INSTRUMENTS
Gas Detection for Life!

INSTRUCTION MANUAL

FOR

RIKEN PORTABLE INFRARED

CO2 GAS MONITOR

MODEL RI-85

Model	RI-85
Measuring gas	CO2
Measuring range	0-10,000ppm

* Note

> Read this instruction manual carefully before starting operation.

> Keep this instruction manual in a place which is available any time necessary.

> This gas detector cannot be applied for purposes beyond specified.

> Safety and quality on the product are not warranted if the product should be applied by the methods which do not obey the operation manual, or if the product is arranged by your own way, or if irregular part is used for repair. And also, accidents caused by the usage above are not under our responsibility.

RKI Instruments, Inc. • 33248 Central Avenue Union City, CA 94587 • Phone (510) 441-5656 • (800) 754-5165 • Fax (510) 441-5650

At first

Thank you very much for your purchasing the portable infrared CO2 gas monitor, Model RI-85. This instrument is a portable gas monitor to monitor CO2 gas in air.

This is instruction manual is the guidebook for the Model RI-85 to operate. Not only a beginner user, but also experienced user has to read this instruction manual and understand it before the actual use.

Following marks appear on this manual to perform safe and effective use:

! Danger

Means heavy damage directly on human life, human body or object due to a cause like touching high voltage.

! Warning

Means heavy damage directly on human body or object due if operation does not obey the instruction manual.

! Caution

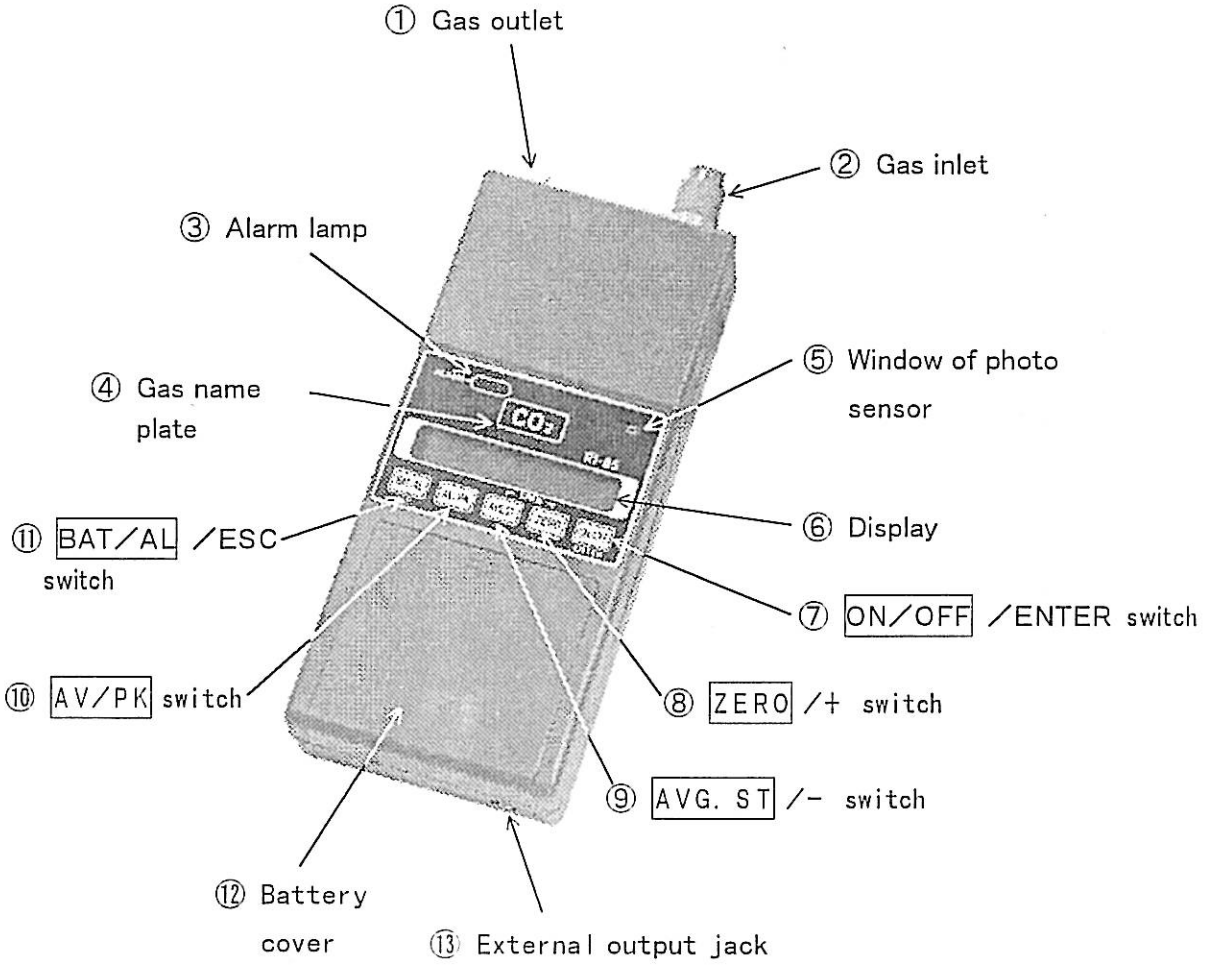
Means damage on human body or object if operation does not obey the instruction manual.

*** Note**

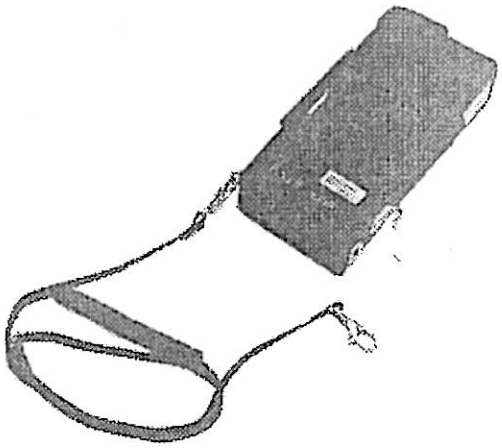
Mentions advice on the operation.

Index

1. Name of each parts



⑭ Carrying case



⑮ Gas sampling hose (spiral)

⑯ PROBE Gas sampling probe

① Gas outlet

② Gas inlet

③ Alarm lump

Lump ON at alarm.

④ Gas name plate

Indicates measuring gas, CO2.

⑤ Window of light receive source

Automatically light ON of instrument display by detecting darkness around.

⑥ Display (LCD display with light)

Indicates gas concentration etc.

⑦ [ON／OFF] ／ENTER switch

Switch for power ON／OFF and to enter the input content.

⑧ [ZERO] ／＋ switch

Switch for zero adjustment and to increase input value.

⑨ [AVG. ST] ／－ switch

To start for measuring average value and to decrease input value.

⑩ [AV／PK] switch

To indicate average value and peak value.

