INSTRUMENTS
Gas Detection for Life!

OPERATING INSTRUCTION MANUAL FOR RIKEN HAND HELD GAS DETECTOR MODEL SP-210/SP-210(L Type)

Safety precautions

- Read and understand the instructions in this manual before operating this detector.
- Keep manual accessible at all time.
- This detector cannot be used for any other purpose than what is specified in this manual.
- Follow all the instructions in this manual.
- We do not assume indemnification for any accident or damage caused by the operation of this gas detector, and our warranty is limited to the replacement of parts or our complete goods.
- Be sure to perform daily inspections. We also recommend to perform regular inspections and gas calibration more than once per year.
- If this detector founds defective, contact authorized distributors, dealers and representative appointed by Riken Keiki Co., Ltd.

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INTRODUCTION

Thank you very much for purchasing our gas detector Model SP-210. This instrument is a handheld gas leak detector to detect natural gas, general combustible gas or LPG.

This manual is just a guide book to operate the SP-210. Your kind reading of this manual is requested not only for first user but for already experienced staff.

This manual contains the following headings to ensure the safe and effective operation.

Identification of each caution mark

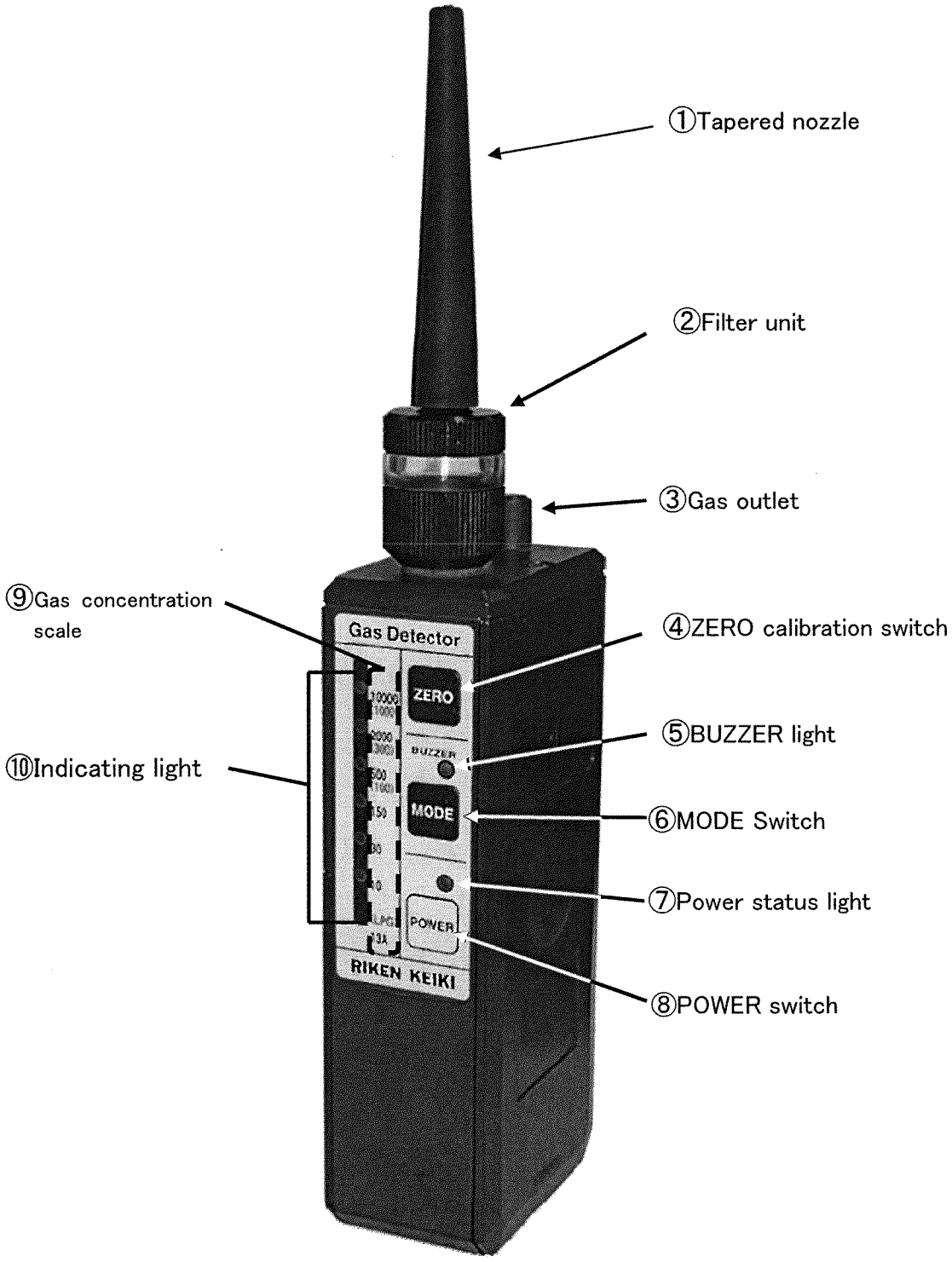
⚠ DANGER	Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury or serious damage to the product. This signal word is to be limited to the most extreme situation.
⚠ WARNING	Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury on the human body or object.
⚠ CAUTION	Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury or some damage on the human body or objects. It may also be used to alert against unsafe practices.
* NOTE	This means "ADVICE" at operation.

