

# **2-Wire Gas Detector Head**

**GD-K88Ai**

**Operating Manual**

Part Number: 71-0415  
Revision: P4  
Released: 4/12/22

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# 1

## Outline of the Product

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### 1-1. Preface

Thank you for choosing our 2-wire gas detector head GD-K88Ai.  
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 and its specifications. It contains information required for using the detector properly. Not only the first-time users but also the users who have already used the product must read and understand the operating manual to enhance the knowledge and experience before using the detector.

When the detector 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 detector is a fixed type gas detector head which detects combustible and toxic gases.
- When the detector detects gas leakage, 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 is a safety unit, not an analyzer or densitometer which performs quantitative/qualitative analysis/measurement for gases. Please fully understand the features of the detector before using it, so that it can be used properly.

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

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

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## 2

# Important Notices on Safety

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### 2-1. Danger Cases



#### **DANGER**

This detector is the intrinsically safe explosion-proof product with Zener Barrier. However, never attempt to detect a gas over the lower explosive limit.

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## 2-2. Warning Cases



### **WARNING**

- **Power supply**  
Before turning on the detector, always check that the voltage is properly applied.
- **Need of grounding circuit**  
Do not cut the grounding circuit inside or outside the detector or disconnect the wire from the grounding terminal.  
In both of the cases, the detector 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.  
Before starting the detector, check the protective functions for defects.
- **Grounding Zener Barrier**  
Arrange A type grounding for Zener Barrier.
- **Operation in a gas**  
The detector employs the intrinsically safe explosion-proof structure (Zener Barrier used separately).  
It can be used in a location where a combustible gas, or steam is present; however, it should be done carefully.  
Consult RKI before operating the detector in such a location.
- **External connection**  
Before connecting the detector to the external control circuit, securely connect it to a protective grounding circuit.
- **Handling of sensor**  
Do not disassemble the sensor unit because it contains electrolyte. If contact occurs, rinse the area immediately with water.
- **Calibration**  
When performing calibration for the detector, be careful not to lack calibration gases by loosing tubes.
- **Response to gas detection**  
When a gas is detected, it indicates a potentially dangerous situation. Take proper actions based on your judgment.

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## 2-3. Precautions



### CAUTION

- Do not use a transceiver near the detector.  
Radio wave from a transceiver or other radio wave transmitting device near the detector or its cables may disturb readings.  
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 detector, wait for five seconds or longer before switching on detector.  
Restarting the detector 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 in an environment with such noises, provide for protective measures against them.

## 2-4. Operating Precautions

This detector is a gas detector that detects combustible and toxic gases in the air and outputs gas concentration signals.

The gas detector is a safety unit, not an analyzer or densitometer which performs quantitative/qualitative analysis/measurement for gases.

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

1. The detector may be interfered by gases other than the gas to be detected, solvents, vapors etc.  
Please note that the gas concentration signal may be fluctuated by interference. In addition, it may be fluctuated by environmental (temperature, humidity, etc.) changes in the installation site.
2. The alarm must be set within a range where the performance of the detector can be ensured.  
In facilities compliant with the High Pressure Gas Safety Act, an alarm setting below our standard alarm setpoint (threshold limit value) may trigger a false alarm.
3. This is a safety unit, not a control unit.  
Use the analog signal output of the detector for an indicator or external recorder.  
If these outputs are used to control other units, we shall not be responsible for any malfunctions.
4. Because the contact point of the gas detector sensor is made of porous polymeric membrane, the water repellency of the membrane is deteriorated by solvents, thus causing an electrolyte leak from its inside. Do not use solvents near the detector.  
If a solvent is used for unavoidable reasons, attach the recommended filter to the areas such as inlet of the gas detector while using the solvent and for one hour after that.
5. For maintenance of the detector, it must go through a regular maintenance, including replacement and adjustment of the regular replacement parts as specified in the operating manual. In addition, because this is a safety unit, it is recommended that a regular maintenance and a calibration are performed every six months in accordance with the regulations.

## 2-5. Important Information about Explosion-Proof

The detector 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.

- Explosion-proof structure and class

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

Explosion-proof structure	:	Intrinsically safe explosion-proof structure
Explosion-proof class	:	ExialICT4X
Certificate number	:	
Certification body	:	Technology Institution of Industrial Safety
Applied standard	:	Recommended Practices for Explosion-Protected Electrical Installations in General Industries

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

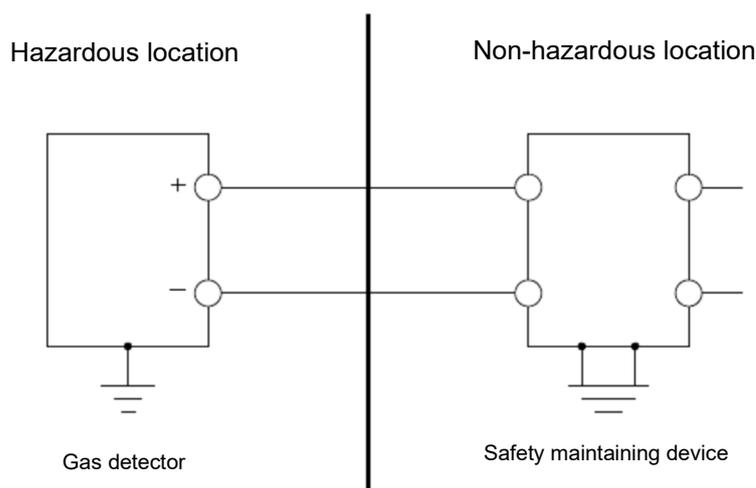
Operating temperatures : -20 - +50°C (\*1)

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 ( $U_o$ )	:	28 V
Intrinsically safe circuit maximum current ( $I_o$ )	:	93 mA
Intrinsically safe circuit maximum power ( $P_o$ )	:	0.65 W

Performance classification and group

Performance classification	:	ia
Group	:	IIC

Relations between the intrinsically safe circuit allowable inductance ( $L_o$ ) and intrinsically safe circuit external wire inductance ( $L_w$ ) and between the intrinsically safe circuit allowable capacitance ( $C_o$ ) and intrinsically safe circuit external wire capacitance ( $C_w$ )

Intrinsically safe circuit allowable inductance ( $L_o$ ) = ( $L_w$ ) or more  
Intrinsically safe circuit allowable capacitance ( $C_o$ ) =  $586 \text{ pF} + (C_w)$  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 contains a battery for sensor backup. Observe the followings to maintain explosion-proof performance.  
<Usable battery>  
Only the following battery can be used. Contact RKI if it is difficult to purchase the battery.  
Type : AAA alkaline dry battery  
Model : LR03  
Nominal voltage : 1.5 V  
Manufacturer : TOSHIBA Corporation  
<Battery Replacement>  
Turn off the power of the detector before replacing the battery.  
Never fail to use the dedicated battery storage case.
- Grounding  
Never fail to ground the detector (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.

Manufacturer: RIKEN KEIKI Co., Ltd.  
2-7-6 Azusawa, Itabashi-ku, Tokyo, 174-8744 Japan  
[www.rikenkeiki.co.jp](http://www.rikenkeiki.co.jp)

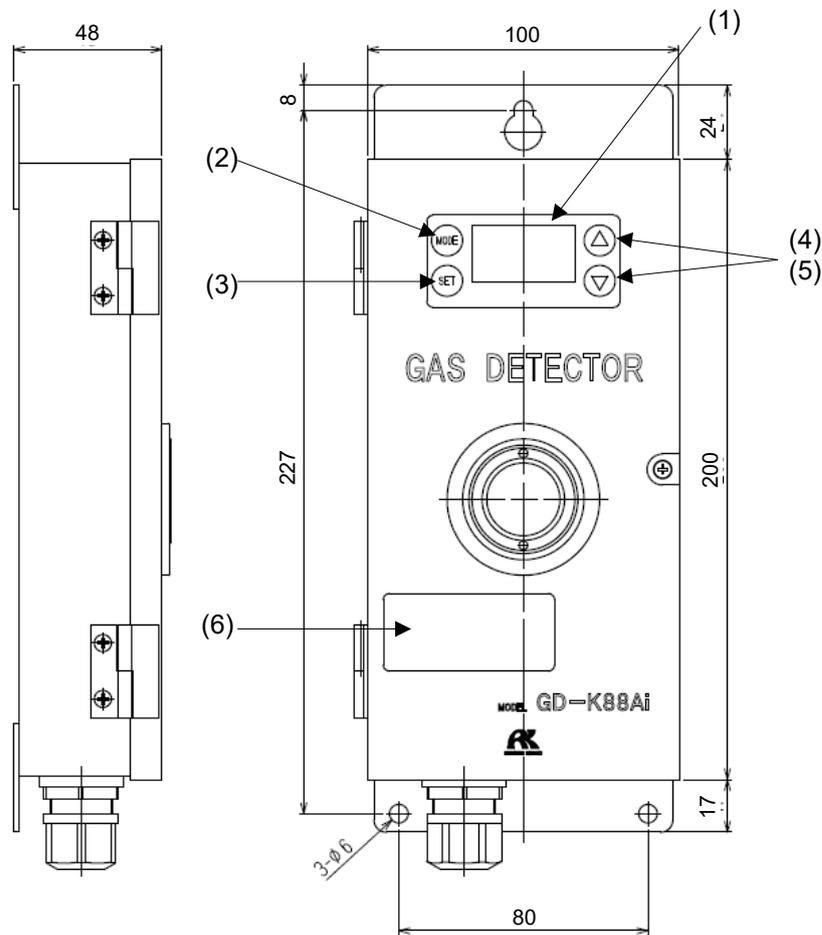
\*1: The temperature range to maintain explosion-proof performance  
The temperature range to maintain gas detection performance is 0 to 40°C. (See Specifications)

