

Gas Detector Head

GD-81D Series

GD-81D
GD-81D-ETD

Operating Manual

RIKEN KEIKI Co., Ltd.

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

Phone : +81-3-3966-1113

Fax : +81-3-3558-9110

E-mail : intdept@rikenkeiki.co.jp

Web site : <https://www.rikenkeiki.co.jp/english/>

Contents

1.	Product Overview	6
1-1	Introduction	6
1-2	Intended use and features	7
1-2-1	Communication systems by model and corresponding sensors	7
1-2-2	Product features	7
1-3	DANGER, WARNING, and NOTE	8
1-4	Checking CE marking	8
2.	Important Safety Information	9
2-1	Danger information	9
2-2	Warning information	9
2-3	Precautions	10
3.	Product Configuration	11
3-1	Main unit and accessories	11
3-2	Part names and functions	12
3-2-1	Main unit part names and functions	12
3-2-2	Front panel and LCD screen part names and functions	14
3-3	Block diagrams	16
3-3-1	Electrical system diagrams	16
3-3-2	Piping diagram	18
4.	Installation	19
4-1	Installation precautions	19
4-2	System design precautions	20
4-3	Providing maintenance space	23
4-3-1	Maintenance space	23
4-4	Main unit installation	25
4-4-1	Installing the main unit	26
4-5	Sensor fitting	28
4-5-1	Sensor types	28
4-5-2	Fitting an F sensor	31
4-5-3	Mounting the sensor unit	33
4-6	Wiring procedure	35
4-6-1	Recommended cables	35
4-6-2	Terminal plate specifications	36
4-6-3	Terminal plate connections	37
4-6-4	Grounding terminal connections	39
4-7	Piping procedure	41
4-7-1	Connecting tubes	42
4-7-2	Removing tubes	43
5.	Usage Instructions	44
5-1	Preparations for startup	44
5-2	Turning on the power	45
5-3	Basic operation flow	47
5-4	User mode	49
5-4-1	User mode setting items	49
5-4-2	Switching to user mode	50
5-5	Performing fresh air adjustment (AIR)	51
5-6	Checking setting values (user mode)	53
5-6-1	Checking the alarm setpoints (CONFIRM)	53

5-6-2	Checking the flow rate (FLOW)	55
5-6-3	Checking the main unit version (81D VER)	56
5-6-4	Checking the sensor version (SEN VER)	57
5-7	Turning off the power	58
6.	Alarm Activation	59
6-1	Gas (oxygen deficiency) alarm activation	59
6-1-1	Alarm activation	59
6-1-2	Contact operation (auto reset)	60
6-1-3	Contact operation (self-latching)	61
6-1-4	Response when a gas alarm is triggered	64
6-2	Fault alarm activation	65
6-3	External output operations	66
6-4	Various functions to ensure proper alarm activation	69
6-4-1	Zero suppression function	69
6-4-2	Zero follower function	70
6-4-3	Sensitivity correction function	70
6-4-4	Adjustment history, alarm trend history, and event history functions	71
6-4-5	Automatic sensor recognition function	71
7.	Maintenance	73
7-1	Maintenance intervals and maintenance items	73
7-2	Performing alarm tests	75
7-3	Maintenance (regular maintenance) mode	77
7-3-1	Maintenance mode setting items	77
7-3-2	Switching to maintenance mode	78
7-4	Performing a gas introduction test	80
7-5	Performing gas adjustment	81
7-5-1	Performing zero adjustment	81
7-5-2	Performing span adjustment	83
7-5-3	Connecting the calibration gas	86
7-6	Adjusting the flow rate	87
7-6-1	Checking the flow rate (FLOW)	87
7-6-2	Manually adjusting the flow rate (FLOW)	89
7-6-3	Correcting the flow rate value (DEF FLOW)	90
7-7	Checking setting values (maintenance mode)	91
7-7-1	Checking the date last adjusted (LAST CAL)	91
7-7-2	Checking the set potential (E VOLT)	92
7-7-3	Checking the temperature of the detector (TEMP)	92
7-8	Setting the sensor use start date (S SET)	93
7-9	Setting environmental settings 1	94
7-9-1	INHIBIT setting (INHIBIT)	94
7-9-2	Alarm setpoint setting (ALM P)	96
7-9-3	Alarm delay time setting (ALM DLY)	97
7-9-4	Fault alarm test (F TEST)	98
7-10	Setting environmental settings 2	100
7-10-1	Date and time setting (DAY TIME)	101
7-10-2	Zero suppression value setting (SUPPRESS)	103
7-10-3	Zero suppression type setting (SUP TYPE)	104
7-10-4	Contact setting during alarm tests (TEST RLY)	105
7-10-5	External output setting during alarm tests (TEST4-20)	106
7-10-6	Energized/de-energized setting (RLY PTRN)	107
7-10-7	Alarm type setting (ALM TYP)	110

7-10-8 Alarm pattern setting (ALM PTRN).....	112
7-10-9 Alarm value limiter setting (AL LIMIT).....	113
7-10-10 Fault alarm pattern setting (FLT PTRN).....	114
7-10-11 Automatic flow adjustment setting (AT FLOW).....	115
7-10-12 Zero follower setting (ZERO F).....	116
7-10-13 24-hour zero follower setting (ZERO 24F).....	117
7-10-14 Sensitivity correction setting (S ASSIST).....	118
7-10-15 External output setting in maintenance mode (MNT OUT) 4 to 20 mA	119
7-10-16 External output adjustment (MA 4-20) 4 to 20 mA	121
7-10-17 Backlight setting (BK LIGHT).....	122
7-10-18 ETHERNET settings (ETHERNET) ETD	123
7-10-19 Pump drive level diagnostic setting (PUMP CK).....	126
7-10-20 Fault contact operation setting for low flow rates (FLT RLY).....	127
7-10-21 Fault alarm external output setting (FLT OUT) 4 to 20 mA	128
7-10-22 Warning display settings (CAU DISP).....	129
7-10-23 Warning output settings (CAU OUT).....	130
7-10-24 Gas name display setting (GAS NAME).....	132
7-10-25 LCD contrast adjustment (CONTRAST).....	133
8. Replacing and Cleaning Parts.....	134
8-1 Replacing consumable parts.....	134
8-1-1 Sensor replacement.....	134
8-1-2 Dust filter replacement.....	138
8-2 Replacing periodic replacement parts.....	139
8-2-1 List of recommended periodic replacement parts.....	139
8-2-2 Pump unit replacement.....	139
8-2-3 Flow sensor unit replacement.....	142
8-3 Cleaning the product.....	144
9. Storage, Relocation, and Disposal.....	145
9-1 Procedures for storage or when not used for extended periods.....	145
9-2 Procedures for relocation or reuse.....	146
9-3 Product disposal.....	147
10. Troubleshooting.....	148
10-1 Product abnormalities.....	148
10-1-1 Main unit abnormalities.....	148
10-1-2 Pyrolyzer unit abnormalities.....	152
10-2 Reading abnormalities.....	153
11. Product Specifications.....	154
11-1 GD-81D Series specifications.....	154
11-1-1 GD-81D specifications.....	154
11-1-2 GD-81D-ETD specifications.....	157
11-2 Sensor specifications.....	160
11-2-1 Catalytic combustion type.....	160
11-2-2 Semiconductor type.....	161
11-2-3 Hot-wire semiconductor type.....	163
11-2-4 Electrochemical type.....	165
11-2-5 Galvanic cell type.....	166
11-2-6 Non-dispersive infrared type.....	167
11-2-7 Pyrolysis-particle type.....	168

12. Appendix 169

 12-1 Detection principles 169

 12-1-1 Catalytic combustion type 169

 12-1-2 Semiconductor type 171

 12-1-3 Hot-wire semiconductor type 173

 12-1-4 Electrochemical type 175

 12-1-5 Galvanic cell type 177

 12-1-6 Non-dispersive infrared type 178

 12-1-7 Pyrolysis-particle type 179

 12-2 Safety manual 182

 12-3 Alarm accuracy and alarm delay time (for use in Japan) 185

 12-4 Terminology 186

1

Product Overview

1-1 Introduction

Thank you for purchasing this GD-81D Series Gas Detector Head (“the product” hereinafter). This operating manual describes product operating procedures and specifications. The manual provides information essential to the correct use of the product.

Make sure you have read and fully understood the contents of this manual before using the product. Keep this operating manual on hand to allow ready reference during use.

If you use any of the following devices, please also refer to the respective operating manuals:

- Pyrolyzer Unit PLU-80 Operating Manual (PT9E-035)
- GD-81D Series (Ethernet Model) Communication Function Manual (PT2E-361)

The contents of this operating manual and the manuals above are subject to change without notice due to product improvements. Any unauthorized duplication or reproduction of this operating manual and the manuals above is prohibited, whether in whole or in part.

RIKEN KEIKI accepts no liability for accidents or damage resulting from use of the product, whether within or outside the warranty period.

Review the warranty policy indicated on the warranty.

The product should be used only by fully-trained personnel.
The maintenance procedures described in this manual should be performed only by fully-trained personnel. Any maintenance procedure not described in this manual must be performed by RIKEN KEIKI or our certified service engineers. Please contact RIKEN KEIKI.

Before using the product, please confirm that the model of the product you purchased matches the model of the product covered by this operating manual.

<Models covered by this operating manual>

- GD-81D
- GD-81D-ETD

<This operating manual>

Where descriptions differ for different product models, this operating manual uses the following icons to indicate each model:

GD-81D	4 to 20 mA
GD-81D-ETD	ETD

Operating procedures and specifications for which no icons appear apply to both models.

1-2 Intended use and features

This product is a fixed gas detector head that detects leaks of various gases used in semiconductor factories and similar locations.

It detects combustible gases and toxic gases in the surrounding atmosphere and activates alarms if preset concentrations are exceeded.

Gas alarms are safety devices. They are not gas concentration meters nor gas analyzers designed to analyze or measure gas quality or gas volumes.

Use the device correctly after confirming you understand the product's features and characteristics.

1-2-1 Communication systems by model and corresponding sensors

This line of products features various models incorporating the following communication systems and corresponding sensors.

Check the specifications before use to confirm the correct gases will be detected in accordance with the intended purpose.

Model	Communication method	Corresponding sensor	Power supply		Contact output	
			24 V DC	PoE	Alarm	Fault
GD-81D	4 to 20 mA	NCF, NCU, SGF, SGU, SHF, SHU, ESF, ESU, OSU, IRF, IRU, SSU	○	-	○	○
GD-81D-ETD	Ethernet	NCF, NCU, SGF, SGU, SHF, SHU, ESF, ESU, OSU, IRF, IRU, SSU, M sensors* ²	○* ¹	○* ¹	○	○

*1: Do not supply power via a 24 V DC power source and PoE connection at the same time.

*2: M sensors refer to a multi-sensor unit containing two ESF sensors. They are not supported by the GD-81D (4 to 20 mA).

<Sensors and detection principles>




Sensor	Detection principle
NCF, NCU	Catalytic combustion type
SGF, SGU	Semiconductor type
SHF, SHU	Hot-wire semiconductor type
ESF, ESU	Electrochemical type
OSU	Galvanic cell type
IRF, IRU	Non-dispersive infrared type
SSU	Pyrolysis-particle type

1-2-2 Product features

- This product detects leaking combustible and/or toxic gases or oxygen deficiency using a built-in sensor.
- The detected gas concentration is displayed on a full-dot LCD.
- This product incorporates a pump to draw in gas and perform gas detection.

1-3 DANGER, WARNING, and NOTE

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

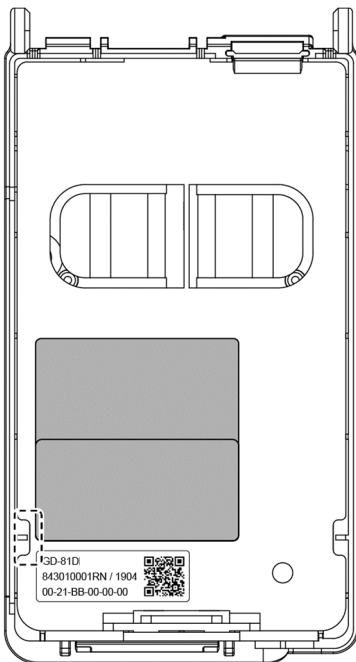
 DANGER	This indicates situations in which improper handling may result in fatal or serious injury or significant property damage.
 WARNING	This indicates situations in which improper handling may result in serious injury or significant property damage.
 CAUTION	This indicates situations in which improper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

Additionally, usage recommendations are indicated as follows:

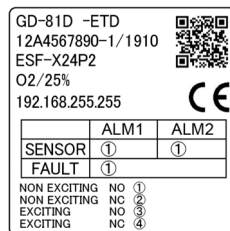
NOTE	This indicates items that will be helpful to know when using the product.
-------------	---

1-4 Checking CE marking

CE marking compliant models feature a CE marking. Check the actual product before use.



Location of CE marking
(Rear of front cover)



CE marking nameplate

2

Important Safety Information

2-1 Danger information



DANGER

- The product is a non-explosion-proof device. Never attempt to use the product to detect gases above the lower explosive limit (LEL).
-

2-2 Warning information



WARNING

Power source

- Before turning on the power for the product, be sure to confirm that the power source meets the specified voltage requirements. Avoid using unstable power sources; doing so may lead to malfunctions.

Protective grounding required

- Do not disconnect the protective grounding wire or terminal.

Defects of protective functions

- Before operating the product, check the protective functions for defects.
Do not turn on the product if you suspect any problems with the protective grounding and other protective functions.

External connections

- Be sure to provide secure protective grounding before connecting the product to the detection target or external control circuit.

Pipes

- Do not apply excessive pressure to the product's sampling pipe openings.
This product is designed to perform gas detection by drawing in gas at atmospheric pressure. Applying excessive pressure to the product's sampling pipe openings (GAS IN, GAS OUT) is hazardous. Doing so may cause the detection target gas to leak from the product.
- Discharge the gas exhausted after detection to a location determined to be safe by connecting an exhaust pipe to the detection target gas outlet (GAS OUT) located on the bottom of the main unit.

Sensor handling

- Never disassemble the sensor or sensor unit, regardless of the detection principle.
The electrochemical type sensor (ESF), electrochemical type sensor unit (ESU), and galvanic cell type sensor unit in particular all contain electrolyte. Contact with electrolyte may result in skin inflammation. Contact with eyes may result in blindness. Contact with clothing may result in discoloration or damage to the fabric.
If contact occurs, rinse the area immediately with water.
-

Zero adjustment in surrounding atmosphere (fresh air adjustment)

- Check the atmosphere for freshness before performing zero adjustment in the surrounding atmosphere (fresh air adjustment for oxygen deficiency alarm models). Correct adjustment will not be possible in the presence of miscellaneous gases. Moreover, it is extremely dangerous if the product cannot detect actual gas leaks correctly.

Operating in an environment with gases

- Do not operate this product in locations where combustible or explosive gases or vapor are present. Operating this product in such environments is extremely hazardous.

Action when a gas alarm is triggered

- A gas alarm indicates the presence of extreme danger. The user must take appropriate action after taking suitable steps to ensure safety.
- Depending on the type of gas detected, the sensor characteristics may be severely degraded. If a gas alarm is triggered, we recommend performing maintenance on the sensor fitted to the product to check its gas sensitivity.

2-3 Precautions



CAUTION

Do not use walkie-talkies near the product.

- Radio waves from walkie-talkies or other radio transmitting devices near the product or cables may affect readings. Use walkie-talkies or similar devices only in locations where they will not affect product functions.

Wait at least five seconds after turning off the power before turning the power back on.

- The product may not function correctly if the power is turned on again within five seconds.

Confirm that the flow rate display indicates the stipulated flow rate before using the product.

- If the flow rate display does not indicate the stipulated flow rate, gas will not be detected properly. Check whether the flow is unstable or absent.

Attach a dust filter.

- Attach the specified filter when using the product to avoid the effects of gas absorption and airborne dust.

The correct dust filter type depends on the type of gas to be detected. Contact RIKEN KEIKI for more information.

Observe the specified operating range to avoid condensation in the pipes.

- Condensation within the pipes may lead to gas adsorption, blockages, and other problems that make it impossible to detect gases accurately. To prevent condensation within the pipes, carefully monitor temperature and humidity both at the sampling point and within the general environment. For gases that become more corrosive when dissolved in water (e.g., highly acidic gases), consequences may include impaired capacity to detect gases and corrosive damage to internal parts.

Do not use external output from the product to control other devices.

- The product is not a control device. Never use the product output to control other devices.

Do not disassemble or modify the product or alter the settings unless absolutely necessary.

- Product performance cannot be guaranteed if the product is disassembled or modified. Additionally, altering the settings unnecessarily without a proper understanding of the details may prevent the alarm from operating correctly.

Read this operating manual carefully to ensure correct use of the product.

Be sure to perform regular maintenance.

- The product is a safety device. Maintain the product periodically to ensure safety. Continuing to use the product without adequate maintenance will result in sensor sensitivity variations, preventing accurate gas detection.

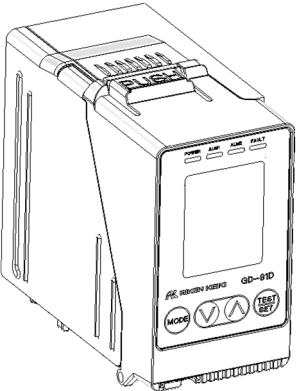
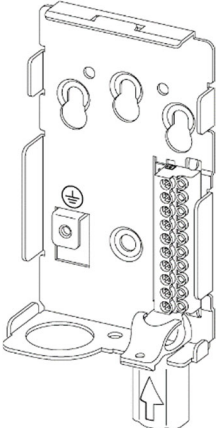
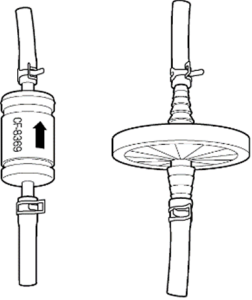
3

Product Configuration

3-1 Main unit and accessories

Open the box and packaging and inspect the main unit and accessories.

If any accessories are missing, contact RIKEN KEIKI.

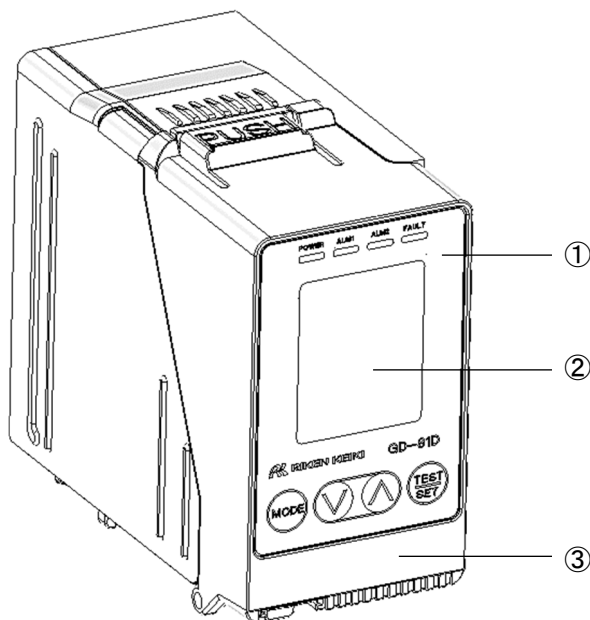
Main unit	Standard accessories		
	Wall mounting unit	Dust filter* ¹ (1)	
			Cable tie (1)
			Quick Reference Guide (1)

*1 One dust filter is supplied. The dust filter supplied will differ depending on the model.

3-2 Part names and functions

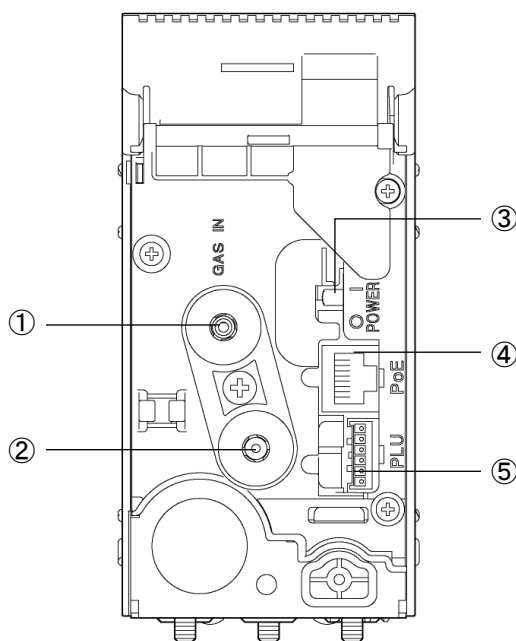
3-2-1 Main unit part names and functions

<Front of main unit>



No.	Name	Function
①	Front panel	The LCD display and keys used to operate the product are located on this panel.
②	LCD screen	Full-dot LCD screen that displays gas concentration and other information
③	Front cover	This cover protects the units inside the main unit.

<Underside of main unit>

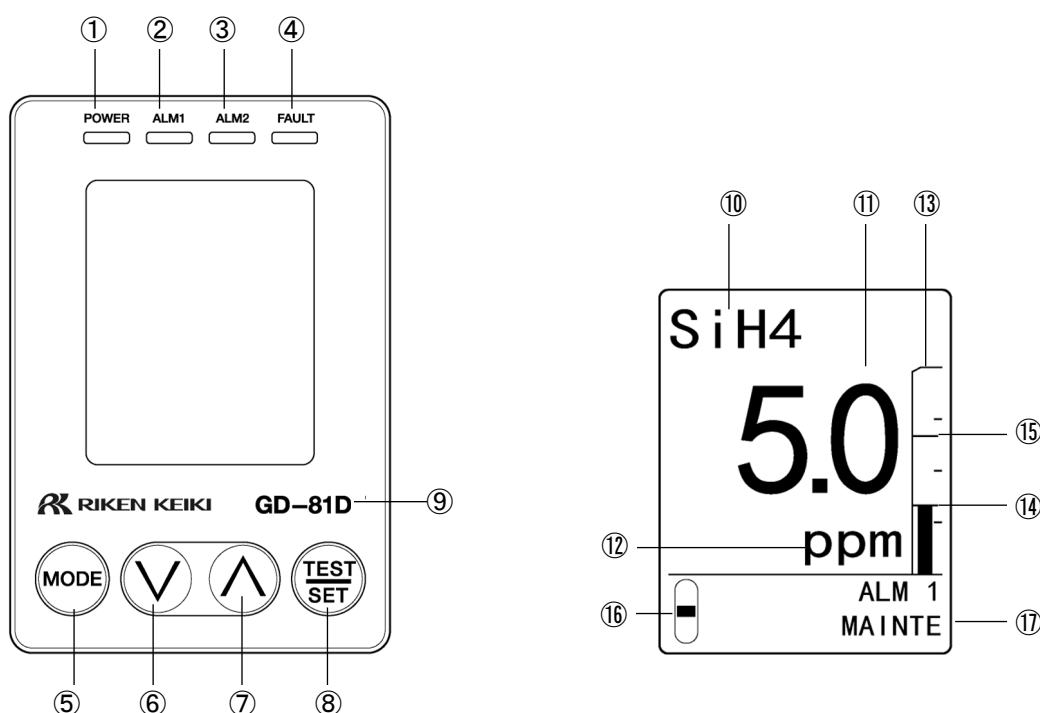


No.	Name	Function
①	GAS IN	This is the sampling pipe opening on the gas inlet side.
②	GAS OUT	This is the sampling pipe opening on the gas outlet side.
③	Power switch	Power ON/OFF switch
④	Ethernet cable connector ^{*1}	RJ-45 connector for Ethernet cable connection
⑤	Pyrolyzer unit cable connector ^{*2}	Connector for the pyrolyzer unit connection cable

*1 For the GD-81D-ETD

*2 When used with the pyrolyzer unit

3-2-2 Front panel and LCD screen part names and functions



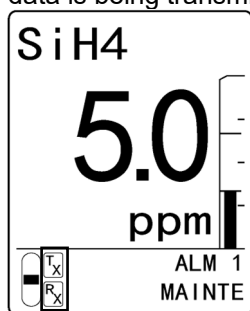
No.	Name	Function
①	Power lamp (POWER)	This is the power lamp. Lights up (green) when the power is on.
②	Alarm lamp (ALM1)	This is the ALM1 (first alarm) alarm lamp. This lights up (red) when the alarm setpoint for ALM1 (first alarm) is reached.
③	Alarm lamp (ALM2)	This is the ALM2 (second alarm) alarm lamp. This lights up (red) when the alarm setpoint for ALM2 (second alarm) is reached.
④	Fault lamp (FAULT)	This is the fault lamp. This lights up (yellow) when there is an abnormality with the product.
⑤	MODE key	Hold down in detection mode to switch to user mode. In user mode or maintenance mode, this key is used to cancel settings and to return to the previous screen. Hold down this key in user mode or maintenance mode to return to detection mode.
⑥	▼ key	Used to adjust values (DOWN)
⑦	▲ key	Used to adjust values (UP)
⑧	TEST/SET key	Hold down in detection mode to switch to the mode used to perform alarm tests. This key is used in various modes to confirm values or make settings.
⑨	Product model	This indicates the product model.
⑩	Gas name display	Displays the name of the detection target gas by chemical formula. The gas name display can be changed to suit the fitted sensors. (Refer to '7-10-24 Gas name display setting (GAS NAME)').
⑪	Concentration display	Displays the gas concentration and other information.
⑫	Units display	Displays units matching sensor specifications (ppm, ppb, vol%, %, %LEL).
⑬	Concentration bar display	The segmented detection range (full scale) displays gas concentrations as bars. It indicates concentrations as ratios of the full scale.

⑭	First alarm setpoint display	This indicates in points the first alarm setpoint as a ratio of the full scale.
⑮	Second alarm setpoint display	This indicates in points the second alarm setpoint as a ratio of the full scale.
⑯	Flow rate display	Indicates the suction flow rate. The suction is 0.5 L/min (standard flow rate) when the suction flow rate indicator bar is positioned in the middle.
⑰	Maintenance display section	Setting details are displayed in user mode and maintenance mode. Alarm contacts are disabled when [MAINTE] is displayed.

* The screen display examples used in this operating manual show SiH₄ as the example detection target gas.

<Communication display> **ETD**

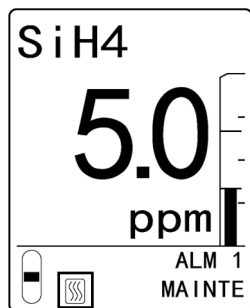
Icons in the maintenance display section indicate whether the product is transmitting or receiving when data is being transmitted or received to/from upstream devices.



Icons indicating data is being transmitted/received

<Pyrolyzer unit connection display>

An icon appears in the maintenance display section when the pyrolyzer unit (PLU-80) is connected.



Icon indicating pyrolyzer unit connection

NOTE

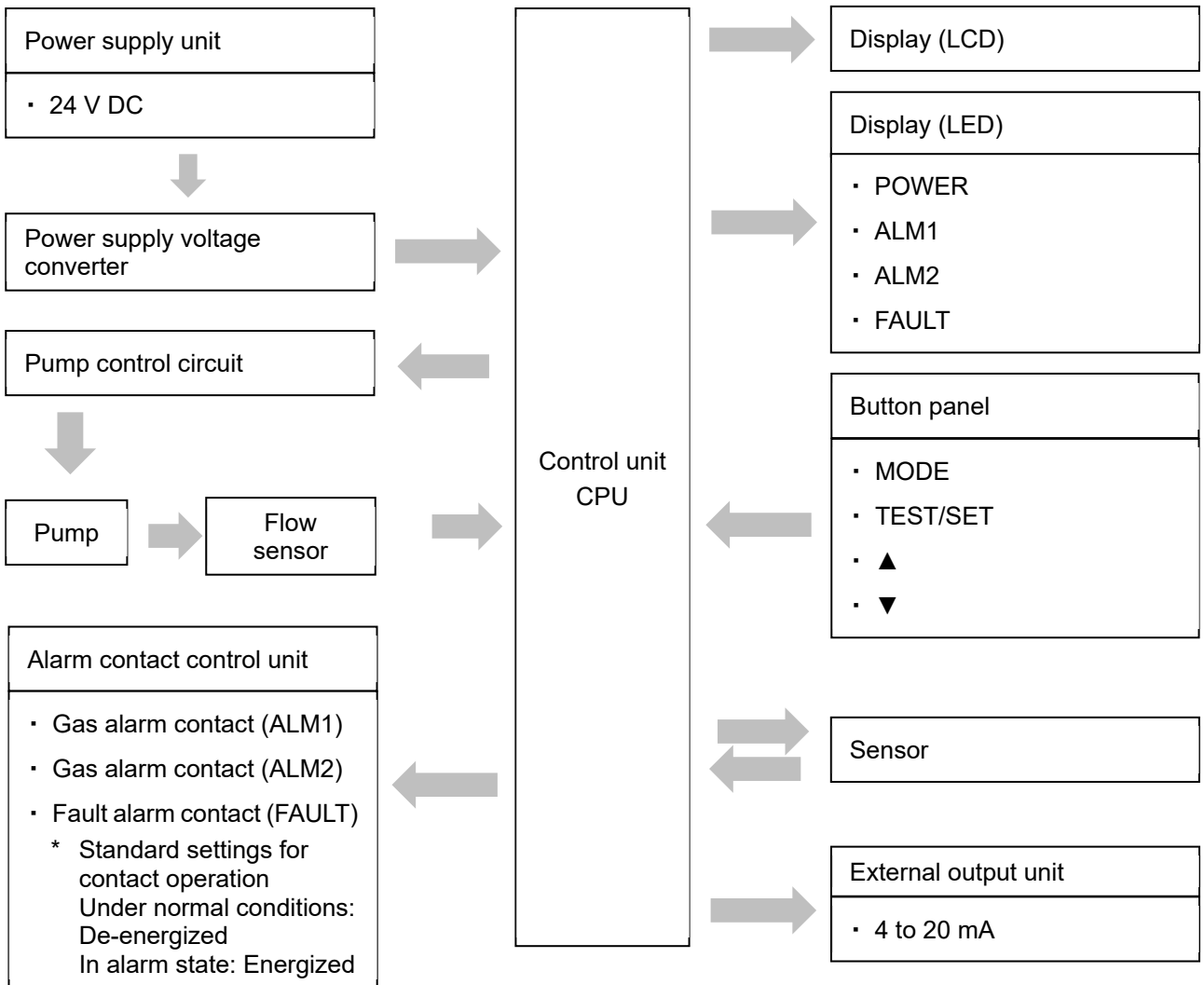
- ▶ The suction flow rate for the product is automatically adjusted by the automatic flow adjustment function. The flow rate is automatically adjusted even if the flow rate display deviates from the stipulated flow rate. No flow adjustment is normally required. Messages indicating [FLOW] (flow instability) or [E-51] (flow abnormality) are displayed if pipe blockages, leaks, or other factors prevent automatic adjustment. If this happens, identify the cause, then adjust manually until the flow reaches the stipulated value. (Refer to '7-6-2 Manually adjusting the flow rate (FLOW)').

3-3 Block diagrams

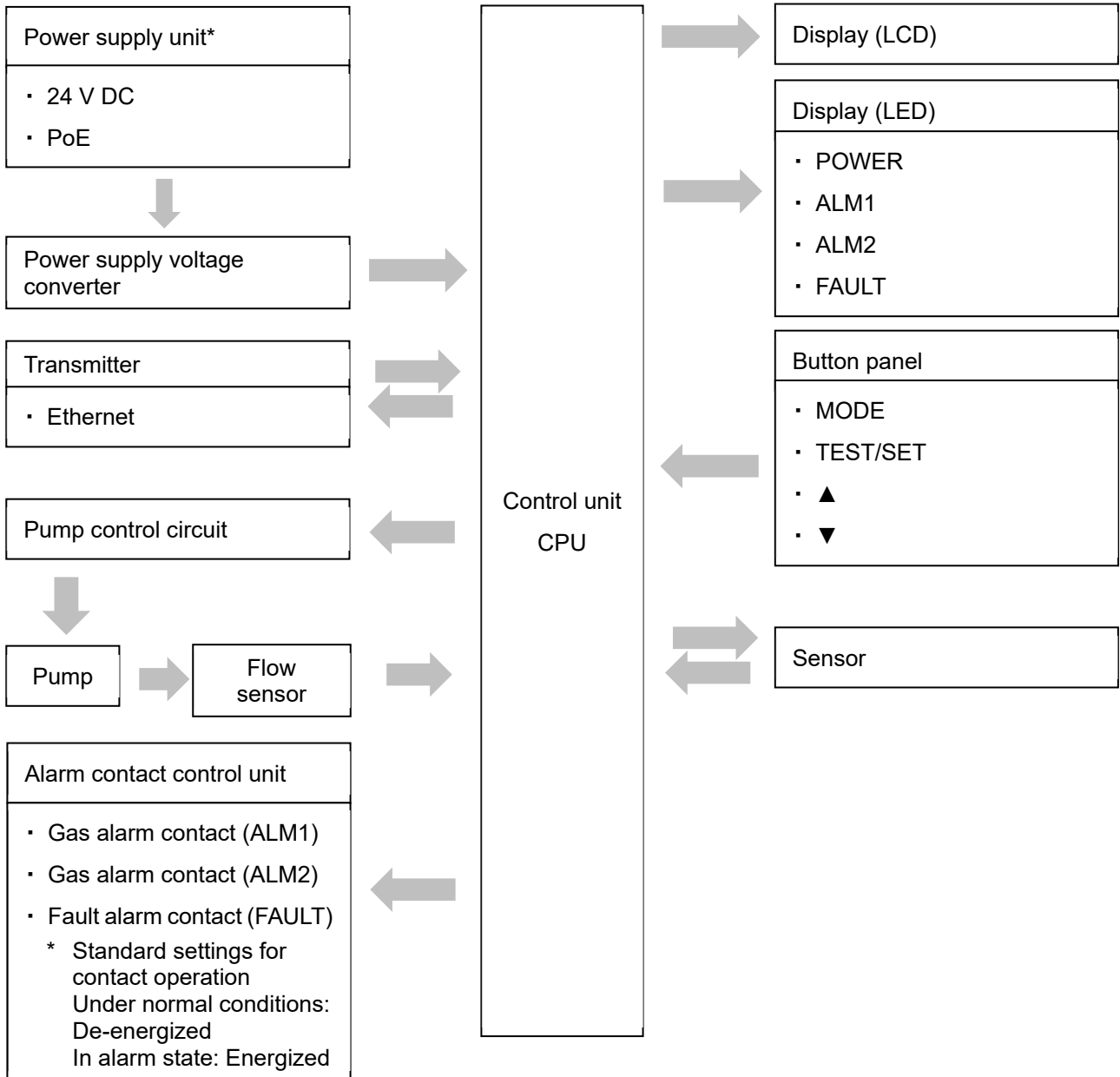
3-3-1 Electrical system diagrams

The product's electrical system diagrams are provided below.

<GD-81D>



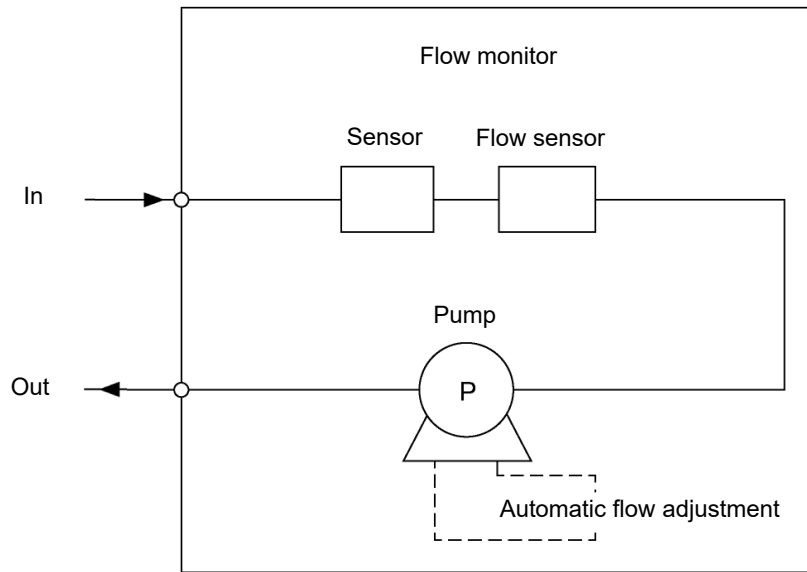
<GD-81D-ETD>



* Do not supply power via a 24 V DC power source and PoE connection at the same time.

3-3-2 Piping diagram

The product's piping diagram is provided below.



4

Installation

4-1 Installation precautions

Be sure to the following precautions before installing.
Failure to observe these precautions may result in product failure and/or inability to detect gas correctly.



CAUTION

- The product is a precision device. Certain conditions at the location (environment) where the product is installed may prevent optimum performance. Assess conditions at the installation location and take necessary measures accordingly.
- The product plays a key role in safety and disaster prevention. Install the required number of units at appropriate locations to ensure efficacy.
- Areas where gas is likely to leak or accumulate may differ depending on the gas type and the work area. Install products after duly considering the location and number of units.

<Do not install in locations subject to vibration or impact>

The product contains precision electronic components. Install the product in a stable location not exposed to vibration, impact, or risk of falling.

<Do not install in locations exposed to water, oil, or chemicals>

Avoid installing in locations associated with risk of splashing water, oil, chemicals, or other liquids.

<Do not install in locations where temperatures can fall below -10 °C (14 °F) or exceed 40 °C (104 °F)>

The operating temperature range for the product is between -10 °C (14 °F) and 40 °C (104 °F). Install in a location where temperatures will not exceed the operating temperature range.

* The operating temperature range may vary depending on the sensor. Check the sensor specifications. (Refer to '11-2 Sensor specifications'.)

<Do not install in locations exposed to direct sunlight or sudden temperature changes>

Avoid installing in locations subject to direct sunlight or radiant heat (infrared radiation from high-temperature bodies) or in locations subject to sudden temperature changes.

Condensation may form inside the product, or the product may be unable to adjust to sudden temperature fluctuations.

<Install away from noise-emitting devices (main unit and cables)>

Install away from locations where high-frequency or high-voltage devices are present.

Failure to do so may result in electromagnetic interference.

<Do not install in locations where maintenance is hazardous or not possible>

The product requires regular maintenance.

Do not install in the following or similar locations where maintenance is hazardous or not possible:

- Within systems where the system must be stopped for maintenance
- Locations where part of the system must be detached to allow maintenance
- Locations where the product cannot be removed due to the presence of pipes or racks
- Locations where maintenance work is hazardous—for example, near high-voltage cables

<Do not install in an improperly grounded system chassis>

When installing within a system chassis, be sure to perform grounding work equivalent to Class D.

<Do not install in the presence of miscellaneous gases>

Do not install the product in locations where miscellaneous gases are present.

<Do not use cleaning agents when cleaning the product>

When cleaning the product, do not use cleaning agents.

4-2 System design precautions



CAUTION

- An unstable power supply or noise may result in malfunctions or false alarms.
- Consider the details described in this section before designing a system that uses the product.

<Use a stable power source>

The product's external output and alarm contacts may activate while the system stabilizes at power-on or after an instantaneous power failure. If you do not want the external output and alarm contacts to activate, use a UPS (uninterruptible power system) or take appropriate measures on the receiving end.

Supply this product with any of the following power sources:

Power supply voltage	GD-81D: 24 V DC \pm 10 % (main unit terminal voltage) GD-81D-ETD: 24 V DC \pm 10 % (main unit terminal voltage) or PoE connection (not to be supplied simultaneously)	
Time allowed after instantaneous power failures	Up to approx. 10 ms*	Example of countermeasure: Deploy an external UPS (uninterruptible power system) or similar to guarantee continuous operation and functionality.
Miscellaneous	Do not use with power sources subject to very high power loads or high frequency noise.	Example of countermeasure: Where necessary, use a line filter or other device. Keep the product away from noise sources.

* To recover from an instantaneous power failure exceeding 10 ms, restart the product.

<Design accounting for heat dissipation>

If you plan to install the product in a closed instrument panel or similar space, install ventilation fans at the top and bottom of the panel.

Install the fans so that the temperature inside the instrument panel remains below 40 °C (104 °F), taking into account the heat produced by the product itself.

<Lightning protection>

In factories or plants where cabling is configured as follows, damage may result in the event of lightning strikes. The cables connected to the product may function as receiving antennas for the lightning:

- When cables are installed outdoors
- When cables are installed in the same duct as cables supplied from outside

Lightning strikes may damage devices connected to the cables. Additionally, note that inductive lightning surges due to lightning strikes cannot be entirely prevented, even if cables are installed in metal ducts or buried underground. While it is not possible to completely protect against lightning disasters, the following protective measures are available:

<Protection against lightning>

Take appropriate measures based on environmental conditions and the importance of the facility.

- Passing the signal transmission path through optical fiber, etc.
- Protection using a lightning arrester (cable safety retainer)

A lightning arrester (cable safety retainer) can be installed before the field devices and central processing equipment to safeguard against inductive lightning surges transmitted through the cable. For information on how to use lightning arresters, please contact the manufacturer.

<Grounding>

Surge noise is caused by lightning strikes and other factors. This product must be grounded to protect against these factors.

NOTE

- ▶ Lightning arresters contain circuitry to remove voltage surges that could potentially damage field devices. For this reason, installing a lightning arrester can attenuate signals. Perform an operation check before installing lightning arresters. Additionally, lightning arresters cannot remove all surge voltages.

<Use alarm contacts correctly>

The alarm contacts on this product are designed to transmit signals to activate external buzzers, alarm indicators, revolving lights, etc.

Do not use for control purposes (e.g., controlling shutoff valves).

CAUTION

- When relay contacts are to be left in a constantly closed state, burning may occur at the contacts with minimal vibration.
- A de-energized b contact (break contact) may cause a momentary open operation due to external forces or other physical impact. (Refer to '7-10-6 Energized/de-energized setting (RLY PTRN)'.)
- If a b contact is used as an alarm contact, implement measures to account for such momentary operation—for example, add a delay operation (of approximately one second) to the signal on the b contact receiving side.

The alarm contact specifications of the product assume resistance loads. If the alarm contacts use inductive loads, a counter-electromotive force will occur at the contacts, leading to the following potential problems:

- Relay contact welding, insulation failure, contact failure
- Damage to electrical components due to high voltages occurring inside the product
- Malfunctions due to CPU runaway

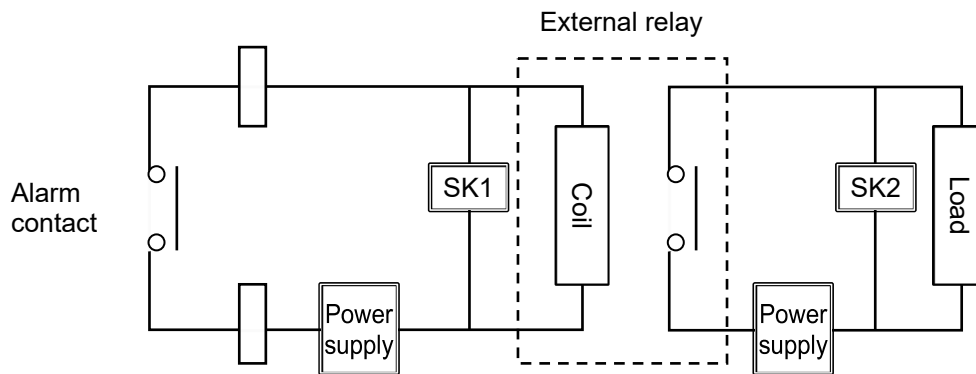
CAUTION

- As a rule, do not use the alarm contacts of the product to operate inductive loads. In particular, never use to operate devices like fluorescent lamps and motors.
- If operating inductive loads, link using an external relay (contact amplification). However, since the external relay coil also constitutes an inductive load, use a relay that runs on low voltage (within 100 V AC) and a suitable surge protector (CR circuit, etc.) to protect the contacts of this product.

When operating a load, stabilize the operation of this product, then take the following measures, where appropriate, to protect the alarm contacts.

- Link the circuits (contact amplification) using an external relay (not exceeding 24 V DC). Add a surge absorber (SK1) appropriate for the rating to the external relay.
- Where necessary, add a surge absorber (SK2) to the load side of the external relay.
- In certain cases, due to load conditions, it may be preferable to attach the surge absorber to the contact side. Confirm load behavior and determine the optimal attachment point.

<On the GD-81D>



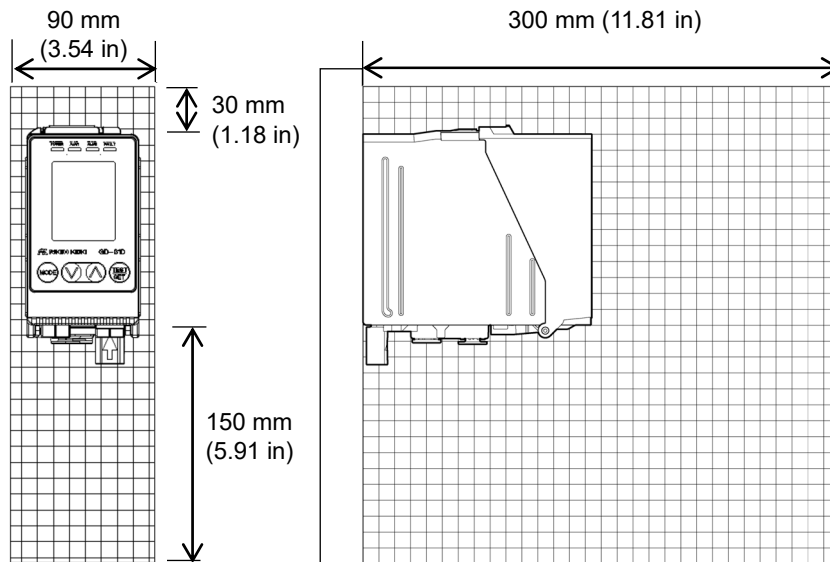
* SK1, SK2: Surge absorbers

4-3 Providing maintenance space

When installing the product, make sure there is space for maintenance.

