RIKEN KEIKI

Portable Gas Detector

SC-9000

Operating Manual
(PT0-211)

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 : https://www.rikenkeiki.co.jp/english/

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Product Overview

1-1 Introduction

Thank you for purchasing the SC-9000 Portable Gas Detector (“the product” hereinafter).
This operating manual describes product operating procedures and specifications. It provides information essential to correct use of the product.
Make sure you have read and fully understood the contents of this manual before using the product.
Keep this operating manual on hand to allow ready reference during use.
The contents of this manual are subject to change without notice to allow product improvements. Any duplication or reproduction of this manual without permission is prohibited, whether in whole or in part.

Also refer to the corresponding manuals when using the following related programs:

- RK Link dedicated portable gas detector app*1 Operating Manual (PT9E-022)
- SW-9000 Series Data Logger Management Program*2 Operating Manual (PT0E-208)
- MT-9000 Series Configuration Program*3 Operating Manual (PT0E-209)

*1: Can be installed on a smartphone from Google Play or App Store free of charge.
*2: Can be installed on a PC from the separately sold CD-ROM.
*3: Can be installed on a PC from the RIKEN KEIKI website.

RIKEN KEIKI accepts no liability for accidents or damage resulting from use of the product, whether within or outside the warranty period.
Be sure to check the warranty policy described in ‘12-6 Warranty policy’.

The product includes Bluetooth® functionality. If the function is enabled (selected at the time of purchase), turning the setting on allows communication with a smartphone on which the RK Link dedicated portable gas detector app has been installed.

1-2 Intended use

The product is a multi-gas gas detector capable of detecting up to three different toxic gases in air.
The toxic gases that can be detected by the product include ammonia (NH_3), chlorine (Cl_2), and silane (SiH_4), commonly used in semiconductor plants.
The alarm function triggers an alarm if the gas concentration reaches or exceeds the alarm setpoints.
Note that the detection results provided by the product do not constitute a guarantee with respect to life or safety.
Check the specifications before use to confirm that correct gases will be detected in accordance with the intended purpose.

The following sensors can be installed in the product:

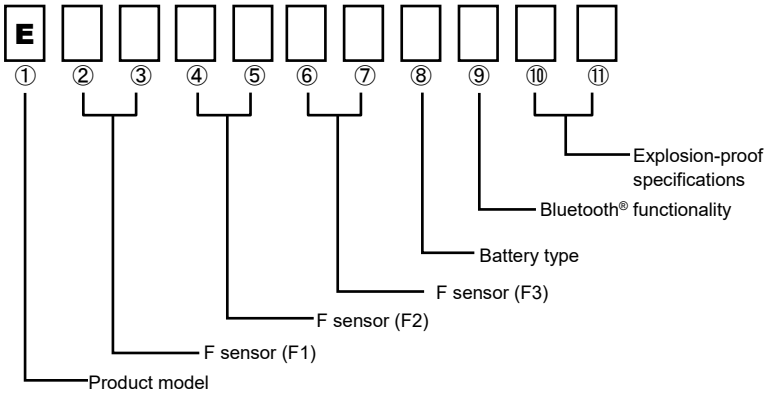
Sensor type		Detection principle	Sensor model
Toxic gas sensor	ESF sensor	Electrochemical type	ESF-B242 (NH_3) ESF-C930 (Cl_2) ESF-B249 (O_3) ESF-A24E2 (HCl) ESF-A24D (HCN) Japan Ex model ESF-B248 (HF) Japan Ex model ESF-B248X (HF) ATEX/IECEx model ESF-A24D (PH_3) ESF-B248 (F_2) ESF-A24D (SiH_4) ESF-A24D2 (NO) ESF-AA20 (NO_2) ESF-A24D (SO_2) ESF-A24E2 (HBr) ESF-B24A (ClF_3) ESF-A24D (Si_2H_6)

1-3 Checking the detection target gases and product model

The detection target gases vary depending on the particular sensors installed in the product.
Check the detection target gases using the product code before use.

1-3-1 Detection target gases and product model

The SC-9000 alphanumeric product codes are categorized as follows:



①: Product model

Code	Details
E	SC-9000

② to ⑦: F sensors (F1/F2/F3)

Code	Details
00	N/A (dummy sensor)
E1	ESF-B242 (NH_3)
E2	ESF-C930 (Cl_2)
E3	ESF-B249 (O_3)
E4	ESF-A24E2 (HCl)
E5	–
E6	ESF-A24D (HCN) Japan Ex model
E7	–
E8	–
E9	ESF-B248 (HF) Japan Ex model

Code	Details
EA	ESF-B248X (HF) ATEX/IECEx model
EB	ESF-A24D (PH_3)
EC	ESF-B248 (F_2)
ED	ESF-A24D (SiH_4)
EE	ESF-A24D2 (NO)
EF	ESF-AA20 (NO_2)
EG	ESF-A24D (SO_2)
EH	ESF-A24E2 (HBr)
EI	ESF-B24A (ClF_3)
EJ	ESF-A24D (Si_2H_6)

* Some restrictions apply to the available F sensor (F1/F2/F3) combinations. (Refer to '1-3-2 F sensor combination patterns'.)

⑧: Battery type

Code	Specifications
L	Lithium ion battery unit BUL-9000
D	Dry battery unit BUD-9000

⑨: Bluetooth® functionality

Code	Specifications
0	Bluetooth® not supported
1	Bluetooth® supported

⑩⑪: Explosion-proof specifications

Code	Specifications
00	Japan Ex
50	ATEX/IECEx

<Example product codes>

The specifications for the product code examples listed here are as follows:

Example product code		EE1E2EDL0 00	E00E400D1 50	E00ECEBL1 00
Product model		SC-9000	SC-9000	SC-9000
F sensor	F1	ESF-B242 (NH_3)	N/A	N/A
	F2	ESF-C930 (Cl_2)	ESF-A24E2 (HCl)	ESF-B248 (F_2)
	F3	ESF-A24D (SiH_4)	N/A	ESF-A24D (PH_3)
Battery type		BUL-9000	BUD-9000	BUL-9000
Bluetooth® functionality		Not supported	Supported	Supported
Explosion-proof specifications		Japan Ex	ATEX/IECEx	Japan Ex

1-3-2 F sensor combination patterns

The F sensor combination patterns are determined as follows:

1. Select the number of sensors from 1, 2, or 3.
2. Select from group A and/or group B sensors listed in <Sensor groups>.
3. Select the gas type combination for the F sensors to be mounted in each slot from those listed for F1, F2, and F3 in <Combination pattern table>.
4. For combinations in which gas types can be swapped, arrange the F1, F2, and F3 sensors in the order indicated in <Sensor code order>.

   Example 1: When the following gas types are selected for pattern 7

   F1: SO_2, F2: Si_2H_6, F3: NO

   Sensors of the selected gas types can be installed in any of slots F1, F2, and F3, so the slots are determined in accordance with the sequence specified in <Sensor code order>. The combination pattern will therefore be as follows:

   F1: NO (EE), F2: SO_2 (EG), F3: Si_2H_6 (EJ) The codes in parentheses are the sensor codes.

   Example 2: When the following gas types are selected for pattern 8

   F1: Si_2H_6, F2: HF, F3: NO

   HF must be mounted in slot F2, and SiH_4. NO can both be used in either slots F1 or F3. The combination pattern will therefore be as follows in accordance with the sequence specified in <Sensor code order>:

   F1: NO (EE), F2: HF (E9), F3: Si2H6 (EJ) The codes in parentheses are the sensor codes.

<Sensor groups>

Group	Details
A	ESF-A24E2 (HCl), ESF-A24D (HCN) Japan Ex model, ESF-A24D (PH_3), ESF-A24D (SiH_4), ESF-A24D2 (NO), ESF-AA20 (NO_2), ESF-A24D (SO_2), ESF-A24E2 (HBr), ESF-A24D (Si_2H_6)
B	ESF-B242 (NH_3), ESF-C930 (Cl_2), ESF-B249 (O_3), ESF-B248 (HF) Japan Ex model, ESF-B248X (HF) ATEX/IECEx model, ESF-B248 (F_2), ESF-B24A (ClF_3)

<Combination pattern table>

Number of sensors	Number of sensors in each group		Pattern	Sensor slot		
	A	B		F1	F2	F3
1 type	1	–	1	–	HCl/HCN[*2]/ PH_3/SiH_4/NO/NO_2/ SO_2/HBr/Si_2H_6	–
	–	1	2	–	NH_3/Cl_2/O_3/HF/F_2/ ClF_3	–
2 types	2	–	3	–	HCl/HCN[*2]/ PH_3/SiH_4/NO/NO_2/ SO_2/HBr/Si_2H_6	HCl/HCN[*2]/ PH_3/SiH_4/NO/NO_2/ SO_2/HBr/Si_2H_6
	1	1	4	–	NH_3	HCl/HCN[*2]/ PH_3/SiH_4/NO/NO_2/ SO_2/HBr/Si_2H_6
			5		Cl_2/O_3/HF/F_2/ClF_3	HCl/HCN[*2]/ PH_3/SiH_4/NO/NO_2/ HBr/Si_2H_6
	–	2	6	NH_3	Cl_2/O_3/HF/F_2/ClF_3	–

Number of sensors	Number of sensors in each group		Pattern	Sensor slot		
	A	B		F1	F2	F3
3 types[*1]	3	–	7	HCN[*2]/ PH_3/SiH_4/NO/ NO_2/SO_2/Si_2H_6	HCl/HCN[*2]/ PH_3/SiH_4/NO/NO_2/ SO_2/HBr/Si_2H_6	HCl/HCN[*2]/ PH_3/SiH_4/NO/NO_2/ SO_2/HBr/Si_2H_6
	2	1	8	HCN[*2]/ PH_3/SiH_4/NO/ NO_2/Si_2H_6	Cl_2/O_3/HF/F_2/ClF_3	HCl/HCN[*2]/ PH_3/SiH_4/NO/NO_2/ HBr/Si_2H_6
	1	2	9	NH_3	Cl_2/O_3/HF/F_2/ClF_3	HCl/HCN[*2]/ PH_3/SiH_4/NO/NO_2/ HBr/Si_2H_6

*1: Three-sensor types cannot be configured with three group B sensors.
*2: Japan Ex model

<Sensor code order>

Code	Sensor
E1	NH_3
E2	Cl_2
E3	O_3
E4	HCl
E5	–
E6	HCN (Japan Ex model)
E7	–
E8	–
E9	HF (Japan Ex model)
EA	HF (ATEX/IECEx model)
EB	PH_3
EC	F_2
ED	SiH_4
EE	NO
EF	NO_2
EG	SO_2
EH	HBr
EI	ClF_3
EJ	Si_2H_6

1-4 DANGER, WARNING, CAUTION, and NOTE

This operating manual uses the following categories to indicate potential damage/hazards if the user disregards the information provided and uses the product incorrectly:

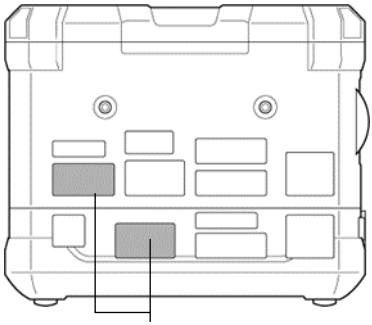
 **DANGER**	This indicates situations in which improper handling may result in fatal or serious injury or significant property damage.
 **WARNING**	This indicates situations in which improper handling may result in serious injury or significant property damage.
 **CAUTION**	This indicates situations in which improper handling may result in minor injury or minor property damage.

Additionally, usage recommendations are indicated as follows:

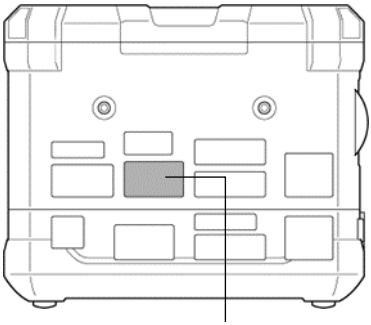
NOTE	This indicates items that will be helpful to know when using the product.

1-5 Checking standards and explosion-proof specifications

The product specifications will vary depending on the specific standards and explosion-proof certification. Check the actual product specifications before use. For CE marking models, refer to the Declaration of Conformity in the Appendix.
Check the affixed nameplate for product specifications.



Typical nameplates for explosion-proof electrical equipment type certified (Japan EX) models



Typical nameplate for ATEX/IECEx models

2

Important Safety Information

To maintain the performance of the product and to ensure safe use, always observe the following DANGER, WARNING, and CAUTION instructions.

2-1 Danger information

DANGER

Main unit explosion-proofing

- Do not modify or alter the circuits or configuration.
- When carrying and using the product in hazardous areas, the following general precautions must be observed to safeguard against static electricity hazards:
  - Wear anti-static clothing and conductive shoes (anti-static work shoes).
  - When using the product indoors, stand on a conductive work floor (with a leakage resistance of 10 MΩ or less).
- The product is explosion-proof. With the exception of specified components, it cannot be disassembled or modified.
- Do not subject the buzzer opening on the main unit to impact.
- The ratings for the main unit are as follows:

  Power source: User-replaceable lithium ion battery unit model BUL-9000 or user-replaceable dry battery unit BUD-9000

  Ambient temperature*: -40 °C to +60 °C

  * Ambient temperature refers to the temperature range in which the explosion-proof performance can be maintained. It does not refer to the temperature range in which product performance is guaranteed. For information on the operating temperature range, refer to '11-1 Main unit specifications' and '11-2 Sensor specifications'.

Battery unit explosion-proofing

- Do not modify or alter the circuits or configuration.
- When carrying and using the product in hazardous areas, the following general precautions must be observed to safeguard against static electricity hazards:
  - Wear anti-static clothing and conductive shoes (anti-static work shoes).
  - When using the product indoors, stand on a conductive work floor (with a leakage resistance of 10 MΩ or less).
- The battery unit can be used only when evaluated in conjunction with this unit and when used in conjunction with a certified main unit.

  The main unit to which the battery unit can be connected is the SC-9000.
- The ratings for the BUL-9000 lithium ion battery unit are as follows:

  Power source: 3.7 V DC, 250 mA

  Battery charging contact allowable voltage: 5.7 V DC (SELV only)

  Ambient temperature*: -40 °C to +60 °C

  * Ambient temperature refers to the temperature range in which the explosion-proof performance can be maintained. It does not refer to the temperature range in which product performance is guaranteed. For information on the operating temperature range, refer to '11-1 Main unit specifications' and '11-2 Sensor specifications'.

- The ratings for the BUD-9000 dry battery unit are as follows:

  Power source: 4.5 V DC, 250 mA

  Interface connector allowable voltage: 5.7 V DC (SELV only)

  Ambient temperature*: -40 °C to +60 °C

  * Ambient temperature refers to the temperature range in which the explosion-proof performance can be maintained. It does not refer to the temperature range in which product performance is guaranteed. For information on the operating temperature range, refer to ‘11-1 Main unit specifications’ and ‘11-2 Sensor specifications’.

Gas outlet

- Toxic gas may be discharged from the gas outlet. Never breathe in this air.

2-2 Warnings

WARNING

If an abnormality occurs

- Contact RIKEN KEIKI immediately. Visit our website for information on the nearest RIKEN KEIKI office. Website: https://www.rikenkeiki.co.jp/

Sampling point pressure

- The product is designed to draw in gas at atmospheric pressure. There is a danger that detection target gas may leak from inside the product if an excessive pressure is applied to the gas inlet (GAS IN) or outlet (GAS OUT) of the product. Be careful to avoid excessive pressure during use.
- Do not connect the sampling probe directly to locations pressurized above atmospheric pressure. Doing so may result in damage to the internal piping.

Sensor handling

- Never disassemble the sensor.
  Electrochemical type sensors in particular contain hazardous electrolyte. Contact with electrolyte may result in skin inflammation. Contact with eyes may result in blindness. Contact with clothing may result in discoloration or damage to the fabric.
  If contact occurs, rinse the area immediately with plenty of water.

Fresh air adjustment in surrounding atmosphere

- When fresh air adjustment is performed in the surrounding atmosphere, check the air for cleanness before starting. The presence of miscellaneous or interference gases will make it impossible to adjust the product correctly, resulting in the danger of erroneous detection when actual gas leaks occur.

Action if a gas alarm occurs

- A gas alarm indicates an extreme hazard. The user must take appropriate action after taking appropriate steps to ensure safety.

Battery level check

- Check the battery level before using the product. The batteries may be depleted when the product is used for the first time or after extended periods without use. Always fully charge or replace with new batteries before use.
- Gas detection will not be possible if a battery low voltage alarm occurs. If the alarm occurs during use, turn off the power and promptly charge or replace the batteries in a safe place.

Miscellaneous

- Do not use the product in rain or submerge it in water. Doing so may cause water to enter the product, resulting in the failure of the sensors or the product. Even if this does not result in failure, a wet sensor may be unable to detect gases.
- When using the product, always make that the product is able to suck in air. If the product inlet is covered or blocked, correct detection will not be possible, possibly leading to accidents.
- Do not leave the product exposed for extended periods to temperatures -10 °C or below. Doing so may cause the pump valve to freeze, disabling normal operation of the pump.
- Do not dispose of the product into fire.
- Do not attempt to wash the product, either in a washing machine or an ultrasonic cleaning machine.

- Do not block the buzzer sound opening. Doing so will muffle or silence the audible warning.
- Do not remove the battery unit while the power is turned on.

2-3 Precautions

CAUTION

Avoid use in locations where oil or chemicals may splash. Avoid deliberately submerging the product in water.

- Avoid using the product in locations where the product may be splashed with liquids such as oil and chemicals.
- The product is not designed to be water pressure resistant. Avoid exposing the product directly to water from a faucet or shower as water may get in the product if it is subjected to water pressure. Note that the product is waterproof against freshwater and tap water, but it is not waterproof against hot water, saltwater, detergent, chemicals, or perspiration.
- The gas inlet (GAS IN) and outlet (GAS OUT) are not waterproof. Take care to prevent water such as rainwater from entering these parts. Failure to do so may prevent gas detection.
- Do not place the product in locations where water or dirt accumulates. Placing the product in such locations may cause malfunction due to water or dirt ingress into the buzzer sound opening or gas inlet (GAS IN), etc.
- The sensor sensitivity will be significantly reduced if dirty water, dust, or metal particles are drawn in. Take adequate care when using in such environments.
- The dustproof and waterproof construction IP66/68 rating (IPx8 implies no water ingress when submerged underwater at a depth of 2 m for one hour) does not mean that the product is capable of detecting gas while or after being subjected to such environmental conditions. Be sure to remove any dust or water before use.

Do not use the product in locations outside the operating temperature range.

- Avoid using the product at temperatures outside the operating temperature range.
- Avoid using the product for extended periods in locations where it is exposed to direct sunlight.
- Avoid storing the product inside parked vehicles in hot weather.

Use within the specified operating humidity range to avoid condensation forming inside the product or sampling probe.

- Condensation forming inside the product or sampling probe may cause clogging or gas adsorption, which may prevent accurate gas detection. Condensation must be avoided at all costs.
  In addition to the usage environment, carefully monitor the temperature and humidity of the sampling point to prevent condensation forming inside the product.

Do not use walkie-talkies near the product.

- Radio waves from walkie-talkies or other radio transmitters near the product may affect readings. If walkie-talkies or other radio wave transmitting devices are used, these must be used away from the product where they do not affect operation.
- Do not use the product near devices that emit strong electromagnetic radiation (high-frequency or high-voltage devices).

Verify that the flow confirmation icon is rotating.

- Accurate gas detection is not possible if the flow confirmation icon is not rotating. Check to confirm that the suction is operating correctly.

Verify that the operating status icon is blinking.

- Gas cannot be detected correctly if the operating status icon is not blinking. (Refer to ‘3-2-3 LCD display’.)

Be sure to perform regular maintenance.

- The product is a safety device and must be regularly maintained without fail. Continuing to use the product without maintenance will result in sensor sensitivity variations, preventing accurate gas detection.

Miscellaneous

- Pressing buttons unnecessarily may change the settings, preventing alarms from activating correctly. Avoid performing any operations not described in this operating manual.
- Do not drop the product or subject it to impact. Doing so may reduce accuracy.
- Do not use the product while charging it.
- Do not prod the buzzer sound opening with sharp objects. Doing so may result in malfunctions or damage to the product and allow foreign matter inside.
- Do not remove the panel sheet on the LCD display. Doing so will impair dustproof and waterproof performance.

Sensors

- If highly adsorptive gas has been sucked in, allow the product to suck in clean air, and confirm that the reading returns to zero before use.
- Due to the way they operate, electrochemical type sensors may exhibit positive or negative sensitivity to gases other than the detection target gas. In environments where interference gases are present, the reading may differ from the actual concentration of the detection target gas present. Note that false alarms or M OVER alarms may be triggered, especially at high concentrations. (Refer to '12-4 List of interference gases for electrochemical type sensors'.)
- Due to the way the sensor operates, an accurate reading may not be displayed immediately after turning on the power. Allow the product to warm up for at least one minute after turning on the power to allow the reading to stabilize before use. Allow the product to warm up for at least 10 minutes after turning on the power before performing gas adjustment.

Battery replacement

- Be sure to turn off the power for the product before replacing the batteries.
- When replacing the batteries, replace all six with new batteries at the same time.
- The following batteries must be used to ensure that the product meets explosion-proof standards. (Applies only when using the dry battery unit)
  Japan Ex model: Toshiba AA alkaline battery (LR6) ×6
  ATEX/IECEx model: Toshiba AA alkaline battery (LR6) ×6 or Duracell (MN1500) ×6
- Note the polarity of the batteries.

Usage

- The operating time will be reduced due to battery performance in cold environments.
- The response of the LCD display may slow at low temperatures.
- Always perform fresh air adjustment under conditions of pressure, temperature, and humidity similar to those in the usage environment and in clean air.
- Wait for the reading to stabilize before performing fresh air adjustment.
- If there is a temperature difference of 15 °C or more between the storage and usage locations, turn on the power and allow the product to stand for about 10 minutes in a similar environment to the usage location to acclimatize before performing fresh air adjustment in clean air.
- Do not use water or organic solvents such as alcohol or benzine when wiping the product. Doing so may discolor or damage the surfaces of the product.
- Even if the product is not used for extended periods, turn the power on at least once every six months to check pump suction (by running the product for approximately three minutes). Grease inside the pump motor may solidify and prevent operation if the product is not operated for extended periods.
- After an extended period of storage, be sure to perform fresh air adjustment before resuming use. For information on readjustment including fresh air adjustment, contact RIKEN KEIKI.
- Do not use the product in locations where miscellaneous gases are present.
- Take care when using the product in locations where interference gases are present. (Refer to '12-4 List of interference gases for electrochemical type sensors'.)

2-4 Safety information

<Product overview>

This product is a suction-type portable gas detector. It is capable of detecting up to three different gas types. When the gas concentration exceeds the alarm setpoint, an LCD display, LED, and piezoelectric buzzer will be activated to alert.

Up to three F sensors can be mounted for detecting toxic gases.

F-sensor will internally process as far as concentration calculation, and transmit digital data for gas concentration to the main CPU.

Sampling of gas is done by the pump installed within the device. The SC-9000 features a single built-in pump for simultaneous detection using all of the sensors installed in the product.

<Power source>

- Either lithium-ion battery unit “BUL-9000” or alkaline battery unit “BUD-9000” can be installed into GX-9000.
- BUL-9000 is specified for chargeable lithium-ion batteries. Use with three Panasonic NCR18650GA batteries arranged in a parallel.
- BUD-9000 is specified to use dry batteries. Japan Ex models use six Toshiba LR6 batteries. ATEX/IECEx models can use either six Toshiba LR6 or six Duracell MN1500 batteries. The six batteries are used in two sets of three in series.
- Since these 2 kinds of batteries differ in the increase of temperature when shorted, their temperature ranges and classes also differ.
- Structure of battery unit allows end users to replace batteries by themselves.
- The battery should be charged with the dedicated AC adapter or by power from IEC60950-certified SELV power source, or IEC62368-1-certified ES1 power source. The maximum voltage from the charger shall not exceed 5.7 Vdc.
- It is also possible to perform USB data communication with a PC that meets the above requirements.
- Batteries should only be charged and replaced in non-hazardous locations.
- Backup battery type CR1220 manufactured by Maxell.

<Japan Ex models>

Explosion-proof class

Main unit:	Ex ia IIC T4 Ga
BUL-9000 lithium ion battery unit:	Ex ia IIC T4 Ga
BUD-9000 dry battery unit:	Ex ia IIC T4 Ga

Compliant explosion-proofing guidelines

Main unit:	JNIOSH-TR-46-1:2020
BUL-9000 lithium ion battery unit:	JNIOSH-TR-46-1:2020
	JNIOSH-TR-46-6:2015
BUD-9000 dry battery unit:	JNIOSH-TR-46-1:2020
	JNIOSH-TR-46-6:2015

Battery unit ratings

BUL-9000 lithium ion battery unit: Power supply: 3.7 V DC, 250 mA
BUD-9000 dry battery unit: Power supply: 4.5 V DC, 250 mA (Toshiba LR6 batteries × 6)

Ambient temperature

Ambient temperature*: -40 °C to +60 °C

* Ambient temperature refers to the temperature range in which the explosion-proof performance can be maintained. It does not refer to the temperature range in which product performance is guaranteed. For information on the operating temperature range, refer to '11-1 Main unit specifications' and '11-2 Sensor specifications'.

<ATEX/IECEx models>

Explosion-proof class	Ambient temperature	Battery type
Ex ia IIC T4 Ga Ⅱ 1 G Ex ia IIC T4 Ga	-40 °C ≤ Ta ≤ +60 °C	BUL-9000
Ex ia IIC T4 Ga Ⅱ 1 G Ex ia IIC T4 Ga	-40 °C ≤ Ta ≤ +60 °C	BUD-9000 LR6 (Toshiba)
Ex ia IIC T4 Ga Ⅱ 1 G Ex ia IIC T4 Ga	-40 °C ≤ Ta ≤ +40 °C	BUD-9000 MN1500 (Duracell)
Ex ia IIC T3 Ga Ⅱ 1 G Ex ia IIC T3 Ga	-40 °C ≤ Ta ≤ +60 °C	BUD-9000 MN1500 (Duracell)

Certificate numbers

- IECEx: IECEx DEK 21.0057X
- ATEX: DEKRA 21 ATEX 0089X

Applicable standards

- IEC 60079-0:2017
- IEC 60079-1:2014-06
- IEC 60079-11:2011
- EN IEC 60079-0:2018
- EN 60079-1:2014
- EN 60079-11:2012

WARNING

- Do not attempt to disassemble or modify the product.
- The product is explosion-proof. With the exception of specified components, it cannot be disassembled or modified.
- If the enclosure is damaged it shall be repaired before further use.
- The sensor must not be exposed to ultraviolet light or used in equipment in which it is not fully enclosed.

