PT2E-1944

RIKEN KEIKI

2-Wire Gas Detector Head

GD-F88Ai

Operating Manual

(PT2-194)

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Outline of the Product

1-1. Preface

Thank you for choosing our 2-wire gas detector head GD-F88Ai.
Please check that the model number of the product you purchased is included in the specifications on this manual.

This manual explains how to use the detector head and its specifications. It contains information required for using the detector head properly. Not only the first-time users but also the users who have already used the product must read and understand the operating manual to enhance the knowledge and experience before using the detector head.
When the detector head is used in combination with an indicator/alarm unit, read also the operating manual of the indicator/alarm unit.

1-2. Purpose of use

- This product is a fixed type gas detector head which detects oxygen concentration in the air.
- When the detector head detects oxygen, it outputs a current according to the gas concentration. The indicator/alarm unit indicates the gas concentration and triggers an alarm if a preset concentration level is exceeded.
- The detector head is a safety unit, not an analyzer or densitometer which performs quantitative/qualitative analysis/measurement.
  Please fully understand the features of the detector head before using it, so that it can be used properly.
- The detector head outputs oxygen concentration in 4 to 20 mA.

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

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

2

Important Notices on Safety

2-1. Danger cases

DANGER

This detector head employs the intrinsically safe explosion-proof structure (safety maintaining device used separately); however, never attempt to detect a gas over the lower explosive limit (LEL).

2-2. Warning cases

WARNING

- Power supply
  Before turning on the detector head, always check that the voltage is properly applied.

- Need of grounding circuit
  Do not cut the grounding circuit inside or outside the detector head or disconnect the wire from the grounding terminal.
  In both of the cases, the detector head will be in danger.

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

- Grounding Zener Barrier
  Never fail to perform A type grounding for Zener Barrier.

- Operation in a gas
  The detector head employs the intrinsically safe explosion-proof structure (safety maintaining device used separately).
  It can be used in a location where a combustible or explosive gas, or steam is present; however, it should be done carefully.
  Consult RIKEN KEIKI before operating the detector head in such a location.

- External connection
  Before connecting the detector head to the external control circuit, securely connect it to a protective grounding circuit.

WARNING

- Handling of sensor
  Do not disassemble the sensor unit because it contains electrolyte. If contact occurs, rinse the area immediately with a large quantity of water.

- Calibration
  When performing calibration for the detector head, be careful of loose tubes, etc. to prevent personnel from contacting gases.

- Response to gas detection
  When a gas is detected, it indicates a potentially dangerous situation. Take proper actions based on your judgment.

2-3. Precautions

CAUTION

- Do not use a transceiver near the detector head.
  Radio wave from a transceiver etc. near the detector head or its cables may disturb indication reading. If a transceiver or other radio wave transmitting device is used, it must be used in a place where it disturbs nothing.

- To restart the the detector head, wait for five seconds or more before doing it.
  Restarting the detector head within five seconds may cause errors.

- Careful consideration should be given to instrumentation to maintain safety even when a trouble like disconnection of power/signal cable or unexpected malfunction or failure occurs.

- This is an electrical appliance. Be careful that it may be affected, in rare cases, by power supply noises, static electricity, and electromagnetic noises. Before using the detector head in an environment with such noises, provide for protective measures against them.

2-4. Operating Precautions

This product is a gas detector that detects oxygen in the air and outputs gas concentration signals.
The detector head is a safety unit, not an analyzer or densitometer which performs quantitative/qualitative analysis/measurement for gases.
Please fully understand the following points before using it, so that it can be used properly.

1. The readings of the detector head fluctuate slightly in response to changes in the air pressure.
   In particular, be careful of alarm activation when a low air pressure is brought in by typhoon. In addition, it may be fluctuated by environmental (temperature, humidity etc.) changes in the installation site.

2. This is a safety unit, not a control unit.
   Use the analog signal output of the detector head for an indicator or external recorder.
   If these outputs are used to control other units, we shall not be responsible for any malfunctions.

3. For maintenance of the detector head, it must go through a regular maintenance, including replacement and adjustment of the regular replacement parts as specified in the operating manual. In addition, because this is a safety unit, it is recommended that regular maintenance and span adjustment be performed every six months.

2-5. Important information about explosion-proof

The detector head is an explosion-proof product.
The following provides information about the explosion-proof structure. Understand the information in this section thoroughly before using the detector head.

● **Explosion-proof structure and class**

The detector head employs the following explosion-proof structure and class. Use the detector head according to the operating environment.

Explosion-proof structure	: Intrinsically safe explosion-proof structure
Explosion-proof class	: Ex ia IIC T4 Ga
Certificate number	: TC22667
Certification body	: Technology Institution of Industrial Safety
Applied standard	: Recommended Practices for Explosion-Protected Electrical Installations in General Industries JNIOSH-TR-46-1:2015 JNIOSH-TR-46-6:2015

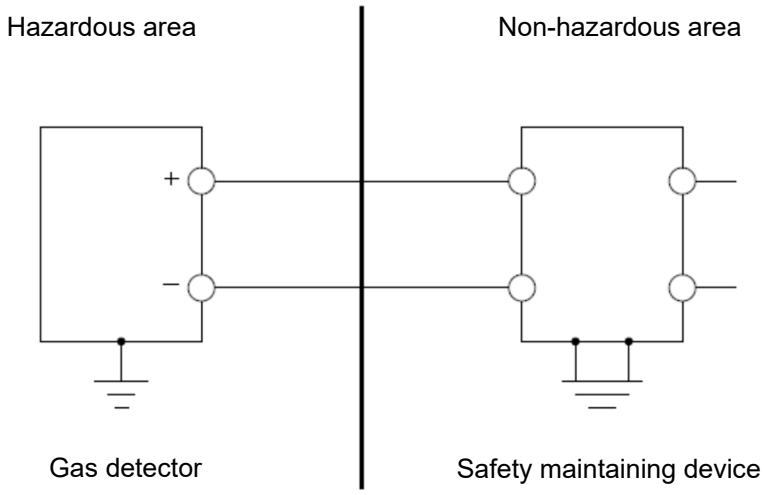
Electrical parameter

Intrinsically safe circuit allowable voltage (*U*i)	: 28 V
Intrinsically safe circuit allowable current (*I*i)	: 93 mA
Intrinsically safe circuit allowable power (*P*i)	: 0. 65 W
Internal capacitance (*C*i)	: 586 pF
Internal inductance (*L*i)	: Negligible value

Operating temperatures:	-20 - +50°C (*1)
Protective class of case:	IP20 (Water-proof: None/Dust-proof: Up to 12.5 mm foreign solid material protected)
Insulation performance:	Meet JIS standard (between the power supply and case, 500 VAC, one minute) under the condition that the capacitor connected to the terminal plate has been removed.

● **System configuration**

Make up the system as shown below.



Important information about explosion-proof (continued)

● **Power supply**

Never fail to use the following safety maintaining device (barrier) to maintain explosion-proof performance.

Ratings to maintain safety

Intrinsically safe circuit maximum voltage (*Uo*)	: 28 V
Intrinsically safe circuit maximum current (*Io*)	: 93 mA
Intrinsically safe circuit maximum power (*Po*)	: 0. 65 W

Performance classification and group

Performance classification:	ia
Group:	IIC

Relations between the intrinsically safe circuit allowable inductance (*Lo*) and intrinsically safe circuit external wire inductance (*Lc*) and between the intrinsically safe circuit allowable capacitance (*Co*) and intrinsically safe circuit external wire capacitance (*Cc*)

Intrinsically safe circuit allowable inductance (*Lo*)	= (*Lc*) or more
Intrinsically safe circuit allowable capacitance (*Co*)	= 586 pF + (*Cc*) or more

● **Wiring**

Determine the cable type to use and laying distance in consideration of the above parameters to maintain explosion-proof performance.
Perform wiring so that a current or voltage that disturbs intrinsically safe explosion-proof performance of the intrinsically safe circuit is not induced to the circuit due to electromagnetic or electrostatic induction.

