



Gas Detector TP-70D Operating Manual

Request for the Customers

- Read and understand this operating manual before using the detector.
- Use the detector in accordance with the operating manual.
- Regardless of warranty period, we shall not make any indemnification for accidents and damage caused by using this product.

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

- Because this is a safety unit, a regular maintenance for every six months and daily maintenance must be performed.
- If any abnormality is found in the detector, notify it to RIKEN KEIKI immediately.
(Visit our Web site to find your nearest RIKEN KEIKI office.)

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1

Outline of the Product

1-1. Preface




Thank you for choosing our gas detector TP-70D. Please check that the model number of the product you purchased is included in the specifications on this manual.

Non-compliance with safety precautions in use of electrical products may lead to fire or bodily injury. This manual explains how to use the detector and its specifications. It contains information required for using the detector 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 detector.

1-2. Purpose of use

- This is a transportable type gas detector which detects leak of gases used in semiconductor factories, etc.
The gas detector is a safety unit, not an analyzer or densitometer which performs quantitative/qualitative analysis/measurement for gases. Please fully understand the features of the detector before using it, so that it can be used properly.
- The detector detects abnormalities in the air caused by presence of gases or other reasons (leak and oxygen deficiency) with the built-in gas sensor unit. The concentrations of detected gases are shown on the character LCD.
- The built-in pump in the detector draws gas to perform gas detection.
- The detector has two-step gas alarm contact and fault alarm contact.
- The detector outputs gas concentration in 4 – 20 mA.

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.

2

Important Notices on Safety

2-1. Danger cases



DANGER

This is not an explosion-proof unit. Do not use the unit in place where combustible gases may exist.

2-2. Warning cases



WARNING

Power supply

Before turning on the detector, always check that the voltage is properly applied. Do not use an unstable power supply because it may cause malfunctions.

Need of grounding circuit

Do not cut the grounding circuit or disconnect the wire from the grounding terminal.

Defects in protective functions

Before starting the detector, check the protective functions for defects. When seeming defects are found in the protective functions, such as protective grounding, do not start the detector.

External connection

Before connecting the detector to external equipments or external control circuit, securely connect it to a protective grounding circuit.

Tubing

The detector is designed to draw gases around it under the atmospheric pressure. If excessive pressure is applied to the sampling inlet and outlet (GAS IN, GAS OUT) of the detector, detected gases may be leaked from its inside, thus leading to dangers. Be sure that excessive pressure is not applied to the detector while used. Detected gases must be exhausted from the detected gas exhausting outlet (GAS OUT) on the bottom of the detector to which an exhaust tube is connected, to a point regarded as a safe place.

Handling the sensor unit

Do not disassemble the electrochemical type sensor unit (ESU) or galvanic cell type sensor unit (OSU) because they contain electrolyte. Electrolyte may cause severe skin burns if it contacts skin, while it may cause blindness if its contacts eyes. If electrolyte is adhered on your clothes, that part on your clothes is discolored or its material is decomposed. If contact occurs, rinse the area immediately with a large quantity of water.

Zero adjustment (fresh air adjustment) in the atmosphere

When zero adjustment (fresh air adjustment for oxygen deficiency alarm) is performed in the atmosphere, check the atmosphere for freshness before beginning the adjustment. If other gases exist, the adjustment cannot be performed properly, thus leading to dangers when the gas leaks.

Operation in a gas

Do not operate the detector in a place where combustible gases or vapors are present. Operating the detector in such an environment will lead to extreme dangers.

Response to gas alarm

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

Fuse

To prevent fire, use a fuse with the specified ratings (current, voltage and type) for the detector. Turn the POWER switch OFF and disconnect the power plug from the outlet before replacing a fuse. Do not use an unspecified fuse or short-circuit the fuse holder.

Power cable

To operate the detector on 200 VAC system, prepare a power cable that supports 200 VAC. The power cable is provided only for the case that the power voltage is 100 VAC system (requested). The provided power cable supports 100 VAC.

2-3. Precautions



CAUTION

Do not use a transceiver near the detector.

Radio wave from a transceiver near the detector or its cables may disturb indication reading. If a transceiver is used, it must be used in a place where it disturbs nothing.

To restart the detector, wait for five seconds or more before doing it.

Restarting the detector in less than five seconds may cause errors.

Verify that the reading on the flow rate indicator corresponds to the specified flow rate before using the detector.

If it does not correspond to the specified flow rate, gas detection cannot be performed properly. Check if the flow rate is unstable or lost.

Attach the dust filter before using the detector.

Before using the detector, attach the specified filter to prevent disturbances by possible gas adsorption or air dust.

A dust filter to be used varies depending on the gas to be detected. For more information on dust filters, please contact RIKEN KEIKI.

Also, the detector itself is not dust-proof. Take an appropriate measure such as attaching a protective cover when the detector is used in a dusty environment.

Observe the operating restrictions to prevent condensation inside the tube.

Condensation formed inside the tube causes clogging or gas adsorption, which may disturb accurate gas detection. Thus, condensation must be avoided. In addition to the installation environment, carefully monitor the temperature/humidity of the sampling point to prevent condensation inside the tube. In particular, when detecting a gas which is dissolved into water and corrodes contacted materials, such as a strong acid gas, the gas is undetectable and furthermore may corrode internal parts. Please observe the operating restrictions.

Do not use the external output of the detector to control other units.

This is not a control unit. It is not allowed to use the external output of the detector to control other units.

Do not disassemble/modify the detector, or change the settings if not necessary.

Disassembling/Modifying the detector will invalidate the warranty of the performance. Changing the settings without understanding the specifications may cause alarm malfunctions. Please use the detector properly in accordance with the operating manual.

Never fail to perform a regular maintenance.

Since this is a safety unit, a regular maintenance must be performed to ensure safety. Continuing to use the gas detector without performing maintenance will compromise the sensitivity of the sensor, thus resulting in inaccurate gas detection.

3

Product Components

3-1. Main unit and standard accessories

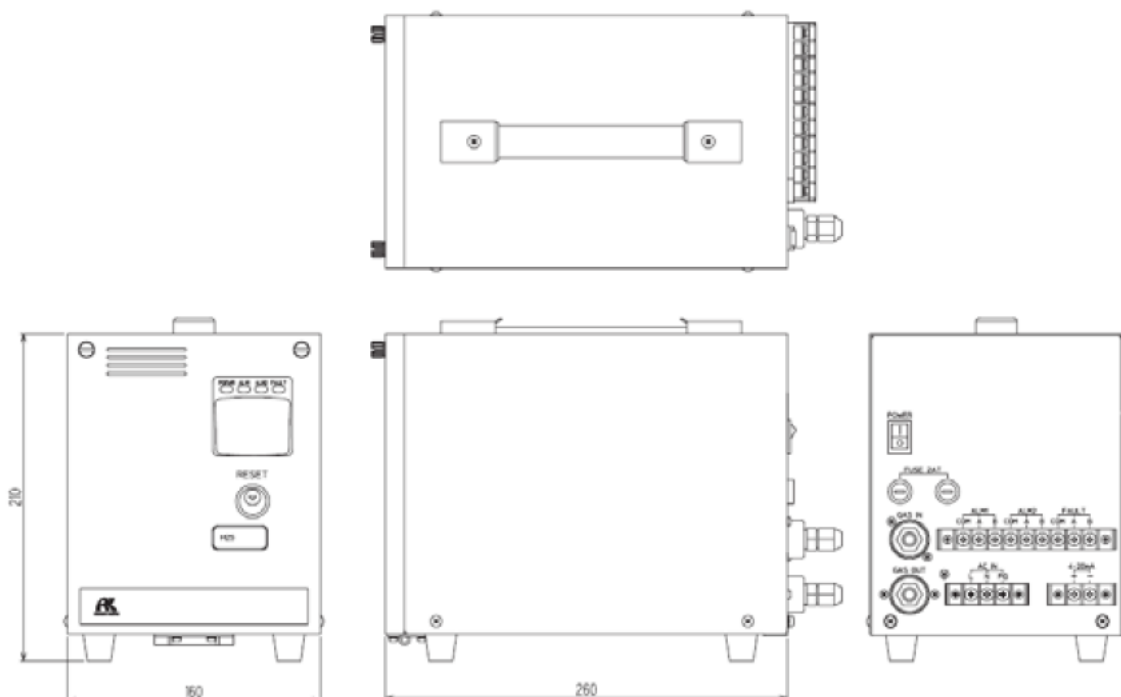
<Main Unit>



<Standard Accessories>

- Operating manual
- Protective rubber cap (to be removed when using the detector)
- Dust filter
- Interference gas removal filter (to be supplied with sensor units for certain gases)

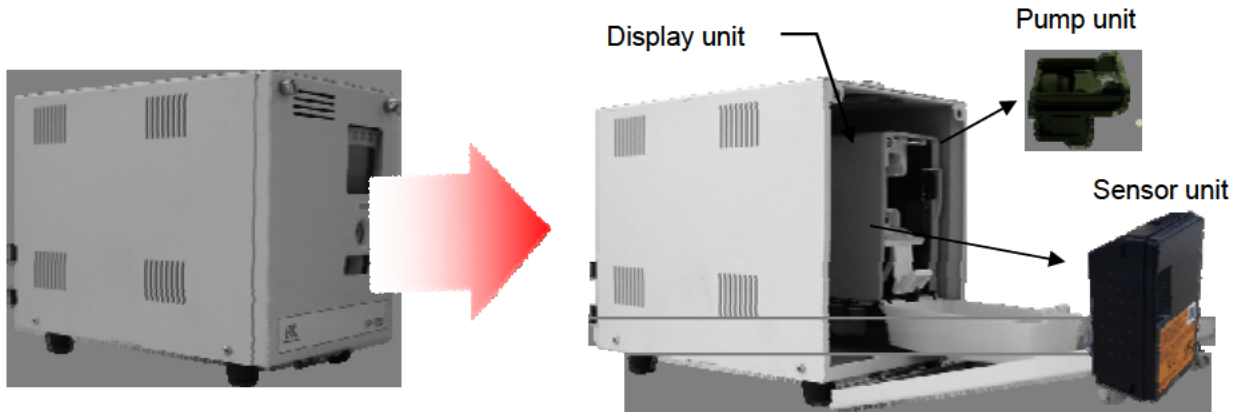
3-2. Outline drawing



3-3. Names and functions for each part

<Main Unit Components>

The detector consists of the following units.



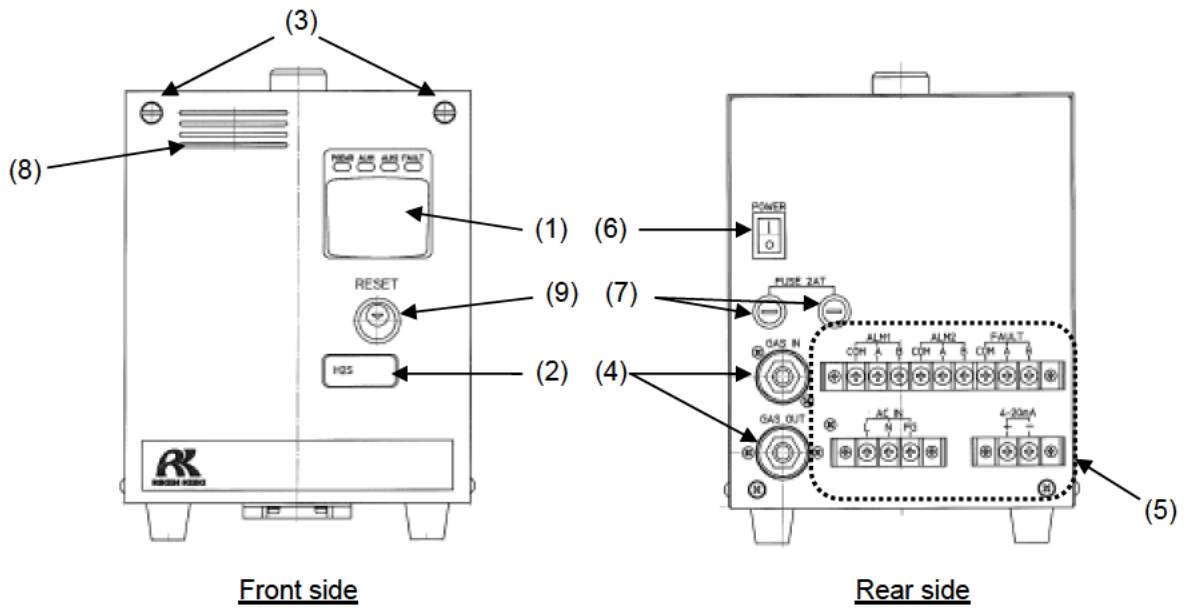
CAUTION

Each unit consists of precision parts. When a unit is detached, be careful not to drop it. Dropping the unit compromises its original performance or causes malfunctions.

NOTE

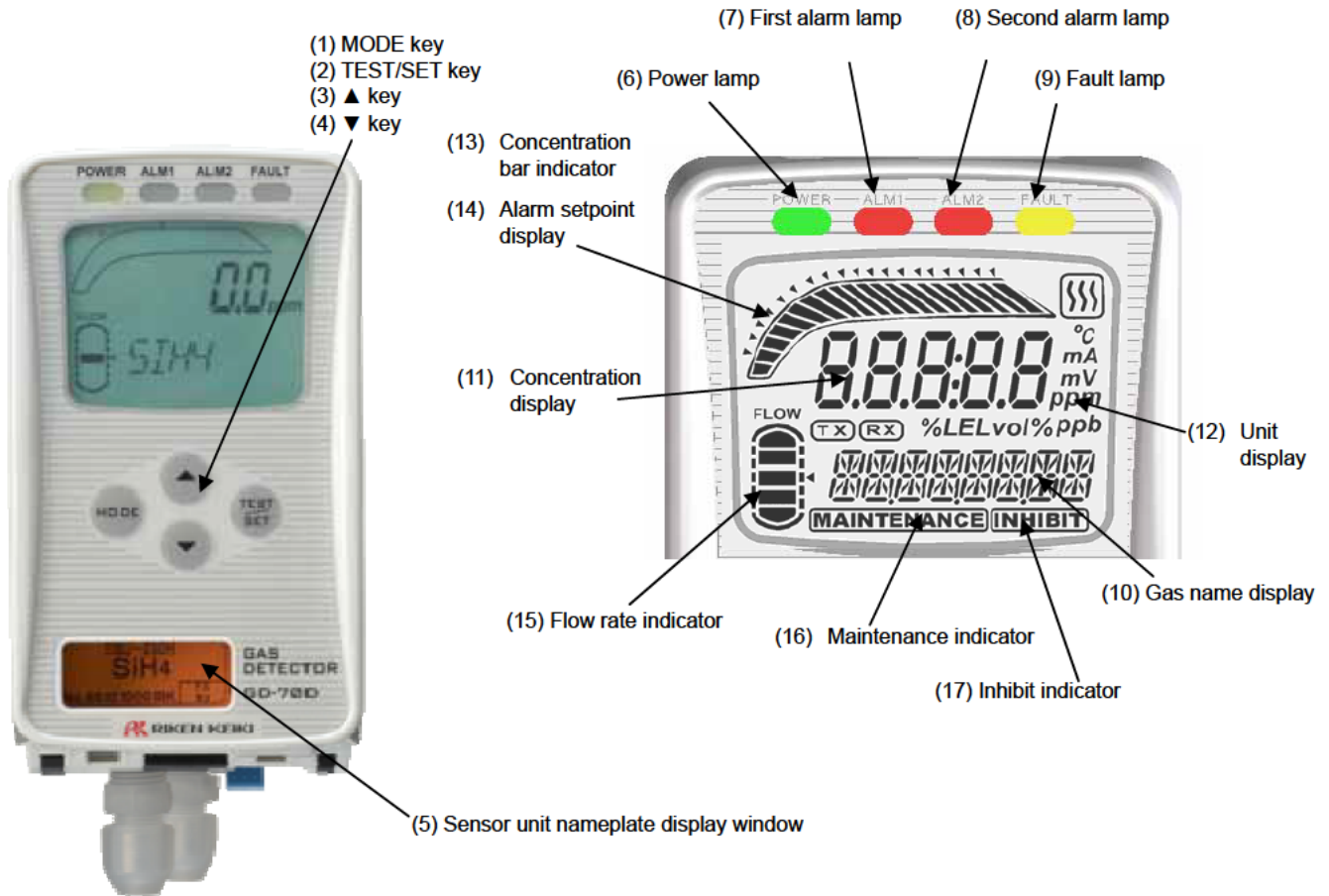
The display unit (GD-70D-TP) is designed specifically for the detector. Do not use a similar product. It will not function normally.

<Exterior of Main Unit>



(1)	Display	Displays the gas concentration and so on.
(2)	Sensor unit nameplate display window	The sensor unit nameplate can be checked from this window. You can identify the currently attached sensor unit.
(3)	Knurled screws	Fixes the front cover. These are used to open/close the front cover.
(4)	Sampling gas inlet/outlet	GAS IN: Connects a sample gas suction tube. GAS OUT: Connects a sample gas exhaust tube.
(5)	External terminal block	Connects cables for power, external signals (4 - 20 mA) and contacts.
(6)	Power switch	Main power switch that turns AC power ON and OFF.
(7)	Fuse	Main fuse.
(8)	Buzzer sound opening	Buzzer sound comes out of this opening.
(9)	Reset switch	Alarm reset switch.

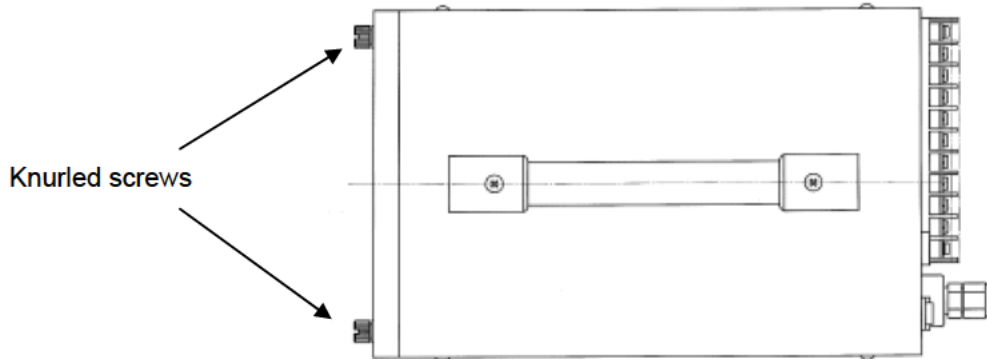
<Display Unit Panel and Character LCD>



(1)	MODE key	Used to enter the maintenance mode. It is also used to cancel or skip in a specific mode. In the alarm test mode, it is used to reset an alarm.
(2)	TEST/SET key	Used to enter the test mode. It is used for value confirmation and so on in a specific mode.
(3)	▲ key	Used to switch screen or change a value (UP).
(4)	▼ key	Used to switch screen or change a value (DOWN). In the detection mode, it is used to reset an alarm.
(5)	Sensor unit nameplate display window	Window to check the nameplate of the sensor unit. You can identify the currently attached sensor unit.
(6)	Power lamp (POWER)	Power lamp. It lights in green when the power is on.
(7)	First alarm lamp (ALM1)	First alarm lamp. It blinks or lights in red when the first alarm is reached.
(8)	Second alarm lamp (ALM2)	Second alarm lamp. It blinks or lights in red when the second alarm is reached.
(9)	Fault lamp (FAULT)	Fault lamp. It lights in yellow when an abnormality is detected in the detector.
(10)	Gas name display	Displays gas name in chemical formula, etc. (e.g. Silane = SIH4)
(11)	Concentration value display	Displays the gas concentration and so on.
(12)	Unit display	Displays the unit according to the specification (ppm, ppb, vol%, %, %LEL).
(13)	Concentration bar indicator	The detectable range (full scale = FS) is divided into 20 with bars. The increase in concentration is displayed in proportion to the full scale.
(14)	Alarm setpoint display	The alarm setpoints (AL1 and AL2) are indicated on the concentration bar.
(15)	Flow rate indicator	Displays the suction flow rate. The center of the bars means the normal suction flow rate of 0.5 L/min.
(16)	Maintenance indicator	Displayed during the maintenance mode. When this indicator is displayed, the alarm contact is disconnected to be disabled.
(17)	Inhibit indicator	Displayed when the inhibition (point skip) is set.

<Detaching and Attaching Sensor Unit>

- Loosen two knurled screws that fix the front cover of the main unit and open the cover.



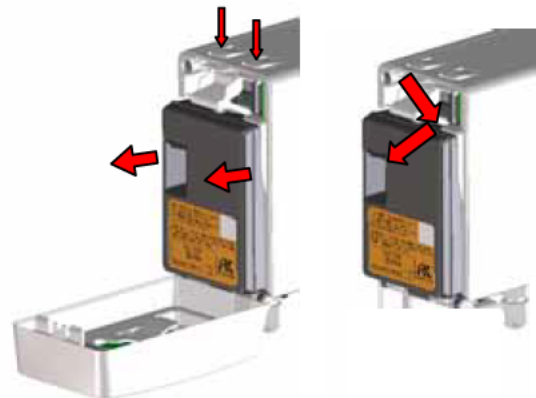
Top view

- Push the two buttons at the top of the display unit together to open the front cover. (Pushing only either one button cannot open the cover, but then pushing the other can open it.)