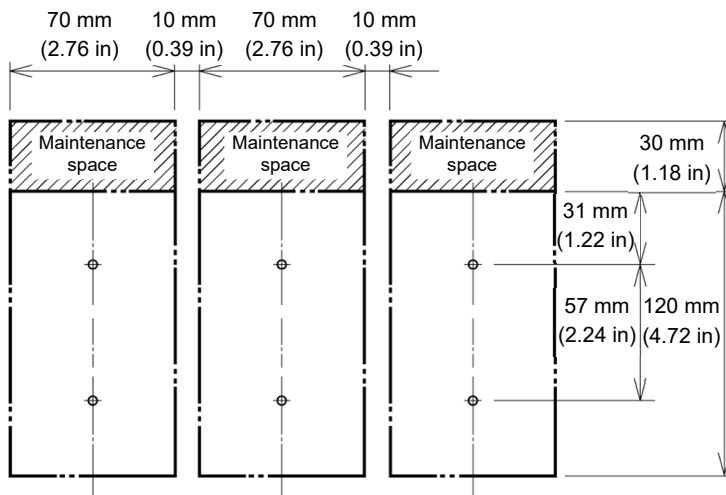
4-3-1 Maintenance space

<When installing one unit of this product>

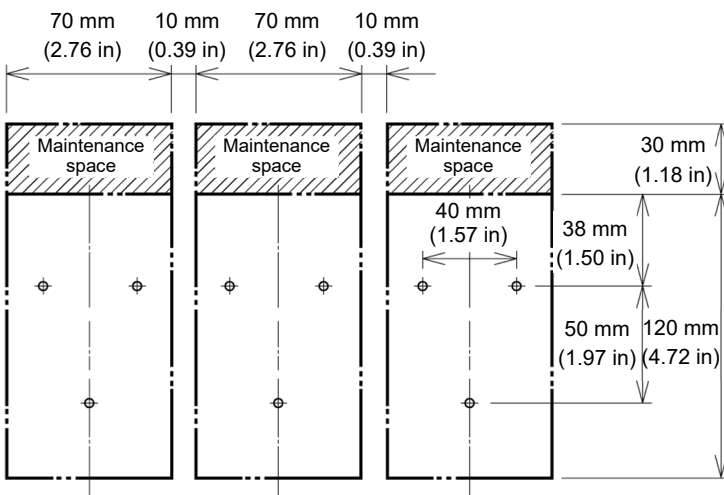


<When installing multiple units of this product in series>

<When installing each unit with two screws>



<When installing each unit with three screws>



CAUTION

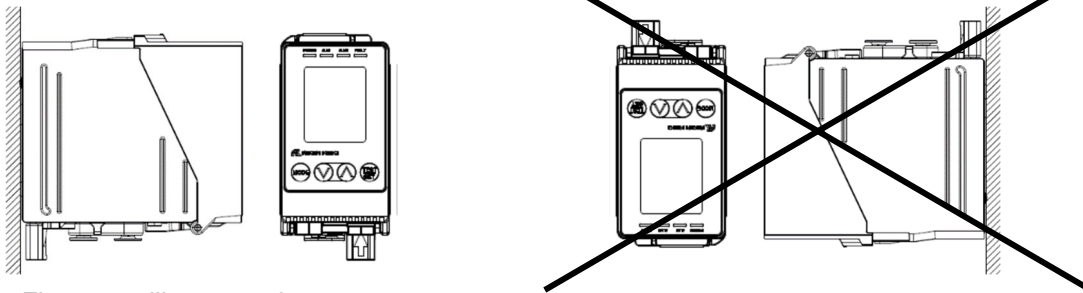
- We recommend installing at a minimum pitch of 10 mm (0.39 in). Leave a gap of at least 5 mm (0.20 in).
If a wall is located either to the left or right end of the installed series of units, leave 10 mm (0.39 in) or more between the wall and the left or right end of the installed units.
- To install multiple units of the product in series, install on a rack or wall to protect against vibrations. If the rack or wall on which the product units are installed lacks sufficient strength, the vibration of the built-in pumps may generate resonance between the units. If this occurs, take appropriate measures—for example, reinforcing the rack or wall.

4-4 Main unit installation

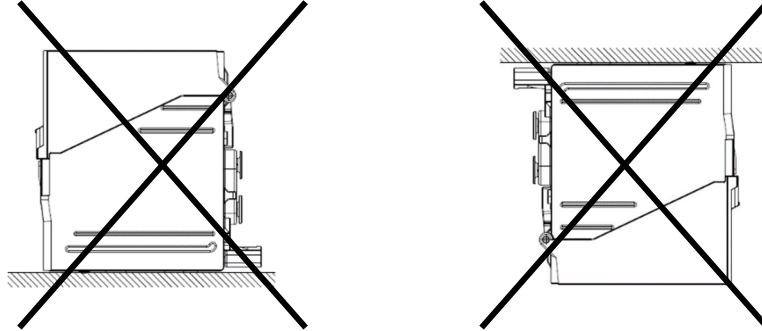
CAUTION

- For performance reasons, this product must be installed facing in a particular direction. Install the product horizontally as shown in the figure below. Keep the product oriented horizontally as shown in the figure below when carrying, temporarily removing, or relocating the product.

<Wall mounting>



<Floor or ceiling mounting>



4-4-1 Installing the main unit

Attach the wall mounting unit to the wall, then attach the main unit to the wall mounting unit.

<Recommended attachment screws>

- Screw type: M5
- Screw length: 8 mm (0.31 in) or more
- Plain washer: O.D. 10 mm (0.39 in) or less (small round)

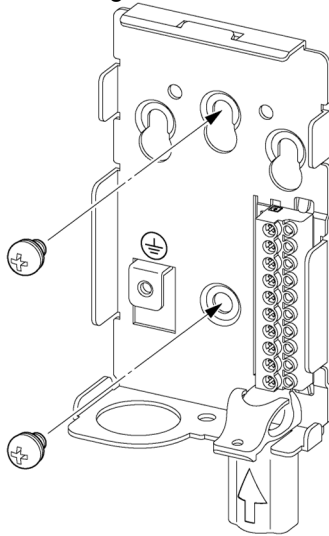


CAUTION

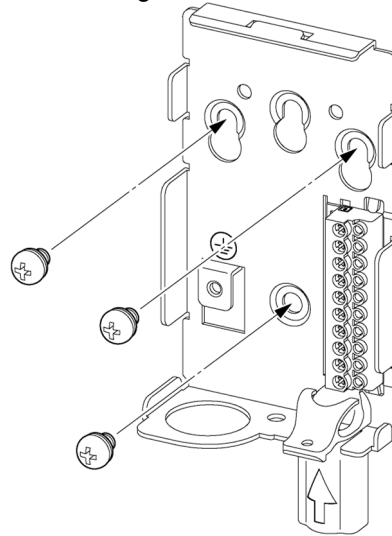
- Install the wall mounting unit so that no gap remains between it and the installation surface. A gap may result in unnecessary vibrations and noise.
- Attach the main unit to the wall mounting unit using the specified method.
If it is not installed using the specified method, the wall mounting unit may deform and may not be able to securely hold the main unit.

1 Secure the wall mounting unit to the installation surface with two or three M4 or M5 screws.

<Securing with two screws>

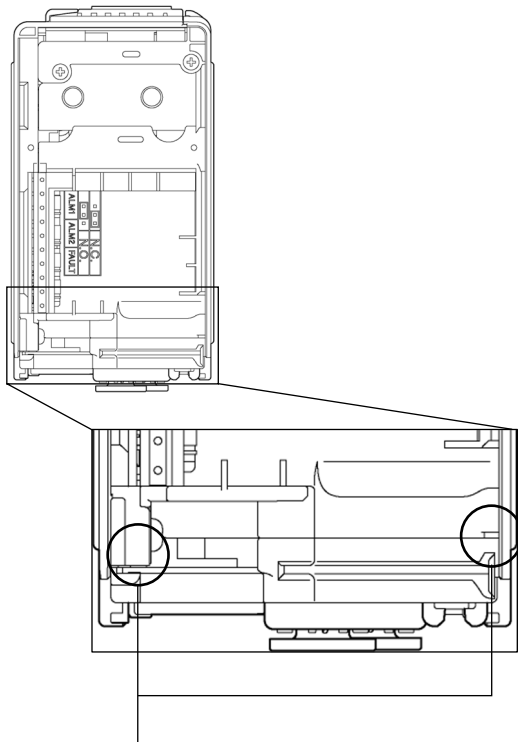


<Securing with three screws>

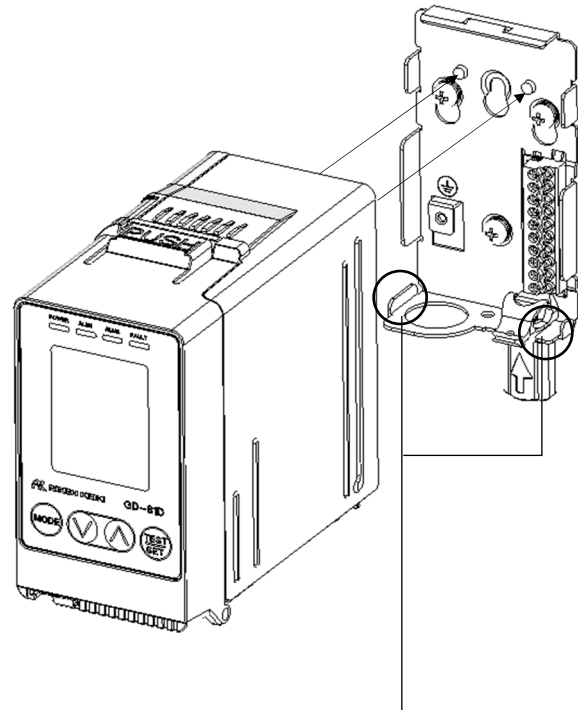


2 Mount the main unit to the wall mounting unit.

Place the bottom of the main unit on the wall mounting unit, then push in horizontally.



Parts mounted on wall mounting unit



Place bottom of main unit rear
(See diagram on left)

3 Check to confirm that the main unit is secure.

Pull the main unit lightly toward you to confirm that it is securely fitted to the wall mounting unit.

4-5 Sensor fitting

4-5-1 Sensor types

The product can be fitted with an F sensor, U sensor, or M sensors (two ESF sensors).

The sensor shape varies depending on the specifications.



CAUTION

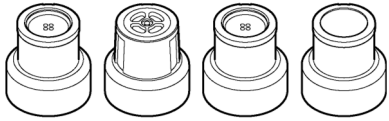
- From a quality and safety standpoint, handle the sensor used with the product with care. To perform storage management, equipment such as a dedicated storage compartment for the sensor and an energizing device is required. As a rule, avoid handling or storing the sensor removed from the product. Contact RIKEN KEIKI to request sensor handling.
- Take particular care not to fit the sensor incorrectly. [C-02] is displayed on the LCD when a sensor is fitted that relies on a different detection principle or has different specifications from those at the time of shipping. If [C-02] is displayed, check the sensor specifications.
- Be sure to perform gas adjustment (zero adjustment, span adjustment) after sensor replacement.

NOTE

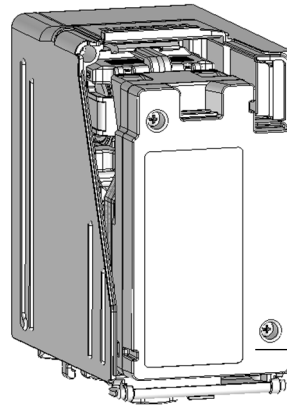
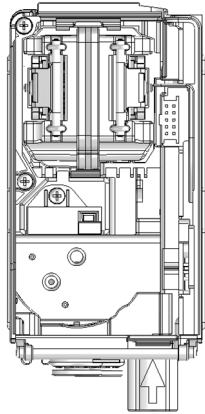
- ▶ The handling of each sensor depends on the detection principle. Contact RIKEN KEIKI for more information.
- ▶ M sensors are not supported by the GD-81D (4 to 20 mA).

<F sensors>

F sensors are used mounted in the F sensor unit.
The F sensor unit holds one F sensor.



Attach the F sensor unit to the product.



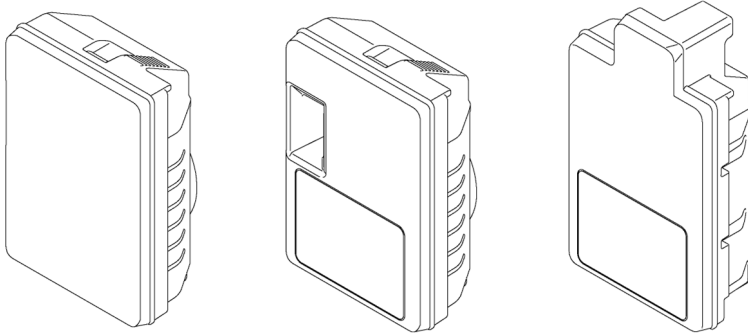
F sensor unit

NOTE

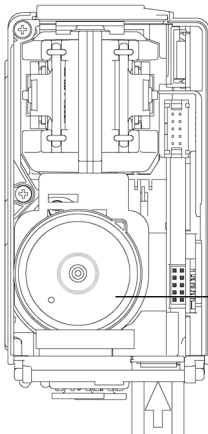
- ▶ The IRF sensor is mounted in a dedicated F sensor unit. Do not remove it from the sensor unit.

<U sensors>

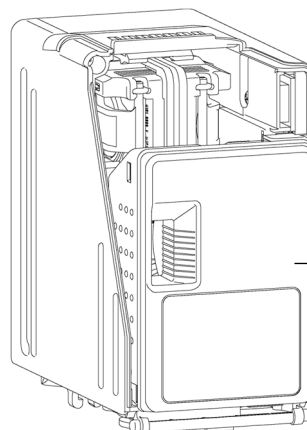
Use one of these U sensor units.



The product comes with the adapter required to attach the U sensor unit.



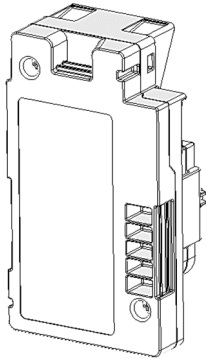
U sensor unit
attachment adapter



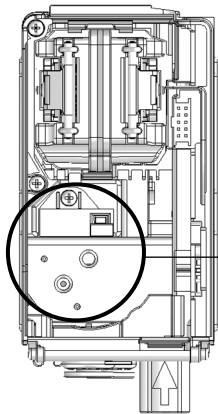
U sensor unit

<M sensors>

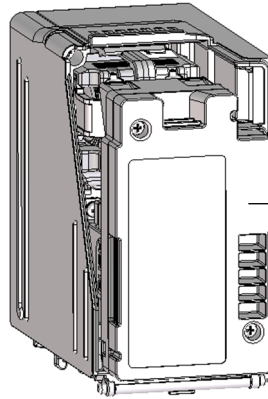
M sensors are used mounted in the M sensor unit.
The M sensor unit holds two ESF sensors.



The product comes with the adapter required to attach the M sensor unit.



M sensor unit attachment adapter



M sensor unit

4-5-2 Fitting an F sensor

When using an F sensor, mount it in the F sensor unit.

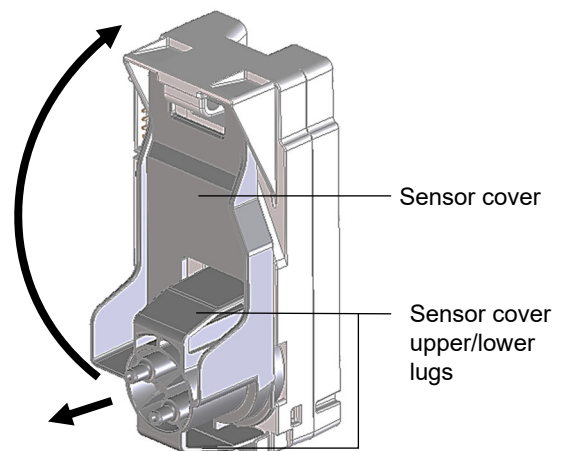
The IRF sensor does not need to be mounted, as it is contained in a dedicated F sensor unit. Do not remove the IRF sensor from the dedicated F sensor unit.

CAUTION

- The F sensor incorporates precision components. Be careful to avoid dropping the F sensor when mounting. Dropping or exposing to strong impact may cause the sensor to malfunction. Dropping or exposing to strong impact may also impair sensor performance.

<F sensor model>

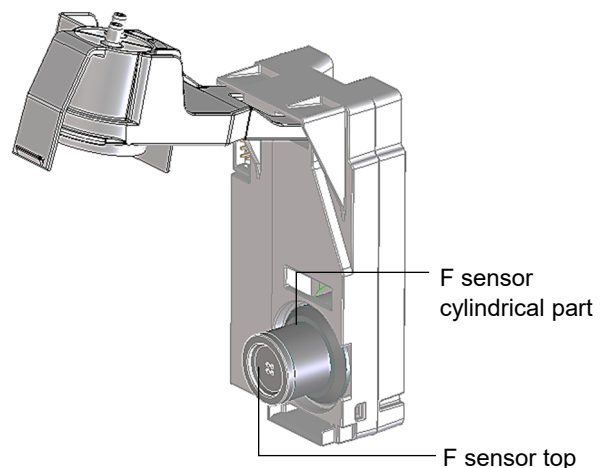
- 1 Grasp the upper and lower lugs on the F sensor unit sensor cover, then pull out toward you, lift up, and open.**



- 2 Attach the F sensor.**

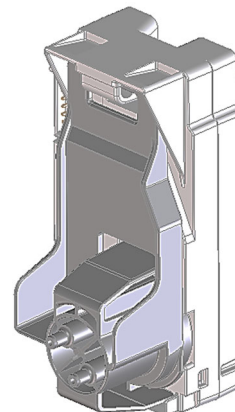
Grip the cylindrical part of the sensor. Match the face of the connector on the sensor unit to the connector on the F sensor, then push in firmly to secure into place.

Avoid pressing on the top of the F sensor while doing this. Doing so may damage the sensor.



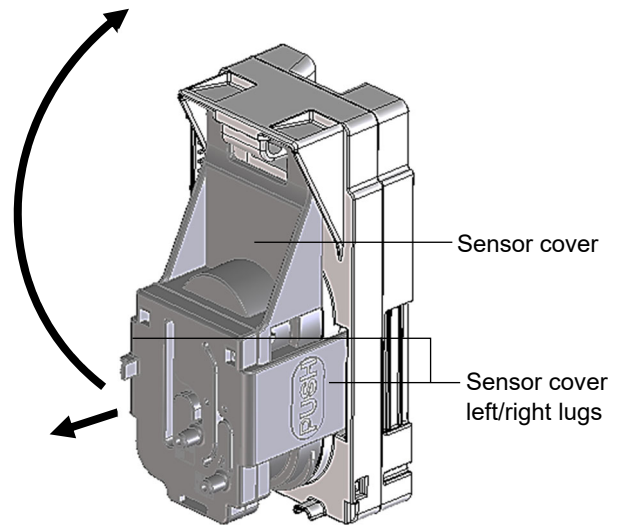
- 3 Return the sensor cover to its original position.**

Close the sensor cover firmly so that it clicks back into place.



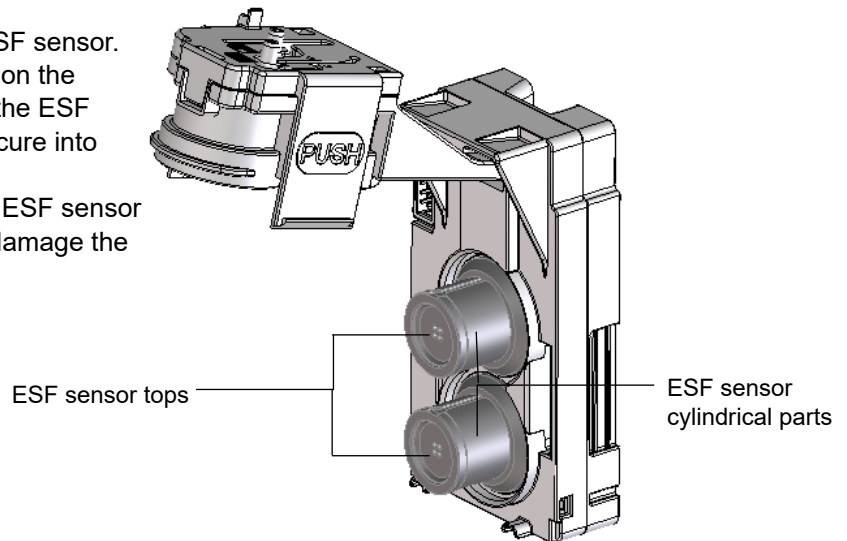
<M sensor model>

- 1 Grasp the left and right lugs on the M sensor unit sensor cover, then pull out toward you, lift up, and open.**



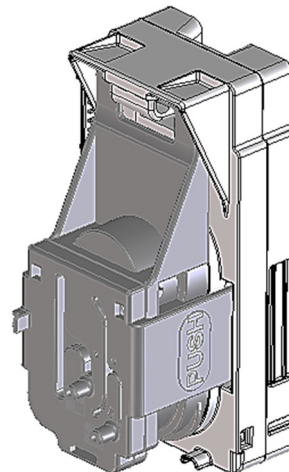
- 2 Attach ESF sensors.**

Grip the cylindrical part of the ESF sensor. Match the face of the connector on the sensor unit to the connector on the ESF sensor, then push in firmly to secure into place. Avoid pressing on the top of the ESF sensor while doing this. Doing so may damage the sensor.



- 3 Return the sensor cover to its original position.**

Close the sensor cover firmly so that it clicks back into place.



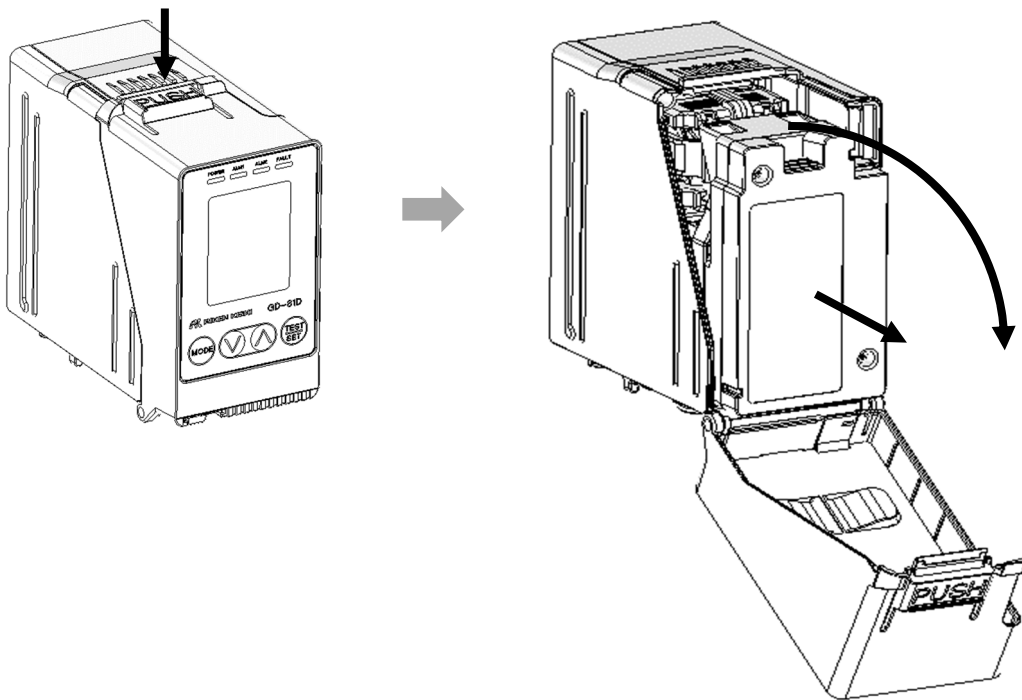
4-5-3 Mounting the sensor unit

CAUTION

- Each sensor unit incorporates precision components. Be careful to avoid dropping the sensor unit when mounting. Dropping or exposing to strong impact can cause the sensor unit to malfunction. Dropping or exposing to strong impact may also impair sensor performance.

1 Push the projection on the top of the main unit and pull it toward you to open the front cover.

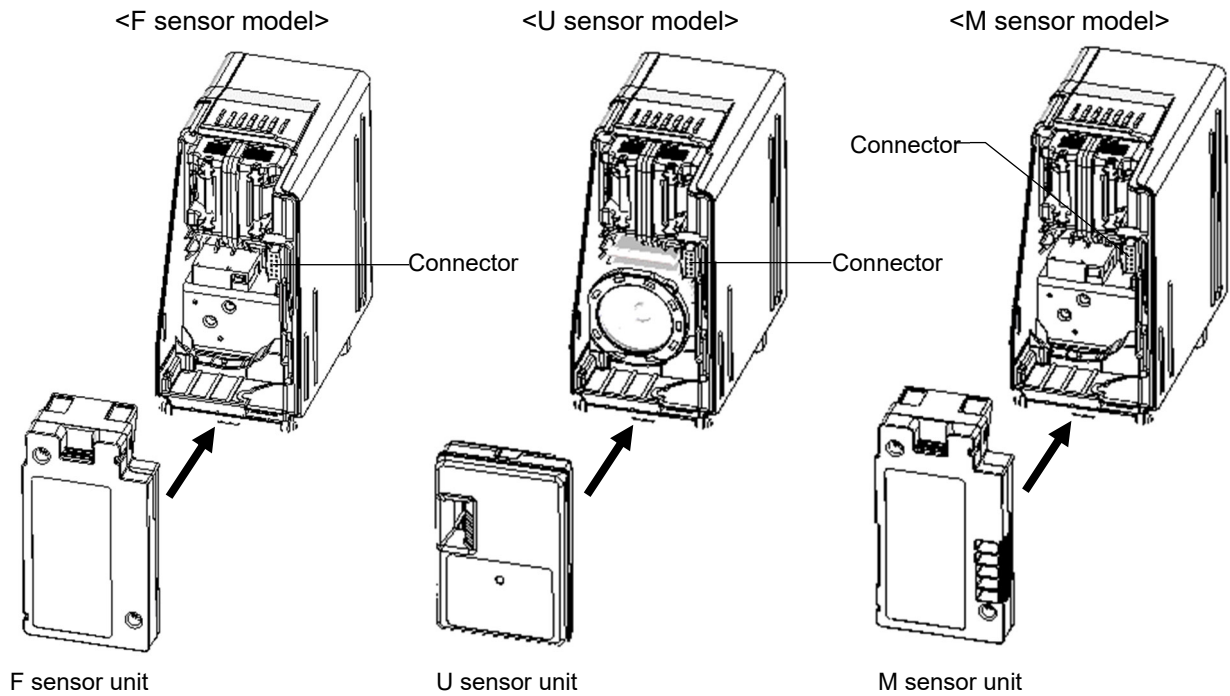
The front cover opens to approximately 120°. Push further down to open to 170°.



* The diagram illustrates the F sensor model.

2 Connect the sensor unit correctly to the connector on the main unit to attach the sensor unit.

Align the sensor unit correctly, then push in firmly to secure in place.



3 Close the front cover on the main unit.

Close the front cover firmly so that it clicks back into place.

4-6 Wiring procedure



CAUTION

- Take care to avoid damaging internal electronic circuits during wiring work. Additionally, avoid excessive cable weights or cable routing that may generate excessive stress.
- Do not route the power cable and signal cable alongside power lines for motors or similar equipment.
If you must lay the cables to run parallel, pass the power cable and the signal cable through a metal conduit. Additionally, ground the conduit.
- If using stranded cable, ensure strands from one core do not make contact with the other core strands.
- Use the specified wiring tools to perform wiring.

4-6-1 Recommended cables

<GD-81D>

Communication method	Recommended cable
Power supply	1.25 mm ² (AWG16) 2-core cable
4 to 20 mA	1.25 mm ² (AWG16) shielded cable
Contact	1.25 mm ² (AWG16) cable

<GD-81D-ETD>

Communication method	Recommended cable
PoE	Ethernet cable (category 5 or better)
Power supply	1.25 mm ² (AWG16) 2-core cable
Contact	1.25 mm ² (AWG16) cable

4-6-2 Terminal plate specifications

<Terminal plate>

1	2	3	4	5	6	7	8	9	10
+	-	+	-	+	-	+	-	+	-
24 V DC		4 to 20 mA*		ALT1		ALT2		FAULT	

* Can be used only with the GD-81D. Not connected with the GD-81D-ETD.

NOTE

- ▶ With the GD-81D-ETD, 24 V DC terminals 1 and 2 are unusable (connection prohibited) when using PoE connection.

<Terminal plate specifications>

- Rated voltage: 400 V
- Rated current: 10 A

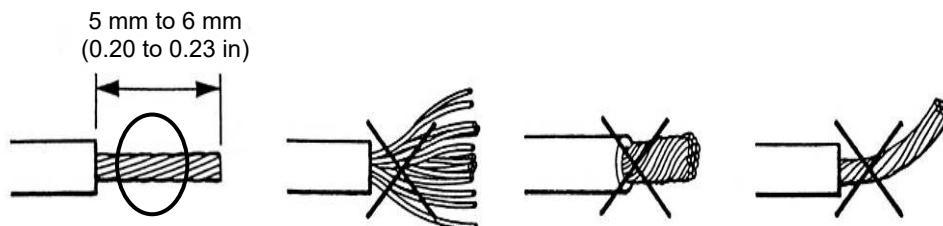
<Connecting conditions>

- Solid wire cable, flexible stranded wire: 0.2 mm² to 1.5 mm²
- Flexible stranded wire fitted with ferrule: 0.25 mm² to 1.25 mm²
- Stripped wire length: 6 mm
- Screw tightening torque: 0.35 Nm to 0.4 Nm
- Wiring tool: SZF 1-0,6X3,5 or flathead screwdriver (3.5 mm [0.14 in] wide, 0.6 mm [0.02 in] thick)

CAUTION

Be sure to strip the cable to the specified length.

- Conduction faults or overheating may result if the stripped wire length is too short and the wire is clamped incorrectly.
- Conduction faults or overheating may result if the stripped wire length is too short and the wire sheathing is clamped.
- An insulation failure or short circuit may result if the stripped wire length is too long and the wire is exposed.
- Make sure the wire does not splay. An insulation failure or overheating may result if the wire splays when inserted.



Be sure to use a terminal plate within the contact capacity and rated voltage specified for the product.

- Failure to do so may result in electric shock.

<Compatible bar terminals>

If you use a bar terminal, use the following:

When laying new wiring	<ul style="list-style-type: none"> ■ Flexible stranded wire fitted with ferrule 1.00 mm² or less <ul style="list-style-type: none"> ▪ Bar terminal model: AI1 series (manufacturer: Phoenix Contact) ▪ Crimping tool model: CRIMPFOX CENTRUS 10S (manufacturer: Phoenix Contact) ■ Flexible stranded wire fitted with ferrule 1.25 mm² <ul style="list-style-type: none"> ▪ Bar terminal model: 216 series (manufacturer: WAGO) ▪ Crimping tool model: 206-204 (manufacturer: WAGO)
When replacing wiring	<ul style="list-style-type: none"> ▪ Bar terminal model: AI1 series (manufacturer: Phoenix Contact) 216 series (manufacturer: WAGO) ▪ Crimping tool model: CRIMPFOX CENTRUS 10S (manufacturer: Phoenix Contact) 206-204 (manufacturer: WAGO)

**CAUTION**

- Be sure to use the specified bar terminals. Performance is guaranteed only for the bar terminals specified.

4-6-3 Terminal plate connections

Use the specified wiring tools to connect the cables to the terminal plate.

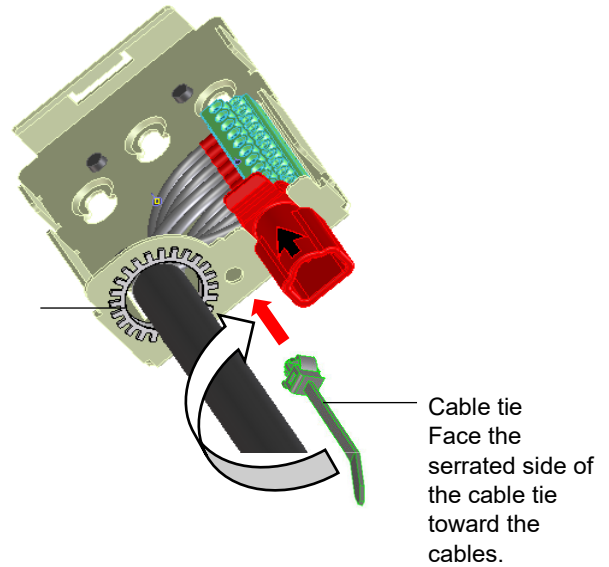
**CAUTION**

- Be sure to use the correct tools.
- As a rule, only one cable can be connected to each wire insertion hole.

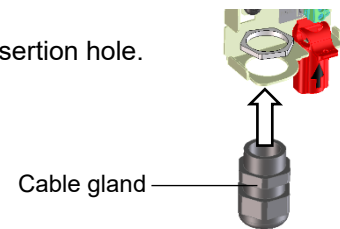
<Cable clamping method>

- 1 Insert the cable tie provided into the hole in the wall mounting unit as shown in the figure.**
Face the serrated side of the cable tie toward the cables here.
- 2 Bundle and secure the cables using the cable tie.**

Wire insertion hole
I.D. 22.8 mm
(0.898 in)

**NOTE**

- ▶ If using a cable gland sold separately, fit the cable gland to the wire insertion hole.



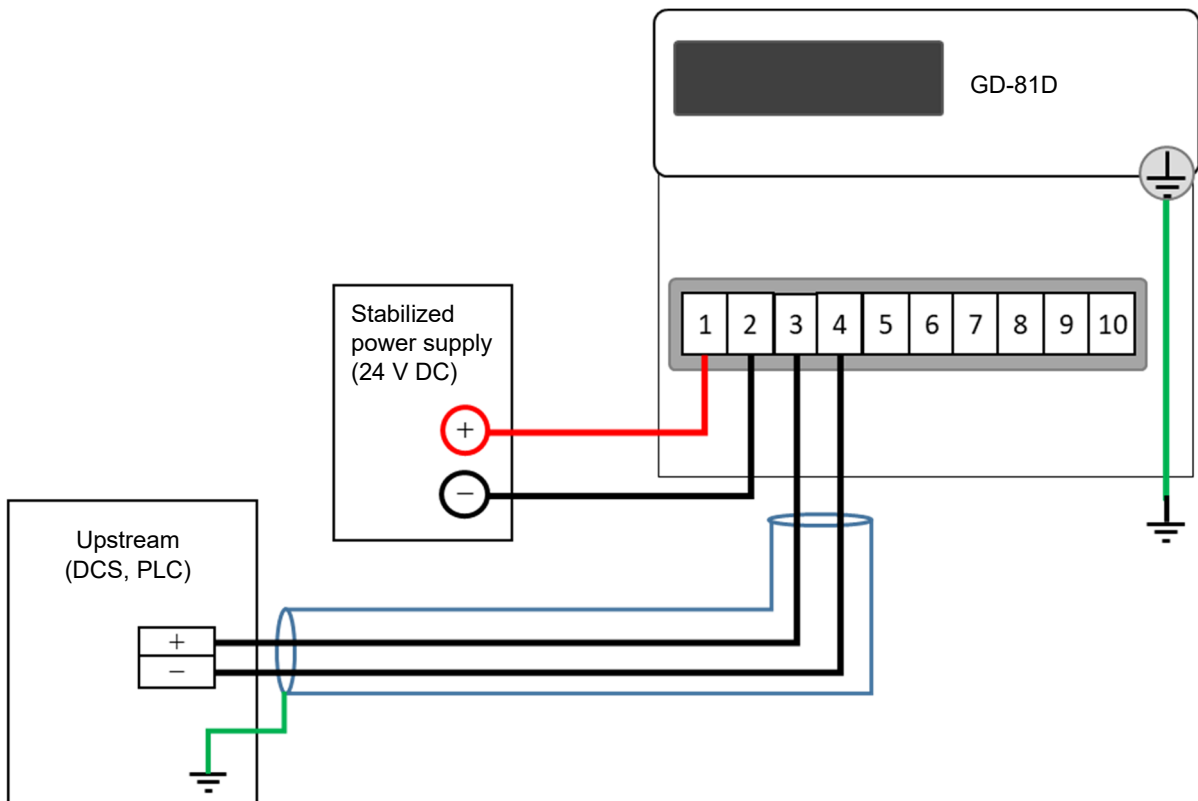
4-6-4 Grounding terminal connections



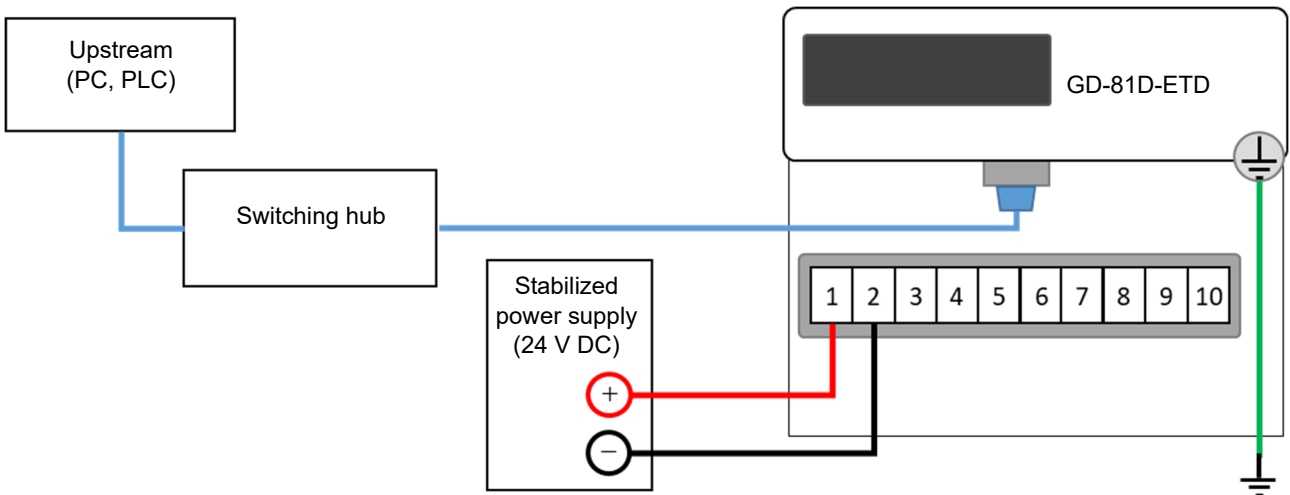
WARNING

- Be sure to ground the product before turning on the power.
- Ground the product to ensure stable operation and safety. Never connect grounding wires to gas pipes.
- Make sure the grounding is Class D or equivalent (grounding resistance not exceeding 100 Ω).
- Use cable lugs on the grounding wire to ensure safe grounding with the cable free of slack and twisting.
- Do not ground to or near the same point used to ground other high-frequency or high-voltage devices.

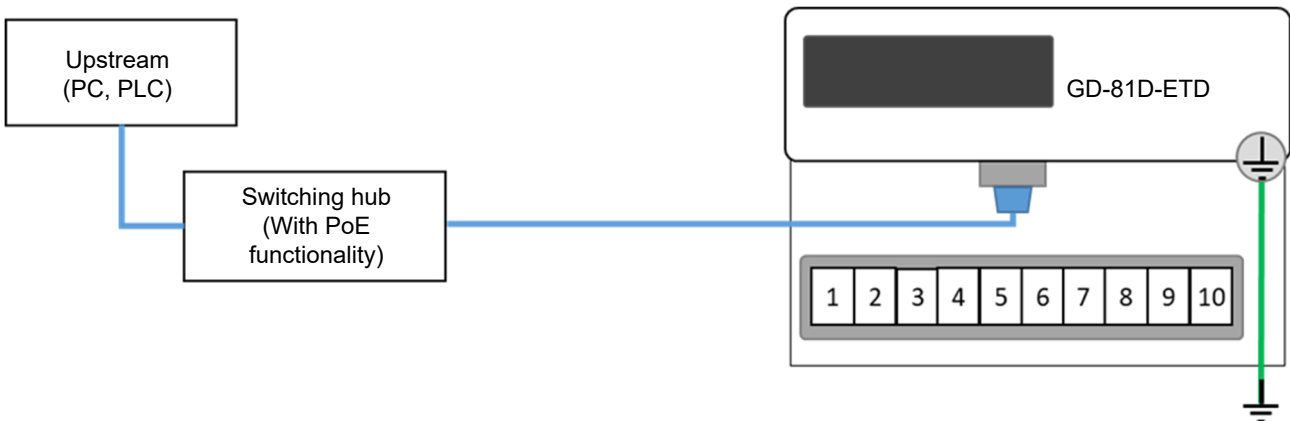
<Connection example: GD-81D>



<Connection example: GD-81D-ETD (24 V DC)>



<Connection example: GD-81D-ETD (PoE)>



* Do not supply power via a 24 V DC power source and PoE connection at the same time.

4-7 Piping procedure

Insert the compatible tubes into the sampling pipe openings (GAS IN, GAS OUT) on the product.
The compatible tubes are O.D. 6 mm (1/4 in) Teflon tubes.



WARNING

- Do not apply excessive pressure to the product's sampling pipe openings.
This product is designed to perform gas detection by drawing in gas at atmospheric pressure. Applying excessive pressure to the product's sampling pipe openings (GAS IN, GAS OUT) is hazardous. Doing so may cause the detection target gas to leak from the product.
- Discharge the gas exhausted after detection to a location determined to be safe by connecting an exhaust pipe to the detection target gas outlet (GAS OUT) located on the bottom of the main unit.



CAUTION

- Make the piping on the GAS IN side as short as possible.
The longer the piping on the GAS IN side, the more time it will take for the gas to arrive. Additionally, depending on the gas, the effects of absorption may increase, causing delays in response or readings showing reduced values.
- Make sure no condensation occurs while installing the pipes.
High humidity in the sampling source area may result in condensation within the piping. For gases that become more corrosive when dissolved in water (e.g., highly acidic gases), consequences may include impaired capacity to detect gases and corrosive damage to internal parts.
- Do not lay piping that includes U or V shaped angles. Keep this in mind when performing the installation work.
- Choose the position of the sampling inlet for the sampling gas after carefully considering gas flow inside the sampling gas line, gas generation process, and other factors.
- Be sure to fit the supplied dust filter at some point in the piping.
- Please contact RIKEN KEIKI for more information on piping length and materials.

4-7-1 Connecting tubes

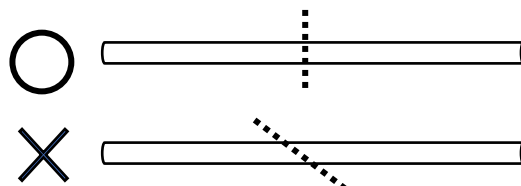
<Compatible tubes>

- Tube type: Teflon tube
- Tube diameter: O.D. 6 mm (1/4 in)
- Compatible tube external diameter tolerance: ± 0.14 mm (0.0055 in)

1 Wipe the tubes clean. Check to confirm they are not dented, scratched, crushed, burred, or scuffed.

2 Cut the tubes perpendicularly using a tube cutter.

Cutting the tubes at an angle may result in damage to the fitting seal when the tubes are inserted, leading to leaks.

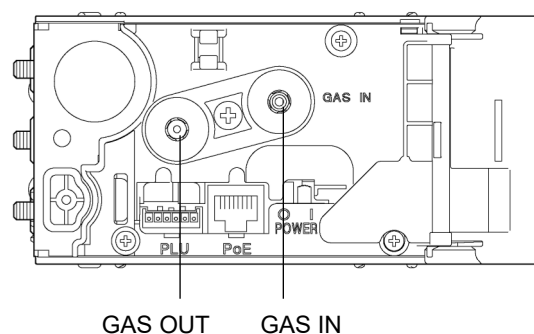


3 Insert the tubes into the sampling pipe openings (GAS IN and GAS OUT) on the underside of the product.

Insert the tube straight on and firmly to the back of the fitting.

Failure to completely insert the tubes may result in leaks.