# 3

## Product Components

### 3-1. Main Unit and Standard Accessories

**<Main Unit>**



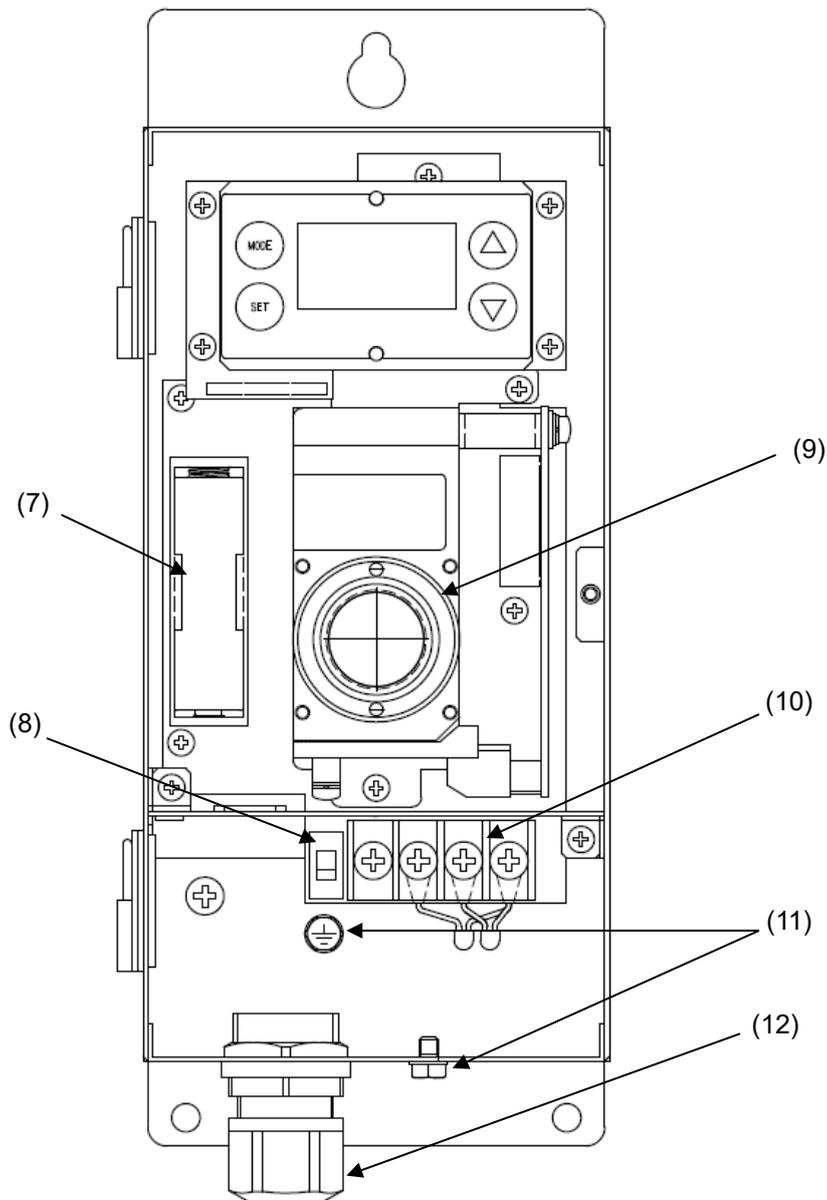
- |        |                |  |
|--------|----------------|--|
| (1)    | LCD display    | Display the gas concentration. (Used at maintenance)   |
| (2)    | MODE switch    | Switches the mode from the detection mode to maintenance mode. Or exits the maintenance mode.                                  |
| (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.  |

**<Standard Accessories>**

- CF-82 CO sensor filter: Attached when the gas to be detected is CO (carbon monoxide).

## 3-2. Names and Functions for Each Part

<Front View of Detector Unit>



- |      |                    |                                       |
|------|--------------------|---------------------------------------|
| (7)  | Battery box        | Houses the battery for sensor backup. |
| (8)  | Power switch       | Turns ON/OFF the power of the unit.   |
| (9)  | Sensor             | Detects a gas.                        |
| (10) | Terminal plate     | Connects the power cable.             |
| (11) | Grounding terminal | A terminal (M4) to ground the unit.   |
| (12) | Cable inlet        | An inlet for connected cable.         |

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# 4

## How to Use

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### 4-1. Before Using the Detector

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

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

### 4-2. Precautions for Installation Sites



#### CAUTION

- This is a precision device. Because the detector may not provide the specified performance in some places (environments), check the environment in the installation point, and then take appropriate actions if necessary.
- Because the detector plays an important role for safety and disaster prevention, as many units of the detector as needed must be installed in appropriate points. Because points where gases leak and gathering 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 consists of sensitive electronic parts. The detector must be installed in a stable place without vibrations or shocks and it cannot drop.

Do not install the detector in a place exposed to 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, or the detector cannot adjust to sudden changes in the temperature.

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

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

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

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

Regular maintenance of the detector must be performed.

Do not install the detector in a place where the machinery must be stopped when maintenance is performed in its inside, where parts of the machinery must be removed to perform maintenance, or where the detector cannot be removed because tubes or racks, etc. prevent access to it.

Do not install the detector in a place where maintenance involves dangers, for example, near a high-voltage cable.

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

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

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

The detector 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.

#### Using a stable power supply

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

The detector 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.)	<u>Example of actions</u> To ensure continuous operation and activation, install a UPS, etc. outside the detector.
Others	Do not use it with a power supply of large power load or high-frequency noise.	<u>Example of actions</u> Use a line filter, 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.

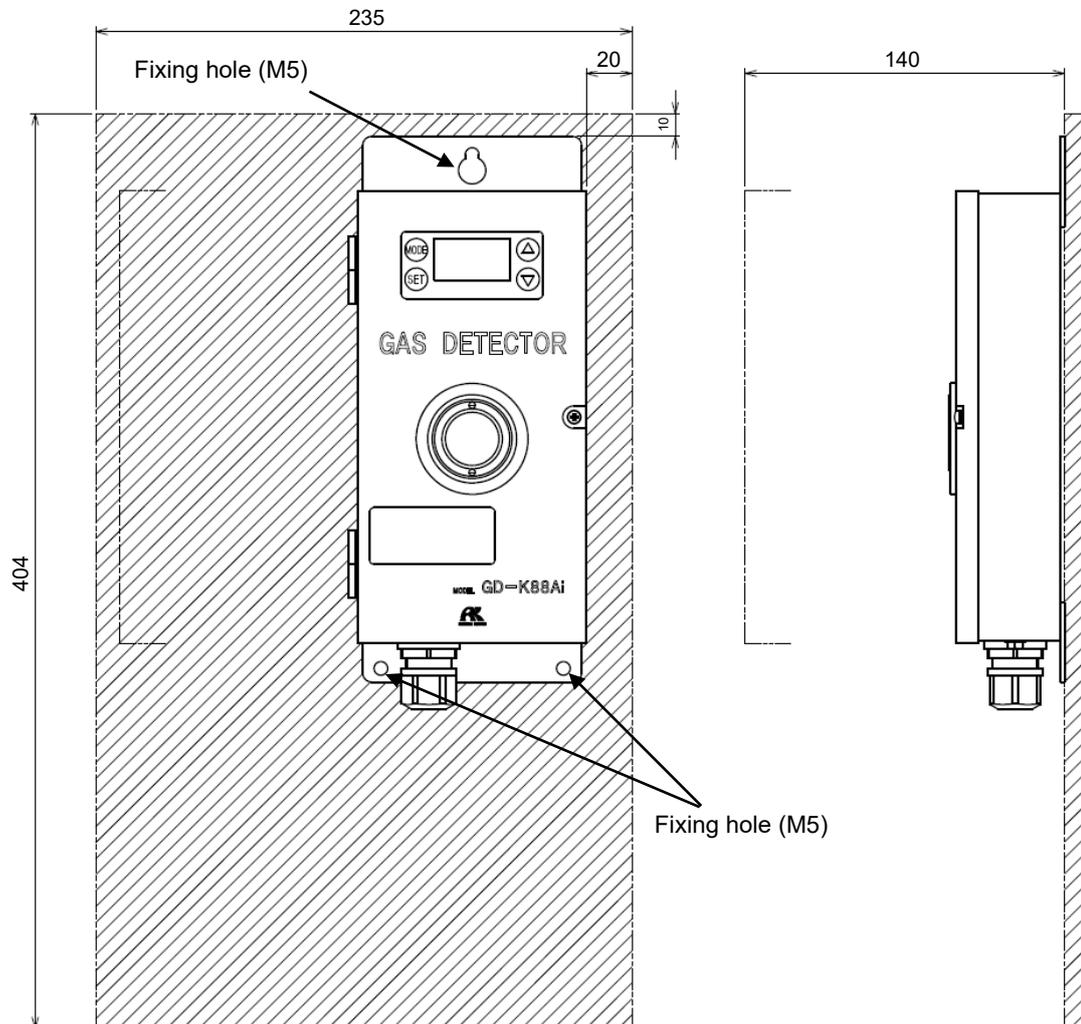
Lightning cannot be prevented. Cables installed in a metal conduit or under the ground cannot be completely protected from inductive lightning surge caused by lightning. Although complete elimination of disasters caused by lightning is impossible, the following protective measures can be taken.