Disposing the gas detector

Any harmful material is not used for this model. When deposing the SP-210, treat it as general incombustible wastes.

CONTENTS

1. NAME OF EACH PART



1. **Tapered nozzle**

The nozzle to sample the gas. The tip of the nozzle is flexible.

2. **Filter unit**

The filter to remove dust.

3. **Gas outlet**

Outlet to exhaust the sampled gas.

4. **Zero calibration switch**

This switch is used for zero calibration. When this switch is pressed more than 1 second, zero calibration starts.

5. **BUZZER light**

The lamp to indicate the setting of the alarm operation

- Green light ON: LED indication and Buzzer sound
- Red light ON : LED indication and Vibration(When you want to turn off the buzzer)
- OFF : LED indication only(When you want to turn off both buzzer and vibration)

6. **MODE Switch**

The switch to change the setting mode. The setting can be changed according to the duration of depressed time and number of switch depression.

Contents alternation	Depressed time	Confirmation of setting
Setting of alarm operation	Below 1 second	See item 2-2
Setting of alarm level and minimum detectable concentration	Above 1 second	See item 2-2

7. **Power status light (Green)**

The light to indicate that the instrument is being energized.

It blinks after turning the power on until finishing warming up. After that, the light is continuously on as long as the instrument normally works. If the battery voltage becomes low or alarm operation occurs, the light starts to blink.

8. **Power switch**

Switch for power-on/ off

9. **Gas concentration scale**

Engraved numerical values(30, 150, etc.) show some tentative gas concentrations(ppm).

Red numerical numbers in red parentheses are the scale (service range) for LPG.

In case of SP-210(L type), red parentheses with numerical members are not engraved or the gas concentration scale.

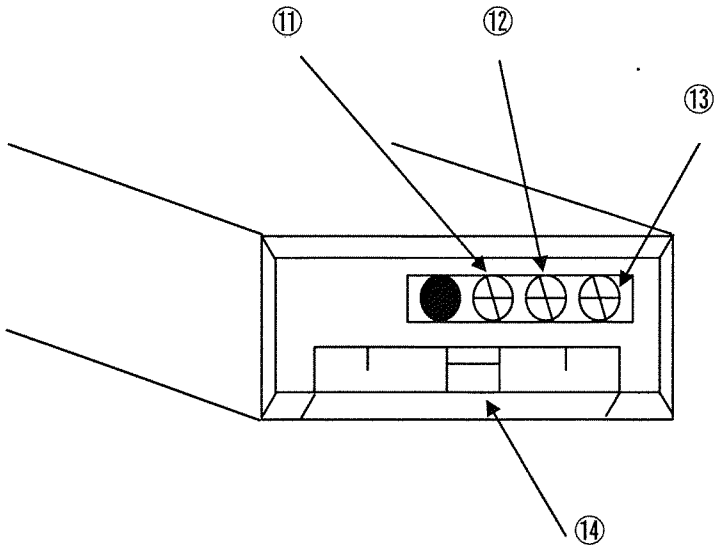
10. **Indication light(Red, Green)**

Red: Concentration of the gas detected and trouble condition judged by self-diagnostic function are indicated by this light.

When low battery voltage alarm or low suction flow alarm are recognized;, all the light start to blink.

