

**INSTRUCTION MANUAL
FOR
RIKEN PERSONAL GAS MONITOR
GAS WATCH 2 SERIES**



RIKEN KEIKI CO., LTD.

2-7-6 Azusawa Itabashi-ku Tokyo, 174-8744 Japan

Phone : Tokyo (03) 3966-1113

Fax : (03) 3558 9110 GIII

E-Mail : intodept@rikenkeiki.co.jp

Website : <http://www.rikenkeiki.co.jp/english/>

Warranty

RIKEN KEIKI CO.,LTD, warrants the GasWatch 2 sold by us to be free from defects in materials, workmanship, and performance for a period of two years from the date of shipment from RIKEN KEIKI CO.,LTD. This includes the instrument and the original sensors. Replacement parts are warranted for 1 year from the date of their shipment from RIKEN KEIKI CO.,LTD. Any parts found defective within their 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

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.

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This warranty covers instruments and parts sold to users only by authorized distributors, dealers, and representatives as appointed by RIKEN KEIKI CO.,LTD.

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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WARNING: ***Understand manual before operating. Substitution of components may impair intrinsic safety. To prevent ignition of a hazardous atmosphere, batteries must only be changed or charged in an area known to be nonhazardous. Not tested in oxygen enriched atmospheres (above 21%).***

Introduction

Using an advanced microprocessor controlled detection system, the GasWatch 2 Personal Single-Gas Monitor detects the presence of either carbon monoxide (CO), hydrogen sulfide (H₂S), or oxygen (O₂). The GasWatch 2's compact size and easy-to-use design makes it ideally suited for a wide range of applications, including sewage treatment plants, tunnels, hazardous waste sites, petrochemical facilities, oil fields, mines, and chemical plants. The GasWatch 2 is even small enough to be worn comfortably on the wrist like a watch. The GasWatch 2 offers a full range of features, including:

- Hands free gas monitoring
- Compact “watch type” design
- Fast, accurate response with digital liquid crystal display (LCD)
- Visual, audible, and vibration alarms
- Microprocessor control for reliability, ease of use, and advanced capabilities
- Peak, STEL, and TWA indication for GW-2C & GW-2H
- Minimum and maximum indication for GW-2X
- STEL, TWA, and over range alarms
- Sensor fail alarm
- Displays current time
- Over 3,000 hours of operation from 1 battery
- CSA classified for Class I, Division I, Groups A, B, C, and D hazardous atmospheres

WARNING: *The GasWatch 2 detects carbon monoxide, hydrogen sulfide, or oxygen deficiency and elevated levels of oxygen, all of which can be dangerous or life threatening. When using the GasWatch 2, 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: GasWatch 2 Specifications

	GW-2C	GW-2H	GW-2X
Target Gas	Carbon Monoxide (CO)	Hydrogen Sulfide (H ₂ S)	Oxygen (O ₂)
Detection Range	0 to 500 ppm	0 to 100.0 ppm	0 to 40.0% vol.
Display Increment	1 ppm	0.5 ppm	0.1% vol.
Detection Principle	Electro Chemical	Electro Chemical	Galvanic Cell
Alarm Points	Low 25 ppm High 50 ppm TWA 25 ppm STEL 200 ppm OVER ..500 ppm	Low 10.0 ppm High 30.0 ppm TWA 10.0 ppm STEL 15.0 ppm OVER....100.0ppm	Low 19.5% vol. (decreasing) High 23.5% vol. (increasing) OVER...40.0% vol
Sampling Method	Diffusion	Diffusion	Diffusion
Response Time	T90 in 30 seconds	T90 in 30 seconds	T90 in 20 seconds
Accuracy	± 5 ppm (up to 150 ppm)	± 1.5 ppm (up to 30 ppm)	± 0.5% vol.
Safety/Regulatory	Designed for Intrinsic Safety		
Power	One coin type 3 volt lithium battery (CR 2450)		
Continuous Operating Hours	Approximately 3,000 Hours With No alarms or Backlighting		
Case	High-impact Plastic, Dust and Weather Proof		
Standard Accessory	Wrist Strap		
Optional Accessories	<ul style="list-style-type: none"> • Belt Clip • Hard Hat Clip 		
Dimensions and Weight	Dimensions: 2.5"(H)x1.7"(W), 0.9x(D)/64(W)x43(H)x23(D)mm Weight: 2 oz. OR 60 grs		
Operating Temp. & Humidity	-10°C - 40°C, below 85% RH (non-condensing)		

Specifications subject to change without notice

Description

This section describes the components of the GasWatch 2. These components include the GasWatch 2's case, sensor cap and sensor cover, sensor, LCD, control buttons, printed circuit boards, alarm lights, buzzer, vibrator, lithium battery, and wrist strap.

