



# Combustible Gas Detection Alarm System

## **GP-147**

### **Operating Manual**

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## 1

# Outline of the Product

## 1-1. Preface

Thank you for choosing our combustible gas detection alarm system GP-147.




Please check that the model number of the product you purchased is included in the specifications on this manual.

This manual explains how to use the alarm system and its specifications. It contains information required for using the alarm system properly. Not only the first-time users but also the users who have already used the product must read and understand the operating manual to enhance the knowledge and experience before using the alarm system.

## 1-2. Purpose of use

- This product is a combustible gas detection alarm system designed exclusively for the detector head using combustible gas sensor.
- The alarm system is a safety unit, not an analyzer or densitometer which performs quantitative/qualitative analysis/measurement for gases. Please fully understand the features of the alarm system before using it, so that it can be used properly.
- A combustible gas that leaked into the air is detected by a combustible gas detector head connected to the indicator/alarm system.  
As a detection result, gas concentration is displayed on the LCD (bar meter display (green and red)). Gas concentrations are displayed in different colors according to danger levels, i.e., in green when the alarm setpoint is not exceeded, and in red if the alarm setpoint is reached or exceeded.
- The alarm system is equipped with the gas alarm contacts of two individual outputs "(First gas alarm contact) + (First gas alarm contact [standard] or Fault alarm contact [option])".
- The base unit provides a common alarm contact, common alarm voltage output (0/6/12 VDC [standard]), contact output for an external buzzer and 24 VDC (load: 10 mA or less) voltage output.
- The alarm system can incorporate a UPS (uninterruptible power system) battery to continue gas detection in the event of a blackout.

## 1-3. Definition of DANGER, WARNING, CAUTION and NOTE

 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.

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# Important Notices on Safety

## 2-1. Danger cases



**DANGER**

This is not an explosion-proof unit.

## 2-2. Warning cases



### WARNING

- **Specified devices**  
Connect only the combustible gas detector heads provided by RIKEN KEIKI to the alarm system. Otherwise, the alarm system or equipment connected to it may be damaged.
- **Power supply**  
Before turning on the alarm system, always check that the voltage is properly applied. Do not use an unstable power supply because it may cause malfunctions.
- **Need of protective grounding**  
Do not cut the protective grounding wire inside or outside the alarm system or disconnect the wire from the grounding terminal.
- **Defects in protective functions**  
Check the protective functions, such as protective grounding and fuse, for a defect. If any defect in protective grounding or other protective functions is suspected, do not operate the alarm system.
- **Fuse**  
To prevent fire, use a fuse with the specified ratings (current, voltage and type) for the alarm system.  
Turn the POWER switch OFF and cut the mains power before replacing a fuse.  
Do not use an unspecified fuse or short-circuit the fuse holder.
- **Operation in a gas**  
Do not operate the alarm system in a place where combustible/explosive gases or vapors are present. Operating the alarm system in such an environment will lead to extreme dangers.
- **External connection**  
Before connecting the alarm system to a detection target or external control circuit, securely connect it to a protective grounding circuit.
- **Maintenance of internal parts**  
Before replacing internal parts or performing any work with the door open, make sure to turn the power switch OFF.
- **Response to a gas alarm**  
There are extreme dangers if a gas exceeding an alarm setpoint is detected. Take proper actions based on your judgment.

## 2-3. Precautions

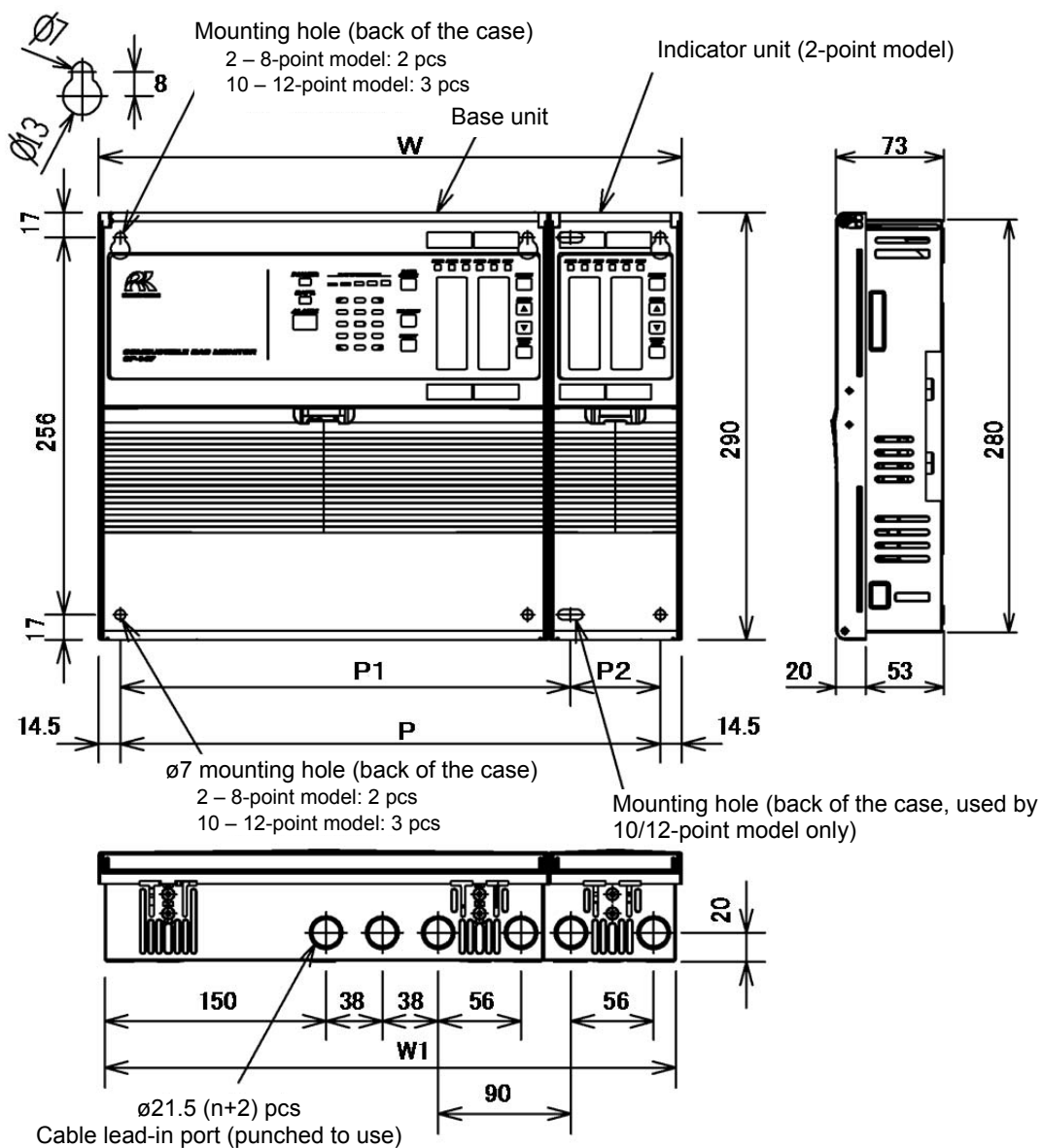


### CAUTION

- Do not use a transceiver near the alarm system.  
Radio wave from a transceiver or other radio wave transmitting device near the alarm system or its cables may disturb readings.
- To restart the alarm system, you must wait 5 seconds or more before doing it.  
Restarting the alarm system in less than 5 seconds may cause errors.
- Do not use the external output of the alarm system to control other units.  
This is not a control unit. It is not allowed to use the external output of the alarm system to control other units.
- Careful consideration should be given to instrumentation to maintain safety even when a trouble like disconnection of power/signal cable or unexpected malfunction or failure occurs.
- Be careful that it may be affected, in rare cases, by electrical noises, static electricity and electromagnetic noises.  
This is an electrical appliance. When the alarm system is used in an environment where electrical noises, static electricity or electromagnetic noises may be generated, take a protective measure beforehand.
- Do not modify the alarm system or change the settings if not necessary.  
Disassembling/modifying the alarm system will invalidate the warranty of the performance.  
Also, changing the settings without understanding the specifications may cause alarm malfunctions.  
We will not be liable for any accidents caused by these conditions. Please use the alarm system properly in accordance with the operating manual.
- Do not forget to perform a regular maintenance.  
Since this is a safety unit, a regular maintenance on it and the detector head must be performed to ensure safety.
- Clean the unit by wiping it gently with a dry cloth. Do not use organic solvents such as alcohol and benzine, detergent or cleaner.
- Always perform zero adjustment after cycling the power, recovering from a blackout, etc.

# Product Functions

### 3-1. Outline drawing





n: Number of points		W	W1	Installation dimension		
				P	P 1	P 2
<input type="checkbox"/>	2	305	297	276		
<input type="checkbox"/>	4	395	387	366		
<input type="checkbox"/>	6	485	477	456		
<input type="checkbox"/>	8	575	567	546		
<input type="checkbox"/>	10	665	657		302	334
<input type="checkbox"/>	12	755	747		308	418

## 3-2. Product components and names

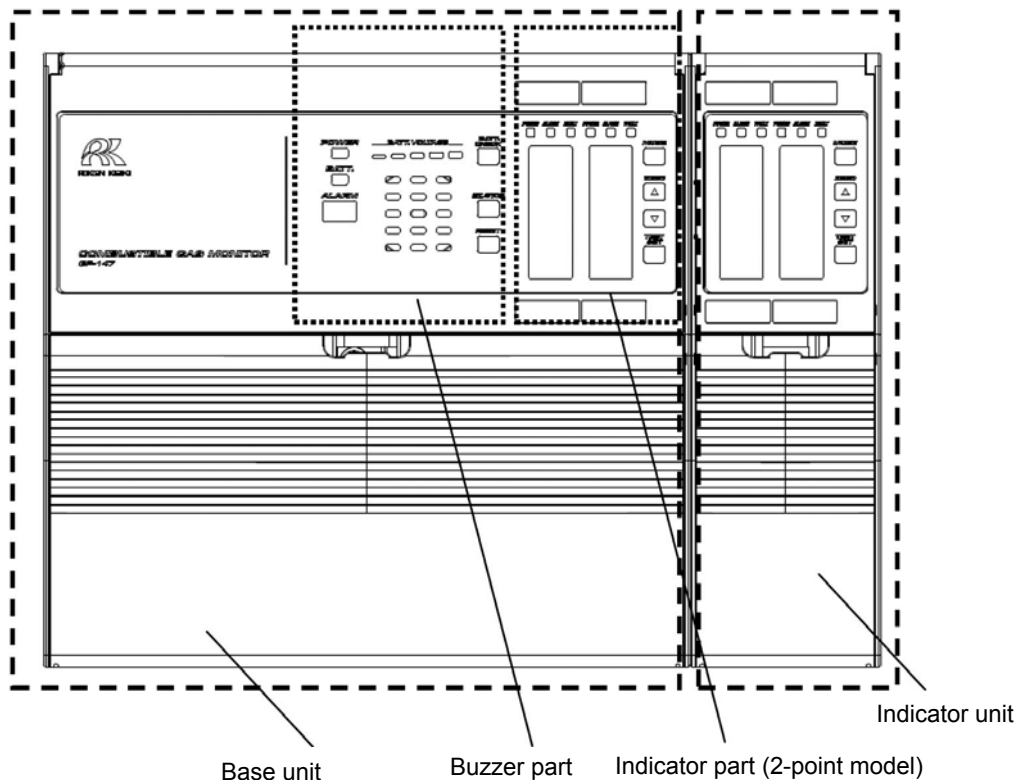
The alarm system consists of a base unit and indicator unit (4-point model or more).

The base unit consists of a buzzer part and indicator part (2-point model), and the indicator unit consists of an indicator part (2-point model).

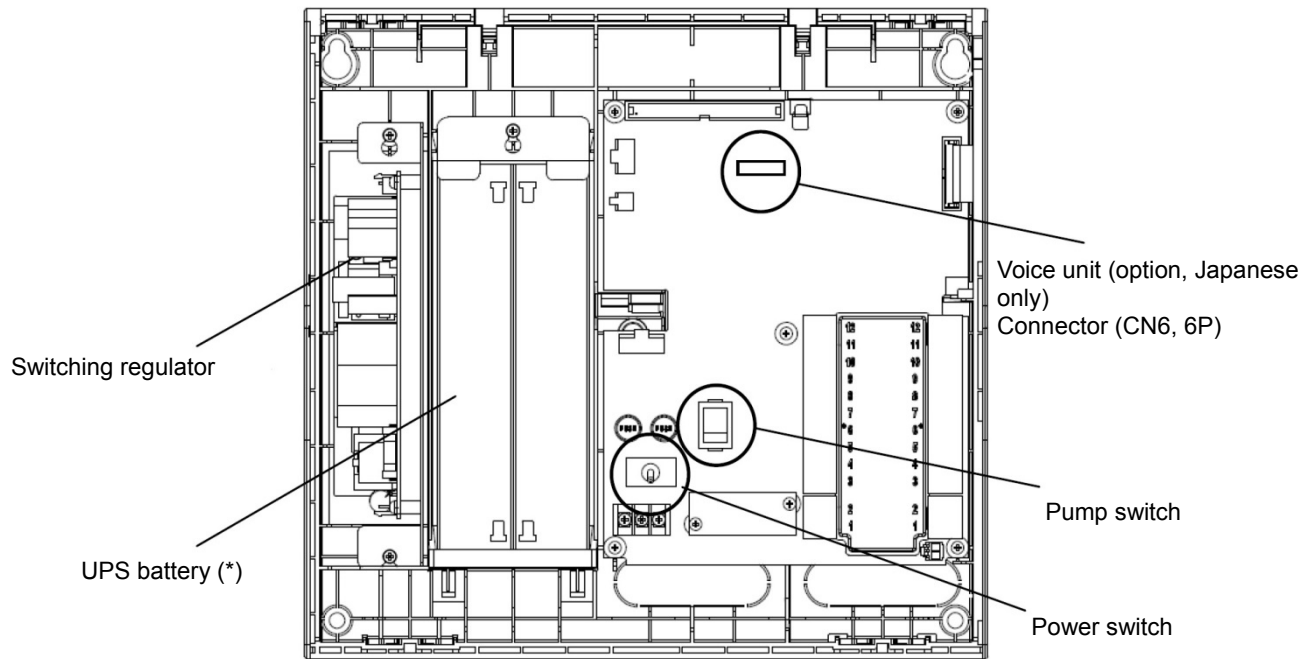
In addition to the indicator part, the base unit incorporates a switching regulator and UPS (uninterruptible power system) battery (\*).

\* For the case of UPS specification

<Appearance>



## &lt;Inside Base Unit&gt;

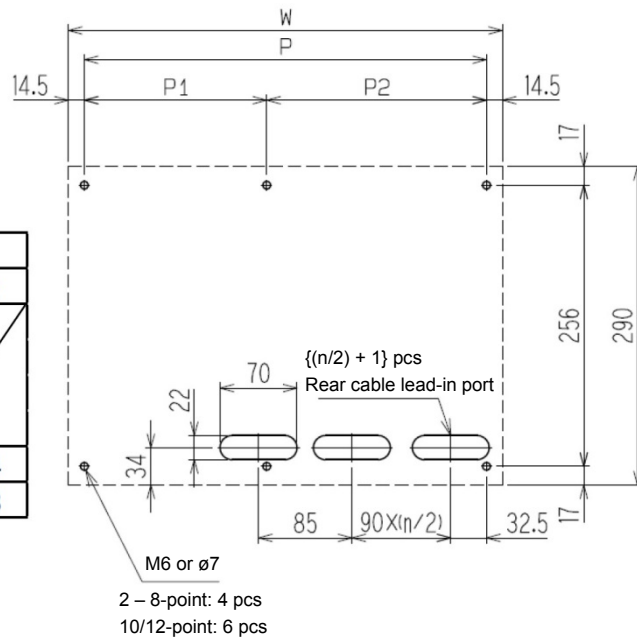


### 3-3. Installation diagram

### Wall mounting type

n: Number of points	W	Installation dimension		
		P	P1	P2
2	305	276		
4	395	366		
6	485	456		
8	575	546		
10	665		302	334
12	755		308	418

n: Number of points

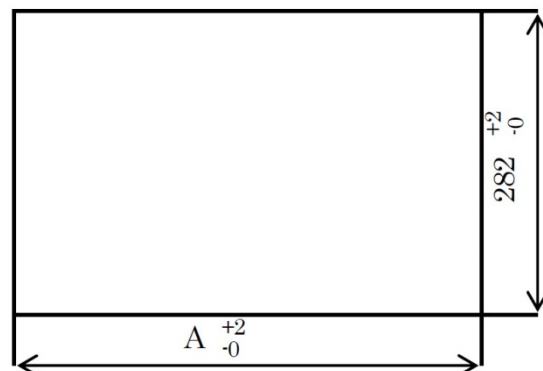


### Installation Diagram for Wall Mounting Type

### Rack mounting type

Number of points n	Cut hole dimension A
2	299
4	389
6	479
8	569
10	659
12	749

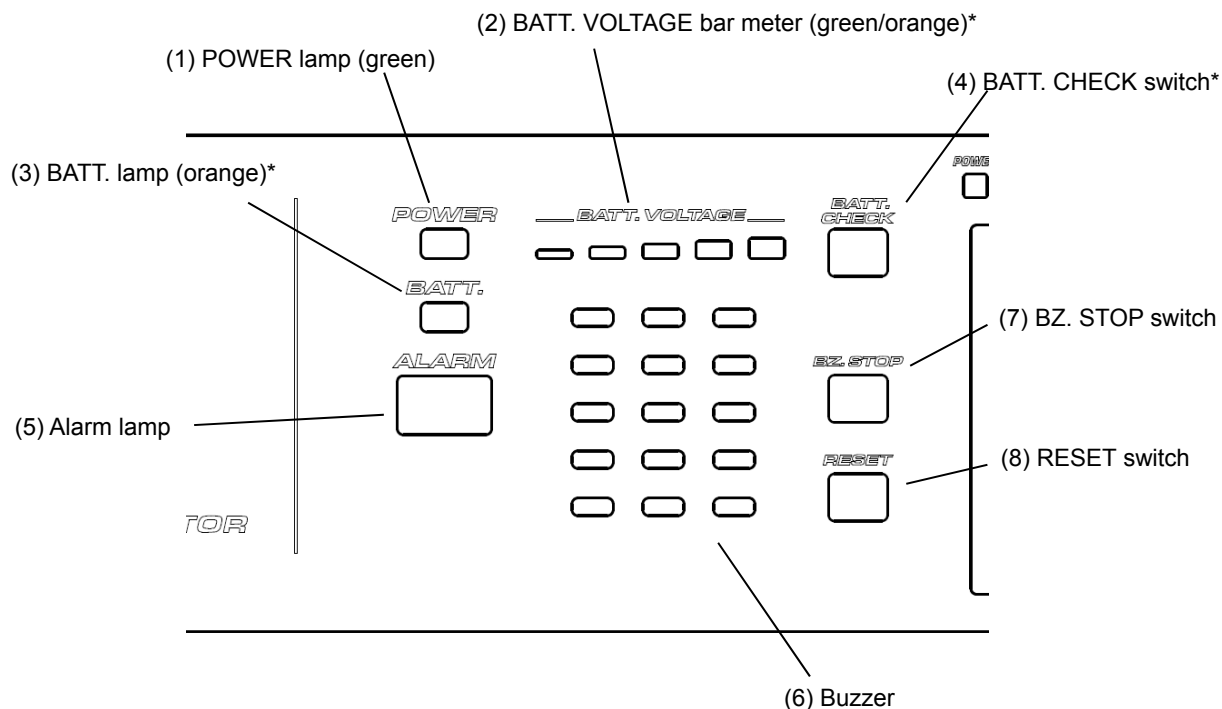
n: Number of points



### Panel Cut for Rack Mounting Type

## 3-4. Names and functions for each part

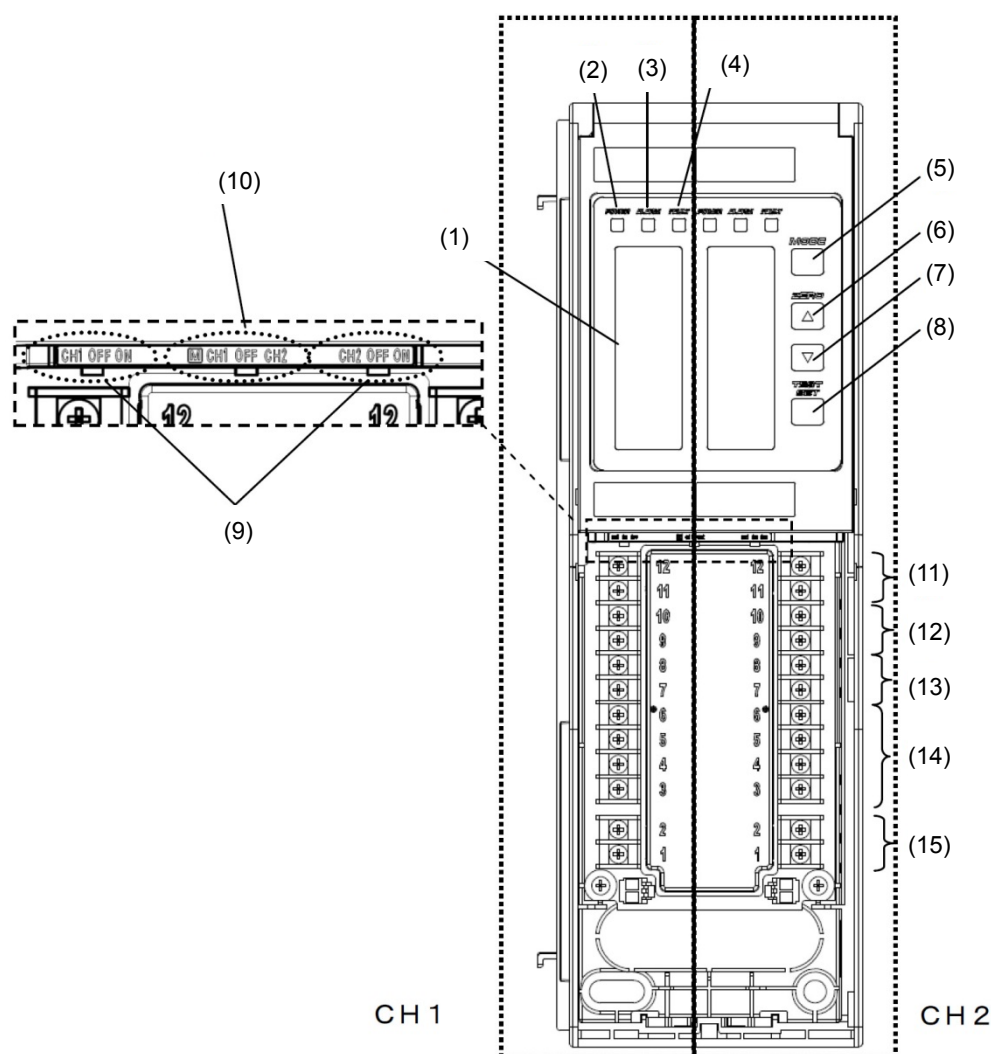
### 3-4-1. Base unit (buzzer part)



Number in the figure	Name	Function
(1)	POWER lamp (green)	Power lamp. Lights up steadily during power-on.
(2)	BATT. VOLTAGE bar meter (green/orange)*	Indicates the battery voltage level with a bar meter.
(3)	BATT. lamp (orange)*	Lights up while the UPS is in operation, or blinks while a battery discharge test is conducted.
(4)	BATT. CHECK switch*	Operated when a battery discharge test is conducted. (Turn ON for over 3 seconds)
(5)	Alarm lamp	Lights up in red at a gas alarm state. It goes out when the alarm is cleared.
(6)	Buzzer	Emits a buzzer sound at an alarm or fault state.
(7)	BZ. STOP switch	Stops a buzzer sound.
(8)	RESET switch	Pressed to reset the gas alarm activation. While the alarm pattern is self-latching, pressing the RESET switch causes a change from self-latching to non latching (auto-reset).

