

Gas Detector with Signal Converter
SD-3 Series
Export specifications

Technical Manual
(PT2-287)

RIKEN KEIKI Co., Ltd.

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

Phone : +81-3-3966-1113

Fax : +81-3-3558-9110

E-mail : intdept@rikenkeiki.co.jp

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

Contents

1.	Product Overview	5
1-1	Introduction	5
1-2	Intended use and features.....	7
1-2-1	Models and Codes.....	7
1-2-2	Detection principles and detection target gases for individual models.....	8
1-2-3	Product features.....	9
1-3	Usage zones and conditions	10
1-4	DANGER, WARNING, and NOTE.....	11
1-5	Method of confirmation for Standards and Explosion proof specification	11
2.	Important Safety Information.....	12
2-1	Danger information	12
2-2	Warning information.....	12
2-3	Caution information.....	13
2-4	Safety information.....	14
3.	Product Configuration.....	31
3-1	Main unit and accessories.....	31
3-1-1	Main unit (SD-3).....	31
3-1-2	Main unit (SD-3SC).....	32
3-1-3	Remote sensor head (GD-3).....	32
3-1-4	Standard accessories	33
3-1-5	Optional accessories.....	34
3-2	Part names and functions.....	38
3-3	Block diagrams	39
4.	Installation.....	41
4-1	Installation precautions	41
4-1-1	General installation information	41
4-1-2	Restrictions regarding installation.....	42
4-2	System design precautions	47
4-2-1	Using a stable power supply.....	47
4-2-2	Lightning strike protective measures	47
4-3	Providing maintenance space	48
4-4	Main unit installation	50
4-4-1	Vertical pole mounting.....	50
4-4-2	Wall mounting.....	51
4-4-3	Attaching protective cover.....	52
4-4-4	Attaching sunshade cover	54
4-5	Remote sensor head (GD-3) installation	56
4-5-1	Wall mounting.....	56
4-5-2	Duct mounting.....	56
4-6	Connecting the grounding terminal	58
4-7	Connecting the power and signal cables	59
4-7-1	Main unit cable and device connectors	59
4-7-2	Connecting the power and signal cables to the main unit	61
4-7-3	Connecting the power and signal cables to the remote sensor head (GD-3)	64
4-7-4	Connecting the main unit (SD-3SC) and remote sensor head (GD-3).....	67
4-7-5	Connecting cables to the terminal plate	72
4-8	Mounting the sensor	75
4-9	Alarm relay setting (option).....	76
4-10	Mounting the splash guard	79

4-11	How to install the lightning arrester	80
5.	Usage Instructions	81
5-1	Preparations for startup	81
5-2	Startup.....	82
5-3	Basic operation flow.....	83
5-4	Operating procedure.....	84
5-5	User mode	85
5-5-1	User mode setting items	85
5-5-2	Switching to user mode	86
5-6	Performing zero calibration.....	87
5-7	Checking settings	89
5-7-1	Checking alarm setpoints	89
5-8	Shutting down	91
6.	Alarm Activation	92
6-1	Gas alarm activation	92
6-1-1	Alarm activation.....	92
6-1-2	Contact operation (auto reset).....	93
6-1-3	Contact operation (self-latching).....	94
6-1-4	Alarm response	97
6-2	Fault alarm activation.....	97
6-3	Warning operation	98
6-4	External output operation	99
6-4-1	For target gases other than oxygen	99
6-4-2	When the target gas is oxygen	103
6-5	Functions to ensure correct alarm activation	106
6-5-1	Zero suppression function	106
6-5-2	Automatic sensor recognition function	107
7.	Maintenance	108
7-1	Maintenance intervals and items.....	108
7-2	Maintenance mode	110
7-2-1	Maintenance mode setting items.....	110
7-2-2	Switching to maintenance mode	111
7-3	Performing tests (test mode)	113
7-3-1	Performing gas test.....	113
7-3-2	Performing alarm test.....	114
7-3-3	Performing fault test.....	116
7-3-4	Performing LED test.....	117
7-3-5	Performing memory test (RAM test).....	118
7-4	Performing calibration.....	119
7-4-1	Calibration preparation.....	119
7-4-2	Performing zero calibration	125
7-4-3	Performing span adjustment.....	126
7-5	Setting environmental settings 1	130
7-5-1	Inhibit setting	130
7-5-2	Alarm setpoint setting.....	131
7-5-3	Zero suppression value setting.....	132
7-5-4	Zero suppression type setting.....	133
7-5-5	Password setting.....	134
7-5-6	Date and time setting	135
7-6	Setting environmental settings 3	136
7-6-1	Double range external output setting NC	137
7-7	Parts replacement.....	138

7-7-1	Sensor replacement.....	138
7-7-2	Replacement of periodic replacement parts.....	139
8.	Storage, Relocation, and Disposal.....	140
8-1	Procedures for storage or when not in use for extended periods	140
8-2	Procedures for relocation or reuse.....	142
8-3	Product disposal	142
9.	Troubleshooting.....	144
9-1	Product abnormalities.....	144
9-2	Reading abnormalities.....	145
10.	Product Specifications.....	147
10-1	SD-3 specifications.....	147
10-1-1	SD-3 (model without EC barrier)	147
10-1-2	SD-3 (model with EC barrier)	150
10-1-3	Electrical ratings (SD-3).....	153
10-2	SD-3SC + GD-3 specifications.....	154
10-2-1	SD-3SC + GD-3 (model without EC barrier).....	154
10-2-2	SD-3SC + GD-3 (model with EC barrier).....	157
10-2-3	Electrical ratings (SD-3SC + GD-3).....	160
10-3	Detection target gases for individual detection principles.....	161
10-3-1	Non-dispersive infrared absorption type (Infrared type).....	161
10-3-2	New ceramic type (catalytic type).....	162
10-3-3	Semiconductor type	163
10-3-4	Hot-wire semiconductor type	165
10-3-5	Electrochemical type.....	167
11.	Appendix.....	168
11-1	Detection principle	168
11-1-1	Non-dispersive infrared absorption type (Infrared type).....	168
11-1-2	New ceramic type (catalytic type).....	169
11-1-3	Semiconductor type	170
11-1-4	Hot-wire semiconductor type	171
11-1-5	Electrochemical type	172
11-2	Terminology.....	173
	Product warranty	174
	Sensor warranty	174
	Revision History.....	175

1

Product Overview

1-1 Introduction

Thank you for purchasing the SD-3 Gas Detector with Signal Converter (“product” hereinafter).

This operating manual describes product operating procedures and specifications. It provides information essential to correct use of the product.

Make sure you have read and fully understood the contents of this manual before using the product.

Keep this operating manual on hand to allow ready reference during use.

The contents of this manual are subject to change without notice to allow product improvements. Any duplication or reproduction of this manual without permission is prohibited, whether in whole or in part.

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

Be sure to read the warranty policy at the end of this document.

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

<Models covered by this operating manual>

	Diffusion type	Suction type
Main unit	SD-3RI	SD-3DRI
	SD-3NC	SD-3DNC
	SD-3GH	SD-3DGH
	SD-3GHS	SD-3DGHS
	SD-3SP	SD-3DSP
	SD-3EC	SD-3DEC
	SD-3ECS	SD-3DECS
	SD-3ECB	SD-3DECB
Main unit	SD-3SC	
Remote sensor head	GD-3RI	
	GD-3NC	
	GD-3GH	
	GD-3GHS	
	GD-3SP	
	GD-3EC	
	GD-3ECS	
	GD-3ECB	

<This operating manual>

In this operating manual, where descriptions differ according to the detection principle, these are indicated by the following icons:

Non-dispersive infrared absorption type (infrared type)	RI
New ceramic type (catalytic type)	NC
Semiconductor type	GH
Hot-wire semiconductor type	SP
Electrochemical type	EC

Operating procedures and specifications for which no icons appear apply to all detection principles.

The display examples provided in this operating manual apply when the detection target gas is combustible (display units: %LEL).

1-2 Intended use and features

The product is a fixed explosion-proof device for continuous monitoring of combustible gases, toxic gases, and oxygen in the air.

An alarm is triggered if combustible gases, toxic gases, or oxygen exceeding preset concentrations are detected in the air.

The detection results are not intended to assure life or safety.

1-2-1 Models and Codes

SD-3 (①) (②) (③) (④) (⑤) (⑥) (⑦) (⑧)

[Remote type: Main unit (SD-3SC) + Remote sensor unit (GD-3)]

SD-3SC (③) (④) (⑤) (⑥) (⑦) (⑧)

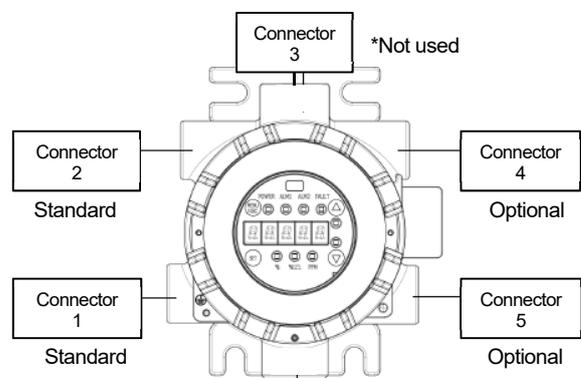
GD-3 (②)

① Diffusion type/suction type selection	
Blank	Diffusion type
D	Suction type (introduced via external unit)
② Sensor type selection	
RI	Infrared type
NC	New ceramic type (catalytic type)
GH	Semiconductor type
GHS	Semiconductor type (for CS ₂)
SP	Hot-wire semiconductor type
EC	Electrochemical type (for CO/O ₂)
ECS	Electrochemical type (for H ₂ S)
ECB	Electrochemical type (other than CO/O ₂ /H ₂ S)
③ Cable connectors	
0	Connector 1 + Connector 2
1	Connector 1 + Connector 2+ Connector 4 + Connector 5
④ Explosion-proof	
1	ATEX/IECEX/UKEX
2	FM (US)
3	Japan Ex
4	cFM (CANADA)
⑤ Functional safety IEC61508*1	
0	None
1	SIL (for RI/NC/EC/ECS/ECB)

⑥ Performance certification	
0	None
1	ATEX
2	US
3	CANADA
4	JIS
⑦ Range setting*2	
0	Single range
1	Double range +4-16 (for NC)
2	Double range + L4-20 (for NC)
3	Double range + H4-20 (for NC)
⑧ Output type selection	
0	4-20 mA + HART
1	4-20 mA + HART + contact (3c)
2	-

*1 W range is not supported in the SIL specification.

*2 HART communication is unavailable when double range (optional) is selected.



Example: Cable connectors

1-2-2 Detection principles and detection target gases for individual models

The product is available in the following models, depending on the specific detection method and detection principle.

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

<List of detection target gases by model>

Main unit model	Detection method	Detection principle	Detection target gas			Remarks
			Combustible gas	Toxic gas	Oxygen	
SD-3RI	Diffusion	Non-dispersive infrared absorption type (infrared type)	○	○		
SD-3NC		New ceramic type (catalytic type)	○			
SD-3GH		Semiconductor type	○	○		
SD-3GHS		Semiconductor type		○		CS ₂ (carbon disulfide) only
SD-3SP		Hot-wire semiconductor type	○	○		
SD-3EC		Electrochemical type		○	○	
SD-3ECS		Electrochemical type		○		H ₂ S (hydrogen sulfide) only
SD-3ECB		Electrochemical type		○		With EC barrier*
SD-3DRI	Suction	Non-dispersive infrared absorption type (infrared type)	○	○		
SD-3DNC		New ceramic type (catalytic type)	○			
SD-3DGH		Semiconductor type	○	○		
SD-3DGHHS		Semiconductor type		○		CS ₂ (carbon disulfide) only
SD-3DSP		Hot-wire semiconductor type	○	○		
SD-3DEC		Electrochemical type		○	○	
SD-3DECS		Electrochemical type		○		H ₂ S (hydrogen sulfide) only
SD-3DECB		Electrochemical type		○		With EC barrier*

*Differs depending on detection target gas.

<List of detection target gases by model (remote sensor type)>

Main unit model	SD-3SC
-----------------	--------

Remote sensor head model	Detection method	Detection principle	Detection target gas			Remarks
			Combustible gas	Toxic gas	Oxygen	
GD-3RI	Diffusion	Non-dispersive infrared absorption type (infrared type)	○	○		
GD-3NC		New ceramic type (catalytic type)	○			
GD-3GH		Semiconductor type	○	○		
GD-3GHS		Semiconductor type		○		CS ₂ (carbon disulfide) only
GD-3SP		Hot-wire semiconductor type	○	○		
GD-3EC		Electrochemical type		○	○	
GD-3ECS		Electrochemical type		○		H ₂ S (hydrogen sulfide) only
GD-3ECB		Electrochemical type		○		With EC barrier*

*Differs depending on detection target gas.

<Sensor models and detection principles>

Sensor model	Detection principle
IRF	Infrared type
NCF	New ceramic type (catalytic type)
SGF	Semiconductor type
SHF	Hot-wire semiconductor type
ESF	Electrochemical type

1-2-3 Product features

<Standard specifications>

- The product is constructed with a stainless steel housing suitable for both indoors and outdoors use.
- Requires a 24 V DC (DC 18 V to 30 V) power supply.
- The gas concentration, status, and command selection menu are displayed using seven-segment LEDs.
- The concentration of the gas detected is converted to a 4 - 20 mA analog output (NAMUR NE43 compliant) or a digital HART output signal.
- It can be connected to a RIKEN KEIKI monitoring system or programmable logic controller (PLC) via a ceiling fitting or approved cable gland.

<Optional specifications>

- The product can be operated as a standalone unit by setting an alarm relay. Using the product as a standalone unit allows control of devices without the need for a central controller.*1

*1: Using the product as a standalone unit requires additional alarm signal settings.

1-3 Usage zones and conditions

The product is approved for use in areas where gases classified in explosive gas groups IIA, IIB, or IIC may be present. This refers to use limited to hazardous zones categorized as Zone 1 or Zone 2 within the product operating temperature range.

1-4 DANGER, WARNING, and NOTE

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

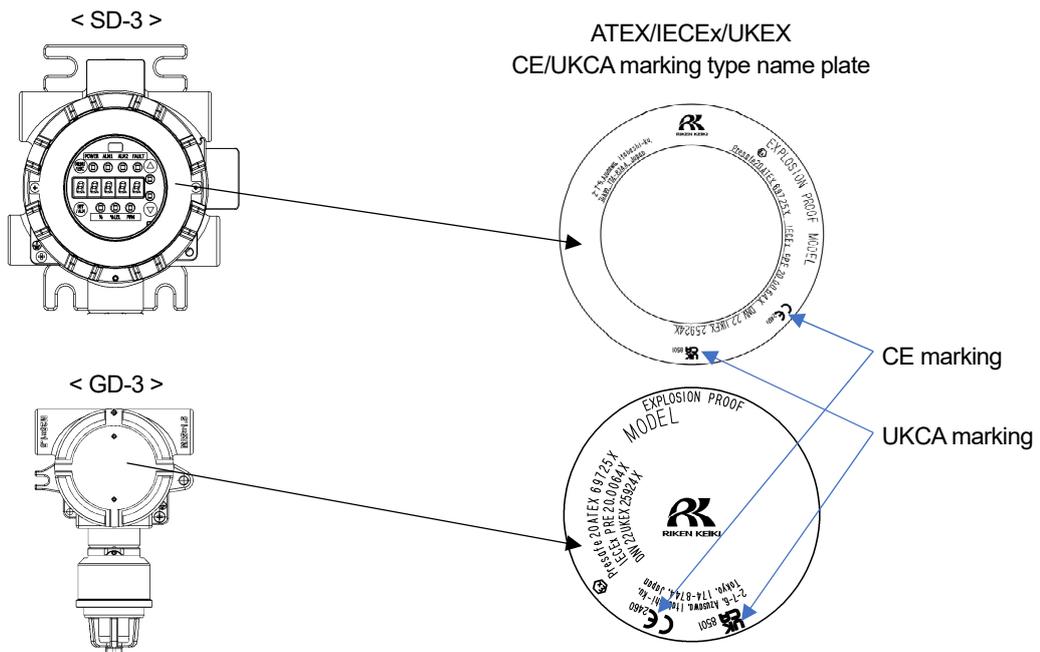
 DANGER	This indicates situations in which improper handling may result in fatal or serious injury or significant property damage.
 WARNING	This indicates situations in which improper handling may result in serious injury or significant property damage.
 CAUTION	This indicates situations in which improper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

Additionally, usage recommendations are indicated as follows:

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

1-5 Method of confirmation for Standards and Explosion proof specification

This instrument has some specification depends on standard and explosion proof certificate. Please confirm the detector specification before using. Please refer Declaration of Conformity that is at the end of this manual if you have CE/UKCA marking type. You can confirm instrument specification to see name plate as follows.



2

Important Safety Information

2-1 Danger information



DANGER

- Do not open the cover while the power is turned on. When opening the cover, use a portable gas detector or other similar device to confirm that there is no gas present in the vicinity.
 - Do not attempt to repair the product.
 - Do not attempt to repair or replace the explosion-proof bonding surface. If you observe scratches, cracks, or deformation on the housing or explosion-proof bonding surface, stop using the product immediately and contact RIKEN KEIKI promptly.
-

2-2 Warning information



WARNING

- Before turning on the power for the product, be sure to confirm that the power source meets the specified voltage requirements.
Using power supplies other than the stipulated voltage will damage the product. Do not use unstable power supplies. Doing so may result in malfunctions.
 - Do not disconnect the protective grounding wire or terminal.
 - Before operating the product, check the protective functions for defects.
Do not operate the product if you suspect any problems with the protective grounding or other protective functions.
 - Connect to a protective ground before connecting to external control circuits.
 - Before adjusting zero for the surrounding atmosphere, confirm that the surrounding atmosphere contains clean air.
The presence of interference gases will prevent proper air calibration. The presence of miscellaneous gases is also extremely dangerous because the product may not detect actual gas leaks correctly.
 - A gas alarm indicates the presence of extreme danger. The user must take appropriate action after taking suitable steps to ensure safety.
 - Do not immerse the product in organic solvents for extended periods. The flame arrester components are made of polyphenylene sulfide (PPS) resin.
-

2-3 Caution information



- The product operation may be affected by radio waves emitted from walkie-talkies or other radio transmitters used near the product or its cables. Position walkie-talkies or other similar devices so that they do not affect the product operation.
- Wait at least 10 seconds before turning the power back on again after turning off. The product may not function correctly if the power is turned back on immediately.
- The product is not a control device. Never use the product output to control other devices.
- Do not disassemble or alter the product. Product performance cannot be guaranteed if the product is disassembled or modified.
- Do not alter settings unnecessarily unless you are fully aware of the consequences. Doing so may result in improper alarm function. Avoid performing any operations not described in this operating manual.
- The product is a safety device. Be sure to maintain the product at regular intervals to ensure safety. Continuing to use the product without adequate maintenance will result in sensor sensitivity degradation and prevent proper gas detection.

2-4 Safety information

<Product overview>

- The products have an explosion-proof construction.
- Sensors are divided into three different types, depending on the corresponding detection principles. The detection methods are divided into the diffusion type and suction type. Suction-type sensors should be used with a suction cap fitted.
- The product is a fixed, continuous monitoring detector. It can be connected to a gas monitoring control unit, recorder, or programmable control unit to output the measured gas readings as a 4 - 20 mA signal or HART signal.
- The following three sets of output specifications are available for this product:
 - No alarm relay, no digital communication
 - 3 alarm relays (contact output) (alarm relays operate in conjunction with gas alarms and faults), no digital signal
 - No alarm relay, digital communication (RS-485 output)
- The electrochemical sensor is made into an explosion-proof construction by using an EC barrier.

<Detection principles and models>

- The models corresponding to the individual detection principles are as follows. The models are classified by detection principle and detection method.

Detection principle (Detection method: Diffusion type)		Model
Optical sensor	Non-dispersive infrared absorption type (infrared type)	SD-3RI
Solid state sensor	Semiconductor type	SD-3GH
		SD-3GHS
	New ceramic type (catalytic type)	SD-3NC
	Hot-wire semiconductor type	SD-3SP
Electrochemical sensor	Electrochemical type	SD-3EC
		SD-3ECS
		SD-3ECB

Detection principle (Detection method: Suction type)		Model
Optical sensor	Non-dispersive infrared absorption type (infrared type)	SD-3DRI
Solid state sensor	Semiconductor type	SD-3DGH
		SD-3DGHS
	New ceramic type (catalytic type)	SD-3DNC
	Hot-wire semiconductor type	SD-3DSP
Electrochemical sensor	Electrochemical type	SD-3DEC
		SD-3DECS
		SD-3DECB

- The SD-3SC is used with a remote sensor head (GD-3) from among the following models:

Detection principle (Detection method: Diffusion type)		Model	
		GD-3 (Remote sensor head)	SD-3
Optical sensor	Non-dispersive infrared absorption type (infrared type)	GD-3RI	SD-3SC
Solid state sensor	Semiconductor type	GD-3GH	
		GD-3GHS	
	New ceramic type (catalytic type)	GD-3NC	
	Hot-wire semiconductor type	GD-3SP	
Electrochemical sensor	Electrochemical type	GD-3EC	
		GD-3ECS	
		GD-3ECB	



WARNING

- The SD-3EC and GD-3EC models are subdivided by the type of explosion-proof construction of the flame arrester fitted to the sensor and whether they include an EC barrier. The expected explosion-proof performance cannot be ensured if the incorrect flame arrester is used. Do not replace with a different flame arrester.
- The SD-3GH and GD-3GH models are subdivided by the type of explosion-proof construction of the flame arrester fitted to the sensor. The expected explosion-proof performance cannot be ensured if the incorrect flame arrester is used. Do not replace with a different flame arrester.

<Explosion-proof performance data>

The range of ambient temperatures in which explosion-proof performance can be maintained will differ depending on whether the optional lightning arrester is fitted.

Refer to the following performance data for each model:

<Without lightning arrester>

Model	Explosion-proof construction	Group	Category	Explosion-proof class	EPL	Ambient temperature*1
SD-3RI	d	II	2G	Ex db IIC T6/T5	Gb	-50 °C ≤ Ta ≤ +60 °C /+70 °C
SD-3DRI						
GD-3RI						
SD-3GH	d	II	2G	Ex db IIC T5/T4	Gb	-50 °C ≤ Ta ≤ +44 °C /+70 °C
SD-3DGH						
GD-3GH						
SD-3GHS	d	II	2G	Ex db IIC T6/T4	Gb	-50 °C ≤ Ta ≤ +47 °C /+70 °C
SD-3DGHS						
GD-3GHS						
SD-3NC	d	II	2G	Ex db IIC T5/T4	Gb	-50 °C ≤ Ta ≤ +44 °C /+70 °C
SD-3DNC						
GD-3NC						
SD-3SP	d	II	2G	Ex db IIC T5/T4	Gb	-50 °C ≤ Ta ≤ +55 °C /+70 °C
SD-3DSP						
GD-3SP						
SD-3EC	d	II	2G	Ex db IIC T4	Gb	-50 °C ≤ Ta ≤ +70 °C
SD-3DEC						
GD-3EC						
SD-3ECS	d	II	2G	Ex db IIC T4	Gb	-50 °C ≤ Ta ≤ +70 °C
SD-3DECS						
GD-3ECS						
SD-3ECB	d+i	II	2G	Ex db ia IIC T4	Gb	-40 °C ≤ Ta ≤ +70 °C
SD-3DECB						
GD-3ECB						
SD-3SC*2	d	II	2G	Ex db IIC T6/T5/T4	Gb	-50 °C ≤ Ta ≤ +47 °C /+55 °C +70 °C
SD-3SC*3	d	II	2G	Ex db IIC T5/T4	Gb	-50 °C ≤ Ta ≤ +44 °C /+70 °C
SD-3SC*4	d	II	2G	Ex db IIC T6/T5	Gb	-50 °C ≤ Ta ≤ +60 °C /+70 °C
SD-3SC*5	d	II	2G	Ex db IIC T4	Gb	-40 °C ≤ Ta ≤ +70 °C

*1: The ambient temperature refers to temperatures in the range within which explosion-proof performance can be maintained. It does not imply the temperature range within which the required product performance may be achieved. For information on the operating temperature range, refer to '10-3 Detection target gases for individual detection principles'.

