

# Model GX-2001 Operator's Manual



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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.

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## Introduction

Using an advanced detection system consisting of four gas sensors, the Model GX-2001 Personal Four-Gas Monitor detects the presence of combustible gas, oxygen (O<sub>2</sub>), carbon monoxide (CO), and hydrogen sulfide (H<sub>2</sub>S) simultaneously. The Model GX-2001's compact size and easy-to-use design makes it ideally suited for a wide range of applications, including sewage treatment plants, utility manholes, tunnels, hazardous waste sites, power stations, petrochemical refineries, mines, paper mills, drilling rigs, and fire fighting stations. The Model GX-2001 offers a full range of features, including:

- Simultaneous four-gas monitoring of combustible gases, O<sub>2</sub>, CO, and H<sub>2</sub>S
- Liquid crystal display (LCD) for complete and understandable information at a glance
- Distinctive audible alarms for dangerous gas conditions and for unit malfunction
- Microprocessor control for reliability, ease of use, and advanced capabilities
- Alarm trend data
- Data logging functions
- STEL/TWA and ceiling alarm display
- Peak hold and average readouts
- Built-in time function
- RF shielded and high impact plastic case of very compact size and light weight
- Belt clip for "hands-free" gas monitoring
- CSA classified for Class I, Division I, Groups A, B, C, and D hazardous atmospheres

**WARNING:** *The Model GX-2001 detects oxygen deficiency and elevated levels of oxygen, combustible gases, carbon monoxide, and hydrogen sulfide, all of which can be dangerous or life threatening. When using the Model GX-2001, you must follow the instructions and warnings in this manual to assure proper and safe operation of the unit and to minimize the risk of personal injury.*

## Specifications

**Table 1 : Model GX-2001 Specifications**

<b>Model Name</b>	<b>Model GX-2001</b>			
Target Gas	Combustibles (HC, CH <sub>4</sub> , etc.)	Oxygen (O <sub>2</sub> )	Hydrogen Sulfide (H <sub>2</sub> S)	Carbon Monoxide (CO)
Range (Increment)	0-100% LEL (1% LEL)	0-40.0 vol% (0.1 vol%)	0-150 ppm (0.5 ppm)	0-300 ppm (1 ppm)
Detection Method	Diffusion			
Response Time	T90 Within 30 Seconds			
Display	7-Segment Digital LCD			
Gas Alarms (Factory Settings)	Alarm 1: 10% LEL Alarm 2: 50% LEL Over: 100% LEL	Alarm 1: 19.5 vol% (Decreasing) Alarm 2: 23.5 vol% Over: 40.0 vol%	Alarm 1: 10 ppm Alarm 2: 30 ppm TWA: 10 ppm STEL: 15 ppm	Alarm 1: 25 ppm Alarm 2: 50 ppm TWA: 25 ppm STEL: 200 ppm
Operating Temperature and Humidity	-10 to 40o C/Below 85% RH (Without Condensation)			
Power Supply	Ni-cad Battery Pack (2.4 VDC Nominal), Direct Charging			
Continuous Operating Hours	Up to 12 Hours (No Alarms after Full Charge)			
Case Standard Accessories	High-impact Plastic, RF Shielded, Dust and Weather Proof Ni-Cad Battery Pack, Belt Clip			
Optional Accessories	<ul style="list-style-type: none"> <li>• Charging Station, 115 VAC Powered</li> <li>• Charging Station with PC Communication Function for Datalog Downloading</li> <li>• Communication Computer Cable</li> <li>• Communication Software (Windows® 95, 98, &amp; NT)</li> <li>• Automatic Calibraiton Station</li> <li>• Hand Aspirated Sample Draw with Hose and Probe</li> <li>• Wrist Strap</li> </ul>			
Dimensions and Weight	Dimensions: 2.8 (H), 2.2 (W), 1.1 (D) inches Weight: Approximately 6 oz.			

## Description

This section describes the components of the Model GX-2001. These components include the Model GX-2001's case, sensors, LCD, control buttons, printed circuit boards, alarm lights, buzzer/vibrator, Ni-cad battery pack, belt clip, and battery charger.

### Case

The Model GX-2001's sturdy, high-impact plastic and metal case is radio frequency (RF) resistant, and is suitable for use in many environmental conditions, indoors and out. The unit is dust proof and weather resistant..

On the front of the case is a digital LCD, which shows gas concentrations, battery level, time, and other readings including TWA, STEL, and peak gas levels. Below the LCD are three control buttons. The first button on the left is labeled MODE/POWER. The other buttons are labeled DISP and AIR, respectively.

Beneath the control buttons is the buzzer, which is located inside the unit.

On the right side of the Model GX-2001 are the diffusion ports for the gas sensors located inside the case. These sensors are, from top to bottom (and are marked on the case), HC (combustible gases), O<sub>2</sub>, CO, and H<sub>2</sub>S.

On the left side of the case are two brass recharging contacts, which are used when the unit is placed in the battery charger, and on top of the case are two alarm lights. On the back of the unit is a rugged metal belt clip enabling hands-free gas monitoring.