Protection against lightning	<p><u>Take appropriate measures in accordance with the importance of the facilities and the environment.</u></p> <ul style="list-style-type: none"> <li>• Provide protection by a lightning arrester (cable arrester). (Although inductive lightning surge can be transmitted through the cable, it is prevented by installing a lightning arrester before the field devices and central processing equipment. For information on how to use a lightning arrester, please contact the manufacturer.)</li> </ul>
Grounding	In addition to lightning, there are more sources of surge noise. To protect 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 M5 screws.)



### CAUTION

Check that the main unit is mounted securely on the wall. If not, the main unit may fall off and cause unexpected injury or damage to the unit.

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

Regular maintenance of the detector must be performed.

Do not install the detector in a place where the machinery must be stopped when maintenance is performed in its inside, where parts of the machinery must be removed to perform maintenance, or where the detector cannot be removed because tubes or racks prevent access to it.

Do not install the detector in a place where maintenance involves dangers, for example, near a high-voltage cable.

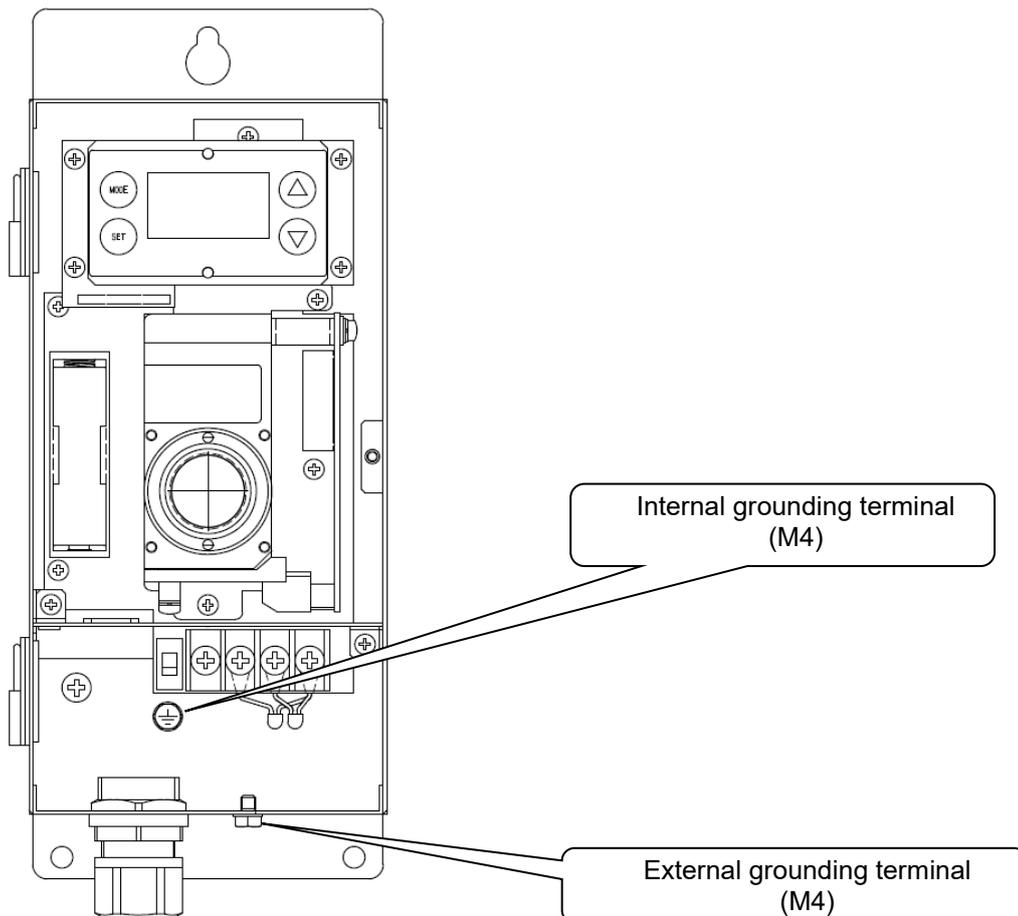
## 4-5. Grounding

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



### WARNING

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



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



### WARNING

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

## 4-6. How to Wire



### 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.

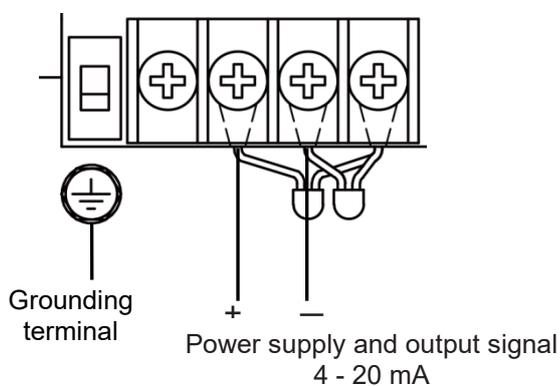
## 4-7. Compatible Cables and Terminal Plate Specifications

### <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.

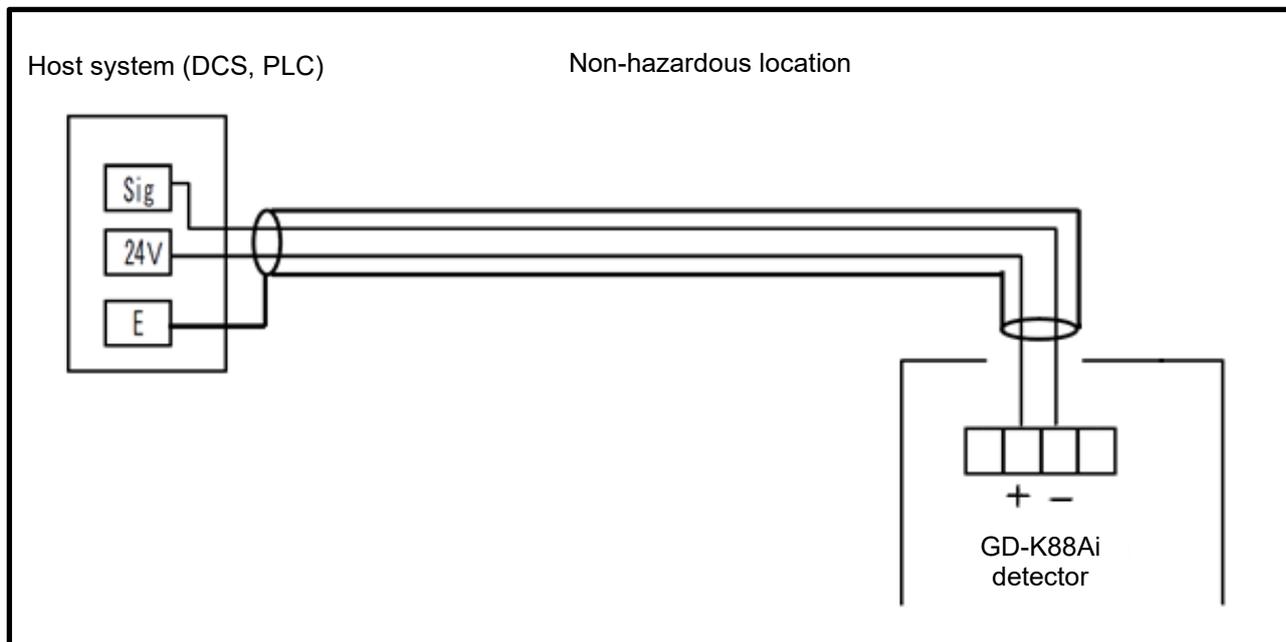
However, the voltage at the terminal plate of the detector becomes lower than the source voltage, depending on the connected safety maintaining device (barrier), type and length of the cable used. It may also vary with the signal current value (4 to 20 mA).