SC-9000 (with BUL-9000)

- Do not charge in a hazardous location.
- Do not charge the unit with a non-genuine charger.
- Do not replace battery unit in a hazardous location.
- When connecting to a PC via USB, the PC must be connected using an IEC 60950-certified SELV power source, or IEC 62368-1-certified ES1 power source. The maximum voltage from the PC shall not exceed 5.7 Vdc.

SC-9000 (with BUD-9000)

- Do not replace battery unit in a hazardous location.
- Do not replace dry batteries in a hazardous location.
- For Japan Ex models, be sure to use alkaline AA batteries, type LR6 manufactured by Toshiba. For ATEX/IECEx models, be sure to use alkaline AA batteries, type LR6 manufactured by Toshiba or MN1500 manufactured by Duracell.
- When connecting to a PC via USB, the PC must be connected to IEC 60950-certified SELV power source, or IEC 62368-1-certified ES1 power source. The maximum voltage from the PC shall not exceed 5.7 Vdc.

Product code

INST. No. 0 0 000 0000 00
A B C D E

A: Last digit of year of manufacture (0 to 9)
B: Manufacturing month (1 to 9, XYZ for Oct. to Dec.)
C: Manufacturing lot
D: Serial number
E: Factory code

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: https://www.rikenkeiki.co.jp/english/

3

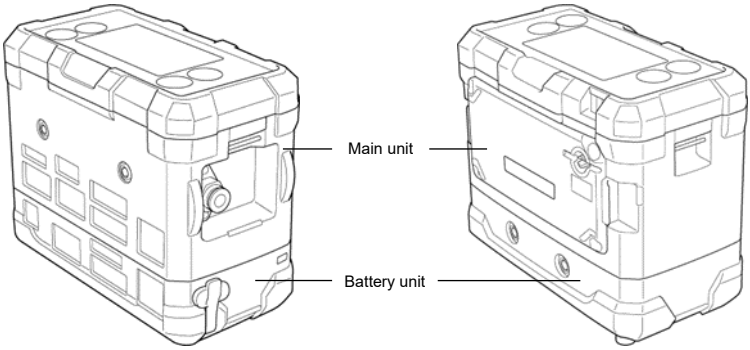
Product Configuration

3-1 Main unit and accessories

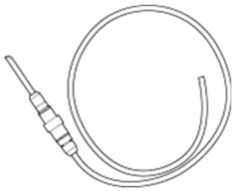
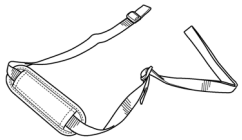
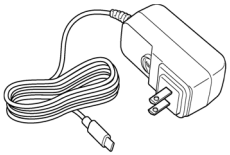
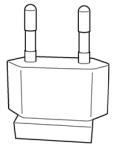
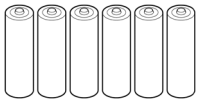
Open the box and packaging and inspect the main unit and accessories.
If any accessories or parts are missing, contact RIKEN KEIKI.

3-1-1 Main unit

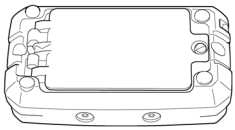
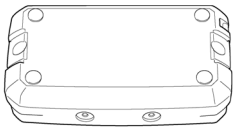
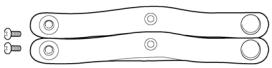
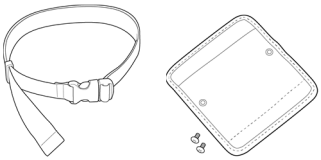
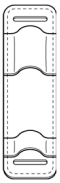
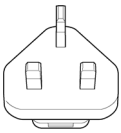
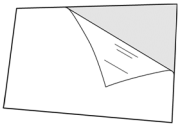
For detailed information on the names and functions of product parts and the LCD display, refer to ‘3-2 Part names and functions’.

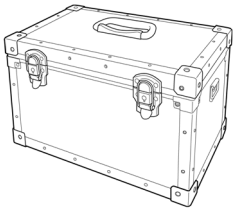
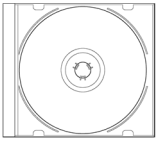


3-1-2 Accessories

Part name		Remarks
	Sampling probe (Approx. 94 cm)	Part No.: 4733 9406 00 (sampling probe)
	Shoulder strap	Part No.: 4777 4592 10
	AC adapter	Provided with lithium ion battery unit (BUL-9000) Part No.: 2594 1342 30
	Adapter plug (EU/Type C)	Provided with lithium ion battery unit (BUL-9000) on ATEX/IECEx models. Part No.: 2594 1435 00
	AA alkaline batteries (×6)	Provided with dry battery unit (BUD-9000) Part No.: 2753 3007 80

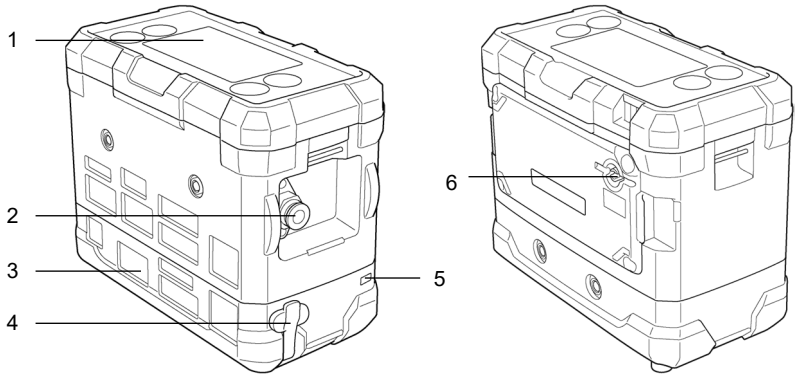
3-1-3 Optional accessories

Part name		Remarks
	Dry battery unit (BUD-9000)	Either the dry battery unit or lithium ion battery is provided, but additional units can be purchased if required. Part No. (BUD-9000) : 4777 9603 60 (Japan Ex model) 4777 9605 10 (ATEX/IECEx model) Part No. (BUL-9000) : 4777 9602 90 (Japan Ex model) 4777 9604 30 (ATEX/IECEx model)
	Lithium ion battery unit (BUL-9000)	
	Filter cylinder retaining belt	Used to attach the filter cylinder to the gas detector. Used only when a sensor requiring a filter cylinder is installed. Part No.: 4777 9444 20
	Waist belt/ Waist belt attachment	Allow the gas detector to be worn close to the body. Use with the shoulder strap is recommended to avoid dropping the gas detector. Part No.: 4775 5653 40 (Waist belt) 4775 9853 10 (Waist belt attachment)
	Sampling probe holder (for sampling probe)	Attached to the shoulder strap; allows storage of the sampling probe tip. Part No.: 4775 5651 00
	Adapter plug (AU/Type O)	Part No.: 2594 1434 20
	Adapter plug (UK/Type BF)	Part No.: 2594 1436 70
	LCD protective film Set of 5	Part No.: 4777 9025 70

Part name		Remarks
	Aluminum storage case	Dimensions: Approx. 365 (W) × 236 (H) × 226 (D) mm* Part No.: 4777 9579 00 * Excluding projections
	Data logger management program	Part No.: 9811 0980 90 (Japan Ex model) 9811 0990 80 (ATEX/IECEx model)
	USB interface cable	Used for interfacing with the PC on which the data logger management program and configuration program are installed. Part No.: 2440 2728 90

3-2 Part names and functions

3-2-1 Main unit and battery unit

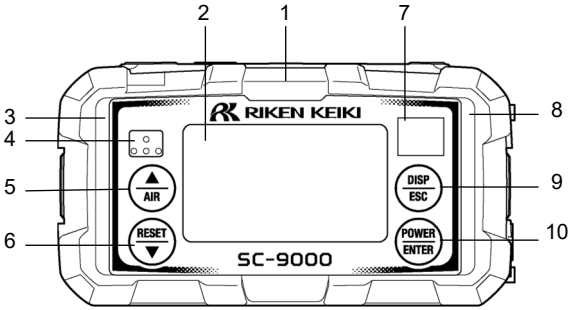


No.	Name	Functions
1	Control panel	Contains the buttons and LCD for operating the product.
2	Gas inlet (GAS IN)	Draws in the gas. Used to connect the sampling probe.
3	Battery unit	The lithium ion battery unit (BUL-9000) or dry battery unit (BUD-9000) that powers the product.
4	Jack cover	Cover for the AC adapter and USB cable connector. Detach the cover to connect the AC adapter to charge when using the lithium ion battery unit (BUL-9000). Connect a USB cable to connect to a PC.
5	Charging indicator lamp (BUL-9000 only)	Lights up in red when charging, and lights up green when charging is complete. Lights up in orange when charging while connected to the PC.
6	Gas outlet (GAS OUT)	Discharges the gas drawn in. (Do not block.)

CAUTION

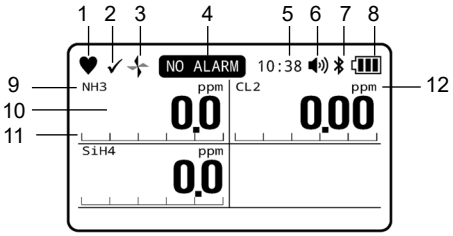
- Do not prod the buzzer sound opening with sharp objects. Doing so may result in ingress of water or foreign matter, resulting in malfunctions or damage to the product.
- Do not remove the panel sheet on the surface. Doing so will impair dustproof and waterproof performance.
- Do not block the buzzer sound opening with tape or other objects. This will prevent adjustment of the internal pressure of the product, which may result in malfunctions.

3-2-2 Control panel



No.	Name	Functions
1	Alarm LED array (top)	The lamps flash red when an alarm occurs.
2	LCD display	Displays information such as gas type and gas concentration.
3	Alarm LED array (left)	The lamps flash red when an alarm occurs and detection is not in progress.
4	Buzzer sound opening	Emits operating and alarm sounds. (Do not block.)
5	▲/AIR button	Performs fresh air adjustment in detection mode. Used to select items and adjust numerical values (up) in display mode and user mode.
6	RESET/▼ button	Turns the pump on and off in detection mode. Also resets alarms. Used to select items and adjust numerical values (down) in display mode and user mode.
7	Gas nameplate	Nameplate indicating the detection target gas name.
8	Alarm LED array (right)	The lamps flash red when an alarm occurs and detection is not in progress (when the power is turned on or in user mode).
9	DISP/ESC button	Selects display mode. Selects display items in display mode.
10	POWER/ENTER button	Turns the power on and off. Used in user mode to confirm values or make settings.

3-2-3 LCD display



No.	Name	Functions
1	Operating status icon	Indicates the detection mode operating status. Blinks when normal.
2	Bump test expiration icon	Displayed until the bump test expiration date when the bump test expiration display setting is enabled.
3	Flow confirmation icon	Indicates the suction status in detection mode. The icon rotates when normal.
4	Gas alarm function off display	Displayed when the gas alarm function is turned off. Alarms will not operate when the gas alarm function is turned off.
5	Clock display	Displays the current time.
6	Buzzer volume icon	Indicates the buzzer volume.
7	Bluetooth® icon	Displayed when the Bluetooth® function is turned on.
8	Battery level icon	Indicates battery levels.
9	Gas name display	Displays the name of the detection target gas. The gas names displayed will vary depending on the sensors installed.
10	Gas concentration display	Displays the detected gas concentration.
11	Gas concentration bar display	The segmented detection range (full scale) displays gas concentrations as bars. It indicates concentrations as ratios of the full scale.
12	Units display	Displays units (ppm) according to sensor specifications.

NOTE

- Approximate battery levels are indicated as follows:
  : Sufficient
  : Low
  : Needs charging (replace the batteries).

  The battery level icon will blink if the battery level drops even further. The LED and buzzer operate every four seconds here.
- The buzzer volume icon indicates as follows:
  : High volume
  : Low volume

4

Alarm Functions

4-1 Gas alarm types

A gas alarm is triggered instantly if the concentration of the detected gas reaches or exceeds the alarm setpoints shown in the following tables. (Self-latching)

Gas alarm types include the first alarm (WARNING), second alarm (ALARM), TWA alarm, STEL alarm, OVER alarm (over scale), and M OVER alarm (negative sensor failure).

Gas alarms are prioritized as follows:

First alarm < second alarm < M OVER alarm < OVER alarm < TWA alarm < STEL alarm

4-2 Gas alarm setpoints

The default settings for gas alarm setpoints are as shown in the following table:

Item	Detection target gas	Ammonia NH_3	Chlorine Cl_2	Ozone O_3
Sensor model		ESF-B242	ESF-C930	ESF-B249
Explosion-proof specifications		Japan Ex and ATEX/IECEx	Japan Ex and ATEX/IECEx	Japan Ex and ATEX/IECEx
Display range		0 – 75.0 ppm	0 – 1.50 ppm	0 – 0.600 ppm
Detection range		0 – 75.0 ppm	0 – 1.50 ppm	0 – 0.600 ppm
Resolution		0.5 ppm	0.01 ppm	0.005 ppm
Alarm setpoints	First alarm	25.0 ppm	0.50 ppm	0.100 ppm
	Second alarm	50.0 ppm	1.00 ppm	0.200 ppm
	TWA	25.0 ppm	0.50 ppm	0.100 ppm
	STEL	35.0 ppm	1.00 ppm	OFF
	OVER	75.0 ppm	1.50 ppm	0.600 ppm
	M OVER	-10.0 ppm	-0.15 ppm	-0.060 ppm

Item	Detection target gas	Hydrogen chloride HCl	Hydrogen cyanide HCN*
Sensor model		ESF-A24E2	ESF-A24D
Explosion-proof specifications		Japan Ex and ATEX/IECEx	Japan Ex
Display range		0 – 6.00 ppm	0 – 15.0 ppm
Detection range		0 – 6.00 ppm	0 – 15.0 ppm
Resolution		0.05 ppm	0.1 ppm
Alarm setpoints	First alarm	2.00 ppm	5.0 ppm
	Second alarm	4.00 ppm	10.0 ppm
	TWA	OFF	OFF
	STEL	OFF	4.7 ppm
	OVER	6.00 ppm	15.0 ppm
	M OVER	-0.60 ppm	-1.5 ppm

* Not included in the ATEX/IECEx model lineup. Due to export restrictions, this cannot be installed in products exported outside Japan.

Item	Detection target gas	Hydrogen fluoride HF*1	Hydrogen fluoride HF*2	Phosphine PH_3
Sensor model		ESF-B248	ESF-B248X	ESF-A24D
Explosion-proof specifications		Japan Ex	ATEX/IECEx	Japan Ex and ATEX/IECEx
Display range		0 – 1.50 ppm	0 – 1.50 ppm	0 – 1.00 ppm
Detection range		0 – 1.50 ppm	0 – 1.50 ppm	0 – 1.00 ppm
Resolution		0.01 ppm	0.01 ppm	0.01 ppm
Alarm setpoints	First alarm	0.50 ppm	0.50 ppm	0.30 ppm
	Second alarm	1.00 ppm	1.00 ppm	0.60 ppm
	TWA	0.50 ppm	0.50 ppm	OFF
	STEL	OFF	OFF	OFF
	OVER	1.50 ppm	1.50 ppm	1.00 ppm
	M OVER	-0.15 ppm	-0.15 ppm	-0.10 ppm

*1: Due to export restrictions, this cannot be installed in products exported outside Japan.
*2: Due to export restrictions, concentrations of 0.0 – 0.4 ppm are indicated as 0.0 ppm.

Item	Detection target gas	Fluorine F_2	Silane SiH_4	Nitrogen monoxide NO
Sensor model		ESF-B248	ESF-A24D	ESF-A24D2
Explosion-proof specifications		Japan Ex and ATEX/IECEx	Japan Ex and ATEX/IECEx	Japan Ex and ATEX/IECEx
Display range		0 – 3.00 ppm	0 – 15.0 ppm	0 – 100 ppm
Detection range		0 – 3.00 ppm	0 – 15.0 ppm	0 – 100 ppm
Resolution		0.02 ppm	0.1 ppm	1 ppm
Alarm setpoints	First alarm	1.00 ppm	5.0 ppm	25 ppm
	Second alarm	2.00 ppm	10.0 ppm	50 ppm
	TWA	OFF	5.0 ppm	25 ppm
	STEL	OFF	OFF	OFF
	OVER	3.00 ppm	15.0 ppm	100 ppm
	M OVER	-0.30 ppm	-1.5 ppm	-10 ppm

Item	Detection target gas	Nitrogen dioxide NO_2	Sulfur dioxide SO_2	Hydrogen bromide HBr
Sensor model		ESF-AA20	ESF-A24D	ESF-A24E2
Explosion-proof specifications		Japan Ex and ATEX/IECEx	Japan Ex and ATEX/IECEx	Japan Ex and ATEX/IECEx
Display range		0 – 15.0 ppm	0 – 6.00 ppm	0 – 6.00 ppm
Detection range		0 – 15.0 ppm	0 – 6.00 ppm	0 – 6.00 ppm
Resolution		0.1 ppm	0.05 ppm	0.05 ppm
Alarm setpoints	First alarm	5.0 ppm	2.00 ppm	2.00 ppm
	Second alarm	10.0 ppm	4.00 ppm	4.00 ppm
	TWA	OFF	OFF	OFF
	STEL	OFF	OFF	OFF
	OVER	15.0 ppm	6.00 ppm	6.00 ppm
	M OVER	-1.5 ppm	-0.60 ppm	-0.60 ppm

Item	Detection target gas	Chlorine trifluoride ClF_3	Disilane Si_2H_6
Sensor model		ESF-B24A	ESF-A24D
Explosion-proof specifications		Japan Ex and ATEX/IECEx	Japan Ex and ATEX/IECEx
Display range		0 – 0.300 ppm	0 – 15.0 ppm
Detection range		0 – 0.300 ppm	0 – 15.0 ppm
Resolution		0.002 ppm	0.1 ppm
Alarm setpoints	First alarm	0.100 ppm	5.0 ppm
	Second alarm	0.200 ppm	10.0 ppm
	TWA	OFF	OFF
	STEL	OFF	OFF
	OVER	0.300 ppm	15.0 ppm
	M OVER	-0.030 ppm	-1.5 ppm

NOTE

- The alarm setpoints indicated for the first alarm (WARNING), second alarm (ALARM), TWA alarm, and STEL alarm in the tables above can be changed (or disabled). (Refer to '7-3-1 Setting alarm setpoints.')
- The M OVER alarm (negative sensor failure) occurs when the zero point drifts to the negative side.
- Gas concentrations are checked at one-second intervals to determine whether to issue an alarm.

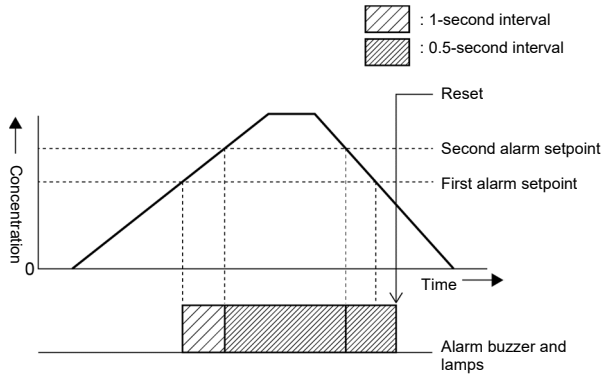
4-3 Gas alarm patterns

<Gas alarm buzzer sounding and lamp flashing patterns>

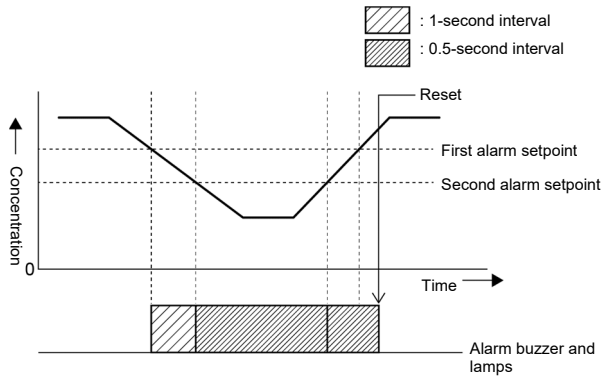
If a gas alarm occurs, the user is notified by the buzzer sounding and the alarm LED array flashing.
The behavior differs depending on the type of alarm.

Alarm type	First alarm	Second alarm	TWA alarm	STEL alarm	OVER alarm	M OVER alarm
Buzzer sounding	Repeated alternating strong and weak beeps at about 1-second intervals “Beep, beep”	Repeated alternating strong and weak beeps at about 0.5-second intervals “Beep, beep, beep, beep”	Repeated alternating strong and weak beeps at about 1-second intervals “Beep, beep”	Repeated alternating strong and weak beeps at about 1-second intervals “Beep, beep”	Repeated alternating strong and weak beeps at about 0.5-second intervals “Beep, beep, beep, beep”	Repeated intermittent beeps at about 1-second intervals: “Beep, beep”
Alarm LED array flashing	Repeated flashing at about 1-second intervals	Repeated flashing at about 0.5-second intervals	Repeated flashing at about 1-second intervals	Repeated flashing at about 1-second intervals	Repeated flashing at about 0.5-second intervals	Repeated flashing at about 1-second intervals

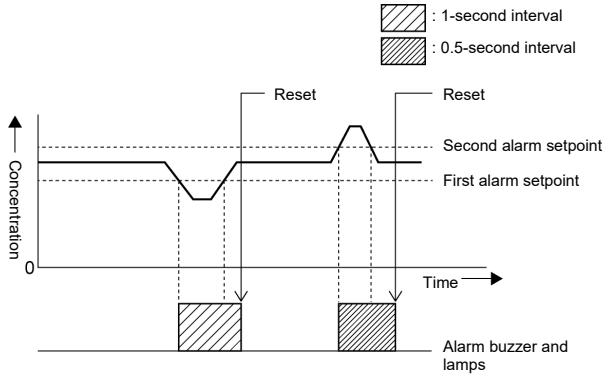
<Alarm pattern (H-HH)>



<Alarm pattern (L-LL)>



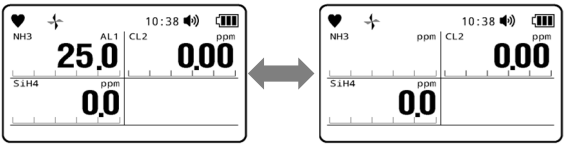
<Alarm pattern (L-H)>



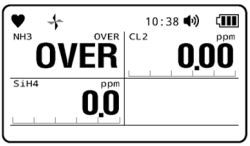
<Gas alarm display>

When a gas alarm occurs, the alarm type is indicated in the units display area of the LCD display, and the corresponding gas concentration display blinks.
If the detection range is exceeded (over scale), [OVER] appears alternately in the units display area, and [OVER] blinks in the gas concentration display area.

<Display example ([NH3]: First alarm triggered)>



<Display example ([NH3]: Over scale)>



Alarm type	First alarm	Second alarm	TWA Alarm	STEL Alarm	OVER Alarm	M OVER Alarm
Units display area indication	AL1	AL2	TWA	STEL	OVER	M OVER
Gas concentration display area indication	Blinking	Blinking	Blinking	Blinking	Blinking [OVER]	Blinking [-OVER]

WARNING

- A gas alarm indicates the presence of extreme danger. The user must take appropriate action after taking appropriate steps to ensure safety.

NOTE

- The alarm pattern can be checked by performing an alarm test at the alarm setpoint display in display mode. Note, however, that the gas concentration display will not blink in alarm tests. (Refer to '8-4 Performing alarm tests'.)
- If self-latching is selected, the alarm is reset when the RESET/▼ button is pressed after the gas concentration has returned to normal.
  If auto-reset is selected, the alarm is reset automatically once the gas concentration has returned to normal.

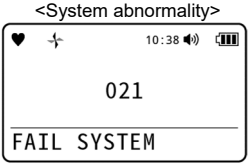
4-4 Fault alarm patterns

A fault alarm is triggered if an abnormality is detected in the product. (Self-latching)
Fault alarm types include system, battery voltage, clock, sensor, and flow rate abnormalities.
If a fault alarm occurs, the user is notified by the buzzer sounding and alarm LED array flashing.

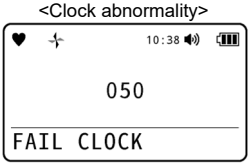
- Buzzer sounding: Repeated intermittent beeps at about 1-second intervals (“Beep-beep, beep-beep”)
- LED array flashing: Repeated flashing at about 1-second intervals

The following shows fault alarm display examples:

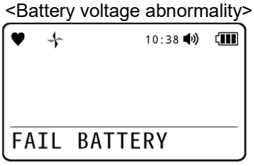
<System abnormality>



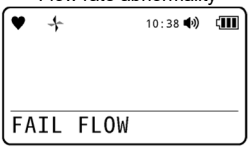
<Clock abnormality>



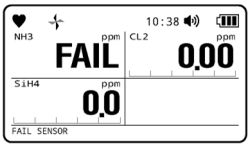
<Battery voltage abnormality>



<Flow rate abnormality>



<Sensor abnormality>



CAUTION

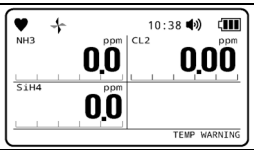
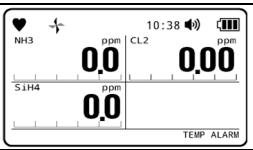
- If a fault alarm occurs, determine the cause and take appropriate action.
  If the problem lies with the product and the fault occurs repeatedly, contact RIKEN KEIKI immediately.

NOTE

- For more information on malfunctions (error messages), refer to ‘10 Troubleshooting’.
- Press the RESET/▼ button to reset the alarm.

4-5 Outside operating temperature range warning

An outside operating temperature range warning occurs in the form of a temperature range error if the product is used outside the continuous use environment operating temperature range for more than 20 minutes.
When a temperature range error occurs, either leave the product for 10 minutes or longer in the operating temperature range, or turn off the power for the main unit.
If an outside operating temperature range warning occurs, the user will be alerted by the audible buzzer and flashing alarm lamp.

