



Furnace Gas Monitor SD-2500

Operating Manual (PT2-159)

Request for the Customers

- Read and understand this operating manual before using the gas monitor.
- Use the gas monitor in accordance with the operating manual.
- Regardless of warranty period, we shall not make any compensation for accidents and damage caused by using this product.
The compensation shall be made only under the warranty policy of products or parts replacement.
- 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 gas monitor, notify it to RIKEN KEIKI immediately.
(Visit our Web site to find your nearest RIKEN KEIKI office.)

RIKEN KEIKI Co., Ltd.

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

Phone : +81-3-3966-1113

Fax : +81-3-3558-9110

E-mail : intdept@rikenkeiki.co.jp

Web site : <http://www.rikenkeiki.co.jp/>

Necessary information for explosion proof construction of Model SD-2500

About Model SD-2500

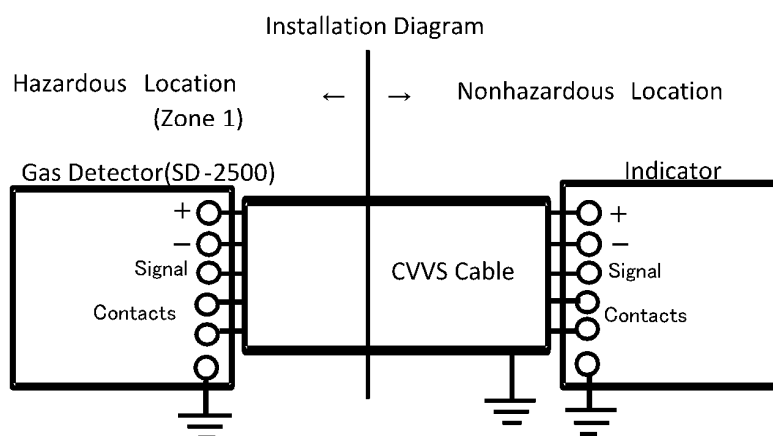
The Model SD-2500 is a fixed mount, continuous-monitoring detector head and provides a 4-20mA signal which indicates the target gas reading for use by a gas monitoring controller, recording device, or programmable controller.

There is one relay, and the relay is used for the gas alarm or the fail alarm.

Technical Data

(Protection Method)	Flameproof enclosure “d”
(Certificate numbers)	IECEX DEK 11.0040X DEKRA 11ATEX0095 X
(Group)	II
(Category)	2 G
(Type of Protection and Marking code)	E x d II C T 3
(Equipment Protection Level)	G b
(Ambient Temperature)	-20°C~60°C
(Process Temperature)	-20°C~160°C
(Electrical Data)	Supply voltage : 24 V dc (Typ.) Output signal : 4 to 20 mA
(Applicable Standard)	IEC 60079-0 : 2007, IEC 60079-1 : 2007 EN 60079-0 : 2009, EN 60079-1 : 2007
(Manual number)	PT2E-159

Installation



Operating Precautions

This gas monitor is a gas detector that detects combustible gases in the air and triggers a gas alarm. The gas detector is a safety unit, not an analyzer or densitometer which performs quantitative/qualitative analysis/measurement for gases.

Please fully understand the following points before using it, so that it can be used properly.

1. This gas monitor may be interfered by gases and vapors other than the gas to be detected. 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 gas monitor 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 gas monitor must be used for an external alarm lamp/buzzer, while the analog signal output must be used for an indicator or external recorder. If these outputs are used to control other units, we shall not be responsible for any malfunctions.
4. The gas sensing part of the gas detection sensor installed in this gas monitor 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 results in serious deterioration of its sensitivity. For safety reasons, do not use the gas monitor under the presence of silicon or sulfide compounds even though their amount is very small.
5. For maintenance of the gas monitor, it must go through a regular maintenance, including replacement and adjustment of the regular replacement parts as specified in the operating manual. In addition, because this is a safety unit, it is recommended that a regular maintenance and a gas calibration are performed every six months in accordance with the regulations.

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1

Outline of the Product

1-1. Preface




Thank you for choosing our furnace gas monitor SD-2500. Please check that the model number of the product you purchased is included in the specifications on this manual.

This manual explains how to use the gas monitor and its specifications. It contains information required for using the gas monitor 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 gas monitor.

1-2. Purpose of use

- The gas monitor is a fixed type detector head that continuously detects combustible gases and that performs the alarm activation when the gas concentration is over the setting value.
This gas monitor is a safety unit, not an analyzer or densitometer which performs quantitative/qualitative analysis/measurement for gases. Please fully understand the features of the gas monitor before using it, so that it can be used properly.
- The gas monitor detects abnormalities in the air caused by presence of gases or other reasons (leak) with the built-in gas sensor. The concentrations of detected gases are displayed on the seven-segment LED.
- The gas monitor has a built-in alarm contact and can be used either as a gas alarm, fault alarm, or common (gas, fault) alarm.
- The gas monitor 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

<About explosion-proof>

- The window plate material is a polycarbonate resin. Do not use organic solvents and alkali types (liquid or vapor). It may cause the color and shape of the window plate to be changed.
- Do not open the lid when applying current.
- Do not attempt to repair the detector.
- For the lid, use hexagon socket head bolts specified by RIKEN KEIKI.
- Do not apply a strong force or shock to the window plate. The explosion-proof performances may be deteriorated due to damages. The explosion protection conditions for the detector is "low (2J)" possibility of mechanical damage.

2-2. Warning cases



WARNING

Power supply

Before turning on the gas monitor, 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 gas monitor, check the protective functions for defects. When seeming defects are found in the protective functions, such as protective grounding, do not start the gas monitor.

External connection

Before connecting the gas monitor to the external control circuit, securely connect it to a protective grounding circuit.



WARNING

Zero adjustment in the atmosphere

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.

Response to a gas alarm

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

2-3. Precautions



CAUTION

Do not use a transceiver near the gas monitor.

Radio wave from a transceiver near the gas monitor 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 gas monitor, wait for five seconds or more before doing it.

Restarting the gas monitor within five seconds may cause errors.

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

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

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

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

Avoid applying organic solvents and others to the window plate for a long time.

The window plate material is a polycarbonate resin. When organic solvents (liquid or highly-concentrated vapor) and others are applied to the plate for a long time, its color and shape may be changed.

Do not forget to perform a regular maintenance.

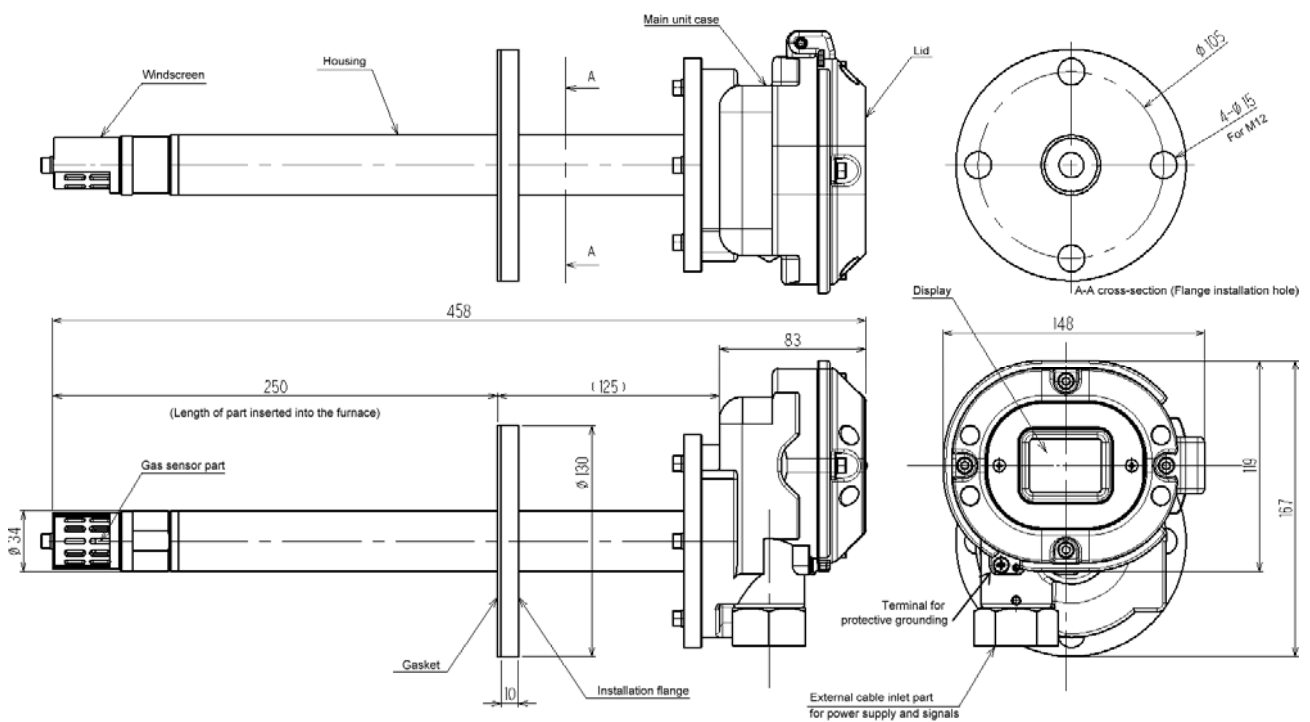
Since this is a safety unit, a regular maintenance must be performed to ensure safety. Continuing to use the gas monitor without performing a maintenance will deteriorate the sensitivity of the sensor, thus resulting in inaccurate gas detection.

3

Product Components

3-1. Main unit and standard accessories

<Main Unit> (including a cable gland)



<Standard Accessories>

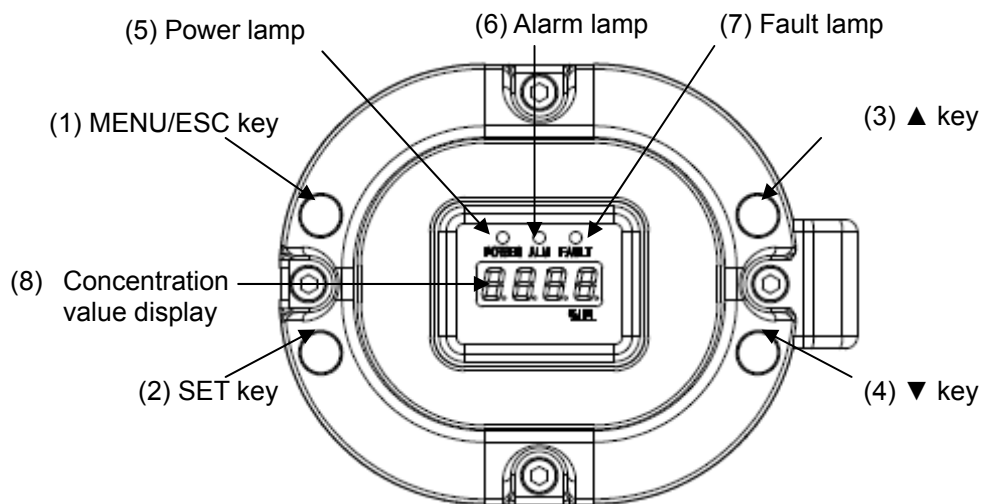
- Operating manual
- Dedicated handling lever (used for the wiring)
- Dedicated control key
- Flange gasket
- Exhaust air direction nameplate



CAUTION

Use the supplied dedicated control key to operate the gas monitor. If products other than these accessories are used, key operations cannot be accepted properly.