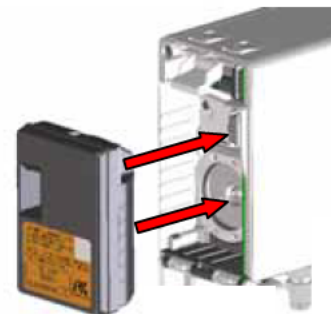


CAUTION

Turn the power off before detaching or attaching the sensor unit.

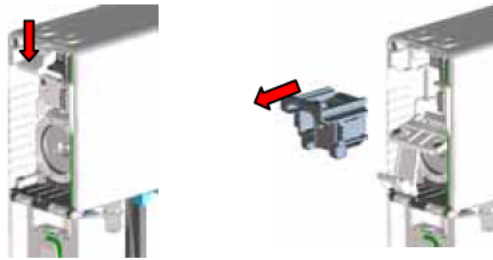


- Hold the convexed parts on both sides of the sensor unit and pull it out. If the sensor unit is hard to detach, insert a finger into the gap at the top right of the sensor unit and pull it out.
- When attaching the sensor unit to the main unit, thrust it onto the main unit and make sure that the sensor unit is securely fixed, otherwise it might come off.
- After replacing the sensor unit, close the front cover of the display unit. Be sure to check the click of the front cover to fix it properly, otherwise it might open again.
- Close the front cover of the main unit and tighten two knurled screws.

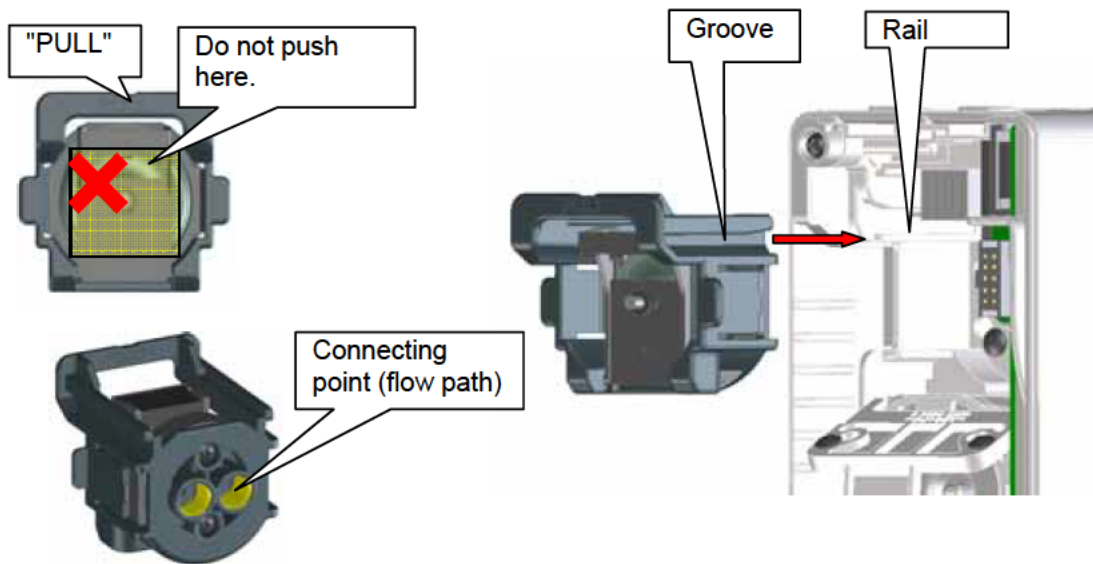


<Detaching and Attaching Pump Unit>

After detaching the sensor unit, push down to open the pump stopper. Pinch the part labeled "PULL" at the top of the pump unit, and pull it out.



When attaching the pump unit to the display unit, position the grooves of the pump unit at the rails of the main unit and push the pump unit. Do not push the center diaphragm. Push the part labeled "PULL". And as the connecting point (flow path) of the pump unit is greased, be sure to check any dust.






<How to Use Sensor Unit>



A sensor unit installed in the detector is the same regardless of the detection principle, thus sensor units are interchangeable. Each sensor unit has a different color in accordance with the principle as shown below. How to handle the sensor unit varies depending on its principle.



CAUTION

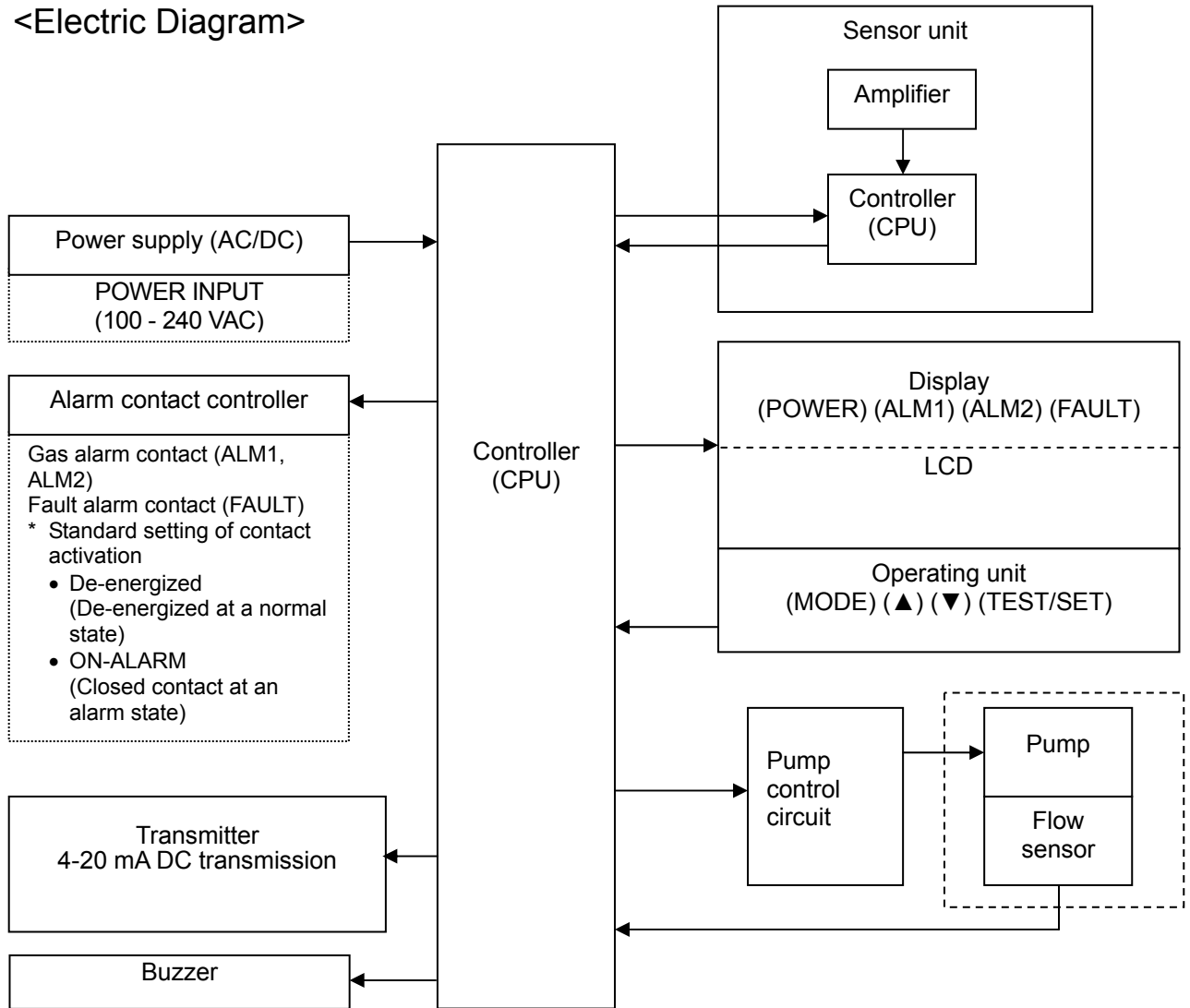
- The sensor unit must be handled carefully to ensure quality as safety unit. When the sensor unit is stored, a dedicated warehouse and power equipment for the sensor unit are needed. In principal, the sensor unit must not be detached from the detector when it is handled or stored. We will take care of your sensor unit.
- Be sure that the sensor unit is not installed improperly. If a sensor unit of different specification or principle from the one shipped from the manufacturer is attached, a message will be displayed on the LCD of the detector ("C-02"). If the message is displayed, check the specifications of the sensor unit.
- After the sensor unit is replaced, always perform a gas calibration (zero adjustment and span adjustment).

<p><u>Electrochemical type (ESU)</u></p> 	<ul style="list-style-type: none"> • Do not disassemble the sensor unit because it contains electrolyte. If contact occurs, rinse the area immediately with a large quantity of water. • The sensor unit identifies the direction. Put the sensor unit in the dedicated case while handling it. Do not place it on its side or upside-down. • When a new sensor unit is installed, it must be warmed up. Although warm-up time is different depending on the type of the installed sensor, it is recommended that warm-up should be performed for three hours or more. Please contact RIKEN KEIKI for more information. • The sensor unit must be stored in a clean, cool and dark place away from direct sunlight. Some types of the sensor units cannot be stored together with other units. Please contact RIKEN KEIKI for more information.  <p style="text-align: center;">Dedicated case</p>
<p><u>New ceramic type (NCU)</u></p> 	<ul style="list-style-type: none"> • Before using this sensor unit, it must be warmed up for two hours or more. • The sensor unit must be stored under normal temperature/humidity in a clean place away from direct sunlight.

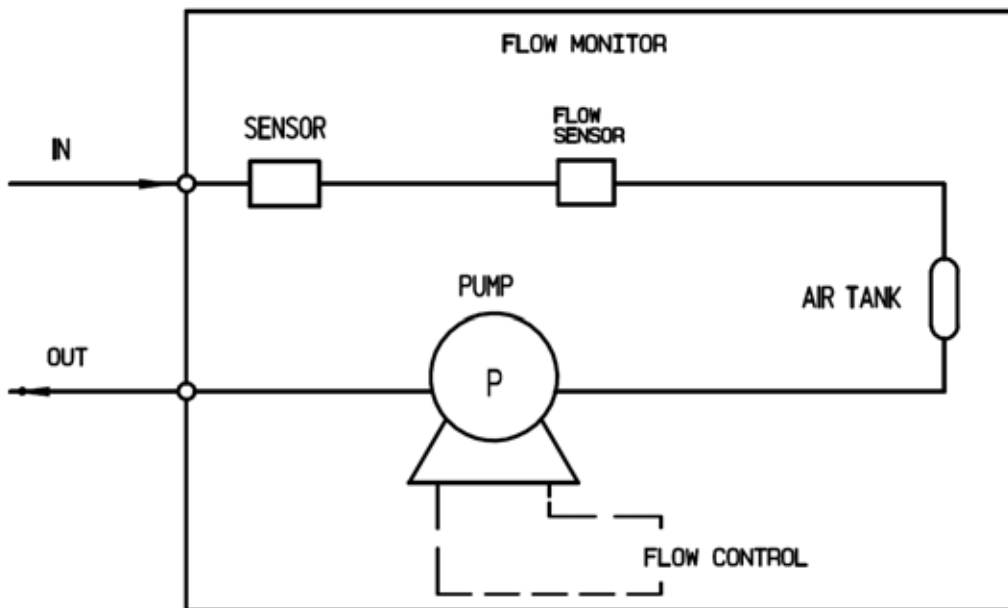
<p>Semiconductor type (SGU)</p> 	<ul style="list-style-type: none"> • Before using the sensor unit, it needs to be warmed up for a specified time. The sensor unit is warmed up sufficiently in our factory before it is delivered to you. Therefore, after you receive the sensor unit, please use it as soon as possible so that unpowered time is minimized. • The warm-up (powered) time before using the sensor unit is related to the unpowered time. <table border="1" data-bbox="497 407 1398 855"> <thead> <tr> <th rowspan="2">Unpowered time</th> <th colspan="2">Suggested powered time</th> </tr> <tr> <th>SGU-8541 (H2)</th> <th>SGU (Others)</th> </tr> </thead> <tbody> <tr> <td>10 minutes or less</td> <td>10 minutes or more</td> <td>2 hours or more</td> </tr> <tr> <td>1 hour or less</td> <td>30 minutes or more</td> <td>2 hours or more</td> </tr> <tr> <td>24 hours or less</td> <td>1 hour or more</td> <td>4 hours or more</td> </tr> <tr> <td>72 hours or less</td> <td>4 hours or more</td> <td>24 hours or more</td> </tr> <tr> <td>10 days or less</td> <td>2 days or more</td> <td>2 days or more</td> </tr> <tr> <td>Less than 1 month</td> <td>7 days or more</td> <td>7 days or more</td> </tr> <tr> <td>Less than 3 months</td> <td>14 days or more</td> <td>14 days or more</td> </tr> <tr> <td>3 months or more</td> <td>1 month or more</td> <td>1 month or more</td> </tr> </tbody> </table> <ul style="list-style-type: none"> • To store the sensor unit under unpowered state, it must be stored under normal temperature/humidity in a clean place away from direct sunlight. 	Unpowered time	Suggested powered time		SGU-8541 (H2)	SGU (Others)	10 minutes or less	10 minutes or more	2 hours or more	1 hour or less	30 minutes or more	2 hours or more	24 hours or less	1 hour or more	4 hours or more	72 hours or less	4 hours or more	24 hours or more	10 days or less	2 days or more	2 days or more	Less than 1 month	7 days or more	7 days or more	Less than 3 months	14 days or more	14 days or more	3 months or more	1 month or more	1 month or more
Unpowered time	Suggested powered time																													
	SGU-8541 (H2)	SGU (Others)																												
10 minutes or less	10 minutes or more	2 hours or more																												
1 hour or less	30 minutes or more	2 hours or more																												
24 hours or less	1 hour or more	4 hours or more																												
72 hours or less	4 hours or more	24 hours or more																												
10 days or less	2 days or more	2 days or more																												
Less than 1 month	7 days or more	7 days or more																												
Less than 3 months	14 days or more	14 days or more																												
3 months or more	1 month or more	1 month or more																												
<p>Galvanic cell type (OSU)</p> 	<ul style="list-style-type: none"> • Do not disassemble the sensor unit because it contains electrolyte. If contact occurs, rinse the area immediately with a large quantity of water. • The sensor unit must be stored under normal temperature/humidity in a clean place away from direct sunlight. 																													

3-4. Block diagram

<Electric Diagram>



<Tubing Diagram>



4

How to Use

4-1. Before using the detector

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

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



CAUTION

After you received the detector, start using the detector within the specified operation start limit of the sensor unit.

4-2. Precautions for installation points



CAUTION

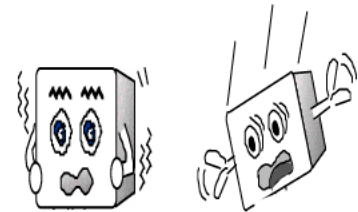
This is a precision device. Because the detector may not provide the specified performance in some places (environments), check the environment in the installation point, and then take appropriate actions if necessary.

Because the detector plays an important role for safety and disaster prevention, you must install as many units of the detector as needed in appropriate points.

Because points where gases leak and remain easily are different depending on the types of gases and the working areas, please decide carefully installation sites and the number of units to be installed.

Do not install the detector in a place with vibrations or shocks.

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



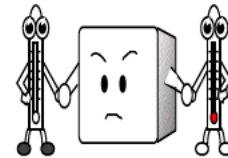
Do not install the detector in a place exposed to water, oil or chemicals.

When selecting installation points, avoid a place where the detector is exposed to water, oil or chemicals.



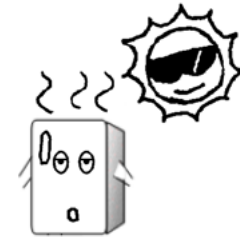
Do not install the detector in a place where the temperature drops below 0°C or rises over 40°C.

The operating temperature of the detector is 0 to 40°C. The detector must be installed in a stable place where the operating temperature is maintained and do not change suddenly.



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

When you select installation sites, 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 detector, or the detector cannot adjust to sudden changes in the temperature.



Keep the detector (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 detector in a place where maintenance of the detector cannot be performed or where handling the detector involves dangers.

Regular maintenance of the detector must be performed.

Do not install the detector 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 detector cannot be removed because tubes or racks prevent access to it. Do not install the detector in a place where maintenance involves dangers, for example, near a high-voltage cable.

Do not install the detector in machinery which is not properly grounded.

Before installing the detector in machinery, the machinery must be grounded properly.

Do not install the detector in a place where other gases exist around it.

The detector must not be installed in a place where other gases exist around it.

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 detector.
- 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.

Using a stable power supply

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

Power supply voltage	100 - 240 VAC \pm 10% (terminal voltage of the detector) 50/60 Hz	
Allowed time of momentary blackout	Up to 500 milliseconds (To recover from the momentary blackout for 500 milliseconds or more, restart the detector.)	<u>Example of actions</u> To ensure continuous operation and activation, install a protective power supply outside the detector.
Others	Do not use it with a power supply of large power load or high-frequency noise.	<u>Example of actions</u> Use a line filter to avoid the noise source if necessary.

Heat radiation designing

When it is installed in the closed instrumentation board, attach ventilation fans above and below the board.

Introducing protective measures against lightning

If cables are installed outside the factory/plant, or if internal cables are installed in the same duct as the cables coming from outside the factory/plant, "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. Although complete elimination of disasters caused by lightning is impossible, the following protective measures can be taken.

Protection against lightning	<p><u>Take appropriate measures in accordance with the importance of the facilities and the environment.</u></p> <ul style="list-style-type: none"> • Connect the transmission signal route by using optical fiber. • Provide protection by a lightning arrester (cable safety retainer). (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.)
Grounding	In addition to lightning, there are more sources of surge noise. To protect units from these noise sources, the units must be grounded.

* The lightning arrester has a circuit to remove a surge voltage which damages field devices, so that signals may be attenuated. Before installing a lightning arrester, verify that it works properly.

Proper use of alarm contact

The alarm contact of the detector is used to transmit signals to activate an external buzzer, an alarm lamp or a rotating lamp. Do not use the detector 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 alarm contact of the detector are based on the resistant 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 detector
- Abnormal operations by an out-of-control CPU

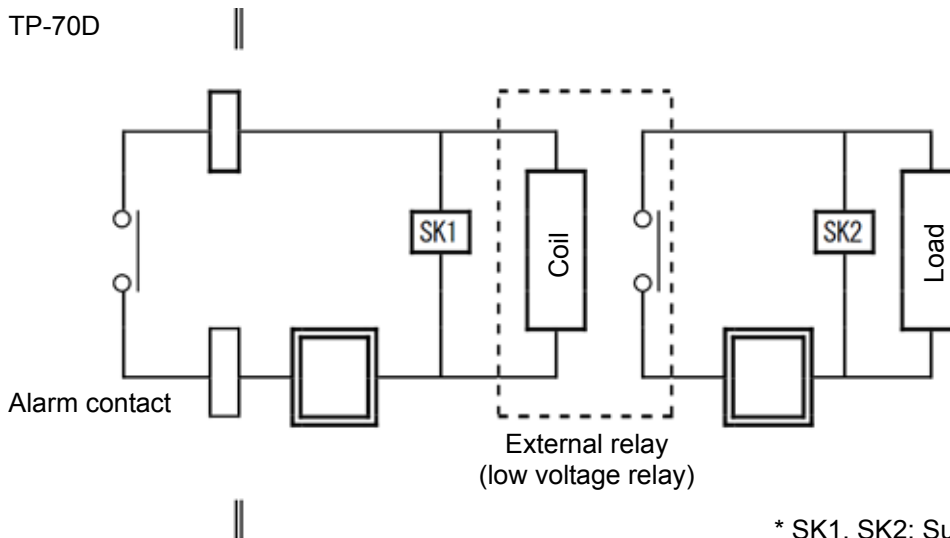


CAUTION

- In principle, do not activate inductive load at the alarm contact of the detector. (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 detector with an appropriate surge absorbing part, such as a CR circuit.

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



* SK1, SK2: Surge absorbing parts

4-4. How to wire



CAUTION

- Be careful not to damage the internal electronic circuit when wiring. In addition, be careful not to apply stresses on the detector when (overweight) cables are installed.
- The power cables and signal cables must not be installed together with the motor power cables, etc. When these cables must be installed together for unavoidable reasons, put the power cables and signal cables in a metal conduit. The conduit must be connected to a grounding circuit.