Alarm type	Outside operating temperature range warning	
Condition	Less than one hour outside range	One hour or more outside range
Buzzer	Repeated intermittent beeps at about 5-second intervals: “Beep”	
Alarm lamp	Repeated flashing at about 5-second intervals	
LCD display		
Reset	Press the RESET/▼ button. However, the alarm will trigger automatically every 20 minutes even after the reset.	Not available

NOTE

- The outside operating temperature range warning occurs in detection mode and display mode.

5

Usage Instructions

5-1 Usage note

Observe all usage precautions when using the product.
Ignoring these precautions may damage the product and result in inability to detect gas concentrations correctly.

Check the following before starting gas concentration detection:

- Confirm that the battery level is sufficient.
- Check to confirm that the sampling tube is not bent or damaged.
- Check to confirm that the filter inside the sampling probe is not contaminated or clogged.
- Check to confirm that the sampling probe is correctly connected to the main unit.
- Product model and specifications
- Gas alarm setpoints

NOTE

- If the settings for the product have been altered from an external device, be sure to confirm that the settings have been altered correctly.
- Protective film is attached to the LCD display on the product to protect it against scratching during shipping.
  Be sure to peel off this protective film before using the product. Explosion-proofing cannot be guaranteed if the protective film is left attached.

5-2 Removing and attaching the battery unit and charging

5-2-1 Removing and attaching the battery unit

Follow the procedure described below to remove and attach the lithium ion battery unit (BUL-9000) or dry battery unit (BUD-9000).

DANGER

- The battery unit must be removed and attached only in a safe place.

CAUTION

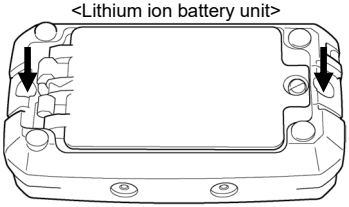
- Be sure to turn off the power for the product before removing or attaching the battery unit.
- Do not touch the main unit connection terminals on the battery unit with bare hands. There is a risk of contact failure due to contamination or damage to internal components due to static electricity.
- Do not short-circuit the connection terminals with metal objects. The battery will overheat or the battery level will drop sharply.
- If the battery unit retaining screws are not fully tightened, the battery unit may fall off or water may get in through the gaps. Water may also get in if minute foreign matter is trapped between the battery unit and the main unit.
- Avoid damaging the rubber seal. To maintain dustproof and waterproof performance, we recommend replacing the rubber seal every two years, regardless of condition.

NOTE

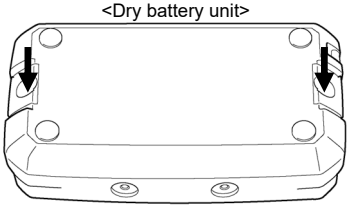
▶ The date and time setting may be reset if the battery unit is removed for extended periods.

1 Loosen the two battery unit retaining screws on the underside of the battery unit.

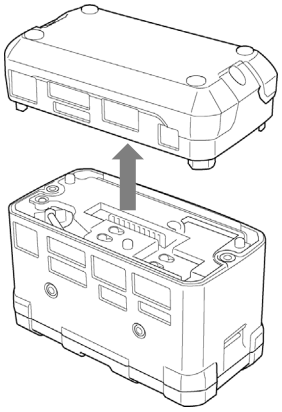
<Lithium ion battery unit>



<Dry battery unit>

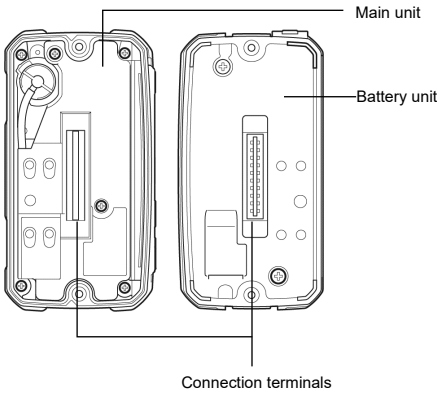


2 Remove the battery unit.



* The diagram illustrates the lithium ion battery unit.

3 Attach a new battery unit.
Note the connection terminals and protrusions to ensure that the battery unit is attached in the correct orientation.



4 Tighten the two battery unit retaining screws on the underside of the main unit.

5-2-2 Charging the lithium ion battery unit (BUL-9000)

When using the product for the first time or if the battery level is low, be sure to charge the lithium battery unit using the dedicated AC adapter.

DANGER

- Charge the lithium ion battery unit only in a safe place.
- Be sure to use the dedicated AC adapter for charging.
- Charge the battery at an ambient temperature between 0 °C and +40 °C.

CAUTION

- Do not use the product while charging. Doing so will prevent correct detection. This will also hasten battery degradation and reduce battery life.
- The AC adapter is neither waterproof nor dustproof. Do not charge the battery while the main unit is wet.
- The AC adapter is not explosion-proof.
- Do not pull the jack cover with excessive force. Doing so may damage the jack cover.
- Do not use the product with the jack cover removed. Doing so may result in ingress of dust or water and result in malfunctions. If the jack cover is damaged, replace with a new one.
- If the jack cover is not securely fitted, water may get inside. Water may also get in if minute foreign matter is trapped beneath the jack cover and the product.
- Always unplug the AC adapter from the power outlet when not in use.

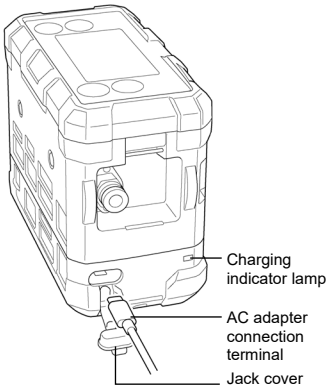
NOTE

- The lithium ion battery unit may get hot during charging. This is not an abnormality.
- Wait at least 10 minutes before use. The main unit will be hot immediately after charging. Using the lithium ion battery while it is still hot may prevent correct detection.
- The battery cannot be recharged when fully charged.

1 **Open the jack cover on the lithium ion battery unit.**

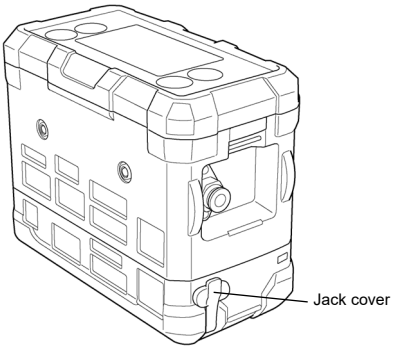
2 **Insert the AC adapter connection terminal into the charging jack on the lithium ion battery unit.**

3 **Plug the AC adapter power plug into the power outlet.**
The charging indicator lamp lights up in green when the AC adapter is connected. Charging begins after approximately three seconds, and the lamp lights up in red. (Full charge requires approximately eight hours at maximum.)
Once charging is completed, the charging indicator lamp lights up in green.



4 **When charging is complete, unplug the AC adapter from the power outlet.**

5 **Remove the AC adapter connection terminal from the lithium ion battery unit charging jack, then close the jack cover.**
Make sure the jack cover is pressed in securely.



WARNING

- When the product is connected to a PC via a USB cable, the charging indicator lamp lights up in green, slow charging starts after approximately 30 seconds, and the lamp lights up in orange.
  Slow charging is auxiliary charging to maintain communication mode. Full charging is not possible. Do not connect the product to a PC for the purpose of charging. Also, do not connect to a commercially available USB power supply.
- The AC adapter provided must be used to charge the product. Do not connect this adapter to a smartphone or other USB device.

NOTE

- Connect the product to a PC via a USB cable to use the product in communication mode.
  Communication mode allows you to use the separately sold SW-9000 Series data logger management program to load and use collected data on the PC.
- When using the lithium ion battery unit, slow charging is used to ensure stable performance in communication mode.
- Do not charge continuously in slow charging mode. Be sure to unplug the USB cable after exiting communication mode.

5-2-3 Replacing the dry battery unit (BUD-9000)

When using the product for the first time or if the battery level is low, replace the batteries with new alkaline AA batteries.

DANGER

- The product explosion-proof standards include the use of the specified dry batteries. When using as an explosion-proof product, use six specified alkaline AA batteries.
- Be sure to use only the specified batteries.
- Be sure to replace the batteries only in a safe place.

CAUTION

Battery replacement

- Be sure to turn off the power for the product before replacing the batteries.
- Note the polarity when inserting new batteries.
- If the battery cover retaining screw is not fully tightened, the dry batteries may fall out, or water may get in through the gaps. Water may also get in if minute foreign matter is trapped between the cover and the main unit.

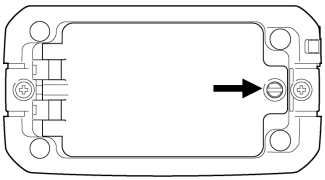
Batteries

- When replacing the batteries, replace all six with new batteries at the same time.
- Do not use rechargeable batteries.

Jack cover

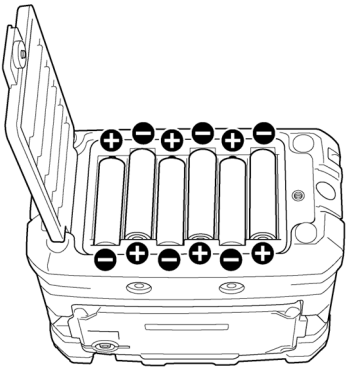
- Do not pull the jack cover with excessive force. Doing so may damage the jack cover.
- Do not use the product with the jack cover removed. Doing so may result in ingress of dust or water and result in malfunctions. If the jack cover is damaged, replace with a new one.
- If the jack cover is not securely fitted, water may get inside. Water may also get in if minute foreign matter is trapped beneath the jack cover and the product.

1 **Use a flathead screwdriver or coin to loosen the battery cover retaining screw on the underside of the product.**



2 Open the battery cover.

3 Insert six new AA alkaline batteries.
Remove any old batteries inside.
Note the polarity when inserting new batteries.



4 Close the battery cover, then tighten the battery cover retaining screw.
Tighten the battery cover retaining screw securely.

5-3 Connecting the sampling probe

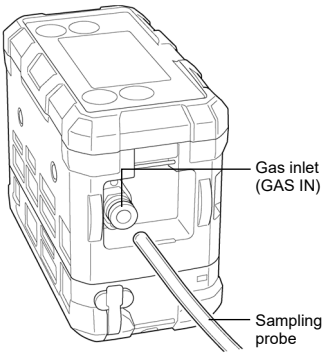
Connect the sampling probe to the gas inlet (GAS IN) on the main unit.
When detecting gas, connect the sampling probe provided to avoid the effects of airborne dust.

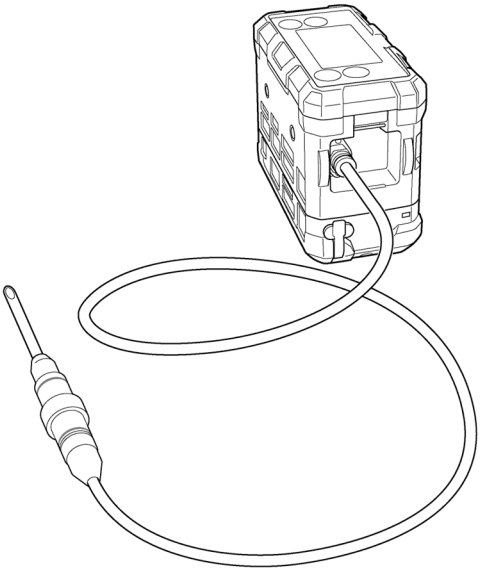
CAUTION

- Do not use a sampling probe other than that specified by RIKEN KEIKI.
- If the sampling probe is bent or the tip is clogged, correct detection will become impossible, and the reading may be lower than the actual gas concentration.
  Check that the sampling probe is not bent and the tip is not obstructed when using the product.
- The sampling probe tip contains a dust filter to prevent foreign matter from being drawn into the sampling probe. If foreign matter is sucked in, replace the dust filter. (Refer to '8-6-2 Replacing the sampling probe dust filter'.)

1 **Insert the sampling probe into the gas inlet (GAS IN) on the main unit.**
Pull the sampling probe to confirm that it does not come loose.

To detach the sampling probe, pull out while pressing the ring on the gas inlet.





5-4 Turning on the power

When the power is turned on, various settings including the date and time and alarm setpoints are displayed, and then the detection mode screen is displayed.

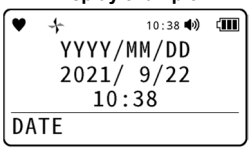
NOTE

- When the power is turned on, the LCD, lamps, and buzzer operate. Before using the product, check that these operations function correctly.

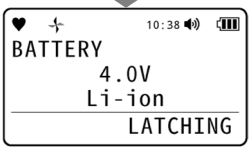
1 Hold down the POWER/ENTER button (for at least three seconds) until the buzzer blips once.
When the power is turned on, the LCD display fully lights up and changes automatically as shown below before entering detection mode. (Approx. 40 seconds)

<Display example>

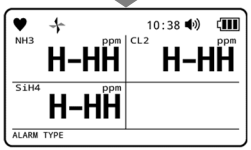
Date and time display



Battery voltage display

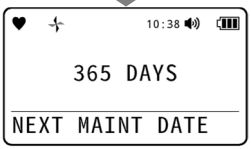


Alarm type display

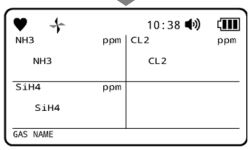


Maintenance notification display*

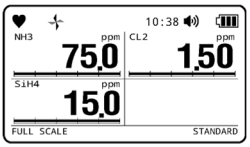
* Japan Ex model: Maintenance notification display
ATEX/IECEx model: Adjustment expiration display



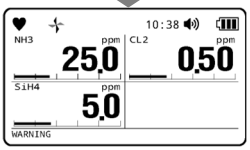
Detection target gas name/calibration gas display



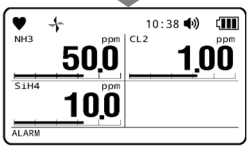
Full scale display



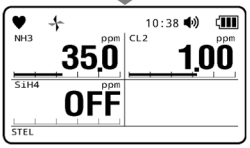
First alarm setpoint display



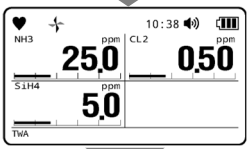
Second alarm setpoint display



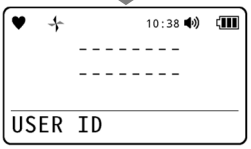
STEL alarm setpoint display



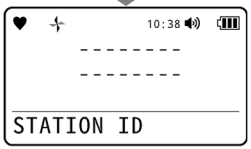
TWA alarm setpoint display



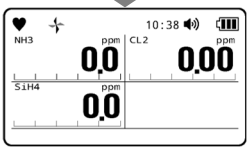
User ID display



Station ID display



Detection mode
The buzzer blips twice and the product switches to detection mode.



CAUTION

- Turn on the power for the product in clean air.
- Fresh air adjustment must be performed before detecting gas concentrations after turning on the power. (Refer to '5-5 Performing fresh air adjustment in detection mode'.)

NOTE

- If an abnormality is detected in the F sensor, [FAIL] will appear, and a sensor abnormality alarm will be triggered.
  If an alarm occurs, press the RESET/▼ button to temporarily reset the sensor abnormality alarm. However, the alarm cannot be reset if there is an abnormality in all of the sensors. After the alarm is reset, [----] appears in the concentration display area of the gas for which the sensor abnormality occurred, and detection is not possible for that particular gas. Contact RIKEN KEIKI immediately.
- If an F sensor abnormality occurs and a sensor abnormality is displayed three times in succession, a confirmation screen will appear asking whether to disable the F sensor. To disable the F sensor, press the POWER/ENTER button. (If you do not wish to disable the sensor, press the DISP/ESC button.)
  If no selection is made within 15 seconds, the next item in initial mode will be selected automatically without disabling the F sensor.
- If an abnormality arises in the internal clock, a fault alarm ([FAIL CLOCK]) may be triggered. If a fault alarm occurs, press the RESET/▼ button to temporarily reset the fault alarm. Detection will start with the incorrect clock time and date.
- In modes other than detection mode and display mode, the LEDs flash every four seconds.

Date and time display

- If a USB connection is detected while the date and time is displayed, the product enters communication mode.
- To enter communication mode, press the RESET/▼ and DISP/ESC buttons simultaneously while the date and time is displayed.

Power supply voltage display

- This displays the type of battery installed and alarm type.
- If a USB connection is detected while the battery voltage is displayed, the product enters communication mode.
- To enter communication mode, press the RESET/▼ and DISP/ESC buttons simultaneously while the battery voltage is displayed.

Sensor startup display

- [SENSOR START UP] is displayed on the screen if the F sensor startup processing is not completed by the time the battery voltage display ends.

Maintenance notification display (Japan Ex model)

- With the Japan Ex model, the number of days remaining until one year (365 days) after the last adjustment date is displayed. The buzzer sounds and [PLEASE CAL] is displayed on the LCD display if more than one year has elapsed since the last adjustment date. Press the DISP/ESC button or RESET/▼ button to proceed to the next screen.

Adjustment expiration display (ATEX/IECEx model)

- When the adjustment notification expiration display setting is enabled with an ATEX/IECEx model (enabled by default), the adjustment expiration and number of days remaining until the adjustment expiration are displayed. If the set adjustment expiration date has passed, notification of expiration is given.
  The behavior varies depending on the adjustment expiration function settings. The default setting is “Confirm”.
  - ・Confirm: Triggers a fault alarm. Press the DISP/ESC button or RESET/▼ button to proceed to the next screen. Pressing the POWER/ENTER button selects user mode gas adjustment.
  - ・Do not confirm: The next screen is automatically displayed after six seconds. Pressing the POWER/ENTER button selects user mode gas adjustment.
  - ・Disable: Triggers a fault alarm. User mode gas adjustment is automatically selected after six seconds.

Bump test expiration display

- When the bump test expiration function is enabled (disabled by default), the bump test expiration and number of days remaining until bump test expiration are displayed. If the set bump test expiration date has passed, notification of expiration is given.
  The behavior varies depending on the bump test expiration function settings. The default setting is “Confirm”.
  - ・Confirm: Triggers a fault alarm. Press the DISP/ESC button or RESET/▼ button to proceed to the next screen. Pressing the POWER/ENTER button selects user mode gas adjustment.
  - ・Do not confirm: The next screen is automatically displayed after six seconds. Pressing the POWER/ENTER button selects user mode gas adjustment.
  - ・Disable: Triggers a fault alarm. User mode gas adjustment is automatically selected after six seconds.

Full scale display

- Displays the full-scale value of the detection target gas.

First alarm setpoint display

- Displays the first alarm setpoint for the detection target gas.

Second alarm setpoint display

- Displays the second alarm setpoint for the detection target gas.

STEL alarm setpoint display

- Displays the STEL alarm setpoint for the detection target gas. [OFF] is displayed when the STEL alarm setpoint is disabled. [----] is displayed when the STEL alarm setpoint is invalid.
- The STEL value is the time-weighted average exposure over a short duration (15 minutes). It is generally accepted that almost all users will not experience adverse health effect if the STEL value does not exceed this value. When both STEL and TWA values are subject to restrictions, both values must be controlled below the specified limits.
- The STEL value refers to the sum of 15 pieces of average value data for detected values over a period of 60 seconds divided by 15. The value is refreshed every 60 seconds.

TWA alarm setpoint display

- Displays the TWA alarm setpoint for the detection target gas. [OFF] is displayed when the TWA alarm setpoint is disabled. [----] is displayed when the TWA alarm setpoint is invalid.
- The TWA value refers to the time-weighted average concentration limit of a toxic substance for a normal 8-hour workday and a 40-hour workweek to which almost all users may be repeatedly exposed without adverse health effect.
- The TWA value refers to the value obtained by integrating average value data for detected values over a period of 60 seconds and then dividing the integrated value for a period of 8 hours by 480. The value is refreshed every 60 seconds.

Automatic fresh air adjustment confirmation display

- If the automatic fresh air adjustment function is enabled, a screen is displayed to confirm whether or not to perform fresh air adjustment before entering detection mode. Pressing the POWER/ENTER button performs fresh air adjustment. To skip fresh air adjustment, press the DISP/ESC button.
  The product enters detection mode when automatic fresh air adjustment ends.
  For information on fresh air adjustment, refer to ‘5-5 Performing fresh air adjustment in detection mode’.

5-5 Performing fresh air adjustment in detection mode

Perform fresh air adjustment before detecting gas concentrations.

WARNING

- When fresh air adjustment is performed in the surrounding atmosphere, check the air for cleanness before starting. Correct fresh air adjustment will not be possible in the presence of miscellaneous gases. It is also extremely dangerous if the product cannot detect actual gas leaks correctly.

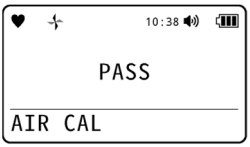
CAUTION

- Perform fresh air adjustment in an environment that meets all of the following conditions:
  - ・Under conditions of pressure, temperature, and humidity similar to those in the usage environment
  - ・In clean air
- Wait for the reading to stabilize before performing fresh air adjustment.
- If the temperature difference between the storage location and usage location is 15 °C or greater, turn on the power and allow the product to adjust to ambient conditions similar to those at the usage location for about 10 minutes. After this, perform fresh air adjustment in clean air before use.
- If the fresh air adjustment during detection function is disabled, fresh air adjustment is not possible. Modify the setting for the fresh air adjustment during detection function using the configuration program which can be installed from the RIKEN KEIKI website.

1 **Hold down the ▲/AIR button in detection mode.**
The fresh air adjustment screen is displayed.
Keep the ▲/AIR button pressed for as long as the screen shown on the right is displayed.
Fresh air adjustment will not be performed if you release the button before the screen shown on the right is displayed or while it is displayed.

2 **Release the ▲/AIR button once [RELEASE] appears on the screen.**

The result is displayed and the product automatically returns to detection mode once fresh air adjustment has been successfully completed.



NOTE

- If fresh air adjustment fails, fresh air adjustment is not performed, and [FAIL] appears in the concentration display area for the failed sensor.
  Press the RESET/▼ button to reset the fault alarm (adjustment failure). Resetting the alarm displays the value prior to fresh air adjustment.

5-6 Gas detection

DANGER

Gas outlet

- Toxic gas may be discharged from the gas outlet. Never breathe in this air.

WARNING

- The product is designed to draw in gas at atmospheric pressure. There is a danger that detection target gas may leak from inside the product if an excessive pressure is applied to the product gas inlet (GAS IN) or outlet (GAS OUT). Be careful to avoid excessive pressure during use.
- Do not connect the sampling probe directly to locations pressurized above atmospheric pressure. Doing so may result in damage to the internal piping.
- A gas alarm indicates the presence of extreme danger. The user must take appropriate action.
- Check the battery level before using the product. The batteries may be depleted when the product is used for the first time or after extended periods without use. Always fully charge or replace with new batteries before use.
- Gas detection will not be possible if a battery low voltage alarm occurs. If the alarm occurs during use, turn off the power and promptly charge or replace the batteries in a safe place.
- Do not block the buzzer sound opening. Doing so will muffle or silence the audible warning.

CAUTION

- Check the product settings before starting gas detection.
- When detecting gas, connect the sampling probe provided to avoid the effects of airborne dust.
- Use the product with the LCD display facing upward. Correct readings may not be obtained if it is used at an angle or laid flat.
- If highly adsorptive gas has been sucked in, allow the product to suck in clean air, and confirm that the reading returns to zero before use.
- Due to the way they operate, electrochemical type sensors may exhibit positive or negative sensitivity to gases other than the detection target gas. In environments where interference gases are present, the reading may differ from the actual concentration of the detection target gas present. Note that false alarms or M OVER alarms may be triggered, especially at high concentrations. (Refer to ‘12-4 List of interference gases for electrochemical type sensors’.)
- Due to the way the sensor operates, an accurate reading may not be displayed immediately after turning on the power. Allow the product to warm up for at least one minute after turning on the power to allow the reading to stabilize before use. Allow the product to warm up for at least 10 minutes after turning on the power before performing gas adjustment.

NOTE

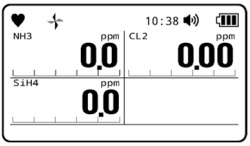
▶ The gas concentration reading for ESF (electrochemical type) sensors is refreshed once every second.

5-6-1 Detecting gas concentration

Detect gas concentrations in detection mode.

Hold the tip of the sampling probe close to the detection area.

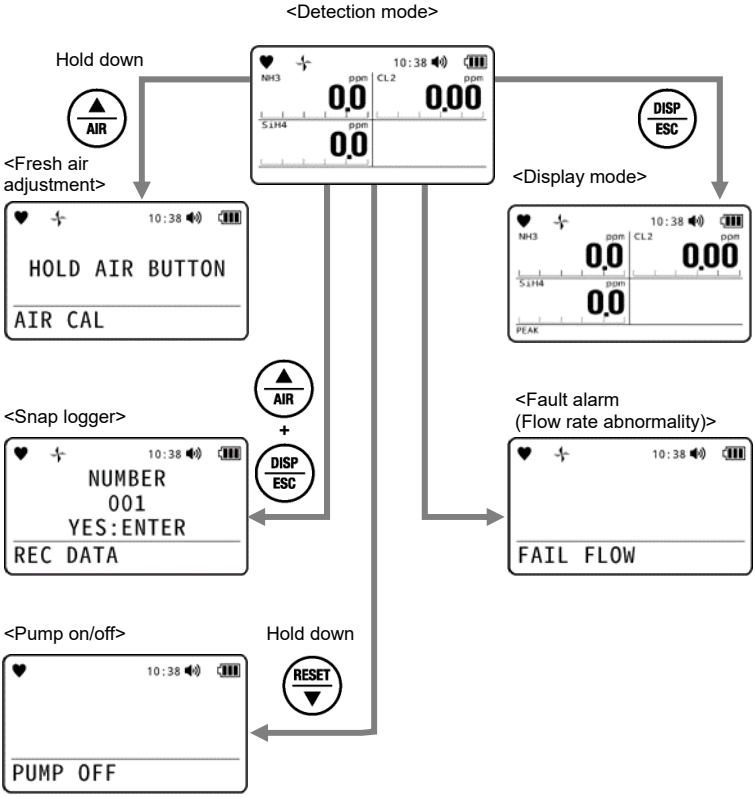
The product sucks in the detection target gas, and the detection results are displayed on the LCD display.



NOTE

- The operating time will be reduced due to battery performance in cold environments at -10 °C or below.
- The response of the LCD display may slow at low temperatures.

5-6-2 Basic operating flow in detection mode



5-6-3 Confirmation beep operation

The confirmation beep is a function that provides audible notification upon bump test expiration or after the occurrence of a gas alarm when the product is operating normally.
The buzzer and LEDs operate at preset intervals while detection is in progress.