### Sensors

The Model GX-2001 uses four sensors to monitor HC (combustible gases), O<sub>2</sub>, CO, and H<sub>2</sub>S simultaneously. The sensors are protected by filters that allow atmosphere to diffuse inward. The sensors use different detection principles, as described below.

#### ***Combustible Gas Sensor***

The LEL 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. The current is amplified by the Model GX-2001's circuitry, converted to a measurement of combustible gas concentration, and displayed on the LCD.

#### ***Oxygen Sensor***

The O<sub>2</sub> sensor is an electrochemical cell. A membrane covers the cell and allows gas to diffuse into the cell at a rate proportional to the partial pressure of oxygen. The oxygen reacts in the cell and produces a voltage proportional to the concentration of oxygen. The voltage is measured by the Model GX-2001's circuitry, converted to a measurement of gas concentration, and displayed on the LCD.

#### ***CO and H<sub>2</sub>S Sensors***

The CO and H<sub>2</sub>S sensors are electrochemical cells that consist of two precious metal electrodes in an acid electrolyte. A gas permeable membrane covers the cell and allows gas to diffuse into the electrolyte. The gas reacts in the cell and produces a current proportional to the concentration of the target gas. The current is amplified by the Model GX-2001's circuitry, converted to a measurement of gas concentration, and displayed on the LCD.

## LCD

The LCD is visible through the GX-2001's front panel. Target gas concentrations, the time, battery condition, and alarm indications are displayed on the LCD.

## Control Buttons

Below the LCD are the control buttons. These buttons are MODE/POWER, DISP, and AIR. They turn on the power to the Model GX-2001, and turn it off. They control what is displayed on the LCD, including battery level, time, date, and year, gas concentrations, peak, TWA, and STEL readings, as well as other messages. They also allow you to perform a Demand Zero, change alarm points, change the date and time, and calibrate the instrument. The functions performed by the control buttons are summarized in the following table:

**Table 2 : The Control Buttons of the Model GX-2001**

Button	Function
<b>MODE/POWER</b>	<ul style="list-style-type: none"> <li>• Turns the unit on and off.</li> <li>• Turns the LCD back light on and off.</li> <li>• Displays peak readings (low minimum and high maximum readings for O<sub>2</sub>).</li> <li>• Resets the alarm circuit (gas alarms).</li> <li>• Enters Calibration Mode with the AIR button.</li> <li>• Enters Alarm Adjustment Mode with the AIR button.</li> <li>• Enters Time Adjustment Mode with the DISP button.</li> </ul>
<b>DISP</b>	<ul style="list-style-type: none"> <li>• Displays the next target gas when the unit is in Measuring Mode.</li> <li>• Enters Time Adjustment Mode with the MODE/POWER button.</li> <li>• Decreases settings when the unit is in Alarm Adjustment Mode or Time Adjustment Mode.</li> <li>• Toggles between field calibration and auto calibration when the unit is in Calibration Mode.</li> </ul>
<b>AIR</b>	<ul style="list-style-type: none"> <li>• Adjusts LCD readings when the a Demand Zero is performed.</li> <li>• Enters Calibration Mode with the MODE/POWER button.</li> <li>• Enters Alarm Adjustment Mode with the MODE/POWER button.</li> <li>• Increases settings when the unit is in Alarm Adjustment Mode or Time Adjustment Mode.</li> <li>• Toggles between field calibration and auto calibration when the unit is in Calibration Mode.</li> </ul>

## **Printed Circuit Boards**

The primary function of the Model GX-2001's three printed circuit boards are to amplify the current sent to them from the four gas sensors, convert the current to a meaningful measurement of gas concentration, display the gas concentration on the LCD, store peak, STEL, and TWA readings, and activate the alarm circuit if an alarm point has been reached. They monitor battery level, battery failure, and sensor failure. They also control the Model GX-2001's time function and the various operating modes of the unit. Note that the printed circuit boards contain no serviceable parts.

## **Alarm Lights**

The Model GX-2001 has two alarm lights mounted on top of the unit. The alarm lights are two red LEDs that alert you to gas, low battery, and sensor failure alarms.

## **Buzzer/Vibrator**

A solid-state electronic buzzer/vibrator is mounted inside the front case of the Model GX-2001. The buzzer/vibrator sounds and vibrates for gas alarms, and it sounds for unit malfunctions, low battery voltage, and as an indicator during normal use of the many display options of the Model GX-2001.

## **Ni-cad Battery Pack**

Inside the Model GX-2001 is a Ni-cad battery pack that supplies 2.4 V to the unit. The battery will run the unit for approximately 12 hours when no alarms have been activated during that time period. The battery is fully rechargeable when the Model GX-2001 is placed into the battery charger. The battery icon on the LCD shows the charge remaining in the battery. When the Model GX-2001 detects a low battery voltage, a low battery warning is activated. The battery can be replaced by removing the belt clip on the back of the Model GX-2001. See the maintenance section of this manual for instructions about recharging and replacing the battery.

## **Belt Clip**

On the back of the Model GX-2001 is a belt clip. The belt clip permits the unit to be worn on a belt or to be clipped to a pocket for hands-free gas monitoring.