*2: When used in combination with GD-3GHS, GD-3SP, GD-3EC, and GD-3ECS

*3: When used in combination with GD-3GH and GD-3NC

*4: When used with the GD-3RI

*5: When used in combination with GF-3ECB

<With lightning arrester>

Model	Explosion-proof construction	Group	Category	Explosion-proof class	EPL	Ambient temperature*1
SD-3RI	d	II	2G	Ex db IIC T6/T5	Gb	-40 °C ≤ Ta ≤ +60 °C/+70 °C
SD-3DRI						
GD-3RI						
SD-3GH	d	II	2G	Ex db IIC T5/T4	Gb	-40 °C ≤ Ta ≤ +44 °C /+70°C
SD-3DGH						
GD-3GH						
SD-3GHS	d	II	2G	Ex db IIC T6/T4	Gb	-40 °C ≤ Ta ≤ +47 °C /+70°C
SD-3DGHS						
GD-3GHS						
SD-3NC	d	II	2G	Ex db IIC T5/T4	Gb	-40 °C ≤ Ta ≤ +44 °C /+70 °C
SD-3DNC						
GD-3NC						
SD-3SP	d	II	2G	Ex db IIC T5/T4	Gb	-40 °C ≤ Ta ≤ +55 °C /+70 °C
SD-3DSP						
GD-3SP						
SD-3EC	d	II	2G	Ex db IIC T4	Gb	-40 °C ≤ Ta ≤ +70 °C
SD-3DEC						
GD-3EC						
SD-3ECS	d	II	2G	Ex db IIC T4	Gb	-40 °C ≤ Ta ≤ +70 °C
SD-3DECS						
GD-3ECS						
SD-3ECB	d+i	II	2G	Ex db ia IIC T4	Gb	-40 °C ≤ Ta ≤ +70 °C
SD-3DECB						
GD-3ECB						
SD-3SC*2	d	II	2G	Ex db IIC T6/T5/T4	Gb	-40 °C ≤ Ta ≤ +47 °C /+55 °C +70 °C
SD-3SC*3	d	II	2G	Ex db IIC T5/T4	Gb	-40 °C ≤ Ta ≤ +44 °C /+70 °C
SD-3SC*4	d	II	2G	Ex db IIC T6/T5	Gb	-40 °C ≤ Ta ≤ +60 °C /+70 °C
SD-3SC*5	d	II	2G	Ex db IIC T4	Gb	-40 °C ≤ Ta ≤ +70 °C

*1: The ambient temperature refers to temperatures in the range within which explosion-proof performance can be maintained. It does not imply the temperature range within which the required product performance may be achieved. For information on the operating temperature range, refer to '10-3 Detection target gases for individual detection principles'.

*2: When used in combination with GD-3GHS, GD-3SP, GD-3EC, and GD-3ECS

*3: When used in combination with GD-3GH and GD-3NC

*4: When used with the GD-3RI

*5: When used in combination with GF-3ECB

<Electrical data>

Model	Supply voltage	Power consumption	Signal output	Option (select one)		
				No alarm relay/ No digital communication	Alarm relay (contact output)/ Resistance load only	Digital communication
SD-3RI	24 V DC (18 V - 30 V DC Max)	3.8 W Max	0 - 22 mA + HART	—	30 V DC, 1 A 250 V AC, 2 A	RS-485 output
SD-3DRI		1.2 W Max	—	—	—	—
GD-3RI			—	—	—	—
SD-3GH	24 V DC (18 V - 30 V DC Max)	4.5 W Max	0 - 22 mA + HART	—	30 V DC, 1 A 250 V AC, 2 A	RS-485 output
SD-3DGH		2 W Max	—	—	—	—
GD-3GH			—	—	—	—
SD-3GHS	24 V DC (18 V - 30 V DC Max)	4.5 W Max	0 - 22 mA + HART	—	30 V DC, 1 A 250 V AC, 2 A	RS-485 output
SD-3DGH		2 W Max	—	—	—	—
GD-3GHS			—	—	—	—
SD-3NC	24 V DC (18 V - 30 V DC Max)	4.5 W Max	0 - 22 mA + HART	—	30 V DC, 1 A 250 V AC, 2 A	RS-485 output
SD-3DNC		2 W Max	—	—	—	—
GD-3NC			—	—	—	—
SD-3SP	24 V DC (18 V - 30 V DC Max)	3.5 W Max	0 - 22 mA + HART	—	30 V DC, 1 A 250 V AC, 2 A	RS-485 output
SD-3DSP		1 W Max	—	—	—	—
GD-3SP			—	—	—	—
SD-3EC	24 V DC (18 V - 30 V DC Max)	2.8 W Max	0 - 22 mA + HART	—	30 V DC, 1 A 250 V AC, 2 A	RS-485 output
SD-3DEC		1 W Max	—	—	—	—
GD-3EC			—	—	—	—
SD-3ECS	24 V DC (18 V - 30 V DC Max)	2.8 W Max	0 - 22 mA + HART	—	30 V DC, 1 A 250 V AC, 2 A	RS-485 output
SD-3DECS		1 W Max	—	—	—	—
GD-3ECS			—	—	—	—
SD-3ECB	24 V DC (18 V - 30 V DC Max)	3.1 W Max	0 - 22 mA + HART	—	30 V DC, 1 A 250 V AC, 2 A	RS-485 output
SD-3DECB		1 W Max	—	—	—	—
GD-3ECB			—	—	—	—
SD-3SC	24 V DC (18 V - 30 V DC Max)	5 W Max	0 - 22 mA + HART	—	30 V DC, 1 A 250 V AC, 2 A	RS-485 output

<Certificate numbers>

- IECEx PRE 20.0064 X
- Presafe 20 ATEX 69725 X
- DNV 22 UKEX 25924X

* The "X" at the end of the certificate number indicates the following special operating conditions:

- The flameproof joints are not intended to be repaired.
- Regarding ATEX specification, the measuring function according to Annex II paragraph 1.5.5 of the Directive is not covered by this EU-type examination.
It shall comply with the requirements from the relevant European harmonized standards which provide guidance on the performance of gas detection equipment and safety devices.
- The measuring function according to schedule 1, paragraph 24 of the Regulation is not covered in this UK-type examination. It shall comply with the requirements from the relevant UK Designated Standards which provide guidance on the performance of gas detection equipment.
- The Equipment with glass window plate must only be placed in areas with low risk of mechanical danger (ref clause 26.4.2 in EN 60079-0).
- The manufacturer's instructions provides guidance for the user to minimize the risk from electrostatic discharge. Maximum capacitance of 6 nF can occur.
- If attached to a flameproof enclosure the surge protectors shall be provided with a high strength locking compound on the mounting thread.
- Refer to manual for ambient temperature.

- The measuring function of the EUT is not covered by this type examination. It shall comply with the requirements from the relevant harmonized standards which provide guidance on the performance of gas detection equipment and safety devices.
- The client should not try to replace the batteries.

<Applicable standards>

- IEC 60079-0:2017
- IEC 60079-1:2014
- IEC 60079-11:2011
- EN IEC 60079-0:2018
- EN 60079-1:2014
- EN 60079-11:2012
- BS EN IEC 60079-0:2018
- BS EN 60079-1:2014
- BS EN 60079-11:2012
-

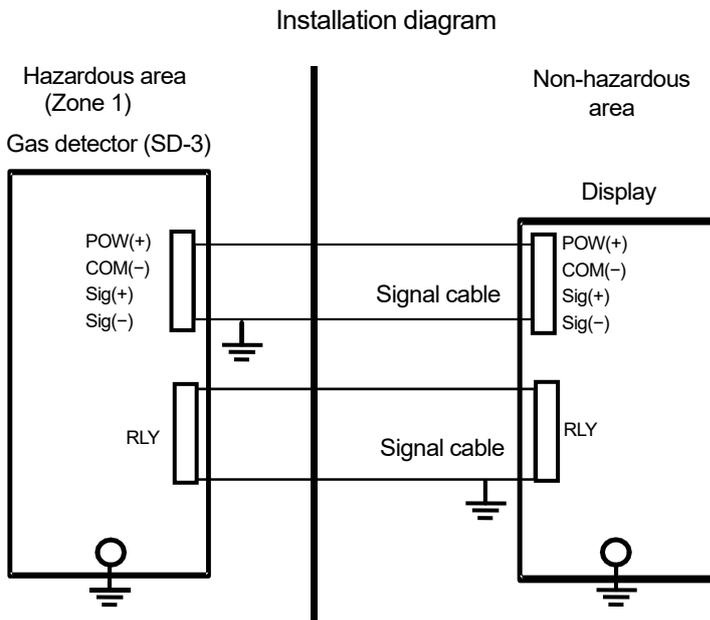
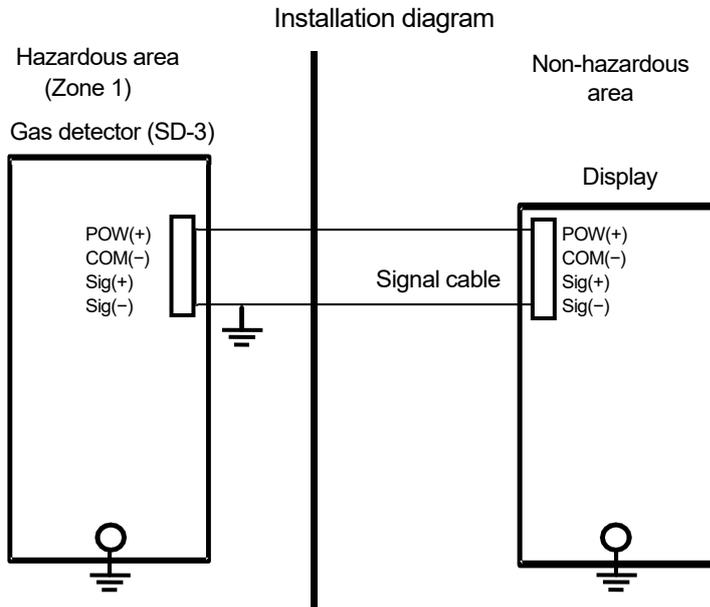
<Operating manual no.>

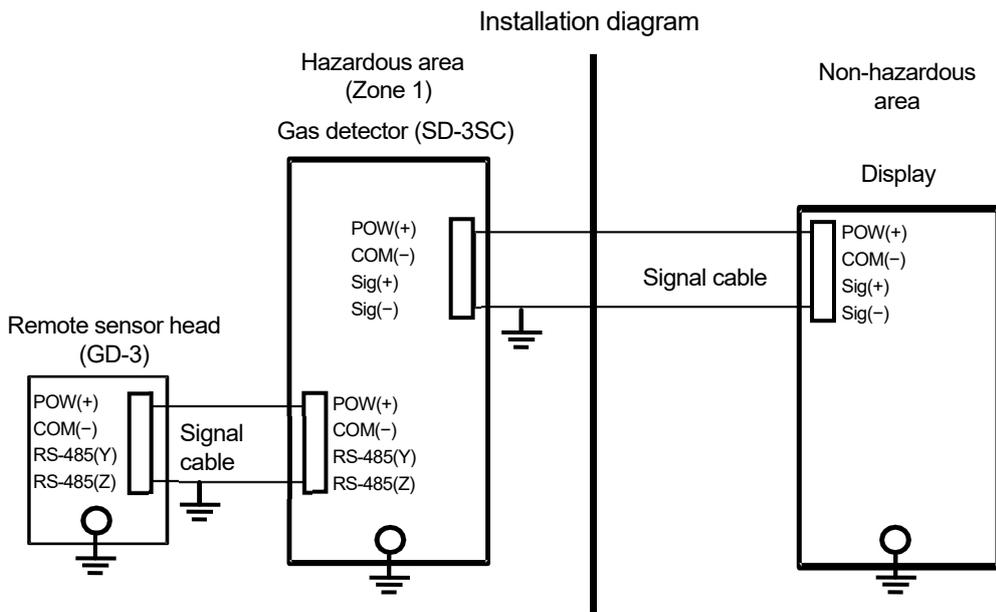
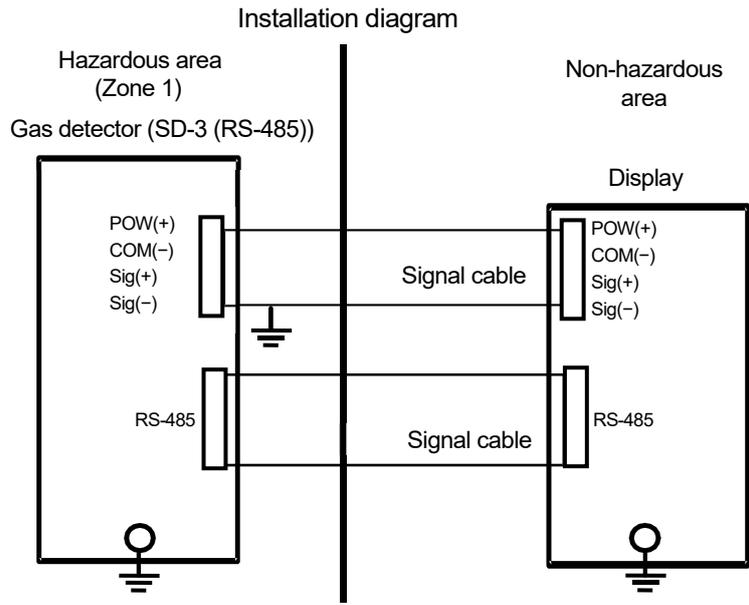
- PT2-287

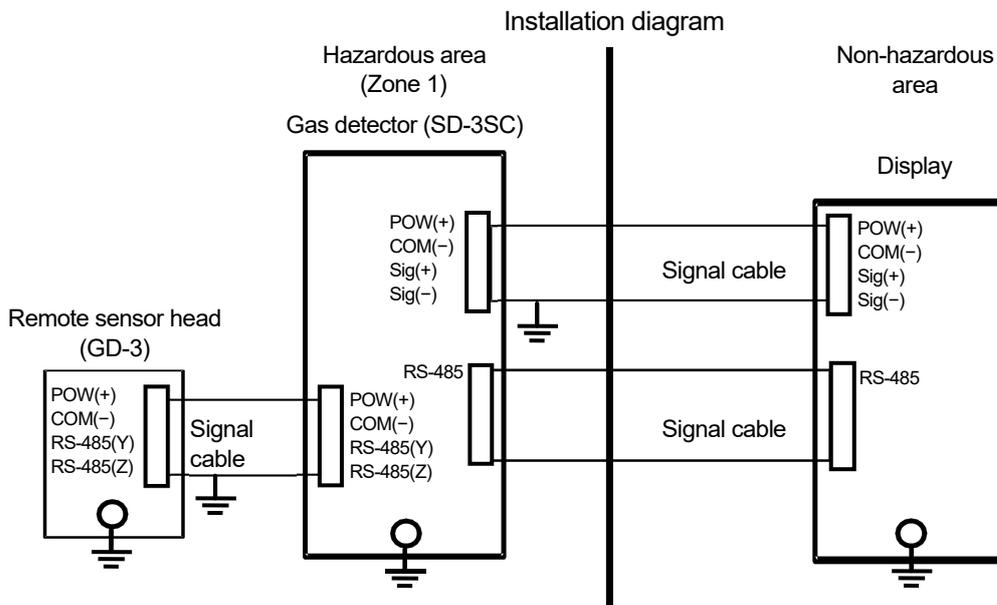
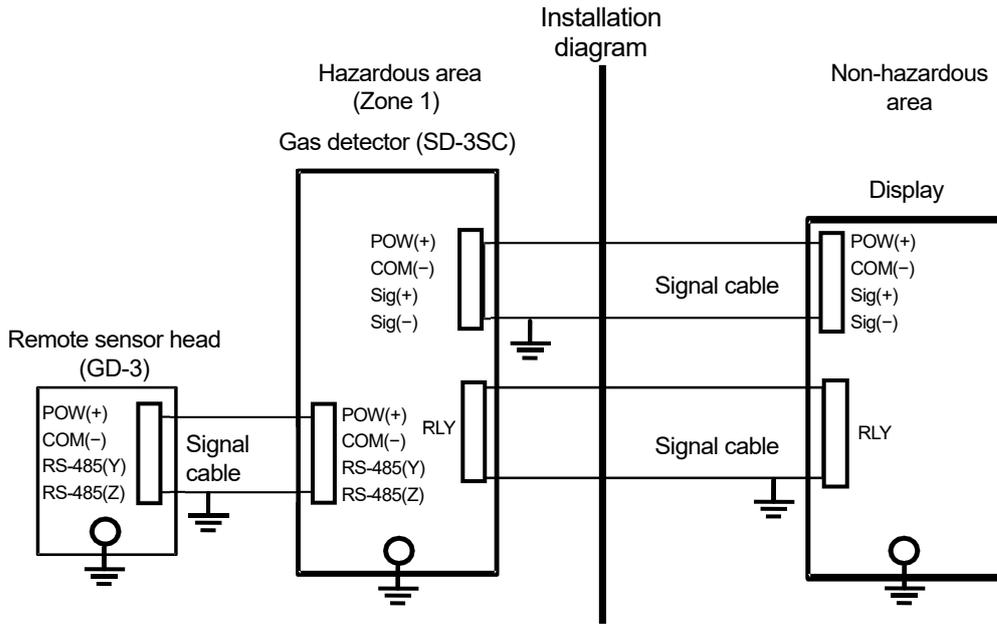


RIKEN KEIKI Co., Ltd.
2-7-6 Azusawa, Itabashi-ku, Tokyo, 174-8744, Japan
Phone: +81-3-3966-1113
Fax: +81-3-3558-9110
Email: intdept@rikenkeiki.co.jp
Website: <https://www.rikenkeiki.co.jp>

<System configuration diagrams>







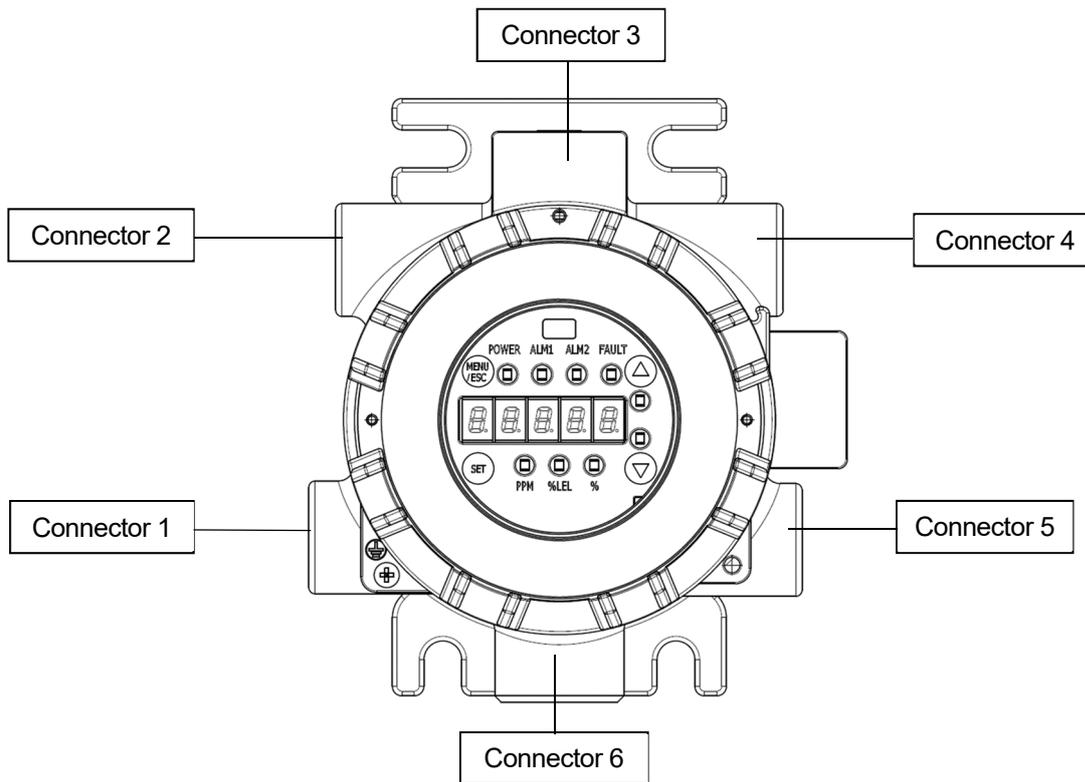
 **CAUTION**

- Install the product in accordance with the required installation conditions.
 - Do not disassemble, modify, or alter the product.
 - Contact RIKEN KEIKI to request readjustment or parts replacement including calibration.
 - Use cable lugs for grounding wire and bonding conductor connections. Make sure the bonding conductors are not loose or twisted.
 - Do not open the cover in locations where explosive gas may be present.
 - The maximum pressure inside the gas channels and sensor is 10.13 kPa (gauge pressure).
 - Be sure to connect the grounding terminal before turning on the power to the product.
 - Make sure the grounding is Class D equivalent (grounding resistance less than 100 Ω).
 - Use crimped terminals to connect the grounding wire to the grounding terminal inside the unit. Use a cable with a cross section area of at least 4 mm² to connect to the external grounding terminal.
 - Use approved cable glands when installing.
 - If the product is installed in a location where the ambient temperature exceeds 65 °C, use cables designed for use at temperatures at least 5 °C above the maximum ambient temperature.
 - Do not subject the window in the cover to strong forces or impact. Doing so may result in damage and impaired explosion-proof performance. (The low risk of mechanical hazards has been confirmed in testing [2 joules].)
 - Do not use more than one adapter per connector.
-
-

 **CAUTION****With suction type**

- Use with a flow rate of at least 0.4 L/min and not exceeding 1.5 L/min.
-

<Connector screw thread types and sizes (SD-3/SD-3SC)>



<Standard>

Connector 1	Connector 2	Connector 3	Connector 4	Connector 5	Connector 6
M25 × 1.5	M25 × 1.5	—	—	—	M25 × 1.5

- “—” indicates no connector is available.
- Connectors 1, 2, and 6 can be used as cable entry ports. Use Connector 6 if the main unit (SD-3SC) is connected to the remote sensor head (GD-3) with a cable. Use approved cable glands when connecting the remote sensor head (GD-3).
- Blank off unused connectors with blanking plugs.
- For more information on using individual connectors, refer to ‘4-7 Cable connection’.

<Optional>

Connectors 4 and 5 are available with optional screw threads, as follows:

Connector 1	Connector 2	Connector 3	Connector 4	Connector 5	Connector 6
M25 × 1.5	M25 × 1.5	—	M25 × 1.5	M25 × 1.5	M25 × 1.5

- “—” indicates no connector is available.
- Connectors 1, 2, 4, and 6 can be used as cable entry ports. Use Connector 6 if the main unit (SD-3SC) is connected to the remote sensor head (GD-3) with a cable. Use approved cable glands when connecting the remote sensor head (GD-3).
- Up to two external cable connectors can be used at the same time. (Excluding the remote sensor head (GD-3) connector cable)
- Connector 2 or 4 can be used to connect the optional lighting arrester using the optional adapter (to convert M25 × 1.5 screw thread to 1/2 NPT screw thread).
- Connector 5 is used for HART communication with an optional HART modem connector. Do not insert external cables or connect a lightning arrester. Blank off with a blanking plug if you do not use HART communication.
- Blank off unused connectors with blanking plugs.
- For more information on using the individual connectors, refer to ‘4-7 Cable connection’.

<Components that can be connected (SD-3/SD-3SC)>

The following components can be connected to the main unit (SD-3/SD-3SC):

	Connector 1	Connector 2	Connector 3	Connector 4	Connector 5	Connector 6
Sensor assembly	×	×	×	×	×	○
EC barrier	×	×	×	×	×	○
Approved cable gland	○	○	×	○	×	○
M25 plug	○	○	×	○	○	×
Adapter (M25 ⇔ 1/2NPT)	○	○	×	○	×	○
Adapter (M25 ⇔ 3/4NPT)	○	○	×	○	×	○
Adapter (M25 ⇔ M20)	○	○	×	○	×	○
Lightning arrester	×	○	×	○	×	×

○: Can be connected

×: Cannot be connected

NOTE

- ▶ Connect only components that are compatible with the individual connectors on the main unit (SD-3/SD-3SC).
- ▶ Tighten M25 plugs and adapters to a torque of at least 30 Nm.
- ▶ Secure a minimum thread engagement of five threads.

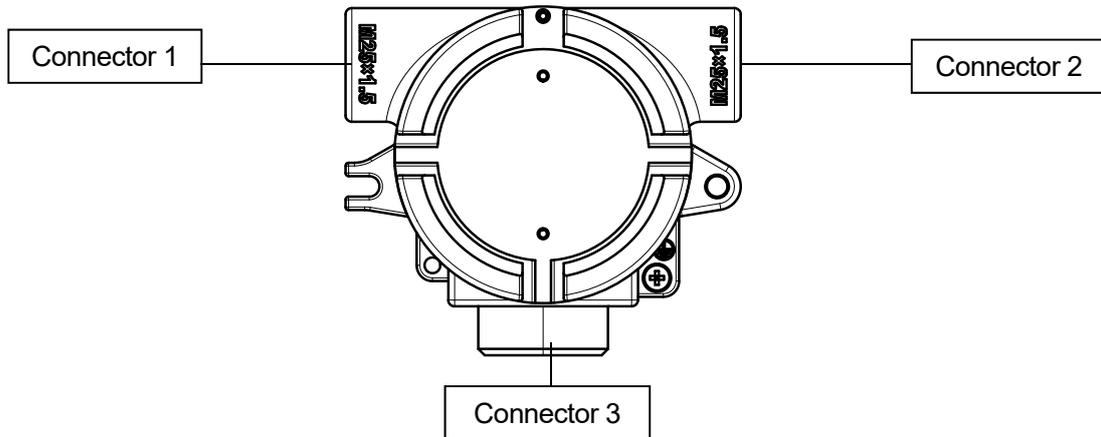
<Lightning arrester details>

Part	Manufacturer	Eaton Electric Limited
	Name/No.	TP48 or TP32 series surge protector
	Explosion-proof performance	II 2G Ex db IIC T6 Gb
Certification Nos.	No. and issue	IECEX BAS 15.0056X Issue 1, Baseefa 04 ATEX 0053X
	Applicable standards	EN 60079-0:2012+A11:2013 EN 60079-1:2014 IEC 60079-0:2011 Edition 6.0 IEC 60079-1:2014 Edition 7.0
Rating	Voltage/current	48 V DC
	Temperature*	-40 - +70 °C
Installation	Attachment screw	1/2NPT

*The minimum ambient temperature for the SD-3/GD-3 when using a surge protector is -40 °C.