⑪ [BAT／AL] ／ESC switch

To indicate battery voltage value/alarm set value and to cancel inputted contents.

⑫ Battery cover

⑬ External output jack

⑭ Carrying case

⑮ Gas sampling hose (spiral) (1m)

⑯ [PROBE] Gas sampling probe (with absorbent cotton)

⑰ Protective filter (Refer to 4-4.)

2. How to use

Check before use

Instrument itself:

- Make sure no defect on the LCD display.

Gas sampling probe (with absorbent cotton):

- Make sure the absorbent cotton is clean. If not, replace it with new one. (Refer to 4-4.)
- In case of drawing water drop, dry it off.
- Make sure no defect on the gas sampling probe.

Gas sampling hose (spiral):

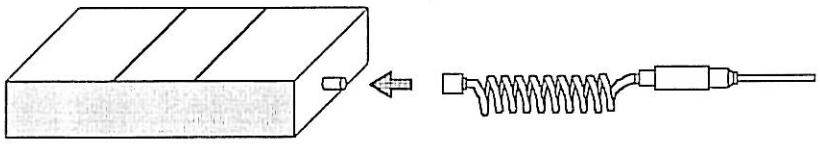
- Make sure no leakage on the gas sampling hose (spiral).
- Make sure the connector fixed firmly.

2－1 Preparation

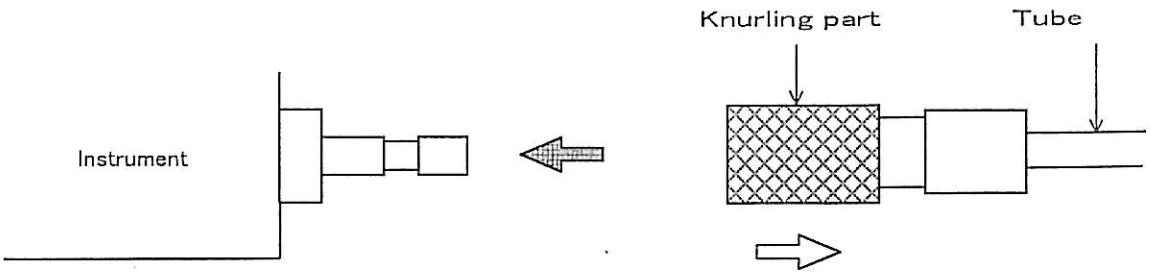
(1) Install dry batteries.(Refer to 4-1.)

(2) Put in the instrument to the carrying case.

(3) Connect gas sampling hose (spiral) and gas sampling probe to the instrument (gas inlet).



Hold the knurling part of connector and pull it to the white arrow (⇨) direction. With holding, put it into the black arrow (⇦) direction. Release the finger from the knurling part, and put it in fully until sounding "click" and rocked the connector.

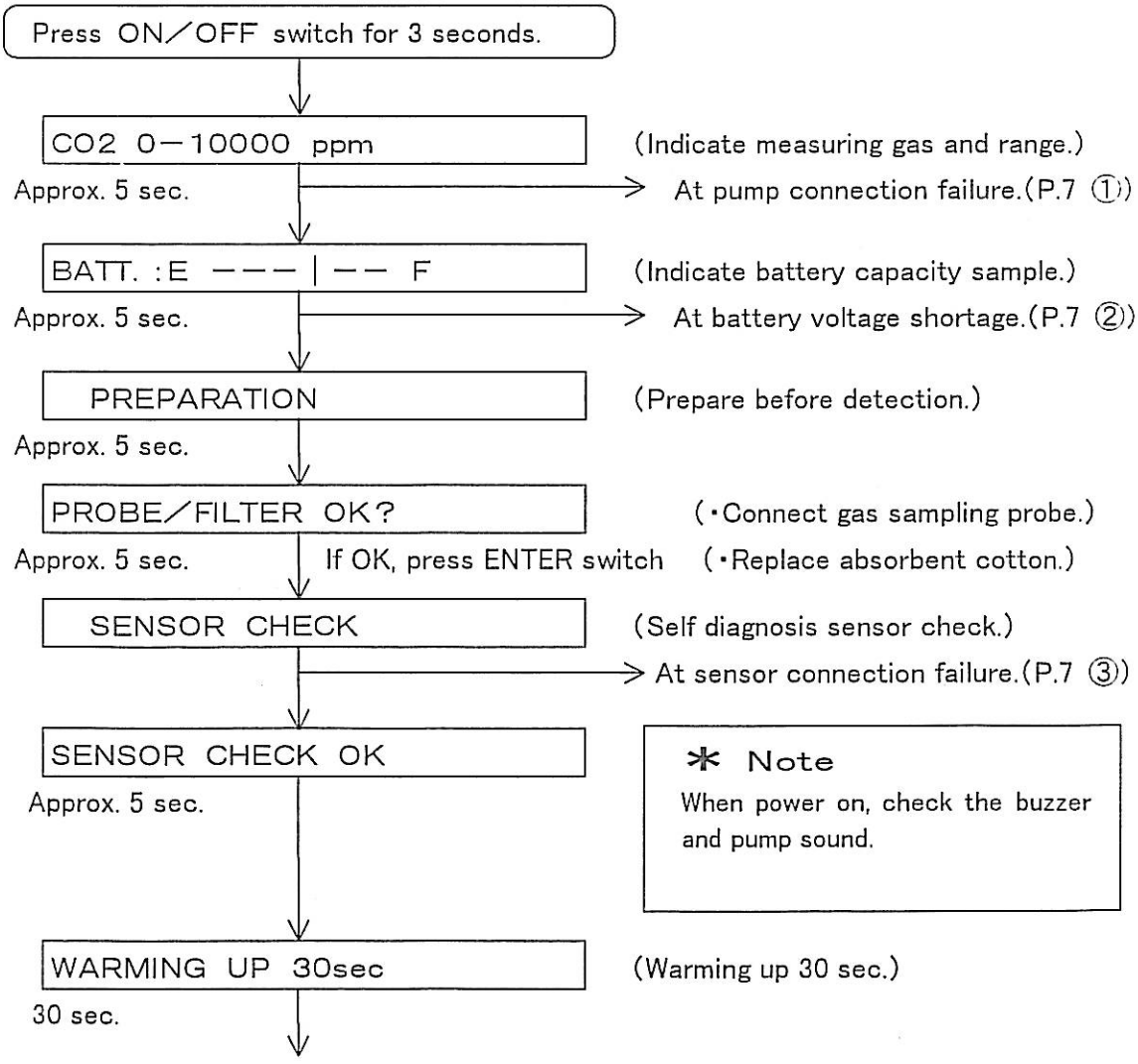


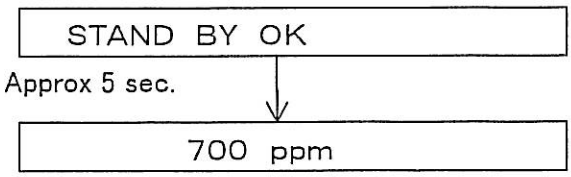
Caution

- Connect gas sampling probe and gas sampling hose (spiral) to the instrument (gas inlet) firmly.
  Otherwise, correct measuring can not be performed.
- Keep the gas sampling probe (with absorbent cotton) on the instrument all the time during gas detection.
- Without filter, the dust, water and oil are sucked in to the instrument. These material might be a cause of breakdown.

