GX-94
Operator's Manual

Part Number: 71-0008RK

Edition: Revision P2

Released: 6/10/2002

WARRANTY

RKI Instruments, Inc., warrants the GX-94 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 that warranty 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
>
> Filter elements, disks, or sheets
>
> Pump diaphragms and valves
>
> Batteries

Warranty is voided by abuse including mechanical damage, alteration, rough handling, or repair procedures not in accordance with the 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 replacement of parts or our complete goods.

TABLE OF CONTENTS

INTRODUCTION

The RKI Model GX-94 is an advanced gas detection instrument in use internationally for personal protection in a variety of industries. The GX-94 is rugged, compact, convenient, and offers a full range of features, including:

- Simultaneous detection of two, three, or four gases. The standard configuration is combustible gas in the %LEL range (HC,) oxygen deficiency (O_2), carbon monoxide (CO), and hydrogen sulfide (H_2S).
- Dot-matrix liquid crystal display (LCD) for complete, understandable information at a glance.
- Visual and audible alarms for alarm conditions and malfunctions.
- Underwriters Laboratories Classification for intrinsic safety for Class I, Division I, Groups A, B, C, and D hazardous atmospheres.
- Microprocessor control for all functions, including data logging and user adjustable alarms.
- Compact size.
- Belt clip and shoulder strap standard.

WARNING

THE GX-94 IS DESIGNED TO DETECT COMBUSTIBLE GAS, OXYGEN DEFICIENCY, HYDROGEN SULFIDE, AND CARBON MONOXIDE, WHICH CAN BE LETHAL. USERS MUST FOLLOW THE INSTRUCTIONS AND WARNINGS IN THIS MANUAL TO ASSURE PROPER AND SAFE OPERATION OF THE INSTRUMENT.

SPECIFICATIONS

Table1 lists physical and environmental specifications for the GX-94. Table 2 lists specifications for the GX-94's sensors and channels.

Table 1: GX-94 Specifications

Target Gases	Combustible Gas (HC); Oxygen (O_2), Carbon Monoxide (CO), Hydrogen Sulfide (H_2S)
Case	RFI Shielded High Impact ABS Plastic
Safety/Regulatory	UL Classified Instrinsically Safe for Class I, Division I, Groups A, B, C, & D
Dimensions	3.54" x 2.52" x 6.3" (90 x 64 x 160 mm)
Weight	25 ounces (700 g)
Power	Two C size alkaline batteries (optional Ni-Cd batteries externally charged)
Continuous Operating Hours (non-alarm operation)	Alkaline: 12 hours Ni-Cd: 8 hours
Operating Temperature & Humidity	14°F to 104°F (-10°C to 40°C) 0 to 95% RH, non-condensing

Table 2: Sensor/Channel Specifications

	Combustible Gas (HC)	Oxygen	Hydrogen Sulfide	Carbon Monoxide
Detection Range	0 - 100% LEL	0 - 40.0%	0 - 100.0 ppm	0 - 500 ppm
Display Increments	1% LEL	0.1%	0.5 ppm	1 ppm
Low Alarm[1]	10% LEL	19.5% (decreasing)	10.0 ppm	25 ppm
High Alarm[1]	50% LEL	23.5% (increasing)	----	----
TWA Alarm[1]	----	----	10.0 ppm	25 ppm
STEL Alarm[1]	----	----	15.0 ppm	400 ppm
Detection Principle	Catalytic Combustion	Electrochemical (galvanic type) Cell	Electrochemical Cell	Electrochemical Cell
Ceiling Alarm	---	----	Off	Off
Accuracy	**0 - 20% LEL** ± 2% LEL **21% - 100% LEL** ± 5% LEL	± 0.5% Oxygen	**0 - 30 ppm** ±1.5 ppm **31 - 100 ppm** ±5 ppm	**0 - 50 ppm** ±5 ppm **51 - 150 ppm** ± 15 ppm **151 - 500 ppm** ± 25 ppm

1 Alarms are user adjustable. See **Viewing and Setting Alarms** in the setup mode section.

DESCRIPTION

Case

The GX-94 has a high impact, RF shielded ABS plastic case with a rubber guard that also functions as a water-resistant seal between the two halves of the case. The case has sturdy plastic flanges on the left and right sides for installation of the shoulder strap. It has an opening on the top front of the GX-94 for the buzzer sound and it has sensor ports which allow diffusion through the sensor screen on the top rear of the GX-94.
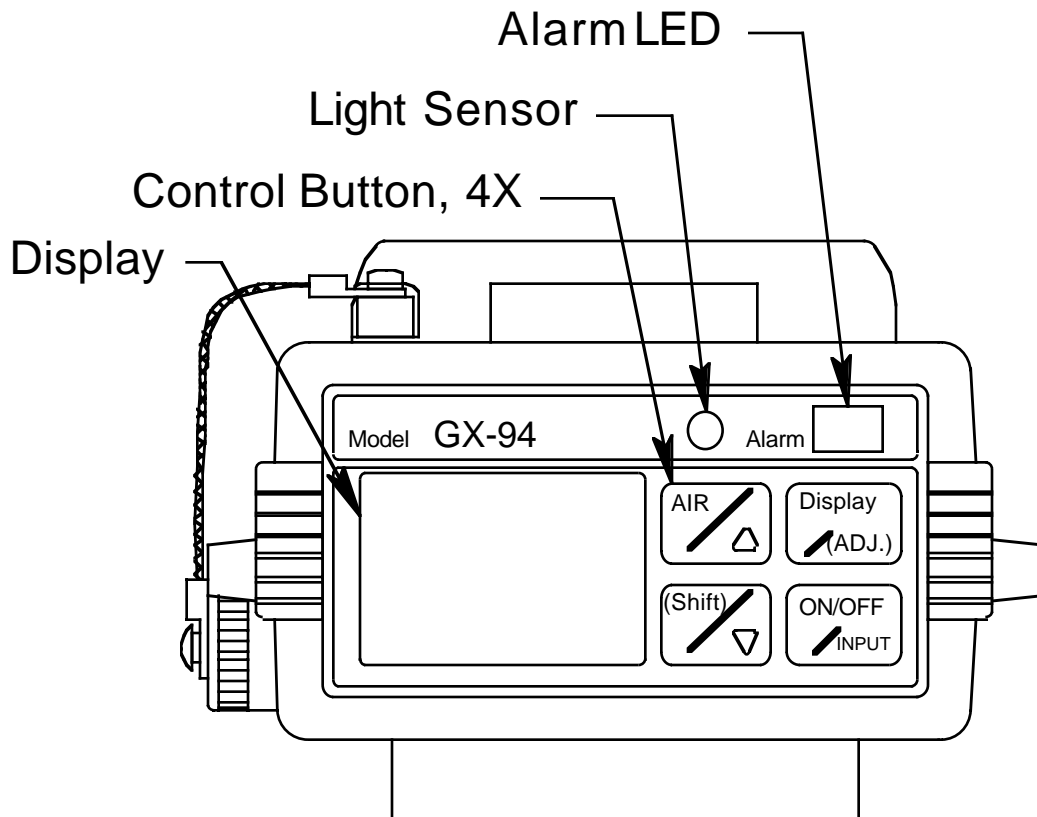
Control Panel

Figure 1: GX-94 Control Panel

The control panel is at the front of the GX-94 for easy access when the

GX-94 is carried or clipped on a belt. It contains the display, the touch-pad buttons that control the many functions of the GX-94, the Alarm LED, and the light sensor. The display is to the left of the buttons and simultaneously shows the gas readings for all active channels. The touch-pad buttons are low profile to reduce the risk of accidental activation and damage. The functions of the control panel buttons are described below in Table 3.

Table 3: GX-94 Button Functions

Button	Function(s)
ON/OFF/INPUT	• turns the GX-94 on and off • used during setup and calibration to enter values
DISPLAY/(ADJ.)	• activates display modes • enters instructions into the GX-94's microprocessor
AIR/▲	• activates the demand zero function (automatically adjusts the GX-94 in fresh air conditions) • scrolls through the various instrument modes • adjusts parameters in the various instrument modes • enters instructions into the GX-94's microprocessor
SHIFT/▼	• scrolls through the various instrument modes • adjusts parameters in the various instrument modes • enters instructions into the GX-94's microprocessor • resets alarms if GX-94 is programmed for latching alarms

Alarm LED

A red light-emitting diode (LED) is visible through a lens located on the upper right front of the control panel above the buttons. It provides a visual indication for alarms and malfunctions.