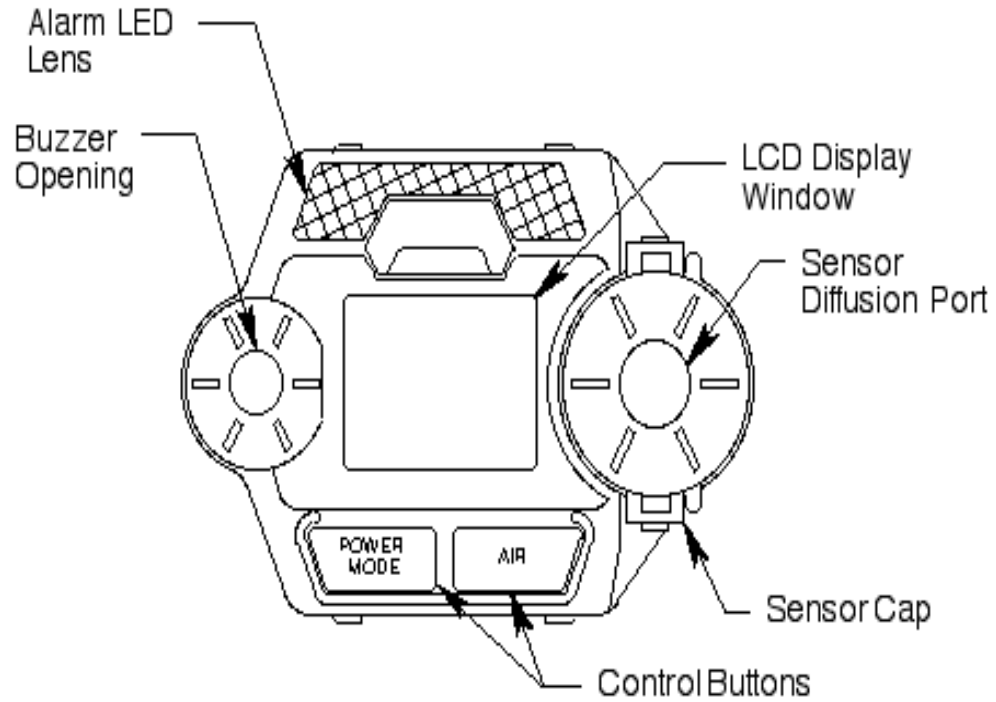


Figure 1 : Components of the GasWatch2

Case

The GasWatch 2's sturdy, high-impact plastic case is suitable for use in many environmental conditions, indoors and out. The unit is dust proof and weather resistant. The case has two halves, the top case and the bottom case. They are held together by four screws in the bottom case. The case is a different color depending on the model. The GW-2C for CO is red, the GW-2H for H₂S is orange, and the GW-2X for oxygen is blue.

The digital LCD is visible through the top case. It displays gas concentrations, battery level, time, and other readings including TWA, STEL, and peak gas levels. Below the LCD are two black control buttons. The button on the left is labeled POWER/MODE. The button on the right is labeled AIR.

To the left of the LCD is the buzzer, which is located inside the unit. To the right of the LCD is the sensor cap which retains the sensor. Above the LCD is a frosted lens through which the alarm lights are visible.

A battery cover is located on the bottom case and is held in place by two screws. The wrist strap attaches to the bottom case.

Sensor Cap/Sensor Cover

The sensor cap snaps onto the right side of the case and retains the sensor. It also retains the sensor cover which is a round disk membrane which protects the sensor from dirt and weather. A gasket installed on the sensor seals against the sensor, sensor cover, and sensor cap.

Sensor

The GasWatch 2 uses either an oxygen, CO, or H₂S sensor. The sensor is protected by the white sensor cover which is held in place by the sensor cap and sensor gasket. The sensor cover allows ambient air to diffuse past it to the sensor. The three sensors used in the three GasWatch 2 models use different detection principles as described below.

Oxygen Sensor

The oxygen sensor is a galvanic type of sensor. 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 GasWatch 2's circuitry, converted to a measurement of gas concentration, and displayed on the LCD.

CO and H₂S Sensors

The CO and H₂S sensors are electrochemical sensors that consist of two precious metal electrodes in an acid electrolyte. A gas permeable membrane covers the sensor face and allows gas to diffuse into the electrolyte. The gas reacts in the sensor and produces a current proportional to the concentration of the target gas. The current is amplified by the GasWatch 2's circuitry, converted to a measurement of gas concentration, and displayed on the LCD.

LCD

The LCD is visible through the top case. Target gas concentrations, the time, battery condition, and alarm indications are displayed on the LCD. When either of the control buttons is pressed, the LCD backlight comes on for 20 seconds.