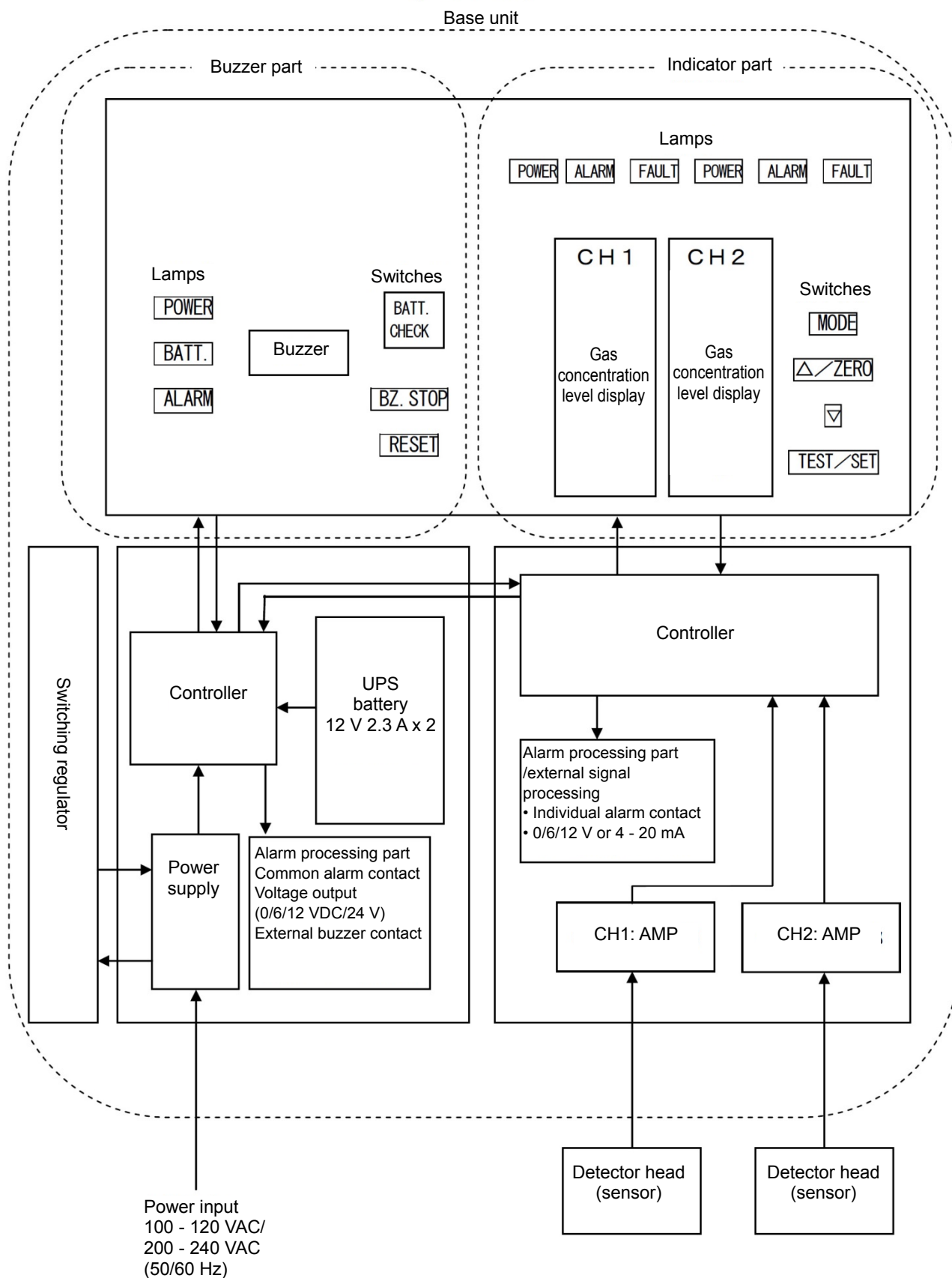
\* For the case of UPS specification

### 3-4-2. Indicator unit (same as the base unit indicator part)



Number in the figure	Name	Function
(1)	LCD display	Displays gas concentration and status message.
(2)	POWER lamp	Power lamp.
(3)	ALARM lamp	Lights up at a gas alarm state.
(4)	FAULT lamp	Lights up at a fault state.
(5)	MODE key	Used for adjustment work.
(6)	Δ/ZERO key	Used to select a maintenance mode item, increase/decrease a reading in span adjustment or alarm test, etc.
(7)	∇ key	Same as (6).
(8)	TEST/SET key	Used to enter the alarm test mode. Confirms a value, etc. in each mode.
(9)	POWER switch	Power switch of each channel.
(10)	Maintenance mode selector switch (MAINT switch)	Used to switch to the target channel for zero or span adjustment.
(11)	Individual alarm contact output 2	Used as either gas alarm contact or fault alarm contact. (Gas alarm contact used as standard)
(12)	Individual alarm contact output 1	Used as gas alarm contact.
(13)	External output signal	Either 0/6/12 VDC or 4-20 mA output can be selected. (0/6/12 VDC output selected as standard)
(14)	Sensor terminal	Connects a detector head.
(15)	Pump output	Used for the power supply of the pump of suction type detector head.

## 3-5. Block diagram



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## 4

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# How to Use

### 4-1. Before using the alarm system

Not only the first-time users but also the users who have already used the alarm system must follow the operating precautions.

Ignoring the precautions may damage the alarm system, resulting in inaccurate gas detection.

## 4-2. Precautions for installation sites



### CAUTION

- Do not install the alarm system in a place exposed to direct sunlight or sudden changes in the temperature.  
When selecting installation points, avoid a place where it is exposed to direct sunlight or radiant heat (infrared rays emitted from a high-temperature object), and where the temperature changes suddenly. Condensation may be formed inside the alarm system.
- When selecting installation points, avoid a place where the alarm system is exposed to liquids, such as water, oil and chemicals.
- Do not install the alarm system in a place where the temperature drops below -10°C or rises over 50°C.  
The operating temperature of the alarm system is -10 to 50°C. The alarm system must be installed in a stable place where the operating temperatures are maintained and do not change suddenly.
- Do not install the alarm system in a place with vibrations or shocks.  
The alarm system consists of sensitive electronic parts. It must be installed on a stable place without vibrations, shocks and risk of drop, etc.
- Keep the alarm system (and its cables) away from noise source devices.  
When selecting installation points, avoid a place where high-frequency devices exist.
  - Do not place the alarm system next to a noise source device.
  - Do not run cables parallel to each other.
  - Do not place cables close to each other.
- Do not install the alarm system in a place where detectable gases stay around.  
Do not install the alarm system and perform detection in a place where detectable gases remain.
- Do not install the alarm system in a place where maintenance of the alarm system cannot be performed or where handling the alarm system involves dangers.  
Regular maintenance of the alarm system must be performed.  
Do not install the alarm system 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 alarm system cannot be removed because tubes, racks, etc. prevent access to it.  
Do not install the alarm system in a place where maintenance involves dangers, for example, near a high-voltage cable.
- Do not install the alarm system in machinery which is not properly grounded.  
Before installing the alarm system in machinery, the machinery must be grounded properly.



## 4-3. Precautions for system designing



### CAUTION

An unstable power supply and noise may cause malfunctions or false alarms. The descriptions in this section must be reflected on the designing of a system using the alarm system.

#### (1) Using a stable power supply

Note that the external output and alarm contact of the alarm system 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 alarm system must be provided with the following power supply.

Power supply voltage	100 - 120 VAC or 200 - 240 VAC, 50/60 Hz (terminal voltage of the main unit)	
Allowed time of momentary blackout	Approx. 100 msec. (without suction type detector head) (To recover from the momentary blackout for 100 msec. or more, restart the alarm system.)	<u>Example of actions</u> Install a UPS, etc. outside the alarm system to ensure continuous operation and activation.
Others	Do not use the alarm system with a power supply of large power load or high-frequency noise.	<u>Example of actions</u> Use a line filter, etc. to avoid the noise source if necessary.

#### (2) Heat radiation designing

When the alarm system is installed in a closed instrumentation panel or the like, attach ventilation fans above and below the panel.

#### (3) Protection against lightning

What is lightning surge?	If cables are installed outside the factory, plant, etc., or if internal cables are installed in the same duct as the cables coming from the outside, "lightning" will cause problems. Because lightning acts as a large emission source while cables act as a receiving antenna, devices connected to the cables may be damaged. Lightning cannot be prevented. Cables installed in a metal conduit or under the ground cannot be completely protected from inductive lightning surge caused by lightning.
Protection against lightning	Although complete elimination of disasters caused by lightning is impossible, the following protective measures can be taken. Take appropriate measures in accordance with the importance of the facilities and the environment. <ul style="list-style-type: none"> <li>• Connect the transmission signal route, etc. by using optical fiber or the like.</li> <li>• Provide protection by a lightning arrester (cable arrester). (Although inductive lightning surge can be transmitted through the cable, it is prevented by installing a lightning arrester before the field devices and central processing equipment. For information on how to use a lightning arrester, please contact the manufacturer.)</li> </ul>
Grounding	In addition to lightning, there are more sources of surge noise. To protect devices from these noise sources, the devices must be grounded.

\* A lightning arrester has a circuit to remove a surge voltage which damages field devices. Therefore, signals may be attenuated by installing the arrester. Before installing a lightning arrester, verify that it works properly.

## (4) Alarm contact

The alarm contact of the alarm system is used to transmit signals to activate an external buzzer or alarm lamp. Do not use the alarm system 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 1-second) to the receiving side of the "b" contact.

The specifications for the alarm contact of the alarm system 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 voltage 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 alarm system
- Abnormal operations by an out-of-control CPU
- Unexpected noise may enter the contact regardless of inductive load, thus posing a risk of above errors.

**CAUTION**

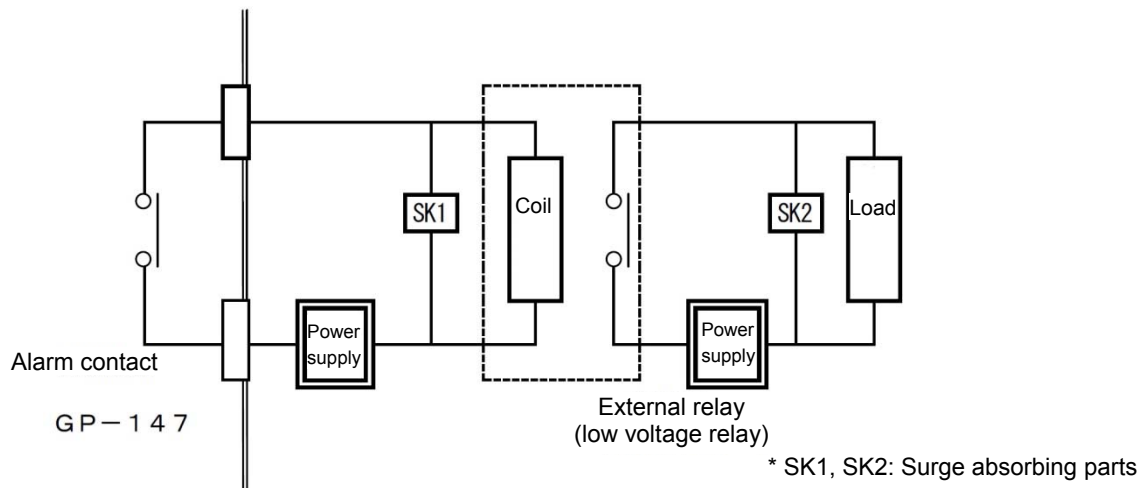
- In principle, do not activate inductive load at the alarm contact of the alarm system. (In particular, never use the inductive load to activate a fluorescent lamp, motor, etc.)
- If inductive load is activated, relay it with an external relay (contact amplification). However, because the coil of an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

\* Followings are examples of inductive load.

- Revolving light, external relay, buzzer, siren, fan, fluorescent lamp, motor, etc.

If load is to be activated, appropriate measures must be taken to stabilize the operation of the alarm system 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.



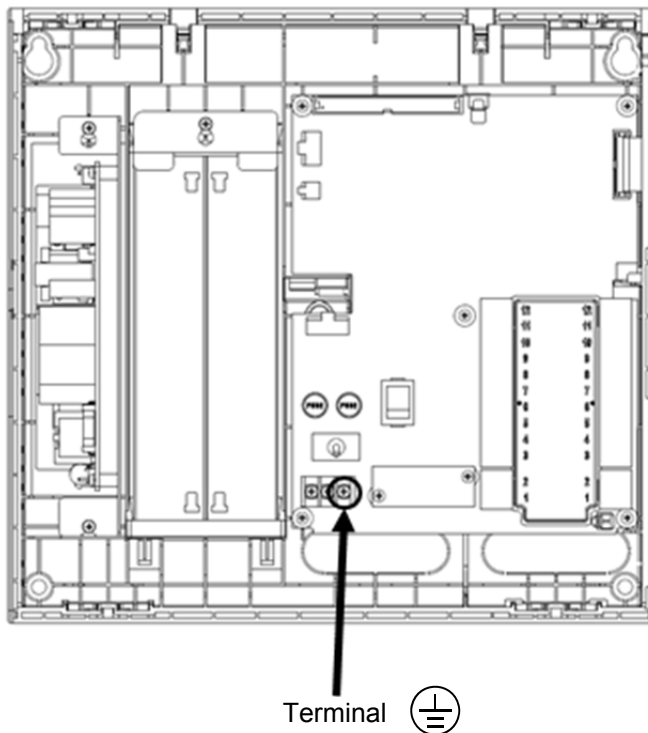
## 4-4. Grounding

Connect the earth terminal  to your grounding terminal.



### WARNING

Before turning on the alarm system, never fail to connect the earth terminal to a grounding terminal.



For stable operation of the alarm system and safety, it must be connected to a grounding terminal. Never connect the grounding wire to a gas pipe. The grounding must be made as D type grounding (below 100  $\Omega$  of grounding resistance).

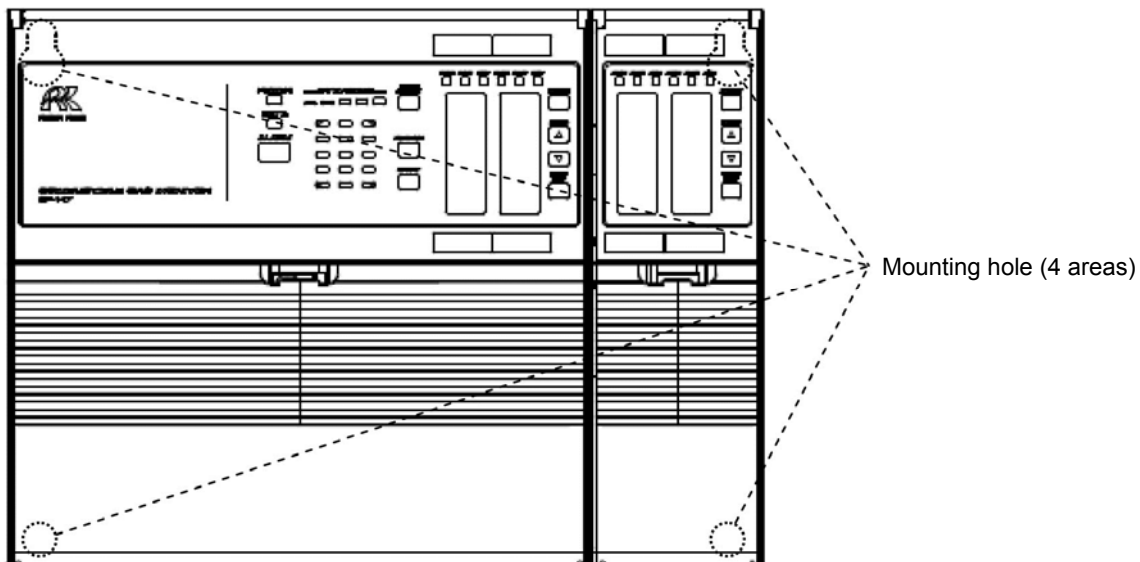
## 4-5. How to install

### 4-5-1. How to install the wall mounting type unit

#### <4 - 8-point Model>

Screw each four fixing screw to the four corners on the wall.

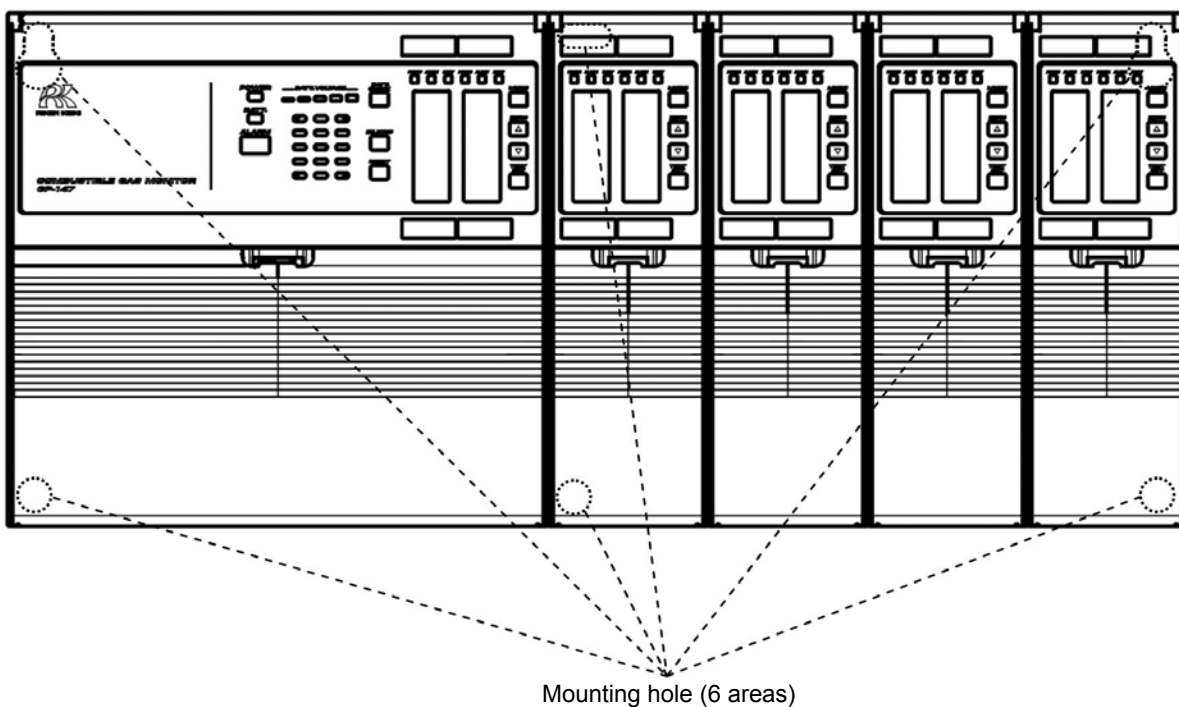
- \* Be careful not to get your fingers caught by the upper door which may be closed by shaking the main unit hard during installation.



#### <10/12-point Model>

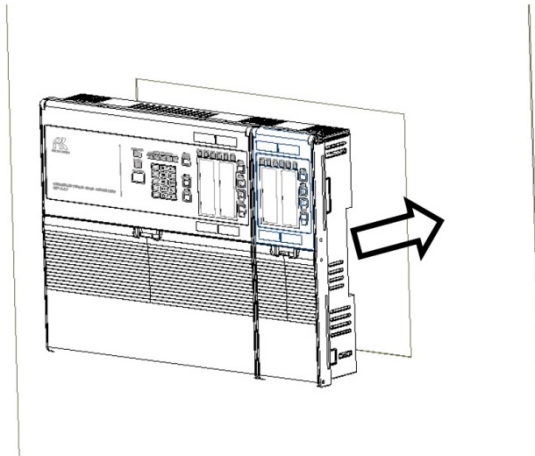
Screw each four fixing screw to the four corners and two points of the indicator unit next to the base unit (six areas in total).

- \* Be careful not to get your fingers caught by the upper door which may be closed by shaking the main unit hard during installation.



## 4-5-2. How to install the rack mounting type unit

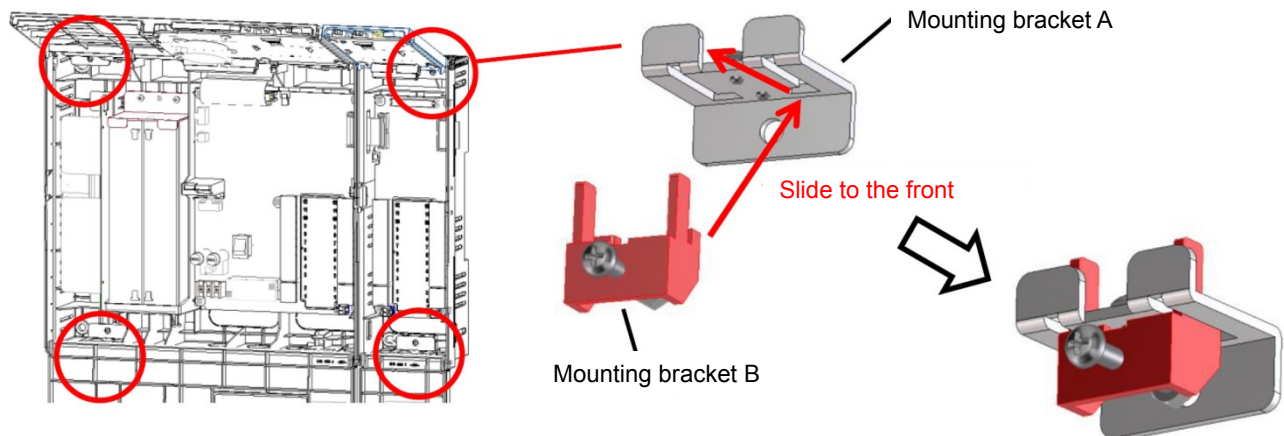
- (1) Fit GP-147 into the fit-in hole.



\* See the installation diagram in Section 3-3 (Page 11) for the installation dimensions.

- (2) Open the upper and lower doors and screw the mounting brackets B (with screws and cap nuts) onto the mounting brackets A attached already at four areas (six areas for 10/12-point model). \* Loosen the screws of mounting brackets B before attaching them.

\* Be careful not to get your fingers caught by the upper door which may be closed by shaking the main unit hard during installation.



- (3) After screwing the mounting brackets B at four areas (or six areas) according to the above step (2), tighten the screws to complete the installation.

\* There are four areas to screw the mounting brackets for the 4 - 8-point model and six for the 10/12-point model as with the wall mounting type.

## 4-6. Connection between devices

### 4-6-1. Connection of power supply

The power supply specification of the alarm system is 100 to 120 VAC or 200 to 240 VAC, 50/60 Hz.

Prepare a power supply that complies with the specification.

Before supplying power, connect the earth terminal of the alarm system to your grounding terminal. The grounding resistance must be D type (below 100  $\Omega$ ). After the alarm system is grounded and it is in a safe state, connect the power supply and other cables.

### 4-6-2. Connection to contact output

The indicator unit outputs the individual alarm contact 1 (gas alarm contact) and individual alarm contact 2 (gas alarm contact or fault alarm contact). Also, the base unit outputs the common alarm contact and external buzzer contact.

The contact capacity is 250 VAC, 2 A for the common alarm contact and 250 VAC, 1A for the external buzzer contact. (Both are resistance loads.) Configure an auxiliary relay circuit to connect a load over the contact capacities.

### 4-6-3. Connection to 0/6/12 VDC output

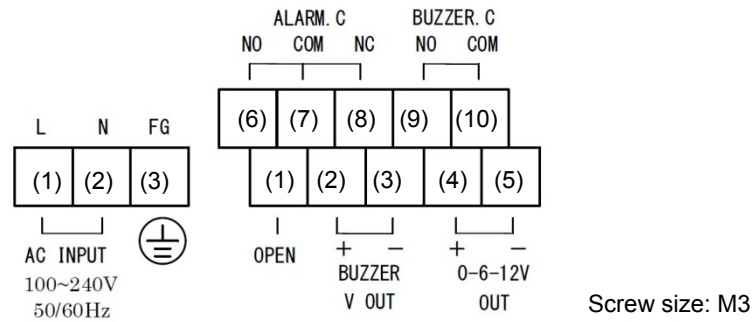
The indicator unit and base unit output a signal of 0/6/12 VDC as standard.

A load current is 10 mA or less. (The external output signal of the indicator unit can be changed to the 4-20 mA output as an option.)

Use a shielded cable equivalent to CVVS for connection.