Light Sensor

A light sensor is located to the left of the alarm LED. It monitors the level of ambient light. When the ambient light level becomes too low to allow

easy viewing of the display, the light sensor prompts the display back-light to turn on.

Note

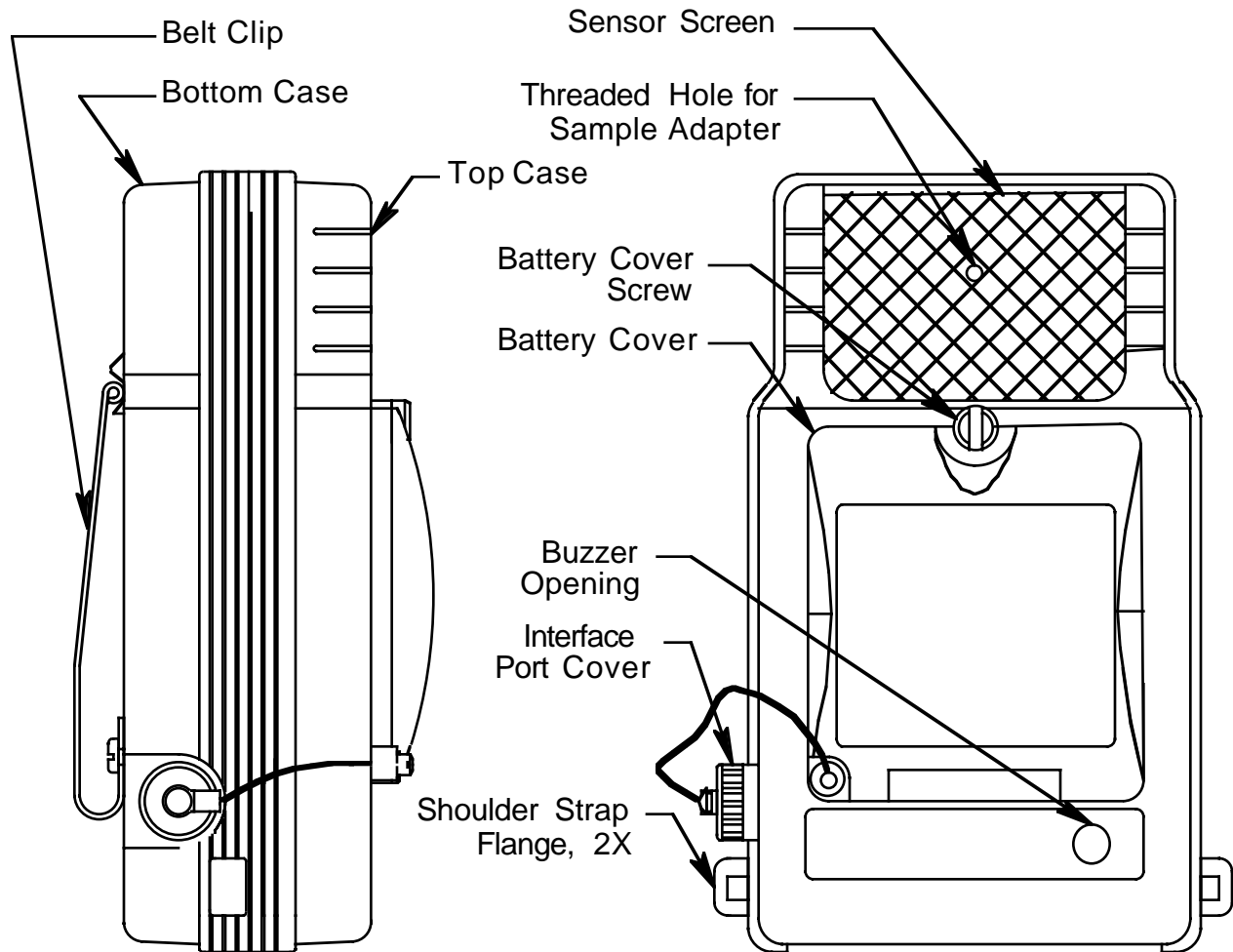The backlight does not operate in Setup Mode.

Figure 2: Top & Side views of the GX-94

Battery Compartment

The battery compartment is located on the top of the GX-94. A tethered battery cover allows easy battery replacement. It is tethered to the inter-face port cover.

The GX-94 uses two "C" size cells. Alkaline batteries will run the GX-94 for approximately 12 hours of non-alarm operation. Rechargeable nickel-cadmium batteries will run it for approximately 8 hours of non-alarm operation. The GX-94 does not include a charging jack, so rechargeable batteries must be removed from the GX-94 and charged separately. See the Parts List at the end of this manual for available bench top battery chargers.

Interface Port

The interface port is for use with the optional remote buzzer or for down-loading logged data to a PC-compatible computer. Downloading data requires the GX-94 Downloading Kit which includes the PC connection cable and the GX-94 Downloading Software. The interface port cover is tethered to the battery cover to reduce the risk of losing it.

Buzzer

A solid-state electronic buzzer is located inside the top of the case near the front, behind a felt screen. The buzzer sounds for gas alarms, mal-function, low battery voltage, and as an indicator during use of the control buttons.

Belt Clip and Strap Flanges

The GX-94 can be worn on the belt using the case-mounted clip. An included shoulder strap can also be attached to the flanges at the sides of the instrument case.

Diffusion Ports

Four sensor diffusion ports are located in the case at the top rear of the GX-94. The diffusion ports are covered by a removable sensor screen which protects the sensors from damage. The CO diffusion port has a recessed area for a charcoal filter. The charcoal filter is retained by the

diffusion screen and scrubs out H_2S and most hydrocarbons which cause a response on the CO sensor.

Sensors

The sensors are located inside the case in the top rear of the GX-94 behind the diffusion ports. A rubber sensor gasket is installed over the sensors and forms a seal between the sensors and the inside of the case to prevent any moisture or dirt which may enter the diffusion ports from entering the inside of the GX-94.

Combustible Gas Sensor

The combustible gas (HC) sensor is contained in a cylindrical metal shell with four connection pins at the base for easy replacement. The flame arrestor on the top of the shell allows atmosphere to diffuse into the sensor.

The HC sensor detects combustible gas and vapors in the atmosphere with a catalytic platinum element. The reaction of gas with oxygen on the catalyst causes a change in the resistance of the element, which is converted by the GX-94's circuitry into a reading of gas concentration.

Oxygen Sensor

The oxygen (O_2) sensor is contained in a cylindrical shell, with two connection pins at the base for easy replacement. The opening at the top of the shell allows atmosphere to diffuse into the sensor.

The O_2 sensor is an electrochemical galvanic cell, which reacts to the oxygen in the atmosphere, producing a voltage proportional to the oxygen concentration. This voltage is converted by the GX-94's circuitry into an oxygen reading.

Toxic Sensors (H$_2$S and CO Sensors)

The toxic sensors are physically identical, except for their external

labels. The toxic sensor is housed in a cylindrical plastic shell with four connection pins at the base for easy replacement. The membrane covered diffusion opening at the top of the shell allows atmosphere to diffuse into the sensor.

The toxic sensors are electrochemical cells, which react to gas in the atmosphere, producing a current proportional to the concentration of gas. The current is converted by the GX-94's circuitry into a measurement of gas concentration.

Circuit Boards

The GX-94 circuit boards analyze, record, control, store, and display the information collected. These circuit boards contain no user-serviceable components.

A 3 volt coin type lithium data backup battery is located on one of these circuit boards, the main CPU board, in a coin type battery holder. This battery assures that any stored data and unit setup are not lost when the main batteries are dead or are removed for replacement. The data backup battery typically lasts for five years. See the Maintenance section for instructions on replacing the data backup battery.

OPERATION

The GX-94 has four operating modes: normal operation mode, display mode, setup mode, and calibration mode. This section describes the GX-94 in normal operation mode. It includes procedures to start up and shut down the GX-94.

Note

The screens illustrated in this section are of a four gas GX-94. If you have a two gas or a three gas GX-94, some of your screens will look slightly different.

Preparation

Normally the GX-94 requires little preparation before use. If you have one of the available sample drawing accessories, see the Accessories section for installation instructions.