Control Buttons

Below the LCD are the two control buttons. They are POWER/MODE and AIR. They turn on the power to the GasWatch 2 and turn it off. They control what is displayed on the LCD, including time, gas concentrations, peak, TWA, and STEL readings, as well as other messages. They also allow you to perform a fresh air adjustment, change alarm points, change the 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 GasWatch 2

Button	Function
POWER/MODE	<ul style="list-style-type: none"> • Turns the unit on and off. • Turns the LCD back light on. • Displays STEL and TWA readings (GW-2H & GW-2C). • Displays peak readings (high for GW-2H & GW-2C and low & high for GW-2X). • Resets the alarm circuit (gas alarms). • Enters Calibration Mode with the AIR button. • Enters Alarm Adjustment Mode with the AIR button. • Enters Time Adjustment Mode with the AIR button.
AIR	<ul style="list-style-type: none"> • Turns the LCD back light on. • Adjusts LCD readings when the a fresh air adjustment is performed. • Enters Calibration Mode with the POWER/MODE button. • Enters Alarm Adjustment Mode with the POWER/MODE button. • Enters Time Adjustment Mode with the POWER/MODE button. • Increases settings when the unit is in Alarm Adjustment Mode, Time Adjustment Mode, or Calibration Mode.

Printed Circuit Boards

The primary function of the GasWatch 2's two printed circuit boards are to amplify the current or voltage signal sent to them from the gas sensor, convert the signal 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 GasWatch 2's time function and the various operating modes of the unit.

NOTE: The printed circuit boards contain no user serviceable parts.

Alarm Lights

The GasWatch 2 has two alarm lights located above the LCD. The alarm lights are two red LEDs that alert you to gas, low battery, sensor failure alarms. They are visible through a frosted lens.

Buzzer

A solid-state electronic buzzer is mounted inside the GasWatch 2. An opening on the left side of the top case allows the buzzer's sound to resonate from the case. The buzzer sounds for gas alarms, unit malfunctions, low battery voltage, and as an indicator during normal use of the various display options of the GasWatch 2.

Vibrator

A vibrating motor (vibrator) is mounted inside the GasWatch 2. The vibrator vibrates momentarily during turn on and for gas alarms.

Lithium Battery

A 3.0 volt coin type lithium battery powers the GasWatch 2. The battery will run the unit for approximately 3,000 hours when no alarms have been activated during that time period. The battery icon on the LCD shows the charge remaining in the battery. When the GasWatch 2 detects a low battery voltage, a low battery warning is activated. When the GasWatch 2 determines that the battery is too low for normal operation, a dead battery alarm is activated. The battery can be replaced by removing the battery door in the bottom case. See the maintenance section of this manual for instructions about replacing the battery.

Wrist Strap

A wrist strap is installed on the back of the GasWatch 2. The wrist strap permits the unit to be worn on the wrist as a watch for hands-free gas monitoring.

Start Up

This section explains how to start up the GasWatch 2 and to get it ready for operation.

Start-up Procedure

1. Press and hold the POWER/MODE button for one second to turn on the GasWatch 2. The the buzzer sounds briefly, the vibrator vibrates briefly, all elements of display are activated, and the alarm lights and LCD backlight turn on for a few seconds.
2. The GasWatch 2 then displays the target gas and time before displaying the battery voltage. The buzzer sounds again after the battery voltage is displayed.

CAUTION: *If the unit is in low battery warning, change the battery immediately. If the unit is in dead battery alarm, change the battery before attempting to use the unit.*

3. The gas sensor inside the GasWatch 2 begins operating and the concentration of the target gas is displayed on the LCD. The GasWatch 2 is now in Measuring Mode. The target gas is displayed in the appropriate units (see specifications) and the current time is displayed at the bottom of the LCD.

NOTE: When using the GasWatch 2 for the first time, check the current time and verify that it is correct for your time zone. If it is not, set the time as described in "Setting the Time."

Performing a Fresh Air Adjustment

Before using the GasWatch 2, it is a recommended to set the fresh air reading for the target gas to ensure accurate gas readings in the monitoring environment.

1. Find a fresh air environment. This is an environment free of toxic or combustible gasses and of normal oxygen content (20.9%).
2. With the unit on and in Measuring Mode, press and hold the AIR button for about three seconds to allow the GasWatch 2 to set the fresh air reading.

While you are pressing the AIR button, the LCD displays "hold," a prompt for you to keep pressing the AIR button.

When the fresh air readings have been set, the LCD displays “Adj” for 2 seconds which prompts you to release the AIR button. The unit will set the reading to 0 ppm for the GW-2C and GW-2H and to 20.9% oxygen for the GW-2X.

1. The unit then returns to normal operation and the display indicates the current gas concentration.

Turning Off the GasWatch 2

1. Press and hold the POWER/MODE button for about five seconds to turn off the unit. The buzzer will pulse while the POWER/MODE button is being pressed before the unit turns off.
2. Release the button when the LCD is blank. The unit is off.