NOTE

- The confirmation beep operates only in detection mode and display mode.
- If a gas alarm has occurred, the gas alarm takes precedent.
- The confirmation beep operation can be modified using the configuration program which can be installed from the RIKEN KEIKI website.

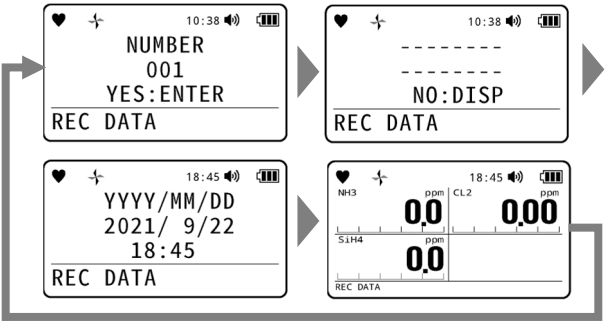
The buzzer and LEDs operate as follows depending on the confirmation beep operation type. The default setting is [OFF].

- [OFF]: Do not operate.
- [LED]: The LEDs operate twice at the set operating time interval.
- [BUZZER]: The buzzer sounds twice at the set operating time interval.
- [LED+BUZZER]: The LEDs and buzzer operate twice at the set operating time interval.
- [BUMP/CAL]: The LEDs light up for one second at the set operating time interval when the span adjustment has expired with the bump test expiration function enabled or when the bump test has expired with the bump test expiration function enabled. The buzzer and LEDs continue to operate even when the product is restarted until span adjustment or bump testing has been performed for all of the installed sensors.
- [ALM ALRT]: The LEDs light up for one second at the set operating time interval when a gas alarm (including negative sensor fault) occurs. The buzzer and LEDs continue to operate, even if the product is restarted, until span adjustment or bump testing has been performed for all of the installed sensors.
- [B/C/ALM]: The LEDs light up for one second at the set operating time interval when a gas alarm (including negative sensor fault) occurs when the span adjustment has expired with the bump test expiration function enabled or when the bump test has expired with the bump test expiration function enabled. The buzzer and LEDs continue to operate even when the product is restarted until span adjustment or bump testing has been performed for all of the installed sensors.

5-7 Recording gas concentration logs (snap logger)

Up to 256 user-specified gas concentration values can be recorded while detection is in progress.
If more 256 data items are recorded, the oldest data is overwritten.

1 Press the ▲/AIR and DISP/ESC buttons simultaneously on the detection mode screen.
The record number, station ID, record date and time, and current gas concentration to be recorded are displayed repeatedly in succession.



2 Press the POWER/ENTER button.
If you do not wish to record, press the DISP/ESC button.

The current gas concentration is recorded.

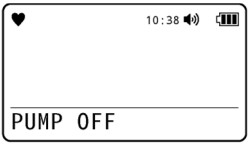
[END] appears and the display returns to the detection mode screen.

NOTE

- Press the ▲/AIR and DISP/ESC buttons simultaneously. The display mode screen will be displayed if the buttons are not pressed together. If this occurs, release both buttons, return to the detection mode screen, then repeat the process.
- The recorded data can be checked on the REC DATA DISP screen in display mode. (Refer to '6-3-2 Displaying the snap logger (gas concentration/alarm status)'.)

5-8 Stopping the pump

1 **Hold down the RESET/▼ button on the detection mode screen (for approximately five seconds).**
The pump stops.



WARNING

- Gas alarms and low flow rate alarms are not triggered while the pump is stopped.

NOTE

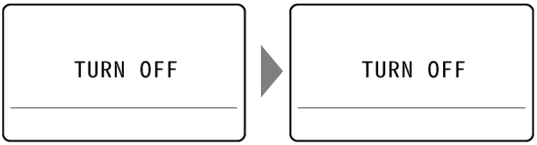
▶ Either press the RESET/▼ button while the pump is stopped, or wait 10 minutes for the pump to restart. The detection mode screen is displayed.

5-9 Turning off the power

CAUTION

- If the concentration display does not return to zero after detection ends, allow the product to stand in clean air until the display returns to zero before turning off the power.

1 **Hold down the POWER/ENTER button (for at least three seconds).**
The buzzer blips three times and [TURN OFF] appears on the display before the power turns off.



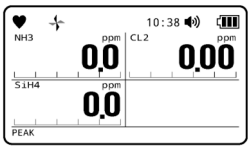
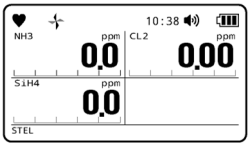
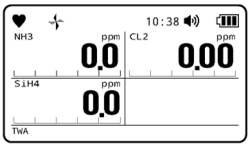
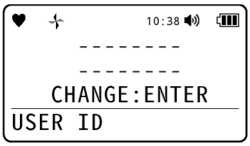
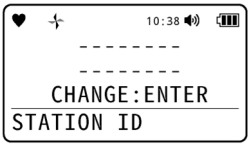
NOTE

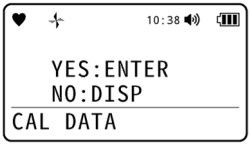
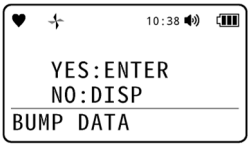
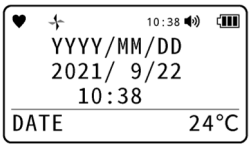
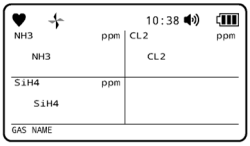
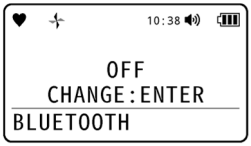
- When turning off the power, hold down the button until the display turns off.
- If the display has not returned to zero when you turn off the power, purging will be performed for up to 30 seconds to clean the product interior. The screen as shown on the right is displayed while purging is in progress.

6

Settings (Display Mode)

6-1 Display mode items

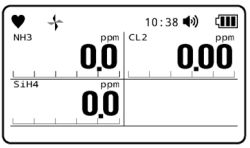
LCD display	Details	Reference
PEAK 	Displays the maximum gas concentration (or minimum concentration for L-H alarm type) detected since the power was turned on.	6-3-1 Clearing the PEAK value
STEL 	Displays the STEL value for 15-minute period prior to the current time (or since the power was turned on). The STEL value refers to the sum of 15 pieces of average value data for detected values over a period of 60 seconds divided by 15. The value is refreshed every 60 seconds. [----] is displayed when the STEL value is an invalid concentration.	
TWA 	Displays the TWA value for 8-hour period prior to the current time (or since the power was turned on). The TWA value refers to the value obtained by integrating average value data for detected values over a period of 60 seconds and then dividing the integrated value for a period of 8 hours by 480. The value is refreshed every 60 seconds. [----] is displayed when the TWA value is an invalid concentration.	
USER ID 	Set the user ID.	6-4-1 Setting the user ID
STATION ID 	Set the station ID.	6-4-2 Setting the station ID

LCD display	Details	Reference
REC DATA DISP 	Displays the gas concentration and alarm status recorded by the snap logger function.	6-3-2 Displaying the snap logger (gas concentration/ alarm status)
CAL DATA 	Displays the date on which gas adjustment was performed for each sensor. This is displayed for ATEX/IECEx models with the adjustment expiration function enabled.	6-3-3 Displaying adjustment records
BUMP DATA 	Displays the date on which the bump test was performed for each sensor. It is displayed when the bump test expiration function is enabled.	6-3-4 Displaying bump test records
DATE 	Displays the current date and time and temperature (°C). The temperature is the product internal temperature. This differs from the actual ambient temperature.	
GAS NAME 	Displays the detection target gas names and calibration gas names.	
ALARM POINTS 	Displays the full-scale value, first alarm setpoint, second alarm setpoint, STEL alarm setpoint, and TWA alarm setpoint for each sensor.	6-3-5 Displaying alarm setpoints
BLUETOOTH 	Sets the connection to a Bluetooth® device when the Bluetooth® function is enabled.	6-4-3 Setting a Bluetooth® device connection

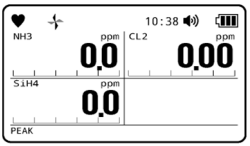
LCD display	Details	Reference
BUZZER VOLUME 	Selects the buzzer volume setting.	6-4-4 Setting the buzzer volume
LANGUAGE CHANGE TO ENGLISH 	Returns the display language to English. This appears if a language other than English has been set with an ATEX/IECEx model.	6-4-5 Switching display language to English (ATEX/IECEx model)
TO JAPANESE 	Returns the display language to Japanese. This appears if a language other than Japanese has been set with a Japan Ex model.	6-4-6 Switching display language to Japanese (Japan Ex model)

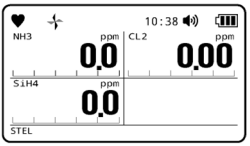
6-2 Switching to display mode

1 Press the DISP/ESC button on the detection mode screen.

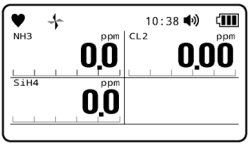


Pressing the DISP/ESC button displays the various setting item screens in sequence.





The product returns to detection mode once the display mode item display has ended.



NOTE

- You can also jump between display mode items by holding down the DISP/ESC button.
- If no button is pressed for approximately 20 seconds in display mode, the product will return to detection mode.

6-3 Checking settings

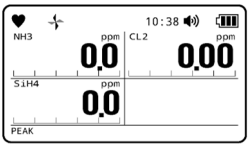
6-3-1 Clearing the PEAK value

This clears the maximum gas concentration detected since the power was turned on.

NOTE

- The PEAK value cannot be cleared if the password protection setting is enabled.
- Disabling the PEAK reset function in [Disp mode item] of the configuration program which can be installed from the RIKEN KEIKI website will prevent clearing of the PEAK value. (The default setting is enabled.)

1 Press the DISP/ESC button several times on the detection mode screen to display the PEAK screen.



2 Hold down the ▲/AIR button (for approximately three seconds).

3 Release the ▲/AIR button once [RELEASE] appears on the screen.

The PEAK value is cleared and the display returns to the screen in Step 1.

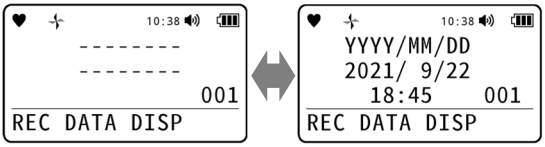
6-3-2 Displaying the snap logger (gas concentration/alarm status)

Displays the gas concentration and alarm status recorded by the snap logger function.

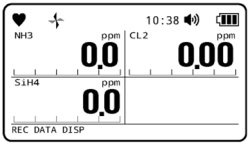
1 Press the DISP/ESC button several times on the detection mode screen to display the REC DATA DISP screen.

2 Press the POWER/ENTER button.
If you do not wish to display the snap logger, press the DISP/ESC button.

3 Press the ▲/AIR or RESET/▼ button to select the record number to be displayed.



4 Press the POWER/ENTER button.
The data is displayed for the record number selected.



5 Press the DISP/ESC button.
The display returns to the screen in Step 3.

NOTE

- [NO DATA] will be displayed if no snap logs are recorded. If this occurs, press the DISP/ESC button or POWER/ENTER button to return to the screen in Step 1.
- To cancel the snap logger display, press the DISP/ESC button in Step 4.

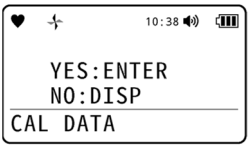
6-3-3 Displaying adjustment records

Displays the date on which gas adjustment was performed for each sensor.

NOTE

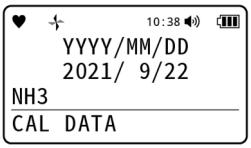
- The adjustment records are displayed for ATEX/IECEx models with the adjustment expiration function enabled (default setting is enabled).

1 Press the DISP/ESC button several times on the detection mode screen to display the CAL DATA screen.



2 Press the POWER/ENTER button.
If you do not wish to display the gas adjustment records, press the DISP/ESC button.

3 Press the ▲/AIR button.
Pressing the ▲/AIR button cycles through the sensors displayed.



4 Press the DISP/ESC button.
The display returns to the screen in Step 1.

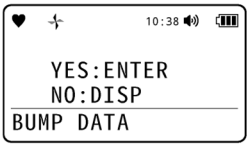
6-3-4 Displaying bump test records

Displays the date on which the bump test was performed for each sensor.

NOTE

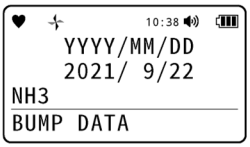
- Bump test records are displayed when the bump test expiration function is enabled (the default setting is disabled).
- The bump test data is also updated automatically when gas adjustment is performed.

1 Press the DISP/ESC button several times on the detection mode screen to display the BUMP DATA screen.



2 Press the POWER/ENTER button.
If you do not wish to display the bump test records, press the DISP/ESC button.

3 Press the ▲/AIR button.
Pressing the ▲/AIR button cycles through the sensors displayed.



4 Press the DISP/ESC button.
The display returns to the screen in Step 1.

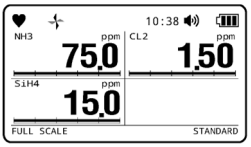
6-3-5 Displaying alarm setpoints

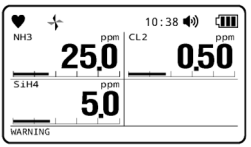
Displays the full-scale value (FULL SCALE), first alarm setpoint (WARNING), second alarm setpoint (ALARM), STEL alarm setpoint (STEL), and TWA alarm setpoint (TWA) for each sensor.

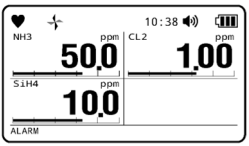
1 Press the DISP/ESC button several times on the detection mode screen to display the ALARM POINTS screen.

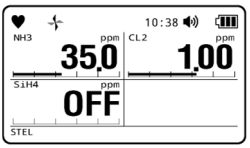
2 Press the POWER/ENTER button.
If you do not wish to display the alarm setpoints, press the DISP/ESC button.

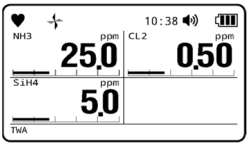
3 Press the ▲/AIR button.
Pressing the ▲/AIR button cycles through the alarm setpoints displayed.
The display changes in the following sequence:
[FULL SCALE] → [WARNING] → [ALARM] → [STEL] → [TWA] → [FULL SCALE] → …











To [FULL SCALE]

4 Press the DISP/ESC button.
The display returns to the screen in Step 1.

NOTE

- To test the alarms, press the POWER/ENTER button while an alarm setpoint is displayed. (Refer to ‘8-4 Performing alarm tests’.)

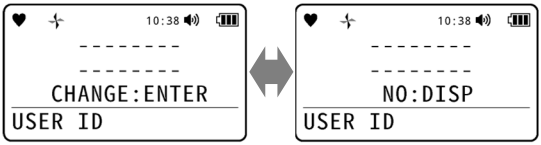
6-4 Display mode settings

6-4-1 Setting the user ID

Set the user ID.

The user ID is used to identify individual users.

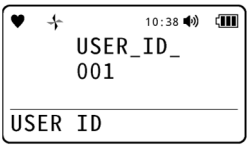
1 Press the DISP/ESC button several times on the detection mode screen to display the USER ID screen.



2 Press the POWER/ENTER button.

If you do not wish to set, press the DISP/ESC button.

3 Press the ▲/AIR or RESET/▼ button to select a user ID.



4 Press the POWER/ENTER button.

The user ID selected is set.

[END] appears, and the display returns to the screen in Step 1.

NOTE

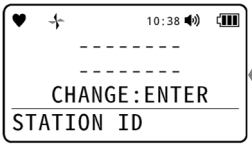
- User IDs can be set from USER_ID_001 to USER_ID_128.
- Hold down the ▲/AIR or RESET/▼ button on the user ID list to move 10 items up or down at a time.
- To cancel the setting, press the DISP/ESC button in Step 4.
- The data logger management program sold separately is required to register and edit user IDs. For information on the data logger management program, contact RIKEN KEIKI.
- If the user ID selection function is disabled in [Disp mode item] of the configuration program which can be installed from the RIKEN KEIKI website, this setting item will no longer appear in display mode. (The default setting is enabled.)

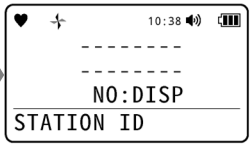
6-4-2 Setting the station ID

Set the station ID.

The station ID is used to identify detection points.

1 Press the DISP/ESC button several times on the detection mode screen to display the STATION ID screen.

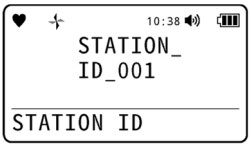




2 Press the POWER/ENTER button.

If you do not wish to set, press the DISP/ESC button.

3 Press the ▲/AIR or RESET/▼ button to select a station ID.



4 Press the POWER/ENTER button.

The station ID selected is set.

[END] appears, and the display returns to the screen in Step 1.

NOTE

- Station IDs can be set from STATION_ID_001 to STATION_ID_128.
- Hold down the ▲/AIR or RESET/▼ button on the station ID list to move 10 items up or down at a time.
- To cancel the setting, press the DISP/ESC button in Step 4.
- The data logger management program sold separately is required to register and edit station IDs. For information on the data logger management program, contact RIKEN KEIKI.
- If the station ID selection function is disabled in [Disp mode item] of the configuration program which can be installed from the RIKEN KEIKI website, this setting item will no longer appear in display mode. (The default setting is enabled.)

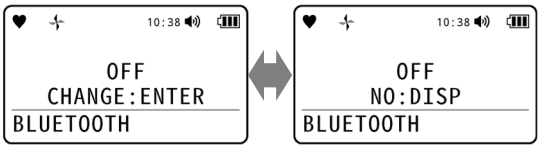
6-4-3 Setting a Bluetooth® device connection

Sets the connection to a Bluetooth® device when the Bluetooth® function is enabled.
Setting this item to [ON] allows communication with a smartphone on which the dedicated app has been installed. The default setting is [OFF].

NOTE

- The Bluetooth® device connection setting is retained even when the power is turned off.
- The Bluetooth® function is an option (specified at the time of ordering).
- RK Link (the dedicated app) can be downloaded free of charge from Google Play or App Store.
- By default, the Bluetooth® function automatically turns [OFF] if no communication occurs for five minutes while the function is turned [ON]. This setting can be altered using the data logger management program sold separately.
- If the Bluetooth® function is disabled in [Disp mode item] of the configuration program which can be installed from the RIKEN KEIKI website, this setting item will no longer appear in display mode. (The default setting is enabled.)

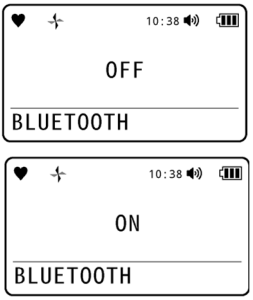
1 Press the DISP/ESC button several times on the detection mode screen to display the BLUETOOTH screen.



2 Press the POWER/ENTER button.
If you do not wish to set, press the DISP/ESC button.

3 Press the ▲/AIR or RESET/▼ button to select [ON] or [OFF].

4 Press the POWER/ENTER button.



The Bluetooth® device connection is set.
[SETTING] appears followed by [END], and the display returns to the screen in Step 1.

NOTE

- To cancel the setting, press the DISP/ESC button in Step 4.

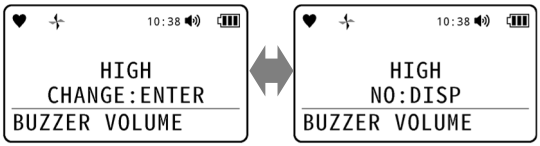
6-4-4 Setting the buzzer volume

Selects the buzzer volume setting.
The volume can be selected as [HIGH] or [LOW]. The default setting is [HIGH].

NOTE

- The buzzer volume setting is retained even when the power is turned off.
- If the buzzer volume setting function is disabled in [Disp mode item] of the configuration program which can be installed from the RIKEN KEIKI website, this setting item will no longer appear in display mode. (The default setting is enabled.)

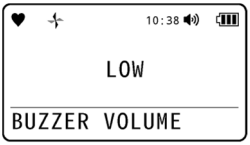
1 Press the DISP/ESC button several times on the detection mode screen to display the BUZZER VOLUME screen.



2 Press the POWER/ENTER button.
If you do not wish to set, press the DISP/ESC button.

3 Press the ▲/AIR or RESET/▼ button to select [HIGH] or [LOW].

4 Press the POWER/ENTER button.



The buzzer volume is set.
[SETTING] appears followed by [END], and the display returns to the screen in Step 1.

NOTE

- To cancel the setting, press the DISP/ESC button in Step 4.

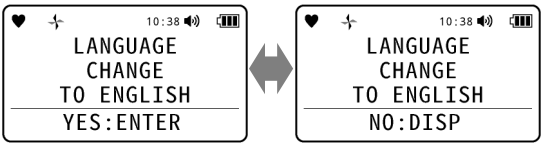
6-4-5 Switching display language to English (ATEX/IECEx model)

Returns the display language to English.

NOTE

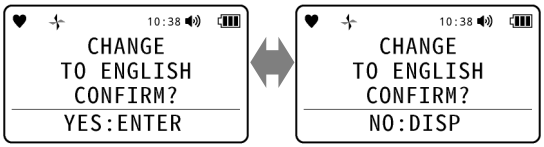
- This can be set if a language other than English has been set with an ATEX/IECEx model. The item does not appear in display mode in other cases.
- The display language setting is retained even when the power is turned off.
- The display language should be set using [LANGUAGE] in user mode. (Refer to '7-4-3 Setting the display language'.)
- If the return to English function is disabled in [Disp mode item] of the configuration program which can be installed from the RIKEN KEIKI website, this setting item will no longer appear in display mode. (The default setting is enabled.)

1 Press the DISP/ESC button several times on the detection mode screen to display the LANGUAGE CHANGE screen.



2 Press the POWER/ENTER button.
If you do not wish to set, press the DISP/ESC button.

3 Press the POWER/ENTER button.



The display switches to English.
[END] appears and the display returns to the screen in Step 1.

NOTE

- To cancel the setting, press the DISP/ESC button in Step 3.

6-4-6 Switching display language to Japanese (Japan Ex model)

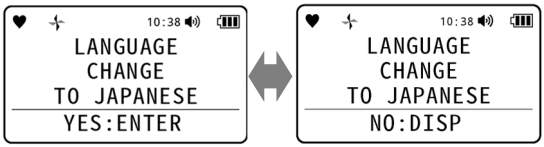
Returns the display language to Japanese.

NOTE

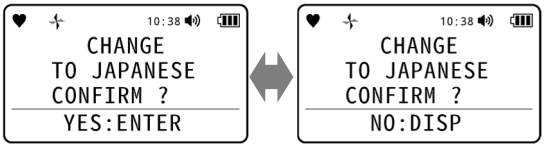
- This can be set if a language other than Japanese has been set with a Japan Ex model. The item does not appear in display mode in other cases.
- The display language setting is retained even when the power is turned off.
- The display language should be set using [LANGUAGE] in user mode. (Refer to '7-4-3 Setting the display language'.)
- If the return to Japanese function is disabled in [Disp mode item] of the configuration program which can be installed from the RIKEN KEIKI website, this setting item will no longer appear in display mode. (The default setting is enabled.)

1 Press the DISP/ESC button several times on the detection mode screen to display the LANGUAGE CHANGE screen.

2 Press the POWER/ENTER button.
If you do not wish to set, press the DISP/ESC button.



3 Press the POWER/ENTER button.



The display switches to Japanese.
[終了] (END) appears, and the display returns to the screen in Step 1.

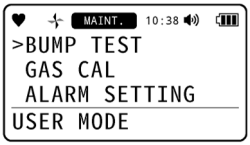
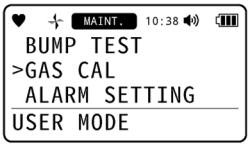
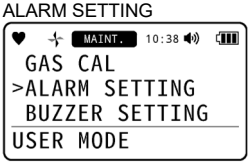
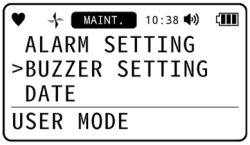
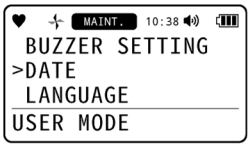
NOTE

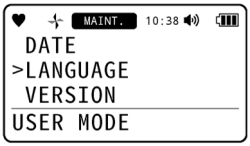
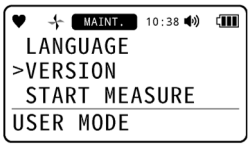
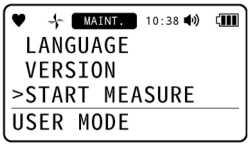
- To cancel the setting, press the DISP/ESC button in Step 3.

7

Settings (User Mode)

7-1 User mode display items

LCD display	Details	Reference
BUMP TEST 	Performs a bump test.	8-3 Performing bump tests
GAS CAL 	Performs fresh air adjustment and span adjustment.	8-2 Performing gas adjustment
ALARM SETTING 	Sets the gas alarm setpoints, alarm type, and alarm pattern for each sensor. Alarm setpoints can also be returned to their default settings.	7-3 Gas alarm settings
BUZZER SETTING 	Enables and disables the buzzer.	7-4-1 Setting the buzzer
DATE 	The internal clock date (year, month, day) and time (hours and minutes) can be set.	7-4-2 Setting the date and time

LCD display	Details	Reference
LANGUAGE 	Set the screen display language.	7-4-3 Setting the display language
VERSION 	Displays the version information for the modules mounted in the product.	7-4-4 Displaying version information
START MEASURE 	Switches to the detection mode screen.	

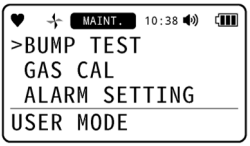
7-2 Switching to user mode

1 **Turn off the power.**
Hold down the POWER/ENTER button.

2 **Press POWER/ENTER and ▲/AIR buttons simultaneously.**

3 **Release the buttons when the buzzer blips once.**
The power turns on, and the user mode menu appears.

4 **Press the ▲/AIR or RESET/▼ button to select the item to be set.**

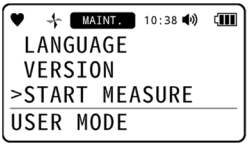


NOTE

- A password input screen is displayed after Step 3 if the user mode password setting is enabled. Press the ▲/AIR or RESET/▼ button to select a number, then press the POWER/ENTER button to confirm. The user mode menu is displayed once the (four-digit) password has been correctly entered. The default password setting is 0000. The password can be changed using the configuration program which can be installed from the RIKEN KEIKI website.