Starting Up the GX-94

1. Press the ON/OFF/INPUT button once. If the Lunch Break feature is on (see Setting the **Lunch Break Function** in the setup mode section), the RESUME screen displays. (If the Lunch Break feature is off, the Battery Voltage screen displays).

```
RESUME
AIR : YES
DISP : NO
```

- Press the AIR/▲ button to resume accumulating the TWA (time weighted average), peak, average, and the time in operation from the last time the GX-94 was used. (The short-term exposure limit [STEL] reading is reset each time the GX-94 is

turned off.) The Battery Voltage Screen displays.

Press DISPLAY/(ADJ.) to reset these measurements. The Battery Voltage screen displays.

If you do not press the AIR/▲ or DISPLAY/(ADJ.) buttons within 5 seconds, the GX-94 automatically resumes the TWA, peak, and average readings and continues accumulating the time in operation from the last session. The Battery Voltage screen displays.

The Battery Voltage screen displays the minimum usable and actual battery voltage. If the battery voltage is too low, the GX-94 will not continue.

```
 BATTERY
 MIN. 2.3V
 BATTERY
 NOW  2.9V
```

This message displays the date and time as set in Calibration Mode.

```
 Apr  25   02
       21:57
 TEMP.   24°C
          75°F
```

The following two screens display while the GX-94 checks itself for proper operation. The GX-94 alerts you if a malfunction occurs.

```
    SELF
 DIAGNOSIS
 10 SECONDS
   TO GO
```

```
   STANDBY

 <HC >< O2 >
 <H2S><CO >
```

When the GX-94 successfully completes its self check, the OK message displays instead of the STAND BY message, then the normal operating screen displays. The normal screen displays current concentrations for all gases. The GX-94 sounds a double tone to indicate it is in normal operation.

```
HC   0 LEL
O2  20.9%
H2S 0.0PPM
CO  0PPM
```

2. Verify that the GX-94 is operating properly. Breathe out over the diffusion grill of the instrument until the oxygen reading drops below the low alarm level. The audible alarm for oxygen deficiency will sound, the ALARM LED will blink, and "O2" will flash on the display.

    To verify detection of combustibles use a controlled source of flammable vapor, for example a bottle of isopropyl alcohol. The audible alarm will sound, the ALARM LED will blink, and "HC" will flash on the display.

Caution

Do not use gas from a cigarette lighter to test response to combustibles. Exposing the sensor to uncontrolled high concentrations of gas in this manner will reduce response and sensor life.

WARNING

IF THE GX-94 DOES NOT RESPOND TO THESE VERIFICATIONS, TAKE IT TO A KNOWN FRESH-AIR ENVIRONMENT, AN ENVIRONMENT FREE OF COMBUSTIBLE AND TOXIC GASSES AND OF NORMAL OXYGEN CONTENT (20.9%), THEN FOLLOW THE

DEMAND ZERO PROCEDURE DESCRIBED IN THE CALIBRATION SECTION. REPEAT THE VERIFY OPERATION PROCEDURE DESCRIBED ABOVE BEFORE USING THE GX-94 IN A POTENTIALLY HAZARDOUS LOCATION.

Normal Operation

The GX-94 will continuously monitor the ambient air and display the target gas concentrations present. If the GX-94 is taken into a low-light environment, the display backlight will automatically turn on.

Turning Off the GX-94

To turn off the GX-94, press and hold down the ON/OFF/INPUT button until the display goes blank, approximately five seconds, then release the button.

ALARMS

Alarm Indications

1. Combustibles (HC) Low and High Alarm

   If the combustible gas detected exceeds the low alarm setting, a pulsed tone will sound, the alarm LED will blink, and the display will flash "HC."

   If the combustible gas detected rises above the high alarm setting, the alarm tone and alarm LED will be continuous.

2. Oxygen Low and High Alarm

   If the oxygen content of the air drops below the low alarm setting, a pulsed tone will sound, the alarm LED will blink, and the display will flash "O2."

   If the oxygen content of the air rises above the high alarm setting, the alarm tone and alarm LED will be continuous.

3. H_2S and CO Low Alarm

   If the H_2S or CO detected exceeds the low alarm setting, a pulsed tone will sound, the alarm LED will blink, and "H2S" or "CO" will flash on the appropriate channel.

<div align="center">Note</div>

   The H_2S and CO channels do not have a high alarm.

4. Short Term Exposure Limit (STEL) Alarm, H_2S and CO Only

   If the average toxic gas level detected over the last 15 minutes exceeds the STEL alarm setting, a pulsing audible alarm will sound and the message "STL" will alternate with the gas name on the display in the field for that gas.

5. Time Weighted Average (TWA) Alarm, H_2S and CO Only

   If the average toxic gas level detected over the last 8 hours exceeds the TWA alarm setting, a pulsing audible alarm will sound

and the message "TWA" will alternate with the gas name on the display in the field for that gas.

6. Ceiling (CLG) Alarm, H_2S and CO Only

    If H_2S or CO detected exceeds the ceiling alarm setting, the audible alarm and LED will be on continuously, and the display will alternate between "CLG" and the gas name on the display in the field for that gas.

Note

The CLG alarm is set to OFF as shipped from RKI Instruments. It is user adjustable. See **Viewing and Setting Alarms** in the setup mode section for adjustment instructions.

7. Overscale Alarm

    If the full scale value is exceeded for any channel, the alarm tone and LED will be continuous. The display will show "MAX" in the gas reading field for that channel.

8. Low Battery

    When the battery charge drops near the lower limit, the GX-94 displays the following screen.

B	0LEL
A	20.^{9}%
T	0.^{0}PPM
•	0PPM

Low Battery
Warning

"BAT." alternates with the gas labels. The unit is still fully functional, but the batteries should be changes as soon as possible.

When the charge drops to the lower limit, the following screen displays:

```
┌─────────────────┐
│    BATTERY      │
│   MIN. 2.3V     │     Low Battery
│    CHANGE       │       Alarm
│    BATTERY      │
└─────────────────┘
```

The buzzer and alarm LED are on steadily and the "CHANGE BATTERY" message flashes. The GX-94 is not operational as a gas monitoring device when the unit is in low battery alarm

10. Sensor Failure and Emergency Operation.

The GX-94 continuously monitors itself for proper operation. If a malfunction occurs, the GX-94 alerts you with audible and visual alarms.

If a sensor fails during operation, the GX-94 will sound a steady tone, the alarm LED will be on, and it will display the following screen with the failed sensor in parentheses (in this example, the combustibles sensor):

```
┌─────────────────┐
│      FAIL       │
│     SENSOR      │
│  <HC > <    >   │
│  <    > <    >  │
└─────────────────┘
```

To continue using the GX-94, turn it off, then follow the start-up sequence. During start-up, the Fail screen will display and the buzzer and alarm LED will pulse momentarily. When the normal operation screen comes up, the display will indicate the failed sensor as "xxx":

```
HC        xxxLEL
O2        20.9%
H2S        0.0PPM
CO          0PPM
```

Resetting Alarms

The GX-94 can be set for latching or self-resetting alarms (see **Setting the Alarm Logic** in the Setup Mode section).

Self-Resetting Alarms

Self-resetting alarms will automatically reset and shut off when the reading falls below (or rises above for oxygen) the alarm point setting.

Latching Alarms

Latching alarms must be reset manually and cannot be reset until the gas concentration falls below (or rises above for oxygen) the alarm point setting. When the gas reading falls below the alarm point setting (or rises above for oxygen), press (SHIFT)/▼ to reset the alarm.

DISPLAY MODE

The GX-94 has four operating modes: normal operation, display mode, setup mode, and calibration mode. With the GX-94 in display mode, you can:

- display, enter, or update user and station ID's
- display peak readings
- display average readings
- display time in operation
- display STEL and TWA readings (H_2S and CO only)
- display battery voltage
- display date, time, and temperature
- clear the data logging memory
- display remaining log time

To enter display mode, from the normal operation screen press the DISPLAY/(ADJ.) button. To scroll from one screen to the next, press the DISPLAY/(ADJ.) button. The screen will hold for 20 seconds before reverting to normal operation screen, or until DISPLAY/(ADJ.) is pressed to go to the next screen.

User and Station ID Screen

This function appears only when the user ID option is activated in setup mode (see **Setting the ID Function** in the setup mode section). Use this screen to view, enter, or update the User ID and Station ID. The User ID and Station ID information is part of the logged data, providing a way to identify the user and location of exposure.

```
┌──────────────────────────┐
│  USER ID                 │
│  ********                │
│  STATION ID              │
│  ********                │
└──────────────────────────┘
```

To enter or update a User and Station ID, press ON/OFF/INPUT. The first character under USER ID will flash (* is default). Press AIR/▲ or SHIFT/▼ to scroll through the alphabet (A-Z) and numbers (0-9). When the correct character shows, press ON/OFF/INPUT to go to the next character. After the correct information is entered, press DISPLAY/ (ADJ) to exit this screen.