● **Battery**

The detector head contains a battery for sensor backup. Observe the followings to maintain explosion-proof performance.

<Usable battery>

Type:	AAA alkaline dry battery
Model:	LR03
Nominal voltage:	1. 5 V

<Battery Replacement>

Turn off the power of the detector head before replacing the battery.
Never fail to use the dedicated battery storage case.

● **Grounding**

Never fail to ground the detector head (D type grounding).

● **Others**

Confirm that no combustible gas is present around before opening the door of the unit.
Never disassemble or modify the unit.

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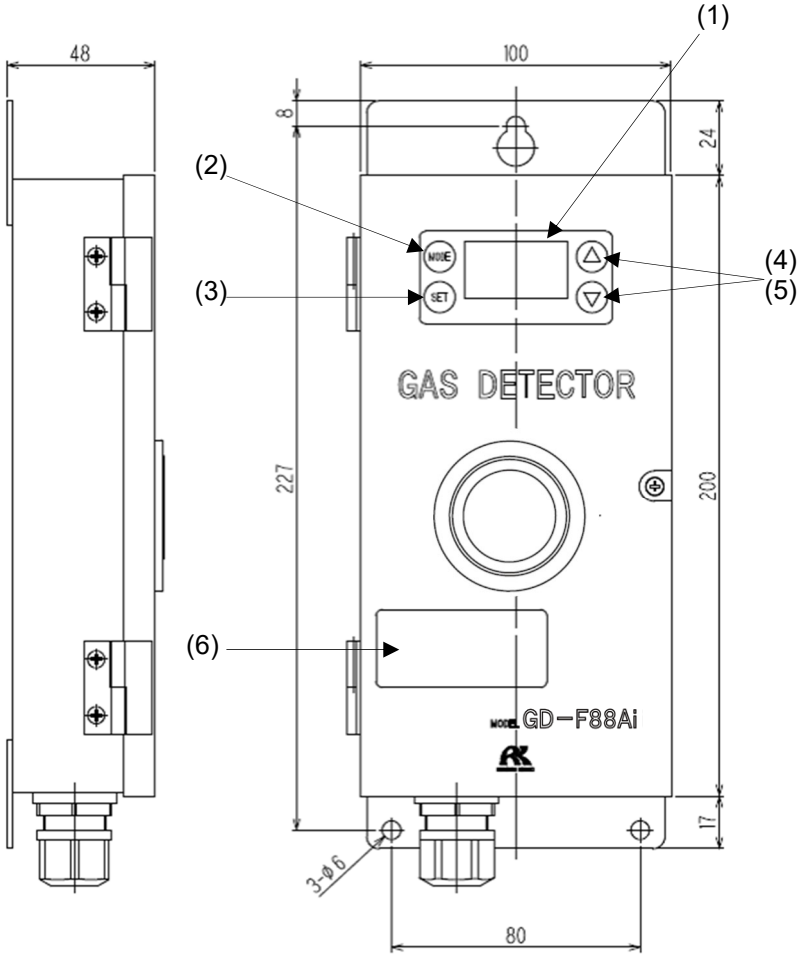
*1: The temperature range to maintain explosion-proof performance
The temperature range to maintain gas detection performance is 0 to +40°C. (See Specifications)

3

Product Components

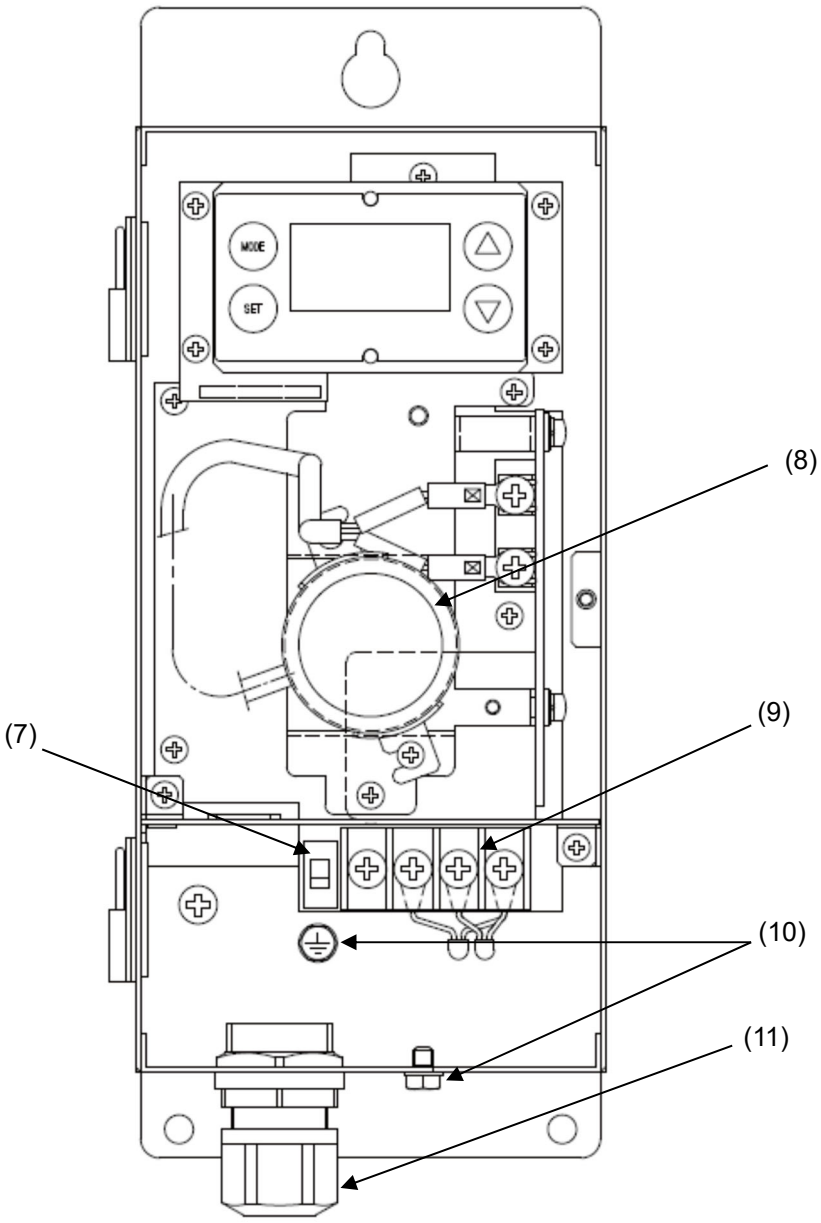
3-1. Main unit and standard accessories

<Main Unit>



(1) LCD display :	Displays the gas concentration. (Used at maintenance)
(2) MODE switch :	Switches the mode from the detection mode to maintenance mode. Or exits the maintenance mode.
(3) SET switch :	Used to set the mode during the maintenance mode.
(4) - (5) UP/DOWN switch :	Used to select an item for each maintenance mode, increase/decrease a reading in zero adjustment or external output test, etc.
(6) Nameplate :	Shows ratings, etc.

3-2. Names and functions for each part



(7) Power switch :	Turns ON/OFF the power of the unit.
(8) Sensor :	Detects a gas.
(9) Terminal plate :	Connects the power cable.
(10) Grounding terminal :	A terminal (M4) to ground the unit.
(11) Cable inlet :	An inlet for connected cable.

4

How to Use

4-1. Before using the detector head

Not only the first-time users but also the users who have already used the detector head never fail to follow the operating precautions.
Ignoring the precautions may damage the detector head, resulting in inaccurate gas detection.

4-2. Precautions for installation sites

CAUTION

- This is a precision device. Because the detector head may not provide the specified performance in some places (environments), check the environment in the installation point, and then take appropriate actions if necessary.
- Because the detector head plays an important role for safety and disaster prevention, as many units of the detector head as needed must be installed in appropriate points.
  Because points where gases leak and remain easily are different depending on the types of gases and the working areas, please decide carefully on installation points and the number of units to be installed.