## **Battery Charger**

The Model GX-2001 has two optional battery chargers. Both are used to recharge the unit's Ni-cad battery pack and both serve as a convenient station for auto calibration. The battery charger with the PC communication feature has a datalogging port for the down loading of data from the Model GX-2001 to the PC. See "Parts List" for more information.

## Start Up

This section explains how to start up the Model GX-2001 and to get it ready for operation.

### Start-up Procedure

1. Press and hold the MODE/POWER button for one second to turn on the Model GX-2001 and to activate its LCD. The alarm lights flash and the buzzer sounds.
2. The Model GX-2001 tests all elements of the LCD, then displays the year, month, day, and time before displaying the battery voltage. The buzzer sounds again after the battery voltage is displayed.

**CAUTION:** *If the battery level is low or if the battery icon is flashing and the unit's buzzer sounds, recharge the Model GX-2001's Ni-cad battery.*

3. The four gas sensors inside the Model GX-2001 begin working, and the concentrations of the target gases are displayed on the LCD in sequential order beginning with oxygen. The Model GX-2001 is now in Measuring Mode.

In Measuring Mode, battery level, time, and gas concentrations are displayed on the LCD. The Model GX-2001 cycles through the four target gases, starting with O<sub>2</sub>, then H<sub>2</sub>S, CO, and HC. Oxygen is displayed as a percentage (%), H<sub>2</sub>S and CO as parts per million (ppm), and HC (combustible gases) as a percentage of the lower explosive limit (% LEL).

**NOTE:** You can test the oxygen sensor and alarm circuit by exhaling into the oxygen sensor. When the LCD reading falls below the alarm point for oxygen, the buzzer will sound, the vibrator will activate, the LCD reading for oxygen will flash, and the alarm lights will turn on.

### Performing a Demand Zero

Before using the Model GX-2001, it is a good idea to set the zero reading (demand zero) for the target gasses to ensure accurate gas readings in the monitoring environment.

1. Find a fresh-air environment.
2. With the unit on and in Measuring Mode, press and hold the AIR button for about three seconds to allow the Model GX-2001 to set the zero reading for HC, CO, and H<sub>2</sub>S and to set the span for O<sub>2</sub>.
3. While you are pressing the AIR button, the LCD displays "Hold," a prompt for you to keep pressing the AIR button.
4. When the zero readings have been set, the LCD displays "Adj," which prompts you to release the AIR button.

### Turning Off the Model GX-2001

1. Press and hold the MODE/POWER button for about five seconds to turn off the unit.
2. The buzzer will sound and the LCD back light will flash.
3. Release the button when the LCD is blank. The unit is off.

## Operation

This section describes the normal operation of the Model GX-2001. It explains how the unit can be used to display peak gas readings of the four target gasses and to display STEL and TWA readings for H<sub>2</sub>S and CO. This section also covers alarm indications.

### Normal Operation

After you have powered up the Model GX-2001 and performed a demand zero for the four target gasses following the instructions of the previous section, "Start Up," the Model GX-2001 is in Measuring Mode.

In Measuring Mode, the battery level, time, and gas concentrations are displayed on the LCD. The Model GX-2001 cycles through the four target gases, starting with O<sub>2</sub>, then H<sub>2</sub>S, CO, and HC. Oxygen is displayed as a percentage (%), H<sub>2</sub>S and CO as parts per million (ppm), and HC (combustible gases) as a percentage of the lower explosive limit (% LEL).

The image shows a simulated LCD display with four rows of information. The first row shows 'Target gas' followed by 'O2'. The second row shows 'Gas concentration' followed by '20.9 %'. The third row shows a battery charge icon (a rectangle with four vertical bars of varying heights) followed by 'Battery charge'. The fourth row shows '21:19' followed by 'Time'.

**Figure 1: LCD in Measuring Mode**

### Displaying Peak Readings

You can display peak readings of the four target gasses when the Model GX-2001 is in Measuring Mode using the MODE/POWER and DISP buttons. With oxygen, you can display both peak and minimum readings.

1. Make sure the Model GX-2001 is in Measuring Mode. The four target gasses should be displaying in sequential order on the LCD.
2. Press the MODE/POWER button once to put the Model GX-2001 in Peak Reading Mode. A small peak (minimum for O<sub>2</sub>) symbol is displayed in the lower left corner of the LCD.
3. Press the DISP button to cycle through the four target gases. The peak readings of these gasses are displayed on the LCD.

NOTE: Oxygen has both a peak and minimum reading.

4. To return to Measuring Mode, normal operation, press and release the MODE/POWER button until the normal screen is displayed.

NOTE: While in Peak Reading Mode, if no control button has been pushed for about 15 seconds, the Model GX-2001 returns to Measuring Mode automatically.

## Displaying STEL and TWA Readings

With the Model GX-2001, you can display STEL and TWA readings for H<sub>2</sub>S and CO. STEL is an acronym for short-term exposure limit, and it shows the average reading for H<sub>2</sub>S and CO during the last 15 minutes. TWA is an acronym for time-weighted average, and it shows the average reading for H<sub>2</sub>S and CO during the last eight (8) hours. If eight (8) hours has not elapsed since the last time the STEL/TWA readings were cleared, the TWA is still calculated over eight hours, with the missing time assigned a zero (0) value for the readings.