<Switching from user mode to detection mode>

1 **Press the ▲/AIR or RESET/▼ button in user mode, select [START MEASURE], then press the POWER/ENTER button.**
The product operates in the same way as when the power has just been turned on and enters detection mode.



7-3 Gas alarm settings

7-3-1 Setting alarm setpoints

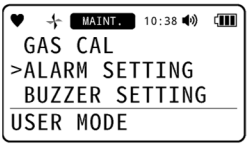
Alarm setpoints can be set individually for each sensor. Alarm setpoints can be set in increments corresponding to the resolution.

Sensor	Detection target gas	Resolution	Setting range lower limit ( ): recommended range	Setting range upper limit
ESF-B242	Ammonia (NH_3)	0.5 ppm	10.0 ppm (25.0 ppm or more)	75.0 ppm
ESF-C930	Chlorine (Cl_2)	0.01 ppm	0.09 ppm (0.50 ppm or more)	1.50 ppm
ESF-B249	Ozone (O_3)	0.005 ppm	0.035 ppm (0.100 ppm or more)	0.600 ppm
ESF-A24E2	Hydrogen chloride (HCl)	0.05 ppm	0.35 ppm (2.00 ppm or more)	6.00 ppm
ESF-A24D (Japan Ex model)	Hydrogen cyanide (HCN)	0.1 ppm	0.9 ppm (5.0 ppm or more)	15.0 ppm
ESF-B248 (Japan Ex model)	Hydrogen fluoride (HF)	0.01 ppm	0.09 ppm (0.50 ppm or more)	1.50 ppm
ESF-B248X (ATEX/IECEx model)	Hydrogen fluoride (HF)	0.01 ppm	0.09 ppm (0.50 ppm or more)	1.50 ppm
ESF-A24D	Phosphine (PH_3)	0.01 ppm	0.06 ppm (0.30 ppm or more)	1.00 ppm
ESF-B248	Fluorine (F_2)	0.02 ppm	0.18 ppm (1.00 ppm or more)	3.00 ppm
ESF-A24D	Silane (SiH_4)	0.1 ppm	0.9 ppm (5.0 ppm or more)	15.0 ppm
ESF-A24D2	Nitrogen monoxide (NO)	1 ppm	6 ppm (25 ppm or more)	100 ppm
ESF-AA20	Nitrogen dioxide (NO_2)	0.1 ppm	0.9 ppm (5.0 ppm or more)	15.0 ppm
ESF-A24D	Sulfur dioxide (SO_2)	0.05 ppm	0.35 ppm (2.00 ppm or more)	6.00 ppm
ESF-A24E2	Hydrogen bromide (HBr)	0.05 ppm	0.35 ppm (2.00 ppm or more)	6.00 ppm
ESF-B24A	Chlorine trifluoride (ClF_3)	0.002 ppm	0.018 ppm (0.100 ppm or more)	0.300 ppm
ESF-A24D	Disilane (Si_2H_6)	0.1 ppm	0.9 ppm (5.0 ppm or more)	15.0 ppm

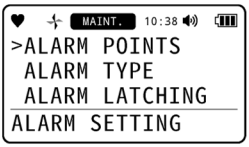
NOTE

- Set the alarm setpoints as follows: First alarm ≤ second alarm (first alarm ≥ second alarm for L-H alarm type)
- Use the product with the alarms set to within a range compatible with product performance. Alarm setpoints below the recommended range may result in false alarms.
- The [STEL] and [TWA] setting screens do not appear when the STEL and TWA alarm setpoints are invalid concentrations.

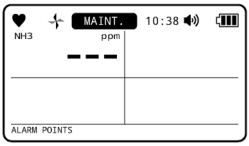
1 Press the ▲/AIR or RESET/▼ button in the user mode menu to select [ALARM SETTING], then press the POWER/ENTER button.



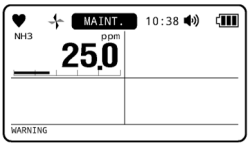
2 Check to confirm that [ALARM POINTS] is selected, then press the POWER/ENTER button.



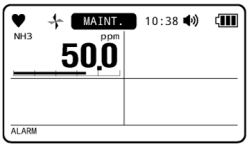
3 Press the ▲/AIR or RESET/▼ button to select the sensor, then press the POWER/ENTER button.



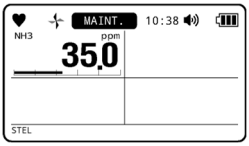
4 Press the ▲/AIR or RESET/▼ button to set the value for the first alarm setpoint, then press the POWER/ENTER button.



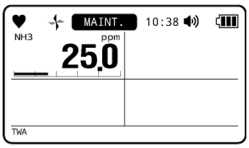
5 Press the ▲/AIR or RESET/▼ button to set the value for the second alarm setpoint, then press the POWER/ENTER button.



6 Press the ▲/AIR or RESET/▼ button to set the value for the STEL alarm setpoint, then press the POWER/ENTER button.



7 Press the ▲/AIR or RESET/▼ button to set the value for the TWA alarm setpoint, then press the POWER/ENTER button.



[END] appears, and the display returns to the screen in Step 3.

NOTE

- Press the ▲/AIR or RESET/▼ button when setting an alarm setpoint to change the value in increments corresponding to the resolution.
- Hold down the ▲/AIR or RESET/▼ button (for less than seven seconds) when setting an alarm setpoint to change the value in increments corresponding to 10 times the resolution. In addition, hold down the button for seven seconds or more to change the value in increments corresponding to more than 10 times the resolution.
- Press the DISP/ESC button when setting an alarm setpoint to return to the previous screen.
- To cancel the setting, press the DISP/ESC button several times to display the first alarm setpoint ([WARNING]) setting screen, then press the DISP/ESC button.
- To return to the user mode menu, press the DISP/ESC button several times to display the alarm setting menu, select [ESCAPE], then press the POWER/ENTER button.

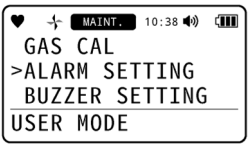
7-3-2 Setting alarm type

Set the gas alarm type for each sensor.
These can be set as [H-HH], [L-LL], or [L-H]. The default setting is [H-HH].

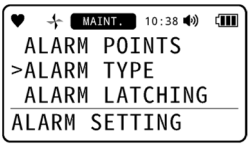
NOTE

- The sensors installed in the product perform optimally with [H-HH]. Do not set to [L-LL] or [L-H].
- The second alarm setpoint is automatically set to the same value as the first alarm setpoint in the following cases:
  - When changed from [H-HH] or [L-H] to [L-LL]
  - When changed from [L-LL] to [H-HH] or [L-H]

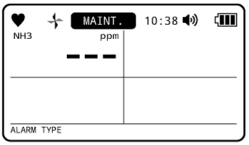
1 Press the ▲/AIR or RESET/▼ button in the user mode menu to select [ALARM SETTING], then press the POWER/ENTER button.



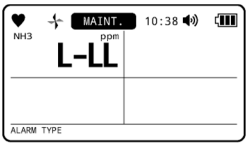
2 Press the ▲/AIR or RESET/▼ button to select [ALARM TYPE], then press the POWER/ENTER button.

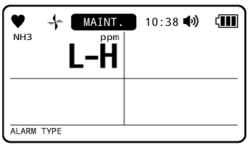


3 Press the ▲/AIR or RESET/▼ button to select the sensor, then press the POWER/ENTER button.



4 Press the ▲/AIR or RESET/▼ button to select an alarm type.
Select [H-HH], [L-LL], or [L-H].
The sensors installed in the product perform optimally with [H-HH]. Do not set to [L-LL] or [L-H].





5 Press the POWER/ENTER button.
The alarm type is set.
[END] appears, and the display returns to the screen in Step 3.

NOTE

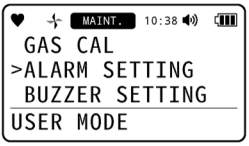
- To cancel the setting, press the DISP/ESC button in Step 5.
- To return to the user mode menu, press the DISP/ESC button several times to display the alarm setting menu, select [ESCAPE], then press the POWER/ENTER button.

7-3-3 Setting alarm pattern

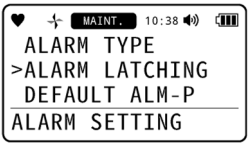
Set the alarm pattern.

This can be set to [LATCHING] or [SELF RESET]. The default setting is [LATCHING].

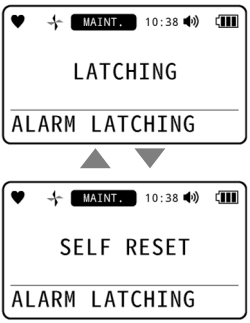
1 Press the ▲/AIR or RESET/▼ button in the user mode menu to select [ALARM SETTING], then press the POWER/ENTER button.



2 Press the ▲/AIR or RESET/▼ button to select [ALARM LATCHING], then press the POWER/ENTER button.



3 Press the ▲/AIR or RESET/▼ button to select [LATCHING] or [SELF RESET].



4 Press the POWER/ENTER button.

The alarm pattern is set.

[END] appears, and the display returns to the screen in Step 2.

NOTE

- To cancel the setting, press the DISP/ESC button in Step 4.
- To return to the user mode menu, select [ESCAPE] on the alarm setting menu, then press the POWER/ENTER button.
- If self-latching is selected, the alarm is reset when the RESET/▼ button is pressed after the gas concentration has returned to normal.

  If auto-reset is selected, the alarm is reset automatically once the gas concentration has returned to normal.

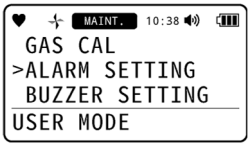
7-3-4 Resetting alarm setpoints

This restores alarm setpoints to their default settings.

NOTE

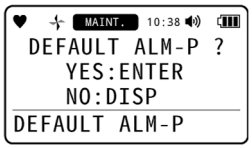
- This item does not appear in user mode if the sensors installed are not the default sensors.
- For more information on alarm setpoint default settings, refer to '4-2 Gas alarm setpoints'.

1 Press the ▲/AIR or RESET/▼ button in the user mode menu to select [ALARM SETTING], then press the POWER/ENTER button.



2 Press the ▲/AIR or RESET/▼ button to select [DEFAULT ALM-P], then press the POWER/ENTER button.

3 Press the POWER/ENTER button.
To cancel resetting to the default settings, press the DISP/ESC button.



4 Press the POWER/ENTER button.
To cancel recording the default settings, press the DISP/ESC button.

The alarm setpoints are reset.
[END] appears, and the display returns to the screen in Step 2.

NOTE

- To return to the user mode menu, select [ESCAPE] on the alarm setting menu, then press the POWER/ENTER button.

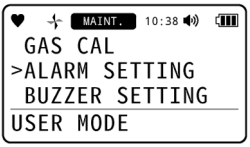
7-3-5 Enabling/disabling the alarm function

Enable and disable the alarm function.

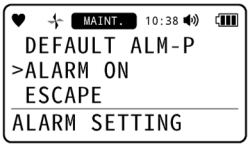
Gas alarms will not operate when the alarm function is set to [OFF]. The [NO ALARM] icon is also displayed at the top of the screen.

The default setting is [ON].

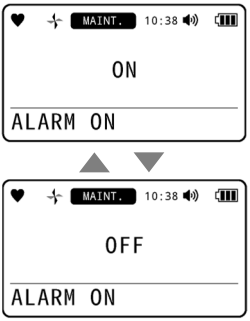
1 Press the ▲/AIR or RESET/▼ button in the user mode menu to select [ALARM SETTING], then press the POWER/ENTER button.



2 Press the ▲/AIR or RESET/▼ button to select [ALARM ON], then press the POWER/ENTER button.



3 Press the ▲/AIR or RESET/▼ button to select [ON] or [OFF].



4 Press the POWER/ENTER button.

The alarm function is set.

[END] appears, and the display returns to the screen in Step 2.

NOTE

- To cancel the setting, press the DISP/ESC button in Step 4.
- To return to the user mode menu, select [ESCAPE] on the alarm setting menu, then press the POWER/ENTER button.

7-4 Other user mode settings

7-4-1 Setting the buzzer

Set the buzzer.

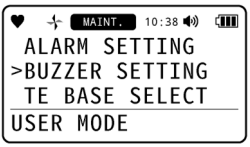
Select one of the following: The default setting is [ALL ON].

- [ALL ON]: The buzzer sounds in all situations. (Button operation tone, alarm sound, and warning sound all sound.)
- [ALL OFF]: The buzzer does not sound except for certain system abnormalities (ROM, RAM, and FRAM). (Button operation tone, alarm sound, and warning sound do not sound.)
- [BUTTON TONE OFF]: Only the button operation tone is disabled. (Alarm sound and warning sound both sound.)

NOTE

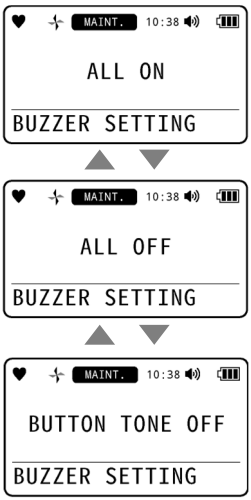
▶ The buzzer always sounds for ROM, RAM, and FRAM abnormalities, regardless of the buzzer setting.

1 Press the ▲/AIR or RESET/▼ button in the user mode menu to select [BUZZER SETTING], then press the POWER/ENTER button.



2 Press the ▲/AIR or RESET/▼ button to select a buzzer setting.

Select [ALL ON], [ALL OFF], or [BUTTON TONE OFF].



3 Press the POWER/ENTER button.

The buzzer is set.

[END] appears, and the display returns to the screen in Step 1.

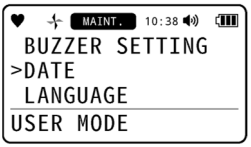
NOTE

▶ To cancel the setting, press the DISP/ESC button in Step 3.

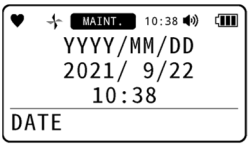
7-4-2 Setting the date and time

Set the internal clock date (year, month, day) and time (hours and minutes).
Set the date and time in the sequence year → month → day → hours → minutes.

1 Press the ▲/AIR or RESET/▼ button in the user mode menu to select [DATE], then press the POWER/ENTER button.



2 Press the ▲/AIR or RESET/▼ button to set an item of the date and time, then press the POWER/ENTER button.
The item currently selected blinks.



3 Repeat Step 2.
After setting the minutes for the time, press the POWER/ENTER button.
[END] appears, and the display returns to the screen in Step 1.

NOTE

- To cancel the setting, press the DISP/ESC button in Step 2.
- Press the DISP/ESC button when setting the date (year, month, or day) or time (hours or minutes) to return to the previous screen.
- Pressing the DISP/ESC button when setting the year for the date returns to the user mode menu.

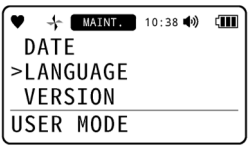
7-4-3 Setting the display language

Set the screen display language. The default setting is [JAPANESE] for Japan Ex models. The default setting is [ENGLISH] for ATEX/IECEx models.

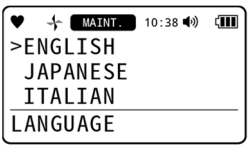
The following languages are available:

- [ENGLISH]
- [JAPANESE]
- [ITALIAN]
- [SPANISH]
- [GERMAN]
- [FRENCH]
- [PORTUGUESE]
- [RUSSIAN]
- [KOREAN]
- [CHINESE(SC)] (simplified Chinese)
- [CHINESE(TC)] (traditional Chinese)
- [VIETNAMESE]
- [POLISH]
- [TURKISH]
- [SLOVAK]
- [CZECH]

1 Press the ▲/AIR or RESET/▼ button in the user mode menu to select [LANGUAGE], then press the POWER/ENTER button.



2 Press the ▲/AIR or RESET/▼ button to select a language.



3 Press the POWER/ENTER button.
[END] appears, and the display returns to the screen in Step 1.

NOTE

▶ To cancel the setting, press the DISP/ESC button in Step 3.

7-4-4 Displaying version information

Displays the version information for the modules mounted in the product.

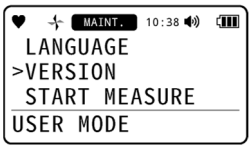
The following information can be displayed:

- Main PCB version
- Sensor PCB version
- R sensor versions
- F sensor (F1/F2/F3) versions
- Option (Bluetooth® function) version
- PID table version

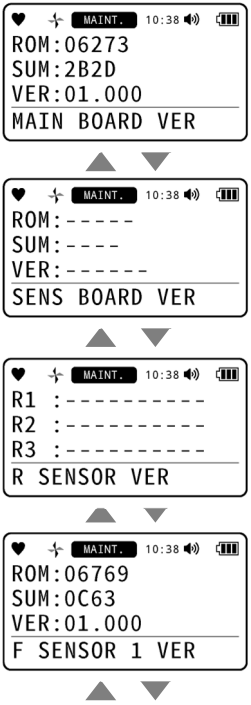
NOTE

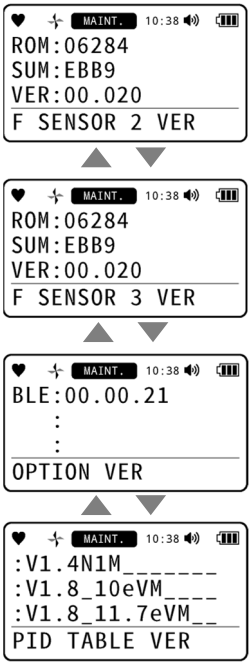
- The information for [ROM] and [SUM] in [MAIN BOARD VER] is displayed as [----] while they are being calculated.
- While the R sensor and PID table version information screens are displayed, no R sensors or PID sensors are installed in the product.

1 Press the ▲/AIR or RESET/▼ button in the user mode menu to select [VERSION], then press the POWER/ENTER button.



2 Press the ▲/AIR or RESET/▼ button to select the version information to be displayed.





3 Press the POWER/ENTER button.
[END] appears, and the display returns to the screen in Step 1.

8

Maintenance

The product is an important safety and disaster-prevention device.
Maintain and inspect the product at regular intervals to ensure performance and to improve disaster prevention and safety reliability.

8-1 Maintenance intervals and items

The following items should be maintained regularly before using the product:

- Daily maintenance: Perform maintenance before work.
- Monthly maintenance: Perform maintenance by testing the alarms once a month.
- Regular maintenance: Perform maintenance at least once a year (ideally, at least once every six months).

Inspection item	Inspection details	Daily maintenance	Monthly maintenance	Regular maintenance
Battery level	Check to confirm that battery levels are adequate.	○	○	○
Concentration display	Check to confirm that the concentration reading is zero after drawing in clean air. If the reading is not zero, check to confirm that no miscellaneous gases are present, then perform fresh air adjustment.	○	○	○
Main unit operation	Check the LCD display to confirm the absence of fault indication.	○	○	○
Filter	Check to confirm that the filter is not dirty.	○	○	○
Alarm test	Test the alarms and check to confirm that the alarm LED arrays and buzzer operate correctly.	–	○	○
Span adjustment	Perform span adjustment using a calibration gas.	–	–	○
Gas alarm check	Check the gas alarm with a calibration gas.	–	–	○

WARNING

- If you encounter a product abnormality, contact RIKEN KEIKI immediately.

NOTE

- Perform span adjustment using calibration gas once every six months.
- Span adjustment requires dedicated tools and preparation of a calibration gas. Contact RIKEN KEIKI for span adjustment.
- The built-in sensors have finite service lives and must be replaced regularly.
- If the sensors cannot be adjusted using span adjustment, the readings are not restored after fresh air adjustment, or the readings fluctuate, the sensors are at the end of their life. Contact RIKEN KEIKI. For more information on sensor warranty periods, refer to the table in '12-6 Warranty policy'.

- The dustproof and waterproof construction IP66/68 rating (IPx8 implies no water ingress when submerged underwater at a depth of 2 m for one hour) does not mean that the product is capable of detecting gas while or after being subjected to such environmental conditions. Be sure to remove any dust or water before use.

<Maintenance service>

RIKEN KEIKI provides services related to regular maintenance, including span adjustment, as well as other adjustments and maintenance.
Preparing calibration gas requires dedicated tools, such as gas cylinders of the specified concentration and gas sampling bags.
Our certified service engineers have expert knowledge of the dedicated tools and products. Please take advantage of the RIKEN KEIKI maintenance service to maintain safe operation of the product.

The major maintenance service items are as follows. Please contact RIKEN KEIKI for more information.

Service	Service details
Battery level check	Checks battery levels.
Concentration display check	Check to confirm that the concentration reading is zero using zero gas. Fresh air adjustment (zero adjustment) is performed if the reading is not zero.
Filter check	Checks the dust filter for contamination and clogging. The filter is replaced if dirty or clogged.
Alarm test	Alarm tests are performed to confirm that the alarm lamps and buzzer operate correctly.
Span adjustment	Adjusts sensitivity using a calibration gas.
Gas alarm check	Checks the gas alarm using a calibration gas. ・ Alarm check (Confirms alarm activation when alarm setpoint is reached.) ・ Delay time check (Checks delay time until alarm activation.) ・ Buzzer, lamps, and concentration reading check (Checks operation for each of the two-step alarms.)
Product cleaning and repair (visual inspection)	Checks the product exterior for dirt and cleaning/repairing of visible areas. Parts are replaced if cracked or damaged.
Product operation check	Operates the buttons to check functions and parameters.
Consumable part replacement	Replaces degraded components such as sensors and filters.

8-2 Performing gas adjustment

Gas adjustment requires dedicated tools and a calibration gas.
Contact RIKEN KEIKI to request gas readjustment.

CAUTION

- Due to the way the sensor operates, an accurate reading may not be displayed immediately after turning on the power. Allow the product to warm up for at least one minute to allow the reading to stabilize before use. Allow the product to warm up for at least 10 minutes before performing gas adjustment.

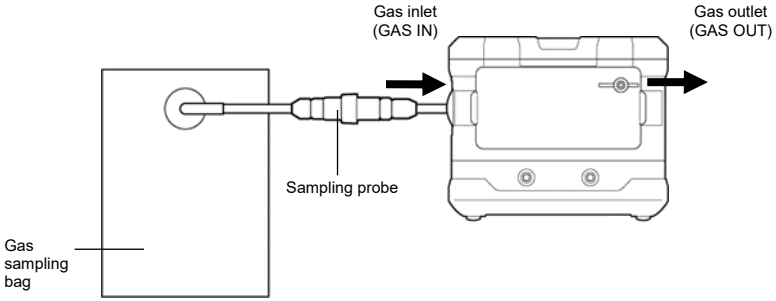
8-2-1 Preparation for gas adjustment

<Required equipment/materials>

- Calibration gas (sold separately)
- Gas sampling bag (sold separately)

<Gas supply method>

Connect the gas sampling bag as shown below to draw in the calibration gas, then adjust once the reading has risen. For information on the calibration gas type and calibration gas introduction time, refer to <Recommended calibration gas concentration and introduction time>.



<Recommended calibration gas concentration and introduction time>

Sensor	Detection target gas	Calibration gas	Calibration gas concentration	Gas introduction time
ESF-B242	Ammonia (NH_3)	Ammonia (NH_3)	40 ppm	120 seconds
ESF-C930	Chlorine (Cl_2)	Chlorine (Cl_2)	0.80 ppm	120 seconds
ESF-B249	Ozone (O_3)	Ozone (O_3) or chlorine (Cl_2)	Depends on calibration gas*1	120 seconds
ESF-A24E2	Hydrogen chloride (HCl)	Hydrogen chloride (HCl)	3.2 ppm	120 seconds
ESF-A24D (Japan Ex model)	Hydrogen cyanide (HCN)	Hydrogen cyanide (HCN) or phosphine (PH_3)	Depends on calibration gas*2	120 seconds
ESF-B248 (Japan Ex model)	Hydrogen fluoride (HF)	Hydrogen fluoride (HF) or chlorine (Cl_2)	Depends on calibration gas*3	120 seconds
ESF-B248X (ATEX/IECEx model)	Hydrogen fluoride (HF)	Hydrogen fluoride (HF) or chlorine (Cl_2)	Depends on calibration gas*3	120 seconds
ESF-A24D	Phosphine (PH_3)	Phosphine (PH_3)	0.48 ppm	120 seconds
ESF-B248	Fluorine (F_2)	Fluorine (F_2) or chlorine (Cl_2)	Depends on calibration gas*4	120 seconds
ESF-A24D	Silane (SiH_4)	Silane (SiH_4)	8.0 ppm	120 seconds
ESF-A24D2	Nitrogen monoxide (NO)	Nitrogen monoxide (NO)	40 ppm	60 seconds
ESF-AA20	Nitrogen dioxide (NO_2)	Nitrogen dioxide (NO_2)	8.0 ppm	60 seconds
ESF-A24D	Sulfur dioxide (SO_2)	Sulfur dioxide (SO_2)	3.20 ppm	120 seconds
ESF-A24E2	Hydrogen bromide (HBr)	Hydrogen bromide (HBr) or hydrogen chloride (HCl)	Depends on calibration gas*5	120 seconds
ESF-B24A	Chlorine trifluoride (ClF_3)	Chlorine trifluoride (ClF_3) or chlorine (Cl_2)	Depends on calibration gas*6	120 seconds
ESF-A24D	Disilane (Si_2H_6)	Disilane (Si_2H_6)	Depends on calibration gas*7	120 seconds

*1: The gas concentration for the ESF-B249 (O_3) differs depending on the calibration gas used. Perform gas adjustment using either of the following gas concentrations:
When using ozone (O_3) (actual gas): 0.16 ppm
When using chlorine (Cl_2) (replacement gas): 0.16 ÷ (conversion factor) ppm

*2: The gas concentration for the ESF-A24D (HCN) differs depending on the calibration gas used. Perform gas adjustment using either of the following gas concentrations:
When using hydrogen cyanide (HCN) (actual gas): 8 ppm
When using phosphine (PH_3) (replacement gas): 8 ÷ (conversion factor) ppm

*3: The gas concentration for the ESF-B248 (HF) and ESF-B248X (HF) differs depending on the calibration gas used. Perform gas adjustment using either of the following gas concentrations:
When using hydrogen fluoride (HF) (actual gas): 0.80 ppm
When using chlorine (Cl_2) (replacement gas): 0.80 ÷ (conversion factor) ppm

*4: The gas concentration for the ESF-B248 (F_2) differs depending on the calibration gas used. Perform gas adjustment using either of the following gas concentrations:
When using fluorine (F_2) (actual gas): 1.60 ppm
When using chlorine (Cl_2) (replacement gas): 1.60 ÷ (conversion factor) ppm

*5: The gas concentration for the ESF-A24E2 (HBr) differs depending on the calibration gas used. Perform gas adjustment using either of the following gas concentrations:
When using hydrogen bromide (HBr) (actual gas): 3.20 ppm
When using hydrogen chloride (HCl) (replacement gas): 3.20 ÷ (conversion factor) ppm

*6: The gas concentration for the ESF-B24A (ClF_3) differs depending on the calibration gas used. Perform gas adjustment using either of the following gas concentrations:
When using chlorine trifluoride (ClF_3) (actual gas): 0.16 ppm
When using chlorine (Cl_2) (replacement gas): 0.16 ÷ (conversion factor) ppm

*7: The gas concentration for the ESF-A24D (Si_2H_6) differs depending on the calibration gas used. Perform gas adjustment using either of the following gas concentrations:
When using disilane (Si_2H_6) (actual gas): 8.0 ppm
When using silane (SiH_4) (replacement gas): 8.0 ÷ (conversion factor) ppm

NOTE

- The recommended calibration gas concentrations are the same as above for the bump test, too.
- The recommended calibration gas concentrations are shown here. If the calibration gas concentration used differs, alter the concentration setting and perform gas adjustment.