Peak Screen

The Peak function shows the highest (lowest for O_2) concentrations detected since the GX-94 was turned on. Peak readings stay in the instrument's memory until a higher (lower for O_2) level is detected, or the unit is turned off.

When the Lunch Break RESUME option is selected during startup, the the GX-94 remembers the peak readings from the last time the unit was on.

```
┌──────────────────────────┐
│  P          0LEL         │
│  E        20.9%          │
│  A         0.0PPM        │
│  K          0PPM         │
└──────────────────────────┘
```

Average Screen

The Average function shows the average gas concentrations detected since the unit was turned on. The average readings are calculated using the logged readings which are saved at the frequency set in the **6. Set Time Interval** menu item in the setup mode.

When selected at startup, the Lunch Break RESUME option enables the GX-94 to continue calculating the average reading from the last operating session.

```
A          0LEL
V        20.⁹%
G         0.⁰PPM
.         12PPM
```

Elapsed Time Screen

The Elapsed Time screen shows the time in minutes since the unit was turned on.

When the Lunch Break RESUME option is selected during start-up, the GX-94 will include the time from the last session when it displays the time in operation.

```
TIME IN
OPERATION
XXX
MINUTES
```

Short-Term Exposure Limit (STEL) Screen

The STEL function shows the average reading for H_2S and CO *during the last 15 minutes.* These values are not affected by the Lunch Break function and are reset every time the unit is turned off.

```
        STEL


H2S        0.0PPM
CO          0PPM
```

Time-Weighted Average (TWA) Screen

The TWA function shows the average reading for toxic gases *during the last 8 hours.* If 8 hours has not elapsed since the last time the STEL/TWA was cleared, the average is still calculated over 8 hours, with the missing time assigned a 0 value for readings.

When the Lunch Break RESUME option is selected during start-up, the GX-94 will include the TWA from the last session.

```
        TWA


H2S        0.0PPM
CO          0PPM
```

Battery Voltage Screen

The Battery Voltage function shows the minimum operating voltage and current battery voltage. New alkaline batteries typically measure 3.0 V; fully charged Ni-Cd batteries typically measure 2.6V.

```
BATTERY
MIN.   2.3V
BATTERY
NOW   2.8V
```

Note

The GX-94 automatically checks battery voltage during start-up; if the measurement is below 2.3V, the GX-94 will not operate.

Time/Date/Temperature Screen

This function shows the current time, date, and ambient temperature, for example:

```
Apr  25  02
     21:57
TEMP.  24°C
       75°F
```

The time is in military format (a 24 hour clock).

Clear Data Logger Screens

The Clear Data Logger screens allow the user to clear the data logger memory. This function shows three screens.

Press AIR/▲ to continue through this function, or DISPLAY/(ADJ.) to skip to the next function.

```
┌─────────────────┐  ┌─────────────────┐  ┌─────────────────┐
│   CLEAR DATA    │  │     ARE YOU     │  │                 │
│    LOGGER ?     │  │     SURE ?      │  │     CLEARED     │
│   YES:  AIR     │  │   YES:  AIR     │  │       OK        │
│   NO:   DISP    │  │   NO:   DISP    │  │                 │
└─────────────────┘  └─────────────────┘  └─────────────────┘
```

If the data logger memory is cleared, the Remaining Log Time will be reset, and all collected data will be erased.

Remaining Log Time Screen

The remaining log time screen shows the time remaining until the data logger memory is full. The remaining time depends upon the logging frequency and how many channels are active. Press DISPLAY/(ADJ.) once more to return to normal operation.

```
┌─────────────────┐
│    LOG TIME     │
│      15.0       │
│     HOURS       │
│   REMAINING     │
└─────────────────┘
```

SETUP MODE

The advanced microprocessor program in the GX-94 allows the user to select and adjust many of the detection and data logging features. In setup mode you can:

- reset the non-volatile RAM to default values
- update the gas combination
- update alarm point settings
- update the GX-94's serial number
- set the temperature
- update the data logging interval time setting
- update the alarm latching setting
- turn the lunch break function on or off
- turn the user ID function on or off
- update the time calibration setting
- update the data logger alarm setting
- update the frequency in Hz of the buzzer sound
- view several internal voltage values

Tips for Using Setup Mode

- Press (SHIFT)/▼ to scroll down through the main menu and submenus, and to lower values in a specific option.
- Press AIR/▲ to scroll up through the main menu and submenus, and to raise values in a specific option.
- When in the main menu, the number in front of a menu item will flash indicating the cursor position and that the item is selected.
- Press ON/OFF/INPUT to enter a selected menu item, and to enter data during programming.
- An adjustable parameter that is flashing can be adjusted with the

AIR/▲ and (SHIFT)/▼ buttons.

Entering Setup Mode

1. Take the GX-94 to a fresh air location—the instrument does not detect gas while in setup mode.
2. If it is not already off, turn the GX-94 off.
3. Hold down the AIR/▲ and (SHIFT)/▼ buttons simultaneously, then press ON/OFF/INPUT. The main menu will appear (release the buttons at this time). The "1" will be flashing indicating the cursor position and that this item is currently selected.

```
1.SET DEF
  NVRAM
2.COMBINE
  GAS
```

4. Scroll to the desired main menu item using the AIR/▲ and (SHIFT)/▼ buttons and press ON/OFF/INPUT to enter that item.

Resetting the NVRAM (1. SET DEF NVRAM)

- DEF. SET ALL

  Allows the user to reset all values for non-volatile RAM; all options are returned to default values.

- DEF. SET ALARM

  Resets only the alarm levels to default values.

- DEF. SET O2 ZERO

  Resets only the O_2 zero setting to the default value.

- DEF. SET TEMP. ZERO

  Resets only the temperature zero setting to the default value.

Updating the Gas Combination (2. COMBINE GAS)

Sets the display and circuitry for types of gases to be detected; there are 11 possible combinations. Press AIR/▲ or (SHIFT)/▼ to scroll through the combinations. Press ON/OFF/INPUT to accept the selected combination.

Note

Change the GAS COMBINATION values only when the appropriate sensors are installed in the corresponding sensor sockets. Calibrate immediately after changing sensor combinations.

Gases selected in this operation will be displayed throughout all setup and normal display screens.

Viewing & Setting Alarms (3. SET ALARM)

Sets the alarm levels for gases detected by the GX-94. Press AIR/▲ to change the alarm level for a single gas, or DISPLAY/(ADJ) to skip that channel.

Press AIR/▲ to raise an alarm level, or (SHIFT)/▼ to lower the alarm level. Hold down the button to scroll quickly through the alarm setting. The lowest available setting for each alarm point is "off."

Press ON/OFF/INPUT to accept the displayed alarm value and move to the next alarm or gas.

- SET ALARM <HC>

  Allows the user to change LOW and HIGH HC alarms for combustible gas.

- SET ALARM <O2>

  Allows the user to change the LOW and HIGH $\%O_2$ alarms. Remember that the LOW O_2 alarm is a *decreasing* alarm, for *falling*

oxygen levels and the HIGH O$_2$ alarm is an increasing alarm, for rising oxygen levels.

- SET ALARM <H2S>

  Allows the user to change the LOW, TWA, STEL, and CLG (ceiling) alarms for H$_2$S.

- SET ALARM <CO>

  Allows the user to change the LOW, TWA, STEL, and CLG (ceiling) alarms for CO.

Setting the Serial Number (4. SET SERIAL No.)

Sets or updates the instrument serial number.

1. At the SERIAL No. screen, the first character (left end) will flash. Press AIR/▲ or (SHIFT)/▼ to scroll through 0 - 9, A - Z to select the desired character.
2. Press ON/OFF/INPUT to enter that value and move to the next character.
3. Repeat steps 1. and 2. until the last serial number character is flashing, then press ON/OFF/INPUT to go to the END screen.

Setting the Temperature (5. SET TEMP)

Sets the ambient temperature reading.

1. The temperature screen displays the current temperature reading. Compare this reading to a reliable thermometer or other source.
2. Press and hold briefly AIR/▲ to raise the reading, or (SHIFT)/▼ to lower the reading. (The reading changes in increments of one degree Celsius).
3. Press ON/OFF/INPUT to accept the displayed reading and exit the SET TEMP menu.