Tube insertion length: Approx. 20 mm (0.787 in)



4 Pull gently on the tubes to confirm that they do not come loose.

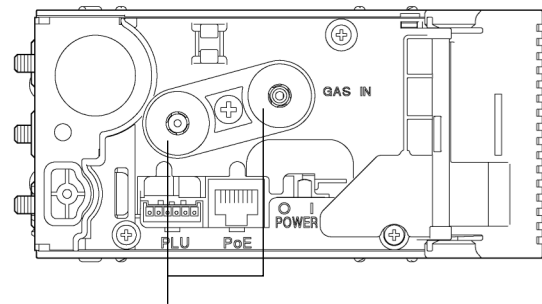
NOTE

- ▶ When pipes are cut, the cut surface may be narrower than the specified inner diameter. In this case, use a file or other implement to widen the inner diameter. Clean the pipe interior using compressed air or the like to blow off any remaining swarf before connecting to the product.
- ▶ Note that the sample gas may be highly absorptive or corrosive. Keep this point in mind when selecting piping materials.
- ▶ Within the specified range of operating temperatures, the suction flow rate for this product by itself is approximately 0.5 L/min. Please consult with RIKEN KEIKI for more information on factors such as pipe length when samples are to be drawn from distant points.
- ▶ There is a risk of damaging the Teflon tubes if the pipes are removed and reinserted. Continuing to use the tubes in this state may result in leaks. If the tubes are damaged, cut off the damaged section before reusing.
- ▶ When bundling piping using cable ties or similar, make sure no external force is applied to the one-touch quick-connect fittings. If external force is applied, leaks may occur at low temperatures.
- ▶ Adhere to the specified bending radius when installing tubing. Failure to do so may result in leaks due to kinking or bending of the tubing.

4-7-2 Removing tubes

- 1 Pull out the tubes straight with the release buttons on the underside of the product depressed.**

If the tubes are pulled out with the release buttons only partially depressed, there is a risk of scraping the tubes and damaging the couplers.

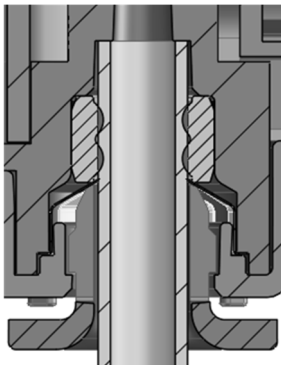


Release buttons

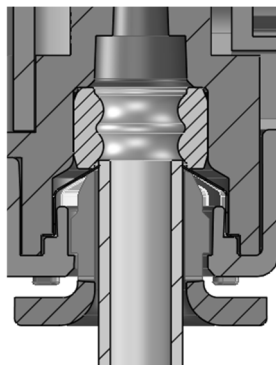
NOTE

- ▶ Note the following before reusing tubes that were previously removed:
 - The length of 9 mm (0.354 in) from the tube end affects sealing. The tube can be reused as long as this section is not dented, scratched, crushed, burred, or scuffed.
 - If the section is dented, scratched, crushed, burred, or scuffed, cut off the section perpendicularly before reusing.
 - If there are scratches on the removed tube, debris may remain inside the piping. Clean the interior of the tube using an industrial cotton swab or similar.

<Reusable>



<Not reusable>



5

Usage Instructions

5-1 Preparations for startup

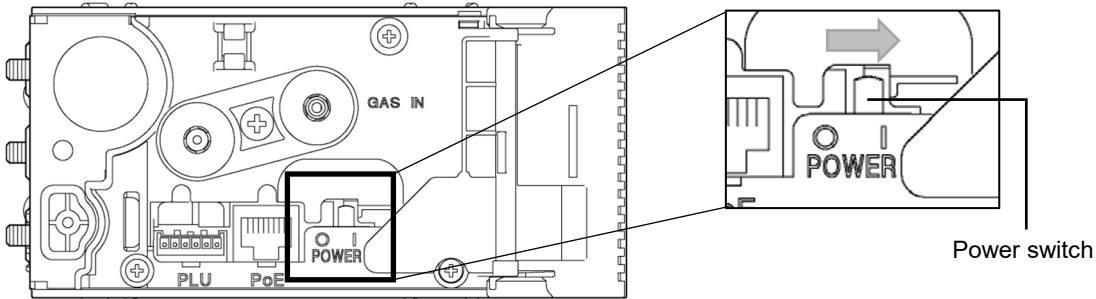
Perform the following checks before connecting the power supply.

Failure to perform these checks may result in electric shock or damage to the product.

- Check to confirm the product is grounded.
- Check to confirm that the external wiring is connected correctly.
- Check to confirm that the power supply voltage is within the rated range.
- External contacts may activate while adjustments are underway.
 - Take precautions to prevent unwanted consequences due to activated contacts.
- Check to confirm that the connected piping is free of blockages and leaks.
 - Blockages in connected pipes will generate excessive pressure on the sensors, which can lead to malfunctions or failure. Depending on the sensor, blockages may also cause fluctuations in readings and false alarms.
- If a filter is required, confirm that the correct filter is fitted properly. Make sure the filter is suitable for the detection target gas.

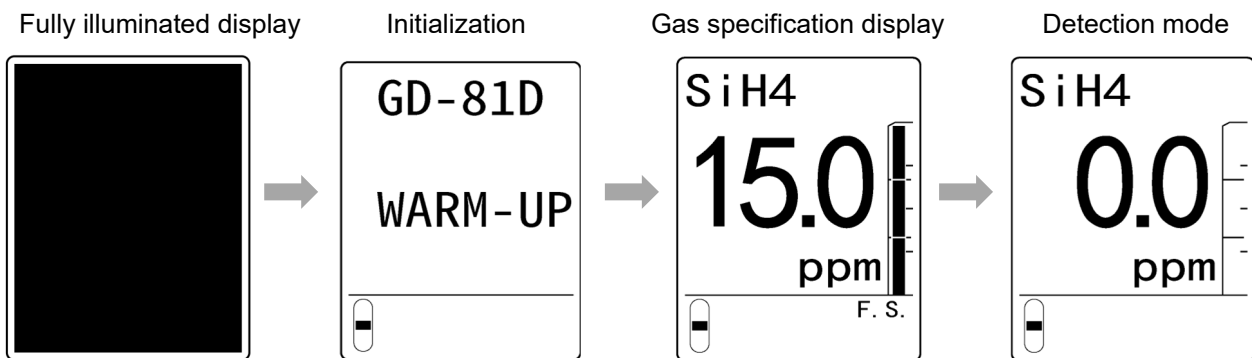
5-2 Turning on the power

To start the product, turn on the power switch on the underside of the main unit.
Before turning on the power switch, confirm that the product is properly connected to an appropriate power source.



When the power switch is turned on, the initialization process including system checks and alarm activation shutoff takes place for approximately 25 seconds, after which the product enters detection mode.

After the power is turned on, the LCD display changes automatically as shown below:



WARNING

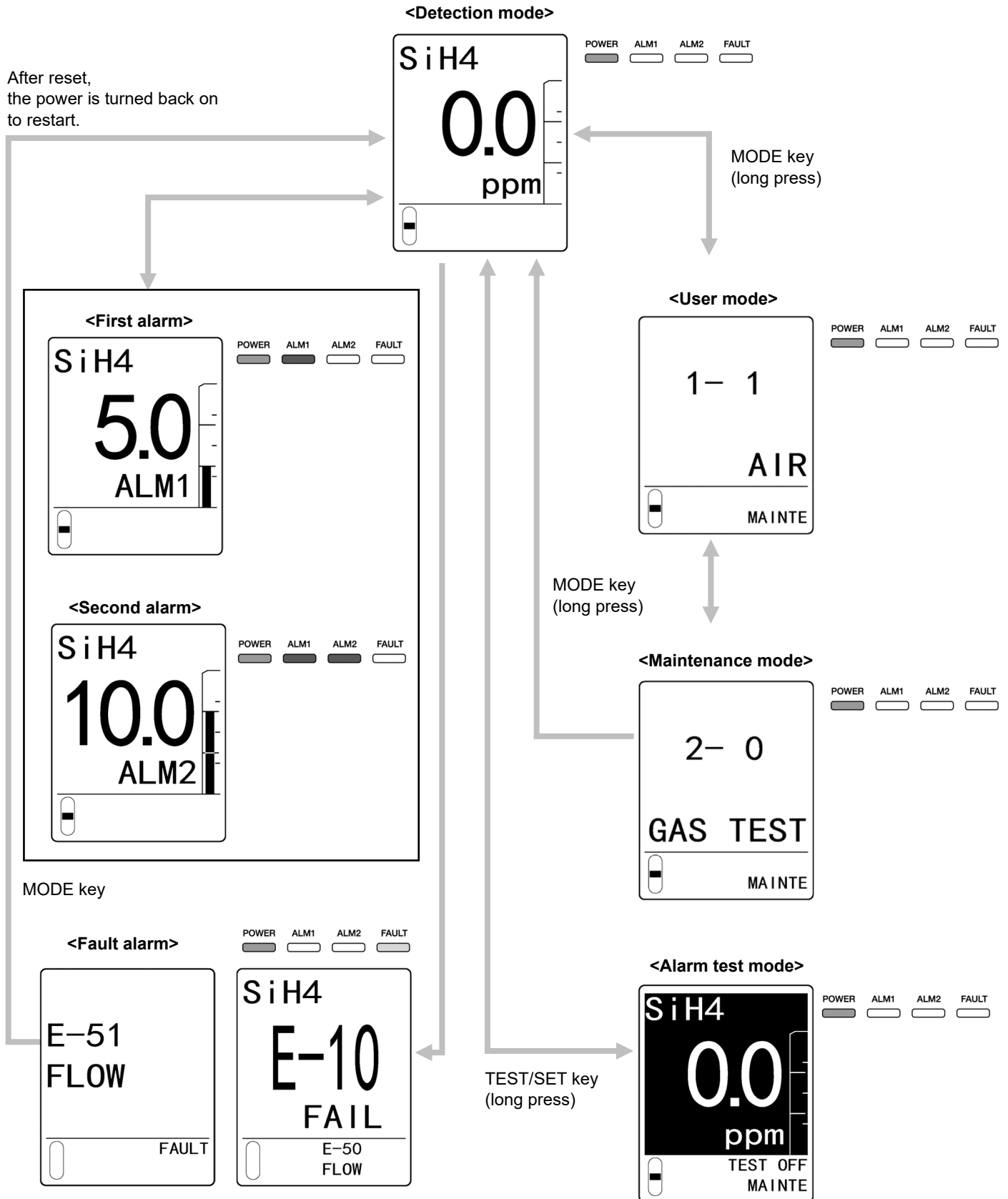
- For oxygen deficiency models, the gas specification display will indicate a value around [20.9] (vol%) when started in air. For models with alarms triggered by air output (0 – 5 vol%, etc.), an alarm may occur after starting. Take note of this.

 **CAUTION**

- Never turn off the power while initialization is underway. The sensor memory is read during initialization.
 - Depending on the sensor type, warmup may be required before startup or after replacing the sensor. Allow the product to warm up for the specified time. (Refer to '11-2 Sensor specifications'.)
 - Alarm behavior and output signals will be unstable during warmup. To avoid problems, notify any departments that may be affected beforehand.
 - Once warmup is complete, check to confirm that the flow rate display indicates the stipulated flow rate, then perform gas adjustment.
 - Depending on the conditions and how long the product was off, the reading may fluctuate immediately after the power is turned on. In this case, the reading should stabilize at zero after a while.
-

5-3 Basic operation flow

After the power is turned on, pressing the keys on the product will have the following effects.
The product normally operates in detection mode.





WARNING

- Switching from detection mode to user mode or maintenance mode while in alarm state will cancel the alarm.
-

5-4 User mode

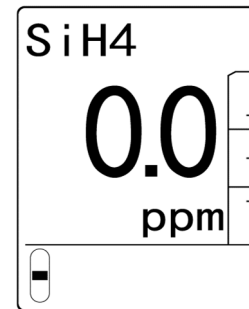
Switch to user mode to perform zero adjustment and to check various settings.

5-4-1 User mode setting items

LCD display	Setting item	Description
[1- 1 AIR]	Fresh air adjustment	Performs fresh air adjustment.
[1- 2 CONFIRM]	Setting display	Displays the current values for the following settings: <ul style="list-style-type: none"> ▪ First alarm setpoint (ALM1) ▪ Second alarm setpoint (ALM2) ▪ Alarm delay time ▪ Zero suppression value ▪ Zero follower setting ▪ Sensitivity correction setting
[1- 3 FLOW]	Total flow display	Displays the current flow rate.
[1- 4 ADDRESS]		Not used
[1- 5 81D VER]	Main unit and pyrolyzer unit version display	Displays the version of the main unit and pyrolyzer unit.
[1- 6 SEN VER]	Sensor version display	Displays the sensor program version.
[1- 7 NET VER]		Not used
[1- 8 M MODE]	To maintenance mode	Switches to maintenance mode.

5-4-2 Switching to user mode

- 1 In detection mode, hold down the MODE key for about three seconds.



The product switches to user mode.

Once the setting operation is complete, hold down the MODE key for about three seconds in user mode to switch to detection mode.



WARNING

- Once the operation is complete, hold down the MODE key to return to detection mode. The product will not detect gases while in the adjustment/setting state. If left in user mode, the product will return to detection mode in 10 hours. Note that this is dangerous because no monitoring occurs during this time.

5-5 Performing fresh air adjustment (AIR)

Perform fresh air adjustment to ensure accurate measurement of gas concentrations.

To perform fresh air adjustment, connect the calibration gas for fresh air adjustment to the product.

For more information on how to connect the calibration gas, refer to '7-5-3 Connecting the calibration gas'.



- After starting the product, wait for the reading to stabilize before performing fresh air adjustment.
- If an IRF (CO₂) sensor is fitted, do not perform fresh air adjustment in ambient air. Performing fresh air adjustment in ambient air will set the reading to zero even if CO₂ is present. When performing fresh air adjustment, use nitrogen (N₂) as the calibration gas.

NOTE

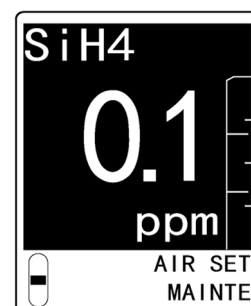
- ▶ On oxygen deficiency models, [1- 1 AIR] corresponds to span adjustment. Introduce clean air to adjust to [20.9] (vol%). For more information on span adjustment, refer to '7-5-2 Performing span adjustment'.

- 1 In user mode, press the ▲ key or ▼ key to select [1- 1 AIR], then press the TEST/SET key.**



- 2 Connect the calibration gas to the product.**
Connect the gas sampling bag for fresh air adjustment and the gas sampling bag for exhaust gas to the product. (Refer to '7-5-3 Connecting the calibration gas'.)

- 3 Introduce the calibration gas for fresh air adjustment. Press the TEST/SET key when the reading has stabilized.**
Fresh air adjustment starts.



4 Check the fresh air adjustment result.

If fresh air adjustment is successful:

[OK] appears. The display reverts to [1- 1 AIR].

If fresh air adjustment fails:

[NG] appears. The display reverts to [1- 1 AIR].

**5 Disconnect the calibration gas from the product.**

Once fresh air adjustment is complete, disconnect the gas sampling bag for fresh air adjustment and the gas sampling bag for exhaust gas.

6 Hold down the MODE key for about three seconds to switch to detection mode.

5-6 Checking setting values (user mode)

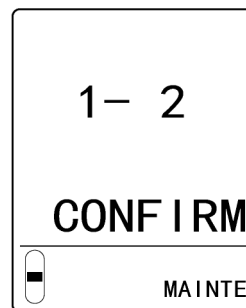
5-6-1 Checking the alarm setpoints (CONFIRM)

Display the first alarm setpoint, second alarm setpoint, alarm delay time, zero suppression value, zero follower setting, and sensitivity correction setting.

NOTE

- ▶ The zero follower setting ON/OFF display will appear only for catalytic combustion type sensors, electrochemical type sensors, non-dispersive infrared type sensors, and pyrolysis-particle type sensors.
- ▶ The sensitivity correction ON/OFF display will appear for electrochemical type sensors.

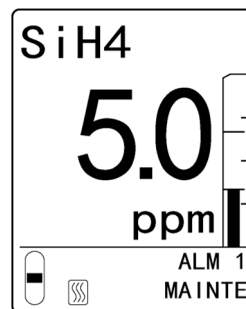
- 1 In user mode, press the ▲ key or ▼ key to select [1- 2 CONFIRM], then press the TEST/SET key.



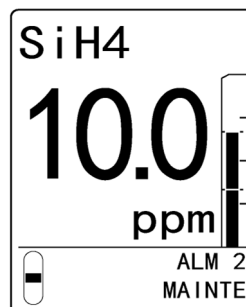
- 2 Check the setting values.

Press the ▲ key or ▼ key to toggle between different settings.

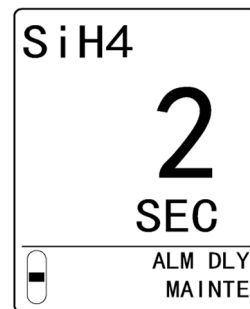
- First alarm setpoint display
Displays the first alarm setpoint.



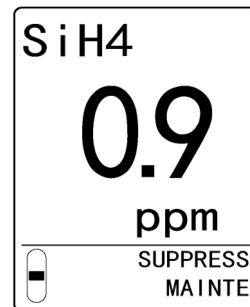
- Second alarm setpoint display
Displays the second alarm setpoint.



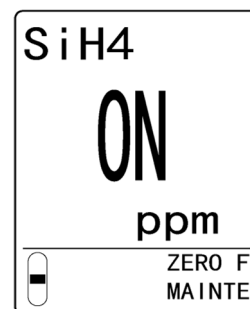
- Alarm delay time
Displays the alarm delay time (in seconds).



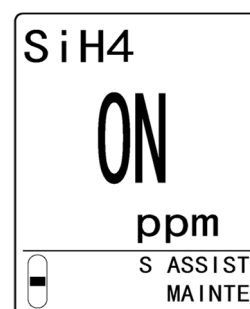
- Zero suppression value display
Displays the zero suppression value.



- Zero follower ON/OFF display
Displays whether the zero follower function is set to [ON] or [OFF].
(Refer to '6-4-2 Zero follower function'.)



- Sensitivity correction ON/OFF display
Displays whether sensitivity correction is set to [ON] or [OFF].
(Refer to '6-4-3 Sensitivity correction function'.)



Press the ▲ key to revert to the first alarm setpoint display.

First alarm setpoint display

3 Press the MODE key.

The display reverts to [1- 2 CONFIRM].

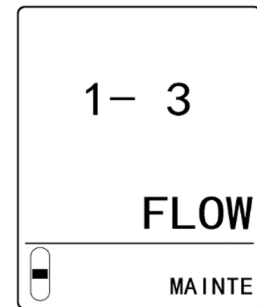
NOTE

- ▶ The first alarm setpoint, second alarm setpoint, and alarm delay time can be set in environmental settings 1 in maintenance mode. (Refer to '7-9 Setting environmental settings 1'.)
- ▶ The zero suppression value, zero follower ON/OFF setting, and sensitivity correction ON/OFF setting can be set in environmental settings 2 in maintenance mode. (Refer to '7-10 Setting environmental settings 2'.)

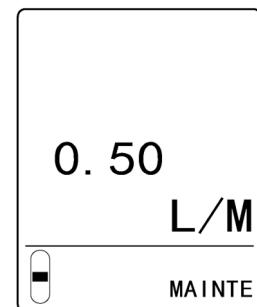
5-6-2 Checking the flow rate (FLOW)

Display the current flow rate (L/min).

- 1 In user mode, press the ▲ key or ▼ key to select [1- 3 FLOW], then press the TEST/SET key.**



- 2 Check the current flow rate (L/min).**



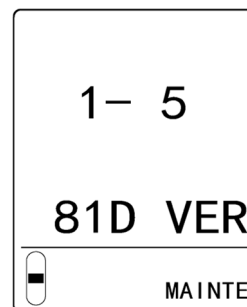
- 3 Press the MODE key.**
The display reverts to [1- 3 FLOW].

5-6-3 Checking the main unit version (81D VER)

Display the ROM/SUM values for the main unit and the pyrolyzer unit.

The ROM/SUM values for the pyrolyzer unit are displayed only when the pyrolyzer unit is connected.

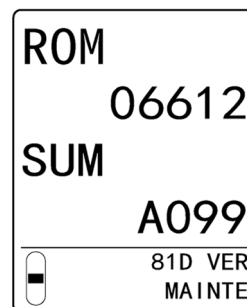
- 1 In user mode, press the ▲ key or ▼ key to select [1- 5 81D VER], then press the TEST/SET key.**



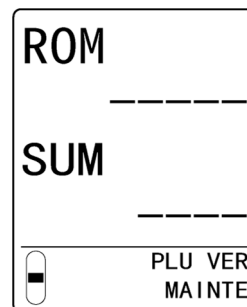
- 2 Check the ROM/SUM values.**

Press the ▲ key or ▼ key to switch the display between the ROM/SUM values for the main unit and the ROM/SUM values for the pyrolyzer unit.

- Main unit ROM/SUM value display



- Pyrolyzer unit ROM/SUM value display



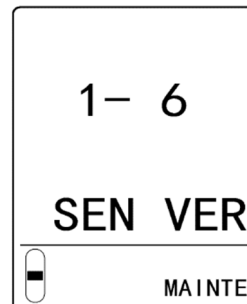
- 3 Press the MODE key.**

The display reverts to [1- 5 81D VER].

5-6-4 Checking the sensor version (SEN VER)

Display the ROM/SUM values for the sensor currently fitted.

- 1 In user mode, press the ▲ key or ▼ key to select [1- 6 SEN VER], then press the TEST/SET key.



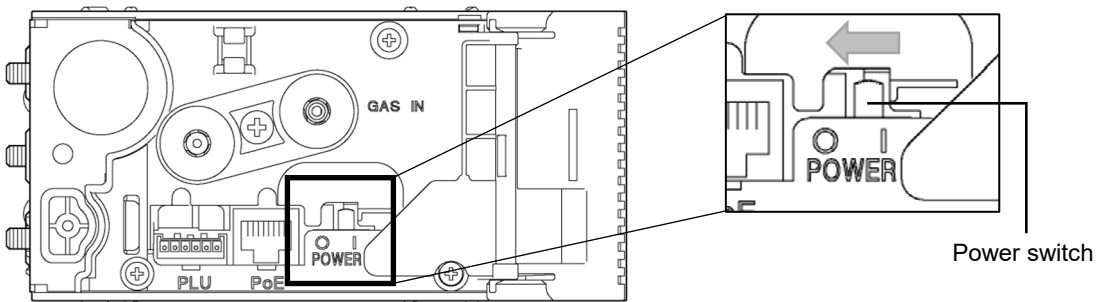
- 2 Check the sensor ROM/SUM values.



- 3 Press the MODE key.
The display reverts to [1- 6 SEN VER].

5-7 Turning off the power

To shut down product operation, turn off the power switch on the underside of the main unit in detection mode.



WARNING

- Turning off the power to the product may activate an alarm in the upstream (central) system.
- Turn off the power to the product only after enabling the INHIBIT function in the upstream (central) system. Also check the operation of any devices connected to the external output or external contact output terminal of the product to confirm shutting down the power will not cause problems.
- If the alarm contacts are energized (optional), the contacts may respond/activate when the power for this product is turned off.
- If the detection target gas is highly adsorbent, allow plenty of fresh air to flow before turning the power off.

6

Alarm Activation

6-1 Gas (oxygen deficiency) alarm activation

6-1-1 Alarm activation

The product issues an alarm when the detected gas or oxygen concentration reaches or exceeds the alarm setpoint. (Auto reset or self-latching)

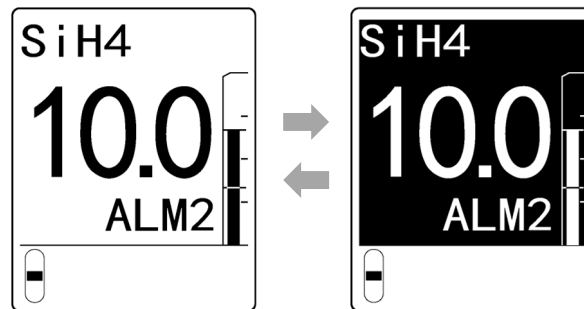
NOTE

- ▶ The alarm setpoints (first and second alarms) and alarm pattern (auto reset or self-latching) are set at the factory before shipping.
- ▶ An alarm delay (default setting: two seconds) is set to prevent accidental alarm activation. This should be canceled if not required. (Refer to '7-9-3 Alarm delay time setting (ALM DLY)'.)

<Gas concentration display>

The gas concentration blinks.

(The display blinks once every two seconds for the first alarm and once every second for the second alarm.)



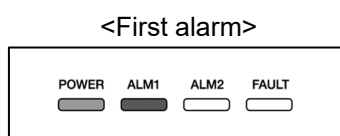
If the detection range is exceeded (full scale over), [OVER] will appear in the gas concentration display area.

<Power/alarm lamp display>

The alarm is a two-step alarm. The alarm lamps light up when the corresponding alarm setpoint is reached or exceeded.

The ALM1 and ALM2 alarm lamps light up (red) as shown below.

The power lamp (POWER) remains lit (green).



ALM1 lights up (red).



ALM1 and ALM2 light up (red).

6-1-2 Contact operation (auto reset)

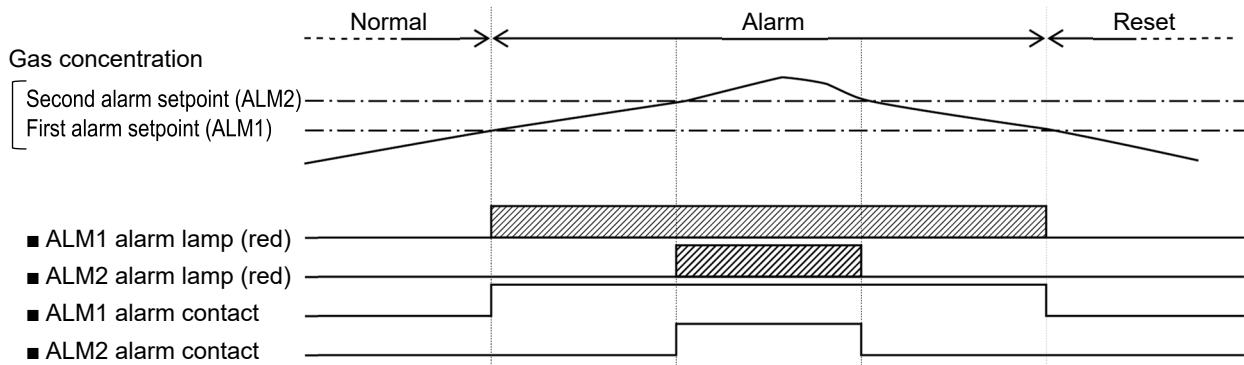
If the gas alarm pattern setting is auto reset, the contacts will activate when the gas concentration reaches or exceeds the alarm setpoint.

The contact operation is automatically reset when the gas concentration falls below the alarm setpoint.

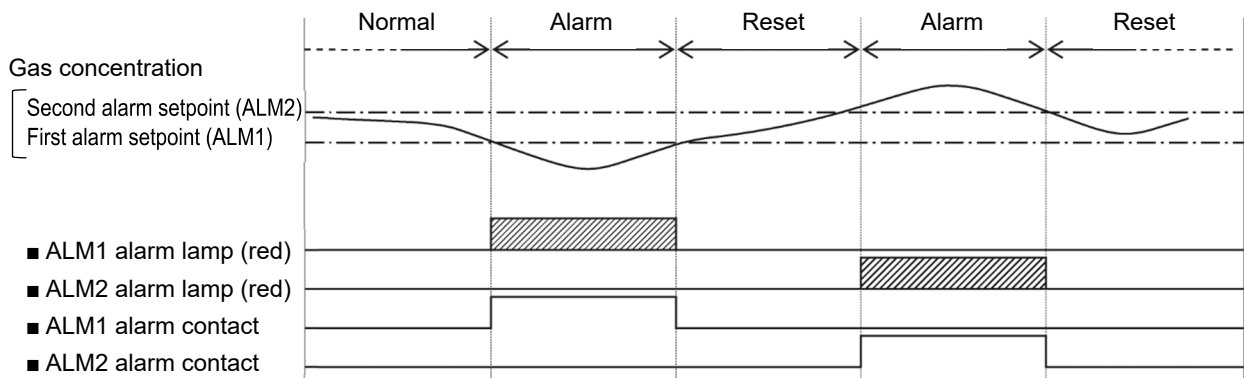
NOTE

- ▶ To cancel the alarm, press the MODE key, TEST/SET key, ▲ key, or ▼ key in detection mode to reset.

<Alarm pattern (H-HH)>

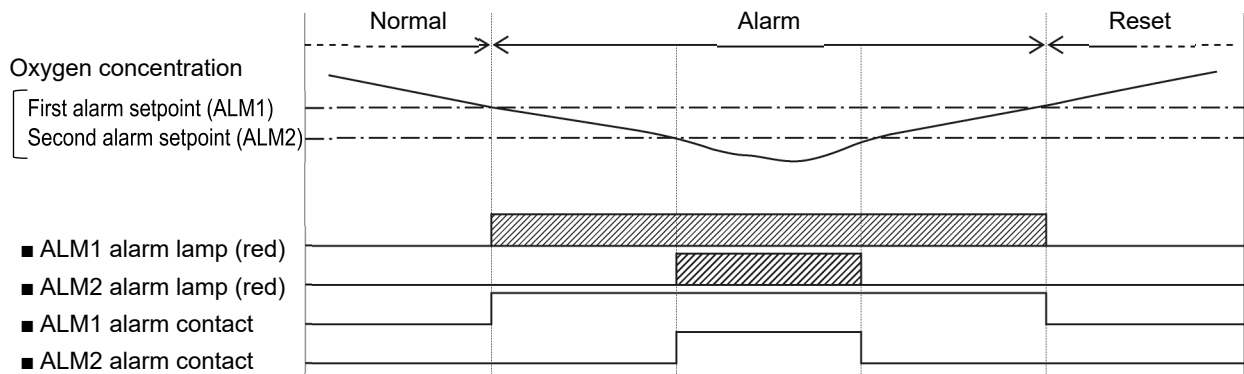


<Alarm pattern (L-H)>



<Alarm pattern (L-LL)>

(Oxygen deficiency alarm)



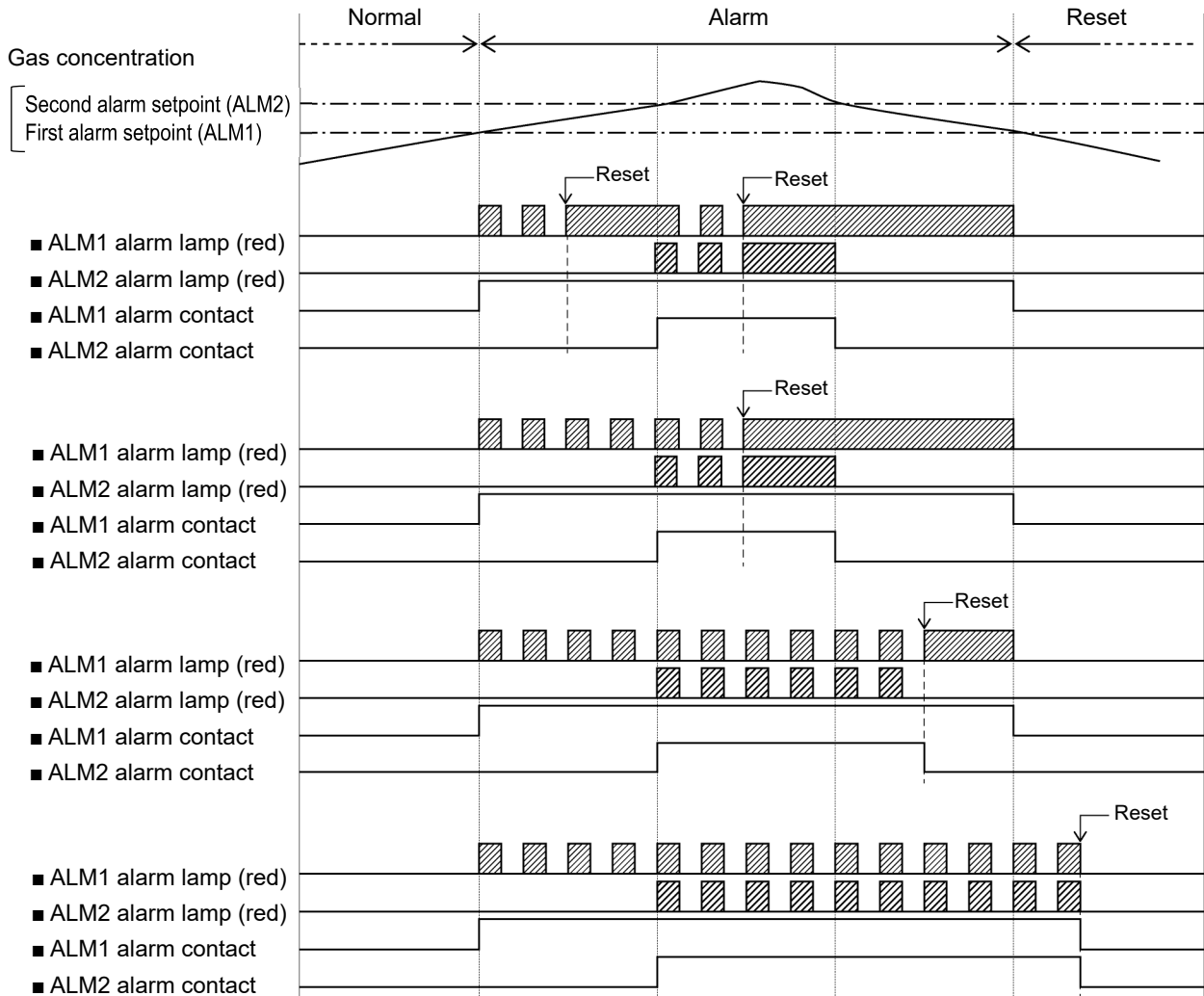
6-1-3 Contact operation (self-latching)

If the gas alarm pattern setting is self-latching, the contacts will activate when the gas concentration reaches or exceeds the alarm setpoint.

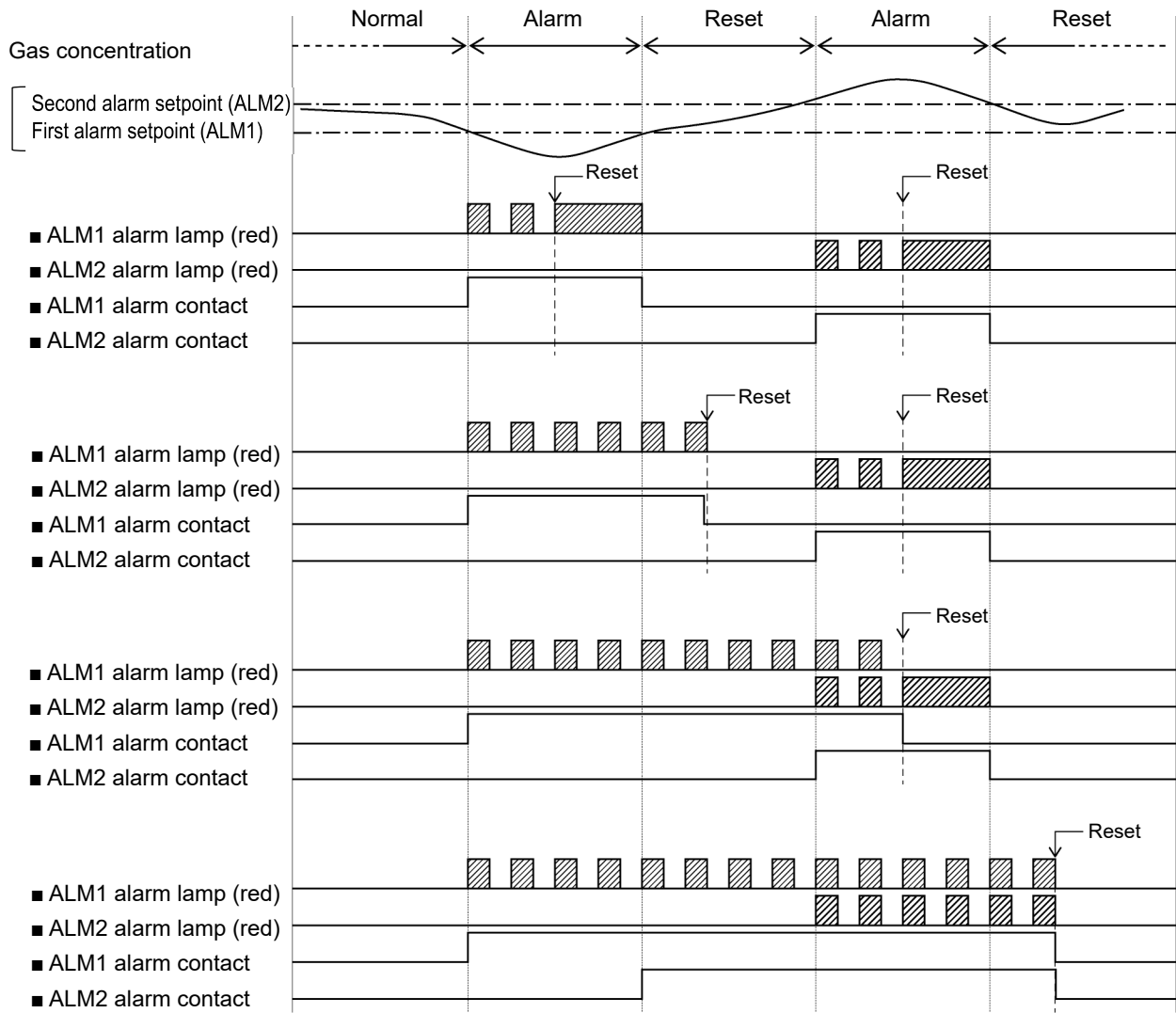
The contact operation is automatically reset when the gas concentration falls below the alarm setpoint after resetting.

The alarm lamps flash when an alarm is triggered. The lamps stop flashing and remain constantly lit when the alarm is reset. Then, the lamps go out when the gas concentration falls below the alarm setpoint.

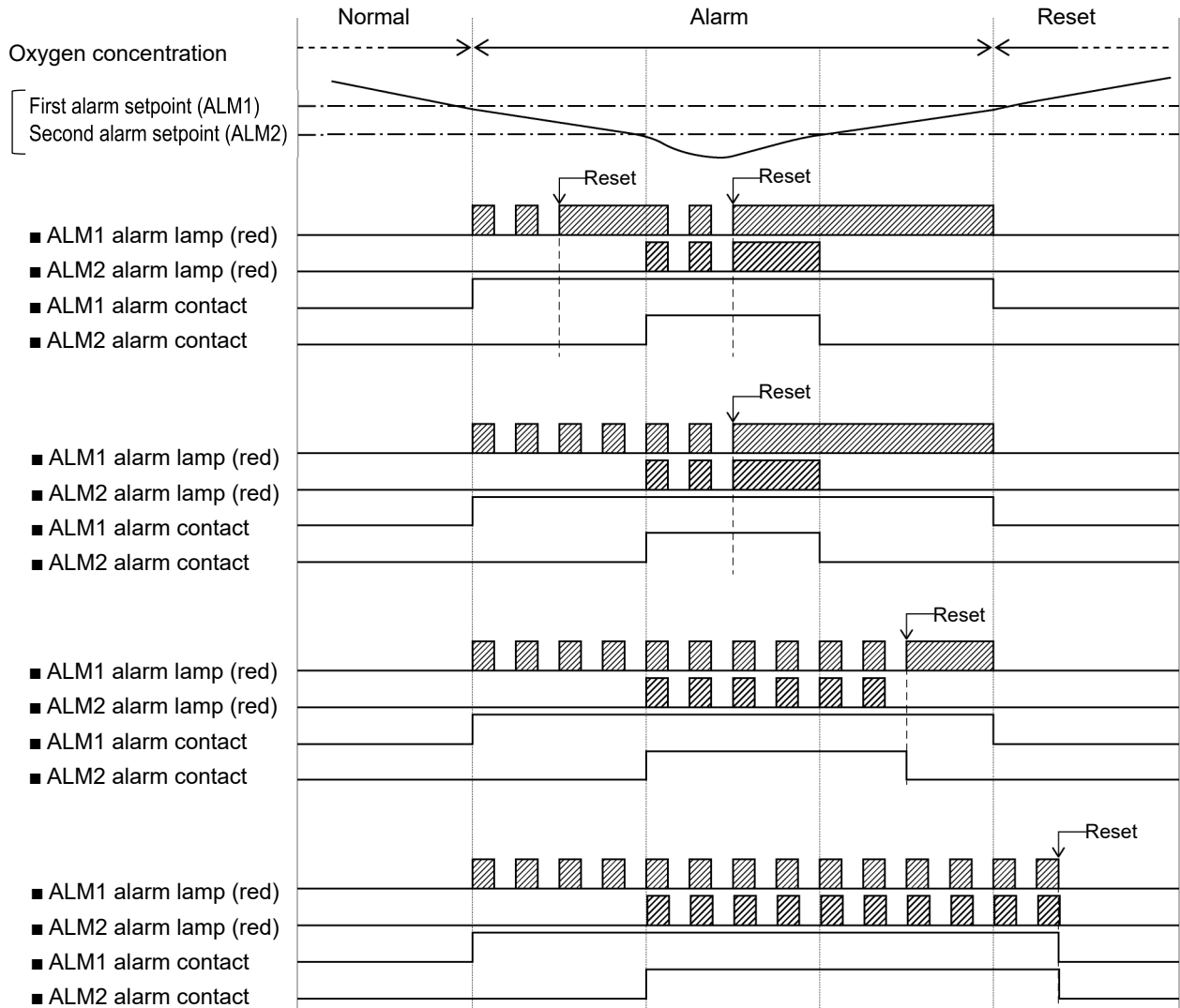
<Alarm pattern (H-HH)>



<Alarm pattern (L-H)>



<Alarm pattern (L-LL)>
(Oxygen deficiency alarm)



6-1-4 Response when a gas alarm is triggered

When a gas alarm is triggered, respond promptly in accordance with your control rules.
In general, take the following actions:

Step 1 Check the product reading.



- In the case of momentary gas leaks, the reading may already have dropped by the time it is checked. Additionally, the reading may drop in the temporary alarm state for reasons such as noise and incidental conditions other than gas alarms.

Step 2 Keep persons out of the monitored zone to ensure safety in accordance with your gas alarm control concentrations.

Step 3 If the gas concentration display remains unchanged, close the main valve for the gas in question and confirm that the concentration reading has dropped.

Step 4 Wear appropriate protective gear to safeguard against hazards involving residual gas and access the gas leakage location. Use a portable gas detector to check for residual gas.

Step 5 Once you have determined that no hazards are present, take the steps necessary to fix the gas leak.



- The sensor may be damaged if a full scale over state has been maintained for an extended period or it may have been in contact with high-concentration gas. Contact RIKEN KEIKI.
- Depending on the type of gas detected, the sensor characteristics may be severely degraded. If a gas alarm is triggered, we recommend performing maintenance on the sensor fitted to the product to check its gas sensitivity.

6-2 Fault alarm activation

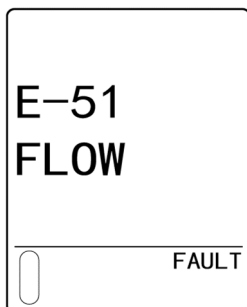
A fault alarm is triggered if abnormal operation is detected in the product or sensor.

When a fault alarm is triggered, the fault lamp (FAULT) will light up (yellow) and the fault code will appear on the LCD.

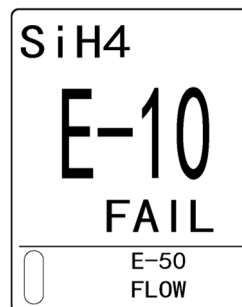
<LCD display>

If a main unit fault and sensor fault are detected at the same time, the main unit fault and sensor fault are displayed alternately.

<Main unit fault>
(Flow loss [E-51 FLOW])



<Sensor fault>
(Poor sensor connection [E-10])



<Power/fault lamp display>



FAULT lights up (yellow).

NOTE

- ▶ Following fault recovery, initialization is performed and the product restarts.
- ▶ Refer to '10. Troubleshooting' for more information on faults and appropriate response.
- ▶ If a fault alarm is triggered, determine the cause and take appropriate action.
- ▶ If faults occur repeatedly due to a problem with the product, contact RIKEN KEIKI immediately.
- ▶ You can perform a fault alarm test. (Refer to '7-9-4 Fault alarm test (F TEST)').