The “X” at the end of the certificate number indicates the following special operating conditions:

Certificate numbers	“X” specific operating conditions	Judgment
IECEX BAS 15.0056X Baseefa 04 ATEX 0053X	Use terminals suitable for the operating conditions or use appropriate termination within the bonds to protect against mechanical damage—for example, when pulling connector cables.	Conforms as assembly.
	These devices are not equipped with grounding or external connectors to junction conductors. The user is responsible for attaching and ensuring adequate grounding.	Conforms as assembly.
	This device is also provided as an “Ex i” version and features markings for both. The user is responsible for determining explosion-proof performance.	Not applicable
	When attaching to a flame-proof housing, apply high-strength thread-locking compound to the mounting screw on the surge protector.	“X” marking

<Components that can be connected (GD-3)>

The following components can be connected to the remote sensor head (GD-3):

	Connector 1	Connector 2	Connector 3
Sensor assembly	×	×	○
EC barrier	×	×	○
Approved cable gland	○	○	×
M25 plug	○	○	○
Adapter (M25 ⇔ 1/2NPT)	○	○	○
Adapter (M25 ⇔ 3/4NPT)	○	○	○
Adapter (M25 ⇔ M20)	○	○	○

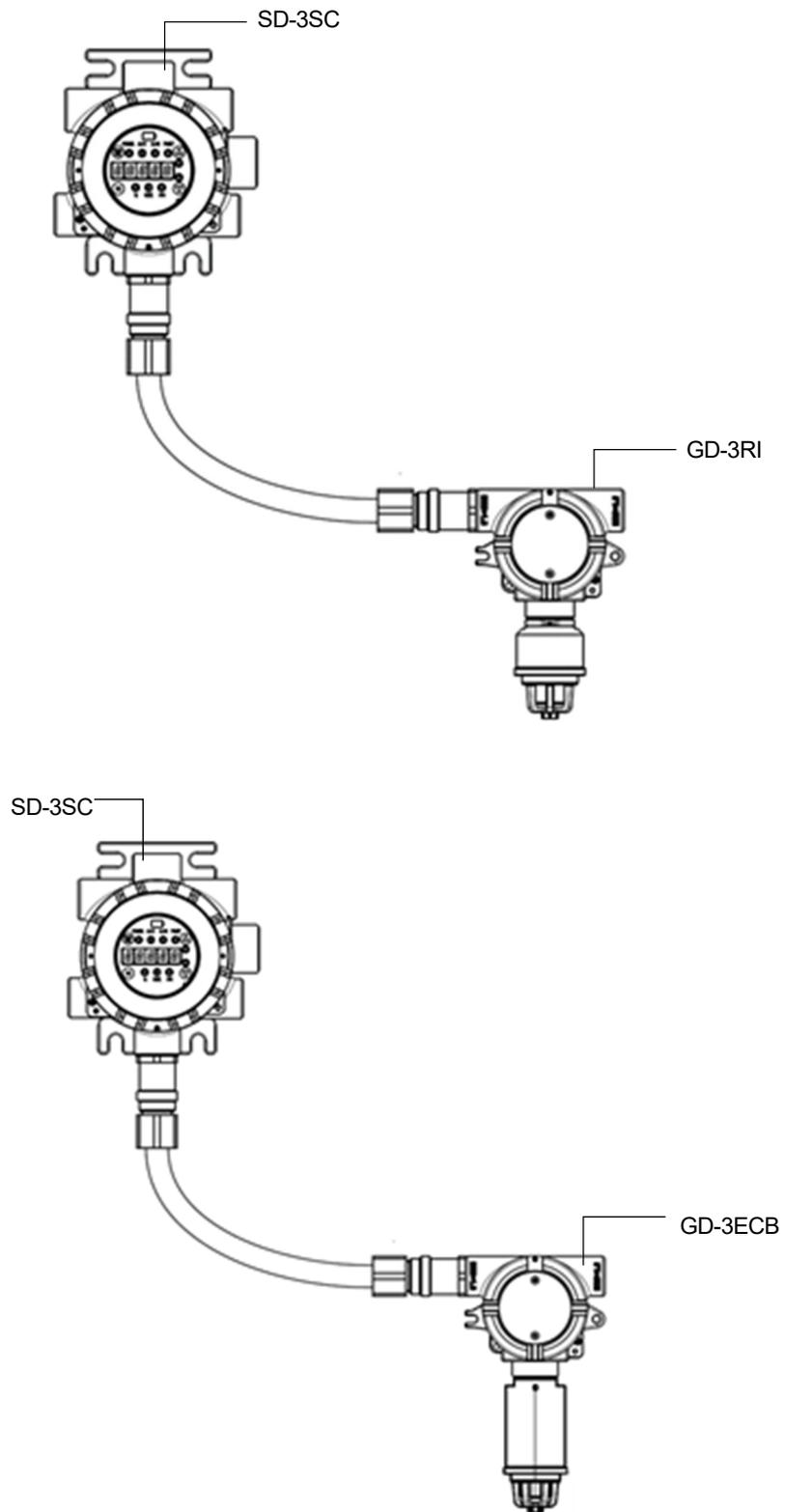
○: Can be connected

×: Cannot be connected

NOTE

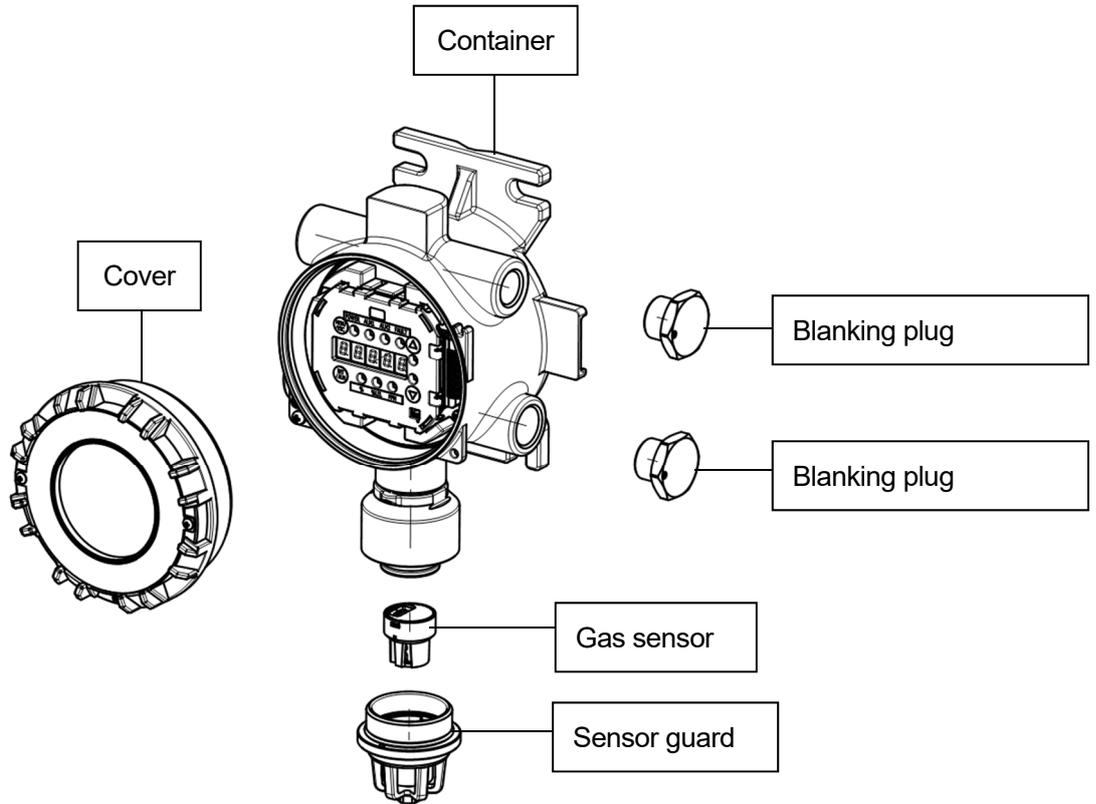
- ▶ Connect only components that are compatible with the individual connectors on the remote sensor head (GD-3).
- ▶ Tighten M25 plugs and adapters to a torque of at least 30 Nm.
- ▶ Secure a minimum thread engagement of five threads.

<Connection examples>

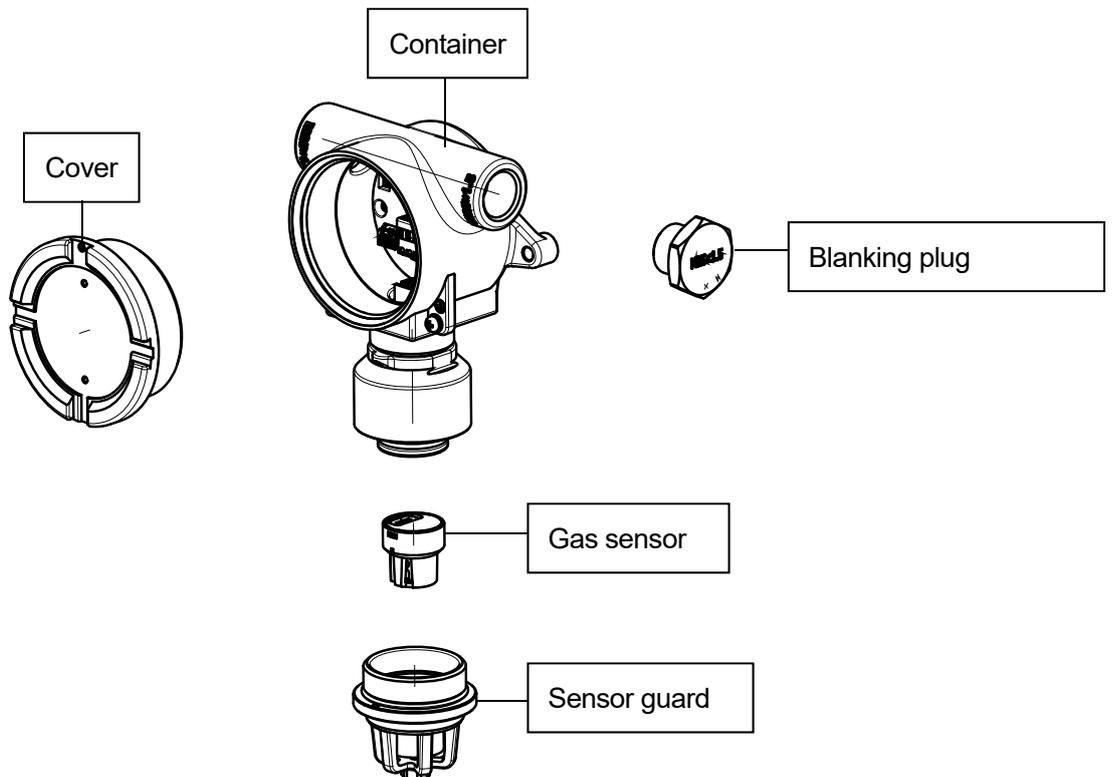


<Exploded view>

<SD-3>



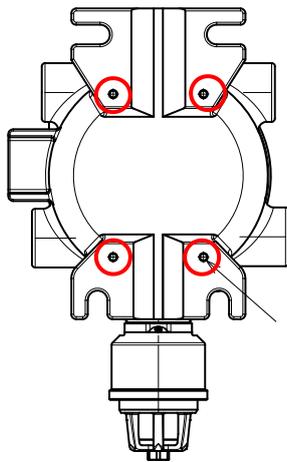
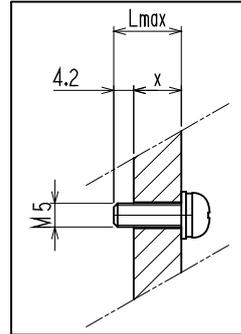
<GD-3>



<Screw holes on rear of container (SD-3)>

Four screw holes are located on the rear of the main unit container.

- Screw size: M5
- Pitch: 0.8
- Screw depth: 5
- Maximum allowable length of male screw:
 $L_{max} = 4.2 \text{ mm} + x$
 ("x" is the intermediate part thickness.)

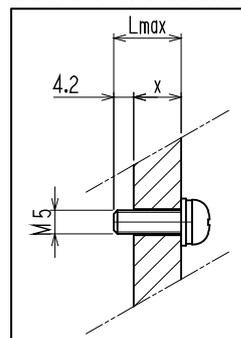


Screw holes on rear of container (four locations)

<Screw holes on rear and underside of container (GD-3)>

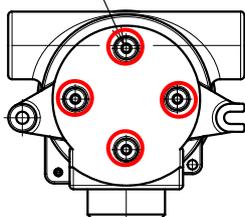
There are four screw holes on the rear of the container and four screw holes on the underside.

- Screw size: M5
- Pitch: 0.8
- Screw depth: 5
- Maximum allowable length of male screw:
 $L_{max} = 4.2 \text{ mm} + x$
 ("x" is the intermediate part thickness.)



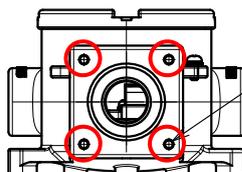
<Container rear>

Screw holes on rear of container (four locations)



<Container underside>

Screw holes on underside of container (four locations)



3

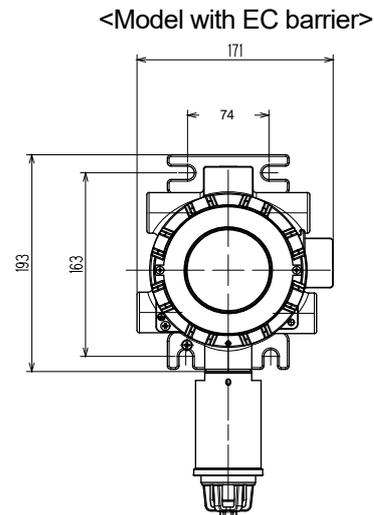
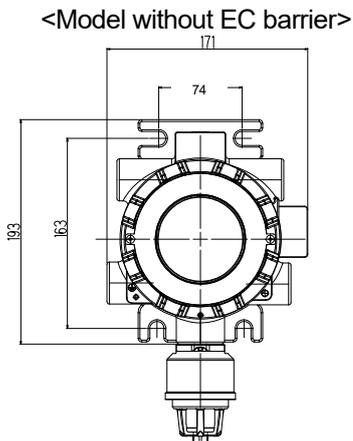
Product Configuration

3-1 Main unit and accessories

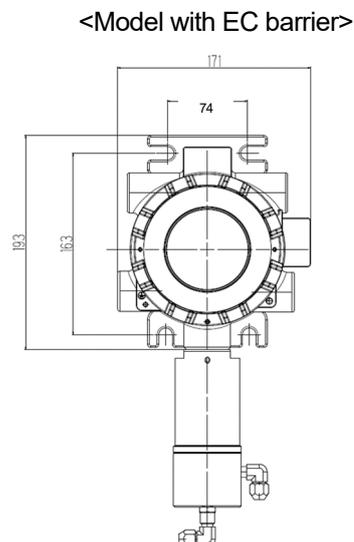
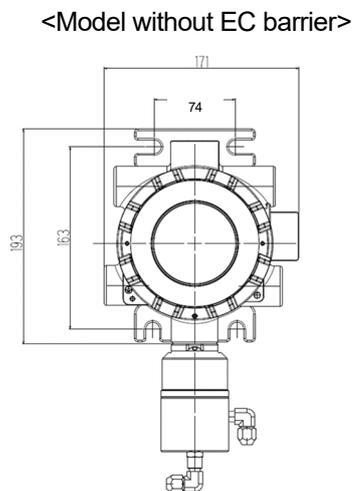
Open the box and packaging and inspect the main unit and accessories.
If anything is missing, contact RIKEN KEIKI.

3-1-1 Main unit (SD-3)

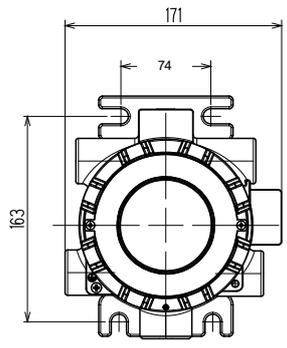
<Diffusion type>



<Suction type>

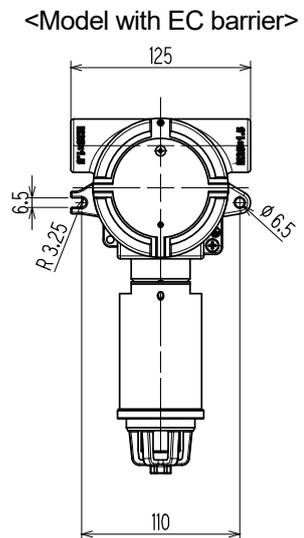
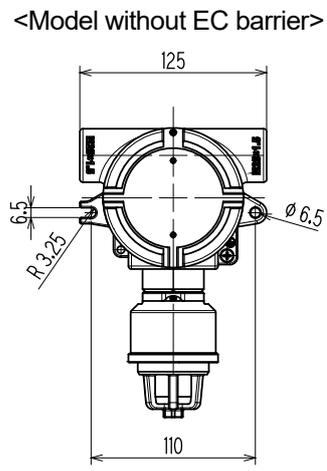


3-1-2 Main unit (SD-3SC)

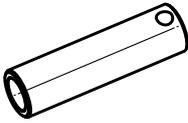
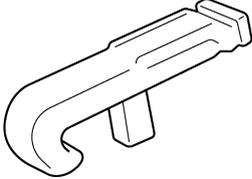


3-1-3 Remote sensor head (GD-3)

<Diffusion type>



3-1-4 Standard accessories

Standard accessory	Quantity	Part No.	Description	
	Control key	Varies depending on quantity ordered.	4286 9200 80	Key used to control the product
	Operating lever	×1	2594 0481 90	Tool used when connecting cable to terminal plate
	Hex key wrench (2 across flats)	Varies depending on quantity ordered.	1510 5020 40	Tool used for tightening M4 hex socket set screws
	Operating manual	×1		

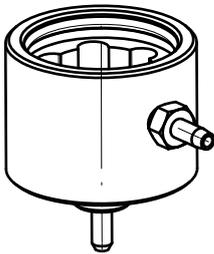
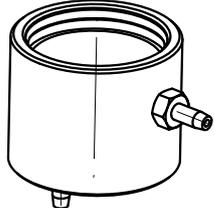
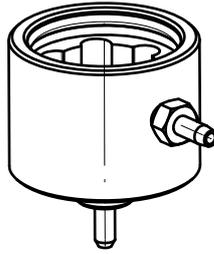
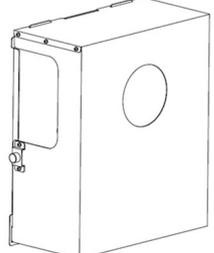
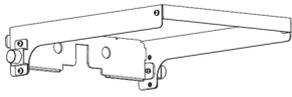
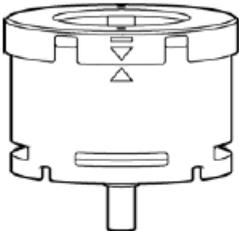
NOTE

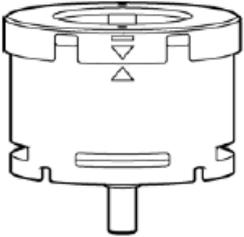
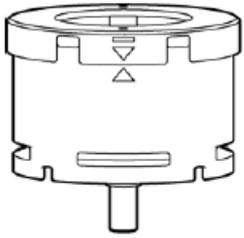
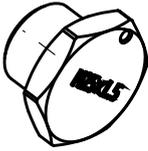
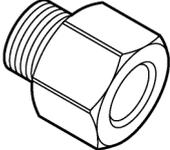
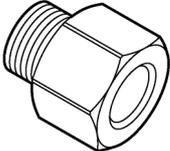
- ▶ The quantity of control keys and hex key wrenches included will vary depending on the quantity of product units ordered.
 - 1 - 10 units: ×1
 - 11 - 20 units: ×2
 - 21 - 50 units: ×3
 - 51 or more units: ×4

**CAUTION**

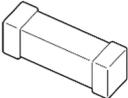
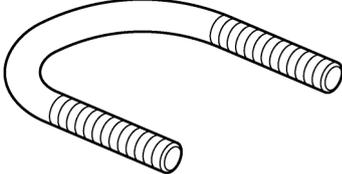
- Use the control key provided to operate the product. The product may not respond properly to commands if an object other than the supplied control key is used.
- The control key provided incorporates an extremely strong magnet. Holding the control key close to credit cards, ID cards, or other magnetized products may corrupt data recorded on these objects.

3-1-5 Optional accessories

Optional accessory	Part No.	Description
	Calibration adapter (for IRF sensor)	4283 9011 00 SD-3RI calibration adapter <Material> Body: PP Nipple: Stainless steel/Teflon
	Calibration adapter (for combustible gas sensor)	4283 9012 70 SD-3NC/GH/GHS/SP calibration adapter <Material> Body: PP Nipple: Stainless steel/Teflon
	Calibration adapter (for ESF sensor)	4283 9013 40 SD-3EC/ECS/ECB calibration adapter <Material> Body: PP Nipple: Stainless steel/Teflon
	Protective cover	Wall mounting 4283 9019 80 Pole mounting 4283 9045 60 Cover to protect the SD-3 main unit <Material> SUS316
	Sunshade cover	4283 9015 90 Cover to suppress temperature rises due to direct sunlight or radiant heat <Material> SUS316
	Splash guard (for IRF sensor)	4283 9076 60 SD-3RI cover to protect sensor from water and dust The identification number "1" is engraved on the underside. <Material> Resin

Optional accessory	Part No.	Description
	Splash guard (for combustible gas sensor)	4283 9077 80 SD-3NC/GH/GHS/SP cover to protect sensor from water and dust The identification number "2" is engraved on the underside. <Material> Resin
	Splash guard (for ESF sensor)	4283 9078 50 SD-3EC/ECS/ECB cover to protect sensor from water and dust The identification number "3" is engraved on the underside. <Material> Resin
	Blanking plug	4283 9018 10 M25 × 1.5 blanking plug <Material> Equivalent to SUS316
	Adapter	4283 4081 70 Adapter to convert M25 × 1.5 screw thread to 1/2NPT screw thread <Material> Equivalent to SUS316
	Adapter	4283 4082 40 Adapter to convert M25 × 1.5 screw thread to 3/4NPT screw thread <Material> Equivalent to SUS316
	Adapter	4283 4132 20 Adapter to convert M25 × 1.5 screw thread to M20 × 1.5 screw thread <Material> Equivalent to SUS316
	Silicone removal filter (SI-8) ^{*1} (for NCF/SGF/SHF sensor)	4283 0030 20 Filter for removing trace amounts of silicone from the air. This can extend sensor life. ^{*2}

Optional accessory	Part No.	Description
	Activated carbon filter (CF-8304) ^{*1} (for NCF/SGF/SHF sensor)	4283 0040 10 Filter for removing trace amounts of silicone from the air. This can extend sensor life. The silicone removal capability of this filter exceeds that of the silicone removal filter. ^{*3} It can also be used to remove interference gases. This can minimize interference effects from gases other than the detection target gas.
	Duct mounting kit (for GD-3RI) (for GD-3NC/GH/SP) (for GD-3EC)	4262 9674 10 4262 9675 90 4262 9676 60 Kit for installing a remote sensor head (GD-3) to a duct <Material> SUS316
	Mounting angle for GD-3	4283 4319 20 This angle is used to mount the GD-3 with splash guard on the wall. <Material> SUS316
	Tag plate with wire chain	0717 0319 40 Tag plate made of SUS316. It can be attached to the enclosure of this unit.
	HART modem connector	2905 2439 10 Connector used when connecting a HART modem
	Lightning arrester (3-wire connection) (TP48-3-N-NDI)	4283 9055 50 Device to limit momentary surge voltages caused by lightning strikes
	Lightning arrester (4-wire connection) (TP48-4-N-NDI)	4283 9056 20 Device to limit momentary surge voltages caused by lightning strikes

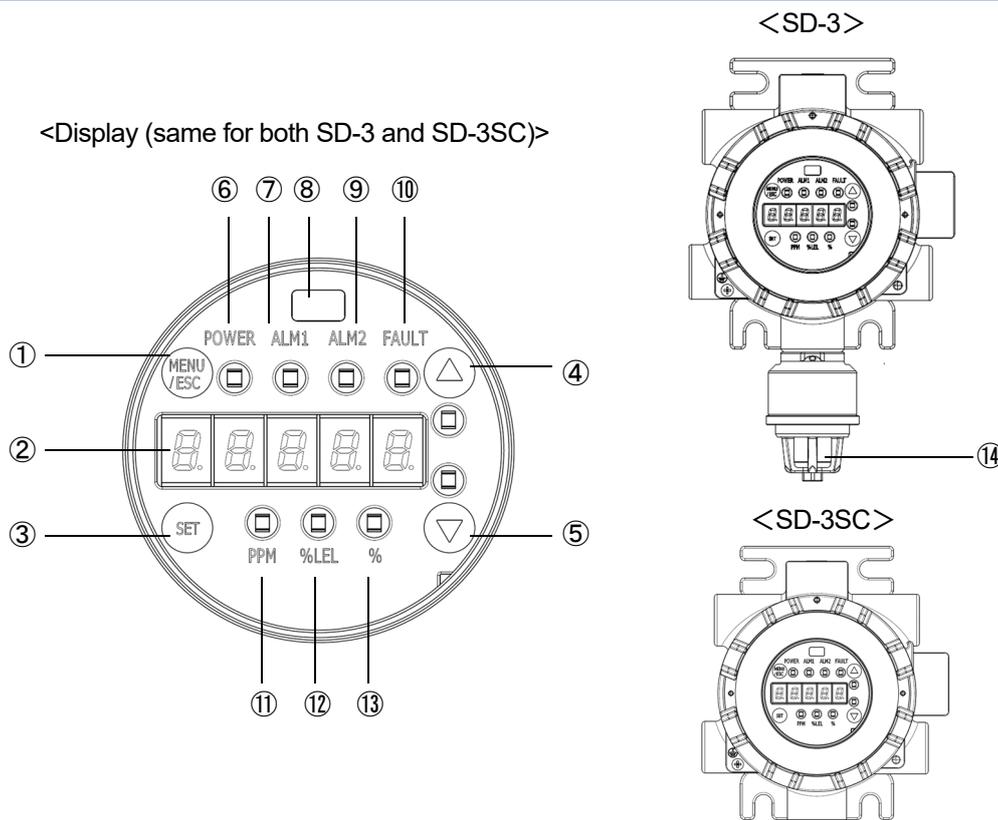
Optional accessory	Part No.	Description
	Fuse	2564 0125 10 Littelfuse's fuse (1.25 A, 100 V DC)
	U bolt	4283 9046 30 Bolt used for mounting the main unit to a pole (size: 50A (2B)) <Material> SUS316

*1: If you use a filter, we recommend fitting a splash guard.