Green: The light to indicate preset alarm level and the minimum detectable concentrations.

- Bottom view-



⑪ Flow adjusting potentiometer

To adjust the pump flow rate.

⑫ Span adjusting potentiometer

To adjust the sensitivity against gas

⑬ Zero adjusting potentiometer

To adjust the zero point roughly

⑭ Cover for battery case

When replacing the batteries, open this cover. At your purchasing, batteries are out from the battery case. Please put these in there.

2. HOW TO USE

Items to check before starting use

Instrument

- Confirm if there is any damage on the display or other parts.

Filter unit

- Check the dirt in the filter unit. If it is dirty, replace it with new one. (See item 4-3.)
- Check any damage on the filter unit.

Tapered nozzle

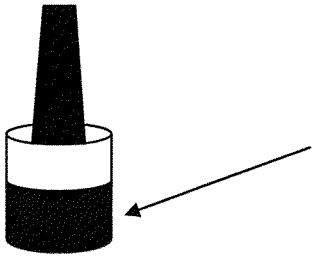
- Check any damage on the tapered nozzle.
- Check any looseness on the connecting part.

2-1 Preparation

(1) Equip batteries into the instrument. (See item 4-1)
(2) Put the instrument into the carrying case.
(3) Connect the following parts in order:
Instrument (Gas inlet port) + Filter unit + Tapered Nozzle.

⚠ CAUTION

- Connect the filter unit and tapered nozzle firmly. Otherwise, correct gas detection cannot be performed.
- Keep the filter unit on the instrument all the time during gas detection.
- Without the filter, the dust, water or oil is sampled into the instrument. These materials might be the source of the trouble.
- Tighten the filter unit by turning the black part. If the clear plastic part is turned, it might not be loosened any more.



2-2. Start up

Start

(1) Press POWER switch for more than 0.5seconds.
- Buzzer beeps once.

Warm up

(2) Warm up starts
- POWER light(Green) blinks.
- All indication lights for gas concentration turn on and then, they turn off from the top to the bottom in order. Warm up will be finished when all indication lights turn off.

Zero calibration

(3) Zero calibration is performed automatically after warm up.
- When the zero calibration finishes, all indication lights turn off and buzzer beeps 3 times. Then, the setting light for alarm and minimum detectable concentration turns on.

*If the measurement is continued, perform the zero calibration regularly by pressing ZERO switch more than 1 second.
When performing zero calibration, expose the instrument to fresh air.

*If any trouble occurs, the maintenance is required.

Confirming battery voltage

(4) If the low battery voltage is noticed or low battery alarm is emitted, replace the batteries (See item 4-1).
- Confirm that POWER light and indication light for gas concentration do not blink.

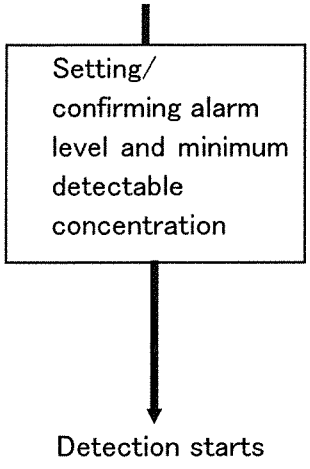
Confirming pump flow rate

(5) Confirm that there is no abnormality on the pump suction.
- Cover the tip of the tapered nozzle by finger for a moment and confirm that flow trouble alarm is emitted.
- At flow trouble alarm, the buzzer beeps intermittently and all gas concentration lights start to blink.

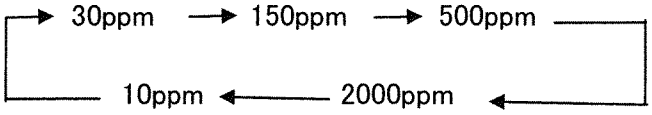
*Release the finger soon after confirming the flow trouble.
If the pump stops more than 3 seconds, it cannot be recovered.
In such case, press the power switch once to turn off the power.

Setting and confirming the alarm operation

(6) Set up the kind of alarm operation by pressing MODE switch more than 1 second (distinguishes by the color of buzzer light).
Green light ON: LED and buzzer
Red light ON : LED and vibration
OFF : LED only



(7) Set up the alarm level and the minimum detectable concentration by pressing MODE switch (below 1 second).



