PT0E-1350

Portable Multi-Gas Monitor

GX-6000

Operating Manual

RIKEN KEIKI Co.,Ltd.

2-7-6 Azusawa, Itabashi-ku, Tokyo, 174-8744, Japan
Phone : +81-3-3966-1113
Fax : +81-3-3558-9110
E-mail : intdept@rikenkeiki.co.jp
Web site : http://www.rikenkeiki.co.jp/english/

Contents

1

Outline of the Product

Preface

Thank you for choosing our portable multi-gas monitor GX-6000 (hereinafter referred to as "gas monitor"). First of all, please check that the model number of the product you purchased matches the model number of the product targeted by this manual.

This manual contains handling methods and specifications for proper use of this product. Not only the first-time users but also the users who have already used the product must read and understand this manual before using it.

Note that the contents of this manual are subject to change without notice for product improvement. Also, any copying or reproduction of this manual, in whole or in part, without permission is prohibited.

Regardless of warranty period, we shall not make any indemnification for accidents and damage caused by using this gas monitor.
Make sure to read the warranty policy specified on the warranty.

Purpose of use

This product is a pump suction type multi-gas monitor that enables simultaneous monitoring of up to six different gases: oxygen in the air, combustible gas <%LEL>, toxic gases (carbon monoxide and hydrogen sulfide) and two of the toxic gases (volatile organic compound, sulfur dioxide, etc.).
The combustible gases detected by this gas monitor are general combustible gases used in ordinary factories, oil tankers, etc., that is HC (displayed in isobutane conversion) or CH4 (methane).

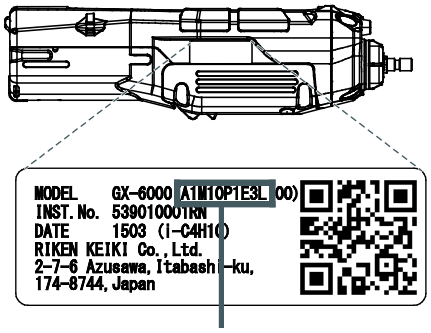
Note that detection results of the gas monitor are not intended to guarantee life or safety in any way.

A combination of gases to be detected varies by the specification of the gas monitor. Check the gases to be detected before use and conduct gas detection properly in accordance with purposes.
Check the gases to be detected by your GX-6000 in "Checking gases to be detected" (P. 4).

In addition to this operating manual, an operating manual for the data logger management program (optional) is available. Contact RIKEN KEIKI if it is needed.

Checking gases to be detected

A combination of gases to be detected varies by the specification of the gas monitor.
Check the gases to be detected by your GX-6000 with the nameplate attached to the side of the product before use.



Check the gases to be detected with the product code

A (Fixed) ○① ○② ○③ ○④ ○⑤ ○⑥ ○⑦ ○⑧ L (Fixed)

Position	Symbol	Gas to be detected
(1)	1	Oxygen (O2)
	0	(O2 out of detection targets)
(2)	H	Combustible gas (HC) <%LEL>
	M	Combustible gas (CH4) <%LEL>
	0	(HC/CH4 <%LEL> out of detection targets)
(3)	1	Hydrogen sulfide (H2S)
	0	(H2S out of detection targets)
(4)	1	Carbon monoxide (CO)
	0	(CO out of targets)
(5) (6)	P1	Volatile organic compound (VOC) <ppb>
	P2	Volatile organic compound (VOC) <ppm>
(7) (8)	E1	Sulfur dioxide (SO2)
	E2	Nitrogen dioxide (NO2)
	E3	Hydrogen cyanide (HCN)
	00	(VOC/SO2/NO2/HCN out of detection targets)

Example) When "1M10P1E3" is indicated, the gases to be detected are "O2, CH4 <%LEL>, H2S, VOC (ppb) and HCN".

Definition of DANGER, WARNING, CAUTION and NOTE

Throughout this manual, the following indications are used to ensure safe and effective work.

 **DANGER**	Indicates that improper handling may cause death or serious damage on life, health or assets.
 **WARNING**	Indicates that improper handling may cause serious damage on health or assets.
 **CAUTION**	Indicates that improper handling may cause minor damage on health or assets.
NOTE	Indicates advice on handling.

2

Important Notices on Safety

To maintain the performance and use the gas monitor safely, observe the following instructions of DANGER, WARNING and CAUTION.

2-1. Danger cases

DANGER

About use

- While conducting measurement in a manhole or confined space, do not lean over or look into the manhole or closed space. It may lead to dangers because oxygen-deficient air or other gases may blow out.
- Oxygen-deficient air or other gases may be discharged from the gas exhausting outlet. Never inhale the air or gases.
- High-concentration (100% LEL or higher) gases may be discharged from the gas exhausting outlet. Never use fire near it.

WARNING

- If any abnormality is found on the gas monitor, promptly contact RIKEN KEIKI. Visit our Web site to find your nearest RIKEN KEIKI office.
  Web site: http://www.rikenkeiki.co.jp/

2-2. Warning cases

WARNING

- Sampling point pressure
  The gas monitor is designed to draw gases around it under the atmospheric pressure. If excessive pressure is applied to the gas inlet and outlet of the gas monitor, detected gases may leak out from its inside and may cause dangerous conditions. Be sure that excessive pressure is not applied to them while used.
- Handling of sensor
  Never disassemble the electrochemical type sensor or galvanic cell type sensor. Inside electrolyte may cause severe skin burns if it contacts skin. Also, it may cause blindness if it contacts eyes. If electrolyte is adhered on your clothes, that part on your clothes is discolored or its material is decomposed. If contact occurs, rinse the area immediately with a large quantity of water.
- Fresh air adjustment in the atmosphere
  When the fresh air adjustment is performed in the atmosphere, check the atmosphere for freshness before beginning the adjustment. If interference gases exist, the adjustment cannot be performed properly, thus causing erroneous detection and leading to dangers when the gas leaks.

WARNING

- Response to gas alarm
  Issuance of a gas alarm indicates that there are extreme dangers. Take proper actions based on your judgment.

Panic alarm and man-down alarm

- Panic and man-down alarms are intended to assist users and people around in making a decision and not intended to guarantee life or safety. Do not depend only on this function to use the gas monitor.
  (Normally the man-down alarm is set to OFF and unavailable. To use this function, please contact RIKEN KEIKI.)
- If a panic or man-down alarm is triggered, the people around must take an appropriate action after confirming the situation.

Battery level check

- Before use, check that there remains sufficient battery power. When the gas monitor is used for the first time or is not used for a long period, the batteries may be exhausted. Replace them with new ones before use.
- If a low battery voltage alarm is triggered, gas detection cannot be conducted. If the alarm is triggered during use, turn off the power and promptly charge or replace the batteries in a safe place.

Others

- Do not throw the gas monitor into fire.
- Do not wash the gas monitor in a washing machine or ultrasonic cleaner.
- Do not block the buzzer sound opening. No alarm sound can be heard.
- Do not remove batteries while the power is ON.

2-3. Precautions

CAUTION

- Do not use the gas monitor where it is exposed to oil, chemicals, etc. Do not submerge the gas monitor under water on purpose.
  - Do not use in a place where the gas monitor is exposed to liquids such as oil and chemicals.
  - The gas inlet and outlet are not water-proof. Be careful not to let water such as rainwater get into these parts. Because this may cause trouble and gas cannot be detected.
  - Do not place the gas monitor where water or dirt gets accumulated. The gas monitor placed at such a location may malfunction due to water or dirt that gets into the buzzer sound opening, gas inlet, etc.
  - Note that drawing in dirty water, dust, metallic powder, etc. will significantly deteriorate the sensor sensitivities. Be very careful when the gas monitor is used in an environment where these elements exist.
- Do not use the gas monitor in a place where the temperature drops below -20ºC or rises over 50ºC.
  - The operating temperature of the gas monitor is -20 to +50ºC. Do not use the gas monitor at higher temperatures, humidities and pressures or at lower temperatures than the operating range.
  - Avoid long-term use of the gas monitor in a place where it is exposed to direct sunlight.
  - Do not store the gas monitor in a sun-heated car.
- Observe the operating restrictions to prevent condensation inside the gas monitor. Condensation formed inside the gas monitor causes clogging or gas adsorption, which may disturb accurate gas detection. Thus, condensation must be avoided. In addition to the installation environment, carefully monitor the temperature/humidity of the sampling point to prevent condensation inside the gas monitor. Please observe the operating restrictions.
- Do not use a transceiver near the gas monitor.
  - Radio wave from a transceiver or other radio wave transmitting device near the gas monitor may disturb readings. If a transceiver or other radio wave transmitting device is used, it must be used in a place away from the gas monitor where it disturbs nothing.
  - Do not use the gas monitor near a device that emits strong electromagnetic waves (high-frequency or high-voltage devices).
- Verify that the pump operation status display is rotating before using the gas monitor. If the pump operation status display is not rotating, gas detection cannot be performed properly. Check whether the flow rate is lost.

CAUTION

- Verify that the operation status display is blinking before using the gas monitor.
  If the operation status display is not blinking, gas detection cannot be performed properly.
- Never fail to perform a regular maintenance.
  Never fail to perform a regular maintenance for the gas monitor to ensure safety. Continuing to use the gas monitor without performing maintenance will compromise the sensitivity of the sensor, thus resulting in inaccurate gas detection.
- Others
  - Pressing buttons unnecessarily may change the settings, preventing alarms from activating correctly. Operate the gas monitor using only the procedures described in this operating manual.
  - Do not drop or give shock to the gas monitor. The accuracy of the gas monitor may be deteriorated.
  - Do not use the gas monitor while charging it.
  - Whereas the gas monitor can detect oxygen, combustible gases, carbon monoxide, hydrogen sulfide, etc., the measurement environment may include gases that have harmful effects on the sensors of this unit.
    The gas monitor cannot be used in the presence of the following gases:
    (1) Sulfides (such as H2S and SO2) continuously existing in high concentrations
    (2) Halogen gases (such as chloride compounds and chlorofluorocarbons)
    (3) Silicone (Si compounds)
    Do not use the gas monitor in the presence of the above gases (such as high-concentration sulfides, halogen gases and silicone), which may shorten the sensor life significantly or cause malfunctions such as inaccurate readings.
    In case the gas monitor is used for detection in the presence of silicone, etc., be sure to check the gas sensitivities before using it again.
- Do not jab the buzzer sound opening with a sharp-pointed item. The unit may malfunction or get damaged, allowing foreign matters, etc. to get inside.
- Do not remove the panel sheet on the LCD display. The dust-proof performance will be deteriorated.
- Do not affix a label or the like on the infrared port. Infrared communications can no longer be conducted.
- Replacement of batteries
  - Turn off the power of the gas monitor before replacing batteries of the battery unit.
  - Replace all of the three batteries with new ones at one time.
  - Pay attention to the polarities of the batteries.
- Usage
  - In a low-temperature environment, the operating time is shortened due to the battery performance property.
  - At low temperatures, the responses of the LCD display may slow down.
  - Perform air calibration under pressure and temperature/humidity conditions close to those in the operating environment and in fresh air.
  - Perform air calibration after the reading is stabilized.
  - If there is a sudden temperature change of 15ºC or more between the storage and operational locations turn on the power of the gas monitor, let it stand for about 10 minutes in a similar environment to the operational location, and perform air calibration in fresh air before using it.
  - When cleaning the gas monitor, do not splash water over it or use organic solvents such as alcohol and benzine on it. The surface of the gas monitor may be discolored or damaged.
  - If the gas monitor is not used for a long time, turn on the power at least once every six months and check that the pump draws in air (about three minutes). The gas monitor, when not activated for a long time, may cease to work because of hardening of the grease in the pump motor.
  - If the gas monitor is not used for a long time, store it after removing the batteries. Battery leaks may result in fire, injury, etc.
  - When using the gas monitor after long-term storage, never fail to perform a calibration. For information on readjustment including calibration, please contact RIKEN KEIKI.

2-4. Safety information

The GX-6000 can measure maximum six gases with six sensors.
Standard unit measures four gases with four sensors for general combustible gases(LEL), Oxygen(O2), Hydrogen Sulfide(H2S) and Carbon Monoxide(CO).
For other remaining two slots are for Smart Sensors which consist of sensor part and circuit board and are connected with apparatus through digital signal output so various sensors. Two different types of detection principle are applied for Smart Sensors and up to two sensors can be installed into the GX-6000.
Gas is sampled by a built-in micro pump.
Either alkaline battery pack “BUD-6000” or lithium-ion battery pack “BUL-6000” can be installed into GX-6000.
Structure of battery unit allows end users to replace it by themselves.
It is supposed to replace the battery unit, alkaline battery, and charge the rechargeable battery at non-hazardous area. Also, Charging BUL-6000 should be done with a specific model, BC-6000 or SDM-6000.

Specification for safety

- •Ex ia IIC T4 Ga
- •  G Ex ia IIC T4 Ga
- •Ambient temperature range for use ： -20°C to +50°C

•Ambient temperature range during battery charging ： 0°C to +40°C

Electrical data

- •Power supply of Li-ion battery unit : BUL-6000
  Two parallel connected Li-ion cells used in battery pack BUL-6000 are from type Maxell INR18650PB1 or SDI INR18650-15M or SONY US18650VT3.
  Um=250V.
- •Power supply of alkaline battery unit : BUD-6000
  Powered by three series AA size alkaline batteries, model LR6 by TOSHIBA.

Certificate numbers

- •IECEx Certificate number ： IECEx *** yy.****
- •ATEX Certificate number ： ****yy ATEX****

ATEX/IECEx 取得後記載します。

List of standards

•IEC 60079-0：2011	・EN60079-0:2012
•IEC 60079-11：2011	・EN60079-11:2012
•IEC 60079-26：2006	・EN60079-26:2007

WARNING

- •DO NOT CHARGE IN HAZARDOUS LOCATION.
- •DO NOT CHARGE IT EXCEPT BY GENUINE CHARGER.
- •DO NOT REPLACE BATTERY UNIT IN HAZARDOUS LOCATION.
- •DO NOT REPLACE DRY BATTERIES IN HAZARDOUS LOCATION.
- •DO NOT ATTEMPT TO DISASSEMBLE OR ALTER THE INSTRUMENT.
- •USE ONLY WITH CONNECTED ALKALINE AA BATTERY, TYPE LR6 MANUFACTURED BY TOSHIBA.

INST. No. 0 0 0 0 0 0 0 0 0 0
A B C D E

A: Manufacturing year (0-9)
B: Manufacturing month (1-9,XYZ for Oct.-Dec.)
C: Manufacturing lot
D: Serial number
E: Code of factory

RIKEN KEIKI

RIKEN KEIKI Co.,Ltd.
2-7-6 Azusawa, Itabashi-ku, Tokyo, 174-8744, Japan
Phone : +81-3-3966-1113
Fax : +81-3-3558-9110 GIII
E-mail : intdept@rikenkeiki.co.jp
Web site : http://www.rikenkeiki.co.jp

3

Product Components

3-1. Main unit and standard accessories

Unpack and check the main unit and accessories.
If any part is missing, contact RIKEN KEIKI.

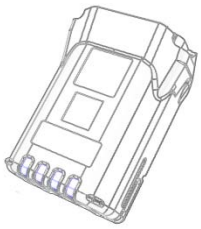
Main unit

See "3-2. Names and functions for each part" (P. 15) for names and functions of each part of the gas monitor and LCD display.

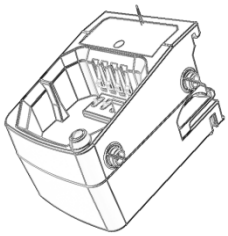
GX-6000 main unit

Standard accessories

Lithium ion battery unit (BUL-6000)
1 pc



Charger
1 pc

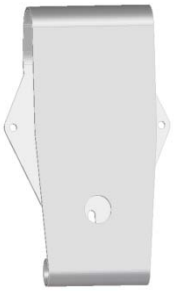


Rubber boot
1 pc

Protect the gas monitor from shocks by being hit, etc.

Belt clip
1 pc
(3 screws)

The gas monitor can be hung from a belt.

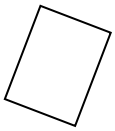


Taper nozzle
1 pc

Hand strap
1 pc

LCD protection film
1 pc

Protect the display from fine scratches.



Product warranty
Operating manual

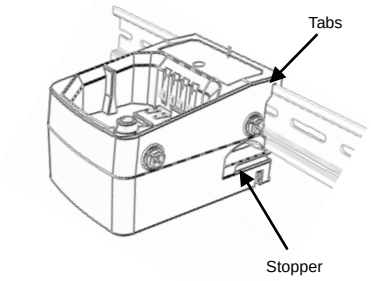
DANGER

About explosion-proof

- Do not modify or change the circuit, structure, etc.
- When measuring the oxygen concentration, do not measure anything but a mixture of air and combustible gases or vapors and toxic gases.
- When using the gas monitor in a hazardous area, take the following countermeasures for preventing dangers resulting from electrostatic charges.
  (1) Wear anti-static clothes and conductive shoes (anti-static work shoes).
  (2) For indoor use, use the gas monitor while standing on a conductive work floor (with a leakage resistance of 10 MΩ or less).
- The connectable battery unit is BUL-6000 or BUD-6000.
  The specifications of the gas monitor are as follows:
  Smart sensor 1 circuit: Allowable voltage of 4.95 V, allowable current of 0.770 A and allowable power of 0.787 W
  Smart sensor 2 circuit: Allowable voltage of 4.95 V, allowable current of 0.770 A and allowable power of 0.787 W
  Main circuit: Allowable voltage of 4.95 V, allowable current of 1.112 A and allowable power of 1.137 W
  Pump circuit: Allowable voltage of 4.95 V, allowable current of 0.770 A and allowable power of 0.787 W
  Motor circuit: Allowable voltage of 4.95 V, allowable current of 0.209 A and allowable power of 0.214 W
  Buzzer circuit: Allowable voltage of 4.95 V, allowable current of 0.355 A and allowable power of 0.363 W

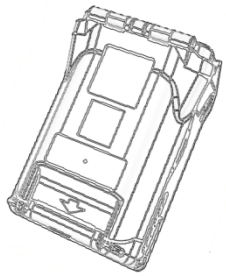
NOTE

- The charger can be attached to a DIN rail to use.
  Use a DIN rail of IEC715 top-hat type TH35.
- Hang the tab of the charger unit on the barb part of DIN rail, and then attach the stopper to the barb part of DIN rail.
- To release, push the stopper downward.



Optional items (sold separately)

Dry battery unit
(BUD-6000)
1 pc



AA alkaline
battery
3 pcs

Various filters

Data logger
management
program

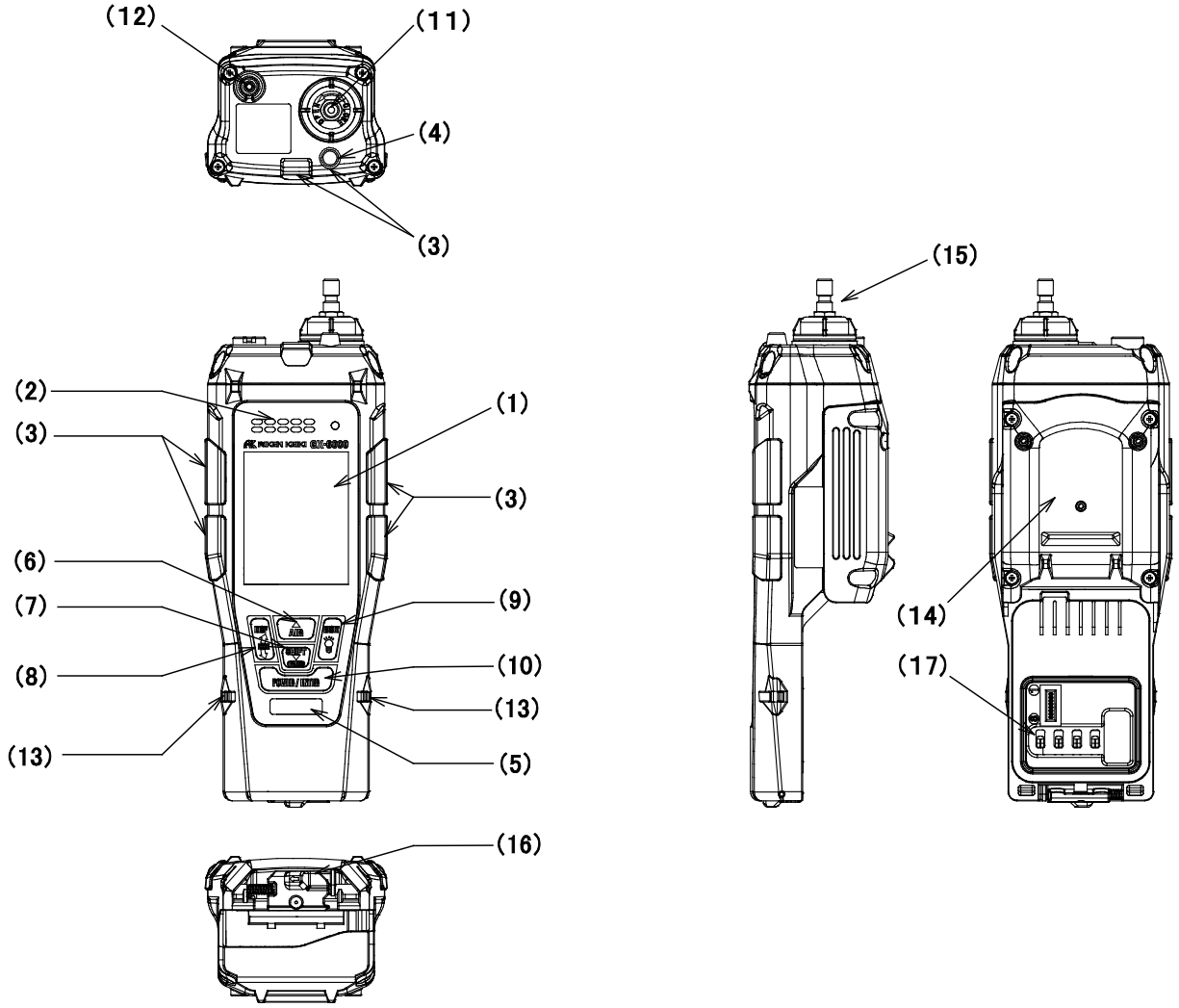
Various
calibration gases

Gas sampling
bag

3-2. Names and functions for each part

This section describes names and functions of main unit and battery unit parts and LCD display.

Main unit



Name	Main function
(1) LCD display	Displays the gas concentration and so on.
(2) Buzzer sound opening	Emits operation and judging sounds. (Do not block it.)
(3) Alarm LED arrays	The red lamp blinks in response to an alarm.
(4) Illumination lamp	Lights up by holding down the 💡 (illumination lamp) button.
(5) Infrared communication port	Used to carry out data communications with a PC when the data logger management program is used.
(6) ▲/AIR button	Used to perform air calibration on the detection screen. Or used to move the cursor (>) up in the DISP and user modes.
(7) SHIFT/▼ /(PANIC) button	Used to move the cursor (>) down in the DISP and user modes. In emergency situations, hold down this button to trigger a panic alarm.
(8) DISP/LOCK button	Displays the DISP mode and changes the display. Holding down this button with LCD inversion (P. 58) set locks the display.

Name		Main function
(9)	**RESET/💡 (illumination lamp) button**	Used to confirm and reset an alarm. Holding down this button turns on the upper illumination lamp.
(10)	**POWER/ENTER button**	Turns on/off the power. Or used to confirm selection in the DISP and user modes.
(11)	**Gas inlet**	Draws in a gas. (Do not block it.)
(12)	**Gas outlet**	Exhausts the gas drawn into the gas monitor. (Do not block it.)
(13)	**Holes for hand strap (2 positions)**	Used to attach the provided hand strap.
(14)	**Sensor cover**	Protects the sensor inside. May be opened only when the sensor is to be replaced.
(15)	**Filter case**	Protects the dust filter inside. Do not remove the case except for maintenance and replacement.
(16)	**Battery unit release lever**	Push the lever while sliding it to remove the battery unit.
(17)	**Battery unit connection terminal**	Used to supply power of the battery unit to the gas monitor.

CAUTION

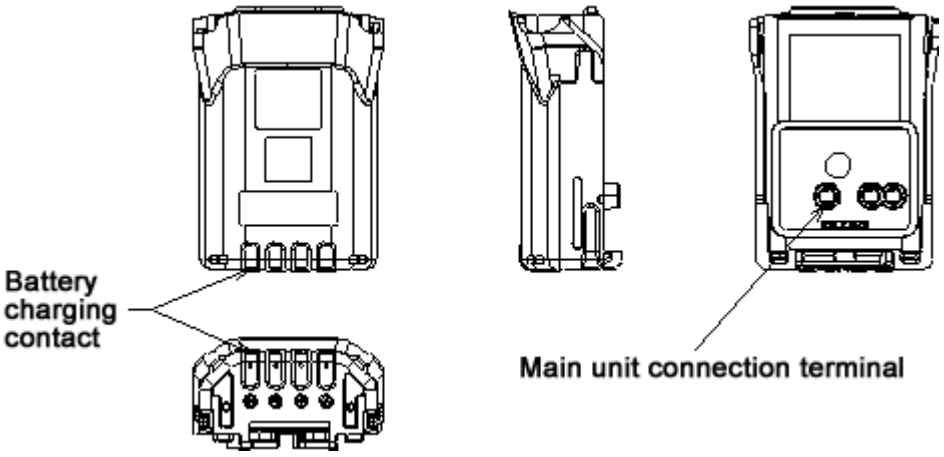
- Do not jab the buzzer sound opening with a sharp-pointed item. Water, foreign matters, etc. may get inside and cause malfunction or damage.
- Do not remove the panel sheet on the surface. The water-proof and dust-proof performances will be deteriorated.
- Do not affix a label or the like on the infrared communication port. Infrared communications can no longer be conducted.

NOTE

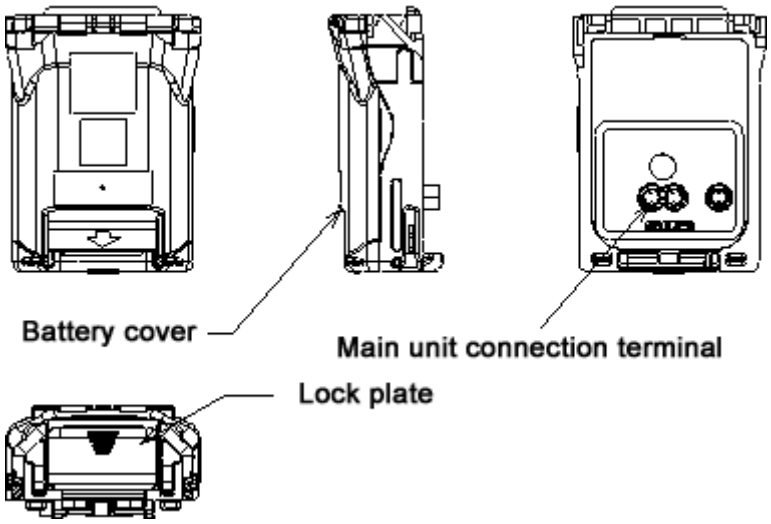
- In this operating manual, the buttons equipped with multiple functions are described in operational procedures in the following manner.
  Example) POWER/ENTER button is described as follows:
  • POWER button in turning on/off the power
  • ENTER button in confirming settings.

Battery unit

<Lithium Ion Battery Unit (BUL-6000)>

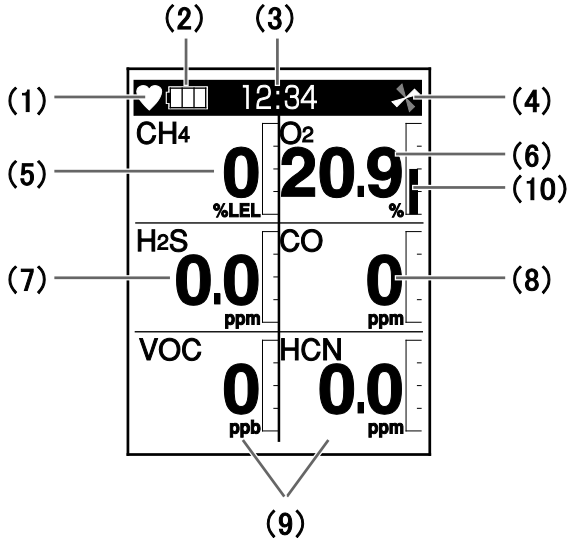


<Dry Battery Unit (BUD-6000)>



LCD display

<Normal Mode>



Name		Main function
(1)	Operating state display	Displays the operating status. Blinks at a normal state.
(2)	Battery level display	Displays the battery level. See NOTE for a guide for battery level.
(3)	Clock display	Displays the current time.
(4)	Pump operation status display	Displays the drawing status. Rotates at a normal state.
(5)	Combustible gas concentration	Displays the gas concentration as numeric output.
(6)	Oxygen concentration	
(7)	Hydrogen sulfide concentration	
(8)	Carbon monoxide concentration	
(9)	Arbitrarily selected gas concentration	
(10)	Bar display	Displays the gas concentration with bar.