*2: Installing the silicone removal filter will limit the target gases that can be detected.

*3: The range of target gases that can be detected will be more limited than when the silicone removal filter is fitted.

3-2 Part names and functions

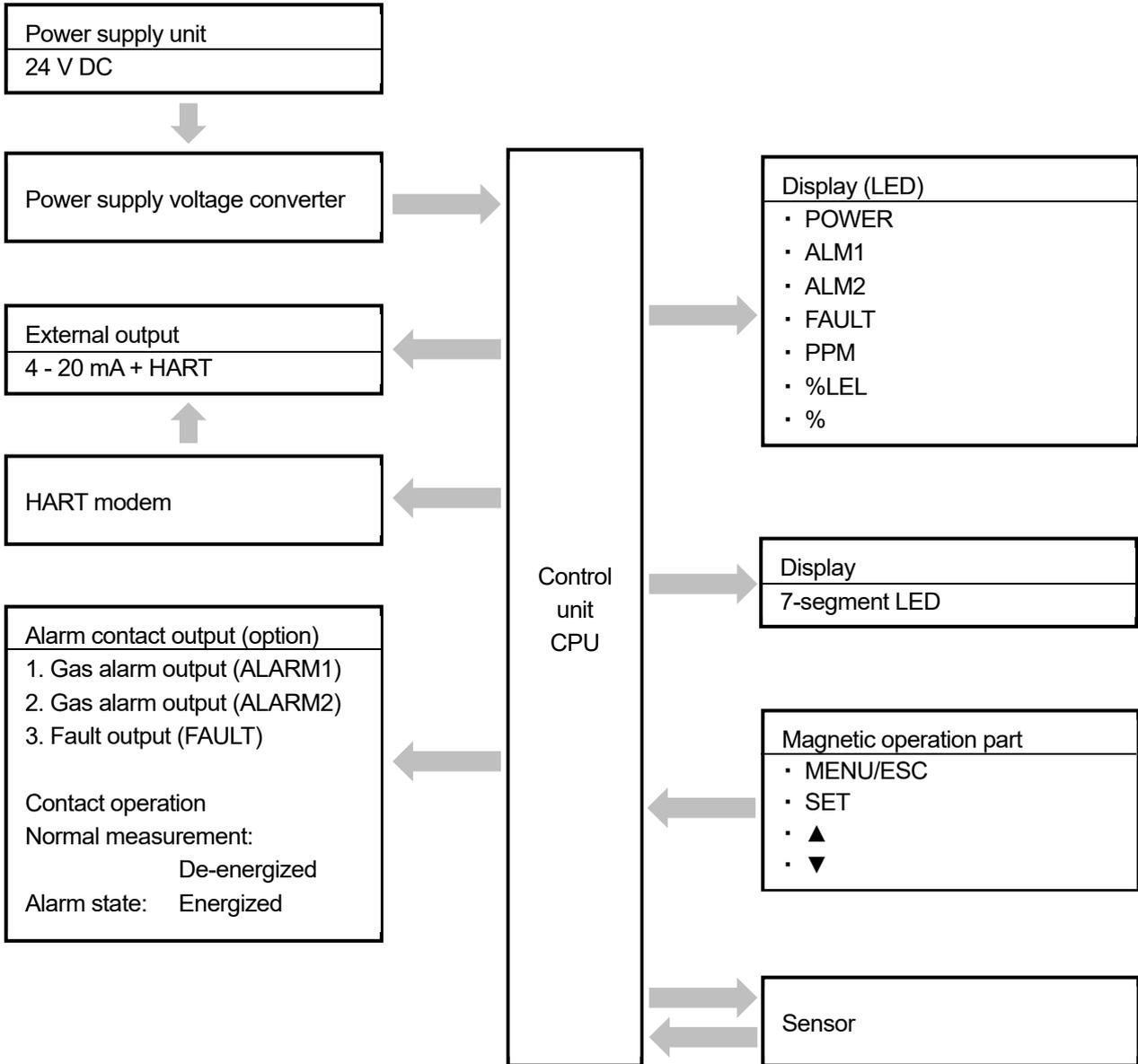


No.	Name	Function
①	MENU/ESC key	Hold down this key in detection mode to switch to user mode. In user mode and maintenance mode, this key is used to cancel a setting or return to the previous screen. Hold down this key in user mode or maintenance mode to return to detection mode.
②	7-segment LED display	Displays the gas concentration and other information.
③	SET key	Press in detection mode to display the ALM1 (first alarm) and ALM2 (second alarm) alarm setpoints. In user mode and maintenance mode, this key is used to confirm a value or select a setting.
④	▲ key	In user mode and maintenance mode, this key is used to select a setting item and adjust (increase) a value.
⑤	▼ key	In user mode, this key is used to switch menus or adjust (lower) a value. Press in detection mode to display the external output.
⑥	Power lamp (POWER)	Power lamp. Lights up in green when the power is on. The lamp flashes in green in user mode and maintenance mode.
⑦	Alarm lamp (ALM1)	ALM1 (first alarm) alarm lamp. Lights up in red when the ALM1 (first alarm) alarm setpoint is reached.
⑧	Infrared port	IrDA communication port
⑨	Alarm lamp (ALM2)	ALM2 (second alarm) alarm lamp. Lights up in red when the ALM2 (second alarm) alarm setpoint is reached.
⑩	Fault lamp (FAULT)	Fault lamp. Lights up in yellow when an abnormality is detected in the product.
⑪	PPM lamp	Lights up in green when a ppm concentration range gas concentration is displayed.
⑫	%LEL lamp	Lights up (green) when a gas concentration within the %LEL concentration range is displayed.
⑬	% lamp	Lights up in green when a vol% concentration range gas concentration is displayed.
⑭	Sensor	Incorporates a gas-detecting sensor.

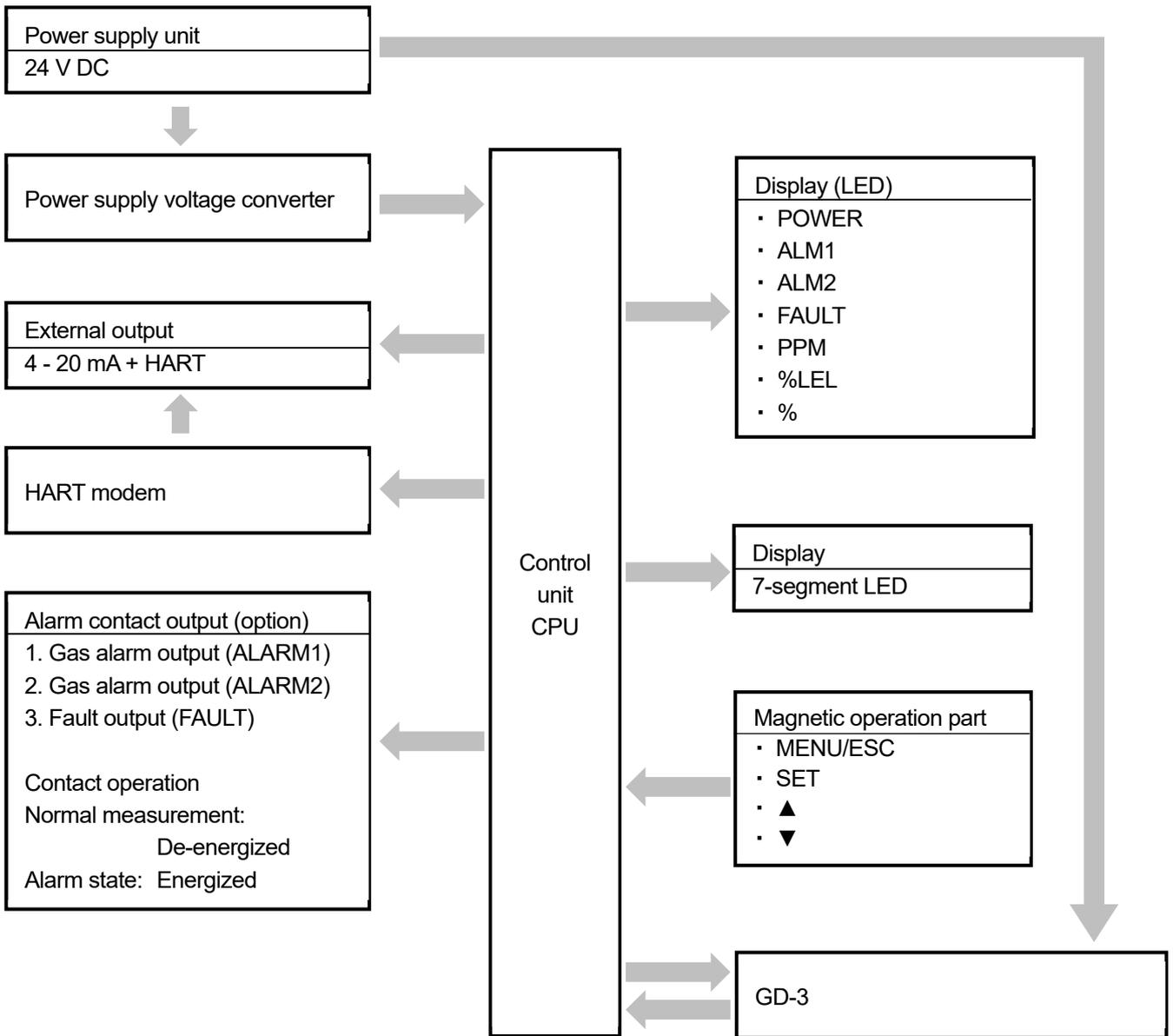
3-3 Block diagrams

The block diagrams (electrical circuit diagrams) for the product are given below.

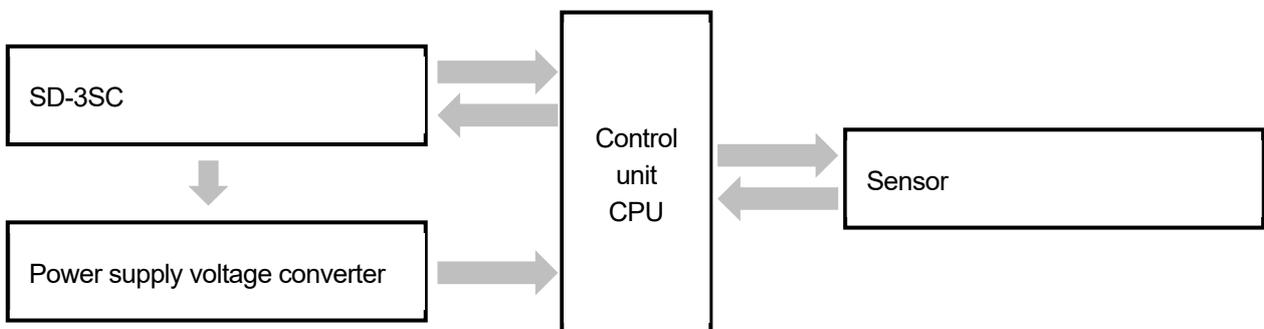
<SD-3>



<SD-3SC>



<GD-3>



4

Installation

4-1 Installation precautions

Selecting an appropriate installation location is vital for system performance.

Be sure to observe the following precautions before installing.

Failure to comply with these precautions may result in failure of the product or improper function.



CAUTION

- The product is a precision device. Certain conditions at the location (environment) where the product is installed may prevent optimum performance. Check the environment at the installation location and take all required precautionary measures depending on circumstances.
- Install the number of units needed at the appropriate locations to ensure that the product plays an important role in safety and disaster prevention.
- Areas where gas is likely to leak or accumulate will differ depending on the gas type and individual work areas. Thoroughly consider the installation locations and number of units to be installed before installation.
- Dirt, snow, mud, or external devices must not prevent gas or vapor from contacting the sensor. The protection class does not guarantee that the instrument will successfully detect gases during and after exposure to these conditions. Check the operation and calibrate the instrument if it has been exposed to dust deposits, submersion, or high pressure water.
- The recommended installation orientation of the detector is with the sensor facing downward. Other orientations are acceptable if the sensor is protected from mechanical damage, dirt, and water intrusion.
- Use genuine special accessories.

4-1-1 General installation information

Observe the following precautions when installing the product:

- If the product is installed in a location where the ambient temperature exceeds 65 °C, use cables designed for use at temperatures at least 5 °C above the maximum anticipated ambient temperature.
- The SD-3 and SD-3SC main units each have two M25 × 1.5 connectors for use when wiring in the field. Connectors must always be blanked off with blanking plugs when not in use.
- The GD-3 has two M25 × 1.5 connectors for connecting the SD-3SC. The connector not in use must be blanked off with a blanking plug at all times.
- Do not mount a sensor that uses a different detection principle from the model type.
- Use ferrules on the ends of stranded cables.
- Secondary circuits should be supplied from an insulated source. (Not suited to alarm relay contacts)
- If installing without using conduits, use cable glands that comply with the explosion-proof certification. In addition, connect cable shielding to the main unit, cable glands, and indicators to increase immunity to electromagnetic noise and other external factors.
- Select the cable, terminal plate, and other parts for wiring to alarm relays (optional) to suit the rated voltage, current, and environmental conditions.

In addition, carefully consider the following points when installing:

- All possible effects on the installation of the gas detector system
- Restrictions and regulations concerning the installation of the gas detector system
- Regulations concerning the operation, power supply, and signal cable connections for the gas detector system
- Ambient environmental effects to which the gas detector system may be subject
- Specifics of the physical characteristics, environmental air movement and flows, and latent leaks of the detection gas
- Accessibility for required maintenance and the shape of the accessories used

4-1-2 Restrictions regarding installation

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

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

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

Avoid installing in locations that pose the risk of splashing liquids such as water, oil, and chemicals. Deploy the optional protective cover (main unit protection) and splash guard (sensor protection) if the product must be installed in a location where it may be exposed to these factors.

<Do not install in locations where temperatures exceed the operating temperature range.>

For information on the product operating temperature range, refer to '10-3. Detection target gases for individual detection principles'.

Install in a stable location where temperatures do not exceed the operating temperature range during use.

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

Install away from locations subject to direct sunlight or radiant heat (infrared radiation from high temperature bodies) and locations subject to sudden temperature changes. Failure to do so may expose the product to temperatures that exceed specified thresholds, internal condensation, or rapid temperature fluctuations the product cannot handle.

Use of the optional sunshade cover is recommended when using the product in locations subject to direct sunlight.

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

The product requires periodic maintenance.

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

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

<Do not install in improperly grounded system housings.>

When installing in a system housing, be sure to implement a Class D-equivalent ground connection.

<Do not install in the presence of miscellaneous gases.>

Do not install in locations where the following gases are present:

Sensor type	Gases affecting sensor sensitivity	Sensor-corroding gases
SGF	<ul style="list-style-type: none"> • Organic silicone gas (e.g., D4 siloxane, D5 siloxane) • Sulfur gases (e.g., SO_x, H₂S) • Polymerization substances (ethylene oxide, acrylonitrile, butadiene, styrene, etc.) • Catalyst poison (phosphorus compounds, halogenated hydrocarbons, metal vapor, etc.) • The degree of influence depends on the sensor model. 	<ul style="list-style-type: none"> • Corrosive gases (e.g., SO_x, NO_x) • Acid gases (e.g., HF, HCl)
SHF		
NCF		
IRF	None	
ESF	None	None

<Precautions when installing in the presence of interference gases>

Take care when installing in locations where the following interference gases are present:

Sensor type	Interference gas
SGF	Hydrocarbons, alcohols, organic solvents, etc. other than the target gas
SHF	
NCF	Hydrocarbons, alcohols, organic solvents, etc. other than the target gas
IRF	Combustible gas sensor: Hydrocarbons, alcohols, organic solvents, etc. other than the target gas CO ₂ sensor: CO, N ₂ O, NO, etc.
ESF	Differs depending on sensor. (e.g., H ₂ with CO sensor)

<Use the appropriate power supply and power cable.>

The product requires a 24 V DC (18 V - 30 V DC) power supply to operate. The power cable used should have a cross section of 1.308 mm² (AWG16) or 2.082 mm² (AWG14). Use shielded 3-core or 4-core cable.

For the installation of cables and power supply

Due to the resistor value of the cable, a voltage drop occurs, causing the actual voltage supply to SD-3 (at the SD-3 terminal) to be lower than the voltage supply at the power source. Because of this, when the voltage drop by the cable causes the actual voltage supply to become below 18VDC, the voltage supply at the power source needs to be increased.

This voltage drop is determined by the type and length of the cable, ambient temperature, as well as the current consumption value of SD-3.

The current consumption value of SD-3 varies depending on the sensor type and the alarm relay state in the SD-3.

<How to obtain the voltage supply at the power source -1>

Use the equation below to obtain the voltage supply value at the power source.

Voltage supply at the power source

$$= A (\text{Current consumption of SD-3}) \times B (\text{Resistor value of the cable to be installed}) + 18V$$

A: Current consumption of SD-3

Choose from the list below. (@18V)

Type	Current consumption (max.)	Remarks
SD-3RI	170mA	
SD-3NC	200mA	
SD-3EC	140mA	
SD-3ECS	140mA	
SD-3ECB	150mA	
SD-3GH	200mA	
SD-3SP	160mA	
SD-3SC + GD-3RI	180mA	
SD-3 SC + GD-3NC	220mA	
SD-3 SC + GD-3EC	150mA	
SD-3 SC + GD-3ECS	150mA	
SD-3 SC + GD-3ECB	160mA	
SD-3 SC + GD-3GH	220mA	
SD-3 SC + GD-3SP	180mA	

B: Resistor value of the cable to be installed

The maximum resistor value can be determined by the type and length of the cable to be installed,

and the upper limit of the operating temperature.

e.g.)

A: The maximum current consumption value = 170 mA (SD-3RI)

B: The maximum resistor value of the cable to be installed = 24Ω (CVV-S, 1.308 mm², 1250m, @70°C)

$$\begin{aligned} \text{Voltage supply at the power source} &= 170\text{mA} \times (24\Omega \times 2) + 18\text{V} \\ &= 8.16\text{V} + 18\text{V} \\ &= 26.16\text{V} \quad (\text{or higher}) \end{aligned}$$

<How to obtain the voltage supply at the power source -2>

When the method in 1 cannot be applied because the type and length of the cable to be installed is unknown, or to make sure if the voltage calculated in 1 poses no problem for the actual voltage to supply, use this method described here.

Alarm test is performed under the following conditions (refer to 7-3-2 Performing alarm test).

- Set the contact action ON.

Press ▲ key to increase the indicator until it reaches full scale over (nnnn), and when that happens, make sure that the voltage of the SD-3 terminal block is over 18VDC.

Fault test is performed under the following conditions (refer to 7-3-3 Performing fault test).

- Set the Fault test ON.

When that happens, make sure that the voltage of the SD-3 terminal block is over 18VDC.

If it's below 18VDC, then increase the voltage supply at the power source. If the temperature at this point increases during the operation, give enough margin to the voltage supply by compensating the voltage drop caused by the increase of the cable resistor value.

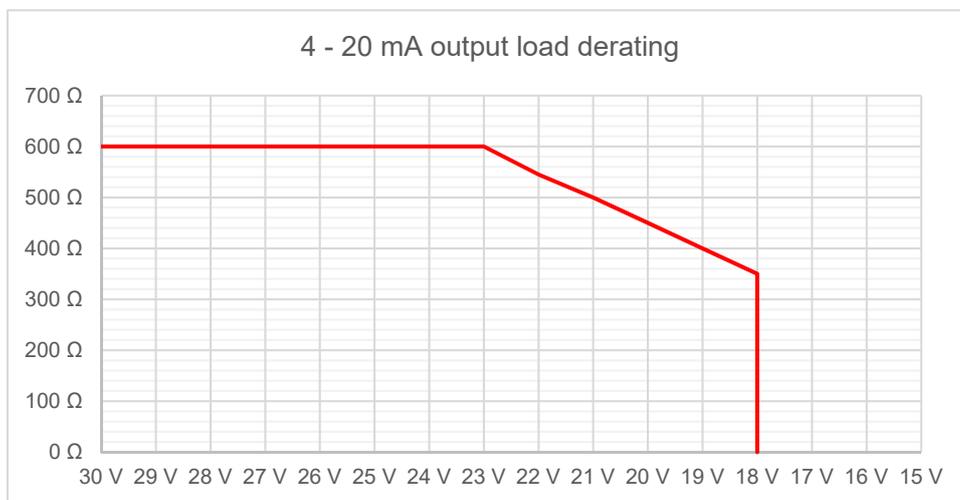
<Install away from noise-emitting devices (main unit and cables).>

Install away from locations where high-frequency or high-voltage devices are present. Failure to do so may result in electromagnetic interference.

<Use the appropriate impedance for the 4 - 20 mA signal output.>

The impedance for the 4 - 20 mA signal output must not exceed 600 Ω to ensure correct operation. This will vary depending on the voltage supplied to the product. The maximum and minimum impedance specified must be satisfied, based on factors such as product operating voltage and interface (HART).

<4 - 20 mA signal output impedance derating depending on supply voltage differences>



<4 - 20 mA signal output impedance range when using HART communication>

Devices equipped with a HART interface can be operated via HART communication or HART multidrop mode.

Operating mode	Signal impedance range for power supply voltage
Operation without HART communication	Max. 300 Ω at 18 V DC Linear increase to max. 600 Ω at 23 V DC
Operation with HART communication (HART mode)	Min. 250 Ω in range 18 V - 30 V DC
	Max. 300 Ω at 18 V DC Linear increase to max. 600 Ω at 23 V DC
HART multidrop operation	250 Ω to 600 Ω in range 18 V - 30 V DC

<Use alarm contacts correctly.>

The alarm contacts on the product are used to transmit signals for operating external buzzers, alarm indicator lamps, or revolving lights. Never use for controls on which human life depends or other mission critical controls (e.g., shutoff valve controls).

Check contact opening and closing periodically, including during regular maintenance. Contacts may not function correctly under certain operating conditions if left inactive for extended periods.