Check that the green light for the set gas concentration turns on. Once adjusted, it saves the memory even with the power off.

2-3. Detecting gas leak

(1) Put the tip of the taper nozzle close to the measuring point.

(2) Read out gas concentration by the indicator light (red).
The indication shows the gas concentration range of the detected gas. If any gas is not detected, any light is not ON except the green light to indicate the alarm point and minimum detectable concentration. If the gas concentration increases above the preset minimum detectable concentration, a red light turns ON and the position of the red light climbs to the top when the gas concentration becomes thicker.

(3) Alarm operates as follows depending on the set up.

- When the instrument detects gas while the green BUZZER light is on, the buzzer intermittently beeps. If the gas concentration gets higher, the speed of the intermittent buzzer sound becomes faster. Once the gas concentration gets beyond the gas indicator light, the buzzer becomes continuous sound.
- When the instrument detects gas while the red BUZZER light is on, it intermittently vibrates. If the gas concentration gets higher, the speed of the intermittent vibration becomes faster. Once the gas concentration gets the highest range, the vibration becomes continuous.
- When the instrument detects gas while the BUZZER light is off, only the LED indicates and no alarm for buzzer sound or vibration is activated.

⚠ CAUTION

- Whenever detection is done, check whether the pump works or not. (Check the pump noise or sucking condition at inlet.) Detection cannot be done with the pump stopped.
- Keep the filter unit on the instrument during gas detection. If it is out from the instrument, ability of the internal pump becomes low or instrument might breakdown.
- Do not cover the gas outlet. The indication changes.

2-4. Turning off the SP-210

●Turning off the power
Press and hold the POWER switch for about 0.5 seconds to turn off the power.

3. ALARMS AND SELF-DIAGNOSIS

This instrument has GAS ALARM and Self-diagnosis functions. Each alarm is indicated by light and buzzer or vibration.

●Kinds of alarm and the alarm pattern

Condition		Display by light	Buzzer	Vibration
Low battery voltage	Precaution	Power light blinks(Green)	None	None
	Alarm	Power light blinks(Green)	Intermittent	None
		Gas indicator light: All blink(Red)		
Low flow rate		Gas indicator light: All blink(Red)	Intermittent	None
Gas alarm (BUZZER light : Green)		Gas indicator light: ON(Red)	Intermittent →Continuous	None
Gas alarm (BUZZER light : Red)		Gas indicator light: ON(Red)	None	Intermittent →Continuous
Gas alarm (BUZZER light : OFF)		Gas indicator light: ON(Red)	None	None

4. MAINTENANCE

4-1 Replacing batteries

When replacing the batteries, change all the three batteries at once.

(1) Confirm that the power is off. If the instrument is energized, turn off the power.
(2) Remove the carrying case from the instrument.
(3) Hook your nail on the lock of the battery cover and pull it down.
(4) When the lock releases, pull the cover upward.
(5) Take out the 3 batteries and put the new batteries by taking care its polarities.
(6) After finishing the replacement, close the battery cover. Then, lock the cover and put the instrument back into the carrying case.

*** NOTE**

- When replacing the batteries, carry out in non-hazardous place where any explosive gas does not exist.
- Use the specified batteries only.
- When removing the batteries, pull out the (+) side first. And, when putting the batteries in, (−) side should be first to make the procedure easier.
- When locking the battery cover, press the center part of the lock and lock the cover. Otherwise, the lid might come to one side and the other is not locked completely.

4-2 Calibration with gas

To keep the correct operation all the time, calibrate the instrument with actual gas regularly (at least once a year.)

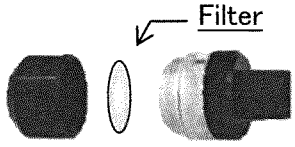
⚠ CAUTION

Since the calibration gas and the special calibration tools are required for calibration, contact with our nearest agent or Riken Keiki.

4-3 Replacing the filter

When it gets dirty and the sample flow rate drops while performing a daily inspection, replace it.

- If there is dust inside the filter unit, remove it.
- If water comes into the filter unit, remove and dry it out.
- The filter unit is disassembled as below:



4-4 Replacing the sensor

If zero adjustment or gas calibration cannot be succeeded even though the battery voltage is OK, it should be thought that the sensor life is terminated. Replace the sensor with new one.