2−2. How to start

By pressing ON/OFF switch for 3 seconds, the power turns on and starts gas detection, through following procedure, battery voltage check, tube/absorbent cotton check and sensor connection check. The starting flow is as follows.





(Preparation is end.)

(Detection starts.
<Gas concentration indicates>)

① Indication and action at pump connection failure.(Refer to 3-1.)

FAIL PUMP (Buzzer: Continuous)

② Indication and action at battery voltage shortage.(Refer to 4-1.)

REPLACE BATTERY (Buzzer: Continuous)

③ Indication and action at sensor connection failure.(Refer to 3-1.)

FAIL SENSOR (Buzzer: Continuous)

2−3 How to detect

After detection starting, the display indicates detected current CO2 concentration value. Though it indicates some hundreds ppm value, it is not trouble/breakdown, but the normal CO2 concentration in the atmosphere. Normal CO2 concentration is different depending upon the condition. Followings is the example of CO2 concentration in the atmosphere.

	CO2 concentration
Inside room	500 ～ 1,500ppm (It may indicate over 2,000 ～ 5,000ppm near an oil stove etc.)
Outside room	300～500ppm (It may indicate over 50,000ppm by auto emission.)
Human expiration	Max. 5vol%(50,000ppm)

(1) Normal detection (moment value detection)

At the place where want to check the CO2 concentration, start measuring and read the indication after over 20 seconds. In order to measure more accurately, read the indication after over 30 seconds.

- Normal indication: 700 ppm
- Indication increments 0—2000ppm : 10ppm
  2000—5000ppm : 25ppm
  5000—10000ppm : 50ppm
- Indication below "0": 0 ppm : Blinking "0".
- Indicate "OVER", in case of over 10,050ppm.

: OVER ppm

Danger

Do not breath in the exhaust gas of the instrument at all, as the exhaust gas may be oxygen deficiency or toxic gas.
In such case, exhaust the gas to the place where can be safe.

Caution

- Do not let water or oil sucked into the instrument. If it should be sucked, the pump or sensor shall be failed.
- When measure, check the running sound of pump and the sucking condition at gas inlet.
  It cannot be measured at stop of pump operation.
- Absorbent cotton filter must be put inside of gas sampling probe. Otherwise, the pump power shall be down and the instrument shall be breakdown.
- Do not block the gas outlet because the display reading may drift.

(2) Average value measuring

Average value can be measured by pressing [AVG. ST] switch while displaying gas concentration.

- Three kinds of measuring time are available, [1 minute] · [3 minutes] · [15 minutes].
- The result of measured average value is memorized after power off.
- Measuring time is a little bit different from the atmosphere temperature.
- By starting measuring average value newly, the previous data is cleared, and new measured average value is memorized. If cancel new average value measuring, the previous data is kept.
- In case of over 10,000ppm (Indicates "OVER"), the all data is measured "10,050ppm".

① [700 ppm] (Gas concentration indication.)

Press [AVG. ST] switch.

② [1min:START→ENT] (Blinking measuring time.)

By [+] [−] switches, measuring time can be selected.

③ [3min:START→ENT] (Blinking measuring time.)

Press [ENTER] switch, start measuring average value.

④ [3min: 800 ppm] (Measuring average value.)

↑ Time count down.

Indicate moment concentration value.

⑤ [58sec: 880 ppm] (Measuring average value.)

Change over from "min" to "sec" when the rest time becomes within 1 minute.

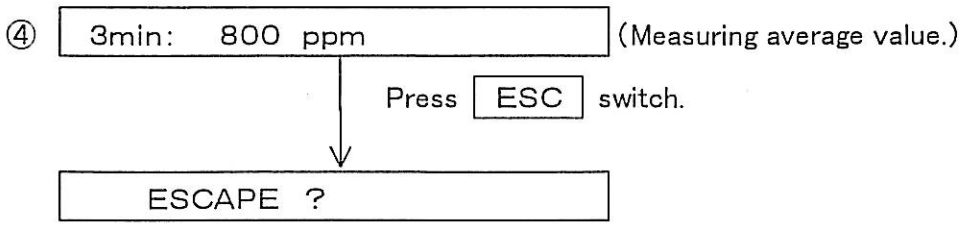
⑥ [AVG. : 850 ppm] (Measuring average value end.)

Press [ESC] switch, return to gas concentration indication. (to ①)

Press [AV/PK] switch, change over to peak value indication. (to (4)-③)

Press [AVG. ST] switch, change over again to measuring average value. (to ②)

In order to cancel measuring average value, press [ESC] switch while ④, ⑤.



Press [ESC] switch, keep measuring average value. (to ⑤)

Press [ENTER] switch, cancel and return to the beginning (measuring mode). (to ①)
The previous data (peak value and average value) are kept.

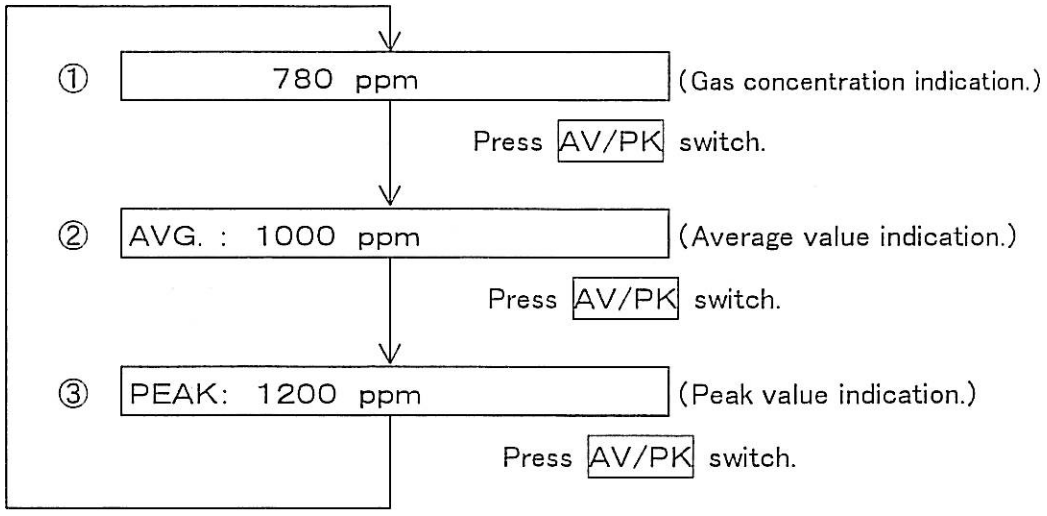
(3) Measuring peak value

- Peak value is memorized automatically from time to time, after power turning on and starting measuring. Peak value can be shown by pressing [AV/PK] switch.
- After measuring average value, the previous data of peak value is cleared.