<Recommended Cable>

4 - 20 mA specification	Shielded cable of CVVS, etc. (1.25sq) - 2-core
For contact	Cable of VCTF, etc. (1.25sq) - max. 9-core

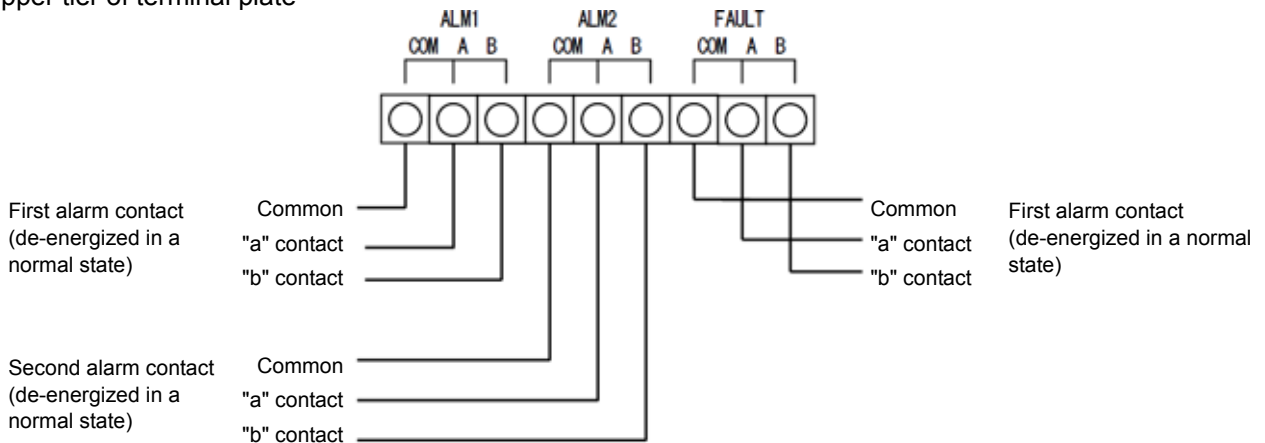


WARNING

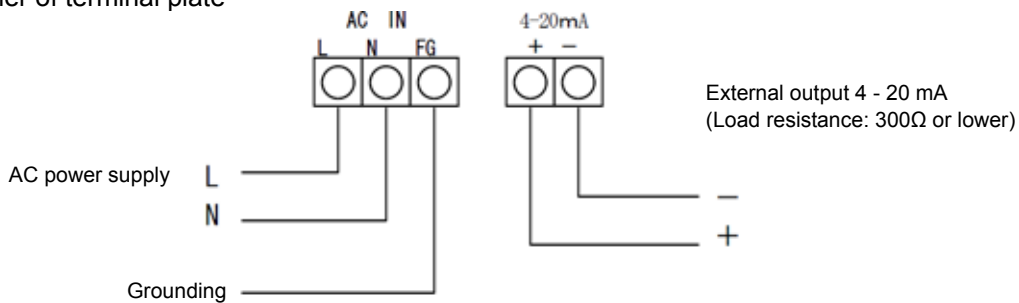
To operate the detector on 200 VAC system, prepare a power cable that supports 200 VAC. The power cable is provided only for the case that the power voltage is 100 VAC system (requested). The provided power cable supports 100 VAC.

<Figure of Terminal Plate>

Upper tier of terminal plate



Lower tier of terminal plate



<Specifications of Terminal Plate>

Specifications of terminal plate

- Rated voltage: 250 VAC
- Rated current: 15A
- Terminal size: M3



CAUTION

The terminal plate specifications given on the left does not mean the connectable load capacity.

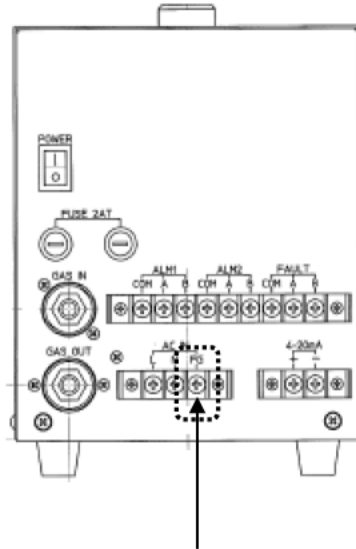
<Grounding>

Connect the detector to your grounding terminal.

**WARNING**

Before turning on the detector, never fail to connect it to a grounding terminal.

For stable operation of the detector and safety, it must be connected to a grounding terminal. Do not connect the grounding wire to a gas pipe. The grounding must be made as D type grounding (below 100 Ω of grounding resistance).



Main unit grounding terminal: Make sure to ground the detector using 3P power cable.

4-5. How to tube

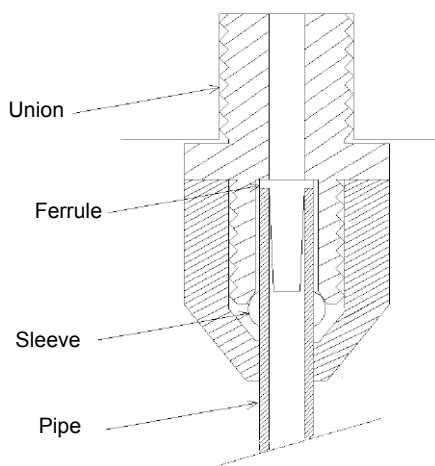
The detector has an Rc1/4 thread inside of the sampling inlet/outlet (GAS IN, GAS OUT), to which "polypropylene" unions are normally attached. Because their material varies depending on the gas to be used, please specify the gas.

The compatible tube is a Teflon tube of $\Phi 6$ (OD) - $\Phi 4$ (ID). The tube must be installed with the supplied ferrules and sleeves attached to prevent a leak.

When the tube is cut, its cut point has a smaller inner diameter. Use a file etc. to expand the inner diameter of the cut point. To remove cut-dust remaining inside of the tube, blow compressed air into the tube before connecting it to the detector.

Some sample gases have highly adsorptive or corrosive property. Select the tube material taking into account these precautions.

The suction flow rate of the detector itself is approximately 0.5 L/min under the operating temperatures. When a gas is drawn from a distant point, please consult us on the tube length.



WARNING

- The detector is designed to draw gases around it under the atmospheric pressure. If excessive pressure is applied to the sampling inlet and outlet (GAS IN, GAS OUT) of the detector, detected gases may be leaked from its inside, thus leading to dangers. Be sure that excessive pressure is not applied to the detector while used.
- Detected gases must be exhausted from the detected gas exhausting outlet (GAS OUT) on the bottom of the detector to which an exhaust tube is connected, to a point regarded as a safe place.



CAUTION

- The longer the tube of the GAS IN is, the longer it takes for a gas to reach the detector. Because some gases have a highly adsorptive property for the tube, resulting in a slow response and a lower reading than the actual value, the length of the GAS IN tube must be minimized.
- When the humidity in the sampling point is high, condensation may be formed inside of the tube. Make sure to avoid condensation when using a gas which is dissolved into water and corrodes contacted materials, such as a strong acid gas, because it is undetectable and furthermore may corrode internal parts. Also avoid an excessive U-shaped or V-shaped tube piping.
- Determine the inlet for the sample gas, considering the air flow of the sample gas line and the gas generating process.
- To remove dust, never fail to attach the supplied dust filter in the middle of the tube.
- It is needed to decide the length and material of the tube. Please contact RIKEN KEIKI for more information.

5

How to Operate

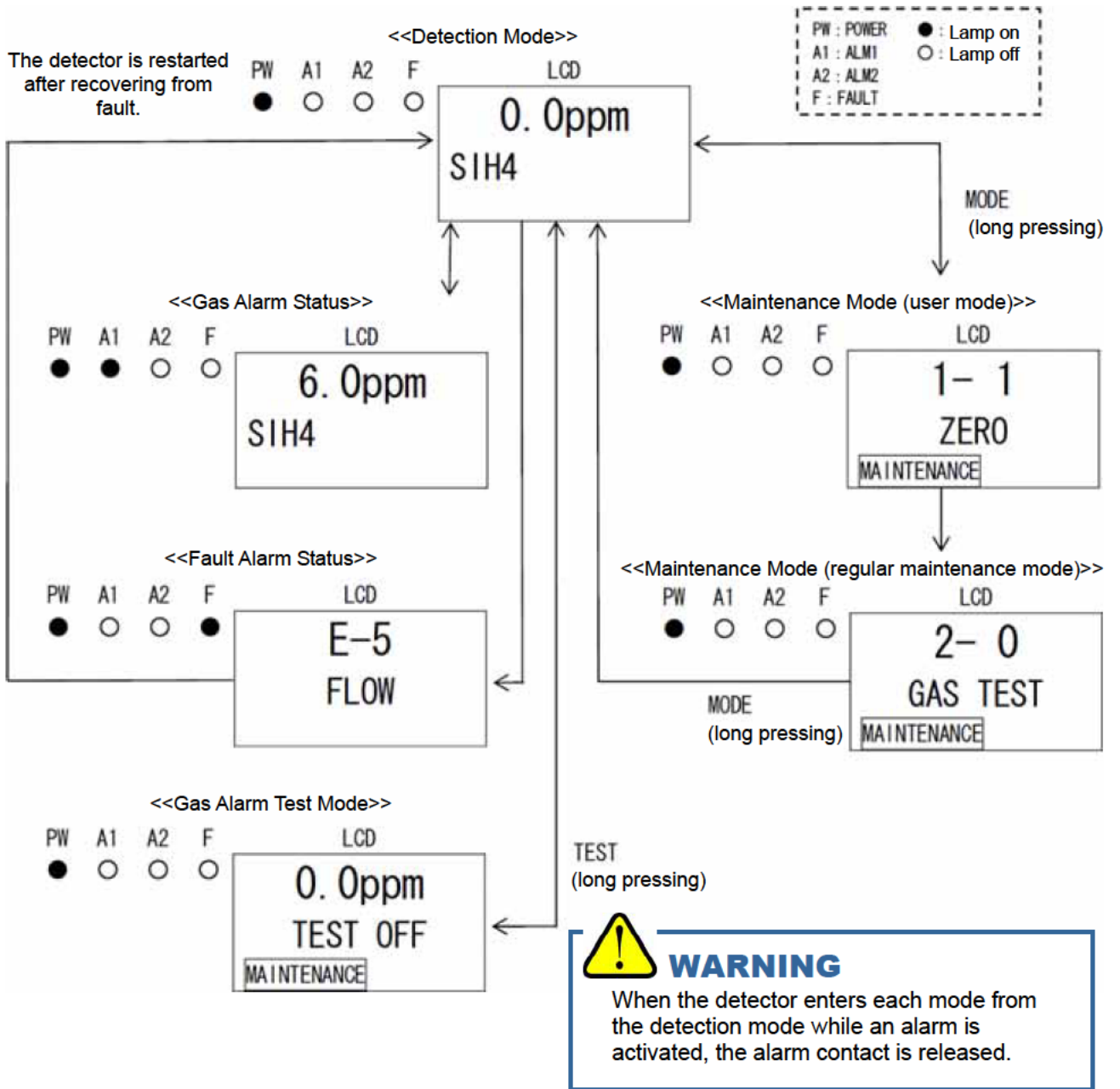
5-1. Preparation for start-up

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

- Connect the detector to a grounding circuit.
- Check that the wiring is connected to external circuit properly.
- Check that the power supply voltage is compliant with the specification.
- Because the external contact may be activated during the adjustment, take measures to prevent an activated contact from having influences on external circuits.
- Remove the protective rubber cap from GAS IN and GAS OUT. If the detector is turned on with the rubber caps remaining while the installation, applied overload may damage the pump and sensor. Never fail to remove the caps.
- Check that there is no clogging or leak in the connected tube. (If the connected tube is clogged, pressure is applied to the sensor unit, causing errors and malfunctions. Note that the reading is fluctuated in the galvanic cell type, which may result in a false alarm.)
- Check that the filter is attached properly. (The filter is specified based on the gas to be detected.)
- Make sure to use a fuse with the specified ratings to prevent fire.
- Check that the detector is leveled. The detector must be installed in the right direction to ensure its performance. (* The direction of the detector must also be kept during transportation, including when it is removed temporarily or relocated.)

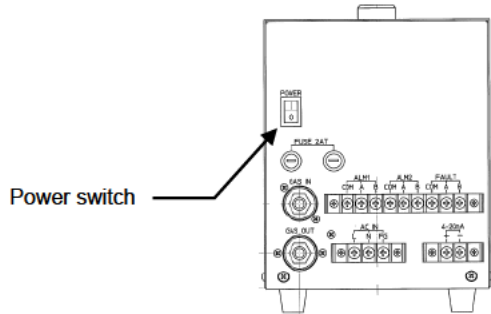
5-2. Basic operating procedures

Normally, the detection mode is used for normal operations. (The detection mode is activated after the power is turned on.)



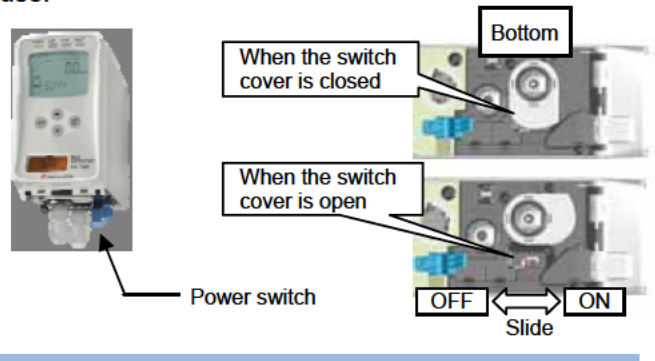
5-3. How to start the detector

- Before turning on the power switch, check that the detector is installed properly.
- Turn on the power switch located on the rear side of the main unit.



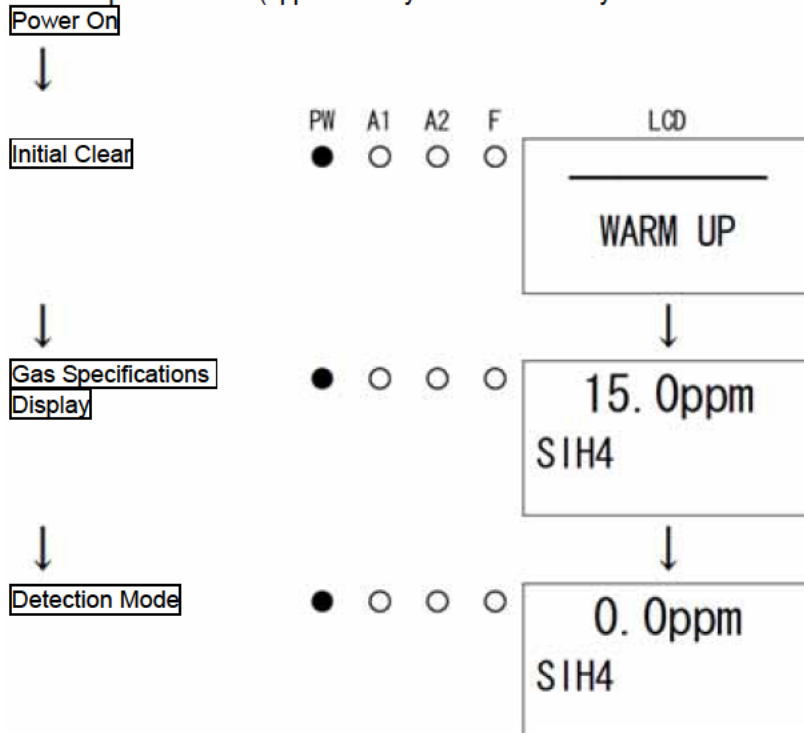
NOTE

The display unit also has a power switch. The power switch is factory-set to ON. It can be left ON for normal use.



- After the detector completes the start-up, it enters the detection mode.

<<Start-up Procedures (approximately 25 seconds for system check of the detector and alarm deactivation)>>



WARNING

When Oxygen (OSU) is selected, approximately AIR (normal oxygen concentration) (20.9 vol%) is output after the detector is started in the atmosphere. For a specification where an alarm is triggered by the AIR (normal oxygen concentration) output (e.g., 0 - 5 vol%), be careful of an alarm issue after the detector is started.



CAUTION

- Do not turn off the detector during the initial clear. The detector is reading the sensor memory during the initial clear.
- If the detector is installed newly or the sensor unit is replaced with new one, the sensor must be warmed up for a specified period which is determined depending on the type of the sensor unit after the detector is started.
When the semiconductor type sensor unit (SGU) is selected, the suggested warm-up completion time is displayed in the maintenance mode.
- 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.
- After the warm-up is completed, check that the reading on the flow rate indicator corresponds to the specified flow rate, and then perform a gas calibration.

5-4. Modes

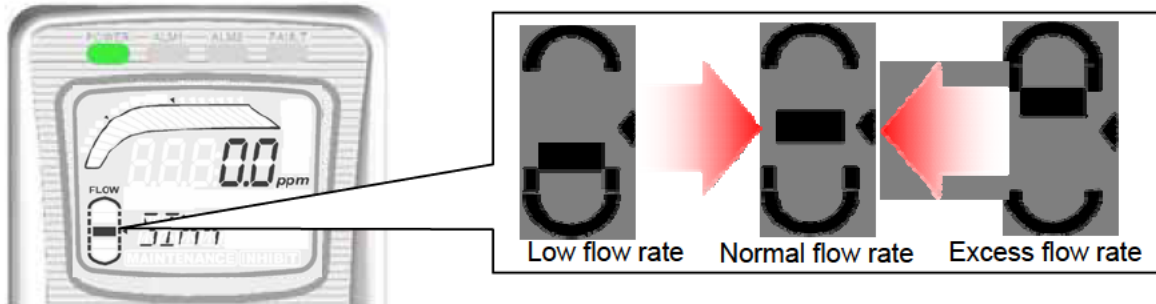
Details on each mode are provided as follows. (* Operations are slightly different depending on the sensor unit.)
Perform each operation with the front cover of the main unit open.

Mode	Item	LCD display	Details
Detection Mode	–	Gas concentration Gas name	Normal state
Gas Alarm Test Mode	–	Gas concentration	Perform the alarm test.
Maintenance Mode (User)	Zero Adjustment (Span Adjustment)	1-1 ZERO (1-1 SPAN)	Perform the zero adjustment. (In case of oxygen 0 - 25 vol%, perform the span adjustment.)
	Setting Display	1-2 CONFIRM	Display the setting of the typical menu. <ul style="list-style-type: none"> • First alarm setpoint (AL1) • Second alarm setpoint (AL2) • Alarm delay time • Zero suppression value • Zero follower ON/OFF • Sensitivity correction ON/OFF
	Flow Rate Indicator	1-3 FLOW	Display the current flow rate.
	Address Display	1-4 ADDRESS	Not used.
	Detector Version Display	1-5 70D VER	Display the program version of the main unit.
	Unit Version Display	1-6 UNIT VER	Display the program version of the sensor unit.
	Net Version Display	1-7 NET VER	Not used.
	Regular Maintenance Mode Switching	1-8 M MODE	Switch to the regular maintenance mode.
Maintenance Mode (Regular maintenance)	Gas Introduction Display	2-0 GAS TEST	Perform the gas introduction test in the regular maintenance mode.
	Zero Adjustment	2-1 ZERO	Perform the zero adjustment.
	Span Adjustment	2-2 SPAN	Perform the span adjustment.
	Last Calibrated Date	2-3 LAST CAL	Display the last calibrated date.
	Bias Voltage (Element Voltage)	2-4 BIAS (2-4 E VOLT)	Display the bias voltage. (Display the element voltage.)
	Flow Rate Setting (adjusted to 0.5 L/min)	2-5 DEF FLOW	Set the flow sensor with the flow rate at 0.5 L/min.
	Pump Ratio/Flow Rate Indicator	2-6 FLOW	Display the output and flow rate of the current pump.
	Detector Temperature	2-7 TEMP	Display the current temperature of the installation environment.
	Suggested Warm-up Completion Date/Time	2-8 WARMTIME	Display the suggested warm-up completion for semiconductor type (SGU).
	Environmental Setting 1	2-9 SETTING1	Operation setting <ul style="list-style-type: none"> • INHIBIT setting (INHIBIT) • Alarm value setting (ALM P) • Alarm delay time setting (ALM DLY) • Regular replacement operation (pump stop) (MAINTE) • Fault alarm test (F TEST)
	Environmental Setting 2	2-10 SETTING2	Functions setting <ul style="list-style-type: none"> • Address setting (ADDRESS) (Not used) • Date/Time setting (DAY TIME) • Zero suppression value setting (SUPPRESS) • Zero suppression system setting (SUP TYPE) • Contact setting for alarm test (TEST RLY) • External output setting for alarm test (TEST4-20) • Energized/De-energized setting (RLY PTRN) (Not used) • Alarm type setting (ALM TYP) • Alarm activation setting (ALM PTRN) • Alarm value limiter setting (AL LIMIT) • Fault activation setting (FLT PTRN) • Flow rate auto-adjustment setting (AT FLOW) • Zero follower ON/OFF setting (ZERO F) • 24 hours zero follower ON/OFF setting (ZERO 24F) • Sensitivity correction ON/OFF setting (S ASSIST) • External output in maintenance mode setting (MNT OUT) • External output adjustment (MA 4-20) • Backlight setting (BK LIGHT) • ETHERNET setting (ETHERNET) (Not used) • Pump drive level diagnosis ON/OFF setting (PUMP CK)
	Pyrolyzer Data Display	2-11 PL DATA	Not used.
	Fault Investigation	2-12 FAULT	Not used.
Factory Mode Switching	2-13 F MODE	Not used.	

5-5. Detection mode

<Flow Rate Indicator>

Because the suction flow rate of the detector is automatically adjusted by the flow rate control function, the flow rate, in principal, does not need to be controlled. As shown on the figure below, when the flow rate does not correspond to the specified flow rate for some reasons, it is adjusted automatically.



CAUTION

If the automatic flow rate adjustment does not work (due to clogged tube or leak), messages such as "FLOW" for an unstable flow rate or "E-05" for flow rate abnormalities are displayed. In this case, you must identify the causes and take appropriate actions.