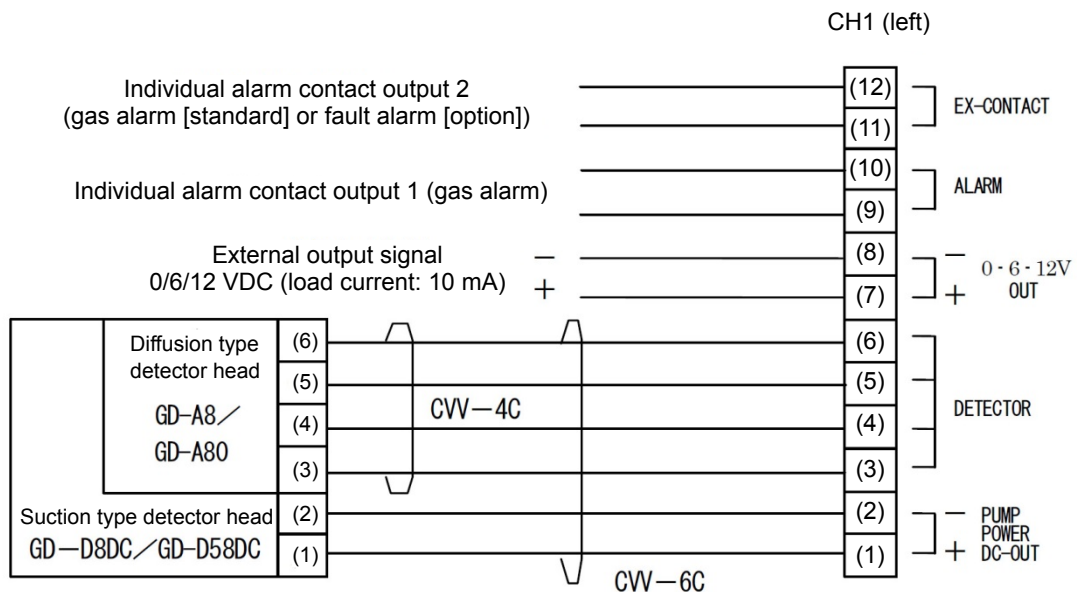
## 4-7. Wiring

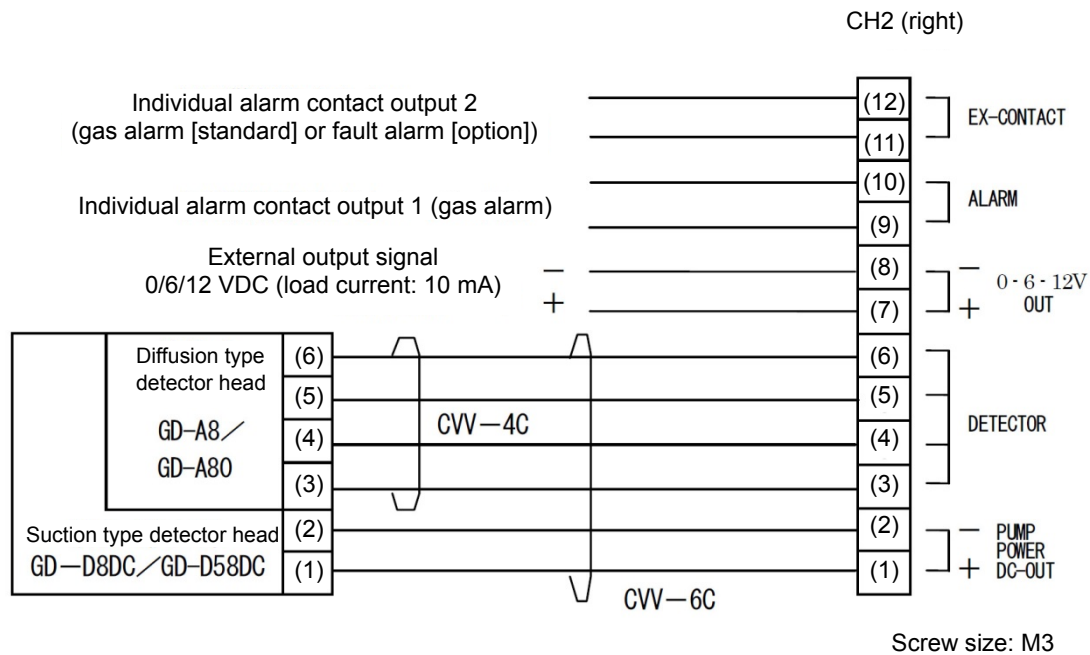
### Base unit external terminals



- (1) (L) }  
 (2) (N) } Power input 100 - 120 VAC or 200 - 240 VAC (50/60 Hz)  
 (3) (FG) }
- (1) (OPEN) — Not used
- (2) (+) }  
 (3) (-) } Power output for external buzzer, 24 VDC (load current: 10 mA or less)
- (4) (+) }  
 (5) (-) } Common alarm voltage output, 0/6/12 VDC (load current: 10 mA or less)
- (6) (NO) }  
 (7) (COM) } Common alarm contact output, no-voltage "c" contact (contact capacity: 250 VAC 2 A, resistance load)  
 (8) (NC) }
- (9) (NO) }  
 (10) (COM) } Contact output for external buzzer (contact capacity: 250 VAC 1 A, resistance load)

### Indicator unit external terminals





### CAUTION

- Be careful not to damage the internal electronic circuit when wiring.
- For the cable connected between the indicator part and detector head, use a 1.25 or 2 mm<sup>2</sup> CVV cable (4-core). We will not be liable for any result caused by using an unspecified cable.
- Cables used for connecting the indicator/alarm unit and detector head, input power, pump power and external output should be arranged separately, and they must not run in the same cable.
- The power cables, detector head cables and signal cables must not be installed together with motor power cables, etc.
- Do not use the output for pump power supply for detector head to operate other devices. Note that only the pumps with the same voltage specification as the input power of the alarm system can be connected. For a pump with a different voltage specification, an additional power supply is required.



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# 5

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## How to Operate

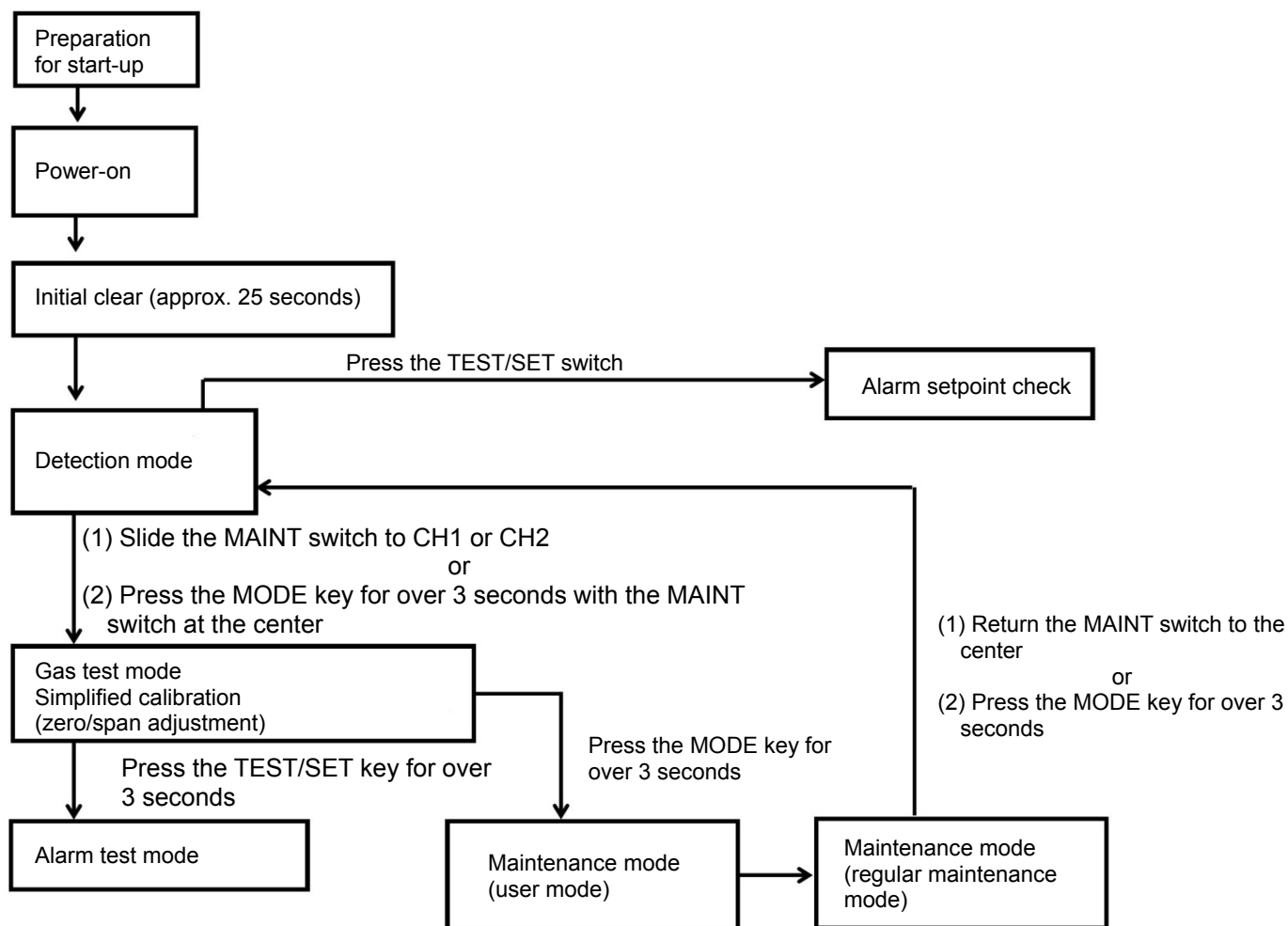
### 5-1. Preparation for start-up

Before connecting a power supply, read and understand the following precautions. Ignoring these precautions may cause an electric shock or damage the alarm system.

- Connect the alarm system to a grounding circuit.
- Check that 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.
- Make sure to use a fuse with the specified ratings to prevent fire.

## 5-2. Basic operating procedures

Normally, the detection mode is activated after the power is turned on.  
The "maintenance mode selector switch" is hereinafter called "MAINT switch".

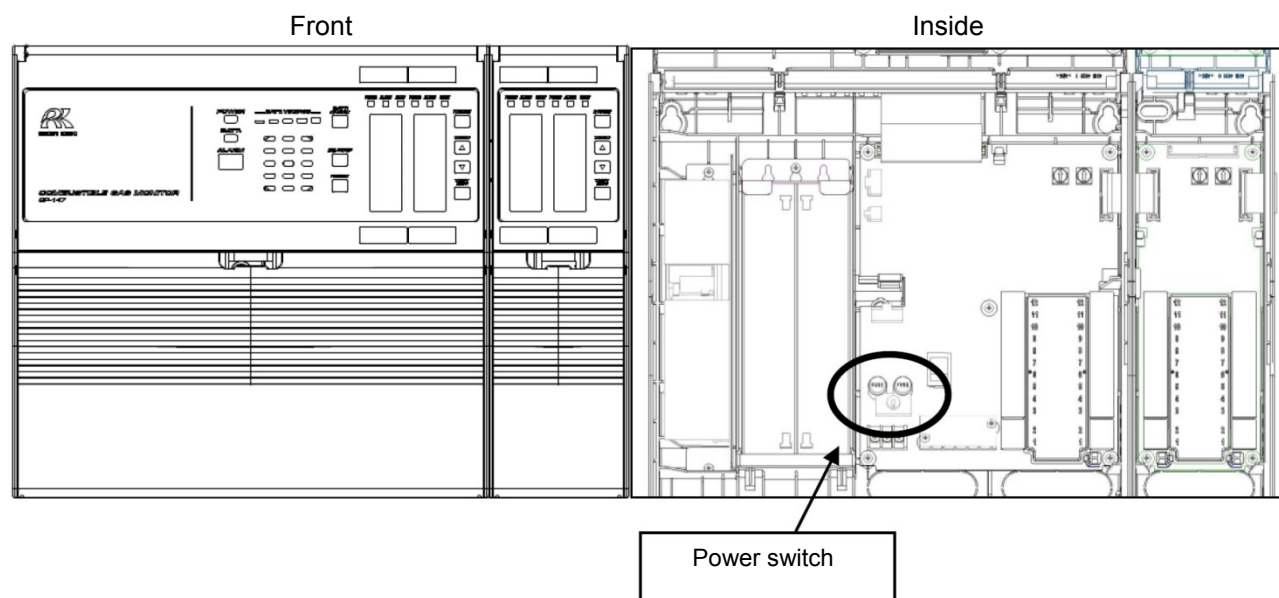


### WARNING

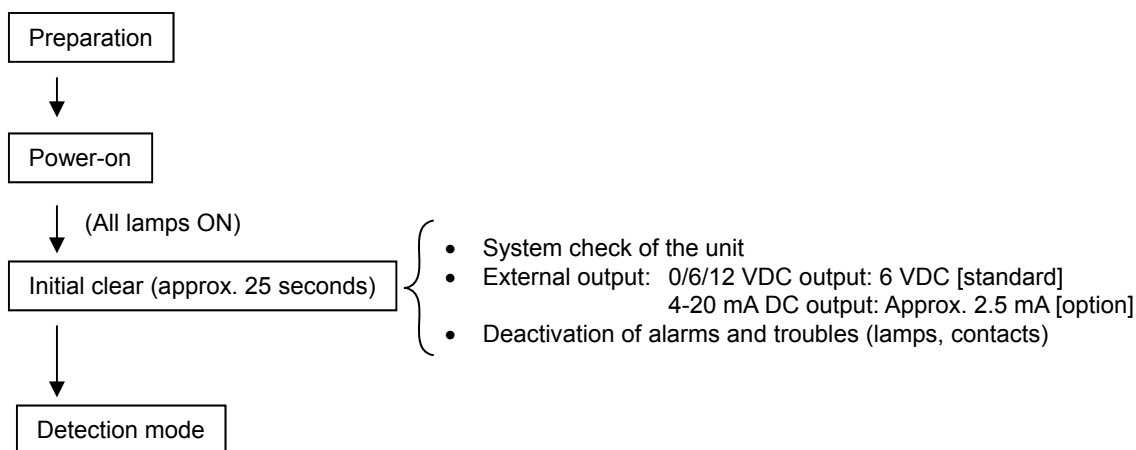
When the alarm system enters each mode from the detection mode while an alarm is activated, the alarm contact is released.

## 5-3. How to start the alarm system

- (1) Before turning on the power switch, check that the alarm system is installed properly.
- (2) Open the front cover of the main unit to find the power switch located at the center in the lower section.
- (3) Move the power switch up to turn ON or down to turn OFF.



- (4) After turning on the power, all lamps light up and the detection mode is entered immediately after initial clear (approximately 25 seconds).  
<Start-up Procedure>



### CAUTION

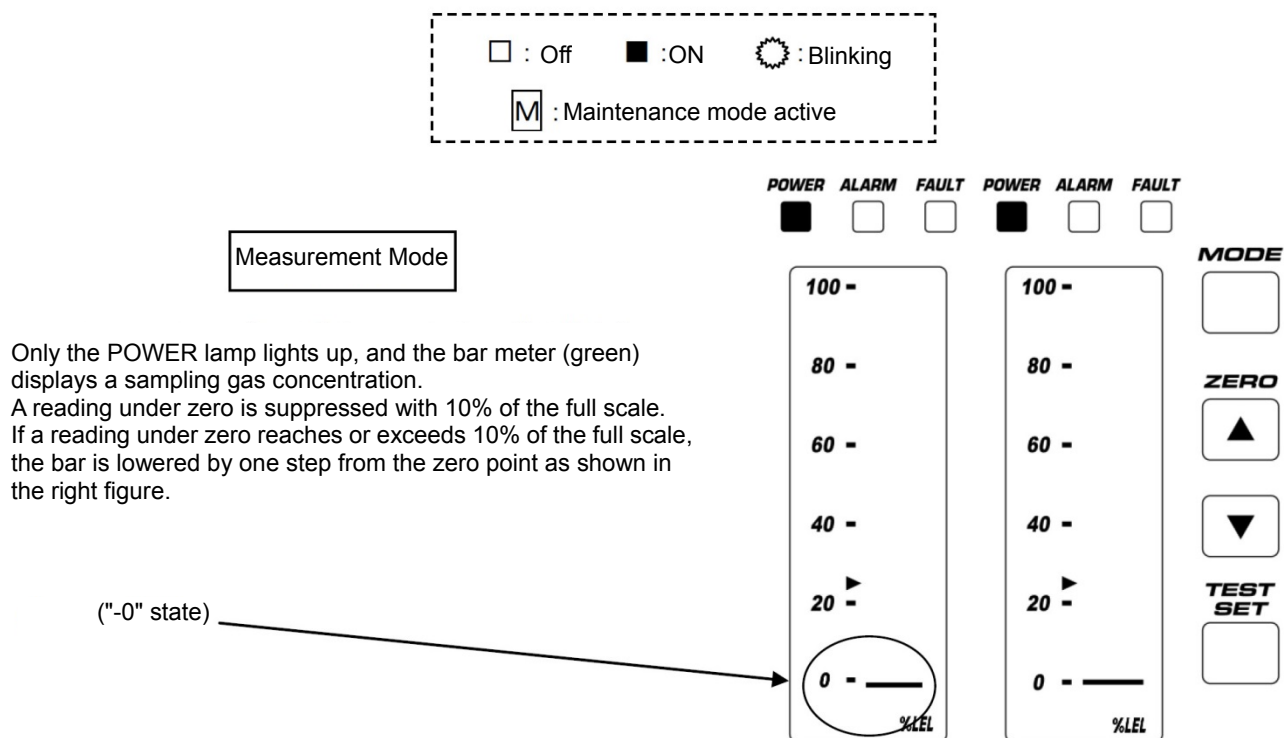
- Do not turn off the alarm system during the initial clear.
- If a new sensor is installed or the sensor is replaced after the alarm system is started, the sensor must be warmed up for a specified period which is determined depending on the type of the sensor. After the warm-up is completed, perform a gas calibration. Read also the operating manual of the gas detector head.
- During the warm-up, the alarm activation and output signals are unstable. Provide a prior notification to the related sections so that they can prepare for false abnormalities.
- When "E-1" is displayed after initial clear, cycle the power or perform heater adjustment in the maintenance mode "2-5.0".

## 5-4. Detection mode

### 5-4-1. Display operation

The alarm system uses the following two types of equipment to display operation status.

- (1) LCD display: Displays detected gas concentration, etc.
  - (2) LED lamp: Indicates the power, gas alarm or fault alarm status.
- \* The LCD display and LED lamp function according to the unit status.

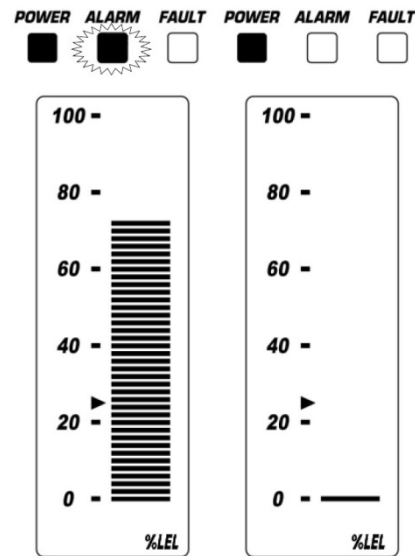


### WARNING

Accurate gas detection cannot be performed in the "-0" state.  
 In this case, perform zero adjustment.

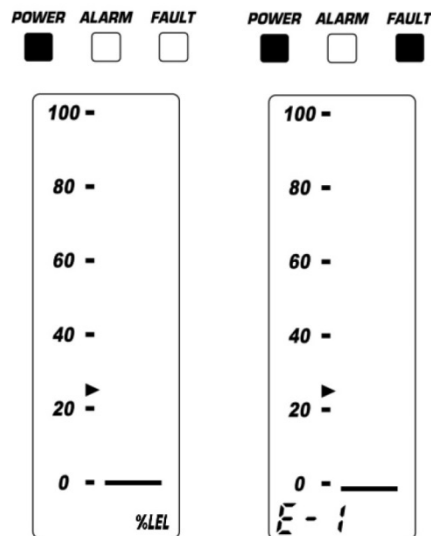
Gas Alarm State

When a gas that reaches or exceeds the alarm setpoint is detected, the gas concentration display (bar meter) turns red, the ALARM lamp blinks in red, and the buzzer sounds. Also, the alarm lamp of the base unit lights up in red.



Fault Display

A fault alarm is triggered when the alarm system detects abnormalities (auto-reset).  
When a fault alarm is triggered, the FAULT lamp lights up in orange, an error code appears on the LCD, and the buzzer sounds.



(LED display)

(Fault detail)

E-9

Memory error: Generated as a result of self-diagnosis at power-on

E-1

Sensor disconnection error: Generated when a sensor disconnection occurs in the measuring mode



— — —

Warm-up for recovering from an error: 25 seconds

External output: 0/6/12 VDC specification [standard]: 0 V, 4-20 mA specification [option]: 0.5 mA

When a fault occurred simultaneously with another, the errors are displayed alternately.

A memory error cannot be cleared. Please contact RIKEN KEIKI.

A sensor disconnection error can be cleared by recovering the sensor from the disconnection state.

## 5-4-2. External output operation

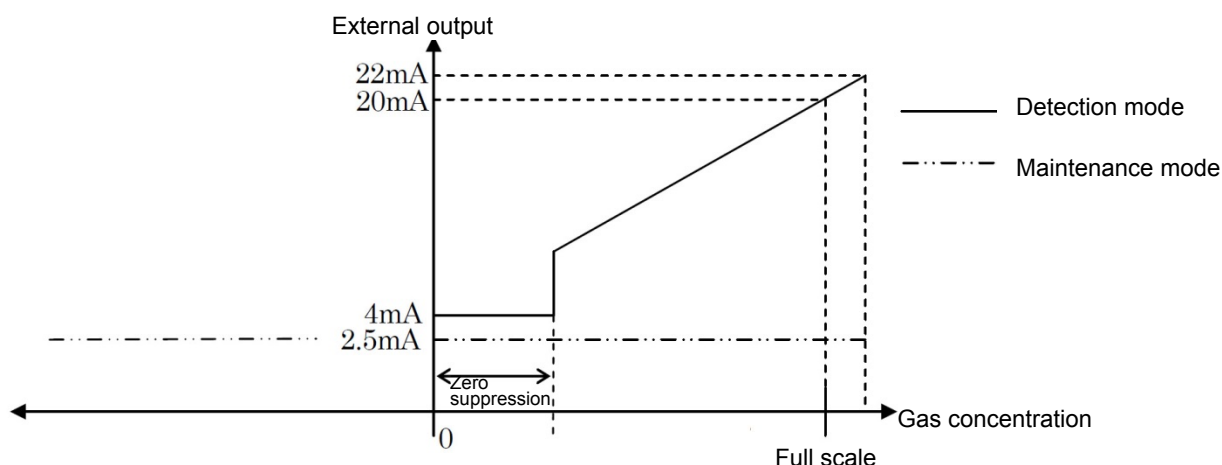
### 1. 0/6/12 VDC specification [standard]

- |                                |   |                               |
|--------------------------------|---|-------------------------------|
| (1) Signal transmission method | : | Voltage output (non-isolated) |
| (2) Transmission path          | : | CVVS                          |
| (3) Transmission distance      | : | 10 m or less                  |
| (4) Connection load resistance | : | 1 MΩ or more                  |
| (5) Status signal level        |   |                               |
| 1. Detection mode              | : | 6 V                           |
| 2. Gas alarm                   | : | 12 V                          |
| 3. Initial clear               | : | 6 V                           |
| 4. Gas test mode               | : | 6 V                           |
| 5. Maintenance mode            | : | 6 V                           |
| 6. Alarm test                  | : | 12 V                          |
| 7. Fault alarm                 | : | 0 V                           |
| (6) Power Off                  | : | 0 V                           |

### 2. 4-20 mA output specification [option]

- |                                |   |  |
|--------------------------------|---|--|
| (1) Signal transmission method | : | Electric current transmission (non-isolated) |
| (2) Transmission path          | : | CVVS   |
| (3) Transmission distance      | : | 1 km or less                                 |
| (4) Connection load resistance | : | 300 Ω or less                                |
| (5) Status signal level        |   |  |
| 1. Detection mode              | : | 4 - 20 mA (depends on the gas concentration) |
| 2. Gas alarm                   | : | 4 - 20 mA (depends on the gas concentration) |
| 3. Initial clear               | : | 2.5 mA (fixed)                               |
| 4. Gas test mode               | : | 2.5 mA (fixed)                               |
| 5. Maintenance mode            | : | 2.5 mA (fixed)                               |
| 6. Alarm test                  | : | 4 - 20 mA (depends on the gas concentration) |
| 7. Fault alarm                 | : | 0.5 mA (fixed)                               |
| (6) Power Off                  | : | 0 mA   |

The following figure shows the relation between "gas concentration" and "external output".