Setting the Data Logging Frequency (6. SET TIME INTERVAL)

Sets the time between the logging of the instantaneous readings for the Data Logger. Hold down the AIR/▲ or (SHIFT)/▼ switch to scroll rapidly through the values. The time interval may be set from 5 seconds to 300 seconds (5 minutes).

Setting the Alarm Logic (7. SET LATCHING)

Toggles alarm logic between self-resetting (default) and latching alarms by turning latching ON or OFF. When Latching is set to OFF (self-resetting), the GX-94 automatically resets the a gas alarm when the gas reading falls below (or rises above for oxygen) the alarm point. When Latching is set to ON, the user must press DISPLAY/(ADJ.) to reset the alarm after the gas reading has dropped below (or risen above for oxygen) the alarm point.

Setting the Lunch Break Function (8. SET LUNCH)

Toggles the Lunch Break feature ON and OFF. With Lunch Break OFF (default) selected, the GX-94 automatically starts new TWA, PEAK, and AVERAGE reading collection at start up and the TIME IN OPERATION starts over at zero. When Lunch Break ON is selected, these items are continued from the last operating session.

Setting the ID Function (9. SET ID)

Toggles the ID INPUT option on and off. With the option off (default) the User ID/Station ID screen does not appear in the Display Mode.

Setting the Calibration Reminder (10. SET TIME CAL.)

Sets the interval between calibration alerts on the GX-94. Default setting is off, with a range of 1 - 9999 hours. Tip: hold AIR/▲ or (SHIFT)/▼

to scroll rapidly through values.

Setting the Data Logging Alarm (11. SET LOG ALARM)

When the Data Logger memory capacity has been filled to the percentage selected here, the GX-94 alerts you. Default setting is off, with a range of 1 - 100%. Tip: hold AIR/▲ or (SHIFT)/▼ to scroll rapidly through values.

Setting the Buzzer Frequency (12. SET TONE)

Sets the frequency of the alarm buzzer in the range 1969 - 2153 Hz. This option is useful in environments with significant background noise and/or a variety of audible signals.

1. The frequency screen displays the current buzzer frequency, along with a continuous tone from the buzzer.
2. Press AIR/▲ to raise the frequency or (SHIFT)/▼ to lower.
3. Press ON/OFF/INPUT to accept the setting and return to the main menu.

Displaying Circuit Voltages (13. DISPLAY VOL.)

Displays the voltage in millivolts (mV) at several test points in the GX-94's circuitry. This menu is a diagnostic tool, and is not adjustable.

Returning to Normal Operation (14. START)

With this item selected, press ON/OFF/INPUT to begin the instrument's normal startup sequence.

CALIBRATION MODE

Calibration mode allows you to calibrate the GX-94's sensor response. It also includes a menu item which allows you to set the date and time.

Calibrate the GX-94 when you replace a sensor. Also calibrate the GX-94 periodically to assure proper sensor response. The frequency of calibration depends upon the amount and type of use. Determine you own calibration frequency taking your application and requirements into account. A typical calibration frequency is once per month.

You can set the GX-94 to notify you when it is due for calibration (see **Setting the Calibration Reminder** in the setup mode section).

Calibration Supplies and Equipment

To calibrate the GX-94, you will need:

- Known calibrating samples of the gases to be detected. The combustible and toxic sample concentrations should be approximately in the middle of the detection ranges; a zero-oxygen source (such as 100% nitrogen) is recommended for setting the O2 zero.
- A 0.5 LPM (liters per minute) fixed flow regulator

Note

> When the RKI fixed flow regulator is screwed onto a gas cylinder, the gas will automatically start to flow at a fixed rate. Install the fixed flow regulator only during calibration.

- Non-absorbent tubing
- GX-94 calibration adapter

To calibrate all sensors at once automatically without the need for a zero-oxygen source, you can use the Auto Calibration feature and the RKI Four Gas Cylinder. This section includes instructions for calibration

with the fixed flow regulator and RKI Four Gas Cylinder. It also includes instructions for calibration with individual gas sources.

Preparation

1. Take the GX-94 to a non-hazardous location with fresh-air conditions.
2. Turn on the instrument and allow one minute to warm up.
3. Perform a demand zero.

    Press and hold the AIR/▲ button on the control panel until. The instrument will indicate on the display that it is adjusting the zero settings. Keep pressing the AIR/▲ button until the display indicates "ZERO ADJUSTED RELEASE AIR KEY".

    The instrument will automatically set the LEL and toxics circuits to zero and the O_2 circuit to 20.9%.
4. Screw the adapter plate to the threaded hole in the sensor screen.
5. Connect the calibration tubing from the adapter plate to the regulator.

Note

Do not screw the fixed flow regulator onto the cylinder at this time since sample will automatically start to flow.

Calibrating the GX-94

Press and hold the (SHIFT)/▼ button, then press the DISPLAY/(ADJ.) button to enter calibration mode. The calibration menu will show the following screen with a flashing number indicating the cursor position:

```
1.AUTO CAL

2.SET SPAN
    <HC>
```

The GX-94's calibration menu includes two methods of calibration: auto calibration or single calibration.

- Auto Calibration: This method allows you to calibrate all four sensors simultaneously. It is designed for use with the RKI Four gas Calibration Cylinder and is the quickest and easiest method to calibrate the GX-94.
- Single Calibration: This method allows you to calibrate one sensor at a time. Use this method if you are only calibrating one or two sensors or if you are using multiple single gas cylinders to calibrate.

Calibrating with the Auto Calibration Method

This section describes calibration using the auto calibration method. To calibrate using the single calibration method, see **Calibrating with the Single Calibration Method** later in this section.

1. Use the AIR/▲ and SHIFT/▼ buttons to select the AUTO CAL menu option. The "1" will be flashing.
2. Press the ON/OFF/INPUT button to continue in the auto calibration menu. The display will ask you if you want to continue with Auto Calibration. Press AIR/▲ to continue or DISPLAY/(ADJ.) to return to the main menu.
3. If you press AIR/▲, the Calibration Values screen appears.
   .

```
C          50LEL
A          12.0%
L          25.0PPM
.          50PPM
```

The gas concentrations displayed in the Calibration Values screen must match the gas concentrations listed on the Four Gas Calibration Cylinder. If all concentrations match, go to step 8. If

one or more concentrations do not match, continue with step 4.

4. To adjust the values on this screen, hold down the (SHIFT)/▼ button and press the DISPLAY/(ADJ.) button. The AUTO CAL. value screen for the combustible gas channel displays.

```
AUTO CAL.
<HC>

50 LEL
```

5. Use the AIR/▲ (increase) and (SHIFT)/▼ (decrease) buttons to set the correct combustible gas value.
6. Press the ON/OFF/INPUT button to enter the new setting. The AUTO CAL. value screen for the next channel displays.
7. Repeat steps 5 and 6 to set the correct values for the remaining channels and return to the Calibration Values screen.

Note

The RKI Four Gas Cylinder contains approximately 12% O_2 by volume. Be sure to set the "O2" auto calibration value to agree with the concentration listed on the cylinder's label, not zero.

8. With the Calibration Values screen displayed, press the ON/OFF/INPUT button. The gas readings will flash.
9. Screw the regulator onto the calibration cylinder. The gas begins to flow.
10. Allow the gas to flow for one minute (the readings should be stable) then press the ON/OFF/INPUT button to set the calibration for each channel to the programmed values.

    If a sensor(s) cannot be calibrated to the proper value, **FAIL PUSH AIR** displays and the GX-94 lists the sensor(s) that failed to

calibrate. The other sensors calibrate normally. The buzzer and alarm LED activate. Press the AIR/▼ button to reset the alarm and return to the main menu. Replace the failed sensor(s), then repeat calibration.

11. **AUTO CAL END** displays, then the Calibration menu displays.
12. Unscrew the regulator from the cylinder.
13. Remove the adapter plate from the GX-94.
14. Press the SHIFT/▼ button to place the prompt next the **7.RETURN** menu option, then press the ON/OFF/INPUT button to return to normal operation.

Calibrating with the Single Calibration Method

This section describes calibration using the single calibration method. To calibrate using the auto calibration method, see **Calibrating with the Auto Calibration Method** earlier in this section.

CAUTION

The single calibration method does not have a "FAIL" notification. Replace sensors that cannot be set to agree with the calibration source, then recalibrate.