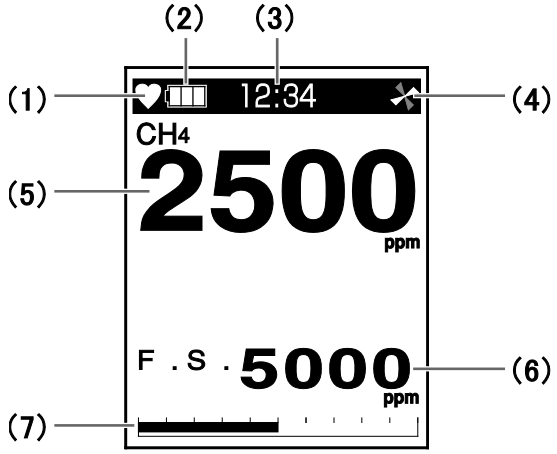
NOTE

- The gas concentration display positions can be changed. See "Changing display positions of measured gases" (P. 66) for how to change the display positions.
- The battery level is indicated as follows:
  - Sufficient
  - Low
  - Need charging (replacement of batteries)

  If the battery level further drops, the battery icon starts blinking.

<Leak Check Mode>

- The gas monitor is equipped with leak check mode as well as normal mode. The leak check mode, however, is set to OFF normally and thus unavailable. To use this function, please contact RIKEN KEIKI.
- Leak check full scale value can be selected from 500, 1000, 2000 and 5000 ppm.
- The following figure shows the LCD display in the leak check mode.



Name	Main function
(1) Operating state display	Displays the operating status. Blinks at a normal state.
(2) Battery level display	Displays the battery level. See NOTE (P. 18) for a guide for battery level.
(3) Clock display	Displays the current time.
(4) Pump operation status display	Displays the drawing status. Rotates at a normal state.
(5) Gas concentration display	Displays the gas concentration as numeric output.
(6) Leak check full scale display	Displays the full scale value to be used in the leak check mode.
(7) Bar display	Displays the gas concentration with bar.

4

Alarm Activation

4-1. Gas alarm activation

<Gas Alarm Type>

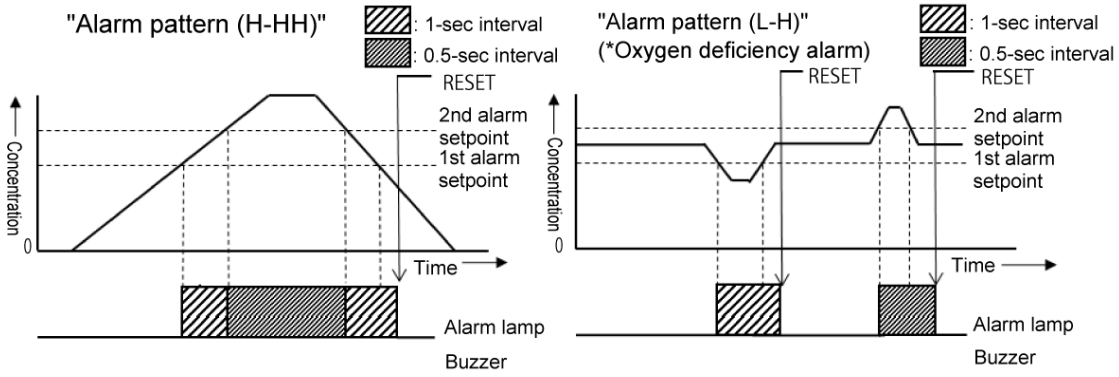
"Gas alarm" is triggered when the concentration of detected gas reaches or exceeds the alarm setpoint values shown in the following table. (Self-latching)
Gas alarm types are the first alarm (AL1), second alarm (AL2), TWA alarm, STEL alarm and OVER alarm (over scale).

Alarm type	First alarm	Second alarm	TWA alarm	STEL alarm	OVER alarm
Oxygen (O2)	19.5 vol%	23.5 vol%	–	–	40.0 vol%
Combustible gas (HC/CH4) <%LEL>	10%LEL	50%LEL	–	–	100%LEL
Hydrogen sulfide (H2S)	5.0 ppm	30.0 ppm	10.0 ppm	15.0 pm	100.0 ppm
Carbon monoxide (CO)	25 ppm	50 ppm	25 ppm	200 ppm	500 ppm
Volatile organic compound (VOC) <ppb>	4300 ppb	6000 ppb	-	-	50000 ppb
Volatile organic compound (VOC) <ppm>	400.0 ppm	600.0 ppm	42.0 ppm	60.0 ppm	6000 ppm
Sulfur dioxide (SO2)	2.00 ppm	5.00 ppm	2.00 ppm	5.00 ppm	6.00 ppm
Nitrogen dioxide (NO2)	3.00 ppm	6.00 ppm	3.00 ppm	–	9.00 ppm
Hydrogen cyanide (HCN)	5.0 ppm	10.0 ppm	–	4.7 ppm	15.0 ppm

<Sounding Buzzer and Blinking Lamp for Gas Alarm>

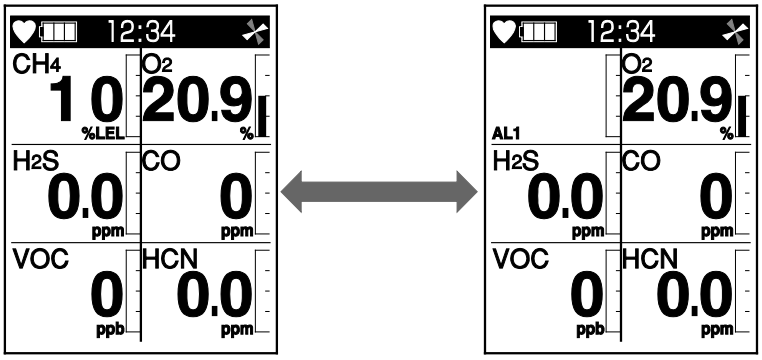
In response to a gas alarm, the buzzer sounds, the alarm LED arrays blink and vibration occurs in two steps.
The following shows the operations of each type.

Alarm type	First alarm	Second alarm	TWA alarm	STEL alarm	OVER alarm
Sounding buzzer	Repeatedly sounds strong and weak beeps at about 1-second intervals. "Beep, beep"	Repeatedly sounds strong and weak beeps at about 0.5-second intervals. "Beep, beep, beep, beep"	Repeatedly sounds strong and weak beeps at about 1-second intervals. "Beep, beep"	Repeatedly sounds strong and weak beeps at about 1-second intervals. "Beep, beep"	Repeatedly sounds strong and weak beeps at about 0.5-second intervals. "Beep, beep, beep, beep"
Blinking alarm LED arrays	Repeatedly blinks at about 1-second intervals.	Repeatedly blinks at about 0.5-second intervals.	Repeatedly blinks at about 1-second intervals.	Repeatedly blinks at about 1-second intervals.	Repeatedly blinks at about 0.5-second intervals.
Vibration	Vibrate at an alarm state.				



<Gas Alarm Display>

In case a gas alarm occurs, the gas concentration and alarm detail are displayed alternately.
If the detection range is exceeded (over scale), "OVER" is displayed in the gas concentration display area.



Display example
Methane (CH4) concentration: 10%LEL
First alarm triggered

Alarm type	First alarm	Second alarm	TWA alarm	STEL alarm	OVER alarm
LCD display	Displays the gas concentration and "AL1" alternately.	Displays the gas concentration and "AL2" alternately.	Displays the gas concentration and "TWA" alternately.	Displays the gas concentration and "STEL" alternately.	Displays the gas concentration and "OVER" alternately.

WARNING

- Issuance of a gas alarm indicates that there are extreme dangers. Take proper actions based on your judgment.

NOTE

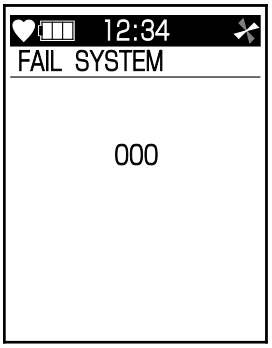
- Responses to an alarm can be checked by alarm test in the DISP mode (P. 49). Note that the display is not changed during alarm test.

4-2. Fault alarm activation

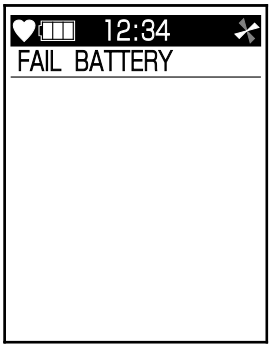
"Fault alarm" is triggered when an abnormality is detected in the gas monitor. (Self-latching)
Fault alarm types are system abnormalities, battery voltage abnormalities, clock abnormalities, low flow rate, sensor abnormalities and calibration failure.
In response to a fault alarm, the buzzer sounds and alarm LED arrays blink.

- Sounding buzzer: Repeatedly sounds intermittent beeps at about one-second intervals. "Beep beep, beep beep"
- Blinking alarm LED arrays: Repeatedly blinks at about one-second intervals.

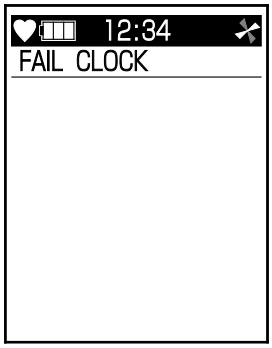
The following shows display examples of fault alarms.



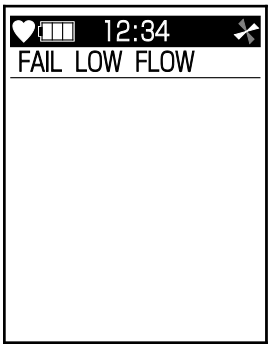
System abnormalities



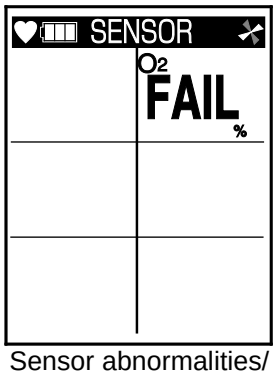
Battery voltage abnormalities



Clock abnormalities



Low flow rate



Sensor abnormalities/ calibration failure

If a fault alarm is triggered, determine the cause and take appropriate action.
If the gas monitor has problems and is repeatedly malfunctioning, contact RIKEN KEIKI immediately.

NOTE

- For information on malfunctions (error messages), see "Troubleshooting" (P. 94).

4-3. Panic alarm

A panic alarm is a manually triggered alarm to notify the people around of abnormalities.

WARNING

- The panic alarm is intended to assist users and people around in making a decision. The detection results are not intended to guarantee life or safety in any way. Do not depend only on this function to use the gas monitor.
- Use the panic alarm appropriately after confirming the situation.

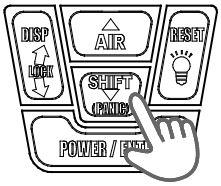
<Sounding Buzzer and Blinking Lamp for Panic Alarm>

Alarm type	Preliminary alarm	Main Alarm
Sounding buzzer	Repeatedly sounds intermittent blips at about 0.5-second intervals. "Blip, blip, blip, blip"	Repeatedly sounds strong and weak beeps at about 1-second intervals. "Beep, beep, beep, beep"
Blinking alarm LED arrays	Repeatedly blinks at about 0.5-second intervals.	Repeatedly blinks at about 1-second intervals.

Trigger and pattern of panic alarm

Hold down the PANIC button to trigger a panic alarm when sensing an abnormality.

For a panic alarm, a main alarm is triggered after a five-second preliminary alarm.



NOTE

To stop a preliminary or main alarm of panic alarm, press the RESET button.

4-4. Man-down alarm

A man-down alarm is triggered if the built-in motion sensor, which monitors the motion of the user carrying the gas monitor, detects no motion of the user for a certain period of time.
Normally the man-down alarm is set to OFF and unavailable. To use this function, please contact RIKEN KEIKI.

WARNING

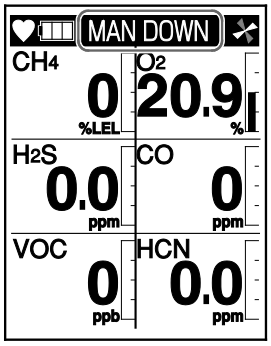
- The man-down alarm is intended to assist people around the user in making a decision. The detection results are not intended to guarantee life or safety in any way. Do not depend only on this function to use the gas monitor.
- Use the man-down alarm appropriately after confirming the situation.

<Sounding Buzzer and Blinking Lamp for Man-down Alarm>

Alarm type	Preliminary alarm 1	Preliminary alarm 2	Main alarm
Sounding buzzer	Repeatedly sounds intermittent blips at about 1-second intervals. "Blip, blip"	Repeatedly sounds intermittent blips at about 0.5-second intervals. "Blip, blip, blip, blip"	Repeatedly sounds strong and weak beeps at about 1-second intervals. "Beep, beep, beep, beep"
Blinking alarm LED arrays	Repeatedly blinks at about 1-second intervals.	Repeatedly blinks at about 0.5-second intervals.	Repeatedly blinks at about 1-second intervals.

Display and pattern of man-down alarm

If an abnormality in the motion of the user is detected, the lamp blinks and alarms are triggered in a step-by-step manner: preliminary alarm 1, preliminary alarm 2 and then main alarm while vibrating.
When a main alarm is triggered, the clock display on the LCD display shows "MAN DOWN".



The following shows the time to switch from a preliminary alarm to main alarm.
- Preliminary alarm 1: 60 seconds after detection
- Preliminary alarm 2: 75 seconds after detection
- Main alarm: 90 seconds after detection

NOTE

- The preliminary alarms of man-down alarm are stopped and measurement state is resumed when the motion of the user is detected.
- To stop the main alarm of man-down alarm, press the RESET button.

5

How to Use

5-1. Before using the gas monitor

Not only the first-time users but also the users who have already used the gas monitor must follow the operating precautions.
Ignoring the precautions may damage the gas monitor, resulting in inaccurate gas detection.

5-2. Preparation for start-up

Before starting gas detection, check the followings.

• Check that the battery level is sufficient
• Check that the taper nozzle is not bent or has no hole
• Check that the filter inside the gas monitor is not contaminated or clogged
• Check that the main unit and taper nozzle are connected properly

Charging and attaching lithium ion battery unit (BUL-6000)

Charge with the provided charger according to the following procedure when the gas monitor is used for the first time or the battery level of the rechargeable battery in the lithium ion battery unit is low.

DANGER

- Replace the lithium ion battery unit in a safe place.
- Charge the battery unit using the provided charger in a safe place.
- Charge the battery unit at ambient temperatures between 0 to 40ºC.
- The specifications of this unit are as follows:
  Maximum voltage: 4.2 V, Ambient temperature: -20 - +50ºC

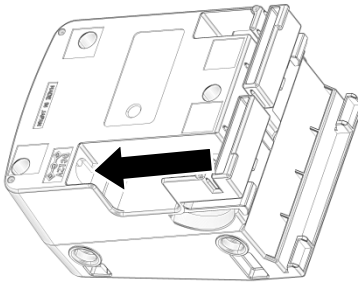
CAUTION

- Do not use the gas monitor while charging it. Correct measurements cannot be obtained. Furthermore, the rechargeable batteries get deteriorated more quickly and may have shorter life.
- Do not charge the batteries while the gas monitor is wet. The charger is neither water-proof nor dust-proof.
- The charger is not explosion-proof.
- After attaching the lithium ion battery unit, lock the battery cover completely. If the battery cover is not completely locked, the battery unit may drop off or water may get in through the clearance.
- Do not damage the rubber seal.
- To maintain the water-proof and dust-proof performances, it is recommended to replace the rubber seal every two years, whether or not it has an abnormality.

<Charging Lithium Ion Battery>

1 Insert the DC plug of the AC adapter into the DC jack of the charger.

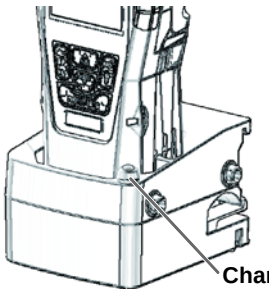
Lay the DC plug cord along the side through the notch at the bottom of the charger.



2 Insert the AC adapter to the outlet.

3 Insert the main unit to the charger straight from above.

When the charger is connected, the charging indicator lamp lights up in red. (Full charge requires about three hours at maximum.)
When charging is completed, the charging indicator lamp goes off.

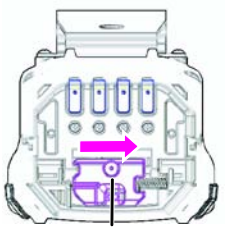


4 When charging is completed, disconnect the AC plug from the outlet.

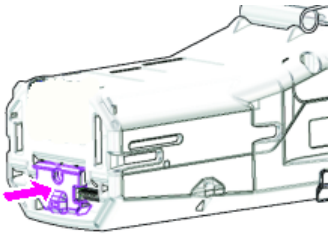
<Removing/Attaching Lithium Ion Battery Unit>

1 Check that the power of the gas monitor is turned off.
If the power is on, press the POWER/ENTER button to turn it off.

2 Slide the battery unit release lever to the right side and push it.

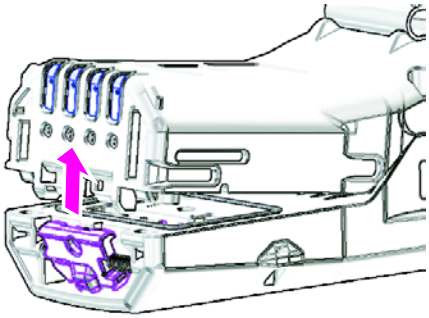


Slide the battery unit release lever to the right side.



Push

3 Remove the lithium ion battery unit from the main unit.

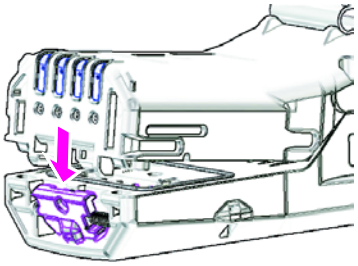


CAUTION

- Disconnect the AC plug from the outlet while it is not in use.

NOTE

- When attaching the battery unit, be sure that the battery unit release lever is locked.
- If it is not completely locked, the battery unit may come off or water may get in through the clearance. Water may also get in if a minute foreign substance is caught beneath the battery unit.
- During charging, the lithium ion battery unit may get hot, but this is not an abnormality.
- Charging causes the main unit temperature to increase. When charging is completed, leave it for at least ten minutes before use. If the gas monitor is used while it is still hot, correct measurement may not be performed.
- Fully charged battery cannot be recharged.
- It is possible to charge the lithium ion battery unit alone after removing it from the main unit.



Attaching optional dry battery unit (BUD-6000)

When the optional dry battery unit is attached instead of lithium ion battery unit, three AA alkaline batteries are used to operate the gas monitor.
When the dry battery unit is used for the first time, or when the battery level is low, replace or attach new AA alkaline batteries according to the following procedure.

DANGER

- Replace the dry battery unit in a safe place.
- Replace the batteries in a safe place.
- The specifications of this unit are as follows:
  Maximum voltage: 4.95 V, Power: LR6 (Manufactured by Toshiba Corporation, 1.5 VDC) x 3,
  Ambient temperature: -20 - +50ºC

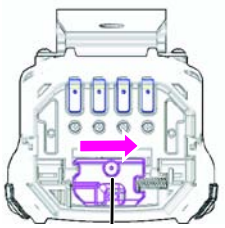
CAUTION

- Turn off the power of the gas monitor before replacing the batteries.
- Replace the batteries in a safe place where explosive gases are not present.
- Replace all of the three batteries with new ones at one time.
- Pay attention to the polarities of the batteries when attaching them.
- After attaching the batteries, lock the battery cover completely. If the battery cover is not completely locked, the dry batteries may drop off or water may get in through the clearance. Water may also get in if a minute foreign substance is caught beneath the battery cover.

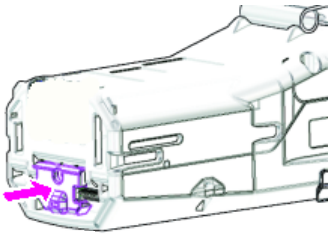
<Removing/Attaching Dry Battery Unit>

1 Check that the power of the gas monitor is turned off.
If the power is on, press the POWER/ENTER button to turn it off.

2 Slide the battery unit release lever to the right side and push it.

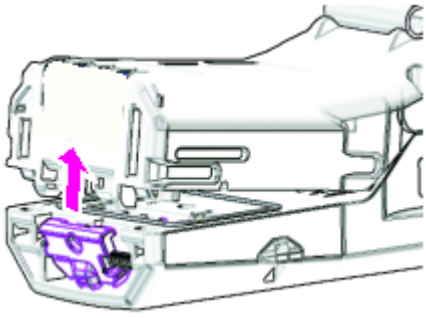


Slide the battery unit release lever to the right side.



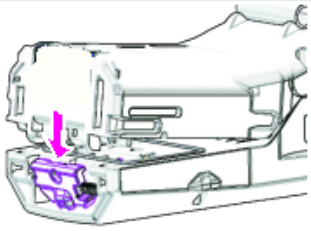
Push

3 Remove the dry battery unit from the main unit.



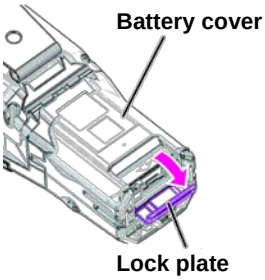
NOTE

- When attaching the battery unit, be sure that the battery unit release lever is locked.
- If it is not completely locked, the battery unit may come off or water may get in through the clearance. Water may also get in if a minute foreign substance is caught beneath the battery unit.

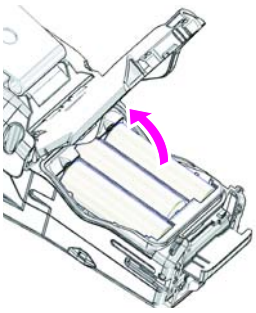


<Replacing Dry Batteries>

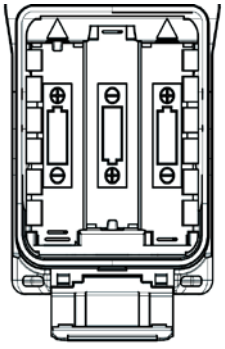
1 Release the lock plate of the battery cover.



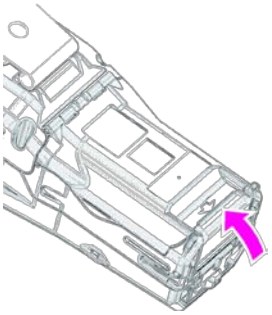
2 Open the battery cover.



3 Put new batteries paying attention to the polarities.
Remove old batteries as needed.

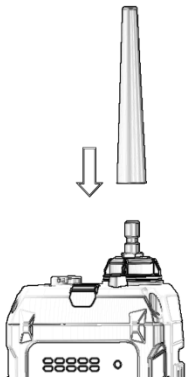


4 Close the battery cover and lock plate.
Close the lock plate securely until it clicks.



Attaching taper nozzle

To perform measurement, attach the taper nozzle to the gas inlet of the gas monitor.



DANGER

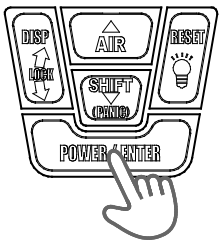
- Do not use the taper nozzles not specified by RIKEN KEIKI or other parts for the gas monitor.

5-3. How to start the gas monitor

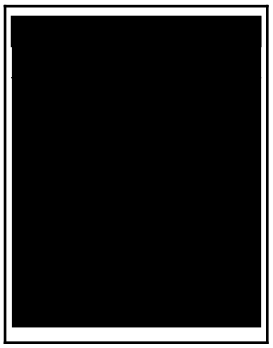
When the power is turned on, various settings including date and alarm setpoint are displayed and then the measurement screen is displayed in the normal mode.

Power-on

Hold down the POWER/ENTER button (over five seconds) until the buzzer blips.
Power is turned on.

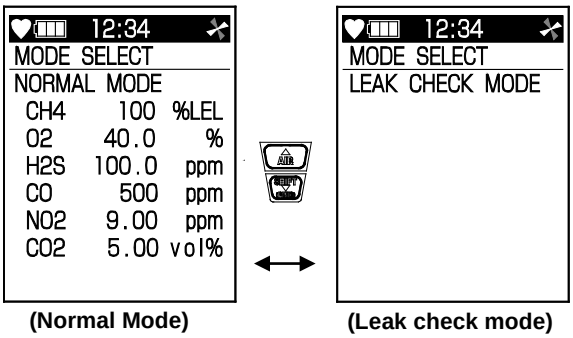


The entire LCD display lights up.



NOTE

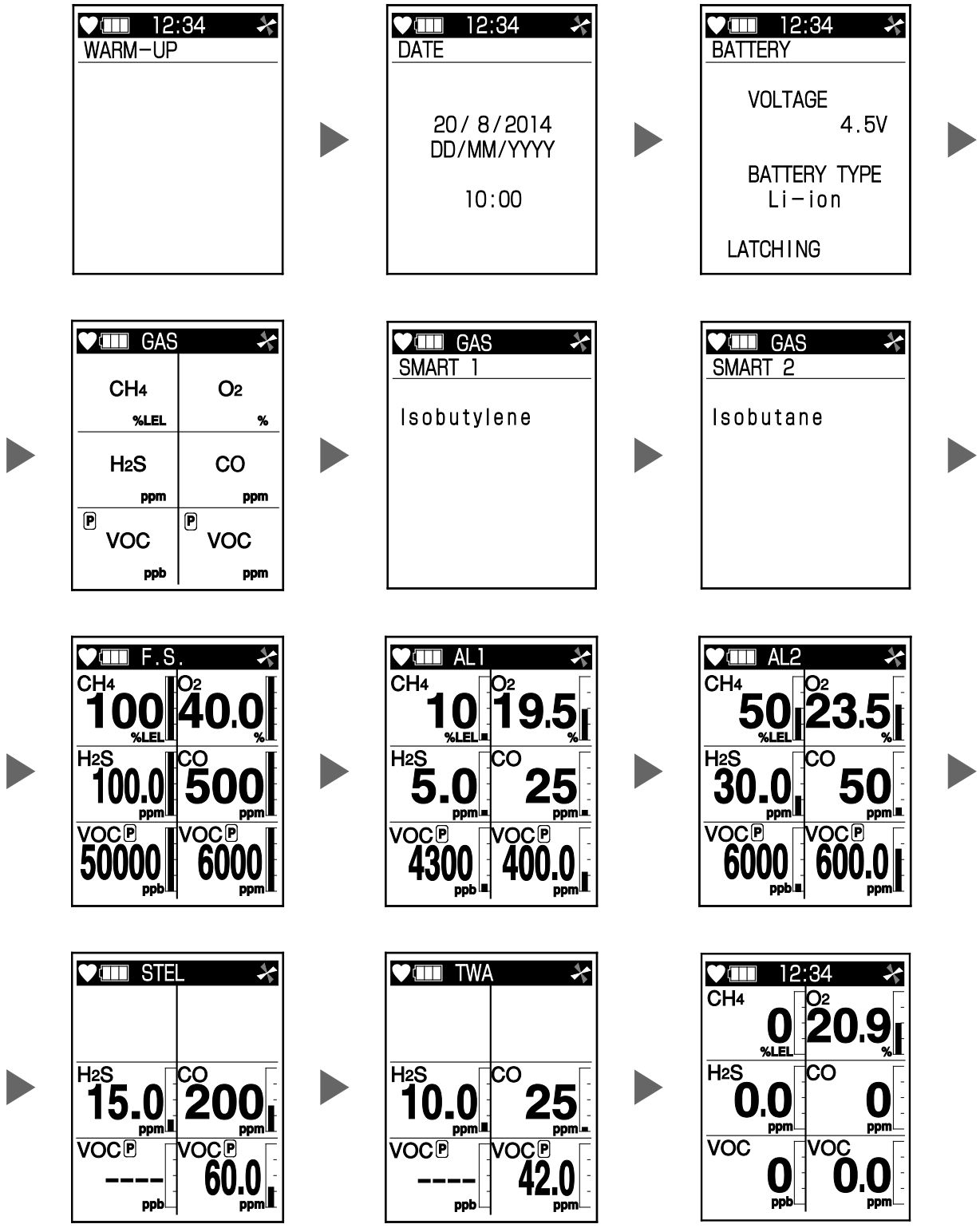
- The gas monitor is equipped with leak check mode as well as normal mode. The leak check mode, however, is set to OFF normally and thus unavailable. To use this function, please contact RIKEN KEIKI.
- When the power is turned on with the leak check mode set to ON, the screen for selecting the normal mode or leak check mode is displayed after the entire LCD display lights up. Select the mode with the ▲/▼ button and press the ENTER button to confirm it.