When wiring the detector, check the following to make sure that the voltage at the terminal plate is appropriate.

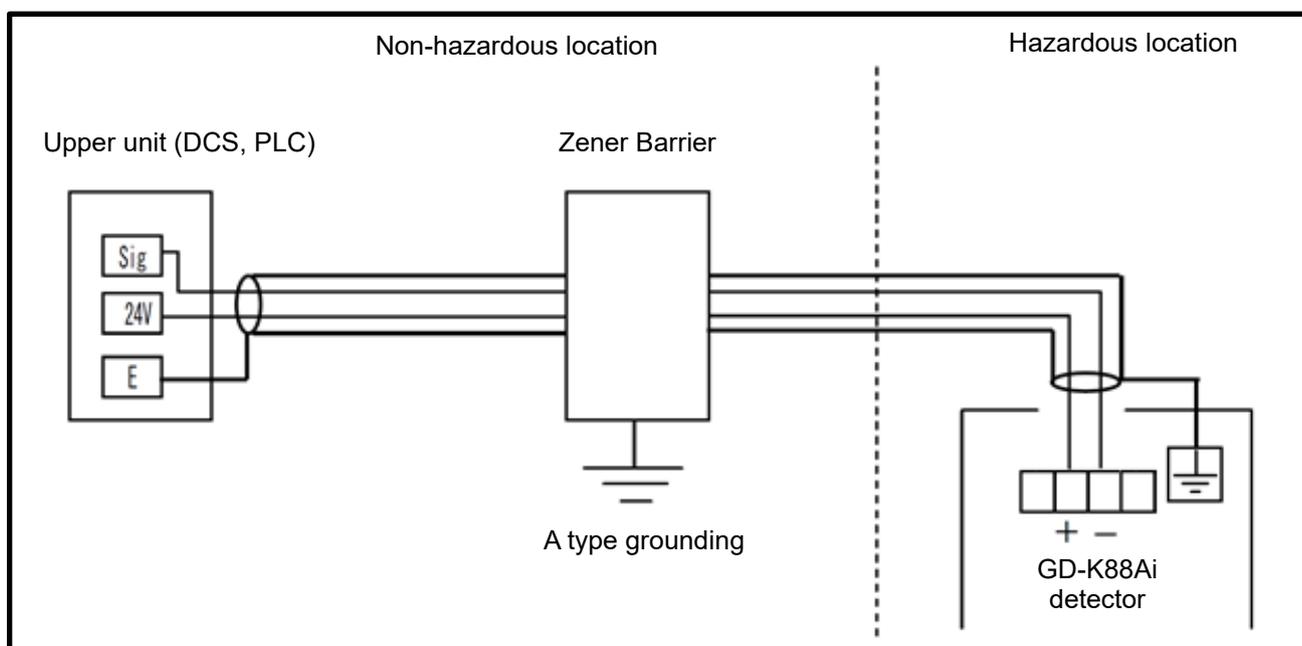
The detector provides stable operation within the power voltage range of 15 to 27 VDC.

## 4-8. Wiring Diagrams

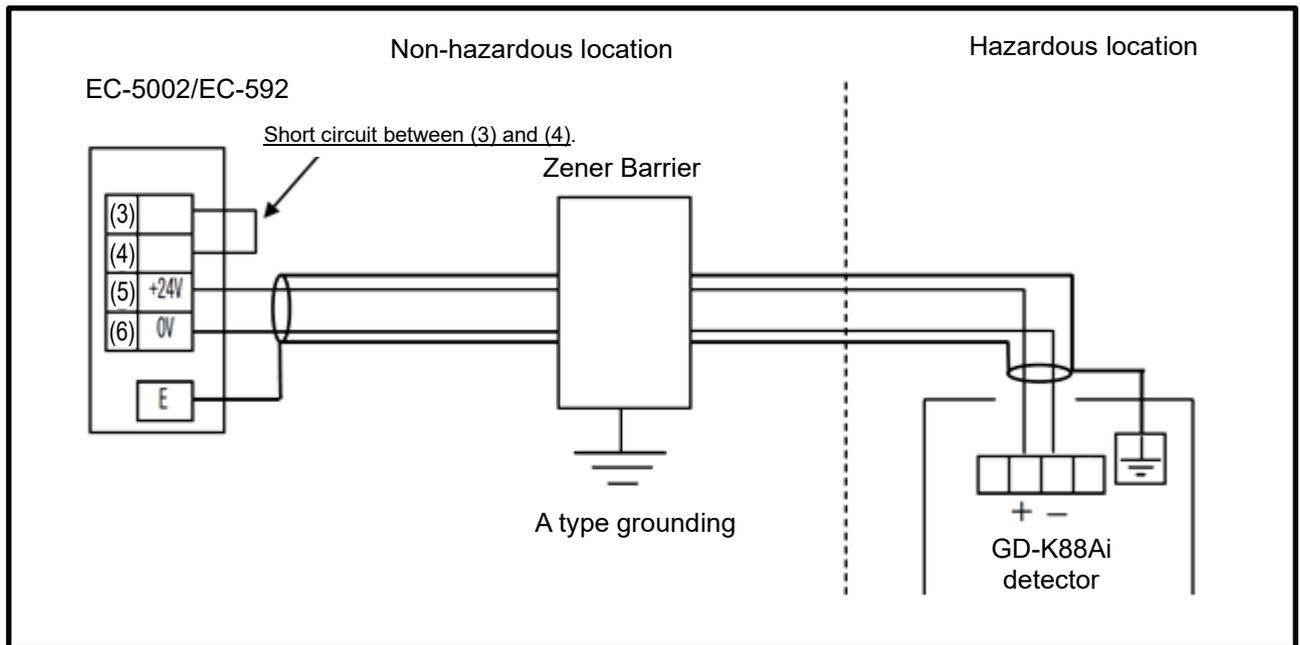
<Indicator, DCS, PLC, etc. (non-explosion proof system)>



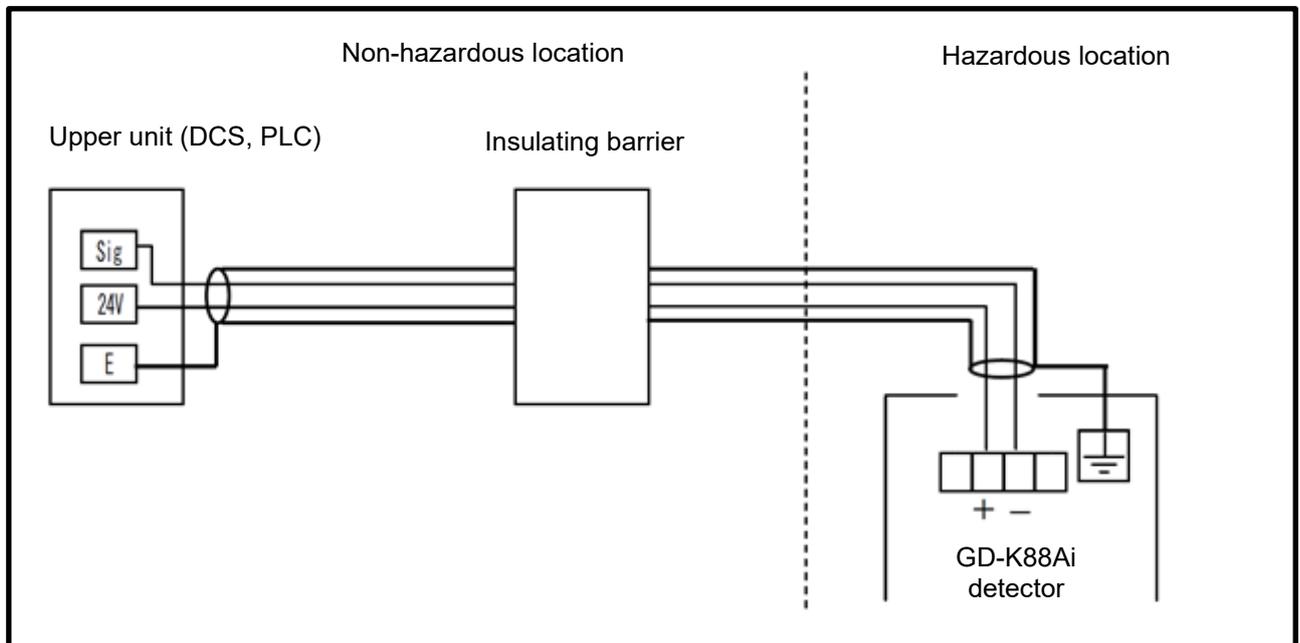
<Zener Barrier to Indicator, DCS, PLC, etc.>