WARNING

- Do not apply pressure to the gas sampling bag when attaching it. Otherwise this may cause the calibration gas to leak inside, preventing correct adjustment.

About the calibration gas

- Calibration gases include hazardous toxic gases. Take care when handling the gases and the related equipment.

Gas sampling bag

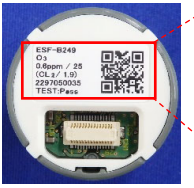
- Use different gas sampling bags for each gas type and concentration to ensure accurate adjustment.

Gas adjustment location

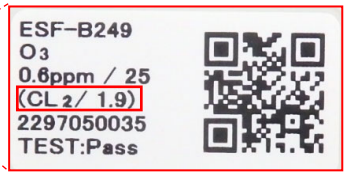
- Do not perform gas adjustment in a confined space.
- Do not perform gas adjustment in locations where gases such as silicone and spray can gases are used.
- Perform gas adjustment in an environment as close as possible to the gas detection environment.
- Calibration gases include hazardous toxic gases. Always perform adjustment in an exhaust booth or recover the calibration gas by attaching an exhaust bag to the gas outlet (GAS OUT).

Gas adjustment using a replacement gas and conversion factor

- When adjusting using a replacement gas, set the calibration gas concentration to the replacement gas concentration × the conversion factor.
  Example: For ESF-B249 (O_3)
  Chlorine (Cl_2) (replacement gas) concentration × conversion factor = ozone (O_3) (calibration gas) concentration
- The conversion factor is printed on the underside of the sensor.



Sensor underside



Typical label indicating replacement gas and conversion factor
(Example: Replacement gas: Chlorine (Cl_2), conversion factor: 1.9)

CAUTION

- Keep in mind that using a gas mixture to perform span adjustment may affect indication accuracy. This is due to interference by gases other than the target gas. Refer to '12-4 List of interference gases for electrochemical type sensors' to avoid combinations of gases that are known to cause interference.

<Gas adjustment menu>

Gas adjustment is performed using [GAS CAL] in user mode.
The following menu displayed in [GAS CAL] allows individual items to be run and set.

- [GAS CAL]
  - [AIR CAL]
  - [SPAN CAL]
    - [CYLINDER A] to [CYLINDER F]
    - [START MEASURE]
    - [SETTING CAL-P]
    - [CYL SETTING]
    - [SPAN GAS SELECT] (when a sensor allowing adjustment using replacement gas is installed)
    - [ESCAPE]
  - [ESCAPE]

NOTE

- With the power turned off, press the POWER/ENTER button and ▲/AIR button simultaneously to switch to user mode. (Refer to '7-2 Switching to user mode'.)
- To exit [GAS CAL], press the ▲/AIR or RESET/▼ button several times to select [ESCAPE], then press the POWER/ENTER button. The display returns to the user mode menu.
- To exit [SPAN CAL], press the ▲/AIR or RESET/▼ button several times to select [ESCAPE], then press the POWER/ENTER button. The display returns to the [GAS CAL] menu.
- The product can enter detection mode from [SPAN CAL]. Press the ▲/AIR or RESET/▼ button several times in [SPAN CAL] to select [START MEASURE], then press the POWER/ENTER button. User mode ends, and the product enters detection mode after performing the same operation as when the power is turned on.

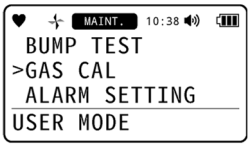
WARNING

- Return to detection mode manually once gas adjustment ends. The product does not return automatically to detection mode from user mode.

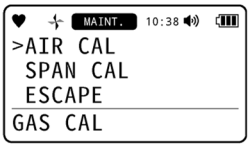
8-2-2 Performing fresh air adjustment

Fresh air adjustment must be performed before detecting gas concentration.
For information on individual sensor adjustment methods and precautions, refer to '5-5 Performing fresh air adjustment in detection mode'.

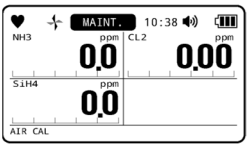
1 Press the ▲/AIR or RESET/▼ button in the user mode menu to select [GAS CAL], then press the POWER/ENTER button.



2 Press the ▲/AIR or RESET/▼ button in the [GAS CAL] menu to select [AIR CAL], then press the POWER/ENTER button.



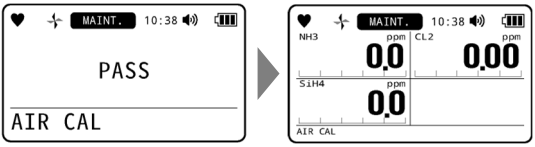
3 Hold down the ▲/AIR button.



Fresh air adjustment is performed.
Keep the ▲/AIR button pressed for as long as the screen shown on the right is displayed.

4 Release the ▲/AIR button once [RELEASE] appears on the screen.

Once fresh air adjustment has been successfully completed, the result is displayed, and the concentration after fresh air adjustment is then displayed.



The display returns to the screen in Step 2.

NOTE

- If fresh air adjustment fails, [FAIL] appears in the gas concentration display area for the failed sensor. Press the RESET/▼ button to reset the fault alarm (adjustment failure). Fresh air adjustment will not be performed on the sensor for which fresh air adjustment failed, and the current gas concentration is displayed.
- If fresh air adjustment fails, repeat fresh air adjustment in clean air. If fresh air adjustment still fails, the sensor is likely to be faulty. Contact RIKEN KEIKI.

8-2-3 Setting span adjustment

The cylinders, calibration gas concentration, and calibration gas can be set for span adjustment.

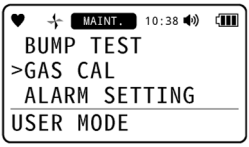
<Set the cylinders>

Set the sensor groups (cylinders) for calibration. When using cylinders with mixtures of multiple gases, gas adjustment can be performed simultaneously for the gases set to the same cylinder. Set based on the cylinders used.

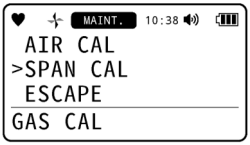
Cylinders A to F can be set.
The default cylinder settings are as follows:

Sensor slot	Default cylinder setting
F1	D
F2	E
F3	C

1 Press the ▲/AIR or RESET/▼ button in the user mode menu to select [GAS CAL], then press the POWER/ENTER button.

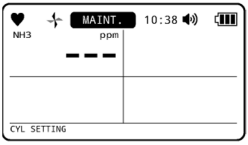


2 Press the ▲/AIR or RESET/▼ button in the [GAS CAL] menu to select [SPAN CAL], then press the POWER/ENTER button.

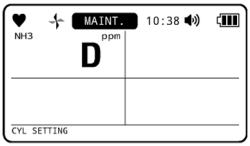


3 Press the ▲/AIR or RESET/▼ button to select [CYL SETTING], then press the POWER/ENTER button.

4 Press the ▲/AIR or RESET/▼ button to select the sensor, then press the POWER/ENTER button.



5 Press the ▲/AIR or RESET/▼ button to set the cylinder, then press the POWER/ENTER button.
Press the button repeatedly to cycle through the following settings [A] → [B] → [C] … [F].
Note that cylinders that cannot be set will not be displayed.



[END] appears, and the display returns to the screen in Step 4.

NOTE

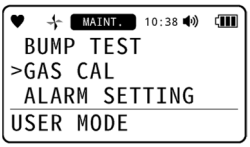
▶ To cancel the setting, press the DISP/ESC button in Step 5.

<Set the gas concentration for span adjustment>

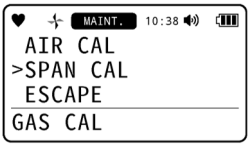
The calibration gas concentration for span adjustment can be set within the following ranges for each sensor. Gas concentration can be set in increments corresponding to the resolution.

Sensor	Detection target gas	Resolution	Setting range lower limit	Setting range upper limit
ESF-B242	Ammonia (NH_3)	0.5 ppm	10.0 ppm	75.0 ppm
ESF-C930	Chlorine (Cl_2)	0.01 ppm	0.09 ppm	1.50 ppm
ESF-B249	Ozone (O_3)	0.005 ppm	0.035 ppm	0.600 ppm
ESF-A24E2	Hydrogen chloride (HCl)	0.05 ppm	0.35 ppm	6.00 ppm
ESF-A24D (Japan Ex model)	Hydrogen cyanide (HCN)	0.1 ppm	0.9 ppm	15.0 ppm
ESF-B248 (Japan Ex model)	Hydrogen fluoride (HF)	0.01 ppm	0.09 ppm	1.50 ppm
ESF-B248X (ATEX/IECEx model)	Hydrogen fluoride (HF)	0.01 ppm	0.09 ppm	1.50 ppm
ESF-A24D	Phosphine (PH_3)	0.01 ppm	0.06 ppm	1.00 ppm
ESF-B248	Fluorine (F_2)	0.02 ppm	0.18 ppm	3.00 ppm
ESF-A24D	Silane (SiH_4)	0.1 ppm	0.9 ppm	15.0 ppm
ESF-A24D2	Nitrogen monoxide (NO)	1 ppm	6 ppm	100 ppm
ESF-AA20	Nitrogen dioxide (NO_2)	0.1 ppm	0.9 ppm	15.0 ppm
ESF-A24D	Sulfur dioxide (SO_2)	0.05 ppm	0.35 ppm	6.00 ppm
ESF-A24E2	Hydrogen bromide (HBr)	0.05 ppm	0.35 ppm	6.00 ppm
ESF-B24A	Chlorine trifluoride (ClF_3)	0.002 ppm	0.018 ppm	0.300 ppm
ESF-A24D	Disilane (Si_2H_6)	0.1 ppm	0.9 ppm	15.0 ppm

1 Press the ▲/AIR or RESET/▼ button in the user mode menu to select [GAS CAL], then press the POWER/ENTER button.

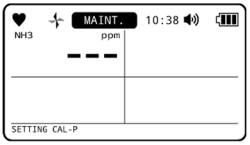


2 Press the ▲/AIR or RESET/▼ button in the [GAS CAL] menu to select [SPAN CAL], then press the POWER/ENTER button.

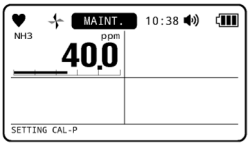


3 Press the ▲/AIR or RESET/▼ button to select [SETTING CAL-P], then press the POWER/ENTER button.

4 Press the ▲/AIR or RESET/▼ button to select the sensor, then press the POWER/ENTER button.



5 Press the ▲/AIR or RESET/▼ button to set the gas concentration for span adjustment, then press the POWER/ENTER button.



[END] appears, and the display returns to the screen in Step 4.

NOTE

- Press the ▲/AIR or RESET/▼ button when setting the gas concentration for span adjustment to change the value in increments corresponding to the resolution.
- Hold down the ▲/AIR or RESET/▼ button (for less than seven seconds) when setting the gas concentration for span adjustment to change the value in increments corresponding to 10 times the resolution. In addition, hold down the button for seven seconds or more to change the value in increments corresponding to more than 10 times the resolution.
- To cancel the setting, press the DISP/ESC button in Step 5.
- Span adjustment should be performed using the calibration gas concentration indicated in '8-2-1 Preparation for gas adjustment'.

8-2-4 Performing span adjustment

Gas adjustment can be performed for gas types selected from cylinders A to F. Prepare the gases for gas adjustment beforehand. (Refer to '8-2-1 Preparation for gas adjustment'.)

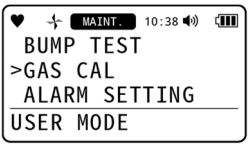
CAUTION

- Keep in mind that using a gas mixture to perform span adjustment may affect indication accuracy. This is due to interference by gases other than the target gas. Refer to '12-4 List of interference gases for electrochemical type sensors' to avoid combinations of gases that are known to cause interference.

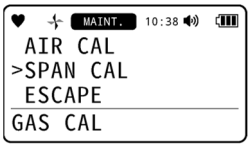
NOTE

- Fresh air adjustment must always be performed before performing span adjustment.
- The calibration gas concentration, cylinders, and calibration gas can be set for span adjustment. (Refer to '8-2-3 Setting span adjustment'.)
- When the automatic start after successful adjustment function is enabled and the cylinder setting is A only, detection will start automatically after a successful span adjustment.
  The automatic start after successful adjustment function setting can be changed using the configuration program which can be installed from the RIKEN KEIKI website.

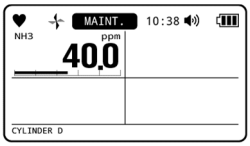
1 **Press the ▲/AIR or RESET/▼ button in the user mode menu to select [GAS CAL], then press the POWER/ENTER button.**



2 **Press the ▲/AIR or RESET/▼ button in the [GAS CAL] menu to select [SPAN CAL], then press the POWER/ENTER button.**

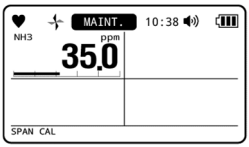


3 **Press the ▲/AIR or RESET/▼ button to select the cylinder to be adjusted, then press the POWER/ENTER button.**
Pressing the button cycles through the settings in the following sequence: [CYLINDER A] → [CYLINDER B] → … [CYLINDER F].
Note that cylinders not set will not be displayed.

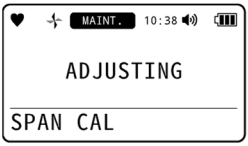


4 Introduce the calibration gas for span adjustment, wait 60 or 120 seconds, then press the POWER/ENTER button.

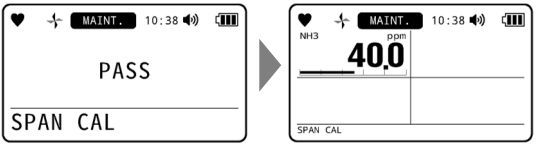
For information on the gas introduction time, refer to '8-2-1 Preparation for gas adjustment'.



Span adjustment is performed.



Once span adjustment has been successfully completed, the result is displayed, and the concentration after span adjustment is then displayed.



The display returns to the screen in Step 3.

NOTE

- If span adjustment fails, [FAIL] appears in the gas concentration display area for the failed sensor. Press any button other than ▲/AIR to reset the fault alarm (adjustment failure). Span adjustment will not be performed on the sensor for which span adjustment failed, and the current gas concentration is displayed.
- If the reserve value display setting is enabled, the reserve value will appear after the gas concentration.
- To cancel span adjustment, press the DISP/ESC button in Step 4.

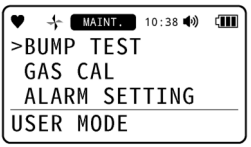
8-3 Performing bump tests

The product includes a function for performing bump tests.
Bump tests can be performed for gas types selected from cylinders A to F.
Prepare the bump test gas in the same way as for gas adjustment, and connect it to the main unit. (Refer to '8-2-1 Preparation for gas adjustment'.)
Bump tests are performed using [BUMP TEST] in user mode.

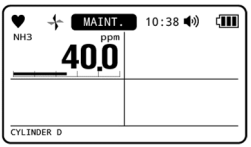
NOTE

- With the power turned off, press the POWER/ENTER button and ▲/AIR button simultaneously to switch to user mode. (Refer to '7-2 Switching to user mode'.)
- To exit [BUMP TEST], press the ▲/AIR or RESET/▼ button several times to select [ESCAPE], then press the POWER/ENTER button. The display returns to the user mode menu.
- The product can enter detection mode from [BUMP TEST]. Press the ▲/AIR or RESET/▼ button several times in [BUMP TEST] to select [START MEASURE], then press the POWER/ENTER button. User mode ends, and the product enters detection mode after performing the same operation as when the power is turned on.
- Use the specified calibration gas for each sensor to perform bump tests.
- When the automatic start after successful bump test function is enabled and the cylinder setting is A only, detection will start automatically after a successful bump test.
  The automatic start after successful bump test function setting can be changed using the configuration program which can be installed from the RIKEN KEIKI website.
- The default settings for bump test execution conditions are as follows:
  - Test time: 30 seconds
  - Tolerance (%): 50 %
  - Adjustment time: 90 seconds
  - Bump adjustment: ON
- The following bump test execution conditions can be changed using the configuration program which can be installed from the RIKEN KEIKI website.
  - Tolerance (%): Threshold for checking the calibration gas
    Calibration concentration ± (Calibration concentration × Tolerance (%))
  - Adjustment time after test failure: Adjustment time - Test time

1 Press the ▲/AIR or RESET/▼ button in the user mode menu to select [BUMP TEST], then press the POWER/ENTER button.

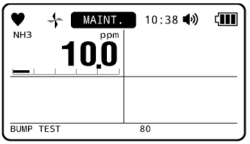


2 Press the ▲/AIR or RESET/▼ button to select the cylinder to be adjusted, then press the POWER/ENTER button.
Pressing the button cycles through the settings in the following sequence: [CYLINDER A] → [CYLINDER B] → … [CYLINDER F].
Note that cylinders not set will not be displayed.

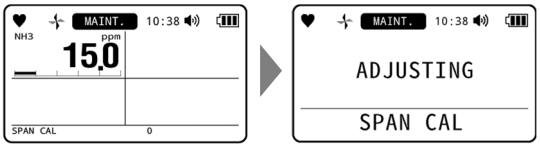


3 Introduce the bump test gas, then press the POWER/ENTER button.

The bump test is performed.
The bump test remaining time is displayed at the bottom of the screen.



If the bump adjustment function is enabled, the product will automatically perform gas adjustment in the event of a bump test failure.
The gas adjustment remaining time is displayed at the bottom of the screen.

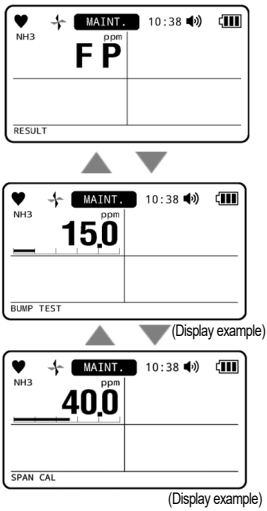


The following results are displayed when the bump test and gas adjustment end.
Press the ▲/AIR or RESET/▼ button to toggle the result display.

・Bump test and gas adjustment results
The bump test result is displayed on the left side of the concentration display area, and the gas adjustment result is displayed on the right side.
[P]: Passed, [F]: Failed

・Bump test gas concentration

・Gas adjustment gas concentration (when gas adjustment was performed)



4 Press the POWER/ENTER button.
[END] appears, and the display returns to the screen in Step 2.

NOTE

- If the setting to perform gas adjustment after a bump test failed is disabled (the default setting is enabled), the bump test result is displayed when the bump test ends. In this case, only the bump test result and bump test gas concentration are displayed.
- To cancel a bump test, press the DISP/ESC button in Step 3.
- If a bump test fails, perform gas adjustment. If gas adjustment also fails, refer to '10 Troubleshooting'.

WARNING

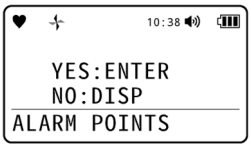
- Return to detection mode manually once the bump test ends. The product does not return automatically to detection mode from user mode.

8-4 Performing alarm tests

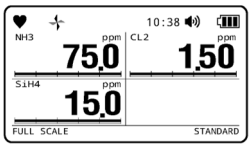
Press the POWER/ENTER button while an alarm setpoint is displayed in the display mode alarm setpoint display to test the corresponding alarm.

1 Press the DISP/ESC button several times on the detection mode screen to display the ALARM POINTS screen.

2 Press the POWER/ENTER button.



3 Press the ▲/AIR button several times to display the alarm setpoint for the alarm test.
Pressing the ▲/AIR button cycles through the alarm setpoints displayed.
The display changes in the following sequence:
[FULL SCALE] → [WARNING] → [ALARM] → [STEL] → [TWA] → [FULL SCALE] → …



4 Press the POWER/ENTER button.
This activates the selected alarm setpoint alarm.

Press the RESET/▼ button to reset the alarm.

NOTE

- Perform alarm tests periodically.

8-5 Cleaning procedure

Clean the product if it becomes excessively dirty. Be sure to turn off the power before cleaning, and wipe clean using a rag or cloth soaked in water and firmly wrung out.
Do not clean using water, organic solvents or commercially available cleaners for cleaning, as these may cause the product to malfunction.

CAUTION

- When wiping the product clean, do not splash water on it or use organic solvents like alcohol and benzine or commercially available cleaners. These may discolor or damage the surface of the product, or cause the sensor to malfunction.

NOTE

► Water may remain in the buzzer sound opening or grooves after the product has got wet.
Remove any moisture as follows:
① Wipe off any moisture on the product using a dry towel or cloth.
② Hold the product firmly and shake about 10 times with the buzzer sound opening facing downward.
③ Use a towel or cloth to wipe up all moisture drained from the interior.
④ Place the product on a dry towel or cloth and allow to stand at room temperature.

8-6 Parts replacement

8-6-1 Periodic replacement parts

The consumable parts of the product are listed below. Consumable parts should be replaced using the recommended replacement intervals as a guide.

NOTE

- The recommended replacement intervals are guidelines only. Replacement intervals may vary depending on actual operating conditions. These intervals do not constitute warranty periods. Replacement intervals may vary depending on the results of regular maintenance.

<Recommended replacement parts list>

Name	Recommended maintenance interval	Recommended replacement interval	Quantity (per unit)	Remarks
Dust filter (For gas sampling probe, set of 10)	6 months	6 months to 1 year	×1	Internal filter Part No.: 4181 5452 30
Dust filter (internal filter)*	6 months	6 months to 1 year	×1	Internal filter Part No.: 4777 4495 90
Tubes (internal piping)*	-	3 to 8 years	1 set	
Rubber seals*	-	3 to 6 years	1 set	
Pump unit (RP-11)*	6 months	1 to 2 years	×1	
Lithium ion battery unit (BUL-9000)	-	500 charge/ discharge cycles	×1	When using lithium ion battery unit (BUL-9000) Part No.: 2931 0884 50
AA alkaline batteries	-	-	×6	When using alkaline dry battery unit (BUD-9000) Part No.: 2753 3007 80

* A function check by a qualified service engineer is required after parts replacement. To ensure safety and the stable operation of the product, request checking by a qualified service engineer. Contact RIKEN KEIKI.

<Sensor replacement intervals>

Sensor model	Detection target gas	Display range	Recommended sensor replacement interval
ESF-B242	Ammonia (NH_3)	0 – 75.0 ppm	2 years
ESF-C930	Chlorine (Cl_2)	0 – 1.50 ppm	3 years
ESF-B249	Ozone (O_3)	0 – 0.600 ppm	1 year
ESF-A24E2	Hydrogen chloride (HCl)	0 – 6.00 ppm	3 years
ESF-A24D (Japan Ex model)	Hydrogen cyanide (HCN)	0 – 15.0 ppm	3 years
ESF-B248 (Japan Ex model)	Hydrogen fluoride (HF)	0 – 1.50 ppm	1 year
ESF-B248X (ATEX/IECEx model)	Hydrogen fluoride (HF)	0 – 1.50 ppm	1 year
ESF-A24D	Phosphine (PH_3)	0 – 1.00 ppm	3 years
ESF-B248	Fluorine (F_2)	0 – 3.00 ppm	1 year
ESF-A24D	Silane (SiH_4)	0 – 15.0 ppm	3 years
ESF-A24D2	Nitrogen monoxide (NO)	0 – 100 ppm	3 years
ESF-AA20	Nitrogen dioxide (NO_2)	0 – 15.0 ppm	3 years
ESF-A24D	Sulfur dioxide (SO_2)	0 – 6.00 ppm	3 years
ESF-A24E2	Hydrogen bromide (HBr)	0 – 6.00 ppm	3 years
ESF-B24A	Chlorine trifluoride (ClF_3)	0 – 0.300 ppm	3 years
ESF-A24D	Disilane (Si_2H_6)	0 – 15.0 ppm	3 years

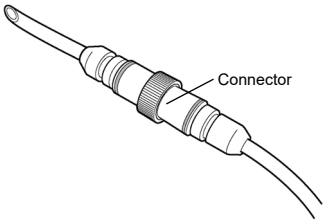
NOTE

- A function check by a qualified service engineer is required after sensor replacement. To ensure safety and the stable operation of the product, request checking by a qualified service engineer. Contact RIKEN KEIKI.

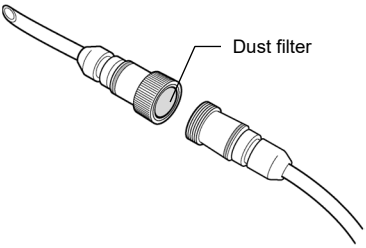
8-6-2 Replacing the sampling probe dust filter

The sampling probe contains a dust filter. The dust filter may become dirty and clogged with use. Replace periodically based on operating conditions.
Be sure to replace the filter, particularly if water is aspirated, the flow rate drops, or the filter appears especially dirty.

1 Rotate the connector on the sampling probe to detach it.



2 Remove the dust filter, and replace with a new one.



3 Rotate the connector to reattach it.
Rotate only by hand. Overtightening with a tool may damage the plastic part.

NOTE

- Do not use filters other than those specified by RIKEN KEIKI.
- For more information on the replacement filters, refer to '8-6-1 Periodic replacement parts'.