5-6. Alarm test mode

This is used when dummy signals the same as the signals of the gas concentration are generated to check the alarm lamp activation of the detector 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). After the test is completed, never fail to press the TEST key to return to the detection mode. (If the detector remains in the alarm test mode, it automatically returns to the detection mode in ten hours.)

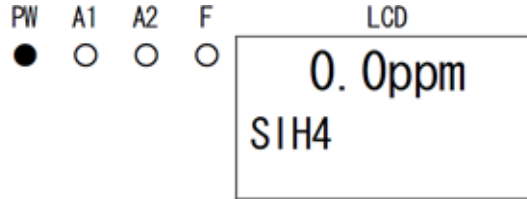
NOTE

In the alarm test mode, press the MODE key to perform a reset. Because the ▲ and ▼ keys are used to up/down the reading in this mode, the ▼ key cannot be used for resetting.

<<Alarm Test Mode>>

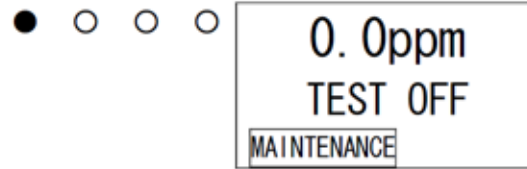
Detection Mode

Press the TEST key for three seconds.



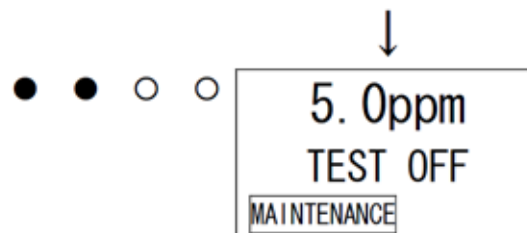
Alarm Test Mode

The message "TEST ON" is displayed when the contact is activated in the alarm test, while the message "TEST OFF" is displayed when not activated. (The setting can be changed.) Increase or decrease the reading by pressing the ▲ or ▼ key.



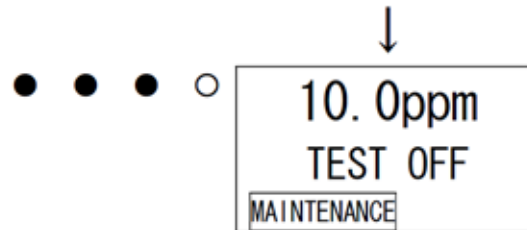
First Alarm

When the reading reaches the first alarm, the ALM1 lamp lights up and buzzer sounds. (When Contact ON is selected, the first alarm contact is activated.)



Second Alarm

When the reading reaches the second alarm, the ALM2 lamp lights up and buzzer sounds. (When Contact ON is selected, the second alarm contact is activated.)



5-7. User mode



WARNING

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

<<User Mode>>

Detection Mode

Press the MODE key for three seconds.

PW A1 A2 F

LCD

0.0ppm
SIH4



User Mode

1-1.ZERO

Perform the zero adjustment.

1- 1
ZERO
MAINTENANCE

→ SET Zero Adjustment ⇒P30



1-2.CONFIRM

Display the setting of the typical menu.

1- 2
CONFIRM
MAINTENANCE

→ SET Setting display ⇒P31



1-3.FLOW

Display the current flow rate.

1- 3
FLOW
MAINTENANCE

→ SET 0.50
L/M
MAINTENANCE



1-4.ADDRESS

This menu is not used on the detector.

1- 4
ADDRESS
MAINTENANCE



1-5.70D VER

Display the program version of the main unit.

1- 5
70D VER
MAINTENANCE

→ SET 01234
56AB
MAINTENANCE

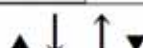


1-6.UNIT VER

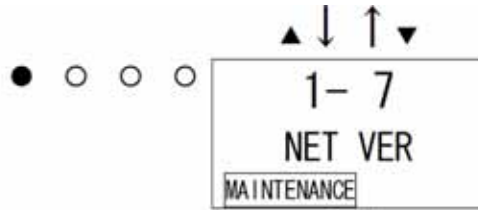
Display the program version of the installed sensor unit.

1- 6
UNIT VER
MAINTENANCE

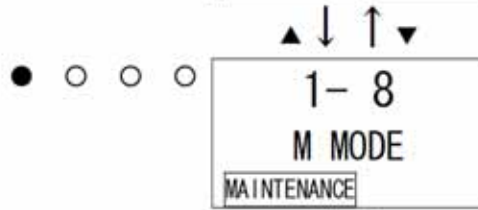
→ SET 01234
56AB
MAINTENANCE



1-7.NET VER
This menu is not used on the detector.



1-8.M MODE
Switch to the regular maintenance mode.



→ SET See "7-2. Regular maintenance mode".

Navigation arrows below the screen.
To **1-1.ZERO**

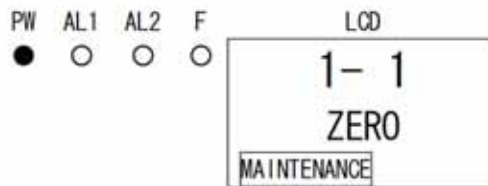
<Zero Adjustment "1-1">

This is used to perform the zero adjustment. Before starting the zero adjustment, let the detector draw the zero adjustment gas and wait until the reading is stabilized.

For oxygen deficiency alarm specification (OSU - 0 - 25 vol%), "1-1" is the span adjustment. In this case, the fresh air adjustment is performed, so that fresh air must be introduced to adjust it to 20.9 vol%. For information on the span adjustment, see "7-3. Gas calibration method".

<<Zero Adjustment>>

1-1.ZERO
Press the SET key.



Current Concentration Value Display
Press the SET key to perform the zero adjustment.



Zero Adjustment Completed
The menu returns to **1-1.ZERO** automatically.



Return to **1-1.ZERO**

* When the zero adjustment fails

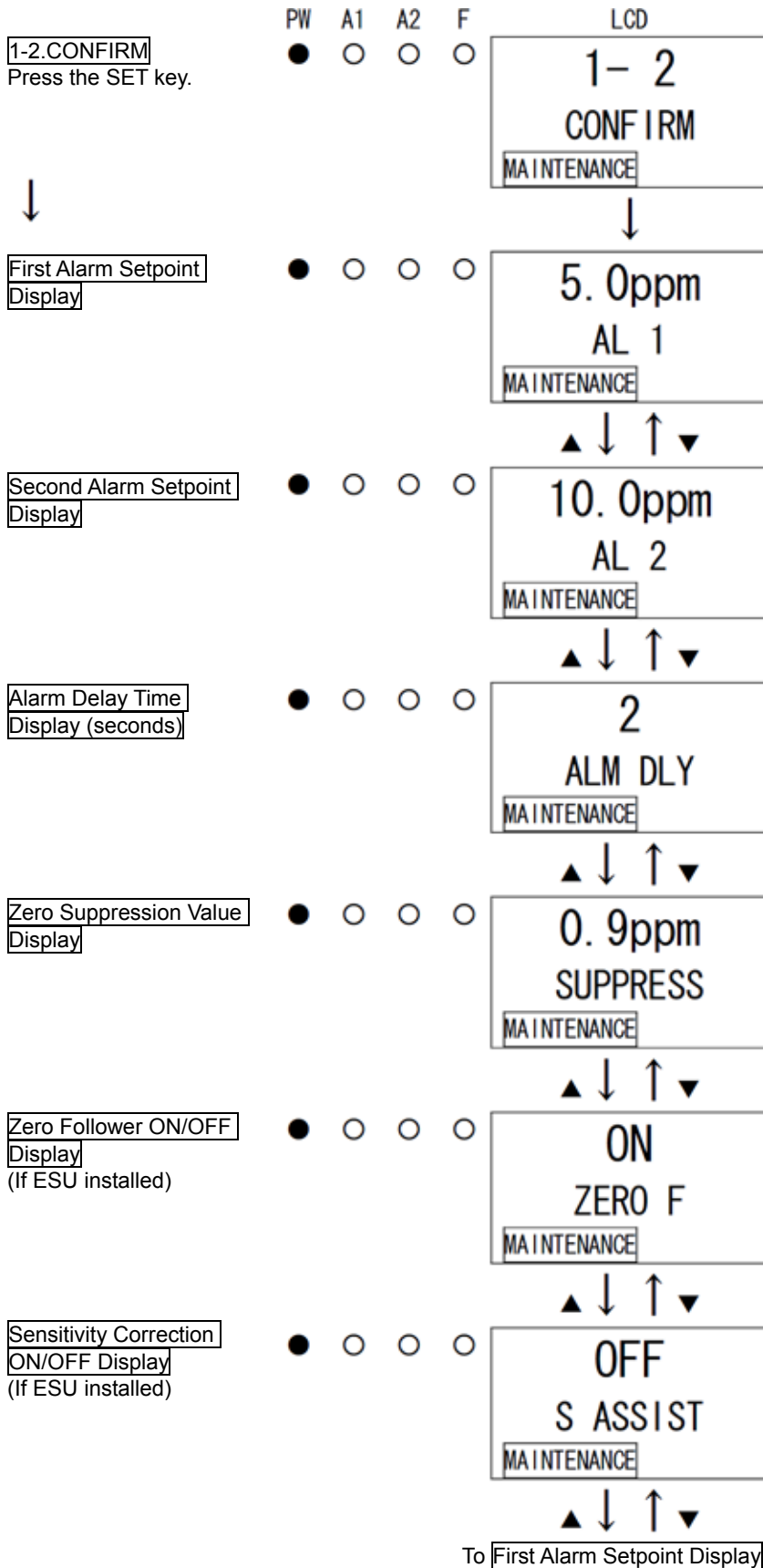


Return to **1-1.ZERO**

<Setting Display "1-2">

This is used to check the setting of typical menus.

<<Setting Display>>



5-8. How to exit

To turn off the detector, turn "OFF" the power switch located on the rear side of the main unit. Then, turn off the power supply to the detector.



WARNING

- When the detector is turned off, an alarm may be triggered on the upper (central) system. Before turning off the detector, 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 detector.
- If the alarm contact is energized (option), it is activated when the detector is turned "OFF".
- If the gas to be detected has an adsorptive property, the detector must be cleaned thoroughly with fresh air before turning "OFF" the detector.

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 (first alarm and second alarm) is factory-set. Although the alarm delay time (standard: 2 seconds) works in the detector to prevent a false activation, it can be cancelled if not needed.

<Display Operation>

Gas Concentration Display

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

Power Indicator Lamp (POWER: Green)

This lights up continuously.

Alarm Indicator Lamp (ALM1: Red), (ALM2: Red)

The alarm consists of two steps. Each of them is triggered when the respective alarm setpoint value is reached to or exceeded.

The alarm indicator lamp goes out when the gas concentration settles below the alarm setpoint after a reset operation.

NOTE

In the detection mode, press the ▼ key to perform a reset.

Alarm Buzzer

The alarm consists of two steps. Each of them is triggered when the respective alarm setpoint value is reached to or exceeded.

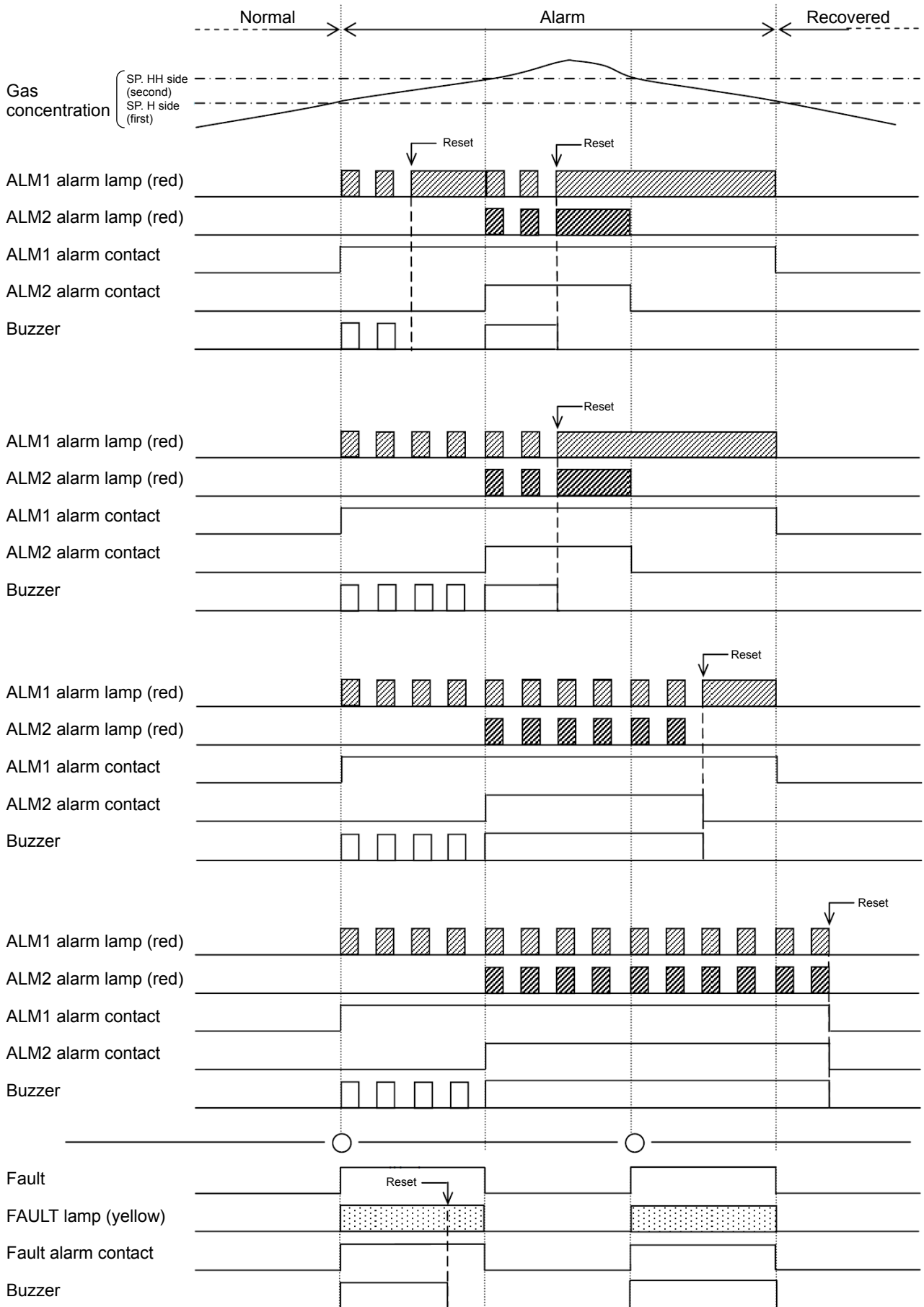
The alarm buzzer stops after a reset operation.

<Contact Activation>

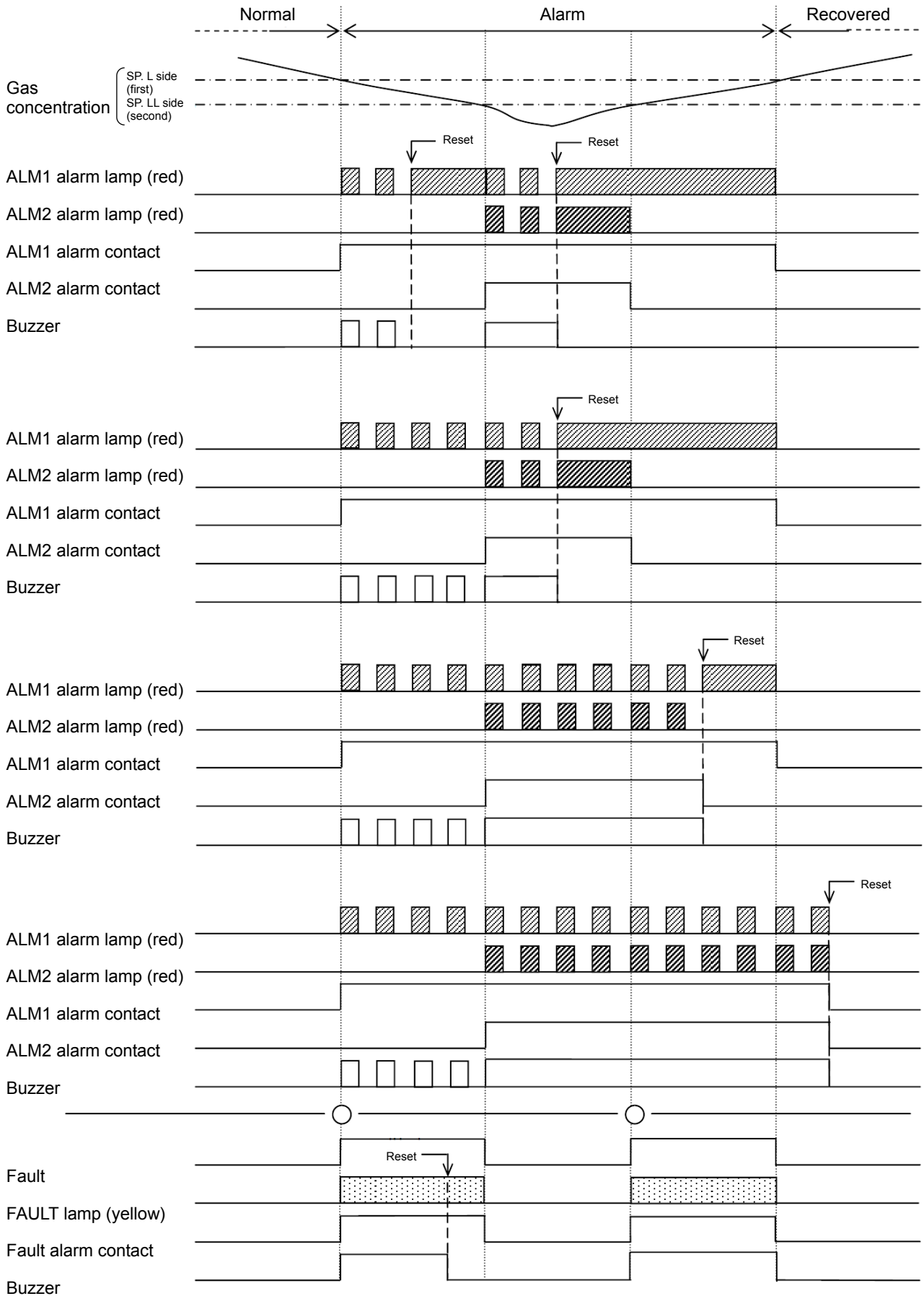
The alarm contact consists of two steps. Each of them is triggered when the respective alarm setpoint value is reached to or exceeded.

The alarm contact is reset when the gas concentration settles below the alarm setpoint after a reset operation.

"Alarm Pattern Example (H-HH)"



"Alarm Pattern Example (L-LL)"



<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.

- Check the reading of the detector.

NOTE

If a gas leak is momentary, the reading may already have dropped when you check it. In addition, when the alarm is triggered by noise or other incidental conditions other than a gas, the reading may have already dropped.

- Based on your management rules of gas alarm, no one should be allowed to access the monitored zone to ensure safety.
- 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.
- 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..
- If you can determine that the point is free from dangers, take actions to fix the gas leak.

6-2. Fault alarm activation

A fault alarm is triggered when the detector detects abnormalities. <<Auto-Reset>> After a fault alarm is triggered, the FAULT lamp (yellow) lights up, buzzer sounds and an error message is displayed on the LCD. Determine the causes and take appropriate actions.

NOTE

The alarm buzzer can be stopped by a reset operation.