1. Make sure the Model GX-2001 is in Measuring Mode. The four target gasses should be displaying in sequential order on the LCD.
2. Using the DISP button, display either H<sub>2</sub>S or CO on the LCD.
3. With either H<sub>2</sub>S or CO displayed on the LCD, press the MODE/POWER button twice to put the Model GX-2001 in STEL Reading Mode. "STEL" displays next to the time reading on the LCD.
4. To put the Model GX-2001 in TWA Reading Mode, press the MODE/POWER button again while the unit is in STEL Reading Mode. "TWA" displays next to the time reading on the LCD.
5. Press the DISP button to toggle between the TWA reading for H<sub>2</sub>S and CO.
6. To return to Measuring Mode, normal operation, press the MODE/POWER button.

NOTE: While in STEL or TWA Reading Mode, if no control button has been pushed for about 15 seconds, the Model GX-2001 returns to Measuring Mode automatically.

## Alarms

This section covers alarm indications, or the types of alarms you will encounter when using the Model GX-2001, including multiple alarms and trouble alarms. It also tells you how to reset the Model GX-2001 after an alarm has occurred and how to respond to an alarm condition.

### *Alarm Indications*

The Model GX-2001 will sound an alarm and the unit will vibrate when one of the target gas concentrations rises above the first alarm point, or in the case of oxygen, falls below the low point alarm setting for that gas.

The Model GX-2001 also sounds an alarm and vibrates when the second alarm point is reached for HC, CO, and H<sub>2</sub>S, when the concentration of oxygen rises above 23.5% in the monitoring area, and when the STEL and TWA alarm points are reached for CO and H<sub>2</sub>S.

When a trouble condition occurs, such as a sensor failure or low battery charge, the unit will also sound an alarm but it will not vibrate.

The table below summarizes the types of alarms produced by the Model GX-2001.

**Table 3 :**

<b>Alarm Type</b>	<b>LCD Indications</b>	<b>Other Indications</b>
<b>Alarm 1</b> Concentration of gas rises above the first alarm point, or for O <sub>2</sub> , falls below the low point setting.	<ul style="list-style-type: none"> <li>• Name of gas displayed.</li> <li>• Alarm light flashes.</li> <li>• Back light turns on.</li> <li>• Gas reading flashes.</li> </ul>	<b>Pulsing Tone</b> <b>Unit Vibrates</b>
<b>Alarm 2</b> Concentration of gas rises above second alarm point, or for O <sub>2</sub> , rises above the high point setting.	<ul style="list-style-type: none"> <li>• Name of gas displayed.</li> <li>• Alarm light flashes.</li> <li>• Back light turns on.</li> <li>• Gas reading flashes.</li> </ul>	<b>Pulsing Tone</b> <b>Unit Vibrates</b>
<b>TWA or STEL</b> Concentration of CO or H <sub>2</sub> S rises above the TWA or STEL alarm point setting.	<ul style="list-style-type: none"> <li>• Name of gas displayed.</li> <li>• Alarm light flashes.</li> <li>• Back light turns on.</li> <li>• TWA or STEL blinking.</li> </ul>	<b>Pulsing Tone</b> <b>Unit Vibrates</b>
<b>Over Range</b>	<ul style="list-style-type: none"> <li>• Name of gas displayed.</li> <li>• Gas reading replaced by blinking brackets. □□□□</li> <li>• Alarm light flashes.</li> <li>• Back light turns on.</li> </ul>	<b>Pulsing Tone</b> <b>Unit Vibrates</b>
<b>Low Battery Warning</b>	<ul style="list-style-type: none"> <li>• Battery icon flashes.</li> </ul>	<b>None</b>
<b>Dead Battery Alarm</b>	<ul style="list-style-type: none"> <li>• Gas reading replaced by <b>FAIL</b>.</li> <li>• Battery icon flashes.</li> </ul>	<b>Double Pulsing Tone</b>
<b>Sensor Failure</b>	<ul style="list-style-type: none"> <li>• Name of gas sensor displayed.</li> <li>• Gas reading replaced by <b>FAIL</b>.</li> </ul>	<b>Double Pulsing Tone</b>

### **Multiple Alarms**

If more than one gas alarm is activated, the LCD shows the concentration of the gas that triggered the last alarm. To see the concentration of the other gasses, press the DISP button until the gas of interest is displayed. When the DISP button is pressed, the displayed gas will stay displayed for 20 seconds, then the display will cycle.

For example, if concentrations of CO and H<sub>2</sub>S in the monitoring environment were to rise above their respective alarm points and CO was the first to do so, the concentration of H<sub>2</sub>S would display on the LCD. Pressing the DISP button would display the concentration of CO for 20 seconds, then HC for three seconds, etc.

If the TWA and STEL alarms are triggered, alarm indications for both gasses occur at the same time. The LCD would then display both "TWA" and "STEL" next to the time and both "TWA" and "STEL" would be blinking.

### **Resetting Alarms**

To reset an alarm, press the MODE/POWER button after the gas reading falls below the Alarm 1 point (or above for oxygen). If a TWA alarm has been activated, it cannot be reset unless you turn off the unit.

- Even though gas concentrations may have returned to normal or have fallen below the alarm point, the alarm indications will continue until you have reset the alarm using the MODE/POWER button.

