zero reading, set the response reading, and return to normal operation.

### Preparing for Calibration

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**NOTE:** This procedure describes calibration using a fixed flow regulator with an on/off knob.

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1. Put the controller into its calibration program or disable external alarms to avoid unwanted alarms during calibration.
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**NOTE:** If you can verify that the GD-K8A is in a fresh air environment, you do not need to apply zero air to set the zero reading.

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2. Connect the calibration kit sample tubing to the calibration adapter and to the fixed flow regulator.
3. Open the GD-K8A's door and attached the calibration adapter over the sensor face.
4. Use small test clips to connect a milliampmeter to the output check pins.
5. Use the following formula to determine the correct GD-K8A response output for the calibrating sample.

$$\text{Response Output (mA)} = (\text{calibrating gas/fullscale}) \times 16 + 4$$

For example, if you have a cylinder of 5 ppm calibration gas with a GD-K8A full scale of 10 ppm:

$$12 \text{ mA} = (5 \text{ ppm}/10 \text{ ppm}) \times 16 + 4$$

### Setting the Zero Reading

1. Screw the zero air calibration cylinder onto the fixed flow regulator.
2. Turn the regulator's on/off knob counterclockwise to open it. Gas will begin to flow.
3. Allow gas to flow for two minutes and verify a milliampmeter reading of 4.0 mA. If necessary, use the zero pot to adjust the reading to 4.0 mA.
4. Turn the regulator's on/off knob clockwise to close it.
5. Unscrew the zero air calibration cylinder from the fixed flow regulator.

### Setting the Response Reading

1. Screw the calibration gas cylinder onto the fixed flow regulator.
2. Turn the regulator's on/off knob counterclockwise to open it. Gas will begin to flow.
3. Allow calibration gas to flow for two minutes and verify that the milliampmeter reading matches the response reading you determined earlier. If necessary, use the span pot to adjust the reading to match the correct response reading.
4. Turn the regulator's on/off knob clockwise to close it.
5. Unscrew the calibration gas cylinder from the fixed flow regulator.
6. Remove the calibration adapter from the sensor face, disconnect the calibration kit sample tubing from the regulator.



7. Remove the milliampmeter test clips from the output check pins.
8. Close the housing door.
9. Allow time for the gas reading to return to normal, then return the controller to normal operation.

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**NOTE:** If the gas reading does not return to normal before returning the controller to normal operation, unwanted alarms may occur.

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

## Parts List

Table 4 lists replacement parts and accessories for the GD-K8A.

**Table 2: Parts List**

Part Number	Description
GD-K8A-XXX	GD-K8A transmitter (specify target gas when ordering)
49-1120RK	AA size alkaline batter, 1.5V, for sensor bias backup
71-0081RK	<i>GD-K8A Operator's Manual</i> (this document)
81-XXXX	Calibration kit (specify target gas when ordering)
81-XXXX	Calibration cylinder (specify target gas when ordering)
81-0076RK	Zero air calibration cylinder (17 liter)
81-0076RK-01	Zero air calibration cylinder (34 liter)
81-0076RK-03	Zero air calibration cylinder (103 liter)
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 34 liter aluminum and 58 and 103 liter steel calibration cylinders
81-1114RK	Calibration adapter
ES-23A-NO	Sensor, nitric oxide
ES-23AHS-ASH3	Sensor, arsine
ES-23AH-NO2	Sensor, nitrogen dioxide
ES-23AH-PH3	Sensor, phosphine
ES-23AH-SIH4	Sensor, silane (for scrubber applications, not interchangeable with ES-23DH-SIH4)
ES-23DH-SIH4	Sensor, silane, standard sensor (not interchangeable with ES-23AH-SIH4)
ES-23DH-HCN	Sensor, hydrogen cyanide
ES-23E-SO2	Sensor, sulfur dioxide, 0 - 15 ppm (not interchangeable with the ES-238-SO2)
ES-238-SO2	Sensor, sulfur dioxide, 0 - 10 ppm (not interchangeable with ES-23E-SO2)
ES-23R-NH3	Sensor, ammonia
ES-K233-CL2	Sensor, chlorine
ES-K233-F2	Sensor, fluorine
ES-K233-HCL	Sensor, hydrogen chloride

**Table 2: Parts List**

<b>Part Number</b>	<b>Description</b>
ES-K233-HF	Sensor, hydrogen fluoride
ES-K239C-O3	Sensor, ozone