(4) Showing peak value and average value

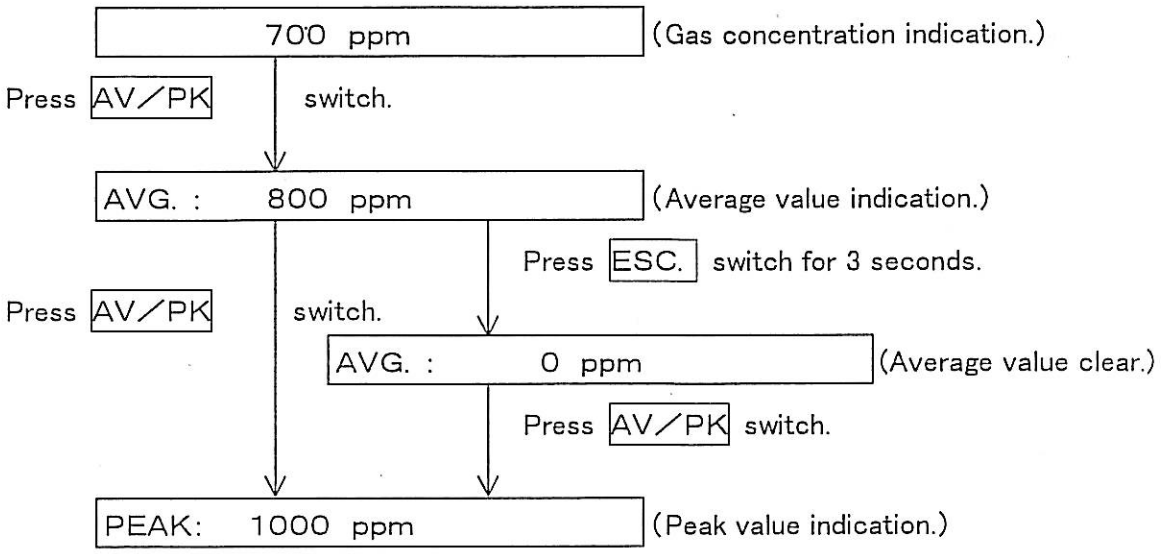
Peak value and average value can be shown in turn by pressing [AV/PK] switch while measuring.

Return to measuring automatically in case of no operation of [AV/PK] switch for 20 seconds.



(5) Clearing average value and peak value

Peak value and average value are cleared by pressing [ESC.] switch for 3 seconds.



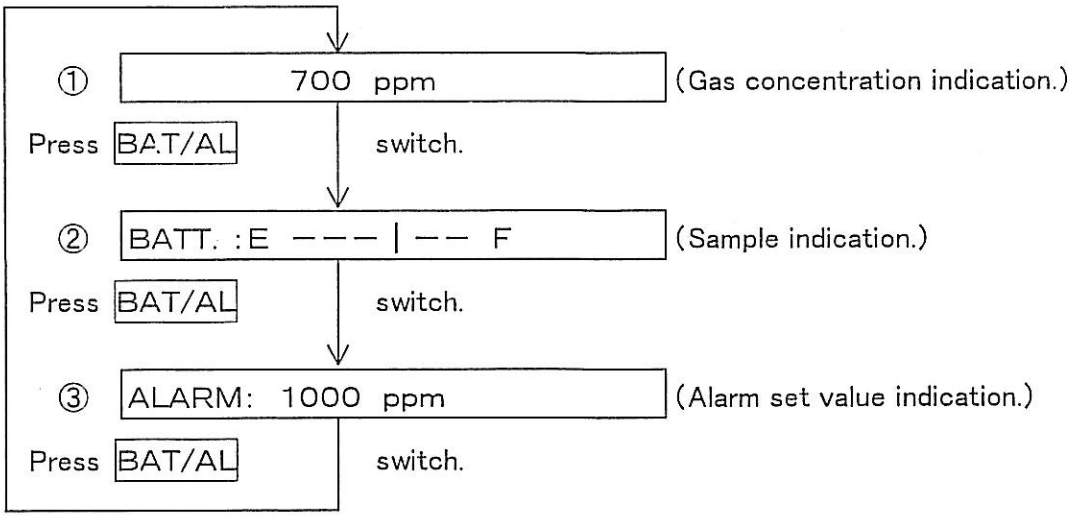
Clearing peak value is as well.

Peak value is renewed from time to time once return to the measuring mode. And after the measuring average value, the memorized data of peak value before is cleared.

(6) Showing battery voltage (sample) and alarm set value

Current battery voltage (sample) and alarm set value can be shown by pressing [BAT/AL] switch while measuring.

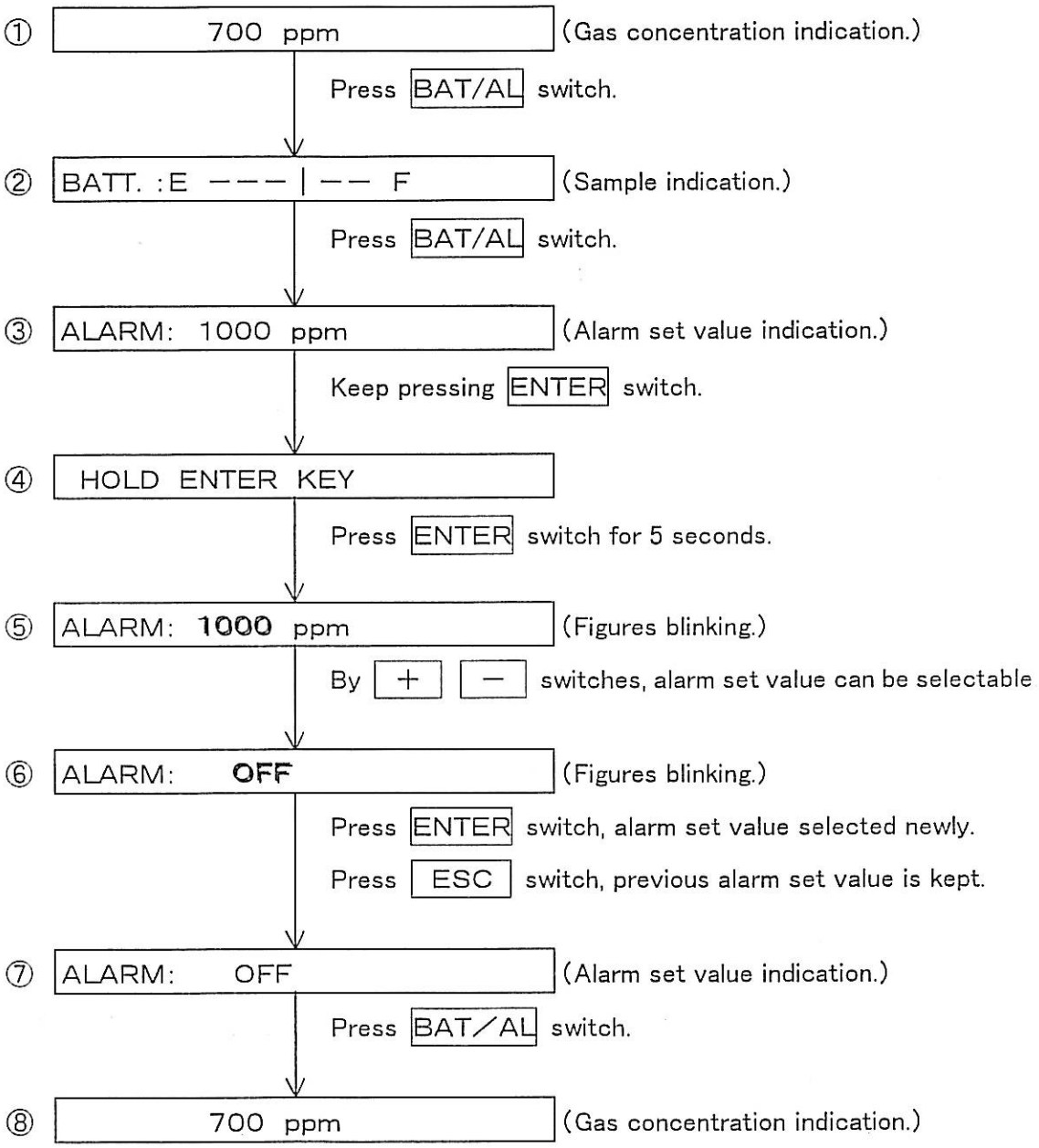
Return to measuring automatically, in case of no operation of [BAT/AL] switch for 20 seconds.