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

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



* E-5 FLOW (flow rate abnormalities)

NOTE

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

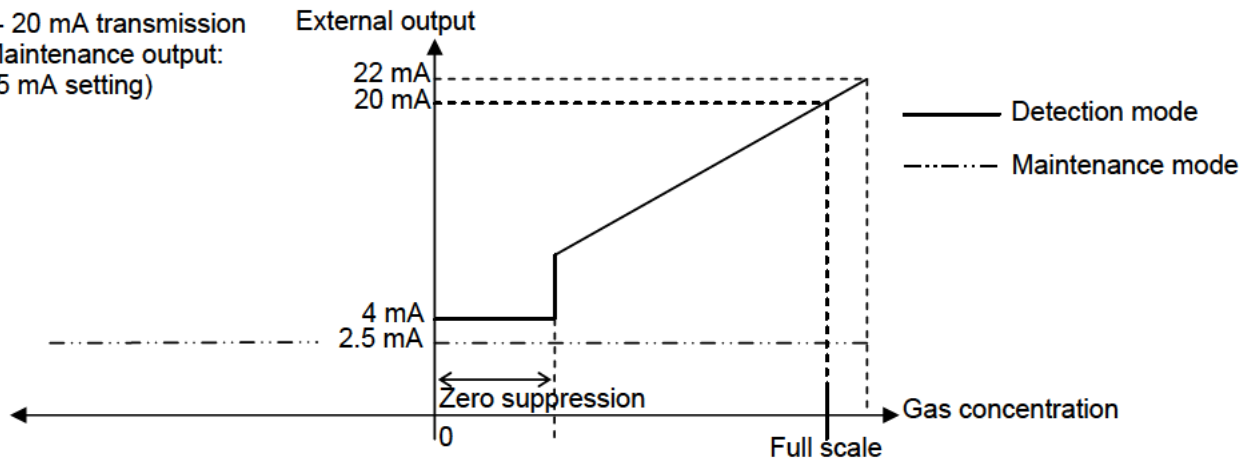
6-3. External output operation

Specifications	4 - 20 mA
Signal Transmission System	Electric current transmission (non-isolated)
Transmission Path	CVVS
Transmission Distance	Below 1 km
Connection Load Resistance	Below 300 Ω
(1) Detection Mode (No Alarm)	4 - 20 mA (concentration output)
(2) Detection Mode (Gas Alarm)	4 - 20 mA (concentration output)
(3) Initial Clear	<u>Depending on the setting of (4)</u> <u>2.5 mA setting: 2.5 mA</u> <u>4 mA, HOLD, 4 - 20 mA setting: 4 mA*</u>
(4) Maintenance Mode	<u>2.5 mA setting: 2.5 mA</u> <u>4 mA setting: 4 mA*</u> <u>HOLD setting: The previous value retained</u> <u>4-20 mA setting: 4 - 20 mA (concentration output)</u>
(5) Alarm Test	<u>Output ON setting: 4 - 20 mA (concentration output)</u> <u>Output OFF setting: <u>Depending on the setting of (4)</u></u>
(6) Fault Alarm	0.5 mA (Fixed)
(7) Inhibit	<u>Depending on the setting of (4)</u> <u>2.5 mA setting: 2.5 mA</u> <u>4 mA, HOLD, 4 - 20 mA setting: 4 mA*</u>
(8) Power Off	0 mA

* OSU - 0 - 25 vol% is equivalent of AIR (20.9 vol% = 17.4 mA)

Example of Gas Concentration and External Output

4 - 20 mA transmission
(Maintenance output:
2.5 mA setting)



CAUTION

<<4 - 20 mA transmission>>

- The 4 - 20 mA output is already adjusted. In case of over scale, an output will not exceed 22 mA.
- Output during inhibit or initial clear is based on 4 - 20 mA output setting in the maintenance mode. Be careful for a possible lower output which drops as low as 2.5 mA during initial clear when OSU (L alarm) is used. In particular, this occurs when the detector is started or the specification is changed. Understand how the detector functions, and take actions, if necessary, so that the receiver side cannot get false alarms (e.g. making an inhibit status).

<Example of Items which Requires Special Precautions>

Maintenance output setting	Sensor unit	Details
2.5 mA	Use OSU (L-LL, L-H).	Output 2.5 mA during maintenance or inhibit. Possibility of false alarm in the upper unit (L alarm)
4 mA, HOLD, 4 - 20 mA	Specification change (To OSU - 0 - 25 vol%)	In case of a change from another principle (H-HH), 4 mA (equivalent of concentration zero) is used until the change is confirmed "C-02".
	Specification change (From OSU - 0 - 25 vol%)	In case of a change from 0 - 25 vol% (L-LL,L-H), 17.4 mA (equivalent of approx. 84%FS) is used until the change is confirmed "C-02".

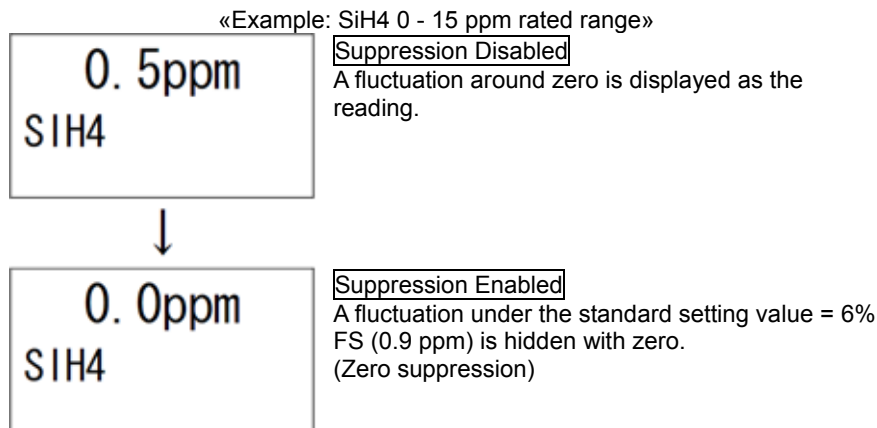
6-4. Other functions

<Suppression Function>

Some types of sensor used with the detector 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.



NOTE

- In the maintenance mode, this function is disabled and the fluctuation of the reading under the setting value is displayed.
- When a sensor unit with the oxygen deficiency alarm (OSU 0 - 25 vol%) is equipped, the zero suppression is shifted to AIR suppression automatically. That is, a small fluctuation of the reading around 20.9 vol% is displayed as 20.9 vol%.



CAUTION

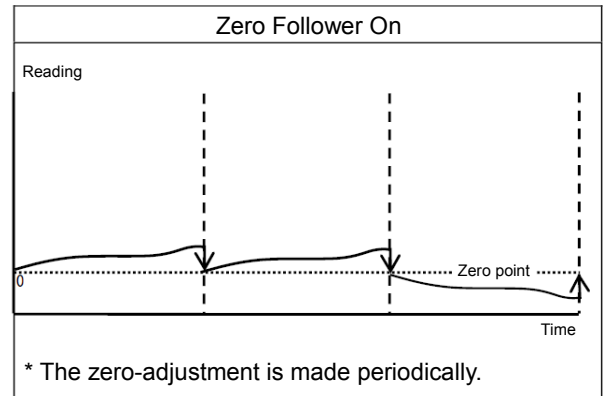
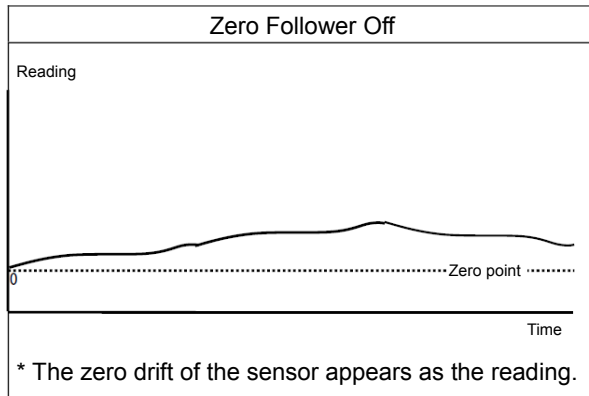
A reading under zero is suppressed with the 10% FS suppression.

A reading that gets 10% FS or more under zero is displayed as "-0.0", which prevents an accurate gas detection and needs the zero adjustment.

<Zero Follower Function>

Some types of sensor used with the detector might have sensitivity variations after being used for a long period.

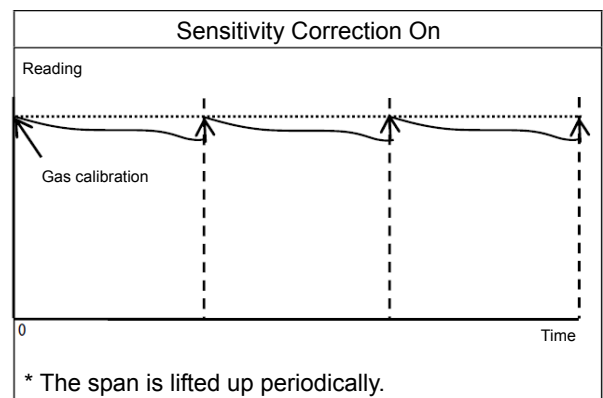
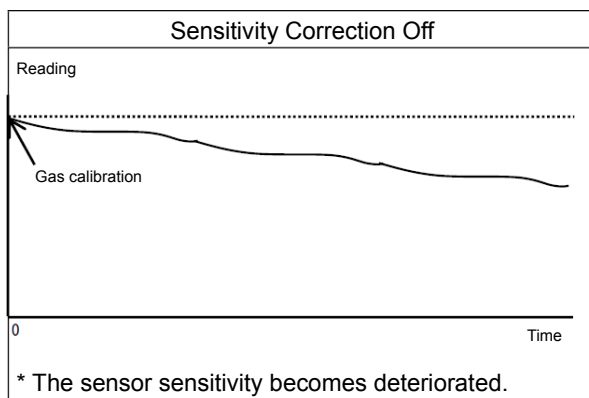
This function corrects the fluctuation of the reading at the zero point (zero drift) among the sensitivity variations over time by a program manipulation to stabilize the zero point, and works on the electrochemical type (ESU).



<Sensitivity Correction Function>

Some types of sensor used with the detector might have sensitivity variations after being used for a long period.

This function compensates the deterioration of the gas sensitivity among the sensitivity variations over time. It works on the electrochemical type (ESU) and makes the span adjustment by a program manipulation based on the principled deterioration pattern.



CAUTION

The sensitivity correction is just an auxiliary function. It uniformly lifts the span up based on the principled deterioration pattern only and cannot consider the sensitivity variation of an individual sensor.

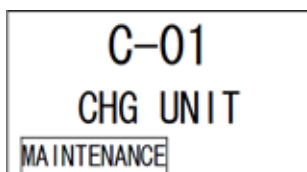
To correct the sensitivity variation of an individual sensor, you must make the regular span adjustment using calibration gas.

<Calibration History/Alarm Trend History/Event History Functions>

The detector and the sensor unit have their own history functions. To use these functions, contact RIKEN KEIKI.

<Sensor Unit Automatic Recognition Function>

The detector has the function to automatically recognize the sensor unit when the sensor unit is replaced or the specification is changed. When a sensor unit with a different serial number or with a different principle or specification is attached, one of the following messages is displayed for helping the correct installation.



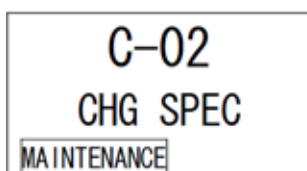
Unit Replacement

Displayed when a unit with the same specification (principle, type, and so on) is attached (e.g. in a regular replacement). Press the MODE key to recognize the new sensor unit and start the detector.

The following is displayed alternately if the unit that you installed has the same or earlier date of manufacture than the one that has been replaced.

「CHG UNIT」 ↔ 「USED SEN」

Check for correct installation if this message is displayed because an old sensor might have been installed by mistake.



Specification Change

Displayed when a unit with a different specification (principle, type, and so on) from the previous one is attached.

Press the MODE key to recognize the unit with the new specification and start the monitor.

If you do not intend the specification change, this message might mean the installation error. Check the correct installation.



CAUTION

If you confirm the specification change (principle, sensor type, detected gases, detectable range, and so on) of the sensor unit for "C-02", the specification of the gas detector is changed. Note that it resets the alarm setpoint (ALM P) as well as the following parameters to the standard setting values.

If you want to use nonstandard setting values, set them in the maintenance mode.

- Alarm delay time setting (ALM DLY)
- Suppression value (SUPPRESS)
- Alarm type (ALM TYP) The OSU specification includes "L-LL", "L-H", and "H-HH".

<Standard Setting Values by Principle>

	ESU	NCU	SGU	OSU (0 - 25 vol%)	OSU (0 - 5 vol%)	OSU (0 - 50 vol%)
Alarm delay	2 seconds	2 seconds	2 seconds	2 seconds	2 seconds	2 seconds
Suppression value	6%FS	6%FS (0 - 100%LEL)	10%FS	0.5 vol% (AIR supp)	0 vol%	0 vol%
Alarm type	H-HH	H-HH	H-HH	L-LL	H-HH	H-HH

"Change from OSU (L-LL alarm)" or "change to OSU (L-LL alarm)" reverses the direction of the alarm. It requires special care because the previous settings are kept for the external output and other settings in the maintenance mode. Immediately after "C-02" is confirmed with the MODE key, the initial clear is started and the new actions are enabled. (The initial clear output is shifted together.)

7

Maintenance

The detector is an important instrument for the purpose of safety. To maintain the performance of the detector 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 for 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 (or 20.9 vol% on the oxygen deficiency meter). When the reading is incorrect, perform the zero adjustment (fresh air adjustment) after ensuring that no other gases exist around it.	○	○	○
Flow Rate Check	See the flow rate indicator to check for abnormalities.	○	○	○
Filter Check	Check the dust filter for dust or clogging.	○	○	○
Alarm Test	Inspect the alarm circuit by using the alarm test function.		○	○
Span Adjustment	Perform the span adjustment by using the calibration gas.			○
Gas Alarm Check	Check the gas alarm 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 expertise and knowledge on the dedicated tools used for services, along with other products. To maintain the safety operation of the detector, please use our maintenance service.

- The followings are typical maintenance services. For more information, please contact RIKEN KEIKI.

Main Services

Power Supply Check	:	<ul style="list-style-type: none"> 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	:	<ul style="list-style-type: none"> Verifies that the concentration display value is zero (or 20.9 vol% on the oxygen deficiency meter) by using the zero gas. Performs the zero adjustment (fresh air adjustment) if the reading is incorrect.
Flow Rate Check	:	<ul style="list-style-type: none"> Checks the flow rate indicator to find abnormalities. Checks the flow rate by using an external flow meter to verify the correctness of the flow rate indicator on the detector. If the flow rate is incorrect, performs the flow rate adjustment.
Filter Check	:	<ul style="list-style-type: none"> Checks the dust filter for dust or clogging. Replaces a dirty or clogged dust filter.
Alarm Test	:	<ul style="list-style-type: none"> Inspects the alarm circuit by using the alarm test function. <ul style="list-style-type: none"> Checks the alarm lamps. (Checks each activation of ALM1 and ALM2.) Checks the external alarm. (Checks the activation of the external alarm, such as a buzzer.)
Span Adjustment	:	Performs the span adjustment by using the calibration gas.
Gas Alarm Check	:	<ul style="list-style-type: none"> Checks the gas alarm by using the calibration gas. <ul style="list-style-type: none"> Checks the alarm. (Checks the alarm activation when the alarm setpoint is reached.) Checks the delay time. (Checks time to delay until the alarm is triggered.) Checks the alarm lamps. (Checks each activation of ALM1 and ALM2.) Checks the external alarm. (Checks the activation of external alarms, such as a buzzer and reset signal.)
Cleaning and Repair of Detector (visual diagnosis)	:	<ul style="list-style-type: none"> Checks dust or damage on surface, cover, or internal parts of the detector, cleans and repairs such parts of the detector. Replaces parts which are cracked or damaged.
Detector Operation Check	:	Uses the keys to check the operation of functions and parameters.
Replacement of Consumable Parts	:	Replaces consumable parts, such as a sensor, filter and pump.

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 detector remains in the regular maintenance mode, it automatically returns to the detection mode in ten hours.)

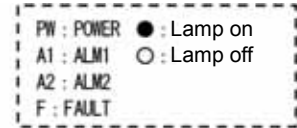
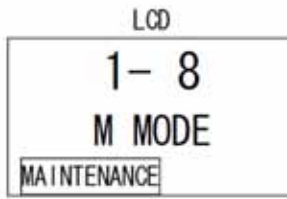
Mode	Item	LCD display	Details
Maintenance Mode (Regular maintenance)	Gas Introduction Display	2-0 GAS TEST	Perform the gas introduction test in the regular maintenance mode.
	Zero Adjustment ⇒P56	2-1 ZERO	Perform the zero adjustment.
	Span Adjustment ⇒P58	2-2 SPAN	Perform the span adjustment.
	Last Cal brated Date	2-3 LAST CAL	Display the last calibrated date.
	Bias Voltage (Element Voltage)	2-4 BIAS (2-4 E VOLT)	Display the bias voltage. (Display the element voltage.)
	Flow Rate Setting (adjusted to 0.5 L/min) ⇒P59	2-5 DEF FLOW	Set the flow sensor with the flow rate at 0.5 L/min.
	Pump Ratio/Flow Rate Indicator ⇒P59	2-6 FLOW	Display the output and flow rate of the current pump.
	Detector Temperature	2-7 TEMP	Display the current temperature of the installation environment.
	Suggested Warm-up Completion Date/Time	2-8 WARMTIME	Display the suggested warm-up completion for semiconductor type (SGU).
	Environmental Setting 1 ⇒P48	2-9 SETTING1	Operation setting <ul style="list-style-type: none"> • INHIBIT setting (INHIBIT) • Alarm value setting (ALM P) ⇒P49 • Alarm delay time setting (ALM DLY) • Regular replacement operation (pump stop) (MAINTE) • Fault alarm test (F TEST) ⇒P49
	Environmental Setting 2 ⇒P50	2-10 SETTING2	Functions setting <ul style="list-style-type: none"> • Address setting (ADDRESS) (Not used) • Date/Time setting (DAY TIME) ⇒P55 • Zero suppression value setting (SUPPRESS) • Zero suppression system setting (SUP TYPE) • Contact setting for alarm test (TEST RLY) • External output setting for alarm test (TEST4-20) • Energized/De-energized setting (RLY PTRN) (Not used) • Alarm type setting (ALM TYP) • Alarm activation setting (ALM PTRN) • Alarm value limiter setting (AL LIMIT) • Fault activation setting (FLT PTRN) • Flow rate auto-adjustment setting (AT FLOW) • Zero follower ON/OFF setting (ZERO F) • 24 hours zero follower ON/OFF setting (ZERO 24F) • Sensitivity correction ON/OFF setting (S ASSIST) • External output in maintenance mode setting (MNT OUT) • External output adjustment (MA 4-20) • Backlight setting (BK LIGHT) • ETHERNET setting (ETHERNET) (Not used) • Pump drive level diagnosis ON/OFF setting (PUMP CK)
	Pyrolyzer Data Display	2-11 PL DATA	Not used.
	Fault Investigation	2-12 FAULT	Not used.
Factory Mode Switching	2-13 F MODE	Not used.	

<<Regular Maintenance Mode>>

User Mode

In "1-8.M MODE", press the SET key.

PW ● A1 ○ A2 ○ F ○



Then press the SET key again for three seconds.

PW ● A1 ○ A2 ○ F ○



Regular Maintenance Mode

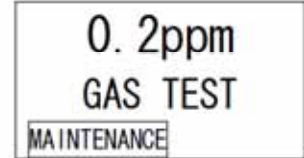
2-0.GAS TEST

Perform a test with the gas. Similar to the detection mode, the reading changes and the alarm lamp lights up after the gas is introduced, but the contact is not activated.

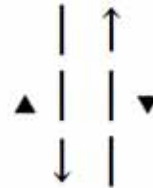
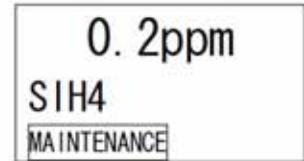
PW ● A1 ○ A2 ○ F ○



→ SET



↓ (Alternate Display) ↑



2-1.ZERO

Perform the zero adjustment.

PW ● A1 ○ A2 ○ F ○



→ SET

Zero Adjustment ⇒ P56



2-2.SPAN

Perform the span adjustment.

PW ● A1 ○ A2 ○ F ○



→ SET

Span Adjustment ⇒ P58



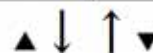
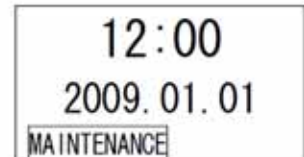
2-3.LAST CAL

Display the last calibrated date.

PW ● A1 ○ A2 ○ F ○



→ SET



2-4.BIAS

Display the bias voltage "BIAS" of electrochemical type (ESU) or the element voltage "E VOLT" of semiconductor type (SGU).

PW ● A1 ○ A2 ○ F ○

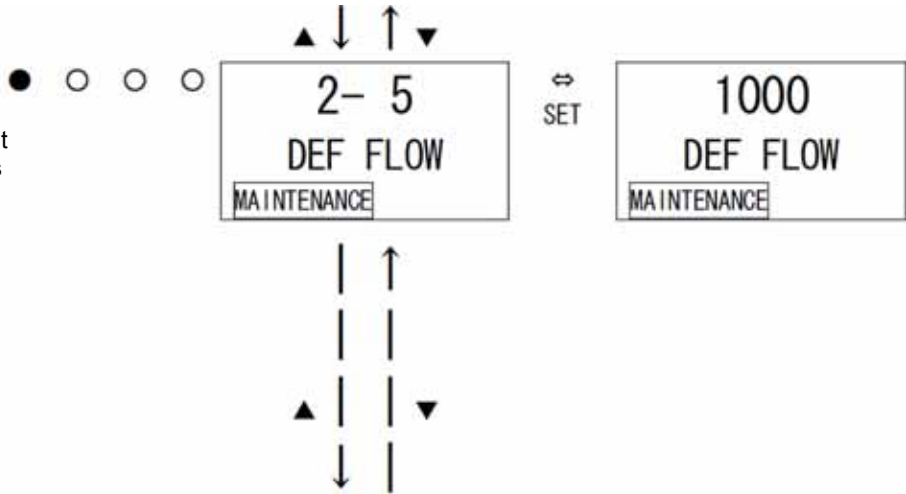


→ SET



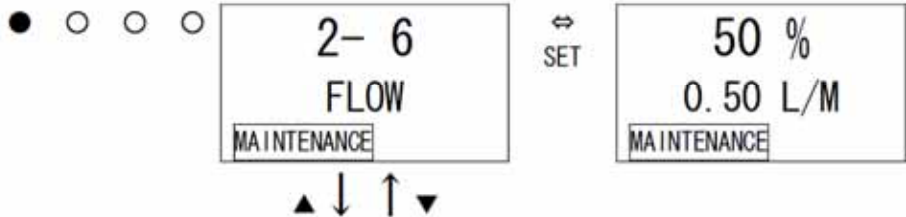
2-5.DEF FLOW

Set the flow rate to the default value when the flow sensor is replaced, etc.
 Normally, this is not used because the detector has already been adjusted.
 On the other hand, if the flow meter is set at other than the specified flow rate, gases cannot be detected properly due to an incorrect flow rate.
 (Press the MODE key to cancel this menu.)