9

Storage and Disposal

9-1 Procedures for storage or when not in use for extended periods

The product must be stored in the following environment:

- In a dark place at normal temperatures and humidity and away from direct sunlight
- In a location free of gases, solvents, and vapor

Store the product in its shipping carton if this has been retained.
If the shipping carton is not available, store away from dust and dirt.

CAUTION

- Store the product with the lithium ion battery unit or dry battery unit attached.
  The product constantly draws power for the sensors and clock even when the power is turned off. The sensors may be damaged or the clock display may become offset if there is no power supply.
- When using the dry battery unit, store the product with the dry batteries left inside. The product constantly requires power for the sensors even when the power is turned off.
- Even if you do not intend to use the product for extended periods, turn the power on at least once every six months to check pump suction for approximately three minutes. Grease inside the pump motor may solidify and prevent operation unless the product is operated.

NOTE

- If the lithium ion battery is stored on its own, we recommend storing after it has been discharged until the battery level icon shows one bar. Storing while fully charged may reduce battery life and accelerate battery deterioration.
- If the dry battery unit is stored on its own, remove the batteries before storing.

9-2 Procedures for use after storage

Perform gas adjustment if the product is used again after an extended period of storage.

CAUTION

- After an extended period of storage, be sure to perform gas adjustment before resuming use. Contact RIKEN KEIKI to request readjustment of the product, including gas adjustment.
- If there is a temperature difference of 15 °C or more between the storage and usage locations, turn on the power and allow the product to stand for about 10 minutes in a similar environment to the usage location to acclimatize before performing fresh air adjustment in clean air.

9-3 Product disposal

Dispose of the product as industrial waste (incombustible) in accordance with local regulations.

WARNING

- Never disassemble the sensor. Electrochemical type sensors in particular contain hazardous electrolyte. Contact with electrolyte may result in skin inflammation. Contact with eyes may result in blindness. Contact with clothing may result in discoloration or damage to the fabric. If contact occurs, rinse the area immediately with plenty of water.
- Dispose of batteries in accordance with the procedures specified by the local authority.

<Disposal in EU member states>

When disposing of the product in an EU member state, dispose of the battery separately.
The battery removed from the lithium ion battery unit or dry batteries used in the dry battery unit must be handled in accordance with waste sorting and collection or recycling systems stipulated by the regulations of EU member states.

NOTE

- Crossed-out recycle dustbin mark
- This pictogram is affixed to products containing batteries to which EU Battery Directive 2006/66/EC applies. It indicates that batteries must be disposed of appropriately.
- Be sure to dispose of the batteries separately from regular waste.

10

Troubleshooting

This troubleshooting section does not address causes of all problems that may occur with the product. It provides brief explanations to assist in determining the causes of common problems.
If you encounter symptoms not addressed here or if problems persist even after taking corrective action, contact RIKEN KEIKI.

10-1 Product abnormalities

<Power source related problems>

Symptom/display	Cause	Action
The power cannot be turned on.	・ The battery is depleted.	Lithium ion battery unit: Charge in a safe place. Dry battery unit: Replace with new dry batteries (all six) in a safe place.
	・ The POWER/ENTER button was pressed for too short a time.	Hold down the POWER/ENTER button until the buzzer blips once.
	・ The battery unit is incorrectly attached.	Check to confirm that the battery unit is correctly attached to the main unit.
Abnormal operation	・ Effects of sudden static electricity noise, etc.	Turn off the power, then turn it back on again to restart.
The product does not operate.	・ Effects of sudden static electricity noise, etc.	Remove the battery unit in a safe place, reattach the battery unit, then turn on the power again.
The product cannot be recharged. (When using lithium ion battery unit)	・ The adapter is not correctly connected.	Insert the AC plug and connection terminal of the AC adapter correctly.
	・ There is a fault in the charging circuit.	Contact RIKEN KEIKI.

<Flow rate abnormality (FAIL FLOW)>

Cause	Action
・ The flow passage is blocked.	Fix the problem (e.g., broken pipe, water aspiration), then press the RESET/▼ button to restart the pump.
・ The pump is deteriorated.	The pump must be replaced. Contact RIKEN KEIKI.
・ The power was turned on in cold temperatures or after extended periods without use	Turn the power off and on several times. The pump may start working.
・ Left for extended periods under cold conditions	The pump valve has frozen, reducing the suction flow rate. Press the RESET/▼ button to restart the pump. The product may need to be restarted several times to restore functionality.

<Low battery voltage abnormality (FAIL BATTERY)>

Cause	Action
・ The battery level is low.	Lithium ion battery unit: Charge in a safe place. Dry battery unit: Replace with new dry batteries (all six) in a safe place.

<System abnormality (FAIL SYSTEM)>

Fault No.	Cause	Action
000	・ Internal ROM abnormality ・ Effects of abnormal noise	Contact RIKEN KEIKI.
010	・ Internal RAM abnormality ・ Effects of abnormal noise	Contact RIKEN KEIKI.
021	・ Internal FRAM abnormality ・ Effects of abnormal noise	Contact RIKEN KEIKI.
031	・ Internal flash abnormality ・ Data logger writing failed ・ Effects of abnormal noise	Gas concentration detection is possible in this state, but the data logger function cannot be used. If this symptom occurs frequently, the flash memory must be replaced. Contact RIKEN KEIKI.
080	・ Main PCB reference voltage abnormality or pressure sensor power supply voltage abnormality ・ Effects of abnormal noise	Turn off the power, then turn it back on again to restart. If the problem persists, contact RIKEN KEIKI.
081	・ Sensor PCB communication abnormality, status abnormality, or reference voltage abnormality ・ Effects of abnormal noise	Turn off the power, then turn it back on again to restart. If the problem persists, contact RIKEN KEIKI.
082	・ Internal thermistor abnormality ・ Ambient conditions significantly outside the operating temperature range	Contact RIKEN KEIKI.
083	・ Bluetooth® fault ・ Effects of abnormal noise	Gas detection is possible in this state, but the Bluetooth® function cannot be used. The Bluetooth® function must be repaired if it is to be used. Contact RIKEN KEIKI.

<Clock abnormality (FAIL CLOCK)>

Fault No.	Cause	Action
050	・ Internal clock abnormality ・ Effects of abnormal noise	Set the date and time. If this symptom occurs frequently, the internal clock must be replaced. Contact RIKEN KEIKI.
051	・ Low backup battery voltage	Lithium ion battery unit: Charge in a safe place, then set the date and time. Dry battery unit: Replace with new dry batteries (all six) in a safe place, then set the date and time. If the problem persists, the backup battery must be replaced. Contact RIKEN KEIKI.

<Sensor abnormality (FAIL SENSOR)>

Symptom	Cause	Action
Span adjustment is not possible.	・ The sensor is not correctly installed. ・ The sensor is faulty.	Check to confirm that the sensor is correctly installed. If the sensor is faulty, it must be replaced. Contact RIKEN KEIKI.
	・ The calibration gas concentration setting differs from the concentration of the calibration gas supplied.	Check to confirm that the calibration gas concentration setting is the same as the concentration of the calibration gas supplied.
Fresh air adjustment is not possible.	・ The sensor is not correctly installed. ・ The sensor is faulty.	Check to confirm that the sensor is correctly installed. If the sensor is faulty, it must be replaced. Contact RIKEN KEIKI.
	・ Clean air is not being supplied around the product.	Supply clean air.
Performing a bump test is not possible.	・ Calibration gas is not being supplied during a bump test.	Supply the correct calibration gas for the bump test.
	・ The calibration gas concentration setting differs from the concentration of the calibration gas supplied.	Check to confirm that the calibration gas concentration setting is the same as the concentration of the calibration gas supplied.
	・ Gas adjustment has not been performed.	Perform fresh air adjustment and span adjustment.

Symptom	Cause	Action
A sensor abnormality is indicated.	・ The sensor is not correctly installed.	Check to confirm that the sensor is correctly installed.
	・ The sensor is faulty.	If the sensor is faulty, it must be replaced. Contact RIKEN KEIKI.
	・ There are problems with communicating with the sensor.	Replace with a new sensor.
	・ An unsupported F sensor is installed in the product.	Replace with an F sensor supported by the product.
	・ The F sensor is installed in the wrong position (order of priority).	Check the F sensor installation order.

<Other>

Symptom	Cause	Action
[PLEASE CAL] is displayed.	Indicates that more than one year has elapsed since the last adjustment date. (Japan Ex models only)	Contact RIKEN KEIKI to request maintenance.
[CAL DATE PAST] is displayed.	Indicates that the set gas adjustment expiration date has passed. (ATEX/IECEx models only)	Either perform gas adjustment yourself or contact RIKEN KEIKI to request maintenance.
[BUMP DATE PAST] is displayed.	Indicates that the set bump expiration date has passed.	Perform a bump test.

10-2 Reading abnormalities

Symptom	Cause	Action
The reading rises (or drops) and remains unchanged.	Sensor drift	Perform fresh air adjustment.
	Presence of interference gases	It is difficult to completely eliminate the effects of interference gases such as solvents. Contact RIKEN KEIKI for information on countermeasures, such as removal filters.
	Slow leakage	They may be a very small leakage (slow leakage) of the detection target gas. Leaving this unresolved may lead to hazardous conditions. Take the same action as for gas alarms.
	Ambient condition fluctuations such as temperature and humidity.	Perform fresh air adjustment.
	Sensor condensation	Perform fresh air adjustment.
Slow response	Dust filter clogging	Replace the dust filter.
	Sampling probe bent or clogged	Fix the problem.
	There is condensation inside the product.	Fix the problem.
	The sensor sensitivity has degraded.	Replace with a new sensor. Contact RIKEN KEIKI.
Gas adjustment is not possible.	The calibration gas concentration is inappropriate.	Prepare the correct calibration gas.
	The sensor sensitivity has degraded.	Replace with a new sensor. Contact RIKEN KEIKI.

11

Product Specifications

11-1 Main unit specifications

Item	Specifications
Concentration display	LCD digital (full dot)
Detection target gas	Toxic gas (ammonia (NH_3), chlorine (Cl_2), ozone (O_3), hydrogen chloride (HCl), hydrogen cyanide (HCN)*1, hydrogen fluoride (HF), fluorine (F_2), silane (SiH_4), nitrogen monoxide (NO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), hydrogen bromide (HBr), chlorine trifluoride (ClF_3), disilane (Si_2H_6))
Detection method	Pump suction type
Suction flow rate	Minimum 0.75 L/min (open flow rate)
Display items	Clock, battery level, operation status
Display languages	Japanese, English, Korean, Chinese (simplified), Chinese (traditional), Vietnamese, Italian, Spanish, Slovak, Czech, German, Turkish, French, Portuguese, Polish, Russian
Buzzer volume	Approx. 95 dB (mean value at 30 cm from source)
Gas alarm indication	Lamp flashing, continuous modulating buzzer sounding, gas concentration readout blinking
Gas alarm pattern	Self-latching, auto-reset
Fault alarm/ self-diagnosis	Flow rate abnormality, system abnormality, sensor abnormality, low battery voltage, adjustment failure, clock abnormality
Fault alarm indication	Lamp flashing, intermittent buzzer sounding, detail display
Fault alarm pattern	Self-latching
Communication specifications	USB 2.0 Type-C (for data logger/setting), Bluetooth® 4.2 (Bluetooth® Low Energy)
Power source	Dedicated lithium ion battery unit (BUL-9000) or dedicated dry battery unit (AA alkaline batteries × 6) (BUD-9000)*2
Continuous operating time	Lithium ion battery unit: Approx. 60 hours Dry battery unit: Approx. 30 hours At 25 °C, no alarm, no lighting
Operating temperature range	-20 °C to +50 °C (no sudden fluctuations) May vary depending on the sensors installed. (Refer to '11-2 Sensor specifications'.)
Operating humidity range	20 to 90 %RH (no condensation) May vary depending on the sensors installed. (Refer to '11-2 Sensor specifications'.)
Operating pressure range	80 kPa to 120 kPa (80 kPa to 110 kPa for explosion-proof range)
Construction	Dustproof and waterproof construction equivalent to IP66/68*3, drop resistant to 1.5 m
Explosion-proof construction	Japan Ex (explosion-proof electrical equipment type certified) models: Intrinsically safe explosion-proof enclosure ATEX/IECEx models: Inherently safe explosion-proof enclosure
Explosion-proof class	Japan Ex (explosion-proof electrical equipment type certified) models: Ex ia IIC T4 Ga ATEX models*4: II 1 G Ex ia IIC T4 Ga IECEx models*4: Ex ia IIC T4 Ga

Item	Specifications
Certifications	CE
External dimensions	Approx. 158 (W) × 85 (H) × 132 (D) mm
Weight	Approx. 1.1 kg

*1: Not included in the ATEX/IECEx model lineup. Due to export restrictions, this cannot be installed in products exported outside Japan.
*2: Japan Ex models can use six Toshiba LR6 batteries.
ATEX/IECEx models can use either six Toshiba LR6 or six Duracell MN1500 batteries.
*3: IPx8 implies no water ingress when submerged underwater at a depth of 2 m for one hour.
*4: As follows for models with the dry battery unit using Duracell (MN1500) batteries:
-20 °C to +40 °C: T4, -20 °C to +50 °C: T3

11-2 Sensor specifications

Item	Detection target gas	Ammonia NH_3	Chlorine Cl_2	Ozone O_3
Sensor model		ESF-B242	ESF-C930	ESF-B249
Explosion-proof specifications		Japan Ex and ATEX/IECEx	Japan Ex and ATEX/IECEx	Japan Ex and ATEX/IECEx
Display range		0 – 75.0 ppm	0 – 1.50 ppm	0 – 0.600 ppm
Detection range		0 – 75.0 ppm	0 – 1.50 ppm	0 – 0.600 ppm
Resolution		0.5 ppm	0.01 ppm	0.005 ppm
Alarm setpoints	First alarm	25.0 ppm	0.50 ppm	0.100 ppm
	Second alarm	50.0 ppm	1.00 ppm	0.200 ppm
	TWA	25.0 ppm	0.50 ppm	0.100 ppm
	STEL	35.0 ppm	1.00 ppm	OFF
	OVER	75.0 ppm	1.50 ppm	0.600 ppm
Operating temperature range		-20 °C to +50 °C	0 °C to +50 °C	10 °C to +40 °C
Operating humidity range		30 to 80 %RH	30 to 80 %RH	30 to 80 %RH
Display accuracy (for identical conditions)		Within ±7.5 ppm	Within ±0.15 ppm	Within ±0.06 ppm
Response time (T90)		19 seconds (typical)	53 seconds (typical)	10 seconds (typical)

Item	Detection target gas	Hydrogen chloride HCl	Hydrogen cyanide HCN*
Sensor model		ESF-A24E2	ESF-A24D
Explosion-proof specifications		Japan Ex and ATEX/IECEx	Japan Ex
Display range		0 – 6.00 ppm	0 – 15.0 ppm
Detection range		0 – 6.00 ppm	0 – 15.0 ppm
Resolution		0.05 ppm	0.1 ppm
Alarm setpoints	First alarm	2.00 ppm	5.0 ppm
	Second alarm	4.00 ppm	10.0 ppm
	TWA	OFF	OFF
	STEL	OFF	4.7 ppm
	OVER	6.00 ppm	15.0 ppm
Operating temperature range		0 °C to +40 °C	-20 °C to +50 °C
Operating humidity range		20 to 90 %RH	20 to 90 %RH
Display accuracy (for identical conditions)		Within ±0.6 ppm	Within ±1.5 ppm
Response time (T90)		46 seconds (typical)	33 seconds (typical)

* Not included in the ATEX/IECEx model lineup. Due to export restrictions, this cannot be installed in products exported outside Japan.

Item	Detection target gas	Hydrogen fluoride HF*1	Hydrogen fluoride HF*2	Phosphine PH_3	Fluorine F_2
Sensor model		ESF-B248	ESF-B248X	ESF-A24D	ESF-B248
Explosion-proof specifications		Japan Ex	ATEX/IECEx	Japan Ex and ATEX/IECEx	Japan Ex and ATEX/IECEx
Display range		0 – 1.50 ppm	0 – 1.50 ppm	0 – 1.00 ppm	0 – 3.00 ppm
Detection range		0 – 1.50 ppm	0 – 1.50 ppm	0 – 1.00 ppm	0 – 3.00 ppm
Resolution		0.01 ppm	0.01 ppm	0.01 ppm	0.02 ppm
Alarm setpoints	First alarm	0.50 ppm	0.50 ppm	0.30 ppm	1.00 ppm
	Second alarm	1.00 ppm	1.00 ppm	0.60 ppm	2.00 ppm
	TWA	0.50 ppm	0.50 ppm	OFF	OFF
	STEL	OFF	OFF	OFF	OFF
	OVER	1.50 ppm	1.50 ppm	1.00 ppm	3.00 ppm
Operating temperature range		0 °C to +40 °C	0 °C to +40 °C	-20 °C to +50 °C	0 °C to +40 °C
Operating humidity range		30 to 80 %RH	30 to 80 %RH	20 to 90 %RH	30 to 80 %RH
Display accuracy (for identical conditions)		Within ±0.15 ppm	Within ±0.15 ppm	Within ±0.10 ppm	Within ±0.30 ppm
Response time (T90)		85 seconds (typical)	85 seconds (typical)	12 seconds (typical)	70 seconds (typical)

*1: Due to export restrictions, this cannot be installed in products exported outside Japan.
*2: Due to export restrictions, concentrations of 0.0 – 0.4 ppm are indicated as 0.0 ppm.

Item	Detection target gas	Silane SiH_4	Nitrogen monoxide NO	Nitrogen dioxide NO_2	Sulfur dioxide SO_2
Sensor model		ESF-A24D	ESF-A24D2	ESF-AA20	ESF-A24D
Explosion-proof specifications		Japan Ex and ATEX/IECEx	Japan Ex and ATEX/IECEx	Japan Ex and ATEX/IECEx	Japan Ex and ATEX/IECEx
Display range		0 – 15.0 ppm	0 – 100 ppm	0 – 15.0 ppm	0 – 6.00 ppm
Detection range		0 – 15.0 ppm	0 – 100 ppm	0 – 15.0 ppm	0 – 6.00 ppm
Resolution		0.1 ppm	1 ppm	0.1 ppm	0.05 ppm
Alarm setpoints	First alarm	5.0 ppm	25 ppm	5.0 ppm	2.00 ppm
	Second alarm	10.0 ppm	50 ppm	10.0 ppm	4.00 ppm
	TWA	5.0 ppm	25 ppm	OFF	OFF
	STEL	OFF	OFF	OFF	OFF
	OVER	15.0 ppm	100 ppm	15.0 ppm	6.00 ppm
Operating temperature range		-20 °C to +50 °C	-20 °C to +50 °C	-20 °C to +50 °C	-20 °C to +50 °C
Operating humidity range		20 to 90 %RH	20 to 90 %RH	20 to 90 %RH	20 to 90 %RH
Display accuracy (for identical conditions)		Within ±1.5 ppm	Within ±10 ppm	Within ±1.5 ppm	Within ±0.60 ppm
Response time (T90)		7 seconds (typical)	7 seconds (typical)	14 seconds (typical)	11 seconds (typical)

Item	Detection target gas	Hydrogen bromide HBr	Chlorine trifluoride ClF_3	Disilane Si_2H_6
Sensor model		ESF-A24E2	ESF-B24A	ESF-A24D
Explosion-proof specifications		Japan Ex and ATEX/IECEx	Japan Ex and ATEX/IECEx	Japan Ex and ATEX/IECEx
Display range		0 – 6.00 ppm	0 – 0.300 ppm	0 – 15.0 ppm
Detection range		0 – 6.00 ppm	0 – 0.300 ppm	0 – 15.0 ppm
Resolution		0.05 ppm	0.002 ppm	0.1 ppm
Alarm setpoints	First alarm	2.00 ppm	0.100 ppm	5.0 ppm
	Second alarm	4.00 ppm	0.200 ppm	10.0 ppm
	TWA	OFF	OFF	OFF
	STEL	OFF	OFF	OFF
	OVER	6.00 ppm	0.300 ppm	15.0 ppm
Operating temperature range		0 °C to +40 °C	0 °C to +40 °C	-20 °C to +50 °C
Operating humidity range		20 to 90 %RH	30 to 80 %RH	20 to 90 %RH
Display accuracy (for identical conditions)		Within ±0.60 ppm	Within ±0.030 ppm	Within ±1.5 ppm
Response time (T90)		77 seconds (typical)	56 seconds (typical)	7 seconds (typical)

CAUTION

- Never disassemble the sensor. Electrochemical type sensors contain hazardous electrolyte.
- Indication accuracy may be reduced when used in high-humidity or low-humidity environments.
- Indication accuracy may be reduced if the temperature varies significantly after adjustment at a high or low temperature.
- The reading may fluctuate if the temperature, humidity, or pressure varies suddenly.
- Sensors will not operate if installed in the wrong direction. Forcibly installing sensors may damage the sensors and main unit. This may also cause the sensors to fail.

NOTE

▶ The alarm setpoints (including “OFF”) indicated in the tables above can be changed. (Refer to ‘7-3-1 Setting alarm setpoints.’)

12

Appendix

12-1 Data logger function

The product is equipped with a data logger function that records detection results and events such as gas alarms, fault alarms, and gas adjustment.

NOTE

- The data logger management program sold separately is required to check data recorded using the data logger function. Contact RIKEN KEIKI for more information.

The data logger provides the following five functions:

(1) Interval trend

Records the changes in detected concentration from the start of detection until the power is turned off.
If the alarm type is H-HH or L-LL, the average value, maximum value, and maximum value detection time are recorded; if the alarm type is L-H, the average value, minimum value, and minimum value detection time are recorded,
The 3,600 most recent data items are recorded.
If the number of items exceeds 3,600, the oldest data will be overwritten by the latest data.
However, if the maximum recording time is exceeded, the oldest data will be deleted before reaching 3,600.

The maximum recording times corresponding to different intervals are as follows:

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

The standard interval is 5 minutes.
The interval can be set using the data logger management program sold separately.

(2) Alarm trend

When an alarm is triggered, this function records the changes in detected concentration for 30 minutes before and after the alarm occurred (one hour in total).
Alarm trend records peak values (maximum values for H-HH and minimum values for L-H or L-LL alarm types) over five-second periods at five-second intervals.
The eight most recent data items are recorded.
If the number of items exceeds 8, the oldest data will be overwritten by the latest data.

(3) Alarm event

Records alarm occurrences as events.
This function records the time the alarm was triggered, the detection target gas, and the type of alarm event.
The 100 most recent events are recorded.
If the number of items exceeds 100, the oldest data will be overwritten by the latest data.

(4) Trouble event

Records fault alarm occurrences as events.

This function records the time when the fault alarm was triggered, the detection target gas, device information, and the type of trouble event.

The 100 most recent events are recorded.

If the number of items exceeds 100, the oldest data will be overwritten by the latest data.

(5) Adjustment history

Records data when adjustment is performed.

Records the adjustment time and concentrations before and after adjustment.

The 100 most recent adjustment history data items are recorded.

If the number of items exceeds 100, the oldest data will be overwritten by the latest data.

NOTE

- If a USB connection is detected while the date and time or battery voltage is displayed after the power is turned on, the product enters communication mode. To enter communication mode, press the RESET/▼ and DISP/ESC buttons simultaneously while the date and time or battery voltage is displayed at startup.
- A fault alarm will be triggered if no communication connection can be confirmed for a preset duration in communication mode. If this occurs, either repeat the communication connection or turn off the power for the product.

12-2 Zero suppression function

Gas sensors are affected by environmental factors such as temperature and humidity. They are also substantially affected by the interference of the detection target gas. Environmental and interference effects may cause the product reading to fluctuate around zero.
The zero suppression function is designed to suppress notifications of reading fluctuations around zero. The function suppresses reading fluctuations below the set value and displays zero instead.

NOTE

- The default setting is enabled. To disable the setting, use the configuration program which can be installed from the RIKEN KEIKI website and refer to the operating manual. If the setting is disabled, readings may fluctuate due to output variations attributable to sensor characteristics.
- Even when enabled, the zero suppression function will function only in detection mode and display mode.
- All readings in the range from zero to the negative suppression value indicated in the following table are suppressed. Values from the negative suppression value to the M OVER value will be displayed, but accurate detection cannot be achieved in this state. Fresh air adjustment should be performed. For information on M OVER values, refer to '4-2 Gas alarm setpoints'.

The zero suppression function settings are as follows:

Sensor	Detection target gas	Suppression value	Suppression type	Negative suppression value	Negative suppression type
ESF-B242	Ammonia (NH_3)	10.0 ppm	Cut-off	-5.0 ppm	Cut-off
ESF-C930	Chlorine (Cl_2)	0.09 ppm	Cut-off	-0.08 ppm	Cut-off
ESF-B249	Ozone (O_3)	0.035 ppm	Cut-off	-0.030 ppm	Cut-off
ESF-A24E2	Hydrogen chloride (HCl)	0.35 ppm	Cut-off	-0.30 ppm	Cut-off
ESF-A24D (Japan Ex model)	Hydrogen cyanide (HCN)	0.9 ppm	Cut-off	-0.8 ppm	Cut-off
ESF-B248 (Japan Ex model)	Hydrogen fluoride (HF)	0.09 ppm	Cut-off	-0.08 ppm	Cut-off
ESF-B248X (ATEX/IECEx model)	Hydrogen fluoride (HF)	0.09 ppm	Cut-off	-0.08 ppm	Cut-off
ESF-A24D	Phosphine (PH_3)	0.06 ppm	Cut-off	-0.05 ppm	Cut-off
ESF-B248	Fluorine (F_2)	0.18 ppm	Cut-off	-0.16 ppm	Cut-off
ESF-A24D	Silane (SiH_4)	0.9 ppm	Cut-off	-0.8 ppm	Cut-off
ESF-A24D2	Nitrogen monoxide (NO)	6 ppm	Cut-off	-5 ppm	Cut-off
ESF-AA20	Nitrogen dioxide (NO_2)	0.9 ppm	Cut-off	-0.8 ppm	Cut-off
ESF-A24D	Sulfur dioxide (SO_2)	0.35 ppm	Cut-off	-0.30 ppm	Cut-off
ESF-A24E2	Hydrogen bromide (HBr)	0.35 ppm	Cut-off	-0.30 ppm	Cut-off
ESF-B24A	Chlorine trifluoride (ClF_3)	0.018 ppm	Cut-off	-0.016 ppm	Cut-off
ESF-A24D	Disilane (Si_2H_6)	0.9 ppm	Cut-off	-0.8 ppm	Cut-off

12-3 Zero follower function

The zero points for the sensors used in the product may fluctuate when used for extended periods.
The zero follower function stabilizes the zero point by adjusting reading fluctuations at the zero point that result from extended periods of use.

