



PT2E-2350

E.O. Gas Monitor

GM-600

Operating Manual

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1

Outline of the Product

Preface

Thank you for choosing our ethylene oxide (E.O.) gas monitor GM-600 (hereinafter referred to as "the monitor"). Please check that the model number of the product you purchased is included in the specifications on this manual.

This manual describes how to use the monitor properly and its specifications. Not only the first-time users but also the users who have already used the monitor must read and understand the operating manual and use this product as described in this manual.

Note that the contents of this manual are subject to change without notice for product improvement. It is also prohibited to copy or reproduce this manual, in whole or in part, without permission.

Regardless of warranty period, we shall not make any indemnification for accidents and damage caused by using the monitor.

Make sure to read the warranty policy specified on the warranty.




Purpose of use

E.O. gas, which is used for sterilization, is a highly dangerous gas. Even at low gas concentration (allowable concentration is 1 ppm for ACGIH in 2015 and Japan Society for Occupational Health in 2015), the gas may adversely affect the human body.

- This is a gas monitor to detect a small amount of E.O. gas leaking from a sterilization device or other device that uses E.O. gas. The gas monitor is a safety unit, not an analyzer or densitometer which performs quantitative/qualitative analysis/measurement for E.O. gas.
Please fully understand the features of the monitor before using it, so that it can be used properly.
- This is an E.O. gas monitor to detect E.O. gas leaking from a sterilization device or other device. Do not use the monitor with it attached to a control device, equipment, etc.
- The monitor notifies of a detected E.O. gas alarm with the buzzer and LCD backlight.
- The monitor has two-step gas alarm contact and fault alarm contact.
- The monitor outputs an alarm contact at a gas alarm state.

Definition of DANGER, WARNING, CAUTION and NOTE

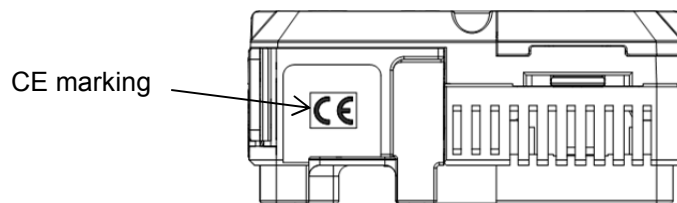
Throughout this manual, the following indications are used to ensure safe and effective work.

 DANGER	This message indicates that improper handling may cause serious damage on life, health or assets.
 WARNING	This message indicates that improper handling may cause serious damage on health or assets.
 CAUTION	This message indicates that improper handling may cause minor damage on health or assets.
NOTE	This message indicates advice on handling.

Method of confirmation for CE marking type

The CE marking is labeled on the detector in case of comply with CE marking. Please confirm the instrument specification before using. Please refer Declaration of Conformity that is at the end of this manual if you have CE marking type.

You can confirm instrument specification to see the CE marking as follows.



CE marking label (Bottom of instrument)
(DC specification only)

2

Important Notices on Safety

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



WARNING

- If an abnormality is found in the monitor, contact RIKEN KEIKI immediately. Visit our Web site to find your nearest RIKEN KEIKI office.
Web site: <http://www.rikenkeiki.co.jp/>

2-1. Danger cases



DANGER

- This is not an explosion-proof unit. Never attempt to measure a gas in an atmosphere over the lower explosive limit.
- Do not extend the remote sensor cable. If the cable is extended, the monitor will not be able to detect gas and may cause dangerous conditions.

2-2. Warning cases



WARNING

- Before turning on the monitor, always check that the voltage is compliant with the specifications. Operating on an unstable power supply may cause malfunctions.
- When the gas adjustment is performed, never fail to perform the air (zero) calibration in fresh air.
- Do not operate this monitor in a place where combustible/explosive gases or vapors are present. Operating the monitor in such an environment will lead to extreme dangers.
- Issuance of a gas alarm indicates that there are extreme dangers. Take proper actions based on your judgment.
- Perform span adjustment at fixed intervals.
- When using the monitor, make sure that the main unit is installed in contact with the atmosphere. Otherwise, correct measurement cannot be obtained and a leak accident may result.
- Do not run the power cable and remote sensor cable of the monitor in parallel with cables of high-frequency or high-voltage and other device's power cables. It may cause a malfunction.
- If a cable of high-frequency or high-voltage and the power cable need to intersect with each other, it should be orthogonally connected.
- When wiring, be careful not to apply any stresses on the cables by pulling, tightening or twisting.
- Do not disassemble/modify the monitor. It may invalidate the warranty of the performance. Changing the settings without understanding them may cause alarm malfunctions. Please use the monitor properly in accordance with the operating manual.
- Do not use the monitor with it attached to a control device, equipment, etc.

2-3. Precautions



CAUTION

- Do not use a device, such as a transceiver, which transmits a radio wave near the monitor or its cables. It may affect the measurement. If a transceiver or other radio wave transmitting device is used, it must be used in a place away from the monitor where it disturbs nothing.
- Restarting the monitor within five seconds after turning it off may cause errors.
- This is not a control unit. It is not allowed to use the external output of the monitor to control other units.
- This is a safety unit. Never fail to perform a regular maintenance to ensure safety. Continuing to use the monitor without performing maintenance will compromise the sensitivity of the sensor, thus resulting in inaccurate gas detection.
- Do not pick the sensor or buzzer opening with a sharp-pointed item. The unit may cause malfunction or get damaged, possibly resulting in incorrect measurements.
- Do not let the monitor draw in water. Do not also install the monitor in a place where the monitor may get wet. Ignoring this may cause malfunction because the monitor is not water- and drip-proof.
- Do not install the remote sensor in a place where the environmental condition exceeds the operating temperature and humidity range (temperature: -10 to +40°C, humidity: 20 to 85%Rh) or steam accumulates.
- This is a precision device. Do not give strong shock or vibration to the monitor.
- When the case is opened for wiring or other operation, do not touch inner parts. When wiring, be sure that excessive pressure is not applied to the power cable and remote sensor cable.
- Do not block the vent for the sensor.

3

Product Components

3-1. Main unit and standard accessories

After opening the carton box, check the monitor and accessories.
If there is anything missing, contact RIKEN KEIKI.

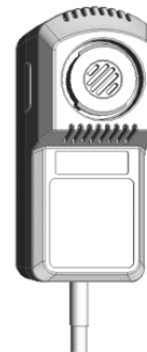
Main unit

For names and functions of individual parts of the monitor and LCD display, see "3-2. Names and functions for each part" (P.9).

GM-600 main unit



Remote sensor (cable length: 3 m)



Standard accessories

- Cross-recessed pan head machine screw (2 pcs.)
- Cross-recessed round head wood screw (2 pcs.)
- 3.2 m AC power cable (1 pc.) *Supplied only with AC specification
- Operating manual (1 pc.)



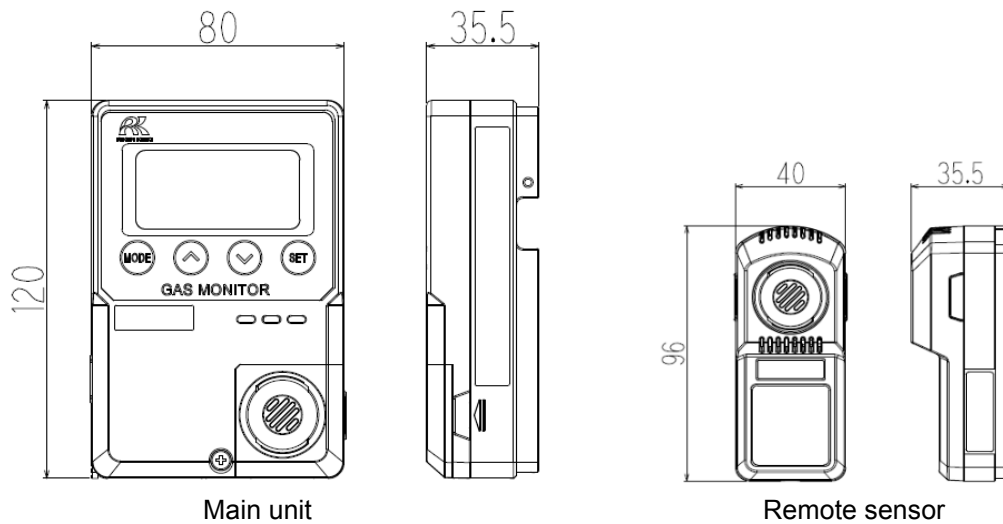
CAUTION

- The main unit and remote sensor (remote type) are precision devices. Be careful not to drop the monitor when installing or uninstalling the main unit or remote sensor. Dropping the monitor may compromise its original performance or cause malfunctions.

Optional accessories

- Installation board (1 pc.)

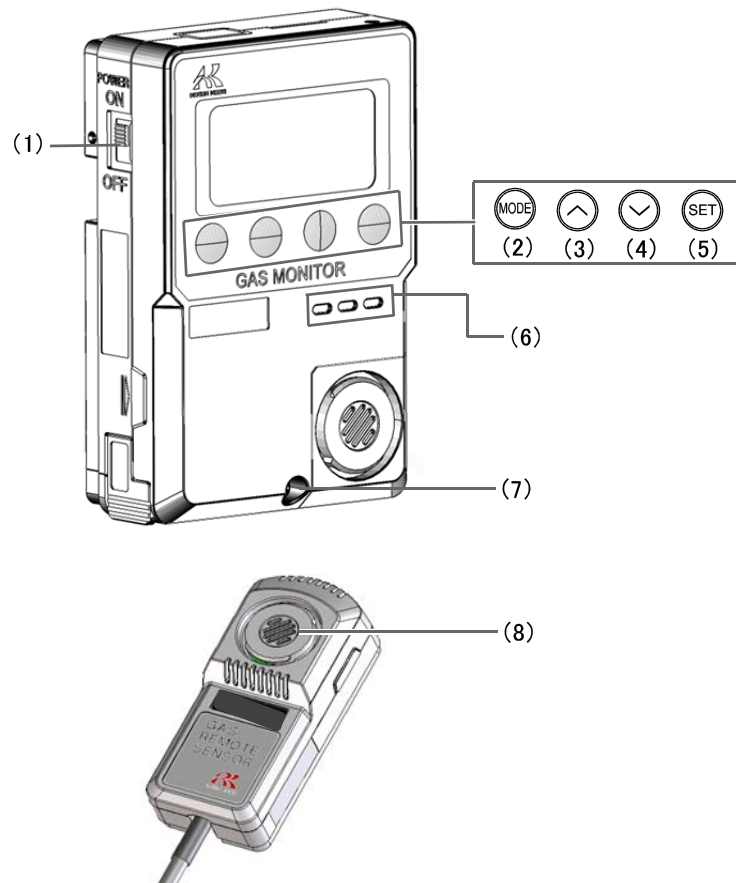
Outline drawing



3-2. Names and functions for each part

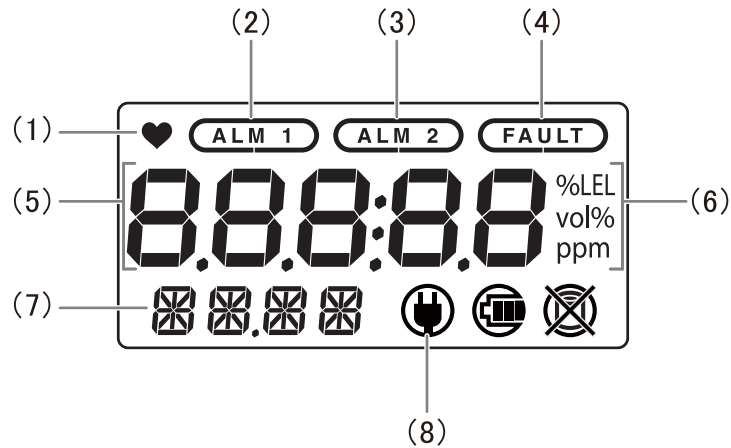
This section describes the names and functions of the individual parts and LCD display that make up the monitor.