<Zener Barrier to EC-5002/EC-592>



<Insulating Barrier to Indicator, DCS, PLC, etc.>



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# 5

## How to Operate

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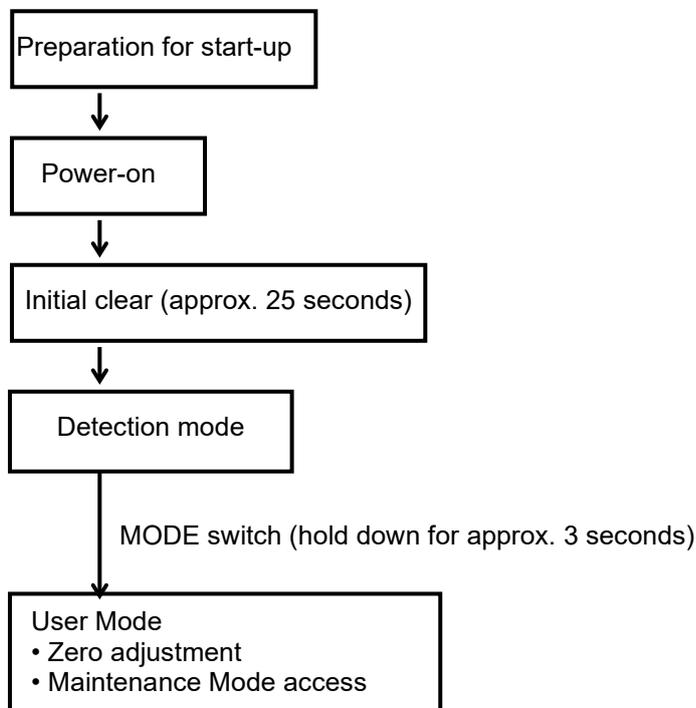
### 5-1. Preparing for Start-up

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

- Check that the detector is installed properly.
- Check that the detector is grounded.
- Check that the external wiring is done properly.
- Check that the power supply voltage meets the specifications.
- 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

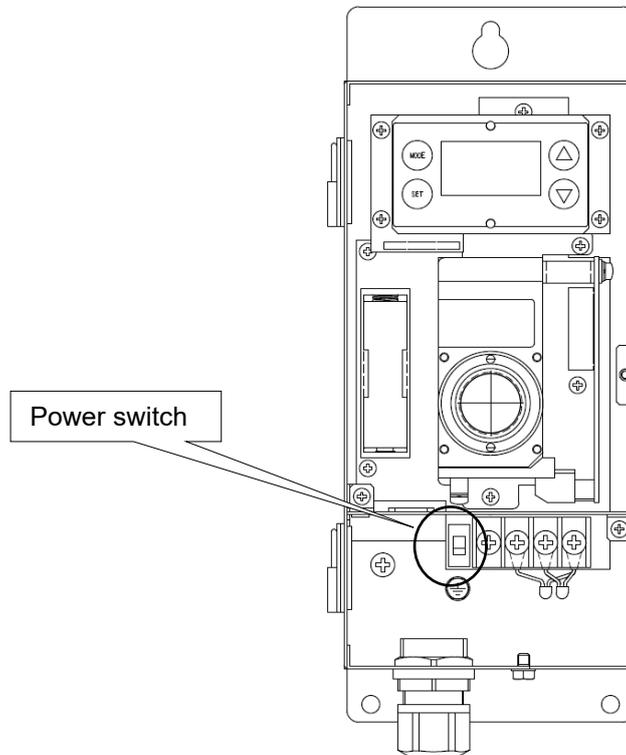
Normally, the detection mode is activated after the power is turned on.



### 5-3. Starting the Detector (power-on)

- Before supplying power to the detector, 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: 4.0 mA



### CAUTION

- Do not turn off the detector during the initial clear. The detector is reading the internal memory during the initial clear.
- If the detector 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		
User Mode	ROM/SUM display	1-0	Display the program version and others. This is not used by the user.		
	Zero adjustment	1-1	Perform the zero adjustment.		
	Setting display	1-2	Display various setting values.		
	Maintenance mode access	1-3	Access maintenance mode.		
Maintenance Mode	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 the zero adjustment.
			Span adjustment	2-2	Perform the span 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 Zero Follower Selection 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 ----- 2-4-N Fault External Output Setting
	Display	2-5			Display various electrical settings. This is not used by the user.
	Switch to factory mode	2-6			Not used.
	Switch to user mode	2-7			Return to user mode.

## 5-5. Detection Mode

## 5-5-1. Display Operation

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

Preparation



Power-on



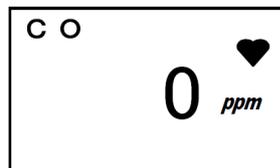
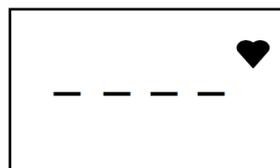
Initial clear (approx. 25 seconds)



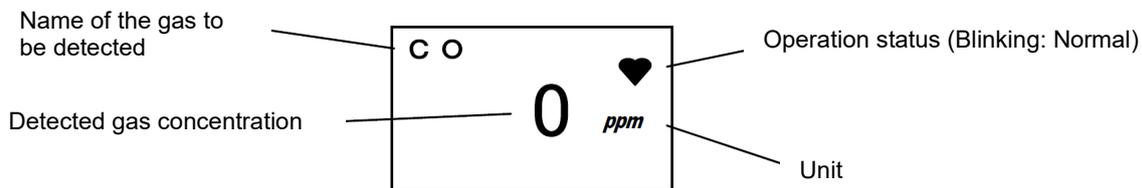
Detection mode

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

LCD display (Example: Gas to be detected: CO)

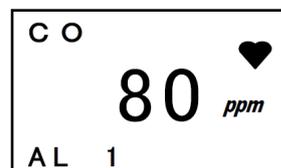


Normal display (description)



Gas alarm display

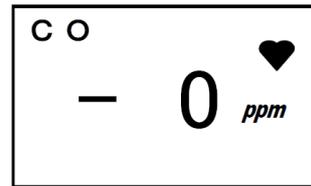
When a gas concentration exceeds the preset alarm setpoint, the gas alarm display appears and an alarm message (AL1 or AL2) is displayed in the lower left side on the display.



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### Negative value display

The "-0" display is shown when the zero level drops to the negative (-) side by 10% or more of the full scale.



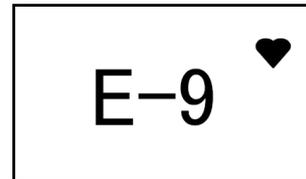
### WARNING

Accurate gas detection cannot be performed with the negative value display.  
In this case, perform zero adjustment.

### 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



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### NOTE

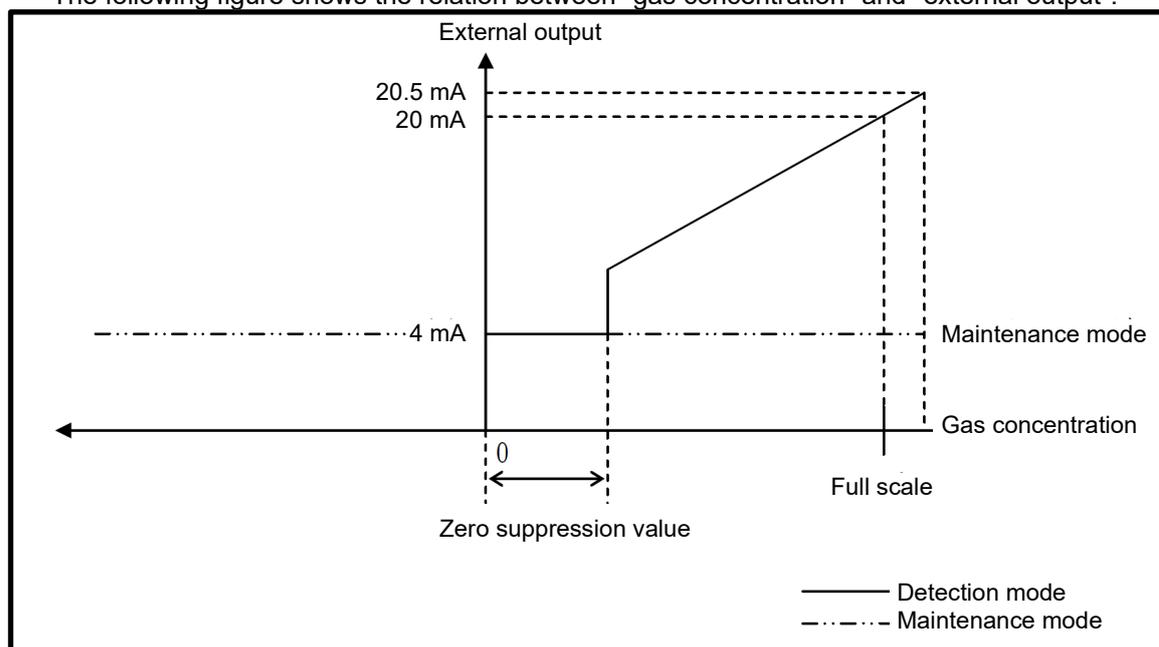
See "8. Troubleshooting" for remedial actions to fault display.