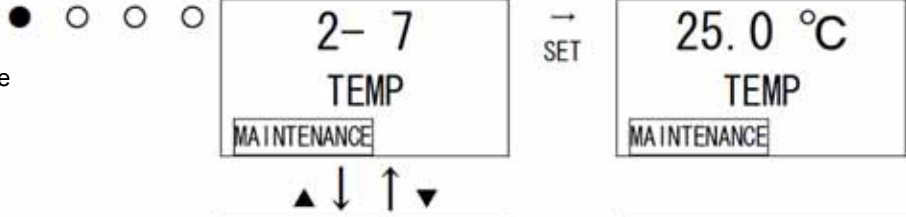
2-6.FLOW

Display the output and flow rate of the current pump.



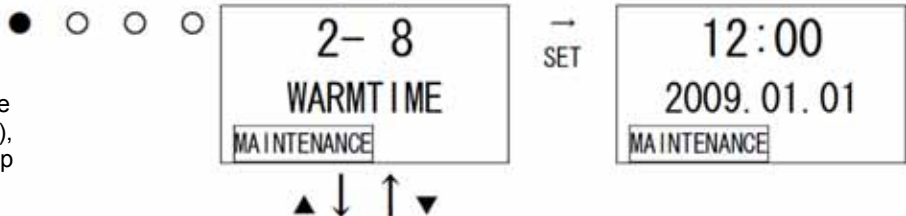
2-7.TEMP

Display the temperature of the detector.



2-8. WARMTIME

Display the suggested warm-up completion date/time for semiconductor type (SGU), which requires a long warm-up time.



2-9. SETTING1

Specify the environmental setting 1.



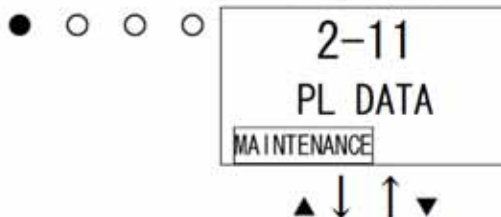
2-10.SETTING2

Specify the environmental setting 2.



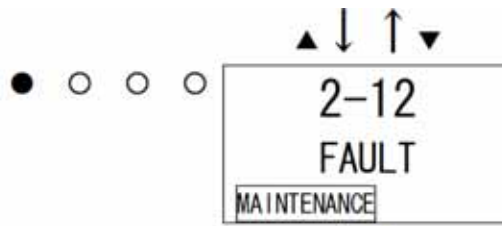
2-11.PL DATA

This menu is not used on the detector.



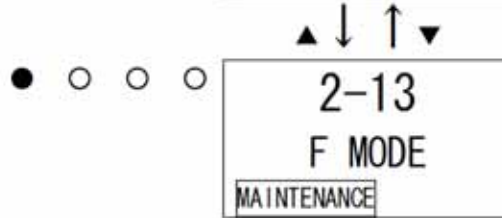
2-12.FAULT

This is used (by the manufacturer) to investigate and analyze the causes of faults. This is not used by the user.



2-13.F MODE

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



To **2-0.GAS TEST**

<Environmental Setting 1 "2-9">

In the environmental setting 1, specify the operation setting.

<<Environmental Setting 1>>

2-9.SETTING1

Press the SET key.

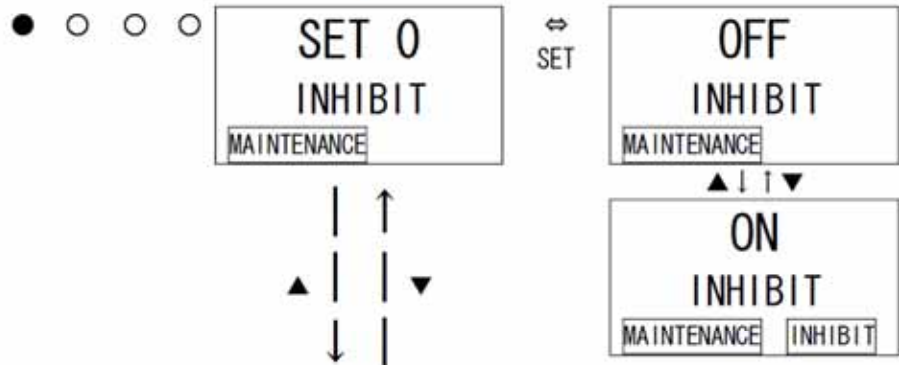


SET 0.INHIBIT

Set Inhibit.

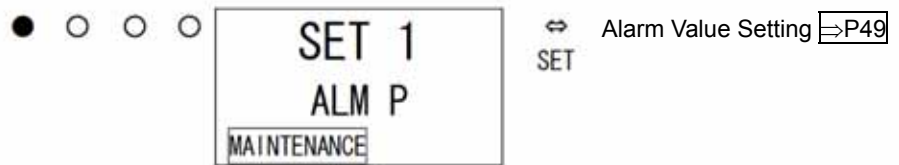
Select either ON/OFF, and then press the SET key to confirm the selection.

When ON is selected, the message **INHIBIT** is displayed on the LCD. As a result, an alarm is not triggered to external circuits even though the detector is in the detection mode.



SET 1.ALMP

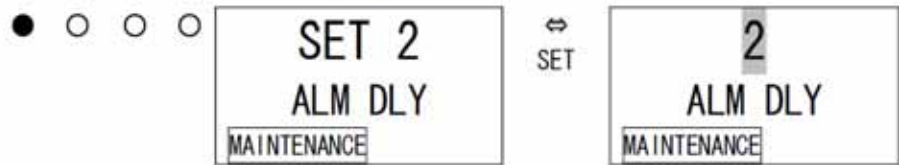
Set the alarm setpoint.



SET 2.ALMDLY

Set the alarm delay time.

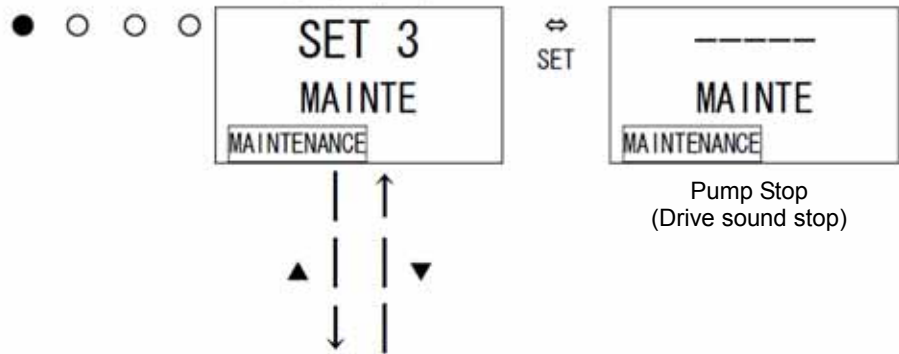
Change the value (second) by pressing the ▲ or ▼ key, and then press the SET key to confirm the value.



SET 3.MAINT

This is used to stop only the pump for replacing the pump or for another purpose.

Press the SET key to stop the pump. Press the SET key again to restart the pump, which returns to the original state. (You can also press the MODE key to cancel this menu and restart the pump.)



SET 4.F TEST

Perform a fault alarm test.



To SET 0.INHIBIT Setting

<Alarm Value Setting "2-9" - "SET 1">

<<Alarm Value Setting>>

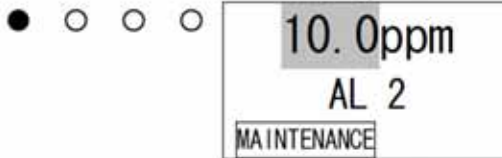
SET 1.ALM P
Press the SET key.



First Alarm Value Setting
Change the value by pressing the ▲ or ▼ key, and then press the SET key to confirm the value. (Press the MODE key to skip this menu.)



Second Alarm Value Setting
Change the value by pressing the ▲ or ▼ key, and then press the SET key to confirm the value. (Press the MODE key to skip this menu.)



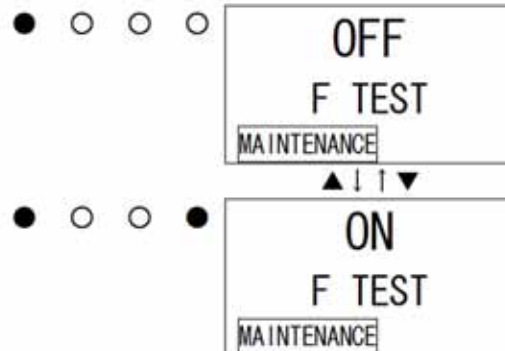
Return to **SET 1.ALM P**

<Fault Alarm Test "2-9" - "SET 4">

SET 4.F TEST
Press the SET key.



Fault Alarm Test ON/OFF
Select either ON/OFF.
Switch ON and press the SET key to trigger the fault alarm.
Return to OFF and press the SET key to cancel the test.
(Pressing the MODE key also enables to cancel this menu and to go back to the original state.)



WARNING

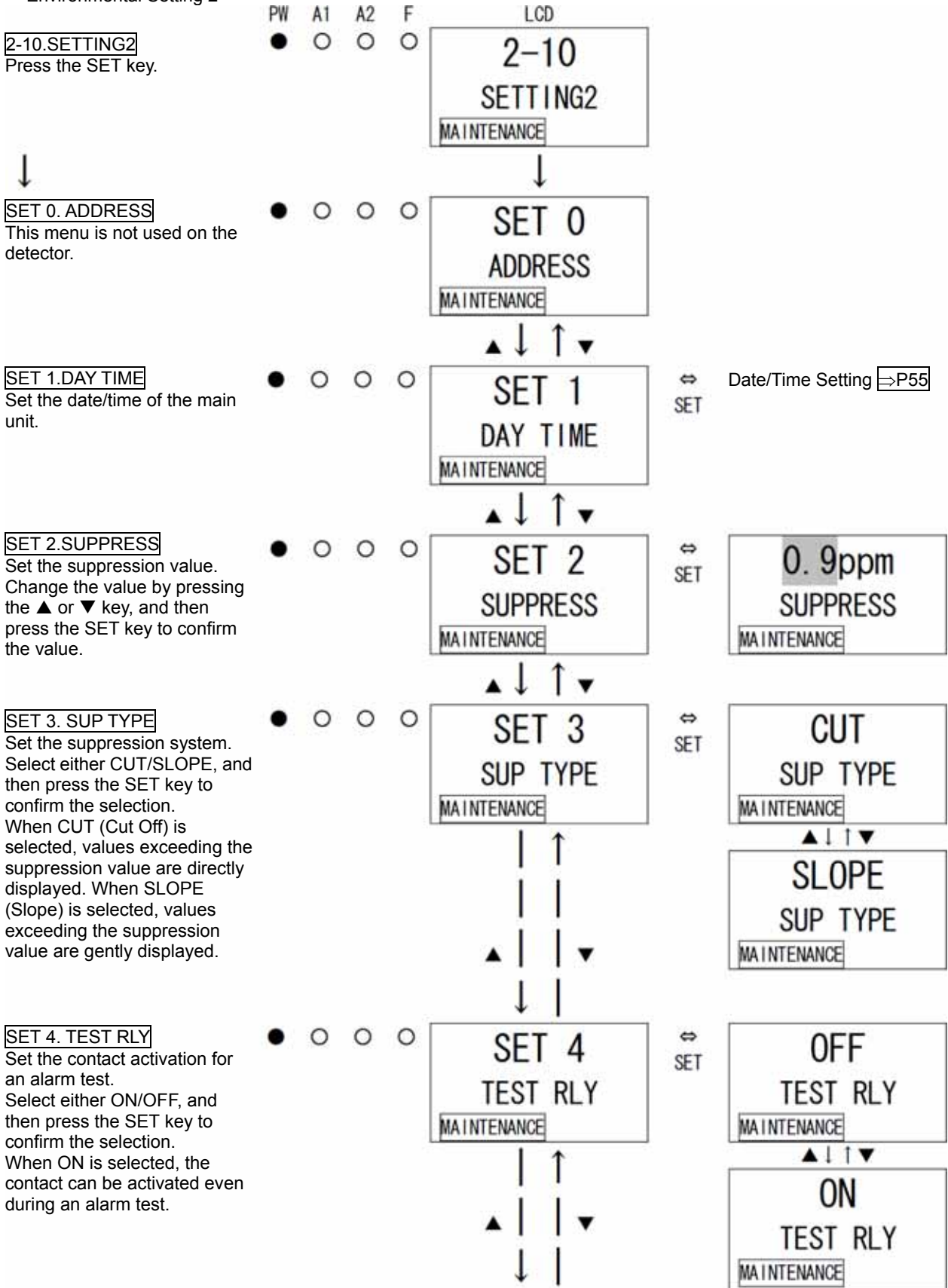
Because the contact (fault) can be activated only by a fault alarm test in the maintenance mode, be careful to perform the test. The fault alarm test cannot be performed during inhibit.

<Environmental Setting 2 "2-10">

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

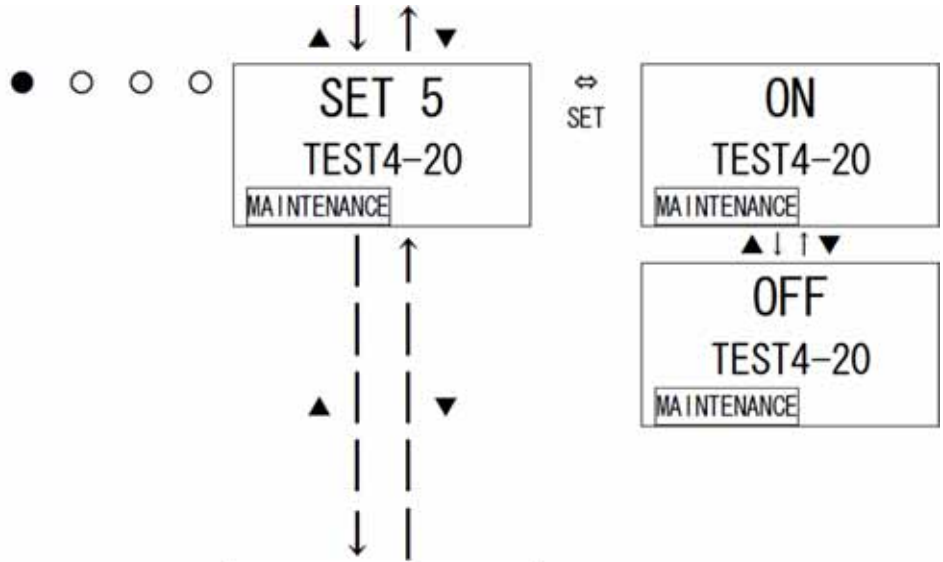
The environmental setting 2 includes setting menus which are usually not used. Be careful not to change these settings by mistake.

<<Environmental Setting 2>>



SET 5.TEST4-20

Set the external output for an alarm test.
 Select either ON/OFF, and then press the SET key to confirm the selection.
 When ON is selected, the external output (4 - 20 mA) is output even during an alarm test.
 When OFF is selected, the output is kept at the one just before the alarm test mode is entered (HOLD).



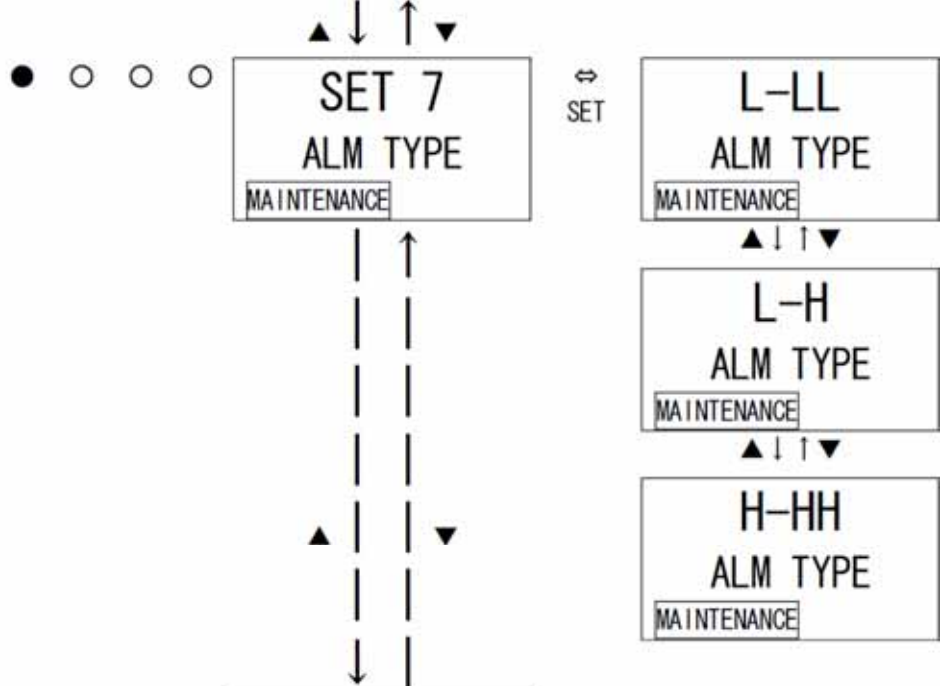
SET 6.RLY PTRN

This menu is not used on the detector.



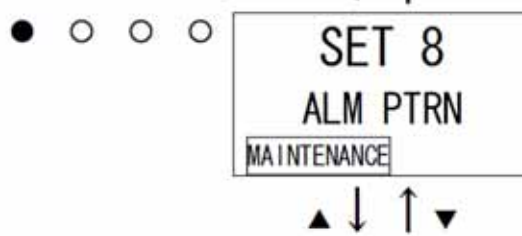
SET 7.ALM TYPE

Set the alarm type.
 When the galvanic cell type (OSU) is installed, you can select either L-LL, L-H, or H-HH.



SET 8.ALM PTRN

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



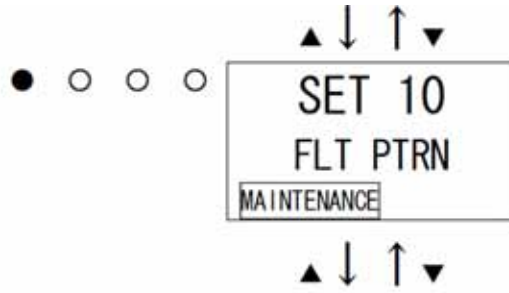
SET 9.AL LIMIT

This is a setting screen of the alarm value limiter. Do not change the setting when the detector is used in a normal way. (ON setting)



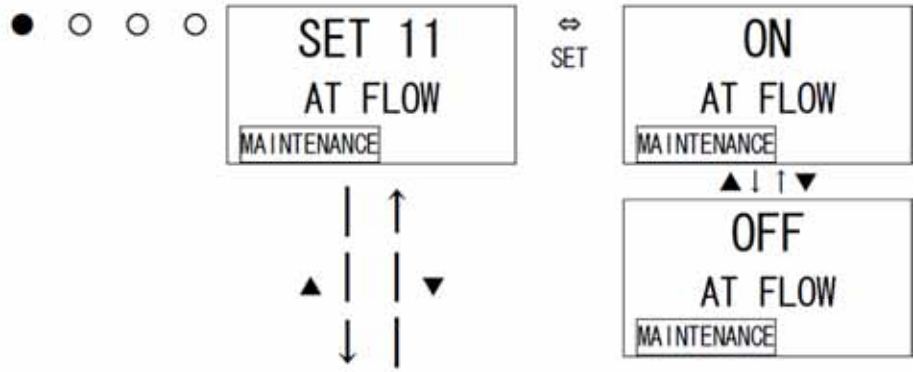
SET 10. FLT PTRN

This is a setting screen of the fault alarm activation. Do not change the setting when the detector is used in a normal way, because it determines how the detector functions. (Auto-reset setting: "nL")



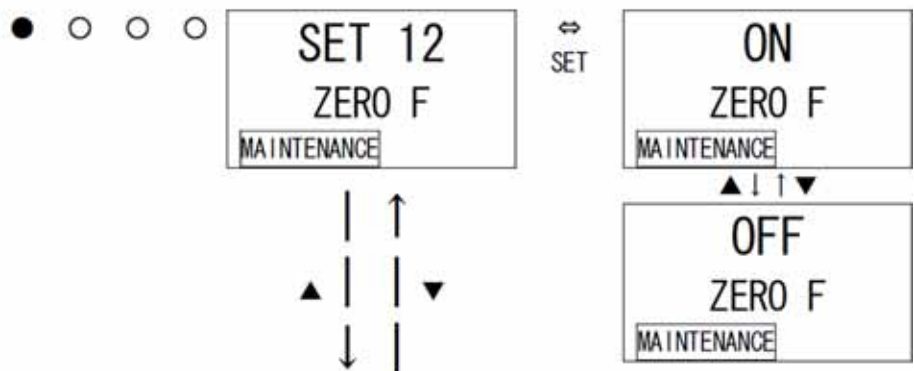
SET 11. AT FLOW

Set the flow rate auto-adjustment. Select either ON/OFF, and then press the SET key to confirm the selection. When ON is selected, the flow rate auto-adjustment is activated.