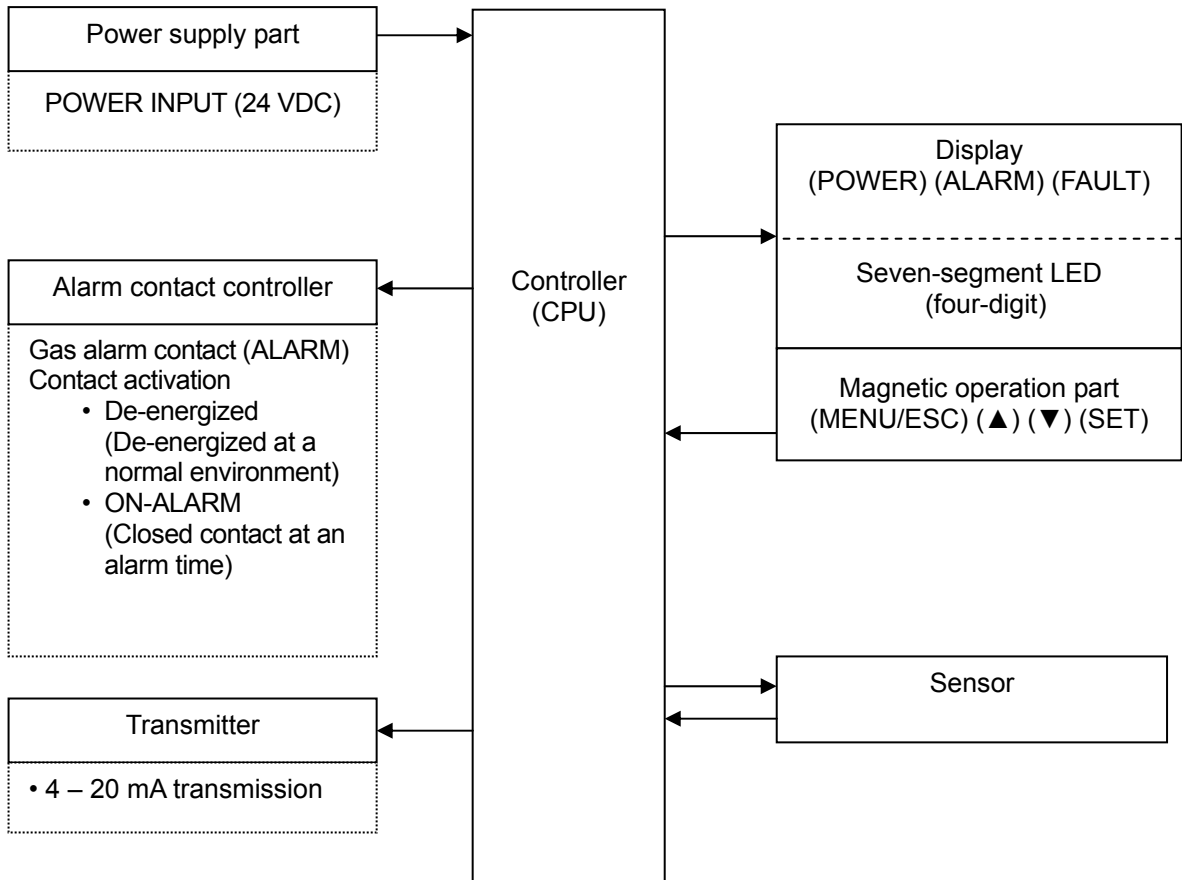
3-2. Names and functions for each part



(1)	MENU/ESC key	Used to enter the maintenance mode. It is also used to cancel in a specific mode.
(2)	SET key	It is used for value confirmation and so on in a specific mode.
(3)	▲ key	Used to switch menus or change a value (UP).
(4)	▼ key	Used to switch menus or change a value (DOWN).
(5)	Power lamp	Power lamp Detection mode: It lights up in green. Maintenance mode: It blinks in green.
(6)	Alarm lamp	Alarm lamp. It lights up in red when the alarm setpoint value is reached.
(7)	Fault lamp	Fault lamp. It lights up in yellow when an abnormality is detected in the gas monitor.
(8)	Concentration value display	Displays the gas concentration and so on.

3-3. Block diagram

<Electric Diagram>



4

How to Use

4-1. Before using the gas monitor

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 gas monitor, resulting in inaccurate gas detection.

4-2. Precautions for installation points



CAUTION

This is a precision device. Because the gas monitor 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 gas monitor plays an important role for safety and disaster prevention, as many units of the gas monitor as needed must be installed 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 on installation points and the number of units to be installed.

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

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

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

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

Install the gas monitor in a place with operating environment temperatures that meet the following requirements:

<Main unit case part>

The gas monitor must be installed in a stable place where the operating temperature is 0 to 50°C and do not change suddenly.

<Gas sensor part>

0 to 160°C

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

When selecting installation points, avoid a place where it is exposed to direct sunlight or radiant heat (infrared rays emitted from a high-temperature object), and where the temperature changes suddenly.

Condensation may be formed inside the gas monitor, or the gas monitor cannot adjust to sudden changes in the temperature.

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

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

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

Regular maintenance of the gas monitor must be performed.

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

Do not install the gas monitor in machinery which is not properly grounded.

Before installing the gas monitor in machinery, the machinery must be grounded properly.

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

The gas monitor 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 gas monitor.

Using a stable power supply

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

The gas monitor must be provided with the following power supply.

Power supply voltage	24 VDC±10%: Terminal voltage of the gas monitor	
Allowed time of momentary blackout	Up to 10 milliseconds (To recover from the momentary blackout for 10 milliseconds or more, restart the gas monitor.)	<u>Example of actions</u> To ensure continuous operation and activation, install a UPS outside the gas monitor.
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.

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"> • Provide protection by a lightning arrester (cable arrester). (Although inductive lightning surge can be transmitted through the cable, it is prevented by installing a lightning arrester before the field devices and central processing equipment. For information on how to use a lightning arrester, please contact the manufacturer.)
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 gas monitor is used to transmit signals to activate an external buzzer, an alarm lamp or a rotating lamp. Do not use the gas monitor 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 gas monitor 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 gas monitor
- Abnormal operations by an out-of-control CPU

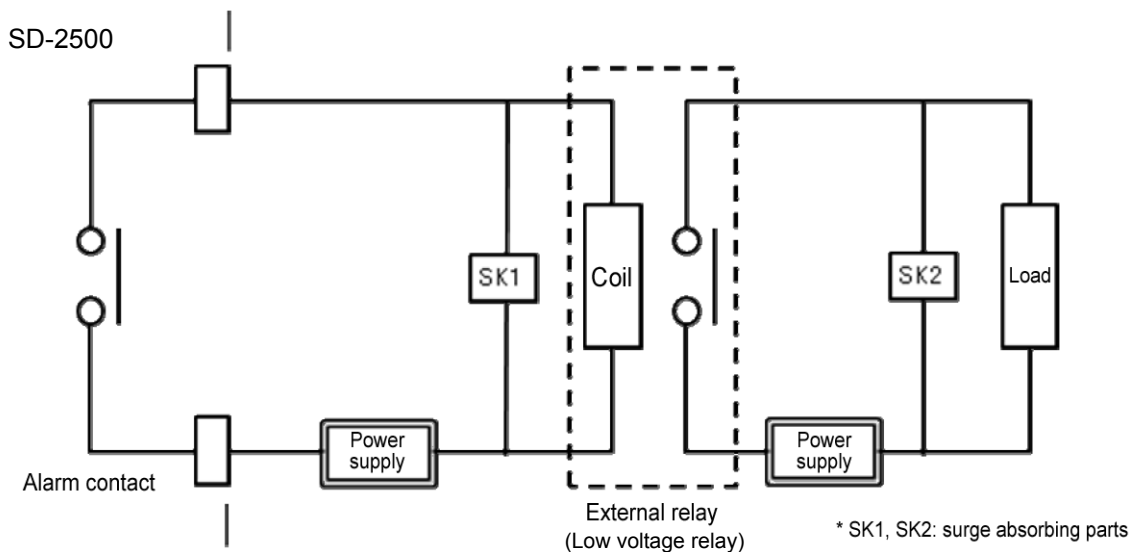


CAUTION

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

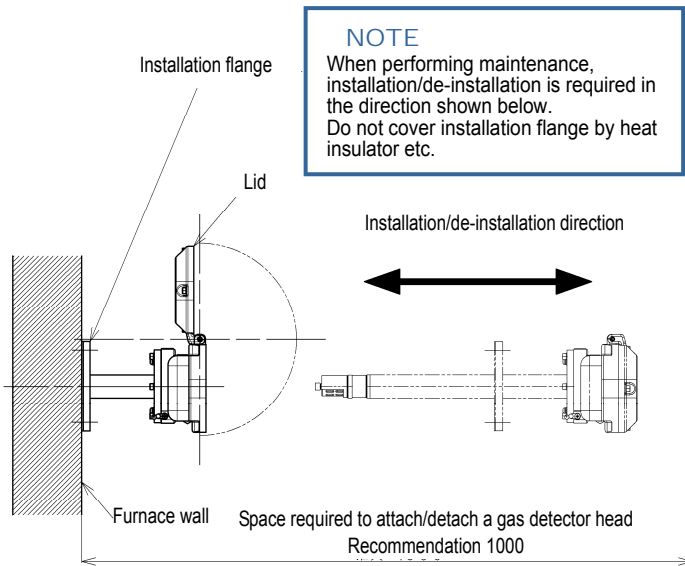
If load is to be activated, appropriate measures must be taken to stabilize the operation of the gas monitor and protect the alarm contact referring to the following information.

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

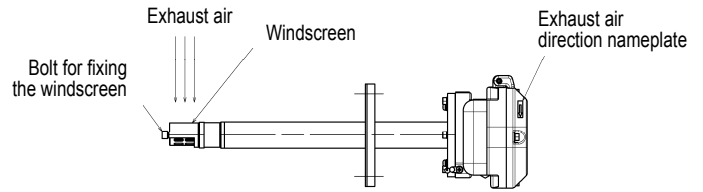


4-4. How to install

<Maintenance Space>



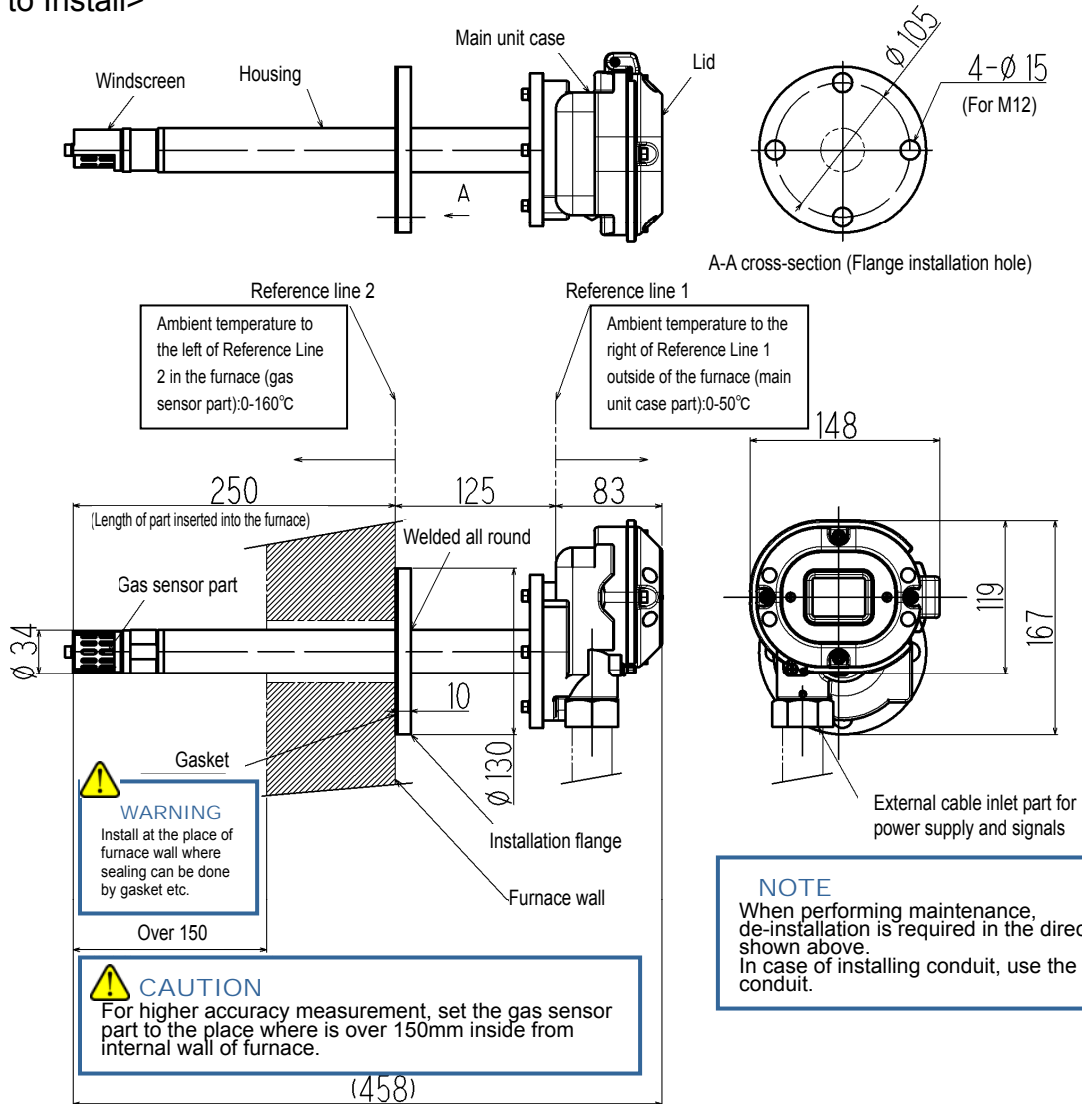
<How to fix the windscreen>



WARNING

- When the detector head is to be installed in a furnace, make sure that the exhaust air hits the windscreen where it is installed.
- Securely fix the windscreen with bolts for fixing it. After the gas detector head is installed, affix the supplied "exhaust air direction nameplate" on the surface of the lid.