### **Responding to Alarms**

This section describes response to gas, over range, battery, and sensor failure alarms.

#### Responding to Gas Alarms

1. Determine which gas alarm has been activated.
2. Follow your established procedure for an increasing gas condition or a decreasing oxygen condition.
3. Reset the alarm using the MODE/POWER button once the alarm condition has been cleared.

#### Responding to Over Range Alarms

**WARNING: An over range condition may indicate an extreme combustible gas, toxic gas, or oxygen content condition. Confirm a normal condition with a different Model GX-2001 or with another gas detecting device.**

1. Determine which gas alarm has been activated.
2. Follow your established procedure for an increasing gas condition.
3. Reset the alarm using the MODE/POWER button once the alarm condition has cleared.
4. Calibrate the Model GX-2001 as described in the calibration section of this manual.
5. If the over range condition continues, you may need to replace the sensor that has triggered the over range alarm.
6. If the over range condition continues after you have replaced the sensor, contact RIKEN KEIKI CO., LTD.. for further instructions.

### Responding to Battery Alarms

**WARNING:** *The Model GX-2001 is not operational as a gas monitoring device during a dead battery alarm. Take the Model GX-2001 to a non-hazardous area and recharge the battery as described in "Recharging the Ni-cad Battery."*

The Model GX-2001 is fully functional during a low battery warning. However, depending upon conditions, the Model GX-2001 has only two-to-three hours of operating time left after the low level battery alarm has been triggered. Recharge the battery pack as soon as possible as described in "Recharging the Ni-cad Battery Pack."

**NOTE:** Alarms and the back light feature consume battery power and reduce the amount of operating time remaining.

### Responding to Sensor Failure Alarms

1. Determine which sensor has triggered the sensor failure alarm.
2. Try calibrating the sensor first, as described in "Calibration," before replacing it.
3. If the sensor failure continues, replace the sensor as described in "Replacing a Sensor."
4. If the sensor failure condition continues after you have replaced the sensor, contact RIKEN KEIKI CO., LTD. for further instructions.

## Displaying and Setting the Alarm Points

The Model GX-2001 allows you to display and set the alarm points of the four target gasses. Each of the target gasses has both a low (Alarm 1) and high (Alarm 2) alarm setting. Two gasses, CO and H<sub>2</sub>S, have STEL and TWA alarm points. The alarm point for oxygen is measured as a percentage of oxygen in the atmosphere. The alarm point for HC is measured as a percentage of the lower explosive limit (% LEL), and CO and H<sub>2</sub>S alarm points are measured in parts per million (ppm). The alarm points and their factory settings are summarized in the table below:

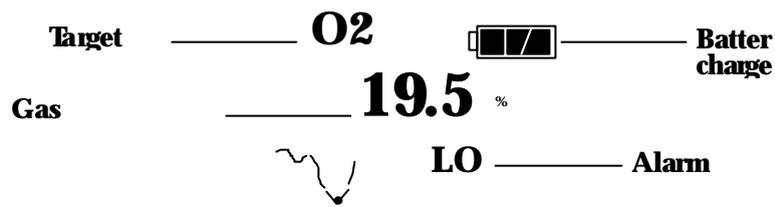
**Table 4 : Alarm Points of the Four Target Gasses**

Gas	Alarm 1	Alarm 2	STEL	TWA
O <sub>2</sub>	19.5% (Decreasing)	23.5%	None	None
HC (Combustibles)	10% LEL	50% LEL	None	None
CO	25 ppm	50 ppm	400 ppm	25 ppm
H <sub>2</sub> S	10 ppm	30 ppm	15 ppm	10 ppm

In the table above, Alarm 1 and Alarm 2 for HC, CO, and H<sub>2</sub>S refer to a rising concentration of these gasses. The first alarm is triggered at the Alarm 1 concentration listed in the table. For HC that would be 10% LEL, for CO that would be 25 ppm, and for H<sub>2</sub>S that would be 10 ppm. The second alarm is triggered when the Alarm 2 concentration is reached. For oxygen, Alarm 1 is triggered when the concentration of oxygen falls below 19.5%. When the concentration of oxygen rises above 23.5%, Alarm 2 is activated.

### ***Display and Adjust the Alarm Points***

1. Make sure the Model GX-2001 is turned off. The LCD should be blank.
2. Press and hold the AIR button, then press and hold the MODE/POWER button.
3. As soon as segments appear on the display (approximately one second), release the AIR button. When the unit “beeps,” release the MODE/POWER button to put the Model GX-2001 into Alarm Point Adjustment Mode. The LCD should show the Alarm 1 setting for O<sub>2</sub> and the battery level.



**Figure 2: LCD in Alarm**

**NOTE:** If the LCD should show “CAL,” the Model GX-2001 is in Calibration Mode. You will need to press and hold the MODE/POWER button to turn off the unit. Begin again with step 2 above.

4. Use the MODE/POWER button to cycle through the alarm points of the target gasses. Oxygen is displayed first followed by H<sub>2</sub>S, CO, then HC. Use the AIR button to increase the alarm point and the DISP button to decrease the alarm point. When using the MODE/POWER button, press it once to display the next reading. If you press and hold the MODE/POWER button, you may turn off the unit.