Operation

This section describes the normal operation of the GasWatch 2. It explains how the unit can be used to display peak, STEL, and TWA readings for the GW-2C and GW-2C, and minimum and maximum readings for the GW-2X. It also covers alarm indications.

Measuring Mode

After you have powered up the GasWatch 2 and performed a fresh air adjustment following the instructions of the previous section, "Start Up," the GasWatch 2 is in Measuring Mode.

In Measuring Mode, the battery level, time, and target gas concentration are displayed on the LCD. The battery icon has four bars visible when the battery is full. As the battery charge decreases, the bars will disappear. On the GW-2C, CO is displayed as parts per million (ppm). On the GW-2H, H₂S is displayed in ppm. On the GW-2X, oxygen is displayed as volume percent (%).

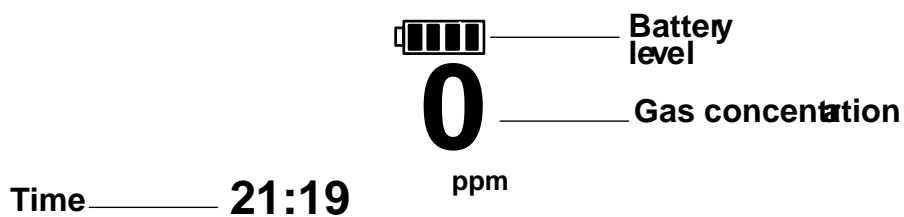


Figure 2: LCD in Measuring Mode

NOTE: The time is displayed in military format with the hour going from 0 to 24.

Displaying the Peak, STEL, and TWA (GW-2C & GW-2H)

You can display the Peak, STEL and TWA readings on the GW-2C and GW-2H when the GasWatch 2 is in Measuring Mode using the POWER/MODE button. STEL is an acronym for short-term exposure limit, and it is the average reading of the target gas (H₂S or CO) during the last 15 minutes. TWA is an acronym for time-weighted average, and it is the average reading for the target gas (H₂S or CO) during the last eight (8) hours. If eight (8) hours has not elapsed since the unit was turned on, the TWA is still calculated over eight hours, with the missing time assigned a zero (0) value for the readings. Similarly, if the unit has not been on for 15 minutes, the missing time is assigned a 0 value and the STEL is calculated over 15 minutes. The Peak, STEL, and TWA readings are cleared when the unit is turned off.

Make sure the GasWatch 2 is in Measuring Mode. The current gas concentration should be displayed on the LCD.

1. Press and release the POWER/MODE button to enter Peak Display Mode. This will activate the LCD backlight and display the Peak reading. A small Peak symbol is displayed in the upper left corner of the LCD.
2. Press and release the POWER/MODE button again to enter STEL Display Mode. This will display the STEL reading. The word "STEL" is displayed in the middle of the LCD above the reading.
3. Press and release the POWER/MODE button again to enter TWA Display Mode. This will display the TWA reading. The word "TWA" is displayed in the middle of the LCD above the reading.
4. Press and release the POWER/MODE button once again to return to Measuring Mode.

NOTE: If you do not press a button for 20 seconds while displaying the Peak, STEL, or TWA readings, the unit will return to Measuring Mode automatically and the backlight will turn off.

Displaying the Min and Max (GW-2X)

You can display the minimum (Min) and maximum (Max) readings on the GW-2X when the GasWatch 2 is in Measuring Mode using the POWER/MODE button. The Min and Max readings are cleared when the unit is turned off.

1. Make sure the GasWatch 2 is in Measuring Mode. The oxygen concentration should be displayed on the LCD.

2. Press and release the POWER/MODE button to enter Min Display Mode. This will activate the LCD backlight and display the Min reading. A small Min symbol is displayed in the upper left corner of the LCD.
3. Press and release the POWER/MODE button again to enter Max Display Mode. This will display the Max reading. A small Max symbol is displayed in the upper left corner of the LCD.
4. Press and release the POWER/MODE button once again to return to Measuring Mode.

NOTE: If you do not press a button for 20 seconds while displaying the Min or Max readings, the unit will return to Measuring Mode automatically and the backlight will turn off.

Alarms

This section covers alarm indications. It also tells you how to reset the GasWatch 2 after an alarm has occurred and how to respond to an alarm condition.

NOTE: False alarms may be caused by radio frequency (RF) or electromagnetic (EMI) interference. Keep the GasWatch 2 away from RF and EMI sources such as radio transmitters or large motors.

Alarm Indications, GW-2C & GW-2H

The GW-2C and the GW-2H will sound an alarm and the unit will vibrate when the target gas concentration, CO or H₂S, rises above the low alarm point. The GasWatch 2 also sounds an alarm and vibrates when the high alarm point, the STEL alarm point, or the TWA alarm points are reached. It also has a low battery warning, a dead battery alarm, an over range alarm, a sensor failure alarm, and a system failure alarm. See Table 3 below for a description of each alarm indication.