ESF sensors	The sensor output is tracked to zero the value if the sensor output repeatedly drops below zero when the power is turned on.

* The zero follower function is enabled when the power is turned on.

NOTE

- The default setting is enabled. To disable the setting, use the configuration program which can be installed from the RIKEN KEIKI website and refer to the operating manual. When the setting is disabled, the zero point may fluctuate due to output variation caused by the sensor characteristics.

12-4 List of interference gases for electrochemical type sensors

The following tables list the interference gases for electrochemical type toxic gas sensors.
The values indicated here are representative values detected in a laboratory environment using new sensors and filters. Note that the condition of the sensors and filters and environmental factors at the site such as temperature and humidity will affect susceptibility to interference. These figures may differ from the actual values. Use them as reference values to identify the presence of interference gases and the degree of interference influence.

CAUTION

- A false alarm may occur with detection performed in an environment where strong interference gases are present.

<ESF-B242 (NH_3)>

Gas name	Chemical formula	Gas concentration	Reading
Chlorine	Cl_2	1.6 ppm	-0.8 ppm
Ozone	O_3	2.2 ppm	4.5 ppm
Hydrogen chloride	HCl	3.2 ppm	-2.6 ppm
Hydrogen cyanide	HCN	7.8 ppm	1.0 ppm
Hydrogen fluoride	HF	6.0 ppm	-5.0 ppm
Phosphine	PH_3	2.6 ppm	0.0 ppm
Fluorine	F_2	1.6 ppm	-1.0 ppm
Silane	SiH_4	7.1 ppm	-1.0 ppm
Nitrogen monoxide	NO	101 ppm	0.0 ppm
Nitrogen dioxide	NO_2	40 ppm	-21.2 ppm
Sulfur dioxide	SO_2	10 ppm	-5.3 ppm
Hydrogen bromide	HBr	15.0 ppm	-2.0 ppm
Chlorine trifluoride	ClF_3	1.6 ppm	-5.0 ppm
Disilane	Si_2H_6	14.8 ppm	0.0 ppm

<ESF-C930 (Cl_2)>

Gas name	Chemical formula	Gas concentration	Reading
Ammonia	NH_3	75 ppm	-0.02 ppm
Ozone	O_3	2.4 ppm	0.24 ppm
Hydrogen chloride	HCl	15 ppm	0.02 ppm
Hydrogen cyanide	HCN	7.8 ppm	-0.01 ppm
Hydrogen fluoride	HF	0.8 ppm	-0.02 ppm
Phosphine	PH_3	2.5 ppm	0.00 ppm
Fluorine	F_2	1.6 ppm	0.36 ppm
Silane	SiH_4	7.1 ppm	-0.02 ppm
Nitrogen monoxide	NO	10 ppm	-0.02 ppm
Nitrogen dioxide	NO_2	7.6 ppm	0.10 ppm
Sulfur dioxide	SO_2	3.2 ppm	-0.03 ppm
Hydrogen bromide	HBr	15 ppm	-0.02 ppm
Chlorine trifluoride	ClF_3	0.16 ppm	0.08 ppm
Disilane	Si_2H_6	15 ppm	-0.02 ppm

<ESF-B249 (O_3)>

Gas name	Chemical formula	Gas concentration	Reading
Ammonia	NH_3	75 ppm	-0.06 ppm
Chlorine	Cl_2	1.5 ppm	2.01 ppm
Hydrogen chloride	HCl	15 ppm	0.58 ppm
Hydrogen cyanide	HCN	5.1 ppm	-0.06 ppm
Hydrogen fluoride	HF	6.0 ppm	0.22 ppm
Phosphine	PH_3	2.5 ppm	0.00 ppm
Fluorine	F_2	0.32 ppm	0.15 ppm
Silane	SiH_4	30 ppm	0.00 ppm
Nitrogen monoxide	NO	100 ppm	0.02 ppm
Nitrogen dioxide	NO_2	40 ppm	0.65 ppm
Sulfur dioxide	SO_2	0.50 ppm	0.01 ppm
Hydrogen bromide	HBr	3.2 ppm	0.08 ppm
Chlorine trifluoride	ClF_3	0.16 ppm	0.10 ppm
Disilane	Si_2H_6	7.2 ppm	0.00 ppm

<ESF-A24E2 (HCl)>

Gas name	Chemical formula	Gas concentration	Reading
Ammonia	NH_3	400 ppm	-0.19 ppm
Chlorine	Cl_2	2.5 ppm	0.40 ppm
Ozone	O_3	2.4 ppm	-0.05 ppm
Hydrogen cyanide	HCN	6.9 ppm	0.03 ppm
Hydrogen fluoride	HF	6.0 ppm	0.39 ppm
Phosphine	PH_3	0.50 ppm	0.89 ppm
Fluorine	F_2	6.0 ppm	-0.16 ppm
Silane	SiH_4	7.1 ppm	0.08 ppm
Nitrogen monoxide	NO	10 ppm	0.51 ppm
Nitrogen dioxide	NO_2	7.6 ppm	0.21 ppm
Sulfur dioxide	SO_2	10 ppm	0.34 ppm
Hydrogen bromide	HBr	3.2 ppm	2.67 ppm
Chlorine trifluoride	ClF_3	0.16 ppm	0.02 ppm
Disilane	Si_2H_6	15 ppm	1.57 ppm

<ESF-A24D (HCN) Japan Ex model>

Gas name	Chemical formula	Gas concentration	Reading
Ammonia	NH_3	400 ppm	0.3 ppm
Chlorine	Cl_2	1.5 ppm	-2.9 ppm
Ozone	O_3	1.8 ppm	-8.5 ppm
Hydrogen chloride	HCl	15 ppm	16.1 ppm
Hydrogen fluoride	HF	9.0 ppm	0.5 ppm
Phosphine	PH_3	1.0 ppm	14.0 ppm
Fluorine	F_2	1.6 ppm	-0.3 ppm
Silane	SiH_4	14.4 ppm	168.1 ppm
Nitrogen monoxide	NO	101 ppm	-3.1 ppm
Nitrogen dioxide	NO_2	15.0 ppm	-66.5 ppm
Sulfur dioxide	SO_2	6.0 ppm	20.4 ppm
Hydrogen bromide	HBr	6.0 ppm	1.0 ppm
Chlorine trifluoride	ClF_3	0.16 ppm	0.2 ppm
Disilane	Si_2H_6	14.8 ppm	194.9 ppm

<ESF-B248 (HF) Japan Ex model>

Gas name	Chemical formula	Gas concentration	Reading
Ammonia	NH_3	75 ppm	-0.06 ppm
Chlorine	Cl_2	0.8 ppm	1.14 ppm
Ozone	O_3	0.32 ppm	0.06 ppm
Hydrogen chloride	HCl	3.2 ppm	2.46 ppm
Hydrogen cyanide	HCN	7.4 ppm	0.00 ppm
Phosphine	PH_3	1.0 ppm	0.00 ppm
Fluorine	F_2	1.6 ppm	1.61 ppm
Silane	SiH_4	20 ppm	0.00 ppm
Nitrogen monoxide	NO	100 ppm	0.00 ppm
Nitrogen dioxide	NO_2	15 ppm	0.21 ppm
Sulfur dioxide	SO_2	0.50 ppm	0.00 ppm
Hydrogen bromide	HBr	3.2 ppm	1.87 ppm
Chlorine trifluoride	ClF_3	1.6 ppm	0.19 ppm
Disilane	Si_2H_6	7.2 ppm	0.00 ppm

<ESF-B248X (HF) ATEX/IECEx model>

Gas name	Chemical formula	Gas concentration	Reading
Ammonia	NH_3	75 ppm	-0.06 ppm
Chlorine	Cl_2	0.8 ppm	1.14 ppm
Ozone	O_3	0.32 ppm	0.06 ppm
Hydrogen chloride	HCl	3.2 ppm	2.46 ppm
Hydrogen cyanide	HCN	7.4 ppm	0.00 ppm
Phosphine	PH_3	1.0 ppm	0.00 ppm
Fluorine	F_2	1.6 ppm	1.61 ppm
Silane	SiH_4	20 ppm	0.00 ppm
Nitrogen monoxide	NO	100 ppm	0.00 ppm
Nitrogen dioxide	NO_2	15 ppm	0.21 ppm
Sulfur dioxide	SO_2	0.50 ppm	0.00 ppm
Hydrogen bromide	HBr	3.2 ppm	1.87 ppm
Chlorine trifluoride	ClF_3	1.6 ppm	0.19 ppm
Disilane	Si_2H_6	7.2 ppm	0.00 ppm

<ESF-A24D (PH_3)>

Gas name	Chemical formula	Gas concentration	Reading
Ammonia	NH_3	250 ppm	0.00 ppm
Chlorine	Cl_2	10 ppm	-1.68 ppm
Ozone	O_3	3.1 ppm	-0.96 ppm
Hydrogen chloride	HCl	15 ppm	0.80 ppm
Hydrogen cyanide	HCN	7.1 ppm	0.77 ppm
Hydrogen fluoride	HF	6.0 ppm	0.02 ppm
Fluorine	F_2	10 ppm	-0.30 ppm
Silane	SiH_4	1.2 ppm	0.94 ppm
Nitrogen monoxide	NO	100 ppm	-0.08 ppm
Nitrogen dioxide	NO_2	7.6 ppm	-2.29 ppm
Sulfur dioxide	SO_2	1.0 ppm	0.23 ppm
Hydrogen bromide	HBr	15 ppm	0.77 ppm
Chlorine trifluoride	ClF_3	0.16 ppm	0.08 ppm
Disilane	Si_2H_6	0.60 ppm	0.61 ppm

<ESF-B248 (F_2)>

Gas name	Chemical formula	Gas concentration	Reading
Ammonia	NH_3	75 ppm	-0.06 ppm
Chlorine	Cl_2	0.8 ppm	1.14 ppm
Ozone	O_3	0.32 ppm	0.06 ppm
Hydrogen chloride	HCl	3.2 ppm	2.45 ppm
Hydrogen cyanide	HCN	7.4 ppm	0.00 ppm
Hydrogen fluoride	HF	0.80 ppm	0.80 ppm
Phosphine	PH_3	1.0 ppm	0.00 ppm
Silane	SiH_4	20 ppm	0.00 ppm
Nitrogen monoxide	NO	100 ppm	0.00 ppm
Nitrogen dioxide	NO_2	15 ppm	0.21 ppm
Sulfur dioxide	SO_2	0.50 ppm	0.00 ppm
Hydrogen bromide	HBr	3.2 ppm	1.86 ppm
Chlorine trifluoride	ClF_3	1.6 ppm	0.19 ppm
Disilane	Si_2H_6	7.2 ppm	0.00 ppm

<ESF-A24D (SiH_4)>

Gas name	Chemical formula	Gas concentration	Reading
Ammonia	NH_3	250 ppm	0.0 ppm
Chlorine	Cl_2	10 ppm	-2.1 ppm
Ozone	O_3	3.1 ppm	-1.2 ppm
Hydrogen chloride	HCl	15 ppm	1.0 ppm
Hydrogen cyanide	HCN	7.1 ppm	1.0 ppm
Hydrogen fluoride	HF	6.0 ppm	0.0 ppm
Phosphine	PH_3	4.8 ppm	6.1 ppm
Fluorine	F_2	10 ppm	-0.4 ppm
Nitrogen monoxide	NO	100 ppm	-0.1 ppm
Nitrogen dioxide	NO_2	7.6 ppm	-2.9 ppm
Sulfur dioxide	SO_2	10 ppm	2.9 ppm
Hydrogen bromide	HBr	15 ppm	1.0 ppm
Chlorine trifluoride	ClF_3	0.16 ppm	0.1 ppm
Disilane	Si_2H_6	7.3 ppm	9.4 ppm

<ESF-A24D2 (NO)>

Gas name	Chemical formula	Gas concentration	Reading
Ammonia	NH_3	250 ppm	0 ppm
Chlorine	Cl_2	10 ppm	-5 ppm
Ozone	O_3	2.9 ppm	-2 ppm
Hydrogen chloride	HCl	15 ppm	2 ppm
Hydrogen cyanide	HCN	7.4 ppm	3 ppm
Hydrogen fluoride	HF	6.0 ppm	0 ppm
Phosphine	PH_3	20.1 ppm	2 ppm
Fluorine	F_2	10 ppm	0 ppm
Silane	SiH_4	7.2 ppm	14 ppm
Nitrogen dioxide	NO_2	41.2 ppm	2 ppm
Sulfur dioxide	SO_2	10 ppm	7 ppm
Hydrogen bromide	HBr	15 ppm	2 ppm
Chlorine trifluoride	ClF_3	0.16 ppm	0 ppm
Disilane	Si_2H_6	7.3 ppm	20 ppm

<ESF-AA20 (NO_2)>

Gas name	Chemical formula	Gas concentration	Reading
Ammonia	NH_3	400 ppm	1.0 ppm
Chlorine	Cl_2	0.8 ppm	0.2 ppm
Ozone	O_3	2.55 ppm	4.60 ppm
Hydrogen chloride	HCl	4.8 ppm	-6.1 ppm
Hydrogen cyanide	HCN	6.4 ppm	-0.08 ppm
Hydrogen fluoride	HF	6.0 ppm	-0.10 ppm
Phosphine	PH_3	2.56 ppm	-8.11 ppm
Fluorine	F_2	1.6 ppm	0.13 ppm
Silane	SiH_4	8.0 ppm	-2.1 ppm
Nitrogen monoxide	NO	101 ppm	0.68 ppm
Sulfur dioxide	SO_2	10 ppm	-0.2 ppm
Hydrogen bromide	HBr	15.0 ppm	-4.44 ppm
Chlorine trifluoride	ClF_3	1.6 ppm	0.93 ppm
Disilane	Si_2H_6	14.8 ppm	-16.15 ppm

<ESF-A24D (SO_2)>

Gas name	Chemical formula	Gas concentration	Reading
Ammonia	NH_3	250 ppm	0.01 ppm
Chlorine	Cl_2	10 ppm	-7.39 ppm
Ozone	O_3	2.9 ppm	-4.07 ppm
Hydrogen chloride	HCl	15 ppm	3.51 ppm
Hydrogen cyanide	HCN	6.9 ppm	3.09 ppm
Hydrogen fluoride	HF	6.0 ppm	0.08 ppm
Phosphine	PH_3	0.48 ppm	2.12 ppm
Fluorine	F_2	10 ppm	-1.31 ppm
Silane	SiH_4	1.2 ppm	4.18 ppm
Nitrogen monoxide	NO	100 ppm	-0.35 ppm
Nitrogen dioxide	NO_2	7.6 ppm	-10.09 ppm
Hydrogen bromide	HBr	15 ppm	3.38 ppm
Chlorine trifluoride	ClF_3	0.16 ppm	0.35 ppm
Disilane	Si_2H_6	0.60 ppm	2.68 ppm

<ESF-A24E2 (HBr)>

Gas name	Chemical formula	Gas concentration	Reading
Ammonia	NH_3	400 ppm	-0.23 ppm
Chlorine	Cl_2	2.5 ppm	0.48 ppm
Ozone	O_3	2.4 ppm	-0.06 ppm
Hydrogen chloride	HCl	3.2 ppm	3.84 ppm
Hydrogen cyanide	HCN	6.9 ppm	0.04 ppm
Hydrogen fluoride	HF	6.0 ppm	0.47 ppm
Phosphine	PH_3	0.50 ppm	1.07 ppm
Fluorine	F_2	6.0 ppm	-0.19 ppm
Silane	SiH_4	7.1 ppm	0.10 ppm
Nitrogen monoxide	NO	10 ppm	0.61 ppm
Nitrogen dioxide	NO_2	7.6 ppm	0.25 ppm
Sulfur dioxide	SO_2	10 ppm	0.41 ppm
Chlorine trifluoride	ClF_3	0.16 ppm	0.02 ppm
Disilane	Si_2H_6	15 ppm	1.88 ppm

<ESF-B24A (ClF_3)>

Gas name	Chemical formula	Gas concentration	Reading
Ammonia	NH_3	75 ppm	-0.10 ppm
Chlorine	Cl_2	0.16 ppm	0.27 ppm
Ozone	O_3	0.34 ppm	0.10 ppm
Hydrogen chloride	HCl	3.2 ppm	3.05 ppm
Hydrogen cyanide	HCN	5.1 ppm	-0.06 ppm
Hydrogen fluoride	HF	1.6 ppm	1.16 ppm
Phosphine	PH_3	2.5 ppm	0.03 ppm
Fluorine	F_2	1.6 ppm	2.23 ppm
Silane	SiH_4	30 ppm	0.00 ppm
Nitrogen monoxide	NO	100 ppm	0.35 ppm
Nitrogen dioxide	NO_2	2.2 ppm	0.08 ppm
Sulfur dioxide	SO_2	0.50 ppm	0.02 ppm
Hydrogen bromide	HBr	3.2 ppm	2.08 ppm
Disilane	Si_2H_6	7.2 ppm	0.03 ppm

<ESF-A24D (Si_2H_6)>

Gas name	Chemical formula	Gas concentration	Reading
Ammonia	NH_3	250 ppm	0.0 ppm
Chlorine	Cl_2	10 ppm	-1.7 ppm
Ozone	O_3	2.4 ppm	-0.7 ppm
Hydrogen chloride	HCl	15 ppm	0.8 ppm
Hydrogen cyanide	HCN	6.4 ppm	0.7 ppm
Hydrogen fluoride	HF	6.0 ppm	0.0 ppm
Phosphine	PH_3	4.8 ppm	4.7 ppm
Fluorine	F_2	10 ppm	-0.3 ppm
Silane	SiH_4	7.2 ppm	5.6 ppm
Nitrogen monoxide	NO	100 ppm	-0.1 ppm
Nitrogen dioxide	NO_2	7.6 ppm	-2.3 ppm
Sulfur dioxide	SO_2	10 ppm	2.2 ppm
Hydrogen bromide	HBr	15 ppm	0.8 ppm
Chlorine trifluoride	ClF_3	0.16 ppm	0.1 ppm

12-5 Radio law certification

This product is certified as complying with radio laws in individual countries and regions as follows.
The following actions are prohibited by radio laws. The user and/or retailer may be subject to punishment if prohibited actions are committed.

- Use in countries or regions in which radio law certification has not been obtained
- Sale in countries or regions in which radio law certification has not been obtained
- Disassembly or modification of the product
- Removal of certification labels from the product

If this product is used aboard marine vessels, the radio laws of the country bordering the territorial waters shall apply. In such cases, use shall be prohibited in countries or regions in which radio law certification has not been obtained.
Check to confirm that industrial, scientific, and medical equipment (e.g., microwave ovens), on-premises radio stations for mobile identification used in plant manufacturing lines (radio stations requiring a license), and specified low-power radio stations are not operated in the frequency band (2.4 GHz) used by the product. If the product causes radio interference to a radio station for mobile identification, take measures to eliminate radio interference—for example, using the product in a different location or stopping radio emissions.

Wireless specifications

Wireless communication	Protocol: Bluetooth® Low Energy Version: Ver. 4.2 Frequency: 2,402 MHz to 2,480 MHz Modulation: FSK Output: Maximum 6 dBm

Radio law certification (Country/region)	Details
Radio Act (Japan)	This product contains radio equipment certified to comply with technical standards in accordance with the Radio Act. Accordingly, a radio station license is not required when using this product.
	R 001-A07864 Construction design certification number: 001-A07864 Wireless frequency: 2,402 MHz to 2,480 MHz Maximum wireless output: 6 dBm
RE Directive (EU countries)	CE We declare that this equipment complies with the basic requirements of Directive 2014/53/EU and other relevant provisions. Connect to the network with radio waves of frequency 2.4 GHz band and maximum output 6 dBm.
FCC compliance (United States)	This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation. FCC CAUTION Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

	Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense. This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment and meets the FCC radio frequency (RF) Exposure Guidelines. This equipment has very low levels of RF energy that is deemed to comply without testing of specific absorption rate (SAR).
IC compliance (Canada)	This device complies with Industry Canada's license-exempt RSSs. Operation is subject to the following two conditions: This device may not cause interference; and This device must accept any interference, including interference that may cause undesired operation of the device. Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes: l'appareil ne doit pas produire de brouillage; l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement. This equipment complies with IC radiation exposure limits set forth for an uncontrolled environment and meets RSS-102 of the IC radio frequency (RF) Exposure rules. This equipment has very low levels of RF energy that is deemed to comply without testing of specific absorption rate (SAR). Cet équipement est conforme aux limites d'exposition aux rayonnements énoncées pour un environnement non contrôlé et respecte les règles d'exposition aux fréquences radioélectriques (RF) CNR-102 de l'IC. Cet équipement émet une énergie RF très faible qui est considérée comme conforme sans évaluation du débit d'absorption spécifique (DAS).
ACMA (Australia)	Model: SC-9000 

12-6 Warranty policy

RIKEN KEIKI CO., LTD. (RIKEN) warrants the product to be free from defects in material and workmanship under normal use and service for a period of the number of years to be listed in “Table: List of warranty years”, beginning on the date of shipment to the buyer. This warranty extends only to the sale of new and unused products to the original buyer. RIKEN’s warranty obligation is limited, at RIKEN’s option, to repair or replacement of a defective product that is returned to a RIKEN KEIKI Quality control center located in Japan within the warranty period. In no event shall RIKEN’s liability hereunder exceed the purchase price actually paid by the buyer for the Product.

This warranty does not include:

a) fuses, disposable batteries or the routine replacement of parts due to the normal wear and tear of the product arising from use;
b) any product which in RIKEN’s opinion, has been misused, altered, neglected or damaged, by accident or abnormal conditions of operation, handling or use;
c) any damage or defects attributable to repair of the product by any person other than an authorized dealer, or the installation of unapproved parts on the product; or

The obligations set forth in this warranty are conditional on:

a) proper storage, installation, calibration, use, maintenance and compliance with the product manual instructions and any other applicable recommendations of RIKEN;
b) the buyer promptly notifying RIKEN of any defect and, if required, promptly making the product available for correction. No goods shall be returned to RIKEN until receipt by the buyer of shipping instructions from RIKEN; and
c) the right of RIKEN to require that the buyer provide proof of purchase such as the original invoice, bill of sale or packing slip to establish that the product is within the warranty period.

THE BUYER AGREES THAT THIS WARRANTY IS THE BUYER’S SOLE AND EXCLUSIVE REMEDY AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. RIKEN SHALL NOT BE LIABLE FOR ANY SPECIAL, INDIRECT, INCIDENTAL, OR BASED ON CONTRACT, TORT OR RELIANCE OR ANY OTHER THEORY.

Since some countries or states do not allow limitation of the term of an implied warranty, or exclusion or limitation of incidental or consequential damages, the limitations and exclusions of this warranty may not apply to every buyer. If any provision of this warranty is held invalid or unenforceable by a court of competent jurisdiction, such holding will not affect the validity or enforceability of any other provision.

Contacting RIKEN KEIKI
Email us at: intdept@rikenkeiki.co.jp
Visit RIKEN KEIKI website at: https://www.rikenkeiki.com/
JAPAN: +81-3-3966-1113

Table: List of warranty years

Product warranty		
3 years		
Sensor warranty		
Sensor model	**Detection target gas**	**Warranty period**
ESF-B242	Ammonia (NH_3)	2 years
ESF-C930	Chlorine (Cl_2)	3 years
ESF-B249	Ozone (O_3)	1 year
ESF-A24E2	Hydrogen chloride (HCl)	3 years
ESF-A24D (Japan Ex model)	Hydrogen cyanide (HCN)	3 years
ESF-B248 (Japan Ex model)	Hydrogen fluoride (HF)	1 year
ESF-B248X (ATEX/IECEx model)	Hydrogen fluoride (HF)	1 year
ESF-A24D	Phosphine (PH_3)	3 years
ESF-B248	Fluorine (F_2)	1 year
ESF-A24D	Silane (SiH_4)	3 years
ESF-A24D2	Nitrogen monoxide (NO)	3 years
ESF-AA20	Nitrogen dioxide (NO_2)	3 years
ESF-A24D	Sulfur dioxide (SO_2)	3 years
ESF-A24E2	Hydrogen bromide (HBr)	3 years
ESF-B24A	Chlorine trifluoride (ClF_3)	3 years
ESF-A24D	Disilane (Si_2H_6)	3 years

Revision history

Issue	Revision details	Issue date
0	First issue (PT0-2160)	June 10, 2024

EU-Declaration of Conformity

Document No. 320CE24109

RIKEN KEIKI

We, RIKEN KEIKI Co., Ltd. 2-7-6, Azusawa, Itabashi-ku, Tokyo, 174-8744, Japan declare under our sole responsibility that the following product conforms to all the relevant provisions.

Product Name Portable Gas Detector
Model SC-9000

Council Directives	Applicable Standards
ATEX Directive (2014/34/EU)	EN IEC 60079-0:2018 EN 60079-11:2012
EMC Directive (2014/30/EU)	EN 50270:2015
RE Directive (2014/53/EU)	EN 300 328 V2.2.2 EN 301 489-1 V2.2.3 EN 301 489-17 V3.2.4 EN 62479:2010
BATTERY Regulation ((EU)2023/1542)	-
RoHS Directive (2011/65/EU[1])	EN IEC 63000:2018

[1]Including substances added by Commission Delegated Directive (EU) 2015/863

EU-Type examination Certificate No.	DEKRA 21ATEX0089X
Notified Body for ATEX	DEKRA Certification B.V. (NB 0344) Meander 1051, 6825 MJ Arnhem P.O. Box 5185, 6802 ED Arnhem The Netherlands
Auditing Organization for ATEX	DEKRA Certification B.V. (NB 0344) Meander 1051, 6825 MJ Arnhem P.O. Box 5185, 6802 ED Arnhem The Netherlands

The marking of the product shall include the following:

Ex II 1 G Ex ia IIC T4...T3 Ga

Alternative Marking:

- T3: when used with cell type MN 1500 (Duracell) at -40℃ ≤ Ta ≤ +60℃
- T4: there are two conditions when T4 is applied in a marking code.
  1) when used with cell type NCR18650GA (Panasonic) or LR6 (Toshiba) at -40℃ ≤ Ta ≤ +60℃;
  2) when used with cell type MN 1500 (Duracell) at -40℃ ≤ Ta ≤ +40℃

Place: Tokyo, Japan

Date: May. 24, 2024

Takakura Toshiyuki
General manager
Quality Control Center