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

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

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

When selecting installation points, avoid a place where it is exposed to direct sunlight or radiant heat (infrared rays emitted from a high-temperature object), and where the temperature changes suddenly. Condensation may be formed inside the detector head, or the detector head cannot adjust to sudden changes in the temperature.

Keep the detector head (and its cables) away from noise source devices.

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

- Do not place the detector head next to a noise source device.
- Do not run cables in parallel or close to each other.

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

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

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

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

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

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

4-3. Precautions for system designing

CAUTION

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

Using a stable power supply

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

Power supply voltage	15 - 27 VDC (terminal voltage of the main unit)	
Allowed time of momentary blackout	Approx. 1 msec. (To recover from the momentary blackout for 1 msec. or more, restart the detector head.)	Example of actions To ensure continuous operation and activation, install a UPS, etc. outside the detector head.
Others	Do not use it with a power supply of large power load or high-frequency noise.	Example of actions Use a line filter, etc. to avoid the noise source if necessary.

Heat radiation designing

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

Introducing protective measures against lightning

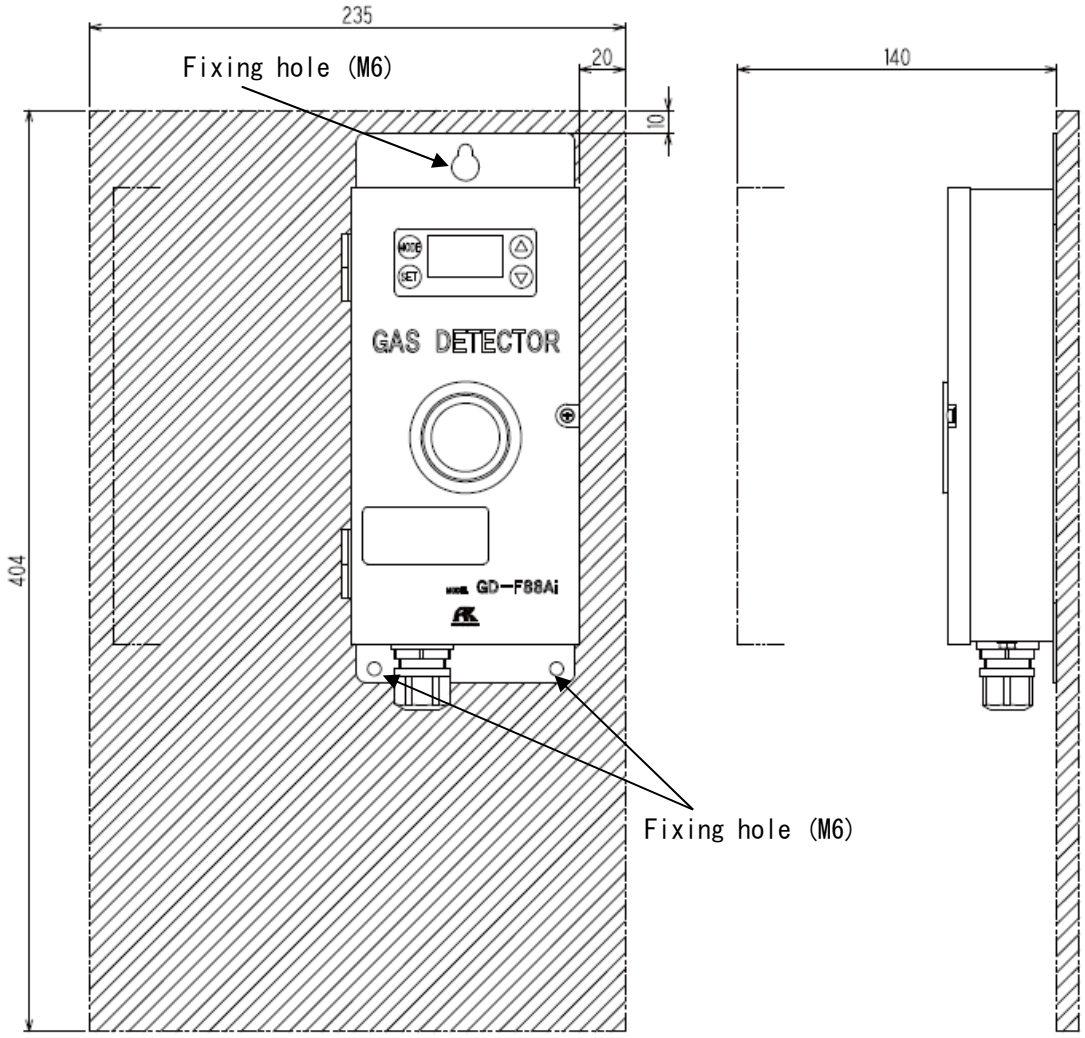
If cables are installed outside the factory/plant, or if internal cables are installed in the same duct as the cables coming from outside the factory/plant, "lightning" will cause problems. Because lightning acts as a large emission source while cables act as a receiving antenna, devices connected to the cables may be damaged.
Lightning cannot be prevented. Cables installed in a metal conduit or under the ground cannot be completely protected from inductive lightning surge caused by lightning. Although complete elimination of disasters caused by lightning is impossible, the following protective measures can be taken.

Protection against lightning	Take appropriate measures in accordance with the importance of the facilities and the environment. • Provide protection by a lightning arrester (cable arrester). (Although inductive lightning surge can be transmitted through the cable, it is prevented by installing a lightning arrester before the field devices and central processing equipment. For information on how to use a lightning arrester, please contact the manufacturer.)
Grounding	In addition to lightning, there are more sources of surge noise. To protect units from these noise sources, the units must be grounded.

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

4-4. How to install

A certain maintenance space needs to be secured in advance to allow the maintenance personnel to safely and properly perform maintenance of the gas detector function and performance. Be sure to secure this space during construction planning or installation.



(1) Mount the main unit on the wall.
(2) Insert screws to the upper and lower fixing holes of the main unit and tighten them. (Use M6 screws.)

CAUTION

Check that the main unit is mounted securely on the wall. If the main unit is not securely installed, it might fall, causing an unexpected injury or a damage of the unit.

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

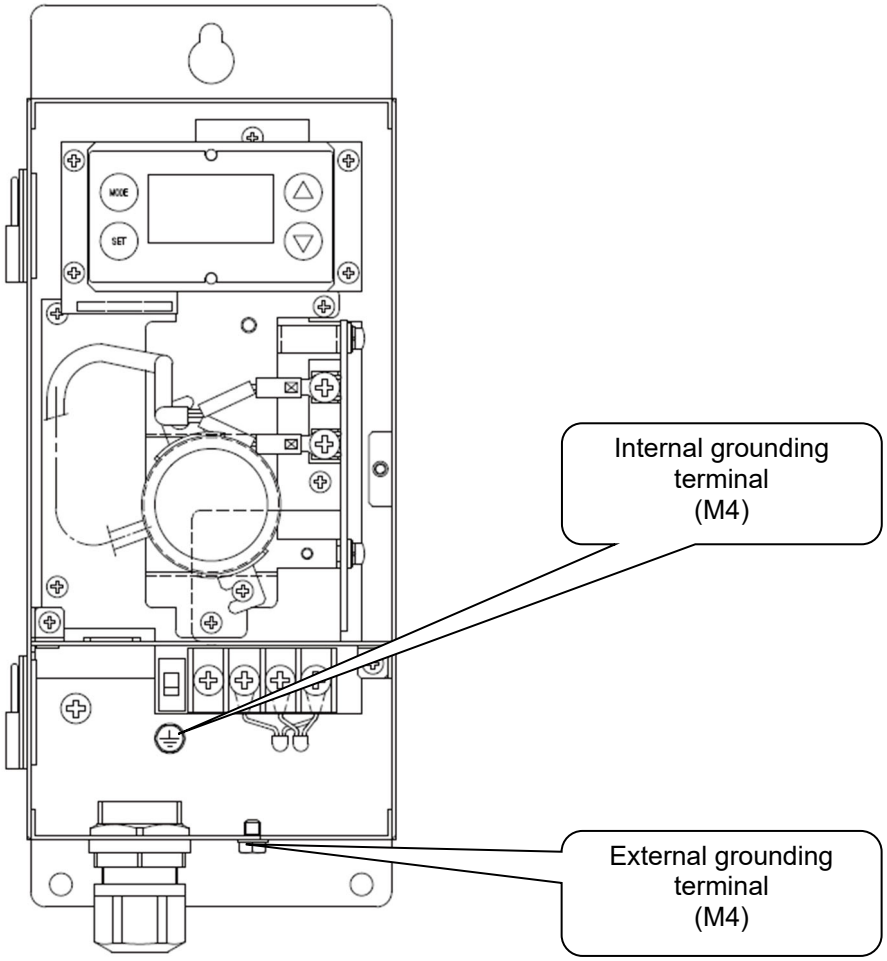
Regular maintenance of the detector head must be performed.
Do not install the detector head in a place where the machinery must be stopped when maintenance is performed in its inside, where parts of the machinery must be removed to perform maintenance, or where the detector head cannot be removed because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