<How to Install>



4-5. How to wire



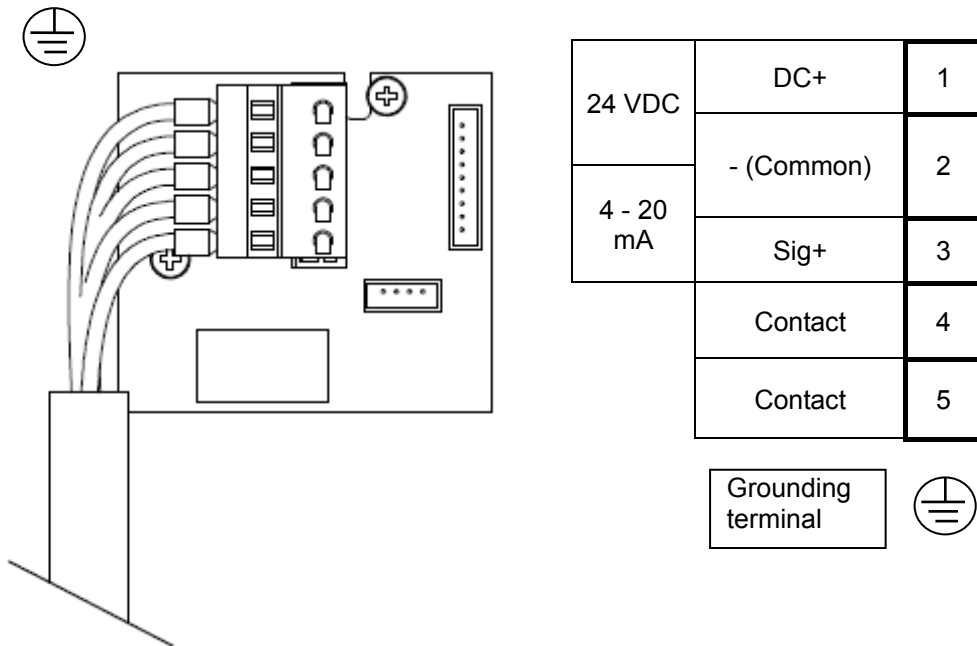
CAUTION

- Be careful not to damage the internal electronic circuit when wiring. In addition, be careful not to apply stresses on the gas monitor 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.
- When stranded wires are used, prevent wires from contacting each other.
- Use the dedicated handling lever to wire.

<Recommended Cable>

3-wire (when the contact is not used)	CVVS1.25 sq - 3-core
5-wire (when the contact is used)	CVVS1.25 sq - 5-core

<Figure of Terminal Plate>



<Specifications of Terminal Plate>

Specifications of terminal plate

- Rated voltage: 250 VAC
- Rated current: 12 A
However, it depends on cables to be used.

Connection conditions

- Cables: 0.08 - 2.5 mm²
- Bare wire length: 8 - 9 mm
- Connecting tool: Dedicated handling lever (accessory)



CAUTION

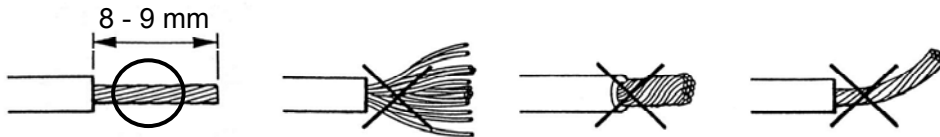
The specified bare wire length must be observed when the wire insulation is peeled off.

Improper clamping of the wire due to a shorter bare wire length may cause defective electric conduction or heating.

Catching the wire insulation due to a shorter bare wire length may cause defective electric conduction or heating.

Exposing the wire due to a longer bare wire length may cause defective insulation or a short circuit.

Be careful not to break up the wire. If the wire is broken up when inserted to the terminal, this may cause defective insulation or heating.



Compatible bar terminal

For a bar terminal, the following items are available.

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



CAUTION

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

<How to Connect to Terminal Plate>

When cables are connected to the connectors, use the dedicated lever or a flathead screwdriver to do it as shown below.



CAUTION

The right tools must be used.

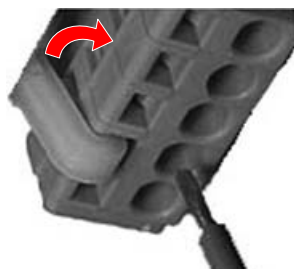
In principal, one wire can be connected to one wiring hole.

When the wire is inserted into the driver slot by mistake, it does not contact the conductive part. This may cause defective electric conduction or heating.

When the wire is inserted under the spring by mistake, it does not contact the conductive part. This may cause defective electric conduction or heating.

NOTE

<How to Use the Dedicated Handling Lever>



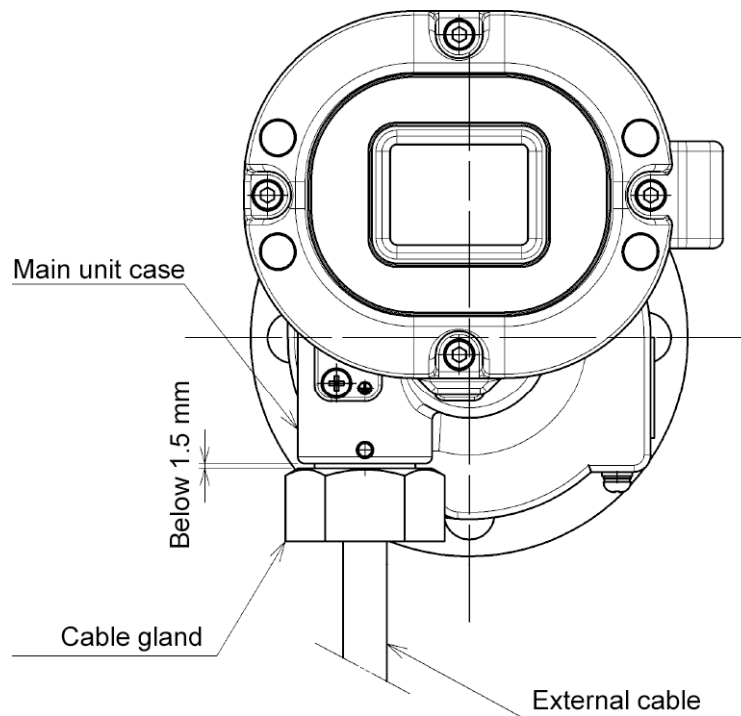
Push the lever with your finger to lower the spring in its inside.



While holding down the lever, insert the wire into the (round) wiring hole until it reaches the deepest point.


To check whether the wire is connected securely, pull the wire gently. (Do not pull the wire strongly.)

<Attaching External Cable>

**CAUTION**

- Tighten a cable gland with a tool until a clearance between the cable gland and a main unit case is below 1.5 mm.
- If it is difficult to tighten the cable gland, grease its screw part and then tighten it with the tool.

<Grounding>

Connect the gas monitor to your grounding terminal with the external terminal .

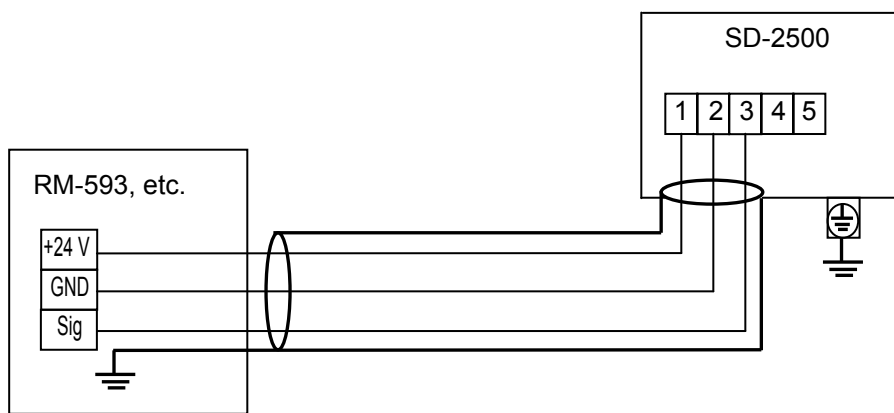


WARNING

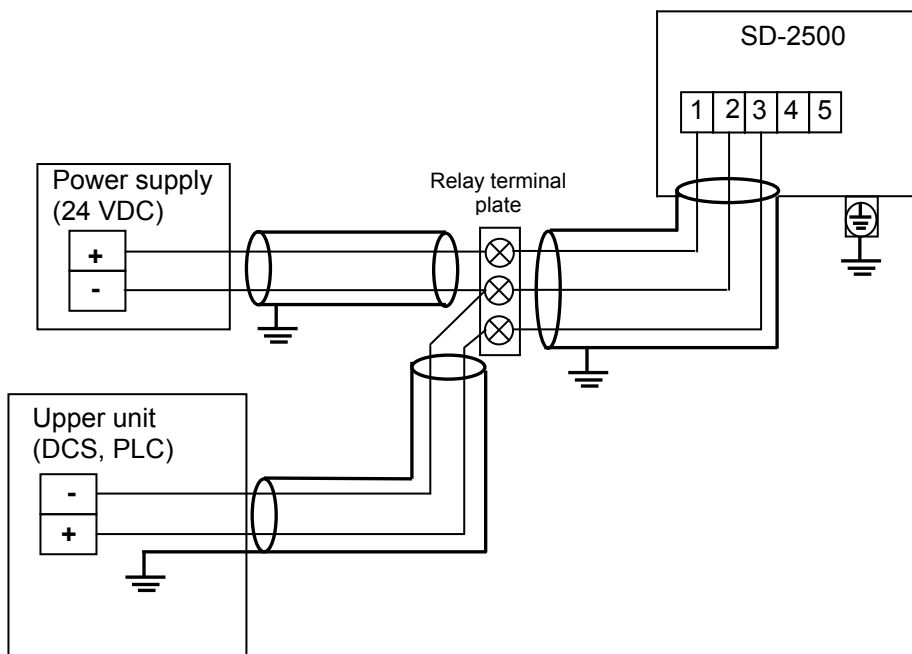
Before turning on the gas monitor, do not forget to connect it to a grounding terminal. For stable operation of the gas monitor and safety, it must be connected to a grounding terminal. Do not connect the grounding wire to a gas pipe. The grounding must be made as D type grounding (below 100 Ω of grounding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

<Wiring Example>

Connecting to the indicator



Connecting to the upper unit (DCS, PLC)



5

How to Operate

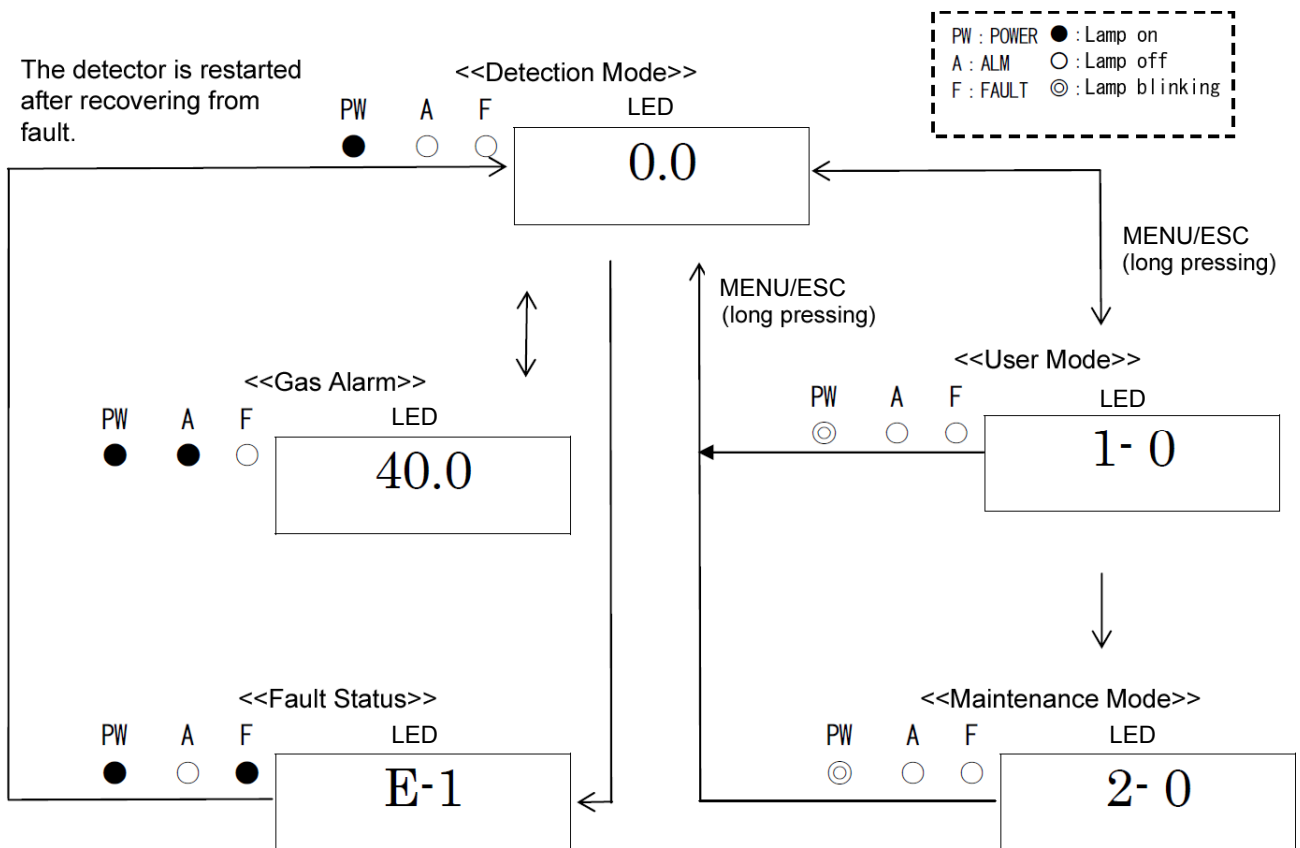
5-1. Preparation for start-up


Before supplying power, read and understand the following precautions. Ignoring these precautions may cause an electric shock or damage the gas monitor.