Main unit



Name	Major function
(1) Power switch	Turns the power ON/OFF. Slide the switch up to power on and down to power off.
(2) MODE button	Used to enter the maintenance mode. It is also used to cancel or skip during setup.
(3) ^ button	Used to change the screen and increase numerical values during setup.
(4) v button	Used to change the screen and decrease numerical values during setup.
(5) SET button	Used to confirm the setting.
(6) Buzzer sound opening	Emits operation and judgment sounds. (Do not block it.)
(7) Screw	Loosen this screw to open the case.
(8) Sensor part	Detects a gas to be detected. The sensor is inside the cover.

Display



Name	Major function
(1) Operating state display	Displays the operating status. Blinks at a normal state.
(2) First alarm display	Lights up in orange at a first alarm state.
(3) Second alarm display	Lights up in red at a second alarm state.
(4) Fault alarm display	Lights up in red at a fault alarm state.
(5) Gas name display Maintenance display	Displays the gas name. Maintenance items and others are displayed during setup.
(6) Unit display	Does not display the gas concentration unit (ppm) in normal measurement.
(7) Maintenance display	Maintenance items and others are displayed during setup.
(8) AC/DC power display	Lights up when the monitor is operating on AC or DC power.

4

How to Install Gas Monitor

4-1. Precautions for installation points

When installing the monitor, never fail to observe the following precautions. Ignoring the precautions may damage the monitor, resulting in inaccurate gas detection.

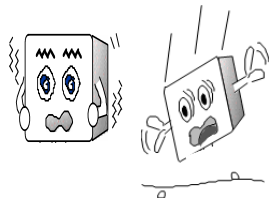


CAUTION

- This is a precision device. Because the monitor may not provide the specified performance in some places (environments), check the environment in the installation site, and then take appropriate actions if necessary. Because the monitor plays an important role for safety and disaster prevention, it must be installed in appropriate points.
- Do not install this product in any of the following locations.
 - Place exposed to direct sunlight or outside
 - Place exposed to water
 - Place exposed to ventilation from an air conditioner, etc.
 - Place exposed to soot, smoke or steam
 - Place where the temperature drops below -10°C or rises over 40°C or the temperature changes suddenly
 - Place with high humidity like a bathroom
 - Place with bad ventilation such as behind a curtain or under the shadow.

<Do not install the monitor in a place with vibrations or shocks.>

The monitor consists of sensitive electronic parts. The monitor must be installed in a stable place without vibrations or shocks, etc. and it cannot drop.



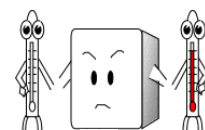
<Do not install the monitor in a place exposed to water, oil or chemicals, etc.>

When selecting installation points, avoid a place where the monitor is exposed to liquids such as water, oil, or chemicals.



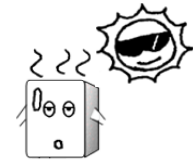
<Do not install the monitor in a place where the temperature drops below -10°C or rises over 40°C .>

The operating temperature of the monitor is -10 to $+40^{\circ}\text{C}$. Install the monitor in a stable place not exceeding the operating temperature range.



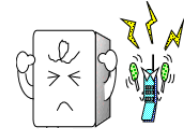
<Do not install the monitor in a place exposed to direct sunlight or sudden changes in the temperature.>

Avoid a place where the monitor is exposed to direct sunlight or radiant heat (infrared rays emitted from a high-temperature object), and where the unit temperature changes suddenly. Condensation may be formed inside the monitor, or the monitor cannot adjust to sudden changes in the temperature.



<Keep the monitor (and its cables) away from noise source devices.>

When selecting installation points, avoid a place where high-frequency/high-voltage devices exist.



<Do not install the monitor in a place where maintenance of the monitor cannot be performed or where handling the monitor involves dangers.>

Regular maintenance of the monitor must be performed. Do not install the monitor in a place where the machinery must be stopped when maintenance is performed in its inside, where parts of the machinery must be removed to perform maintenance, or where the monitor cannot be removed because racks or other things prevent access to it. Do not install the monitor in a place where maintenance involves dangers, for example, near a high-voltage cable.

4-2. Precautions for system designing

Note the following precautions for system designing of the monitor.



CAUTION

- An unstable power supply and noise may cause malfunctions or false alarms.

Using a stable power supply

The external output and alarm contact of the monitor may be activated when the power is turned on, when momentary blackout occurs, or when the system is being stabilized. In such cases, use a UPS (uninterruptible power system), or take appropriate actions on the receiving side. The monitor must be provided with the following power supply.

Power supply voltage	100 VAC ±10% (50/60 Hz), 24 VDC±10%
Allowed time of momentary blackout	Up to 10 milliseconds (To recover from the momentary blackout for 10 milliseconds or more, restart the monitor.) Example of actions To ensure continuous operation and activation, install a UPS (uninterruptible power system), etc. outside the monitor.
Others	Do not use it with a power supply of large power load or high-frequency noise. Example of actions Use a line filter, etc. to avoid the noise source if necessary.

Proper use of alarm contact

The alarm contact of the monitor is used to transmit signals to activate an external buzzer, alarm lamp or rotating lamp. Do not use it for controlling purpose (e.g., controlling the shutdown valve).



CAUTION

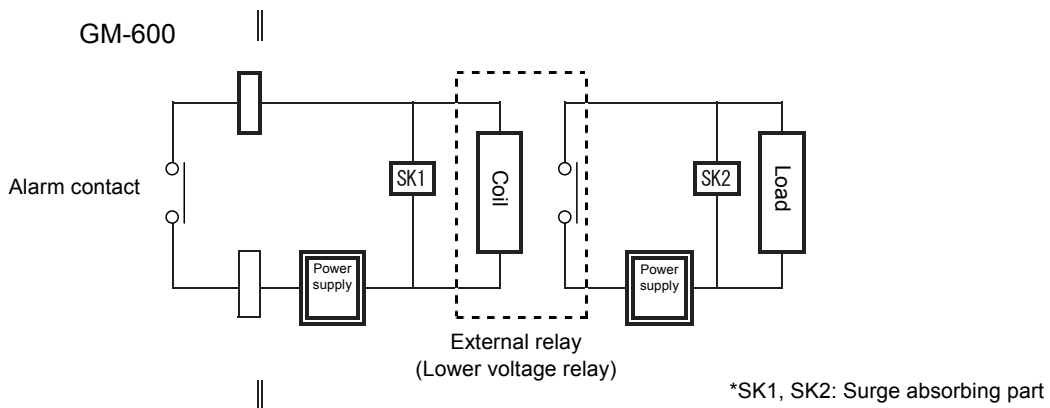
- The b contact (break contact) under de-energized state may be opened momentarily by a physical shock, such as external force.
When the b contact is selected for the alarm contact, take appropriate actions to prepare for a momentary activation, for example, add signal delay operation (approximately one second) to the receiving side of the b contact.

The specifications for the external output gas alarm contact of the monitor are based on the resistance load conditions. If inductive load is used at the alarm contact, the following errors will occur easily because counter electromotive force is generated at the contact.

- Deposition, defective insulation or defective contact at the relay contact
- Damage of any electric parts due to high-voltage generated inside the monitor
- Abnormal operations by an out-of-control CPU

If load is to be activated, appropriate measures must be taken to stabilize the operation of the monitor and protect the alarm contact referring to the following information.

- Relay it with an external relay at a lower voltage of 100 VAC or below (contact amplification). At the same time, the surge absorbing part SK1 suitable for the specifications must be attached to the external relay.
- In addition, the surge absorbing part SK2 must be attached to the loaded side of the external relay if necessary.
- It may be recommended that the surge absorbing part should be attached to the contact for certain load conditions. It must be attached to an appropriate position by checking how the load is activated.



CAUTION

- In principle, do not activate inductive load at the alarm contact of the monitor. In particular, never use the inductive load to activate a fluorescent lamp or motor.
- If inductive load is activated, relay it with an external relay (contact amplification). However, because the coil of an external relay also involves inductive load, select a relay at a lower voltage (100 VAC or below), and then protect the contact of the monitor with an appropriate surge absorbing part, such as a CR circuit.

4-3. Installation of monitor

Install the main unit on the wall 50 to 180 cm up from the floor.

If wall screws are available, remove the screw at the lower part of the main unit to open the cover and install the unit using the mounting holes on the back of the unit.



CAUTION

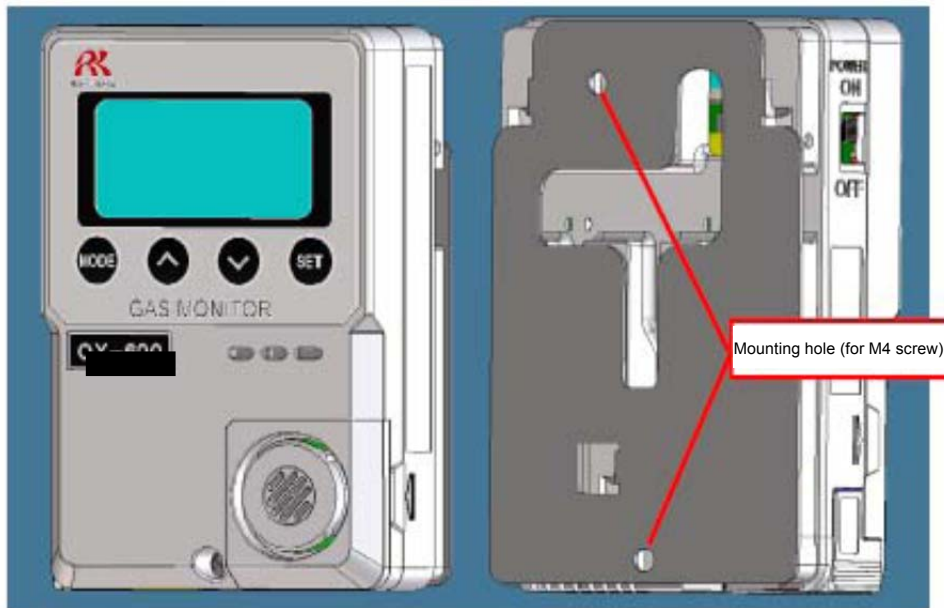
- Install the sensor in a place not directly exposed to ventilation from an air conditioner. Sudden changes in the temperature may cause the readings not to come back.