1. Use the AIR/▲ and (SHIFT)/▼ button to place the cursor next to the channel you want to calibrate. In this example the combustible gas channel is calibrated. Place the cursor next to the SET SPAN <HC> menu option. The number 2 will flash.

:

```
1.AUTO CAL


2.SET SPAN
      <HC>
```

2. Press the ON/OFF/INPUT button to display the HC CAL. screen. The gas reading is flashing

```
HC CAL.
0 LEL
APPLY/GAS/
ADJ/INPUT
```

2. Screw the regulator onto the cylinder. The gas begins to flow.

Note

The combustible gas sensor is a general hydrocarbon sensor that responds to most flammable gases; the response will vary depending upon the substance. For best results, calibrate the GX-94 to the target gas.

3. Allow the gas to flow for one minute. After one minute, if the reading does not correspond to the calibration gas concentration, press the AIR/▲ button to increase the reading, or the (SHIFT)/▼ button to decrease the reading. The GX-94 will beep each time a switch is pressed.
4. When the reading is correct, press the ON/OFF/INPUT button. The display will read HC CAL. END, then automatically return to the main menu.
5. Unscrew the regulator from the cylinder.
6   Repeat steps 1 through 5 for any other channels you want to calibrate. Make sure you use an appropriate calibration cylinder for each channel.

CAUTION

When calibrating the oxygen channel, the menu item

reads "OXYGEN ZERO". Verify the concentration of oxygen listed on the cylinder's label and set the zero reading to the same concentration. A 100% nitrogen source (0% oxygen) is recommended when using single calibration.

7. After the last channel is calibrated, press the (SHIFT)/▼ button until the number 7 in front of RETURN, the last menu item, flashes.
8. Press the ON/OFF/INPUT button to return to normal operation.

Setting the Date and Time

The number 6 option in the calibration menu is SET DATE/TIME. Use this item to set the current date and time for the GX-94.

From the normal operation screen, press and hold the (SHIFT)/▼ button, then press the DISPLAY/(ADJ.) button to enter Calibration Mode. The calibration menu will show the following screen with a flashing number indicating the cursor position:

```
1.AUTO CAL

2.SET SPAN
   <HC>
```

1. Use the (SHIFT)/▼ button to place the cursor in from of menu item **6. SET DATE/TIME**. The number 6 will flash.
2. Press the ON/OFF/INPUT button. The display will show the current settings, with the month flashing.
2. Press AIR/▲ or (SHIFT)/▼ to scroll to the desired month.
3. Press ON/OFF/INPUT to enter the selection and go to the next setting (day).
4. Repeat steps 2 and 3 for each value: day, year, hours, minutes. You may skip past a correct setting by pressing ON/OFF/INPUT.

NOTE

The time is displayed in military format, a 24 hour clock instead of a 12 hour clock.

5. After the minutes are entered, press ON/OFF/INPUT to return to the main menu.
6. Press (SHIFT)/▼ to scroll to the last menu item, 7 RETURN.
7. Press ON/OFF/INPUT to return to normal operation.

MAINTENANCE

Main Batteries

1. Check the battery voltage periodically by pressing the DISPLAY button to reach the Battery Voltage Screen. Replace the batteries before the voltage drops to the operational limit (see Alarms, Low Battery).

WARNING

TAKE THE GX-94 TO A NON-HAZARDOUS LOCATION BEFORE REPLACING THE BATTERIES.

2. To replace the batteries, unscrew the battery compartment cover retaining screw and remove the cover. Remove the batteries and verify that the battery compartment and electrical contacts are clean. Insert fresh batteries (alkaline or fully-charged Ni-Cd) according to the polarity (+/-) markings in the compartment and replace the cover.

Note

The batteries continuously supply a bias voltage to maintain the toxic sensors, even when the instrument is off (see Sensor Maintenance). The power drain is minimal, but will result in a normal discharge of the batteries over a period of several weeks.

Note

If the batteries are fully discharged before replacement, allow up to 1/2 hour for the toxic channels to show a normal response.

Lithium Memory Backup Battery

The memory backup battery is a 3.0 volt lithium battery which protects against loss of the GX-94's memory when the main batteries are dead or removed. The memory backup battery typically lasts for 5 years. Replace the memory backup battery every 5 years or if you notice that the GX-94 is losing logged data when the main batteries are changed.
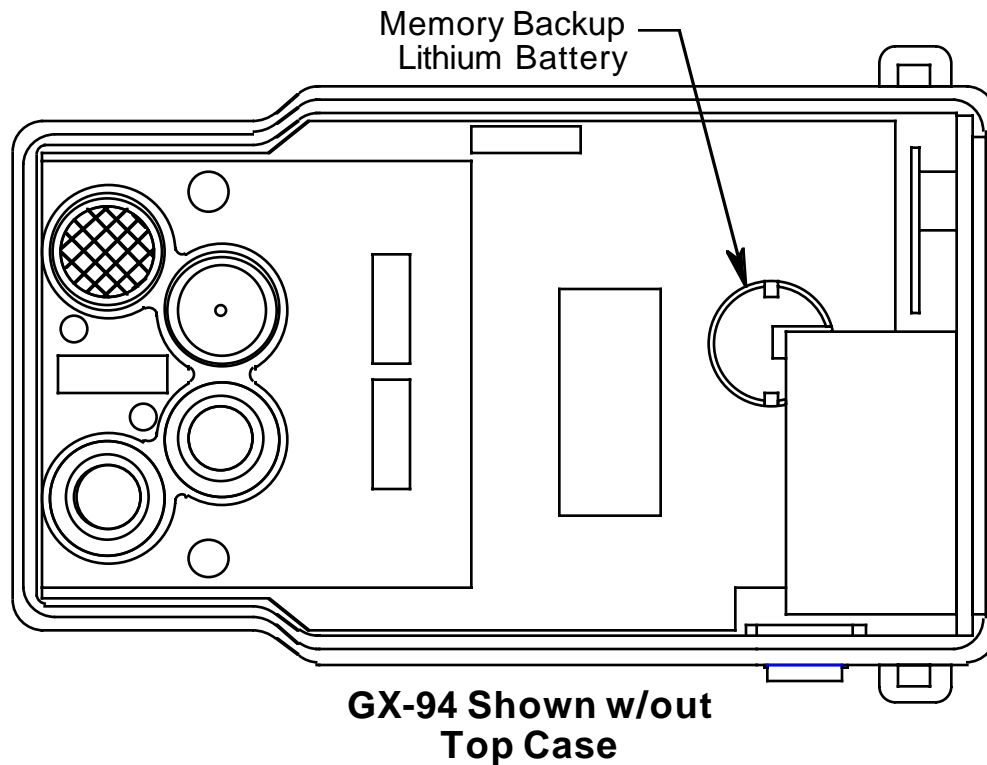
Memory Backup
Lithium Battery

**GX-94 Shown w/out
Top Case**

Figure 3: Lithium Backup Battery

1. Take the GX-94 to a non-hazardous location and turn the power off.
2. Remove the four (4) phillips screws from the bottom of the instrument. (Two in the belt clip and two next to the label.)
3. Pull the bottom and top case apart where the rubber cushion covers the seam. This opens the entire case.
4. Locate the lithium backup battery. Refer to Figure 3 above.
5. Gently pry the battery out of its holder with a small screw driver.

6. Install a fresh battery in the battery holder. Use a CR2032 3.0 volt coin type lithium battery. See the Parts List at the end of this manual for a replacement battery available from RKI Instruments, Inc.

7. Reinstall the cover, belt clip, and screws.

Charcoal Filter

The CO sensor diffusion opening is equipped with an activated carbon filter disk that includes an integral rubber boot. It removes H_2S and most hydrocarbons to limit interference with the CO measurement.