4-5. Grounding

Connect the the detector head to your grounding terminal with the internal or external terminal.

WARNING

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



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

WARNING

Perform A type grounding when Zener Barrier is connected for explosion-proof specification.

4-6. Wiring

CAUTION

- Be careful not to damage the internal electronic circuit when wiring.
- The connected cables must not be installed together with the motor power cables, etc.
- When stranded wires are used, prevent wires from contacting each other.

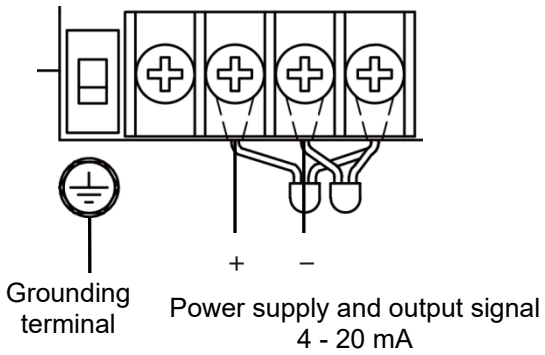
4-7. Compatible cables and terminal plate specifications

<Recommended Cables>

Use CVVS 1. 25 sq 2-core single or stranded wire.

<Specifications of Terminal Plate>

- Rated voltage: 250 VAC
- Rated current: 20 A



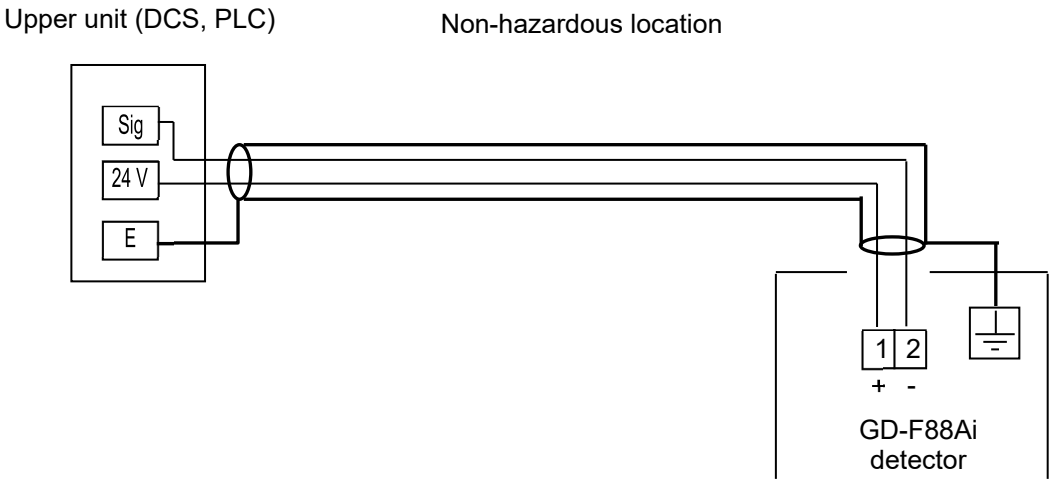
<Supply Voltage>

The supply voltage is normally 24 VDC.
However, the voltage at the terminal plate of the detector head becomes lower than the source voltage, depending on the connected safety maintaining device (barrier), type and length of the cable used.
It may also vary with the signal current value (4 to 20 mA).
When wiring the detector head, check the following to make sure that the voltage at the terminal plate is appropriate.
The detector head provides stable operation within the power voltage range of 15 to 27 VDC.

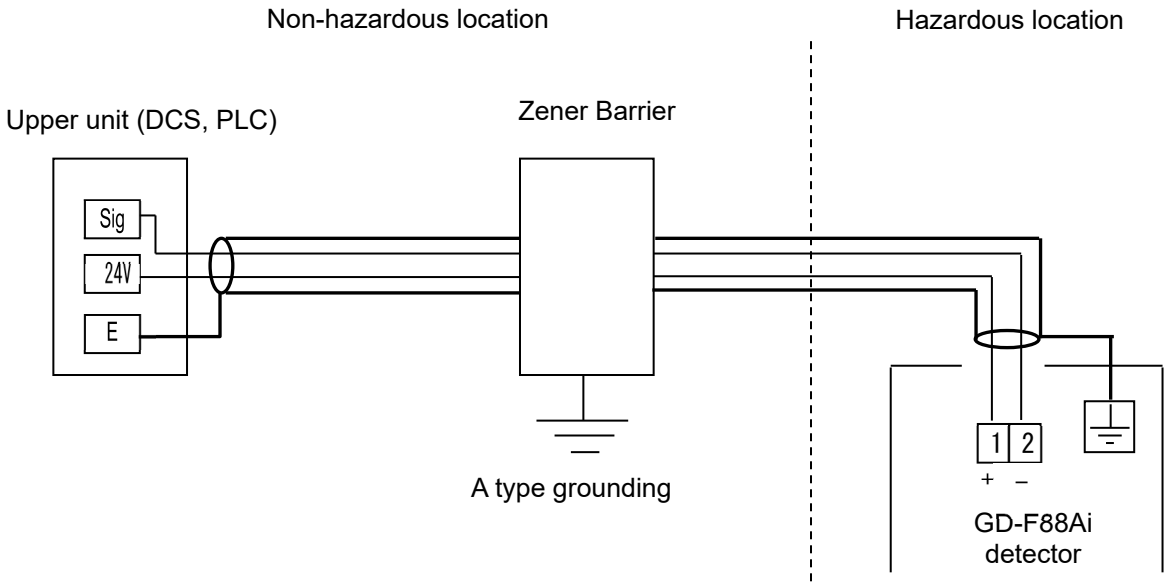
< Withstand voltage performance>
The detector has a withstand voltage performance of 500V AC for 1 minute between the power supply and output signal terminals and the earth (between containers).