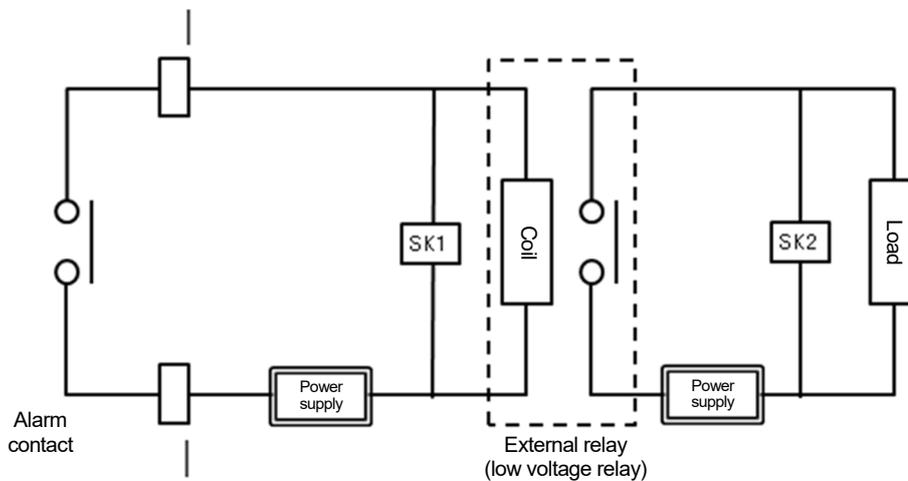
The alarm contact specifications for the product apply under resistance load conditions. If inductive loads occur at the alarm contacts, a counter-electromotive force will be generated at the contacts, leading to the following potential problems:

- Alarm relay contact welding, insulation failure, contact failure
- Damage to electrical components due to high voltage inside the product
- Malfunctions due to CPU runaway

If the product is used to operate loads, take the following measures to stabilize product operations and protect the alarm contacts:

- Use an external relay (low voltage, not exceeding 100 V AC) to link the circuits (contact amplification). Add a surge absorber (SK1) appropriate for the rating to the external relay.
- Where necessary, add a surge absorber (SK2) on the load side of the external relay.
- Depending on the load conditions, it may be better to add the surge absorber to the contact side. Check load behavior to determine the optimal location.

<SD-3>



* SK1, SK2: Surge absorbers

**DANGER**

- Never use for controls on which human life depends or other mission critical controls (e.g., shutoff valve controls).
-

**WARNING**

- Contacts may not function correctly if left inactive for extended periods. Check contact opening and closing periodically.
 - Contact faults may occur if exposed to organic gases or sulfidizing gases for extended periods.
 - In principle, do not use the alarm contacts of the product to operate inductive loads. In particular, never use to operate devices like fluorescent lamps and motors.
 - If operating inductive loads is absolutely unavoidable, link the circuits using an external relay (contact amplification). Since the external relay coil constitutes another inductive load, use a relay operating at low voltage (under 100 V AC), and protect the product contacts with a suitable surge absorber (e.g., CR circuit).
 - Do not use in atmospheres where silicone is present.
-

**CAUTION**

- A de-energized b contact (break contact) may result in momentary opening in the event of an external force or other physical impact. If a b contact is used as an alarm contact, implement measures to account for such momentary operations—for example, by adding a delay operation (of approximately one second) to the signal on the b contact receiving side.
-

4-2 System design precautions

Consider the following precautions when designing a system in which the product is used:



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

4-2-1 Using a stable power supply

The product's external output and alarm contacts may activate as the system stabilizes when the power is turned on or right after an instantaneous power failure. If external output and alarm contacts activate due to power failures or other reason, use a UPS (uninterruptible power system) or take other appropriate measures. The product should be powered using a power supply specified below.

Power supply voltage	24 V DC (18 V - 30 V DC): Main unit terminal voltage	
Time allowed for instantaneous power failures	Up to approx. 20 ms ^{*1}	Typical action: Use an external uninterruptible power supply or similar system to guarantee continuous operation and functionality.
Miscellaneous	Do not use with power supplies subject to very high power loads or high frequency noise.	Typical action: Where necessary, use a line filter or other device. Keep the product away from sources of noise.

*1: Restart the product when recovering after instantaneous power failures of 20 ms or more.

4-2-2 Lightning strike protective measures

In factories or plants where cabling is configured as follows, damage may result in the event of lightning strikes due to the cables connected to the devices acting as a receiving antenna for the lightning:

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

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

<Lightning strike protective measures>

Implement appropriate measures based on environmental conditions and the importance of the facility. A lightning arrester (cable protector) can be installed before the field devices and central processing equipment as a safeguard against inductive lightning surges transmitted through the cables. For information on how to use lightning arresters, please contact the manufacturer.

<Grounding>

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

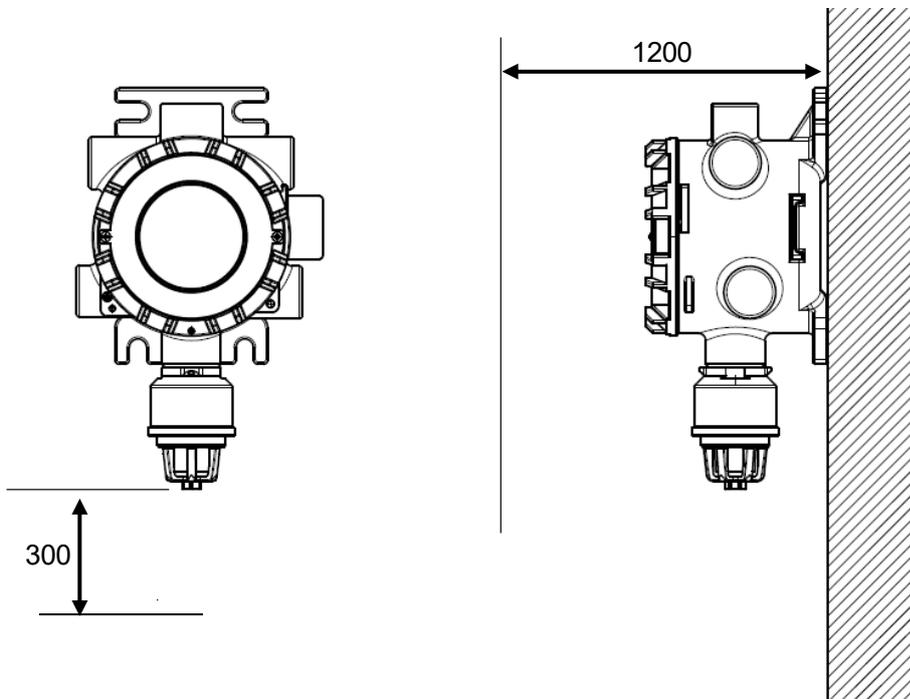
NOTE

- ▶ Lightning arresters contain circuitry to remove voltage surges that could damage field devices. Installing lightning arresters may therefore cause signal attenuation. Perform an operation check before installing a lightning arrester. Also note that lightning arresters cannot remove all voltage surges.

4-3 Providing maintenance space

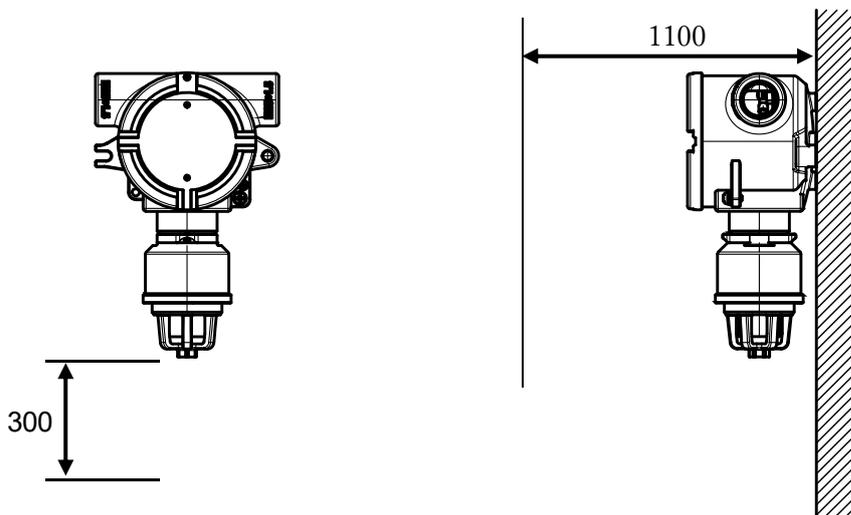
When mounting the product, allow space to open and close the covers during maintenance.

<Main unit (SD-3/SD-3SC)>



*The diagram illustrates the SD-3. The maintenance space for the SD-3SC is identical.

<Remote sensor head (GD-3)>





The product requires periodic maintenance.

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

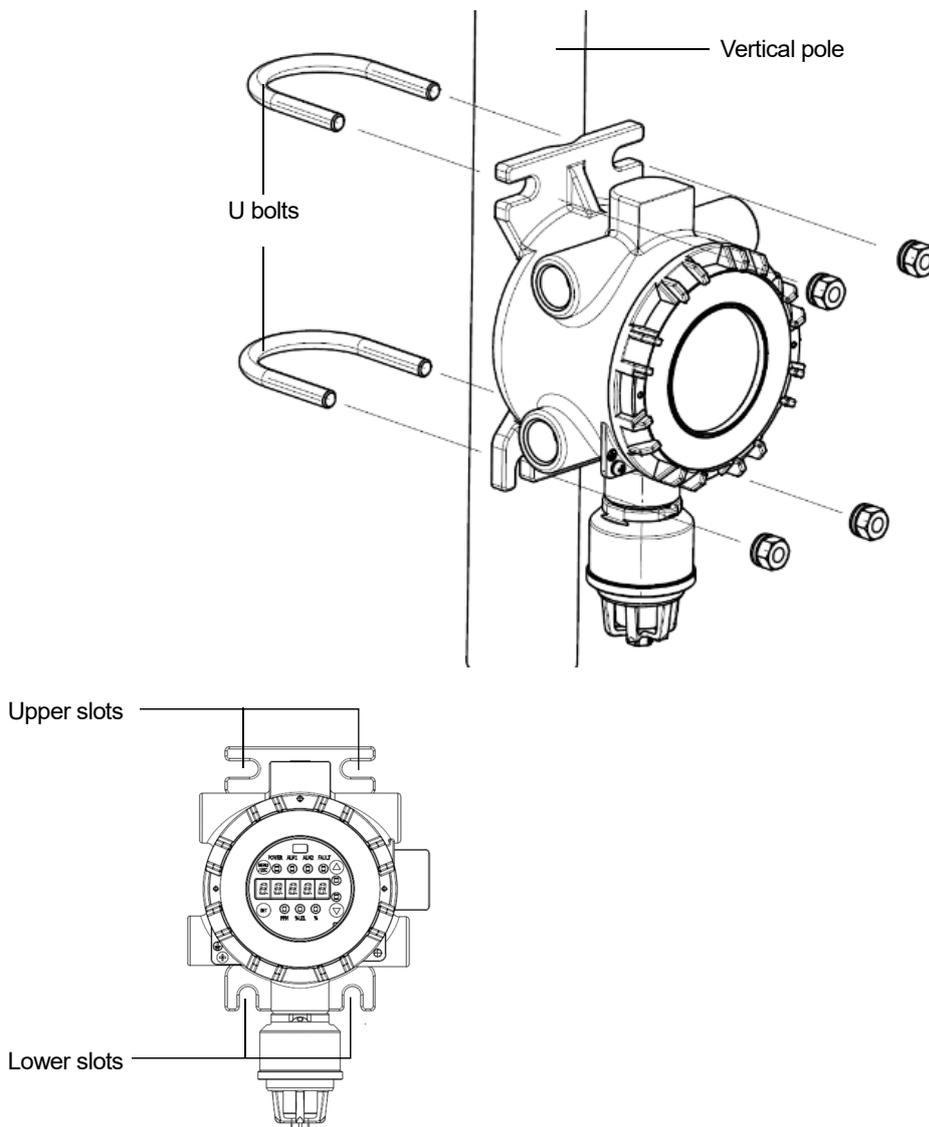
- Locations such as within systems that must be stopped for maintenance
 - Locations where part of the system must be detached to allow maintenance
 - Locations where the product cannot be removed due to the presence of pipes or racks
 - Locations where maintenance work is hazardous—for example, close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

4-4 Main unit installation

4-4-1 Vertical pole mounting

Mount the main unit (SD-3/SD-3SC) to a vertical pole (size: 50A (2B)) using two U bolts.

- 1 Fit one U bolt around the vertical pole and through the upper slots on the main unit.
- 2 Secure the U bolt to the main unit with two washers, two spring washers, and two M10 nuts.
- 3 Fit the second U bolt around the vertical pole and through the lower slots on the main unit.
- 4 Secure the U bolt to the main unit with two washers, two spring washers, and two M10 nuts.

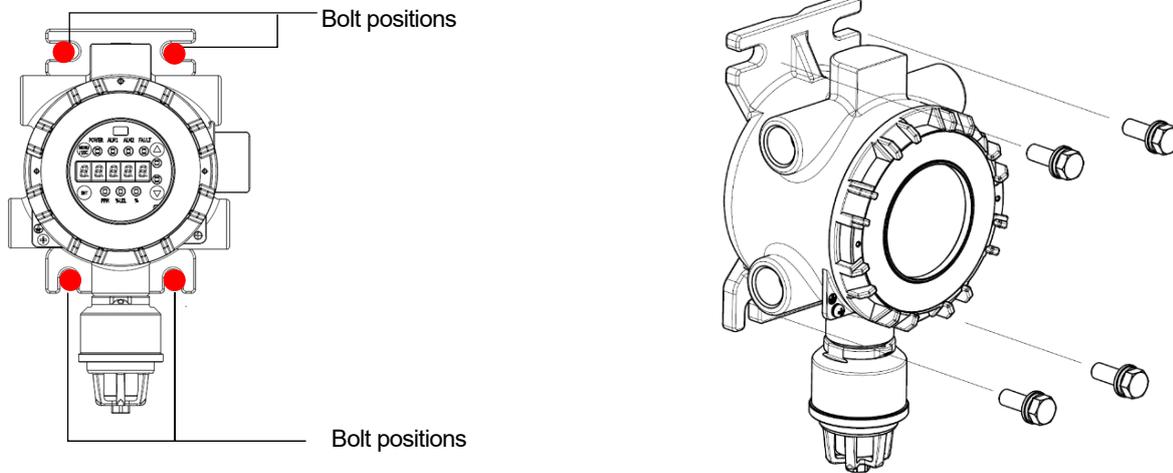


*The diagram illustrates the SD-3. The mounting method for the SD-3SC is identical.

4-4-2 Wall mounting

Mount the main unit (SD-3/SD-3SC) to a wall.

- 1 Place the main unit against the wall surface and secure with four M10 double SEMS bolts.



*The diagram illustrates the SD-3. The mounting method for the SD-3SC is identical.

CAUTION

The product requires periodic maintenance.

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

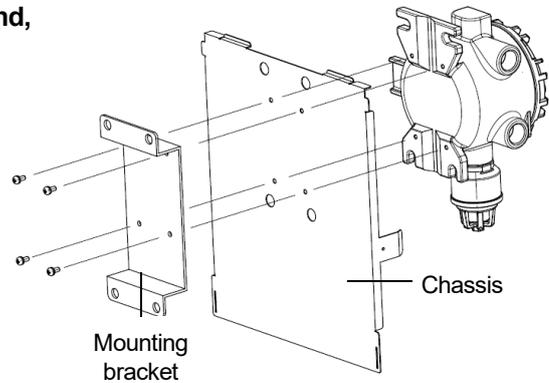
- Locations such as within systems that must be stopped for maintenance
- Locations where part of the system must be detached to allow maintenance
- Locations where the product cannot be removed due to the presence of pipes or racks
- Locations where maintenance work is hazardous—for example, close to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

4-4-3 Attaching protective cover

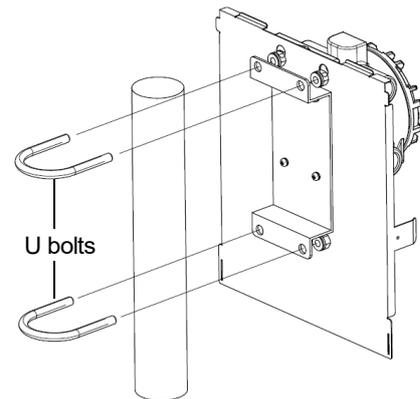
Attach the protective cover to the main unit (SD-3/SD-3SC).

<Pole mounting (pole size: 50A (2B))>

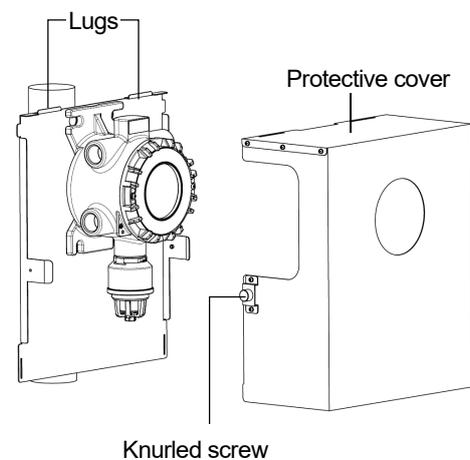
- 1 **Attach the chassis and mounting bracket to the main unit. Secure with four M5 × 6 double SEMS bolts from behind, as shown in the diagram to the right.**



- 2 **Fit one U bolt around the vertical pole and through the upper slots on the main unit. Secure with two washers, two spring washers, and two M10 nuts.**
- 3 **Fit the second U bolt around the vertical pole and through the lower slots on the main unit. Secure with two washers, two spring washers, and two M10 nuts.**



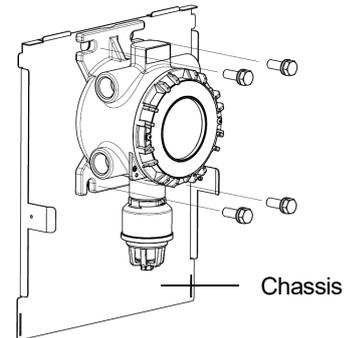
- 4 **Attach the protective cover, aligning it with the two lugs at the top of the chassis.**
- 5 **Secure the protective cover in place by tightening the knurled screws on either side of the cover.**



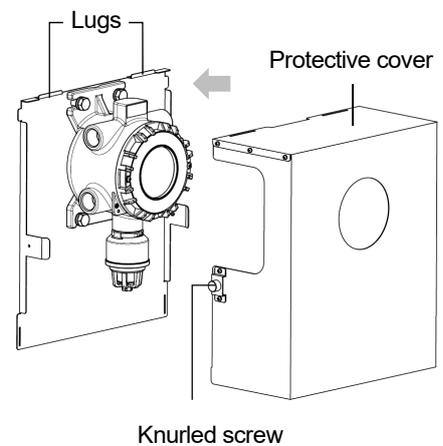
*The diagram illustrates the SD-3. The mounting method for the SD-3SC is identical.

<Wall mounting>

- 1 Secure the main unit and chassis with four M10 double SEMS bolts.**



- 2 Attach the protective cover, aligning it with the two lugs at the top of the chassis.**
- 3 Secure the protective cover in place by tightening the knurled screws on either side of the cover.**



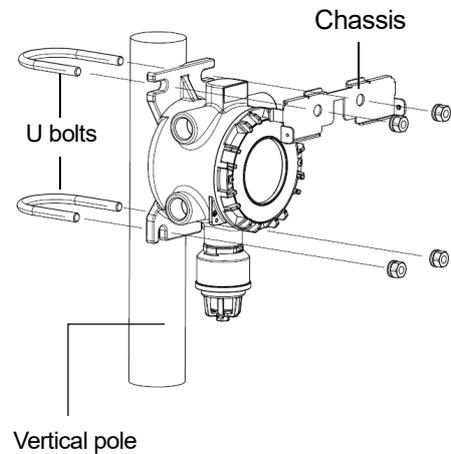
*The diagram illustrates the SD-3. The mounting method for the SD-3SC is identical.

4-4-4 Attaching sunshade cover

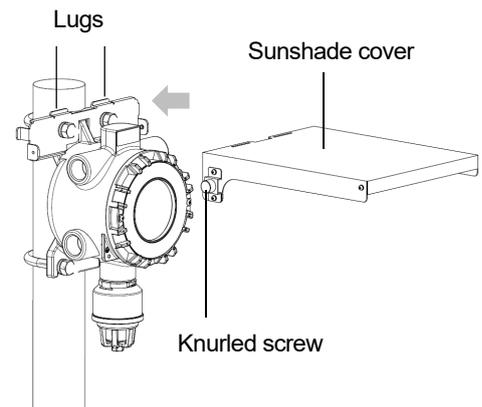
Attach the sunshade cover to the main unit (SD-3/SD-3SC).

<Pole mounting (pole size: 50A (2B))>

- 1 Fit one U bolt around the vertical pole and through the upper slots on the main unit. Secure with the chassis, two washers, two spring washers, and two M10 nuts.
- 2 Fit the second U bolt around the vertical pole and through the lower slots on the main unit. Secure with two washers, two spring washers, and two M10 nuts.



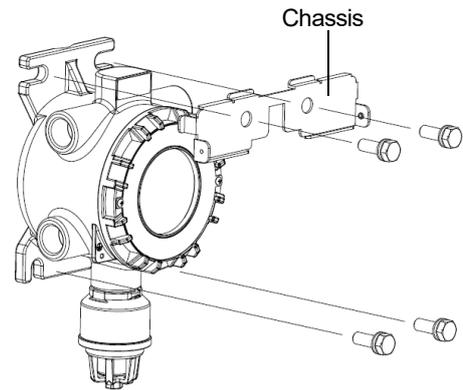
- 3 Attach the sunshade cover, aligning it with the two lugs at the top of the chassis.
- 4 Secure the sunshade cover in place by tightening the knurled screws on either side of the cover.



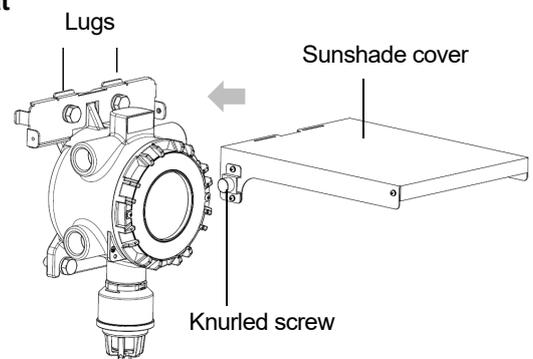
*The diagram illustrates the SD-3. The mounting method for the SD-3SC is identical.

<Wall mounting>

- 1 **Secure the main unit and chassis with four M10 double SEMS bolts.**



- 2 **Attach the sunshade cover, aligning it with the two lugs at the top of the chassis.**
- 3 **Secure the sunshade cover in place by tightening the knurled screws on either side of the cover.**

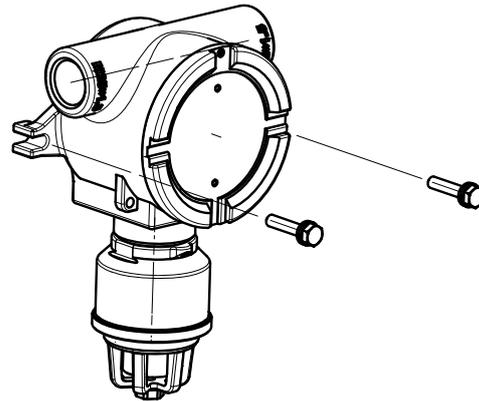
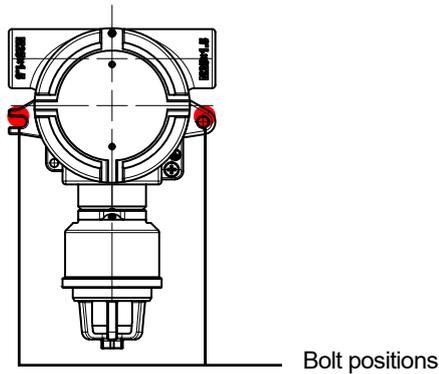


*The diagram illustrates the SD-3. The mounting method for the SD-3SC is identical.

4-5 Remote sensor head (GD-3) installation

4-5-1 Wall mounting

- 1 Place the remote sensor head (GD-3) against the wall surface and secure with two M6 double SEMS bolts.

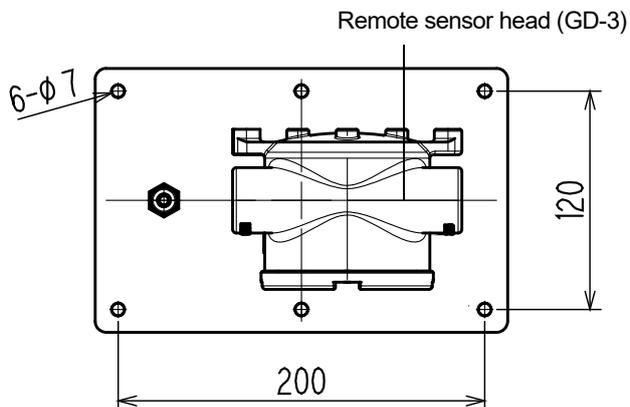


4-5-2 Duct mounting

Attach the remote sensor head (GD-3) to a duct.