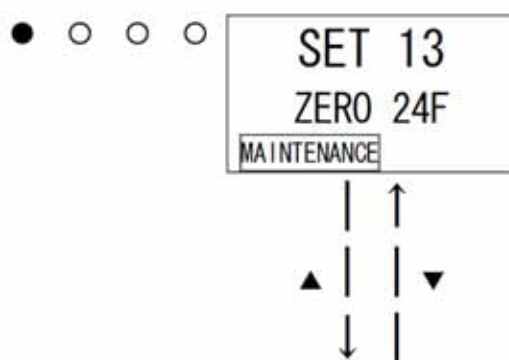
SET 12. ZERO F

Set the zero follower when the electrochemical type (ESU) is installed. Select either ON/OFF, and then press the SET key to confirm the selection. When ON is selected, the zero follower function is activated.



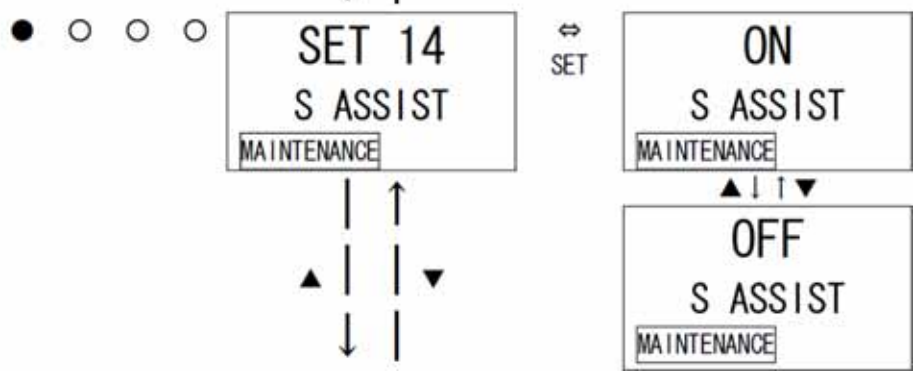
SET 13. ZERO 24F

This is a supplemental setting screen for the above zero follower function. (A setting to determine whether the first-24-hour zero follower will be performed after the power is turned on.) Do not change the setting when the detector is used in a normal way. (ON setting)



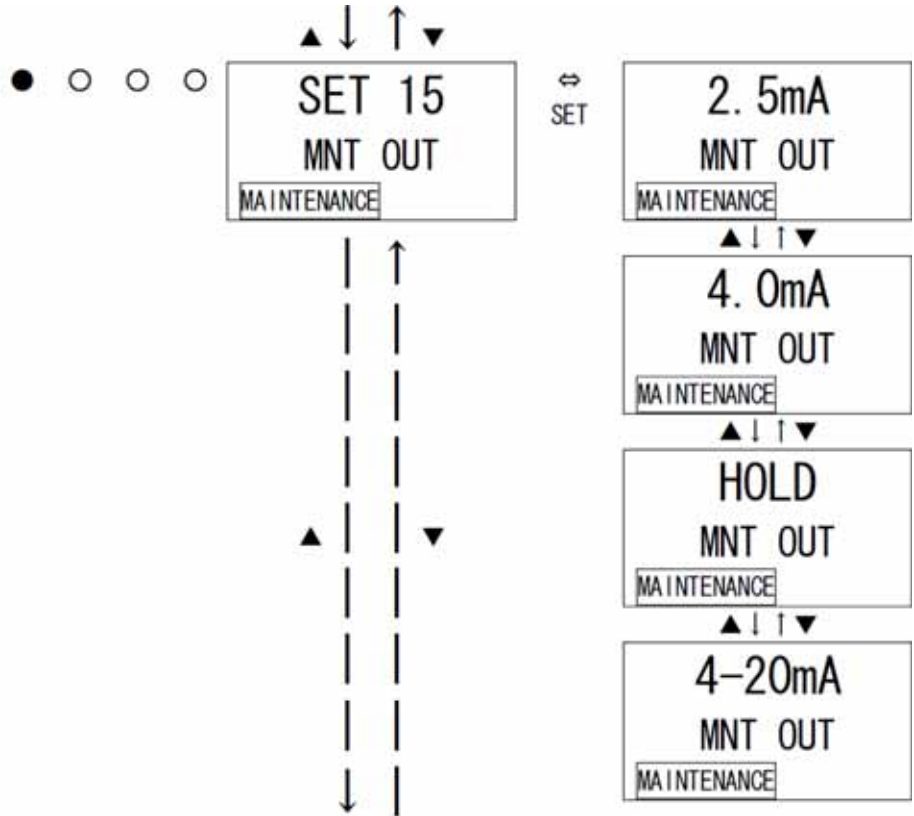
SET 14. S ASSIST

Set the sensitivity correction when the electrochemical type (ESU) is installed. Select either ON/OFF, and then press the SET key to confirm the selection. When ON is selected, the sensitivity correction function is activated.



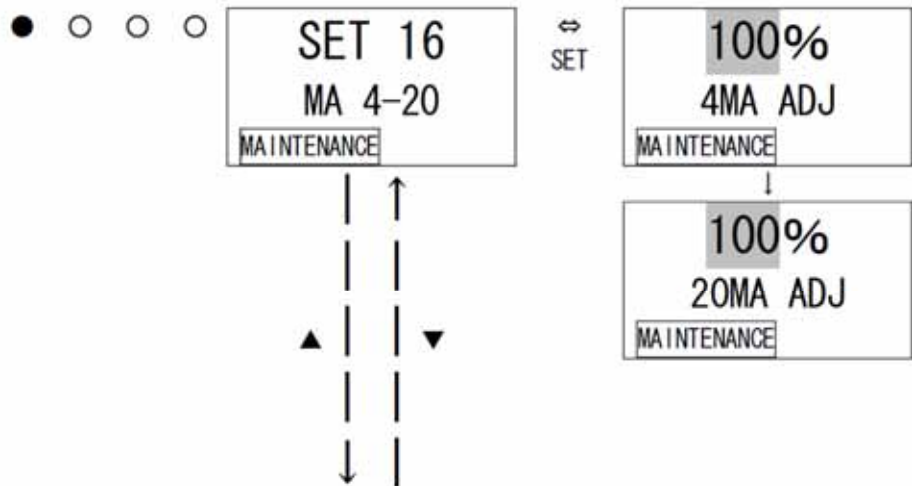
SET 15. MNT OUT

Set the external output for the maintenance mode. Select either 2.5 mA/4.0 mA/HOLD (previous value)/4 - 20 mA (linked to display SET value), and then press the SET key to confirm the selection.



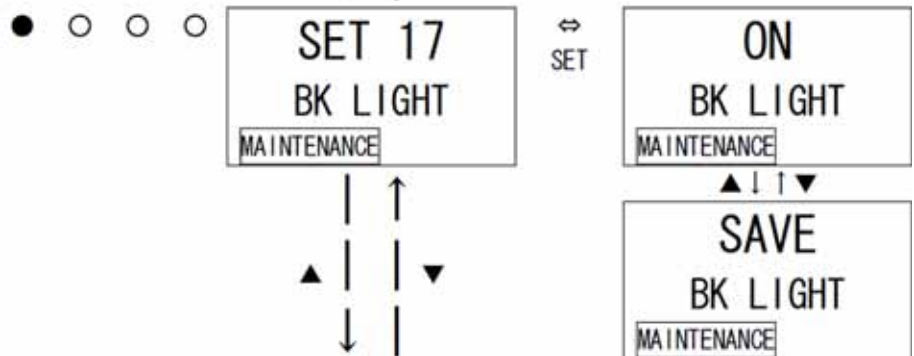
SET 16. MA 4-20

Adjust the external output (4 - 20 mA). Adjust the output (%) by pressing the ▲ or ▼ key, and then press the SET key to confirm the value. (It must be adjusted to the upper unit or the ammeter.) After adjustment of 4 mA is completed, perform the adjustment of 20 mA. (Press the MODE key to skip this menu.)



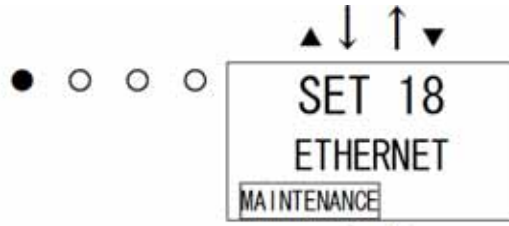
SET 17. BK LIGHT

Set the backlight. Select either ON/SAVE, and then press the SET key to confirm the selection. When ON is selected, the backlight lights up continuously. When SAVE is selected, the backlight is usually turned off, but lights up only during an operation or event.



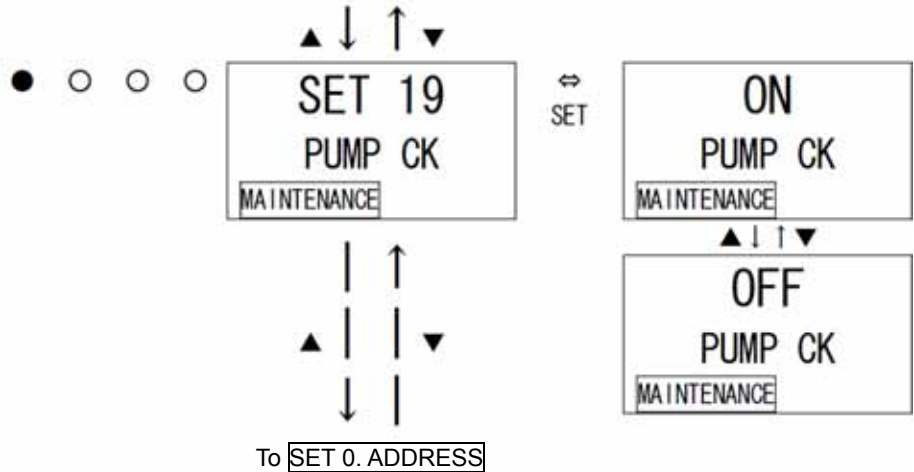
SET 18. ETHERNET

This menu is not used on the detector.



SET 19.PUMP CK

Set the pump drive level diagnosis. Select either ON/OFF, and then press the SET key to confirm the selection. When ON is selected, the message "FLOW" is displayed if the flow rate is sufficient even though the pump drive level is low. (A function to check the conditions for applying pressure, etc.)



<Date/Time Setting "2-10" - "SET 1">

<<Date/Time Setting>>

SET 1.DAY TIME
Press the SET key.



Date/Time Setting Display
Press the SET key.



Year Setting
Change the value by pressing the ▲ or ▼ key, and then press the SET key to confirm the value.



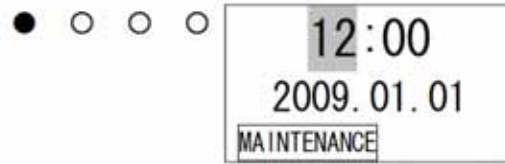
Month Setting
Change the value by pressing the ▲ or ▼ key, and then press the SET key to confirm the value.



Date Setting
Change the value by pressing the ▲ or ▼ key, and then press the SET key to confirm the value.



Hour Setting
Change the value by pressing the ▲ or ▼ key, and then press the SET key to confirm the value.



Minute Setting
Change the value by pressing the ▲ or ▼ key, and then press the SET key to confirm the value.



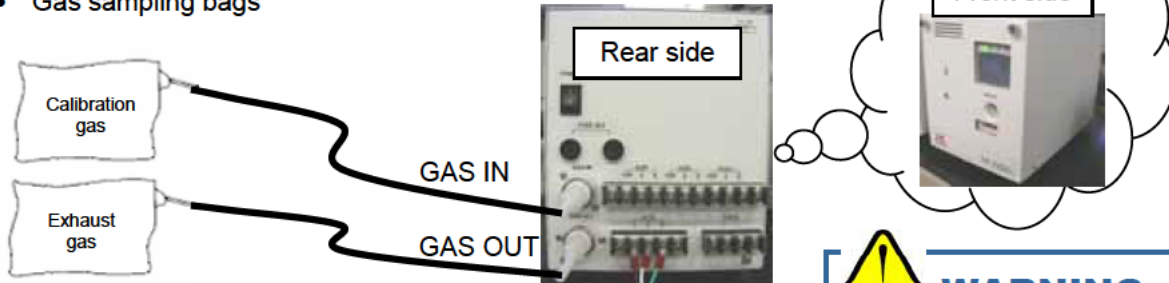
Return to **SET 1.DAY TIME**

* In the Date/Time Setting mode, press the MODE key to cancel this menu and go back to the previous setting.

7-3. Gas calibration method

Perform a gas calibration in each mode (zero adjustment mode and span adjustment mode) using the calibration gas.

- Zero adjustment gas (collected in a gas sampling bag)
- Span gas (collected in a gas sampling bag)
- Gas sampling bags



WARNING

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

<Zero Adjustment "2-1">

This is used to perform the zero adjustment.



WARNING

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

NOTE

Before starting the zero adjustment, let the detector draw the zero adjustment gas and wait until the reading is stabilized.

<<Zero Adjustment>>

2-1.ZERO

Press the SET key.



Current Concentration Value Display

Press the SET key to perform the zero adjustment.



Zero Adjustment Completed

The menu returns to 2-1. ZERO automatically.



Return to 2-1.ZERO

* When the zero adjustment fails



Return to 2-1.ZERO

This is used to perform the span adjustment. For the oxygen deficiency alarm specification (OSU - 0 - 25 vol%), this is the same as "1-1".

<>

2-2.SPAN

Press the SET key.



Gas Introduction

Introduce a gas, and then press the SET key when the reading is stabilized.

* In case of less than 10%FS, this is not switched to the next menu.

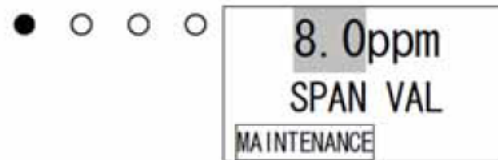


CAUTION
Do not press the SET key before the reading is stabilized.



Span Adjustment

Because the reading will be fixed, adjust the introduced gas concentration by pressing the ▲ or ▼ key. After adjusting the value, press the SET key. (20.9 vol% in the oxygen deficiency alarm specification)



Span Adjustment Completed



Adjustment Result Recording

To record the adjustment result, press the SET key. (Press the MODE key to cancel this menu.)



Adjustment Completed

The menu returns to **2-2.SPAN** automatically.



Return to **2-2.SPAN**



CAUTION

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

* When the span adjustment fails



Return to **2-2.SPAN**

7-4. Other adjustments/Cleaning method

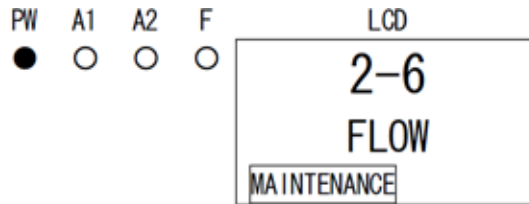
<Flow Rate Manual Adjustment "2-6" and Flow Rate Default Set "2-5">

The flow rate of the detector is automatically adjusted to 0.5 L/min. Turning off the auto-adjustment function enables the manual adjustment. (See 2-10 - SET-11)

The manual flow rate adjustment can be performed in the regular maintenance mode "2-6. FLOW".

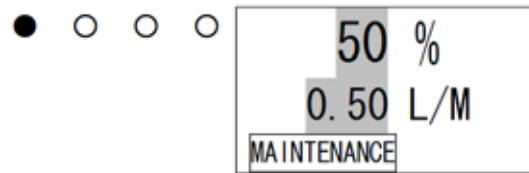
2-6.FLOW

Press the SET key.



Flow Rate Adjustment

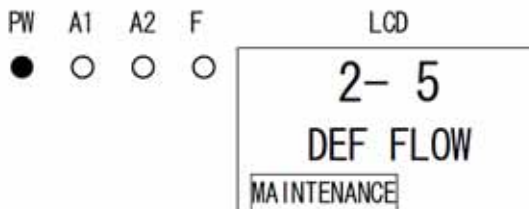
As the output is increased or decreased by pressing the ▲ or ▼ key, the flow rate changes accordingly. Adjust the flow rate to 0.5 L/min, and then press the SET key. (Press the MODE key to cancel this menu.)



Regardless of the flow rate auto-adjustment or manual-adjustment, when the reading on the flow rate indicator is incorrect (due to aging deterioration, improper flow rate default set, or other reasons), it must be set to provide the right flow rate. To set the Flow Rate Indicator, prepare and connect a flow meter (which indicates 0.5 L/min precisely), and perform the default set with the flow meter while it is indicating 0.5 L/min in the regular maintenance mode "2-5. DEF FLOW".

2-5.DEF FLOW

Press the SET key.



Flow Rate Adjustment/Default Set

Adjust the flow rate by pressing the ▲ or ▼ key until the connected flow meter indicates 0.5 L/min ±10%, and then press the SET key. (Press the MODE key to cancel this menu.)



CAUTION

Perform the flow rate default set after checking that the suction volume is 0.5 L/min by using a flow meter.



WARNING

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

<Cleaning of Detector>

Clean the detector if it becomes extremely dirty. The detector must be turned off while cleaning it. Use a waste cloth to remove dust. Do not use water or organic solvent for cleaning because they may cause malfunctions.

Because an extremely large amount of dust inside the tube may disturb the gas detection, it must be cleaned with dry AIR, etc.

7-5. How to replace parts

<Replacement of Consumables>

Sensor Unit Replacement

Replace the sensor unit as shown in the figure.

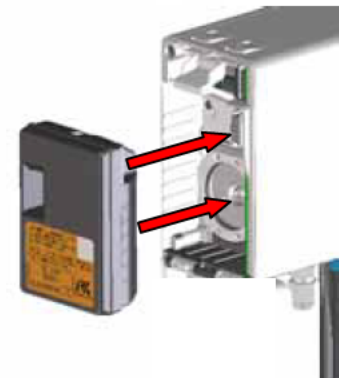
Push the two buttons at the top of the display unit together to open the front cover. (Pushing only either one button cannot open the cover, but then pushing the other can open it.)

Hold the convexed parts on both sides of the sensor unit and pull it out. If the sensor unit is hard to detach, insert a finger into the gap at the top right of the sensor unit and pull it out.



When attaching the sensor unit to the main unit, thrust it onto the main unit and make sure that the sensor unit is securely fixed, otherwise it might come off.

After replacing the sensor unit, close the front cover. Be sure to check the click of the front cover to fix it properly, otherwise it might open again.



CAUTION

- Turn OFF the power when the sensor unit is replaced.
- After the sensor unit is replaced, always perform a gas calibration (zero adjustment and span adjustment).

External Dust Filter Replacement

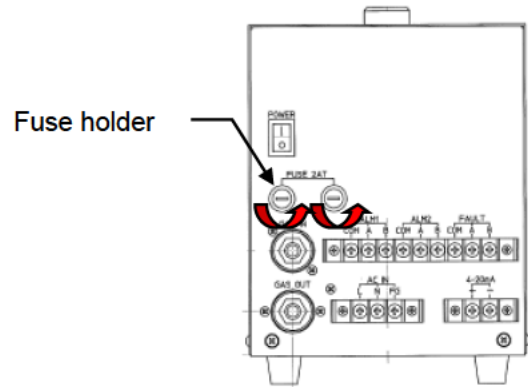
Because the external dust filter may gradually get dirty or clogged over the time, it must be replaced regarding the operating conditions. Check the external dust filter, and then replace it as necessary.

Fuse Replacement

Make sure that the power switch of the main unit is turned OFF and the power plug is disconnected from the outlet. While pushing the fuse holder, turn it counterclockwise by approximately 90 degrees and pull it out (see the right figure).

Replace the fuse with new one.

Return the fuse holder, and push and turn it clockwise by approximately 90 degrees.



WARNING

To prevent fire, use a fuse with the specified ratings (current, voltage and type) for the detector. Turn the POWER switch OFF and disconnect the power plug from the outlet before replacing a fuse. Do not use an unspecified fuse or short-circuit the fuse holder.

<Replacement of Regular Replacement Parts>

List of recommended regular replacement parts

No.	Item	Maintenance intervals	Replacement intervals	Quantity (pieces/unit)
1	Pump unit	0.5 year	1 - 2 years	1
2	Flow sensor	1 year	5 years	1

NOTE

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

Replacement of Pump Unit

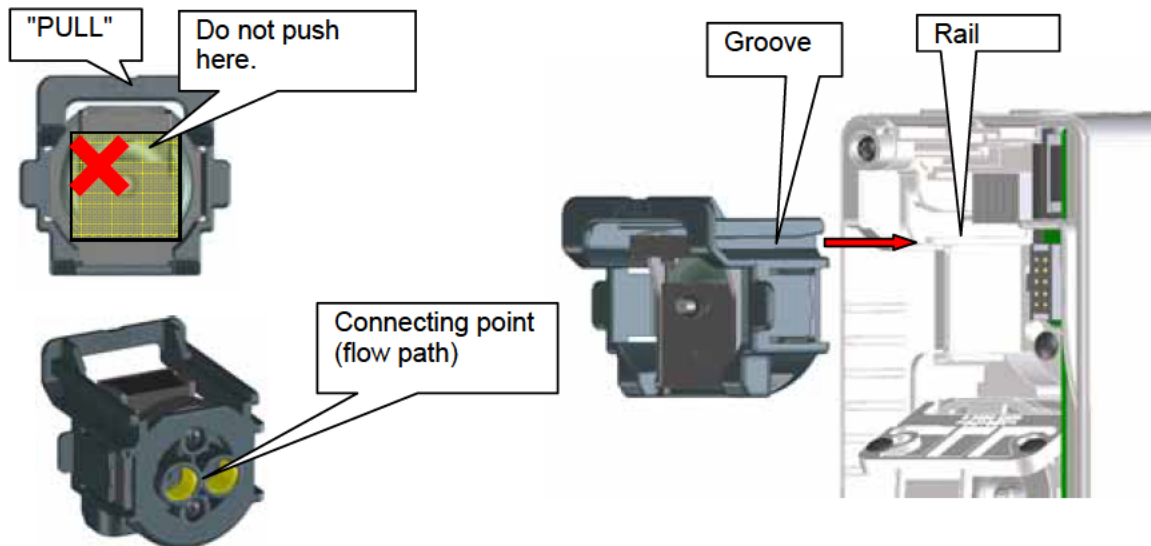
Replace the pump unit as shown in the figure.