(Normal Mode) **(Leak check mode)**

Screen transition from selecting normal mode to displaying measurement screen

When the power is turned on, the LCD display changes automatically as shown below before the measurement screen is displayed.



The buzzer blips twice and then the measurement screen is displayed.

CAUTION

- After start-up, perform air calibration (P. 33) before performing gas detection.

NOTE

- If any abnormality is detected in the sensor, "FAIL" is displayed in place of measured value just before entering the measurement screen and a sensor abnormality alarm is triggered. In this case, press the RESET button to temporarily reset the sensor abnormality alarm. However, the alarm cannot be reset if there is an abnormality in all the sensors. After the alarm is reset, "- - - -" appears in the concentration display area of the gas with sensor abnormality. Detection of the gas having sensor abnormality will become unavailable. Promptly contact RIKEN KEIKI.
- If there is an abnormality in the built-in clock, a fault alarm FAIL CLOCK may be triggered. Press the RESET button in this case. The fault alarm is temporarily reset, and measurement is started with incorrect clock time.

WARM-UP

- Displays the WARM-UP screen.

DATE

- Displays a year/month/day and time. The date/time and display type can be set in the user mode (P. 63).

BATTERY

- Displays the battery level (voltage) in the upper section of the screen.
- Displays the used battery (lithium ion or dry battery) in the center of the screen.
- Displays the gas alarm pattern setting (LATCHING <self-latching>) in the lower section of the screen.

GAS

- Displays the gas name of detection target. Detection principles are indicated by the following symbols for some gases.

Symbol	Gas to be detected	Detection principle
Ⓟ	Volatile organic compound (VOC)	Photoionization type
Ⓔ	Sulfur dioxide (SO2) Nitrogen dioxide (NO2) Hydrogen cyanide (HCN)	Electrochemical type

GAS SMART 1/GAS SMART 2

- For the specification targeting volatile organic compound (VOC) for detection, isobutylene or a gas name set for reading is displayed. See "VOC reading setting" (P. 59) for the reading setting.

F.S.

- Displays the full scale value of the gas to be detected.

AL1

- Displays the first alarm setpoint of the gas to be detected.

AL2

- Displays the second alarm setpoint of the gas to be detected.

STEL

- Displays the STEL alarm setpoint of the gas to be detected. A STEL value refers to a concentration of toxic substances which does not have harmful effects on the users' health by 15-minute continuous exposure provided that everyday exposure does not exceed TWA value.

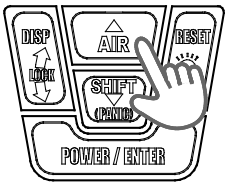
TWA

- Displays the TWA alarm setpoint of the gas to be detected. A TWA value refers to a time weighted average concentration of toxic substances which is considered no harm on almost all the users' health by repeated exposure at regular work of eight hours a day or 40 hours a week.

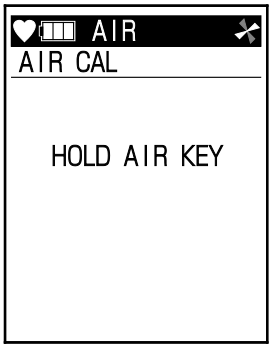
5-4. Air calibration

Air calibration is zero adjustment to correctly measure the current gas concentration.

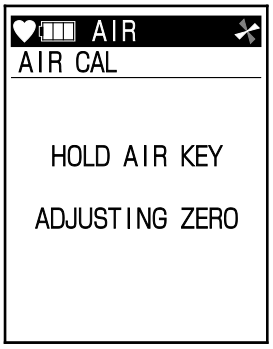
1 Hold down the AIR button on the measurement screen.



The air calibration screen is displayed.

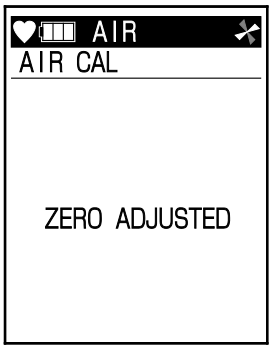


Keep the AIR button pressed while the screen shown in the right figure is displayed.
Zero adjustment is not performed when the button is released before the screen is displayed.

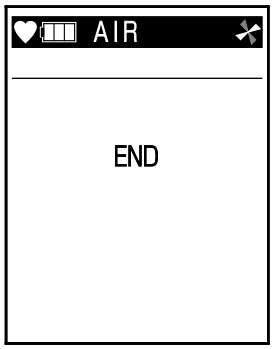


2 Release the AIR button when the screen shown in the right figure is displayed.

When zero adjustment is completed, the screen shown in the right figure is displayed.



When zero adjustment is successfully completed, the measurement screen returns automatically.



WARNING

- When air calibration is performed in the atmosphere, check the atmosphere for freshness before beginning it. If interference gases exist, zero adjustment cannot be performed properly, thus leading to dangers when the gas leaks.

CAUTION

- Perform air calibration under pressure and temperature/humidity conditions close to those in the operating environment and in fresh air.
- Perform air calibration after the reading is stabilized.
- If there is a sudden temperature change of 15ºC or more between the storage and operational locations turn on the power of the gas monitor, let it stand for about 10 minutes in a similar environment to the operational location, and perform air calibration in fresh air before using it.

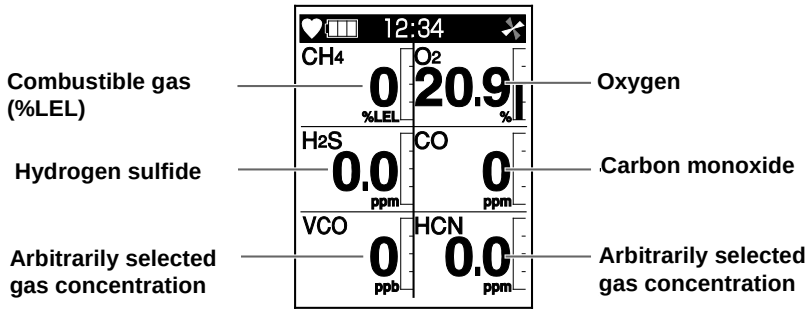
NOTE

- When air calibration fails, "FAIL" appears in the concentration display area of the faulty sensor as well as "SENSOR". Press the RESET button to reset the fault alarm (calibration failure). When the alarm is reset, the value before calibration is displayed.

5-5. How to detect

With the measurement screen displayed, put the taper nozzle close to the detection area and read the value on the LCD display.

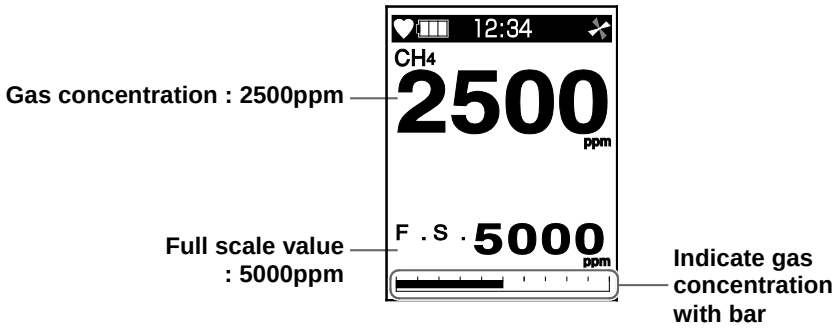
<Normal Mode>



Display example

<Leak Check Mode>

The gas monitor is equipped with leak check mode as well as normal mode. The leak check mode, however, is set to OFF normally and thus unavailable. To use this function, please contact RIKEN KEIKI.



DANGER

- While conducting measurement in a manhole or confined space, do not lean over or look into the manhole or closed space. It may lead to dangers because oxygen-deficient air or other gases may blow out.
- Oxygen-deficient air or other gases may be discharged from the gas exhausting outlet of the gas monitor. Never inhale the air or gases.
- High-concentration (100% LEL or higher) gases may be discharged from the gas exhausting outlet of the gas monitor. Never use fire near it.

WARNING

- The gas monitor is designed to draw gases around it under the atmospheric pressure. If excessive pressure is applied to the gas inlet and outlet of the gas monitor, detected gases may leak out from its inside and may cause dangerous conditions. Be sure that excessive pressure is not applied to them while used.
- Do not connect the taper nozzle directly to a detection area with a pressure higher than the atmospheric pressure. The internal piping system may be damaged.
- When air calibration is performed in the atmosphere, check the atmosphere for freshness before beginning it. If interference gases exist, the calibration cannot be performed properly, thus leading to dangers when the gas leaks.
- Issuance of a gas alarm indicates that there are extreme dangers. Take proper actions based on your judgment.
- Gas detection cannot be performed with a low battery voltage. If the low battery voltage alarm is triggered during use, turn off the power and promptly charge or replace the batteries in a safe place.
- Do not block the buzzer sound opening. No alarm sound can be heard.

CAUTION

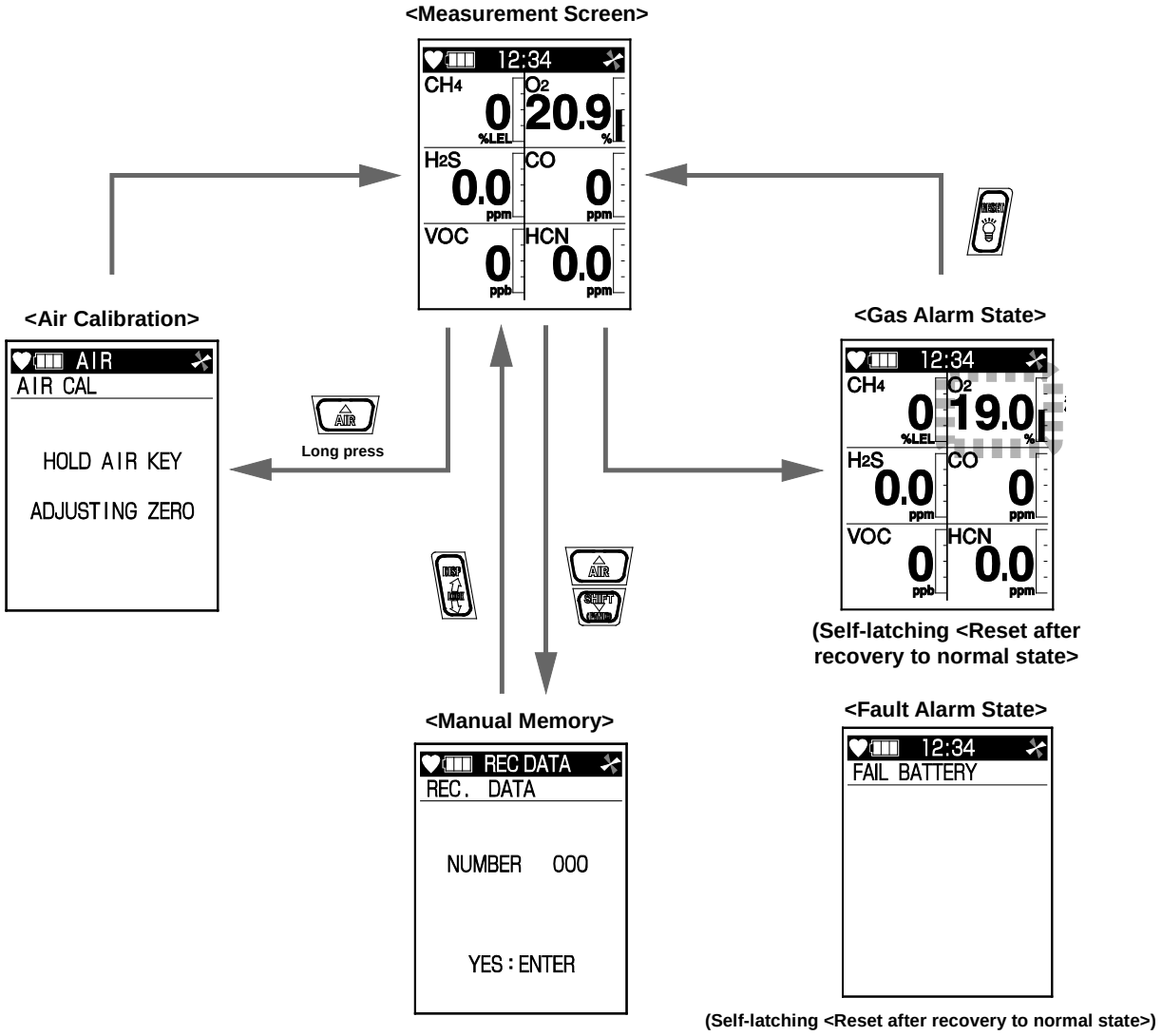
- An oxygen concentration higher than a certain level is required for the combustible gas sensor <%LEL> of the gas monitor to correctly detect gases and display concentrations.
- When measuring concentrations of oxygen in inert gases for a long time, the carbon dioxide concentration in the air must be 15% or less. When the gas monitor is used in the inert gas with a carbon dioxide concentration higher than 15%, perform measurement in as short time as possible. Using the gas monitor under high concentrations for a long time may shorten the life of the oxygen sensor.
- Long-time detection of a high-concentration combustible gas may adversely influence the combustible gas sensor <%LEL>. If presence of high-concentration combustible gas in a measurement location is known in advance, set the combustible gas sensor <%LEL> protection setting (P. 44) to ON before use.

NOTE

- In a low-temperature environment, the operating time is shortened due to the battery performance property.
- At low temperatures, the responses of the LCD display may slow down.
- If a combustible gas with 100%LEL or higher concentration is drawn, some adsorbed gas may remain in the taper nozzle or filter. After drawing a high-concentration combustible gas, be sure to draw in fresh air and perform the air clening until the reading indicates zero to remove adsorbed gases. Performing fresh air calibration before cleaning completely may result in inaccurate adjustment, giving adverse influence on measurement.

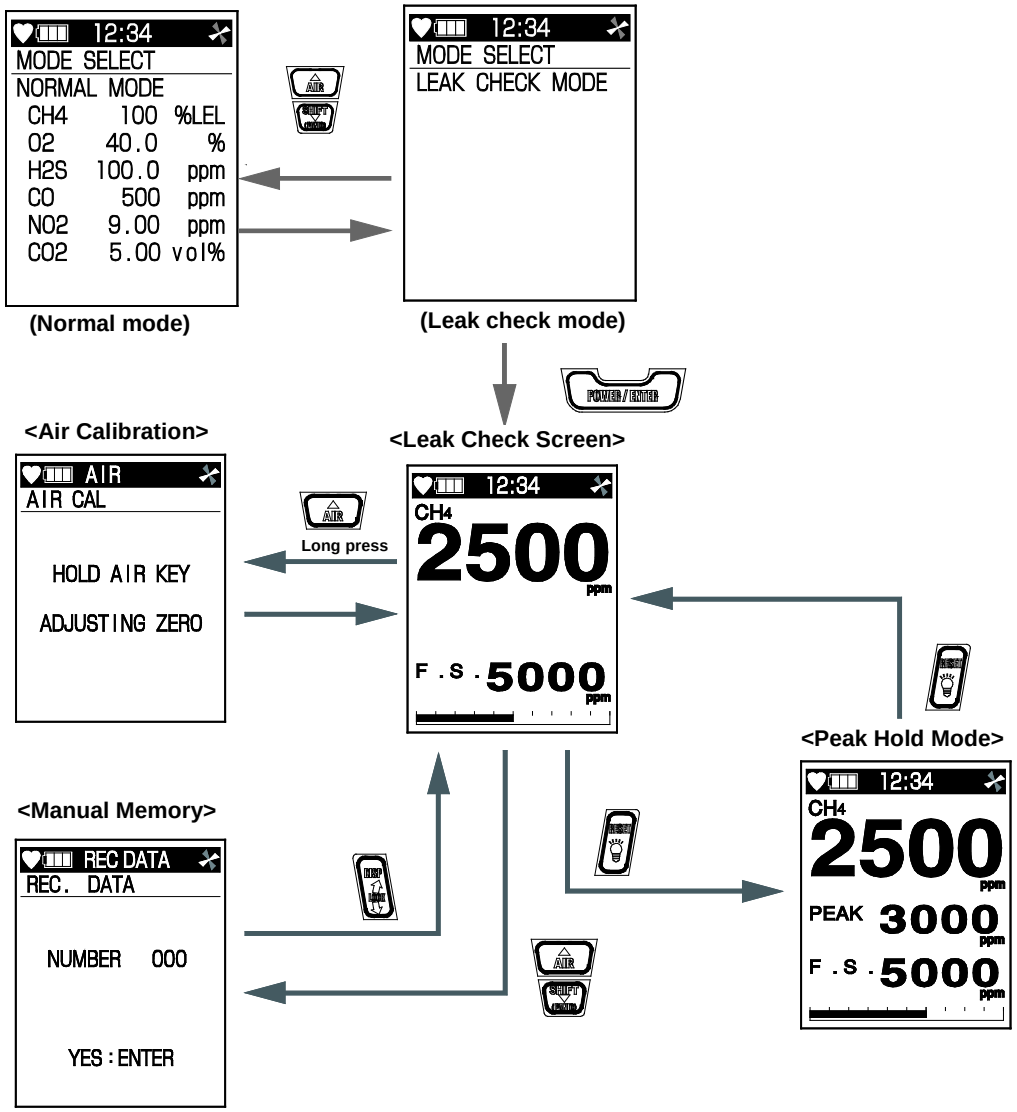
Basic operating procedures

<Normal Mode>
This mode is used on the measurement screen after power-on.



<Leak Check Mode>

The gas monitor is equipped with leak check mode as well as normal mode. The leak check mode, however, is set to OFF normally and thus unavailable. To use this function, please contact RIKEN KEIKI.
With the leak check mode set to ON, the mode selection screen is displayed after power-on. When the leak check mode is selected, the following screen transition is made.



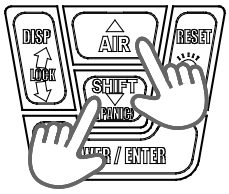
NOTE

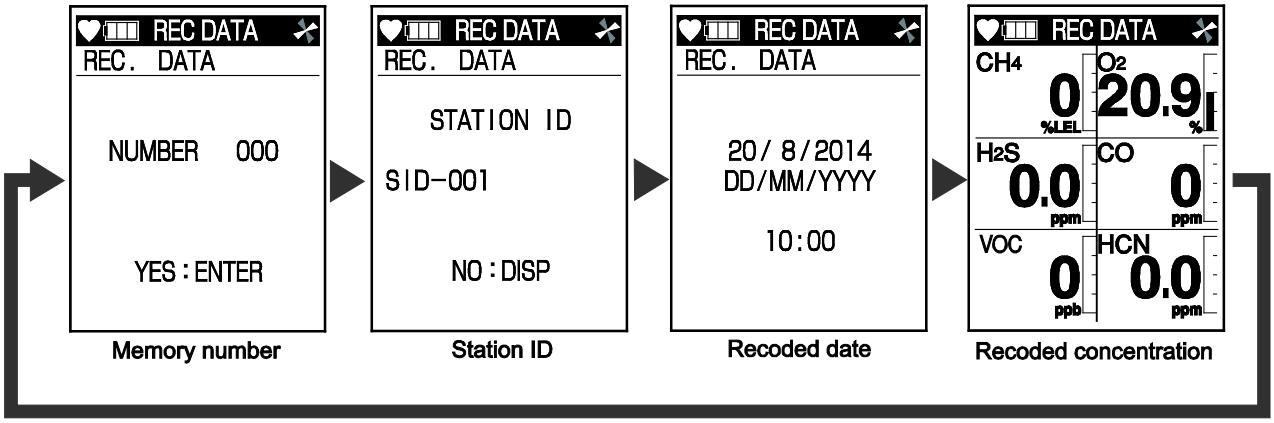
- In the leak check mode, a full scale value can be selected from four levels: 500 ppm, 1000 ppm, 2000 ppm and 5000 ppm. The value switches to another every time the DISP button is pressed.
- The buzzer sounds intermittently according to the gas concentration. As the concentration becomes higher, the interval of beeps of the buzzer becomes shorter.
- For the specification targeting carbon monoxide (CO) for detection, the PEAK value and carbon monoxide (CO) concentration can be set so that they are displayed alternately every time the RESET button is pressed. Contact RIKEN KEIKI for the setting.

Manual memory

Up to 256 arbitrary instantaneous values during measurement can be recorded.
When the number of recorded data points reaches the maximum, recorded data will be overwritten, starting from the oldest data.

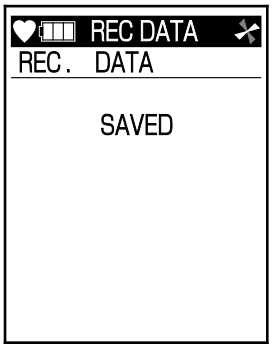
1 **Hold down the ▲ and ▼ buttons at the same time on the measurement screen.**
The memory number, station ID, recorded date and recorded concentration are displayed in turn as shown below.





2 **Press the ENTER button.**
"SAVED" is displayed on the screen, and the memory number, station ID, date and gas concentration at the time the ENTER button is pressed are recorded.

After recording, the data from memory number to recorded concentration are displayed again in turn. To continue recording the data, press the ENTER button.



3 **Press the DISP button to end.**
The measurement screen returns.

NOTE

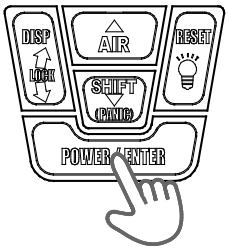
- The gas concentration data recorded by manual memory can be viewed according to "Log data display" (P. 54).

5-6. Power-off

CAUTION

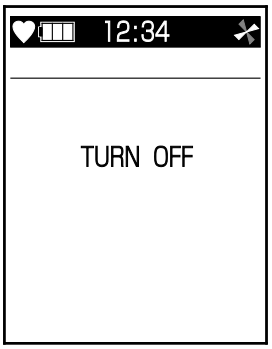
- If the concentration display is not reset to zero (or 20.9% for the oxygen concentration display) after measurement is completed, leave the gas monitor in fresh air until the display returns to zero and then turn off the power.

Keep the POWER/ENTER button pressed.



To turn off the power, hold down the POWER/ENTER button after the display returns to zero (0, or 20.9% for oxygen) in a safe place.

The buzzer blips three times and "TURN OFF" appears on the display before the power is turned off.



Power-off

NOTE

- To turn off the power, keep the button pressed until the display disappears.

CAUTION

- When the gas monitor is contaminated, clean it with a waste cloth, etc.
- When cleaning the gas monitor, do not use organic solvents such as alcohol and benzine on it.

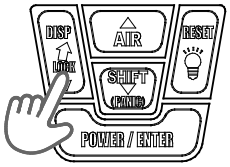
6

Setting Procedure

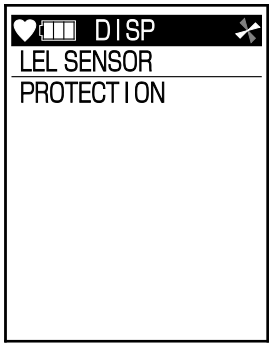
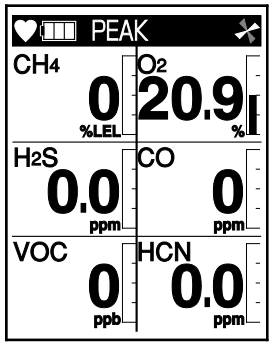
6-1. Display setting (DISP mode) flow

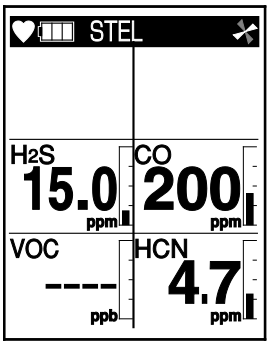
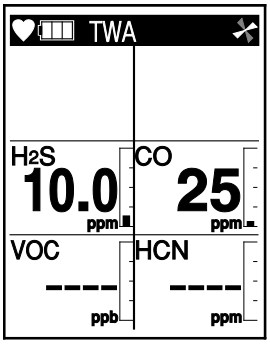
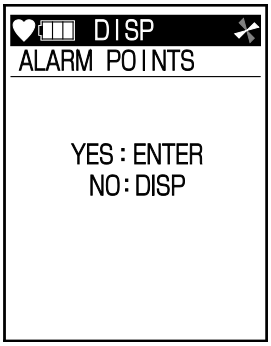
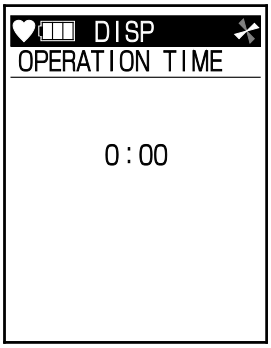
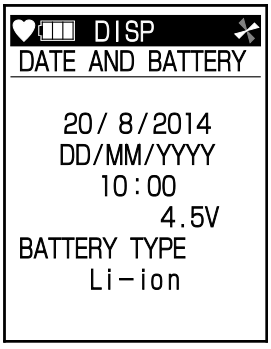
The DISP mode allows users to view and change various display settings.

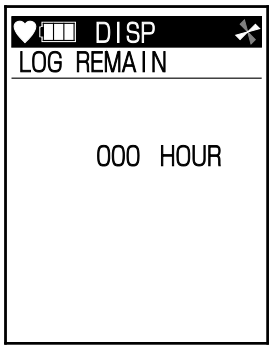
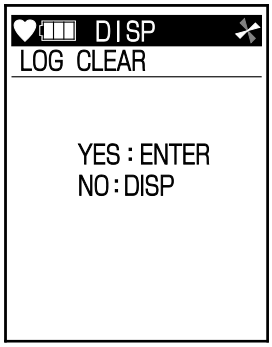
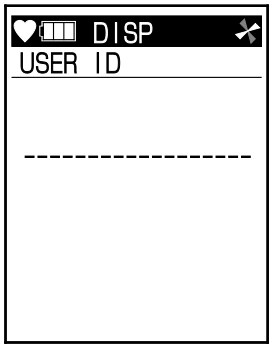
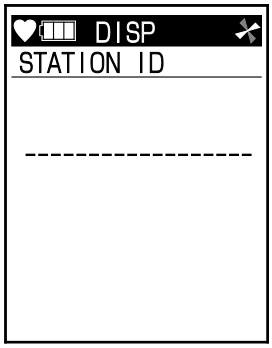
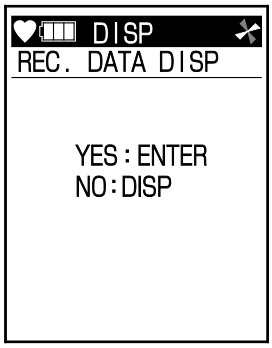
Press the DISP button on the measurement screen.
Various screens are displayed in turn by pressing the DISP button.

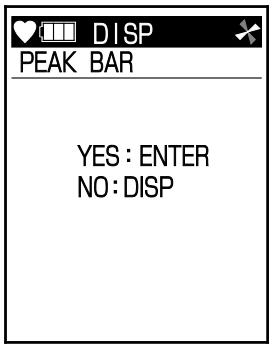
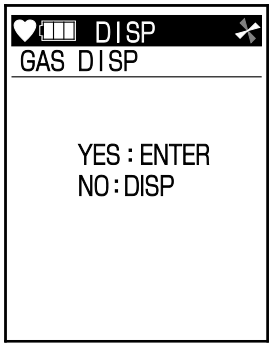
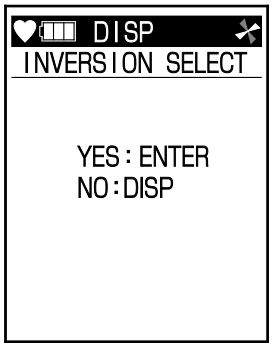
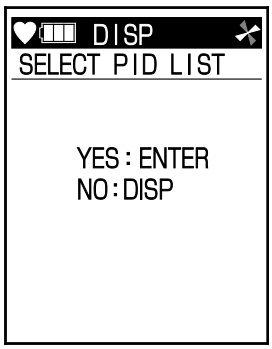
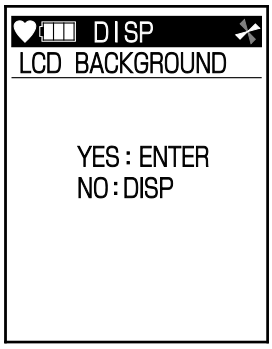


Press the DISP button when settings are completed.
The previous screen returns. Press the button several times more to call the measurement screen.