Alarm Indications, GW-2X

The GW-2X will sound an alarm and the unit will vibrate when the oxygen concentration falls below the low alarm point or rises above the high alarm point. It also has a low battery warning, a dead battery alarm, an over range alarm, a sensor failure alarm, and a system failure alarm. See Table 3 below for a description of each alarm indication.

The table below summarizes the types of alarms produced by the GasWatch 2.

Alarm Types and Indications

Alarm Type	LCD Indications	Other Indications
<p>Low Alarm Concentration of gas rises above the low alarm point, or for the GW-2X, falls below the low alarm point.</p>	<ul style="list-style-type: none"> • Gas reading flashes. • Back light turns on 	<ul style="list-style-type: none"> • Pulsing tone once per second • Unit vibrates once per second • Alarm lights flash once per second
<p>High Alarm Concentration of gas rises above the high alarm point.</p>	<ul style="list-style-type: none"> • Gas reading flashes. • Back light turns on 	<ul style="list-style-type: none"> • Pulsing tone twice per second • Pulsing tone twice Pulsing tone twice per second • Unit vibrates twice per second • Alarm light flashes twice per second.
<p>TWA or STEL (GW-2C & GW-2H Only) Concentration of CO or H₂S rises above the TWA or STEL alarm point.</p>	<ul style="list-style-type: none"> • Back light turns on. • TWA or STEL blinks to the left of the battery icon. • If the unit is in both TWA alarm and STEL alarm, both TWA and STEL will be displayed 	<ul style="list-style-type: none"> • Pulsing tone once per second • Unit vibrates once per second • Alarm light flashes once per second.
<p>Over Range</p>	<ul style="list-style-type: none"> • Gas reading replaced by blinking brackets. □□□□ • Back light turns on. 	<ul style="list-style-type: none"> • Pulsing tone once per second • Unit vibrates once per second • Alarm light flashes.
<p>Low Battery Warning</p>	<ul style="list-style-type: none"> • Last remaining bar on the right in battery icon flashes. 	<ul style="list-style-type: none"> • None
<p>Dead Battery Alarm</p>	<ul style="list-style-type: none"> • Gas reading replaced by FAIL. • Battery icon flashes. 	<ul style="list-style-type: none"> • Double Pulsing Tone (two pulses in quick succession) once a

		second
Sensor Failure	<ul style="list-style-type: none"> Gas reading replaced by FAIL. 	<ul style="list-style-type: none"> Double Pulsing Tone (two pulses in quick succession) once a second
System Failure	<ul style="list-style-type: none"> Gas reading replaced by FAIL. Time replaced by SYS below FAIL 	<ul style="list-style-type: none"> Double Pulsing Tone (two pulses in quick succession) once a second

Resetting Alarms

To reset an alarm, press the POWER/MODE button after the gas reading falls below the low alarm point (or above for the GW-2X). If a TWA or STEL alarm has been activated, it cannot be reset unless you turn off the unit.

- Even though the gas concentration may have returned to normal or may 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, sensor failure, and system failure alarms.

Responding to Gas Alarms

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

Responding to an Over Range Alarm

WARNING: *An over range condition may indicate an extreme toxic gas or oxygen concentration. Confirm the gas concentration with a different GasWatch 2 or with another gas detecting device.*

1. Follow your established procedure for an increasing gas condition.
2. Reset the alarm using the MODE/POWER button once the alarm condition has cleared.
3. Calibrate the GasWatch 2 as described in the calibration section of this manual.

4. If the over range condition continues, you may need to replace the sensor.
5. 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 GasWatch 2 is not operational as a gas monitoring device during a dead battery alarm. Take the GasWatch 2 to a non-hazardous area and change the battery as described in “Changing the Lithium Battery.”*

The GasWatch 2 is fully functional in a low battery warning condition. However, only a couple of days of operation may remain depending on certain conditions such as alarm occurrences. Change the battery as soon as possible when a low battery warning occurs as described in “Changing the Lithium Battery.”

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

Responding to a Sensor Failure Alarm

1. Try calibrating the sensor first, as described in “Calibration,” before replacing it.
2. If the sensor failure continues, replace the sensor as described in “Replacing a Sensor.”
3. If the sensor failure condition continues after you have replaced the sensor, contact RKI Instruments, Inc. for further instructions.

Responding to a System Failure Alarm

1. If a system failure occurs, try turning off the unit and turning it on again.
2. If the unit is still in system failure, contact RIKEN KEIKI. CO.LTD. for further instructions.