NOTE

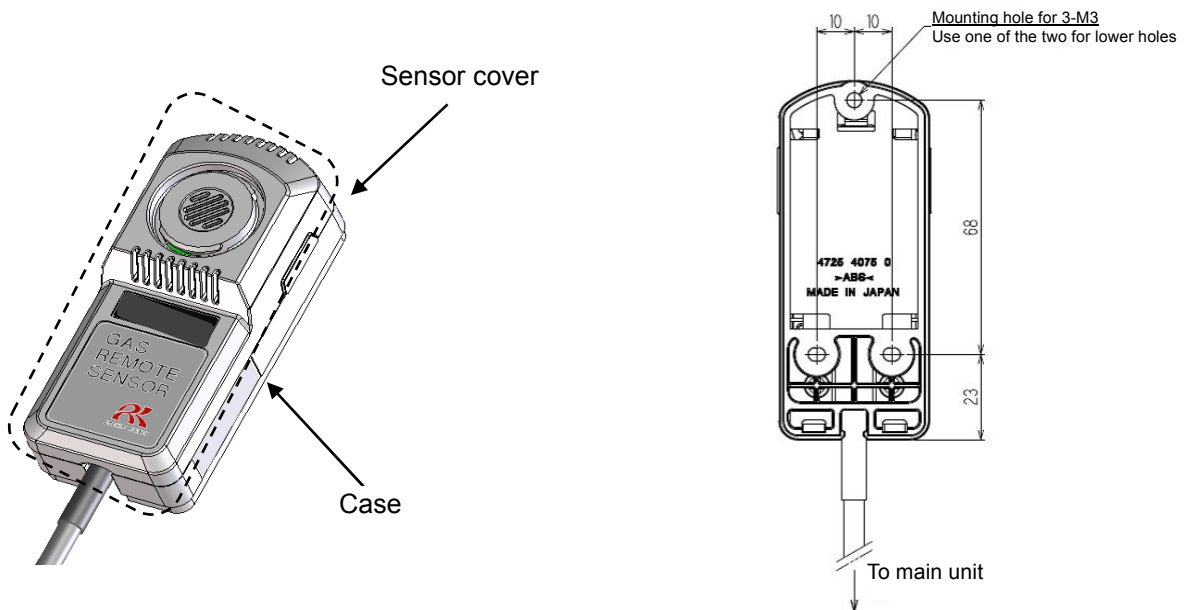
- To install the main unit to the wall with screws, use the mounting holes on the back of the unit according to the following procedure.
 - (1) Loosen the screw at the lower part of the main unit and open the surface cover of the case.
 - (2) Fix the main unit with two screws (M4) through the mounting holes.
 - (3) Put the surface cover back on the case and tighten the screw at the lower part of the main unit.

When the installation board(option) is used, fix the board before installing the main unit.



<Installation of Remote Sensor>

Install the remote sensor in a place where E.O. gas may leak and about 20 to 30 cm up from the floor.



NOTE

- To install the remote sensor, use the mounting holes on the back of the unit according to the following procedure. Tighten the screws through one upper mounting hole and one of the two lower mounting holes.
 - Open the surface cover of the remote sensor.
 - Fix the sensor with two screws (M4) through the mounting holes (one upper mounting hole and one of the two lower mounting holes).
 - Put the cover back on the remote sensor.
- Reason for installing the remote sensor about 20 to 30 cm up from the floor**
 Since the specific gravity of E.O. gas is greater than air, it tends to stay near the floor if it leaks. Installing the monitor near the floor is preferred, but it can be easily affected by dirt, dust, water droplet, etc. Therefore, it is more effective to install it about 20 to 30 cm up from the floor.

**DANGER**

- Do not extend the remote sensor cable. If the cable is extended, the monitor may not be able to detect gas and may cause dangerous conditions.

**CAUTION**

- Do not install the remote sensor in a place where the environmental condition exceeds the operating temperature range (temperature: -10 to +40°C, humidity: 20 to 85%Rh) or steam accumulates.
- When cleaning the floor near the installation site, cover the remote sensor with a plastic bag to protect it from silicon wax, etc.
- Be careful not to damage the board or case when installing or uninstalling the remote sensor.
- The remote sensor must be stored under normal temperature/humidity in a clean place away from direct sunlight.

4-4. Precautions for wiring

If the monitor operates on AC or DC power, or inductive load is used at the alarm contact, wiring work is required.

The following cables are recommended for wiring the monitor with the power supply, signal cable and contact.

<Recommended Cables>

For AC power	Solid wire/stranded wire: 0.2 - 1.5 mm ²
For DC power	CVVS: 0.2 - 1.5 mm ²
For contact	Cable such as CVV (0.2 - 1.5 mm ²) Up to 4 cores



CAUTION

- Be careful not to damage the internal electronic circuit when wiring. In addition, be careful not to apply stresses on the monitor when (overweight) cables are installed.
- The power and signal cables must be wired separately from the motor power cables.
- When stranded wires are used, prevent wires from contacting each other.

<Cable Connection Conditions>

Connectable cable, bare wire length and connection tools are as follows:

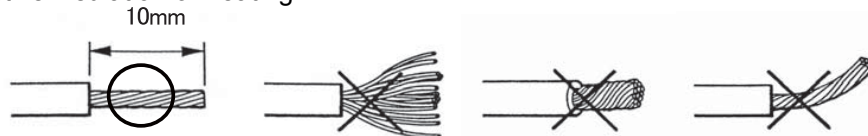
- Cable: 0.2 - 1.5 mm²
- Bare wire length: 10 - 11 mm
- Connecting tools: Dedicated screwdrivers manufactured by WAGO and equivalent (edge width 3.0 to 4.5 mm x 0.5 mm)



CAUTION

The specified bare wire length must be observed when the wire insulation is peeled off.

- Improper clamping of the wire due to a shorter bare wire length may cause defective electric conduction or heating.
- Catching the wire insulation due to a shorter bare wire length may cause defective electric conduction or heating.
- Exposing the wire due to a longer bare wire length may cause defective insulation or a short circuit.
- Be careful not to break up the wire. If the wire is broken up when inserted to the terminal, this may cause defective insulation or heating.



<Compatible Bar Terminal>

For a bar terminal, the following items are available.

- Bar terminal (ferrule): Model 216 Series (manufactured by WAGO)
- Crimping tool: Model VarioCrimp 4 (206-204) (manufactured by WAGO)



CAUTION

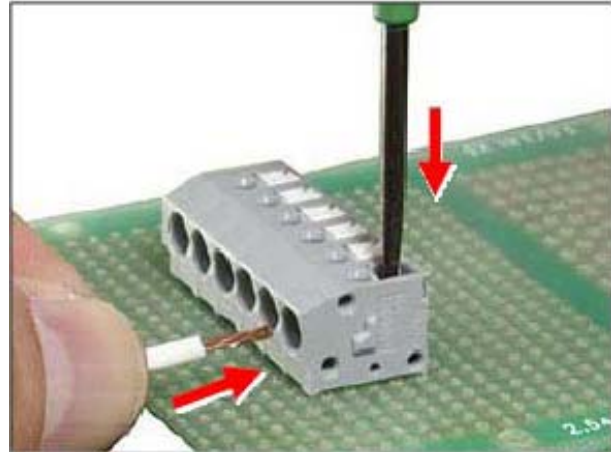
- A bar terminal of the specified model must be used. Using other bar terminals invalidates the warranty of the performance.

How to connect to terminal plate

When cables (wires) are connected to the terminal plate inside the main unit, use the dedicated screwdriver or a compatible flathead screwdriver.

When connecting a stranded wire, be sure to press the push button and open the spring while connecting the wire.

- 1 Push the push button straight downward using the compatible screwdriver or equivalent to open the spring.
- 2 Insert a wire with a specified bare wire length (10 mm) until the end of it reaches the deepest point.
- 3 Release the screwdriver. The wire is connected.



CAUTION

- Never fail to use the correct tool.
- Do not insert more than one wire into one wiring hole. If the total size (mm²) of two or more wires is within the maximum wire connection range of the terminal plate, it may cause reduced spring clamping force, defective insulation due to clogged wire sheath, defective contact or coming off of wires.

NOTE

<Compatible Screwdriver>

When opening the spring, use the compatible screwdriver manufactured by WAGO or equivalent (a screwdriver with an edge width of 3.0 to 4.5 mm x 0.5 mm which can fully open the spring: See the table below). In doing this work, be careful not to apply excessive force. Ignoring this may damage the housing/push buttons or cause dropping off of the push buttons.

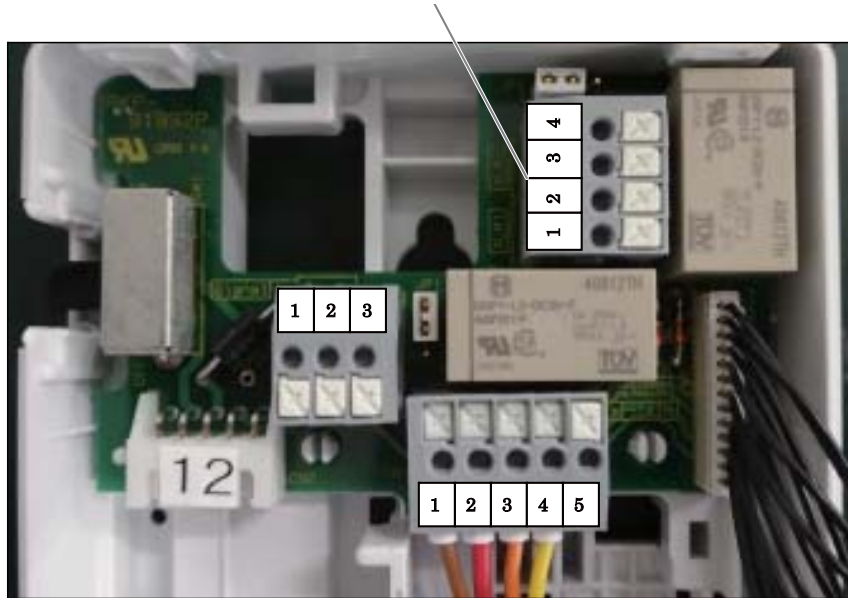
Compatible screwdriver manufactured by WAGO	
Screwdriver (M) straight type	210-120J
Screwdriver (M) straight type (short shaft & grip)	210-350/01 210-657
Screwdriver (M) straight type (insulated shaft type)	210-720



Figure of terminal plate

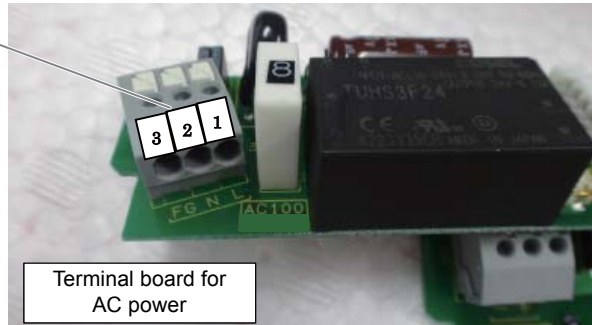
The overview of the terminal plate inside the main unit is as follows:

For Contact(TN3)
1-2: Not used
3-4: ALM2(2nd)



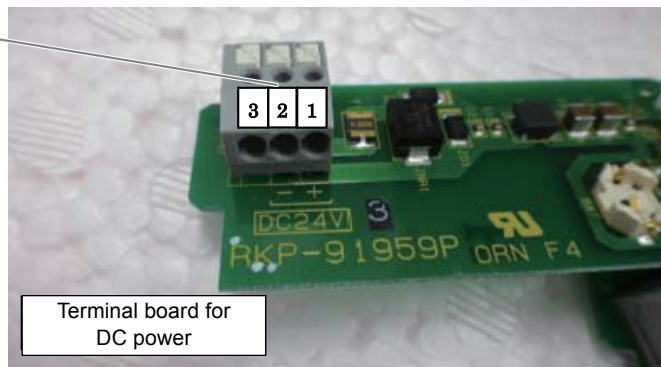
<For Connecting AC Power>

AC power (TND)
100 - 120 VAC \pm 10% (50 Hz/60 Hz)
1: L
2: N
3: FG



<For Connecting DC Power>

DC power (TND)
24 VDC \pm 10%
1: (+)
2: (-)
3: N.C



5

How to Use

5-1. Before using the monitor

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



CAUTION

- After you received the monitor, start using the monitor within the specified operation start limit of its sensor.