6-3 External output operations

Model	GD-81D	GD-81D-ETD	
Signal transmission method	4 to 20 mA analog transmission (non-insulated)	Ethernet (10BASE-T/100BASE-TX)	
Transmission path	Shielded cable	Ethernet cable	
Transmission distance	Max. 1 km (3,280 ft)	Max. 100 m (328 ft) (depending on system conditions)	
Connected load resistance	300 Ω or less	-	
1	Detection mode (No alarm)	<Normal> 4 to 20 mA (Concentration output) <With dummy sensor connected> 2.5 mA setting: 2.5 mA 4 mA, HOLD, 4 to 20 mA setting: 4 mA (depending on maintenance mode setting)	<ul style="list-style-type: none"> Concentration data
2	Detection mode (In gas alarm state)	<Normal> 4 to 20 mA (Concentration output) <With dummy sensor connected> 2.5 mA setting: 2.5 mA 4 mA, HOLD, 4 to 20 mA setting: 4 mA (depending on maintenance mode setting)	<ul style="list-style-type: none"> Concentration data Each alarm bit
3	Initialization	2.5 mA setting: 2.5 mA 4 mA, HOLD, 4 to 20 mA setting: 4 mA* (depending on maintenance mode setting)	<ul style="list-style-type: none"> Initialization bit
4	Maintenance mode	2.5 mA setting: 2.5 mA 4.0 mA setting: 4.0 mA* HOLD setting: Retains previous value. 4 to 20 mA setting: 4 to 20 mA (Concentration output)	<ul style="list-style-type: none"> Concentration data Adjustment bit
5	Alarm test	Output ON setting: 4 to 20 mA (Concentration output) Output OFF setting: Retains previous value.	<ul style="list-style-type: none"> Concentration data Adjustment bit Test bit
6	Fault alarm	0.5 mA setting: 0.5 mA 21.5 mA setting: 21.5 mA Option setting: Setting possible 0.0 to 4.0 mA	<ul style="list-style-type: none"> Each fault bit
7	INHIBIT	2.5 mA setting: 2.5 mA 4 mA, HOLD, 4 to 20 mA setting: 4 mA* (depending on maintenance mode setting)	<ul style="list-style-type: none"> Concentration data Adjustment bit INHIBIT
8	Power supply off	0 mA	<ul style="list-style-type: none"> Signal OFF

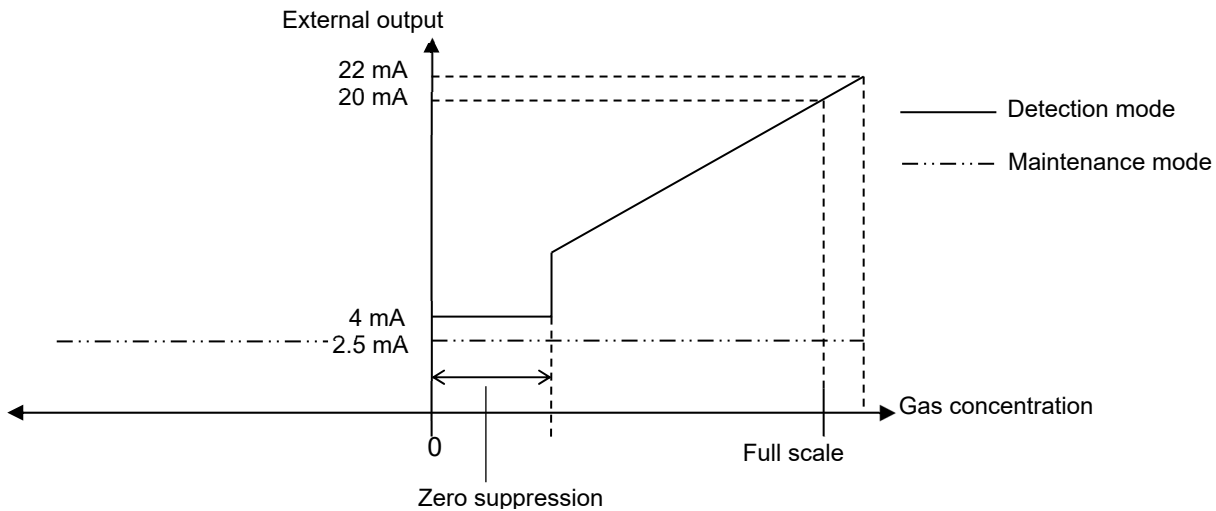
* Equivalent to air (20.9 vol% = 17.4 mA) when F.S. 25.0 vol% O₂ is measured
 Equivalent to air (21.0 vol% = 10.7 mA) when F.S. 50.0 vol% O₂ is measured
 (Alarm types: L-LL and L-H only)

<Analog transmission (4 to 20 mA)> **4 to 20 mA**

<Gas concentration and external output example>

Maintenance output: 2.5 mA setting

Fault output: 0.5 mA setting



NOTE

- ▶ If the fault output is 21.5 mA, the upper limit will be 20.5 mA. In the option setting, the upper limit is 22 mA as is the case of 2.5 mA.



CAUTION

- 4 to 20 mA output setting has already been adjusted. If the full scale is exceeded, the output will not exceed approximately 22 mA.
- If the INHIBIT function is enabled or during initialization, the output follows the 4 to 20 mA output setting in maintenance mode.
Be particularly careful while the product is starting and when changing the specifications.
- Make sure you have a good understanding of this behavior. If necessary, take the necessary steps on the receiver (e.g., putting into skip state) so that no false alarms occur.
- When replacing a sensor, the output that depends on the settings of the new sensor will be applied when the replacement is confirmed.

The following cases in particular require special care:

- Replacement after which [C-02] is displayed: A sensor whose detection target gas is O₂ has been replaced with a sensor for a gas other than O₂.
- Replacement after which [C-02] is displayed: A sensor whose detection target gas is other than O₂ has been replaced with a sensor for O₂.
- Replacement that changes the alarm type: A L-LL or L-H type sensor has been replaced with an H-HH type sensor.

<Ethernet> **ETD**

The following functions are provided through connections to external software using standard network protocols. For more information, refer to the 'GD-81D Series (Ethernet Model) Communication Function Manual (PT2E-361)'.

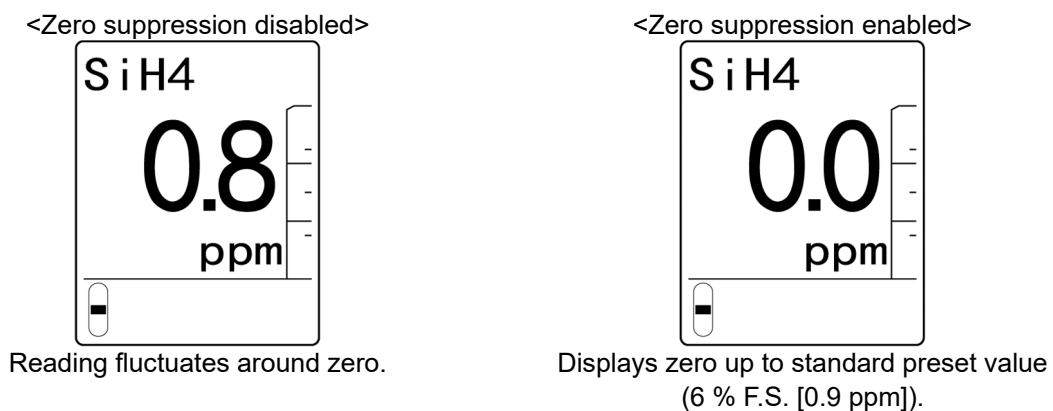
- Web function (HTTP)
Using a web browser of the upstream PC, you can view and change settings and perform adjustment and testing on graphical screens.
- Email transmission function (SMTP)
A notification is sent to the addresses registered on an external mail server when a gas alarm or fault alarm is triggered.
- Time synchronization function (SNTP)
Time data is acquired from a time server to keep the time up to date.
- Modbus slave function (Modbus/TCP)
The product can function as a Modbus slave, returning settings in response to read requests and modifying settings in response to write requests.
- Function for connecting to PLCs (FINS/MC)
This function sends setting values to the PLCs and provides information for the PLCs to process with a ladder program. It also reads from the PLCs to change, adjust, or test setting values.

6-4 Various functions to ensure proper alarm activation

6-4-1 Zero suppression function

The sensors used in the product are susceptible to fluctuations in ambient conditions (e.g., temperature and humidity characteristics) and interference gases (interference characteristics). These can affect readings. This means readings may fluctuate around zero levels even under normal conditions. The zero suppression function is designed to minimize the effects of these ambient fluctuations and interference gases around the zero level. Use this function to suppress fluctuations in readings of less than the preset value to give zero readings (or [20.9] (vol%) for oxygen deficiency).

For example, SiH₄ readings will be indicated as follows:



NOTE

- ▶ The standard preset value for the zero suppression function differs depending on sensor specifications.
- ▶ This function is disabled in maintenance mode. Fluctuations in readings of less than the value set are displayed.
- ▶ When an oxygen deficiency alarm model sensor (OSU, ESU-X23, ESF-X24P: 0 – 25 vol%) is fitted, the zero suppression function works in the atmosphere (20.9 vol%), which is the normal value. In this case, if readings fluctuate near 20.9 vol%, the reading displayed is [20.9] (vol%) (AIR suppression).

CAUTION

- The negative suppression value (below zero) is subject to suppression corresponding to 10 % of full scale. If the value below zero becomes 10 % of full scale or larger, the reading will be displayed as [-0.0], and accurate gas detection will not be possible in this state. Perform zero adjustment.

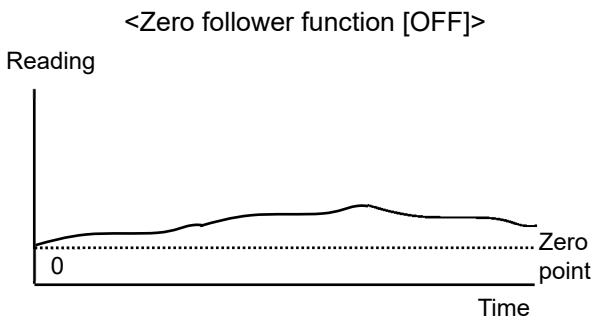
6-4-2 Zero follower function

Depending on sensor specifications, the sensors used in the product may suffer sensitivity degradation when used for extended periods.

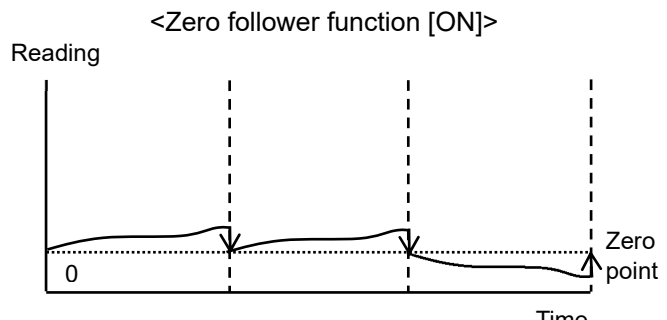
The zero follower function is programmed processing designed to stabilize the zero point by correcting fluctuations in readings (zero drift) caused by the sensitivity variation over time of the zero point.

NOTE

- ▶ You can set the zero follower function for catalytic combustion type sensors, electrochemical type sensors, non-dispersive infrared type sensors, and pyrolysis-particle type sensors. (Default setting: [ON])
- ▶ The 24-hour zero follower function performs zero following only for the first 24 hours after the power is turned on.



Sensor zero drift appears in readings.



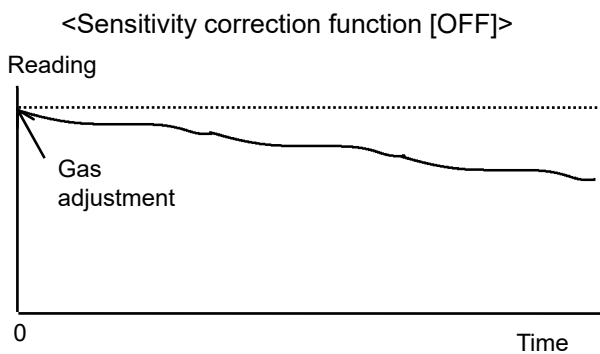
Zeroing is performed periodically.

6-4-3 Sensitivity correction function

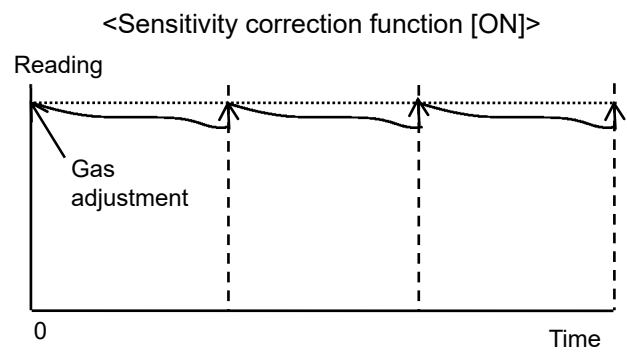
Depending on type, the electrochemical type sensors used in the product may suffer sensitivity degradation when used for extended periods. The sensitivity correction function compensates for (assists) the changing gas sensitivity as it deteriorates over time. Span adjustment is performed according to programmed processing based on theoretically derived degradation trends.

NOTE

- ▶ You can set the sensitivity correction function for electrochemical type sensors. (Default setting: [ON])



Sensor sensitivity degrades.



Span adjustment is performed periodically.



CAUTION

- The sensitivity correction function is a support function. Fixed span adjustment is performed based on theoretically derived degradation trends. Span adjustment is not performed based on the individual sensitivity variations of each sensor.
- Corrections of individual sensors' sensitivity variations must be performed as periodic span adjustment using the calibration gas.

6-4-4 Adjustment history, alarm trend history, and event history functions

History functions are available for both the product and the sensor.

Contact RIKEN KEIKI if you require the adjustment history, alarm trend history, or event history functions.

6-4-5 Automatic sensor recognition function

This product features a function that automatically recognizes the sensor after sensor replacement or if sensor specifications change.

The following display warns against incorrect fitting if a sensor with a different serial number, detection principle, or specifications is fitted:

<When replaced with a sensor of the same specifications>

[C-01] appears if the sensor is replaced with a sensor of the same specifications (e.g., detection principle, model)—for example, upon periodic replacement.

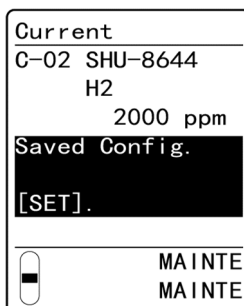
Press the TEST/SET key to recognize the sensor as a new sensor and to start up.

<When replaced with a sensor of different specifications>

[C-02] appears if the sensor is replaced with a sensor of different specifications (e.g., detection principle and model).

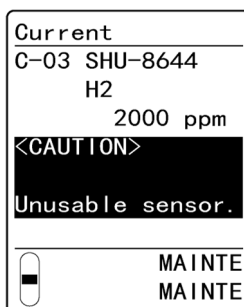
Press the TEST/SET key to recognize the sensor as a sensor with new specifications and to start up.

If you did not intend to change the specifications, the sensor may have been fitted by mistake. Check the sensor.



<If not replaced correctly>

If the new sensor is unusable, [C-03] or [C-04] will appear. The product cannot return to detection mode. Contact RIKEN KEIKI.



**CAUTION**

- When [C-02] is displayed, if you confirm changes in sensor specifications (e.g., detection principal, sensor type, detection target gas, and detection range), the gas detector specifications will change accordingly.
The following parameters including alarm setpoints will be reset to their initial values.
Change the parameters in maintenance mode if values other than the initial values are required.
 - Alarm delay time: 2 seconds
 - Zero suppression value (varies depending on sensor specifications) (Refer to '6-4-1 Zero suppression function'.)
 - Alarm type: H-HH (L-LL for oxygen (ESF, OSU) sensors)
 - In maintenance mode, settings for external output remain unchanged from before the sensor replacement. Take particular note of this.
 - When [C-02] appears, confirming with TEST/SET will start initialization at the same time the operation switches over. The initialization output also switches in conjunction.
 - The oxygen deficiency alarm OSU and ESF-X24P sensors include three types of alarms: L-LL, L-H, and H-HH.
The order of the alarm reverses when you change from L-LL or change to L-LL.
 - For the GD-81D-ETD, the data from the sensor with different specifications will be output before confirming changes in sensor specifications.
-

7

Maintenance

The product is an important safety and disaster prevention device. Perform product maintenance at regular intervals to ensure performance and to improve disaster prevention and safety reliability.

7-1 Maintenance intervals and maintenance items

Perform the following maintenance.

- Daily maintenance: Perform maintenance before commencing work.
- Monthly maintenance: Inspect the alarm circuit (alarm test) once a month.
- Regular maintenance: Perform maintenance at least once every six months to ensure performance as a safety device.

Maintenance item	Maintenance details	Daily Maintenance	Monthly Maintenance	Regular Maintenance
Power supply check	Check to confirm that the power lamp lights up.	○	○	○
Concentration display check	Check to confirm that the concentration reading is zero (or [20.9] (vol%) for oxygen deficiency). If the reading is offset, confirm that no miscellaneous gas is present in the vicinity, then perform zero adjustment (fresh air adjustment).	○	○	○
Flow rate check	Check the flow rate display and confirm the absence of any abnormalities.	○	○	○
Filter check	Check to confirm that the dust filter is not dirty or clogged.	○	○	○
Alarm test	Use the alarm test function to check the alarm circuit.		○	○
Gas adjustment	Perform gas adjustment using the calibration gas.			○
Gas alarm check	Check the gas alarm using the calibration gas.			○

<Maintenance service>

RIKEN KEIKI provides services related to regular maintenance, including gas adjustment, adjustments, and servicing.

Preparing the calibration gas requires dedicated equipment, including gas cylinders of the specified concentration and gas sampling bags. Our certified service engineers have expert knowledge of these dedicated tools and products.

Please take advantage of the RIKEN KEIKI maintenance service to maintain safe operation of the product.

The main maintenance service details are as follows. Contact RIKEN KEIKI for more information.

Service	Service details
Power supply check	<ul style="list-style-type: none"> ▪ Check the power supply voltage. ▪ Check to confirm that the power lamp lights up. (Check to confirm that the power lamp (POWER), alarm lamps (ALM1, ALM2), and fault lamp (FAULT) can be identified on the system.) ▪ Check the operation with the UPS (uninterruptible power system), if it is used.
Concentration display check	<p>Check to confirm that the concentration reading indicates zero using the zero adjustment gas. Perform zero adjustment (fresh air adjustment) if the reading is offset.</p> <p>For oxygen deficiency alarm models, introduce clean air and confirm that the concentration reading is [20.9] (vol%). Perform span adjustment if the reading is offset.</p>
Flow rate check	<p>Confirm the absence of abnormalities in the flow rate display.</p> <p>Use an external flowmeter to check the flow rate. Check to confirm that the flow rate display of this product is correct. Perform flow adjustment if the flow rate is offset.</p>
Filter check	<p>Check to confirm the dust filter is neither dirty nor clogged.</p> <p>Replace the filter if clearly dirty or clogged.</p>
Alarm test	<p>Use the alarm test function to check the alarm circuit.</p> <ul style="list-style-type: none"> ▪ Check the alarm lamps (check operations for both ALM1 and ALM2). ▪ Check external alarms (check buzzer and other external alarm operations).
Gas adjustment	<p>Perform gas adjustment using a calibration gas.</p>
Gas alarm check	<p>Check the gas alarm using the calibration gas.</p> <ul style="list-style-type: none"> ▪ Check alarms (confirm alarm activation when alarm setpoint is reached). ▪ Check delay time (check delay time until alarm activation). ▪ Check the alarm lamps (check operations for both ALM1 and ALM2). ▪ Check external alarms (check buzzer, reset signal, and other external alarm operations).
Product cleaning and repair (visual inspection)	<p>Check the product exterior, covers, and interior for dirt and damage, and clean and repair problem areas.</p> <p>Replace parts if cracked or damaged.</p>
Product operation check	<p>Operate the keys to check the behavior of various functions and the parameters.</p>
Consumable parts replacement	<p>Replace degraded components, including the sensor, filter, and pump.</p>

7-2 Performing alarm tests

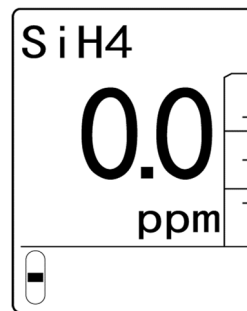
A signal is emitted that simulates a gas concentration, enabling checks of the alarm lamps and the status of signal transmissions to external devices.



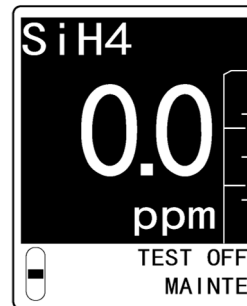
- Before starting an alarm test, notify the related departments so that measures can be taken to ensure that problems do not arise due to external output signals or alarm contacts.
- When the alarm test is complete, hold down the TEST/SET key to return to detection mode. The product will not detect gases while in the adjustment/setting state. If left in alarm test mode, the product will return to detection mode in 10 hours. Note that this is dangerous because no monitoring occurs during this time.

1 In detection mode, hold down the TEST/SET key for about three seconds.

The product switches to alarm test mode.



2 Press the ▲ key or ▼ key to set the concentration.



3 Check to confirm that an alarm is triggered.

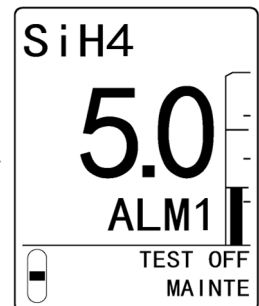
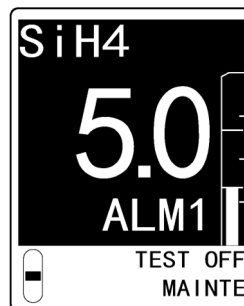
The first alarm is triggered when the concentration reaches the first alarm setpoint.

When the first alarm is triggered, the alarm lamp (ALM1) lights up (red), and the LCD display blinks once every second.

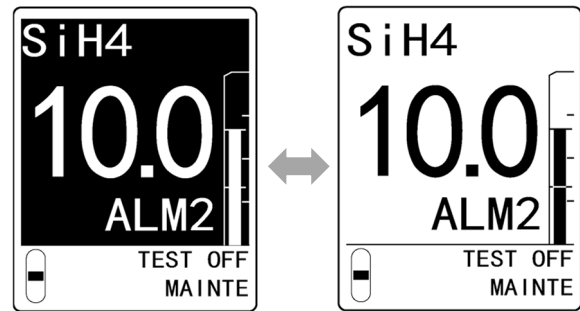
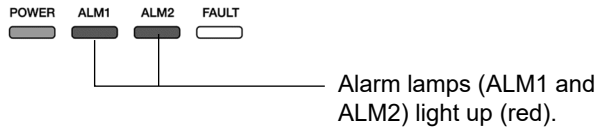
When [TEST ON], then the contact of the first alarm is activated.



Alarm lamp (ALM1) lights up (red).



The second alarm is triggered when the concentration reaches the second alarm setpoint. When the second alarm is triggered, the alarm lamp (ALM2) lights up (red), and the LCD display blinks once every second. When [TEST ON], then the contact of the second alarm is activated.



4 Press the TEST/SET key to reset the reading.

5 Once the operation is complete, hold down the SET key for about three seconds to switch to detection mode.

NOTE

- ▶ Contacts will operate during alarm tests if [TEST ON] is displayed; they will not operate if [TEST OFF] is displayed. Set whether contacts operate during alarm tests in environmental settings 2 in maintenance mode. (Refer to '7-10-4 Contact setting during alarm tests (TEST RLY)'.)
- ▶ Set whether there is external output during alarm tests in environmental settings 2 in maintenance mode. (Refer to '7-10-5 External output setting during alarm tests (TEST4-20)'.)

7-3 Maintenance (regular maintenance) mode

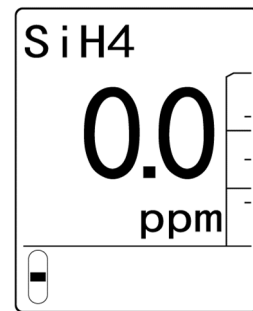
Switch to maintenance mode to perform zero adjustment, span adjustment, and to make various settings.

7-3-1 Maintenance mode setting items

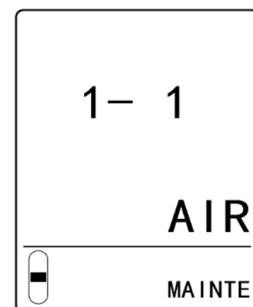
LCD display	Setting item	Description
[2- 0 GAS TEST]	Gas introduction test	Performs a gas introduction test.
[2- 1 ZERO]	Zero adjustment	Performs zero adjustment.
[2- 2 SPAN]	Span adjustment	Performs span adjustment.
[2- 3 LAST CAL]	Date last adjusted	Displays the date on which adjustment was last performed.
[2- 4 E VOLT]	Set potential	Displays the set potential.
[2- 5 DEF FLOW]	Flow rate value correction	Corrects the flow rate value so that the flow rate becomes 0.5 L/min \pm 10 % (0.45 to 0.55 L/min).
[2- 6 FLOW]	Flow rate display, flow adjustment	Adjusts the pump and displays the current flow rate.
[2- 7 TEMP]	Ambient temperatures	Displays the current temperature in the installation environment.
[2- 8 WARMTIME]		Not used
[2- 9 SETTING1]	Environmental settings 1	Allows to set INHIBIT, alarm setpoints, etc. Performs fault tests and maintenance. (Refer to '7-9 Setting environmental settings 1'.)
[2-10 SETTING2]	Environmental settings 2	Allows to set the alarm pattern, fault alarm pattern, zero suppression value, date and time, external output, etc. (Refer to '7-10 Setting environmental settings 2'.)
[2-11 PL DATA]	Pyrolyzer unit data display	Displays various pyrolyzer unit data when using the pyrolyzer unit (PLU-80). (Refer to 'Pyrolyzer Unit PLU-80 Operating Manual (PT9E-035)'.)
[2-12 FAULT]		Not used
[2-13 S SET]	Sensor use start setting	Allows to set the sensor use start date.
[2-14 F MODE]	To factory mode	Not used
[2-15 RETURN]	To user mode	Switches to user mode.

7-3-2 Switching to maintenance mode

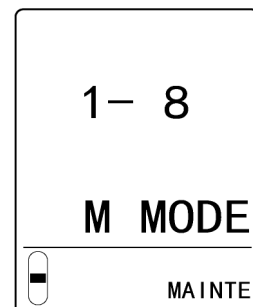
- 1 In detection mode, hold down the MODE key for about three seconds.



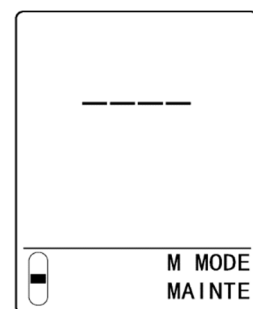
The product switches to user mode.



- 2 Press the ▲ key or ▼ key to select [1- 8 M MODE], then press the TEST/SET key.

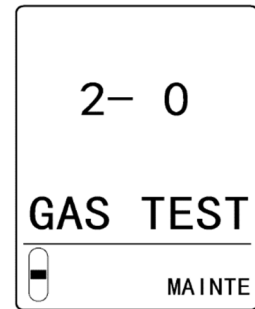


- 3 Hold down the TEST/SET key for about three seconds.



The product switches to maintenance mode.

Once the setting operation is complete, hold down the MODE key for about three seconds in maintenance mode to switch to detection mode.



WARNING

- Once the operation is complete, hold down the MODE key in maintenance mode to return to detection mode. The product will not detect gases while in the adjustment/setting state. The product will return to detection mode in 10 hours if left in maintenance mode. However, due to the possibility that replacement work is underway, the product will not return to detection mode if left in maintenance mode under environmental settings 1 ([SET- 3 MAINTE] under [2- 9 SETTING1]). This is dangerous because no monitoring occurs during this time. Take note of this.

NOTE

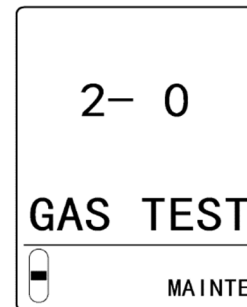
- ▶ If password setting is [ON], a password must be entered to switch to maintenance mode.
 - ▶ The password is set beforehand by RIKEN KEIKI. Please contact RIKEN KEIKI if you do not know the password.
 - ▶ Select [2-15 RETURN] in maintenance mode and press the TEST/SET key to switch to user mode.
-

7-4 Performing a gas introduction test

Perform operational checks to confirm that the sensor react to the gas correctly.

You can check the operation of the sensor without activating the contacts, external output(s), or alarms.

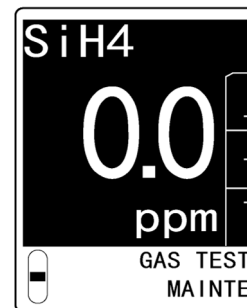
- 1 In maintenance mode, press the ▲ key or ▼ key to select [2- 0 GAS TEST], then press the TEST/SET key.



- 2 Connect the gas sampling bag for the gas introduction test and the gas sampling bag for exhaust gas to the product, then introduce the gas.

For more information on connecting the gas sampling bag for the gas introduction test, refer to '7-5-3 Connecting the calibration gas'.

- 3 Check to confirm that the concentration is displayed.



- 4 Disconnect the gas for the gas introduction test from the product.

Once the gas introduction test is complete, disconnect the gas sampling bag for the gas introduction test and the gas sampling bag for exhaust gas.

- 5 Press the MODE key.

- 6 Hold down the MODE key for about three seconds to switch to detection mode.

7-5 Performing gas adjustment

Before performing gas adjustment, prepare a gas sampling bag with the calibration gas and another gas sampling bag for exhaust gas.

7-5-1 Performing zero adjustment

Correct zero adjustment is required for accurate measurement of gas concentrations. Zero adjustment is essential for accurate measurements.



WARNING

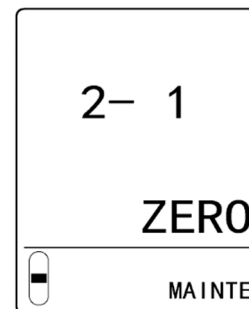
- Before performing zero adjustment in the surrounding atmosphere, confirm that the surrounding atmosphere is filled with clean air. The presence of miscellaneous gases will make correct zero adjustment impossible and cause safety hazards in the event of an actual gas leak.
- If an IRF (CO₂) sensor is fitted, do not perform zero adjustment in ambient air. If zero adjustment is performed in ambient air, the reading will be set to zero even though CO₂ is present in the air. When performing zero adjustment, use nitrogen (N₂) as the calibration gas.



CAUTION

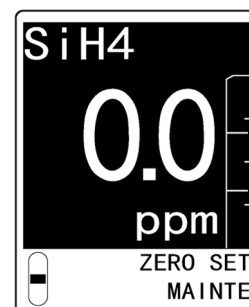
- To perform zero adjustment, introduce the zero adjustment gas, then wait for the reading to stabilize.
- Perform zero adjustment with the zero adjustment gas. Depending on the sensor, introducing the wrong gas will result in impaired indication accuracy and slower response.

- 1 In maintenance mode, press the ▲ key or ▼ key to select [2- 1 ZERO], then press the TEST/SET key.



- 2 **Connect the calibration gas to the product.**
Connect the gas sampling bag for zero adjustment and the gas sampling bag for exhaust gas to the product. (Refer to '7-5-3 Connecting the calibration gas'.)

- 3 Press the TEST/SET key.



4 Introduce the zero adjustment gas, then press the TEST/SET key.

Zero adjustment starts.

5 Check the zero adjustment result.

If zero adjustment is successful:

[OK] appears. The display reverts to the display in step 3.

If zero adjustment fails:

[NG] appears. The display reverts to the display in step 3.



6 Disconnect the calibration gas from the product.

Once zero adjustment is complete, disconnect the gas sampling bag for zero adjustment and the gas sampling bag for exhaust gas.

7 Press the MODE key.

The display reverts to [2- 1 ZERO].

8 Hold down the MODE key for about three seconds to switch to detection mode.

7-5-2 Performing span adjustment

Perform span adjustment to ensure accurate measurement of gas concentrations.

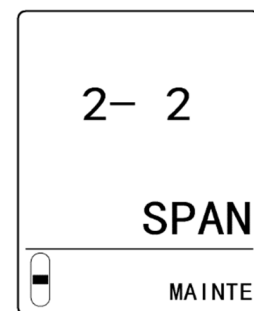


CAUTION

- To perform span adjustment, introduce the calibration gas, then wait for the reading to stabilize.
- Perform span adjustment using the calibration gas. Depending on the sensor, introducing the wrong gas will result in impaired indication accuracy and slower response.
- After introducing the calibration gas, supply air or zero adjustment gas and allow to stand for around five minutes.

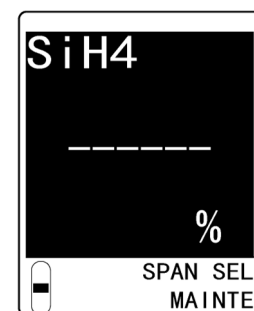
Failure to allow enough time at this step may prevent correct adjustment, resulting in impaired indication accuracy in detection mode and slower response.

- 1 In maintenance mode, press the ▲ key or ▼ key to select [2- 2 SPAN], then press the TEST/SET key.**

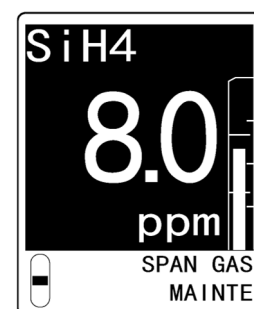


- 2 Connect the calibration gas to the product.**
Connect the gas sampling bag for span adjustment and the gas sampling bag for exhaust gas to the product. (Refer to '7-5-3 Connecting the calibration gas'.)

- 3 Press the TEST/SET key.**



- 4 Introduce the calibration gas, and press the TEST/SET key when the concentration has stabilized.**
The TEST/SET key will not work if the concentration is less than 10 % of the full scale.

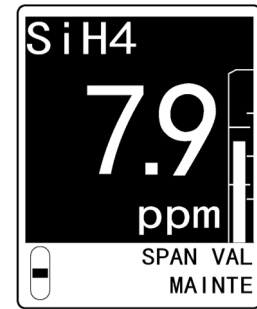


5 Press the ▲ key or ▼ key to match the introduced gas concentration.

For oxygen deficiency alarm models, adjust so that it becomes [20.9] (vol%).

6 Press the TEST/SET key.

Span adjustment starts.

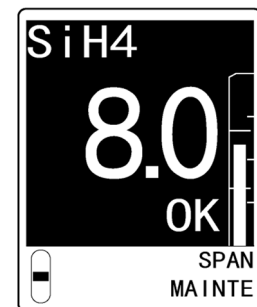


7 Check the span adjustment result.

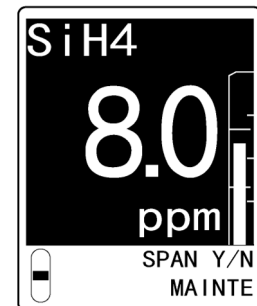
If span adjustment is successful:
[OK] appears.

If span adjustment fails:

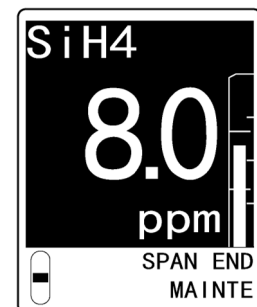
[NG] appears. The display reverts to the display in step 3.



8 To record the span adjustment result, press the TEST/SET key. Press the MODE key to skip recording.



Span adjustment ends. The display reverts to the display in step 3.



9 Disconnect the calibration gas from the product.

Once span adjustment is complete, disconnect the gas sampling bag for span adjustment and the gas sampling bag for exhaust gas.

10 Press the MODE key.

The display reverts to [2- 2 SPAN].

11 Hold down the MODE key for about three seconds to switch to detection mode.

NOTE

- ▶ Hold down the ▲ key and ▼ key together in step 3 to display the margin for the selected sensor. The sensor margin function is used to check how much the reading can rise when the adjustment gas is introduced during span adjustment. In other words, it checks the reserve capacity of the sensor.
The margin is reset when the product is restarted. The margin is not displayed if span adjustment has not been performed.

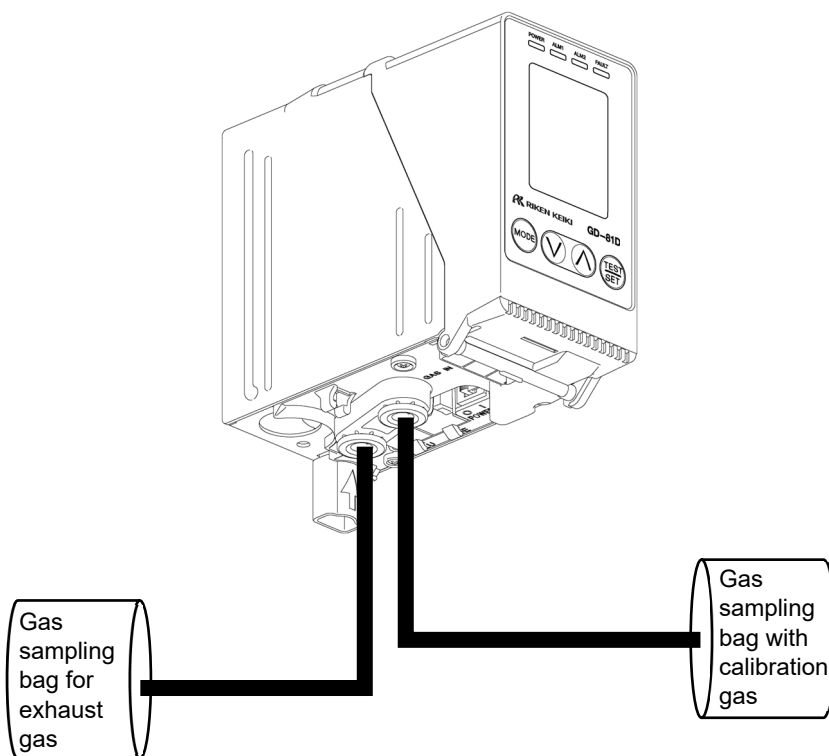


Margin after span adjustment
at 8.0 ppm

7-5-3 Connecting the calibration gas

With the pump stopped, connect the gas sampling bag with calibration gas and the gas sampling bag for exhaust gas to the product.

Connect the gas sampling bag with calibration gas to GAS IN on the product and connect the gas sampling bag for exhaust gas to GAS OUT.



7-6 Adjusting the flow rate

The flow rate for the product is automatically adjusted by the automatic flow adjustment function to 0.5 L/min \pm 10 % (0.45 to 0.55 L/min).

Disable the automatic flow adjustment function to adjust the flow rate manually.

NOTE

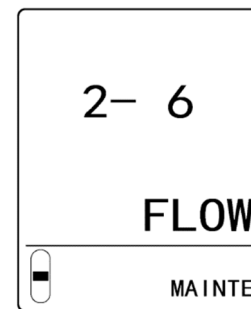
- ▶ Set the automatic flow adjustment function ON/OFF in environmental settings 2. (Refer to '7-10-11 Automatic flow adjustment setting (AT FLOW)'.)

7-6-1 Checking the flow rate (FLOW)

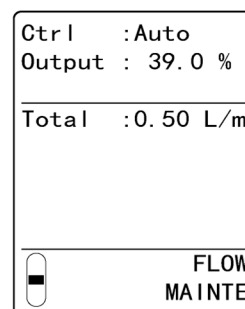
Display the current flow rate. The following information is displayed:

- [Ctrl]: Automatic flow adjustment function enabled/disabled setting
(If the automatic flow adjustment function is enabled, [Auto] is displayed; if disabled, [Manual] is displayed.)
- [Output]: Current output ratio
- [Total]: Total flow rate (L/min)

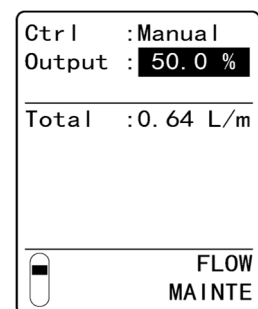
- 1 In maintenance mode, press the ▲ key or ▼ key to select [2- 6 FLOW], then press the TEST/SET key.**



- 2 Check the flow rate.**



Automatic flow
adjustment: Enabled

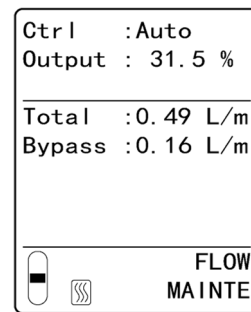


Automatic flow
adjustment: Disabled

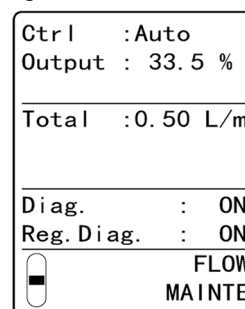
- 3 Press the MODE key.**
The display reverts to [2- 6 FLOW].

NOTE

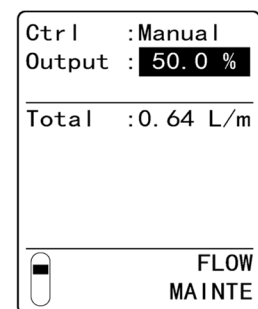
- ▶ If the pyrolyzer unit is connected, the bypass flow rate for the pyrolyzer unit is displayed for [Bypass], in addition to the current flow rate.



- ▶ Press the ▲ and ▼ keys together in step 2 while the flow rate is displayed to view the following information as you hold down the keys:
 - [Diag.]: Self-diagnostic function ON/OFF setting
 - [Reg.Diag.]: Regular self-diagnostic ON/OFF setting



Automatic flow
adjustment: Enabled

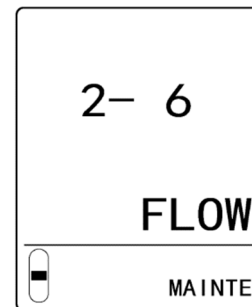


Automatic flow
adjustment: Disabled

7-6-2 Manually adjusting the flow rate (FLOW)

When the automatic flow adjustment function is disabled, you can manually adjust the flow rate.

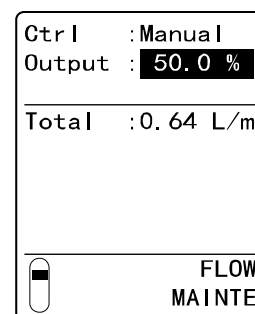
- 1 In maintenance mode, press the ▲ key or ▼ key to select [2- 6 FLOW], then press the TEST/SET key.



- 2 Press the ▲ key or ▼ key to increase or decrease the pump output to adjust the flow rate to a value above 0.5 L/min.

Pump output increases 0.5 % each time you press the ▲ key.

Pump output decreases 0.5 % each time you press the ▼ key.



- 3 Press the TEST/SET key.

The pump output is set. The display reverts to [2- 6 FLOW].

NOTE

- ▶ Press the MODE key in step 3 to cancel the setting and revert the display to [2-6 FLOW].

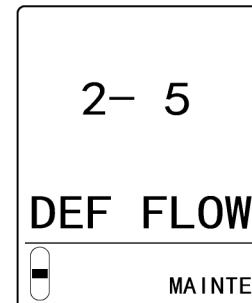
7-6-3 Correcting the flow rate value (DEF FLOW)

Due to aging deterioration of the flow sensor, inappropriately resetting the default flow rate value, etc., an error affecting the flow rate display may occur. In such cases, correct the flow rate display.

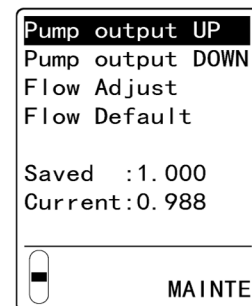
Flow rate value can be corrected regardless whether the automatic flow adjustment function is enabled or disabled.

Connect a flowmeter (one that can accurately indicate 0.5 L/min) to this product.

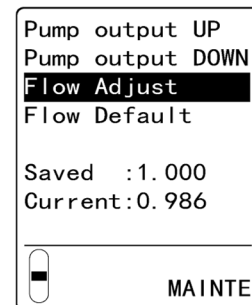
- 1 In maintenance mode, press the ▲ key or ▼ key to select [2- 5 DEF FLOW], then press the TEST/SET key.



- 2 Press the ▲ key or ▼ key to select [Pump output UP] or [Pump output DOWN], then press the TEST/SET key.
 Select [Pump output UP] to increase pump output.
 Select [Pump output DOWN] to decrease pump output.
 Increase or decrease the pump output to adjust the connected flowmeter reading to 0.5 L/min \pm 10 %.



- 3 Press the ▲ key or ▼ key to select [Flow Adjust], then press the TEST/SET key.



The flow rate value is corrected. The display reverts to [2- 5 DEF FLOW].

NOTE

- ▶ By selecting [Flow Default] and pressing the TEST/SET key, you can restore the default correction coefficient.
- ▶ Press the MODE key in step 3 to cancel the setting and revert the display to [2- 5 DEF FLOW].

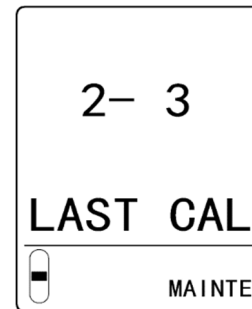
7-7 Checking setting values (maintenance mode)

7-7-1 Checking the date last adjusted (LAST CAL)

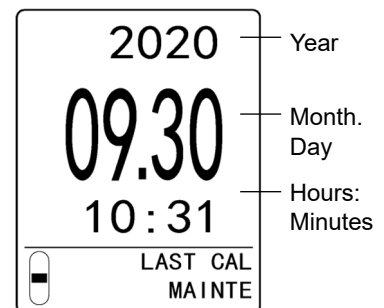
Display the date on which the sensor was last adjusted.

No date is displayed if the sensor has not been adjusted since its manufacture.

- 1 In maintenance mode, press the ▲ key or ▼ key to select [2- 3 LAST CAL], then press the TEST/SET key.



- 2 Check the date last calibrated.

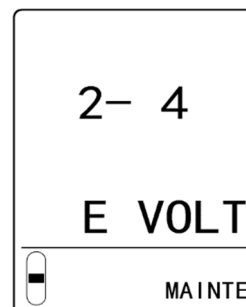


- 3 Press the MODE key.
The display reverts to [2- 3 LAST CAL].