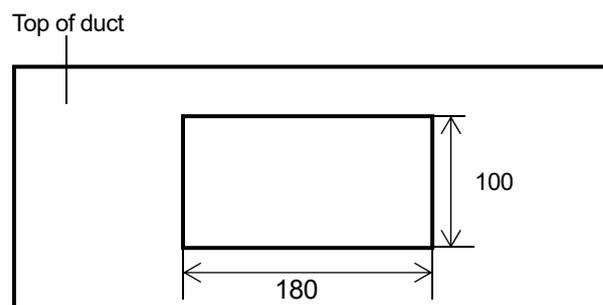
Attach to a duct using the duct mounting kit.

The duct mounting kit has the following dimensions:



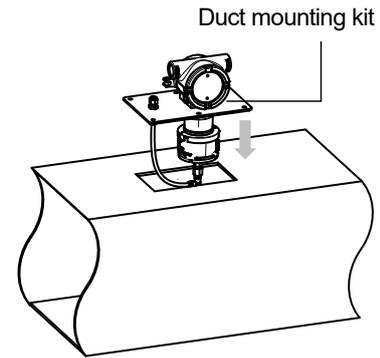
- 1 Cut out an opening in the top of the duct.

Refer to the diagram to the right for the dimensions of the opening.

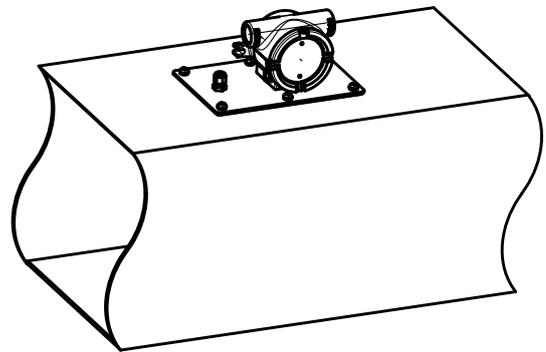
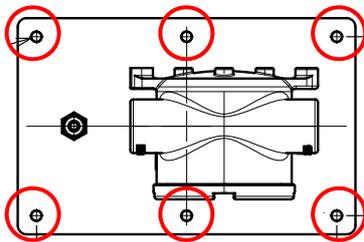


2 Insert the remote sensor head (GD-3) into the duct mounting kit and secure with four M5 bolts.

Connect a tube to the sensor on the remote sensor head (GD-3) to enable calibration. The tube should protrude from the top of the duct mounting kit.

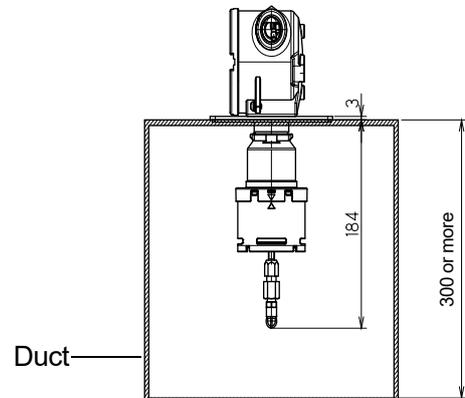


3 Insert the duct mounting kit into the opening in the duct. Secure in place with six M6 bolts.



NOTE

- ▶ When mounting the remote sensor head (GD-3) inside a duct, make sure the sensor is not in contact with the duct inner wall.
- ▶ In the duct-mounted version, for external gas calibration, make a piping connection between the guard attached to the sensor section and the duct-mounted gas IN.



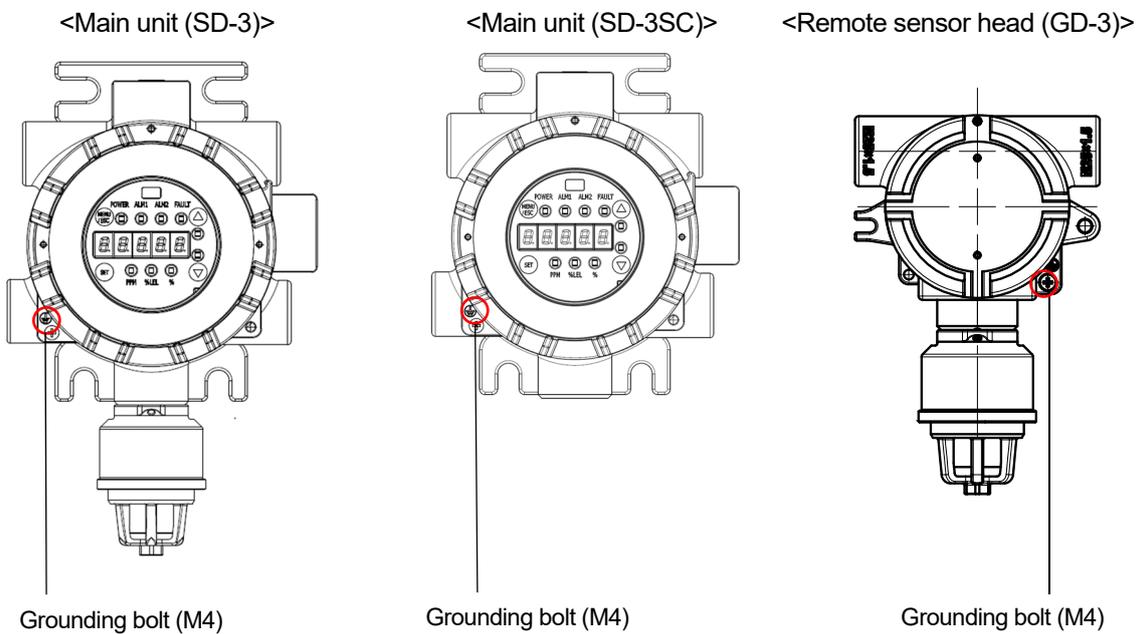
4-6 Connecting the grounding terminal



WARNING

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

Connect the grounding bolt to the local grounding terminal.



NOTE

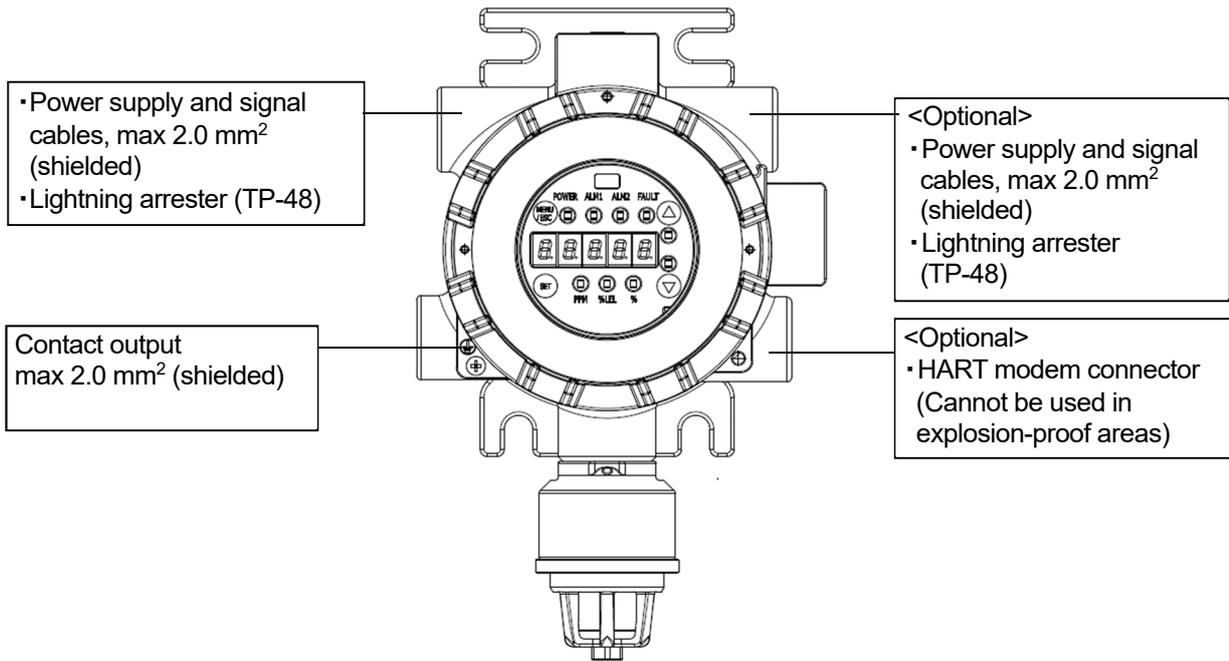
- ▶ The grounding bolt is marked with the  symbol.

4-7 Connecting the power and signal cables

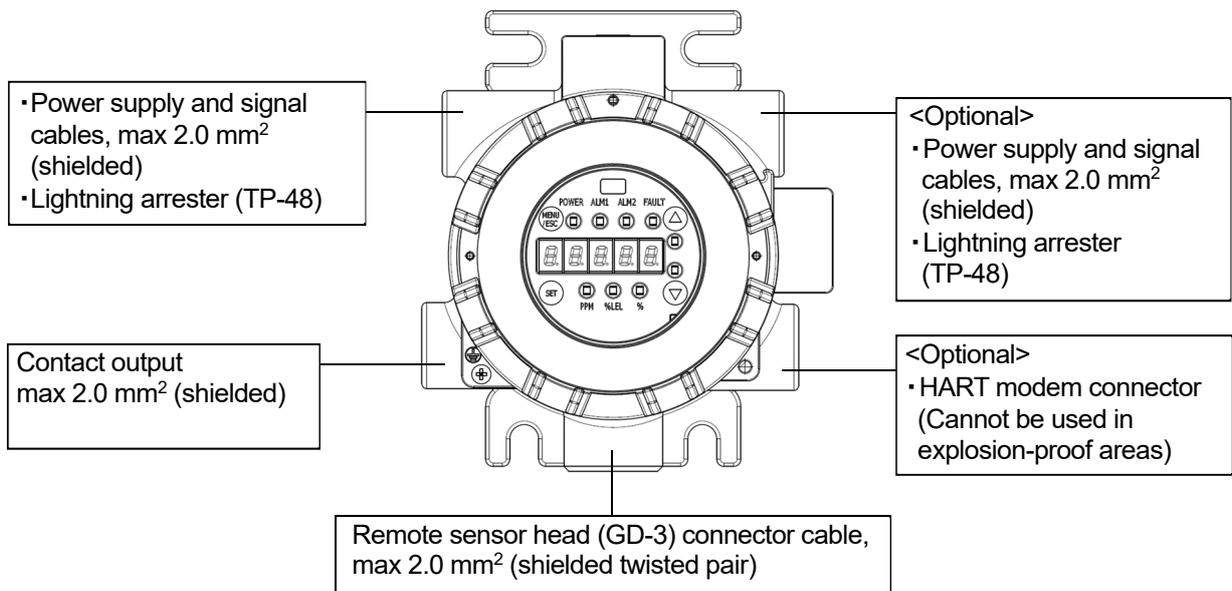
4-7-1 Main unit cable and device connectors

The cable and device connectors on the main unit are as follows:

<SD-3>



<SD-3SC>



NOTE

- ▶ Use the approved cable glands when connecting the remote sensor head (GD-3).
 - ▶ Up to two external cable connectors can be used at the same time (excluding the remote sensor head (GD-3) connector cable). Use the approved cable glands for the connection.
 - ▶ Blank off unused connectors with blanking plugs.
 - ▶ Do not use more than one adapter per connector.
 - ▶ Do not use an adapter together with a blanking plug.
-

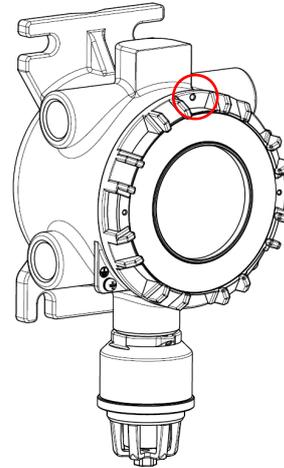
4-7-2 Connecting the power and signal cables to the main unit

Connect the power cable, signal cable, and contact cables to the main unit (SD-3/SD-3SC).

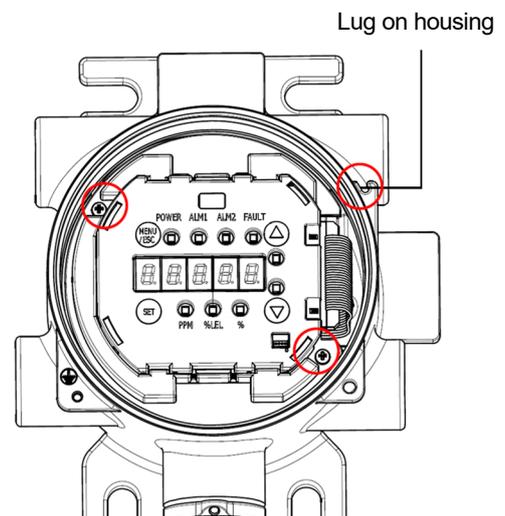
- 1 Unscrew the M4 hex socket set screw on the main unit cover, then rotate the cover counterclockwise to remove.**

Use a hex key wrench (2 across flats) to unscrew the M4 hex socket set screw.

Be careful to avoid dropping the cover while unscrewing and removing it.



- 2 Unscrew the two M3 screws securing the display unit.**



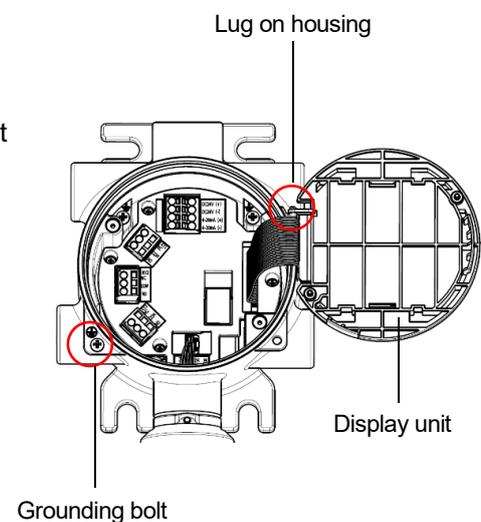
- 3 Pull out the display unit and hang on the lug on the housing.**

The display unit is connected to the terminal plate unit by a flat cable. Pulling with excessive force may disconnect the cable.

During the removal process, avoid pulling on the display unit with excessive force.

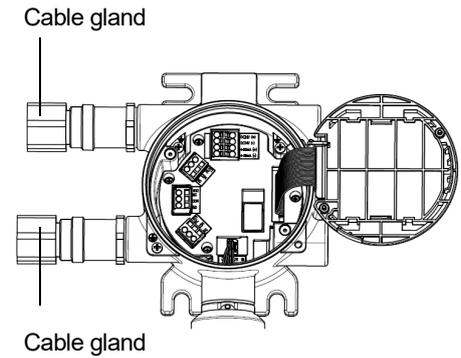
- 4 Ground the main unit.**

Make sure the grounding is Class D equivalent (grounding resistance not exceeding 100 Ω). For information on grounding, refer to '4-6 Connecting the grounding terminal'.



5 Attach cable glands or conduits to the connectors on the main unit.

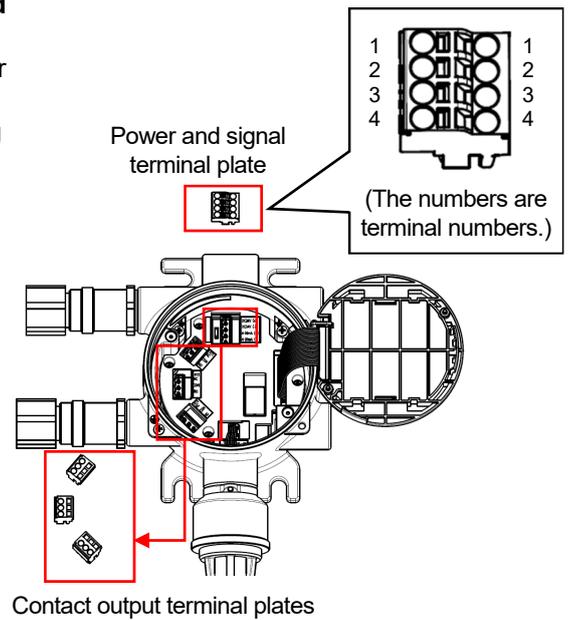
Use appropriate cable glands or conduits to suit the purpose and type of the cable.



6 Pull out the terminal plates from the terminal plate board.

7 Connect the power and signal cables to the power and signal terminal plate.

Connect the cables to the following terminals on the power and signal terminal plate. For more information on the contact cable connections, refer to '4-9 Alarm relay setting (option)'. For information on connecting cables to the terminal plate, refer to '4-7-5 Connecting cables to the terminal plate'.

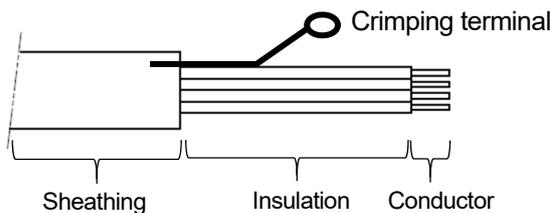


<Using 3-core cable>

Terminal No.	Power/signal cable connection
1	Power supply (+)
2	Common (power supply (-), signal (-))
3	Signal (+)

<Using 4-core cable>

Terminal No.	Power/signal cable connection
1	Power supply (+)
2	Power supply (-)
3	Signal (+)
4	Signal (-)



Recommended insulation length: 40 - 50 mm

When connecting cables, connect the cable shielding to the terminals at the top left or top right on the inside of the main unit.

Depending on the installation location, noise interference may result. If this happens, remove the shielding.

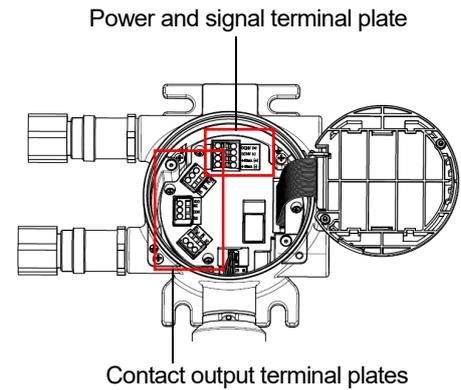
8 Connect the required number of contact cables to the contact output terminal plates.

For information on connecting cables to the terminal plate, refer to '4-7-5 Connecting cables to the terminal plate'.

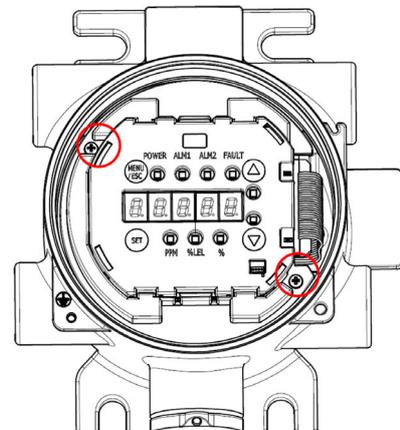
*No contact output terminal plate is present with the no contact output option.

9 Mount the terminal plates on the terminal plate board.

Adjust the cable position so that no load is applied to the terminal plates.

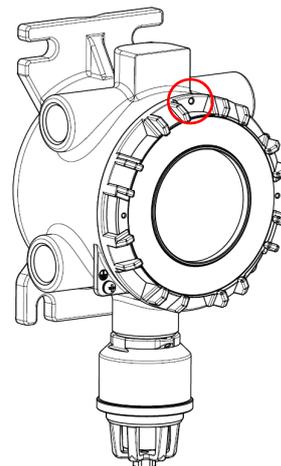
**10 Return the display unit to its original position and secure with the two M3 screws.**

Take care not to trap the cable here.

**11 Rotate the cover clockwise to attach and secure with the single M4 hex socket set screw.**

Use a key wrench (2 across flats) to tighten the M4 hex socket set screw.

Take care not to trap the cable when attaching the cover. Rotate the cover clockwise until it moves no further to securely fasten in place.



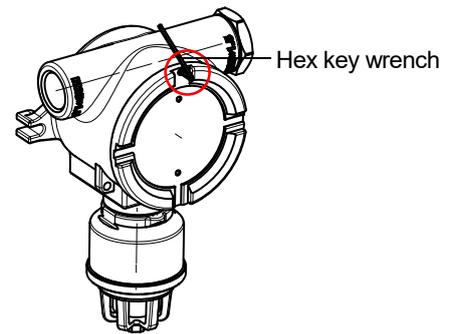
*The diagram illustrates the SD-3. The connection method for the SD-3SC is identical.

4-7-3 Connecting the power and signal cables to the remote sensor head (GD-3)

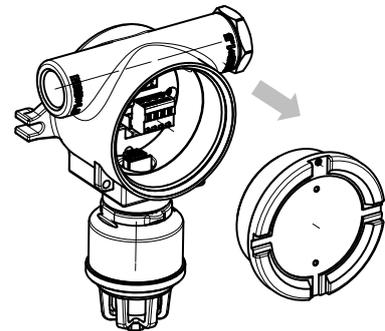
1 Unscrew the single M4 screw on the remote sensor head (GD-3) cover.

Use a hex key wrench (2 across flats) to unscrew the M4 hex socket set screw.

Be careful to avoid dropping the cover while unscrewing and removing it.

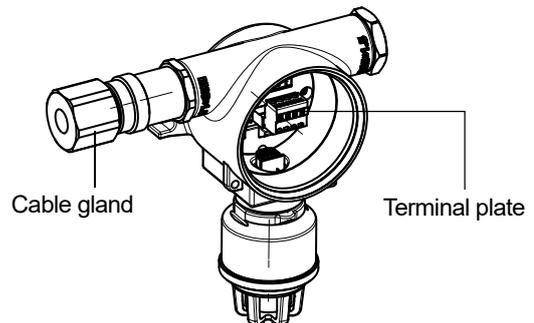


2 Rotate the cover counterclockwise and remove.

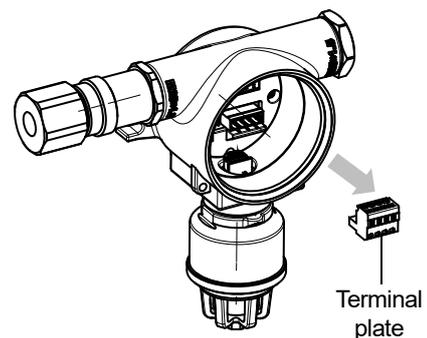


3 Attach a cable gland or conduit to the connector on the remote sensor head (GD-3).

Use an appropriate cable gland or conduit to suit the purpose and type of the cable.



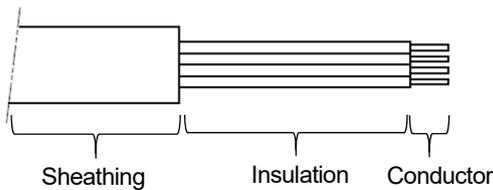
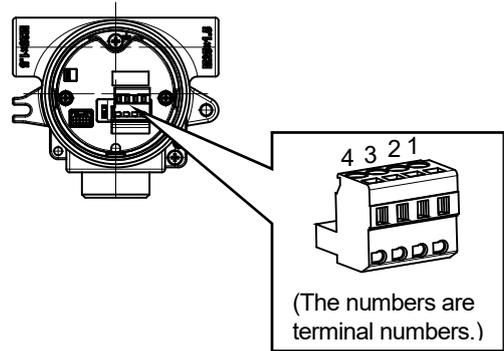
4 Pull out the terminal plate (TN1) from the terminal plate board.



5 Connect the power and signal cables to the terminal plate.

Connect the cables to the following terminals on the terminal plate. For information on how to connect cables to the terminal plate, refer to '4-7-5 Connecting cables to the terminal plate'.

Terminal No.	Power/signal cable connection
1	Power supply (+)
2	Power supply (-)
3	Signal (+)
4	Signal (-)



Recommended insulation length: 40 - 50 mm

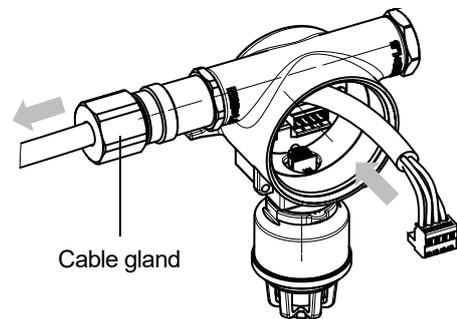
When connecting cables, connect the cable shielding to the terminals at the top left or top right on the inside of the main unit.

Depending on the installation location, noise interference may result.

In such cases, remove the shielding.

6 Route the cable from inside the main unit to the connector.

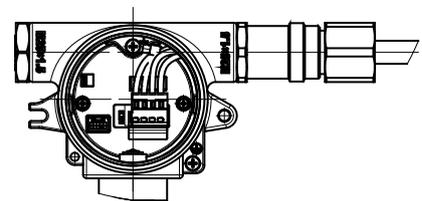
Route to the connector on the side where the cable gland or conduit is attached.