(7) Alarm set value selection

The figures of alarm set value start blinking by pressing [ENTER] switch for 5 seconds, alarm set value can be selectable.

Available alarm set values are following 3 kinds. [1000ppm] · [5000ppm] · [OFF]



2—4 How to finish

How to turn off.

By pressing [ON/OFF] switch for 5 seconds, the power turns off.

The buzzer alarms approx. 15 times while pressing [ON/OFF] switch.

3. Alarm/Self-diagnosis

3－1 Kinds of alarm and pattern

The function of gas alarm and self-diagnosis are available to this model. Each alarm is informed by lamp, buzzer and indication.

Kinds of alarm and pattern

Condition		Lump	Buzzer	Indication
When power on	Battery voltage shortage	OFF	Continuous	"REPLACE BATTERY"
	Sensor connection failure	OFF	Continuous	" FAIL SENSOR "
	Pump connection failure	OFF	Continuous	" FAIL PUMP "
	System error	OFF	No buzzer	" SYSTEM ERROR "
During measuring	Gas alarm	ON	Continuous	Indicates current concentration value
	Battery voltage shortage pre-alarm	OFF	Intermittent (30 sec. interval)	Blinking "B" on left side of display.
	Battery voltage shortage alarm	OFF	Continuous	"REPLACE BATTERY"
	Zero calibration failure	OFF	No buzzer	" FAIL ZERO "
	Span calibration failure	OFF	No buzzer	" FAIL SAPN "

3－2 Treatment for alarm/Self-diagnosis

(1) Battery voltage shortage("REPLACE BATTERY")

Replace 4 pcs of batteries with new one according to "4－1. Replacing battery".

(2) Sensor connection failure("FAIL SENSOR")

In case of dropping, giving hard impact and long time usage, it might indicate this error message.

(3) Zero calibration failure("FAIL ZERO")

In case of not drawing zero gas correctly and of sucking water etc., it might indicate this error message. Correct zero calibration should be done.

(4) Span calibration failure("FAIL SPAN")

In case of not drawing calibration gas correctly and sucking water etc., it might indicate this error message. Correct span calibration should be done.

(5) Pump connection failure("FAIL PUMP")

In case of dropping, giving hard impact and long time usage, it might indicate this error message.

(6) System error ("SYSTEM ERROR")

In case of affected heavy noise, it might indicate this error message. Power turns on again. If indicating same error message again, please consult RIKEN KEIKI or our representatives.

4. Maintenance

4－1 Replacing battery

Replace all 4 batteries with new one according to following procedure.

(1) Confirm the battery is run down.
Power off, in case of power on.

(2) Remove the instrument from carrying case.

(3) Slide the battery cover with pushing softly.

(4) Remove old batteries 4 pcs, and install new one taking care of direction.

> ✳ Note
>
> - Specified battery must be used.
> - It is easy to remove the battery from positive (+) side, install the battery from negative (−) side.

(5) After replacing battery, be as before.

4－2 Zero calibration

In order to keep the quality of this instrument, zero calibration must be done before start measuring.
"Absorption tube" is required for zero calibration. Following two methods are available for zero calibration.
In order to make calibration more accurately, ② is better.

① Using absorption tube (with absorbent agent)
② Using zero gas with sampling bag