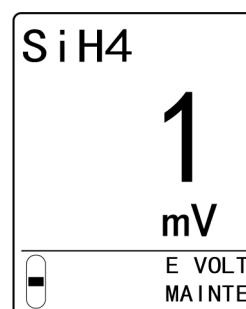
7-7-2 Checking the set potential (E VOLT)

Display the set voltage of the electrochemical type sensor (ESF), or the element voltage of the semiconductor type sensor (SGF) or hot-wire type semiconductor sensor (SHF).

- 1 In maintenance mode, press the ▲ key or ▼ key to select [2- 4 E VOLT], then press the TEST/SET key.



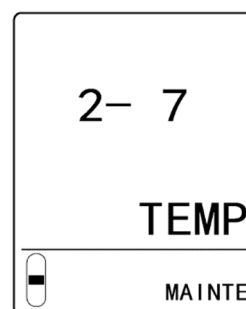
- 2 Check the set potential or element voltage.



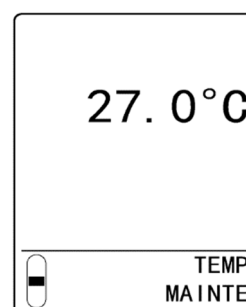
- 3 Press the MODE key.
The display reverts to [2- 4 E VOLT].

7-7-3 Checking the temperature of the detector (TEMP)

- 1 In maintenance mode, press the ▲ key or ▼ key to select [2- 7 TEMP], then press the TEST/SET key.



- 2 Check the temperature of the detector.



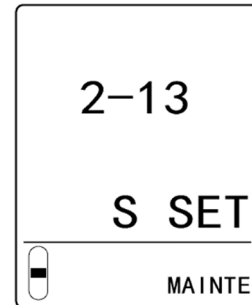
- 3 Press the MODE key.
The display reverts to [2- 7 TEMP].

7-8 Setting the sensor use start date (S SET)

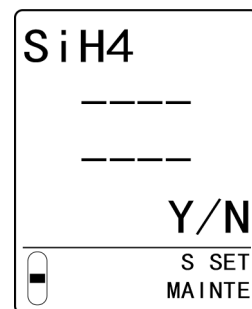
Set the sensor use start date.

This setting becomes invalid when the sensor is replaced.

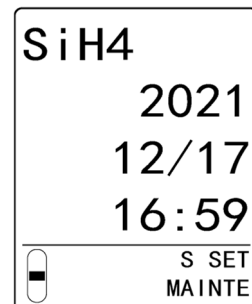
- 1 In maintenance mode, press the ▲ key or ▼ key to select [2-13 S SET], then press the TEST/SET key.



- 2 Press the TEST/SET key to enable the setting of the sensor use start date.



- 3 Check the sensor use start date.



- 4 Press the MODE key when the setting is complete.
The display reverts to [2-13 S SET].

7-9 Setting environmental settings 1

The following items can be set in environmental settings 1:

LCD display	Setting item	Remarks
[2- 9 SETTING1]	Environmental settings 1	
[SET- 0 INHIBIT]	INHIBIT setting	
[SET- 1 ALM P]	Alarm setpoint setting	
[SET- 2 ALM DLY]	Alarm delay setting	
[SET- 3 MAINTE]	Maintenance	Refer to '8. Replacing and Cleaning Parts'.
[SET- 4 F TEST]	Fault test	
[SET- 5 OPT ACT]		Not used

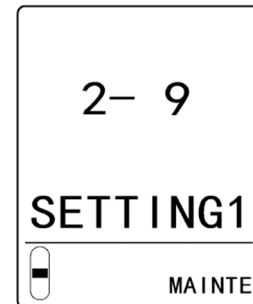
7-9-1 INHIBIT setting (INHIBIT)

Set ON/OFF for INHIBIT.

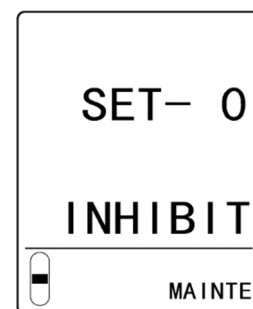
Set to [ON] to disable external alarm signal output even when gas concentrations exceed the alarm setpoints in detection mode. Additionally, the fault alarms and cautions on the main unit will no longer be issued. This setting is primarily used when testing and maintaining the product.

The default setting is [OFF].

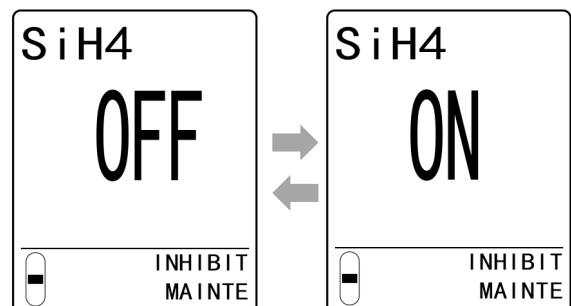
- In maintenance mode, press the ▲ key or ▼ key to select [2- 9 SETTING1], then press the TEST/SET key.



- Select [SET- 0 INHIBIT] and press the TEST/SET key.



- Press the ▲ key or ▼ key to select [OFF] or [ON], then press the TEST/SET key.



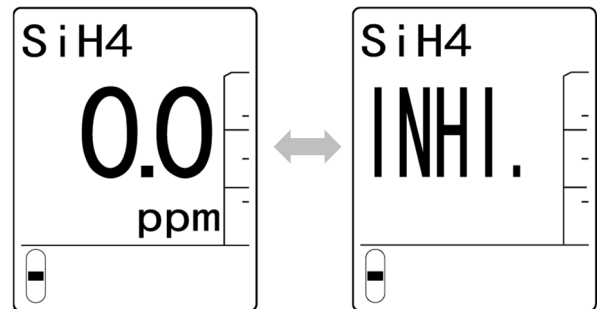
The display reverts to [SET- 0 INHIBIT].

4 Press the MODE key.

The display reverts to [2- 9 SETTING1].

NOTE

- ▶ For sensors for which the INHIBIT setting has been set to [ON], when you switch to detection mode, the display alternates between the concentration display and [INHI.].

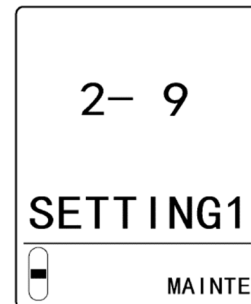


- ▶ For M sensors, make the INHIBIT setting for each of the two sensor slots. If a sensor slot is not set to [ON], the product will issue an external alarm during tests and maintenance.

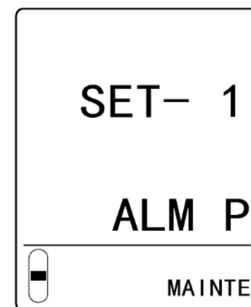
7-9-2 Alarm setpoint setting (ALM P)

Set the gas alarm setpoints (first alarm setpoint and second alarm setpoint).

- 1 In maintenance mode, press the ▲ key or ▼ key to select [2- 9 SETTING1], then press the TEST/SET key.

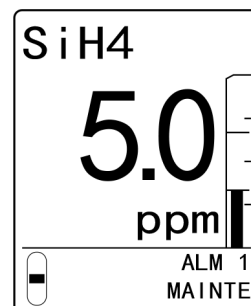


- 2 Press the ▲ key or ▼ key to select [SET- 1 ALM P], then press the TEST/SET key.



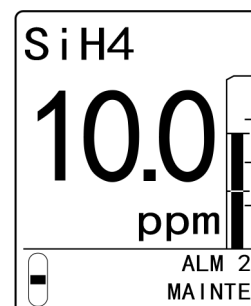
- 3 Press the ▲ key or ▼ key to set the alarm value for the first alarm setpoint, then press the TEST/SET key.

<First alarm setpoint setting>



- 4 Press the ▲ key or ▼ key to set the alarm value for the second alarm setpoint, then press the TEST/SET key.

<Second alarm setpoint setting>



The display reverts to [SET- 1 ALM P].

- 5 Press the MODE key.
The display reverts to [2- 9 SETTING1].

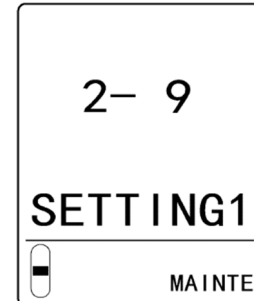
7-9-3 Alarm delay time setting (ALM DLY)

Set the alarm delay time.

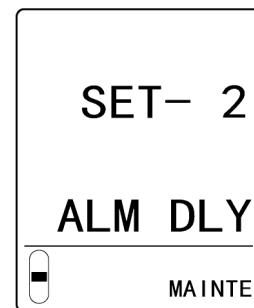
Set a time (0 to 60 seconds) to temporarily suspend activation to prevent false alarms caused by external noise.

The default setting is two seconds.

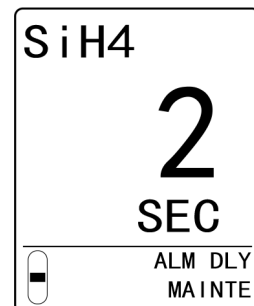
- 1 In maintenance mode, press the ▲ key or ▼ key to select [2- 9 SETTING1], then press the TEST/SET key.



- 2 Press the ▲ key or ▼ key to select [SET- 2 ALM DLY], then press the TEST/SET key.



- 3 Press the ▲ key or ▼ key to set the alarm delay time, then press the TEST/SET key.



The display reverts to [SET- 2 ALM DLY].

- 4 Press the MODE key.
The display reverts to [2- 9 SETTING1].

7-9-4 Fault alarm test (F TEST)

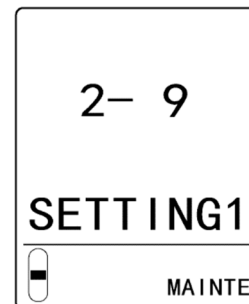
Perform a fault alarm test.

Test whether a fault alarm is triggered when a fault occurs with this product.

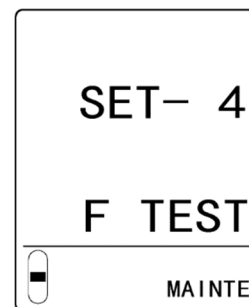


- When you perform a fault alarm test, depending on the setting, the fault contact may be activated even when in maintenance mode. Note this when performing this operation.
- The fault alarm test cannot be performed when INHIBIT is set to [ON].

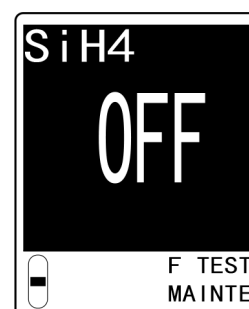
- 1 In maintenance mode, press the ▲ key or ▼ key to select [2- 9 SETTING1], then press the TEST/SET key.



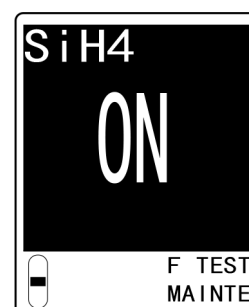
- 2 Press the ▲ key or ▼ key to select [SET- 4 F TEST], then press the TEST/SET key.



- 3 Press the TEST/SET key.
The gas concentration display ([OFF]) blinks.

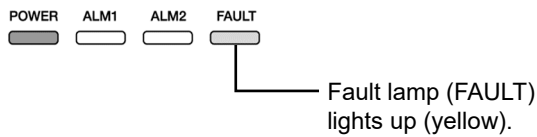


- 4 Press the ▲ key or ▼ key to select [ON], then press the TEST/SET key.



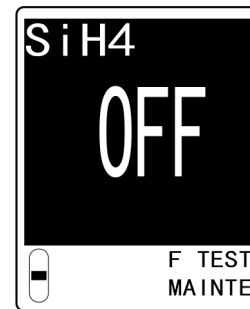
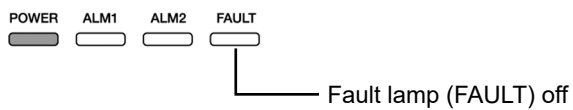
5 Check to confirm that a fault alarm is triggered, then press the TEST/SET key.

When the fault alarm is triggered, the fault lamp (FAULT) lights up (yellow).



6 Press the ▲ key or ▼ key to select [OFF], then press the TEST/SET key.

When the fault alarm is reset, the fault lamp (FAULT) turns off.



The display reverts to the display in step 3.

7 Press the MODE key.

The display reverts to [SET- 4 F TEST].

8 Press the MODE key.

The display reverts to [2- 9 SETTING1].

7-10 Setting environmental settings 2

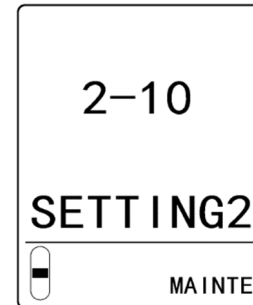
The following items can be set in environmental settings 2:

LCD display	Setting item	Remarks
[2-10 SETTING2]	Environmental settings 2	
[SET- 0 ADDRESS]	Address setting	Not used
[SET- 1 DAY TIME]	Date and time setting	
[SET- 2 SUPPRESS]	Zero suppression value setting	
[SET- 3 SUP TYPE]	Zero suppression type setting	
[SET- 4 TEST RLY]	Contact setting during alarm tests	
[SET- 5 TEST4-20]	External output during alarm tests	4 to 20 mA
[SET- 6 RLY PTRN]	Energized/de-energized setting	
[SET- 7 ALM TYPE]	Alarm type setting	
[SET- 8 ALM PTRN]	Alarm pattern setting	
[SET- 9 AL LIMIT]	Alarm value limiter setting	
[SET-10 FLT PTRN]	Fault alarm pattern setting	
[SET-11 AT FLOW]	Automatic flow adjustment setting	
[SET-12 ZERO F]	Zero follower setting	
[SET-13 ZERO 24F]	24-hour zero follower setting	
[SET-14 S ASSIST]	Sensitivity correction setting	
[SET-15 MNT OUT]	External output setting in maintenance mode	4 to 20 mA
[SET-16 MA 4-20]	External output adjustment	4 to 20 mA
[SET-17 BK LIGHT]	Backlight setting	
[SET-18 ETHERNET]	ETHERNET settings	ETD
[SET-19 PUMP CK]	Pump drive level diagnostic setting	
[SET-20 FLT RLY]	Fault contact operation setting for low flow rates	
[SET-21 FLT OUT]	Fault alarm external output setting	4 to 20 mA
[SET-22 CAU DISP]	Warning display setting	
[SET-23 CAU OUT]	Warning output setting	
[SET-24 GAS NAME]	Gas name display setting	
[SET-25 CONTRAST]	LCD contrast adjustment	

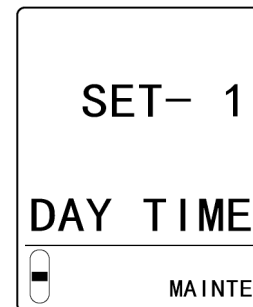
7-10-1 Date and time setting (DAY TIME)

Set the date and time (year, month, date, hours, and minutes) for the internal clock.

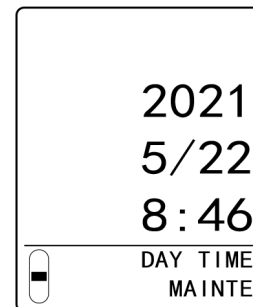
- 1 In maintenance mode, press the ▲ key or ▼ key to select [2-10 SETTING2], then press the TEST/SET key.



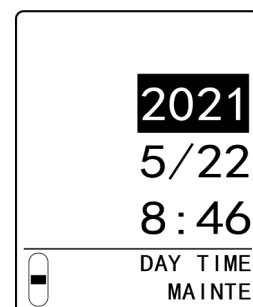
- 2 Press the ▲ key or ▼ key to select [SET- 1 DAY TIME], then press the TEST/SET key.



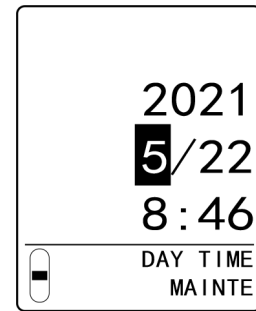
- 3 Press the TEST/SET key.



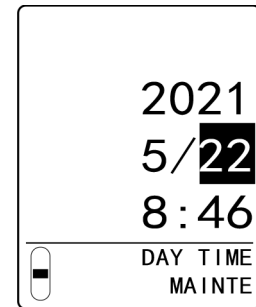
- 4 Press the ▲ key or ▼ key to set the last two digits of the year, then press the TEST/SET key.



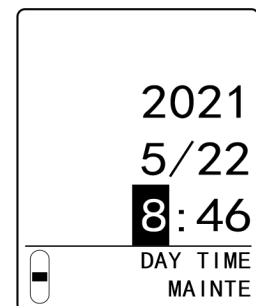
- 5 Press the ▲ key or ▼ key to set the month, then press the TEST/SET key.



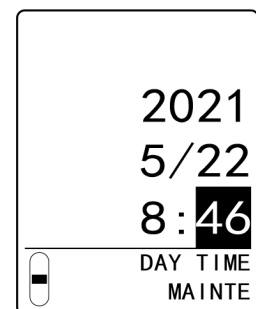
- 6 Press the ▲ key or ▼ key to set the day, then press the TEST/SET key.



- 7 Press the ▲ key or ▼ key to set the hour (24-hour clock display), then press the TEST/SET key.



- 8 Press the ▲ key or ▼ key to set the minutes, then press the TEST/SET key.



The date/time is set. The display reverts to [SET- 1 DAY TIME].

- 9 Press the MODE key.
The display reverts to [2-10 SETTING2].

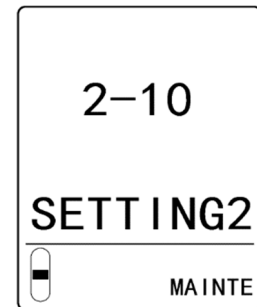
NOTE

- ▶ Press the MODE key in each date/time setting step to return to the previous step.
- ▶ Press the MODE key in step 3 to cancel the date/time setting and revert the display to [SET- 1 DAY TIME].

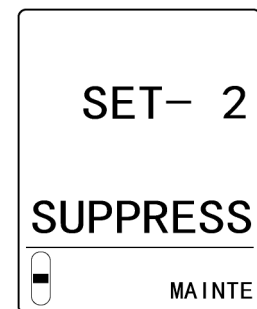
7-10-2 Zero suppression value setting (SUPPRESS)

Set the zero suppression value.

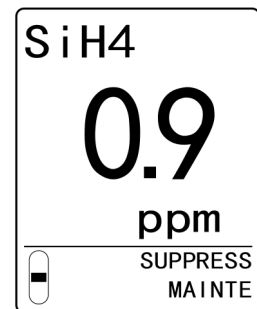
- 1 In maintenance mode, press the ▲ key or ▼ key to select [2-10 SETTING2], then press the TEST/SET key.



- 2 Press the ▲ key or ▼ key to select [SET- 2 SUPPRESS], then press the TEST/SET key.



- 3 Press the ▲ key or ▼ key to select the zero suppression value, then press the TEST/SET key.



The display reverts to [SET- 2 SUPPRESS].

- 4 Press the MODE key.
The display reverts to [2-10 SETTING2].

7-10-3 Zero suppression type setting (SUP TYPE)

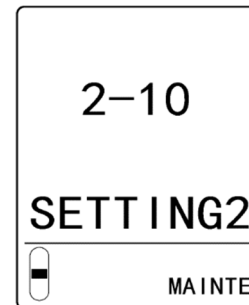
Set the zero suppression type.

Select either of the following:

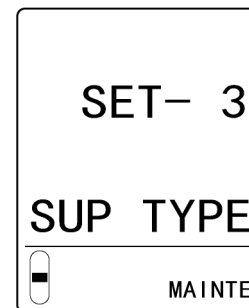
- CUT type ([CUT]): Values exceeding the zero suppression value are shown as is.
- SLOPE type ([SLOPE]): Values exceeding the zero suppression value are smoothed for display.

The default setting is CUT type ([CUT]).

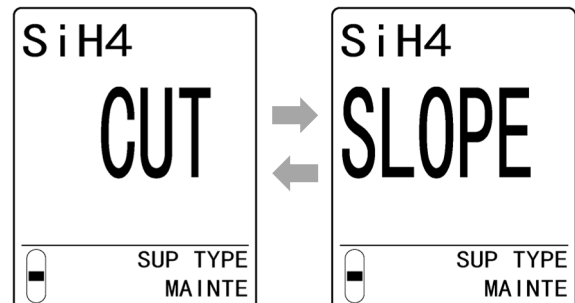
- 1 In maintenance mode, press the ▲ key or ▼ key to select [2-10 SETTING2], then press the TEST/SET key.



- 2 Press the ▲ key or ▼ key to select [SET- 3 SUP TYPE], then press the TEST/SET key.



- 3 Press the ▲ key or ▼ key to select [CUT] or [SLOPE], then press the TEST/SET key.



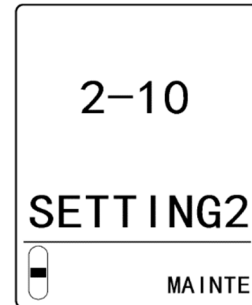
The display reverts to [SET- 3 SUP TYPE].

- 4 Press the MODE key.
The display reverts to [2-10 SETTING2].

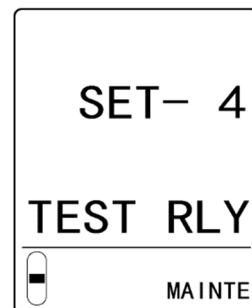
7-10-4 Contact setting during alarm tests (TEST RLY)

Set ON/OFF for contact operation during alarm tests.
Set to [ON] to allow contacts to operate during alarm tests.
The default setting is [OFF].

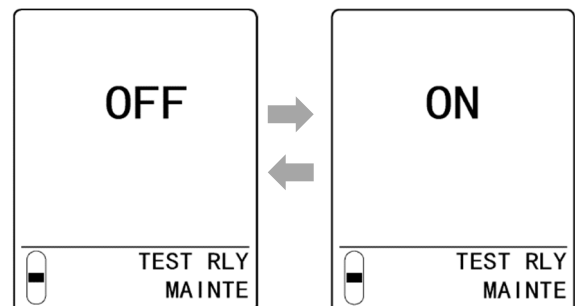
- 1 In maintenance mode, press the ▲ key or ▼ key to select [2-10 SETTING2], then press the TEST/SET key.



- 2 Press the ▲ key or ▼ key to select [SET- 4 TEST RLY], then press the TEST/SET key.



- 3 Press the ▲ key or ▼ key to select [OFF] or [ON], then press the TEST/SET key.



The display reverts to [SET- 4 TEST RLY].

- 4 Press the MODE key.
The display reverts to [2-10 SETTING2].

NOTE

- ▶ Press the MODE key in step 3 to cancel the setting and revert the display to [SET- 4 TEST RLY].

7-10-5 External output setting during alarm tests (TEST4-20)

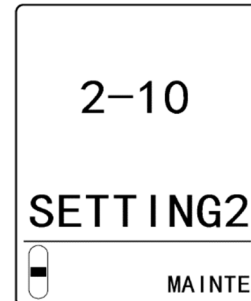
4 to 20 mA

Set ON/OFF for external output during alarm tests.

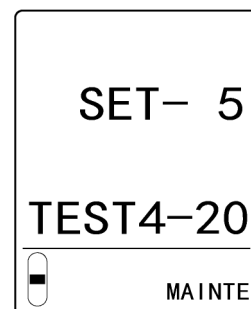
Set to [ON] to use external output (4 to 20 mA) during alarm tests.

When set to [OFF], the output from immediately before the alarm test is retained.

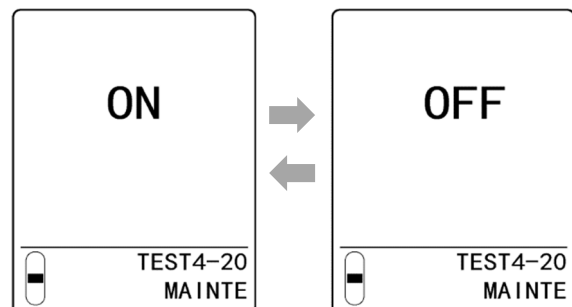
- 1 In maintenance mode, press the ▲ key or ▼ key to select [2-10 SETTING2], then press the TEST/SET key.



- 2 Press the ▲ key or ▼ key to select [SET- 5 TEST4-20], then press the TEST/SET key.



- 3 Press the ▲ key or ▼ key to select [ON] or [OFF], then press the TEST/SET key.



The display reverts to [SET- 5 TEST4-20].

- 4 Press the MODE key.
The display reverts to [2-10 SETTING2].

NOTE

- ▶ Press the MODE key in step 3 to cancel the setting and revert the display to [SET- 5 TEST4-20].

7-10-6 Energized/de-energized setting (RLY PTRN)

Set energized/de-energized for the first alarm contact, second alarm contact, and fault alarm contact.
Set de-energized ([ND]) or energized ([NE]) for each contact.

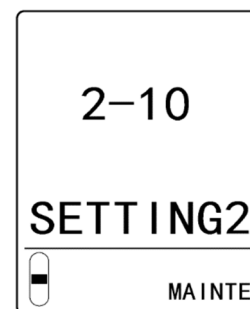
- If the setting is de-energized, the relay is energized in alarm state. (De-energized in normal conditions)
 - With contact a, it is open in normal conditions and closed in alarm state.
 - This behavior is reversed with contact b.
- If the setting is energized, the relay is energized in normal conditions. (De-energized in alarm state)
 - With contact a, it is closed in normal conditions and open in alarm state.
It is also open when power supply is stopped.
 - This behavior is reversed with contact b.

The default setting is de-energized ([ND]) for both contacts.

<Setting alarm contacts>

Set the first and second alarm contacts.

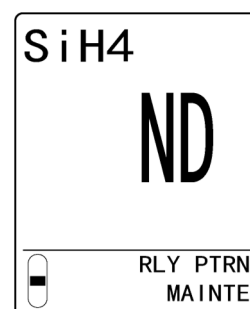
- 1 In maintenance mode, press the ▲ key or ▼ key to select [2-10 SETTING2], then press the TEST/SET key.



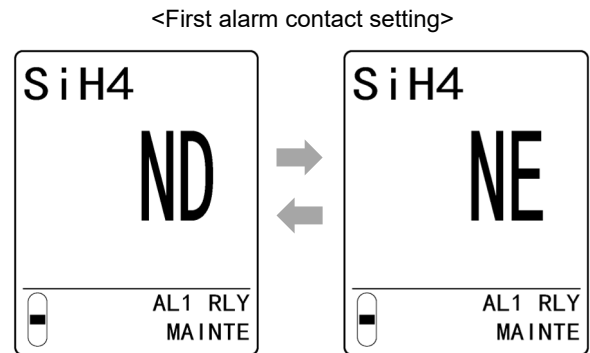
- 2 Press the ▲ key or ▼ key to select [SET- 6 RLY PTRN], then press the TEST/SET key.



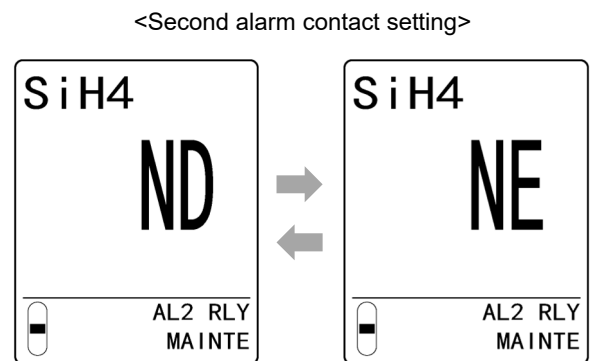
- 3 Press the TEST/SET key.



- 4 Press the ▲ key or ▼ key to select [ND] or [NE], then press the TEST/SET key.



- 5 Press the ▲ key or ▼ key to select [ND] or [NE], then press the TEST/SET key.

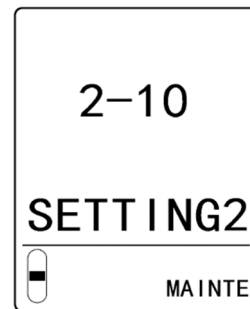


The display reverts to the display in step 3.

- 6 Press the MODE key.
The display reverts to [SET- 6 RLY PTRN].
- 7 Press the MODE key.
The display reverts to [2-10 SETTING2].

<Setting fault alarm contact>

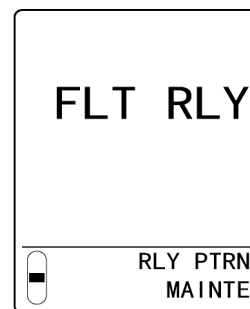
- 1 In maintenance mode, press the ▲ key or ▼ key to select [2-10 SETTING2], then press the TEST/SET key.



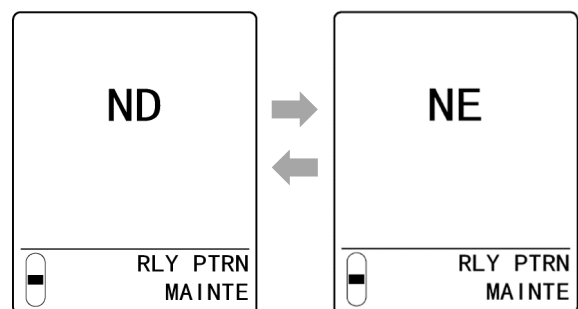
- 2 Select [SET- 6 RLY PTRN], then press the TEST/SET key.



- 3 Press the ▲ key or ▼ key to select [FLT RLY], then press the TEST/SET key.



- 4 Press the ▲ key or ▼ key to select [ND] or [NE], then press the TEST/SET key.



The display reverts to the display in step 3.

- 5 Press the **MODE** key.
The display reverts to [SET- 6 RLY PTRN].

- 6 Press the **MODE** key.
The display reverts to [2-10 SETTING2].

7-10-7 Alarm type setting (ALM TYP)

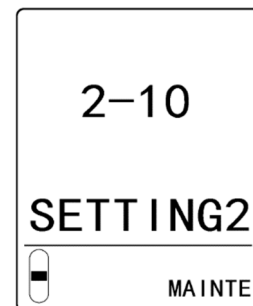
Set the alarm type.

When the oxygen deficiency alarm OSU sensor is fitted, H-HH type, L-LL type, or L-H type can be set.
The default setting is L-LL type.

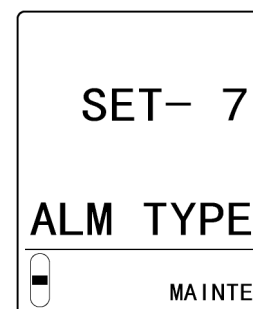
NOTE

- ▶ You can set the alarm type for oxygen deficiency model sensors. For other sensors, it will be H-HH type.
- ▶ The ESU (O₂) sensor can be set to L-LL only.

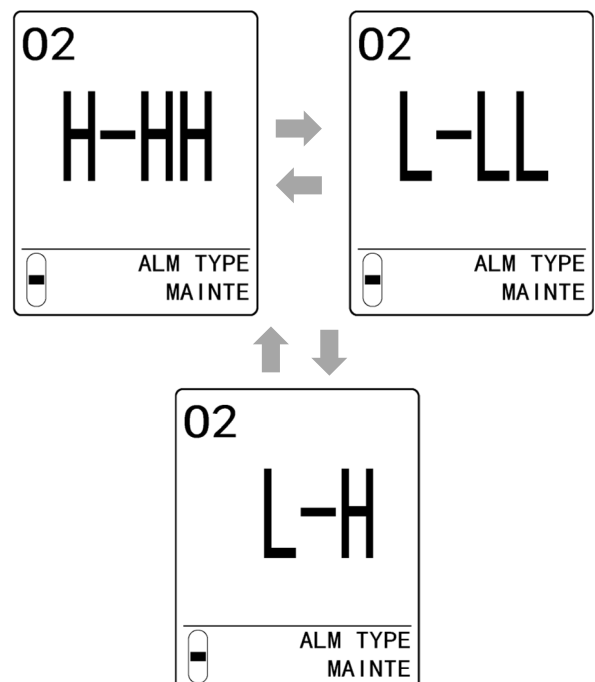
- 1 In maintenance mode, press the ▲ key or ▼ key to select [2-10 SETTING2], then press the TEST/SET key.



- 2 Press the ▲ key or ▼ key to select [SET- 7 ALM TYPE], then press the TEST/SET key.



- 3 Press the ▲ key or ▼ key to select [H-HH], [L-LL], or [L-H], then press the TEST/SET key.



The display reverts to [SET- 7 ALM TYPE].

4 Press the MODE key.

The display reverts to [2-10 SETTING2].

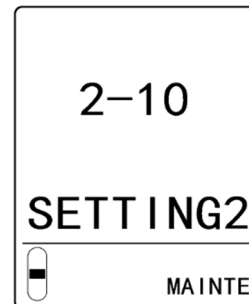
7-10-8 Alarm pattern setting (ALM PTRN)

Set the alarm pattern for the alarm setpoints.
Set to either auto reset ([NL]) or self-latching ([L]).
The default setting is auto reset ([NL]).

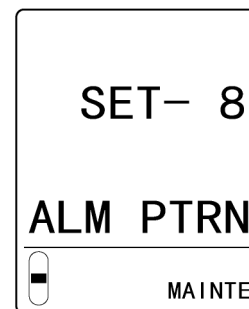
NOTE

- ▶ The alarm pattern setting will affect how the product behaves. For normal use, leave this setting unchanged.

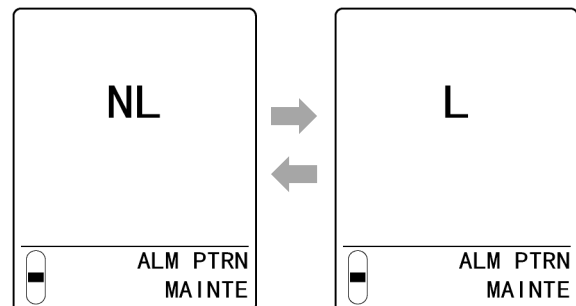
- 1 In maintenance mode, press the ▲ key or ▼ key to select [2-10 SETTING2], then press the TEST/SET key.



- 2 Press the ▲ key or ▼ key to select [SET- 8 ALM PTRN], then press the TEST/SET key.



- 3 Press the ▲ key or ▼ key to select [NL] or [L], then press the TEST/SET key.



The display reverts to [SET- 8 ALM PTRN].

- 4 Press the MODE key.
The display reverts to [2-10 SETTING2].

NOTE

- ▶ Press the MODE key in step 3 to cancel the setting and revert the display to [SET- 8 ALM PTRN].

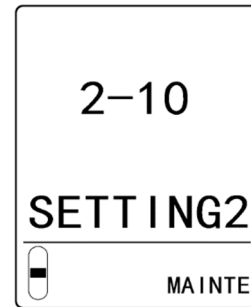
7-10-9 Alarm value limiter setting (AL LIMIT)

Set ON/OFF for the alarm point limiter.
The default setting is [ON].

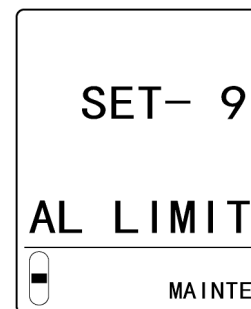
NOTE

- ▶ The alarm value limiter setting will affect how the product behaves. For normal use, leave this setting unchanged.

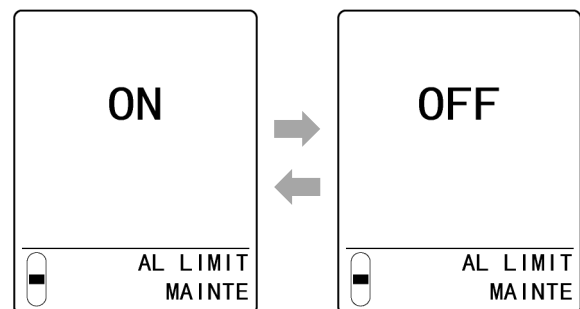
- 1 In maintenance mode, press the ▲ key or ▼ key to select [2-10 SETTING2], then press the TEST/SET key.



- 2 Press the ▲ key or ▼ key to select [SET- 9 AL LIMIT], then press the TEST/SET key.



- 3 Press the ▲ key or ▼ key to select [ON] or [OFF], then press the TEST/SET key.



The display reverts to [SET- 9 AL LIMIT].

- 4 Press the MODE key.
The display reverts to [2-10 SETTING2].

NOTE

- ▶ Press the MODE key in step 3 to cancel the setting and revert the display to [SET- 9 AL LIMIT].

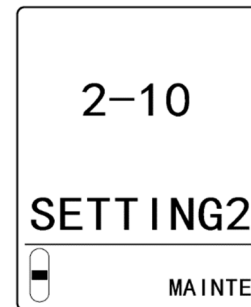
7-10-10 Fault alarm pattern setting (FLT PTRN)

Set the fault alarm pattern.
Set to either auto reset ([NL]) or self-latching ([L]).
The default setting is auto reset ([NL]).

NOTE

- ▶ The fault alarm pattern setting will affect how the product behaves. For normal use, leave this setting unchanged.

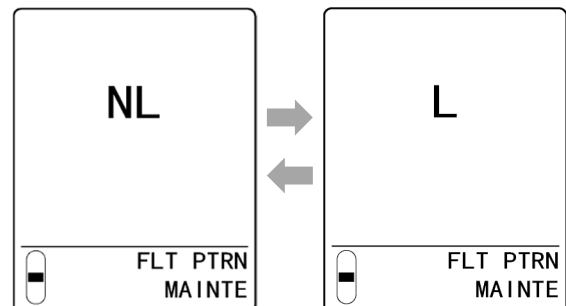
- 1 In maintenance mode, press the ▲ key or ▼ key to select [2-10 SETTING2], then press the TEST/SET key.



- 2 Press the ▲ key or ▼ key to select [SET-10 FLT PTRN], then press the TEST/SET key.



- 3 Press the ▲ key or ▼ key to select [NL] or [L], then press the TEST/SET key.



The display reverts to [SET-10 FLT PTRN].

- 4 Press the MODE key.
The display reverts to [2-10 SETTING2].

NOTE

- ▶ Press the MODE key in step 3 to cancel the setting and revert the display to [SET-10 FLT PTRN].

7-10-11 Automatic flow adjustment setting (AT FLOW)

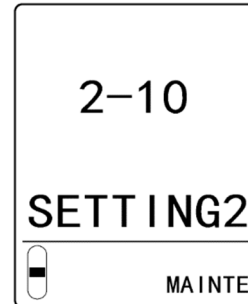
Set ON/OFF for the automatic flow adjustment function.

The automatic flow adjustment function is enabled when set to [ON].

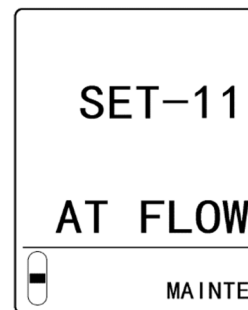
The automatic flow adjustment function is disabled when set to [OFF] to allow manual flow adjustment.

The default setting is [ON].

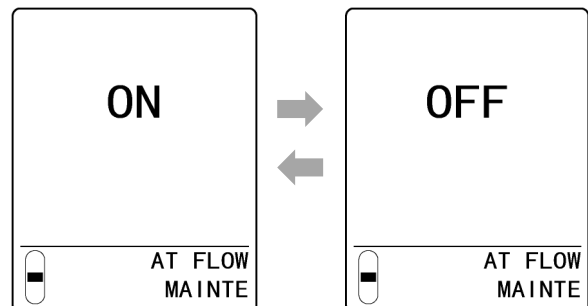
- 1 In maintenance mode, press the ▲ key or ▼ key to select [2-10 SETTING2], then press the TEST/SET key.



- 2 Press the ▲ key or ▼ key to select [SET-11 AT FLOW], then press the TEST/SET key.



- 3 Press the ▲ key or ▼ key to select [ON] or [OFF], then press the TEST/SET key.



The display reverts to [SET-11 AT FLOW].

- 4 Press the MODE key.
The display reverts to [2-10 SETTING2].

NOTE

- ▶ Press the MODE key in step 3 to cancel the setting and revert the display to [SET-11 AT FLOW].

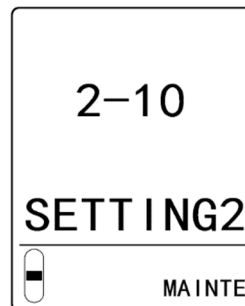
7-10-12 Zero follower setting (ZERO F)

Set ON/OFF for the zero follower function. (Refer to '6-4-2 Zero follower function'.)
The default setting is [ON].

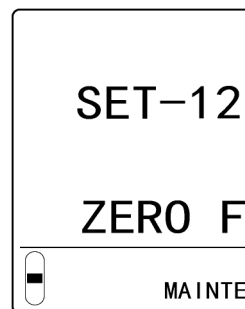
NOTE

- ▶ You can set the zero follower setting for catalytic combustion type sensors, electrochemical type sensors, non-dispersive infrared type sensors, and pyrolysis-particle type sensors.

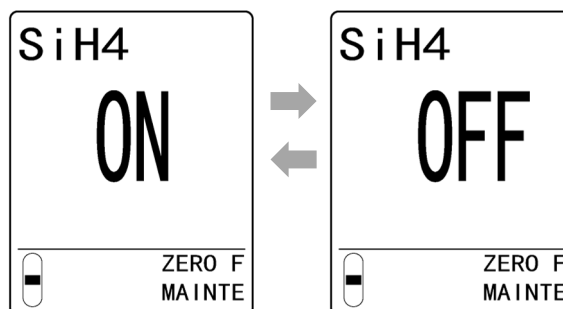
- 1 In maintenance mode, press the ▲ key or ▼ key to select [2-10 SETTING2], then press the TEST/SET key.



- 2 Press the ▲ key or ▼ key to select [SET-12 ZERO F], then press the TEST/SET key.



- 3 Press the ▲ key or ▼ key to select [ON] or [OFF], then press the TEST/SET key.



The display reverts to [SET-12 ZERO F].

- 4 Press the MODE key.
The display reverts to [2-10 SETTING2].

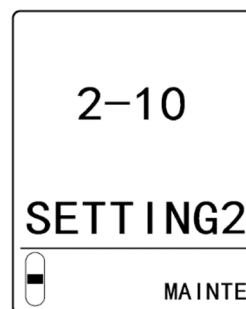
7-10-13 24-hour zero follower setting (ZERO 24F)

Set the 24-hour zero follower function. (Refer to '6-4-2 Zero follower function'.)
The default setting is [ON].

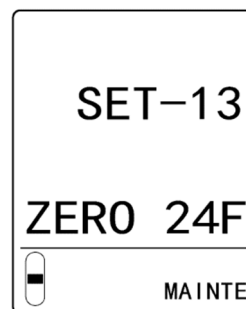
NOTE

- ▶ You can set the 24-hour zero follower setting for catalytic combustion type sensors, electrochemical type sensors, non-dispersive infrared type sensors, and pyrolysis-particle type sensors.

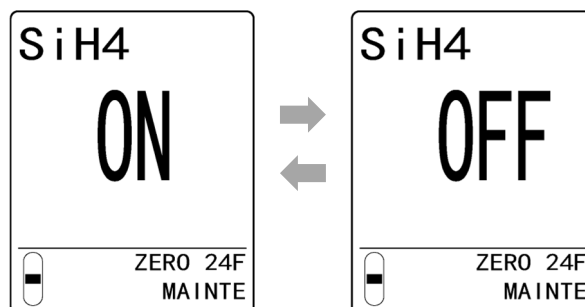
- 1 In maintenance mode, press the ▲ key or ▼ key to select [2-10 SETTING2], then press the TEST/SET key.



- 2 Press the ▲ key or ▼ key to select [SET-13 ZERO 24F], then press the TEST/SET key.



- 3 Press the ▲ key or ▼ key to select [ON] or [OFF], then press the TEST/SET key.



The display reverts to [SET-13 ZERO 24F].

- 4 Press the MODE key.
The display reverts to [2-10 SETTING2].

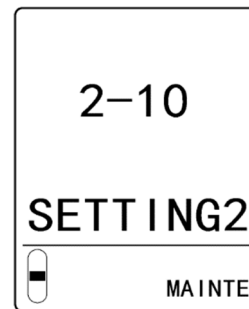
7-10-14 Sensitivity correction setting (S ASSIST)

Set ON/OFF for the sensitivity correction function. (Refer to '6-4-3 Sensitivity correction function'.)
The default setting is [ON].

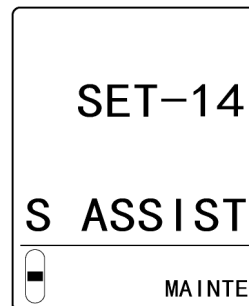
NOTE

- ▶ You can set the sensitivity correction setting for electrochemical type sensors.

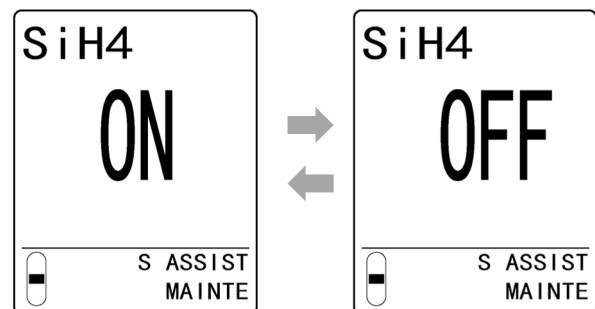
- 1 In maintenance mode, press the ▲ key or ▼ key to select [2-10 SETTING2], then press the TEST/SET key.



- 2 Press the ▲ key or ▼ key to select [SET-14 S ASSIST], then press the TEST/SET key.