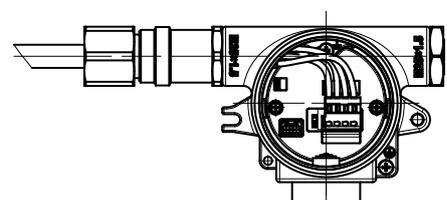
7 Mount the terminal plate on the terminal plate board.

Adjust the cable position so that no load is applied to the terminal plates.

<With cable (external cable) routed to right-hand side>



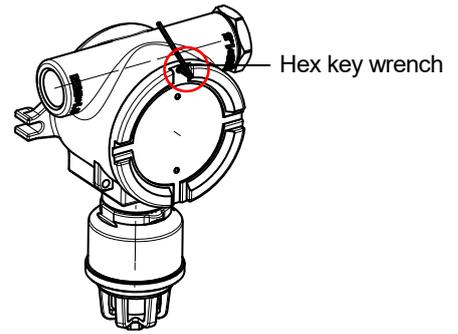
<With cable (external cable) routed to left-hand side>



8 Rotate the cover clockwise to attach and secure with the single M4 hex socket set screw.

Use a hex key wrench (2 across flats) to tighten the M4 hex socket set screw.

Take care not to trap the cable when attaching the cover. Rotate the cover clockwise until it moves no further to securely fasten in place.

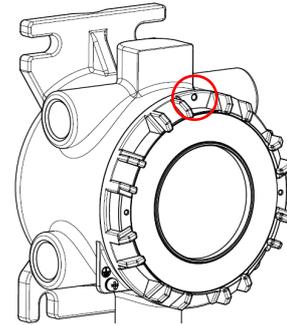


4-7-4 Connecting the main unit (SD-3SC) and remote sensor head (GD-3)

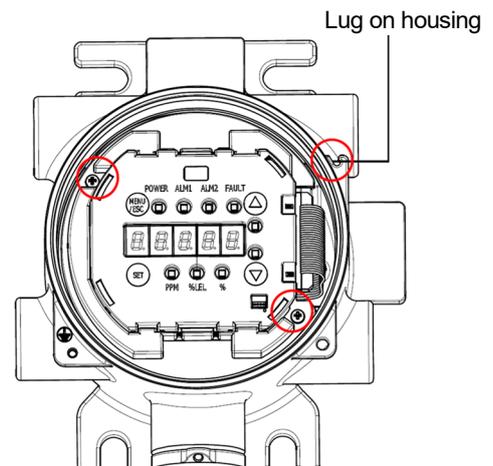
- 1 Unscrew the M4 hex socket set screw on the main unit (SD-3SC) cover, then rotate the cover counterclockwise to remove.**

Use a hex key wrench (2 across flats) to unscrew the M4 hex socket set screw.

Be careful to avoid dropping the cover while unscrewing and removing it.



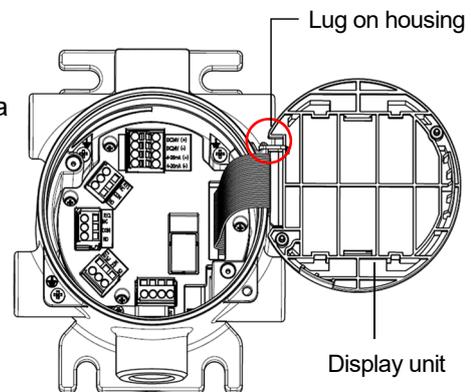
- 2 Unscrew the two M3 screws securing the display unit.**



- 3 Pull out the display unit and hang on the lug on the housing.**

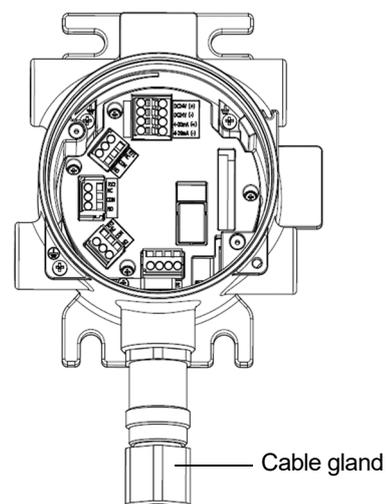
The display unit is connected to the terminal plate unit by a flat cable. Pulling with excessive force may disconnect the cable.

During the removal process, avoid pulling on the display unit with excessive force.

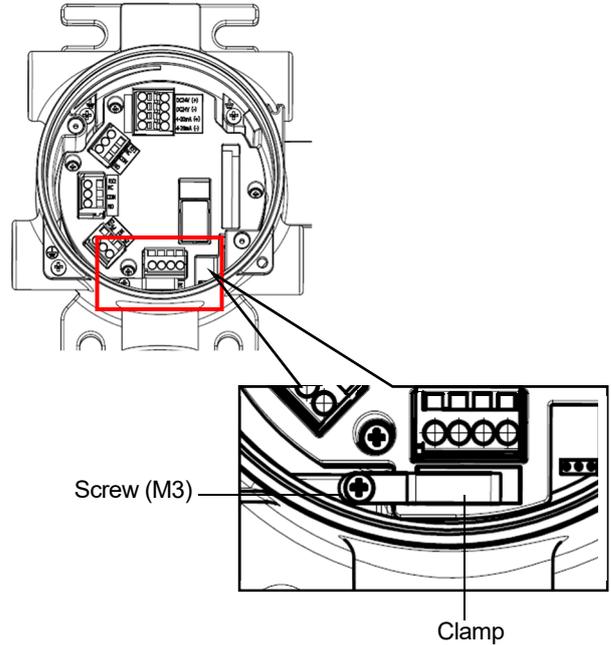


- 4 Attach a cable gland or conduit to the connector on the main unit.**

Use an appropriate cable gland or conduit to suit the purpose and type of the cable.

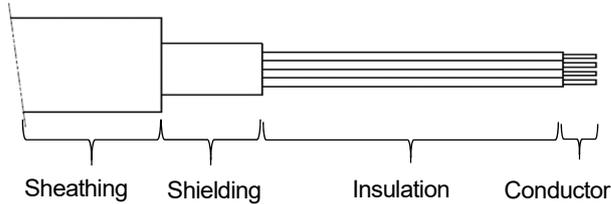


- 5 Pull out the remote connection terminal plate from the terminal plate board.
- 6 Unscrew the single M3 screw securing the clamp and remove the clamp.

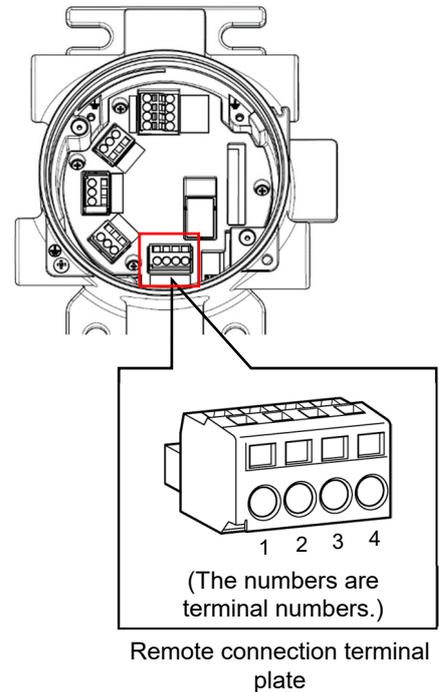


- 7 Connect the power and signal cables extending from the remote sensor head (GD-3) to the remote connection terminal plate.
- Connect the cables to the following terminals on the remote connection terminal plate. For information on connecting cables to the terminal plate, refer to '4-7-5 Connecting cables to the terminal plate'.

Terminal No.	Power/signal cable connection
1	Power supply (+)
2	Power supply (-)
3	Signal (+)
4	Signal (-)



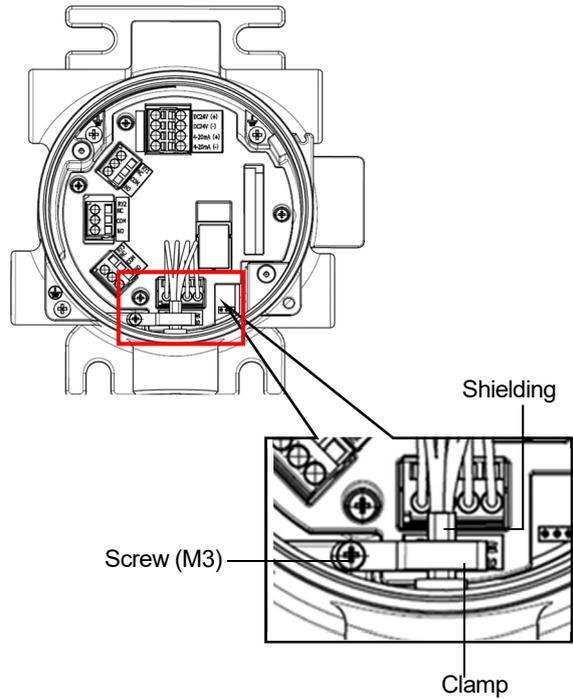
Recommended shielding length: 30 - 40 mm
 Recommended insulation length: 130 - 140 mm



- 8 Mount the terminal plate on the terminal plate board.
- Adjust the cable position so that no load is applied to the terminal plates.

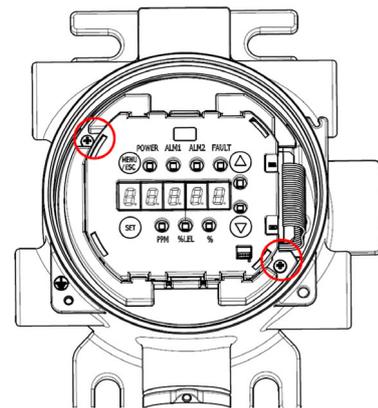
9 Clamp the shield wire.

Use the single M3 screw to clamp the cable shielding.



10 Return the display unit to its original position and secure with the two M3 screws.

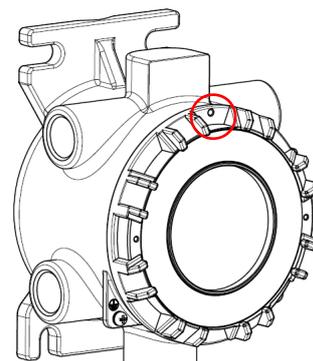
Take care not to trap the cable here.



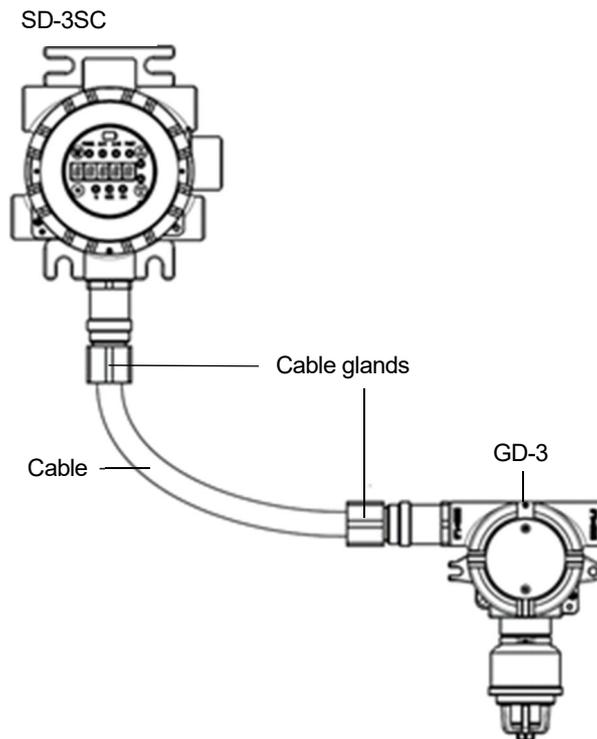
11 Rotate the cover clockwise to attach and secure with the single M4 hex socket set screw.

Use a hex key wrench (2 across flats) to tighten the M4 hex socket set screw.

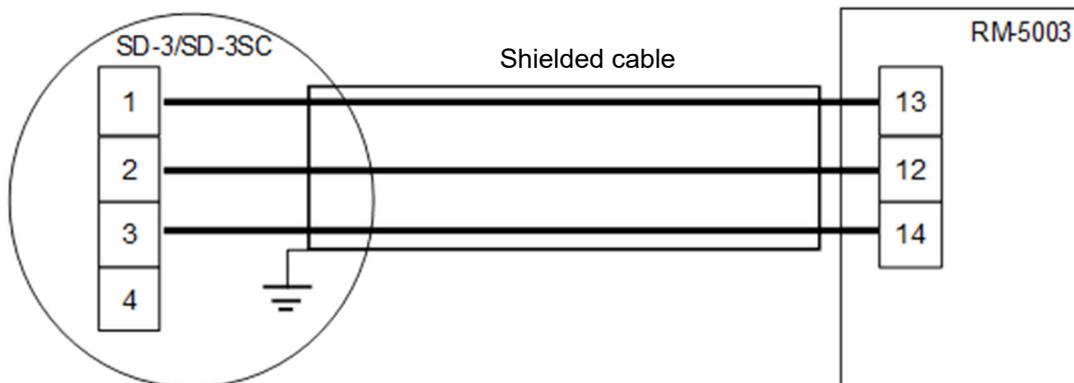
Take care not to trap the cable when attaching the cover. Rotate the cover clockwise until it moves no further to securely fasten in place.



<SD-3SC and GD-3 connection example>



<SD-3/SD-3SC and RM-5003 terminal plate connection example>



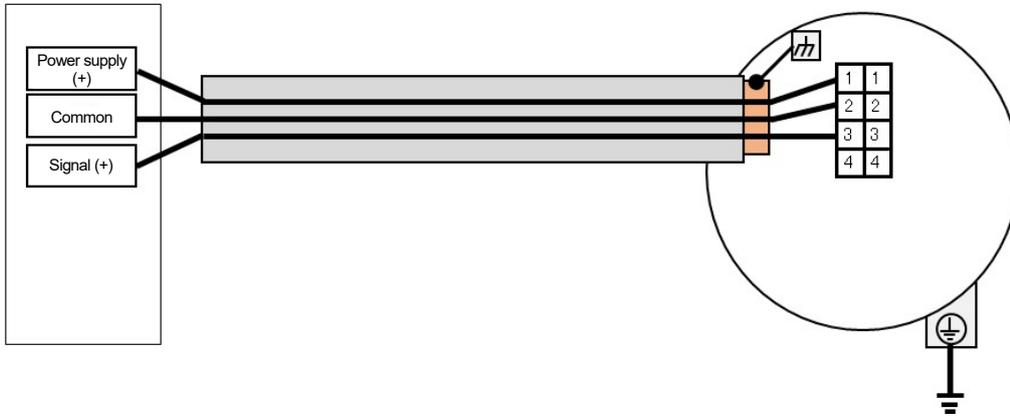
<Indicator connection example>

<SD-3>

Indicator (e.g., RM-5003)

SD-3

Connect the shield to the grounding bolt on the chassis

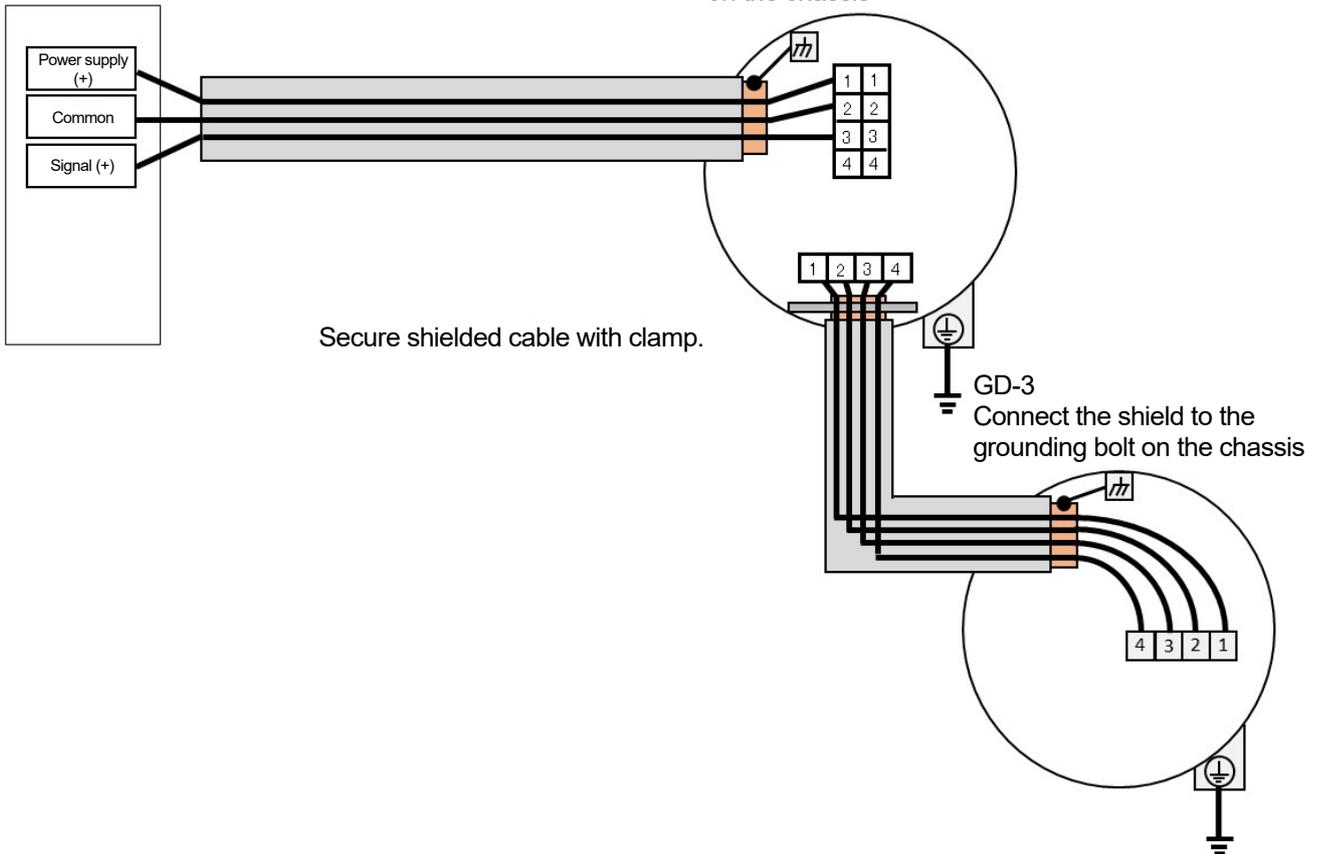


<SD-3SC>

Indicator (e.g., RM-5003)

SD-3SC

Connect the shield to the grounding bolt on the chassis



4-7-5 Connecting cables to the terminal plate

Strip the cable to the specified length and connect to the cable wire insertion holes on the terminal plate.

<Terminal plate specifications>

- Rated voltage: 300 V AC
- Rated current: 10 A

Specifications will vary depending on the cable used.

<Connecting conditions>

- Cable used: 0.25 mm² - 2.5 mm²
- Maximum sheathing external diameter: 4.1 mm
- Stripped wire (conductor) length: 8 mm - 9 mm (9 mm - 10 mm for SD-3 TN1 only)
- Connecting tool: Flathead screwdriver (blade tip 2.5 mm × 0.5 mm) or operating lever (provided)



Be sure to strip the cable to the specified (conductor) length.

- Conduction faults or overheating may result if the stripped wire (conductor) length is too short and the wire is clamped incorrectly.
- Conduction faults or overheating may result if the stripped wire (conductor) length is too short and the wire sheathing is clamped.
- An insulation failure or short circuit may result if the stripped wire (conductor) length is too long and the wire is exposed.
- Make sure the wire does not splay. An insulation failure or overheating may result if the wire splays when inserted.
- To avoid the above, if the stripped wire is stranded wire cable, we recommend using a bar terminal (ferrule).



<Compatible rod terminal>

If you use rod terminals, use the following item:

- Rod terminal (ferrule): Model 216 series (manufactured by WAGO)
- Crimping tool: Model Variocrimp 4 (206-1204) (manufactured by WAGO)



- Be sure to use the specified rod terminals. We cannot guarantee performance if you use rod terminals other than those specified.

<Connecting cables to terminal plate>

To connect cables to the terminal plate, use the operating lever provided as a standard accessory or a flathead screwdriver (blade tip 2.5 mm × 0.5 mm).

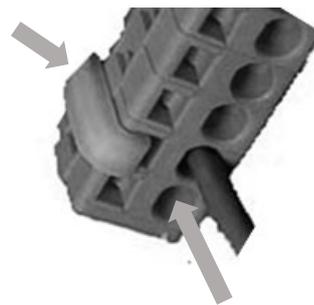
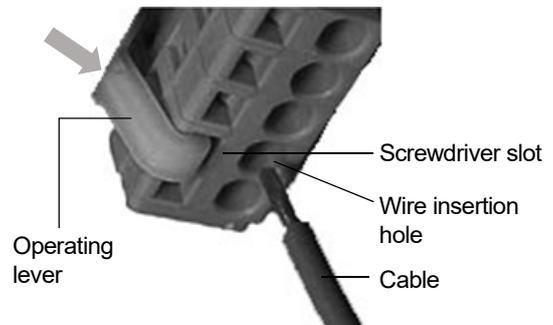
The operating lever provided as a standard accessory cannot be used when connecting power and signal cables to TN1 on the SD-3. Use a flathead screwdriver in this case.

CAUTION

- Be sure to use the correct tools.
- As a rule, only one cable can be connected to each wire insertion hole.
- If a cable is inserted into the screwdriver slot, the conductor may not make contact, resulting in conduction faults or overheating.

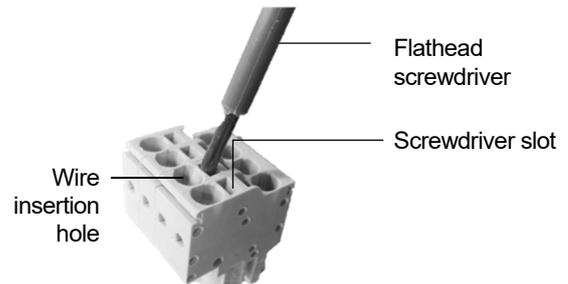
When using the operating lever provided as a standard accessory, connect the cable to the terminal plate as follows.

- 1 Hook the operating lever on to the screwdriver slot (rectangular hole) in the terminal plate as shown in the figure to the right.**
- 2 Push the operating lever with your finger to push down the spring inside the terminal plate.**
- 3 While continuing to press the operating lever, insert the cable into the wire insertion hole (round hole) until it contacts the end.**
- 4 Release the operating lever.**
The cable is now connected to the terminal plate.
Gently pull on the cable to confirm that it is correctly connected.
Avoid pulling with excessive force.

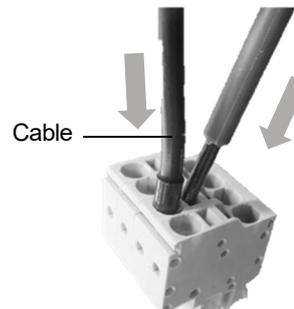


When using a flathead screwdriver to connect to TN1 on the SD-3, connect the cable to the terminal plate as follows:

- 1 Insert the flathead screwdriver into the screwdriver slot (rectangular hole) in the terminal plate as shown in the figure to the right.**



- 2 With the flathead screwdriver still being inserted, insert the cable into the wire insertion hole (round hole) until it contacts the end.**



- 3 Release the flathead screwdriver.**

The cable is now connected to the terminal plate.

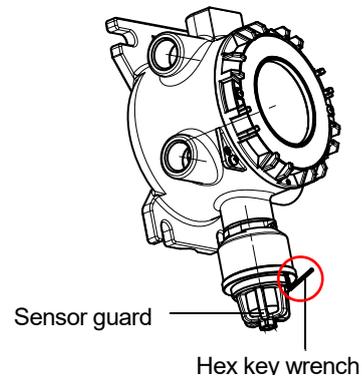
Gently pull on the cable to confirm that it is correctly connected.

Avoid pulling with excessive force.

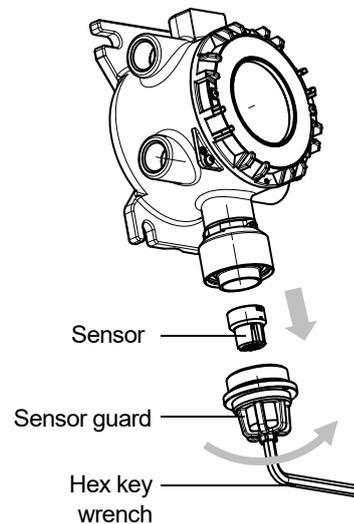
4-8 Mounting the sensor

Mount the sensor on to the main unit (SD-3) or remote sensor head (GD-3).

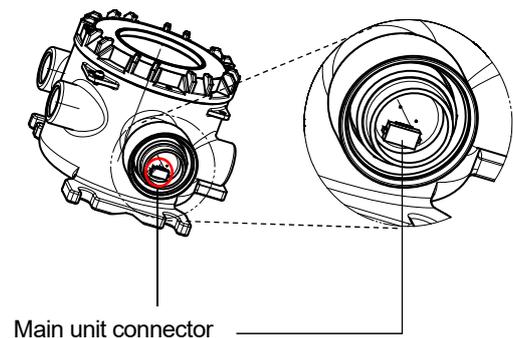
- 1 **Remove suction cap, splash guard, and filter, if fitted.**
- 2 **Unscrew the single M4 bolt securing the sensor guard.**
Use a hex key wrench (2 across flats) to unscrew the M4 hex socket set screw.