Item	Details	LCD display	Remarks
Combustible gas sensor <%LEL> protection setting **(Displayed only for the specification targeting combustible gas <%LEL> for detection)**	Protects the combustible gas sensor <%LEL> from high-concentration combustible gases.		Press the ENTER button to go to the setting screen (P. 47)
PEAK display/clear	Displays the maximum concentration of gas (or minimum concentration for oxygen) detected from power-on to the present.		Go to the display/clear screen (P. 48)

STEL value display	Displays the STEL value after power-on.		
TWA value display	Displays the TWA value after power-on.		
Full scale/ alarm setpoint display/ alarm test	Displays the full scale and alarm setpoint values and allows users to check the alarm activation of the setting displayed.		Press the ENTER button to go to the confirmation screen (P. 49)
Measurement time display	Displays the measurement time from power-on.		
Date/voltage display	Displays a date and time, battery level and battery type.		

Data logger remaining time display	Displays the remaining time which data logger can record.		
Clear log data	Clears the data recorded in the manual memory.		Press the ENTER button to go to the clear screen (P. 51)
User ID display/selection	Displays user ID and allows users to select it.		Press the ENTER button to go to the display/selection screen (P. 52)
Station ID display/selection	Displays station ID and allows users to select it.		Press the ENTER button to go to the display/selection screen (P. 53)
Log data display	Displays data recorded in the manual memory.		Press the ENTER button to go to the display screen (P. 54)

Peak display setting	Used to set peak display so that a peak value blinks on the bar displayed on the right side of gas concentration on the measurement screen.		Press the ENTER button to go to the setting screen (P. 55)
Gas concentration display setting	Used to set the measurement screen to split display to six divisions or single display. When the single display is selected, automatic or manual switching of display can be set.		Press the ENTER button to go to the setting screen (P. 56)
LCD inversion setting	Used to invert the LCD display by 180 degrees according to the direction of the gas monitor.		Press the ENTER button to go to the setting screen (P. 58)
VOC reading setting **(Displayed only for the specification targeting VOC for detection)**	By changing the setting to the pre-registered gas in the gas monitor, the converted concentration from the detection target gas (isobutylene) will be displayed.		Press the ENTER button to go to the setting screen (P. 59)
LCD black and white inversion setting	Used to invert the black and white display of LCD.		Press the ENTER button to go to the setting screen (P. 61)

English display setting **(Displayed only when selecting languages other than English)**	Used to resume English display when another language is set.		Press the ENTER button to go to the setting screen (P. 62)

NOTE

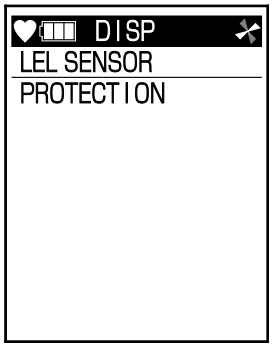
- If the screen is left unoperated for 20 seconds, the measurement screen returns.
- Pressing the DISP button on the English display setting screen returns to the measurement screen.

6-2. Display setting

Combustible gas sensor <%LEL> protection setting
(only for the specification targeting combustible gas <%LEL> for detection)

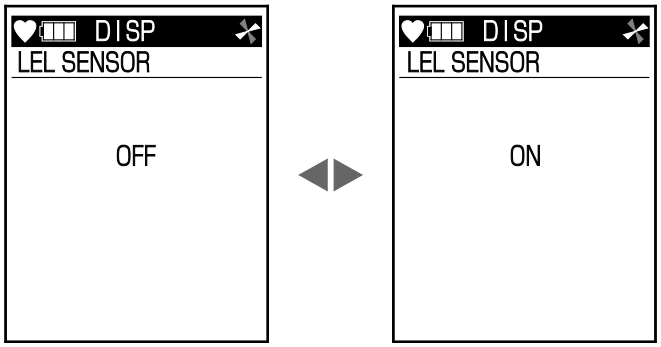
The combustible gas sensor <%LEL> is turned off to protect it from contact with high-concentration combustible gases.

1 **Press the DISP button to display the screen shown in the right figure, and then press the ENTER button.**



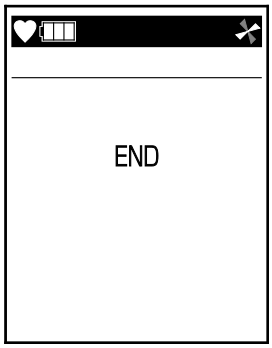
2 **Select with the ▲/▼ button.**

Select the combustible gas sensor <%LEL> protection setting.



3 **Press the ENTER button.**

When the setting is completed, the screen shown in the step 1 returns automatically.



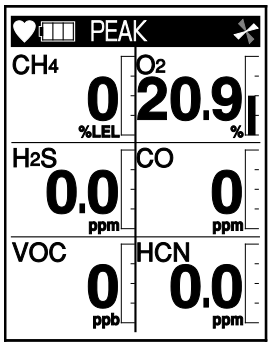
NOTE

- With ON selected, "- - - -" is displayed in the combustible gas <%LEL> concentration display area. Also, "NO ALARM" is displayed in the clock display area and the gas alarm function is disabled for all gases.

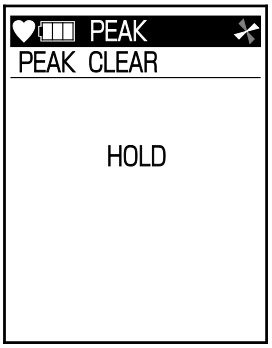
PEAK display/clear

This item is used to display or clear the maximum concentration (or minimum concentration for oxygen) detected during measurement from power-on to the present.

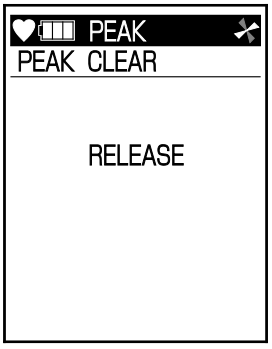
1 **Press the DISP button to display the screen shown in the right figure.**



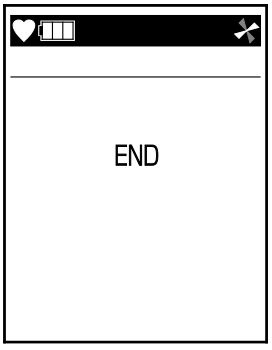
2 **Hold down the RESET button to clear PEAK value.**



3 **When "RELEASE" is displayed, release the RESET button.**



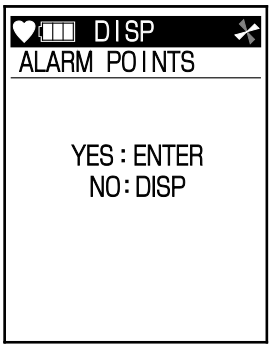
PEAK value has been cleared.
After PEAK value is cleared, the screen shown in the step 1 returns automatically.



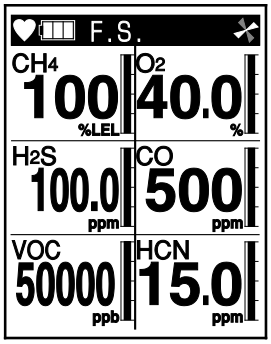
Full scale/alarm setpoint display/alarm test

This item is used to display the full scale and alarm setpoint values and check the alarm activation of the setting displayed.
Note that the LCD display is not changed during alarm test.

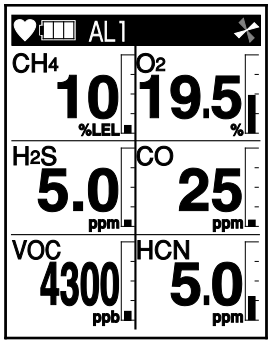
1 **Press the DISP button to display the screen shown in the right figure, and then press the ENTER button.**



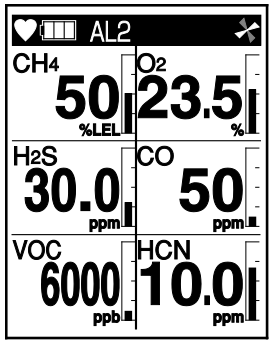
2 **Press the ▲/▼ button to display the full scale or alarm setpoint values.**



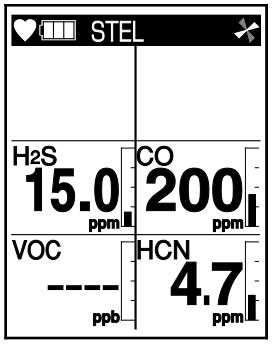
Full scale display



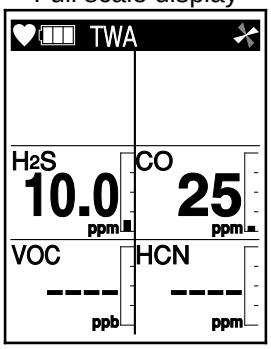
Alarm 1 display



Alarm 2 display



STEL Value Display



TWA Value Display

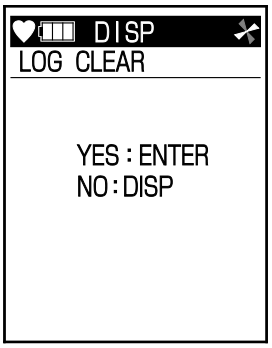
3 **Display a desired screen and press the ENTER button.**
The alarm LED arrays blink in red, allowing the user to check the alarm activation of the screen displayed.

4 **Press the ENTER button to stop the alarm activation.**
To exit from the display and alarm test, press the DISP button to return to the screen shown in the step 1.

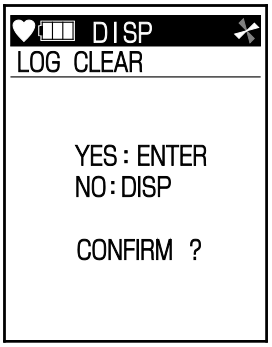
Clear log data

This item is used to clear the log data recorded in the manual memory.

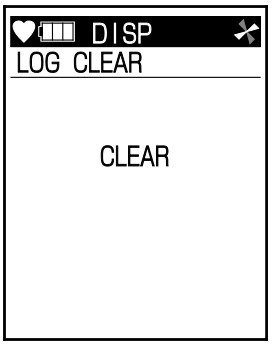
1 **Press the DISP button to display the screen shown in the right figure, and then press the ENTER button.**



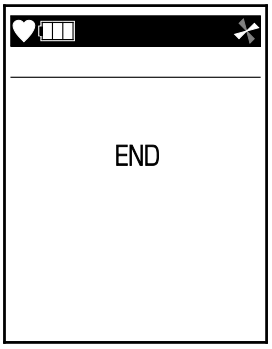
2 **Press the ENTER button to clear the log data.**
Press the DISP button to return to the screen shown in the step 1 without clearing the log data.



3 **Press the ENTER button.**



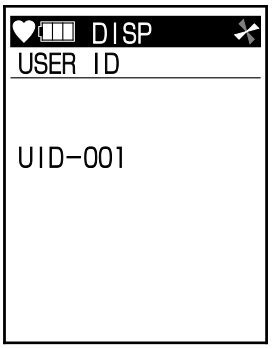
The log data has been cleared.
After the log data is cleared, the screen shown in the step 1 returns automatically.



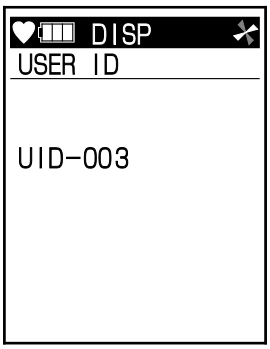
User ID display/selection

This item is used to display or select user ID.

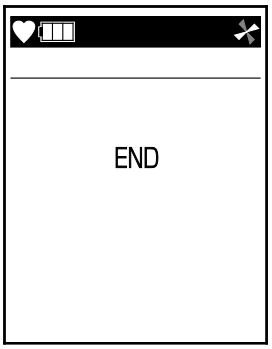
1 **Press the DISP button to display the screen shown in the right figure, and then press the ENTER button.**



2 **Select user ID with the ▲/▼ button.**
Press the DISP button to return to the screen shown in the step 1 without displaying or selecting user ID.

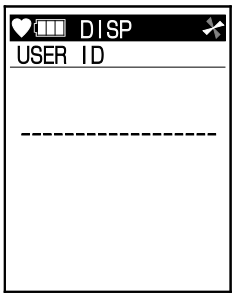


3 **Press the ENTER button.**
When the selection is completed, the screen shown in the step 1 returns automatically.



NOTE

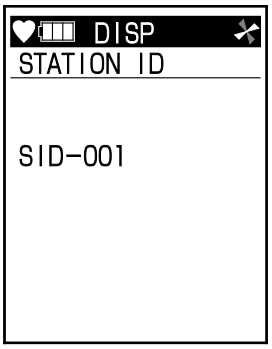
- When the unit is used for the first time, user ID is displayed as shown in the right figure.
- If not specified, user ID numbers are registered as 001 to 128.
- The data logger management program (optional) is required to register or change an ID. Contact RIKEN KEIKI to purchase it.



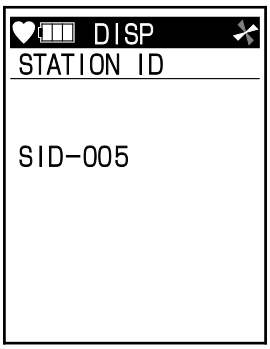
Station ID display/selection

This item is used to display or select station ID.

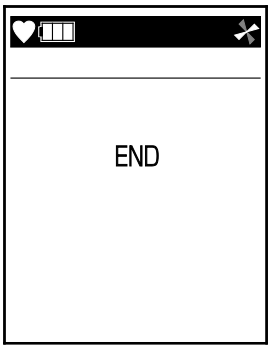
1 **Press the DISP button to display the screen shown in the right figure, and then press the ENTER button.**



2 **Select station ID with the ▲/▼ button.**
Press the DISP button to return to the screen shown in the step 1 without displaying or selecting station ID.

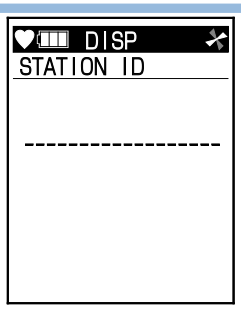


3 **Press the ENTER button.**
When the selection is completed, the screen shown in the step 1 returns automatically.



NOTE

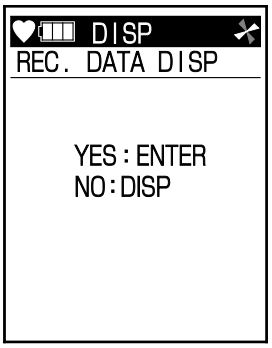
- When the unit is used for the first time, station ID is displayed as shown in the right figure.
- If not specified, station ID numbers are registered as 001 to 128.
- The data logger management program (optional) is required to register or change an ID. Contact RIKEN KEIKI to purchase it.



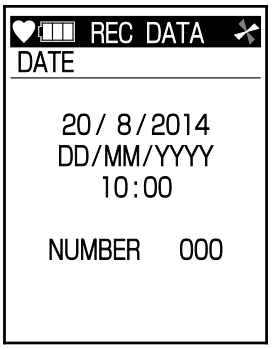
Log data display

This item is used to display log data recorded in the manual memory.

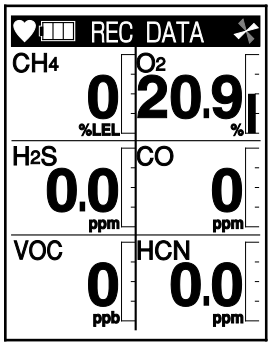
1 **Press the DISP button to display the screen shown in the right figure, and then press the ENTER button.**



2 **Select recorded data with the ▲/▼ button.**
Recorded data is indicated by year/month/day, time and memory number. When a station ID has been set, it is displayed under a memory number. Press the DISP button to return to the screen shown in the step 1 without displaying the log data.

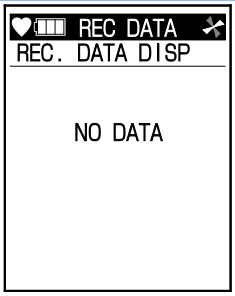


3 **Press the ENTER button.**
The selected recorded data is displayed. Press the ENTER button again to return to the screen shown in the step 2.
To exit from the log data display, press the DISP button to return to the screen shown in the step 1.



NOTE

- See "Manual memory" (P.40) for recording gas concentrations.
- When no gas concentration is recorded, the screen shown in the right figure appears.

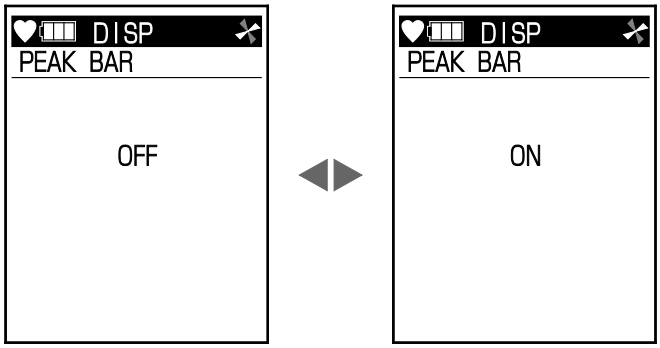


Peak display setting

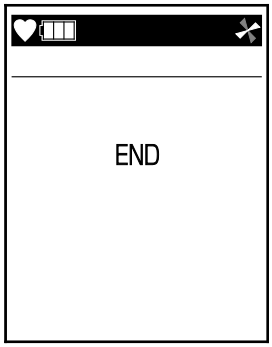
This item is used to set peak display so that a peak value blinks on the bar displayed on the right side of gas concentration on the measurement screen.

1 **Press the DISP button to display the screen shown in the right figure, and then press the ENTER button.**

2 **Select with the ▲/▼ button.**
Select whether or not to blink peak value on the bar.
Press the DISP button to return to the screen shown in the step 1 without changing the setting.

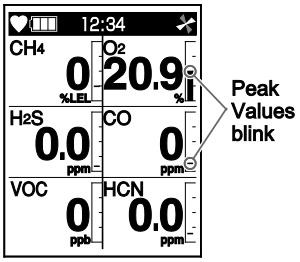


3 **Press the ENTER button.**
When the setting is completed, the screen shown in the step 1 returns automatically.



NOTE

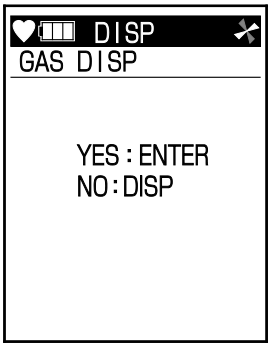
- When the peak bar display setting is selected, peak value blinks on the bar as shown in the right figure.



Gas concentration display setting

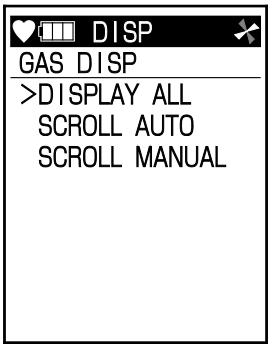
This item is used to select the measurement screen display type from split display to six divisions and single display. For the single display, automatic or manual switching of display can be selected.

1 **Press the DISP button to display the screen shown in the right figure, and then press the ENTER button.**



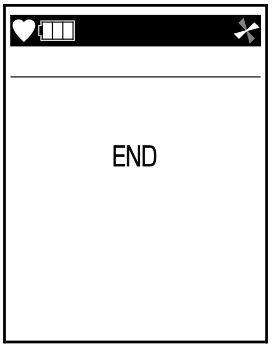
2 **Select display type with the ▲/▼ button.**

DISPLAY ALL indicates a split display to six divisions.
SCROLL AUTO indicates a single display which displays multiple channels in turn automatically.
SCROLL MANUAL indicates a single display which switches a gas concentration display to another manually by pressing the ENTER button.
Press the DISP button to return to the screen shown in the step 1 without changing the setting.



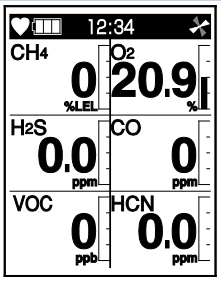
3 **Press the ENTER button.**

When the setting is completed, the screen shown in the step 1 returns automatically.



NOTE

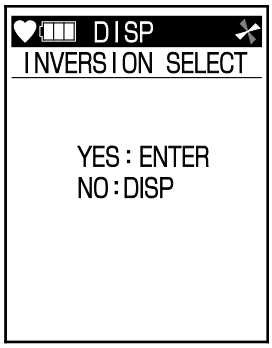
- The figures on the right show examples of split display to six divisions and single display.
- The gas concentration display setting is reset by turning on/off the power.



LCD inversion setting

This item is used to invert the LCD display by 180 degrees according to the direction of the gas monitor.

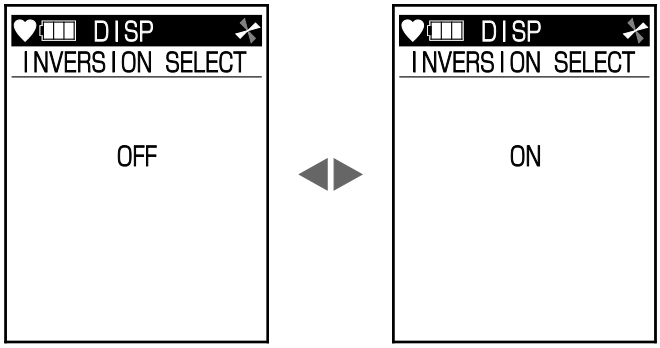
1 **Press the DISP button to display the screen shown in the right figure, and then press the ENTER button.**



2 **Select with the ▲/▼ button.**

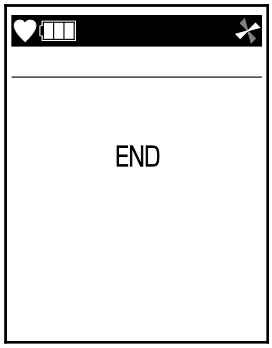
Select the LCD inversion setting.

Press the DISP button to return to the screen shown in the step 1 without changing the setting.



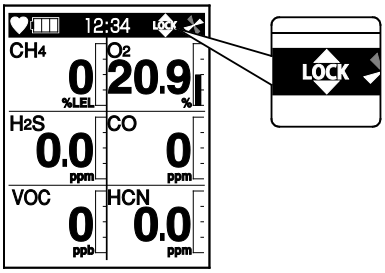
3 **Press the ENTER button.**

When the setting is completed, the screen shown in the step 1 returns automatically.



NOTE

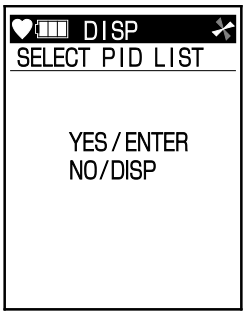
- When the LCD inversion setting is set to OFF (display direction fixed), "LOCK" is displayed (lights up steadily) in the upper right section of the screen as shown in the right figure.
- Even when the LCD inversion setting is set to ON (display direction inverted), the display direction can be fixed by holding down the DISP button during use. While the display direction is fixed, "LOCK" is displayed (blinks) in the upper right section of the screen as shown in the right figure.
- For the case the display direction is fixed by holding down the DISP button, the setting is reset by turning on/off the power.



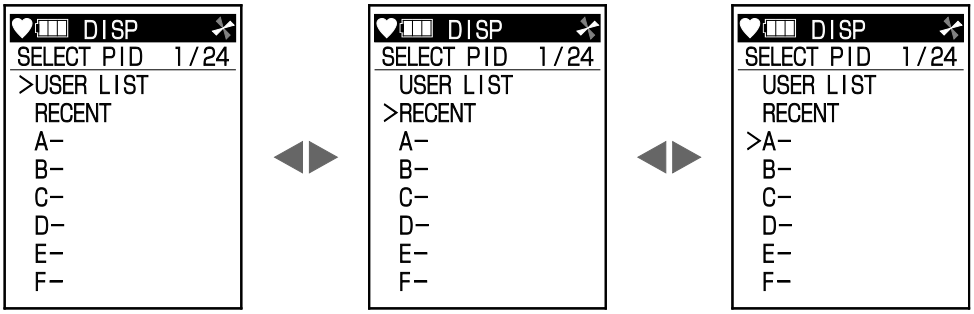
VOC reading setting (only for the specification targeting VOC for detection)

Normally, a volatile organic compound (VOC) concentration is displayed after isobutylene conversion; however, the reading can be converted to a pre-registered gas concentration.

1 **Press the DISP button to display the screen shown in the right figure, and then press the ENTER button.**

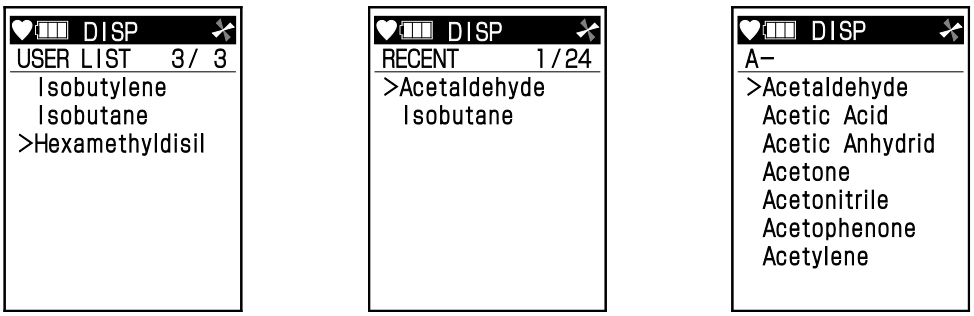


2 **Select with the ▲/▼ button.**
USER LIST indicates a set gas list, and RECENT indicates a recently selected gas list. All gases are displayed from A to X.



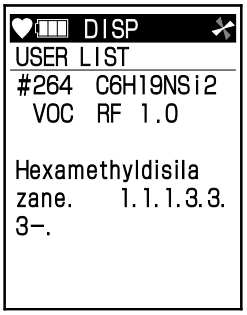
3 **Press the ENTER button.**
Gas types are displayed.

Press the DISP button to return to the step 2.

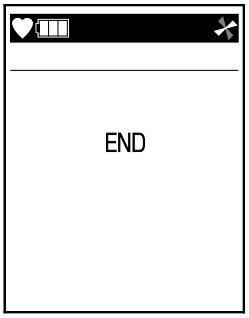


4 **Press the ENTER button.**
The name, chemical formula, conversion factor, etc. of each gas are displayed.

Press the DISP button to return to the step 3.



5 **Press the ENTER button.**
When the setting is completed, the screen shown in the step 1 returns automatically.



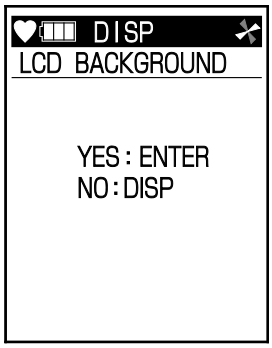
NOTE

- The setting is retained after power-off.
- Up to 30 frequently selected gas types can be registered in USER LIST.
- The data logger management program (optional) is required to use USER LIST.
- The history of selecting gas type from the list of all gases can be kept in RECENT (up to eight types).
- See the appendix "List of gases for reading VOC" (P. 103) for the gas types available for reading.

LCD black and white inversion setting

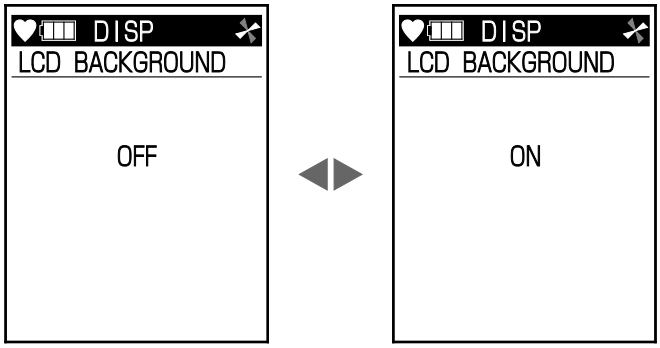
This item is used to invert the black and white display of LCD.

1 **Press the DISP button to display the screen shown in the right figure, and then press the ENTER button.**



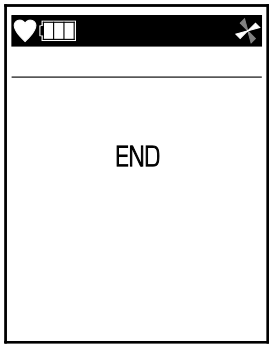
2 **Select with the ▲/▼ button.**

Select the LCD black and white inversion setting.
Press the DISP button to return to the screen shown in the step 1 without changing the setting.



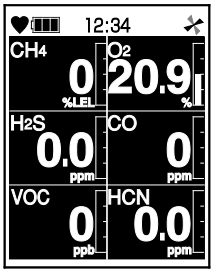
3 **Press the ENTER button.**

When the setting is completed, the screen shown in the step 1 returns automatically.



NOTE

- The figure on the right shows an example of black and white inversion.



English display setting

This item is used to resume English display when another language is used.
To correct erroneous language setting, resume English display once using this function and set again.