Displaying and Setting the Alarm Points

The GasWatch 2 allows you to display and set the alarm points. There is a Low Alarm point and a High alarm point on all three models. The GW-2C and GW-2H also have STEL and TWA alarm points. The alarm points and their factory settings for the three GasWatch 2 models are summarized in the table below:

1. Alarm Points of the Four Target Gasses

Model	Low Alarm	High Alarm	STEL	TWA
GW-2C (CO)	25 ppm	50 ppm	200 ppm	25 ppm
GW-2H (H ₂ S)	10.0 ppm	30.0 ppm	15.0 ppm	10.0 ppm
GW-2X (O ₂)	19.5% Decreasing	23.5% Increasing	N/A	N/A

In the table above, Low Alarm and High Alarm for the GW-2C and GW-2H refer to a rising concentration of the target gasses. The Low Alarm is triggered at the Low Alarm concentration listed in the table. For the GW-2C that would be 25 ppm CO, and for the GW-2H that would be 10.0 ppm. The High Alarm is triggered when the High Alarm concentration is reached.

For the GW-2X, Low Alarm is triggered when the concentration of oxygen falls below 19.5%. When the concentration of oxygen rises above 23.5%, High Alarm is activated.

Displaying and setting the Alarm Points

1. Make sure the GasWatch 2 is turned off. The LCD should be blank.
2. Press and hold the AIR button, then press and hold the POWER/MODE button.

As soon as segments appear on the display (approximately one second), release the AIR button. When the unit “beeps,” release the POWER/MODE button to put the GasWatch 2 into Alarm Point Adjustment Mode. The LCD should display the Low Alarm setting for the target gas and the battery level.

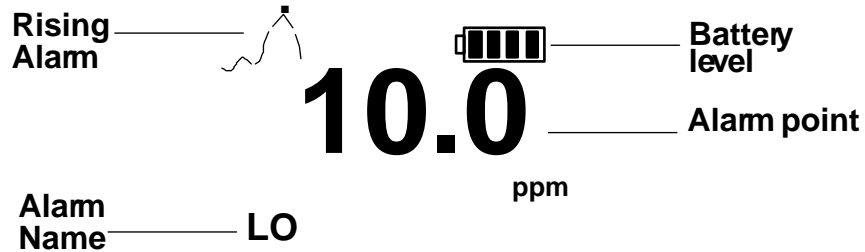


Figure 3: LCD in Alarm Adjustment Mode, GW-2C & GW-2H

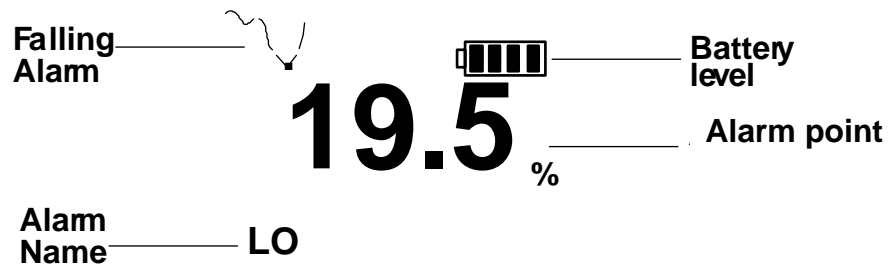


Figure 4 : LCD in Alarm Adjustment Mode, GW-2C & GW-2H

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

1. Use the POWER/MODE button to cycle through the alarm points by pressing and releasing. If you press and hold the POWER/MODE button, you may turn off the unit. When an alarm point is displayed, use the AIR button to increase the alarm point. If you pass the desired setting, continue increasing the alarm point until it reaches the maximum setting and it will “wrap around” to the minimum setting.
2. If you adjust an alarm setting, press the POWER/MODE button to save the new setting. The next alarm point will be displayed.

NOTE: You can only cycle through the alarm points once before the GasWatch 2 goes into its startup sequence followed by Measuring Mode. If you want to cycle through the alarm points again, press and hold the POWER/MODE button to turn off the GasWatch 2. Then begin with step 2 above to put the unit back into Alarm Point Adjustment Mode.

1. When you are finished viewing or adjusting the alarm point settings, press and release the 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 GasWatch 2.) The GasWatch 2 will then go into its startup sequence followed by Measuring Mode.

Setting the Time

The GasWatch 2 allows you to set the time.

1. Make sure the GasWatch 2 is on and in Measuring Mode.
2. Press and hold the Air button, then press and hold the POWER/MODE button to put the GasWatch 2 into Time Adjustment Mode. Release the buttons when the word "SET" appears on the LCD. Below "SET", the time will be displayed and the hour in the time will be flashing.