---

## 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 : 1000 m or less
- (4) Connection load resistance : 300  $\Omega$  or less
- (5) Status signal level
  - 1. Detection mode : 4.0 - 20.0 mA (depends on the gas concentration)
  - 2. Initial clear : 4.0 mA
  - 3. Maintenance mode : 4.0 mA or lower
  - 4. External output test : 4.0 - 20.0 mA (varies with the test value)
  - 5. Fault state : 3.5 mA
  - 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. If readjustment for 4-20mA is needed after installation, it must be done by a qualified service engineer.

---

## 5-6. User Mode

### 5-6-1. Description

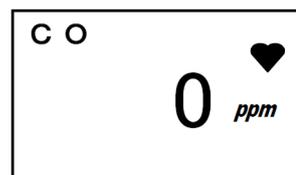
Press and hold MODE for three seconds while in Detection Mode to access User Mode.  
Press and hold MODE for three second while in User Mode to return to Detection Mode.  
The instrument will automatically return to Detection Mode 10 hours after the last button press.

- 4.0 - 20.0 mA: 4.0 mA

Press and hold MODE for 3 seconds



Entering User Mode



### WARNING

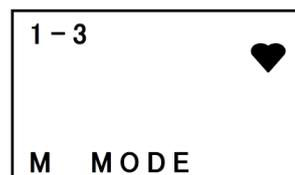
The external output signal (gas concentration signal) is 4.0 mA (normal state) while in User Mode.

1-1. Zero Adjustment



Select with ▲/▼ switch

1-3. Maintenance Mode access



## 5-6-2. Zero Adjustment

This is used to perform the zero adjustment.

### NOTE

- If the zero calibration fails, it returns to 1-1 after FAIL is displayed. In this case, the zero adjustment has not been completed.

(1) From Detection Mode, press and hold MODE for three seconds to enter User Mode.

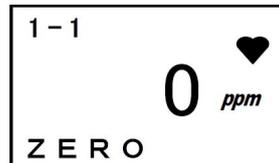


(2) With "1-1. ZERO" displayed, press and release SET.

(3) Introduce a zero adjustment gas. When the reading is stable, press and release SET. The display blinks and the zero adjustment is performed.



(4) Press and release SET to confirm the setpoint.



### WARNING

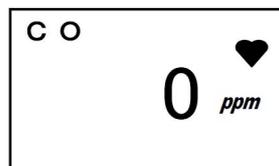
Do not turn off the power until PASS disappears.



When the process ends normally, the LCD displays PASS and then goes to "1-1. ZERO" screen.



(5) Press and hold MODE for three seconds to return to Detection Mode.



### WARNING

After the adjustment is completed, be sure to press and hold MODE to return to Detection Mode.



### CAUTION

If the unit remains in User Mode, it automatically returns to Detection Mode ten hours after the last button press.

## 5-6-3. External Output Test

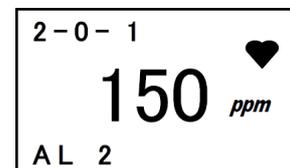
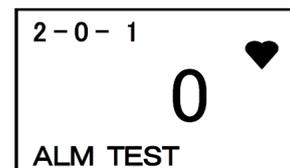
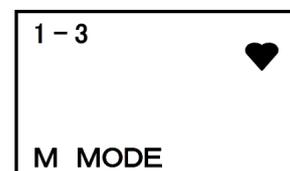
This is used to check the transmission status by outputting a signal equivalent to gas concentration to the external device.



### WARNING

Before starting the external output test (transmission test), notify related sections so that they can prepare for a false alarm.

- (1) From Detection Mode, press and hold MODE for three seconds to enter User Mode.
- (2) With "1-3. M MODE" displayed, press and release SET.
- (3) Hold SET while "----" is displayed to enter Maintenance Mode.
- (4) With "2-0 TEST" displayed, press and release SET.
- (5) With "2-0-1. ALM TEST" displayed, press and release SET.
- (6) Increase the reading with the ▲/▼ switch to check the transmission status.  
When the test is completed, press and hold MODE for three seconds to return to "2-0 TEST".
- (7) With "2-0 TEST" displayed, press and hold MODE for three seconds to return to Detection Mode.



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## 5-7. Power-Off

To turn off the detector, 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.



### **WARNING**

Before turning off the detector, decide whether the power can be turned off by checking the operation of the devices connected to the external output of the detector.

---

# 6

## Maintenance

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The detector is an important safety instrument.  
To maintain the performance and reliability of the detector, perform regular maintenance.  
Continuing to use the detector without performing maintenance might cause sensitivity degradation, resulting in inaccurate detection.

### 6-1. Maintenance Intervals and Items

- Daily maintenance : Perform maintenance before beginning to work.
- Monthly maintenance : Perform maintenance 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 and that the reading indicates a normal value.	○	○	○
Alarm test*	Inspect the alarm circuit by using the alarm test function.	—	○	○
Span adjustment	Perform the span adjustment using calibration gas.	—	—	○
Gas alarm check	Check the gas alarm using calibration gas.	—	—	○

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

---

## 6-2. Zero Calibration

**NOTE:** If your GD-K88Ai is sampling a fresh air environment (environment free of combustible and toxic gases and of normal oxygen concentration, 20.9%), you do not need to use a zero air cylinder to introduce fresh air.

### <Materials>

- 0.5 LPM fixed flow regulator with on/off knob
- Calibration cup
- Calibration tubing
- Zero air cylinder

### <Zero Air Gas Application Time>

The table below outlines how long to let calibration gas flow for each target gas.

Target Gas	Calibration Gas Application Time
Cl <sub>2</sub>	2 minutes
CO	1 minute
H <sub>2</sub> O <sub>2</sub>	2 minutes
HCl	2 minutes
H <sub>2</sub> S	2 minutes
NH <sub>3</sub>	3 minutes
NO	1 minute
NO <sub>2</sub>	1 minute
Si <sub>2</sub> H <sub>6</sub>	2 minutes
SiH <sub>4</sub>	2 minutes
SO <sub>2</sub>	2 minutes

### <Procedure>

1. From Detection Mode, press and hold MODE for three seconds to enter User Mode.
2. Use ▲/▼ to navigate to "1-3 M. MODE".
3. With "1-3. M MODE" displayed, press SET.
4. Hold SET while "----" is displayed to enter Maintenance Mode.
5. With "2-0 TEST" displayed, use ▲/▼ to navigate to "2-1 ZERO".
6. With "2-1 ZERO" displayed, press and release SET.
7. Install the calibration cup onto the sensor.
8. Screw the 0.5 LPM regulator onto the zero air cylinder.
9. Connect the regulator to the calibration cup inlet with tubing.
10. Turn the regulator knob counterclockwise to open it.
11. Let zero air flow for the time listed in the table above.
12. When the reading is stable, press and release SET. The display blinks and the zero adjustment is performed.
13. Press and release SET again to save the adjustment.
14. Turn the regulator knob clockwise to close it.
15. Remove the calibration cup from the sensor.

---

## 6-3. Span Calibration

### <Materials>

- 0.5 LPM fixed flow regulator with on/off knob
- Calibration cup
- Calibration tubing
- Calibration cylinder

### <Calibration Gas Application Time>

The table below outlines how long to let calibration gas flow for each target gas.

Target Gas	Calibration Gas Application Time
Cl <sub>2</sub>	2 minutes
CO	1 minute
H <sub>2</sub> O <sub>2</sub>	2 minutes
HCl	2 minutes
H <sub>2</sub> S	2 minutes
NH <sub>3</sub>	3 minutes
NO	1 minute
NO <sub>2</sub>	1 minute
Si <sub>2</sub> H <sub>6</sub>	2 minutes
SiH <sub>4</sub>	2 minutes
SO <sub>2</sub>	2 minutes

### <Procedure>

1. From Detection Mode, press and hold MODE for three seconds to enter User Mode.
2. Use ▲/▼ to navigate to "1-3 M. MODE".
3. With "1-3. M MODE" displayed, press SET.
4. Hold SET while "----" is displayed to enter Maintenance Mode.
5. With "2-0 TEST" displayed, use ▲/▼ to navigate to "2-2 SPAN".
6. With "2-2 SPAN" displayed, press and release SET.
7. Install the calibration cup onto the sensor.
8. Connect the regulator to the calibration cup inlet with tubing.
9. For toxic gas cylinders, like Cl<sub>2</sub>, it is important to vent the regulator while installing it onto the cylinder. Venting the regulator during installation helps prevent air from getting into the cylinder and degrading the gas. Open the regulator by turning the knob counterclockwise and install it onto the cylinder.
10. Let calibration gas flow for the time listed in the table above.
11. Press ▲/▼ until the reading on the display matches the concentration listed on your calibration cylinder.
12. Press and release SET. The reading will start to flash.
13. Press and release SET again to save the adjustment.
14. Turn the regulator knob clockwise to close it.
15. Remove the calibration cup from the sensor.