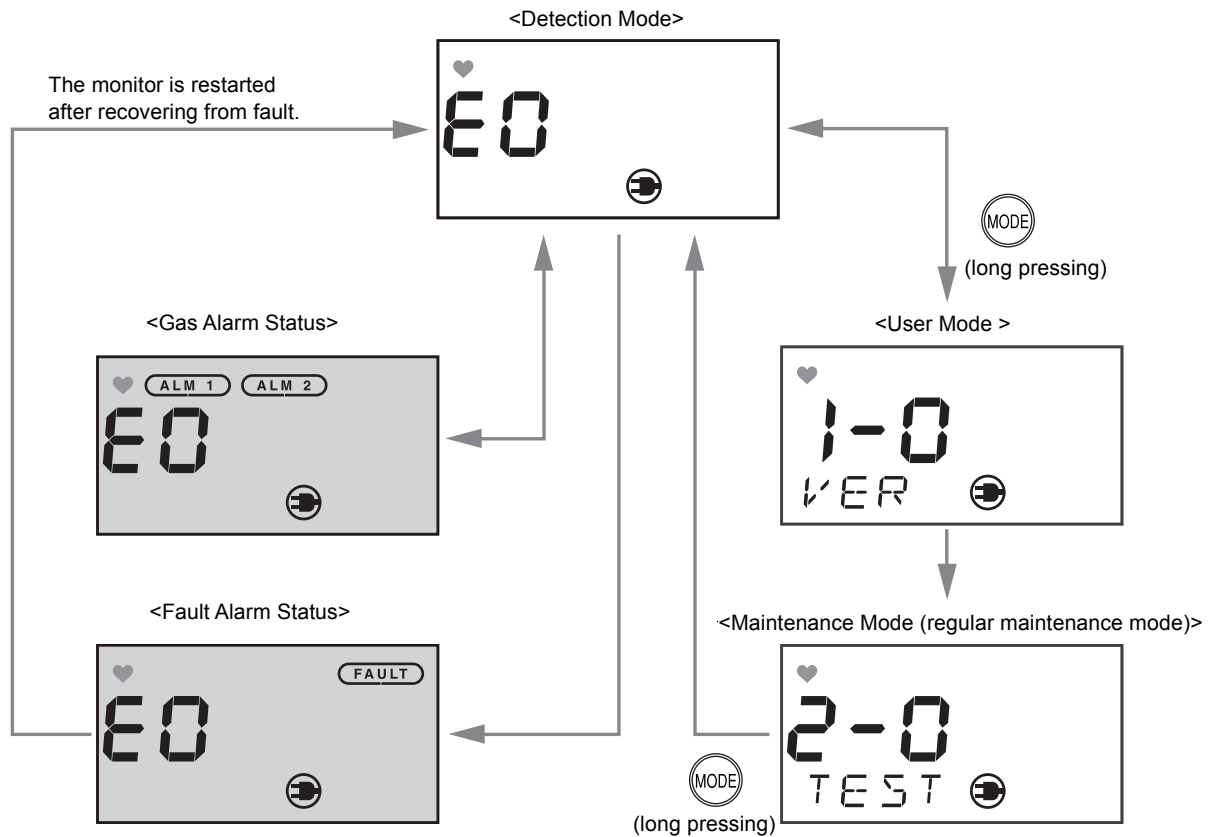
5-2. Preparation for start-up

Check the following points before starting ethylene oxide monitoring.

- Before turning on the power, check that the monitor is installed properly and the external wiring is done properly.
- Check that the power supply voltage is compliant with the specifications.
- Because the external contact may be activated during the adjustment, take measures to prevent an activated contact from having influences on external circuits.

5-3. Basic operating procedures

Normally, the detection mode is activated after the power is turned on.

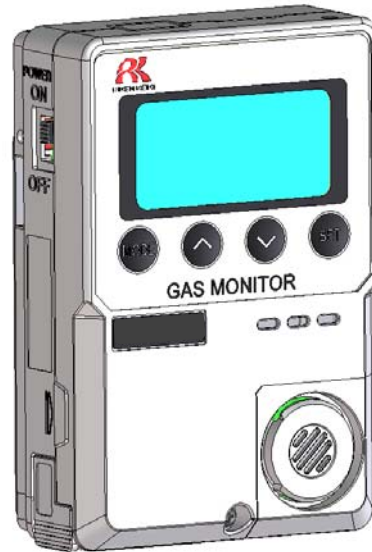
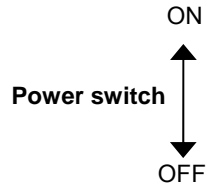


WARNING

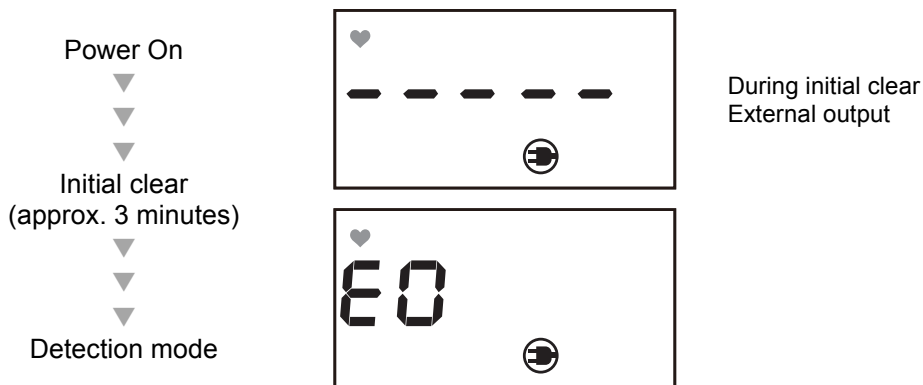
- When the alarm system enters each mode from the detection mode while an alarm is activated, the alarm contact is released.

5-4. Power-on

- Before turning on the power switch, check that the monitor is installed properly.
- Slide the power switch up to power on and down to power off.
- Turn on the power switch.
- After the monitor completes the start-up, it enters the detection



<Start-up Procedures (approximately 3 minutes for system check of the monitor and alarm deactivation)>



CAUTION

- Do not turn off the monitor during the initial clear. When turning it on again, abnormal operation may occur.
- After initial clear, perform calibration.

5-5. Modes

Mode	Item	LCD display	Details
Detection mode	—	Gas name	Normal state
Maintenance mode (User)	Version display	1-0 VER	Indicate the program version.
	Fresh air adjustment	1-1 AIR	Perform zero adjustment.
	Setting display	1-2 CONF	Not used.
	Regular maintenance mode switching	1-3 MMOD	Switch to the regular maintenance mode.
Maintenance mode (Regular maintenance)	Gas introduction display	2-0 TEST	2-00: Not used (----) 2-01: Alarm Test (ALM) 2-02: Not used (----) 2-03: Not used (----) 2-04: Not used (----)
	Zero adjustment	2-1 ZERO	Perform the zero adjustment.
	Span adjustment	2-2 SPAN	Perform the span adjustment.
	Zero/span initialization	2-3 SDEF	Not used.
	Environmental setting	2-4 SET	2-40: Not used (----) 2-41: Not used (----) 2-42: Not used (----) 2-43: Not used (----) 2-44: Not used (----) 2-45: Not used (----) 2-46: Not used (----) 2-47: Not used (----) 2-48: Not used (----) 2-49: Not used (----) 2-4A: Not used (----) 2-4b: Not used (----) 2-4C: Not used (----) 2-4d: Buzzer ON/OFF Setting (BZZR) 2-4E: Gas Alarm Contact ON/OFF (AL-R) 2-4F: Not used (----) 2-4H: LCD Backlight ON/OFF (LCD) 2-4J: Not used (----) 2-4L: Not used (----)
	Display	2-5 DISP	Not used.
	Factory mode switching	2-6 FMOD	Not used.
	User mode switching	2-7 UMOD	The monitor returns to the user mode.

5-6. User mode

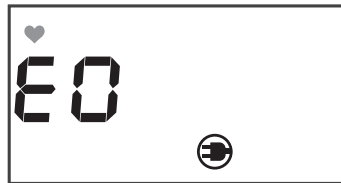


WARNING

- After the adjustment is completed, never fail to press the **MODE** button to return to the detection mode. (If the monitor remains in the user mode, it automatically returns to the detection mode in ten hours.)

Detection mode

Press the **MODE** button for three seconds.

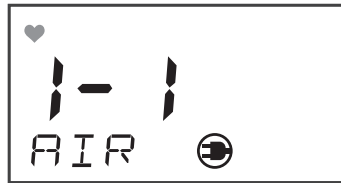


User mode

1-0.VER
Indicate the program version.



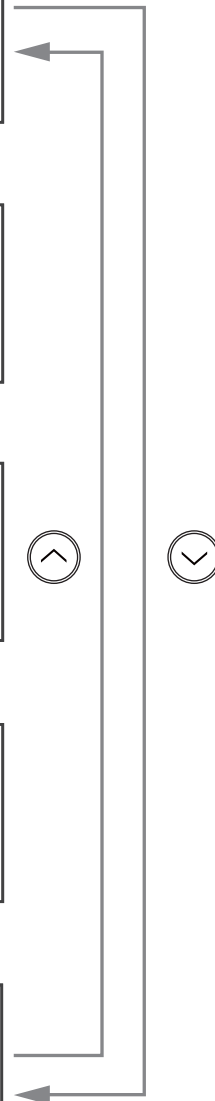
1-1.AIR
Perform the zero adjustment.



1-2.CONF
Not used.



1-3.MMOD
Switch to the regular maintenance mode.



<Fresh Air (Zero) Adjustment "1-1">

This is used to perform the fresh air adjustment.

**CAUTION**

- After power-on and warm up, never fail to perform the zero adjustment (perform in fresh air).