- 3 Press the ▲ key or ▼ key to select [ON] or [OFF], then press the TEST/SET key.



The display reverts to [SET-14 S ASSIST].

- 4 Press the MODE key.
The display reverts to [2-10 SETTING2].

7-10-15 External output setting in maintenance mode (MNT OUT) 4 to 20 mA

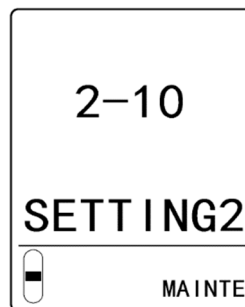
Set the external output in maintenance mode.

Select one of the following:

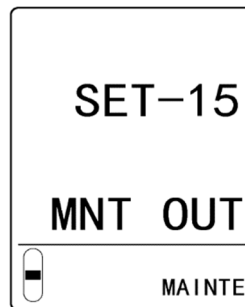
- 2.5 mA ([2.5]): Set the external output value to 2.5 mA.
- 4.0 mA ([4.0]): Set the external output value to 4.0 mA.
- HOLD ([HOLD]): Value from immediately prior to detection mode is held.
- 4 to 20 mA ([4-20]): Set the external output value to 4 to 20 mA (linked to the display value).

The default setting is 2.5 mA ([2.5]).

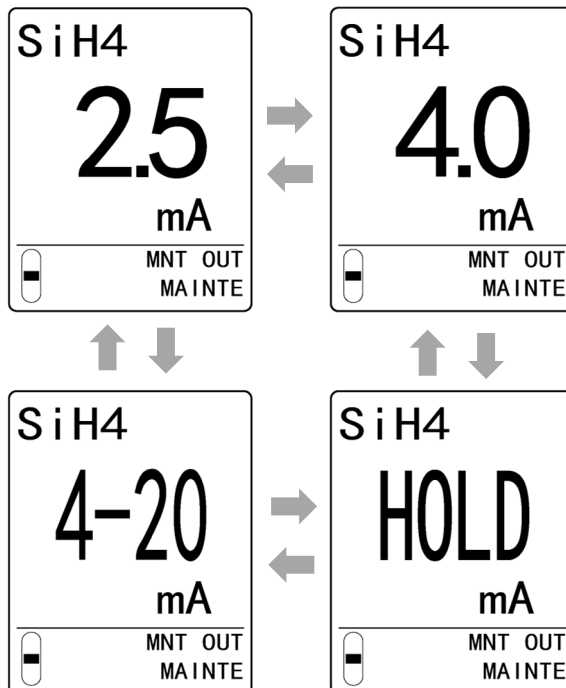
1 In maintenance mode, press the ▲ key or ▼ key to select [2-10 SETTING2], then press the TEST/SET key.



2 Press the ▲ key or ▼ key to select [SET-15 MNT OUT], then press the TEST/SET key.



3 Press the ▲ key or ▼ key to select [2.5], [4.0], [HOLD], or [4-20], then press the TEST/SET key.



The display reverts to [SET-15 MNT OUT].

4 Press the MODE key.

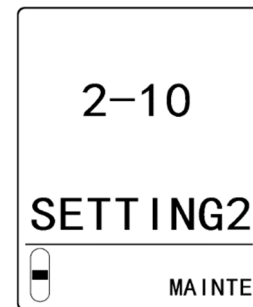
The display reverts to [2-10 SETTING2].

7-10-16 External output adjustment (MA 4-20)

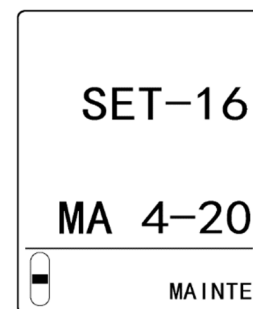
4 to 20 mA

Adjust the external output of 4 mA and 20 mA.
Connect the product signal cable to an ammeter.

- 1 In maintenance mode, press the ▲ key or ▼ key to select [2-10 SETTING2], then press the TEST/SET key.

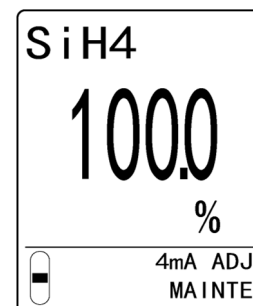


- 2 Press the ▲ key or ▼ key to select [SET-16 MA 4-20], then press the TEST/SET key.



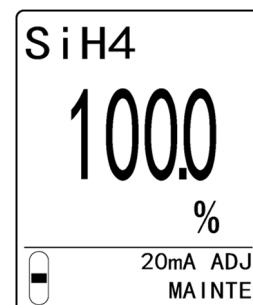
- 3 Press the ▲ key or ▼ key to adjust the output (%). Confirm that the ammeter reading is 4 mA and press the TEST/SET key.

<4 mA adjustment>



- 4 Press the ▲ key or ▼ key to adjust the output (%). Confirm that the ammeter reading is 20 mA and press the TEST/SET key.

<20 mA adjustment>



The display reverts to [SET-16 MA 4-20].

- 5 Press the MODE key.
The display reverts to [2-10 SETTING2].

7-10-17 Backlight setting (BK LIGHT)

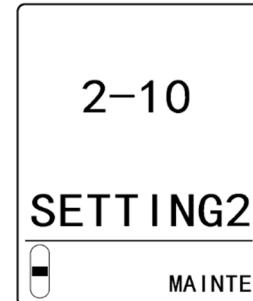
Set ON/SAVE for the LCD backlight.

The backlight will remain lit if this is set to [ON].

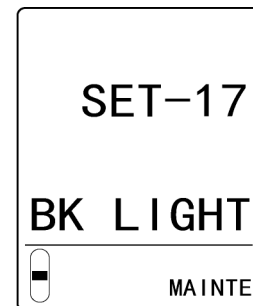
When set to [SAVE], the backlight will illuminate only when an operation or event takes place.

The default setting is [ON].

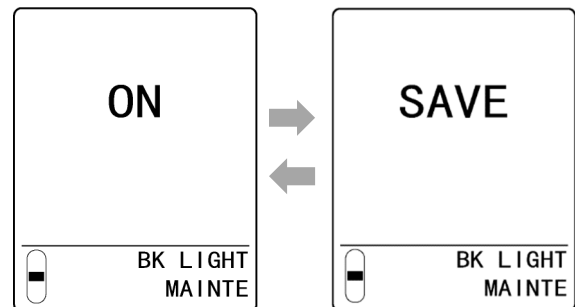
- 1 In maintenance mode, press the ▲ key or ▼ key to select [2-10 SETTING2], then press the TEST/SET key.



- 2 Press the ▲ key or ▼ key to select [SET-17 BK LIGHT], then press the TEST/SET key.



- 3 Press the ▲ key or ▼ key to select [ON] or [SAVE], then press the TEST/SET key.



The display reverts to [SET-17 BK LIGHT].

- 4 Press the MODE key.
The display reverts to [2-10 SETTING2].

NOTE

- ▶ Press the MODE key in step 3 to cancel the setting and revert the display to [SET-17 BK LIGHT].

7-10-18 ETHERNET settings (ETHERNET)

ETD

Make ETHERNET settings.

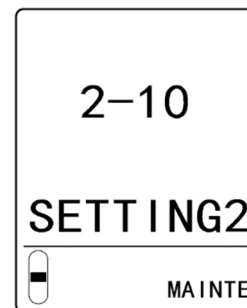
Make the following settings:

- [IP Address]: Set the IP address.
- [Subnet Mask]: Set the subnet mask.
- [Default Gateway]: Set the default gateway.
- [DHCP]: Set DHCP ON/OFF.
If set to [ON], the IP address is acquired automatically from the DHCP server. [IP Address], [Subnet Mask], and [Default Gateway] settings are not used in this case.
- [PLC Mode]: Set the PLC mode.
- [PLC Area]: Set the PLC area.
- [PLC Data Select]: Set the PLC data. This will be [ON(*HOLD)] for F sensor and U sensor models.

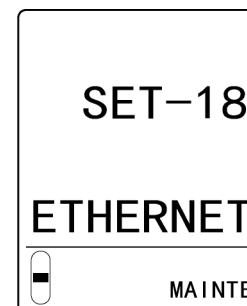
NOTE

- ▶ [MAC Address] is an identification number unique to the device. This setting cannot be changed.

- 1 In maintenance mode, press the ▲ key or ▼ key to select [2-10 SETTING2], then press the TEST/SET key.



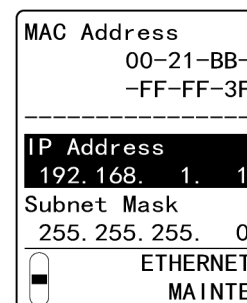
- 2 Press the ▲ key or ▼ key to select [SET-18 ETHERNET], then press the TEST/SET key.



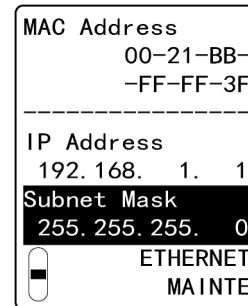
- 3 Select [IP Address], then press the TEST/SET key.

- 4 Press the ▲ key or ▼ key to set the IP address, then press the TEST/SET key.

Repeat step 4 to set each of the numerals for the IP address.

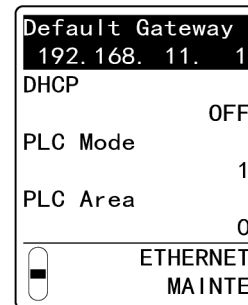


5 Press the ▲ key or ▼ key to select [Subnet Mask], then press the TEST/SET key.



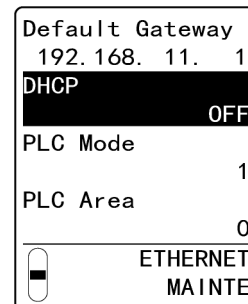
6 Press the ▲ key or ▼ key to set the subnet mask, then press the TEST/SET key.
Repeat step 6 to set each of the numerals for the subnet mask.

7 Press the ▲ key or ▼ key to select [Default Gateway], then press the TEST/SET key.



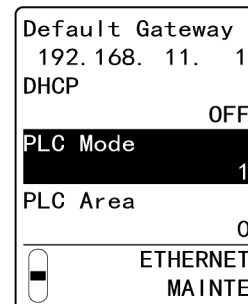
8 Press the ▲ key or ▼ key to set the default gateway, then press the TEST/SET key.
Repeat step 8 to set each of the numerals for the default gateway address.

9 Press the ▲ key or ▼ key to select [DHCP], then press the TEST/SET key.



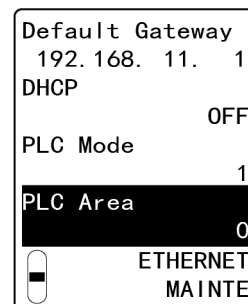
10 Press the ▲ key or ▼ key to select [ON] or [OFF], then press the TEST/SET key.

11 Press the ▲ key or ▼ key to select [PLC Mode], then press the TEST/SET key.



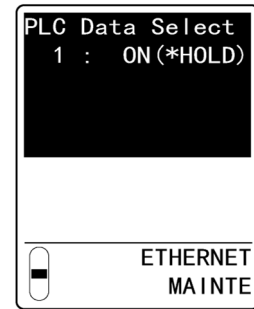
12 Press the ▲ key or ▼ key to set the PLC mode, then press the TEST/SET key.

13 Press the ▲ key or ▼ key to select [PLC Area], then press the TEST/SET key.

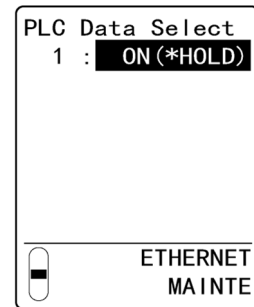


14 Press the ▲ key or ▼ key to set the PLC area, then press the TEST/SET key.

- 15 Press the ▲ key or ▼ key to select [PLC Data Select], then press the TEST/SET key.



- 16 Check to confirm that the selection is [ON(*HOLD)], then press the TEST/SET key.



- 17 Press the MODE key.
The display reverts to [SET-18 ETHERNET].

- 18 Press the MODE key.
The display reverts to [2-10 SETTING2].

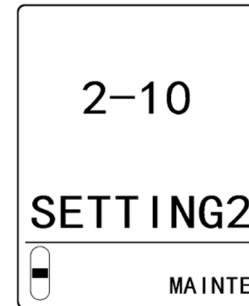
NOTE

- ▶ Press the MODE key in each ETHERNET setting to return to the previous setting.
-

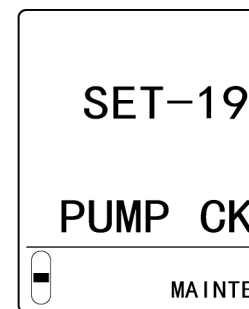
7-10-19 Pump drive level diagnostic setting (PUMP CK)

Set ON/OFF for pump drive level diagnostics.
Set to [ON] to run periodic diagnostics on pump drive levels.
The default setting is [ON].

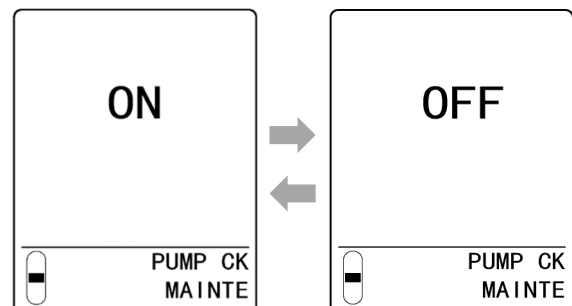
- 1 In maintenance mode, press the ▲ key or ▼ key to select [2-10 SETTING2], then press the TEST/SET key.



- 2 Press the ▲ key or ▼ key to select [SET-19 PUMP CK], then press the TEST/SET key.



- 3 Press the ▲ key or ▼ key to select [ON] or [OFF], then press the TEST/SET key.



The display reverts to [SET-19 PUMP CK].

- 4 Press the MODE key.
The display reverts to [2-10 SETTING2].

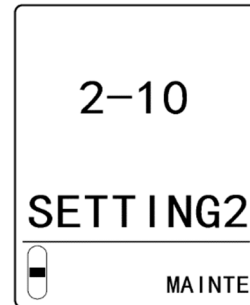
NOTE

- ▶ Press the MODE key in step 3 to cancel the setting and revert the display to [SET-19 PUMP CK].

7-10-20 Fault contact operation setting for low flow rates (FLT RLY)

Set ON/OFF for the operation of fault contacts when flow is low ON or OFF.
When set to [ON], the fault contact operates when the flow rate is low.
The default setting is [ON].

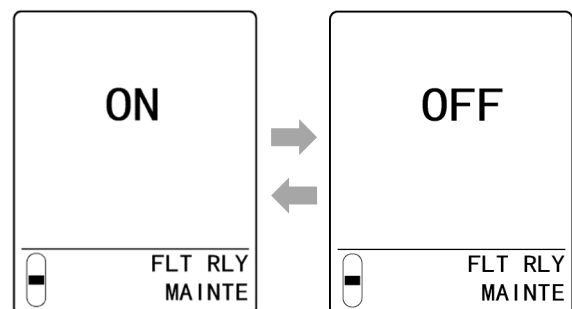
- 1 In maintenance mode, press the ▲ key or ▼ key to select [2-10 SETTING2], then press the TEST/SET key.



- 2 Press the ▲ key or ▼ key to select [SET-20 FLT RLY], then press the TEST/SET key.



- 3 Press the ▲ key or ▼ key to select [ON] or [OFF], then press the TEST/SET key.



The display reverts to [SET-20 FLT RLY].

- 4 Press the MODE key.
The display reverts to [2-10 SETTING2].

NOTE

- ▶ Press the MODE key in step 3 to cancel the setting and revert the display to [SET-20 FLT RLY].

7-10-21 Fault alarm external output setting (FLT OUT)

4 to 20 mA

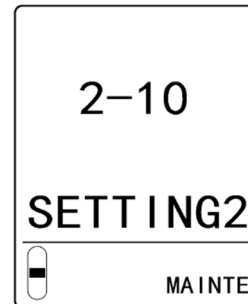
Sets the external output for fault alarms.

Select one of the following:

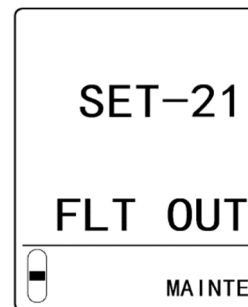
- 0.5 mA ([0.5]): Set the external output value to 0.5 mA.
- 21.5 mA ([21.5]): Set the external output value to 21.5 mA.
- OPT ([OPT]): Set in the range between 0.0 mA and 4.0 mA. (digit: 0.1)

The default setting is 0.5 mA ([0.5]).

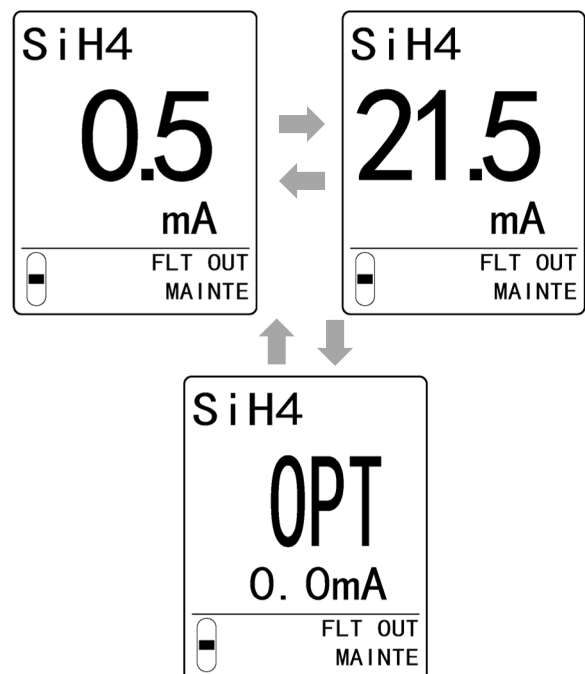
- 1 In maintenance mode, press the ▲ key or ▼ key to select [2-10 SETTING2], then press the TEST/SET key.



- 2 Press the ▲ key or ▼ key to select [SET-21 FLT OUT], then press the TEST/SET key.



- 3 Press the ▲ key or ▼ key to select [0.5], [21.5], or [OPT], then press the TEST/SET key. If you select [OPT], press the ▲ key or ▼ key to set the external output value, then press the TEST/SET key.



The display reverts to [SET-21 FLT OUT].

- 4 Press the MODE key. The display reverts to [2-10 SETTING2].

7-10-22 Warning display settings (CAU DISP)

Set whether to display warnings on the LCD.

Set ON/OFF for each of the following warnings.

For more information on each warning, refer to '10. Troubleshooting'.

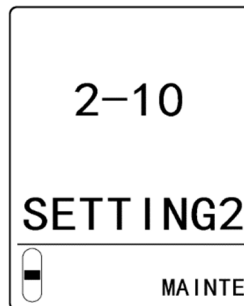
- [E-8X] (E-80, E-81, E-82)
- [E- 9]
- [E- 6]
- [E-94]
- [E-5X] (E-50, E-56, E-57, E-58, E-59)
- [E-15]
- [E-83]
- [E-84]
- [E-98]

The default settings are as follows:

GD-81D-ETD: All warnings are [ON].

GD-81D: [E- 6] is [OFF]; all others are [ON].

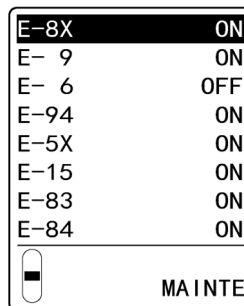
- 1 In maintenance mode, press the ▲ key or ▼ key to select [2-10 SETTING2], then press the TEST/SET key.



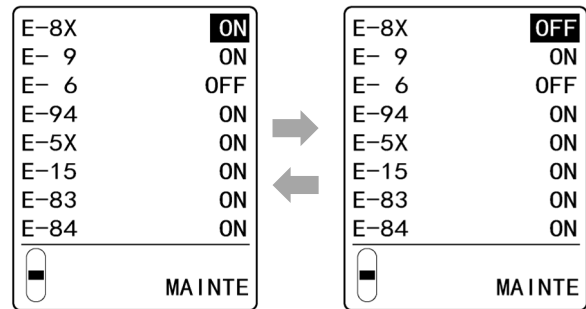
- 2 Press the ▲ key or ▼ key to select [SET-22 CAU DISP], then press the TEST/SET key.



- 3 Press the ▲ key or ▼ key to select the fault code, then press the TEST/SET key.



- 4 Press the ▲ key or ▼ key to select [ON] or [OFF], then press the TEST/SET key.



The display reverts to the display in step 3.
To continue setting other fault codes, repeat steps 3 and 4.

- 5 Press the MODE key when the settings are complete.
The display reverts to [SET-22 CAU DISP].

- 6 Press the MODE key.
The display reverts to [2-10 SETTING2].

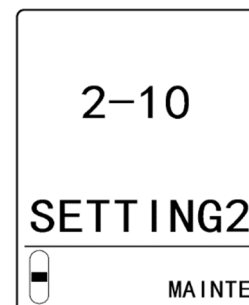
7-10-23 Warning output settings (CAU OUT)

Set whether to externally output warnings.
Set ON/OFF for each of the following warnings.
For more information on each warning, refer to '10. Troubleshooting'.

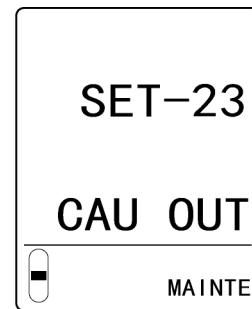
- [E-8X] (E-80, E-81, E-82)
- [E- 9]
- [E- 6]
- [E-94]
- [E-5X] (E-50, E-56, E-57, E-58, E-59)
- [E-15]
- [E-83]
- [E-84]
- [E-98]

The default settings are as follows:
GD-81D-ETD: All warnings are [ON].
GD-81D: [E- 6] is [OFF]; all others are [ON].

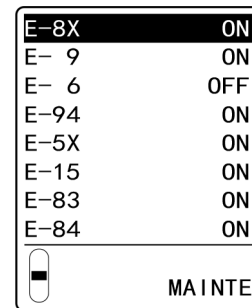
- 1 In maintenance mode, press the ▲ key or ▼ key to select [2-10 SETTING2], then press the TEST/SET key.



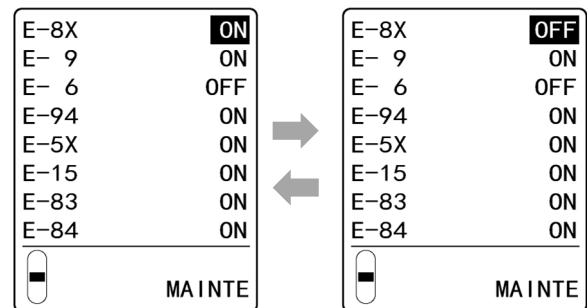
- 2 Press the ▲ key or ▼ key to select [SET-23 CAU OUT], then press the TEST/SET key.



- 3 Press the ▲ key or ▼ key to select the fault code, then press the TEST/SET key.



- 4 Press the ▲ key or ▼ key to select [ON] or [OFF], then press the TEST/SET key.



The display reverts to the display in step 3.
To continue setting other fault codes, repeat steps 3 and 4.

- 5 Press the MODE key when the settings are complete.
The display reverts to [SET-23 CAU OUT].

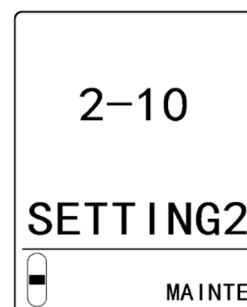
- 6 Press the MODE key.
The display reverts to [2-10 SETTING2].

7-10-24 Gas name display setting (GAS NAME)

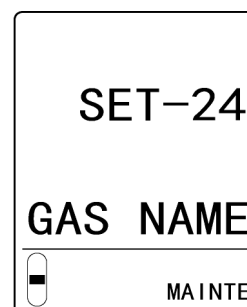
Set the gas name displayed on the LCD.

The gas name can be up to eight characters long.

- 1 In maintenance mode, press the ▲ key or ▼ key to select [2-10 SETTING2], then press the TEST/SET key.



- 2 Press the ▲ key or ▼ key to select [SET-24 GAS NAME], then press the TEST/SET key.



- 3 Press the TEST/ SET key or MODE key to move the cursor.

To move to the next character, press the TEST/SET key.

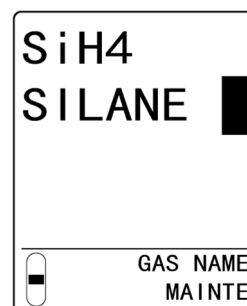
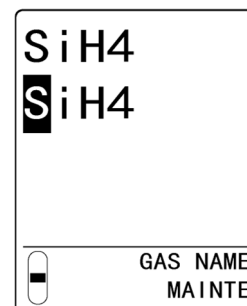
To move to the previous character, press the MODE key.

- 4 Press the ▲ key or ▼ key to select the character, then press the TEST/SET key.

Press the ▲ key or ▼ key repeatedly to cycle through character types: numbers (0 to 9), letters (A to Z), "-" (bar), and the space.

Press the ▲ key and ▼ key together to switch between upper and lower cases.

- 5 Repeat steps 3 and 4. Move the cursor to the end of line when the setting is complete, then press the TEST/SET key.



The display reverts to the display in step 3.

The display will also revert to the display in step 3 if you move the cursor to the beginning of the line and press the MODE key.

- 6 Press the MODE key.

The display reverts to [SET-24 GAS NAME].

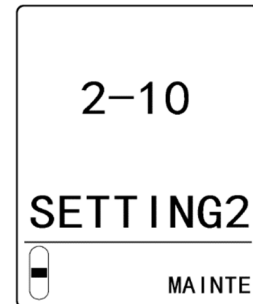
- 7 Press the MODE key.

The display reverts to [2-10 SETTING2].

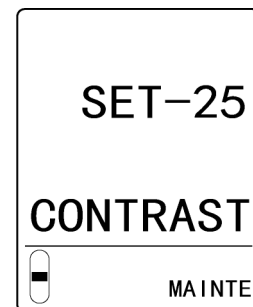
7-10-25 LCD contrast adjustment (CONTRAST)

Adjust the contrast of the LCD.

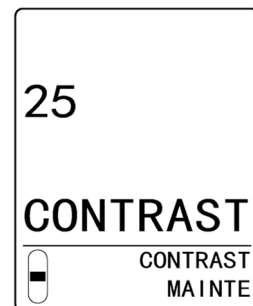
- 1 In maintenance mode, press the ▲ key or ▼ key to select [2-10 SETTING2], then press the TEST/SET key.



- 2 Press the ▲ key or ▼ key to select [SET-25 CONTRAST], then press the TEST/SET key.



- 3 Press the ▲ key or ▼ key to adjust contrast, then press the TEST/SET key.



The display reverts to [SET-25 CONTRAST].

- 4 Press the MODE key.
The display reverts to [2-10 SETTING2].

NOTE

- ▶ Press the MODE key in step 3 to cancel the setting and revert the display to [SET-25 CONTRAST].

8

Replacing and Cleaning Parts

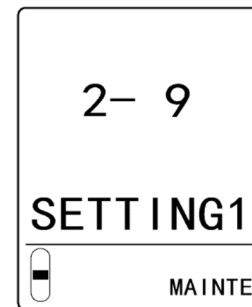
8-1 Replacing consumable parts

Sensors and dust filters are consumables.
Replace them when needed based on operating conditions.

8-1-1 Sensor replacement

If the main unit is running, stop the pump before replacing the sensor.

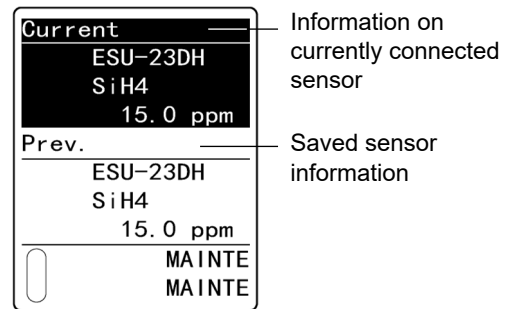
- 1 In maintenance mode, press the ▲ key or ▼ key to select [2- 9 SETTING1], then press the TEST/SET key.



- 2 Press the ▲ key or ▼ key to select [SET- 3 MAINTE], then press the TEST/SET key.
The pump stops.

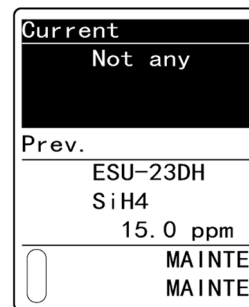


- 3 Press the TEST/SET key.**
The sensor power turns off.



The following information is displayed, depending on the sensor status:

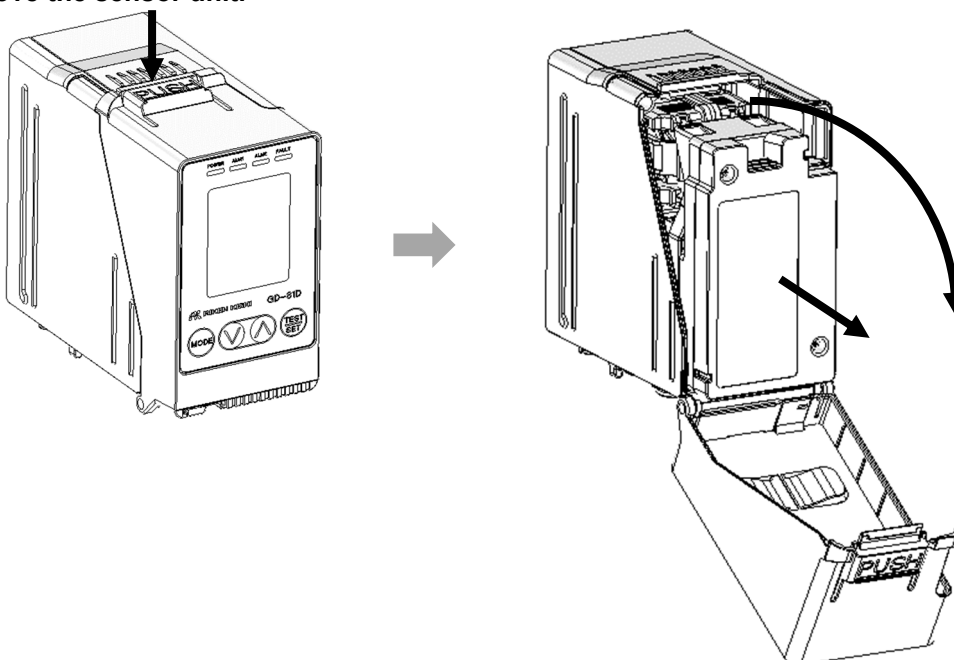
- [Not any]: Not connected
 [Dummy]: Dummy connection
 [C-01]/[C-02]: The sensor was replaced.
 [C-03]/[C-04]: The sensor is unusable.
 [USED]: The sensor may be older than the one previously fitted.



- 4 Pull the projection on the top of the main unit toward you to open the front cover.**

The front cover opens to approximately 120°. Push further down to open to 170°.

- 5 Remove the sensor unit.**



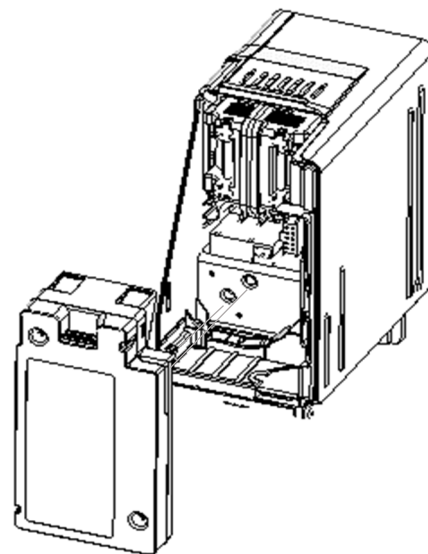
* The diagram illustrates the F sensor model.

- 6 Replace the sensor inside the sensor unit.**

For F sensors (excluding the IRF sensor) and M sensors, replace the sensor inside the sensor unit referring to '4-5-2 Fitting an F sensor'.

7 Attach the sensor unit.

Align the sensor unit correctly, then push in firmly to secure in place. (Refer to '4-5-3 Mounting the sensor unit'.)



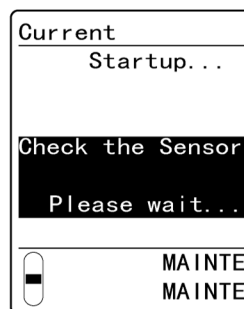
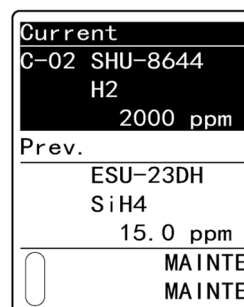
* The diagram illustrates the F sensor model.

8 Close the front cover on the main unit.

Close the front cover firmly so that it clicks back into place.

9 Press the ▼ key.

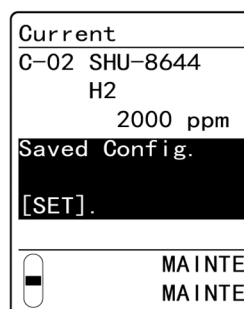
The pump restarts. Sensor reconnection is confirmed.



10 Press the TEST/SET key when the screen indicates sensor replacement is complete.

The display reverts to [SET- 3 MAINT].

If replacement was not completed properly, refer to '<If sensor was not replaced correctly>' in this section.



11 Press the MODE key.

The display reverts to [2- 9 SETTING1].

**CAUTION**

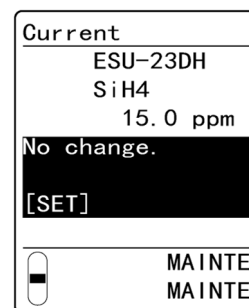
- To attach the sensor unit to the main unit, align the sensor unit, then push in firmly to secure into place. Improper attachment may cause the sensor unit to fall out and damage the connector.
- Be sure to perform gas adjustment (zero adjustment, span adjustment) after sensor replacement.

<If sensor was not replaced correctly>

If the sensor was not replaced correctly, either of the following screens is displayed depending on the situation:

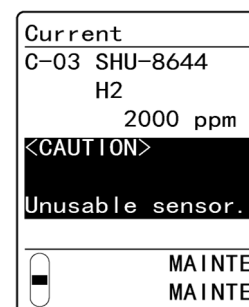
- If the sensor was not replaced

Press the TEST/SET key to revert the display to [SET- 3 MAINTE].
The pump restarts.



- If the new sensor is unusable

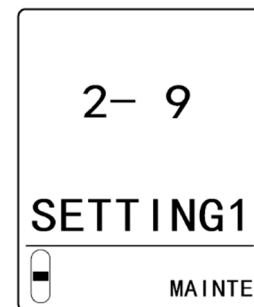
The product cannot return to detection mode.
Contact RIKEN KEIKI.



8-1-2 Dust filter replacement

Check to confirm that the dust filter is neither dirty nor clogged. Replace it if necessary.
If the main unit is running, stop the pump before replacing the dust filter.

- 1 In maintenance mode, press the ▲ key or ▼ key to select [2- 9 SETTING1], then press the TEST/SET key.**

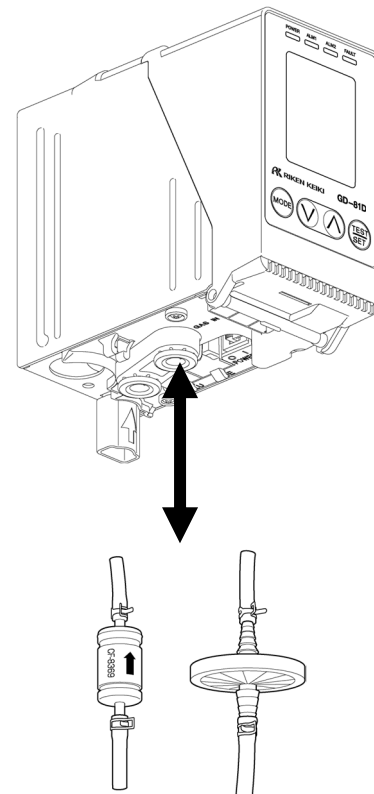


- 2 Press the ▲ key or ▼ key to select [SET- 3 MAINTE], then press the TEST/SET key.**
The pump stops.



- 3 Remove the dust filter fitted to the GAS IN side of the main unit.**
The dust filter varies depending on the operating environment.

- 4 Fit a new dust filter to the GAS IN side of the main unit.**



- 5 Once replacement is complete, press the MODE key.**
The display reverts to [SET- 3 MAINTE] and the pump restarts.

- 6 Press the MODE key.**
The display reverts to [2- 9 SETTING1].

8-2 Replacing periodic replacement parts

8-2-1 List of recommended periodic replacement parts

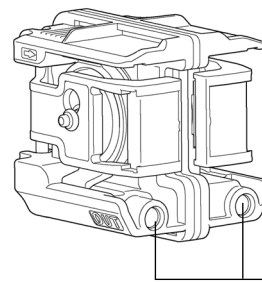
No.	Name	Check interval	Replacement interval	Quantity (piece/unit)
1	Pump unit	0.5 years	1 to 2 years	1
2	Flow sensor unit	1 year	5 years	1

8-2-2 Pump unit replacement

If the main unit is running, stop the pump before replacing the pump unit.

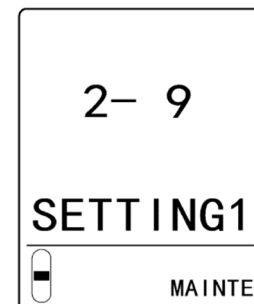
NOTE

- ▶ Before fitting the pump unit, confirm that the pump unit connections (flow passages) are free of dirt or other foreign matter.
The grease applied to the connecting parts attracts dirt.



Connecting parts (flow passages)

- 1 In maintenance mode, press the ▲ key or ▼ key to select [2- 9 SETTING1], then press the TEST/SET key.

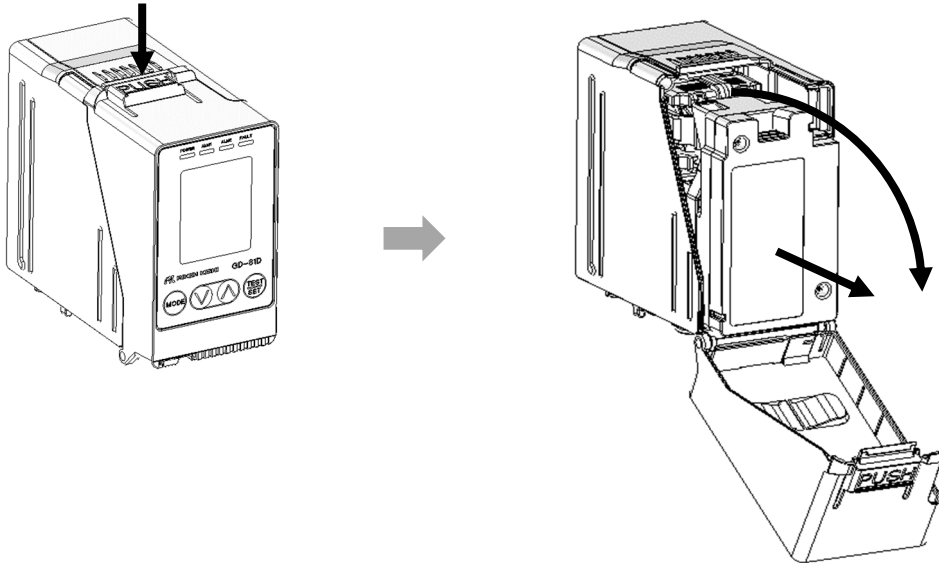


- 2 Press the ▲ key or ▼ key to select [SET- 3 MAINTE], then press the TEST/SET key.
The pump stops.

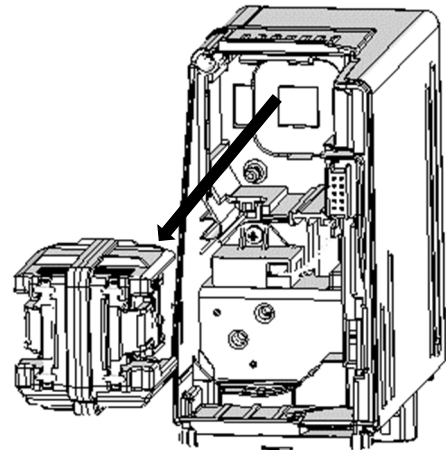


3 Pull the projection on the top of the main unit toward you to open the front cover.

The front cover opens to approximately 120°. Push further down to open to 170°.

4 Remove the sensor unit.

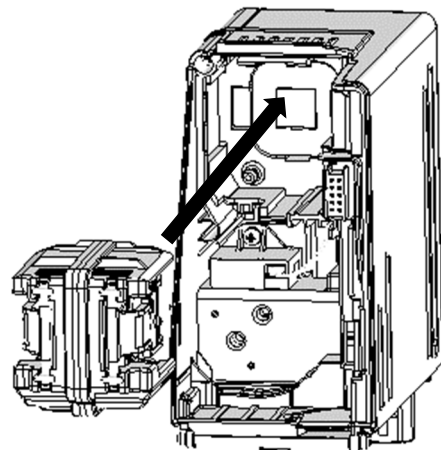
* The diagram illustrates the F sensor model.

5 Pull out the pump unit toward you.

* The diagram illustrates the F sensor model.

6 Match the new pump unit to the shape of the main unit and push into place.

Match the projections on the pump unit with the grooves on the main unit, then push in. Press the center of the pump unit, pushing it so that the pump unit is secured properly.



* The diagram illustrates the F sensor model.

7 Attach the sensor unit.

Push in the sensor unit until it is secured firmly in place.

8 Close the front cover on the main unit.

Close the front cover firmly so that it clicks back into place.

9 Once replacement is complete, press the MODE key.

The display reverts to [SET- 3 MAINTE] and the pump restarts.

10 Press the MODE key.

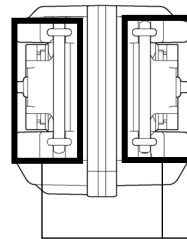
The display reverts to [2- 9 SETTING1].

 **CAUTION**

- To attach the sensor to the main unit, align the sensor unit, then push in firmly to secure into place. Improper attachment may cause the sensor unit to fall out and damage the connector.

NOTE

- ▶ When pressing the pump unit into the main unit, do not press on the diaphragms on the sides of the pump unit.

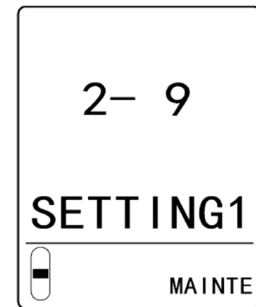


Do not press on these parts.

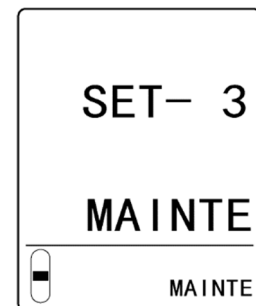
8-2-3 Flow sensor unit replacement

If the main unit is running, stop the pump before replacing the flow sensor unit.

- 1 In maintenance mode, press the ▲ key or ▼ key to select [2- 9 SETTING1], then press the TEST/SET key.

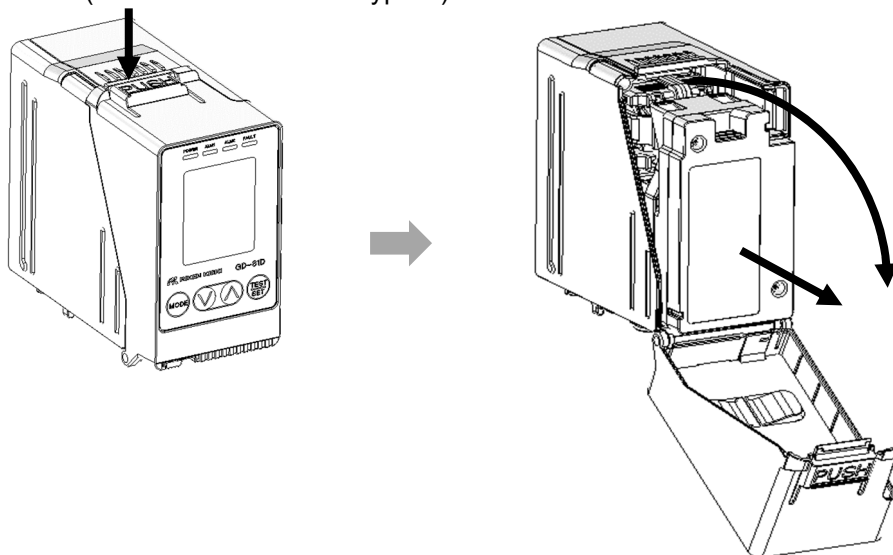


- 2 Press the ▲ key or ▼ key to select [SET- 3 MAINTE], then press the TEST/SET key.
The pump stops.



- 3 Pull the projection on the top of the main unit toward you to open the front cover.
The front cover opens to approximately 120°. Push further down to open to 170°.

- 4 Remove the sensor unit.
With a U sensor model, the U sensor unit adapter must also be removed. (Refer to '4-5-1 Sensor types'.)