- Connect the gas monitor to a grounding circuit.
- Check that the wiring is connected to external device properly.
- Check that the power supply voltage is compliant with the specifications.
- Because the external contact may be activated during the adjustment, take measures to prevent an activated contact from having influences on external device.

5-2. Basic operating procedures


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



 **WARNING**
 When the gas monitor enters other mode from the detection mode while an alarm is activated, the alarm is reset.

5-3. How to start the gas monitor

- Before supplying power (24 VDC) to the gas monitor, check that the gas monitor is installed properly.
- Supply power (24 VDC) to the gas monitor (turn on the gas monitor).
- After the gas monitor completes the start-up, it enters the detection mode swiftly.

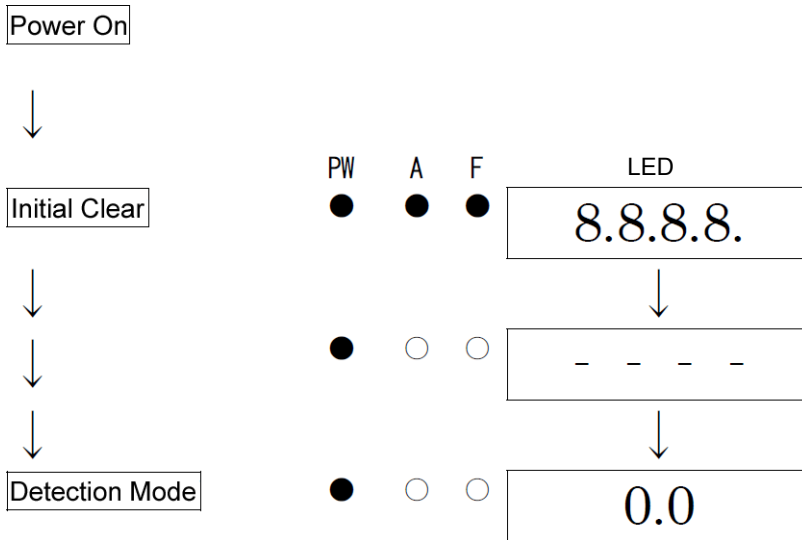
 **CAUTION**

- Do not turn off the gas monitor during the initial clear. The gas monitor is reading the internal memory during the initial clear.
- After the warm-up is completed, perform a gas calibration.

NOTE

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

Power on -> Initial clear (approximately 25 seconds) -> Detection mode



5-4. Modes

Details on each mode are provided as follows.



CAUTION

- Do not change the settings if not necessary. Changing the settings without understanding the specifications may cause malfunctions.

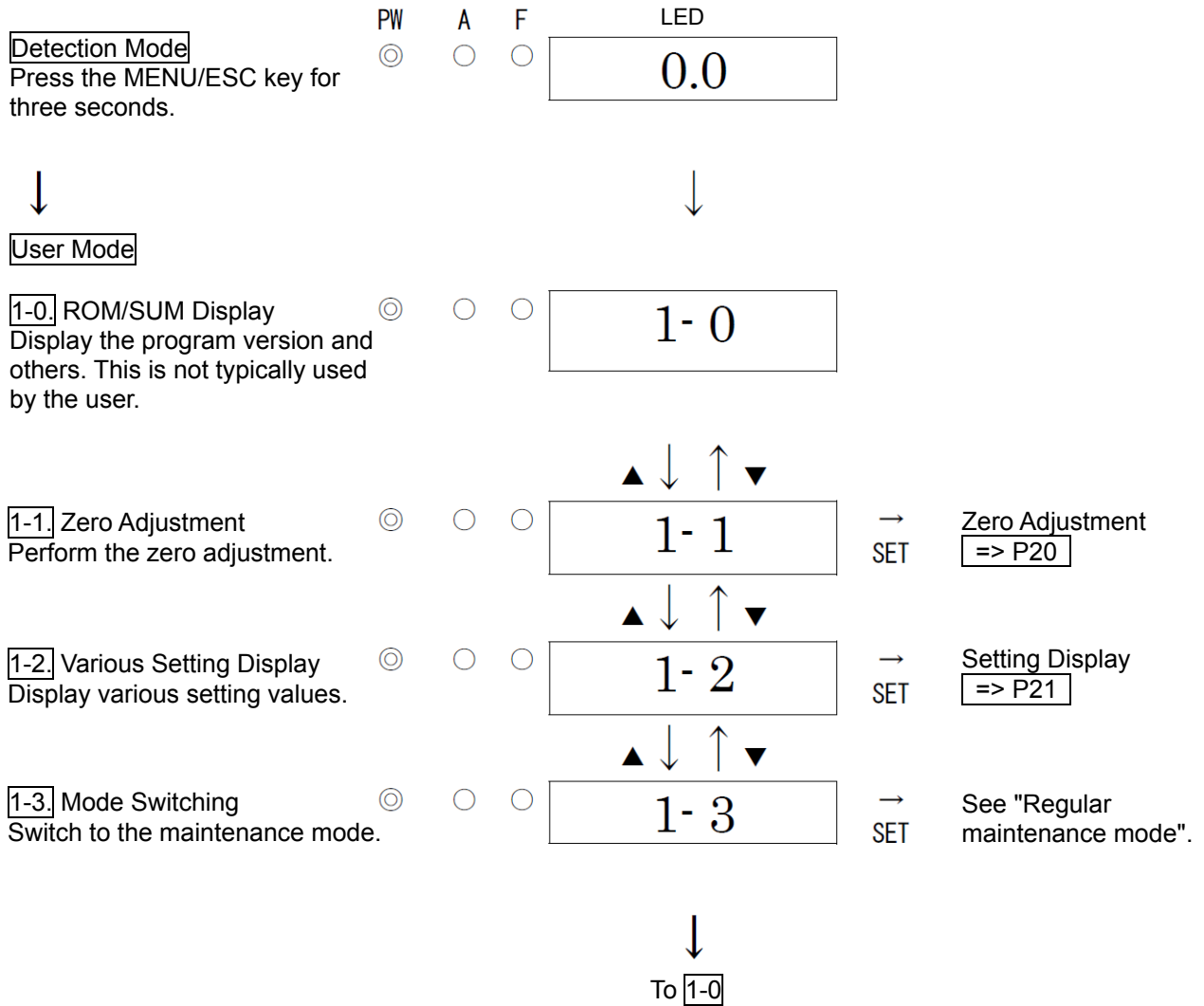
Mode	Item	LED display	Details
Detection Mode	-	Gas concentration	Normal state
Maintenance Mode (User)	ROM/SUM Display	1-0	Display the program version and others. This is not typically used by the user.
	Zero Adjustment	1-1	Perform the zero adjustment.
	Setting Display	1-2	Display various setting values.
	Switch to maintenance mode	1-3	Switch to the regular maintenance mode.
Maintenance Mode (Regular maintenance)	Test Mode	2-0	Perform various tests. 2-0.0 Gas Test 2-0.1 Alarm Test 2-0.2 Fault Test 2-0.3 LED Test 2-0.4 Memory Test
	Zero Adjustment	2-1	Perform the zero adjustment.
	Span Adjustment	2-2	Perform the span adjustment.
	Zero/Span Initialization	2-3	Initialize zero/span values.
	Environmental Setting	2-4	Used for various environmental settings. 2-4.0 Sensor Power Supply ON/OFF 2-4.1 INHIBIT Setting 2-4.2 Alarm Setpoint Setting 2-4.3 Alarm Delay Time Setting 2-4.4 Alarm Pattern Setting 2-4.5 Zero Suppression Pattern Setting 2-4.6 Zero Suppression Value Setting 2-4.7 Alarm Contact Specification Setting 2-4.8 Energized/De-energized Contact Setting 2-4.9 Maintenance Mode External Output Setting 2-4.A External Output Setting 2-4.B Alarm Test External Output Setting 2-4.C Sensor Operation Start Setting 2-4.D Password Setting 2-4.E Sensor Fault Alarm Pattern Setting
	Display	2-5	Display various electrical settings. This is not typically used by the user.
	Switch to factory mode	2-6	Not used
	Switch to user mode	2-7	Returns to the user mode.

5-5. User mode



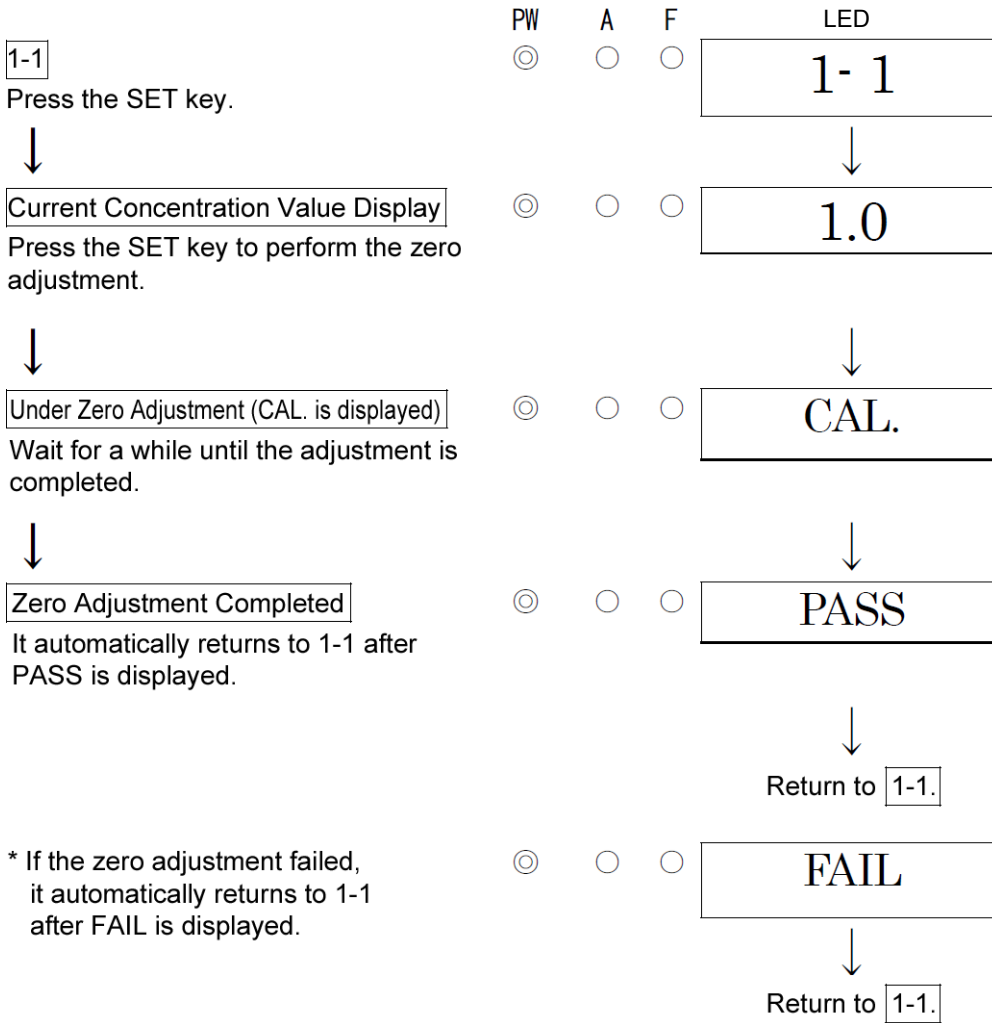
WARNING

After the adjustment is completed, never fail to press MENU/ESC key to return to the detection mode. (If the gas monitor remains in the user mode, it automatically returns to the detection mode in ten hours.)



<Zero Adjustment "1-1">

This is used to perform the zero adjustment.