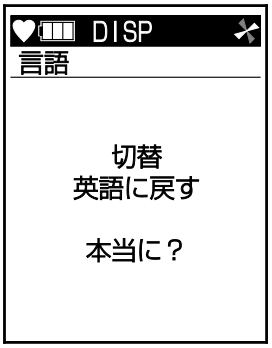
(**Example**: Resuming English display from Japanese display)

1 **Press the DISP button to display the screen shown in the right figure, and then press the ENTER button.**

<Display Contents>
LANGUAGE

CHANGE
TO ENGLISH
YES/ENTER
NO/DISP

2 **Press the ENTER button.**
Press the DISP button to return to the screen shown in the step 1 without changing to English display.

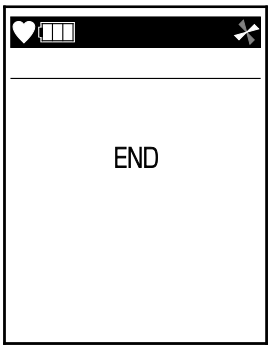


LANGUAGE

CHANGE
TO ENGLISH

CONFIRM?

The displayed language is changed to English.
When the setting is completed, the screen shown in the step 1 (displayed in English) is displayed automatically.



NOTE

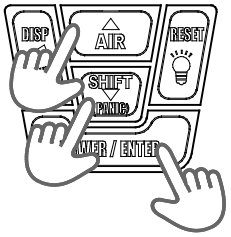
- The language setting can be changed in the user mode (P. 63) as well.

6-3. User mode setting

The display positions of date/time, gas concentration, etc. can be changed in the user mode to make them easier to use.

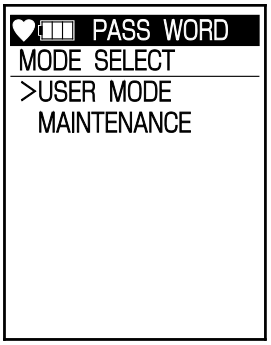
Displaying user mode

1 **When the power is off, press the POWER button while pressing the ▲ or ▼ button.**

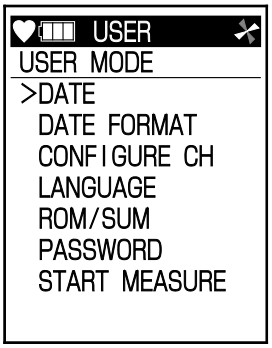


The screen to select user or maintenance mode is displayed.

2 **Select USER MODE and press the ENTER button.**



The user mode menu is displayed.



3 **When the setting is completed, select START MEASURE in the user mode menu and then press the ENTER button.**
The unit operates just like after turning on the power and goes on to the measurement screen.

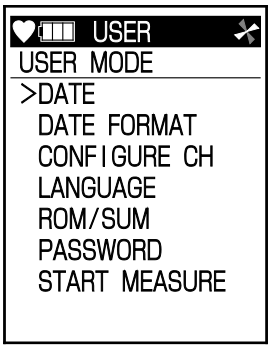
NOTE

- The user mode menu returns after setting various items. Press the DISP button to return in the process of setting.
- The maintenance mode is intended for important settings to perform normal measurement. This is unavailable for users to prevent an accidental change of settings. If the maintenance mode is selected accidentally, turn off the power once and then turn it on again.

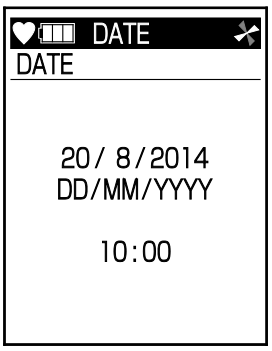
Setting date/time

This item is used to set date/time.

1 **Select DATE with the ▲/▼ button.**

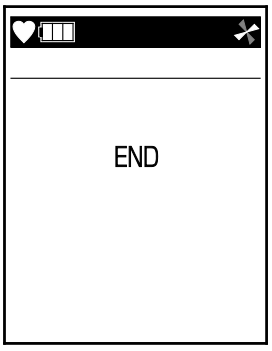


2 **Press the ENTER button.**
The year portion (YYYY) blinks.
Change numbers with the ▲/▼ button.



3 **When year is set, press the ENTER button.**
The month portion (MM) blinks.
Change numbers with the ▲/▼ button.
Similarly, set day, hour and minute.
Press the DISP button to go back to the previous portion like month to year.

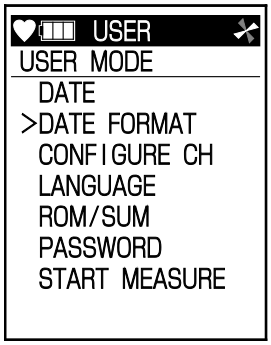
4 **When minute is set, press the ENTER button.**
When the setting is completed, the user mode menu returns automatically.



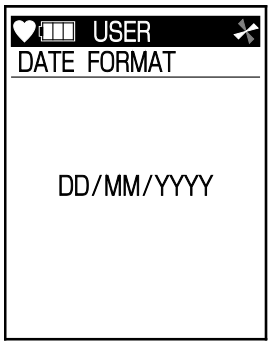
Selecting date display format

A desired format can be selected from three options for date display.

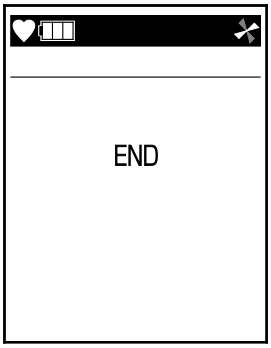
1 **Select DATE FORMAT with the ▲/▼ button and then press the ENTER button.**



2 **Select display with the ▲/▼ button.**
DD/MM/YYYY indicates day/month/year.
MM/DD/YYYY indicates month/day/year.
YYYY/MM/DD indicates year/month/day.
Press the DISP button to return to the screen shown in the step 1 without changing the display format.



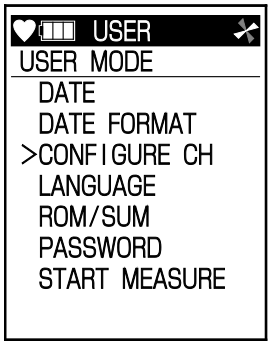
3 **Press the ENTER button.**
When the setting is completed, the user mode menu returns automatically.



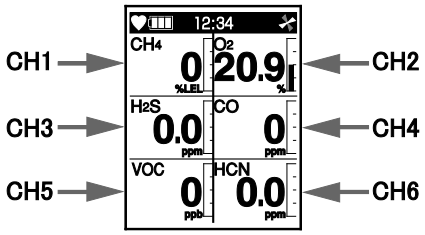
Changing display positions of measured gases

The measured gas concentration display positions can be changed.

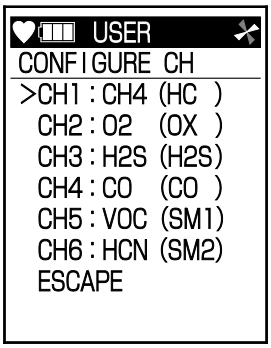
1 **Select CONFIGURE CH with the ▲/▼ button and then press the ENTER button.**



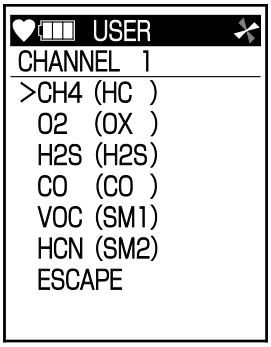
2 **Select the display position to change with the ▲/▼ button and then press the ENTER button.**
Display positions of CH1 to CH6 are as follows.



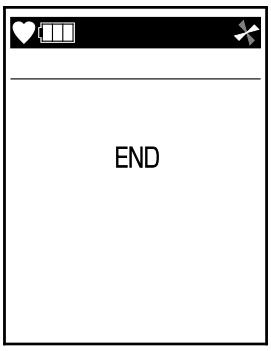
Use ESCAPE to return to the user mode menu.



3 **Select the display to exchange with the ▲/▼ button.**
The display positions of the selected channel and the selected channel in the step 2 (blinking) are exchanged.



4 **Press the ENTER button.**
When the setting is completed, the screen shown in the step 2 returns automatically. To return to the user mode menu, press the DISP button, or select ESCAPE and press the ENTER button.



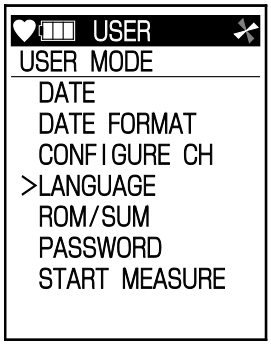
NOTE

- The display of the same measured gas cannot be allocated to multiple CH positions.

Changing display language

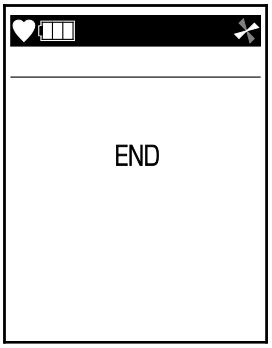
This item is used to change the language used on the LCD display.

1 **Select LANGUAGE with the ▲/▼ button and then press the ENTER button.**



2 **Select language with the ▲/▼ button.**

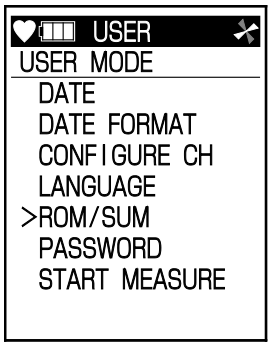
3 **Press the ENTER button.**
When the setting is completed, the display changes to the selected language and the user mode menu returns automatically.



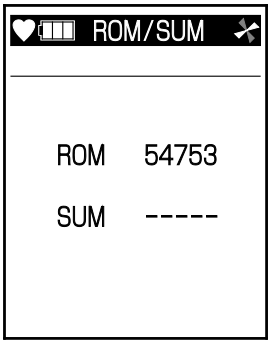
Displaying ROM/SUM

This item is used to check ROM number and the version of error detection data (checksum) sent with data.

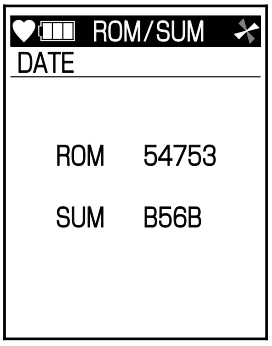
1 **Select ROM/SUM with the ▲/▼ button and then press the ENTER button.**



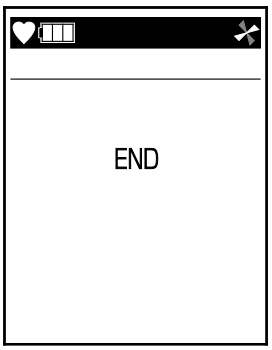
ROM number is displayed.



After calculation, SUM is displayed.



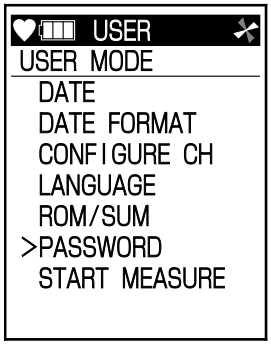
2 **Press the ENTER button.**
The display ends and then the user mode menu returns automatically.



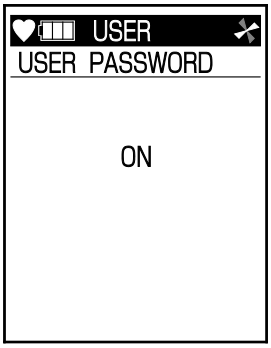
Setting password

This item is used to set password to enter the user mode.

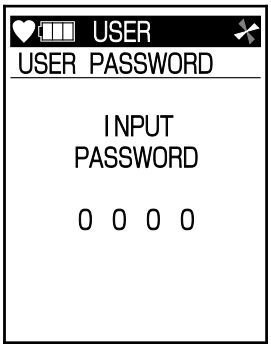
1 **Select PASSWORD with the ▲/▼ button and then press the ENTER button.**



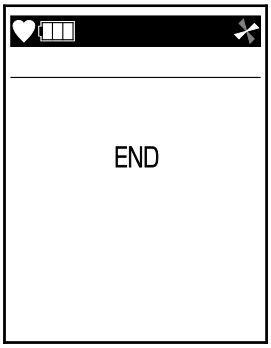
2 **Select ON with the ▲/▼ button and then press the ENTER button.**



3 **Set a four-digit password.**
The leftmost "0" blinks.
Select a number from 0 to 9 with the ▲/▼ button and then press the ENTER button. The next digit will blink.

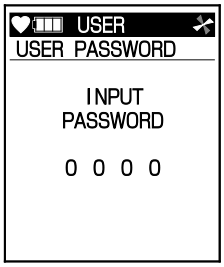


4 **Press the ENTER button.**
When the setting is completed, the user mode menu returns automatically.



NOTE

- With a password set, the password entry screen shown in the right figure appears before entering the user mode or CAL mode. Enter a password with the ▲/▼ button and then press the ENTER button.



7

Maintenance

The gas monitor is an important instrument for the purpose of safety.
To maintain the performance of the gas monitor and improve the reliability of safety, perform a regular maintenance.

7-1. Maintenance intervals and items

Perform the following maintenance regularly before use.

- Daily maintenance: Perform maintenance before beginning to work.
- Monthly maintenance: Perform alarm test once a month.
- Regular maintenance: Perform maintenance once or more for every six months to maintain the performance as a safety unit.

Maintenance item	Maintenance content	Daily maintenance	Monthly maintenance	Regular maintenance
Battery level	Check that the battery level is sufficient.	○	○	○
Concentration display	Make the gas monitor draw in fresh air. Check that the concentration display value is zero (or 20.9% on the oxygen meter). When the value is other than zero, perform zero adjustment by air calibration after ensuring that no interference gases exist around.	○	○	○
Operation of main unit	Check the LCD display for a fault indication.	○	○	○
Pump operation	Check the pump operation status display for a fault indication.	○	○	○
Filter	Check that the filter is not contaminated.	○	○	○
Alarm test	Perform alarm test and check that the alarm LED arrays, buzzer and vibrator function normally.	—	○	○
Span adjustment	Perform span adjustment using a calibration gas.	—	—	○
Gas alarm check	Check the gas alarm using a calibration gas.	—	—	○

WARNING

- If any abnormality is found on the gas monitor, promptly contact RIKEN KEIKI.

NOTE

- Perform span adjustment using a calibration gas at least once every six months.
- The span adjustment requires dedicated equipment and creation of calibration gas. Therefore, contact RIKEN KEIKI for span adjustment.
- The built-in sensors of the gas monitor have a validity period and must be replaced regularly.
- The sensor life has expired if, for example, the sensors cannot be calibrated in span adjustment, the readings do not come back after air calibration, or the readings fluctuate. In this case, contact RIKEN KEIKI. Note that the warranty period is one year.

About maintenance services

We provide services on regular maintenance including span adjustment, other adjustments and maintenance.

To make the calibration gas, dedicated tools, such as a gas cylinder of the specified concentration and gas sampling bag must be used.
Our qualified service engineers have expertise and knowledge on the dedicated tools used for services, along with other products. To maintain the safety operation of the gas monitor, please use our maintenance service.
The followings are typical maintenance services. Please contact RIKEN KEIKI for more information.

<Typical Maintenance Services>

Battery level check	Checks the battery level.
Concentration display check	Verifies that the concentration display value is zero (or 20.9% on the oxygen meter) using a zero gas. Performs air calibration (zero adjustment) if the reading is incorrect.
Flow rate check	Checks the flow rate by using an external flow meter.
Filter check	Checks the dust filter for dust or clogging. Replaces a dirty or clogged dust filter.
Alarm test	Performs alarm test to check that the alarm lamp, buzzer and vibrator function normally.
Span adjustment	Performs span adjustment using a calibration gas.
Gas alarm check	Checks the gas alarm using a calibration gas. • Checks the alarm. (Checks triggering of alarm when the alarm setpoint is reached.) • Checks the delay time. (Checks time to delay until the alarm is triggered.) • Checks the buzzer, lamp, vibrator and concentration display. (Checks each activation of two-step alarm.)
Cleaning and repair of the unit (visual diagnosis)	Checks dust or damage on the surface of the unit, cleans and repairs such parts. Replaces parts which are cracked or damaged.
Unit operation check	Operates the buttons to check the operation of functions and parameters.
Replacement of consumable parts	Replaces consumable parts, such as a sensor, filter and pump.

7-2. Calibration (CAL mode)

The CAL mode of the gas monitor provides AUTO CAL and SINGLE CAL in addition to AIR calibration.
AUTO CAL performs calibration with the predetermined gas concentration, while SINGLE CAL performs calibration by setting gas concentration each time for a single channel.
The gas monitor is equipped with a bump test (function check) function; however, it is set to OFF normally and thus unavailable. To use this function, please contact RIKEN KEIKI.
Perform span adjustment of sensors using a calibration gas at least once every six months (recommendation).
The span adjustment requires dedicated equipment and a calibration gas. Contact RIKEN KEIKI for it.

CAUTION

- Do not use a lighter gas to check the sensitivity of the gas monitor. A constituent of the lighter gas may deteriorate the sensor performances.

7-2-1. Preparation for calibration

<Required Equipment/Material>

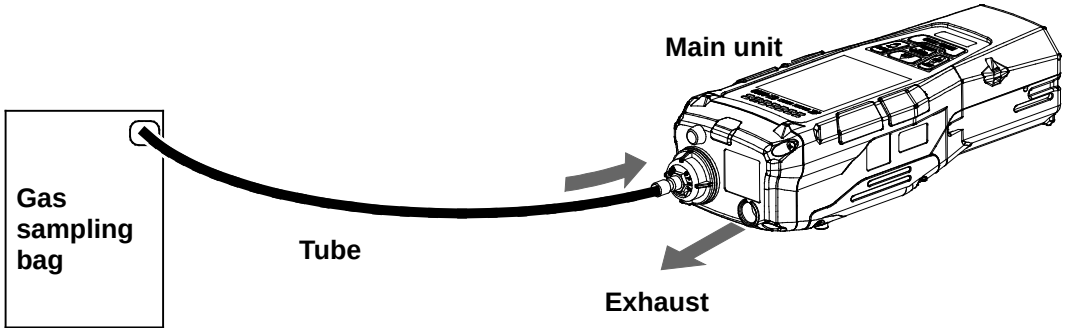
- Calibration gas (optional)
- Gas sampling bag (optional)

<Recommended Calibration Gas Concentration>

Gas to be detected	Calibration gas	Calibration gas concentration
Oxygen (O2)	Oxygen (O2)	12.5 vol%
Carbon monoxide (CO)	Carbon monoxide (CO)	50 ppm
Combustible gas (HC) <%LEL>	Isobutane (i-C4H10)	50%LEL
Combustible gas (CH4) <%LEL>	Methane (CH4)	50%LEL
Hydrogen sulfide (H2S)	Hydrogen sulfide (H2S)	25.0 ppm
Volatile organic compound (VOC) <ppb>	Isobutylene (i-C4H8)	20000 ppb
Volatile organic compound (VOC) <ppm>	Isobutylene (i-C4H8)	100 ppm
Sulfur dioxide (SO2)	Sulfur dioxide (SO2)	3.20 ppm
Nitrogen dioxide (NO2)	Nitrogen dioxide (NO2)	4.80 ppm
Hydrogen cyanide (HCN)	Hydrogen cyanide (HCN)	5.0 ppm

<Connection>

To perform calibration, connect a gas sampling bag to the unit as shown below.



WARNING

Calibration gas

A calibration gas uses a hazardous gas (combustible gas, toxic gas, oxygen deficiency, etc.). Handle the gas and related jigs and tools with due care.

Gas sampling bag

Use different gas sampling bags for each gas type and concentration to perform accurate calibration.

Place for calibration

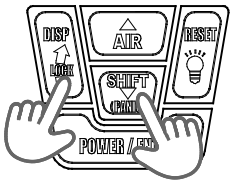
- Do not perform calibration in a confined space.
- Perform calibration in a place where no silicone, spray can gases, etc. is used.
- Perform calibration indoors at normal temperatures without remarkable fluctuation (within ±5ºC).

Calibration gas discharge

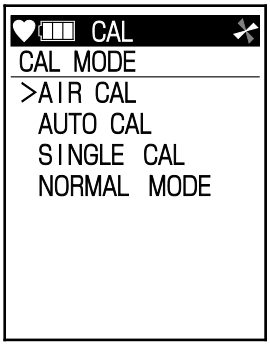
- The gas outlet of the gas monitor must be left open without any pipe connected for release. Discharge the gas to a safe place.
- A calibration gas uses a hazardous gas (combustible gas, toxic gas, oxygen deficiency, etc.). Discharge the gas with due care.

7-2-2. Entering CAL mode

1 With the measurement screen displayed in the normal mode, press the DISP and SHIFT buttons at the same time.



The CAL mode screen is displayed.

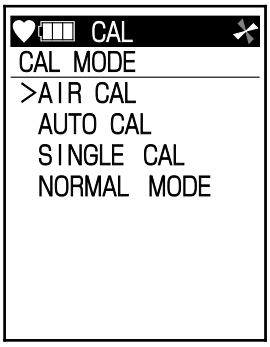


NOTE

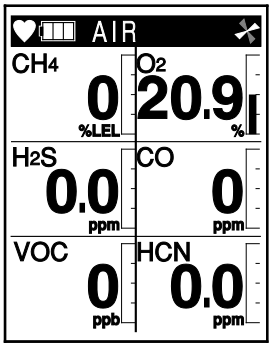
- Selecting NORMAL MODE returns to the measurement screen.
- Press the DISP button to return to the previous screen.

7-2-3. Air calibration (AIR CAL)

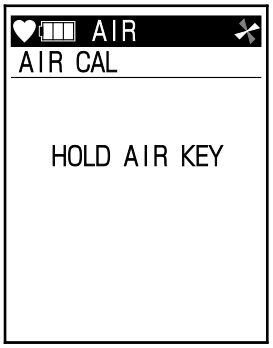
1 **In the CAL mode, select AIR CAL with the ▲/▼ button and then press the ENTER button.**



2 **Hold down the AIR button.**

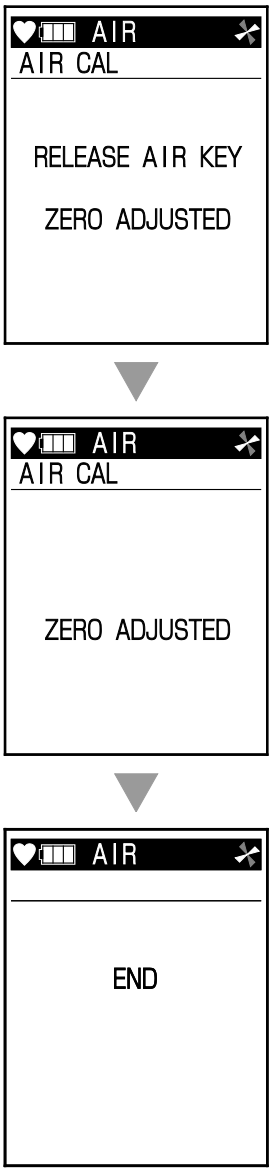


The air calibration screen is displayed.



Keep the AIR button pressed while the screen shown in the right figure is displayed.

3 **Release the AIR button when the screen shown in the right figure is displayed.**



When zero adjustment is successfully completed, the screen shown in the step 2 returns. Press the DISP button to return to the CAL mode menu.

WARNING

- When air calibration is performed in the atmosphere, check the atmosphere for freshness before beginning it. If interference gases exist, zero adjustment cannot be performed properly, thus leading to dangers when the gas leaks.

CAUTION

- Perform air calibration under pressure and temperature/humidity conditions close to those in the operating environment and in fresh air.
- Perform air calibration after the reading is stabilized.

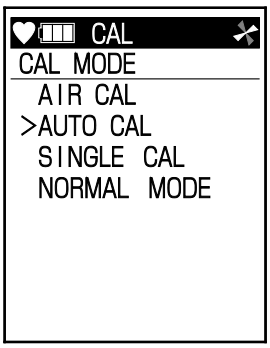
NOTE

When air calibration fails, "FAIL" appears in the measured value display area of the faulty sensor as well as "SENSOR". Press the RESET button to reset the fault alarm (calibration failure). When the alarm is reset, the value before calibration is displayed.

7-2-4. AUTO CAL

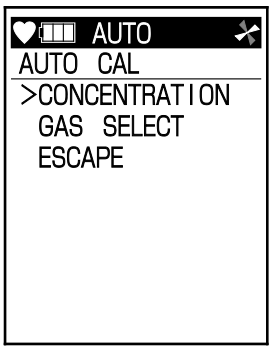
Calibration is performed using the predetermined gas concentration. Simultaneous calibration is available for the four channels: oxygen, combustible gas <%LEL> and toxic gases (carbon monoxide and hydrogen sulfide).
Prepare a calibration gas (P. 73).

1 **In the CAL mode, select AUTO CAL with the ▲/▼ button and then press the ENTER button.**



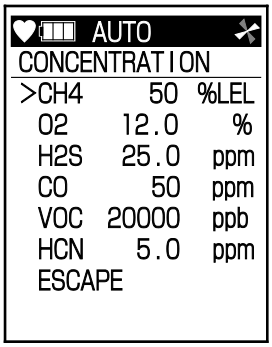
2 **Select COCENTRATION or GAS SELECT with the ▲/▼ button and then press the ENTER button.**

- Setting gas concentration
  Select "CONCENTRATION" -> Go to step 3
- Selecting gas type
  Select "GAS SELECT" -> Go to step 4
- Canceling calibration
  Select "ESCAPE" -> Go to CAL mode menu

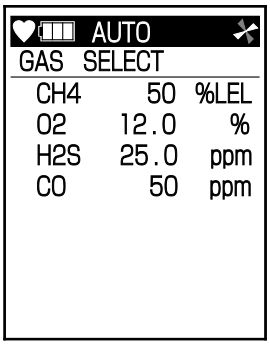


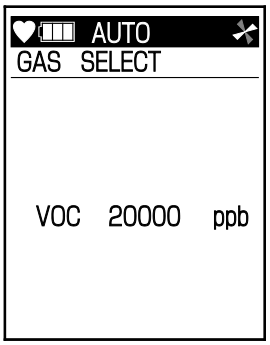
3 **Select gas with the ▲/▼ button and then press the ENTER button.**

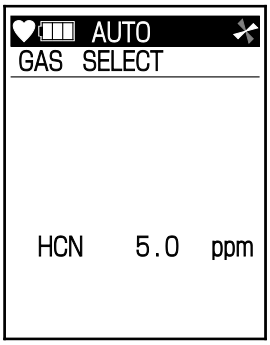
The concentration value of the selected gas blinks. Select calibration gas concentration with the ▲/▼ button and then press the ENTER button to confirm it. Select ESCAPE to return to the screen shown in the step 2.



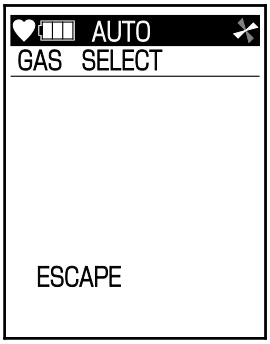
4 **Select calibration target gas with the ▲/▼ button and then press the ENTER button.**
Simultaneous calibration is available for the four channels: oxygen, combustible gas <%LEL> and toxic gases (carbon monoxide and hydrogen sulfide).





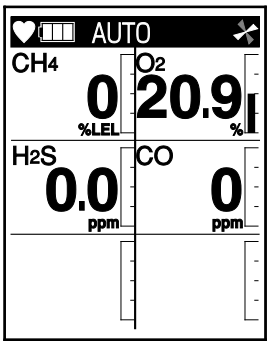


Select ESCAPE to return to the screen shown in the step 2.



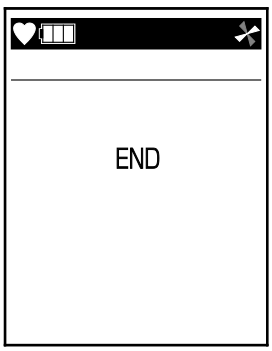
5 Make the gas monitor draw in the calibration gas from the gas inlet and press the ENTER button after 60 seconds.

Calibration is executed.
To stop the calibration process, press the DISP button to return to the screen shown in the step 4.



6 Press the DISP button.

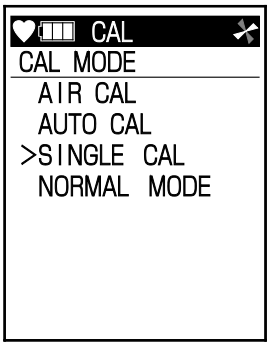
The CAL mode menu returns after finishing AUTO CAL.



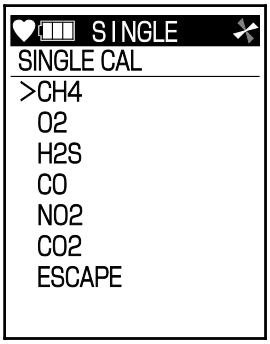
7-2-5. SINGLE CAL

Calibration is performed by setting gas concentration each time for a single channel. Prepare a calibration gas (P. 73).