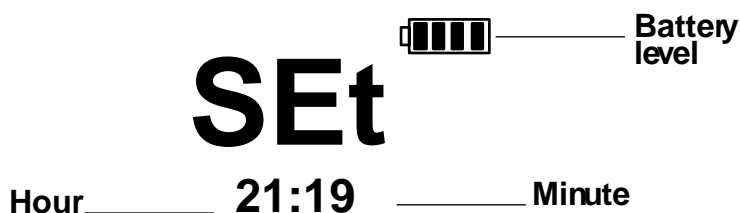


Figure 5: LCD in Time Adjustment Mode

1. Use the AIR button to increase the hour to the desired setting. If you pass the desired setting, continue to increase the hour until it reaches 23 and then wraps around to 0, then set to the desired setting.
2. Press the POWER/MODE button to accept the hour setting. The minute starts flashing.
3. Use the Air button to increase the minute setting to the desired setting.
4. Press the POWER/MODE button to accept the minute setting and return to Measuring Mode.

Calibration

This section covers the calibration of the GasWatch 2. Setting the fresh air reading is described first followed by setting the span (GW-2C and GW-2H) and zero (GW-2X) reading. You are told what is needed to complete the task, how to assemble the calibration kit, and how to set the span (zero for GW-2X) reading.

WARNING: Use a 0.5 LPM (liters per minute) fixed flow regulator when calibrating. Use of a different flow rate may adversely affect the accuracy of the calibration.

Setting the Fresh Air Reading

You will need to set the fresh air reading first before setting the span (zero for GW-2X) reading.

1. Find a fresh-air environment. This is an environment free of toxic or combustible gasses and of normal oxygen content (20.9%).
2. Turn on the GasWatch 2 by pressing and holding the POWER/MODE button for one second. Allow the unit to finish its warm-up sequence.
3. Press and hold the AIR button for about three seconds to allow the GasWatch 2 to set the fresh air reading. It will set the reading on the GW-2C and GW-2H to 0 ppm and on the GW-2X it will set the reading to 20.9% oxygen.
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 fresh air reading has been set, the LCD displays “Adj,” which prompts you to release the AIR button.

Setting the Span (Zero for GW-2X) Reading

This section tells you how to set the span reading on the GW-2C and GW-2H and the zero reading on the GW-2X using the Calibration Mode.

Preparation

Set the fresh air reading as described in “Setting the Fresh Air Reading.” You will also need the supplies listed below. A calibration kit is available from RKI Instruments, Inc. for each GasWatch 2 model for this purpose (see “Parts List”).

- A gas cylinder with an appropriate concentration of the target gas for the GW-2C or GW-2H, or a cylinder of 100% nitrogen for the GW-2X.

NOTE: On the GW-2X, instead of 100% nitrogen (0% oxygen), it is allowable to use an oxygen concentration of up to 19.5% to set the zero reading.

- 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 cup that will fit over the GasWatch 2's sensor.

Assembling the Calibration Kit

WARNING: ***Calibrate the GasWatch 2 in a non-hazardous environment.***

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

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

Setting the Span Readings for the Target Gas

1. Make sure you have set the fresh air reading and have set up the calibration kit as described in the procedure above.
2. Make sure the GasWatch 2 is off.
3. Press and hold the AIR button, then press and hold the POWER/MODE button. Release both buttons when you hear a "beep." The unit is in calibration mode and the LCD displays "CAL" in the lower left, the battery level. It also displays the gas concentration the unit expects you to use, the calibration value, when setting the span or zero reading.
4. If necessary, use the AIR button to adjust the calibration value to the desired setting. The calibration value must match the gas concentration in the calibration cylinder.
5. Press the POWER/MODE button to accept the calibration value and proceed to the calibration screen. The current gas reading is displayed.
6. Attach the regulator to the gas cylinder. The fixed-flow regulator automatically begins introducing the calibration sample to the sensor.

NOTE: If you wish to cancel the span or zero adjustment process, press and hold the AIR button for about 3 seconds. The unit will cancel the span or zero adjustment and begin its startup sequence.

7. Let the gas flow for two minutes and then press the POWER/MODE button. The unit will adjust the span (GW-2C or GW-2H) or zero (GW-2X) based on the calibration value that was saved in step 5 above.

8. Remove the regulator from the gas cylinder and the calibration cup from the unit. As soon as the unit makes the calibration adjustment, it will begin its startup sequence and then enter Measuring Mode.

NOTE: If the gas reading is high enough (low enough for the GW-2X) when the unit enters Measuring Mode, an alarm condition will occur. Reset the alarm using the POWER/MODE button when the gas reading falls below (rises above for the GW-2X) the alarm point.

Maintenance

This section describes troubleshooting procedures for the GasWatch 2. It also describes how to change the GasWatch 2's battery as well as how to replace the sensor cover and gas sensor.

Troubleshooting

The troubleshooting table describes error messages, symptoms, probable causes, and recommended action for problems you may encounter with the GasWatch 2.