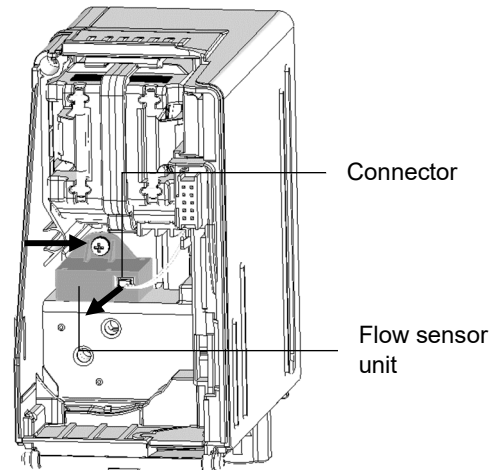


* The diagram illustrates the F sensor model.

- 5 Disconnect the cable connected to the connector on the flow sensor unit.**
Pulling the cable with excessive force may break the cable. Do not use undue force.

- 6 Unscrew the screw that secures the flow sensor unit.**

- 7 Remove the flow sensor unit.**

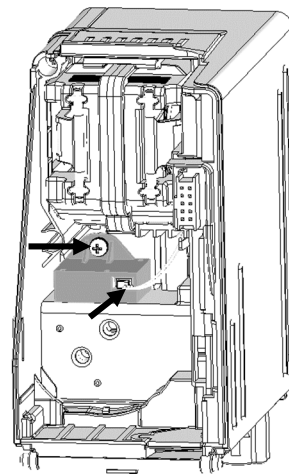


- 8 Match the new flow sensor unit to the shape of the main unit, then push into place.**

Fit to the main unit while taking care not to pinch the flow sensor unit cable.

- 9 Secure the flow sensor unit using a screw.**
Confirm that the flow sensor unit is firmly secured. Gas leaks may result if it is not firmly secured.

- 10 Connect the cable to the connector on the new flow sensor unit.**



- 11 Attach the sensor unit.**
With a U sensor model, attach the U sensor unit adapter before attaching the sensor unit. (Refer to '4-5-1 Sensor types'.)

Push in the sensor unit until it is secured firmly in place.

- 12 Close the front cover on the main unit.**
Close the front cover firmly so that it clicks back into place.

- 13 Once replacement is complete, press the MODE key.**
The display reverts to [SET- 3 MAINTE] and the pump restarts.

- 14 Press the MODE key.**
The display reverts to [2- 9 SETTING1].

**CAUTION**

- To attach the sensor to the main unit, align the sensor unit, then push in firmly to secure into place. Improper attachment may cause the sensor unit to fall out and damage the connector.
-

8-3 Cleaning the product

Clean the product if it becomes excessively dirty.

- Always turn off the power before cleaning the product.
- Wipe off any dirt with a dry cloth.
 - Using water or organic solvents to clean the product may result in malfunctions.
- Use dry air to clean pipes. If the piping interior is extremely dirty, it may affect gas detection.

9

Storage, Relocation, and Disposal

9-1 Procedures for storage or when not used for extended periods

The product must be stored under the following conditions:

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

<Storage conditions (sensors)>

Model	Storage period (months)	Temperature (°C/°F)		Humidity* ¹ (%RH)		Pressure (kPa)		Remarks
	-	Min	Max	Min	Max	Min	Max	
NCF	6	-10/14	40/104	0	90	80	120	<ul style="list-style-type: none"> • The sensor must be stored in the specified packing case. • Store in a location not exposed to direct sunlight. • Store in an environment free of corrosive gas, vibration, and dust. • Avoid condensation and moisture. • Store in an environment free of gases that may result in catalyst poisoning (e.g., silicone, chlorine, sulfur gases).
NCU	6	-10/14	35/95	0	85	80	120	
SGF	6	-10/14	40/104	0	90	80	120	
SGU	6	0/32	35/95	0	85	80	120	
SHF	6	-10/14	40/104	0	90	80	120	
SHU	6	0/32	35/95	0	85	80	120	
ESF	6	-10/14	40/104	0	90	80	120	
ESU* ²	6/9 (Max)	10/50	30/86	30	70	80	120	
OSU* ²	8 (Max)	5/41	35/95	30	80	80	120	
IRF	6	-10/14	40/104	0	90	80	120	
IRU	6	0/32	40/104	0	90	80	120	
SSU* ²	24	10/50	35/95	0	85	80	120	<ul style="list-style-type: none"> • Store as a Type L transportation package. (Dedicated box, nameplate, safety manual, lock, etc.) • Store in a location not exposed to direct sunlight. • Store in an environment free of corrosive gas, vibration, and dust. • Avoid condensation and moisture.

*1 Maximum humidity corresponds to an absolute humidity of 33 g/m³ (33.6 °C [92.48 °F] 90 %RH).

*2 Storage period calculated from date of manufacture

9-2 Procedures for relocation or reuse

Before relocating the product, refer to '4-1 Installation precautions' and '4-4 Main unit installation' for guidance on the destination location. Refer to '4-6 Wiring procedure' and '4-7 Piping procedure' for information on wiring and piping work.

Try to keep the unpowered period as brief as possible during the relocation.



CAUTION

- Gas adjustment must be performed before resuming use of a product that was relocated or was previously stopped and stored. Contact RIKEN KEIKI for readjustments, including gas adjustment.
-

9-3 Product disposal

- Dispose of the gas monitor as industrial waste (incombustible) in accordance with local regulations.
- Used sensors must be returned to RIKEN KEIKI.
- Avoid direct contact with any fluid that leaks from the electrochemical type sensor (ESF), electrochemical type sensor unit (ESU), or galvanic cell type sensor (OSU). Place the unit into a plastic bag and make sure no fluid leaks out.
If fluid leaks from the sensor in the detector head, turn off the power and immediately contact RIKEN KEIKI.
- Pyrolysis-particle type sensors (SSU-1925/SSU-1925A) contain radioactive material equivalent to 37 kBq and must be transported appropriately as a Type L transportation package. When returning the product, arrange for transportation with a carrier capable of handling Type L transportation packages.
- The pyrolysis-particle type sensor (SSU-1927) contains radioactive material, but is not subject to transportation or disposal restrictions, as the radioactivity level does not exceed the restriction value of 10 kBq stipulated by the IAEA (International Atomic Energy Agency).
- Built-in batteries must be disposed of appropriately when disposing of electrochemical type sensor (ESF) or electrochemical type sensor unit (ESU) incorporated into the product.

<Battery built into the electrochemical type sensor (ESF)>

Model	Type
CR1632	Lithium battery

<Battery built into the electrochemical type sensor unit (ESU)>

Model	Type
LR6T (JE)	Alkaline battery

 **WARNING**

- Never disassemble the sensor or sensor unit, regardless of the detection principle. The electrochemical type sensor (ESF), electrochemical type sensor unit (ESU), and galvanic cell type sensor unit (OSU) in particular all contain electrolyte. Contact with electrolyte may result in skin inflammation. Contact with eyes may result in blindness. Contact with clothing may result in discoloration or damage to the fabric.
If contact occurs, rinse the area immediately with water.

<Disposal in EU member states>

- Waste Electrical and Electronic Equipment (WEEE) Directive



The symbol shown on the left is affixed to the product to indicate that the product and its components must not be disposed of as general or household waste and must be disposed of separately in the appropriate manner. Proper disposal helps prevent potential harm to human health and the environment. When disposing of the product, use the return and collection systems available in your country to ensure appropriate treatment, collection, and recycling. For more information on the collection and recycling of used products, contact your retailer or supplier.

- Battery regulations



The symbol shown on the left is affixed to the product or the battery to indicate that batteries must be disposed of separately from general or household waste. When disposing of the battery, use the collection systems available in your country to ensure appropriate treatment, collection, and recycling.

10

Troubleshooting

This troubleshooting section does not address causes of all problems that may occur with the product. It provides brief explanations to assist in determining the causes of common problems.

If you encounter symptoms not addressed here or if problems persist even after taking corrective action, contact RIKEN KEIKI.

10-1 Product abnormalities

10-1-1 Main unit abnormalities

<Power source related problems>

Symptom/display	Cause	Action
The power cannot be turned on.	The power switch is turned off.	Turn on the power switch.
	Power supply circuit abnormality/instantaneous interruption	Supply the rated voltage if using the 24 V DC power source. When using PoE connection, check the PoE power hub operation and specifications. Review the setup and assess the need for an uninterruptible power source, power line filter, or insulating transformers.
	Incorrect product installation	Check to confirm that the main unit is correctly fitted to the wall mounting unit. If no improvement results even when correctly fitted, contact RIKEN KEIKI.
	Cable problems (wire breakage, loose connection, short circuit)	Check the wiring for this product and for other devices in the vicinity.
Abnormal operation	Effects of sudden surge noise	Turn off the power and restart. If similar symptoms recur frequently, take appropriate measures to address the noise source.

<Sensor problems>

If the category is "Fault alarm", the fault lamp (FAULT) either lights or flashes.

Category	Symptom/display (Fault code)	Cause	Action
Fault alarm	[E-10 F-UNIT]	The sensor is not connected or connected improperly.	Check to confirm that the sensor is properly attached and that the sensor connector is connected properly.
		There are problems with communicating with the sensor.	Replace with a new sensor.
	[E-18 S ZERO]	Zero drift due to changes in ambient conditions or deterioration exceeded the zero follower function range.	Perform zero adjustment. Replace the sensor if this happens often even after zero adjustment.
	[E-11 SENSOR]	There is a problem with the sensor.	Replace with a new sensor. Avoid handling with bare hands if you see signs of external damage. Handle carefully.
	[E-12 CIRCUIT]		
	[E-13 S VOLT]		
	[E-14 S E-VOLT]		
	[E-15 S K-VOLT]		
	[E-16 S E-CUR]		
	[E-20 S ROM]		
	[E-21 S RAM]		
	[E-22 S MEMORY]		
	[E-23 S EXT-AD]		
	[E-27 S S-VOLT]		
[E-28 S TEMP]			
[E-29 S B-VOLT]			
Warning display	[E-80]	The sensor has reached the end of its service life or is degraded; or the output has reached the end of its service life.	Replace with a new sensor.
	[E-81]		
	[E-82]		
	[E-83]	The temperature exceeded the maximum temperature at which the sensor is designed to function.	Ambient temperatures may exceed specifications. Gas detection can still be performed in this state, but the sensor will degrade more quickly. If possible, use within the temperature range indicated in the specifications. Replace the sensor if this occurs frequently even at temperatures within specifications.
	[C-15]	A warning was issued in the sensor.	Gas detection can still be performed in this state, but performance may be impaired. Replace the sensor as soon as possible.
[E-84]			

<Flow problems>

If the category is "Fault alarm", the fault lamp (FAULT) either lights or flashes.

Category	Symptom/display (Fault code)	Cause	Action
Fault alarm	[E-51 FLOW]	The protective rubber caps are still attached.	Remove the protective rubber caps attached to GAS IN and GAS OUT.
		Pump failure	Replace the pump unit.
		Flow loss due to clogged dust filter	Replace the dust filter.
		Flow loss due to bent or blocked inlet or outlet piping	Fix the problem.
		The sensor is not connected or connected improperly.	Check to confirm that the sensor is properly attached and that the sensor connector is connected properly.
	[E-52 F SENS]	Flow sensor* wire breakage or faulty connection * Pyrolyzer unit flow sensor when the pyrolyzer unit is connected	Contact RIKEN KEIKI.
	[E-54 F SENS B]	Pyrolyzer unit flow sensor wire breakage or faulty connection	
	[E-55 F SENS B]	Flow loss due to pyrolyzer unit internal clogging	
	[E-57 F SENS]	The pyrolyzer unit is faulty.	
	Warning display	[E-50 FLOW]	Flow instability due to impaired pump performance
Flow instability due to clogged dust filter			Replace the dust filter.
Flow instability due to bent or blocked inlet or outlet piping			Fix the problem.
[E-58 F SENS]		An abnormality was discovered during routine flow sensor diagnostics	The flow sensor performance may be degraded. Degradation of the flow sensor may result in the flow rate falling outside the stipulated range of 0.5 L/min \pm 10 % (0.45 to 0.55 L/min) even if the displayed flow rate is the stipulated value. Gas detection can still be performed as long as no other fault alarm such as flow loss occurs. Note that you must replace the flow sensor to clear this warning. Contact RIKEN KEIKI.

Category	Symptom/display (Fault code)	Cause	Action
-	The difference between the flow rate measured on the main unit and the actual flow rate is outside the stipulated range (0.5 L/m ± 10 % [0.45 to 0.55 L/min]).	Improper default flow rate setting	The default flow rate setting on the main unit may be incorrect. Use a flowmeter to set the default flow rate. (Refer to '7-6-3 Correcting the flow rate value (DEF FLOW)'). Frequent occurrence of these symptoms may indicate a defective flow sensor. Sensor replacement is necessary for recovery. Contact RIKEN KEIKI.

<System problems>

If the category is "Fault alarm", the fault lamp (FAULT) either lights or flashes.

Category	Symptom/display (Fault code)	Cause	Action
Fault alarm	[E-99 B-VOLT]	The rated voltage is not being supplied to the product.	Check the power source and supply the rated voltage.
	[E-90 ROM]	Problems with internal ROM, RAM, or nonvolatile memory	Contact RIKEN KEIKI.
	[E-91 RAM]		
	[E-92 MEMORY]		
Warning display	[E- 6 COMM]	Communication cable problems	Check the wiring for this product and for related devices. For the GD-81D, set the warning display and warning output [E- 6] to [OFF]. (Refer to '7-10-22 Warning display settings (CAU DISP)' and '7-10-23 Warning output settings (CAU OUT)'). * The same measures are required if no LAN cable is used with the GD-81D-ETD.
		The communication between the main unit and the communication board is faulty	Contact RIKEN KEIKI. For the GD-81D, set the warning display and warning output [E- 6] to [OFF]. (Refer to '7-10-22 Warning display settings (CAU DISP)' and '7-10-23 Warning output settings (CAU OUT)').
		Effects of external noise	Turn off the power and restart. If similar symptoms recur frequently, take appropriate measures to address the noise source.
	[E- 9 RTC]	Internal clock abnormality	Set the date and time. Corrections may not work if the sensitivity correction function is enabled. (Refer to '7-10-1 Date and time setting (DAY TIME)'). Frequent occurrence of these symptoms may indicate a defective internal clock. Internal clock replacement is necessary for recovery. Contact RIKEN KEIKI.
	[E-94 FLASH]	Problem with internal flash memory	Gas detection can still be performed in this state, but some internal data logging functions may not function properly. Contact RIKEN KEIKI.

10-1-2 Pyrolyzer unit abnormalities

<Power source related problems>

Symptom/display	Cause	Action
The power cannot be turned on.	The power switch is turned off.	Turn on the power switch for the pyrolyzer unit.
	Power supply circuit abnormality/instantaneous interruption	Supply the rated voltage. Review the setup and assess the need for an uninterruptible power source, power line filter, or insulating transformers.
	Incorrect installation of the pyrolyzer unit	Check to confirm that the pyrolyzer unit is correctly fitted to the wall mounting unit. If no improvement results even when correctly fitted, contact RIKEN KEIKI.
	Cable problems (wire breakage, loose connection, short circuit)	Check the wiring for the pyrolyzer unit and related devices.
Abnormal operation	Effects of sudden surge noise	Turn off the pyrolyzer unit power and restart. If similar symptoms recur frequently, take appropriate measures to address the noise source.

<Other problems>

Category	Symptom/display (Fault code)	Cause	Action
Warning display	[E-70 PL COMM]	The pyrolyzer unit is not connected or the connection is faulty.	Check to confirm that the pyrolyzer unit is connected and that the pyrolyzer unit connector is securely connected.
		There is a problem with communication with the pyrolyzer unit.	Replace with a new pyrolyzer unit.
	[E-71 PL FAULT]	The pyrolyzer unit is faulty.	Contact RIKEN KEIKI.
	[E-72 PL VOLT]		
	[E-73 PL CUR]		
	[E-74 PL FAN]	The fan is not running.	Remove any foreign object jamming the fan on the top of the pyrolyzer unit. If the problem persists even when the action above is taken, contact RIKEN KEIKI.
	[E-75 PL TEMP]	The temperature exceeded the maximum internal temperature at which the pyrolyzer unit is designed to function.	If the ambient temperature is higher than the specified range, take measures to ensure operation within the appropriate temperature range. Remove the problem if the fan on the top of the pyrolyzer unit is blocked or jammed by a foreign object. If the problem persists even when the action above is taken, contact RIKEN KEIKI.
	[E-76 PL LOW]	The rated voltage is not being supplied to the product.	Check the power source and supply the rated voltage.
[E-77 PL ADD]	A pyrolyzer unit was connected to the gas detector of a model not requiring a pyrolyzer unit.	If the gas detector does not require a pyrolyzer unit, turn off the power to the product and the pyrolyzer unit, then remove the pyrolyzer unit. If the gas detector requires a pyrolyzer unit, contact RIKEN KEIKI.	

	[E-78 PL ROM]	The pyrolyzer unit is faulty.	Contact RIKEN KEIKI.
	[E-79 PL RAM]		

10-2 Reading abnormalities

Symptom	Cause	Action
The reading rises (or drops) and remains unchanged.	Sensor drift	Perform zero adjustment or fresh air adjustment.
	Presence of interference gases	It is difficult to completely eliminate the effects of interference gases such as solvents. Contact RIKEN KEIKI for information on countermeasures, such as interference gas removal filters.
	Slow leakage	There may be a very small leakage (slow leakage) of the detection target gas. Leaving this unresolved may lead to hazardous conditions. Take the same action as for gas alarms.
	Environmental fluctuations	Perform zero adjustment or fresh air adjustment. Galvanic cell types in particular are susceptible to the effects of atmospheric pressure. Zero adjustment or fresh air adjustment must be performed.
A gas alarm is triggered despite the absence of a gas leak or other abnormalities at the detection point.	Presence of interference gases	It is difficult to completely eliminate the effects of interference gases such as solvents. Contact RIKEN KEIKI for information on countermeasures, such as interference gas removal filters.
	Effects of noise	Turn off the power and restart. If similar symptoms recur frequently, take appropriate measures to address the noise source.
	Sudden environmental changes	Reading alarms may be triggered by sudden changes in ambient conditions such as temperature. The product cannot be used if ambient conditions fluctuate rapidly and often. Take appropriate action to prevent such changes.
Slow response	Clogged dust filter	Replace the dust filter.
	Bent or blocked inlet or outlet piping	Fix the problem.
	There is condensation inside the inlet piping.	Fix the problem.
	The sensor sensitivity has degraded.	Replace with a new sensor unit.
Gas adjustment is not possible.	The calibration gas concentration is inappropriate.	Prepare the correct calibration gas.
	The sensor sensitivity has degraded.	Replace with a new sensor unit.

11

Product Specifications

11-1 GD-81D Series specifications

11-1-1 GD-81D specifications

Detection principle (sensor)	Catalytic combustion type (NCF, NCU) / semiconductor type (SGF, SGU) / hot-wire semiconductor type (SHF, SHU) / electrochemical type (ESF, ESU ^{*1}) / galvanic cell type (OSU) / non-dispersive infrared type (IRF, IRU) / pyrolysis-particle type (SSU) ^{*2}
Detection target gas	Combustible gas, toxic gas, oxygen, carbon dioxide, etc.
Concentration display	Full-dot display
Detection method	Pump suction type
Suction flow rate	Approx. 0.5 L/min
Power supply indication	POWER lamp lit (green)
Display items	Gas name display, flow rate display, mode display, pyrolyzer connection display ^{*2}
Gas alarm type	Two-step alarm (H-HH) / Oxygen (ESU) sensor: two-step alarm (L-LL) / Oxygen (ESF, OSU) sensors: two-step alarm (L-LL / L-H / H-HH)
Gas alarm indication	First alarm: ALM1 lamp lit (red), second alarm: ALM2 lamp lit (red)
Gas alarm pattern	Auto reset / self-latching
Gas alarm contacts	No-voltage contact 1a/1b (for ALM1/ALM2) Always de-energized (energized in alarm state) / always energized (de-energized in alarm state)
Fault alarm, self-diagnosis	System abnormality, sensor abnormality, flow abnormality, pyrolyzer abnormality ^{*2}
Fault alarm indication	FAULT lamp lit (yellow), information display
Fault alarm pattern	Auto reset / self-latching
Fault alarm contact	No-voltage contact 1a/1b Always de-energized (energized in alarm state) / always energized (de-energized in alarm state)
Contact capacity	24 V DC, 0.5 A (resistance load)
Contact cable	1.25 mm ² (AWG16) cable, maximum 6 cores
Transmission method	3-wire analog transmission (common, power, signal) / 2-wire analog transmission (4 to 20 mA DC, non-insulated, resistance load 300 Ω or less, including cable resistance)
Transmission cable	1.25 mm ² (AGW16) shielded cable, 3-core / 2-core
Power supply	24 V DC ± 10 %
Power supply cable	1.25 mm ² (AWG16) cable, 2-core (not required for 3-wire analog transmission)
Power consumption	See '<Power consumption>' on next page.
Piping connectors	One-touch quick connect coupler PTFE tube O.D. 6 × I.D. 4 mm (1/4 × 1/8 in) / (1/4 × 3/16 in)
Functions	White backlight, alarm delay, suppression, zero follower, sensitivity correction, flow control, adjustment history, alarm trend history, event history

Initialization	Approx. 25 seconds
Operating temperature range^{*3}	-10 °C to +40 °C (14 °F to 104 °F) (no sudden changes)
Operating humidity range^{*3}	20 to 90 %RH (no condensation)
Construction	Wall mounting type
External dimensions (excluding projections)	Approx. 70 (W) × 120 (H) × 145 (D) mm (approx. 2.76 × 4.72 × 5.71 in)
Weight	Approx. 0.8 kg (approx. 1.76 lb)
Exterior color	Main unit: black, front door: white

*1: For certain gas types, a pyrolyzer unit (PLU-80) is used.

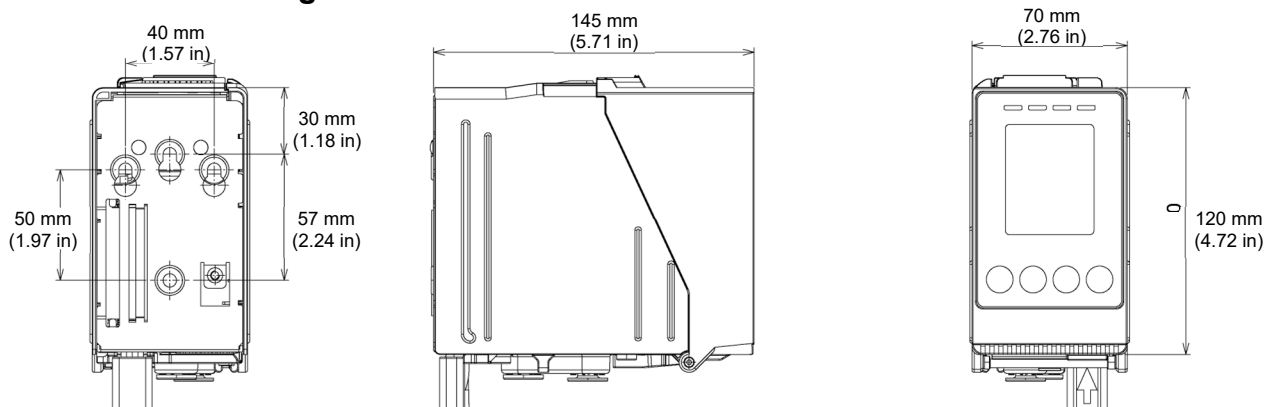
*2: When using the pyrolyzer unit (PLU-80)

*3: May vary depending on the sensor installed.

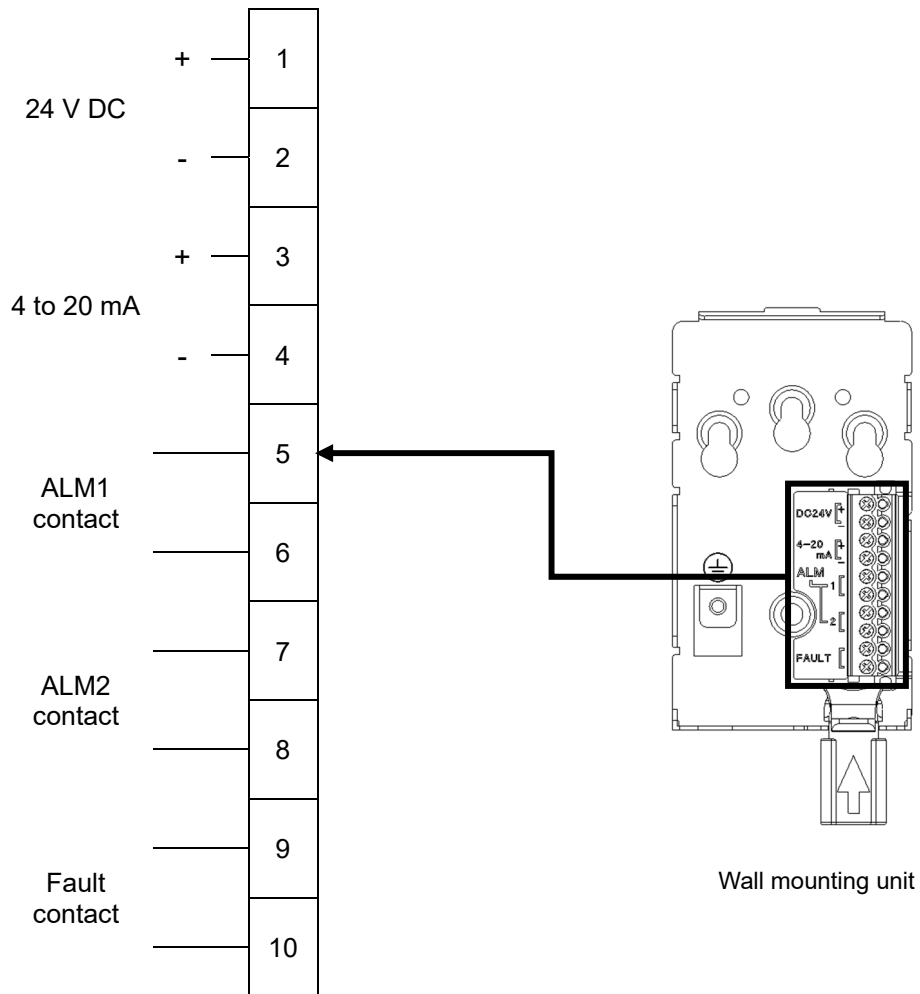
<Power consumption>

Sensor	Typ. (W)	Max. (W)
NCF	2.5	5.0
NCU	3.0	5.5
SGF	2.5	5.0
SGU	2.5	5.0
SHF	2.0	4.5
SHU	2.5	5.0
ESF	1.5	4.0
ESU	1.5	4.0
OSU	1.5	4.0
IRF	2.5	5.0
IRU	2.5	5.0
SSU	1.5	4.0

<Exterior drawings>



<Terminal plate>



11-1-2 GD-81D-ETD specifications

Detection principle (sensor)	Catalytic combustion type (NCF, NCU) / semiconductor type (SGF, SGU) / hot-wire semiconductor type (SHF, SHU) / electrochemical type (ESF, ESU* ¹ , M sensors) / galvanic cell type (OSU) / non-dispersive infrared type (IRF, IRU) / pyrolysis-particle type (SSU)* ²
Detection target gas	Combustible gas, toxic gas, oxygen, carbon dioxide, etc.
Concentration display	Full-dot display
Detection method	Pump suction type
Suction flow rate	Approx. 0.5 L/min
Power supply indication	POWER lamp lit (green)
Display items	Gas name display, flow rate display, mode display, communication status display, pyrolyzer connection display* ²
Gas alarm type	Two-step alarm (H-HH) / Oxygen (ESU) sensor: two-step alarm (L-LL) / Oxygen (ESF, OSU) sensors: two-step alarm (L-LL / L-H / H-HH)
Gas alarm indication	First alarm: ALM1 lamp lit (red), second alarm: ALM2 lamp lit (red)
Gas alarm pattern	Auto reset / self-latching
Gas alarm contacts*³	No-voltage contact 1a/1b (for ALM1/ALM2) Always de-energized (energized in alarm state) / always energized (de-energized in alarm state)
Fault alarm, self-diagnosis	System abnormality, sensor abnormality, flow abnormality, communication abnormality, pyrolyzer abnormality* ²
Fault alarm indication	FAULT lamp lit (yellow), information display
Fault alarm pattern	Auto reset / self-latching
Fault alarm contact	No-voltage contact 1a/1b Always de-energized (energized in alarm state) / always energized (de-energized in alarm state)
Contact capacity	24 V DC, 0.5 A (resistance load)
Contact cable	1.25 mm ² (AWG16) cable, maximum 6 cores
Transmission method	Ethernet (10BASE-T / 100BASE-TX)
Transmission cable	Category 5 or better Ethernet cable
Power supply	24 V DC ± 10 % / PoE connection
Power supply cable	1.25 mm ² (AWG16) cable, 2-core (not required for PoE)
Power consumption	See '<Power consumption>' on next page.
Piping connectors	One-touch quick connect coupler PTFE tube O.D. 6 × I.D. 4 mm (1/4 × 1/8 in) / (1/4 × 3/16 in)
Functions	White backlight, alarm delay, suppression, zero follower, sensitivity correction, flow control, adjustment history, alarm trend history, event history
Initialization	Approx. 25 seconds
Operating temperature range*⁴	-10 °C to +40 °C (14 °F to 104 °F) (no sudden changes)
Operating humidity range*⁴	20 to 90 %RH (no condensation)
Construction	Wall mounting type
External dimensions (excluding projections)	Approx. 70 (W) × 120 (H) × 145 (D) mm (approx. 2.76 × 4.72 × 5.71 in)
Weight	Approx. 0.8 kg (approx. 1.76 lb)
Exterior color	Main unit: black, front door: white

*1: For certain gas types, a pyrolyzer unit (PLU-80) is used.

*2: When using the pyrolyzer unit (PLU-80)

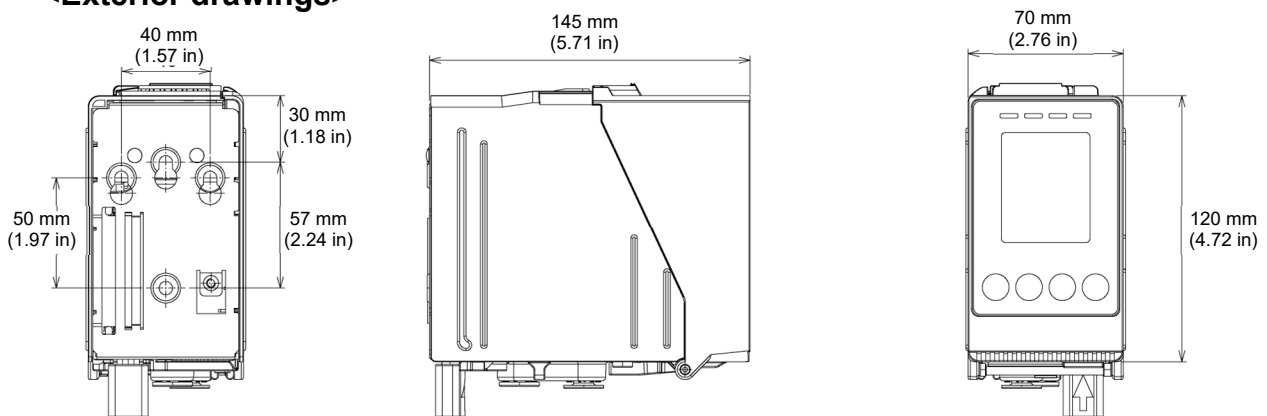
*3: When M sensors are fitted, the contact activates when a gas alarm or fault alarm is triggered for either of the two gas sensors.

*4: May vary depending on the sensor installed.

<Power consumption>

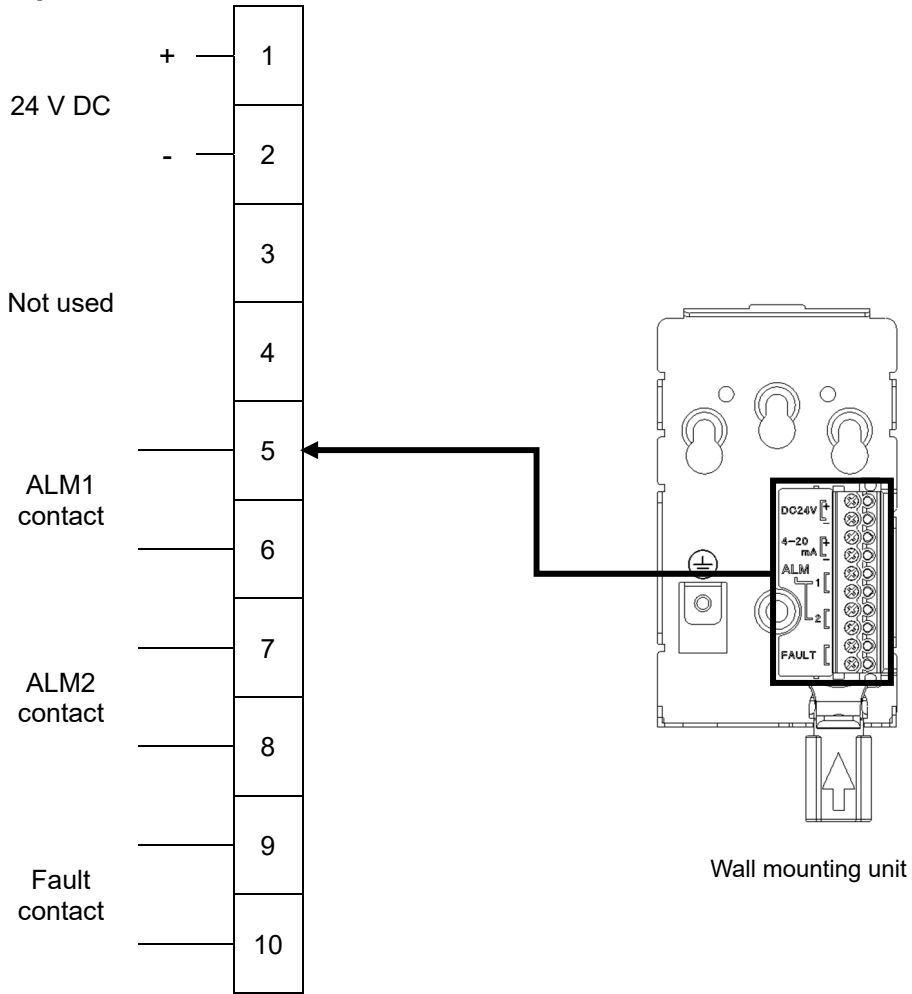
Power supply	Sensor	Typ. (W)	Max. (W)
24 V DC	NCF	3.5	5.5
	NCU	4.0	6.0
	SGF	3.5	5.5
	SGU	3.5	5.5
	SHF	3.0	5.0
	SHU	3.5	5.5
	ESF	2.5	4.5
	ESU	2.5	4.5
	M sensors	3.0	5.0
	OSU	2.5	4.5
	IRF	3.5	5.5
	IRU	3.5	5.5
	SSU	2.5	4.5
PoE	NCF	4.5	7.5
	NCU	5.0	8.0
	SGF	4.5	7.5
	SGU	4.5	7.5
	SHF	4.0	7.0
	SHU	4.5	7.5
	ESF	3.5	6.5
	ESU	3.5	6.5
	M sensors	4.0	7.0
	OSU	3.5	6.5
	IRF	4.5	7.5
	IRU	4.5	7.5
	SSU	3.5	6.5

<Exterior drawings>



* An RJ-45 Ethernet connector is located on the underside of the main unit.

<Terminal plate>



11-2 Sensor specifications

11-2-1 Catalytic combustion type

Sensor	NCF	NCU
Detection target gas	Combustible gas	
Detection range	0 – 100 %LEL	
Alarm setpoints	1st: 25 %LEL, 2nd: 25 %LEL	
Alarm type	Two-step alarm (H-HH)	
Operating temperature range (no sudden changes)	-10 °C to +40 °C (14 °F to 104 °F)	0 °C to +40 °C (32 °F to 104 °F)
Operating humidity range (no condensation)	95 %RH or less	

NOTE

Installation location precautions

- ▶ Install in a stable location within the specified operating temperature range and free of sudden temperature fluctuations.
- ▶ Sensor characteristics may degrade significantly in the presence of silicone gases (organic silicone gases), various types of halogen gases, sulfide gases, or acidic gases.
- ▶ Readings may fluctuate if the product is subjected to strong external impact or vibrations. If this occurs, perform zero adjustment and span adjustment.
- ▶ When low vapor pressure gases are detected by aspiration, the gas may condense when aspirated from warmer areas and detected in cooler areas, or blockages may occur in sintered alloy. Keep vapor pressure in mind when using the product.

Adjustment precautions

- ▶ Indication accuracy may degrade in situations in which temperatures fluctuate more than ± 20 °C (68 °F) above or below the ambient temperature in which zero adjustment or span adjustment was performed. If this occurs, repeat zero adjustment or span adjustment.
- ▶ When performing gas adjustment, allow the product to warm up for at least two hours in clean air before proceeding with zero adjustment and span adjustment.

General operation related precautions

- ▶ For specifications of F.S. 5,000 ppm or less, variations in atmospheric temperature and humidity may cause the zero point to drift. If so, turn the zero follower function ON. However, we recommend using a sensor with a different detection principle. The zero follower function is not available if gases are always present.
- ▶ Readings may be affected by combustible gases other than the detection target gas.
- ▶ When oxygen concentrations fall, the readings may also fall.
- ▶ Some interference may occur in the presence of highly thermally conductive gases such as CO₂, Ar, and He in high concentrations as base gases.
- ▶ The zero point may fluctuate if the sensor is in continuous contact with high-concentration gas of 100 % LEL or more for extended periods. If this occurs, perform zero adjustment and span adjustment.
- ▶ The sensor may be hot during replacement. Be careful to avoid burns when replacing the sensor. If the sensor is hot, turn off the power and wait for it to cool.

Other precautions

- ▶ Contact RIKEN KEIKI for specifications and information on other sensors.

11-2-2 Semiconductor type

Sensor	SGF		SGU	
Detection target gas	Combustible gas	Toxic gas	Combustible gas	Toxic gas
Detection range	0 – several thousand ppm			
Alarm setpoints	1st: 1/4 F.S., 2nd: 1/2 F.S.			
Alarm type	Two-step alarm (H-HH)			
Operating temperature range (no sudden changes)	-10 °C to +40 °C (14 °F to 104 °F)		0 °C to +40 °C (32 °F to 104 °F)	
Operating humidity range (no condensation)	20 to 95 %RH (moisture content 95 %RH or less at 37 °C [98.6 °F])			

NOTE

Installation location precautions

- ▶ Sensor characteristics may degrade significantly in the presence of silicone gases (organic silicone gases), various types of halogen gases, sulfide gases, or acidic gases.
- ▶ Readings may fluctuate in the presence of fluctuations (e.g., temperature and humidity) in the installation location.
- ▶ When low vapor pressure gases are detected by aspiration, the gas may condense when aspirated from warmer areas and detected in cooler areas, or blockages may occur in sintered alloy. Keep vapor pressure in mind when using the product.
- ▶ Readings may fluctuate if the product is subjected to strong external impact or vibrations. If this occurs, perform zero adjustment and span adjustment.

Adjustment precautions

- ▶ Select the calibration gas after accounting for typical humidity in the operating environment.
- ▶ When performing gas adjustment, allow the product to warm up in clean air for a period appropriate to the time it has been unpowered before proceeding with zero adjustment and span adjustment. For details of warmup times, refer to '<Warmup times for semiconductor type sensors>' below.
- ▶ Indication accuracy may degrade in situations in which temperatures fluctuate more than ± 20 °C (68 °F) above or below the ambient temperature in which zero adjustment or span adjustment was performed. If this occurs, repeat zero adjustment or span adjustment.
- ▶ Adjustment is not possible if the reading during adjustment does not exceed the zero suppression value. Use a calibration gas that gives a reading higher than the zero suppression value.

General operation related precautions

- ▶ Readings may be affected by combustible gases other than the detection target gas.
- ▶ When oxygen concentrations fall, the readings may also fall.
- ▶ Some interference may occur in the presence of highly thermally conductive gases such as CO₂, Ar, and He in high concentrations as base gases.
- ▶ The zero point and readings may fluctuate if the sensor comes into contact with high-concentration gas that is at full scale or higher. If this occurs, replace the sensor.
- ▶ Readings may fall in environments where gas is continuously present.
- ▶ The sensor may be hot during replacement. Be careful to avoid burns when replacing the sensor. If the sensor is hot, turn off the power and wait for it to cool.
- ▶ Depending on the conditions and how long the product was off, the reading may fluctuate immediately after the power is turned on. The reading should quickly stabilize at zero.

Other precautions

- ▶ Contact RIKEN KEIKI for specifications and information on other sensors.

<Warmup times for semiconductor type sensors>

Unpowered period	Warmup time			
	SGF-8581	Other SGF sensors	SGU-8541	Other SGU sensors
Within 10 minutes	1 hour or more	30 minutes or more	10 minutes or more	2 hours or more
Within 1 hour	2 hours or more	2 hours or more	30 minutes or more	2 hours or more
Within 24 hours	4 hours or more	4 hours or more	1 hour or more	4 hours or more
Within 72 hours	24 hours or more	24 hours or more	4 hours or more	24 hours or more
Within 10 days	2 days or more	2 days or more	2 days or more	2 days or more
Less than 1 month	7 days or more	7 days or more	7 days or more	7 days or more
1 month to less than 3 months	14 days or more	14 days or more	14 days or more	14 days or more
3 months or more	1 month or more	1 month or more	1 month or more	1 month or more

* Note that the warmup time will differ depending on the sensor fitted.

<Definition of combustible gas>

- All sensor models of %LEL (vol%) range and ppm range specifications are applicable to the following 13 gases.
Acetylene, isobutane, LPG, LNG, ethane, ethylene, hydrogen, deuterium, town gases, butane, propane, propylene, and methane
- Sensors of the %LEL (vol%) range specification are applicable to other combustible gases.

<Definition of toxic gas>

- All gases not included in the combustible gas list are treated as toxic gases.

11-2-3 Hot-wire semiconductor type

Sensor	SHF		SHU
Detection target gas	Combustible gas	Toxic gas	Combustible gas
Detection range	0 – several thousand ppm		
Alarm setpoints	1st: 1/4 F.S., 2nd: 1/2 F.S.		
Alarm type	Two-step alarm (H-HH)		
Operating temperature range (no sudden changes)	-10 °C to +40 °C (14 °F to 104 °F)		0 °C to +40 °C (32 °F to 104 °F)
Operating humidity range (no condensation)	20 to 95 %RH (moisture content 95 %RH or less at 37 °C [98.6 °F])		

NOTE

Installation location precautions

- ▶ Sensor characteristics may degrade significantly in the presence of silicone gases (organic silicone gases), various types of halogen gases, sulfide gases, or acidic gases.
- ▶ Readings may fluctuate in the presence of fluctuations (e.g., temperature and humidity) in the installation location.
- ▶ When low vapor pressure gases are detected by aspiration, the gas may condense when aspirated from warmer areas and detected in cooler areas, or blockages may occur in sintered alloy. Keep vapor pressure in mind when using the product.
- ▶ Readings may fluctuate if the product is subjected to strong external impact or vibrations. If this occurs, perform zero adjustment and span adjustment.

Adjustment precautions

- ▶ Select the calibration gas after accounting for typical humidity in the operating environment.
- ▶ When performing gas adjustment, allow the product to warm up in clean air for a period appropriate to the time it has been unpowered before proceeding with zero adjustment and span adjustment. For details of warmup times, refer to '<Warmup times for hot-wire semiconductor type sensors>' below.
- ▶ Indication accuracy may degrade in situations in which temperatures fluctuate more than ± 20 °C (68 °F) above or below the ambient temperature in which zero adjustment or span adjustment was performed. If this occurs, repeat zero adjustment or span adjustment.
- ▶ Adjustment is not possible if the reading during adjustment does not exceed the zero suppression value. Use a calibration gas that gives a reading higher than the zero suppression value.

General operation related precautions

- ▶ Readings may be affected by combustible gases other than the detection target gas.
- ▶ When oxygen concentrations fall, the readings may also fall.
- ▶ Some interference may occur in the presence of highly thermally conductive gases such as CO₂, Ar, and He in high concentrations as base gases.
- ▶ The zero point and readings may fluctuate if the sensor comes into contact with high-concentration gas that is at full scale or higher. If this occurs, replace the sensor.
- ▶ Readings may fall in environments where gas is continuously present.
- ▶ The sensor may be hot during replacement. Be careful to avoid burns when replacing the sensor. If the sensor is hot, turn off the power and wait for it to cool.
- ▶ Depending on the conditions and how long the product was off, the reading may fluctuate immediately after the power is turned on. The reading should quickly stabilize at zero.

Other precautions

- ▶ Contact RIKEN KEIKI for specifications and information on other sensors.

<Warmup times for hot-wire semiconductor type sensors>

Unpowered period	Warmup time		
	SHF-8603	Other SHF sensors	SHU-8644
Within 10 minutes	10 minutes or more	1 hour or more	10 minutes or more
Within 1 hour	30 minutes or more	2 hours or more	30 minutes or more
Within 24 hours	1 hour or more	4 hours or more	1 hour or more
Within 72 hours	4 hours or more	24 hours or more	4 hours or more
Within 10 days	2 days or more	2 days or more	1 day or more
Less than 1 month	7 days or more	7 days or more	3 days or more
1 month to less than 3 months	14 days or more	14 days or more	14 days or more
3 months or more	1 month or more	1 month or more	1 month or more

* Note that the warmup time will differ depending on the sensor fitted.