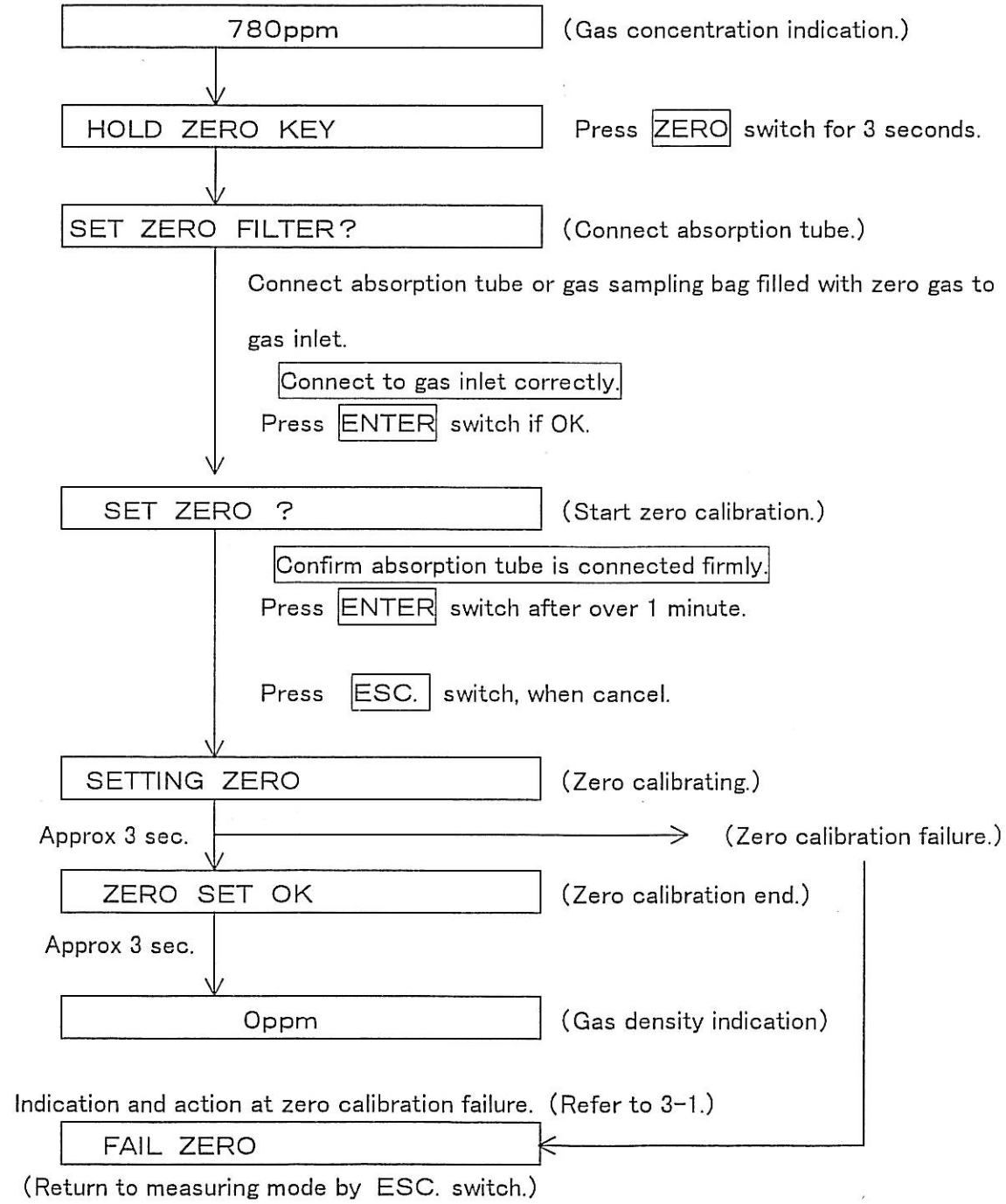
Zero gas and gas sampling bag are optional accessories.

(1) Prepare absorption tube (with absorbent agent) or zero gas and gas sampling bag for zero calibration.

(2) Remove gas sampling probe, gas sampling hose (spiral), prepare absorption tube or gas sampling bag to be able to connect to gas inlet.

(3) Power turns on, and make zero calibration.

Zero calibration procedure is as follows.



Caution

If zero calibration is done with sucking CO2 gas in the atmosphere directly, correct detection can not be performed. Normally, CO2 exists 300ppm ～500ppm in the air. (Refer to 2－3.)

＊ Note

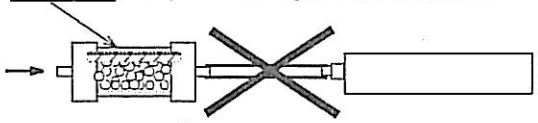
In case of using zero gas.

- Gas sampling bag should be filled with zero gas.
- Before filled with zero gas, gas sampling bag should be empty fully by using sampling pump of this instrument etc.

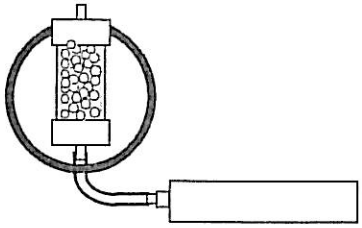
In case of using absorption tube

- Absorption tube should be filled with absorbent agent in advance.
- When filling absorbent agent to the tube, fill up closely, and fix them by absorbent cotton.
- Remove the cap of absorption tube, when use.
- Attach the cap with absorption tube after use, in order to cut off the porous contact with atmosphere. The capacity of absorption goes down due to absorbing CO2 gas in the atmosphere.
- Store absorption tube in a dry room where direct sunshine does not reach.
- Absorption tube should be used vertically. If use it horizontally, CO2 in air may not be adsorbed.

Wrong　This part, air pass through, CO2 can not be absorbed.



Correct



- The number of times for absorption tube usage capability is depending upon CO2 concentration in sample gas, storage condition, closeness, temperature and humidity.
  In order to make zero calibration more accurately, it is better to use new absorbent agent or use zero gas.
  Following table is the sample of number of times for 1 minute sample drawing/time. In case that CO2 concentration in the atmosphere can not be known, replace with new one earlier than followings.

CO2 concentration in the atmosphere	Expected number of times for usage capability.
500ppm	Approx. 1000 times
1000ppm	Approx. 500 times
2000ppm	Approx. 200 times
4000ppm	Approx. 100 times.

- Do not draw high concentration CO2 gas during zero calibration.
- Do not blow human expiration to gas inlet during zero calibration.

✳ Note

- Press ESC switch when cancel previous operation.
  However, it is not available after setting operation.

4—3. Span calibration

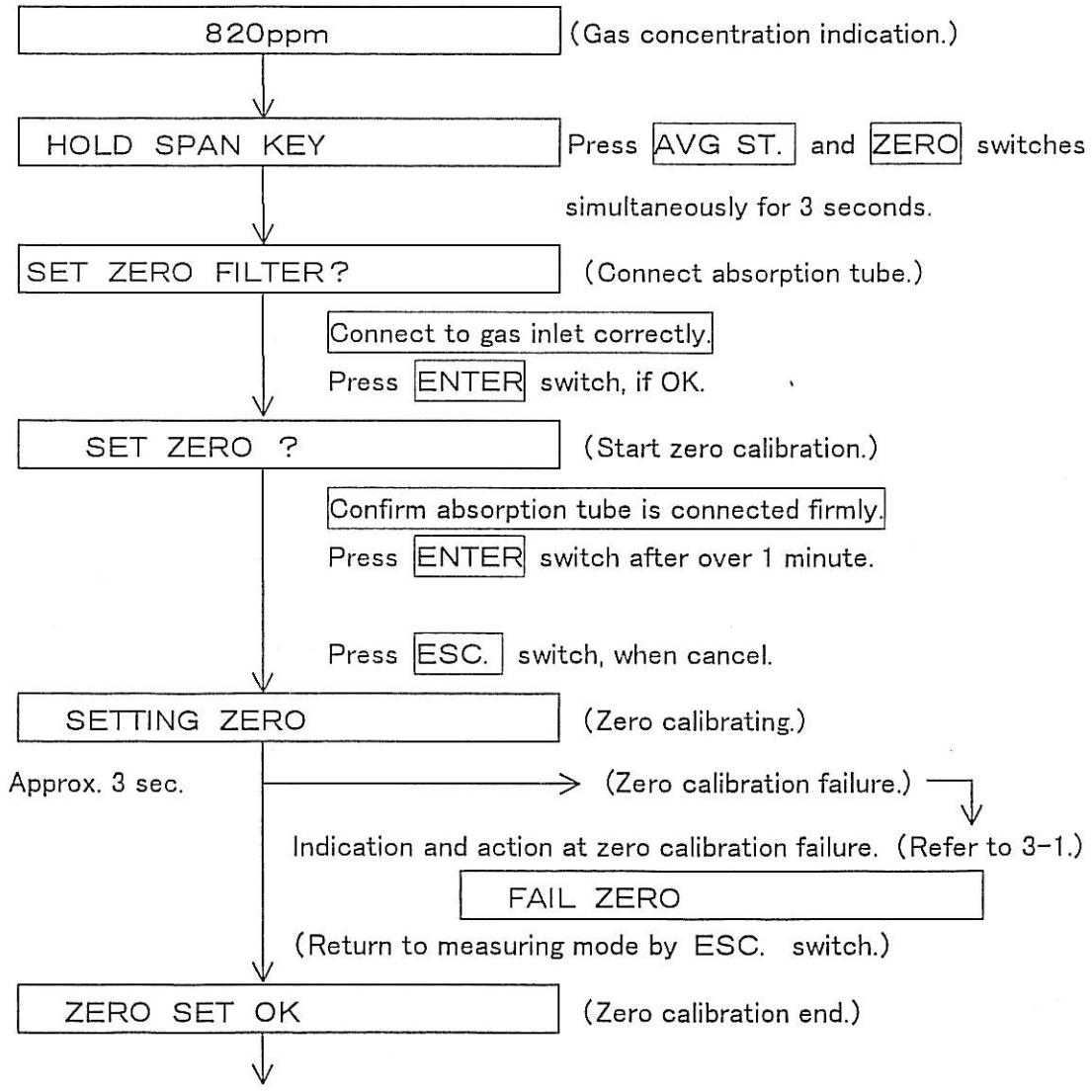
Regular span calibration (over 1 time every 6 months) must be done after long time no use and/or requiring more accurate measuring.