### CAUTION

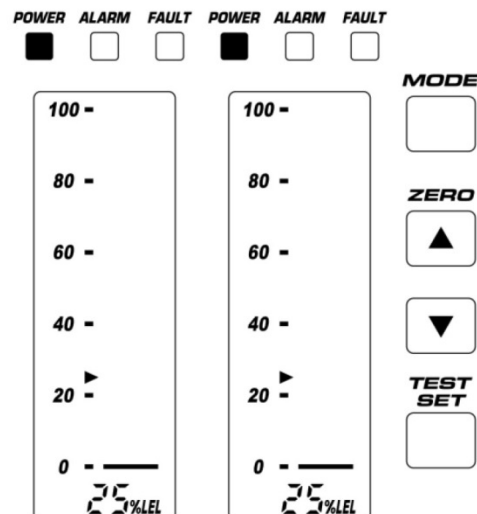
The 4-20 mA output is already adjusted. If readjustment becomes necessary after installation, it must be done by a qualified service engineer.

## 5-4-3. Alarm setpoint check

This is used to check the alarm setpoint value.

- (1) When the TEST/SET key is pressed in the detection mode, the current alarm setpoint value is displayed for checking.
- (2) Release the TEST/SET key to return to the detection mode.

☐ : Off    ☒ : ON     : Blinking  
☐ M : Maintenance mode active



## 5-5. Gas test mode

### <How to Enter the Gas Test Mode>

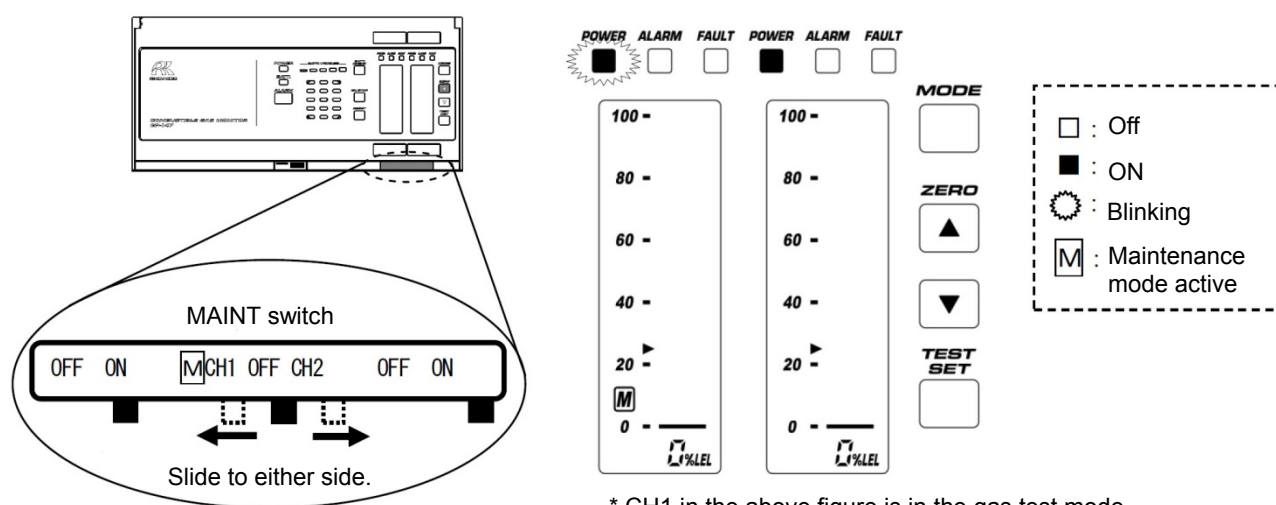
There are two methods for entering the gas test mode on GP-147.

- (1) Move the MAINT switch to put one channel into the maintenance mode.
- (2) Press the MODE key to put two channels into the maintenance mode at the same time.

### <Method (1)>

The following figures show an enlarged view around the MAINT switch of the indicator part (left) and enlarged view of the indicator part (right).

In the detection mode, slide the MAINT switch located at the center to the "CH1" side to put CH1 into the gas test mode. Likewise, slide the MAINT switch to the "CH2" side to put CH2 into the gas test mode. At this time, the "M" mark (maintenance mode active) lights up at the channel to which the MAINT switch is slid on the LCD, and a gas concentration value is displayed (digital display). Return the MAINT switch to the center to return to the detection mode.

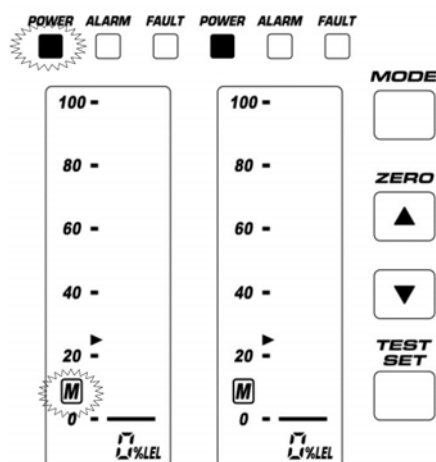


\* CH1 in the above figure is in the gas test mode.

### <Method (2)>

The following figure shows an enlarged view of the indicator part.

Press the MODE key for over 3 seconds in the measuring mode to put both CH1 and CH2 into the gas test mode. At this time, the "M" marks (maintenance mode active) blink on the LCDs of both channels and gas concentration values are displayed (digital display).



In the above state, slide the MAINT switch to the desired side (CH1 or CH2) to enable key operations for each channel. To return to the detection mode, move the MAINT switch to the center and press the MODE key for over 3 seconds.



## 5-6. Alarm test mode

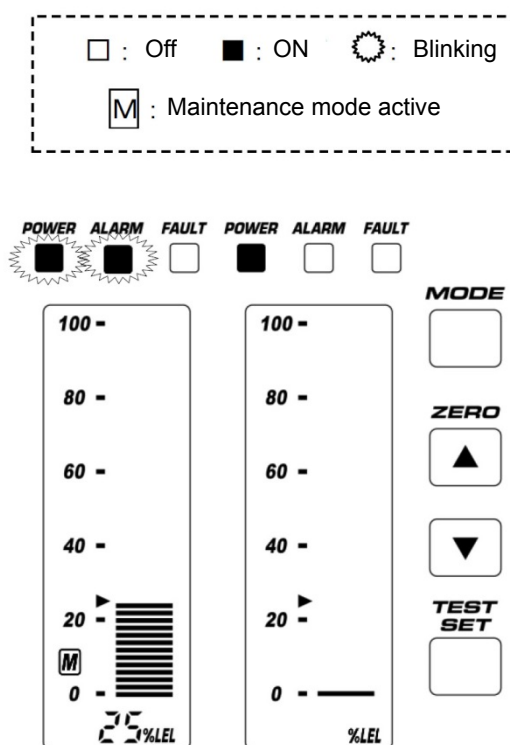
This is used when dummy signals the same as the signals of the gas concentration (0/6/12 VDC or 4 - 20 mA) are generated to check the alarm lamp, alarm buzzer and alarm contact activation of the alarm system and the transmission to external circuits.



### WARNING

Before starting the alarm test (transmission test), provide a notification to the related sections so that they can prepare for false abnormalities (external output signals and alarm contact).

- (1) Press the SET switch for over 3 seconds in the gas test mode to enter the alarm test mode.
- (2) Increase the reading with the ▲ key. When an alarm setpoint is reached, the ALARM lamp blinks in red and the buzzer sounds (alarm contact activation). Also, the alarm lamp of the base unit lights up in red.
- (3) Press the BZ. STOP switch to stop the buzzer. When the RESET switch is pressed, the alarm lamp changes from blinking to steady-on to enter the auto-reset state. When the reading is decreased below the alarm setpoint with the ▼ key, the alarm lamp and alarm contact are reset.
- (4) Press the MODE key for over 3 seconds to return to the gas test mode.



\* CH1 in the above figure is in an alarm state.



### WARNING

After the test is completed, never fail to return to the detection mode. If the alarm system remains in the alarm test mode, it automatically returns to the detection mode in ten hours.

## 5-7. Simplified calibration (zero/span adjustment)

There are two ways to perform calibration for the alarm system: executing simplified calibration from the gas test mode and executing calibration from the maintenance mode (regular maintenance mode). This section describes how to perform the simplified calibration. See Pages 62 and 63 for the calibration executed from the regular maintenance mode. If a customer needs to perform calibration, we recommend the simplified calibration be performed.

Perform calibration using the calibration gas.

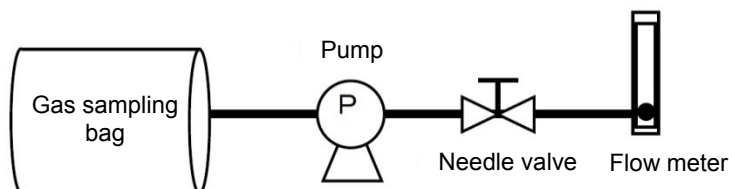
- Zero adjustment gas (collected in a gas sampling bag)
- Calibration gas (collected in a gas sampling bag)
- Gas sampling bag for exhaust gas

\* When a diffusion type detector is connected, a pump is required.

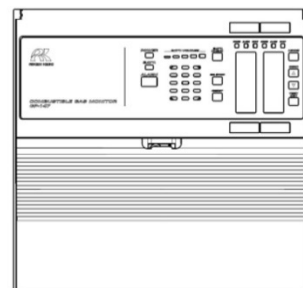


### WARNING

After the adjustment is completed, never fail to return to the detection mode.



«GP-147»



### WARNING

Perform zero adjustment using the zero adjustment gas or in a place where the surrounding air is fresh.

If interference gases exist, the adjustment cannot be performed properly, thus leading to dangers when the gas leaks actually.

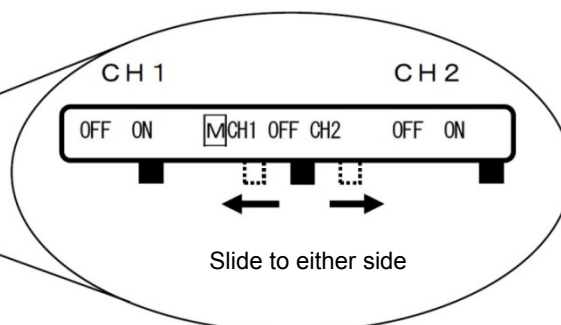
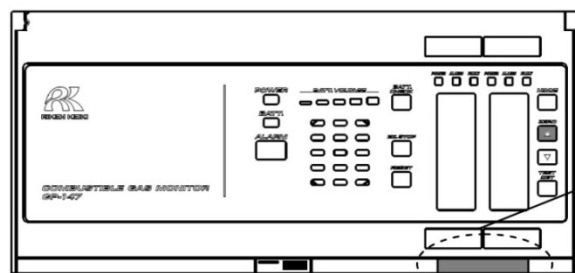


### CAUTION

Always perform zero adjustment after cycling the power or recovering from a blackout.

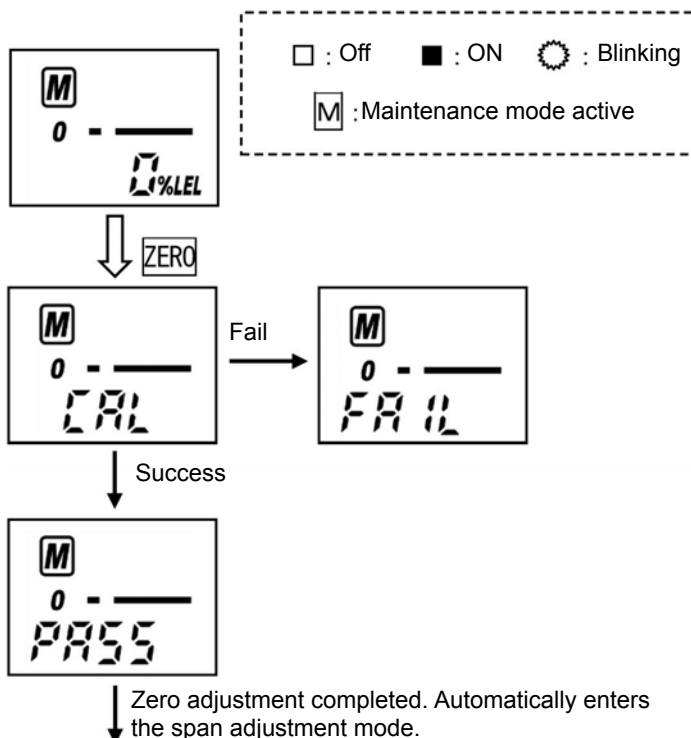
<How to Perform Simplified Calibration>

(1) Slide the MAINT switch to the calibration target channel side.



- (2) Press the ZERO (▲) key for over 3 seconds.  
After CAL is displayed, zero adjustment is performed automatically.  
When the adjustment is completed, PASS is displayed and the span adjustment mode is entered automatically.

\* "FAIL" is displayed when zero adjustment fails.  
Press the TEST/SET key and try again.



- (3) Introduce the calibration gas.

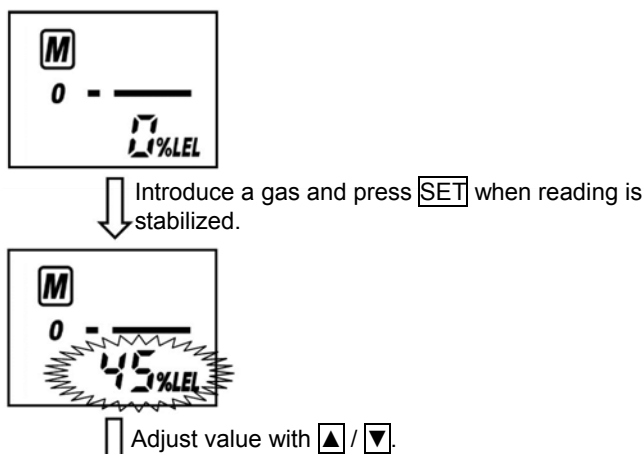
- (4) Press the TEST/SET key when the reading is stabilized.

\* SET is unavailable below 10% of the full scale.



### CAUTION

Do not press the TEST/SET key before the reading is stabilized.



- (5) When the reading starts blinking, adjust the gas concentration with the ▲/▼ key.

- (6) Press the TEST/SET key.  
After CAL is displayed, gas adjustment is performed automatically.  
When the adjustment is completed, PASS is displayed.

\* "FAIL" is displayed when zero adjustment fails.  
Press the TEST/SET key and try again.



### CAUTION

Exhaust gas must be collected in the exhaust bag or discharged through the exhaust line.

- (7) Return the MAINT switch to OFF.

## 5-8. UPS unit operation (\* for the case of UPS specification)

### 5-8-1. Hardware functions

(1) External power supply monitoring function

The switching power supply voltage is monitored while the external power supply is in operation. If it drops to or below 20 V, the UPS is switched on automatically assuming that the external power supply is turned off (blackout occurs).

(2) UPS monitoring function (over discharge protection)

The battery voltage is monitored while the UPS is in operation. If it drops to or below 21 V, UPS is cut off (stopped) automatically.

### 5-8-2. Operation at power-on

(1) Initial clear

To avoid false alarms, any input from the switches or information from the indicator part or indicator/alarm unit is rejected for approximately 25 seconds after power-on.

*POWER*



*BATT.*



□ : Off    ■ : ON    ◉ : Blinking

Ⓜ : Maintenance mode active

### 5-8-3. Basic functions

(1) Power status display function

The POWER or BATT. lamp lights up according to the power supply status.

(1) External power supply in operation: Only the POWER lamp lights up.

*POWER*



*BATT.*



(2) UPS in operation: Only the BATT. lamp lights up.

*POWER*



*BATT.*



(3) Discharge test mode: Only the BATT. lamp blinks.

*POWER*



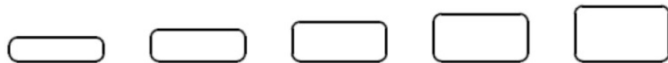
*BATT.*



## (2) Battery voltage display function

The battery voltage is read and displayed with the bar meter.

**BATT. VOLTAGE**



(1)	(2)	(3)	(4)	(5)	
26 V or more: (1), (2), (3), (4), (5)	Steady-on	Color: Green			
25 V or more: (1), (2), (3), (4)	Steady-on	Color: Green			
24 V or more: (1), (2), (3)	Steady-on	Color: Green			
23 V or more: (1), (2)	Steady-on	Color: Orange			
21 V or more: (1)	Steady-on	Color: Red			
Less than 21 V: (1)	Blinking	Color: Red			

The bar meter is displayed in green for all the cases of 24 V and above.

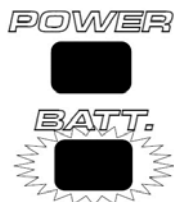
## (3) Discharge test function

The battery performance is checked as follows using the self-discharge function.

- (1) Press the BATT. CHECK switch for over 3 seconds.

The BATT. VOLTAGE bar meter lights up in green/orange and a discharge test is started.

The POWER lamp lights up and the BATT. lamp blinks.



- (2) The discharge test is completed.

Press the BATT. CHECK switch for over 3 seconds.

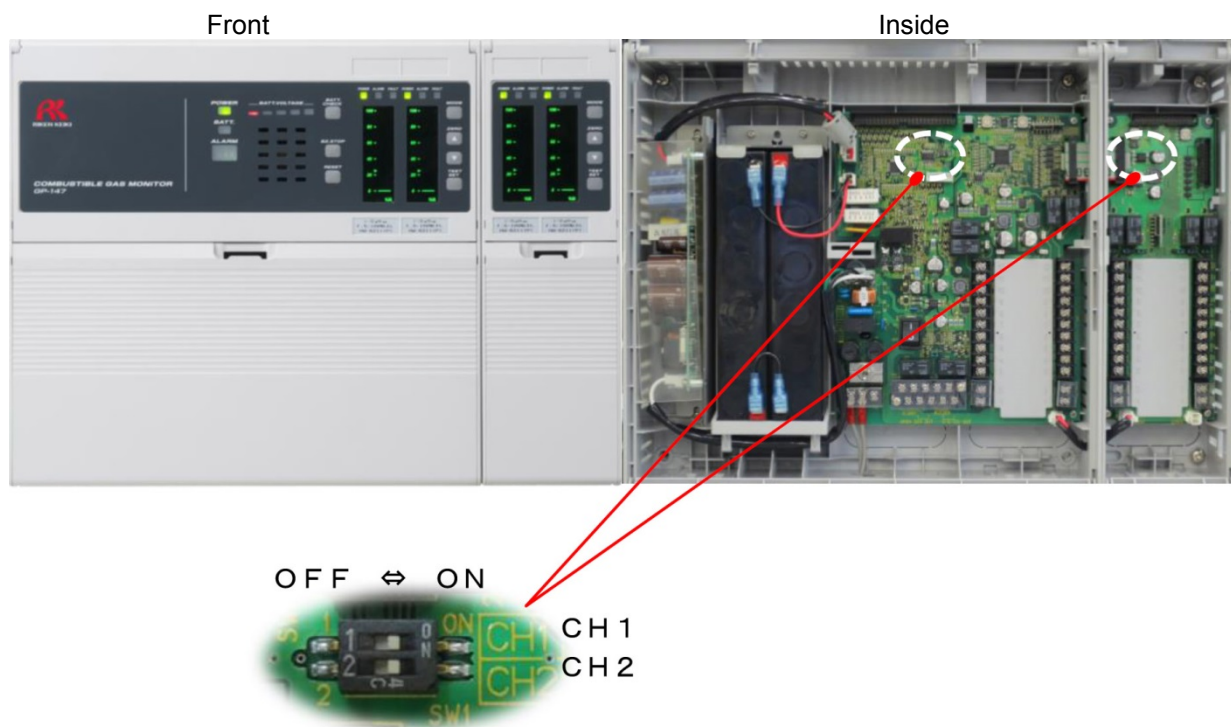
The normal operation returns.

### 5-8-4. Backup point selection function

On GP-147, whether to perform backup can be selected for each indicator using the selector switch. Power can be supplied only to the necessary point in the event of a blackout to perform continuous monitoring of gas leakage efficiently.

<How to Select a Backup Point>

- (1) Open the front cover of the main unit to find the selector switch for backup located on the PCB of each indicator unit (CH1/CH2).
- (2) Select ON/OFF for each channel using the selector switch for backup. Select ON to perform backup in the event of a blackout, or select OFF when backup is not required.



The selector switch for backup is located on the PCB of each indicator unit.

### 5-9. How to exit

To turn off the alarm system, open the front cover of the base unit and turn "OFF" the power switch. Then, turn off the power supply (100 - 240 VAC) to the alarm system.



#### WARNING

- When the alarm system is turned off, an alarm may be activated on the upper (central) system. Before turning off the alarm system, 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 alarm system.

## 6

# Operations and Functions

## 6-1. Gas alarm activation

Gas alarm: Triggered when the concentration of detected gas reaches or exceeds the alarm setpoint value.  
<Self-latching>

### NOTE

The alarm setpoint (standard) is factory-set.

Although the alarm delay time (standard: 2 seconds) works in the alarm system to prevent a false activation, it can be cancelled if not needed.

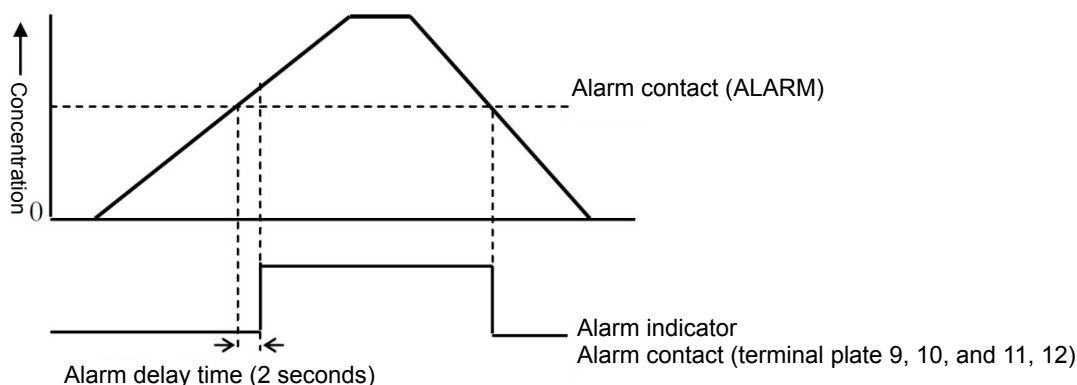
#### (1) Display operation

1. Gas concentration  
When the detection range is exceeded (over scale), the bar meter display starts blinking.
2. Power indicator lamp (POWER lamp: Green)  
This lights up continuously.
3. Alarm indicator lamp (Alarm lamp: Red, ALARM lamp: Red)  
When an alarm setpoint is reached or exceeded, the alarm lamp lights up and the ALARM lamp blinks.  
The alarm indicator lamp goes out when the gas concentration falls below the alarm setpoint after Bz. STOP -> reset operation.

#### (2) External output operation

1. 0/6/12 VDC output [standard]  
When an alarm is triggered, 12 VDC is output. The connectable load is 10 mA or less.
2. 4-20 mA output [option]  
A current proportional to the gas concentration is output.  
In case of over scale, an output will not exceed approximately 22 mA.
3. Alarm contact  
The contact is activated when the gas concentration reaches or exceeds the alarm setpoint.  
The contact activation is automatically reset when the gas concentration falls below the alarm setpoint after BZ. STOP -> reset operation.

"Alarm Pattern"



## (3) Response to gas alarm

In case of responding to a leaked gas

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

- (1) Check the reading of the alarm system.

**NOTE**

If a gas leak is momentary, the reading may already have dropped 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 dropped.