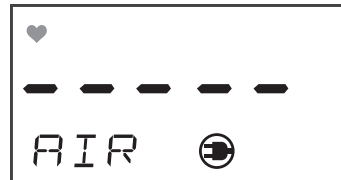
1-1.AIR

Press the **SET** button.



**Current
Concentration Value
Display**

Press the **SET** button
to display "-----".



**Fresh Air Adjustment
Completed**

Press the **SET** button
to perform the fresh air
adjustment.



If "PASS" is displayed,
the fresh air
adjustment is
completed.

If "FAIL" is displayed,
perform fresh air
adjustment again.

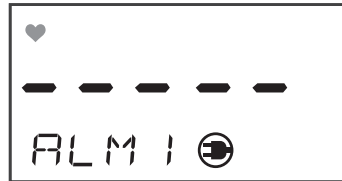
<Setting Display "1-2">

The setting display "1-2 CONF" is not used.

1-2.CONF
Not used.



When the **SET** button is pressed, press the **MODE** button to return to the previous screen.



5-7. Power-off

Slide the power switch down to power off.

After turning off the power switch of the monitor, turn off the power supply (100 VAC or 24 VDC) of the monitor.



CAUTION

- When the monitor is turned off, an alarm may be triggered on the upper (central) system. Before turning off the monitor, the inhibit (point skip) on the upper (central) system must be activated. Decide whether the power can be turned off by checking the operation of the devices connected to the external output or external contact output terminal of the monitor.

6

Alarm Activation and Functions

6-1. Gas alarm activation

A gas alarm is activated when detected gas concentration reaches the preset alarm setpoint.



CAUTION

- The monitor may trigger an alarm under the following conditions, as well as when detecting E.O. gas.
 - When using a solvent, such as alcohol, formalin, etc., near the remote sensor
 - When installing the remote sensor in a place with high humidity and temperature
 - When the monitor is covered with steam, vapor, etc.

An alarm is also triggered by the following gas concentration.

<Example>	First alarm	Second alarm
Carbon dioxide	2%	20%
Ethyl alcohol	80 ppm	500 ppm
Formalin	400 ppm	2000 ppm

- If the monitor often triggers a gas alarm for other than the above reasons, ventilate the room and investigate a place where gas leaks to eliminate the cause.
If an alarm is easily triggered, the room where the remote sensor is installed could be the cause. In such a case, ventilate the room for a long time.

NOTE

- The alarm setpoint (first alarm and second alarm) is factory-set.
- Although the alarm delay time (standard: 2 seconds) works in the monitor to prevent a false activation, it can be cancelled in the maintenance mode (P.32) if not needed.
- The alarm delay time only for the buzzer is 20 seconds.

Display operation

<Concentration Display>

In case of over the detection range (Over Scale), "〇〇〇〇" is displayed on the LCD.

<During Power-on>

The LCD is continuously displayed.

<Alarm Display (ALM1: Yellow Backlight), (ALM2: Red Backlight)>

The alarm consists of two steps. The yellow or red backlight lights up when the respective alarm setpoint value is reached to or exceeded.

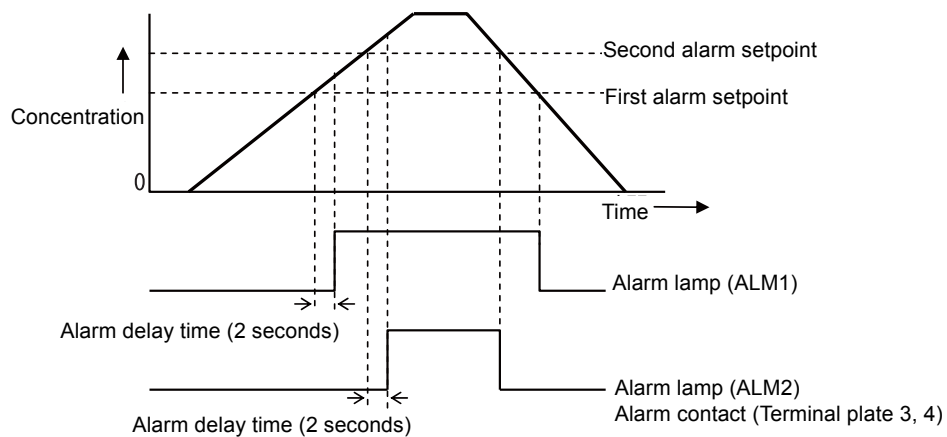
**CAUTION**

- If the monitor enters maintenance mode while a gas alarm is triggered, and if it returns to the detection mode while gas still exists, it does not trigger any alarms for about 15 minutes and cannot check if gases exist.

Contact activation

The contact is activated when the gas concentration reaches or exceeds the alarm setpoint value. The contact activation is reset automatically when the gas concentration drops below the alarm setpoint value.

"Alarm pattern (H-HH)"

**WARNING**

- If the **MODE** or **SET** button is pressed to enter another mode while an alarm is triggered, the contact activation is reset.

Response to gas alarm (In case of responding to leaked gas)

When a gas alarm is triggered, take actions in accordance with your management rules of gas alarm. Normally, take the following actions.

- Check the reading of the monitor.
- If the gas alarm display continues to be displayed, close the main valve of the gas, and then check that the gas concentration reading is back to normal.

NOTE

- If a gas leak is momentary, the reading may already be back to normal when checking it. In addition, when the alarm is triggered by noise or other incidental conditions other than a gas, the reading may have already returned to normal.

6-2. Fault alarm activation

A fault alarm is triggered when the monitor detects abnormalities. After a fault alarm is triggered, FAULT is displayed and the backlight (red) lights up on the LCD. (An error message is displayed on the LCD. Determine the causes and take appropriate actions.)

After the monitor is successfully returned from the fault, it restarts with the process normally performed right after it is turned on (initial clear).

If the monitor has problems and is repeatedly malfunctioning, contact RIKEN KEIKI immediately.

NOTE

- For information on malfunctions (error messages), see "Troubleshooting" (P.46).

7

Maintenance

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

NOTE

- The sensors of the remote sensor have a validity period and must be replaced regularly.

7-1. Maintenance intervals and items

This is a safety unit. Never fail to perform daily and regular maintenance before use.

- Daily maintenance: Perform maintenance before commencing each work.
- Regular maintenance: Perform maintenance once or more for every six months to maintain the performance as a safety unit.

Maintenance item	Maintenance content	Daily maintenance	Regular maintenance
Power supply check	Check that the LCD display lights up.	○	○
Alarm test	Inspect the alarm circuit by using the alarm test function.	—	○

<RIKEN KEIKI will keep the main unit and remote sensor during regular maintenance.>

The rough idea for span adjustment is two to three years.

Since span adjustment requires the main unit, RIKEN KEIKI will keep both the remote sensor and main unit and perform the adjustment.

If the gas sensitivity significantly deteriorates, the remote sensor will be replaced.

About maintenance services

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

To make the calibration gas, dedicated tools, such as a gas cylinder of the specified concentration and gas sampling bag must be used.

Our qualified service engineers have expertise and knowledge on the dedicated tools used for services, along with other products.

To maintain the safety operation of the monitor, please use our maintenance service.

Typical maintenance services are listed as follows. For details, please contact RIKEN KEIKI.

<Typical Maintenance Services>

Item	Services
Power supply check	Checks the power supply voltage. Checks that the LCD display lights up. (Verifies that relevant points can be identified on the system.)
Alarm test	Inspects the alarm circuit by using the alarm test function. Checks the alarm display (Checks the activation each for ALM1 and ALM2.) Checks the alarm activation such as a buzzer.
Cleaning and repair of the unit	Checks dust or damage on the surface, cover or internal parts of the unit, and cleans or repairs such parts as needed. (Visual diagnosis) Replaces parts which are cracked or damaged.
Unit operation check	Operates the buttons to check the operation of functions and parameters, etc.
Replacement of consumable parts	Replaces consumable parts, such as a sensor.

7-2. Maintenance (regular maintenance) mode

The maintenance mode allows for checking the status of the monitor and adjusting and changing the settings.



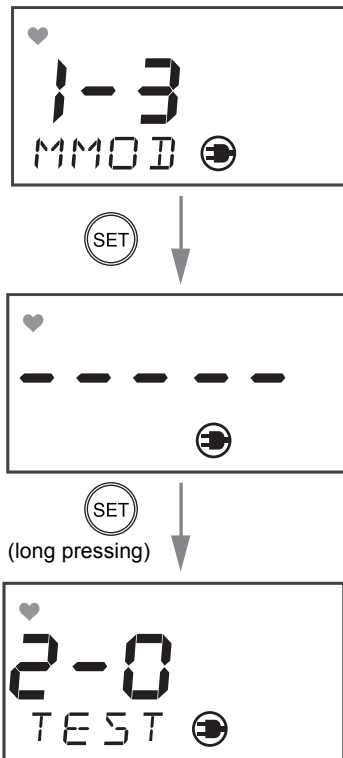
WARNING

- After adjustment, press the **MODE** button to return to the measuring state.
The monitor automatically returns to the measuring state in 10 hours.

Mode	Item	LCD display	Details
Maintenance Mode (Regular maintenance)	Gas introduction display	2-0 GAS TEST	2-00: Not used (----) 2-01: Alarm Test (ALM) 2-02: Not used (----) 2-03: Not used (----) 2-04: Not used (----)
	Zero adjustment	2-1 ZERO	Perform the zero adjustment.
	Span adjustment	2-2 SPAN	Perform the span adjustment.
	Zero/span initialization	2-3 SDEF	Not used.
	Environmental setting	2-4 SET	2-40: Not used (----) 2-41: Not used (----) 2-42: Not used (----) 2-43: Not used (----) 2-44: Not used (----) 2-45: Not used (----) 2-46: Not used (----) 2-47: Not used (----) 2-48: Not used (----) 2-49: Not used (----) 2-4A: Not used (----) 2-4b: Not used (----) 2-4C: Not used (----) 2-4d: Buzzer ON/OFF Setting (BZZR) 2-4E: Gas Alarm Contact ON/OFF (AL-R) 2-4F: Not used (----) 2-4H: LCD Backlight ON/OFF (LCD) 2-4J: Not used (----) 2-4L: Not used (----)
	Display	2-5 DISP	Not used.
	Factory mode switching	2-6 F MODE	Not used.
	User mode switching	2-7 U MODE	The monitor returns to the user mode.

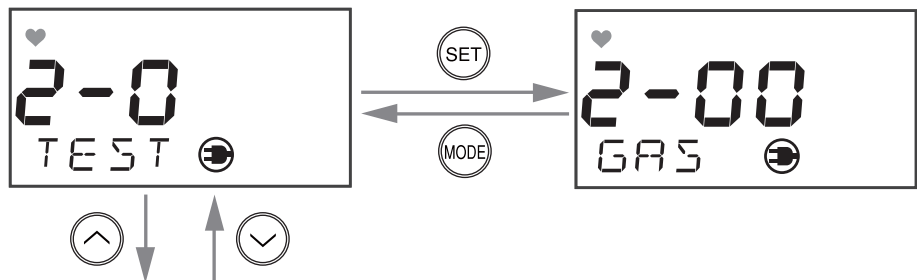
<Regular Maintenance Mode>

User mode
Press the **SET** button
in "1-3. M MOD".