Span calibration is done in following order [Preparation] → [Zero calibration] → [Span calibration] .

(1) [Preparation] Prepare absorption tube or zero gas, span gas and gas sampling bag. Zero gas, span gas and gas sampling bag are optional accessories.

(2) [Zero calibration] First of all, make zero calibration.
For zero calibration before span calibration, use absorption tube with absorbent agent. In order to make span calibration more accurately, it is better to use zero gas.

(3) [Span calibration] Secondly, make span calibration. Introduce span gas to gas sampling bag, make span calibration according to following procedure.



SPAN CAL. ? (Start span calibration.)

Press ENTER switch.

SET SPAN GAS ?

(Press ENTER switch after introducing calibration gas to gas inlet.)

Make sure introducing calibration gas.

ADJUST SPAN ? (Calibration → Press ENTER switch.

Cancel → Press ESC. switch.)

2300ppm ADJ>−/+ (Indication value increase gradually.)

Wait for over 1 minute after start introducing calibration gas.

5000ppm ADJ>−/+ (Adjust to specified gas concentration of calibration gas by −, + switches.)

SETTING SPAN (Span calibrating.) → Span calibration failure

Span calibration complete correctly.

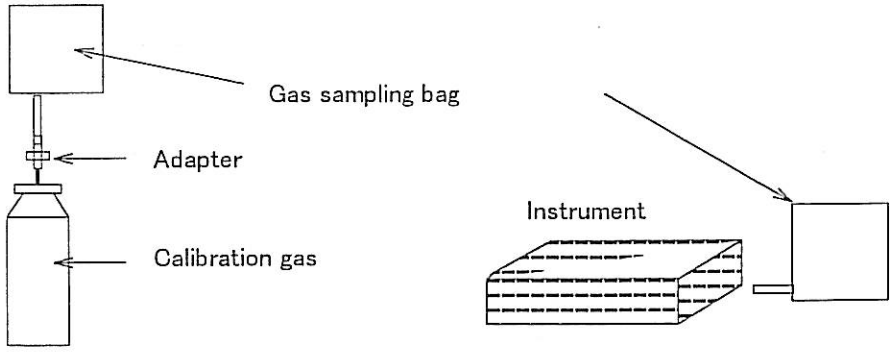
SPAN SET OK (Span calibration end.)

830ppm (Gas concentration indication.(current value))

(Indication and action at span calibration failure. (Refer to 3-1.))

FAIL SPAN

(Return to measuring mode by ESC. switch.)



Caution

Do not connect calibration gas bottle/cylinder to gas inlet directly.
It might become cause of break down inside of instrument.

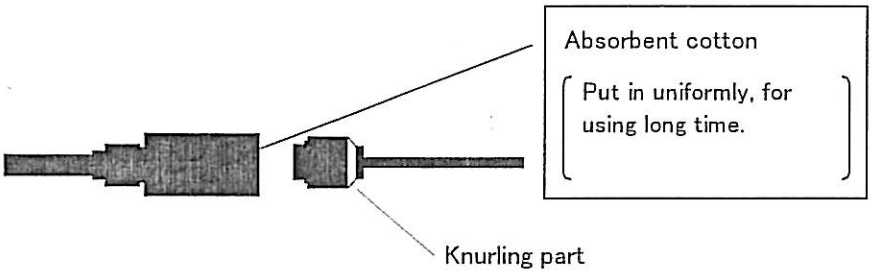
4－4 Replacing absorbent cotton

Check the absorbent cotton inside of gas sampling probe, and replace with new one if it is dirty.

(1) Remove knurling part of gas sampling probe.

(2) Pick out absorbent cotton inside of gas sampling probe.

(3) Put in new absorbent cotton inside of gas sampling probe uniformly, and attach knurling part of gas sampling probe as before.



Caution

- Put in absorbent cotton uniformly.
- Shortage of absorbent cotton might become cause of breakdown because of sucking dust in the air.
- Too much absorbent cotton might become cause of lower pump suction rate. It makes response later, and correct measuring can not be performed.
- Leave absorbent cotton with absorbing water, oil and dust, it might become cause of breakdown. In such case, replace it with new one.
- Protective filter is set inside of gas inlet. Do not remove it except when maintenance. If it is dirty, replace it with new one. Protective filter is optional accessory.

4－5 Daily maintenance/Regular maintenance

(1) Daily maintenance

- Check any defect on switches, lump, display and body.
- Replacing absorbent cotton inside of gas sampling probe.
- Check pump operation.(Normal pump sound.)
- Check battery voltage.

(2) Regular maintenance

Regular maintenance at manufacture/representative one time every year is recommended.
Ask RIKEN KEIKI or representative.

4－6 Replacing parts

Following parts have each lifetime. Replace them with new one regularly.

Absorbent cotton	:	Any time, if it is dirty
Pump	:	Approx. 1 year (Depending upon using frequency.)
Protective filter	:	Approx. 1 year (Depending upon using frequency)
Sensor	:	Approx. 5 years. (Depending upon using frequency)

4－7 Storage/Treatment for not being used long time

Store in dry room where direct sunshine does not reach, after replacing absorbent cotton.
Remove battery if it is not used for over 1 month.