- (2) Based on your management rules of gas alarm, no one can be allowed to access the monitored zone to ensure safety.
- (3) If the gas concentration display continues to be shown, close the main valve of the gas, and then check that the gas concentration reading is dropped.
- (4) Assuming that gases remain, wear protective equipment to avoid dangers and go to the gas leak point, and then check if gases remain using a portable gas detector etc.
- (5) Check that the point is free from dangers, and take actions to fix the gas leak.

## 6-2. Fault alarm activation

**Fault alarm:** Triggered when an abnormality is detected in the alarm system.

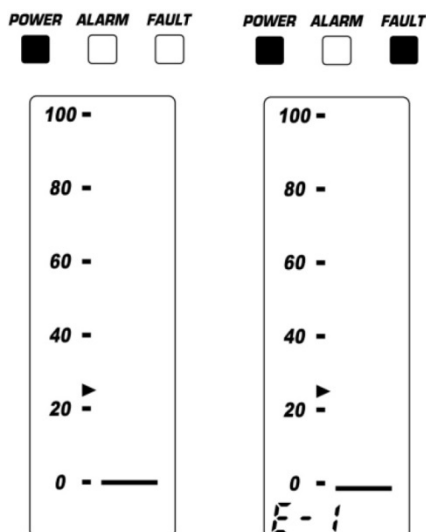
<Auto-reset> applies to the cases other than the system error "E-00".

When a fault alarm is triggered, the FAULT lamp lights up in orange, an error code appears on the LCD, and the buzzer sounds. The buzzer sound can be stopped by pressing the BZ\_STOP key.

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

When a fault occurred simultaneously with another, the errors are displayed alternately.

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



\* Display example: E-1 sensor disconnection error

**NOTE**

For information on malfunctions (error messages), see "9. Troubleshooting".



## 6-3. Gas alarms triggered by a factor unrelated to gas detection

The alarm system may react to an interference gas.

Contact RIKEN KEIKI for interference gases.

A drift caused by aging deterioration of the sensor may be a cause.

Check the reading at daily maintenance and perform calibration for the detector head as needed.

Noise from peripheral devices may be a cause.

Actions such as relocation, rewiring and adding a noise suppression part to the alarm system or detector head can be taken.

The action actually taken depends on the situation of each site.

Temporary noise from lightning, etc. may affect the alarm system. When a cause-and-effect relationship is found, a surge protection measure can be taken according to the situation.

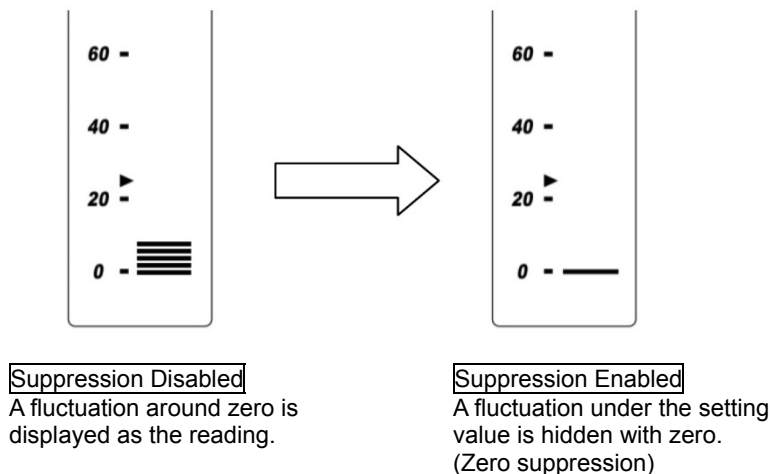
## 6-4. Other functions

### <Suppression Function>

Some types of detector heads connected to the alarm system are influenced by environmental changes (temperature, humidity, and other characteristics) or interference gases (interference characteristics) in no small measure, which affects the reading.

Therefore, the reading might fluctuate around zero even in a normal state with no gas leakage.

This function obscures influences by environmental changes and interference gases around zero that have no meaning for your management rules of gas alarm. This function is used to hide (suppress) the fluctuation of the reading under the setting value, indicating zero.



### CAUTION

A reading under zero is suppressed with the 10% FS suppression.

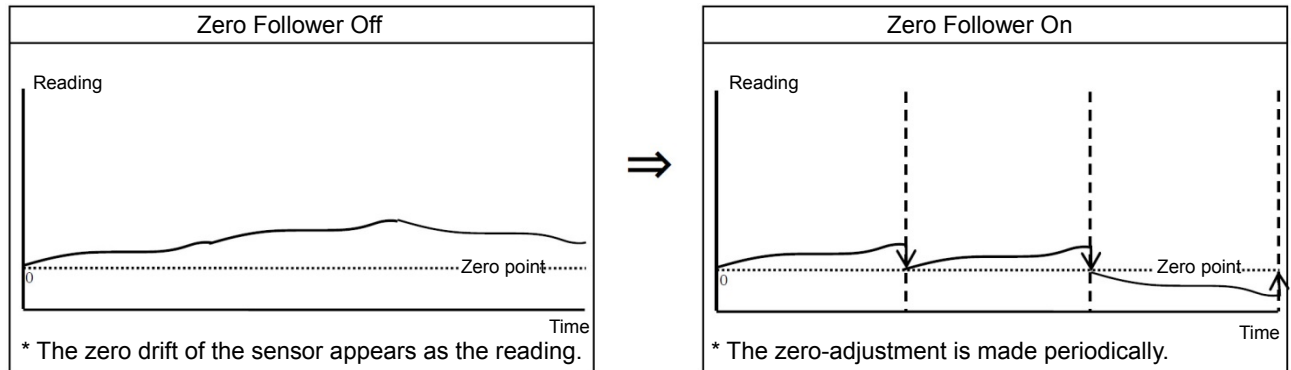
If a reading under zero reaches or exceeds the 10% FS, the bar is lowered by one step from the zero point (-0 state).

Because accurate gas detection cannot be performed in this state, perform zero adjustment.

## &lt;Zero Follower Function&gt;

Some types of detector heads connected to the alarm system might have sensitivity variations after being used for a long period.

This function corrects the fluctuation of the reading at the zero point (zero drift) among the sensitivity variations over time by a program manipulation to stabilize the zero point.



## &lt;Peak Hold Function&gt;

In normal measurement (detection mode), the peak concentration since an alarm activation is held and displayed on the bar.

When the full scale is exceeded, the FS bar blinks. Press BZ. STOP and then RESET to release the hold state.

## 7

# Maintenance

The alarm system is an important instrument for the purpose of safety.

To maintain the performance of the alarm system and improve the reliability of safety, perform a regular maintenance.

## 7-1. Maintenance intervals and items

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

Maintenance item	Maintenance content	Daily maintenance	Monthly maintenance	Regular maintenance
Power supply check	Check that the power lamp lights up.	○	○	○
Concentration display check	Check that the concentration display value is zero. When the reading is incorrect, perform zero adjustment after ensuring that no other gases exist around the detector head.	○	○	○
Alarm test	Inspect the alarm circuit by using the alarm test function.	-	○	○
Span adjustment	Perform the span adjustment by using the calibration gas.	-	-	○

### <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 sufficient knowledge about the dedicated tools used for services, along with other products. To maintain the safety operation of the alarm system, please use our maintenance service.

- The followings are typical maintenance services. Please contact RIKEN KEIKI for more information.

### Main services

- Power supply check : Checks the power supply voltage. Verifies that the power lamp lights up.  
(Verifies that relevant points can be identified on the system.)  
(When a UPS (uninterruptible power system) is used, checks the operation with the UPS.)
- Concentration display check : Verifies that the concentration display value is zero by using the fresh air.  
Performs zero adjustment if the reading is incorrect.

Alarm test	: Inspects the alarm circuit by using the alarm test function. <ul style="list-style-type: none"><li>• Checks the alarm lamps. (Checks the alarm activation.)</li><li>• Checks the external alarm. (Checks the activation of the external alarm, such as a buzzer.)</li></ul>
Span adjustment	: Performs span adjustment by using the calibration gas.
Gas alarm check	: Checks the gas alarm by using the calibration gas. <ul style="list-style-type: none"><li>• Checks the alarm. (Checks triggering of alarm when the alarm setpoint is reached.)</li><li>• Checks the delay time. (Checks time to delay until the alarm is triggered.)</li><li>• Checks the alarm lamps. (Checks the alarm activation.)</li><li>• Checks the external alarm. (Checks the activation of the external alarm, such as a buzzer.)</li></ul>
Cleaning and repair of unit	: Checks dust or damage on the surface, cover or internal parts of the unit, cleans and repairs such parts.
(Visual diagnosis)	Replaces parts which are cracked or damaged.
Unit operation check	: Uses the keys to check the operation of functions and parameters, etc.
Replacement of consumable parts	: Replaces a consumable part of the sensor.

## 7-2. Regular maintenance mode



## WARNING

After the adjustment is completed, never fail to press the MODE key to return to the detection mode. If the alarm system remains in the regular maintenance mode, it automatically returns to the detection mode in ten hours.

If the detection mode automatically returns after the regular maintenance mode was entered with the MAINT switch, return the MAINT switch to the center (OFF).

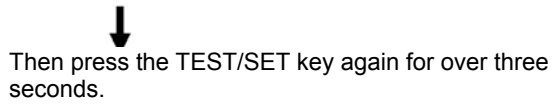
Otherwise, other switches cannot be operated.

Mode	Item	LCD display	Details
Maintenance mode (Regular maintenance)	Test => P48	2-0	2-0. 0 ..... Not used. 2-0. 1 ..... Not used. 2-0. 2 ..... Fault alarm test => P49 2-0. 3 ..... LED and LCD test => P49 2-0. 4 ..... Memory test => P50
	Zero adjustment => P62	2-1	Performs zero adjustment.
	Span adjustment => P63	2-2	Performs span adjustment.
	Zero/span initialization	2-3	Initializes zero and span values.
	Environmental setting 1 => P51	2-4	Functions setting 2-4. 0 Sensor intermittent operation setting while UPS is used 2-4. 1 ..... Not used. 2-4. 2 ..... Alarm setpoint setting => P54 2-4. 3 ..... Alarm delay time setting 2-4. 4 ..... Alarm activation setting => P54 2-4. 5 ..... Zero suppression type setting 2-4. 6 ..... Zero suppression value setting 2-4. 7 ..... Contact setting 2-4. 8 ..... Energized/De-energized alarm contact setting => P55 2-4. 9 ..... Zero follower setting 2-4. A ..... Maintenance mode external output setting => P56 2-4. B ..... External output adjustment => P57 2-4. C ..... External output setting for alarm test 2-4. D ..... Contact output setting for alarm test 2-4. E ..... Password setting 2-4. F ..... Sensor operation setting at a fault state
	Environmental setting 2 => P58	2-5	Functions setting 2-5. 0 ..... Heater current adjustment => P60 2-5. 1 ..... Not used. 2-5. 2 ..... Measured gas selection => P61 2-5. 3 ..... Alarm value limiter setting 2-5. 4 ..... Fault delay time setting 2-5. 5 ..... Buzzer setting for fault state 2-5. 6 ..... 24-hour zero follower setting 2-5. 7 ..... Green LCD brightness adjustment 2-5. 8 ..... Red LCD brightness adjustment
	Displays => P61	2-6	2-6. 0 ..... Heater current display 2-6. 1 ..... Fault detail display
	Factory mode switching	2-7	Not used.
	Return to the user mode.	2-8	Returns to the user mode "1-0".

<Regular Maintenance Mode>

User Mode

Press the TEST/SET key with "1-3" displayed.



Regular Maintenance Mode

2-0

Perform various tests.

2-1

Perform zero adjustment.

Simplified calibration (=> P34) can be performed instead.

2-2

Perform span adjustment.

Simplified calibration ( $\Rightarrow$  P34) can be performed instead.

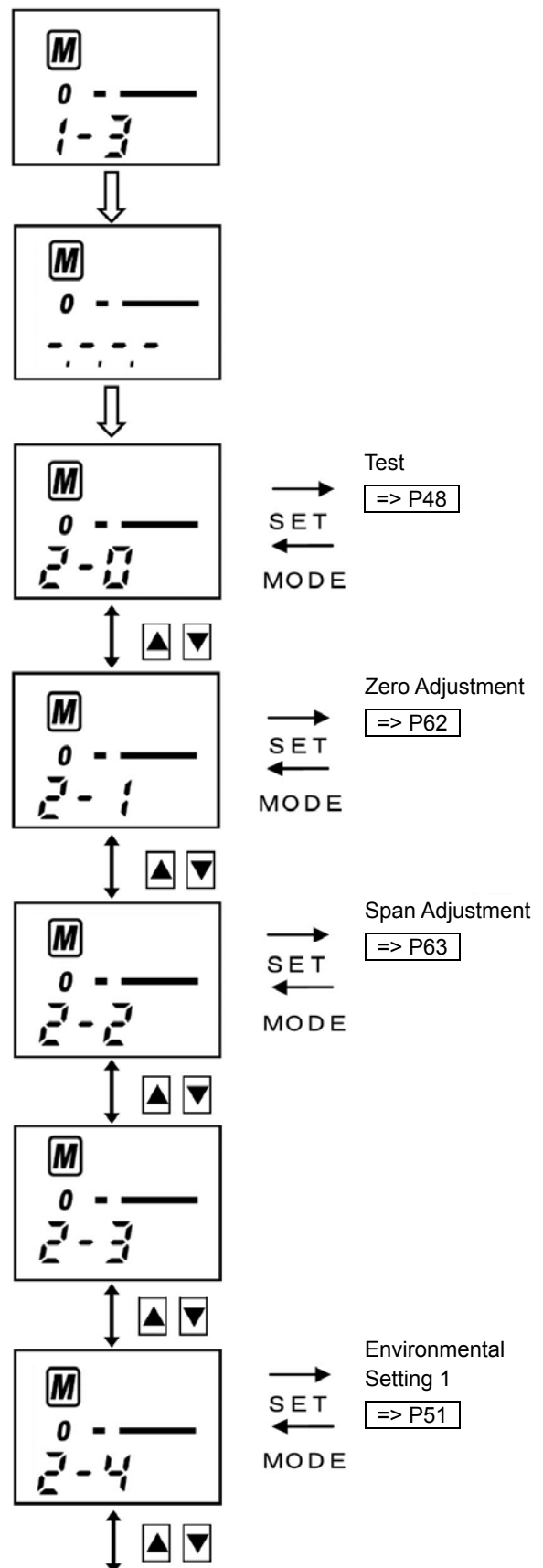
2-3

Initialize zero and span values.

Execute this before performing calibration (zero/span adjustment) after sensor replacement.

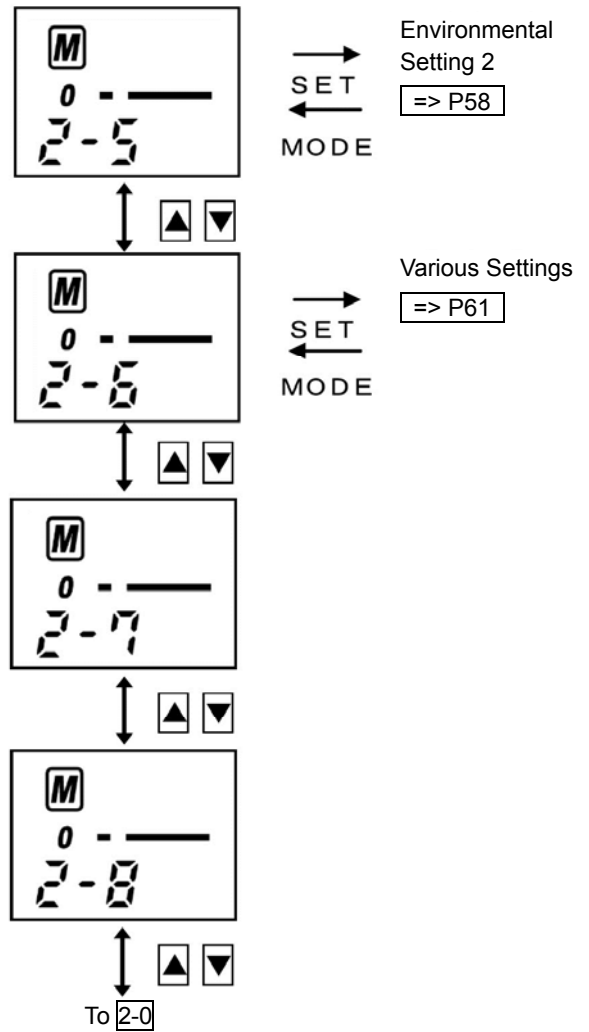
2-4

Environmental setting 1: Configure various settings.



**2-5**

Environmental setting 2: Configure various settings.

**2-6**

Check various displays  
(heater current, fault detail).

**2-7**

Enter the factory mode.  
This is not used by the user.

**2-8**

Return to the user mode "1-0".

<Test 2-0>2-0

Press the TEST/SET key.

2-0.0

Not used.

2-0.1

Not used.

2-0.2

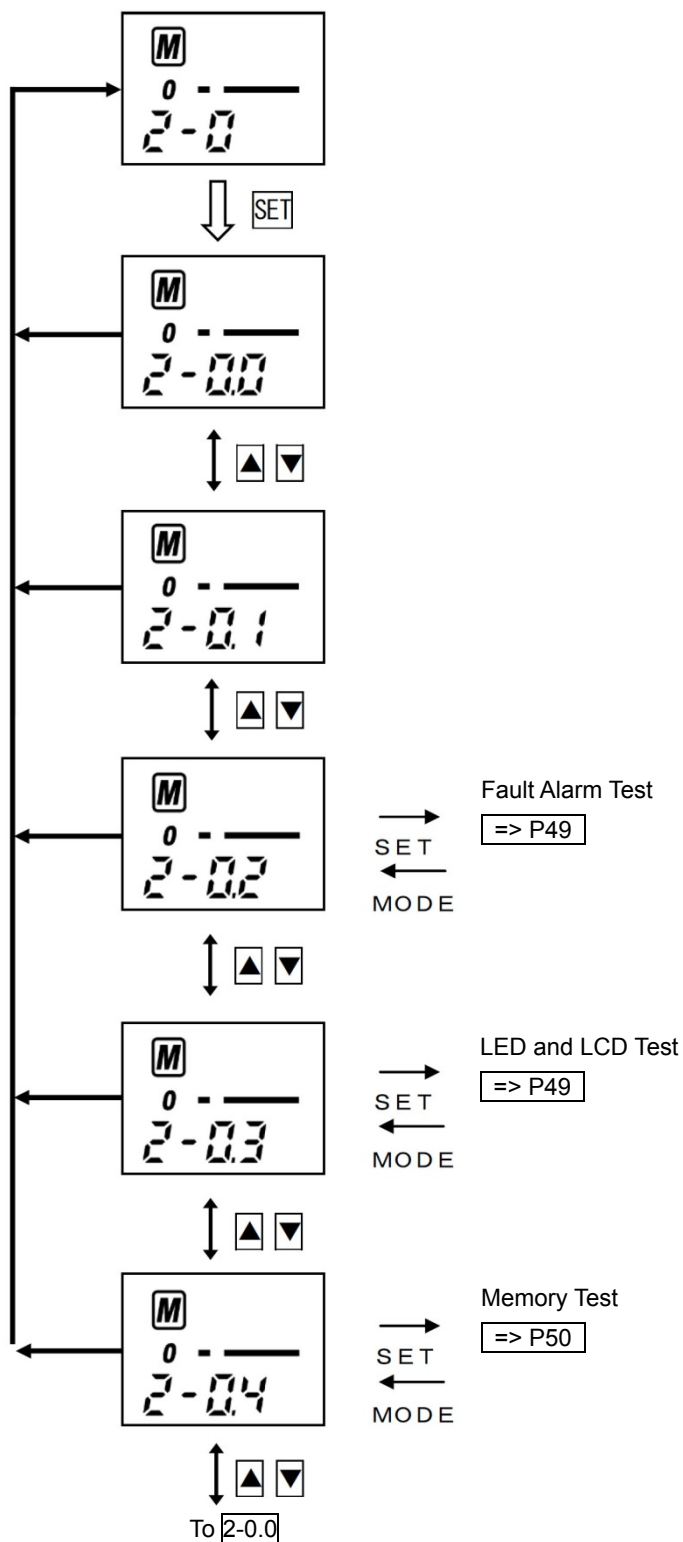
Conduct a fault alarm test.

2-0.3

Test LED and LCD.

2-0.4

Conduct a memory test.

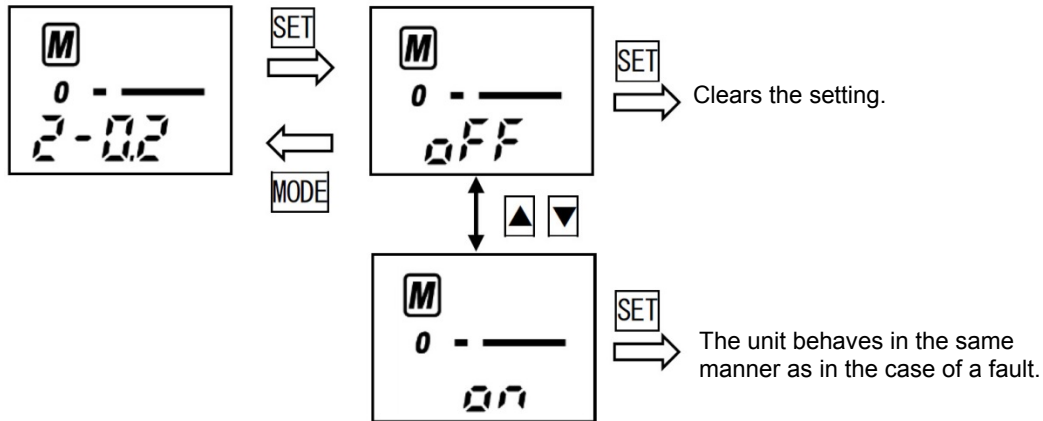




## &lt;Fault Alarm Test 2-0. 2&gt;

- (1) Select 2-0.2 from the menu screen.
- (2) Press the TEST/SET key.
- (3) Select ON/OFF with the ▲/▼ key.
- (4) Press the TEST/SET key to confirm it.
- (5) Return to "2-0.2" with the MODE key.

Pressing the MODE key during a fault alarm test clears the setting and returns to "2-0.2".

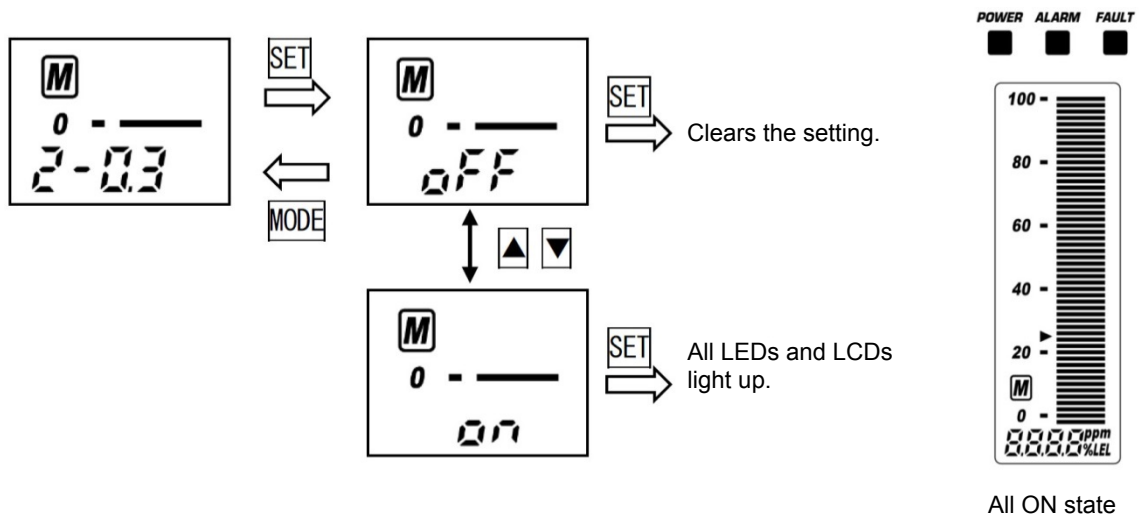
**WARNING**

Operate the unit carefully since the contact functions during a fault alarm test.