<Definition of combustible gas>

- All sensor models of %LEL (vol%) range and ppm range specifications are applicable to the following 12 gases.
Acetylene, isobutane, LPG, LNG, ethane, ethylene, hydrogen, town gases, butane, propane, propylene, and methane.
- Sensors of the %LEL (vol%) range specification are applicable to other combustible gases.

<Definition of toxic gas>

- All gases not included in the combustible gas list are treated as toxic gases.

11-2-4 Electrochemical type

Sensor	ESF	ESU	ESF	ESU	ESU + PLU* ¹
Detection principle	Electrochemical type				
Detection target gas	Toxic gases * ²		Oxygen		NF ₃ COS
Detection range	Depends on detection target gas.		0 – 25 vol%		0 – 30 ppm 0 – 90 ppm
Alarm setpoints	Depends on detection target gas.		1st: 18 vol% 2nd: 18 vol%		1st: 10 ppm 2nd: 20 ppm 1st: 30 ppm 2nd: 60 ppm
Alarm type	Two-step alarm (H-HH)		Two-step alarm (L-LL, L-H, H-HH)	Two-step alarm (L-LL)	Two-step alarm (H-HH)
Operating temperature range (no sudden changes)	ESF* ² : -10 °C to +40 °C (14 °F to 104 °F) ESU* ² : 0 °C to +40 °C (32 °F to 104 °F)				
Operating humidity range (no condensation)	ESF* ² : 20 to 90 %RH ESU* ² : 30 to 70 %RH				

*1 Specifications with the pyrolyzer unit connected.

For information on the pyrolyzer unit (PLU-80) specifications, refer to the 'Pyrolyzer Unit PLU-80 Operating Manual (PT9E-035)'.

*2 The range of operating temperatures and operating humidity may differ depending on the detection target gas.

NOTE

- ▶ Contact RIKEN KEIKI for specifications and information on other sensors.

11-2-5 Galvanic cell type

Sensor	OSU
Detection principle	Galvanic cell type
Detection target gas	Oxygen
Detection range	0 – 25 vol%
Alarm setpoints	1st: 18 vol%, 2nd: 18 vol%
Alarm type	Two-step alarm (L-LL, L-H, H-HH)
Operating temperature range (no sudden changes)	0 °C to +40 °C (32 °F to 104 °F)
Operating humidity range (no condensation)	95 %RH or less

NOTE

- ▶ Contact RIKEN KEIKI for specifications and information on other sensors.

11-2-6 Non-dispersive infrared type

Sensor	IRF	IRU
Detection principle	Non-dispersive infrared type	
Detection target gas	CO ₂	N ₂ O
Detection range	0 – 2,000 ppm 0 – 2 vol% 0 – 5 vol%	0 – 500 ppm
Alarm setpoints	1st: 1,000 ppm (0 – 2,000 ppm) 1 vol% (0 – 2 vol%) 1 vol% (0 – 5 vol%) 2nd: 1,000 ppm (0 – 2,000 ppm) 1 vol% (0 – 2 vol%) 1 vol% (0 – 5 vol%)	1st: 50 ppm 2nd: 100 ppm
Alarm type	Two-step alarm (H-HH)	
Operating temperature range (no sudden changes)	-10 °C to +40 °C (14 °F to 104 °F)	0 °C to +40 °C (32 °F to 104 °F)
Operating humidity range (no condensation)	95 %RH or less	

NOTE

- ▶ Allow the product to warm up for 10 minutes with this sensor unit mounted before use.
- ▶ Ensure identical temperatures, humidity, and pressure in the adjustment and measurement environments. (Readings may fluctuate due to temperature, humidity, and pressure characteristics. In some cases, readings may exceed the zero suppression value due to sensor characteristics.)
- ▶ If the composition of the base gas differs greatly for adjustment and measurement—for example, if an air base is used for adjustment but an Ar base is used for measurement—readings may differ due to infrared adsorption characteristics, even if the concentration of the target gas is the same.
- ▶ IRU (N₂O) sensors are susceptible to CO₂ interference.
- ▶ Store in a clean location at normal temperature and humidity, and out of direct sunlight.
- ▶ Contact RIKEN KEIKI for specifications and information on other sensors.

11-2-7 Pyrolysis-particle type

Sensor	SSU + PLU ^{*1}
Detection principle	Pyrolysis-particle type
Detection target gas	Toxic gas
Detection range	0 – 15 ppm (For TEOS. Depends on detection target gas.)
Alarm setpoints	1st: 10 ppm, 2nd: 10 ppm (For TEOS. Depends on detection target gas.)
Alarm type	Two-step alarm (H-HH)
Operating temperature range (no sudden changes)	0 °C to +40 °C (32 °F to 104 °F)
Operating humidity range (no condensation)	30 - 80 %RH

*1 Specifications with the pyrolyzer unit connected

For information on the pyrolyzer unit (PLU-80) specifications, refer to the 'Pyrolyzer Unit PLU-80 Operating Manual (PT9E-035)'.

NOTE

- ▶ Contact RIKEN KEIKI for specifications and information on other sensors.

12

Appendix

12-1 Detection principles

12-1-1 Catalytic combustion type

<Sensor overview>

This uses an ultrafine particle oxidation catalyst to detect gas concentrations over a wide range, from low concentrations (ppm) up to the lower explosive limit (LEL). This revolutionary gas detection sensor was developed by RIKEN KEIKI and designed specifically to detect combustible gases.

<Sensor structure and principle>

- Construction

The catalytic combustion type sensors consist of a detecting element and a compensating element. (Some sensors lack a compensating element.) The detecting element consists of an ultrafine particle oxidation catalyst that reacts with combustible gases sintered on top of a precious metal coil. This undergoes a combustion reaction in the presence of the detection target gas.

The compensating element consists of a material inert to combustible gases sintered on top of a precious metal coil. This compensates for atmospheric effects.

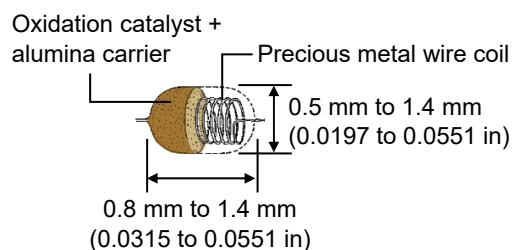
- Principle

When combustible gas burns on the surface of the detecting element heated to between 300 °C and 450 °C (572 °F and 842 °F) by the precious metal coil, this increases the temperature of the element.

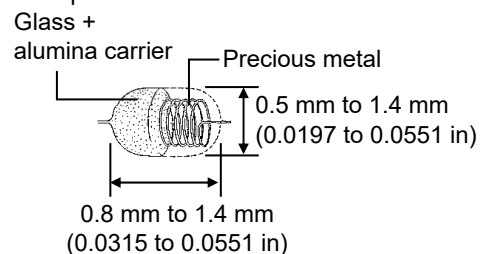
The resistance of the precious metal wire coil forming the element also varies in accordance with this temperature variation. The resistance variation is roughly proportional to gas concentration. This variation in resistance is thus extracted as a voltage using a bridge circuit and the gas concentration is worked out.

<Sensor element diagram>

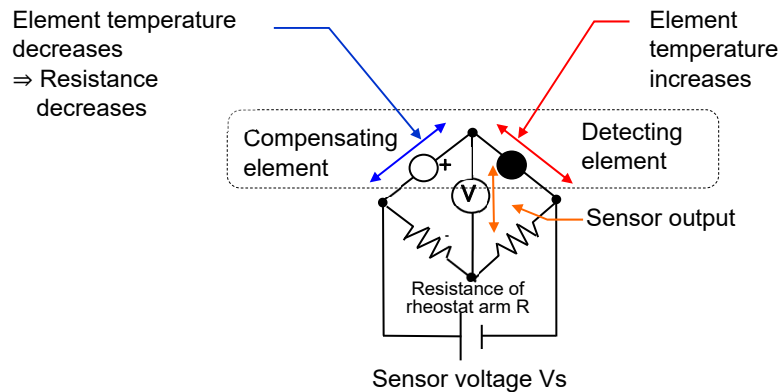
Detecting element: Detects gas.



Compensating element: Compensates for atmospheric effects.



<Bridge circuit>



<Points to note when using a catalytic combustion type sensor>

In particular, note the following points when using a catalytic combustion type sensor:

1. The product may be subject to interference from gases or vapors other than the target gas. Take care to avoid alarm activation due to interference. The product may also experience fluctuations due to environmental changes (e.g., in temperature or humidity) at the location where it is installed.
2. The alarm setpoint should be set within the performance range of the device. In facilities subject to the High Pressure Gas Safety Act, settings below the standard alarm setpoints specified by RIKEN KEIKI may result in false alarms.
3. The product is a safety device. It is not a control device. Use the alarm contact outputs on the product with external alarm lamps or buzzers. Use the analog signal output for indicators or external recorders. RIKEN KEIKI rejects liability for malfunctions in cases in which this signal is used for any other controls.
4. The gas sensing parts in the gas detecting sensors of this product are metal-oxide porous sintered alloys impregnated with oxidation catalysts. The surface area of the gas sensing parts will shrink when silicone and sulfides attach to the surface of the sintered bodies. This can impair sensitivity significantly. For safety reasons, avoid using this product in environments containing even trace amounts of silicone or sulfides.
5. Regular maintenance is essential, including periodic parts replacement and readjustments as described in this operating manual. The product is a safety device. We recommend regular maintenance and gas adjustment every six months in accordance with regulations.

12-1-2 Semiconductor type

<Sensor overview>

This method detects gas concentrations from variations in resistance that occur when a metal oxide semiconductor comes into contact with the detection target gas. This general-purpose gas detector sensor is ideal for detecting a wide range of gases, from toxic gases to combustible gases.

<Sensor structure and principle>

• Construction

The sensor consists of a metal oxide semiconductor (SnO₂) formed around a heater coil and alumina tube. The alumina tube has two gold electrodes at each end to measure semiconductor resistance.

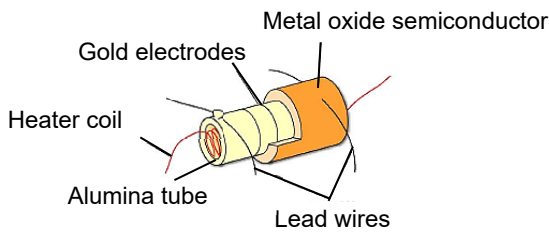
• Principle

Oxygen from the atmosphere is adsorbed as O⁻ and O²⁻ to the surface of the metal oxide semiconductor heated to between 350 °C and 400 °C (662 °F and 752 °F) by the heater coil. The semiconductor maintains a constant resistance. If a methane or other such gas comes into contact with this surface and becomes chemically adsorbed, the oxygen is oxidized and released by the adsorbed O²⁻ ions. The following chemical reaction occurs here at the sensor surface:

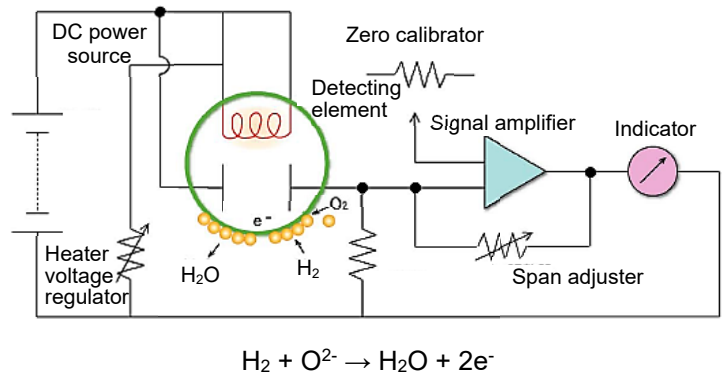


In other words, as methane gas is adsorbed to the sensor surface removing adsorbed oxygen, the increase in free electrons inside the sensor reduces the resistance. This variation in resistance can be measured and used to calculate the gas concentration.

<Sensor element diagram>



<Drive circuit>



<Points to note when using the semiconductor type sensor>

In particular, note the following points when using the semiconductor type sensor:

1. The product may be subject to interference from gases or vapors other than the target gas.
Take care to avoid alarm activation due to interference. The product may also experience fluctuations due to environmental changes (e.g., in temperature or humidity) at the location where it is installed.
2. The alarm setpoint should be set within the performance range of the device.
In facilities subject to the High Pressure Gas Safety Act, settings below the standard alarm setpoints specified by RIKEN KEIKI may result in false alarms.
3. The product is a safety device. It is not a control device.
Use the alarm contact outputs on the product with external alarm lamps or buzzers. Use the analog signal output for indicators or external recorders. RIKEN KEIKI rejects liability for malfunctions in cases in which this signal is used for any other controls.
4. The gas sensing parts in the gas detecting sensors of this product are metal-oxide porous sintered alloys. The surface area of the gas sensing parts will shrink when silicone and sulfides attach to the surface of the sintered bodies. This can impair sensitivity significantly.
For safety reasons, avoid using this product in environments containing even trace amounts of silicone or sulfides.
5. Regular maintenance is essential, including periodic parts replacement and readjustments as described in this operating manual. The product is a safety device. We recommend regular maintenance and gas adjustment every six months in accordance with regulations.

12-1-3 Hot-wire semiconductor type

<Sensor overview>

This sensor type detects gas concentrations based on variations in the resistance of a platinum coil integrated with a metal oxide semiconductor whose resistance changes when it comes into contact with a gas. The high-sensitivity low-concentration detection gas sensor is configured as a detecting element of metal oxide semiconductor sintered around a platinum coil.

<Sensor structure and principle>

- Construction

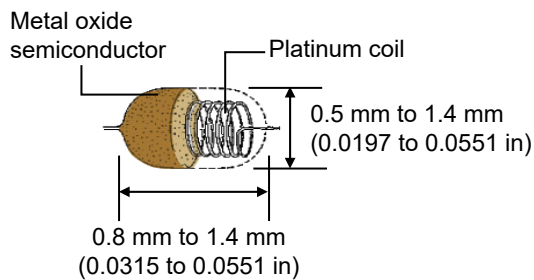
The sensor consists of a detecting element formed of a metal oxide semiconductor sintered around a platinum coil.

- Principle

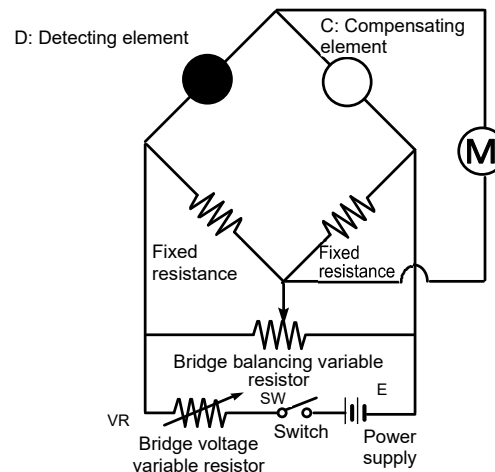
The resistance (R) of the detecting element is the combined resistance of the semiconductor resistance (R_S) and the platinum coil resistance (R_H).

The detecting element is heated to between 300 °C and 400 °C (572 °F and 752 °F) by the platinum coil and maintains constant resistance. If methane or another such gas comes into contact with the detecting element, oxygen adsorbed to the surface of the metal oxide semiconductor is released, increasing the number of free electrons inside the semiconductor and reducing the resistance of the semiconductor. This reduces the resistance of the entire detecting element. This variation in resistance is thus extracted as a voltage using a bridge circuit and the gas concentration is worked out.

<Detecting element diagram>



<Drive circuit>



Basic circuit

<Points to note when using the hot-wire semiconductor type sensor>

In particular, note the following points when using the hot-wire semiconductor type sensor:

1. The product may be subject to interference from gases or vapors other than the target gas.
Take care to avoid alarm activation due to interference. The product may also experience fluctuations due to environmental changes (e.g., in temperature or humidity) at the location where it is installed.
2. The alarm setpoint should be set within the performance range of the device.
In facilities subject to the High Pressure Gas Safety Act, settings below the standard alarm setpoints specified by RIKEN KEIKI may result in false alarms.
3. The product is a safety device. It is not a control device.
Use the alarm contact outputs on the product with external alarm lamps or buzzers. Use the analog signal output for indicators or external recorders. RIKEN KEIKI rejects liability for malfunctions in cases in which this signal is used for any other controls.
4. The gas sensing parts in the gas detecting sensors of this product are metal-oxide porous sintered alloys. The surface area of the gas sensing parts will shrink when silicone and sulfides attach to the surface of the sintered bodies. This can impair sensitivity significantly.
For safety reasons, avoid using this product in environments containing even trace amounts of silicone or sulfides.
5. Regular maintenance is essential, including periodic parts replacement and readjustments as described in this operating manual. The product is a safety device. We recommend regular maintenance and gas adjustment every six months in accordance with regulations.

12-1-4 Electrochemical type

<Sensor overview>

This sensor type detects a gas concentration in the form of a current generated if the detection target gas is electrolyzed on electrodes maintained at constant potential. This is the most effective gas sensor for detecting toxic gas. Gases can be selectively detected by selecting a specific potential.

<Sensor structure and principle>

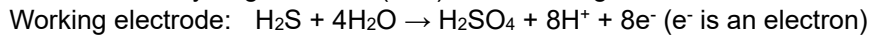
- Construction

The sensor consists of an electrode (working electrode) formed of a precious metal catalyst on a gas permeable membrane, a reference electrode, and a counter electrode, all enclosed in a plastic container filled with electrolyte solution.

- Principle

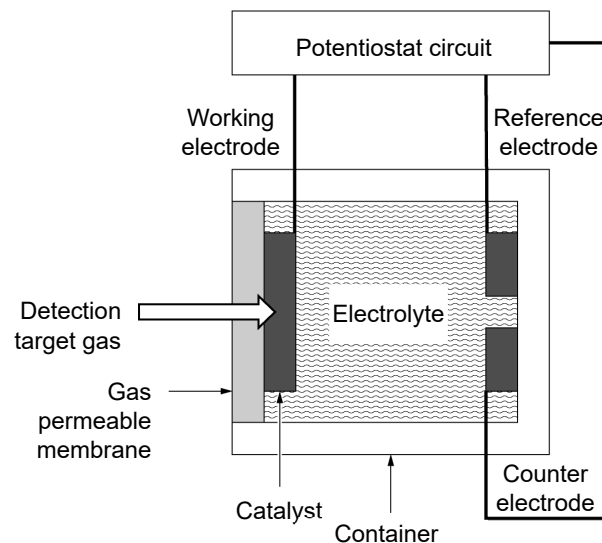
A potentiostat circuit is used to maintain constant potential between the working electrode and reference electrode. The detection target gas passes through the gas permeable membrane and undergoes electrolysis reaction on reaching the working electrode. A side reaction also occurs at the counter electrode so that the same amount of electric current flows through it as that produced at the working electrode.

Example: In the case of hydrogen sulfide (H₂S), the following chemical reaction occurs:



The current generated here is proportional to gas concentrations. Gas concentrations can be determined by measuring the current flowing through the working electrode.

<Structure diagram>



<Points to note when using the electrochemical type sensor>

In particular, note the following points when using the electrochemical type sensor:

1. The product may be subject to interference from solvent vapor or gases other than the target gas. Take care to avoid alarm activation due to interference. The product may also experience fluctuations due to environmental changes (e.g., in temperature or humidity) at the location where it is installed.
2. The alarm setpoint should be set within the performance range of the device. In facilities subject to the High Pressure Gas Safety Act, settings below the standard alarm setpoints (maximum allowable concentrations) specified by RIKEN KEIKI may result in false alarms.
3. The product is a safety device. It is not a control device. Use the alarm contact outputs on the product with external alarm lamps or buzzers. Use the analog signal output for indicators or external recorders. RIKEN KEIKI rejects liability for malfunctions in cases in which this signal is used for any other controls.
4. The contact point of the gas detection sensor consists of a porous polymer membrane. Solvents may impair the water repellency of the membrane and result in leaking electrolyte. Avoid using solvents near the detector. If the use of solvents is unavoidable, place our recommended filter over areas like the gas detector inlet when using solvents and for about one hour thereafter.
5. Regular maintenance is essential, including periodic parts replacement and readjustments as described in this operating manual. The product is a safety device. We recommend regular maintenance and gas adjustment every six months in accordance with regulations.

12-1-5 Galvanic cell type

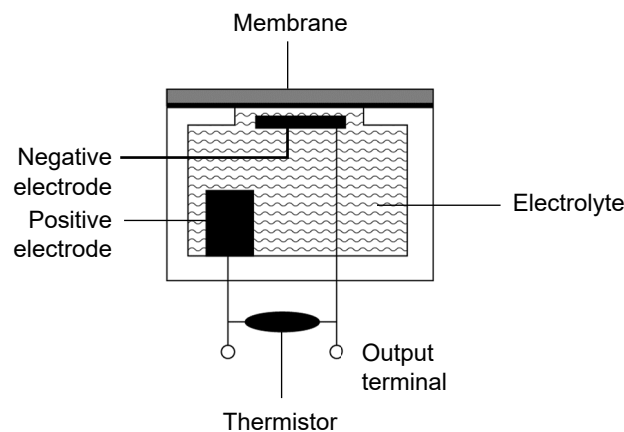
<Sensor overview>

Connecting wires to precious metal and base metal electrodes immersed in an electrolyte forms a battery (galvanic cell). If oxygen passes through a membrane, a reduction reaction occurs at the precious metal electrode and an oxidation reaction occurs at the base metal electrode.

<Sensor structure and principle>

The current produced by the reduction and oxidation reactions occurring at the precious metal and base metal electrodes is passed through a load resistor (thermistor), where it is converted into a voltage and read off.

If the oxygen concentration falls, the oxygen reduction reaction at the precious metal electrode decreases, resulting in a lower voltage across the thermistor.



<Points to note when using the galvanic cell type sensor>

In particular, note the following points when using a galvanic cell type sensor:

1. The product readings fluctuate slightly depending on variations in atmospheric pressure. Be careful to avoid alarm activation, particularly at times of low atmospheric pressure, such as during typhoons. The product may also experience fluctuations due to environmental changes (e.g., in temperature or humidity) at the location where it is installed.
2. The alarm setpoint should be set within the performance range of the device.
In facilities subject to the High Pressure Gas Safety Act, settings below the standard alarm setpoints specified by RIKEN KEIKI may result in false alarms. The standard alarm setpoint is 18 vol%.
3. The product is a safety device. It is not a control device.
Use the alarm contact outputs on the product with external alarm lamps or buzzers. Use the analog signal output for indicators or external recorders. RIKEN KEIKI rejects liability for malfunctions in cases in which this signal is used for any other controls.
4. Regular maintenance is essential, including periodic parts replacement and readjustments as described in this operating manual. The product is a safety device. We recommend regular maintenance and gas adjustment every six months in accordance with regulations.

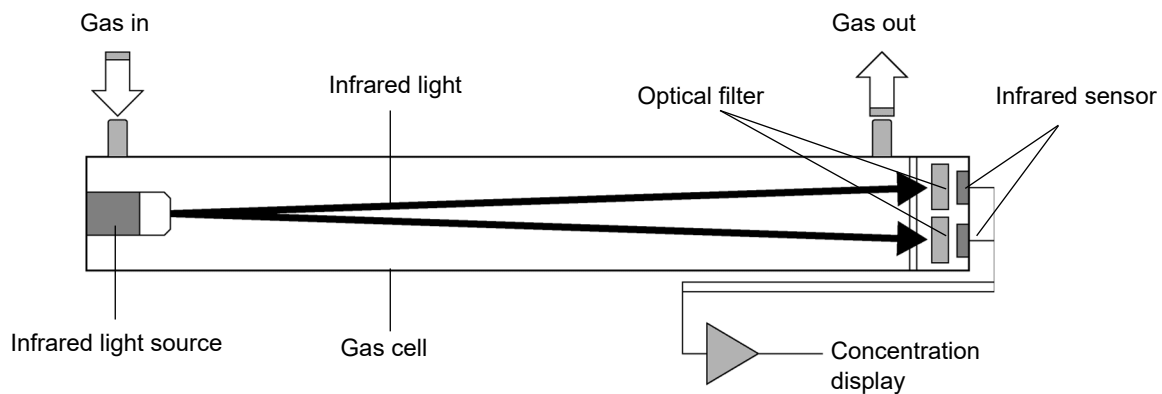
12-1-6 Non-dispersive infrared type

<Sensor overview>

When a detection target gas enters the cell, the infrared light emitted from the light source is absorbed by the detection target gas, reducing the amount of infrared radiation reaching the infrared sensor. This reduction is detected by the infrared sensor and is output as a gas concentration.

<Sensor structure and principle>

An optical filter is mounted in front of the infrared sensor, allowing only the infrared light of the wavelength absorbed by the detection target gas to pass through. Therefore, a gas that absorbs a wavelength of light that differs from the wavelength of infrared light absorbed by the detection target gas cannot be detected by an infrared sensor. Likewise, gases such as N₂ and H₂ that do not absorb infrared light cannot be detected by an infrared detector.



<Points to note when using the non-dispersive infrared type sensor>

In particular, note the following points when using a non-dispersive infrared type sensor:

1. The alarm setpoint should be set within the performance range of the device.
In facilities subject to the High Pressure Gas Safety Act, settings below the standard alarm setpoints specified by RIKEN KEIKI may result in false alarms.
2. The product is a safety device. It is not a control device.
Use the alarm contact outputs on the product with external alarm lamps or buzzers. Use the analog signal output for indicators or external recorders. RIKEN KEIKI rejects liability for malfunctions in cases in which this signal is used for any other controls.
3. Regular maintenance is essential, including periodic parts replacement and readjustments as described in this operating manual. The product is a safety device. We recommend regular maintenance and gas adjustment every six months in accordance with regulations.

12-1-7 Pyrolysis-particle type

<Sensor overview>

Heating the detection target gas to several hundreds of degrees Celsius causes solid oxides to form as particulates.

This sensor uses the alpha particle absorption method to detect the particulates formed.

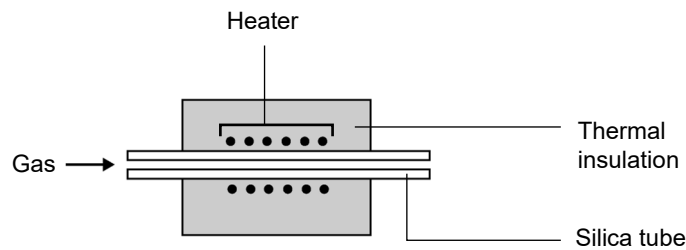
<Sensor structure and principle>

• Construction

The sensor consists of a pyrolyzer heater that heats the gas to several hundreds of degrees Celsius and a particle detector that detects oxides.

The pyrolyzer heater contains a silica tube in the center around which the heating element is wound. The heater is surrounded by thermal insulation.

The particle detector consists of a measurement cell in which a continuous ion current is generated by alpha particles, combined with an integral compensation cell (into which no gas is introduced).



• Principle

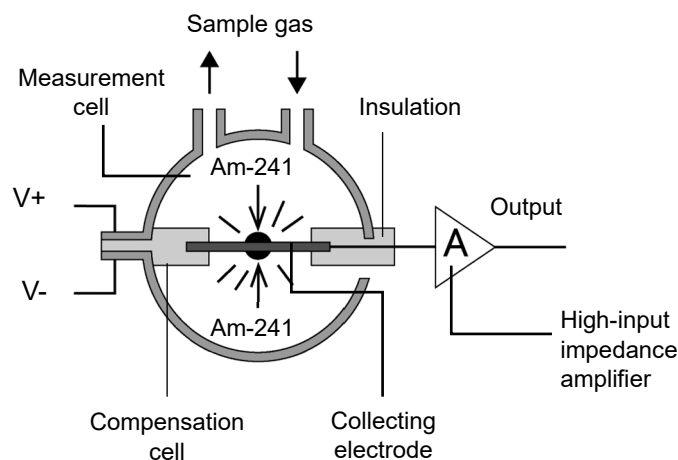
Many metal-organic (MO) gases such as TEOS produce particulate oxides when heated. Sample gas decomposed into oxides and other substances after passing through the pyrolyzer heater is fed to the particle detector.

The air inside the measurement cell in the particle detector is ionized by the internal alpha radiation source^{*1}, generating an ion current.

Another ion current is also generated inside the compensation cell, and a constant ratio is maintained between the ion currents in the measurement cell and compensation cell when no gas is present. When particulates are then introduced into the measurement cell in this state, the particulates adsorb ions, which reduces the ion current.

This changes the ratio between the ion currents in the measurement cell and compensation cell. The detector uses this change to detect the gas.

*1 SSU-1925: Am-241 37 kBq, SSU-1927: Am-241 7.4 kBq



<Points to note when using the pyrolysis-particle type sensor>

In particular, note the following points when using a pyrolysis-particle type sensor:

1. The product may be subject to interference from gases or vapors other than the target gas.
Take care to avoid alarm activation due to interference. The product may also experience fluctuations due to environmental changes (e.g., in temperature or humidity) at the location where it is installed.
2. The alarm setpoint should be set within the performance range of the device.
In facilities subject to the High Pressure Gas Safety Act, settings below the standard alarm setpoints (maximum allowable concentrations) specified by RIKEN KEIKI may result in false alarms.
3. The product is a safety device. It is not a control device.
Use the alarm contact outputs on the product with external alarm lamps or buzzers. Use the analog signal output for indicators or external recorders. RIKEN KEIKI rejects liability for malfunctions in cases in which this signal is used for any other controls.
4. The SSU-1925 gas detector sensor used in this product contains radioactive material equivalent to 37 kBq. Do not disassemble or improperly dispose of the product. For information on sensor handling, refer to '12-2 Safety manual'.
5. The pyrolysis-particle type sensor unit (SSU-1927) contains radioactive material. The radioactivity level does not exceed the restriction value of 10 kBq stipulated by the IAEA (International Atomic Energy Agency). The unit is not subject to restrictions regarding transportation or disposal.
6. Regular maintenance is essential, including periodic parts replacement and readjustments as described in this operating manual. The product is a safety device. We recommend regular maintenance and gas adjustment every six months in accordance with regulations.

<Pyrolysis-particle type sensor unit (SSU-1925)>

The SSU-1925/SSU-1925A sensor units contain a pyrolysis-particle type sensor, which is a radioisotope device.

This has been certified as a specified design certified device posing extremely low risk of radiation hazards based on examinations by the Nuclear Safety Technology Center registration and certification body in accordance with the stipulations of 'Article 12-3 of Law Concerning Prevention of Radiation Hazards Due to Radioisotopes, etc.'.

(SSU-1925 certification number: ㊦091, SSU-1925A certification number: ㊦207)

No notification is required for use of a gas detector incorporating a pyrolysis-particle type sensor (within the scope described in this operating manual).

Handling of the pyrolysis-particle type sensor itself must comply with the certification conditions described in the 'Safety manual'.

<Safety of radioactive isotope ^{241}Am (37 kBq) used in the pyrolysis-particle type sensor unit (SSU-1925/SSU-1925A)>

The pyrolysis-particle type sensor incorporated into the product uses a radioactive isotope ^{241}Am source ($18.5 \text{ kBq} \times 2 = 37 \text{ kBq}$).

Specified design certified devices are subject to a restriction threshold of '1 cm dose equivalent rate at a distance 10 cm from the device surface' for certification. The allowable value is as follows:

	Allowable value
1 cm dose equivalent rate at a distance 10 cm from the device surface	$1 \mu\text{Sv}\cdot\text{h}^{-1}$

This product, which uses the radioactive isotope ^{241}Am source ($18.5 \text{ kBq} \times 2 = 37 \text{ kBq}$), fully meets the conditions for certification based on the following 1 cm dose equivalent rate produced at a distance of 10 cm from the device surface:

<1 cm dose equivalent rate at a distance 10 cm from the sensor surface (calculated value)>

$$D = \frac{Q}{r^2} \cdot \Gamma_{1\text{cm}} = \frac{2 \times 18.5 \times 10^{-3}}{(0.1)^2} \times 0.0151 = 0.056 [\mu\text{Sv}\cdot\text{h}^{-1}]$$

Q : Radioactive isotope level $2 \times 18.5 \times 10^{-3} \text{ MBq} = 37 \text{ kBq}$

$\Gamma_{1\text{cm}}$: 1 cm dose equivalent rate constant for ^{241}Am $0.0151 \mu\text{Sv}\cdot\text{m}^2\cdot\text{MBq}^{-1}\cdot\text{h}^{-1}$
(Quoted from Isotope Handbook 12th Edition)

r : Distance from source 0.1 m

Adequate safety has been approved provided the product is used in compliance with the certification conditions described in the 'Safety manual'.

12-2 Safety manual

Before using the pyrolysis-particle type sensor unit (SSU-1925/SSU-1925A), please read the following safety manual thoroughly and make sure you are familiar with the contents.

Adequate safety has been approved provided the product is used in compliance with the certification conditions described in the safety manual.

<SSU-1925>

No. 4019 4059 2

<Safety manual>

The pyrolysis-particle type sensors (SS-1923/1924 and SS-1925^{Note 1}) are radioisotope equipped devices that use the 37 kBq²⁴¹Am radioactive isotope.

These pyrolysis-particle type sensors have been granted specified design certification from the Nuclear Safety Technology Center (a registered certification organization) as devices posing extremely low risk of radiation hazards.

(SS-1923/1924: Certification No. ㊦027; SS-1925: Certification No. ㊦091)

No notification or filing is required when using these sensors within Japan^{Note 2}.

However, since these sensors are subject to legal regulations, they must be used in accordance with the following certification conditions^{Note 3}.

- Do not disassemble the sensors^{Note 4}.
- The sensors must be used as built-in parts of RIKEN KEIKI products, and must not be removed from the products without specific reason.
- If the sensors are to be removed for storage, store in the dedicated container specified by RIKEN KEIKI and in a locked room to prevent unauthorized removal.
- When the sensors are no longer needed, do not dispose of them. Instead, return them to RIKEN KEIKI.
- The sensors must be handled as equivalent to Type L transported goods. They must be transported either inside the dedicated container specified by RIKEN KEIKI or built in a RIKEN KEIKI product labeled “Equivalent to Radioactive Type L Transported Goods.”
- The sensors must be transported by a carrier authorized to handle Type L transported goods^{Note 5}.

Note 1: SS-1925 refers to the sensor built in the SSU-1925 pyrolysis-particle type sensor unit.

Note 2: When using the sensors outside Japan, use in accordance with the laws and regulations of the destination country.

Note 3: If the sensors are to be used in a manner that does not comply with the certification conditions, usage notification must be filed with the Nuclear Regulation Authority.

If you find cases in which these sensors are improperly controlled, please notify RIKEN KEIKI.

Note 4: Do not disassemble the SSU-1925 pyrolysis-particle type sensor unit containing the SS-1925 sensor.

Note 5: RIKEN KEIKI and its authorized service providers are capable of handling Type L transported goods.

Website for information on design certification: <http://www.nsr.go.jp/>



RIKEN KEIKI Co., Ltd.

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

Tel: 03-3966-1111

<SSU-1925A>

No. 4019 4081 1

Safety manual

The pyrolysis-particle type sensor (SS-1925A^{Note 1}) is a radioisotope equipped device that uses the 37 kBq ^{241}Am radioactive isotope. This sensor has been granted specified design certification from the Nuclear Safety Technology Center (a registered certification organization) as a device posing extremely low risk of radiation hazards. (SS-1925A: Certification No. ㊦207)

No notification or filing is required when using this product within Japan^{Note 2}.

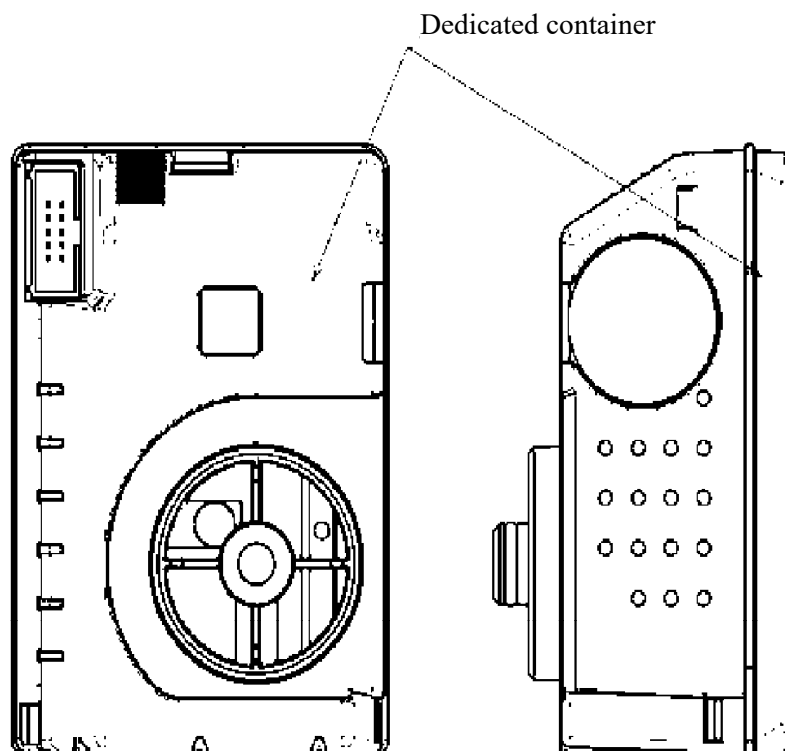
However, since this sensor is subject to legal regulations, it must be used in accordance with the following certification conditions^{Note 3}.

<Usage Conditions>

- To prevent radiation hazards, do not disassemble the sensor^{Note 4}.
- The sensor must be used as a built-in part of a RIKEN KEIKI product, and must not be removed from the product without specific reason.

<Storage Conditions>

- Store inside the dedicated container specified by RIKEN KEIKI labeled “RADIOACTIVE.”
- Store in a locked room to prevent unauthorized removal of the radioisotope equipped device.
- When the product is no longer needed, do not dispose of it. Instead, return it to RIKEN KEIKI.



P1

No. 4019 4081 1

<Transport Conditions>

- The product must be transported by a carrier authorized to handle Type L transported goods ^{Note 5}.
- The product must be transported in accordance with the following standards after placing it in the dedicated container specified by RIKEN KEIKI and checking to confirm that there is no damage.
 - a. The consignment must be equivalent to Type L transported goods as specified in Article 18-3, Paragraph 1, Item 1 of the Regulations.
 - b. The consignment must be able to be handled easily and safely.
 - c. The consignment must be proof against any cracking or damage due to foreseeable changes in temperature and internal pressure, vibration, etc. during shipping.
 - d. The consignment must be free of unnecessary surface protrusions and easy to decontaminate.
 - e. There must be no risk of hazardous physical or chemical reactions between materials or between the materials and the radioactive isotope contained or packaged.
 - f. Measures must be taken to prevent unintended valve operation.
 - g. The consignment must be prominently labeled “Radioactive” and “Equivalent to Type L transported goods.” A similar label must also be placed where it is clearly visible when the dedicated container is opened.
 - h. The 1 cm dose equivalent rate on the surface of the dedicated container must not exceed 5 microsievarts per hour.
 - i. The surface density of the radioactive isotope on the dedicated container must not exceed the surface density limit specified in Article 18-4, Item 8 of the Regulations.
 - j. No items other than the necessary documentation and goods required for the use of the radioactive isotope (only those items that do not compromise the safety of the radioactive transported goods) must be stored or packaged together.

When transporting, be mindful of the Regulations for Transporting Radioactive Isotopes, etc. by Vehicle.

Note 1: SS-1925A refers to the sensor built in the SSU-1925A pyrolysis-particle type sensor unit.

Note 2: When using the product outside Japan, use in accordance with the laws and regulations of the destination country.

Note 3: If the product is to be used in a manner that does not comply with the certification conditions, usage notification must be filed with the Nuclear Regulation Authority.

If you find cases in which the sensor is improperly controlled, please notify RIKEN KEIKI.

Note 4: Do not disassemble the SSU-1925A pyrolysis-particle type sensor unit containing the SS-1925A sensor.

Note 5: RIKEN KEIKI is capable of handling Type L transported goods.

Website for information on specific design certification: <http://www.nra.go.jp/>

RIKEN KEIKI Co., Ltd.
2-7-6 Azusawa Itabashi-ku, Tokyo 174-8744
Tel: 03-3966-1111

P2

12-3 Alarm accuracy and alarm delay time (for use in Japan)

For use in Japan, the sensors listed in '11-2 Sensor specifications' provide performance meeting the requirements of the following ministerial ordinance-related exemplified standards related to the High Pressure Gas Safety Act.

1. High Pressure Gas Safety Act related
- 1.2 Ministerial ordinance-related exemplified standards
 - 1.2.1 Exemplified standards relating to the Regulation on Safety of General High Pressure Gas
 23. Gas leak detection alarm equipment and installation locations
 1. Functions
 - 1.3 The alarm accuracy of gas detection alarm equipment shall be within $\pm 25\%$ of the alarm setpoint for combustible gases or specified inert gases, within $\pm 5\%$ for oxygen, and within $\pm 30\%$ for toxic gases.
 - 1.4 The delay until the gas detection alarm equipment issues an alarm shall be confirmed using the alarm delay test specified in '6.7.2 Alarm delay test' of Japanese Industrial Standard JIS M 7626 (1994) (revision planned). This confirmation shall be performed by introducing gas at a concentration 1.6 times the alarm setpoint concentration into the detector, and the resulting delay shall be within 30 seconds. However, for specific gases that are structurally or theoretically slower (such as ammonia, carbon monoxide, and similar gases), the delay shall be within 1 minute.
 - 1.2.2 Exemplified standards relating to the Regulations on the Safety of Liquefied Petroleum Gas
 24. Gas leak detection alarm equipment and installation locations
 1. Functions
 - 1.3 Alarm accuracy shall be within $\pm 25\%$ of the alarm setpoint.
 - 1.4 The delay until the gas detection alarm equipment issues an alarm shall normally be within 30 seconds at a gas concentration 1.6 times the alarm setpoint concentration.
 - 1.2.4 Exemplified standards relating to Regulations on the Safety of Industrial Complexes
 36. Gas leak detection alarm equipment and installation locations (excluding piping systems)
 1. Functions
 - 1.3 The alarm accuracy of gas detection alarm equipment shall be within $\pm 25\%$ of the alarm setpoint for combustible gases or specified inert gases and within $\pm 30\%$ for toxic gases.
 - 1.4 The delay until the gas detection alarm equipment issues an alarm shall be confirmed using the alarm delay test specified in '6.7.2 Alarm delay test' of Japanese Industrial Standard JIS M 7626 (1994) (revision planned). This confirmation shall be performed by introducing gas at a concentration 1.6 times the alarm setpoint concentration into the detector, and the resulting delay shall be within 30 seconds. However, for specific gases that are structurally or theoretically slower (such as ammonia, carbon monoxide, and similar gases), the delay shall be within 1 minute.
 - 1.2.5 Exemplified standards relating to Regulations on Refrigeration Safety
 13. Gas leak detection alarm equipment and installation locations (Functions)
 - 13.1 (3) The alarm accuracy shall be within $\pm 25\%$ of the alarm setpoint for combustible gases or specified inert gases and within $\pm 30\%$ for toxic gases.
 - (4) The delay until the gas detection alarm equipment issues an alarm shall normally be within 30 seconds at a gas concentration 1.6 times the alarm setpoint concentration. However, for specific gases that are structurally or theoretically slower (such as ammonia and similar gases), the delay shall be within 1 minute.

12-4 Terminology

Term	Definition
Dust filter	A filter for removing dust. We recommend fitting an external dust filter if the product will be used in dusty surroundings. Different filters are specified for different detection target gases. Contact RIKEN KEIKI.
vol%	Indicates gas concentrations in units of parts per hundred by volume.
ppm	Indicates gas concentration in units of parts per million by volume.
ppb	Indicates gas concentrations in units of parts per billion by volume.
%LEL	Unit in which the lower explosive limit (LEL) of the target combustible gas is set to 100
Gas adjustment	Refers to an evaluation of the correlation between product readout values, display values, and setting values with actual values using calibration gas.
Maintenance mode	Mode for performing device maintenance During product maintenance, the alarm contacts are cut off, and the external output signal outputs a signal indicating the product is in maintenance mode. This enables the device to be isolated for maintenance.
Initialization	During the few seconds after turning on the power, the readings are unstable. This function cuts off alarm contacts during this time to prevent errors. The external output outputs a signal indicating the product is in initialization mode.
Zero suppression	This function makes fluctuations in ambient conditions and interference gas less noticeable.
Alarm delay time	This function temporarily suspends activation to prevent false alarms caused by external noise.
INHIBIT (Inhibit)	This function temporarily stops gas detection functions during product maintenance, etc. This is also called "point skip," which has the same function.
Pyrolyzer unit	Unit that decomposes gas by heating to high temperatures The unit pyrolyzes specific gases by heating to high temperatures to produce a gas that can be detected.

Revision history

Issue	Revision details	Issue date
0	First issue	Aug. 07, 2025
1	Correction 1-4 Checking CE/UKCA mark / correction 9-3 Product disposal / deletion CE declaration	Oct. 31, 2025
2	Deletion GD-81D-ET (PT2-3435)	Mar. 31, 2026