5. Disposing the instrument

Any harmful material is not used for the instrument. When disposing the instrument, treat it as general unburnable waist.

6. 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 frequency.

Condition	Cause	Treatment
Power does not turn on.	• Empty batteries. • Battery consumed up. • Wrong battery direction.	Install battery correctly, referring "4-1. Replacing battery".
	• Too short pressing time of ON/OFF switch.	Keep on pressing ON/OFF switch for approx. 3 seconds (until start displaying).
Pump does not work.	• Low battery voltage.	Replace battery with new one (refer to 4-1.), turn power on again (refer to 2-2.).
	• Absorbent cotton is clogged.	Replace absorbent cotton with new one (refer to 4-4.).
	• Protective filter inside of gas inlet is clogged.	Replace protective filter with new one.
	• Display "FAIL PUMP". By giving an excessive shock/impulse to the instrument such as dropping/throwing etc and by using for a long time period, such message may be displayed.	Carry out the daily check or regular check (refer to 4.).
No suction.	• Absorbent cotton and/or tube at the side of gas in are detached or clogged.	Check the clog/twist etc of absorbent cotton and tube (refer to 2-1.).
Indicate below 300ppm by drawing atmosphere.	• Normally, CO2 concentration in the atmosphere is 300 ~ 500ppm (outside or room). The message may be displayed in case that atmospheric pressure and/or temperature change abnormally, or in case of no calibration for a long time.	Carry out zero calibration and/or span calibration in normal atmospheric pressure and temperature.
	• The massage may be displayed in case that zero and/or span calibration are carried out correctly.	Use calibration gas and/or absorption tube correctly.

7. Caution of usage

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 is a precision apparatus. Once it get shocked, the ability cannot be maintain.
- Be not splashed with water. It might be a cause of breakdown as the instrument body is not the water proof structure.
- Do not use transceivers close to the instrument. If it received 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 condense, the accurate detection cannot be performed.
- Internal filter and absorbent cotton must be attached when operation.

8. Specifications

8－1 Specifications

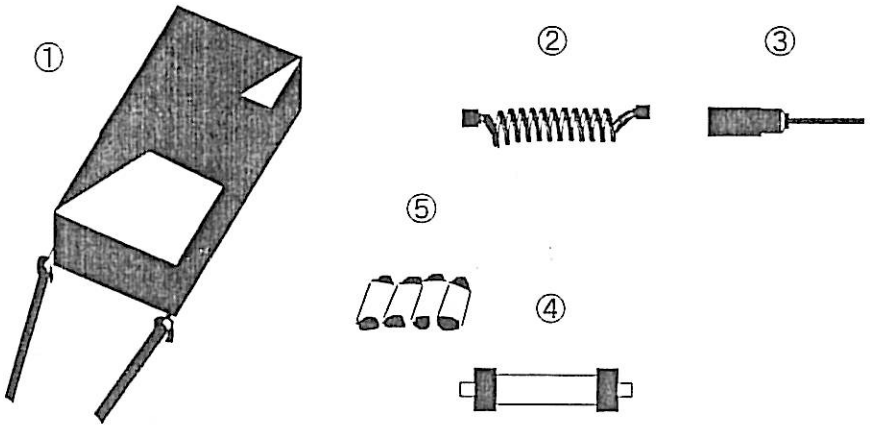
Model	RI－85	
Measuring gas	Carbon dioxide (CO2) in air	
Detection principle	Non-Dispersive Infrared Detection (NDIR)	
Measuring range	0～10,000ppm ※	
Display	Current reading, Average value, or Peak reading (Push button select).	
Alarm function	Alarm set value	1,000ppm, 5,000ppm, OFF(selectable)
	Alarm display	ALARM lamp and buzzer (non-latching)
Average value measuring time	Selected from 1 minute, 3 minutes and 15 minutes.	
Peak value indication	Peak value can be reset.	
Repeatability	±3% of F. S. (with constant conditions)	
Response time	Within 15 seconds to 90% response(T90, from gas inlet)	
Sampling method	Sample-drawing with internal pump	
External output signal (Option)	0～1VDC linear output (Load resistance : Minimum 500kΩ) (The plug for external output signal is option)	
Ambient temperature and humidity	－10 ～ 40℃, below 90%RH(non-condensing)	
Power source	AA size dry battery x 4 pcs.	
Continuous operation	Approx. 12 hours (Alkaline batteries, no alarms or no illumination, room temp.)	
Design/structure	Non-explosion proof design	
Dimensions	Approx. 85(W)x190(H)x40(D)mm	
Weight	Approx. 500g(instrument only including batteries.)	

※: Resolution : 10ppm/digit from 0 – 2,000ppm
25ppm/digit from 2,000ppm – 5,000ppm
50ppm/digit from 5,000ppm – 10,000ppm

8－2 Accessories

Standard accessories:

①Carrying case ②Gas sampling hose (spiral) ③Gas sampling probe(with absorbent cotton) ④Absorption tube ⑤AA size dry battery ⑥Instruction manual



Optional accessories:

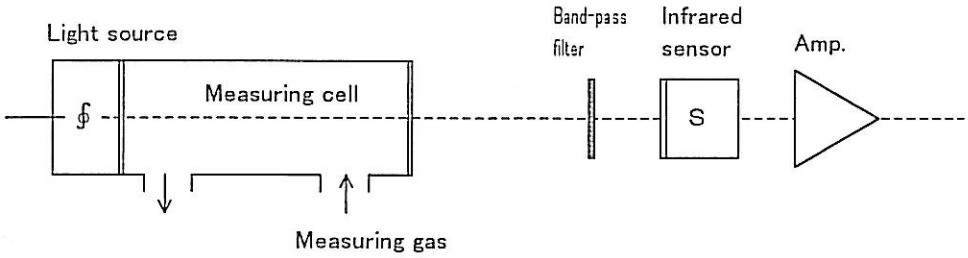
①Gas sampling bag ②Absorbent agent for absorption tube ③Plug for external output signal ④Protective filter

9. Detection principle

Model RI-85 is based of NDIR method (Non-disparsive Infrared) and this structure is shown below.

The infrared beam emitted from the light source passes through the measuring cell, and optical band pass filter which can pass the absorption wave of measuring gas and attains to the infrared sensor. The amount of infrared attaining to the infrared sensor through measuring cell is absorbed by the measuring gas when measuring gas is supplied into the measuring cell and will decrease according to its cencentration. The variable amount of infrared is measured by the infrared sensor and it is displayed as gas concentration.

Then, there is no sensitivity against other gases which have the different absorption wave from the measuring gas. And, there is no sensitivity against N2 and H2 etc which cannot absorb infrared. There is not poisoning material to be absorbed and almost no sensitivity drop on this detection principle.



RKI INSTRUMENTS
Gas Detection for Life!

PRODUCT WARRANTY
1/1/2002

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.