## &lt;LED and LCD Test 2-0. 3&gt;

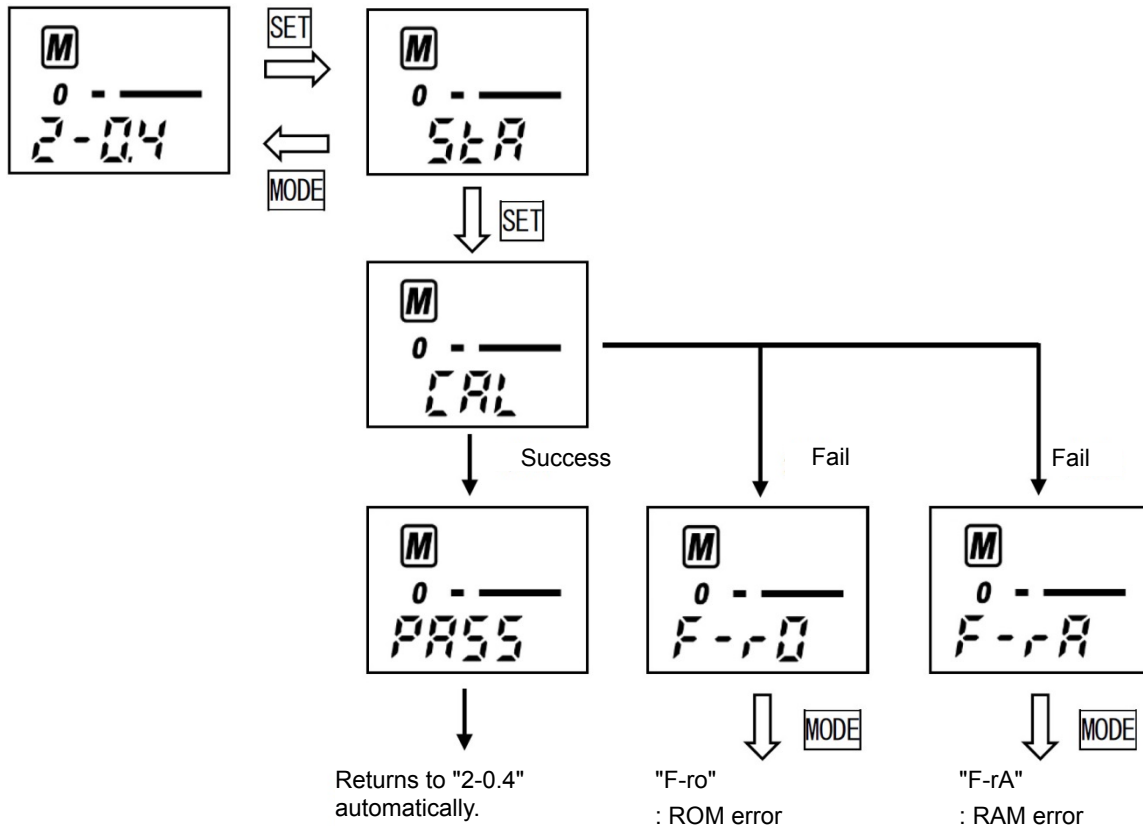
- (1) Select 2-0.3 from the menu screen.
- (2) Press the TEST/SET key.
- (3) Select ON/OFF with the ▲/▼ key.
- (4) Press the TEST/SET key to confirm it.
- (5) Return to "2-0.3" with the MODE key.

Pressing the MODE key during a test clears the setting and returns to "2-0.3".



## &lt;Memory Test 2-0.4&gt;

- (1) Select 2-0.4 from the menu screen.
  - (2) Press the TEST/SET key.
  - (3) Press the TEST/SET key again.
  - (4) After "CAL" is displayed, a memory test starts automatically.
  - (5) If the test is successful, "PASS" appears and "2-0.4" returns automatically.
- \* If the test fails, use the MODE key to return.



<Environmental Setting 1 2-4>

In the environmental setting 1, specify the settings of functions. (\* It is recommended that setting changes should be recorded in a log.)

The environmental setting 1 includes setting menus which are usually not used. Be careful not to change these settings by mistake.

2-4

Select 2-4 from the regular maintenance mode.

Press the TEST/SET key.

2-4. 0

Set whether to make the sensor perform intermittent operation while UPS is used. Select ON/OFF with the ▲/▼ key and press the TEST/SET key to confirm it.

When ON is selected, intermittent operation is performed while UPS is used. The standard specification is OFF, and continuous operation is performed while UPS is used.

2-4. 1

Not used.

2-4. 2

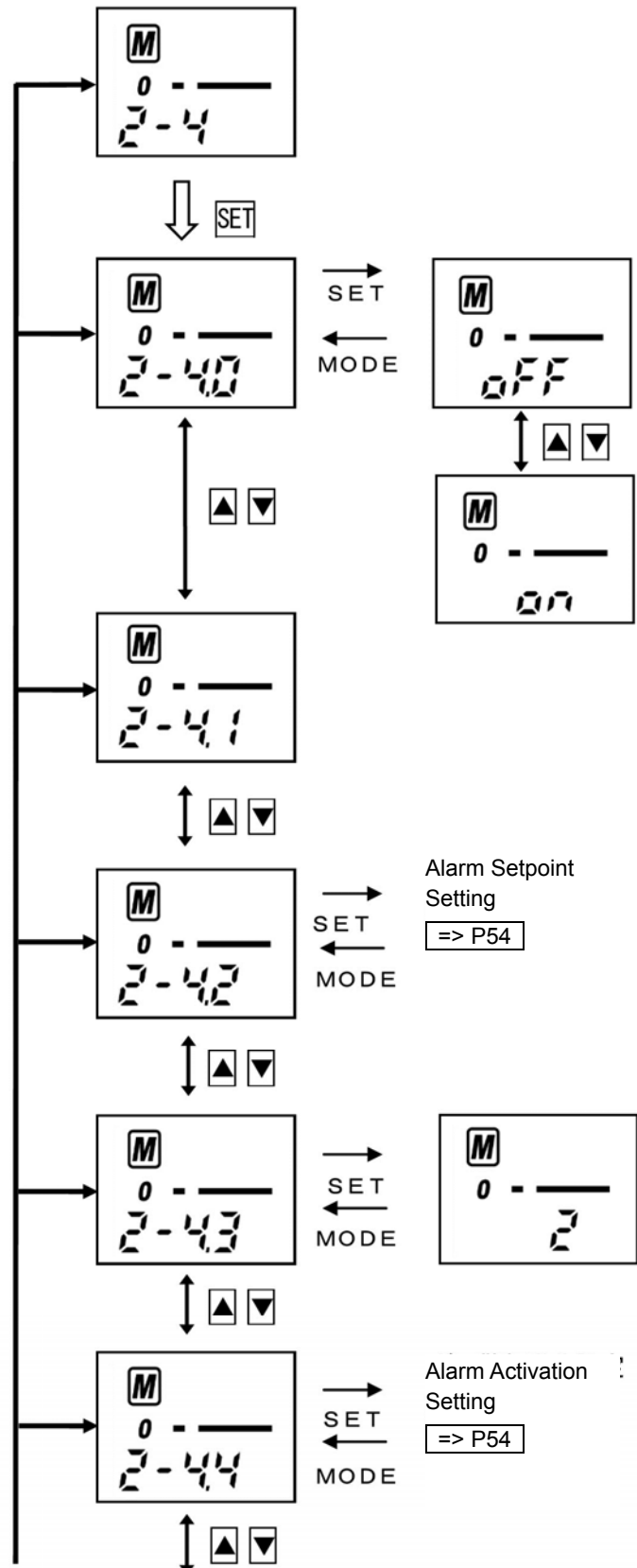
Set the alarm setpoint.

2-4. 3

Set the alarm delay time.  
Change the value (second) by pressing the ▲/▼ key, and then press the TEST/SET key to confirm the value.  
(Set range: 0 - 60)

2-4. 4

This is a setting screen of the gas alarm activation. Do not change the setting when the alarm system is used in a normal way, because it determines how the alarm system functions.  
(Default: Self-latching "L")



**2-4. 5**

Set the suppression type.

Select CUT/SLOP with the ▲/▼ key and press the TEST/SET key to confirm it.

When CUT (cut off) is selected, values exceeding the suppression value are directly displayed.

When SLOP (slope) is selected, values exceeding the suppression value are gently displayed.

**2-4. 6**

Set the suppression value.

Change the value by pressing the ▲/▼ key, and then press the TEST/SET key to confirm the value.

**2-4. 7**

Set the individual alarm contact (2).

Select AL (gas alarm contact)/FAU (fault alarm contact) with the ▲/▼ key and press the TEST/SET key to confirm it.

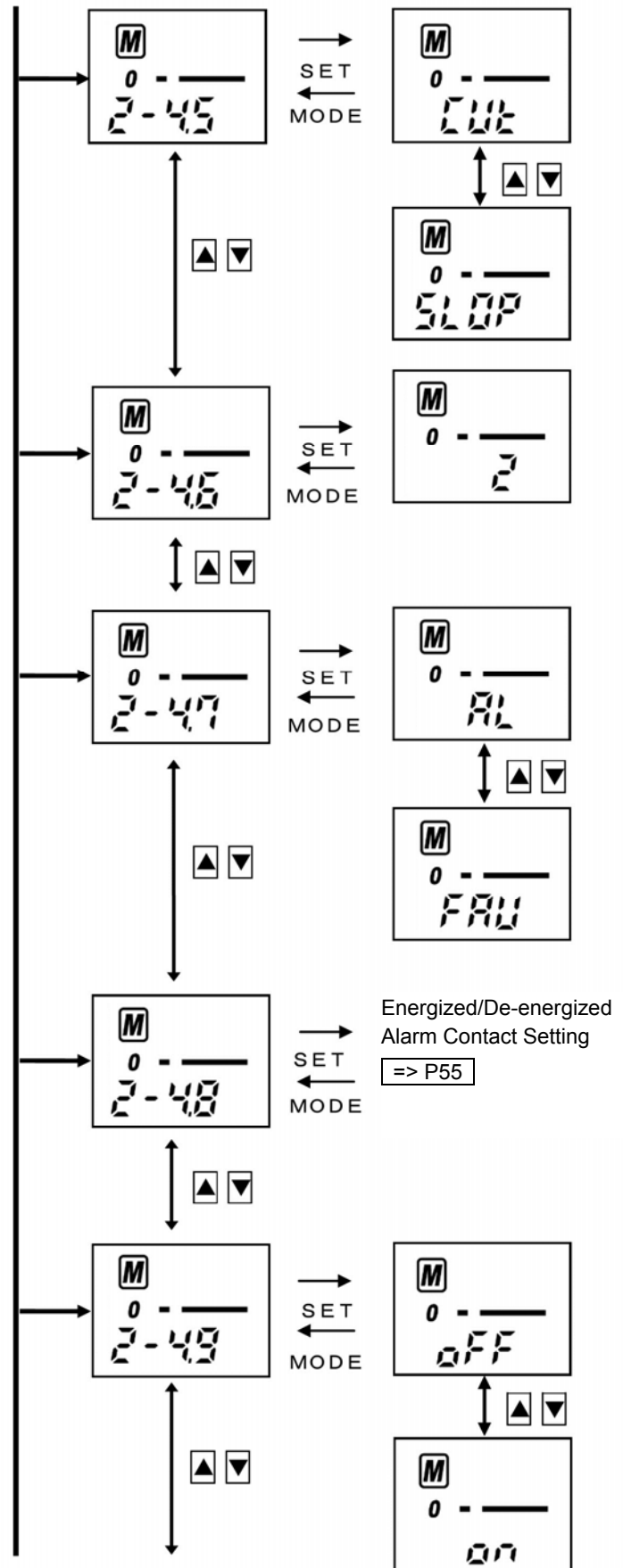
**2-4. 8**

Select either energized/de-energized for the alarm contact.

**2-4. 9**

Set the zero follower.

Select ON/OFF with the ▲/▼ key and press the TEST/SET key to confirm it. When ON is selected, the zero follower function is activated.



**2-4. A**

Set the external output for the maintenance mode.

**2-4. B**

Adjust the external output (4 - 20 mA).

\* The setting is applicable only for the 4-20 mA specification.

**2-4. C**

Set the external output for an alarm test.

Select ON/OFF with the ▲/▼ key and press the TEST/SET key to confirm it. When ON is selected, the test concentration is output as the external output during an alarm test. When OFF is selected, the output is held at the one before the alarm test mode is entered.

\* The setting is applicable only for the 4-20 mA specification.

**2-4. D**

Set the contact activation for an alarm test.

Select ON/OFF with the ▲/▼ key and press the TEST/SET key to confirm it. When ON is selected, the contact can be activated during an alarm test.

**2-4. E**

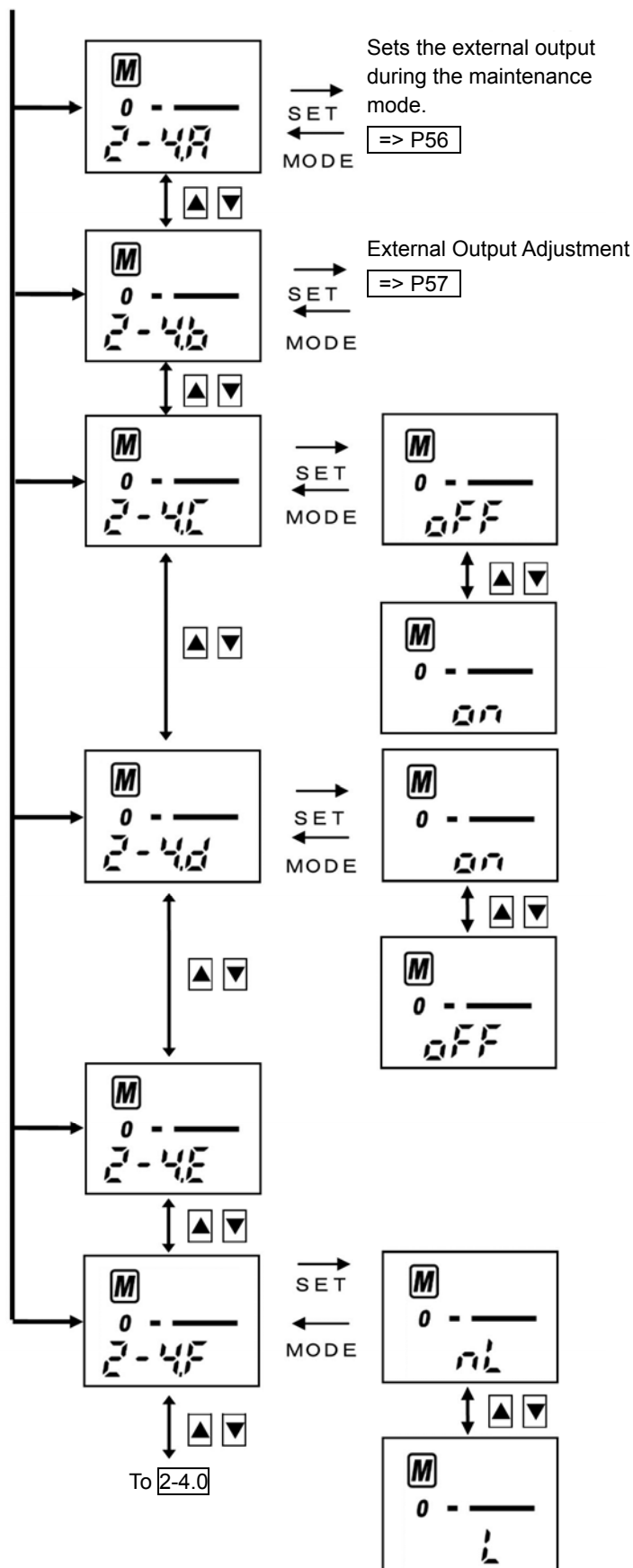
Set the password.

**2-4. F**

This is a setting screen of sensor operation at a fault state.

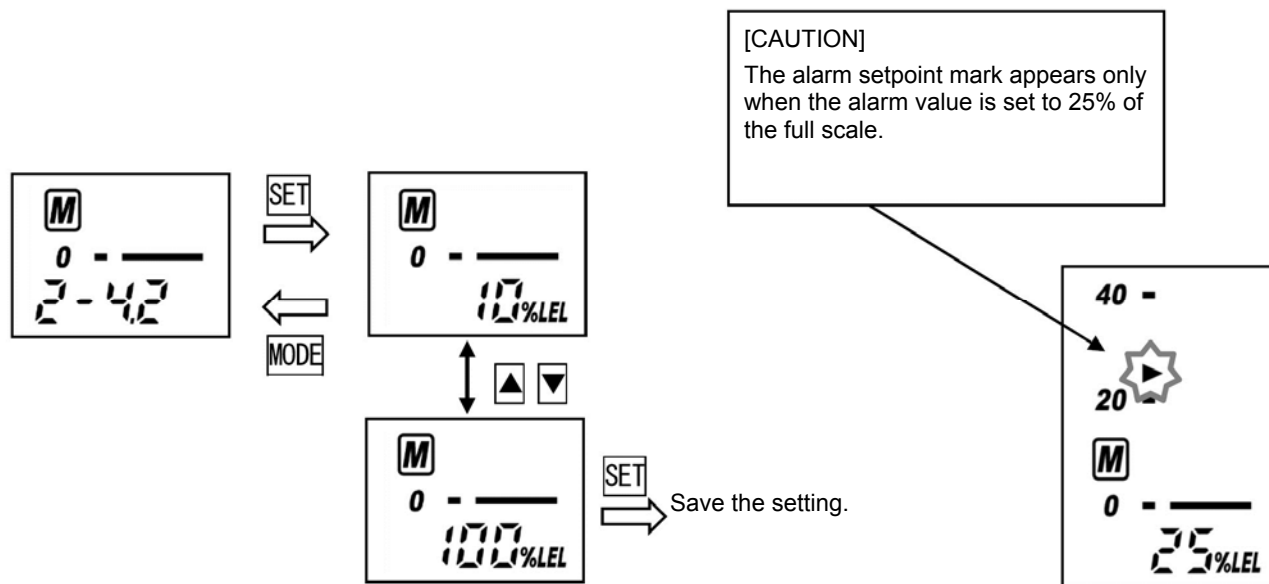
Do not change the setting when the alarm system is used in a normal way, because it determines how the alarm system functions.

(Default: Auto-reset "nL")



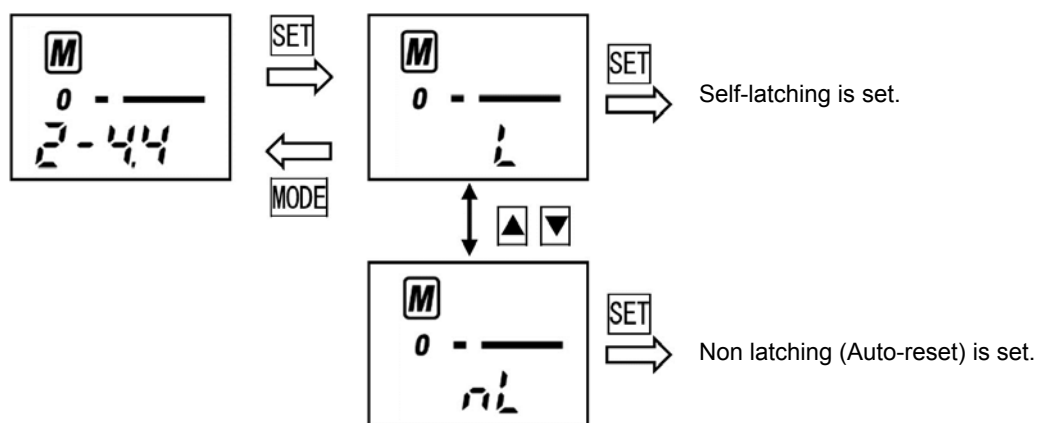
## &lt;Alarm Setpoint Setting 2-4. 2&gt;

- (1) Select 2-4.2 from the menu screen.
- (2) Press the TEST/SET key.
- (3) Change the alarm value with the ▲/▼ key.  
(Set range: 10 - 100)
- (4) Press the TEST/SET key to save the setting.  
After the setting is completed, "2-4.2" returns automatically.



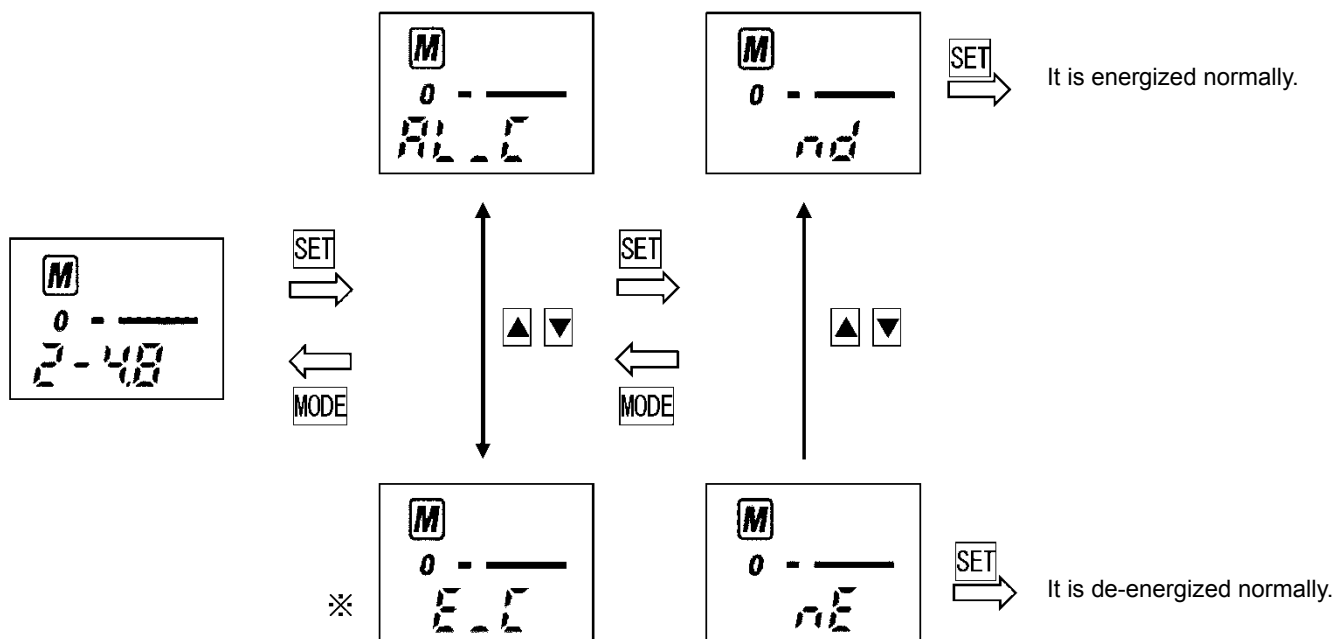
## &lt;Alarm Activation Setting 2-4. 4&gt;

- (1) Select 2-4.4 from the menu screen.
- (2) Press the TEST/SET key.
- (3) Select L/NL with the ▲/▼ key.
- (4) Press the TEST/SET key to save the setting.  
After the setting is completed, "2-4.4" returns automatically.



## &lt;Energized/De-energized Alarm Contact Setting [2-4. 8]&gt;

- (1) Select [2-4.8] from the menu screen.
- (2) Press the TEST/SET key.
- (3) Select AL\_C (Gas alarm contact)/E\_C (Fault contact)\* with the ▲/▼ key, and press the TEST/SET key.
- (4) Select nd (energized)/nE (de-energized) with the ▲/▼ key.
- (5) Press the TEST/SET key to save the setting.  
After the setting is completed, "2-4.8" returns automatically.



※ When individual alarm contact is set as fault alarm [option] by [2-4.7].

**NOTE**

When de-energized is selected, the relay is energized and activated in response to an alarm (de-energized at a normal environment).

- When the contact "a" is used, it is open at a normal state while closed in response to an alarm.
- When the contact "b" is used, it is activated conversely.

When energized is selected, the relay is energized at a normal environment (de-energized in response to an alarm).

- When the contact "a" is used, it is closed at a normal state while open in response to an alarm. It is open at power-off as well.
- When the contact "b" is used, it is activated conversely.