Diffusion Screen

Charcoal Filter w/Rubber Boot
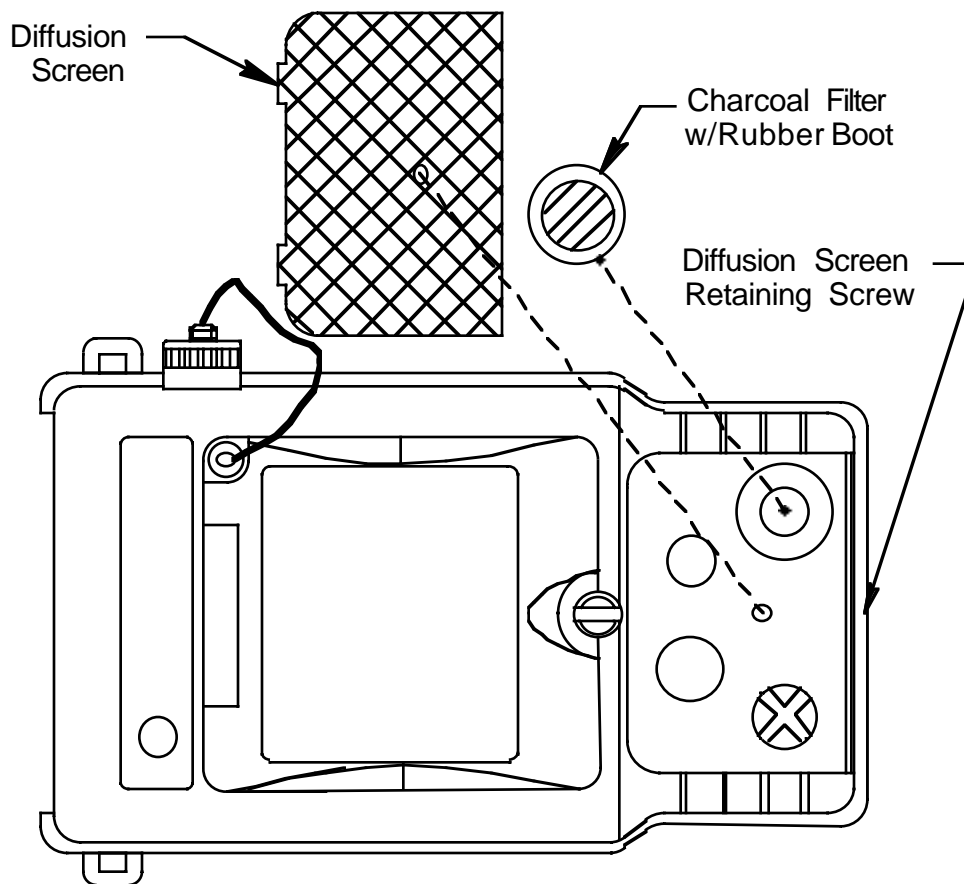
Diffusion Screen Retaining Screw

Figure 4: Charcoal Filter Replacement

To replace the filter:

1. Unscrew the diffusion screen retaining screw located at the rear of the unit.

2.   Remove the diffusion screen.
3.   Remove the old charcoal filter w/rubber boot from the CO sensor diffusion port. Place the new filter in the filter slot. Replace the filter when CO readings become suspect (e.g., CO circuit calibrates properly, but shows response in a known CO-free environment), or when replacing sensor, whichever comes first.
4.   Replace the diffusion screen.
5.   Replace the diffusion screen retaining screw.

Sensor Maintenance

Electrochemical sensors (O_2, H_2S, CO) gradually deteriorate, regard-less of use, and require periodic replacement. Combustibles sensor life is generally related to exposure to combustible gas, but certain environ-mental factors may affect duration.

The GX-94 sensors are easy to replace but contain no user serviceable parts. For genuine RKI sensors, call RKI or your local distributor. All sensors are covered by a limited warranty; see warranty for details.

Combustibles Sensor

Replace the combustibles sensor when:

1.   The combustibles circuit cannot be calibrated correctly.
2.   The HC (%LEL) display does not show 0 immediately after the start-up sequence, and it cannot be set to zero by the Demand Zero command.

O_2 Sensor

Replace the O_2 sensor when:

1.   The O_2 circuit cannot be set to 00.0% on an oxygen-free sample.
2.   The OXY (O_2) display does not show 20.9% immediately after the start-up sequence and after the Demand Zero operation.
3.   The O_2 reading tends to drift with instrument orientation.

Toxics Sensors

Replace the sensor when:

1. The detection circuit cannot be calibrated correctly.
2. The display does not show 00 immediately after the start-up sequence and cannot be set to zero by the Demand Zero command.

Note

Allow up to 1/2 hour after the toxics sensors have been replaced to show a normal response, then calibrate.
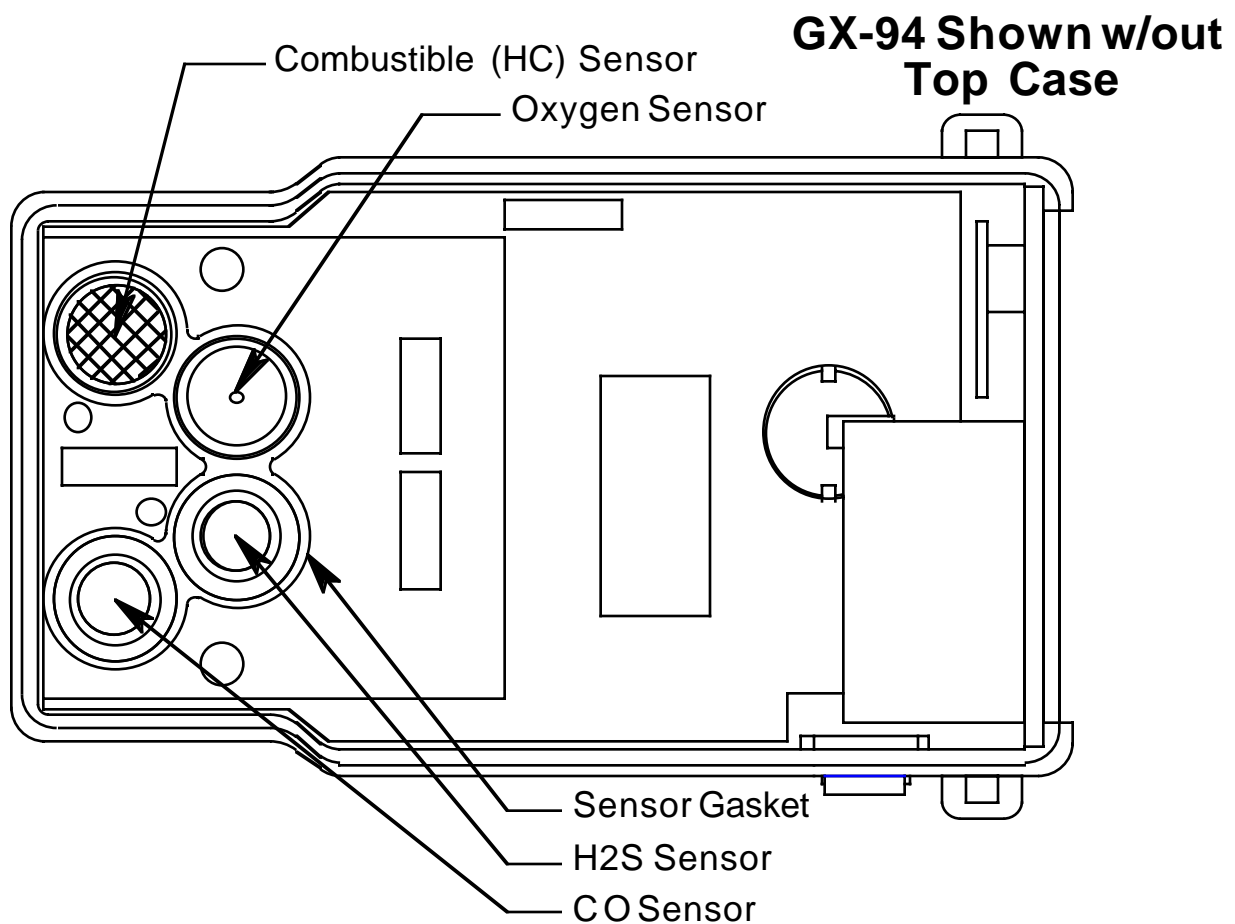
Sensor Replacement

Figure 5: GX-94 Sensors

1. Take the GX-94 to a non-hazardous location and turn the power off.
2. Remove the four (4) Phillips screws from the bottom of the instrument. (Two in the belt clip and two next to the label.)
3. Pull the top and bottom case apart where the rubber cushion covers the seam. This opens the entire case.
4. Remove the sensor gasket from the sensors.
5. To replace individual sensors, gently unplug from the circuit board by pulling straight up.
6. Carefully insert a new sensor. Be sure to sure to place the sensor in the correct position; sensors are not interchangeable between positions.
7. Reinstall the sensor gasket on the sensors.
8. Reinstall the cover, belt clip, and screws.
9. For Oxygen, CO, and H2S sensors, wait up to 1/2 hour for the sensors to stabilize. Combustible sensors need no stabilization period. Turn on the instrument and perform a demand zero using the AIR/ ▲ button.
10. Calibrate the channels with the new sensors (see Calibrating the GX-94).