**NOTE:** You can only cycle through the target gasses once before the Model GX-2001 goes into Start-up Mode followed by Measuring Mode. If you want to cycle through the gasses again, press and hold the MODE/POWER button to turn off the Model GX-2001. Then begin with step 2 above to put the unit back into Alarm Point Adjustment Mode.

5. When you are finished viewing or adjusting the alarm point settings, press the MODE/ POWER button repeatedly until the ROM number for your unit appears on the LCD. (the ROM is the component that contains the software that runs the Model GX-2001.) The Model GX-2001 will then go into Start-up Mode followed by Measuring Mode.

## Setting the Time and Date

The Model GX-2001 allows you to set the time and date.

1. Make sure the Model GX-2001 is turned off. The LCD should be blank.
2. Press and hold the DISP button, then press and hold the MODE/POWER button to put the Model GX-2001 into Time Adjustment Mode. Release the buttons when the unit beeps. The LCD shows the year, month, day, and time. The year is flashing at the top of the LCD.

**2000** \_\_\_\_\_ Year  
Month \_\_\_\_\_ **11.13** \_\_\_\_\_ Day  
Hour \_\_\_\_\_ **21:06** \_\_\_\_\_ Minute

Figure 3: LCD in Time Adjustment Mode

3. To change the time and date,
  - Use the MODE/POWER button to cycle through the time and date values.
  - You can only change a value if it is flashing.
  - Use the AIR button to increase a value.
  - Use the DISP button to decrease a value.

NOTE: Once you have cycled through the time and date values, the Model GX-2001 will go into Start-up Mode followed by Measuring Mode. If you want to cycle through the time and date values again, press and hold the MODE/POWER button to turn off the Model GX-2001. Then begin with step 2 above to put the unit back into Time Adjustment Mode.

4. To leave Time Adjustment Mode, press the MODE/POWER button to cycle through to the end of the time and date values. The Model GX-2001 then enters Start-up Mode followed by Measuring Mode.

# Calibration

This section covers the calibration of the Model GX-2001. Setting the zero reading is described first followed by single calibration and auto calibration. For single calibration, you are told what is needed to complete the task, how to assemble the calibration kit, and how to set the span readings of the four target gasses. The same topics are covered for auto calibration.

## Setting the Zero Readings for All Target Gasses

Whether you will calibrate the Model GX-2001 using single calibration or auto calibration, you will need to set the zero readings first before setting the span readings for each gas.

1. Find a fresh-air environment.
2. Turn on the Model GX-2001 by pressing and holding the MODE/POWER button for one second.
3. Press and hold the AIR button for about three seconds to allow the Model GX-2001 to set the zero reading for HC, CO, and H<sub>2</sub>S and to set the span for O<sub>2</sub>.
4. While you are pressing the AIR button, the LCD displays "Hold," a prompt for you to keep pressing the AIR button.
5. When the zero readings have been set, the LCD displays "Adj," which prompts you to release the AIR button.

## Single Calibration

This section tells you how to calibrate the Model GX-2001 using the single calibration (CAL) menu.

### *Preparation*

Before you calibrate the Model GX-2001, you must set the zero readings as described in "Setting the Zero Readings for All Target Gasses." You will also need the supplies listed below. Calibration kits from RIKEN KEIKI CO., LTD.. are available for this purpose (see "Parts List").

- Either a 3-gas or 4-gas calibration cylinder with the following recommended concentrations:
  - 50% LEL methane (CH<sub>4</sub>)
  - 12 % oxygen
  - 50 ppm CO
  - 10 ppm H<sub>2</sub>S (4-gas cylinder only)
  - Balance of nitrogen
- To carry out the calibration, you will need a fixed-flow regulator with a flow rate of 0.5 LPM (liters per minute), non-absorbent tubing, and a calibration adapter plate that will fit over the Model GX-2001's four sensors.

### ***Assembling the Calibration Kit***

**WARNING:** *Calibrate the Model GX-2001 in a non-hazardous environment.*

1. Attach the adapter plate to the unit. It snaps onto the sensor area.
2. Attach the calibration tubing to the adapter plate, then attach the opposite end of the tubing to the regulator.

**NOTE:** Do not attach the regulator to the gas cylinder at this time.

If you are going to calibrate the Model GX-2001 for all the target gasses at one time, it is recommended that you start with the oxygen sensor first followed by the H<sub>2</sub>S, CO, and HC sensors in that order.

The reason for this calibration sequence is that while the Model GX-2001 is in Calibration Mode, you will only be able to toggle through the target gasses one time, using the MODE/POWER button, before the unit goes into its start-up sequence.

If you want to go back to a target gas, you will need to turn off the Model GX-2001 before putting the unit back into Calibration Mode.

### ***Setting the Span Readings for All Target Gasses***

When setting the span readings manually for one gas sensor at a time, you will calibrate each gas sensor individually.