⚠ CAUTION

- The sensor life depends on the operating condition.
  For example; The sensor life gets shortened if the instrument is used in a place where much dust exists, where pressure easily changes, or where temperature and humidity are extremely high or low. Avoid to use SP-210 under such environment.
- Gas calibration is required every time after the sensor is replaced.
  Calibration gas and some special calibration tools are required for the gas calibration.

4-5 Daily inspection/ Regular inspection

(1) Daily inspections

- Confirming the switches, the lamps, the display and the main part. (Any damage?)
- Filter (Isn't it dirty?)
- Confirming the pump operation. (Doesn't it has an odd noise?)
- Confirming the battery voltage.

(2) Regular inspections

It is recommended to have the regular inspections at least once a year. For the adjustment, contact with our nearest agent or Riken Keiki.

4-6 Storage or treatment when not in use for a long time

Store it in a dry room where direct sunshine does not reach. Pull the batteries out if the instrument is not used more than 1 month.

5. TROUBLE SHOOTING

The trouble shooting below does not cover all the problems. It might help to discover the causes of the problems which seem to occur the most frequently.

Symptom	Probable cause	Recommended action
Power does not turn on.	>No battery inside >Battery power is extremely exhausted. >The polarity of the batteries is wrong.	Refer to the section "4-1 Replacing batteries."
	>The instrument gets a hard shock during the operation.	Pull the batteries out. After leaving the instrument with batteries out for 10 sec., equip the batteries with the instrument again.
Pump does not work.	>Battery voltage gets low.	Replace the batteries(Ref:4-1) and turn the power on again.
	>Filter is clogged.	Replace the filter (Ref:4-3)
Zero calibration or gas calibration cannot be performed.	>Usage period of the sensor terminates.	Replace the sensor soon.

6. CAUTION ON OPERATION

To maintain the ability of the instrument, keep the following items:

⚠ WARNING

Never modify or change the electric circuit or the structure.
If any modification or change takes place, the ability cannot be maintained.

⚠ CAUTION

- Do not drop or hit the instrument. This instrument is a precision apparatus. Once it get shocked, the ability cannot be maintain.
- Do not use transceivers close to the instrument. If it receives an electric noise, the indication is affected. Or the noise might break the instrument.
- Change of the atmospheric pressure and temperature might affect the indication of the instrument.
- If the instrument freezes, the accurate detection cannot be performed.

7. SPECIFICATION

7-1 Standard specifications

Model	SP-210		SP-210(L-type)
Target gas	Natural gas, City gas, LPG(Service range)		LPG
Detection principle	Catalytic/Semiconductor combination sensor method, automatic sample drawing		
Detection range	10～10,000ppm (LPG: 100～10,000ppm)		10～10,000ppm
Display of detected level	Simple display by 6-step LED bar indicator		
Alarm functions	Alarm point	Available to set by 5 steps in the range of 10～10,000ppm	
	Alarm indications	Buzzer sound, vibration and LED bar (Self-reset mode)	
Response time	Within 3 seconds		
Operating conditions	-10℃～+50℃		-20℃～+50℃
	Below 90%RH(Non-condensing)		
Power source	AA size batteries (3 pcs.)		
Continuous operation	Approx 8 hours (at 20℃) with alkaline batteries Provided with low battery warning		
Explosion proof	Exibd Ⅱ BT3 (Approval No.TC16855 in Japan)		
Dimensions	Approx 35(W) x 128(H) x 57(D) mm		
Weight	Approx 320 g		

7-2 Accessories

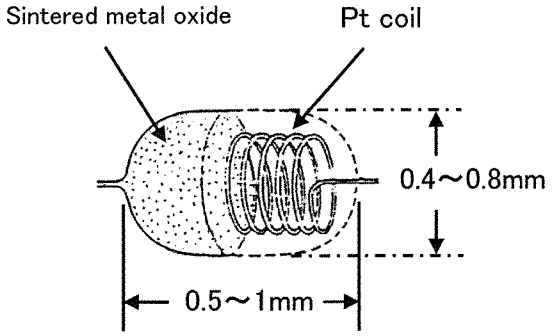
Standard accessories

① Carrying case ..... 1 pce.
② Tapered nozzle ..... 1 pce.
③ Filter unit ..... 1 pce.
④ Filter disk ..... 1 pkg.(5 pcs.)
⑤ AA size alkaline battery ..... 3 pcs.
⑥ Operating instruction manual ..... 1 pce.