4-8. System connection example

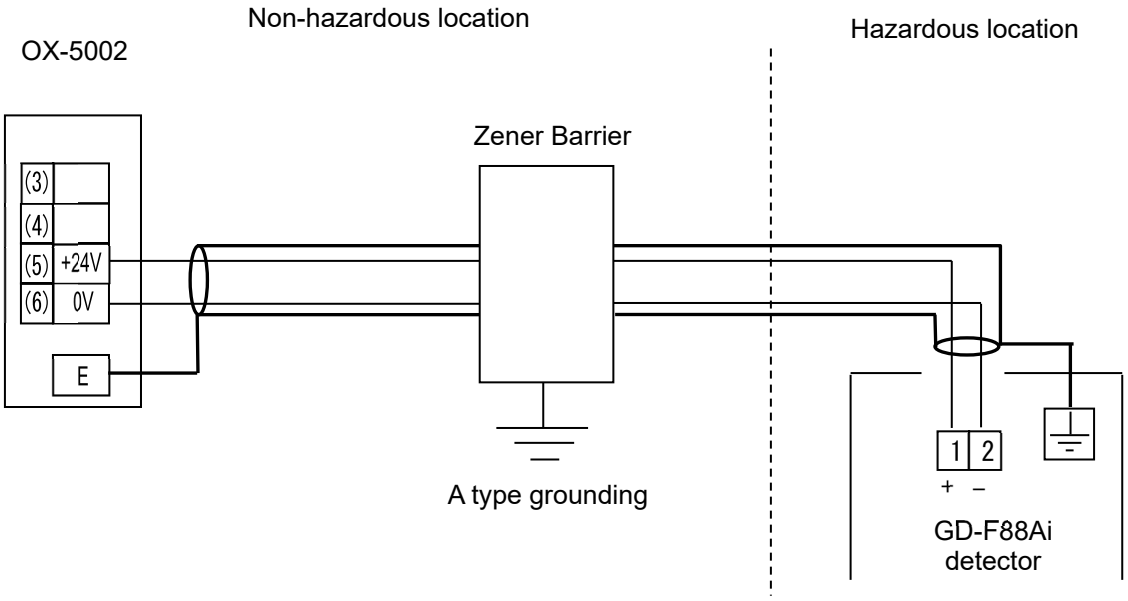
4-8-1. Example of connecting to indicator, DCS, PLC, etc. (non-explosion-proof system)



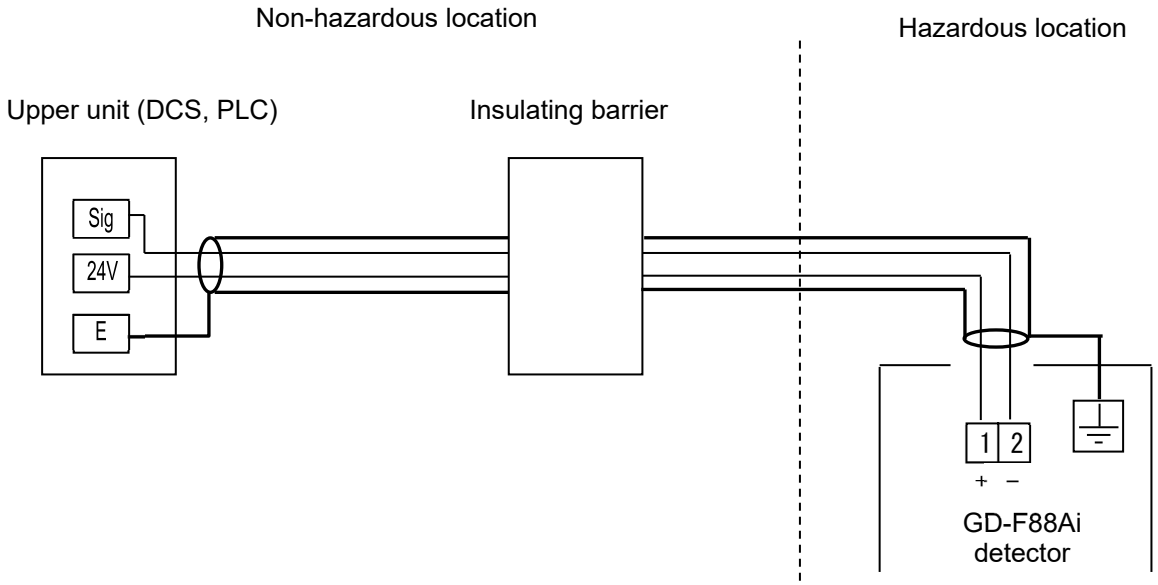
4-8-2. Example of connecting to Zener Barrier, indicator, DCS, PLC, etc.



4-8-3. Example of connecting to Zener Barrier and indicator



4-8-4. Example of connecting to insulating barrier, indicator, DCS, PLC, etc.



5

How to Operate

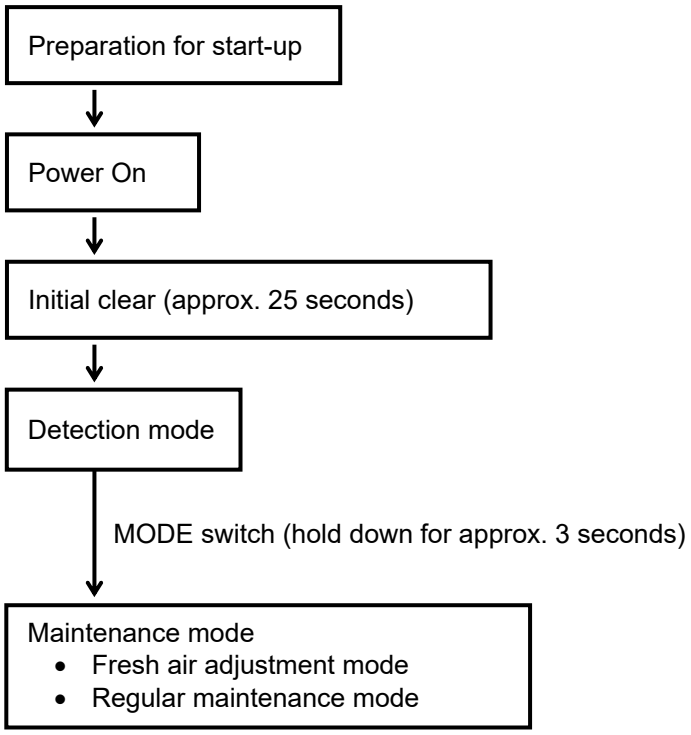
5-1. Preparation for start-up

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

- Check that the detector head is installed properly.
- Check that the detector head is grounded.
- Check that the external wiring is done properly.
- Check that the power supply voltage meets the specification and rating.
- The external output may be fluctuated during adjustment. Take an appropriate measure to avoid the influence on the gas monitoring system.
- Make sure to use a fuse with the specified ratings to prevent fire.

5-2. Basic operating procedures

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



CAUTION

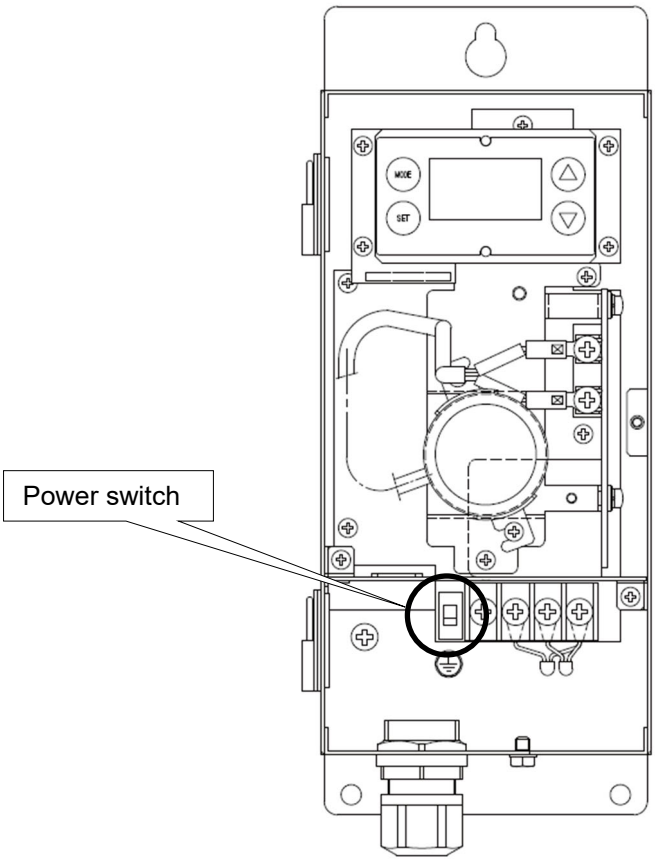
The regular maintenance mode is used by a qualified service engineer.
Do not operate the mode unless instructed to do so.

5-3. How to start the detector head (power-on)

- Before supplying power to the detector head, check that the preparation for start-up is completed.
- Turn on the power switch located on the left side of the power terminal plate.