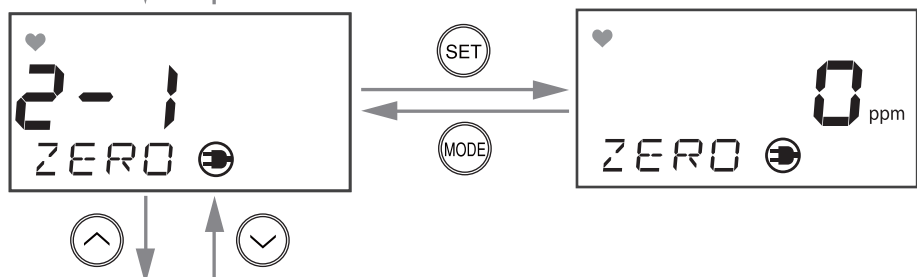


Then press the **SET** button again for about three seconds.

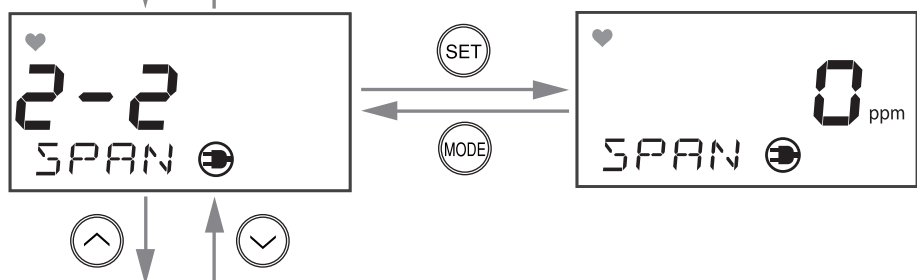
2-0.GAS TEST
Perform an alarm test
in 2-01.



2-1.ZERO
Perform the zero
adjustment.



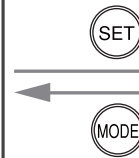
2-2.SPAN
Perform the span
adjustment.



2-3.SDEF
Not used.



2-4.SET
Specify the settings.



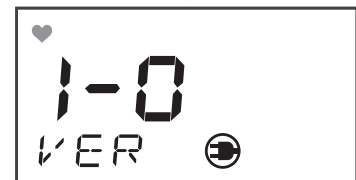
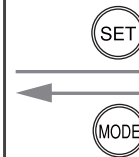
2-5.DISP
Not used.



2-6.F MODE
Not used.

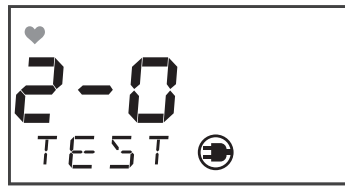


2-7.U MODE
The monitor returns to the user mode.

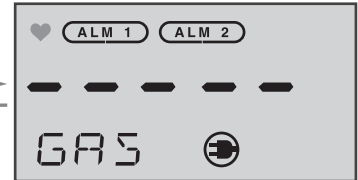


<Gas Introduction Display>

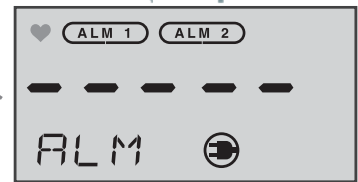
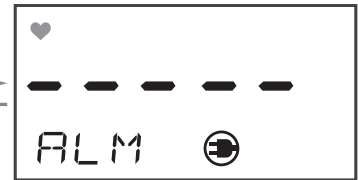
2-0.GAS TEST
Perform an alarm test in 2-01.



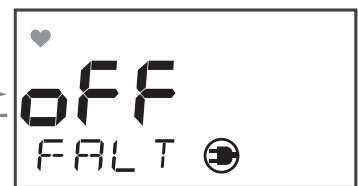
2-00.GAS
Not used.



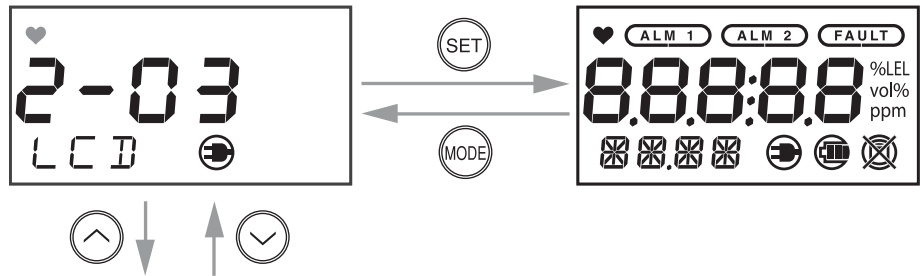
2-01.ALM
Perform the alarm test. Alarm display is changed by pressing Δ ∇ button.



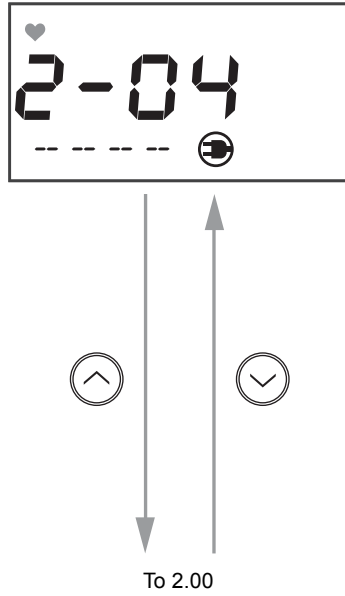
2-02.FALT
Not used.



2-03.LCD
Not used.



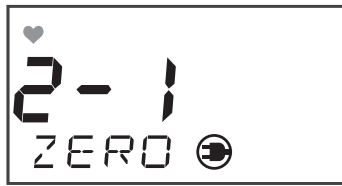
2-04.
Not used.



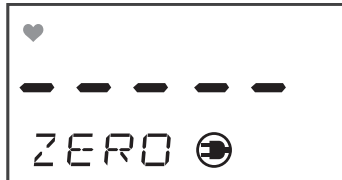
<Zero Adjustment>

2-1.ZERO
Perform the zero adjustment.

Press the **SET** button.



Press the **SET** button again.



"PASS" is displayed when adjustment is completed, and "FAIL" is displayed when it fails.
If "FAIL" is displayed, perform zero adjustment again.



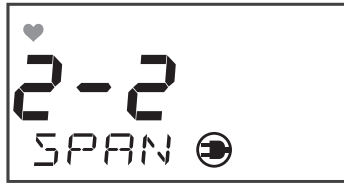
Zero adjustment will end.



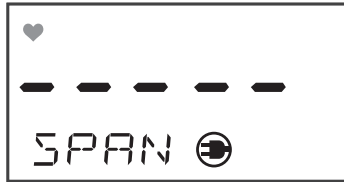
2-2.SPAN

Perform the span adjustment.

Press the **SET** button.



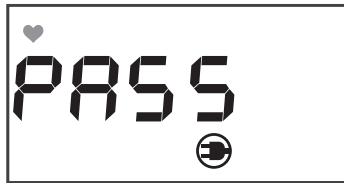
Press the **SET** button again.



Supply calibration gas and press the **SET** button.



"PASS" is displayed when adjustment is completed, and "FAIL" is displayed when it fails.
If "FAIL" is displayed, perform span adjustment again.

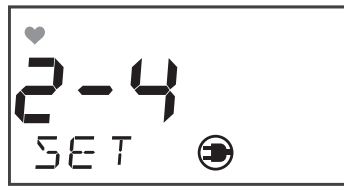


Span adjustment will end.



<Environmental Setting>

2-4.SET
Specify the settings.



2-40.
Not used.



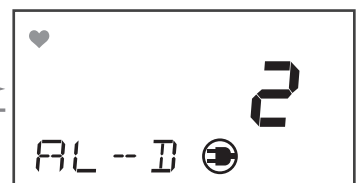
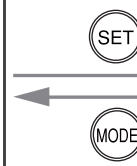
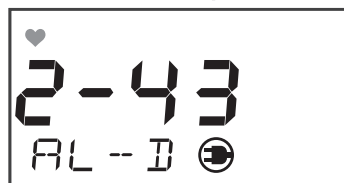
2-41.
Not used.



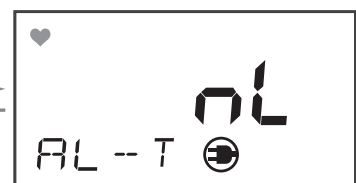
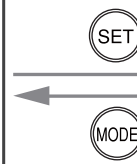
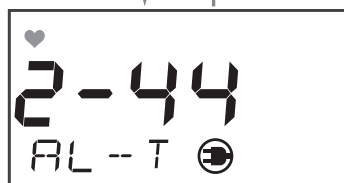
2-42.AL-P
Not used.



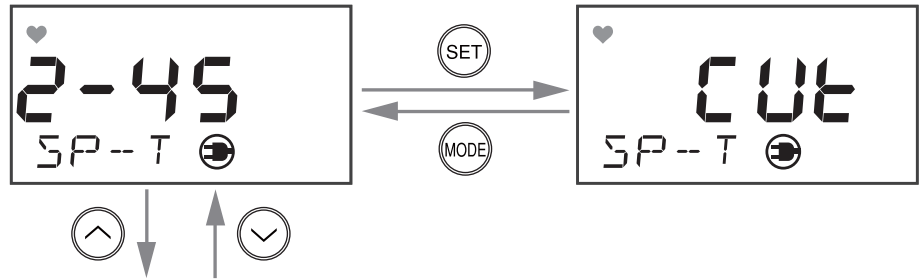
2-43.AL-D
Not used.



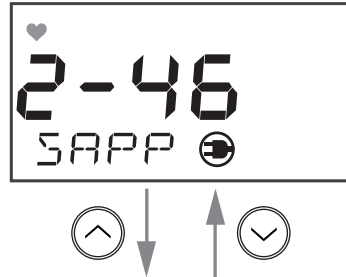
2-44.AL-T
Not used.



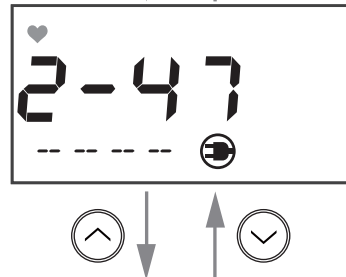
2-45.SP-T
Not used.



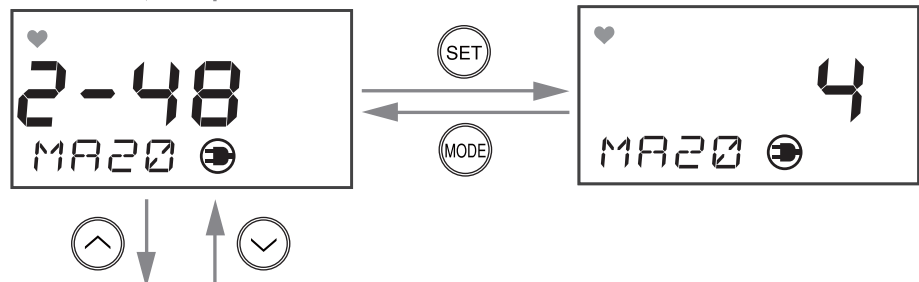
2-46.SAPP
Not used.