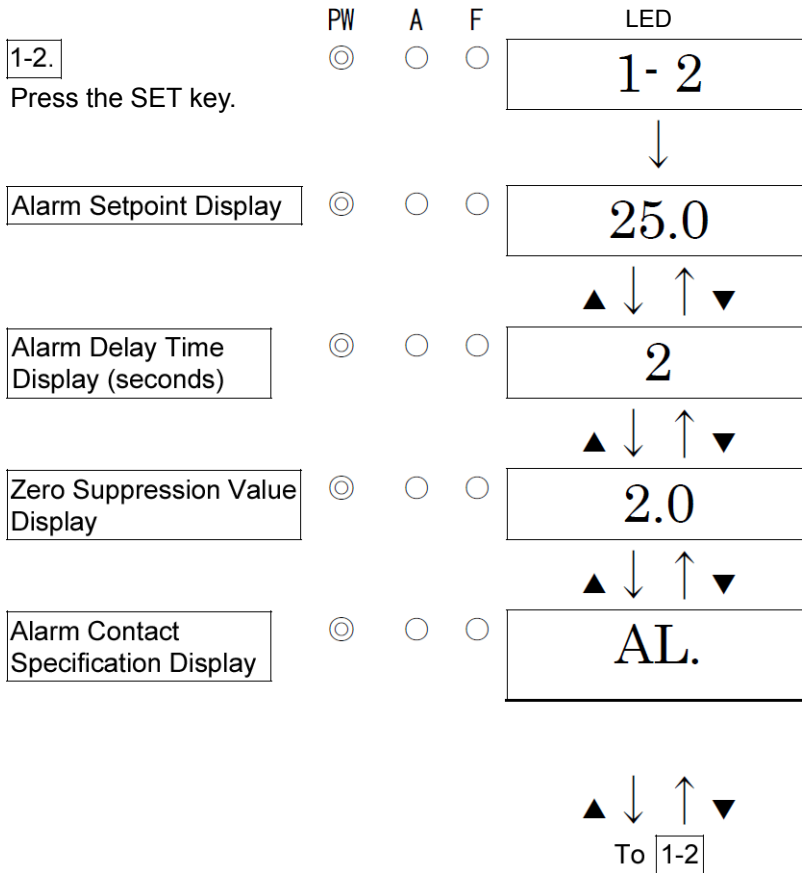


NOTE

- If the zero calibration failed since the zero point was significantly fluctuated from around zero, it returns to 1-1 after FAIL rather than PASS is displayed. In this case, the zero adjustment has not been completed.

<Setting Display "1-2">

Display various setting values.



AL.: The contact is activated due to the gas alarm.
 FAU.: The contact is activated due to the fault alarm.
 A. or F.: The contact is activated due to the gas alarm or the fault alarm.

5-6. How to exit

To turn off the gas monitor, turn off the power supply (24 VDC) to the gas monitor.

WARNING

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

6

Operations and Functions

6-1. Gas alarm activation

Gas alarm: Activated when the concentration of detected gas reaches or exceeds the alarm setpoint value.
<<Auto-Reset>>

NOTE

The alarm setpoint is factory-set. Although the alarm delay time (standard: 2 seconds) works in the gas monitor 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), "〇〇〇〇" is displayed on the LED.

Power Indicator Lamp (POWER: Green)

During operation, this lights up continuously.

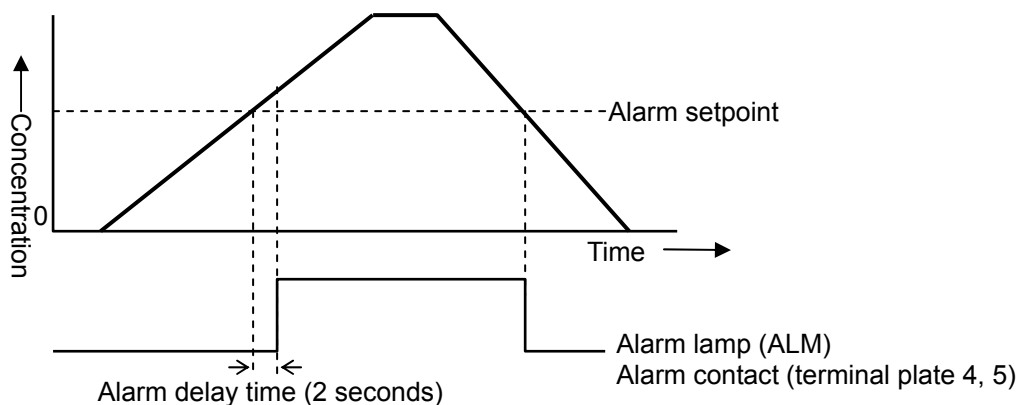
Alarm Indicator Lamp (ALM: Red)

It lights up when the alarm setpoint value is reached to or exceeded.

<Contact Activation>

The contact is activated when the gas concentration reaches or exceeds the alarm setpoint value. (only when the alarm is used)

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



<Response to Gas Alarm>

A gas concentration value exceeds the alarm setpoint

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 gas monitor.

NOTE

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

- Based on your management rules of gas alarm, no one can be allowed to access the monitored zone to ensure safety.
- If the gas concentration display continues to be displayed, close the main valve of the gas, and then check that the gas concentration reading dropped.
- Access the gas leak point, equipped with a protective gear to avoid dangers caused by possibly remaining gases, and check whether gases remain or not by using a portable gas detector.
- Check that the point is free from dangers, and take actions to fix the gas leak.

6-2. Fault alarm activation

A fault alarm is triggered when the gas monitor detects abnormalities. After a fault alarm is triggered, the fault lamp (yellow) lights up and an error message is displayed on the LED. Determine the causes and take appropriate actions.

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

If the gas monitor has problems and is repeatedly malfunctioning, contact our overseas sales department or local representatives immediately.

NOTE

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

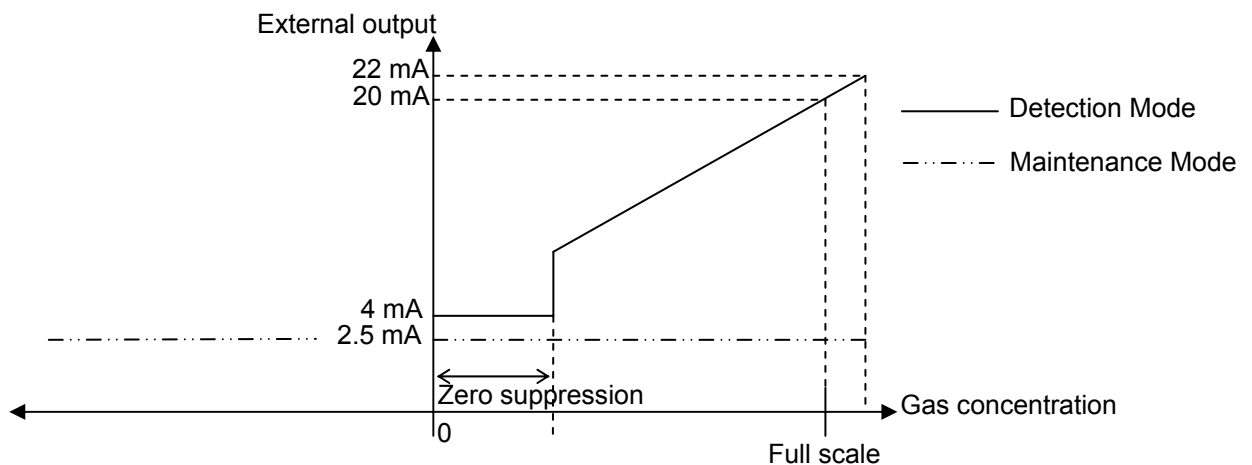
6-3. External output operation

Signal Transmission System		Electric current transmission (non-isolated) 4 – 20 mA
Transmission Path		CVVS
Transmission Distance		CVVS 1.25 sq: Maximum 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	Depending on the setting of the section 4. <u>2.5 mA setting:</u> 2.5 mA <u>4 mA, HOLD, 4 - 20 mA setting:</u> 4 mA
4	Maintenance Mode	<u>2.5 mA setting:</u> 2.5 mA <u>4 mA setting:</u> 4 mA <u>HOLD setting:</u> The previous value retained <u>4-20 mA setting:</u> 4 - 20 mA (concentration output)
5	Alarm Test	<u>Output ON setting:</u> 4 - 20 mA (concentration output) <u>Output OFF setting:</u> 4 mA
6	Fault Alarm	0.5 mA (Fixed)
7	INHIBIT	Depending on the setting of the section 4. <u>2.5 mA setting:</u> 2.5 mA <u>4 mA, HOLD, 4 - 20 mA setting:</u> 4 mA
8	Power Off	0 mA

Example of Gas Concentration and External Output

4 - 20 mA specification

(Maintenance output: 2.5 mA setting)



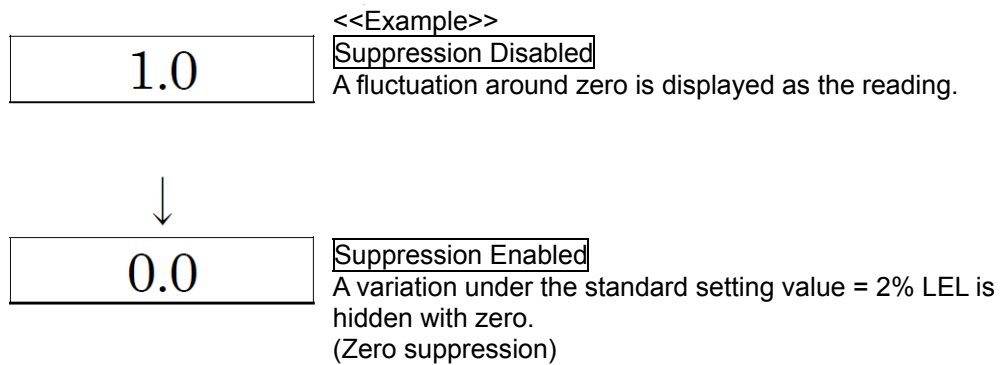
CAUTION

- 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. In particular, when the gas monitor is started or the specification is changed, be careful about 4-20 mA output setting. Understand how the gas monitor functions, and take actions, if necessary, so that the signal receiver side can prepare to avoid false alarms.

6-4. Other functions

<Suppression Function>

The sensors used with the gas monitor 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 be fluctuated around zero even in a normal environment. 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 variation of the reading under the setting value is displayed.



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.

7

Maintenance

This is an important instrument for the purpose of safety.

To maintain the performance of the gas monitor and improve the reliability of safety, perform a regular maintenance.

7-1. Maintenance intervals and items

- 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. When the reading is incorrect, perform the zero adjustment (AIR adjustment) after ensuring that no other gases exist around it.	○	○	○
Alarm Test	Check the alarm circuit by using the alarm test function.	–	○	○
Span Adjustment	Perform the sensitivity calibration 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 gas monitor, please use our maintenance service.
- The followings are typical maintenance services. For more information, please contact our overseas sales department or local representative.

Main Services

Power Supply Check	: Checks the power supply voltage. Verifies that the power lamp lights up. (Verifies that relevant points can be identified on the system.) (When a UPS (uninterruptible power system) is used, checks the operation with the UPS.)
Concentration Display Check	: Verifies that the concentration display value is zero (or 20.9 vol% on the oxygen deficiency meter) by using the zero gas. Performs the zero adjustment (AIR adjustment) if the reading is incorrect.
Flow Rate Check	: 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 gas monitor. If the flow rate is incorrect, performs the flow rate adjustment.
Filter Check	: Checks the dust filter for dust or clogging. Replaces a dirty or clogged dust filter.
Alarm Test	: 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 sensitivity calibration by using the calibration gas.
Gas Alarm Check	: 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 the Gas Monitor (visual diagnosis)	: Checks dust or damage on surface, cover, or internal parts of the gas monitor, clean and repair such parts of the gas monitor. Replaces parts which are cracked or damaged.
Gas Monitor 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.