<Initial Clear (approx. 25 seconds)>

System check of the unit
External output: 17.4 mA



CAUTION

- Do not turn off the detector head during the initial clear. The detector head is reading the internal memory during the initial clear.
- If the detector head is installed newly or the new sensor is replaced, the sensor must be warmed up for a specified period which is determined depending on the type of the sensor after the detector is started.
- After the warm-up is completed, perform a calibration.

5-4. Modes

Details on each mode are provided as follows.

CAUTION

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

Mode	Item	LED display	Details
Detection Mode	-	Gas concentration	Normal state
Maintenance mode (User)	ROM/SUM display	1-0	Display the program version and others. This is not typically used by the user.
	Zero adjustment	1-1	Perform zero adjustment.
	Setting display	1-2	Display various setting values.
	Regular maintenance mode switching	1-3	Switch to the regular maintenance mode.
Maintenance mode (Regular maintenance)	Test mode	2-0	Perform various tests. 2-0-0 Gas Test 2-0-1 Alarm Test 2-0-2 Fault Test 2-0-3 LCD Test 2-0-4 ----------
	Zero adjustment	2-1	Perform zero adjustment.
	Span (fresh air) adjustment	2-2	Perform span (fresh air) adjustment.
	----------	2-3	----------
	Environmental setting	2-4	Used for various environmental settings. 2-4-0---------- 2-4-1 INHIBIT Setting 2-4-2 Alarm Setpoint Setting 2-4-3 Alarm Delay Time Setting 2-4-4 Alarm Pattern Setting 2-4-5 Zero Suppression Type Setting 2-4-6 Zero Suppression Value Setting 2-4-7 ---------- 2-4-8 ---------- 2-4-9 ---------- 2-4-A Maintenance Mode External Output Setting 2-4-B External Output Adjustment 2-4-C Alarm Test External Output Setting 2-4-D Sensor Operation Start Setting 2-4-E ---------- 2-4-F ---------- 2-4-G Alarm Limiter Setting 2-4-J Sensitivity Correction Setting 2-4-K Date/Time Setting 2-4-M Air Pressure Correction 2-4-N Fault External Output Setting
	Display	2-5	Display various electrical settings. This is not typically used by the user.
	Switch to factory mode	2-6	Not used.
	Switch to user mode	2-7	Return to the user mode.

5-5. Description of operation (detection mode)

5-5-1. Display operation

The operation status of the detector head is displayed on the LCD.

Preparation

↓

Power-on

↓

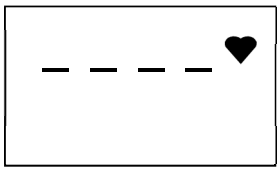
Initial clear (approx. 25 seconds)

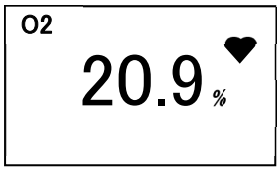
↓

Detection mode

In the detection mode, the sampling gas concentration is displayed on the LCD.

LCD display

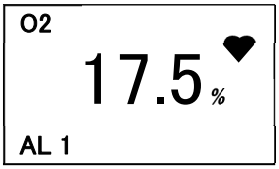




Normal display (description)

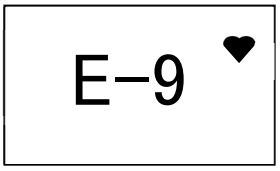
Gas alarm display

When a gas concentration exceeding the preset alarm setpoint is detected, the gas alarm display appears and an alarm message (AL1 or AL2) is displayed in the lower left section of the display.



Fault Display

If a fault occurs on the detector, the fault detail is displayed on the LCD.



(LCD display) (Fault detail)
E-9 System abnormalities
E-1 Sensor not connected/Sensor disconnection

NOTE

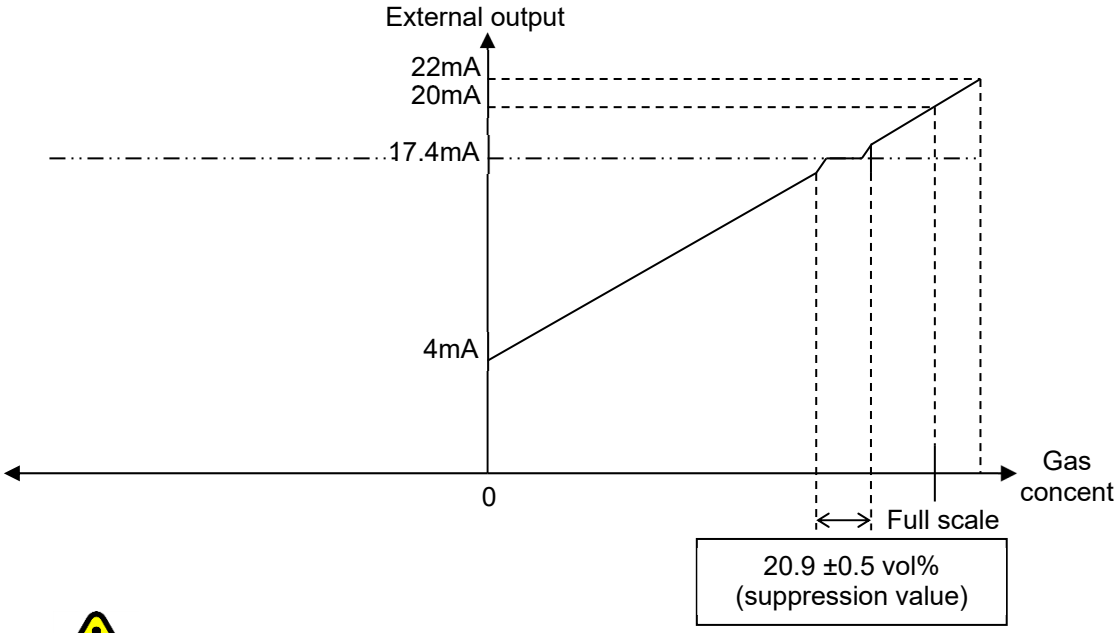
See "8. Troubleshooting" for remedial actions to fault display.

5-5-2. External output operation

4 - 20 mA transmission

(1) Signal transmission method: Electric current transmission (non-isolated)
(2) Transmission path: CVVS 2c 1.25 sq
(3) Transmission distance: 500 m or less
(4) Connection load resistance: 300 Ω or less
(5) Status signal level
1. Detection mode: 4.0 - 20.0 mA (depends on the gas concentration)
2. Initial clear: 17.4 mA
3. Maintenance mode: 17.4 mA
4. External output test: 4.0 - 20.0 mA (varies with the test value)
5. Fault state: 21.0 mA or more
6. Power off: 0.0 mA

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



CAUTION

The 4 - 20 mA output is adjusted. Do not attempt to perform readjustment after installation. It must be done by a qualified service engineer.

5-6. Description of operation (maintenance)

5-6-1. Maintenance mode

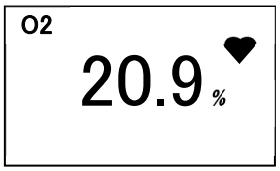
Enter the maintenance mode to perform each adjustment.
Holding down the MODE switch for three seconds in the detection mode enters the maintenance mode.
Holding down the MODE switch for three seconds in the maintenance mode returns to the detection mode.
If the maintenance mode is left unoperated for 10 hours, the detection mode automatically returns.

■ **17.4 - 20.0 mA: 4.0 mA**

Hold down the MODE switch for 3 seconds

↓

Enter the maintenance mode



WARNING

When the maintenance mode is entered while gas detection is performed, the external output signal (gas concentration signal) becomes 17.4 mA (normal state).

* The maintenance mode consists of "Daily Maintenance" and "Regular Maintenance", and "Daily Maintenance (Fresh Air Adjustment)" is normally used.