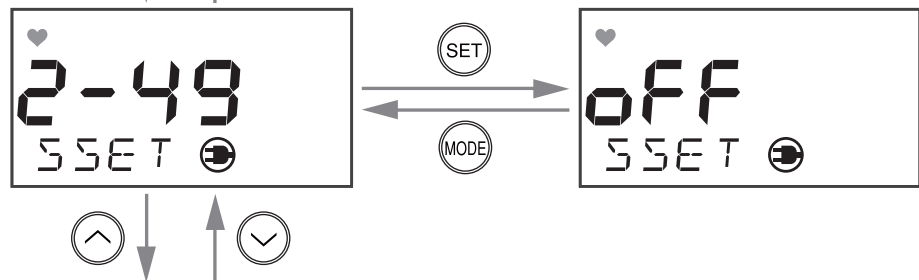
2-47.
Not used.



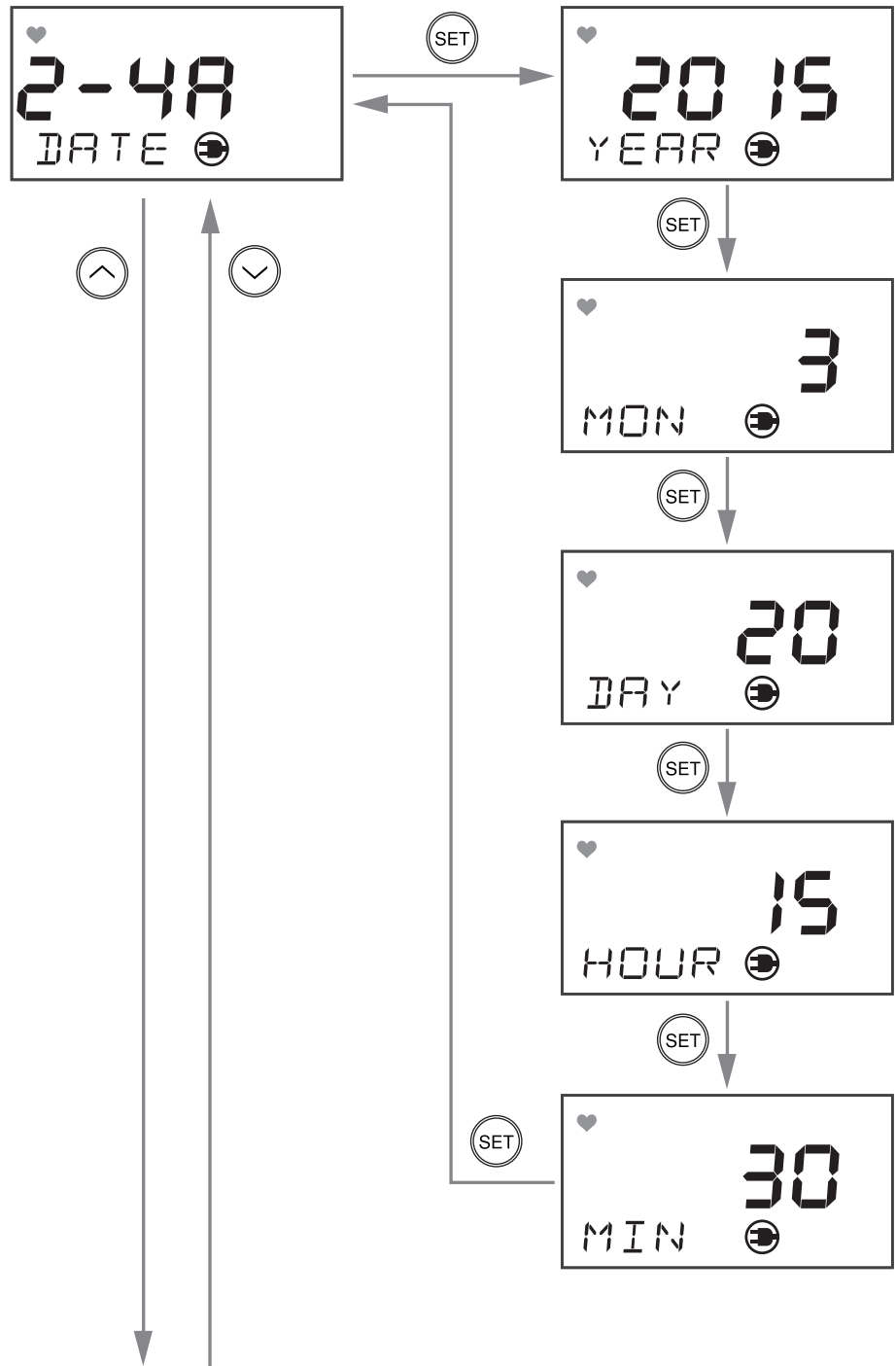
2-48.MA20
Not used.



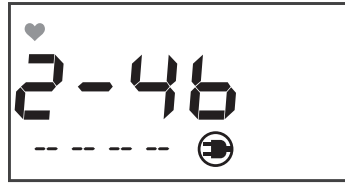
2-49.SSET
Not used.



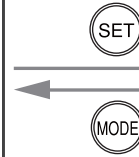
2-4A.DATE
Not used.



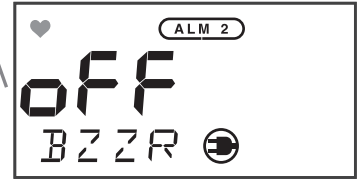
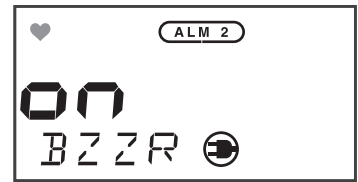
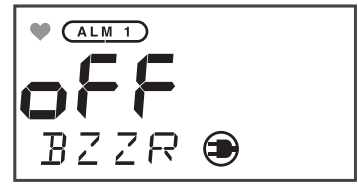
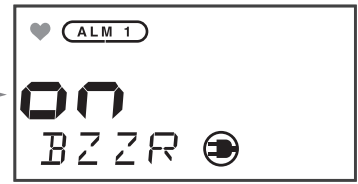
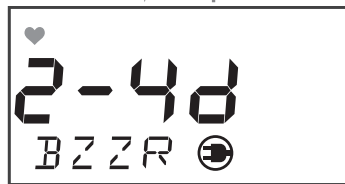
2-4b.
Not used.



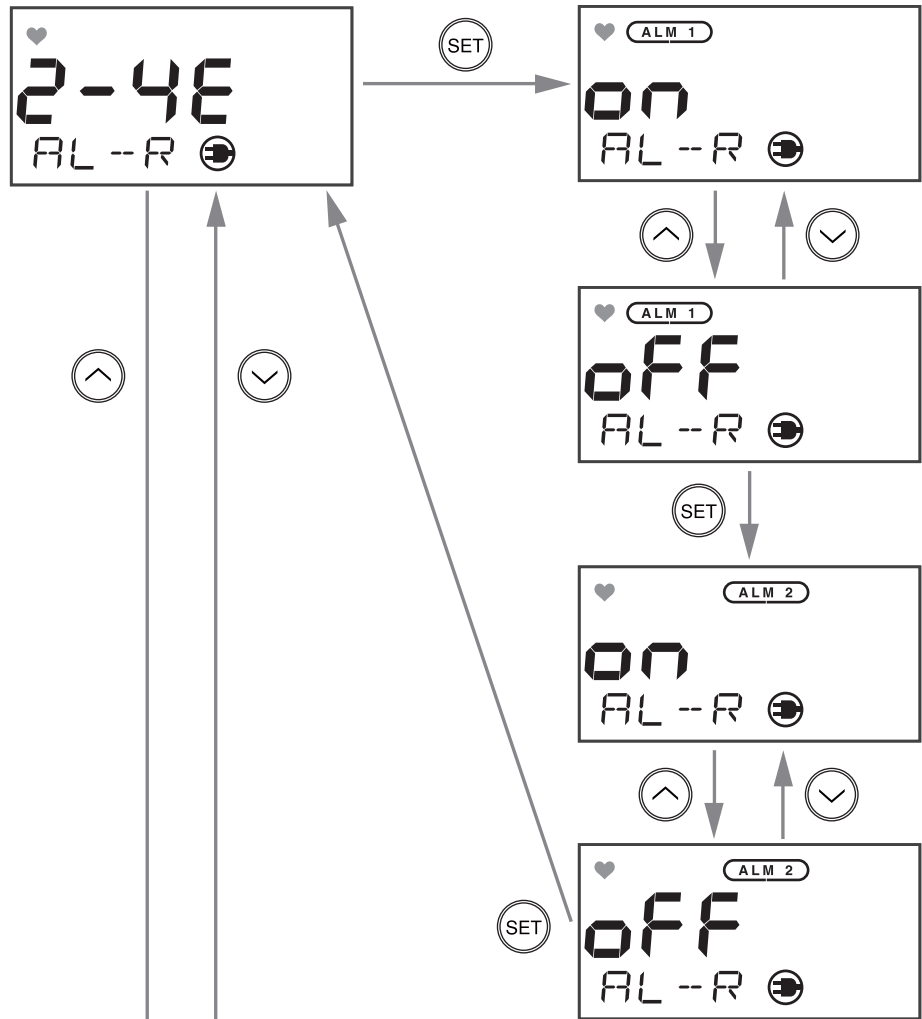
2-4C.TERY
Not used.



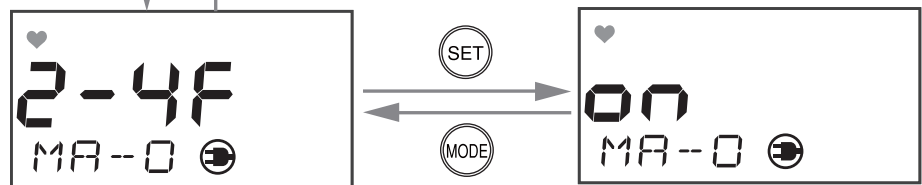
2-4d.BZZR
Set the buzzer to ON/OFF.



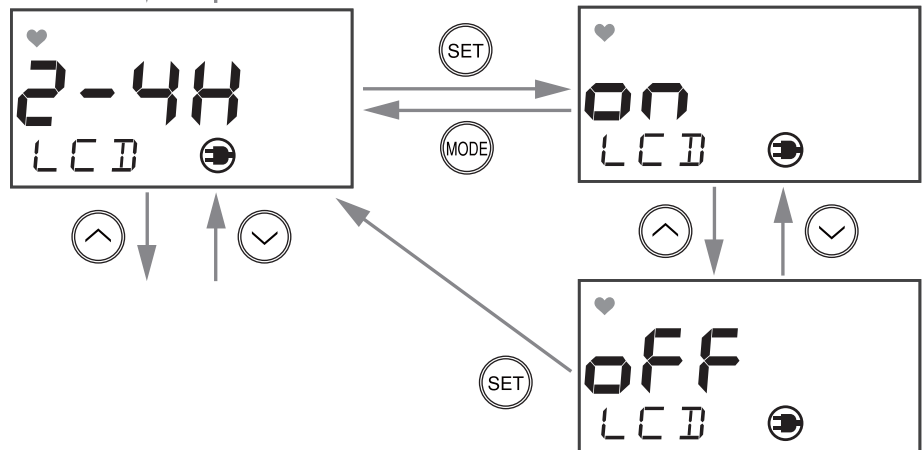
2-4E.AL-R
Set the gas alarm state contact to ON/OFF.