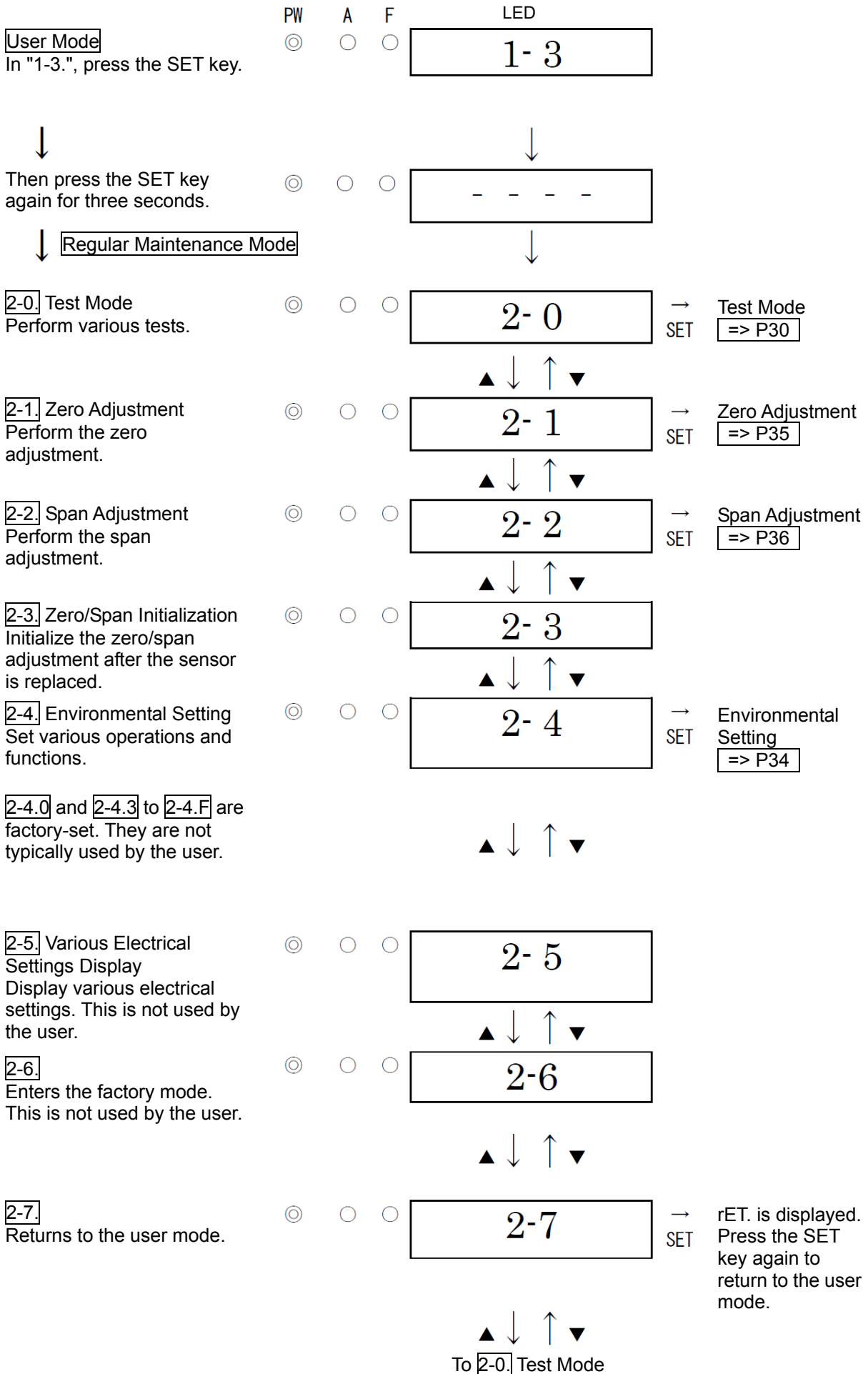
7-2. Regular maintenance mode



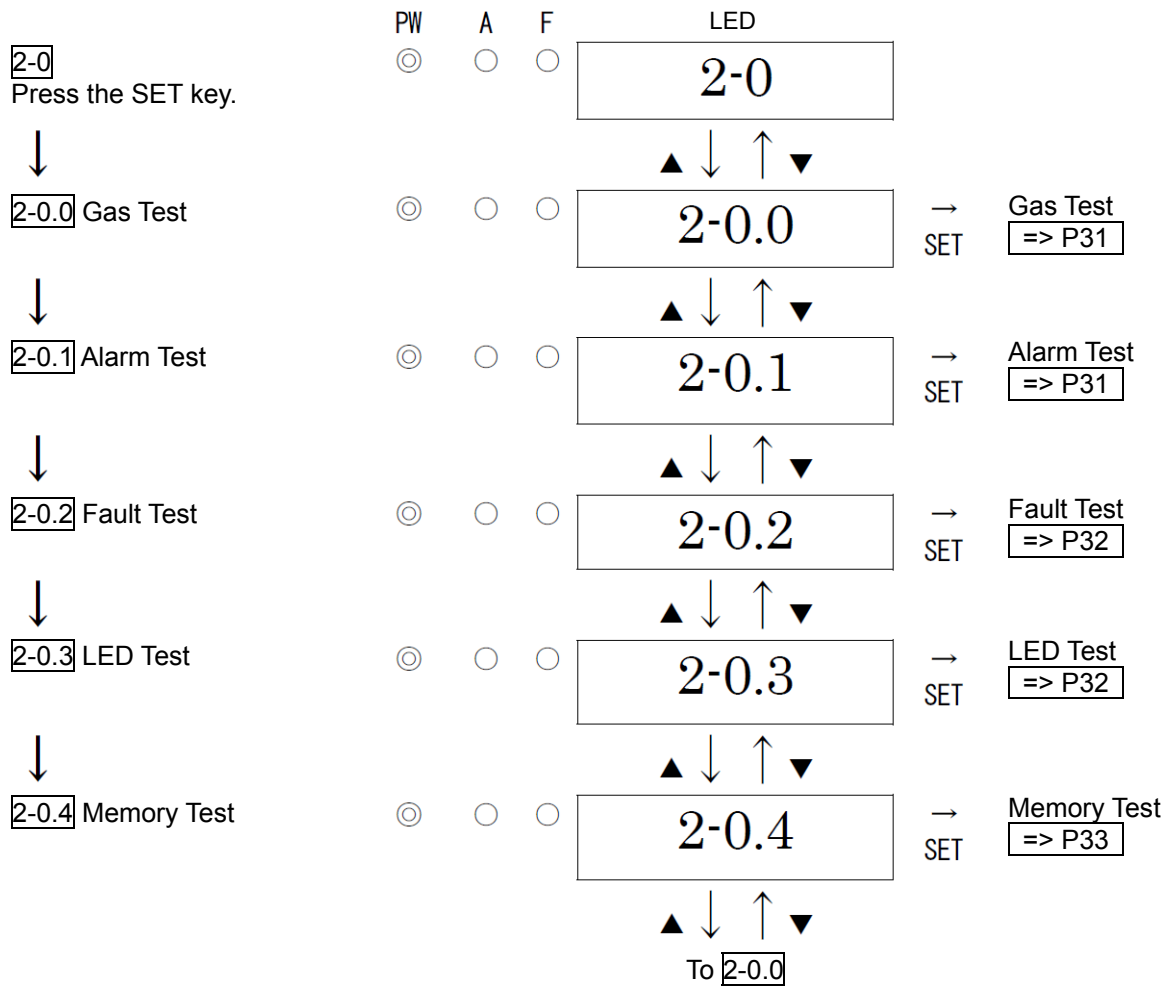
WARNING

After the adjustment is completed, never fail to press MENU/ESC key to return to the detection mode. (If the gas monitor remains in the regular maintenance mode, it automatically returns to the detection mode in ten hours.)

Mode	Item	LED display	Details
Maintenance Mode (Regular maintenance)	Test Mode	2-0	Perform various tests. 2-0.0 Gas Test 2-0.1 Alarm Test 2-0.2 Fault Test 2-0.3 LED Test 2-0.4 Memory Test
	Zero Adjustment	2-1	Perform the zero adjustment.
	Span Adjustment	2-2	Perform the span adjustment.
	Zero/Span Initialization	2-3	Initialize zero/span values.
	Environmental Setting	2-4	Used for various environmental settings. 2-4.0 Sensor Power Supply ON/OFF 2-4.1 INHIBIT Setting 2-4.2 Alarm Setpoint Setting 2-4.3 Alarm Delay Time Setting 2-4.4 Alarm Pattern Setting 2-4.5 Zero Suppression Pattern Setting 2-4.6 Zero Suppression Value Setting 2-4.7 Alarm Contact Specification Setting 2-4.8 Energized/De-energized Contact Setting 2-4.9 Maintenance Mode External Output Setting 2-4.A External Output Setting 2-4.B Alarm Test External Output Setting 2-4.C Sensor Operation Start Setting 2-4.D Password Setting 2-4.E Sensor Fault Alarm Pattern Setting
	Display	2-5	Display various electrical settings. This is not typically used by the user.
	Switch to factory mode	2-6	Not used.
	Switch to user mode	2-7	Returns to the user mode.



<Alarm Test Mode "2-0">



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 MENU/ESC key to return to the detection mode. (If the gas monitor remains in the alarm test mode, it automatically returns to the detection mode in ten hours.)
- In the alarm test mode, the gas concentration equal to the reading is output even in the maintenance mode depending on the setting. Take actions, if necessary, so that the signal receiver side can prepare to avoid false alarms.

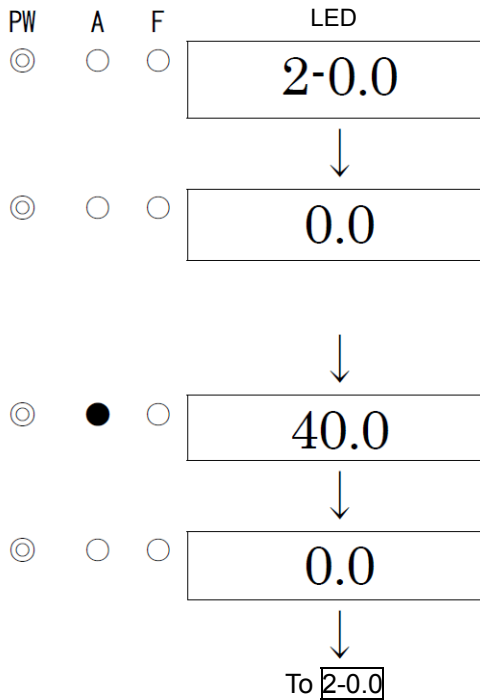
<Gas Test "2-0.0">

2-0.0

Press the SET key.



Introduce the test gas and perform the gas test.



Stop introducing the test gas. When the reading drops, press the MENU/ESC key to cancel the test and go back to the original state.



WARNING

Because the contact and gas concentration output can be activated by a gas test even in the maintenance mode depending on setting, be careful to perform the test.

<Alarm Test "2-0.1">

2-0.1

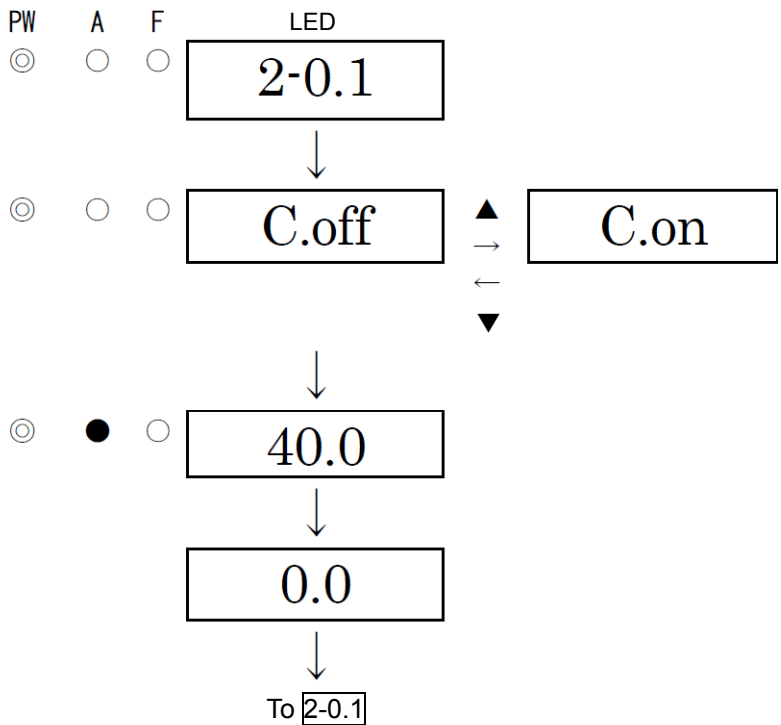
Press the SET key.



Alarm Test ON/OFF

(The used contact setting is "Alarm", "Alarm or Fault")

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



Perform the gas alarm test by increasing or decreasing the reading with the ▲ or ▼ key. Press the MENU/ESC key to cancel the test and to go back to the original state.



WARNING

Because the contact and gas concentration output can be activated by an alarm test even in the maintenance mode depending on setting, be careful to perform the test.

<Fault Alarm Test "2-0.2">

2-0.2

Press the SET key.



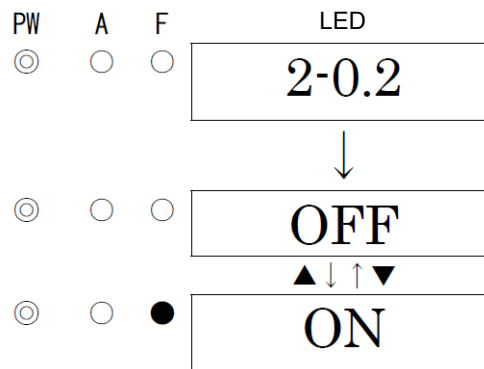
Fault Test ON/OFF

Select either ON/OFF.

Switch ON and press the SET key to activate the fault alarm.

Return to OFF and press the SET key to cancel the fault alarm.

(Pressing the MENU/ESC key also enables to cancel the fault alarm and to go back to the original state.)



WARNING

Because the contact and gas concentration output can be activated by a fault alarm test even in the maintenance mode depending on setting, be careful to perform the test.

<LED Test "2-0.3">

2-0.3

Press the SET key.



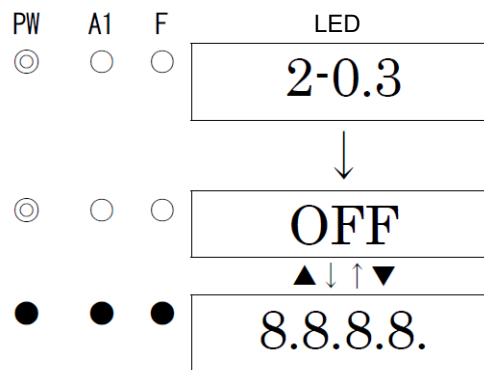
LED Test ON/OFF

Select either ON/OFF.