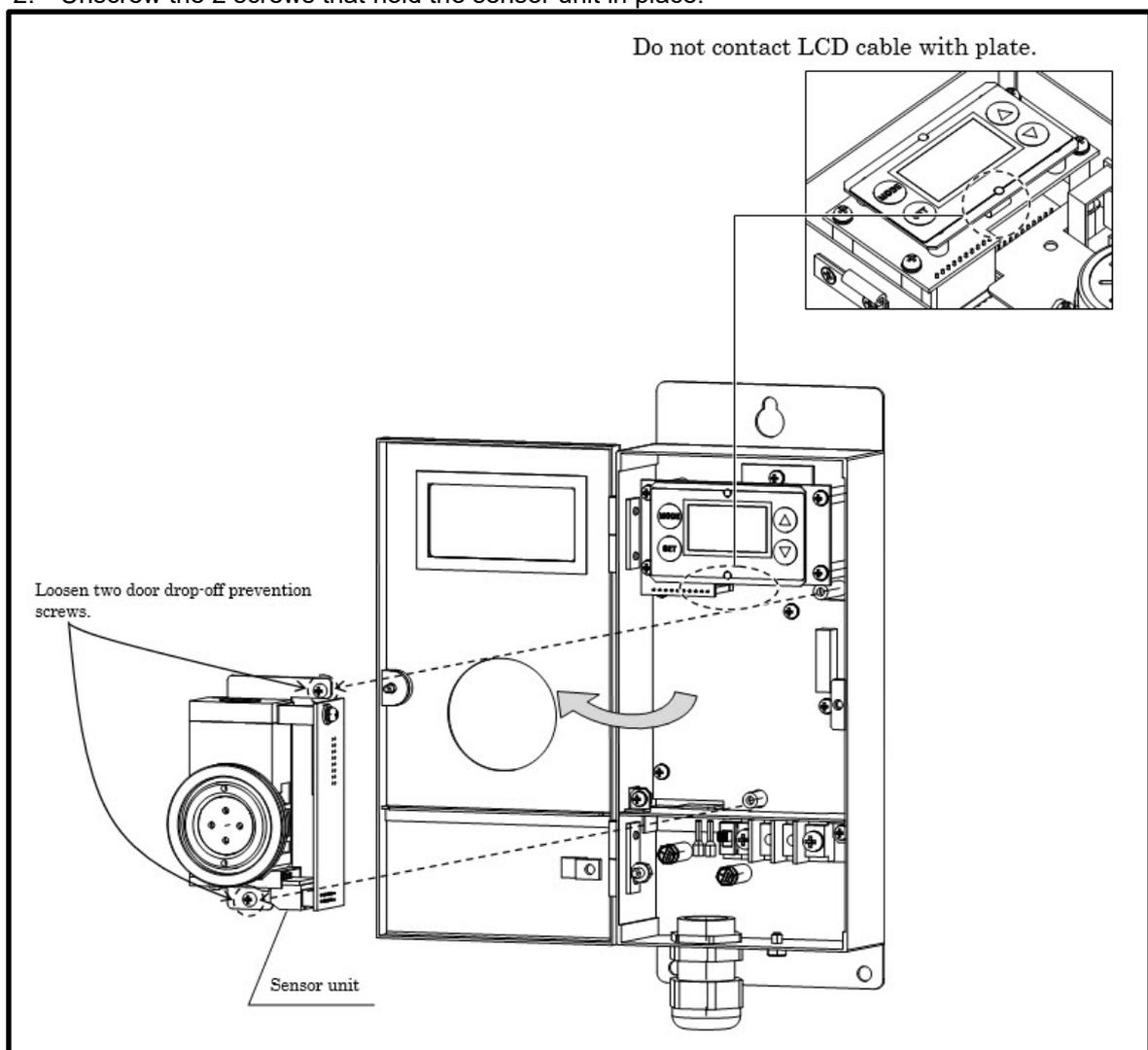
## 6-4. Replacing Parts

### <Replacing the Gas Sensor>

#### NOTE

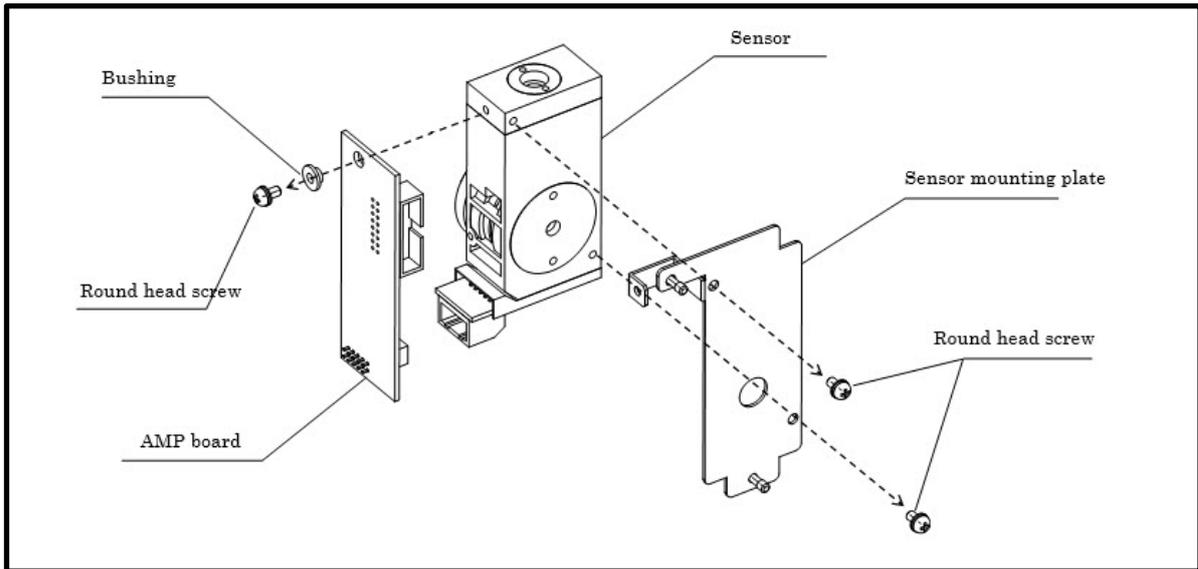
- If adjustment to the standard gas concentration value fails even with the maximum sensitivity, it indicates that the gas sensor has come to the end of its life. The gas sensor needs to be replaced.
- After replacing the gas sensor, electrical adjustment and calibration using the standard gas are necessary.

1. Open the housing door.
2. Unscrew the 2 screws that hold the sensor unit in place.



3. Pull the sensor unit away from the main unit.

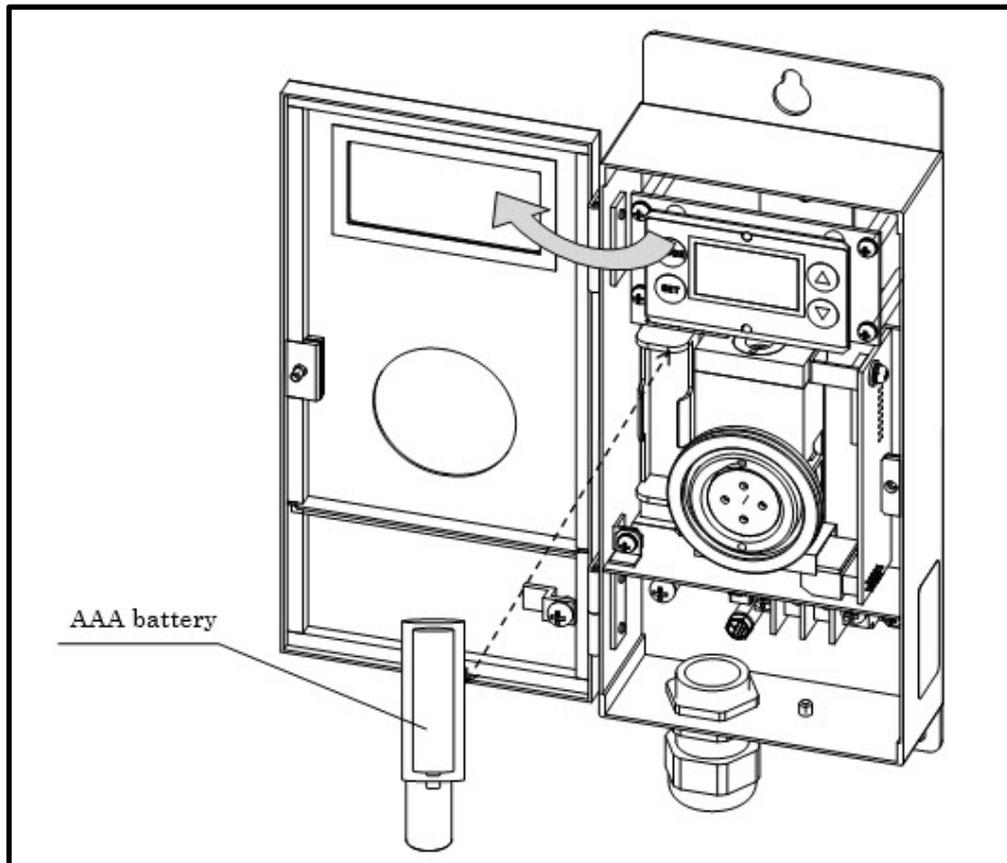
4. Unscrew and remove the AMP board and the sensor mounting plate from the old sensor.