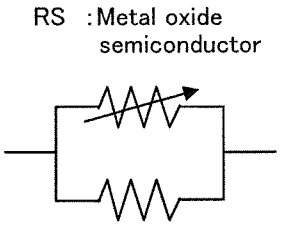
8. DETECTION PRINCIPLE

This instrument applies a catalytic/semiconductor combination sensor to detect target gases. Gas concentration detected by this sensor is converted to an electric signals, amplified and made A/D conversion.
They are diagnosed and processed by CPU and then, make operation of light and buzzer.
Operation principles for the gas sensor and circuit are as following.

8-1 Gas sensor



Structure



Resistance of detecting element: $R = \frac{RH \cdot RS}{RH + RS}$

[Structure]
The resistance(R) of the detecting element is a combined resistance of semiconductor's resistance(RS) and platinum wire's resistance(RH). The detecting element which is heated up to 300℃～400℃ by the coil of platinum wire keeps a constant resistance.
When the detecting element is exposed to the reducing gas such as methane, LPG, etc., the oxygen adsorbed on the surface of the metal oxide semiconductor is separated.
Then, the free moving electron inside semiconductor increases and the resistance of semiconductor decreases.
As a result, the bridge circuit becomes unbalanced and outputs the voltage in proportion to the gas concentration.

8-2 Circuit

The voltage signal from the sensor corresponding to the gas concentration is amplified to a prescribed voltage with AMP circuit. Amplified signal is converted to digital signal by A/D conversion circuit and taken in CPU. The digital signal being taken in CPU is processed and converted to the digital signal corresponding to gas concentration. Then it makes LED bar indication and buzzer operation.
The contents of diagnosis and process are as following.

① Warm up time and initial process.
② One-touch zeroing and the process at the time of abnormality
③ Monitoring of battery voltage and the process at the time of low voltage.
④ Monitoring of gas concentration and the process at the time of abnormality.

And monitoring of switch operations and it process, etc.

INSTRUMENTS
Gas Detection for Life!

RKI Instruments, Inc. warranties gas alarm equipment sold by us to be free from defects in materials, workmanship, and performance for a period of one year* from the date of shipment from RKI Instruments, Inc. Any parts found defective within that period will be repaired or replaced, at our option, free of charge. Parts must be returned to RKI Instruments, Inc. for repair or replacement. This warranty does not apply to those items which by their nature are subject to deterioration or consumption in normal service, and which must be cleaned, repaired or replaced on a routine basis.

Examples of such items are:

a). . . . . Pump diaphragms and valves
b). . . . . Fuses
c). . . . . Batteries
d). . . . . Filter elements

Warranty is voided by abuse including mechanical damage, alteration, rough handling, or repair procedures not in accordance with instruction manual. This warranty indicates the full extend of our liability, and we are not responsible for removal or replacement costs, local repair costs, transportation costs, or contingent expenses incurred without our prior approval.

THIS WARRANTY IS EXPRESSLY IN LIEU OF ANY AND ALL OTHER WARRANTIES AND REPRESENTATIONS, EXPRESSED OR IMPLIED, AND ALL OTHER OBLIGATIONS OR LIABILITIES ON THE PART OF RKI INSTRUMENTS, INC. INCLUDING BUT NOT LIMITED TO, THE WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. IN NO EVENT SHALL RKI INSTRUMENTS, INC. BE LIABLE FOR INDIRECT, INCIDENTAL OR CONSEQUENTIAL LOSS OR DAMAGE OF ANY KIND CONNECTED WITH THE USE OF ITS PRODUCTS OR FAILURE OF ITS PRODUCTS TO FUNCTION OR OPERATE PROPERLY.

This warranty covers instruments and parts sold to users only by authorized distributors, dealers and representatives as appointed by RKI Instruments, Inc.

We do not assume indemnification for any accident or damage caused by the operation of this gas monitor and our warranty is limited to the replacement of parts or our complete goods. Warranty covers parts and labor performed at RKI Instruments, Inc. only, and does not cover field labor or shipment of parts back to RKI.

* The Models GX-2001 and GasWatch 2 carry a two year warranty. The two year warranty applies to the instrument including original sensors. Replacement parts and sensors have a standard one year warranty.