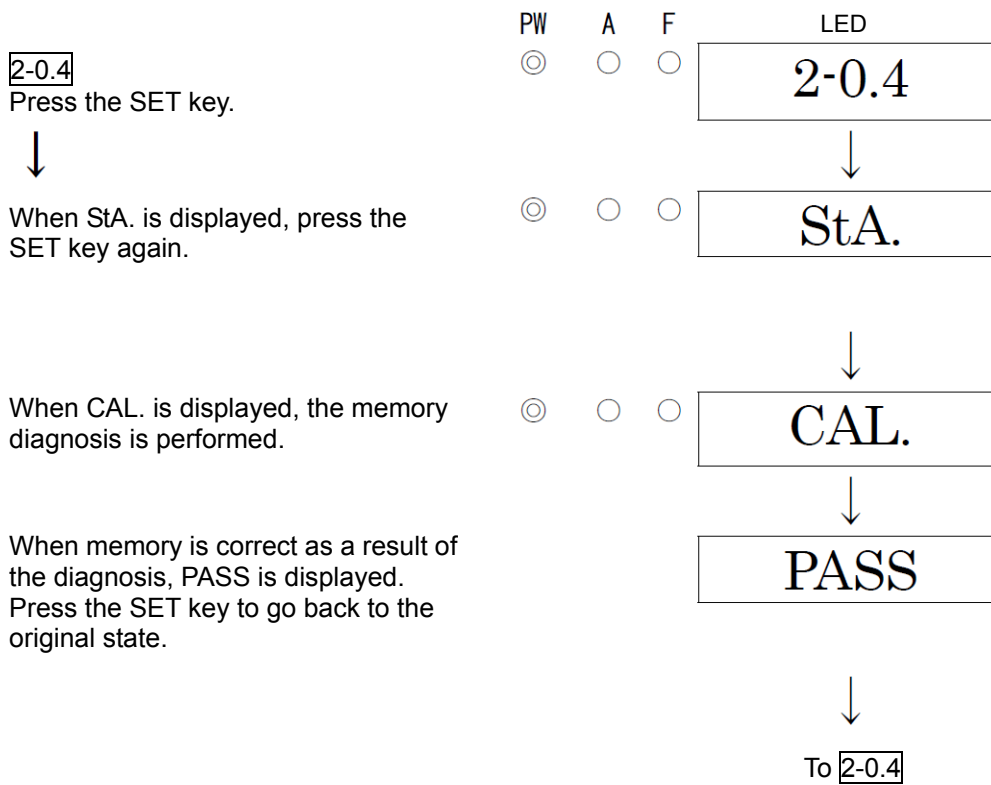
Switch ON and press the SET key to turn on the LEDs (POWER, ALM, FAULT) and to display the gas concentration of 8.8.8.8.

Return to OFF and press the SET key to cancel the test.

(Pressing the MENU/ESC key also enables to cancel the test and to go back to the original state.)



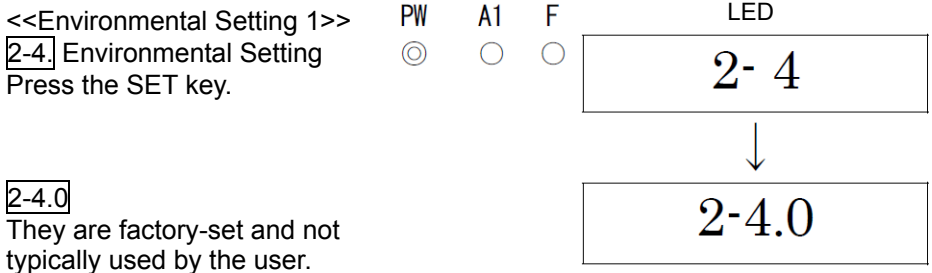
<Memory Test "2-0.4">

**NOTE**

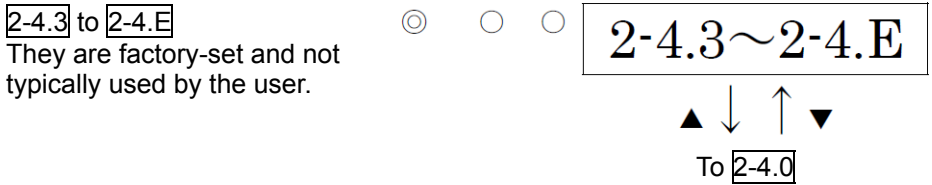
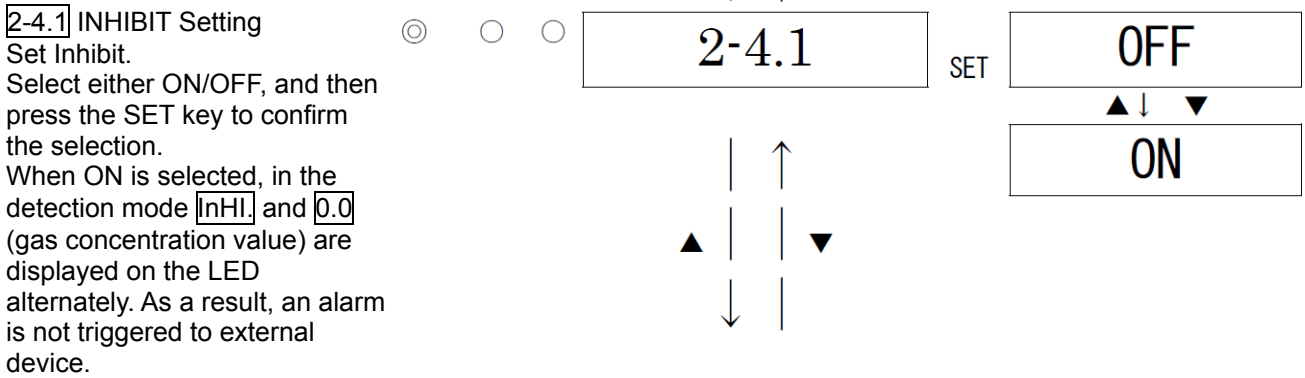
When abnormalities are found in memory as a result of the diagnosis, PASS is not displayed. F-RA is displayed for the RAM fault, and F-RO is displayed for the ROM fault. For both the RAM fault and ROM fault, F-RA and F-RO are displayed alternately.

<Environmental Setting "2-4">

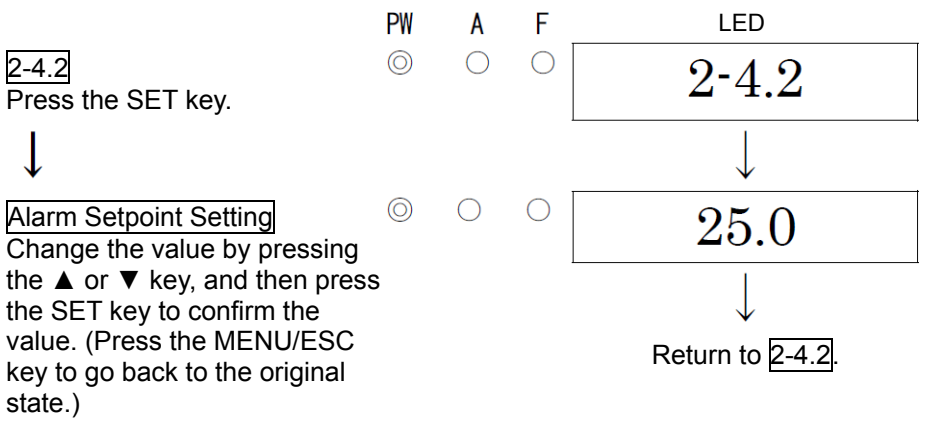
Set various operations and functions in the environmental setting.



They are factory-set and not typically used by the user.



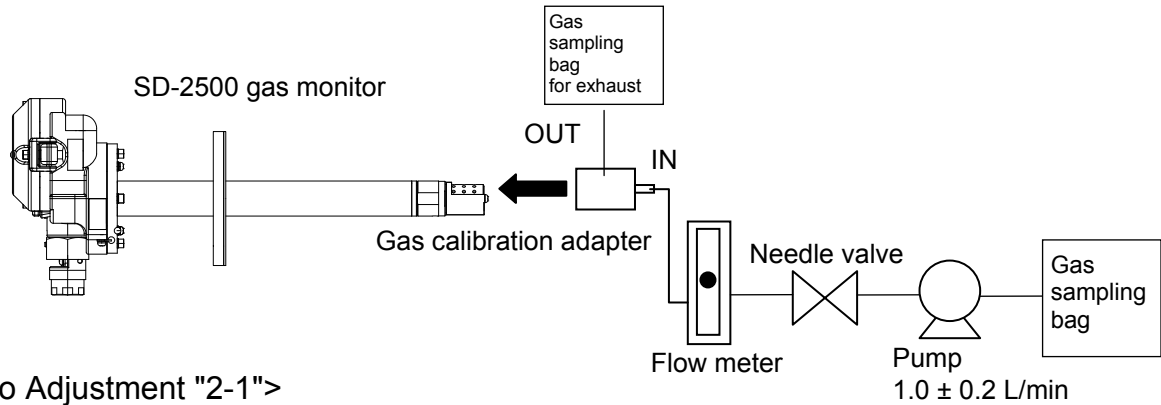
<Alarm Setpoint Setting "2-4.2">



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



<Zero Adjustment "2-1">

This is used to perform the zero adjustment.

2-1

Press the SET key.



Current Concentration Value Display

Press the SET key to perform the zero adjustment.



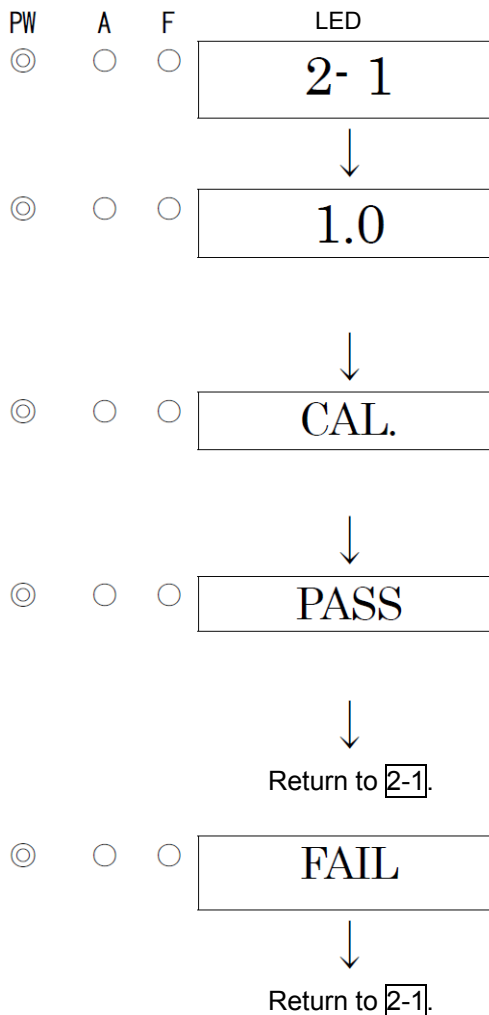
Under Zero Adjustment (CAL. is displayed)

Wait for a while until the adjustment is completed.



Zero Adjustment Completed

It automatically returns to 2-1 after PASS is displayed.




* If the zero adjustment failed, it automatically returns to 2-1 after FAIL is displayed.

NOTE

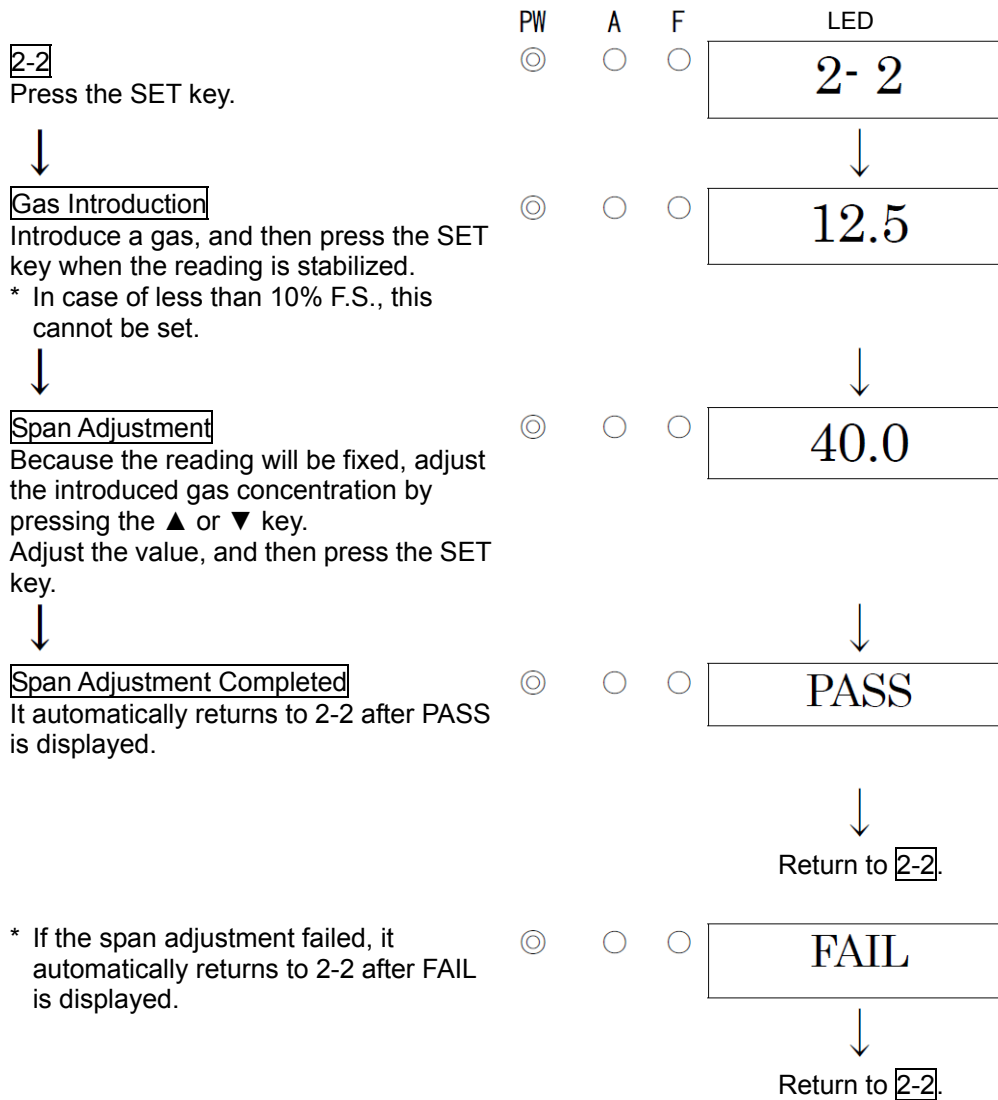
- If the zero calibration failed since the zero point was significantly fluctuated from around zero, it returns to 2-1 after FAIL rather than PASS is displayed. In this case, the zero adjustment has not been completed.