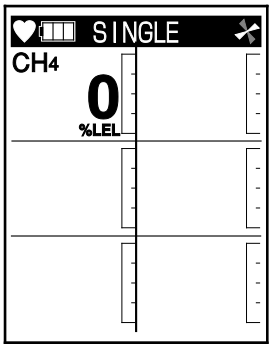
1 **In the CAL mode, select SINGLE CAL with the ▲/▼ button and then press the ENTER button.**



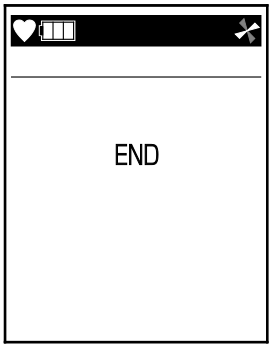
2 **Select a sensor with the ▲/▼ button and then press the ENTER button.**
Select ESCAPE to return to the screen shown in the step 2.



3 **Make the gas monitor draw in the calibration gas from the gas inlet, and adjust the displayed gas concentration to the concentration of the calibration gas used with the ▲/▼ button.**
Press the ENTER button 60 seconds after starting drawing in the gas to execute calibration.
To stop the calibration process, press the DISP button to return to the screen shown in the step 4.



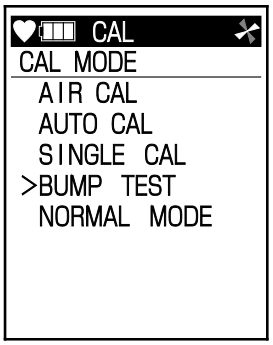
4 **Press the DISP button.**
The CAL mode menu returns after finishing SINGLE CAL.



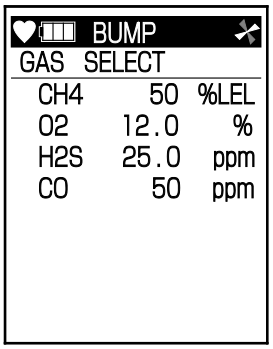
7-2-6. BUMP TEST

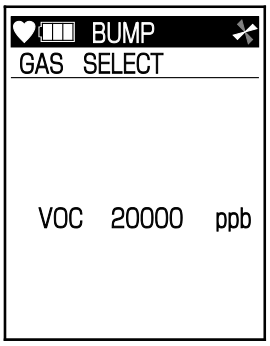
The gas monitor is equipped with a bump test (function check) function; however, it is set to OFF normally and thus unavailable.
To use this function, please contact RIKEN KEIKI.
Simultaneous execution of bump test is available for the four channels: oxygen, combustible gas <%LEL> and toxic gases (carbon monoxide and hydrogen sulfide). Prepare a bump test gas as in the case of calibration gas (P. 73).

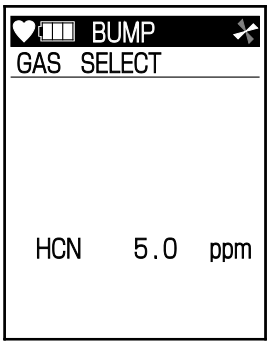
1 **Select BUMP TEST with the ▲/▼ button and then press the ENTER button.**



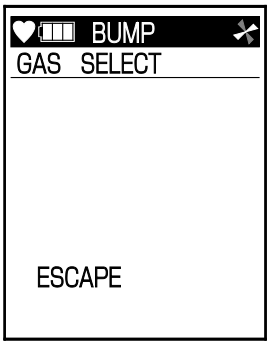
2 **Select the gas to be tested with the ▲/▼ button.**
Simultaneous testing is available for the four channels: oxygen, combustible gas <%LEL> and toxic gases (carbon monoxide and hydrogen sulfide).





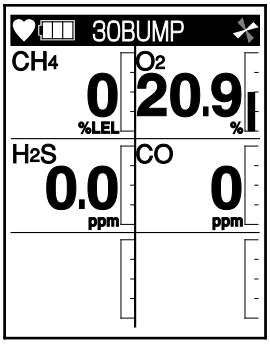


Select ESCAPE to return to the CAL mode menu.



3 Make the gas monitor draw in the test gas from the inlet and press the ENTER button.

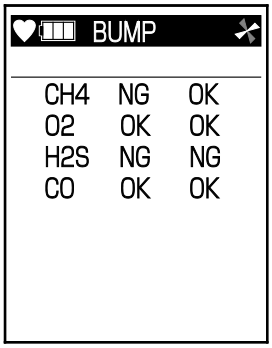
BUMP TEST starts and a 30-second countdown starts.
To stop the process, press the DISP button to return to the screen shown in the step 4.



After 30 seconds, the result of BUMP TEST is displayed.

If the result of BUMP TEST is NG, calibration is started automatically. Check that calibration has been performed accurately for all gases and OK has been displayed before use.

If NG is displayed as a result of calibration, replace the sensor (P. 85).



4 Press the DISP button.

The CAL mode menu returns after finishing SINGLE CAL.

7-3. How to clean

Clean the gas monitor if it becomes extremely dirty. The gas monitor must be turned off while cleaning it. Use a waste cloth or the like to remove dust. Do not use water or organic solvent for cleaning because they may cause malfunctions.
Because an extremely contaminated taper nozzle may disturb the gas detection, it must be cleaned with dry air, etc.

CAUTION

- When cleaning the gas monitor, do not splash water over it or use organic solvents such as alcohol and benzine on it. It may cause discoloration or damage to the surface or sensor failure.

NOTE

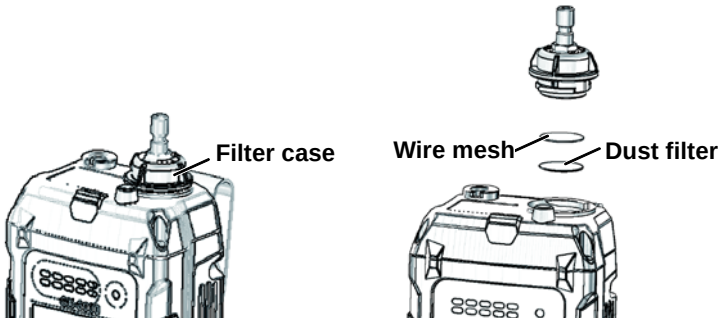
- When the gas monitor gets wet, water may remain in the buzzer sound opening or grooves. Drain water as follows:
  (1) Wipe away moisture on the gas monitor thoroughly using a dry towel, cloth, etc.
  (2) While holding the gas monitor firmly, shake it about ten times with the buzzer sound opening facing downward.
  (3) Wipe away moisture coming out from the inside thoroughly using a towel, cloth, etc.
  (4) Place the gas monitor on a dry towel, cloth, etc. and let it stand at normal temperatures.

7-4. Parts replacement

7-4-1. Gas inlet filter replacement

The gas inlet part contains a dust filter and wire mesh filter. Because the filters may gradually get dirty or clogged over time, they must be replaced according to the operating conditions. Especially the dust filter must be replaced when it shows a sign of water absorption, low flow rate or contamination. See the regular replacement parts (P. 90) for a replacement filter.

1 Turn the filter case counterclockwise and remove it.
2 Take out the filter and replace with a new filter.
3 Attach the filter case that has been removed.



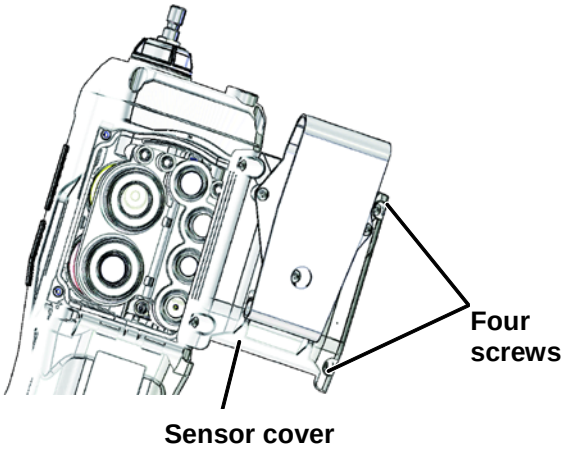
NOTE

- The dust filter and wire mesh filter are attached to the main unit side.
- Use only the filters specified by RIKEN KEIKI.

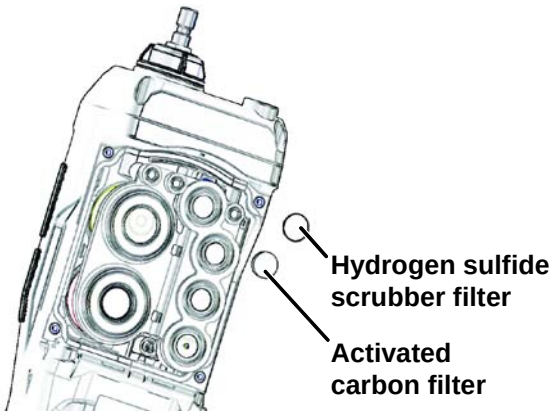
7-4-2. Sensor filter replacement

The sensor part contains various filters. Replace them regularly. See the regular replacement parts (P. 90) for a replacement filter.

1 Remove the battery unit, loosen the four screws of the sensor cover and remove the sensor cover.



2 Take out filters and replace them with new ones.



3 Attach the sensor cover to the main unit and tighten the four screws.

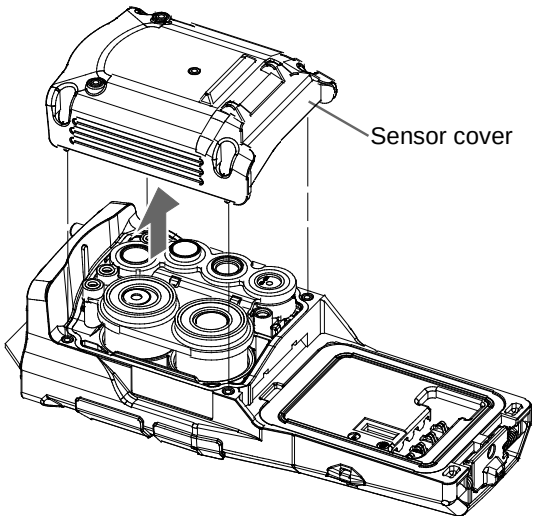
CAUTION

- Turn off the power of the gas monitor before replacing the filter.
- Do not remove the sensor cover except for filter replacement. When the sensor cover is not attached properly, accurate measurement may not be possible due to leaks, or water may get inside.
- Use the dedicated filters for this gas monitor only. Using a similar product may have harmful effects on the gas detection performance.
- If the screws are not tightened completely, accurate gas measurement may not be possible due to leaks, or water may get inside. The same thing may occur if a minute foreign substance gets stuck.

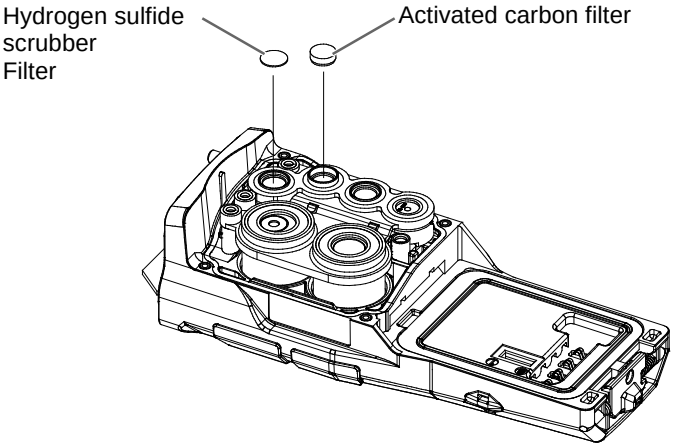
7-4-3. Sensor replacement

The built-in sensors of the gas monitor have a validity period and must be replaced regularly.
The sensor life has expired if, for example, the sensors cannot be calibrated in span adjustment, the readings do not come back after air calibration, or the readings fluctuate. Replace them as necessary. See "Regular replacement parts" (P. 85) for recommended replacement intervals of sensors.

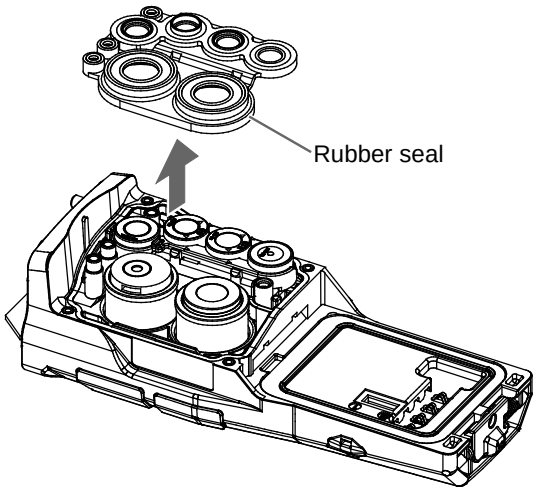
1 Remove the four screws at the back of the main unit and remove the sensor cover.



2 Remove the hydrogen sulfide scrubber filter and activated carbon filter from the rubber seal.



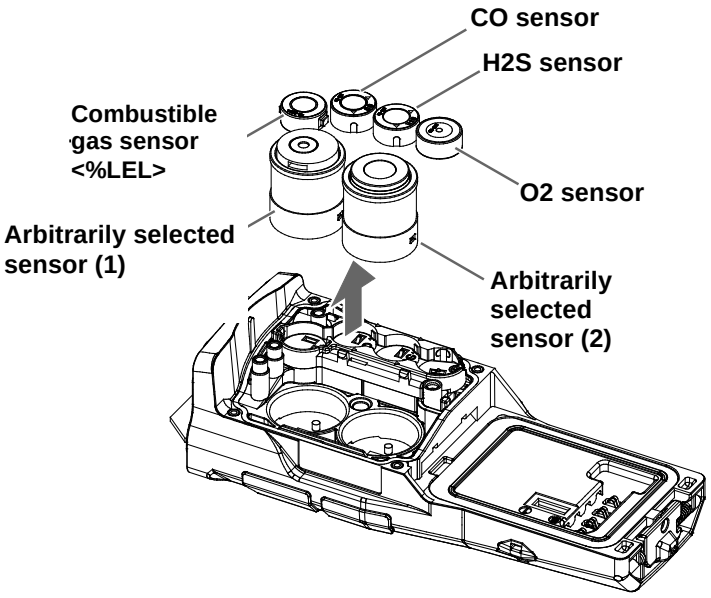
3 Remove the rubber seal.



4 **Replace the sensor.**

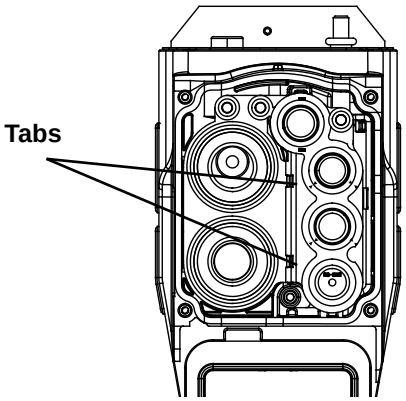
Attach a new sensor to the position where the old sensor was mounted. Attach the sensor according to the following instructions.

- Combustible gas sensor <%LEL>
  The contact piece on the side of the sensor comes in contact with the contact piece of the main unit.
- CO and H2S sensors
  The triangle marks (▲) on the sensor and main unit are facing each other.
- Arbitrarily selected sensor (1) and (2)
  The connector at the back of the sensor is inserted to the connector of the main unit.



5 Attach the rubber seal, new hydrogen sulfide scrubber filter and activated carbon filter, and then fix the sensor cover by tightening the four screws.

To attach the rubber seal, hang it on the tabs (two locations) of the case to fix.



NOTE

- The mounted sensors vary by the specification.
- To replace a sensor, be sure to attach a new sensor to the position where the old sensor was attached. If a sensor is attached to a wrong position, "SENSOR FAIL" is displayed or correct measurement cannot be performed.
- If the mounting position of the arbitrarily selected sensor is lost, attach the VOC sensor <ppb>, VOC sensor <ppm> and other sensor in this order to the arbitrarily selected sensor (1) mounting position and arbitrarily selected sensor (2) mounting position. If the sensor is attached in the wrong order, "SENSOR FAIL" is displayed and measurement becomes unavailable.
- When replacing a sensor, replace the sensor filter as well.
- Use only the filters specified by RIKEN KEIKI.
- Never fail to perform calibration (P. 73) after sensor replacement.

7-4-4. VOC sensor maintenance

The electronics in the MiniPID sensor are designed to be maintenance-free and not accessible. Periodic sensor maintenance is required for the Mini Pellet and the lamp.

When does my MiniPID require maintenance?

Your MiniPID lamp will need cleaning from time to time. How often depends on the environment you are measuring. If you are measuring indoor air quality where the VOC concentrations are low and there are few particulates, then a monthly or even less frequent calibration may be adequate. However, if you are measuring high VOC concentrations and particulates are present in high concentration then check calibration frequently and when the PID has lost sensitivity or error state shows, change the pellet as explained below.
Signs when the PID needs attention:

- If the baseline climbs after you zero the PID, then the pellet needs replacing.
- If the PID becomes sensitive to humidity, then the pellet needs replacing.
- If the baseline shifts/unstable when PID moves, then pellet needs replacing.
- If sensitivity has dropped too much (note the change required when checking calibration), then the lamp needs cleaning.

When do I clean the MiniPID lamp?
Cleaning of the MiniPID lamp is recommended as a first action when presented with an MiniPID that needs cleaning. Use the procedure described below. It is recommended that a cell is recalibrated after cleaning a lamp, especially if the cell has been used for a few months since the sensor was last used.

When do I replace the MiniPID electrode pellet?
The MiniPID pellet can last the lifetime of the MiniPID if used in clean environments, or may only last a month if used in heavily contaminated sites. The pellet is a disposable item, so always hold a spare pellet if you are working in a dirty environment. If the cell shows signs of contamination after the lamp window has been cleaned, or is known to have been subjected to severe contamination, then it should be replaced. Instructions for replacing the pellet are below. It is recommended that the MiniPID is recalibrated after replacing the pellet.

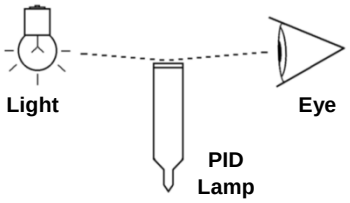
When do I replace the MiniPID lamp?
An MiniPID will last a long time, typically a few thousand hours. Lamps are warranted for 12 months; replacement bulbs are available and are not expensive to replace. The sensitivity of the MiniPID is approximately in direct proportion to the lamp light intensity, so as a bulb fails, the response to a particular, low gas concentration becomes more noisy.

Validity of lamp warranty is compromised if lamp cleaning maintenance is not followed and lamp has obvious fouling/contamination.

Removing Mini Pellet and Lamp

Caution: Always use the Pellet removal tool. Any other tools (for example screwdrivers) may damage your MiniPID body and will invalidate your warranty.

1. Gently remove the sensor from equipment.
2. Place the MiniPID, pellet side down, onto a clean surface.
3. Locate pellet removal tool into the side slots of the MiniPID and squeeze together until pellet and lamp are released.
4. Lift carefully the MiniPID body away from the pellet and lamp.
5. Occasionally the lamp may be temporarily lodged in the cell and will need to be freed carefully with tweezers.
6. Occasionally the small spring behind the lamp will come out when the lamp is removed from the sensor. Simply replace it in to the sensor house.



Cleaning the MiniPID Lamp

Inspection of the lamp may reveal a layer of contamination on the detection window that presents itself as a 'blue hue.' To check for contamination, hold the lamp in front of a light source and look across the window surface

Only clean the lamp using our recommended lamp cleaning kit and detailed instructions. To avoid contaminating the sensor and affecting accuracy, do not touch the lamp window with bare fingers. You may touch the lamp body with clean fingers.

MiniPID lamp cleaning kit A-31063

The vial of cleaning compound contains alumina (CAS Number 1344-28-1) as a very fine powder. Cleaning should be undertaken in a well-ventilated area. A full material safety data sheet MSDS is available on request from Ion Science Ltd. Key safety issues are identified below:

Hazard identification:

- May cause irritation of respiratory tract and eyes

Storage:

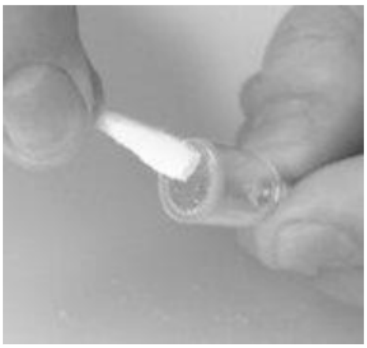
- Keep container closed to prevent water adsorption and contamination.

Handling:

- Do not breathe in the powder. Avoid contact with skin, eyes and clothing
- Wear suitable protective clothing
- Follow industrial hygiene practices: Wash face and hands thoroughly with soap and water after use and before eating, drinking, smoking or applying cosmetics.
- The powder carries a TVL(TWA) limit of 10 mg/m^3

Cleaning the Lamp

Use of MiniPID lamp cleaning kit A-31063



1. Open the container of alumina polishing compound.
2. With a clean cotton bud, collect a small amount of the powder.
3. Use this cotton bud to polish the PID lamp window. Use a circular action, applying light pressure to clean the lamp window. Do not touch the lamp window with fingers.
4. Continue polishing until an audible “squeaking” is made by the cotton bud moving over the window surface. (usually within 15 seconds)
5. Remove the residual powder from the lamp window with a clean cotton bud. Care must be taken not to touch the tips of cotton buds that are to be used to clean the lamps as this may contaminate them with finger print oil.
6. Ensure the lamp is completely dry and any visible signs of contamination are removed before refitting.

Discarding the MiniPID pellet

Discard the contaminated pellet. The pellet does not have any toxic components, but if it has been contaminated by toxic materials, then show due care when disposing.

Re-fitting MiniPID pellet and lamp

Caution! Never refit a damaged lamp

1. Place the lamp inside the O-ring seal in the pellet as illustrated. Twisting the lamp slightly during insertion will help to ensure the lamp window is snug against the pellet's front electrode. The lamp should be freely supported by the O-ring.

2. Lay the pellet front face down on a clean, flat surface and then screw the lamp down into the O-ring until it firmly abuts against the front electrode face – this is most important. Then bring the MiniPID body carefully down over the lamp so as not to disturb its positioning within the pellet and then push the body firmly onto the face down pellet so that it clicks into place.

3. Refit the sensor into the sensing equipment.

4. Re-calibrate the equipment in accordance with manufacturer's instructions.

7-4-5. Regular replacement parts

Consumable parts of the gas monitor are listed below. Replace the consumable parts according to the recommended intervals.

<List of Recommended Replacement Parts>

Name	Recommended check intervals	Recommended replacement intervals	Quantity	Remarks
Activated carbon filter	3 months	6 months	1	Used for CO sensor. Sold as a set containing five filters.
Hydrogen sulfide scrubber filter	3 months	6 months	1	Used for combustible gas sensor (%LEL). Sold as a set containing five filters.
Dust filter	3 months	6 months	1	Sold as a set containing ten filters.
Combustible gas sensor <%LEL> (NC-6264AZP)	6 months	3 years	1	
O2 sensor (OS-BM2C)	6 months	1 year	1	
H2S sensor (ES-1827i)	6 months	1 year	1	
CO sensor (ES-1821)	6 months	1 year	1	
SO2 sensor (ESS-03DH)	6 months	1 year	1	
NO2 sensor (ESS-03DH)	6 months	1 year	1	
HCN sensor (ESS-03DH)	6 months	1 year	1	
VOC sensor <ppb> (PIS-001)	6 months	4 years	1	
VOC sensor <ppm> (PIS-002)	6 months	4 years	1	
PID lamp (10.6 eV)	6 months	1 year	1	Used for VOC sensor.
Electrode pellet <ppb>	6 months	1 year	1	Used for VOC sensor <ppb>.
Electrode pellet <ppm>	6 months	1 year	1	Used for VOC sensor <ppm>.
Pump unit (RP-12)	6 months	1 - 2 years	1	
Rubber seals	-	2 years	1 set	*
Lithium ion battery unit (BUL-6000)	-	About 500 cycles of charging and discharging	1	For customers who use the lithium ion battery unit.
Alkaline dry battery	-	-	3	For customers who use the alkaline battery unit (optional accessory). AA type.

* The operation must be checked after replacement by a qualified service engineer. For the stable operation of the unit and safety, ask a qualified service engineer to take care of replacement of the part. Request it from RIKEN KEIKI.

NOTE

- The above replacement intervals are recommendation only. The intervals may change depending on the operating conditions. These intervals do not mean the warranty periods either. The result of the regular maintenance may determine when to replace the parts.

8

Storage and Disposal

8-1. Procedures to store the gas monitor or leave it for a long time

The gas monitor must be stored under the following environmental conditions.
• In a dark place under the normal temperature and humidity away from direct sunlight
• In a place where gases, solvents or vapors, etc. are not present

Store the gas monitor in a shipping carton, if any, in which the product was delivered.
Store the gas monitor away from dust, etc. if the shipping carton is not available.

CAUTION

- If the gas monitor is not used for a long time, store it after removing the lithium ion battery unit. Or remove dry batteries when the dry battery unit is used. Leaks from dry batteries may result in fire or injury.
- If the gas monitor is not used for a long time, turn on the power at least once every six months and check that the pump draws in air (about three minutes). The gas monitor, when not activated for a long time, may cease to work because of hardening of the grease in the pump motor.

NOTE

- If the gas monitor with the lithium ion battery unit attached is not used for a long time, it is recommended to store it after discharging the batteries until the battery level icon shows one battery mark or so. If the gas monitor is stored with the batteries fully charged, the batteries get deteriorated more quickly and may have shorter life.
- If the gas monitor with the dry battery unit attached is not used for a short time, store it with dry batteries attached. Since the sensor of the gas monitor is energized at all times including power-off time, it is required to keep dry batteries attached for storage.

8-2. Procedures to use the gas monitor again

When using the gas monitor after storage, perform calibration.

CAUTION

- Contact RIKEN KEIKI for readjustment including calibration.
- If there is a sudden temperature change of 15ºC or more between the storage and operational locations, turn on the power of the gas monitor, let it stand for about 10 minutes in a similar environment to the operational location, and perform air calibration in fresh air before using it.

8-3. Disposal of products

When the gas monitor is disposed of, it must be treated properly as an industrial waste in accordance with the local regulations.

WARNING

- Do not disassemble the electrochemical type sensor or galvanic cell type sensor because they contain electrolyte. Electrolyte may cause severe skin burns if it contacts skin, while it may cause blindness if it contacts eyes. If electrolyte is adhered on your clothes, that part on your clothes is discolored or its material is decomposed.
  If contact occurs, rinse the area immediately with a large quantity of water. Dispose of dry batteries in accordance with procedure specified by the local authority.

<Disposal in EU Member States>

When disposing of the gas monitor in EU member states, sort the batteries as specified.
Handle the batteries removed from the lithium ion battery unit (BUL-6000) or dry batteries used for the dry battery unit (BUD-6000) according to the classified refuse collection system and recycling system based on the regulations of EU member states.

NOTE

Crossed-out recycle dustbin mark

- This symbol mark is indicated on the products which contain the batteries which fall under EU Battery Directive 2006/66/EC. Such batteries need to be disposed of as specified by the latest Directive. This symbol mark indicates that the batteries need to be separated from the ordinary waste and disposed of appropriately.

9

Troubleshooting

The troubleshooting does not explain the causes of all the malfunctions which may occur on the gas monitor. This simply helps to find the causes of malfunctions which may frequently occur.
If the gas monitor shows a symptom which is not explained in this manual, or still has malfunctions even though remedial actions are taken, please contact RIKEN KEIKI.

9-1. Abnormalities on unit

Symptoms <Screen display>	Causes	Actions
The power cannot be turned on.	The battery level is too low.	Lithium ion battery unit: Charge in a safe place.
		Dry battery unit: Replace all the three dry batteries with new ones in a safe place.
	The POWER button was not pressed enough.	For power-on, press the POWER button and release it when the buzzer blips.
	Improper installation of the battery unit	Check whether the battery unit is properly attached to the main unit.
Abnormal operations	Disturbances by sudden static electricity noise, etc.	Turn off the power once and then turn it on again (restart).
Cannot operate the gas monitor.	Disturbances by sudden static electricity noise, etc.	Remove the battery unit in a safe place. Then reinstall it and turn on the power to perform operations.
A low battery voltage alarm is displayed. <FAIL BATTERY>	The battery level is low.	Lithium ion battery unit: Turn off the power and charge it in a safe place.
		Dry battery unit: Turn off the power and replace the dry batteries with new ones in a safe place.
The batteries cannot be charged. (Lithium ion battery unit only)	The charger is not connected properly.	Connect the AC plug and DC plug of the AC adapter properly.
	A charging circuit abnormality occurred.	Request the dealer or Riken Keiki local representative for repair.
	The batteries have been fully charged.	When fully charged batteries are charged again, the charging indicator lamp does not go on.
A low flow rate alarm is displayed. <FAIL LOW FLOW>	Water, oil or the like is drawn.	Check the taper nozzle for any damage or mark of drawn water, oil, etc.
	The filter is clogged.	Check the filter for attachment condition, clogging, torsion, etc.