Table 2: Troubleshooting the GasWatch 2

Symptoms	Probable Causes	Recommended Action
<ul style="list-style-type: none"> • The LCD is blank. 	<ul style="list-style-type: none"> • The unit may have been turned off. • The battery may need to be replaced. 	<ol style="list-style-type: none"> 1. To turn on the unit, press and hold the MODE/POWER button. 2. If the unit does not turn on, replace the battery. 3. If the difficulties continue, contact RIKEN KEIKI CO.,LTD for further instruction.
<ul style="list-style-type: none"> • The LCD shows abnormally high or low readings but other gas detection instruments do not. 	<ul style="list-style-type: none"> • The unit may need to be recalibrated. • The sensor may need replacement. 	<ol style="list-style-type: none"> 1. Recalibrate the unit. 2. Replace the sensor and calibrate the unit. 3. If the difficulties continue, contact RIKEN KEIKI CO.,LTD for further instruction.

Symptoms	Probable Causes	Recommended Action
<ul style="list-style-type: none"> “FAIL” displays during span or zero adjustment. 	<ul style="list-style-type: none"> The calibration value may not match the cylinder gas concentration. The sample gas is not reaching the sensor because of a bad connection The calibration cylinder may be out of gas or is outdated. The sensor may need replacement. 	<ol style="list-style-type: none"> 1. Check all calibration tubing for leaks or for any bad connections. 2. Make sure the GasWatch 2 has been properly set up for calibration. 3. Verify that the calibration cylinder contains an adequate supply of fresh test sample. 4. If the fail condition continues, replace the sensor. 5. If the difficulties continue, contact RIKEN KEIKI CO.,LTD. for further instruction.
<ul style="list-style-type: none"> “FAIL SYS” is indicated on the LCD 	<ul style="list-style-type: none"> A microprocessor failure has occurred. 	<ol style="list-style-type: none"> 1. Turn off the unit and turn it on again. 2. If difficulties continue, contact RIKEN KEIKI CO.,LTD.

Replacing the Lithium Battery

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

Replace the lithium battery when the battery icon indicates that the unit is in low battery warning.



When in low battery warning, only one battery level indication bar remains and it is flashing.

1. Verify that the GasWatch 2 is off.

2. On the back of the unit, unscrew the two screws that retain the battery cover far enough so you can pull the cover away from the bottom case. The screws are held captive in the battery cover if you do not unscrew the too far.
3. Carefully remove the old battery.
4. Carefully install the new battery, type CR 2450, noting the polarity indications on the battery cover and in the battery compartment. The negative (-) side of the battery goes in first.
5. Reinstall the battery cover.

NOTE: When the battery is changed, since all power to the unit is lost when the old battery is removed, the clock is reset to 0:00 when the new battery is installed. The clock must be set to the correct time after the battery is changed.

6. Press the POWER/MODE button for a few seconds.
7. The display will indicate "SET" and show the time as 0:00 with the hour flashing.
8. Use the AIR button to increase the hour to the desired setting. If you pass the desired setting, continue to increase the hour until it reaches 23 and then wraps around to 0, then set to the desired setting.
9. Press the POWER/MODE button to accept the hour setting. The minute starts flashing.
10. Use the Air button to increase the minute setting to the desired setting.
11. Press the POWER/MODE button to accept the minute setting. The unit will begin its startup sequence and the enter Measuring Mode.

Replacing the Sensor

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

1. Verify that the GasWatch 2 is off.
2. With a flat blade screw drive, gently pry off the sensor cap. It snaps onto the top case with two tabs.
3. Remove the sensor gasket with the sensor cover from the sensor.
4. Carefully remove the old sensor from the sensor socket.

NOTE: The sensors in the GW-2C (CO sensor) and GW-2H (H₂S sensor) are keyed and can only be inserted in the socket one way. Note the orientation of the old sensor before you remove it. The sensor in the GW-2X is not keyed.

5. Carefully insert the replacement sensor in the socket. Make sure the sensor face with the colored ring is facing up.

CAUTION: *When replacing the sensor, verify that the sensor is properly aligned with its socket before inserting it into the socket. The CO and H2S sensors have alignment slots which match up with alignment tabs in the sockets. Forcing a sensor into its socket may damage the sensor or the socket.*

6. Reinstall the sensor gasket with the sensor cover over the sensor.
7. Reinstall the sensor cap.
8. Calibrate the new sensor as described in the calibration section of this manual.

Replacing the Sensor Cover

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

1. Verify that the GasWatch 2 is off.
2. With a flat blade screw drive, gently pry off the sensor cap. It snaps onto the top case with two tabs.
3. Remove the old sensor cover from its recess in the sensor gasket.
4. Install the new sensor cover into the recess in the sensor gasket.
5. Reinstall the sensor cap.

Parts List

Table 6 lists replacement parts and accessories for the GasWatch 2.

Table 2: Parts List

Description
Lithium battery, 3.0 volt, coin type, CR 2450
Carbon monoxide sensor ES-1821
Hydrogen sulfide sensor ES-1827
Oxygen sensor OS-BM2