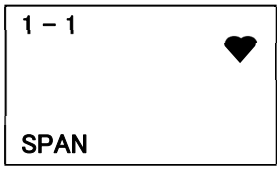
Daily maintenance

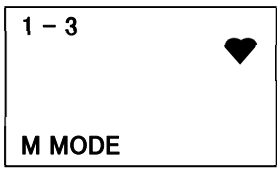
1-1. Zero Adjustment

Select with ▲/▼ switch

↓

1-3. Regular maintenance mode





CAUTION

Do not operate "1-3. Regular Maintenance Mode" unless instructed to do so. Request it from RIKEN KEIKI.

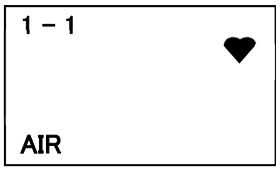
5-6-2. Fresh air adjustment

This is used to perform the fresh air adjustment.

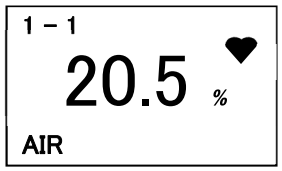
NOTE

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

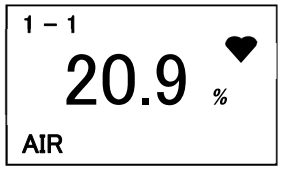
(1) Hold down the MODE switch over three seconds to enter the maintenance mode.



(2) Press the SET switch with the "1-1. Fresh Air Adjustment" menu displayed.
Draw a zero adjustment gas. When the reading is stabilized, press the SET switch again. The display blinks and fresh air adjustment is performed.

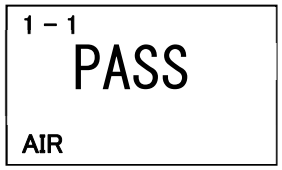


(3) Press the SET switch to confirm the setpoint.

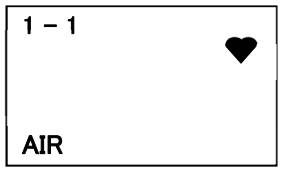


WARNING

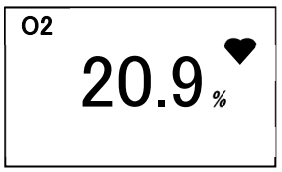
Do not turn off the power until PASS disappears.



When the process ends normally, the LCD displays PASS and then goes to "1-1. Fresh Air Adjustment”.



(4) Hold down the MODE switch over three seconds to return to the detection mode.



WARNING

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

CAUTION

If the buzzer unit remains in the maintenance mode, it automatically returns to the detection mode in ten hours.

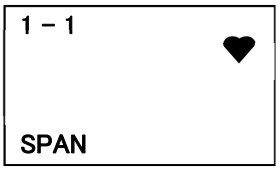
5-6-3. External output test

This is used to check the transmission status by outputting a signal equivalent to gas concentration to the external device.

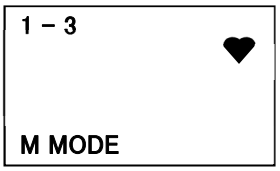
WARNING

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

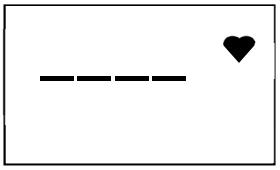
(1) Hold down the MODE switch over three seconds to enter the maintenance mode.



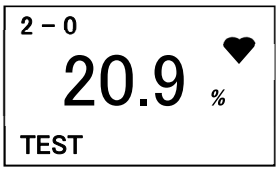
(2) "1-3. How to wire". Regular Maintenance Mode Switching" menu displayed.

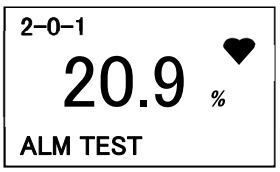


(3) Holding down the SET switch while "----" is displayed enters the regular maintenance mode.

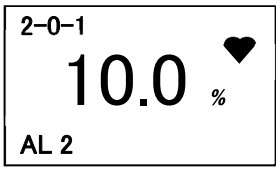


(4) Press the SET switch while "2-0" is displayed to display "2-0-1. Alarm Test". Then make a selection with the SET switch.

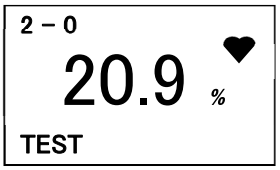




(5) Increase the reading with the ▲/▼ switch to check the transmission status.
When the test is completed, hold down the MODE switch over three seconds to return to "2-0".



(6) While "2-0" is displayed, hold down the MODE switch over three seconds to return to the detection mode.



5-7. How to exit

To turn off the detector head, turn off the power switch located on the left side of the power terminal plate. Then, turn off the power supply (24 VDC) to the detector head.

WARNING

Decide whether the power can be turned off by checking the operation of the devices connected to the external output of the detector head head before turning it off.

6

Maintenance

The detector head is an important instrument for the purpose of safety.
To maintain the performance of the detector head and improve the reliability of safety, perform a regular maintenance.
Continuing to use the detector head without performing maintenance will compromise the sensitivity of the gas sensor, thus resulting in inaccurate detection.

6-1. Maintenance intervals and items

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

Maintenance item	Maintenance content	Daily maintenance	Monthly maintenance	Regular maintenance
Status display check	Check that the status indicates normal measurement state.	○	○	○
Gas concentration display	Check that a gas to be detected is not present around the detector head and that the reading indicates a normal value.	○	○	○
Alarm test*	Inspects the alarm circuit by using the alarm test function.	—	○	○
Span adjustment	Perform the span adjustment by using the calibration gas.	—	-	○
Gas alarm check	Check the gas alarm by using the calibration gas.	—	-	○

* Check and adjustment are performed at the indicator/alarm unit side. See the operating manual of the indicator/alarm unit for details.

<About Maintenance Services>

- We provide services on regular maintenance including span adjustment, other adjustments and maintenance.
  To make the calibration gas, dedicated tools, such as a gas cylinder of the specified concentration and gas sampling bag must be used.
  Our qualified service engineers have expertise, knowledge and other information on the dedicated tools used for services, along with other products. To maintain the safety operation of the detector head, please use our maintenance service.
- Typical maintenance services are listed as follows. Please contact RIKEN KEIKI for more information.

Main services

Power supply check	:	Checks the power supply voltage.
Status display check	:	Checks that the status indicates normal measurement state.
Concentration display check*	:	Verifies that the concentration display value is zero by using the zero gas. Performs zero adjustment if the display is incorrect.
Alarm test*	:	Inspects the alarm circuit by using the alarm test function. • Checks the alarm lamps. (Checks the activation.) • Checks the external alarm. (Checks the activation of the external alarm, such as a buzzer.)
Span adjustment	:	Performs the span adjustment by using the calibration gas.
Cleaning and repair of the unit (visual diagnosis)	:	Checks dust or damage on the surface, cover or internal parts of the unit, and cleans or repairs such parts as needed. Replaces parts which are cracked or damaged.
Unit operation check	:	Uses the keys to check the operation of functions, parameters, etc.
Replacement of consumable parts	:	Replaces consumable parts, such as a sensor and filter.

* Check and adjustment are performed at the indicator/alarm unit side.

6-2. Replacement parts

<Replacement of Gas Sensor>

Our service engineers need to replace and adjust the sensor. Please contact RIKEN KEIKI.

NOTE

- If adjustment to the standard gas concentration value fails even with the maximum sensitivity, it indicates that the gas sensor has come to the end of its life. The gas sensor needs to be replaced.
- After replacing the gas sensor, electrical adjustment and calibration using the standard gas are necessary.

7

Storage, Relocation and Disposal

7-1. Procedures to store the detector head or leave it for a long time

The detector head must be stored under the following environmental conditions.

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

7-2. Procedures to relocate the detector head or use it again

When the detector head is relocated, select a new place in accordance with "4-2. Precautions for installation sites" and "4-4. How to install".
For information on wiring work, see "4-6. Wiring" and "4-7. Compatible cables and terminal plate specifications". The unpowered time must be minimized when the detector head is relocated.