2-4F.MA-O
Not used.



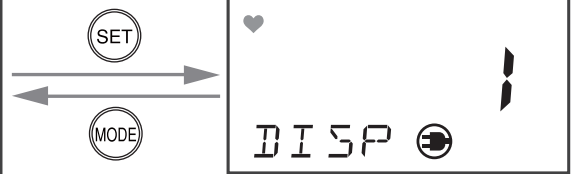
2-4H.LCD
Set the LCD backlight to ON/OFF.



2-4J.TYPE
Not used.



2-4L DISP
Not used.



8

Storage and Disposal

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

The monitor must be stored under the following environmental conditions.

- In a dark place under the normal temperature and humidity away from direct sunlight
- In a place where gases, solvents or vapors, etc. are not present

If the remote sensor continues to be unpowered, it takes long for the sensor to be stabilized. A time before the sensor is stabilized varies depending on the unpowered time. The following table shows an approximate time before the sensor is stabilized.

Unpowered time	Initial powered time
24 hours or less	4 hours or more
72 hours or less	24 hours or more
10 days or less	2 days or more
Less than 1 month	7 days or more
Less than 3 months	14 days or more
3 months or more	1 month or more

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

8-2. Procedures to relocate the monitor or use it again

When the monitor is relocated, see "Precautions for installation points" (P.11) and "Installation of monitor" (P. 14) for relocation sites and wiring work.

For wiring work, see "Precautions for wiring" (P.17) as well. The unpowered time must be minimized when the monitor is relocated.



CAUTION

- When using a relocated or stopped/stored monitor again, never fail to perform a calibration. Contact RIKEN KEIKI for information on readjustment including calibration. (RIKEN KEIKI will keep the monitor for adjustment.)

8-3. Disposal of products

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

Never fail to return the used sensor to RIKEN KEIKI.

If liquid is leaked from the sensor, do not touch the liquid. The sensor must be put into a plastic bag to prevent the liquid from leaking to the outside. If any liquid leaked from the sensor is found in the monitor unit, turn off the power and contact RIKEN KEIKI immediately.

9

Troubleshooting

The Troubleshooting does not explain the causes of all the malfunctions which occur on the monitor. This simply helps to find the causes of malfunctions which frequently occur.

If the monitor shows a symptom which is not explained in this manual, or still has malfunctions even though remedial actions are taken, please contact RIKEN KEIKI.

Symptom/Display	Causes	Actions
The power cannot be turned on.	The power switch is turned off.	Turn on the power switch.
	Abnormalities/momentary blackout of power supply system	Provide the rated voltage. Take measures such as checking or adding the UPS, power supply line filter and insulation transformer.
	The main unit is not installed properly.	Check whether the main unit is properly attached to the wall-mounted unit.
	Cable abnormalities (open circuit/not connected/short circuit)	Check the wiring of the monitor and related devices around it.
Abnormal operations	Disturbances by sudden surge noise, etc.	Turn off and restart the monitor. If a symptom like this is observed frequently, take appropriate measures to eliminate the noise.
Sensor abnormalities E-1	The remote sensor is not connected or improperly connected.	Check that the remote sensor is connected and the connectors of the sensor board are securely fastened.
	Errors in communication with the remote sensor	Replace the sensor board with new one.
Clock abnormalities E-9	Abnormalities of the clock inside the monitor	Make a setting of date/time. If a symptom like this is observed repeatedly, the built-in clock is seemingly malfunctioning. Thus, it must be replaced. Please contact RIKEN KEIKI.
System abnormalities E-9 SYSTEM	The rated voltage is not supplied to the monitor.	Check the power supply, and supply the rated voltage.
	Abnormalities of ROM, RAM or EEPROM inside the monitor	Please contact RIKEN KEIKI.
The reading drops and it remains so.	Drifting of sensor output	Perform the zero calibration.
	Presence of interference gas	Disturbances by interference gases, such as solvents, cannot be eliminated completely. For information on actions, such as removal filter, please contact RIKEN KEIKI.
	Environmental changes	Perform the zero calibration.

Symptom/Display	Causes	Actions
An alarm is triggered despite of no abnormalities at the detection point.	Presence of interference gas	Disturbances by interference gases, such as solvents, cannot be eliminated completely. For information on actions, such as removal filter, please contact RIKEN KEIKI.
	Disturbance by noise	Turn off and restart the monitor. If a symptom like this is observed frequently, take appropriate measures to eliminate the noise.
	Sudden change in the environment	When the environment (temperature, etc.) changes suddenly, the monitor cannot adjust to it and is affected by it. In some cases, the monitor triggers an indication alarm. Because the monitor cannot be used under sudden and frequent environmental changes, the user should take some preventive actions to eliminate them, for example, relocating the monitor to a place not directly exposed to ventilation from an air conditioner.
	Deteriorated sensor sensitivity	Replace the sensor with new one.
	Lack of warm-up	Take enough warm-up time.
Span adjustment impossible	Improper calibration gas concentration	Use the proper calibration gas.
	Deteriorated sensor sensitivity	Replace the sensor with new one.

10

Product Specifications

10-1. List of specifications

Model	GM-600	
Power supply specification	100 VAC ($\pm 10\%$) 50 Hz/60 Hz	24 VDC ($\pm 10\%$)
Detection principle	Semiconductor	
Detection method	Diffusion type	
Gas to be detected	Ethylene oxide (E.O.)	
Alarm setpoint value	1st	10 ppm
	2nd	50 ppm
Gas alarm type	Two-step alarm (H-HH)	
Alarm delay (second alarm, lighting up the red backlight)	30 seconds or less	
Alarm delay time	20 seconds (only for buzzer)	
Gas alarm display	1st	Displays the gas name (E.O.), lights up in orange (with the orange backlight), auto-reset
	2nd	Lights up the gas name (E.O.) display in red (with the red backlight), sounding buzzer, auto-reset
External output	Gas alarm contact (second)	No-voltage contact (first, second): 1a or 1b and auto-reset Rated load: 125 VAC 1 A or 30 VDC 1 A (resistant load)
Power consumption	Maximum Approx. 6 VA	Maximum Approx. 4 W
Use temperature/humidity range	-10 - +40°C (At a constant condition), Below 20 - 85%Rh (Non-condensing)	
Structure	Wall mounting type, sensor (remote type)	
Dimensions (main unit/remote sensor)	Approx. 80 (W) x 120 (H) x 35.5 (D)/Approx. 40 (W) x 96 (H) x 35.5 (D)	
Weight (main unit/remote sensor)	Approx. 200 g/Approx. 60 g	Approx. 180 g / Approx. 60 g
Main unit - Remote sensor cable	Approx. 3 m	

10-2. List of accessories

- Cross-recessed pan head machine screw (2 pcs.)
- Cross-recessed round head wood screw (2 pcs.)
- 3.2 m AC power cable (1 pc.) *Supplied only with AC specification
- Operating manual (1 pc.)

10-3. Optional accessories

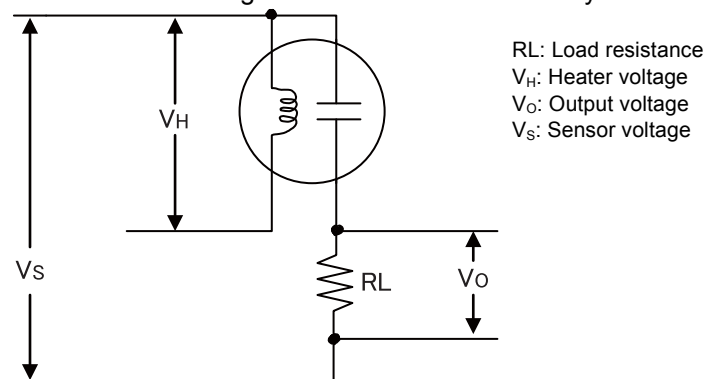
- Installation board (1 pc.)

11

Appendix

11-1. Detection principle of semiconductor type

The electric conductivity of semiconductor changes when gas is adsorbed on its surface. The monitor can measure gas concentration based on changes in the electric conductivity.



Important precautions

1. The monitor may be interfered by gases other than the gas to be detected, solvents, vapors, etc. Please note that the alarm may be triggered by interference. In addition, it may be fluctuated by environmental (temperature, humidity, etc.) changes in the installation site.
2. The alarm must be set within a range where the performance of the monitor can be ensured. In facilities compliant with the High Pressure Gas Safety Act, an alarm setting below our standard alarm setpoint (threshold limit value) may trigger a false alarm.
3. This is a safety unit, not a control unit.
The alarm contact output of the monitor must be used for an external alarm lamp/buzzer, while the analog signal output must be used for an indicator or external recorder. If these outputs are used to control other units, we shall not be responsible for any malfunctions.
4. The gas sensing part of the gas detection sensor installed in this monitor is made of porous sintered alloy. If silicon or sulfide compounds are accumulated on the surface of porous sintered alloy, the area of the gas sensing part becomes smaller, which may result in serious deterioration of its sensitivity. For safety reasons, do not use the monitor under the presence of silicon or sulfide compounds even though their amount is very small.
5. For maintenance of the monitor, it must go through a regular maintenance, including replacement and adjustment of the regular replacement parts as specified in the operating manual. In addition, because this is a safety unit, it is recommended that a regular maintenance and a calibration are performed every six months in accordance with the regulations.

11-2. Definition of terms

ACGIH	It stands for American Conference of Governmental Industrial Hygienists, an institution to recommend a guideline for toxicity of materials.
ppm	Gas concentration indicated in the unit of one-millionth of the volume
Initial clear	The reading is unstable for seconds after the power is turned on. To prevent malfunctions for that period, the alarm contact is deactivated. In addition, a signal to indicate the initial clear status is sent out to the external output.
Alarm delay time	A function which temporarily suspends activation to prevent a false alarm caused by noise from its outside.
Calibration	Find relationship of the readings, display values or setpoints with the actual values by using the calibration gas.
Japan Society for Occupational Health	It is an institution to set and recommend a guideline for toxicity of materials in Japan.
Maintenance mode	When maintenance is performed on the monitor, the alarm contact is disconnected, and a signal to indicate the maintenance mode status is sent out to the external output signal. As a result, maintenance can be performed on a single unit of the monitor.

Declaration of Conformity

We, **RIKEN KEIKI CO., LTD.**

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

declare in our sole responsibility that the following product conforms to all the relevant provisions.

Product Name: Compact Gas Monitor

Model Name: DC24V(DC model)(OX-600/EC-600/GM-600)
DC3V(Battery model)(OX-600/EC-600)

Council Directives: EMC 2004/108/EC
RoHS : 2011/65/EU

Applicable Standards: EMC EN50270:2015
RoHS : EN50581(2012)

Year to begin affixing CE Marking: 2015

Place: Tokyo, Japan

Signature: *Tetsuya Kawabe*

Full Name: Tetsuya Kawabe

Date: Jul 31, 2015

Title: Director, Quality control center