After detaching the sensor unit, push down to open the pump stopper. Pinch the part labeled "PULL" at the top of the pump unit, and pull it out.



When attaching the pump unit to the main unit, position the grooves of the pump unit at the rails of the main unit and push the pump unit.

Do not push the center diaphragm. Push the part labeled "PULL". And as the connecting point (flow path) of the pump unit is greased, be sure to check any dust.

**Replacement of Flow Sensor**

After the flow sensor is replaced, the operation must be checked by a qualified service engineer.

For the stable operation of the detector and safety, ask a qualified service engineer to take care of replacement of the parts whose operation must be checked. Please contact RIKEN KEIKI.

8

Storage, Relocation and Disposal

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

The detector 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 are not present

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

When the detector is relocated, select a new place in accordance with "4-2. Precautions for installation points".

For information on wiring and tubing, see "4-4. How to wire" and "4-5. How to tube". The unpowered time must be minimized when the detector is relocated.



CAUTION

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

8-3. Disposal of products

- A used sensor unit must be returned to us. Please return the sensor unit to RIKEN KEIKI.
- If liquid is leaked from the electrochemical type sensor unit (ESU) or galvanic cell type sensor unit (OSU), do not touch the liquid. The sensor unit must be put into a plastic bag to prevent leaking. If liquid is leaked from the sensor of the detector, turn "OFF" the power and contact RIKEN KEIKI immediately.
- When the detector is disposed of, it must be treated properly as an industrial waste in accordance with the local regulations.



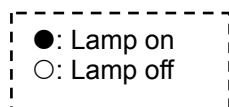
WARNING

- Do not disassemble the electrochemical type sensor unit (ESU) or the galvanic cell type sensor unit (OSU) because they contain electrolyte. Electrolyte may cause severe skin burns if it contacts skin, while it may cause blindness if it contacts eyes. If electrolyte is adhered on your clothes, that part on your clothes is discolored or its material is decomposed. If contact occurs, rinse the area immediately with a large quantity of water.

9

Troubleshooting

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



<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.
		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.
		Cable abnormalities (open circuit/not connected/short circuit)	Check the wiring of detector and related devices around it.
		Fuse open-circuit	Find out why the fuse has blown and take appropriate actions before replacing it.
<u>Abnormal operations</u>	○	Disturbances by sudden surge noise, etc.	Turn off and restart the detector. If such a symptom is observed frequently, take appropriate measures to eliminate the noise.
<u>Incorrect flow rate indicator</u> (Specified Value Display does not correspond to 0.5 L/min.)	○	Improper flow rate default set	Seemingly performed an improper default set, i.e., performed a default set of flow rate on the detector when the flow rate is not 0.5 L/min. Prepare another flow meter and perform the flow rate default set again. <u>If such a symptom is observed frequently, the flow sensor is seemingly malfunctioning. Thus, it must be replaced. Please contact RIKEN KEIKI.</u>
<u>Sensor unit abnormalities</u> <u>E-1 SENSOR</u>	●	The unit is not connected or improperly connected.	Check that the sensor unit is connected and the connectors of the unit are securely fastened.
		Errors in communication with the unit	Replace the sensor unit with a new one.
		Zero drift caused by environmental changes or aging deterioration is out of the range of zero follower.	Perform the zero adjustment. If the symptom persists after the zero adjustment, replace the sensor unit with a new one.
		Faults of the unit itself	Check the sensor unit and replace it with a new one. If it is apparently damaged, do not touch it with bare hands and handle it carefully.

Symptom/Display	FAULT	Causes	Actions
<u>Flow rate warning</u> <u>FLOW</u>	○	Unstable flow caused by deteriorated performance of the pump	Seemingly the pump is worn out and its performance is deteriorated. Although gas detection can be performed under this condition, the pump unit must be replaced as soon as possible.
		Unstable flow caused by clogged dust filter	Replace the dust filter.
		Unstable flow caused by bended or clogged suction tube or exhaust tube	Fix the defective parts.
		Pressure difference is present in the sampling condition. (The flow rate is ensured even though the pump drive level is low.)	In some sampling conditions (presence of pressure difference between IN and OUT), the flow rate is ensured even though the pump drive level is low. Although the detector can be used in such a situation, the diagnosis function of its pump drive level issues this message. The message can be eliminated by disabling this function. (See "7-2. Regular maintenance mode") Check the operating conditions before taking actions. * If the flow rate indicator is incorrect, the message may be displayed even though pressure difference is not present.
		Abnormalities are found in regular maintenance of the flow sensor.	Seemingly the performance of the flow sensor is deteriorated. In this case, the flow rate may not be in the range of 0.5 L/min \pm 10% even though the flow rate indicator indicates the specified value. Although gas can be detected provided that flow loss (fault alarm) does not occur, the flow sensor must be replaced to fix the symptom. Please contact RIKEN KEIKI.
<u>Flow rate abnormalities</u> <u>E-5 FLOW</u>	●	Protective rubber cap is not removed.	Remove the protective rubber cap from GAS IN and GAS OUT.
		Broken pump	Replace the pump unit.
		Flow loss caused by clogged dust filter	Replace the dust filter.
		Flow loss caused by bended or clogged suction tube or exhaust tube	Fix the defective parts.
		Open circuit or defective connection of flow sensor	Please contact RIKEN KEIKI.
<u>Clock abnormalities</u> <u>E-9</u>	○	Abnormalities of the clock inside the detector	Make a setting of date/time. Note that when the sensitivity correction function of ESU is used, correction may not be made properly. If such a symptom is observed repeatedly, the built-in clock is seemingly malfunctioning. Thus, it must be replaced. Please contact RIKEN KEIKI.
<u>System abnormalities</u> <u>E-9 SYSTEM</u>	●	The rated voltage is not supplied to the detector.	Check the power supply, and supply the rated voltage.
		Abnormalities of ROM, RAM, or EEPROM inside of the detector	Please contact RIKEN KEIKI.

<Abnormalities of Readings>

Symptoms	Causes	Actions
<u>The reading rises (drops) and it remains so.</u>	Drifting of sensor output	Perform the zero adjustment (fresh air 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 the zero adjustment (fresh air adjustment). In particular, the galvanic cell type is affected by the air pressure.
<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 detector. 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 detector cannot adjust to it and is affected by it. In some cases, the detector triggers an indication alarm. Because the detector 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 dust filter.
	Bended or clogged suction tube or exhaust tube	Fix the defective parts.
	Condensation is formed inside the suction tube.	Fix the defective parts.
	Deteriorated sensor sensitivity	Replace the sensor unit with a new one.
<u>Span adjustment impossible</u>	Improper calibration gas concentration	Use the proper calibration gas.
	Deteriorated sensor sensitivity	Replace the sensor unit with a new one.

10

Product Specifications

10-1. List of specifications

<Common Specifications>

Concentration display	Character LCD (Digital and Bar Meter Display)
Suction flow rate	0.5 L/min \pm 10%
Power display	POWER lamp on (green)
Displays	Gas name display/flow rate indicator/mode display
Gas alarm display	First: ALM1 lamp blinks or lights up (Red), and buzzer sounds/Second: ALM2 lamp blinks or lights up (Red), and buzzer sounds
Gas alarm pattern	Fault alarm pattern or non latching (Auto-reset)
Gas alarm contact	No-voltage contact 1C De-energized (energized at an alarm) or energized (de-energized at an alarm)
Fault alarm/self diagnosis	System abnormalities/sensor abnormalities/flow rate abnormalities
Fault alarm display	FAULT lamp on (Yellow)/detail display/buzzer sounds
Fault alarm pattern	Auto-reset
Fault alarm contact	No-voltage contact 1C De-energized (energized at an alarm) or energized (de-energized at an alarm)
Contact capacity	125 VAC - 3 A/30 VDC - 2 A (Resistant load)
Contact cable	Cable of VCTF, etc. (1.25sq) - max. 9-core
Transmission system	Analog transmission
Transmission specifications	4 - 20 mA DC (no-insulation/load resistance under 300 Ω)
Transmission cable	Shielded cable of CVVS, etc. (1.25sq) - 2-core
Transmission distance	Below 1 km
Functions	White backlight/alarm delay/suppression/zero follower/sensitivity correction/flow control Calibration history/alarm trend history/event history
Tube connecting hole	Rc1/4 (O.D Φ 6-1t half-union for Teflon tube <PP> supplied)
Power supply	100 - 240 VAC \pm 10%, 50/60 Hz
Initial clear	Approx. 25 seconds
Structure	Tabletop type
External dimensions	Approx. 160 (W) x 210 (H) x 260 (D) mm (projection portions excluded)
Weight	Approx. 4.3 kg

* Specifications subject to changes without notice.

<Specifications for Each Principle>

	ESU	SGU	OSU *4
Detection principle	Electrochemical type	Semiconductor type	Galvanic cell type
Gas to be detected	Toxic gas *1	Combustible gas Toxic gas	Oxygen
Detection range	Depending on the gas to be detected	Depending on the gas to be detected	0 to 25 vol%
Detection method	Pump suction type	Pump suction type	Pump suction type
Alarm setpoint	Depending on the gas to be detected	Depending on the gas to be detected	18 vol% (1st) 18 vol% (2nd)
Alarm accuracy (under the same conditions)	Within $\pm 30\%$ *2	Combustible: within $\pm 25\%$ *2 Toxic: within $\pm 30\%$ *2	Within ± 1 vol% (Accuracy of the reading: within ± 0.7 vol%)
Alarm delay time (under the same conditions)	60 seconds or less *3	Combustible: 30 seconds or less *3 Toxic: 60 seconds or less *3	5 seconds or less *5 (90% response: within 30 seconds)
Alarm type	Two-step alarm (H-HH)	Two-step alarm (H-HH)	Two-step alarm (L-LL, L-H)
Power consumption	Approx. 7 VA (max 18 VA)	Approx. 12 VA (max 20 VA)	Approx. 7 VA (max 18 VA)
Operating temperatures (at a constant condition)	0 - 40°C	0 - 40°C	0 - 40°C
Operating humidities (Non-condensing)	30 - 70%RH	Below 95%RH	Below 95%RH
	NCU	* Specifications subject to changes without notice.	
Detection principle	New ceramic type		
Gas to be detected	Combustible gas		
Detection range	Depending on the gas to be detected		
Detection method	Pump suction type		
Alarm setpoint	Depending on the gas to be detected		
Alarm accuracy (under the same conditions)	Within $\pm 25\%$ *2		
Alarm delay time (under the same conditions)	30 seconds or less *3		
Alarm type	Two-step alarm (H-HH)		
Power consumption	Approx. 12 VA (max 20 VA)		
Operating temperatures (at a constant condition)	0 - 40°C		
Operating humidities (Non-condensing)	Below 95%RH		

* 1 The operating temperature/humidity may be different depending on the gas to be detected.

* 2 To the alarm setpoint value

* 3 By providing the gas 1.6 times the alarm setpoint (excluding delay in the tube and in the communication)

* 4 Oxygen deficiency specification

* 5 By letting the detector detect the gas of 10 - 11 vol% (excluding delay in the tube and in the communication).

NOTE

For information on other specifications such as oxygen leak specifications (OSU), please contact RIKEN KEIKI.

10-2. List of accessories

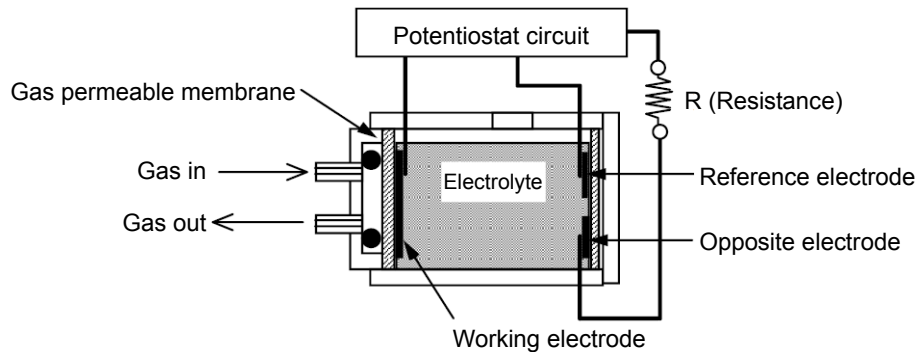
- Operating manual
- Protective rubber cap
- Dust filter
- Interference gas removal filter
(to be supplied with sensor units for certain gases)

10-3. Detection principle

<Electrochemical Type>

The electric potential between the working electrode and reference electrode is kept at a certain level by a potentiostat circuit.

The gas to be detected is electrolyzed directly at the working electrode. Because the electric current generated there is proportional to the gas concentration, the gas concentration can be known by measuring the electric current flown between the working electrode and the opposite electrode.



Structure diagram

Special precautions for this principle

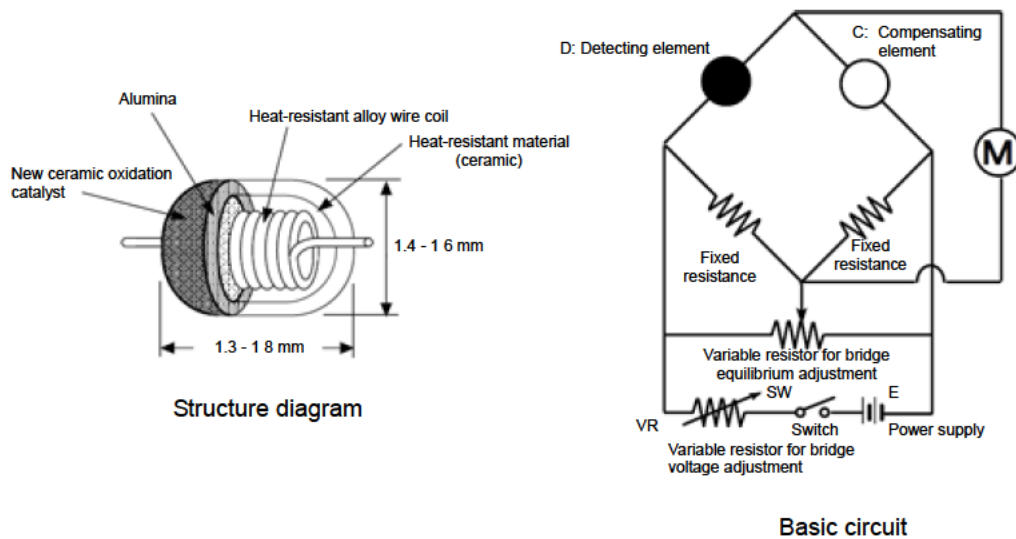
1. The detector may be interfered by gases other than the gas to be detected, solvents, vapors, etc. Please note that the alarm may be triggered by interference. In addition, it may be fluctuated by environmental (temperature, humidity, etc.) changes in the installation site.
2. The alarm must be set within a range where the performance of the detector 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 detector 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. Because the contact point of the gas detector sensor is made of porous polymeric membrane, the water repellency of the membrane is deteriorated by solvents, thus causing an electrolyte leak from its inside.
Do not use solvents near the detector. If a solvent is used for unavoidable reasons, attach the recommended filter to the inlet of the gas detector while using the solvent and for one hour after that.
5. For maintenance of the detector, 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 gas calibration are performed every six months in accordance with the regulations.

<New Ceramic Type>

When a combustible gas burns on the surface of a highly active new ceramic oxidation catalyst in catalytic combustion, the new ceramic-type sensor measures resultant temperature changes by measuring the resistance changes in the heat-resistant alloy wire coil.

The sensor consists of two elements: A detecting element having a heat-resistant alloy wire coil with an ultrafine particle (new ceramic) oxidation catalyst sintered on it together with a carrier and a temperature-compensating element with a mixture of gas-inert alumina and glass sintered on it.

When a combustible gas comes into contact with the surface of the detecting element with new ceramic oxidation catalyst sintered on it, the gas burns, causing the temperature to rise. In accordance with this temperature change, there occurs a change in the resistance of a heat-resistant alloy wire coil that constitutes the element. These resistance values are approximately proportional to gas concentrations. From the changes in the resistance values, potential differences are obtained using a bridge circuit and displayed as gas concentrations on the meter.

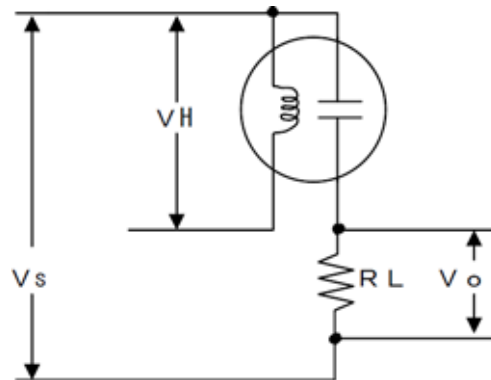


Special precautions for this principle

1. This detector may be interfered by gases other than the gas to be detected and vapors. 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 detector can be ensured. In facilities compliant with the High Pressure Gas Safety Act, an alarm setting below our standard alarm setpoint may trigger a false alarm.
3. This is a safety unit, not a control unit. The alarm contact output of the detector 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 detector is made of metal porous sintered alloy permeated with an oxidation catalyst. 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 detector under the presence of silicon or sulfide compounds even though their amount is very small.
5. For maintenance of the detector, 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 gas calibration are performed every six months in accordance with the regulations.

<Semiconductor Type>

Metal dioxide can measure gas concentration based on changes in the electric conductivity of semiconductor caused by gas adsorbed on its surface.



RL: Load resistance
VH: Heater voltage

Vo: Output voltage
Vs: Sensor voltage

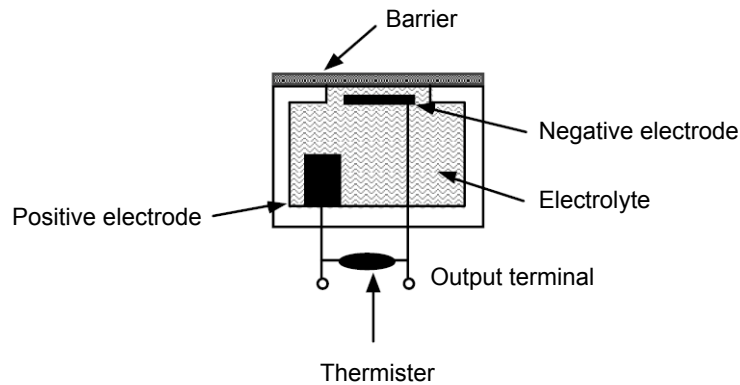
Special precautions for this principle

1. This detector may be interfered by gases other than the gas to be detected and vapors. 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 detector can be ensured. In facilities compliant with the High Pressure Gas Safety Act, an alarm setting below our standard alarm setpoint may trigger a false alarm.
3. This is a safety unit, not a control unit.
The alarm contact output of the detector 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 detector 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 detector under the presence of silicon or sulfide compounds even though their amount is very small.
5. For maintenance of the detector, 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 gas calibration are performed every six months in accordance with the regulations.

<Galvanic Cell Type>

By immersing precious metal and lead in electrolyte and connecting them with a lead wire, a battery can be made (galvanic cell). When oxygen passes through the barrier, deoxidizing reaction occurs at the precious metal electrode while oxidizing reaction occurs at the lead electrode.

The electric current generated by this reaction goes through load resistance (thermister), where it is converted into voltage so that it can be read. When the oxygen concentration is decreased, deoxidizing reaction at the precious metal electrode is also decreased, thus lowering the voltage at both ends of the thermister.



Structure diagram

Special precautions for this principle

1. The readings of the detector fluctuate slightly in response to changes in the air pressure. In particular, be careful of alarm activation when a low air pressure is brought in by typhoon. 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 detector can be ensured. The standard alarm setpoint value is 18 vol%.
3. This is a safety unit, not a control unit.
The alarm contact output of the detector 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. For maintenance of the detector, 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 span adjustment are performed every six months.

Definition of Terms

External Dust Filter	When the detector is used in a dusty environment, it is recommended that a dust filter should be attached to its outside. The filter is specified based on the gas to be detected. Please contact RIKEN KEIKI for more information.
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
ppb	Gas concentration indicated in the unit of one-billionth 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 detector, 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 detector.
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.
Inhibit	The gas detection function is temporarily suspended during maintenance, etc. of the detector. This is also called "point skip", which has the same function.