CAUTION

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

7-3. Disposal of products

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

WARNING

Do not disassemble the sensor because it contains electrolyte.
Electrolyte may cause severe skin burns if it contacts skin, while it may cause blindness if it contacts eyes.
If electrolyte is adhered on your clothes, that part on your clothes is discolored or its material is decomposed.
If contact occurs, rinse the area immediately with a large quantity of water.

8

Troubleshooting

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

(1) Nothing is displayed on LCD (power cannot be turned on).

<Causes and Actions>

- Check that the power voltage indicated at the terminal is appropriate.
  If it is lower than the source voltage significantly, there may be a problem in the connected safety maintaining device, cable or cable connection.

(2) Abnormal operations

<Causes and Actions>

- A sudden surge noise can be the cause. To recover, turn OFF the detector head power and then turn it ON again to restart.
- If such a symptom is observed frequently, take appropriate measures to eliminate the noise.

(3) Span adjustment impossible

<Causes and Actions>

- Check that the calibration gas concentration is appropriate.
  Use the proper calibration gas.
- The sensor sensitivity may be deteriorated.
  The sensor needs to be replaced.

(4) Fault indication appears.

1. System abnormality "E-00"
   <Causes and Actions>
   - An abnormality occurs in the internal part of the detector.
     Contact RIKEN KEIKI.

2. Sensor connection abnormality "E-01"
   <Causes and Actions>
   - The sensor has not been connected, or poor connection of the connector occurs.
   - Check that the sensor is attached and that the sensor is attached securely to the connector. If the situation does not improve, contact RIKEN KEIKI.

9

Product Specifications

9-1. List of specifications

＜Oxygen Deficiency Alarm) SPECIFICATION＞

Model	GD-F88Ai
Detection principle	Galvanic cell method
Gas to be detected	O2
Concentration display	7-segment LCD (4 digits)
Detection range	0～25vol%
Detection method	Diffusion type
Alarm preset point	18vol%(1st<L>)【Standard】 18vol%(2nd<LL>)【Standard】
Indicate accuracy (under an identical condition)	Within ±0.7vol%
Response time (under an identical condition)	Within 30sec(T90)
Alarm-delay time (under an identical condition)	By anoxia alarm(Alarm setpoint value:18vol%), Within 5sec(when introducing 10～11vol% gas)
Gas alarm type	Two-step alarm (L-LL)
Gas alarm indication	Alarm message(AL1/AL2)
Gas alarm action	Latching or non latching
Trouble alarm·Self diagnosis	System failure/Sensor failure
Trouble alarm indication	Content display
Trouble alarm action	Non latching
Transmission method	2-wire analog transmission + digital transmission (HART Communication)
Transmission specifications	4-20mADC (load resistance: 300Ω or less)
Communication scheme	HART 7
Power supply	24VDC±10%
Power consumption	Approx. 0.6W
Transmission cable	Shielded cable of CVVS, etc. (1.25mm^2) - 2-core
Transmission distance	Up to 1km with CVVS 1.25 mm^2 (up to 600m between the detector head and Zener Barrier)
Safety maintaining device	Zener Barrier (MTL7728ac/MTL7728+/MTL7728-) or insulating barrier (MTL5541/RN221N-J1/KFD2-STC4-Ex1)
Operating temperature	-10 - +40℃ (non-rapidly-vary)
Operating humidity	Less than 95%RH (non-condensing)
Structure	Wall mounted type
Explosion-proof structure	Intrinsically safe explosion-proof structure, with safety maintaining device (barrier) used
Explosion-proof class	Ex ia ⅡC T4 Ga
External dimensions	Approx. 100(W)x241(H)x48(D)mm (projection portions excluded)
Weight	Approx. 1.0kg

Material	SECC or SS304
Paint	Bake-coated with melamine
Outer color	Munsell 2.5Y9/2

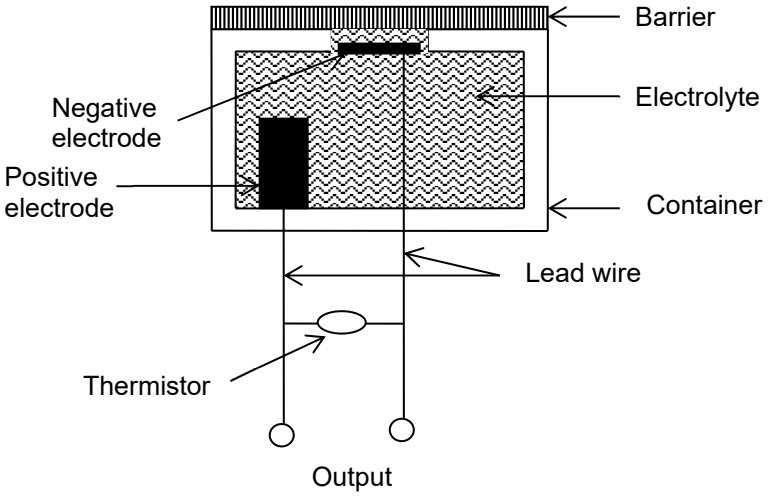
＜Gas minitoring SPECIFICATION＞

Model	GD-F88Ai
Detection principle	Galvanic cell method
Gas to be detected	O2
Concentration display	7-segment LCD (4 digits)
Detection range	0～5vol%/0～10vol%/0～25vol%
Detection method	Diffusion type
Alarm preset point	Depend on measuring range
Indicate accuracy (under an identical condition)	Within ±0.7vol%(below 25vol% range) Within ±3vol%(above 25vol% range)
Response time (under an identical condition)	Within 30sec(T90)
Gas alarm type	Two-step alarm (H-HH, L-H, and L-LL)
Gas alarm indication	Alarm message(AL1/AL2)
Gas alarm action	Latching or non latching
Trouble alarm·Self diagnosis	System failure/Sensor failure
Trouble alarm indication	Content display
Trouble alarm action	Non latching
Transmission method	2-wire analog transmission + digital transmission (HART Communication)
Transmission specifications	4-20mADC (load resistance: 300Ω or less)
Communication scheme	HART 7
Power supply	24VDC±10%
Power consumption	Approx. 0.6W
Transmission cable	Shielded cable of CVVS, etc. (1.25mm^2) - 2-core
Transmission distance	Up to 1km with CVVS 1.25 mm^2 (up to 600m between the detector head and Zener Barrier)
Safety maintaining device	Zener Barrier (MTL7728ac/MTL7728+/MTL7728-) or insulating barrier (MTL5541/RN221N-J1/KFD2-STC4-Ex1)
Operating temperature	-10 - 40℃ (non-rapidly-vary)
Operating humidity	Less than 95%RH (non-condensing)
Structure	Wall mounted type
Explosion-proof structure	Intrinsically safe explosion-proof structure, with safety maintaining device (barrier) used
Explosion-proof class	Ex ia ⅡC T4 Ga
External dimensions	Approx. 100(W)x241(H)x48(D)mm (projection portions excluded)
Weight	Approx. 1.0kg
Material	SECC or SS304
Paint	Bake-coated with melamine
Outer color	Munsell 2.5Y9/2

9-2. Detection principle

Galvanic cell type

A negative electrode of noble metal and a positive electrode of lead are placed in a resin container filled with electrolyte. A part of the container is opened and covered with a barrier. The negative electrode is installed in contact with the barrier. Lead wires are drawn from the positive and negative electrodes to obtain outputs. A thermistor is connected between the lead wires to perform temperature compensation for the sensor outputs.



10

Definition of Terms

Galvanic cell type	This is a principle of the sensor installed in the detector head. See "9-2. Detection principle" for details.
vol%	A unit used to express the percentage of a specific substance (or gas) in a volume of solution.
Atmosphere	An atmosphere with a temperature within the range of -10 to 40℃ and a humidity of 95% RH or less at one atmospheric pressure (1013 hPa).
Full scale	Adjusts the readings to the calibration gas concentration value by using the calibration gas.
Calibration	Find relationship of the readings, display values or setting values with the actual values by using the calibration gas.