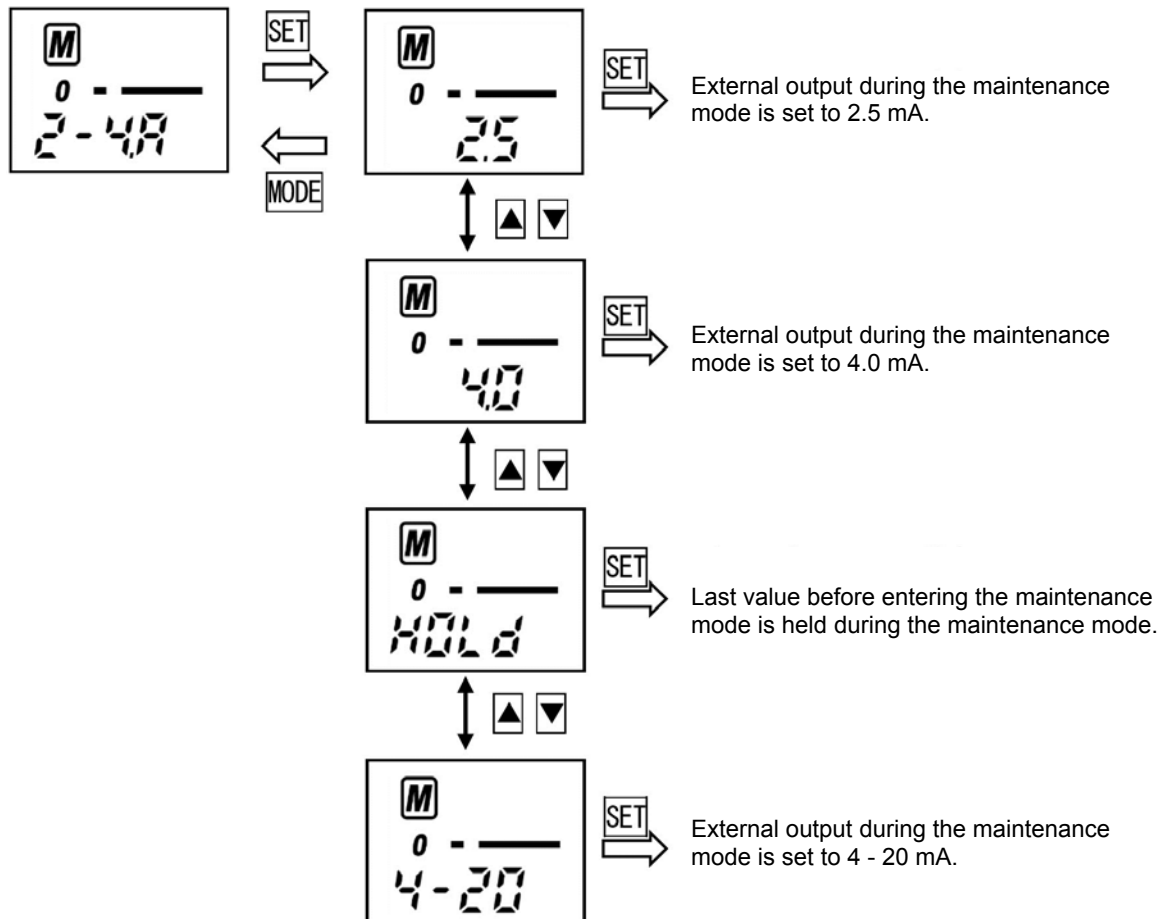
**NOTE**

To change the settings of the contact specifications (such as the "a" or "b" contact), please contact RIKEN KEIKI.

<Maintenance Mode External Output Setting 2-4. A>

\* The setting is applicable only for the external output with 4-20 mA specification.

- (1) Select 2-4.A from the menu screen.
- (2) Press the TEST/SET key.
- (3) Select 2.5/4.0/HOLD/4-20 with the  $\blacktriangle/\blacktriangledown$  key.
- (4) Press the TEST/SET key to save the setting.

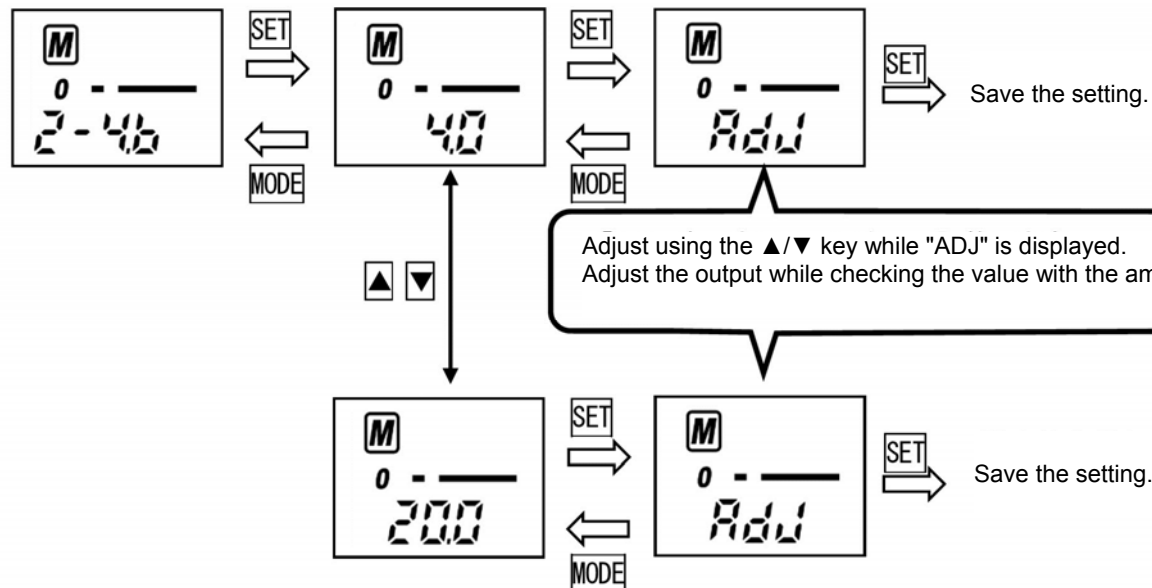
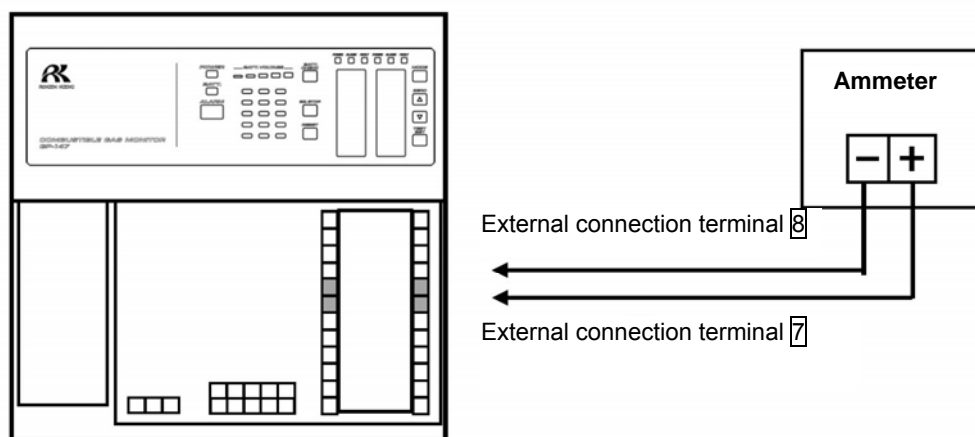




## &lt;External Output Adjustment 2-4. B&gt;

- \* The setting is applicable only for the external output with 4-20 mA specification.
- \* The adjustment requires an ammeter separately.

- (1) Connect an ammeter to the external connection terminals 8 (+) and 9 (-).
  - (2) Select 2-4.B from the menu screen.
  - (3) Press the TEST/SET key.
  - (4) Select 4.0/20.0 with the ▲/▼ key.
  - (5) Press the TEST/SET key.
  - (6) Adjust using the ▲/▼ key while checking the value with the ammeter.
  - (7) Press the TEST/SET key to save the setting.
- After the setting is completed, "2-4.B" returns automatically.



## &lt;Environmental Setting 2&gt;

In the environmental setting 2, specify the settings of functions. (\* It is recommended that setting changes should be recorded in a log.)

The environmental setting 2 includes setting menus which are usually not used. Be careful not to change these settings by mistake.

**2-5**

Select **2-5** from the regular maintenance mode.

Press the TEST/SET key.

**2-5. 0**

Adjust the heater current.

**2-5. 1**

Not used.

**2-5. 2**

Select the measured gas.

**2-5. 3**

This is a setting screen of the alarm value limiter.

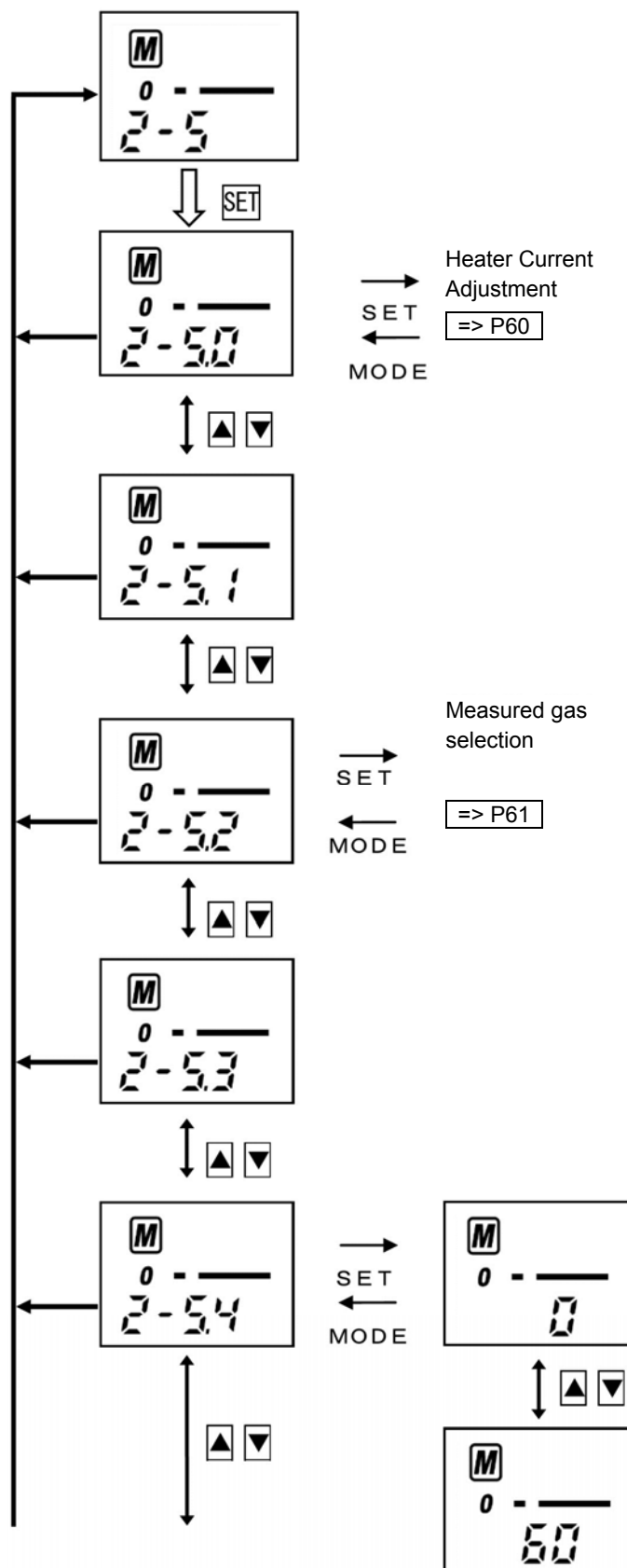
Do not change the setting when the alarm system is used in a normal way. (Default: ON)

**2-5. 4**

Set the fault delay time.

Change the value (second) by pressing the ▲/▼ key, and then press the TEST/SET key to confirm the value.

(Set range: 0 - 60)



2-5.5

Set the buzzer for a fault state.

Select ON/OFF with the ▲/▼ key and press the TEST/SET key to confirm it. When ON is selected, the buzzer sounds at a fault state.

2-5. 6

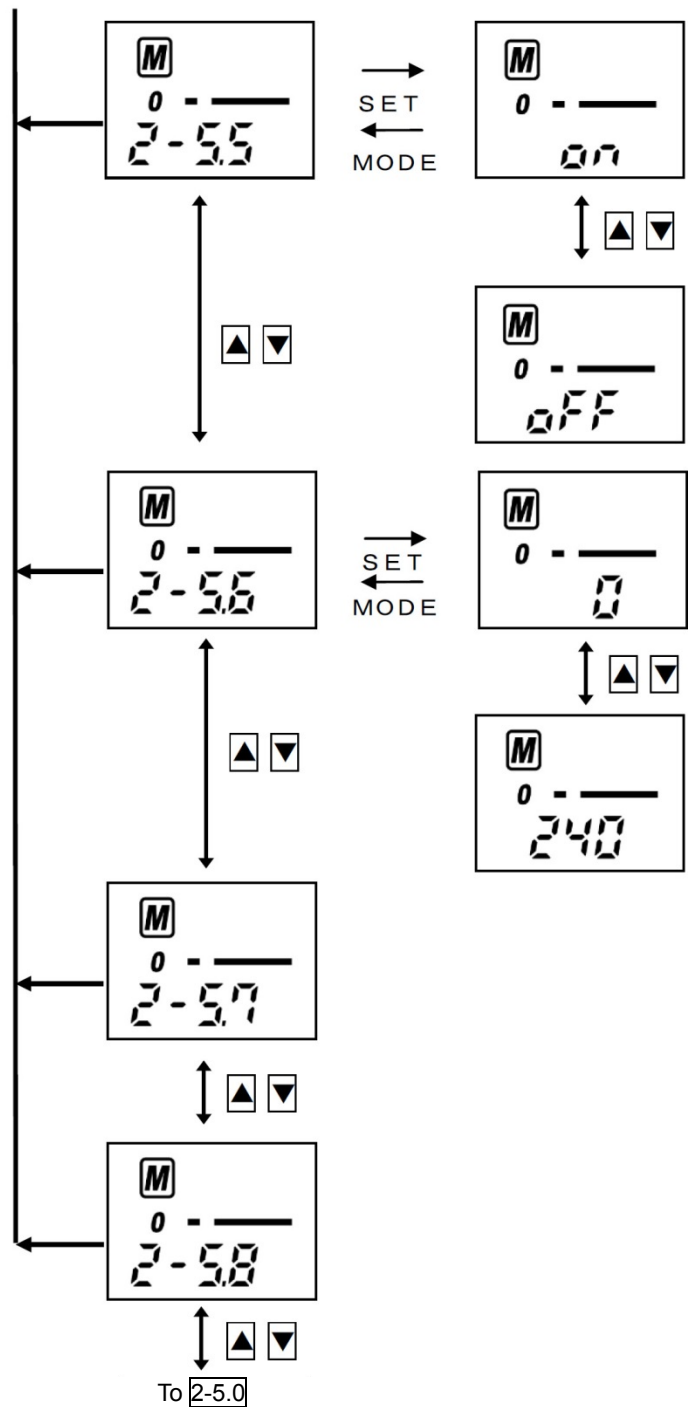
Set the 24-hour zero follower.

2-5.7

Adjust the brightness of the LCD backlight (green).  
Adjust the value with the ▲/▼ key and press the  
TEST/SET key to confirm it.

2-5. 8

Adjust the brightness of the LCD backlight (red).  
Adjust the value with the ▲/▼ key and press the  
TEST/SET key to confirm it.



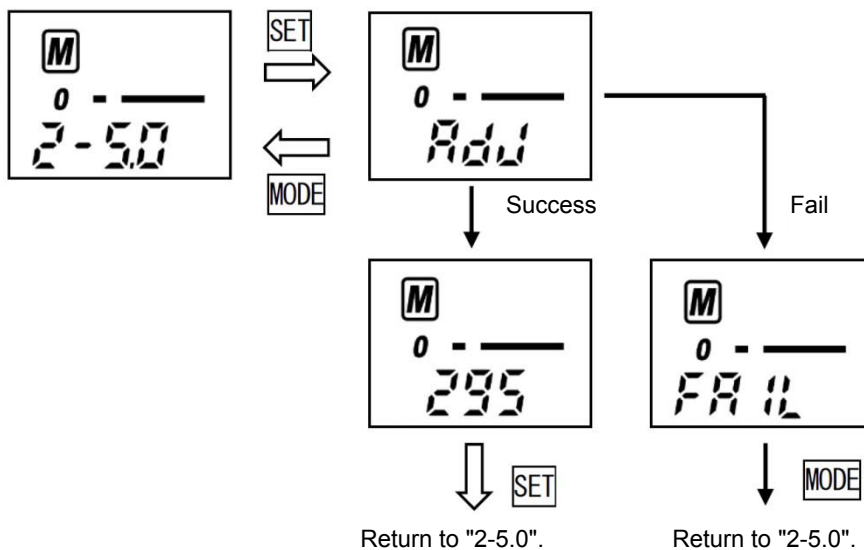
<Heater Current Adjustment 2-5.0>



## CAUTION

- Execute this before performing calibration (zero/span adjustment) after sensor replacement.
- After cycling the power or recovering from a blackout and so on, always perform zero calibration after making sure that a gas to be detected is not present around the unit.
- When "E-1" is displayed after initial clear, cycle the power or perform heater adjustment in the maintenance mode "2-5.0".

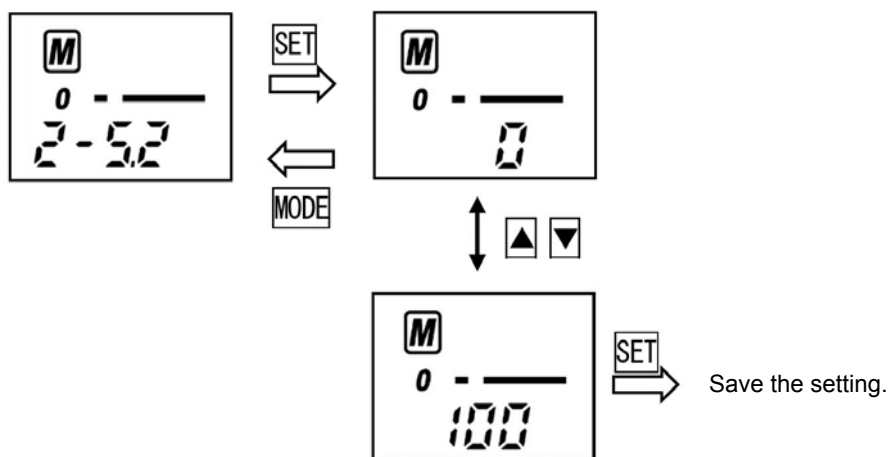
- (1) Select 2-5.0 from the menu screen.
- (2) Press the TEST/SET key.
- (3) The heater current is adjusted automatically.
- (4) After the adjustment, press the TEST/SET key to return to "2-5.0".



\* The heater current varies by the built-in sensor.

## &lt;Measured Gas Selection 2-5. 2&gt;

- (1) Select 2-5.2 from the menu screen.
  - (2) Press the TEST/SET key.
  - (3) Select the measured gas with the ▲/▼ key. (Set range: 0 - 100)
  - (4) Press the TEST/SET key to save the setting.
- After the setting is completed, "2-5.2" returns automatically.



## &lt;Environmental setting 2&gt;

## 2-6

Press the TEST/SET key.

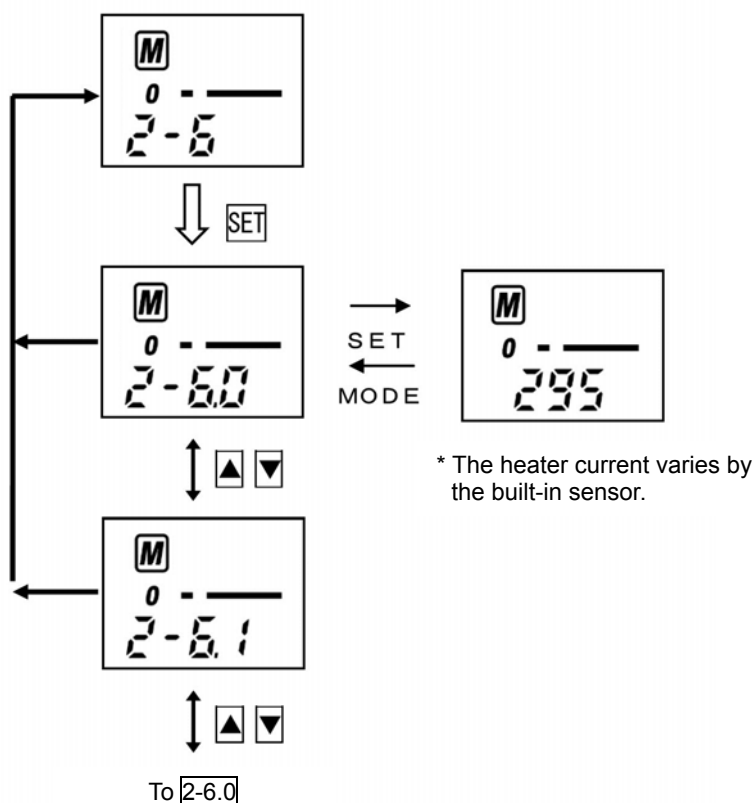
## 2-6. 0

Display the heater current value.

Press the TEST/SET key to display the current heater current value.

## 2-6. 1

Display a fault detail with an error code.



## 7-3. Calibration method

Perform calibration on the detector head (sensor) connected to the indicator in each mode (zero adjustment mode and span adjustment mode) using the calibration gas.

Perform calibration using the calibration gas.

- Zero adjustment gas (collected in a gas sampling bag)
- Calibration gas (collected in a gas sampling bag)
- Gas sampling bag for exhaust gas

\* When a diffusion type detector is connected, a pump is required.



### WARNING

After the adjustment is completed, never fail to return to the detection mode.

<Zero Adjustment **2-1**>

This is used to perform the zero adjustment on the detector head (sensor).

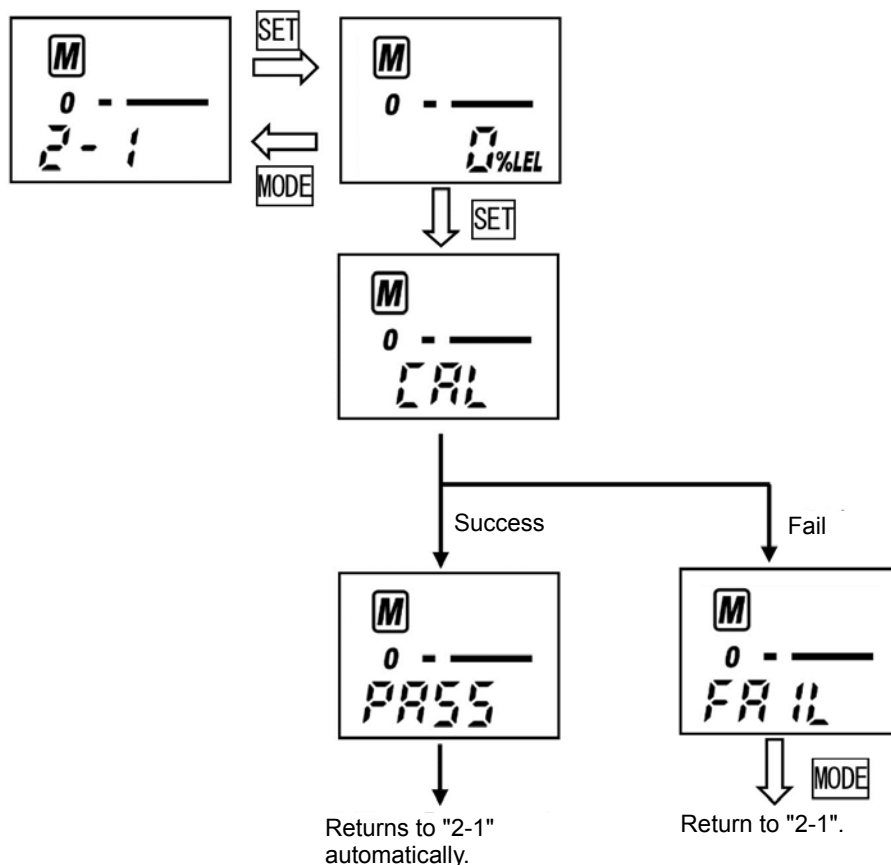


### WARNING

Perform zero adjustment using the zero adjustment gas or in a place where the surrounding air is fresh.