1. Make sure you have set the zero readings for all the target gasses and have set up the calibration kit as described in the procedure above. If you are going to calibrate all the target gasses, start with O<sub>2</sub> followed by H<sub>2</sub>S, CO, and HC.
2. Make sure the Model GX-2001 is off.
3. Press and hold the AIR button, then press and hold the MODE/POWER button. Release both buttons when you hear a "beep." The LCD displays "CAL," the battery level, and the time.
4. Pressing the MODE/POWER button allows you to toggle through each target gas once so you can calibrate that gas. In the upper left corner of the LCD, "CAL" and the name of the target gas being calibrated, such as "O<sub>2</sub>," are displayed alternately in rapid succession.
5. Attach the regulator to the gas cylinder. The fixed-flow regulator automatically begins introducing the calibration sample to the sensors.
6. Let the gas flow for two minutes before adjusting the span.
7. Use the AIR button to increase the reading and the DISP button to decrease the reading until you have matched the concentration of the calibration sample.

**NOTE:** If you cannot adjust the display reading to match the calibration sample, you may need to replace the sensor you are calibrating, as described in "Replacing a Sensor."

8. After you have set the span for the sensor, press the MODE/POWER button to display the next sensor. In the upper left corner of the LCD, "CAL" and the name of the target gas being calibrated, such as "H<sub>2</sub>S" are displayed alternately in rapid succession.
9. Repeat steps 7 and 8 above to set the span for the remaining target gasses.
10. When you are finished setting the span for the target gasses, remove the regulator from the cylinder, remove the adapter plate from the unit, then store the contents of the calibration kit in a safe place for future use.
11. Use the MODE/POWER button to place the Model GX - 2001 in Measuring Mode or to turn the unit off.

## **Auto Calibration**

This section tells you how to calibrate the Model GX - 2001 using the auto calibration (AUTO CAL) menu.

### ***Preparation***

Before you calibrate the Model GX - 2001, you must set the zero readings as described in "Setting the Zero Readings for All Target Gasses." You will also need the supplies listed below. Calibration kits from RIKEN KEIKI CO., LTD.. are available for this purpose (see "Parts List").

- Either a 3-gas or 4-gas calibration cylinder with the following recommended concentrations:
  - 50% LEL methane (CH<sub>4</sub>)
  - 12 % oxygen
  - 50 ppm CO
  - 10 ppm H<sub>2</sub>S (4-gas cylinder only)
  - Balance of nitrogen
- To carry out the calibration, you will need a fixed-flow regulator with a flow rate of 0.5 LPM and non-absorbent tubing.

### ***Setting Up the Model GX-2001 for Auto Calibration***

**WARNING:** *Calibrate the Model GX-2001 in a non-hazardous environment.*

1. Attach the adapter plate to the unit.
2. Attach the calibration tubing to the adapter plate, then attach the opposite end of the tubing to the regulator.

### ***Setting the Span Readings for All the Target Gasses***

1. Make sure you have set the zero readings for all the target gasses and have set up the GX-2001 for calibration as described in the procedure above.
2. Make sure the Model GX-2001 is off.
3. Press and hold the AIR button, then press and hold the MODE/POWER button. Release both buttons when you hear a "beep." The LCD displays "CAL," the battery level, and the time.
4. Press either the DISP or AIR button to select Auto Calibration Mode. The word, "Auto" is displayed next to the battery icon at the top of the LCD.
5. Press the MODE/POWER button again to start checking the current auto calibration settings of the unit's gas sensors, beginning with oxygen. In the upper left corner of the LCD, the word, "CAL," and the name of the gas sensor being checked will flash alternately. The LCD will also show the current auto calibration setting (e.g., 12.0% for O<sub>2</sub>). Press either the DISP or AIR button to check the current auto calibration setting of the next gas sensor. (By using the DISP or AIR button, you will be able to cycle through all the sensors.)

**NOTE:** The auto calibration settings should match the gas concentration levels in the four-gas cylinder.

6. Press the MODE/POWER button to proceed. The current gas reading is shown. Press the DISP or AIR button to scroll.
7. Attach the regulator to the cylinder. The fixed flow regulator automatically starts introducing the calibration sample to the sensors.
8. Let the gas flow for two minutes, then press the MODE/POWER button to perform auto calibration for all sensors.

**NOTE:** If "FAIL" displays on the LCD and the buzzer sounds while auto calibration is being performed, you may need to replace sensor(s), as described in "Replacing a Sensor." Press the MODE/POWER button to see what sensors have failed.

9. The Model GX-2001 will enter its start-up sequence if no sensors have failed the auto calibration.
10. Remove the regulator from the cylinder, remove the adapter plate from the unit, then store the contents of the calibration kit in a safe place for future

use

## Maintenance

This section describes troubleshooting procedures for the Model GX-2001. It also describes how to recharge the Model GX-2001's Ni-cad battery as well as how to replace the unit's battery, sensor cover, and gas sensors.

## Troubleshooting

The troubleshooting table describes error messages, symptoms, probable causes, and recommended action for problems you may encounter with the Model GX-2001.