This is used to perform the span adjustment.



CAUTION

- Before starting the span adjustment, provide the gas monitor with the span adjustment gas and wait until the indicator is stabilized.



NOTE

- If the span adjustment failed since the reading was significantly fluctuated from the introduced gas concentration, it returns to 2-2 after FAIL rather than PASS is displayed. In this case, the span adjustment has not been completed.
Check if the correct concentration span adjustment gas has been provided and check the gas adjustment tool for a gas leak. If there are mistakes, perform the span adjustment again.
If the span adjustment cannot be performed even when there is no mistake or after recalibration, the gas sensor life might have expired. After turning off the power supply, please contact our overseas sales department or local representatives.

7-4. Parts replacement

<Sensor Replacement>

Our service engineers need to replace the sensor and perform the gas calibration. Please contact our overseas sales department or local representatives.

NOTE

The gas calibration using the standard gas is required after the sensor is replaced. Please request it to our overseas sales department or local representatives.

<Replacement of Regular Replacement Parts>

List of recommended regular replacement parts

No.	Item	Maintenance intervals	Replacement intervals (year)	Quantity (pieces/unit)
1	O-ring (for the housing joint surface)	1 year	3 - 6 years	1
2	Rubber seal (for flange installation)	1 year	3 - 6 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.

8

Storage, Relocation and Disposal

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

The gas monitor must be stored under the following environmental conditions.

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

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

When the gas monitor is relocated, select a new place in accordance with "4-2. Precautions for installation points" and "4-4. How to install".

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



CAUTION

- When using a relocated or stopped/stored gas monitor again, do not forget to perform a gas calibration. For information on readjustment including a gas calibration, please contact our overseas sales department or local representatives.

8-3. Disposal of products

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

9

Troubleshooting

The Troubleshooting does not explain the causes of all the malfunctions which occur on the gas monitor. This simply helps to find the causes of malfunctions which frequently occur. If the gas monitor shows a symptom which is not explained in this manual, or still has malfunctions even though remedial actions are taken, please contact our overseas sales department or local representatives.

<Abnormalities on Unit>

Symptom/Display	FAULT	Causes	Actions
<u>The power cannot be turned on.</u>	-	The wiring is not correct.	Connect the wiring properly.
		The terminal plate is removed.	Connect the terminal plate properly.
		Abnormalities/momentary blackout of power supply system	Provide the rated voltage. Check the UPS, power supply line filter and insulation transformer, and then take additional measures.
		Cable abnormalities (open circuit/not connected/short circuit)	Check the wiring of gas monitor and related devices around it.
<u>Abnormal operations</u>	-	Disturbances by sudden surge noise, etc.	Turn off and restart the gas monitor. If such a symptom is observed frequently, take appropriate measures to eliminate the noise.
<u>Sensor abnormalities</u> E-1	●	The sensor is not connected or improperly connected.	Check if the sensor cable is securely fastened to the terminal plate.
		Faults of the sensor	Replace the sensor with a new one.
<u>System abnormalities</u> E-9	●	The rated voltage is not supplied to the gas monitor.	Check the power supply, and supply the rated voltage.
		Abnormalities of ROM, RAM, or EEPROM inside of the gas monitor	Please contact our overseas sales department or local representatives.

<Abnormalities of Readings>

Symptoms	Causes	Actions
<u>The reading rises (drops) and it remains so.</u>	Drifting of sensor output	Perform the zero adjustment.
	Environmental changes	When the sensor ambient temperature rises (or drops), the "zero point" drops (or rises), but this is not a malfunction. Perform the zero adjustment at the operating temperature.
<u>A gas alarm is triggered despite of no gas leak and no other abnormalities at the detection point.</u>	Disturbance by noise	Turn off and restart the gas monitor. 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 gas monitor cannot adjust to it and is affected by it. In some cases, the gas monitor triggers an indication alarm. Because the gas monitor cannot be used under sudden and frequent environmental changes, the user should take some preventive actions to eliminate them.
<u>Slow response</u>	Deteriorated sensor sensitivity	Replace the sensor with a new one.

10

Product Specifications

10-1. List of specifications

<Japanese Specifications>

Detection principle	Catalytic combustion method
Detectable gas	NMP
Gas concentration display	LED(4digits · 7segments)
Measuring range	0~100%LEL
Resolution	0.5%LEL
Detection method	Direct-insert method
Alarm preset point	25%LEL 【Standard】
Power indication	POWER lamp lighting(green)
Output	Gas concentration signal Alarm contact(Gas alarm or Trouble alarm or Gas · Alarm common alarm)
Alarm accuracy (under an identical condition)	Less than $\pm 25\%$ (against alarm preset point)
Alarm-delay time (under an identical condition)	Less than 30sec(when introducing 1.6 times thicker gas than alarm preset point)
Gas alarm type	Single alarm(H)
Gas alarm indication	ALM lamp lighting(red)
Gas alarm action	Auto-recover
Trouble alarm · Self diagnosis	System failure/Sensor failure
Trouble alarm indication	FAULT lamp lighting(yellow)/content display
Trouble alarm action	Auto-recover
Alarm contact	No-voltage contact 1a or 1b Non-exciting at normal(exciting at alarm) or exciting at normal(non-exciting at alarm)
Contact capacity	AC250V · 0.5A/DC30V · 0.5A(resistive load)
Transmission scheme	Three-wire analog transmission (in common with power supply<power supply,signal,common>)
Specification of transmission	DC4~20mA (linear · load resistance less than 300 Ω · resolution ability 200division)
Transmission cable	CVVS worth of shield cable(1.25sq) · 3-core or 5-core (by using alarm contact)
Transmission distance	Less than 1km
Power supply	DC24V(DC20~26.4V)
Power consumption	MAX.3W
Cabling port	Flame proof packing method

Initial clear	Approx.25sec
Operating temperature	Sensor : 0~160°C(non-rapidly-vary) Case : 0~30°C(non-rapidly-vary)
Structure	Direct-insert type
Explosion-proof structure	Flame proof structure
Explosion-proof grade	Exd II CT3 (TIIS<Japan>)
Outer dimension	Approx.148(W)×167(H)×458(D)mm(protecting excluding)
Weight	Approx.4.6kg
Color	Munsell 7.5BG5/2

* Specifications subject to changes without notice.

<Overseas Specifications>

Detection principle	Catalytic combustion method
Detectable gas	NMP
Gas concentration display	LED(4digits · 7segments)
Measuring range	0~100%LEL
Resolution	0.5%LEL
Detection method	Direct-insert method
Alarm preset point	25%LEL 【Standard】
Power indication	POWER lamp lighting(green)
Output	Gas concentration signal Alarm contact(Gas alarm or Trouble alarm or Gas · Alarm common alarm)
Alarm accuracy (under an identical condition)	Less than ±25%(against alarm preset point)
Alarm-delay time (under an identical condition)	Less than 30sec(when introducing 1.6 times thicker gas than alarm preset point)
Gas alarm type	Single alarm(H)
Gas alarm indication	ALM lamp lighting(red)
Gas alarm action	Auto-recover
Trouble alarm · Self diagnosis	System failure/Sensor failure
Trouble alarm indication	FAULT lamp lighting(yellow)/content display
Trouble alarm action	Auto-recover
Alarm contact	No-voltage contact 1a or 1b Non-exciting at normal(exciting at alarm) or exciting at normal(non-exciting at alarm)
Contact capacity	AC250V · 0.5A/DC30V · 0.5A(resistive load)
Transmission scheme	Three-wire analog transmission (in common with power supply<power supply,signal,common>)
Specification of transmission	DC4~20mA (linear · load resistance less than 300Ω · resolution ability 200division)
Transmission cable	CVVS worth of shield cable(1.25sq) · 3-core or 5-core (by using alarm contact)
Transmission distance	Less than 1km
Power supply	DC24V(DC20~26.4V)
Power consumption	MAX.3W
Cabling port	Flame proof packing method
Initial clear	Approx.25sec
Operating temperature	Sensor : 0~160°C(non-rapidly-vary) Case : -20~60°C(non-rapidly-vary)
Structure	Direct-insert type

Explosion-proof structure	Flame proof structure
Explosion-proof grade	II 2GExd II CT3Gb (ATEX/IECEEx<DEKRA>)
Outer dimension	Approx.148(W)×167(H)×458(D)mm(protecting excluding)
Weight	Approx.4.6kg
Color	Munsell 7.5BG5/2

* Specifications subject to changes without notice.

10-2. List of accessories

- Operating manual 1sheet
- Dedicated handling lever 1pce.
- Dedicated control key Depends on ordered quantity of the unit.

1~10 units	1 pce.
11~20 units	2 pcs.
21~50 units	3 pcs.
51 units and above	4 pcs.

- Flange gasket 1pce.
- Exhaust air direction nameplate 1pce.

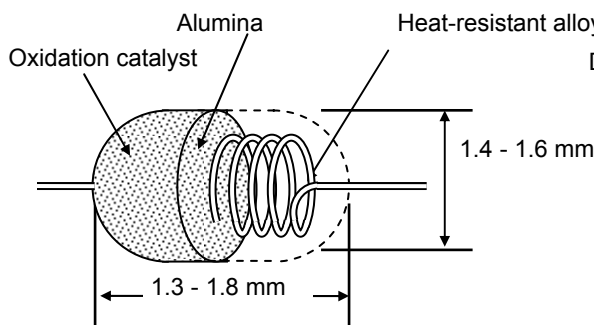
10-3. Detection principle

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

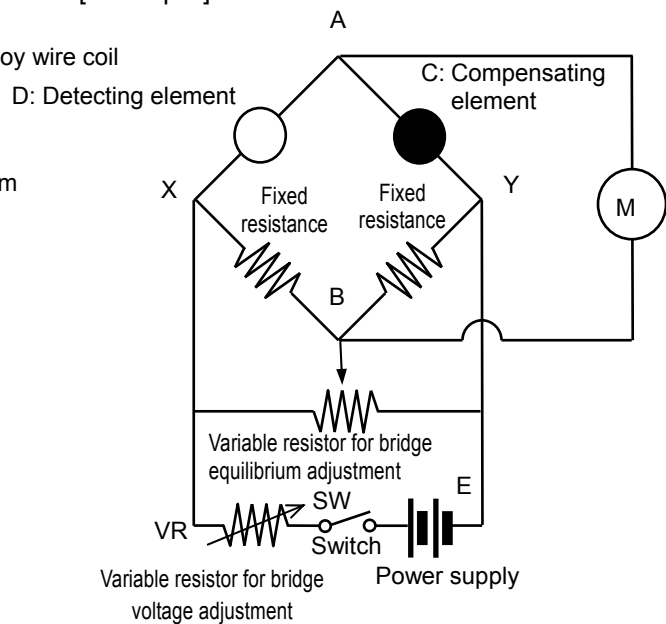
The sensor consists of two elements: A detecting element having a heat-resistant alloy wire coil with an ultrafine particle oxidation catalyst sintered on it together with a carrier and a temperature-compensating element with a mixture of gas-inert alumina and glass sintered on it.

When a combustible gas comes into contact with the surface of the detecting element with 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.

[Structure]



[Principle]



11

Definition of Terms

Catalytic combustion type	This is a principle of the sensor installed in the detector head. See "10-3. Detection principle" for details.
Initial clear	Output from the detector head fluctuates for a while after turning on the power. This is a function to prevent triggering alarm during that time.
Full scale	Maximum value of the detection range.
%LEL	A unit which the lower explosive limit (LEL) of the combustible gas to be detected is set to 100.
Calibration	Adjusts the readings to the calibration gas concentration value by using the calibration gas.
Zero suppression	A function to cut off the specific drifting that the sensor has.
Alarm delay time	A function which temporarily suspends activation to prevent a false alarm caused by noise from its outside.