If interference gases exist, the adjustment cannot be performed properly, thus leading to dangers when the gas leaks.

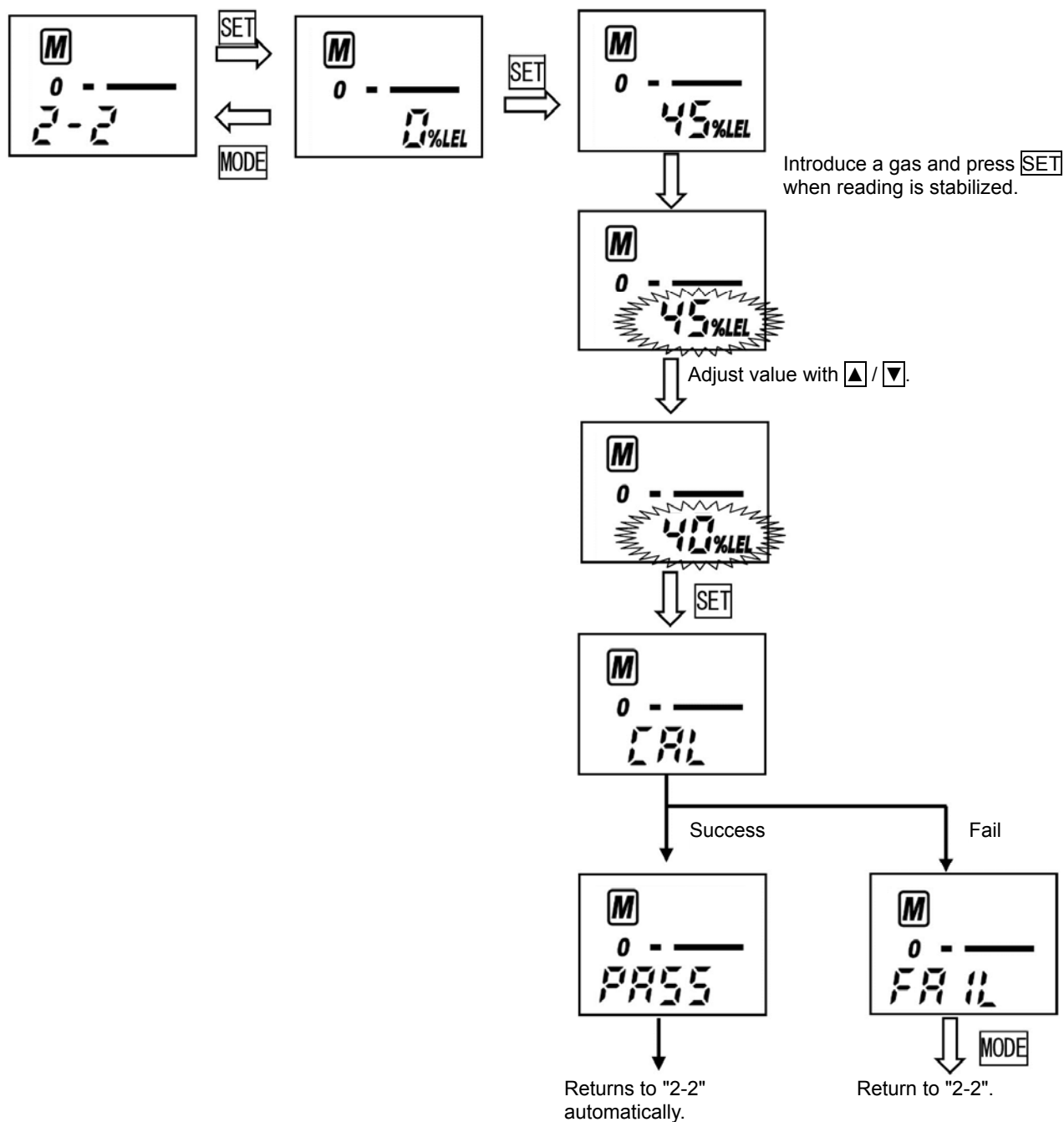
- (1) Select **2-1** from the menu screen.
  - (2) Press the TEST/SET key.
  - (3) After CAL is displayed, zero adjustment is performed automatically.
  - (4) If the adjustment is successful, "PASS" appears and "2-1" returns automatically.
- \* "FAIL" appears when the adjustment fails.



## &lt;Span Adjustment 2-2&gt;

This is used to perform the span adjustment on the detector head (sensor).

- (1) Select 2-2 from the menu screen.
- (2) Press the TEST/SET key.
- (3) Introduce the calibration gas.
- (4) Press the TEST/SET key when the reading is stabilized.  
\* SET is unavailable below 10% of the full scale.
- (5) When the reading starts blinking, adjust the gas concentration with the ▲/▼ key.
- (6) Press the TEST/SET key.
- (7) After CAL is displayed, gas adjustment is performed automatically.
- (8) If the adjustment is successful, "PASS" appears and "2-2" returns automatically.



## 8

# Storage, Relocation and Disposal

## 8-1. Procedures to store the alarm system or leave it for a long time

The alarm system 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
- In a place free from vibrations or shocks.

## 8-2. Procedures to relocate the alarm system or use it again

When the alarm system is relocated, select a new place in accordance with "4-2. Precautions for installation sites" and "4-5. How to install".

For information on wiring work, see "4-7. Wiring". The unpowered time for the detector head (sensor) or indicator must be minimized when the alarm system is relocated.



### CAUTION

When using a relocated or stopped/stored alarm system again, never fail to perform calibration. For information on readjustment including a calibration, please contact RIKEN KEIKI.

## 8-3. Disposal of products

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



## 9

# Troubleshooting

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

## NOTE

Read also the operating manual of the detector head connected to the alarm system.

●: Lamp on  
○: Lamp off

### <Abnormalities on Unit>

Symptom/Display	FAULT	Causes	Actions
<u>The power cannot be turned on.</u>	-	The power switch is turned off.	Turn ON the power switch.
		Fuse disconnection	Find out why the fuse has blown and take appropriate actions before replacing it.
		Incorrect connection of power cable	Check the terminal plate and correct the incorrect wiring.
		Abnormalities/momentary blackout of power supply system	Provide the rated voltage. Take measures such as checking or adding the UPS, power supply line filter, insulation transformer, etc.
		Cable abnormalities (disconnection/not connected/short circuit)	Check the wiring of alarm system and related devices around it.
<u>Abnormal operations</u>	○	Disturbances by sudden surge noise, etc.	Turn off and restart the alarm system. If such a symptom is observed frequently, take appropriate measures to eliminate the noise.
<u>Span adjustment impossible</u>	○	Calibration gas concentration	Use the proper calibration gas.
		Sensor sensitivity deterioration	Replace the sensor.
<u>Sensor abnormalities</u> E-1	●	Sensor disconnection and short-circuit in the detector head Heater adjustment error	Connect the cable between the alarm system and the detector head (sensor) properly or replace the sensor. When "E-1" is displayed after initial clear, cycle the power or perform heater adjustment in the maintenance mode "2-5.0".
<u>System abnormalities</u> E-9	●	Abnormality in the memory within the detector head	Please contact RIKEN KEIKI.

## &lt;Abnormalities of Readings&gt;

Symptoms	Causes	Actions
<u>The reading rises (drops) and it remains so.</u>	Drifting of sensor output	Perform zero adjustment.
	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.
	Slow leak	A very small amount of the gas to be detected may be leaking (slow leak). Because ignoring it may cause dangers, take a remedial measure, i.e., taking actions the same as those for the gas alarm.
	Environmental changes	Perform zero adjustment.
<u>A gas alarm is triggered despite of no gas leak and no other abnormalities at the detection point.</u>	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 alarm system. If such a symptom is observed frequently, take appropriate measures to eliminate the noise.
	Sudden change in the environment	When the environment (temperature, etc.) changes suddenly, the alarm system cannot adjust to it and is affected by it. In some cases, the alarm system triggers an indication alarm. Because the alarm system cannot be used under sudden and frequent environmental changes, you must take any preventive actions to eliminate them.
<u>Slow response</u>	Clogged dust filter	Replace the suction type detector head or dust filter of the calibration gas supply pump.
	Bended or clogged suction tube or exhaust tube	Fix the detective part (suction type detector head or calibration gas supply pump).
	Condensation is formed inside the suction tube.	Fix the detective part (suction type detector head or calibration gas supply pump).
	Deteriorated sensor sensitivity	Replace the sensor with a new one.
<u>Span adjustment impossible</u>	Improper calibration gas concentration	Use the proper calibration gas.
	Deteriorated sensor sensitivity	Replace the sensor with a new one.

**NOTE**

Fuses rated at 250 V/5 A T can be used for the alarm system.

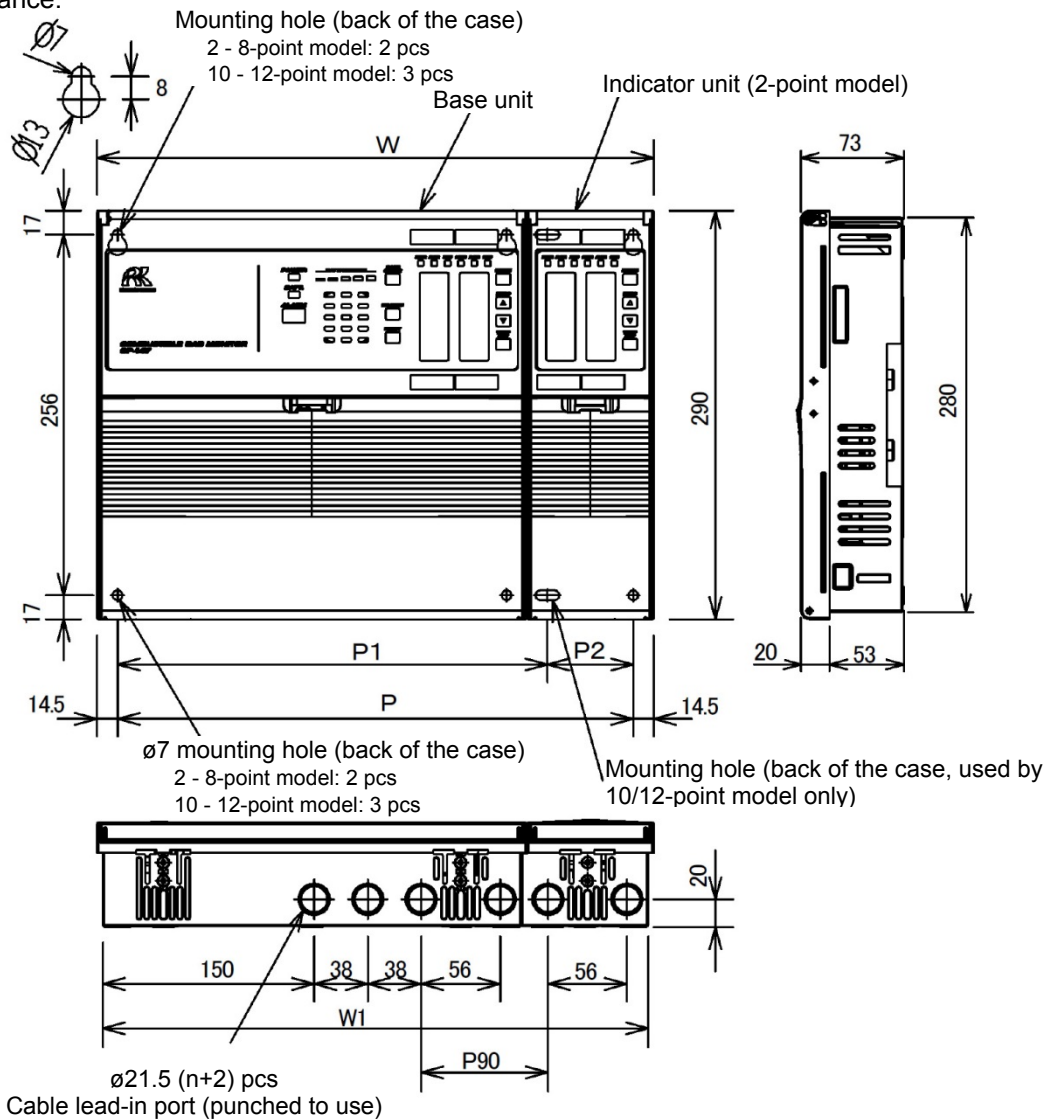
## 10

# Product Specifications

## 10-1. Specifications

- Structure: Wall mounting or rack mounting type, non splash-proof
  - Paint color: Door: Munsell N7. 2 (light gray)
  - UPS (uninterruptible power system): Available [standard] or unavailable [option]
  - External dimensions and weight:
    - 2-point model: Approx. 290 (H) x 305 (W) x 73 (D) mm, approx. 3.9 kg
    - 4-point model: Approx. 290 (H) x 395 (W) x 73 (D) mm, approx. 5.0 kg
    - 6-point model: Approx. 290 (H) x 485 (W) x 73 (D) mm, approx. 5.8 kg
    - 8-point model: Approx. 290 (H) x 575 (W) x 73 (D) mm, approx. 6.6 kg
    - 10-point model: Approx. 290 (H) x 665 (W) x 73 (D) mm, approx. 7.4 kg
    - 12-point model: Approx. 290 (H) x 755 (W) x 73 (D) mm, approx. 8.2 kg
- \* The weight above represents the total weight including the base unit (buzzer part, indicator part (2-point model) and UPS battery included) and indicator/alarm unit.

- Appearance:



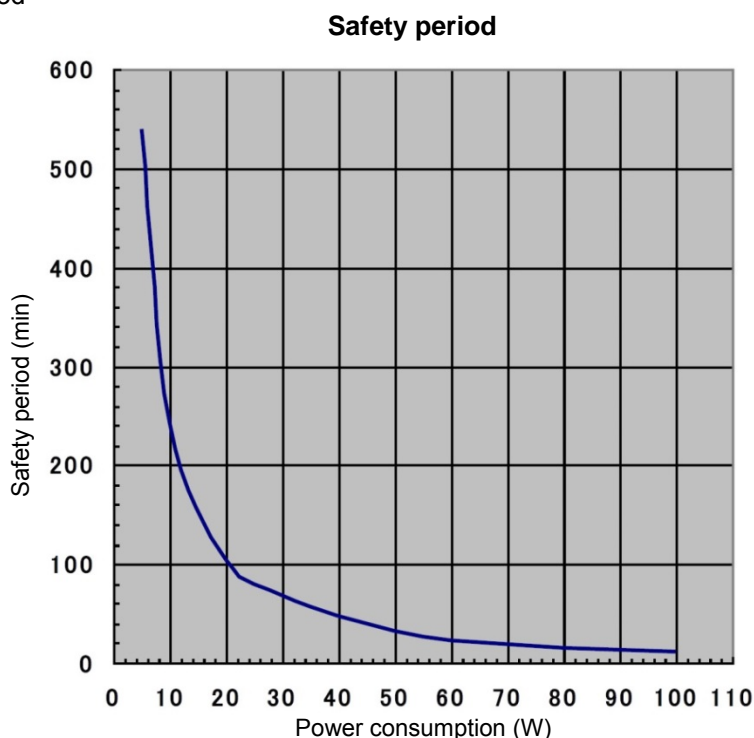
n: Number of points		W	W1	Installation dimension		
				P	P 1	P 2
<input type="checkbox"/>	2	305	297	276		
<input type="checkbox"/>	4	395	387	366		
<input type="checkbox"/>	6	485	477	456		
<input type="checkbox"/>	8	575	567	546		
<input type="checkbox"/>	10	665	657		302	334
<input type="checkbox"/>	12	755	747		308	418

## 1. Base unit (including the buzzer part, indicator part (2-point model) and UPS battery)

- Structure: Incorporated type (Up to 5 indicator units can be used)
- Common alarm contact output: No-voltage "c" contact (contact capacity: 250 VAC 2 A, resistance load)
- Common alarm voltage output: Normal state: 6 VDC (load current: 10 mA or less)  
Gas alarm state: 12 VDC (load current: 10 mA or less)  
Troubled state: 0 V
- Contact output for external buzzer: No-voltage "a" contact [standard] or "b" contact [option] (contact capacity: 250 VAC 1 A, resistance load)
- Power output for external buzzer: 24 VDC (load current: 10 mA or less)
- Display: LCD (bar meter display (2 colors: red and green))  
Battery level meter (5 LED lamps)  
commercial power supply/UPS, auto switch on
- Alarm type: Alarm lamp, self-latching, buzzer [standard] or voice [option, Japanese only]
- Power input: 100 - 120 VAC or 200 - 240 VAC (50/60 Hz)
- Use temperature/humidity range: -10 to 50°C (at a constant condition), 10 - 90% RH (non-condensing)
- Detection while UPS is used: Continuous detection (continuous power supply) [standard] or intermittent detection at intervals of 15 seconds (intermittent power supply) [option]
- External connection terminal: 13P (1P not used)  
Power input (3P)  
Common alarm contact output (3P)  
Common alarm voltage output (2P)  
Contact output for external buzzer (2P)  
Power output for external buzzer (2P)  
Vacant terminal (1P)
- Power consumption: Max 45 VA (18 W) (detector head included, pump power supply excluded)

## 2. UPS battery

- Used battery: Lead battery 12 V 2.3 Ah x 2 pcs
- Other functions: Equipped with the over discharge protection circuit, backup point selection function
- Safety period



## 3. Indicator unit

- Structure: 2-point model (per unit), incorporated type
- Concentration display: LCD (bar meter display (2 colors: red and green))
- Individual alarm contact output: (2 contacts) No-voltage "a" contact [standard] or "b" contact [option] (contact capacity: 250 VAC 2 A, resistance load)
- External output signal: 0/6/12 VDC (load current: 10 mA or less) [standard] or 4 - 20 mA DC (load resistance: 300  $\Omega$  or less) [option]
- External connection terminal: 12P
  - Input/output to detector head (4P)
  - Pump power output (24 VDC) (2P)
  - Individual alarm contact output 1 (gas alarm) (2P)
  - Individual alarm contact output 2 (2P)
  - (gas alarm [standard] or fault alarm [option])
  - External output signal (2P)
- Alarm delay: 2 seconds [standard] or up to 60 seconds/1-second increment [option]
- Other functions:
  - Alarm test: Alarm activation check
  - Peak gas concentration display: When gas concentration exceeds an alarm setpoint, the peak value of gas concentration is displayed and held on the bar meter.
- Power: Supplied from the base unit
- Power consumption: Max 18 VA (13 W) (detector head included, pump power supply excluded)
- Cable between detector heads: Cable equivalent to CVV 4-core
- Transmission distance between detector heads:
  - Within 300 m using CVV (0.75 mm<sup>2</sup>) cable
  - Within 500 m using CVV (1.25 mm<sup>2</sup>) cable
  - Within 500 m using CVV (2.0 mm<sup>2</sup>) cable

## 10-2. List of accessories

- Operating manual: 1
- Mounting bracket: The supplied quantity depends on the number of points.  
(Supplied for the rack mounting type only)

2 - 8-point model	4
10/12-point model	6

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# Definition of Terms

% LEL	A percentage unit of the concentration of a combustible gas assuming the lower explosive limit (LEL) of the combustible gas as 100. LEL (Lower Explosive Limit) refers to the lowest concentration of a combustible gas in air capable of causing explosion when ignited.
vol%	Gas concentration indicated in the unit of one-hundredth of the volume
ppm	Gas concentration indicated in the unit of one-millionth of the volume
Calibration	Find relationship of the readings, display values or setpoints with the actual values by using the calibration gas.
Maintenance mode	When maintenance is performed on the alarm system, 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 alarm system.
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.
Zero suppression	A function to cut off the influences of environmental changes, interference gases, etc.
Alarm delay time	A function which temporarily suspends activation to prevent a false alarm caused by noise from its outside.
Response time	The time to trigger an alarm after introducing a gas with the concentration 1.6 times higher than the alarm setpoint. (The delay time in a tube for the case of connecting a suction tube outside is excluded.) The response time of the alarm system is 30 seconds at maximum.
Inhibit	The gas detection function is temporarily suspended during maintenance etc. of the alarm system. This is also called "point skip", which has the same function.

## Appendix

# Power Consumption Calculation Method and Simplified Safety Period Chart

Obtain the power consumption of GP-147 according to the following table.

(1) Power consumption of commercial power supply used for main unit (VA)

	Part	Continuous detection
A	Base unit * Including the indicator unit (1 unit, 2 channels)	21.1 (VA)
B	Indicator/alarm unit (1 unit, 2 channels)	19.3 (VA)
C	Isobutane sensor (HW-6211)	3.8 (VA)
D	Methane sensor (HW-6239)	2.8 (VA)
E	Hydrogen sensor (NC-6244A)	1.8 (VA)
F	Suction type detector head	33.0 (VA)

(2) Power consumption while running UPS battery (W)

	Part	Continuous detection	Intermittent detection
A	Base unit * Including the indicator unit (1 unit, 2 channels)	2.8 (W)	2.8 (W)
B	Indicator/alarm unit (1 unit, 2 channels)	2.3 (W)	2.3 (W)
C	Isobutane sensor (HW-6211)	1.3 (W)	0.8 (W)
D	Methane sensor (HW-6239)	0.9 (W)	0.5 (W)
E	Hydrogen sensor (NC-6244A)	0.6 (W)	0.4 (W)
F	Suction type detector head	8.7 (W)	8.7 (W)

The power consumption calculating formula (P73) and data in the simplified power consumption/safety period chart (P73) are calculated based on the power consumption (W) of battery use.



[Calculating formula]

GP-147 (xx\_point model)

Base unit and indicator unit

(1)  $\boxed{A} + \boxed{B} \times \text{_____ units} = \text{_____}$

Total detector heads: \_\_\_\_\_ units

Isobutane sensor

(2)  $\boxed{C} \times \text{_____ units} = \text{_____}$

Methane sensor

(3)  $\boxed{D} \times \text{_____ units} = \text{_____}$

Hydrogen sensor

(4)  $\boxed{E} \times \text{_____ units} = \text{_____}$

Suction type detector head

(5)  $\boxed{F} \times \text{_____ units} = \text{_____}$

Power consumption (1) + (2) + (3) + (4) + (5) = \_\_\_\_\_

The safety period is approximately \_\_\_\_\_ minutes according to the calculation result (W) and UPS battery specification.

Note 1: The result obtained here for UPS should be used for reference.

2: Parallel running (addition) of UPS is prohibited.

3: As calculation conditions, the battery should be fully charged when discharge starts, and the reading should indicate 0% LEL.

Simplified power consumption/safety period chart (following power consumptions apply to the case of diffusion type, mounting all units and 0% LEL)

Quantity	Powered continuously			Powered intermittently		
	Isobutane sensor (HW-6211) used			Isobutane sensor (HW-6211) used		
	Power consumption		Safety period	Power consumption	Safety period	
2	28.4 (VA)	5.4 (W)	600 minutes or more		4.4 (W)	600 minutes or more
4	36.0 (VA)	10.3 (W)	Approx. 270 minutes		8.3 (W)	Approx. 360 minutes
6	43.5 (VA)	15.2 (W)	Approx. 160 minutes		12.2 (W)	Approx. 210 minutes
8	52.1 (VA)	20.1 (W)	Approx. 100 minutes		16.1 (W)	Approx. 140 minutes
10	60.0 (VA)	25.0 (W)	Approx. 80 minutes		20.0 (W)	Approx. 110 minutes
12	67.0 (VA)	29.9 (W)	Approx. 60 minutes		23.9 (W)	Approx. 80 minutes
Methane sensor (HW-6239) used				Methane sensor (HW-6239) used		
2	25.0 (VA)	4.6 (W)	600 minutes or more		3.8 (W)	600 minutes or more
4	32.9 (VA)	8.7 (W)	Approx. 340 minutes		7.1 (W)	Approx. 420 minutes
6	39.1 (VA)	12.8 (W)	Approx. 190 minutes		10.4 (W)	Approx. 250 minutes
8	45.5 (VA)	16.9 (W)	Approx. 130 minutes		13.7 (W)	Approx. 180 minutes
10	52.0 (VA)	21.0 (W)	Approx. 100 minutes		17.0 (W)	Approx. 140 minutes
12	58.4 (VA)	25.1 (W)	Approx. 80 minutes		20.3 (W)	Approx. 100 minutes

\*The power consumption of the sensor is calculated assuming that the transmission distance between detector heads is 100 m.