**Table 5 : Troubleshooting the Model GX-2001**

Symptoms	Probable Causes	Recommended Action
<ul style="list-style-type: none"> <li>The LCD is blank.</li> </ul>	<ul style="list-style-type: none"> <li>The unit may have been turned off.</li> <li>The battery pack may need recharging.</li> <li>The battery pack may need replacement.</li> </ul>	<ol style="list-style-type: none"> <li>To turn on the unit, press and hold the MODE/POWER button.</li> <li>If the unit does not turn on, the battery pack may need to be recharged. Place the Model GX-2001 in its battery charger and recharge the battery pack.</li> <li>If recharging the unit does not work, replace the battery pack.</li> <li>If the difficulties continue, contact RIKEN KEIKI CO., LTD.. for further instruction.</li> </ol>
<ul style="list-style-type: none"> <li>The LCD shows abnormally high or low readings but other gas detection instruments do not.</li> </ul>	<ul style="list-style-type: none"> <li>The Model GX-2001 may need to be recalibrated.</li> <li>The sensor for the affected channel(s) may need replacement.</li> </ul>	<ol style="list-style-type: none"> <li>Recalibrate the unit.</li> <li>Replace the sensor for the affected channel(s).</li> <li>If the difficulties continue, contact RIKI Instruments for further instruction.</li> </ol>
<ul style="list-style-type: none"> <li>"FAIL" displays during auto calibration or unable to set the response readings during single calibration.</li> </ul>	<ul style="list-style-type: none"> <li>The auto calibration values may not match the cylinder gas concentrations. (auto calibration only)</li> <li>The sample gas is not reaching the sensor because of a bad connection</li> <li>The calibration cylinder may be out of gas or is outdated.</li> <li>The sensor for the affected channel(s) may need replacement.</li> </ul>	<ol style="list-style-type: none"> <li>Check all calibration tubing for leaks or for any bad connections.</li> <li>Make sure the Model GX-2001 has been properly set up for calibration.</li> <li>Verify that the calibration cylinder contains an adequate supply of fresh test sample.</li> <li>If the fail condition continues, replace the sensor(s).</li> <li>If the difficulties continue, contact RIKEN KEIKI CO., LTD.. for further instruction.</li> </ol>

## Recharging the GX-2001's Ni-cad Battery Pack

**WARNING:** *Recharge the Ni-cad battery in a non-hazardous environment.*

1. Verify that the Model GX-2001 is off.
2. Plug the battery charger's AC power cord into an electrical outlet.
3. Place the Model GX-2001 in the battery charger.

**NOTE:** There are two optional battery chargers for the Model GX-2001. Both may be powered from 100-240 VAC 50/60 Hz. One battery charger has a PC communication feature for datalog downloading. See "Parts List" for more information.

4. While the unit is being charged, the red LED on the top face of the charger is on.
5. When the red LED turns off, the GX-2001's battery pack is fully charged. It takes approximately 90 minutes to recharge a fully discharged battery pack.
6. To verify whether the battery pack is fully recharged, remove the unit from the battery charger, then press the MODE/POWER button to start up the unit. If the battery icon on the LCD is fully colored in, then the unit has been completely recharged.



## Replacing the Ni-cad Battery Pack

**WARNING:** *Replace the Ni-cad battery in a non-hazardous environment.*

1. Verify that the Model GX-2001 is off.
2. On the left or right side of the Model GX-2001, unscrew two of the screws securing the belt clip retaining pins to the unit.
3. Carefully slide out the small pins holding the belt clip to the unit by grasping them with your fingers.
4. Unscrew the four screws holding the metal plate to the back of the Model GX-2001, then remove the plate.
5. Carefully press on the upper tab of the battery with a small flat blade screw driver and gently pry up to remove the battery from the GX-2001's housing.

**CAUTION:** *When replacing the battery, be certain to insert the bottom of the battery (the thickest and largest part) **first** into the housing of the Model GX-2001 before inserting the top. Inserting the top of the battery first before the bottom may damage the circuit board underneath.*

6. Replace the battery. Insert the bottom first so it snaps into place, then the top.
7. Replace the screws, small rods, metal plate, and belt clip in reverse order as described in steps 2 through 4 above.

## Replacing the Sensor Cover

**WARNING:** *Replace the sensor cover in a non-hazardous environment.*

1. Verify that the Model GX-2001 is off.
2. Unscrew the two screws that secure the sensor retainer to the Model GX-2001.
3. Using a small flat blade screwdriver, gently pry each side of the retaining strip away from the sensor retainer.
4. Remove the sensor cover, then insert the replacement cover.
5. Reattach the retaining strip in its original position. The retaining strip should snap into place onto the sensor retainer.
6. Replace the two screws that secure the sensor retainer to the Model GX-2001, which you removed in step 2 above.

## Replacing a Sensor

**WARNING:** *Replace the sensors in a non-hazardous environment.*

1. Verify that the Model GX-2001 is off.
2. Unscrew the two screws that secure the sensor retainer to the Model GX-2001, then remove the sensor retainer.
3. Remove the sensor from its socket.

**CAUTION:** *When replacing a sensor, verify that the sensor is properly aligned with its socket before inserting it into the socket. Forcing the sensor in place may damage the sensor or the socket.*

4. Carefully insert the replacement sensor in the socket.
5. Place the sensor retainer in its original position, then secure it to the Model GX-2001 with the two screws you removed in step 2.
6. Start up the Model GX-2001 by pressing and holding the MODE/POWER button.
7. Calibrate the new sensor as described in the calibration section of this manual.