Symptoms <Screen display>	Causes	Actions
A low flow rate alarm is displayed. <FAIL LOW FLOW>	The pump has deteriorated.	Request the dealer or Riken Keiki local representative to replace the pump.
	The unit was stored for a long time without being used (six months or longer).	When the low flow rate alarm is displayed, turn off the unit once and then turn it on again (restart). Repeat this procedure several times. If the problem still persists, request RIKEN KEIKI to replace the pump.
Air calibration impossible <SENSOR FAIL>	Fresh air is not supplied around the gas monitor.	Supply fresh air.
	Deteriorated sensor sensitivity	Replace the sensor with new one. (P. 85)
Sensor abnormalities <SENSOR FAIL>	Deteriorated sensor sensitivity	Replace the sensor with new one. (P. 85) (If "FAIL" is displayed in place of measured value at power-on, the alarm can be reset by pressing the RESET button. The operation can be continued using only the normal sensors to detect other gases.)
	The sensor mounting position is incorrect.	Mount the sensor properly. (P. 85)
	(VOC sensor) The PID lamp is contaminated.	Clean the PID lamp. (P. 83)
	(VOC sensor) Deteriorated electrode pellet	Replace the electrode pellet with new one. (P. 83)
	(VOC sensor) Deteriorated PID lamp	Replace the PID lamp with new one. (P. 83)
System abnormalities <FAIL SYSTEM>	A circuit abnormality occurred.	Request Riken Keiki for repair.
Error No. 000	Abnormalities of internal ROM	
Error No. 010	Abnormalities of internal RAM	
Error No. 021	Abnormalities of internal FRAM	
Error No. 022	Abnormalities of internal FLASH memory	
Clock abnormalities <FAIL CLOCK>	Abnormalities of the internal clock	Make a setting of date/time. (P. 64) If a symptom like this is observed repeatedly, the built-in clock is seemingly malfunctioning. Thus, it must be replaced. Please contact RIKEN KEIKI.
Cannot enter the user mode.	A password to enter the user mode has been forgotten.	Please contact RIKEN KEIKI.

9-2. Abnormalities of readings

Symptoms	Causes	Actions
The reading rises (drops) and it remains so.	Drifting of sensor output	Perform zero adjustment (air calibration). (P. 34)
	Presence of interference gas	Disturbances by interference gases, such as solvents, cannot be eliminated completely.
	Slow leak	A very small amount of the gas to be detected may be leaking (slow leak). Because ignoring it may cause dangers, take actions and measures which are taken at an occurrence of gas alarm.
	Environmental changes	Perform zero adjustment (air calibration). (P. 34) In particular, the galvanic cell type is affected by the air pressure.
A gas alarm is triggered despite of no gas leak and no other abnormalities at the detection point.	Presence of interference gas	Disturbances by interference gases, such as solvents, cannot be eliminated completely.
	Disturbance by noise	Turn off the power once and then turn it on again (restart). If a symptom like this is observed frequently, take appropriate measures to eliminate the noise.
Slow response	Clogged dust filter	Replace the dust filter. (P. 83)
	Bended or clogged taper nozzle	Fix the defective parts.
	Condensation is formed inside the gas monitor.	Fix the defective parts by providing dry air, etc.
	Deteriorated sensor sensitivity	Replace the sensor with new one. (P. 85)
Calibration impossible	Improper calibration gas concentration	Use the proper calibration gas.
	Deteriorated sensor sensitivity	Replace the sensor with new one. (P. 85)
VOC concentration rises despite of no abnormalities like gas leak at the detection point after zero calibration.	Deteriorated electrode pellet	Replace the electrode pellet with new one. (P. 83)
VOC sensor sensitivity has been deteriorated significantly.	The PID lamp is contaminated.	Clean the PID lamp. (P. 83)
	Deteriorated PID lamp	Replace the PID lamp with new one. (P. 83)

10

Product Specifications

10-1. List of specifications

<Common Specifications>

Concentration display	Digital LCD (full-dot display, 160 x 128 dots)
Detection method	Pump suction type
Flow rate	0.45 L/min or more (Open flow rate)
Displays	Clock display, battery level display, operating state display and flow check display
Display language	English, Japanese, German, Russian, Korean
Buzzer sound volume	95 dB (A) or higher (30 cm)
Gas alarm display	Lamp blinking, continuous modulating buzzer sounding, gas concentration and alarm detail display blinking and vibration
Gas alarm pattern	Self-latching
Fault alarm/self diagnosis	System abnormalities, sensor abnormalities, battery voltage drop, calibration failure, and low flow rate
Fault alarm display	Lamp blinking, intermittent buzzer sounding, and detail display
Fault alarm pattern	Self-latching
Panic alarm display	Preliminary alarm: Lamp blinking, intermittent buzzer sounding Main alarm: Lamp blinking, continuous modulating buzzer sounding
Panic alarm pattern	Self-latching
Man-down alarm display (*)	Preliminary alarm: Lamp blinking, intermittent buzzer sounding Main alarm: Lamp blinking, continuous modulating buzzer sounding
Man-down alarm pattern (*)	Non latching (auto-reset)
Transmission specification	IrDA (for data logger)
Power supply	Standard: Dedicated lithium ion battery unit [BUL-6000] Option: Dedicated dry battery unit <AA alkaline dry battery x 3> [BUD-6000]
Continuous operating time	BUL-6000: About 14 hours (25ºC, no alarm and no lighting) BUD-6000: About 8 hours (25ºC, no alarm and no lighting)
Operating temperatures	-20 - +50ºC
Operating humidities	Below 95% RH (Non-condensing)
Structure	Drip-proof and dust-proof performances (compliant to IP67 level) (tubes excluded)
Explosion-proof structure	Intrinsically safe explosion-proof structure
Explosion-proof class	Ex ia IIC T4 Ga (ATEX/IECEx)
Operating environment	Operating temperature range: -20 - +50ºC, operating humidity range: Below 95%RH (non-condensing)
External dimensions	Approx. 70 (W) x 201 (H) x 54 (D) mm (projection portions excluded)
Weight	Approx. 500 g (When BUL-6000 is used)/Approx. 450 g (When BUD-6000 is used)

* Normally the man-down alarm function is set to OFF and unavailable. To use this function, please contact RIKEN KEIKI.

<Specifications of Each Sensor>

Gas to be detected	Combustible gas (HC/CH4) <%LEL>	Oxygen (O2)	Hydrogen sulfide (H2S)	Carbon monoxide (CO)
Detection principle	New ceramic	Galvanic cell type	Electrochemical type	Electrochemical type
Detection range <Service range>	0 - 100%LEL	0 - 25.0% <to 40.0 vol%>	0 - 30.0 ppm <to 100.0 ppm>	0 – 150 ppm <to 500 ppm>
Minimum resolution	1%LEL	0.1 vol%	0.5 ppm	1 ppm
Alarm setpoint	10%LEL (AL1) 50%LEL (AL2) 100%LEL (OVER)	19.5 vol% (AL1） 23.5 vol% (AL2) 40.0 vol% (OVER)	5.0 ppm (AL1） 30.0 ppm (AL2) 10.0 ppm (TWA) 15.0 ppm (STEL) 100.0 ppm (OVER)	25 ppm (AL1) 50 ppm (AL2) 25 ppm (TWA) 200 ppm (STEL) 500.0 ppm (OVER)

Gas to be detected	Volatile organic compound (VOC) <ppb>	Volatile organic compound (VOC) <ppm>	Sulfur dioxide (SO2)	Nitrogen dioxide (NO2)
Detection principle	Photoionization type	Photoionization type	Electrochemical type	Electrochemical type
Detection range	50000 ppb	6000 ppm	0 - 6.00 ppm	0 - 9.00 ppm
Minimum resolution	1 ppb (0 - 5000 ppb) 10 ppb (5000 – 50000 ppb)	0.1 ppm (0 - 600.0 ppm) 1 ppm (600 – 6000 ppm)	0.05 ppm	0.05 ppm
Alarm setpoint	4300 ppb (AL1) 6000 ppb (AL2) 50000 ppb (OVER)	400.0 ppm (AL1) 600.0 ppm (AL2) 42.0 ppm (TWA) 60.0 ppm (STEL) 6000 ppm (OVER)	2.00 ppm (AL1) 5.00 ppm (AL2) 2.00 ppm (TWA) 5.00 ppm (STEL) 6.00 ppm (OVER)	3.00 ppm (AL1) 6.00 ppm (AL2) 3.00 ppm (TWA) 9.00 ppm (OVER)

Gas to be detected	Hydrogen cyanide (HCN)
Detection principle	Electrochemical type
Detection range	0 - 15.0 ppm
Minimum resolution	0.1 ppm
Alarm setpoint	5.0 ppm (AL1) 10.0 ppm (AL2) 4.7 ppm (STEL) 15.0 ppm (OVER)

10-2. List of accessories

Standard accessories	• Lithium ion battery unit (BUL-6000) • Charger (1 pc) • Rubber boot (1 pc) • Belt clip (1 pc) • Taper nozzle (1 pc) • Hand strap (1 pc) • LCD protection film (1 pc) • Operating manual • Product warranty
Optional items (sold separately)	• Dry battery unit (BUD-6000) • AA alkaline battery (3 pcs) • Various filters • Data logger management program • Various calibration gases • Gas sampling bag

11

Appendix

11-1. Calibration history/various trend/event history functions

The gas monitor has history and trend functions. To use these functions, please contact RIKEN KEIKI.

NOTE

- The data logger management program (optional) is required to use the history and trend functions. Please contact RIKEN KEIKI for more information.

Data logger provides five functions.

(1) Interval trend

Records the change of measured concentration from power-on to power-off.
Up to 100 latest data are recorded.
After the number of recorded data reaches 100, the oldest data will be overwritten by the latest data.
* However, when the maximum recording time is exceeded, the oldest data will be deleted before reaching 100.

The maximum recording time is specified as follows for each interval time.

Interval time	10-second	20-second	30-second	1-minute	3-minute	5-minute	10-minute
Maximum recording time	10 hours	20 hours	30 hours	60 hours	180 hours	300 hours	600 hours

*The standard interval time is "5 minutes."

Interval time can be set by "Data Logger Management Program" (optional).

(2) Alarm trend

Starting immediately after the alarm is triggered, this function records the change of measured concentration for one hour, which is from 30 minutes before the alarm was triggered until 30 minutes after the alarm was triggered.
Alarm trend records the peak value of five-second time at a 5-second interval.
Last eight measurement data shall be recorded.
When the number of data exceeds eight, the oldest data will be overwritten by the latest data.

(3) Alarm event

Records the trigger of alarm as an event.
The event records the time of alarm trigger, target measurement gas and type of alarm event (AL1, AL2, OVER).
Up to 100 latest events are recorded.
After the number of recorded events reaches 100, the oldest data will be overwritten by the latest data.

(4) Trouble event

Records the trigger of fault alarm as an event.
The event records the time when the trouble was triggered, the target gas of measurement, and the type of fault event.
Up to 100 latest events are recorded.
After the number of recorded events reaches 100, the oldest data will be overwritten by the latest data.

(5) Calibration history

Records data when the calibration is performed.
The history records the calibration time, concentration values before and after the calibration, as well as the calibration error.
Up to 100 latest calibration data are recorded.
After the number of recorded data reaches 100, the oldest data will be overwritten by the latest data.

NOTE

- The data logger function of this gas monitor is entirely based on the overwriting system (the oldest data is deleted and the latest data is recorded).
- The recorded data can be read out by the "Data Logger Management Program" (optional). See the operating manual of "Data Logger Management Program" for more information.

11-2. Definition of terms

ppb	Gas concentration indicated in the unit of one-billionth of the volume
ppm	Gas concentration indicated in the unit of one-millionth of the volume
vol%	Gas concentration indicated in the unit of one-hundredth of the volume
LEL	The acronym of Lower Explosion Limit. LEL refers to the lowest concentration of a combustible gas in air capable of causing explosion when ignited.
TWA (Time weighted average exposure limit)	An abbreviation for "Threshold Limit Value Time Weighted Average." A time weighted average concentration of toxic substances which is considered no harm on almost all the workers' health by repeated exposure at regular work of eight hours a day or 40 hours a week.
STEL (Short term exposure limit)	An abbreviation for "Threshold Limit Value Short Term Exposure Limit." A concentration of toxic substances which does not have harmful effects on the workers' health by 15-minute continuous exposure provided that everyday exposure does not exceed TWA value.
Self-latching	One of alarm patterns. Once an alarm is triggered, this keeps the alarm activated until it is reset even when the alarm conditions are not met.
Non latching (auto-reset)	One of alarm patterns. When an alarm is triggered, this stops the alarm automatically when the alarm conditions are not met.

11-3. List of gases for reading VOC

Normally, a volatile organic compound (VOC) concentration is displayed as isobutylene; however, the reading can be converted to a pre-registered gas concentration. See "VOC reading setting" (P. 59) for the setting.

Gas name	Formula	CAS No.	Response factor
A			
Acetaldehyde	C2H4O	75-07-0	3.4
Acetamide	C2H5NO	60-35-5	2
Acetic acid	C2H4O2	64-17-7	36.2
Acetic anhydride	C4H6O3	108-24-7	4
Acetoin	C4H8O2	513-86-0	1
Acetone	C3H6O	67-64-1	0.7
Acetophenone	C8H8O	98-86-2	0.6
Acetyl bromide	C2H3BrO	506-96-7	3
Acetylglycine, N-	C4H76NO3	543-24-8	2
Acrolein	C3H4O	107-02-8	3.2
Acrylic Acid	C3H4O2	79-10-7	2.7
Alkanes, n-, C6+			1
Allyl alcohol	C3H6O	107-18-6	2.1
Allyl bromide	C3H5Br	106-95-6	3
Allyl chloride	C3H5Cl	107-05-1	4.5
Allyl glycidyl ether	C6H10O2	106-92-3	0.8
Allyl propyl disulfide	C6H12S2	2179-59-1	0.4
Ammonia	NH3	7664-41-7	8.5
Amyl acetate	C7H14O2	628-63-7	1.8
Amyl acetate, sec-	C9H14O2	626-38-0	2
Amyl alcohol	C5H12O	71-41-0	3.5
Amyl alcohol, tert-	C5H12O	75-85-4	1.5
Amyl methyl ether, tert-	C6H14O	994-05-8	0.8
Anethole	C10H12O	104-46-1	0.4
Aniline	C6H7N	62-53-3	0.48
Anisole	C7H8O	100-66-3	0.5
Anisyl aldehyde	C8H8O2	123-11-5	0.4
Arsine	AsH3	7784-42-1	2.5
Asphalt, petroleum fumes		8052-42-4	1
B			
Benzaldehyde	C7H6O	100-52-7	0.9
Benzene	C6H6	71-43-2	0.46

Gas name	Formula	CAS No.	Response factor
Benzene thiol	C6H5SH	108-98-5	0.7
Benzoic acid	C7H6O2	65-85-0	0.7
Benzonitrile	C7H5N	100-47-0	0.7
Benzoquinone, o-	C6H4O2	583-63-1	1
Benzoquinone, p-	C6H4O2	106-51-4	1
Benzoyl bromide	C7H6BrO	618-32-6	2
Benzyl 2-phenylacetate	C15H14O2	102-16-9	0.5
Benzyl acetate	C9H10O2	140-11-4	0.6
Benzyl alcohol	C7H8O	100-51-6	1.3
Benzyl chloride	C7H7Cl	100-44-7	0.48
Benzyl formate	C8H8O2	104-57-4	0.8
Benzyl isobutyrate	C11H14O2	103-28-6	0.5
Benzyl nitrile	C8H7N	140-29-4	1
Benzyl propionate	C10H12O2	122-63-4	0.5
Benzylamine	C9H8N	100-46-9	0.6
Biphenyl	C12H10	92-52-4	0.4
Borneol	C10H18O	507-70-0	0.8
Bromine	Br2	7726-95-6	15
Bromo-2,2-dimethylpropane, 1-	C5H11Br	630-17-1	2
Bromo-2-chloroethane, 1-	C2H4Cl	107-04-0	8
Bromo-2-methylpentane, 1-	C6H13Br	25346-33-2	2
Bromoacetone	C3H5BrO	598-31-2	1
Bromoacetylene	C2HBr	593-61-3	4
Bromobenzene	C6H5Br	108-86-1	0.3
Bromobutane, 1-	C4H9Br	105-65-9	1
Bromobutane, 2-	C4H9Br	78-76-2	1.5
Bromocyclohexane	C6H11Br	108-85-0	3
Bromoethane	C2H5Br	74-96-4	5
Bromoethanol, 2-	C2H4BrO	540-51-2	2
Bromoethyl methyl ether, 2-	C3H7OBr	6482-24-2	2.5
Bromoform	CHBr3	75-25-2	2.8
Bromopentane, 1-	C5H11Br	203-776-0	2
Bromopropane, 1-	C3H7Br	106-94-5	1.3
Bromopyridine, 3-	C5H4BrN	636-55-1	2
Bromopyridine, 4-	C5H4BrN	1120-87-2	2
Bromotrimethylsilane	C3H9BrSi	2857-97-8	2

Gas name	Formula	CAS No.	Response factor
But-2-ynal	C4H4O	1119-19-3	3
But-3-ynal	C4H4O	52844-23-2	1.5
Butadiene diepoxide, 1,3-	C4H6O2	1464-53-5	4
Butadiene, 1,3-	C4H6	106-99-0	0.8
Butane, n-	C4H10	106-97-8	44
Butanedione, 2,3-	C4H6O2	431-03-8	0.4
Butanoic acid	C4H8O2	107-92-6	5
Butanol, 1-	C4H10O	71-36-3	4
Buten-3-ol, 1-	C4H8O	598-32-3	1.2
Butene, 1-	C4H8	106-98-9	1.5
Butene, 2-	C4H8	107-07-7	1.3
Butene, cis-2-	C4H8	590-18-1	1.3
Butene, trans-2-	C4H8	624-64-6	1.3
Butenoic acid, 3-	C4H6O2	107-93-7	2
Butoxyethanol, 2-	C6H14O2	111-76-2	1.1
Butoxyethyl acetate, 2-	C8H16O3	76-22-2	1
Butoxyethylacetate, 2-	C8H16O3	112-07-2	3
Butyl acetate	C6H12O2	123-86-4	2.4
Butyl acetate, sec-	C6H12O2	105-46-4	2.4
Butyl acetate, tert-	C6H12O2	540-88-5	2
Butyl acrylate	C7H12O2	141-32-2	1.5
Butyl alcohol, sec-	C4H10O	78-92-2	3
Butyl benzene, tert-	C10H16	35952	0.4
Butyl butyrate	C8H16O2	109-21-7	1.8
Butyl chloroformate	C5H9O2Cl	592-34-7	3.2
Butyl cyclohexan-1-ol, 4- tert-	C10H20O	98-52-2	1.4
Butyl cyclohexyl acetate, 2- tert-	C12H22O2	88-41-5	0.8
Butyl ether, n-	C8H18O	142-96-1	0.7
Butyl glycidyl ether	C7H14O2	192337	2
Butyl iodide	C4H9I	542-69-8	1
Butyl isocyanate	C5H9NO	111-36-4	2.5
Butyl lactate	C7H14O3	138-22-7	2.5
Butyl mercaptan	C4H10S	109-79-5	0.5
Butyl mercaptan, tert-	C4H9S	75-66-1	0.4
Butyl methacrylate	C8H14O2	97-88-1	1
Butyl propionate, n-	C7H14O2	590-02-1	1.8

Gas name	Formula	CAS No.	Response factor
Butylamine, n-	C4H11N	109-73-9	1
Butylamine, sec-	C4H11N	513-49-5	0.9
Butylamine, tert-	C4H11N	75-64-9	0.9
Butylene carbonate, 1,2-	C5H8O3	224-651-7	2
Butylphenol, o-sec-	C10H14O	89-72-5	0.9
Butyn-1-ol, 2-	C4H6O	764-01-2	1.5
Butyn-2-one	C4H4O	1423-60-5	3
Butyraldehyde	C4H8O	123-72-8	1.6
Butyrolactone, gamma-	C4H6O2	96-48-0	15
Butyryl chloride	C4H9OCl	141-75-3	3
C			
Camphene	C10H16	565-00-4	0.5
Camphor	C10H16O	76-22-2	0.4
Carbon disulfide	CS2	75-15-0	1.4
Carbon suboxide	C3O2	504-64-3	10
Carbon tetrabromide	CBr4	558-13-4	3
Carene	C10H16	13466-78-9	0.5
Carvone, R-	C10H14O	6485-40-1	1
Caryophyllene	C15H24	13877-93-5	0.4
Chlorine dioxide	ClO2	10049-04-4	1
Chloro-1,1-difluoroethene, 2-	C2H3ClF2	359-10-4	1.5
Chloro-2-propanone, 1-	C3H5ClO	28615	1
Chloroacetaldehyde	C2H3OCl	107-20-0	3
Chlorobenzene	C6H5Cl	108-90-7	0.36
Chlorobutane, 1-	C4H9Cl	109-69-6	10
Chlorobutane, 2-	C4H9Cl	78-86-4	8
Chlorocyclohexane	C6H111Cl	542-18-7	4
Chloroethanol, 2-	C2H5ClO	107-07-3	10
Chloroethyl methyl ether, 2-	C3H7ClO	627-42-9	2.6
Chloromethoxyethane	C3H7ClO	3188-13-4	4
Chloromide	NH2Cl	10599-90-3	2
Chloroprene	C4H5Cl	126-99-8	1.3
Chloropyridine, 2-	C5H4ClN	109-09-1	1
Chlorostyrene, o-	C8H7Cl	2039-87-4	0.4
Chlorotoluene, m-	C7H7Cl	108-41-8	0.5
Chlorotoluene, o-	C7H7Cl	95-49-8	0.5
Chlorotoluene, p-	C7H7Cl	108-41-8	0.39

Gas name	Formula	CAS No.	Response factor
Chlorotrifluoroethylene	C2ClF3	79-38-9	1
Cinnamic acetate	C11H12O2	21040-45-9	0.4
Cinnamic alcohol	C9H10O	203-212-3	0.4
Cinnamic aldehyde	C8H8O	104-55-2	0.4
Citral	C10H16O	5392-40-5	1
Citronellal	C10H18O	106-23-0	0.9
Citronellol	C10H20O	26489-01-0	1
Citronellol acetate	C12H22O2	150-84-5	1.5
Citronellol formate	C11H20O2	105-85-1	1.5
Citronellyl isobutyrate	C14H26O2	97-89-2	0.9
Coumarin	C9H6O2	91-64-5	0.4
Cresol, m-	C7H8O	108-39-4	2.2
Cresol, o-	C7H8O	95-48-7	1.1
Cresol, p-	C7H8O	106-44-5	1.1
Cresyl acetate, p-	C9H10O	140-39-6	1
Cresyl ethyl ether, p-	C9H12O	622-60-6	0.8
Cresyl methyl ether	C8H10O	104-93-8	0.8
Crotonaldehyde	C4H6O	4170-30-3	1
Cumene	C9H12	98-82-8	0.32
Cycloalkanes			1.5
Cyclobutanone	C6H6O	214-745-6	1.2
Cyclobutene	C4H6	833-35-5	3
Cycloheptane	C7H14	291-64-5	1.1
Cyclohex-2-enedione, 1,4-	C6H6O2	4505-38-8	1
Cyclohexane	C6H12	110-82-7	1.2
Cyclohexanol	C6H12O	108-93-0	2.9
Cyclohexanone	C6H10O	108-94-1	1.1
Cyclohexanthiol	C6H14S	1569-69-3	0.5
Cyclohexene	C6H10	110-83-8	0.8
Cyclohexyl acetate	C8H14O2	622-45-7	1.2
Cyclohexylamine	C6H13N	108-91-8	1
Cyclooctadiene	C8H12	29965-97-7	1
Cyclopentadiene	C5H6	542-92-7	0.8
Cyclopentane	C5H10	287-92-3	4
Cyclopentanone	C5H8O	120-92-3	0.7
Cyclopentene	C5H8	142-29-0	1.5

Gas name	Formula	CAS No.	Response factor
Cyclopentene-1,3-dione, 4-	C5H4O2	930-60-9	1
Cymene, p-	C10H14	99-87-6	0.35
D			
Decahydronaphthalene	C10H18	91-17-8	0.9
Decanal	C10H20O	112-31-2	0.9
Decane	C10H24	124-18-5	0.9
Decyne, 1-	C10H18	764-93-2	1.3
Diacetone alcohol	C6H12O2	123-42-2	0.8
Diazine, 1,2-	C4H4N2	289-80-5	3
Diazine, 1,3-	C4H4N2	289-95-2	3
Dibromoacetylene	C2Br2	623-61-3	1.5
Dibromochloromethane	CHBr2Cl	124-48-1	10
Dibromocyclohexane, 1,2-	C6H10Br2	5401-62-7	3
Dibromocyclopentane	C5H8Br2	33547-17-0	3
Dibromodichloromethane	CBr2Cl2	594-18-3	4
Dibromoethane, 1,2-	C2H4Br2	106-93-4	2
Dibromoethene, 1,1-	C2H2Br2	593-92-0	1.5
Dibromoethene, 1,2-	C2H2Br2	540-49-8	1.5
Dibromomethane	CH2Br2	74-95-3	1.2
Dichloro-1,2-difluoroethene, 1,2-	C2Cl2F2	598-88-9	2
Dichloro-1-propene, 2,3-	C3H4Cl2	78-88-6	1.4
Dichloro-2,2,-difluoroethene, 1,1-	C2H2Cl2F2	79-35-6	1
Dichloroacetylene	C2Cl2	7572-29-4	5
Dichlorobenzene, o-	C6H4Cl2	95-50-1	0.5
Dichlorobenzene, p-	C6H4Cl2	106-46-7	0.5
Dichloroethene, 1,1-	C2H2Cl2	75-35-4	1
Dichloroethene, cis-1,2-	C2H2Cl2	156-59-2	0.8
Dichloroethene, trans-1,2-	C2H2Cl2	156-60-5	0.36
Dichloroethylene 1,2-	C2H2Cl2	540-59-0	0.36
Dichloroethyne	C2Cl2	7572-29-4	2
Dichloromethane	CH2Cl2	27639	39
Dichloromethylamine	CH3Cl2N	7651-91-4	2
Dicyclohexylamine	C12H22N	101-83-7	0.8
Dicyclopentadiene	C10H12	77-73-6	0.9
Diesel fuel		68334-30-5	0.8
Diethoxymethane	C4H10O2	110-71-4	1.3
Diethyl carbonate	C5H10O3	105-58-8	2

Gas name	Formula	CAS No.	Response factor
Diethyl ether	C4H10O	60-29-7	0.9
Diethyl maleate	C8H12O4	141-05-9	2
Diethyl phosphite	C4H11O3P	762-04-9	2
Diethyl phthalate	C12H14O4	84-66-2	1
Diethyl sulfate	C4H10SO4	64-67-5	3
Diethyl sulfide	C4H10S	352-93-2	0.6
Diethyl sulfone	C4H10O2S	597-35-3	2
Diethylacetylene	C6H10	928-49-4	2
Diethylamine	C4H11N	109-89-7	1.3
Diethylaminoethanol, 2-	C6H15ON	100-37-8	2.7
Diethylaminopropylamine, 3-	C7H18N2	104-78-9	1.2
Diethylenetriamine	C4H13N3	111-40-0	0.9
Diethylhydroxylamine	C4H12NO	3710-84-7	2
Diethylsilane	C4H12Si	542-91-6	2
Diglycidyl ether	C6H10O3	123639	3
Dihydroeugenol	C10H14O2	2785-87-7	0.4
Dihydrojasmone	C11H18O	1128-08-1	0.6
Dihydromercenol	C10H20O	18479-58-8	0.8
Dihydroxybenzene, 1,2-	C6H6O2	120-80-9	1
Dihydroxybenzene, 1,3-	C6H6O2	108-46-3	1
Diiodomethane	CH2I2	27704	1.2
Diisobutyl ketone	C9H18O	108-83-8	0.8
Diisobutylene	C8H16	107-39-1	0.6
Diisopropyl benzene	C12H18	25321-09-9	0.4
Diisopropyl ether	C6H14O	108-20-3	0.7
Diisopropylamine	C6H15N	108-18-9	0.7
Diketene	C4H4O2	674-82-8	2.2
Dimethoxybenzene, 1,4-	C8H10O2	150-78-7	1.3
Dimethoxyethane, 1,2-	C3H8O	109-87-5	1.2
Dimethoxymethane	C3H8O2	109-87-5	1.4
Dimethyl cyclohexane, 1,2-	C8H16	583-57-3	0.8
Dimethyl disulfide	C2H6S2	624-92-0	0.2
Dimethyl ether	C2H6O	115-10-6	1.3
Dimethyl octan-1-ol, 3,7-	C10H22O	106-21-8	1.2
Dimethyl octan-3-ol, 3,7-	C10H22O	78-69-3	1.2
Dimethyl pentane, 2,4-	C7H16	108-08-7	1