ACCESSORIES

Sample-Drawing Pump

The GX-94 Sample-Drawing pump converts the GX-94 into a portable sample drawing system. The pump is easy to install and use, and is built to give years of dependable service.

Installing the Pump

1. Slide the pump onto the sensor end of the GX-94, as shown in Figure 6.
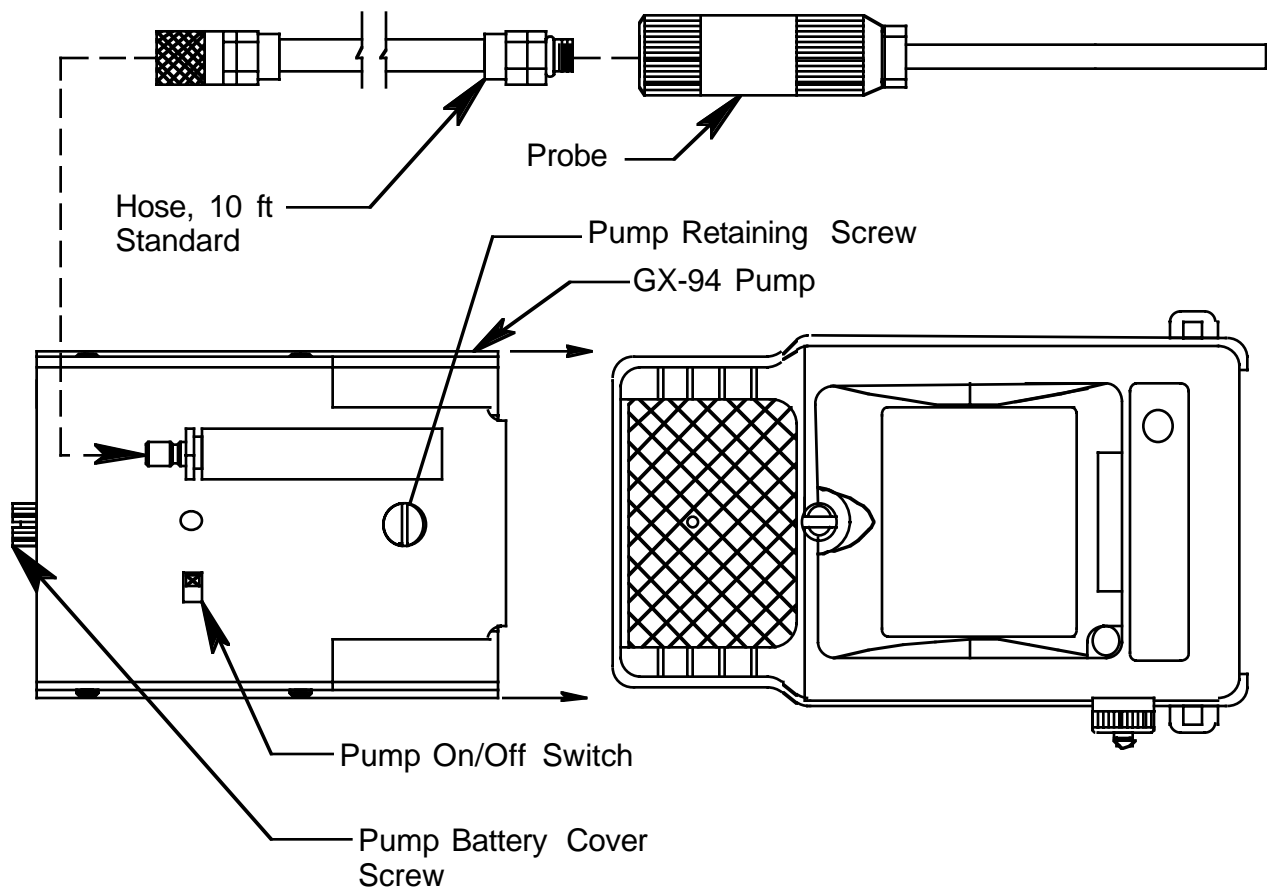

Figure 6: Attaching the GX-94 Pump

2. Make sure the pump retaining captive screw on top of the pump

inserts into the threaded hole in the sensor screen, then tighten it to connect the pump and the instrument.

3. Connect the sample hose and probe to the pump inlet.

Using the GX-94 with the Pump

1. Turn on the GX-94 and slide the pump power switch to the ON position. Verify that the pump is running (low humming sound).
2. After the GX-94 has completed normal start-up, place the probe tip in the area to be monitored.

Note

Allow a few seconds for the GX-94 to respond to changes in the sample; response time will vary with sample hose length. Do not immerse the probe tip in liquids.

3. The GX-94 will display gas concentrations, sound alarms, and log data normally.
4. If the sample system (probe, filter, hose, pump) is blocked or restricted, the Low Flow alarm on the pump will sound. This alarm is a steady tone and lit yellow LED on the top of the pump. Take the GX-94 to a non-hazardous area, then check the probe, filter, and hose for foreign material and examine the hose for pinches or kinks.

WARNING

WHEN THE PUMP IS INSTALLED, THE GX-94 CANNOT MONITOR FOR GAS UNLESS THE PUMP IS TURNED ON AND OPERATING CORRECTLY. TO RETURN THE GX-94 TO AMBIENT MONITORING, REMOVE THE PUMP.

Pump Maintenance

1. Replace the pump battery when the pump won't start or can't maintain flow adequate to keep the Low Flow alarm off.
    a. Loosen the battery cover screw on the end of the pump to remove the battery cover.
    b. Replace the old battery with a "C" size alkaline or fully charged Ni-Cad battery.
    c. Replace the battery cover.

2. Inspect the cotton filter in the probe handle periodically. Replace the cotton filter when it is visibly dirty, or when it does not allow adequate flow to the pump (Low Flow failure).
    a. Unscrew the probe handle.
    b. Remove and discard the clogged filter. Replace with a cotton filter.
    c. Re-install the probe handle and test the pump assembly.

PARTS LIST

Table 4 lists replacement parts and accessories for the GX-94.

Table 4: Parts List

Part Number	Description
06-1248RK	Tubing, for calibration kit (order by the foot)
13-0190RK	Shoulder strap
20-0307RK	Vinyl carrying case for instrument only
20-0602RK	Waterproof carrying case for instrument and accessories
33-1031RK	Cotton Filter for probe, pack of 25 cotton balls
33-7103RK	Charcoal filter w/rubber boot for CO sensor diffusion port
35-1513RK	Calibration/sample adapter plate
47-5000RK	Downloading cable
49-1402RK	Data logging backup battery, 3.0 volt lithium, CR2032 coin type
49-1130RK	Battery, size C, alkaline (unit requires 2)
49-1230RK	Battery, size C, Ni-Cad (unit requires 2)
49-3100RK	Ni-Cad battery charger, bench top, for up to 8 batteries, 115 VAC
49-3102RK	Ni-Cad battery charger, bench top, for up to 4 batteries, 12 VDC
61-0217RK	Sensor, LEL, HW-6295A
65-1058RK	Sensor, oxygen (O_2), OS-BM1
65-2008RK	Sensor, carbon monoxide (CO), ES-031
65-2038RK	Sensor, hydrogen sulfide (H_2S), ES-037A

Table 4: Parts List

Part Number	Description
80-0009RK-10	Hose,10 ft., polyurethane, for use with pump or aspirator adapter
80-0150RK	Probe, for use with pump or aspirator adapter
81-1169RK	GX-94 pump adapter with 10 ft. hose and probe
81-0090RK-01	Calibration cylinder, 3-gas,50% LEL CH_4/12% Oxy/50 ppm CO, nitrogen balance, 34 liter
81-0090RK-03	Calibration cylinder, 3-gas,50% LEL CH_4/12% Oxy/50 ppm CO, nitrogen balance, 103 liter
81-0154RK-02	Calibration cylinder, 4-gas, 50% LEL CH_4/12% Oxy/50 ppm CO/50 ppm H2S, nitrogen balance, 58 liter
81-1003RK	Regulator for calibration kit, fixed flow at 0.5 LPM, no gauge, for 17/34 liter cylinders
81-1004RK	Regulator for calibration kit, fixed flow at 0.5 LPM, with gauge, for 58/103 liter cylinders
81-1119RK	Hand aspirated sample adapter with 10 ft. hose and probe
82-5004RK	Data logging package, includes cable/software/instructions
83-0001RK	GX-94 downloading software only