5. Install the AMP board and sensor mounting plate to the new sensor.
6. Reinstall the sensor unit to the main unit.
7. Calibrate the sensor as described on page 30.
8. Replace the backup battery as described below.

#### <Replacing the Battery>

1. Open the housing door.
2. Remove the old AAA battery from the battery holder.
3. Install a new AAA battery in the AA battery spacer and reinstall it into the main board.



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# 7

## Storage, Relocation, and Disposal

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### 7-1. Procedures to Store the Detector or Leave it for a Long Time

The detector must be stored under the following environmental conditions.

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

### 7-2. Procedures to Relocate the Detector or Use it Again

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

For information on wiring work, see "4-6. How to wire" and "4-7. Compatible cables and terminal plate specifications". The unpowered time must be minimized when the detector is relocated.



#### **CAUTION**

Perform a calibration when using detector again after relocation or long-term storage.

### 7-3. Disposal

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

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# 8

## Troubleshooting

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The troubleshooting guide explains the most frequent detector malfunctions but does not explain all detector malfunctions. If the detector shows a symptom which is not explained in this manual, or still has malfunctions even though remedial actions are taken, please contact RKI.

<Abnormalities on Unit>

Symptom/Display	FAULT	Causes	Actions
<u>The power cannot be turned on.</u>	—	The wiring is not correct.	Connect the wiring properly.
		The terminal plate is removed.	Connect the terminal plate properly.
		Abnormalities/momentary blackout of power supply system	Provide the rated voltage. Take measures such as checking or adding the UPS, power supply line filter and insulation transformer.
		Cable abnormalities (open circuit/not connected/short circuit)	Check the wiring of detector and related devices around it.
<u>Abnormal operations</u>	—	Disturbances by sudden surge noise, etc.	Turn off and restart the alarm system. If such a symptom is observed frequently, take appropriate measures to eliminate the noise.
<u>System abnormalities</u> [E-9]	●	Abnormalities of ROM, RAM or EEPROM inside the detector	Please contact RKI.
<u>Sensor abnormalities</u> [E-1]	●	The sensor is not connected or improperly connected.	Check if the sensor cable is securely fastened to the terminal plate.
		Faults of the sensor	Please contact RKI.

<Abnormalities of Readings>

\* Take remedial actions to indicator/alarm unit as well See the operating manual of the indicator/alarm unit for details.

Symptoms	Causes	Actions
<u>The reading rises (drops) and does not go back.</u>	Drifting of sensor output	Perform zero adjustment.
	Presence of interference gas	It is difficult to eliminate interference gases, such as solvents completely. Please contact RKI to arrange removal filters.
	Slow leak	A very small amount of the gas to be detected may be leaking (slow leak). Because ignoring it may cause dangers, take a remedial measure, i.e., taking actions the same as those for the gas alarm.
	Environmental changes	Perform zero adjustment.
<u>A gas alarm is triggered despite of no gas leak and no other abnormalities at the detection point.</u>	Presence of interference gas	It is difficult to eliminate interference gases, such as solvents completely. Please contact RKI to arrange removal filters.
	Disturbance by noise	Turn off and restart the alarm system. If such a symptom is observed frequently, take appropriate measures to eliminate the noise.
	Sudden change in the environment	When the environment (temperature, etc.) changes suddenly, the detector cannot adjust to it and is affected by it. In some cases, the detector triggers an indication alarm. Because the detector cannot be used under sudden and frequent environmental changes, any preventive actions to eliminate them should be taken by the user.
<u>Slow response</u>	Deteriorated sensor sensitivity	Replace the sensor with a new one.
<u>Span adjustment impossible</u>	Improper calibration gas concentration	Use the proper calibration gas.
	Deteriorated sensor sensitivity	Replace the sensor with a new one.

# 9

## Product Specifications

### 9-1. List of Specifications

Detection principle	Electrochemical type
Gas to be detected	Toxic and combustible gases
Concentration display	7-segment LCD (4 digits)
Detection range	Depends on the gas to be detected
Detection method	Diffusion type
Transmission method	2-wire analog transmission
Transmission specifications	4 - 20 mA DC (load resistance: 300 Ω or less)
Power supply	15 - 27 VDC
Transmission cable	Shielded cable of CVVS, etc. (1.25 sq) - 2-core
Transmission distance	Up to 1 km with CVVS 1.25 sq (up to 600 m between the detector head and Zener Barrier)
Safety maintaining device <sup>*1</sup>	Zener Barrier (MTL728ac/MTL728+/MTL728-) or insulating barrier (MTL5541/RN-221N-EJ/KFD2-SCD-EX1.LK)
Operating temperature	0 - 40°C
Operating humidities	30 - 70%RH (Non-condensing.)
Structure	Box type/Wall mounted type
Explosion-proof structure	Intrinsically safe explosion-proof structure, with safety maintaining device (barrier) used
Explosion-proof class	ExialICT4
Explosion-proof certification number	TC20741
External dimensions	Approx. 100 (W) x 241 (H) x 48 (D) mm (projection portions excluded)
Weight	Approx. 1.0 kg
Outer color	Munsell 2.5Y9/2
Paint	Bake-coated with melamine

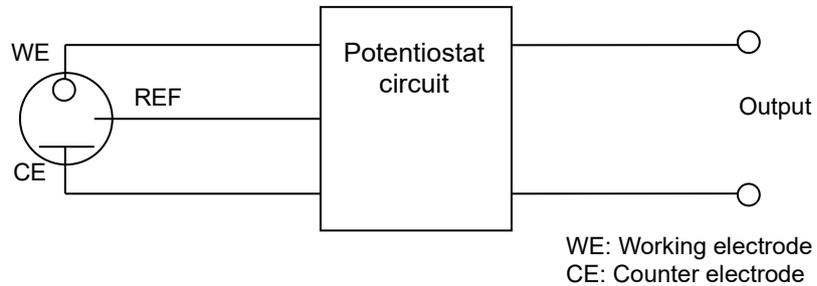
\* Specifications subject to changes without notice.

\*1 Recommended item

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## 9-2. Detection Principle

An electrochemical type sensor electrolyzes a gas directly while maintaining the interface between electrode and electrolyte at a constant potential (bias voltage). A gas is electrolyzed by an electrolysis cell to which a certain potential (bias voltage) is applied, and the gas is detected from the electrolytic current generated at that time.



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# 10

## Definition of Terms

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Electrochemical type	This is a principle of the sensor installed in the detector head. See "9-2. Detection principle" for details.
Initial clear	Output from the detector head fluctuates for a while after turning on the power. This is a function to prevent triggering alarm during that time.
Full scale	Maximum value of the detection range.
ppm	A concentration unit that means part per million of gas to be detected.
Calibration	Adjusts the readings to the calibration gas concentration value by using the calibration gas.

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# 11

## Parts List

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Part Number	Description
06-1248RK	Calibration kit tubing (3/16 in. x 5/16 in.; specify length when ordering)
81-1114RK	Calibration cup
ESM-23-CO-300	Replacement sensor, 0 – 300 ppm CO
ESM-237-H2S	Replacement sensor, 0 – 30 ppm H2S
ESM-238-SO2	Replacement sensor, 0 – 6.00 ppm SO2
ESM-23A-NO	Replacement sensor, 0 – 100 ppm NO
ESM-23AH-NO2	Replacement sensor, 0 – 15.0 ppm NO2
ESM-23AH-PH3	Replacement sensor, 0 – 15.0 ppm PH3
ESM-23AH-SiH4	Replacement sensor, 0 – 15.0 ppm SiH4
ESM-23DH-H2O2	Replacement sensor, 0 – 3.00 ppm H2O2
ESM-23DH-Si2H6	Replacement sensor, 0 – 15.0 ppm Si2H6
ESM-23E-SO2	Replacement sensor, 0 – 30.0 ppm SO2
ESM-23R-NH3	Replacement sensor, 0 – 75.0 ppm NH3
ESM-K233-CL2	Replacement sensor, 0 – 3.00 ppm Cl2
ESM-K235-CL2-10	Replacement sensor, 0 – 10.0 ppm Cl2