Gas name	Formula	CAS No.	Response factor
Dimethyl phosphite	C2H7O3P	868-85-9	8
Dimethyl phthalate	C10H10O4	131-11-3	1
Dimethyl sulfoxide	C2H6OS	67-68-5	1
Dimethylacetamide N,N-	C4H9NO	127-19-5	1.3
Dimethylacetylene	C4H6	503-17-3	1
Dimethylamine	C2H7N	124-40-3	1.4
Dimethylaminoethanol, 2-	C4H11NO	108-01-0	1.5
Dimethylaniline, NN-	C8H11N	121-69-7	0.6
Dimethylboron bromide	C2H6BBr	5158-50-9	4
Dimethylbutyl acetate	C8H16O2	108-84-9	1.6
Dimethylcycloheptane, 1,2-	C9H18	13151-50-3	1.3
Dimethylethylamine, NN-	C4H11N	598-56-1	3
Dimethylformamide	C3H7NO	25174	0.8
Dimethylhydrazine, 1,1-	C2H8N2	57-14-7	1
Dimethylmethylphosphonate	C3H9P03	756-79-6	5
Dimethylsilane	C2H8Si	1111-74-6	2
Dimethylthiophosphoryl chloride	C2H6ClO2PS	2524-03-0	1
Di-n-butylamine	C8H19N	111-92-2	0.9
Di-n-propylamine	C6H15N	142-84-7	1
Dioxane, 1,4-	C4H8O2	123-91-1	1.5
Dioxolane	C3H6O2	646-06-0	1.8
Dipentene	C10H16	138-86-3	0.9
Diphenyl ether	C12H10O	101-84-8	0.8
Dipropyl ether	C6H14O	111-43-3	0.8
Dipropylene glycol	C6H14O3	110-98-5	4
Disilane	Si2H6	1590-87-0	2
Disulfur dibromide	S2Br2	13172-31-1	1.5
Disulfur dichloride	S2Cl2	10025-67-9	3
Di-tert-butyl-p-cresol	C15H24O	128-37-0	0.3
Divinylbenzene	C10H10	1321-74-0	0.4
Dodecene	C12H36	112-40-3	0.8
E			
Epichlorohydrin	C3H5ClO	106-89-8	3.4
Epoxypropyl isopropyl ether, 2,3-	C6H12O2	4016-14-2	1.1
Estargol	C10H12O	140-67-0	0.7
Ethanol	C2H6O	64-17-5	8.7
Ethanolamine	C2H7NO	141-43-5	3

Gas name	Formula	CAS No.	Response factor
Ethoxy-2-methylpropane, 1-	C6H14O	627-02-1	0.8
Ethoxy-2-propanol, 1-	C5H10O2	1569-02-4	2
Ethoxy-butane, 2-	C6H14O	19316-73-5	0.8
Ethoxyethanol, 2-	C4H10O2	110-80-5	2
Ethoxyethyl acetate, 2-	C6H12O3	111-15-9	3
Ethyl 2,2,2-trifluoroethyl ether	C4H7F3O	461-24-5	5
Ethyl 2-methylbutyrate	C7H14O2	7452-79-1	2
Ethyl acetate	C4H8O2	141-78-6	3.6
Ethyl acetoacetate	C6H10O3	141-97-9	3
Ethyl acrylate	C5H8O2	140-88-5	2
Ethyl benzene	C8H10	100-41-4	0.5
Ethyl benzoate	C9H10O2	93-89-0	0.9
Ethyl butyrate	C6H12O2	105-54-4	1
Ethyl chloroformate	C3H5O2Cl	541-41-3	83
Ethyl cyanoacrylate	C6H7O2N	7085-85-0	1.5
Ethyl cyclohexane	C8H16	1678-91-7	1
Ethyl decanoate	C12H24O2	110-38-3	1.8
Ethyl formate	C3H6O2	109-94-4	29.8
Ethyl hexanoate	C8H16O2	123-66-0	2.6
Ethyl hexanol, 2-	C8H18O	104-76-7	1.5
Ethyl hexyl acrylate, 2-	C11H20O2	103-11-7	1
Ethyl iodide	C2H5I	27459	1.2
Ethyl isopropyl ketone	C6H12O	565-69-5	0.8
Ethyl lactate	C5H10O3	97-64-3	3
Ethyl mercaptan	C2H6S	27607	0.56
Ethyl methacrylate	C6H10O2	97-63-2	1.5
Ethyl morpholine, 4-	C6H13NO	100-74-3	0.6
Ethyl octanoate	C10H20O2	106-32-1	2.3
Ethyl phenyl acetate	C10H12O2	101-97-3	1.2
Ethyl propanoate	C4H10O2	105-37-3	2
Ethyl tert-butyl ether	C6H14O2	637-92-3	0.6
Ethyl toluene	C9H12	611-14-3	0.4
Ethyl-3-ethoxypropionate	C7H14O3	763-69-9	3
Ethyl-3-propylacrolein, 2-	C8H14O2	645-62-5	1
Ethylacetylene	C4H6	107-00-6	3
Ethylamine	C2H7N	27491	1

Gas name	Formula	CAS No.	Response factor
Ethylene	C2H4	74-85-1	8
Ethylene carbonate	C3H4O3	96-49-1	3
Ethylene glycol	C2H6O2	107-21-1	20
Ethylene glycol diacetate	C6H10O4	111-55-7	4
Ethylene glycol monopropyl ether	C5H12O2	2807-30-9	3
Ethylene oxide	C2H4O	75-21-8	15
Ethylenediamine	C2H8N2	107-15-3	0.8
Ethyleneimine	C2H5N	2179-59-1	2
Ethylhexanal, 2-	C8H16O	123-05-7	1.5
Ethylhexenal, 2-	C8H14O	645-62-5	1.3
Ethylvanillin	C9H10O3	121-32-4	1
Eucalyptol	C10H18O	470-82-6	0.6
Eugenol	C10H12O2	97-53-0	0.4
Eugenol methyl ether	C11H14O2	93-15-2	0.4
F			
Fenchol	C10H18O	1632-73-1	0.4
Ferrocene	C10H10Fe	102-54-5	0.8
Fluorobenzene	C6H5F	462-06-6	0.8
Fluorobenzoic acid, 4-	C7H5FO2	456-22-4	2
Formamide	CH3ON	27735	2
Furfural	C5H4O2	35796	0.82
Furfuryl alcohol	C5H6O2	98-00-0	2
Furfuryl mercaptan	C5H6OS	35828	0.5
G			
Gasoline		8006-61-9	0.8
Geraniol	C10H18O	106-24-1	0.7
Geranyl acetate	C12H20O2	105-87-3	1.2
Gerenial	C10H16O	141-27-5	0.6
Germane	GeH4	7782-65-2	10
Glutaraldehyde	C5H8O2	111-30-8	0.9
Glycidyl methacrylate	C7H10O3	106-91-2	1.2
Glyoxal	C2H2O2	107-22-2	1
H			
Heptan-2-one	C7H14O	110-43-0	0.7
Heptan-3-one	C7H14O	106-35-4	0.8
Heptane	C7H16	142-82-5	1.6
Heptanol	C7H16O	53535-33-4	1.7

Gas name	Formula	CAS No.	Response factor
Heptene, 1-	C7H14	592-76-7	0.9
Heptylcyclopentan-1-one, 2-	C12H22O	137-03-1	0.8
Heptyne, 1-	C7H12	628-71-7	2
Hex-1-en-3-ol	C6H12O	4798-44-1	0.9
Hexachlorodisilane	Cl6Si	13465-77-5	8
Hexafluorobutadiene	C4F6	685-63-2	3
Hexamethyldisilazane, 1,1,1,3,3,3-.	C6H19NSi2	999-97-3	1
Hexamethyldisiloxane	C6H18OSi2	107-46-0	0.3
Hexamethylene diisocyanate	C8H12N2O2	822-06-0	1.5
Hexan-2-one	C6H12O	591-78-6	0.8
Hexane	C6H14	110-54-3	2.6
Hexanoic acid	C6H12O2	142-62-1	3
Hexanol	C6H14O	111-27-3	2
Hexene, 1-	C6H12	592-41-6	0.9
Hexenyl acetate, cis-3-	C8H14O2	3681-71-8	1.5
Hexenyl butyrate, cis-3-	C10H18O2	16491-36-4	1.5
Hexylaldehyde	C6H12O	66-25-1	0.6
Hydrazine	H4N2	302-01-2	3
Hydrogen iodide	HI	10034-85-2	5
Hydrogen selenide	H2Se	2148909	2
Hydrogen sulfide	H2S	2148878	4
Hydrogen telluride	H2Te	2148973	1.5
Hydroxycitronellal	C10H20O2	107-75-5	1
Hydroxyethyl acrylate	C5H8O3	818-61-1	1.2
Hydroxylamine	H3NO	7803-49-8	2
Hydroxypropyl acrylate, 2-	C6H10O3	999-61-1	1.5
I			
Indene	C9H8	95-13-6	0.5
Indole	C8H7N	120-72-9	0.4
Iodine	I2	7553-56-2	0.2
Iodobenzene	C5H5I	591-50-4	0.2
Iodoethene	C2H3I	593-66-8	1.2
Iodoform	CHI3	75-47-8	1.5
Iodomethane	CH3I	74-88-4	0.4
Isoalkanes, C10-C13	C8H18O	68551-17-7	1
Isoamyl acetate	C7H14O2	123-92-2	1.6
Isoamyl salicilate	C12H16O3	87-20-7	1

Gas name	Formula	CAS No.	Response factor
Isoamylene	C5H10	513-35-9	1
Isopentene	C5H10	563-46-2	0.8
Isobornyl acetate	C12H20O2	125-12-2	0.4
Isobutane	C4H10	75-28-5	8
Isobutanol	C4H10O	78-83-1	3.5
Isobutyl acetate	C6H12O2	110-19-0	2.3
Isobutyl acrylate	C7H12O2	106-63-8	1.3
Isobutylene	C4H8	115-11-7	1
Isobutylene epoxide	C4H8O	558-30-5	3
Isobutyraldehyde	C4H8O	78-84-2	1.2
Isobutyric acid	C4H8O2	79-31-2	4
Isodecanol	C10H22O	25339-17-7	0.9
Isoeugenol	C10H12O2	97-54-1	0.4
Isoheptane	C7H16	591-76-4	1.2
Isojasmone	C11H18O	95-41-0	0.7
Isomenthone	C10H18O	1196-31-2	0.6
Isononanol	C9H20O	3452-97-9	1.5
Isooctane	C8H18	565-75-3	0.74
Isooctanol	C8H18O	26952-21-6	1.7
Isopentane	C5H12	78-78-4	6
Isophorone	C9H14O	78-59-1	0.8
Isophorone diisocyanate	C12H18N2O2	4098-71-9	0.6
Isoprene	C5H8	78-79-5	0.8
Isopropanol	C3H8O	67-63-0	4.4
Isopropanolamine	C3H9NO	78-96-6	1.5
Isopropoxyethanol, 2-	C5H12O2	109-59-1	1.5
Isopropyl acetate	C5H10O2	108-21-4	2.2
Isopropyl chloroformate	C4H7O2Cl	108-23-6	1.6
Isopropyl mercaptan	C3H8S	75-33-2	0.56
Isopropyl nitrite	C3H7NO2	541-42-4	4
Isopropylamine	C3H9N	75-31-0	1.2
Isopropylaminoethanol, 2-	C5H13NO	109-56-8	2
Isopropylcyclohexane	C9H18	696-29-7	0.9
Isothiazole	C3H3NS	288-16-4	3
Isothiocyanatomethane	C2H3NS	556-61-6	1.5
Isoxazole	C3H3NO	288-14-2	6
J			

Gas name	Formula	CAS No.	Response factor
Jasmal	C11H22O3	1322-17-4	1.4
Jasmone, cis-	C11H16O	488-10-8	0.5
Jet Fuel JP-4			0.8
Jet Fuel JP-5			0.7
Jet Fuel JP-8			0.7
K			
Kerosene		8008-20-6	0.8
Ketene	C2H2O	463-51-4	3
L			
Linalool oxide	C10H18O2	14049-11-7	0.6
Linalyl acetate	C12H20O2	115-95-7	0.9
M			
Maleic anhydride	C4H2O3	108-31-6	2
Menthol	C10H20O	1490-04-6	0.5
Menthone	C10H18O	89-80-5	0.4
Mercaptoacetic acid	C2H4O2S	25143	1
Mesitylene	C9H12	108-67-8	0.3
Methacrylic acid	C4H6O2	79-41-4	2.3
Methacrylonitrile	C4H5N	126-98-7	5
Methanol	CH4O	67-56-1	200
Methoxy-1-butanol, 3-	C5H12O2	2517-43-3	3
Methoxy-1-propanol, 2-	C4H10O2	1589-47-5	2
Methoxy-2,2-dimethylpropane	C6H14O	1118-00-9	0.7
Methoxybutyl acetate, 3-	C7H14O3	4435-53-4	2
Methoxyethanol, 2-	C3H8O2	109-86-4	2.7
Methoxyethene	C3H6O	107-25-5	1
Methoxyethoxyethanol, 2-	C5H12O3	111-77-3	1.4
Methoxyethyl acetate	C5H10O3	110-49-6	2.7
Methoxyethyl ether, 2-	C6H14O3	111-96-6	0.8
Methoxymethylethoxy-2-propanol	C7H16O3	34590-94-8	1.3
Methoxypropan-2-ol, 1-	C4H10O2	107-98-2	2
Methoxypropane, 2-	C4H10O	555-17-5	0.9
Methoxypropyl acetate	C6H12O3	108-65-6	1.2
Methyl 2-methylpropanoate	C5H10O2	547-63-7	2
Methyl acetate	C3H6O2	79-20-9	5.2
Methyl acetoacetate	C5H8O3	105-45-3	3
Methyl acrylate	C4H6O2	96-33-3	3.4

Gas name	Formula	CAS No.	Response factor
Methyl anthranilate	C8H9NO2	134-20-3	0.4
Methyl benzoate	C8H8O2	93-58-3	0.7
Methyl benzoate	C8H8O2	93-58-3	1.2
Methyl bromide	CH3Br	74-83-9	1.9
Methyl dimethylacrylate	C6H10O2	924-50-5	2.5
Methyl ethyl ketone	C4H8O	78-93-3	0.8
Methyl ethyl ketone peroxides	C8H18O2	1338-23-4	0.8
Methyl heptyne carbonate	C9H14O2	111-12-6	1.3
Methyl ionone	C14H22O	1335-46-2	0.4
Methyl isobutyl ketone	C6H12O	108-10-1	0.8
Methyl isobutyl ketone	C5H10O	563-80-4	0.8
Methyl isocyanate	C2H3NO	624-83-9	5
Methyl isothiocyanate	C2H3NS	556-61-6	0.6
Methyl mercaptan	CH4S	74-93-1	0.7
Methyl methacrylate	C5H8O2	80-62-6	1.6
Methyl phenyl acetate	C9H10O2	101-41-7	0.4
Methyl propargyl ether	C4H6O	627-41-8	2
Methyl propionate	C4H8O2	554-12-1	1.5
Methyl propynoate	C4H4O2	922-67-8	10
Methyl salicylate	C8H8O3	119-36-8	0.8
Methyl sulfide	C2H6S	75-18-3	0.5
Methyl tert-butyl ether	C5H12O	1634-04-4	0.8
Methyl thiocyanate	C2H3NS	556-64-9	2
Methyl thioglyconate	C3H6O2S	2365-48-2	1
Methyl undecanal, 2-	C12H24O	110-41-8	1.1
Methyl vinyl ketone	C4H6O	78-94-4	0.6
Methyl-1-butene, 3-	C5H10	563-45-1	0.8
Methyl-2-butanol, 3-	C5H12O	6032-29-7	3.3
Methyl-2-propen-1-ol, 2-	C4H8O	513-42-8	1.1
Methyl-2-pyrrolidinone, N-	C5H9NO	872-50-4	0.9
Methyl-5-hepten-2-one, 6-	C8H14O	110-93-0	0.8
Methylamine	CH5N	74-89-5	1.4
Methylamyl acetate	C8H16O2	108-84-9	1.2
Methylbutan-1-ol, 3-	C5H12O	123-51-3	3
Methylbutanol	C5H12O	137-32-6	1.5
Methylcyclohexane	C7H14	108-87-2	1.1

Gas name	Formula	CAS No.	Response factor
Methylcyclohexanol	C7H14O	25639-42-3	2.4
Methylcyclohexanol, 4-	C7H14O	589-91-3	2.4
Methylcyclohexanone, 2-	C7H12O	583-60-8	1
Methylcyclopentane	C6H14	96-37-7	1.5
Methylenepentane, 3-	C6H12	760-21-4	0.8
Methylheptan-3-one, 5-	C8H16O	541-85-5	0.8
Methylhexan-2-one, 5-	C7H14O	110-12-3	0.8
Methylhydrazine	CH6N2	60-34-4	1.3
Methylpent-3-en-2-one, 4-	C6H10O	141-79-7	0.7
Methylpentan-2-ol, 4-	C6H14O	108-11-2	2.8
Methylpentane, 2-	C6H14	107-83-5	1.5
Methylpentane, 3-	C6H14	96-14-0	1.5
Methylpentane-2,4-diol, 2-	C6H14O2	107-41-5	4
Methylpropanoyl chloride, 2-	C4H7ClO	79-30-1	6
Methylstyrene	C9H10	25013-15-4	0.5
Methylthiopropional, 3-	C4H8OS	3268-49-3	2
Mineral oil		8042-47-5	0.8
Mineral spirits		64475-85-0	0.8
Monoisobutanolamine	C4H11NO	124-68-5	1.6
Morpholine	C4H9NO	110-91-8	2
Myrcene	C10H16	123-35-3	0.5
N			
Naphthalene	C10H8	91-20-3	0.4
Naphthol methyl ether, 2-	C11H10O	34068	0.5
Nitric oxide	NO	10102-43-9	8
Nitrobenzene	C6H5NO2	98-95-3	1.7
Nitrogen dioxide	NO2	10102-44-0	10
Nonane	C9H20	111-84-2	1.3
Nonanol (all isomers)	C9H20O	143-08-8	1.2
Nonene (all isomers)	C9H18	27215-95-8	0.8
Nonene, 1-	C9H18	124-11-8	0.55
Norbornadiene, 2,5-	C7H8	121-46-0	0.6
Propylamine, n-	C3H9N	107-10-8	1
O			
Ocatanol (all isomers)	C8H18O	111-87-5	1.5
Octamethyltrisiloxane	C8H24O2Si3	107-51-7	0.3
Octane	C8H18	111-65-9	1.3

Gas name	Formula	CAS No.	Response factor
Octene (all isomers)	C8H16	25377-83-7	0.9
Octene, 1-	C8H16	111-66-0	0.58
Oxalyl bromide	C2Br2O2	15219-34-8	5
Oxydiethanol 2,2-	C4H10O3	111-46-6	2
P			
Paraffin wax, fume		8002-74-2	1
Paraffins, normal		64771-72-8	1
Pentacarbonyl iron	FeC5O5	13463-40-6	1
Pentan-2-one	C5H10O	107-87-9	0.8
Pentan-3-one	C5H10O	96-22-0	0.8
Pentanal	C5H10O	110-62-3	1.2
Pentandione, 2,4-	C5H8O2	123-54-6	0.8
Pentane	C5H12	109-66-0	5
Pentanoic acid	C5H10O2	109-52-4	4
Pentanol, 2-	C5H12O	6032-29-7	1.5
Pentanol, 3-	C5H12O	584-02-1	1.5
Pentene, 1-	C6H12	109-67-1	1.3
Pentylcyclopentan-1-one, 2-	C10H18O	4819-67-4	1
Pentylcyclopentane	C10H20	3741-00-2	1.1
Pentyne, 1-	C5H8	627-19-0	3
Peracetic acid	C2H4O3	79-21-0	2
Perfluorobutadiene	C4H6	682-63-5	10
Perfluoro-tert-butylamine	C4H2F9N	2809-92-9	5
Petroleum ether		8032-32-4	0.9
Phellandrene	C10H16	99-83-2	0.8
Phenethyl methyl ether, 2-	C9H12O	3558-60-9	0.6
Phenol	C6H6O	108-95-2	1.2
Phenyl ethyl isobutyrate, 2-	C12H16O2	103-48-0	1.5
Phenyl propene, 2-	C9H10	98-83-9	0.4
Phenyl-2,3-epoxypropyl ether	C9H10O2	122-60-1	0.8
Phenylacetaldehyde	C8H8O	122-78-1	0.7
Phenylacetic acid	C8H8O2	103-82-2	1
Phenylethyl acetate, 1-	C10H12O2	93-92-5	0.7
Phenylethyl alcohol, 2-	C8H10O	60-12-8	1.2
Phosphine	PH3	7803-51-2	2
Picoline, 3-	C6H7N	108-99-6	0.9
Pine oil		8002-09-3	1

Gas name	Formula	CAS No.	Response factor
Pinene, α-	C10H16	80-56-8	0.27
Pinene, β-	C10H16	127-91-3	0.27
Piperazine	C4H10N2	110-85-0	0.8
Piperidine	C5H11N	110-89-4	0.9
Piperylene	C5H8	504-60-9	0.7
Prop-2-yn-1-ol	C3H4O	107-19-7	2.9
Propadiene	C3H4	463-49-0	1
Propan-1-ol	C3H8O	71-23-8	4.8
Propanamide	C3H7NO2	79-05-0	2
Propane-1,2-diol	C3H8O2	57-55-6	3
Propanolamine	C3H9NO	156-87-6	1.5
Propargyl chloride	C3H3Cl	624-65-7	2
Propen-1-imine, 2-	C3H5N	73311-40-7	2
Propene	C3H6	115-07-1	1.4
Propiolic acid	C3H2O3	471-25-0	8
Propionaldehyde	C3H6O	123-38-6	1.7
Propionic acid	C3H6O2	79-09-4	8
Propoxy-2-propanol, 1-	C6H14O2	1569-01-3	1.1
Propyl acetate, n-	C5H10O2	109-60-4	2.5
Propyl butanoate	C7H14O2	105-66-8	2.3
Propyl formate	C4H8O2	110-74-7	10
Propyl iodide	C3H7I	107-08-4	1
Propylbenzene (all isomers)	C9H12	74296-31-4	0.45
Propylene carbonate	C4H6O3	108-32-7	2
Propylene glycol ethyl ether acetate	C7H14O3	98516-30-4	1.2
Propylene oxide	C3H6O	75-56-9	2.7
Propyleneimine	C3H7N	75-55-8	1.3
Propyne	C5H4	74-99-7	4
Pyrazine	C4H4N2	290-37-3	3
Pyrdinol, 4-	C5H5NO	626-64-2	3
Pyridine	C5H5N	110-86-1	0.8
Pyridylamine 2-	C5H6N2	504-29-0	0.8
R			
Rose oxide, cis-	C10H18O	16409-43-1	0.8
S			
Stibine	SbH3	7803-52-3	1.5
Styrene	C8H8	100-42-5	0.35

Gas name	Formula	CAS No.	Response factor
Sulfur dichloride	SCl2	234-129-0	2
T			
Terpineol, α-	C10H18O	98-55-5	0.8
Terpinolene	C10H16	586-62-9	0.59
Terpinyl acetate, α-	C12H20O2	80-26-2	1.2
Tert-butanol	C4H10O	75-65-0	2.6
Tert-butyl bromide	C4H9Br	507-10-7	1.5
Tert-butyl formate	C5H10O2	762-75-4	8
Tetrabromoethane, 1,1,2,2-	C2H2Br4	79-27-6	2
Tetracarbonylnickel	NiC4O4	13463-39-3	1
Tetrachloroethylene	C2Cl4	127-18-4	0.44
Tetrachloropyridine, 2,3,5,6-	C5HNCl4	2402-79-1	1
Tetraethyl orthosilicate	C8H20O4Si	78-10-4	2
Tetrafluoroethylene	C2F4	116-14-3	15
Tetrahydrofuran	C4H8O	109-99-9	1.6
Tetrahydronaphthalene	C10H12	119-64-2	0.4
Tetrahydrothiophene	C4H8S	110-01-0	0.6
Tetramethyl succinonitrile	C8H12N2	3333-52-6	1
Tetramethylbenzene (all isomers)	C10H14	95-93-2	0.3
Tetramethylbutane, 2,2,3,3-	C8H18	594-82-1	1
Tetramethylgermane	C4H12Ge	865-52-1	2
Tetramethylsilane	C3H10Si	993-07-0	2
Tetrathydropyran	C5H10O	142-68-7	3
Thioacetic acid	C2H4OS	507-09-5	2
Thiocarbonyl fluoride	CSF2	420-32-6	6
Thiocyanogen	C2S2N2	505-14-6	8
Thioformaldehyde trimer	C3H6S3	291-21-4	1.5
Thiophene	C4H4S	110-02-1	0.4
Thiophosgene	CS2Cl	463-71-8	1
Titanium-n-propoxide	C12H28O4Ti	3087-37-4	3
Toluene	C7H8	108-88-3	0.5
Toluene-2,4-diisocyanate	C9H6N2O2	584-84-9	1.6
Toluenesulfonyl chloride, p-	C7H7SO2Cl	98-59-9	3
Toluidine, o-	C7H9N	95-53-4	0.5
Tolylaldehyde, p-	C8H8O	104-87-0	0.8
Triazine, 1,3,5-	C3H3N3	290-87-9	6
Tributyl phosphate	C12H27O4P	126-73-8	5

Gas name	Formula	CAS No.	Response factor
Tributylamine	C12H27N	102-82-9	1.2
Trichlorobenzene 1,2,4-	C6H3Cl3	120-82-1	0.6
Trichloroethylene	C2HCl3	79-01-6	0.7
Triethyl phosphate	C6H15P04	78-40-0	3.5
Triethyl phosphate	C6H15O4P	78-40-0	3
Triethyl phosphite	C6H15O3	122-52-1	1.5
Triethyl silane	C2H6Si	617-86-7	2
Triethylamine	C6H15N	121-44-8	0.9
Triethylbenzene	C12H18	25340-18-5	0.35
Triethylene aluminum	C6H15Al	97-93-8	1
Trifluoroethene	C2HF2	359-11-5	5
Trifluoroethyl methyl ether, 2,2,2-	C3H5F3O	460-43-5	10
Trifluoroiodomethane	CF3I	2314-97-8	2
Trimethoxymethane	C4H10O3	149-73-5	1
Trimethylamine	C3H9N	53-50-3	0.5
Trimethylbenzene mixtures	C9H12	25551-13-7	0.3
Trimethylbenzene, 1,3,5-	C9H12	108-67-8	0.4
Trimethylborate	C3H9FBO3	121-43-7	1
Trimethylcyclohexane, 1,2,4-	C9H18	2234-75-5	1
Trimethylene oxide	C3H6O	503-30-0	1.5
Trimethylsilane	C3H10Si	993-07-7	1
Trioxane	C3H4O3	110-88-3	2
Turpentine	C10H16	9005-90-7	0.6
TVOC			1
U			
Undecane	C11H24	1120-21-4	0.9
V			
Vanillin	C8H8O3	121-33-5	1
Vinyl acetate	C4H6O2	108-05-2	1.1
Vinyl bromide	C2H3Br	593-60-2	1.5
Vinyl chloride	C2H3Cl	75-01-4	2.1
Vinyl ethyl ether	C4H8O	109-92-2	0.6
Vinyl fluoride	C2H3F	75-02-5	2
Vinyl-2-pyrrolidinone, 1-	C6H9NO	88-12-0	0.9
Vinylcyclohexene, n-	C8H12	100-40-3	0.7
Vinylene carbonate	C3H2O3	872-36-6	1
Vinylidine difluoride	C2H2F2	75-38-7	5

Gas name	Formula	CAS No.	Response factor
Vinylsilane	C2H6Si	7291-09-0	1.5
X			
Xylene mixed isomers	C8H10	1330-20-7	0.33
Xylene, m-	C8H10	108-38-3	0.4
Xylene, o-	C8H10	95-47-6	0.6
Xylene, p-	C8H10	106-42-3	0.6
Xylidine, all	C8H11N	1300-73-8	0.7