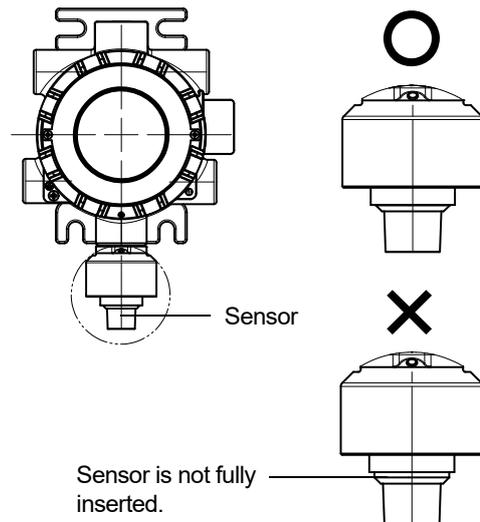
- 3 **Rotate and remove the sensor guard.**
Remove using a hex key wrench (8 across flats) or wrench.
- 4 **Pull out and remove the sensor, if fitted.**



- 5 **Match the main unit connector and sensor connector and fully insert the sensor.**
Push the sensor all the way into the main unit connector. Avoid forcibly turning or pushing in the sensor when inserting it, as this may damage the main unit. Take care when inserting.



6 Confirm that the sensor is fully inserted.

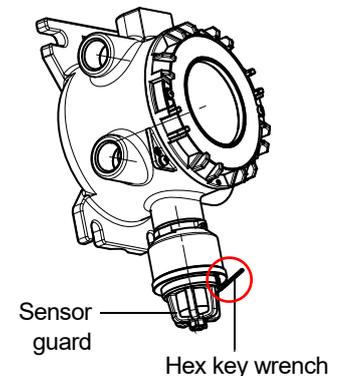


7 Attach the sensor guard to the main unit.

Attach using a hex key wrench (8 across flats) or wrench.

8 Use the single M4 hex socket set screw to secure the sensor guard in place.

Use a hex key wrench to tighten the M4 hex socket set screw.



*The diagram illustrates the SD-3. The mounting method for the remote sensor head (GD-3) is identical.

CAUTION

- Depending on the sensor, some fluctuation of the reading may occur if foreign objects are introduced while replacing the sensor.

4-9 Alarm relay setting (option)

The product can be operated as a standalone unit by setting an alarm relay. By default, the alarm relay is set to a de-energized state.

WARNING

- If using a supply voltage of 30 V AC or 42.4 V DC or greater, either fit protective tubing to the cable or use a double insulation cable.

CAUTION

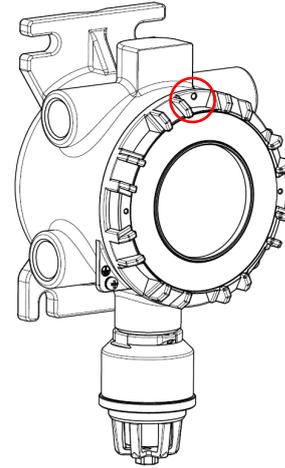
- Note that recurring use with the alarm relay contacts normally closed may result in the contacts seizing due to minute vibrations.
- Connect the alarm relay cable and sensor before turning on the power to the product.

To set the alarm relay, connect the alarm unit cables to the TN2 (Relay1:ALARM1), TN3 (Relay2:ALARM2), and TN4 (Relay3:FAULT) terminal plates on the main unit (SD-3/SD-3SC).

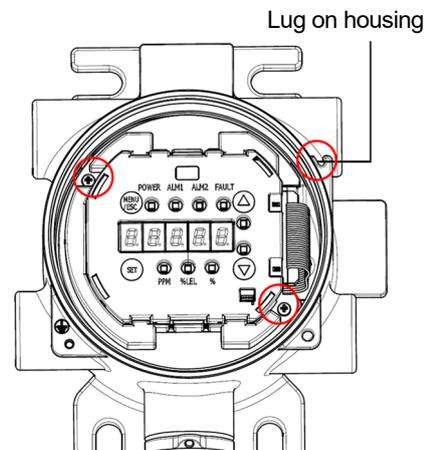
1 Unscrew the M4 hex socket set screw on the main unit cover, then rotate the cover counterclockwise to remove.

Use a hex key wrench (2 across flats) to unscrew the M4 hex socket set screw.

Be careful to avoid dropping the cover while unscrewing and removing it.



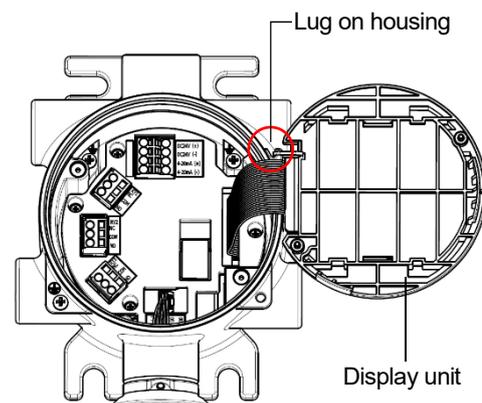
2 Unscrew the two M3 screws securing the display unit.



3 Pull out the display unit and hang on the lug on the housing.

The display unit is connected to the terminal plate unit by a flat cable. Pulling with excessive force may disconnect the cable.

During the removal process, avoid pulling on the display unit with excessive force.



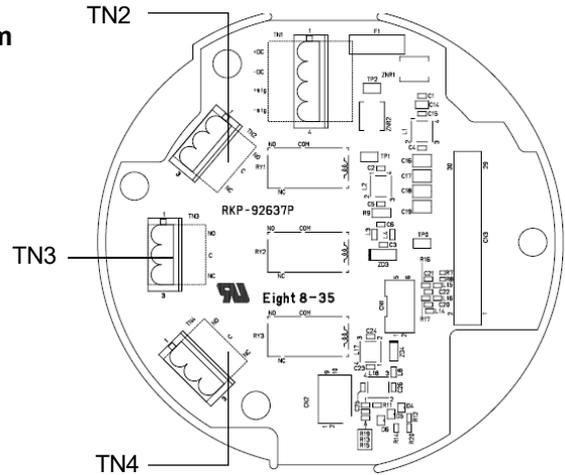
4 Pull out the terminal plates (TN2 (Relay1:ALARM1), TN3 (Relay2:ALARM2), and TN4 (Relay3:FAULT)) from the terminal plate board.

5 Connect the alarm unit wires to the corresponding terminals on the detached terminal plates.

Use either terminal 1 (N.O.) or terminal 3 (N.C.) on the terminal plate.

For information on how to connect cables to the terminal plates, refer to '4-7-5 Connecting cables to the terminal plate'.

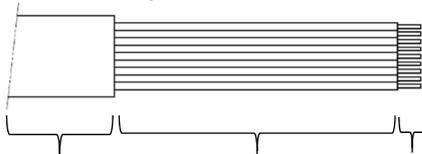
Common for TN2 (Relay1:ALARM1), TN3 (Relay2:ALARM2), and TN4 (Relay3:FAULT) (Default (normally de-energized) terminal assignment)



Terminal No.	Cable connection
1	N.O.
2	Common
3	N.C.

N.O.: Normally open

N.C.: Normally closed



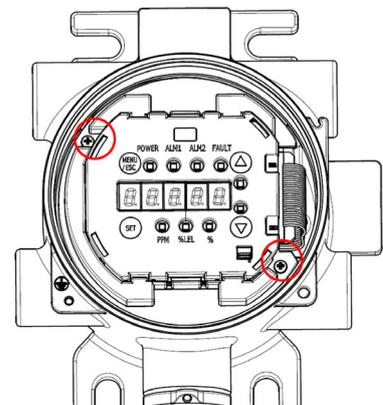
Recommended insulation length: 120 - 130 mm

6 Mount the terminal plates (TN2 (Relay1:ALARM1), TN3 (Relay2:ALARM2), and TN4 (Relay3:FAULT)) on the terminal plate board.

Adjust the cable position so that no load is applied to the terminal plates.

7 Return the display unit to its original position and secure with the two M3 screws.

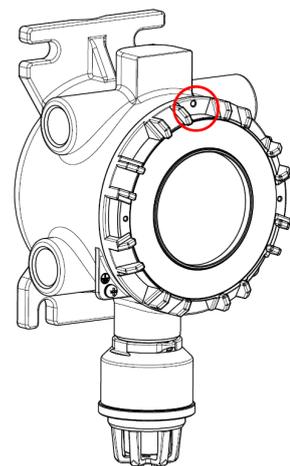
Take care not to trap the cable here.



8 Rotate the cover clockwise to attach and secure with the single M4 hex socket set screw.

Use a hex key wrench (2 across flats) to tighten the M4 hex socket set screw.

Take care not to trap the cable when attaching the cover. Rotate the cover clockwise until it moves no further to securely fasten in place.

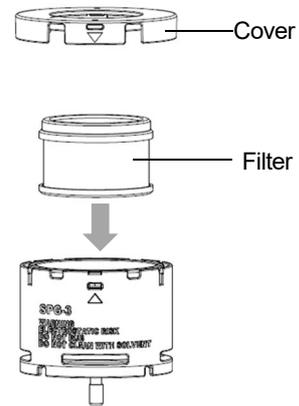


*The diagram illustrates the SD-3. The connection method for the SD-3SC is identical.

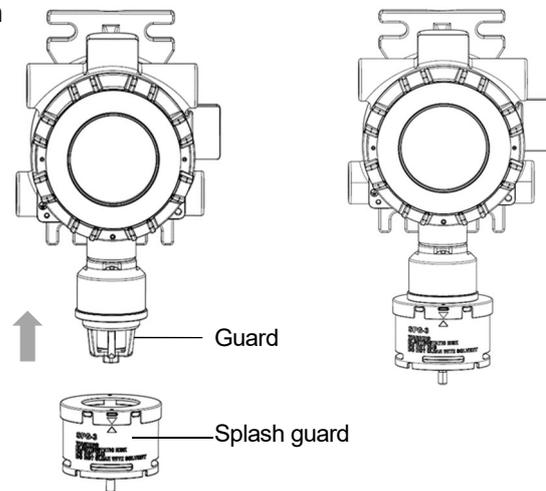
4-10 Mounting the splash guard

When using a silicone removal filter or activated carbon filter, fit the filter inside the splash guard before mounting the splash guard.

- 1 When using a silicone removal filter or activated carbon filter, remove the splash guard cover, fit the filter inside the splash guard, and reattach the cover.**
This step is required only when using a silicone removal filter or activated carbon filter.



- 2 Mount the splash guard over the guard on the main unit, then turn clockwise to secure into place.**
Mount the splash guard securely by rotating clockwise until it will not rotate any further.
Avoid rotating with excessive force.



*The diagram illustrates the SD-3. The mounting method for the remote sensor head (GD-3) is identical.

NOTE

- ▶ Three different splash guard types are available: for the IRF sensor; for the combustible gas sensor; and for the ESF sensor. The corresponding identification number is engraved on the underside of each splash guard.

- IRF sensor identification number: 1
- Combustible gas sensor identification number: 2
- ESF sensor identification number: 3

- ▶ The splash guards are compatible with the following SD-3 and GD-3 models:

<for IRF sensor>

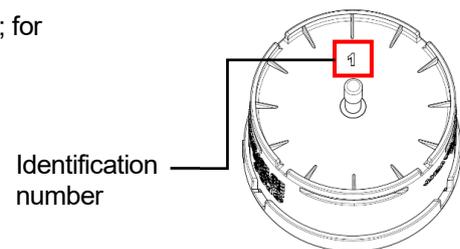
SD-3RI
GD-3RI

<for combustible gas sensor>

SD-3NC
SD-3GH
SD-3GHS
SD-3SP
GD-3NC
GD-3GH
GD-3GHS
GD-3SP

<for ESF sensor>

SD-3EC
SD-3ECS
SD-3ECB
GD-3EC
GD-3ECS
GD-3ECB



4-11 How to install the lightning arrester

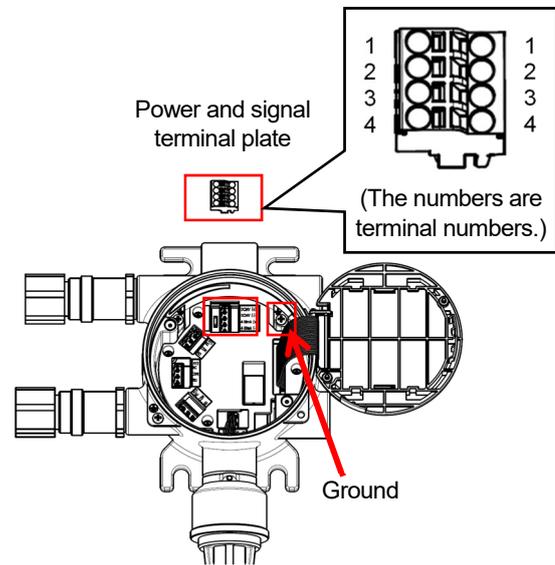
SD-3 can connect a simple lightning arrester. Be sure to use the specified model and connect it to the terminal block for power and signal.

<Using 3-core cable>

Terminal No.	Power/signal cable connection	Connection of lightning arrester
1	Power supply (+)	Blue
2	Common (power supply (-), signal (-))	Brown
3	Signal (+)	Black
Ground	—	Yellow/Green

<Using 4-core cable>

Terminal No.	Power/signal cable connection	Connection of lightning arrester
1	Power supply (+)	Blue
2	Power supply (-)	Brown
3	Signal (+)	Black
4	Signal (-)	White
Ground	—	Yellow/Green



NOTE

- ▶ [Designated lightning arrester]
Type: TP48-3-N-NDI
TP48-4-N-NDI

*When connecting a lightning arrester, use connection port 2 or 4. If a lightning arrester other than the specified one is used, the explosion-proof performance will not be satisfied.

- ▶ When installing a surge arrester, check its operation before using it. Also, surge arresters cannot remove all surge voltages.



CAUTION

- Only ATEX and IECEx specifications are applicable.
- Discontinue use if operational problems occur.

5

Usage Instructions

5-1 Preparations for startup

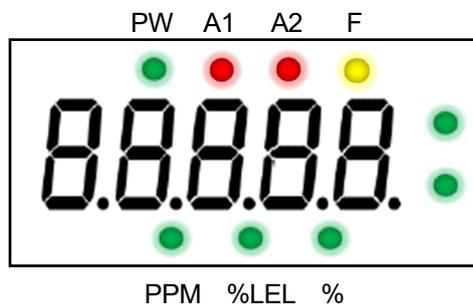
Carry out the following checks before connecting the power supply. Failure to perform these checks may result in electric shock or damage to the product.

- Check to confirm that the product is grounded.
- Check to confirm that external wiring is correctly connected.
- Check to confirm that the power supply voltage is within the rated range.
- External contacts may operate while adjustment is under way. Take precautions to prevent any external effects from the contacts operating.

<How to read display examples>

LED display examples are shown as follows in this operating manual.

The display examples are for cases in which the detection target gas is combustible gas (display units: %LEL lit).



- PW: POWER (Power lamp) ● lit (green) / ● flashing (green)
- A1: ALM1 (Alarm lamp) ● lit (red)
- A2: ALM2 (Alarm lamp) ● lit (red)
- F: FAULT (Fault lamp) ● lit (yellow)
- PPM: Units lamp ● lit (green)
- %LEL: Units lamp ● lit (green)
- %: Units lamp ● lit (green)

5-2 Startup

CAUTION

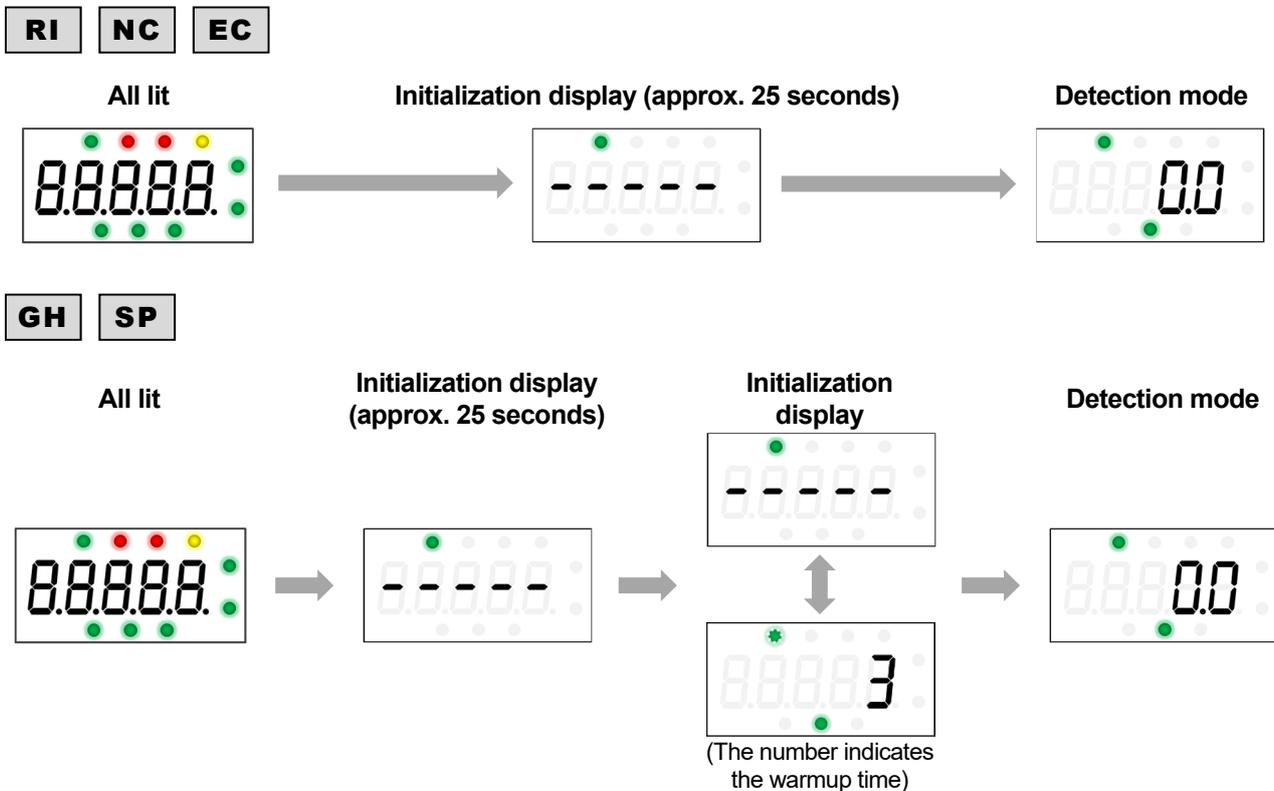
- Check to confirm that the product has been correctly installed before turning on the power supply (24 V DC).

Turn on the power supply (24 V DC) and start the product.

The product takes approximately 25 seconds before switching to detection mode after the power is turned on. System checks, alarm cutoff, and other initialization occurs during this time.

The display automatically changes as follows after the power is turned on.

The product is normally used in detection mode after the power is turned on.

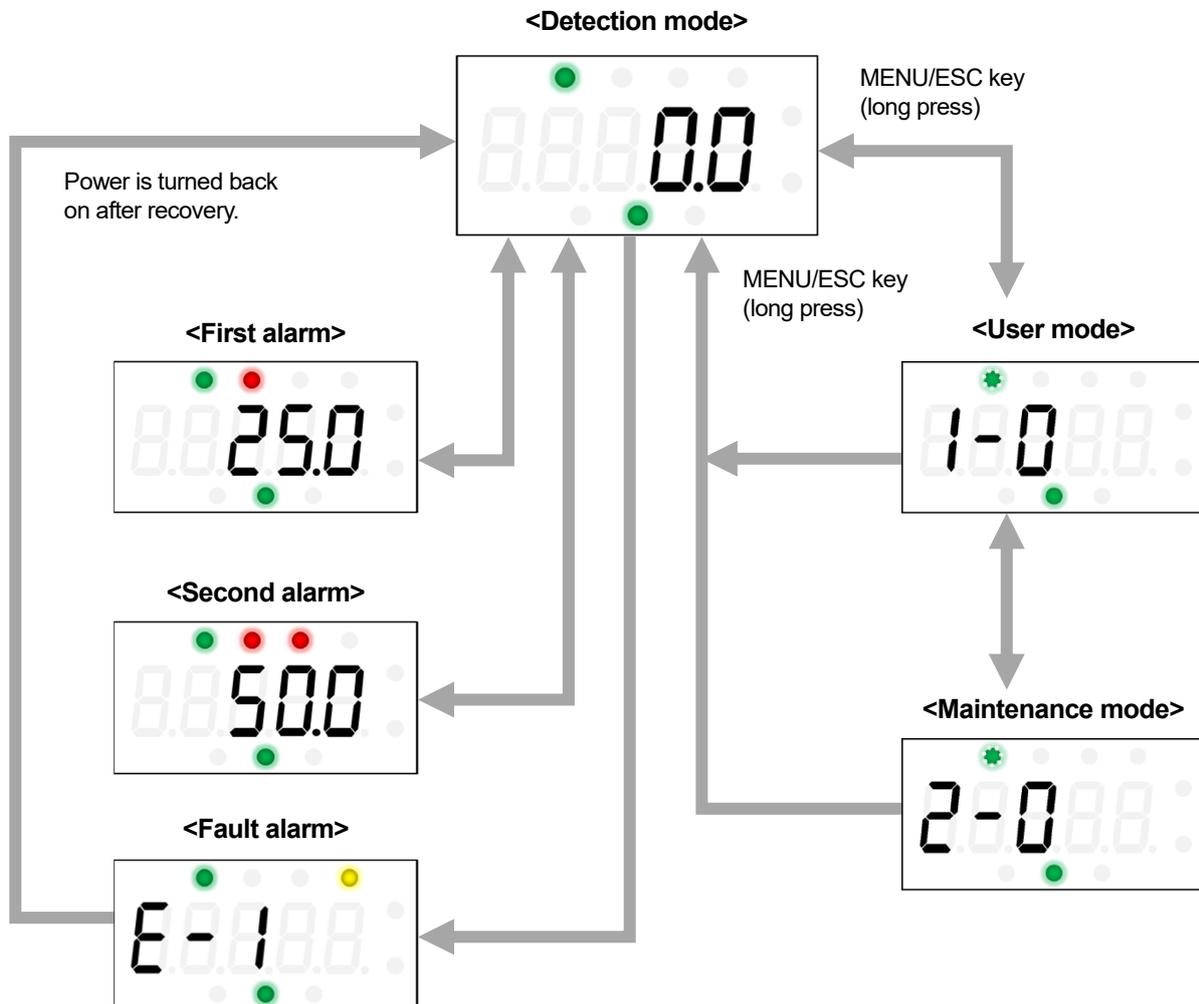


CAUTION

- Never turn off the power while initialization is underway. The internal memory is read during initialization.
- A specific warmup is required for each sensor type at startup and after sensor replacement. Allow the product to warm up for the specified time. Expected warmup completion times for the semiconductor type (SGF) and hot-wire semiconductor type (SHF) sensors are indicated after initialization. Alarm activation and output signals will be unstable during warmup. Notify the relevant department beforehand to avoid conditions that may lead to errors.
- Perform calibration once warmup is complete.

5-3 Basic operation flow

After the power is turned on, the product operates as follows when you press the MENU/ESC key:



WARNING

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

NOTE

- ▶ The LEDs on the product comprise a five-digit seven-segment display. Setting details are displayed as item numbers.
When setting in user mode or maintenance mode, select the item number corresponding to the details to be set. (Refer to '5-5-1 User mode setting items' and '7-2-1 Maintenance mode setting items'.)

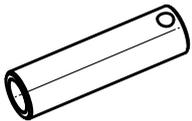
5-4 Operating procedure

The product is operated using the control key.

Use the control key to touch the four keys (MENU/ESC key, SET key, ▲ key, and ▼ key) on the front of the product.

This operating manual refers to the action of touching the individual keys using the control key as “pressing.”

<Control key>



CAUTION

- Do not press the control key forcibly against the glass.

5-5 User mode

Switching to user mode lets you perform zero calibration and check various settings.



CAUTION

- Do not alter settings unnecessarily. Altering the settings without a proper understanding of the details may prevent the product from operating correctly.

5-5-1 User mode setting items

Item No.	Setting item	LED display	Details
1-0	Version information		Displays the program version and other information. This is not normally used by the user.
1-1	Zero calibration		Performs zero calibration. (Refer to '5-6 Performing zero calibration'.)
1-2	Setting display		Displays the alarm settings. (Refer to '5-7 Checking settings'.)
1-3	Maintenance mode selection		Switches to maintenance mode. (Refer to '7-2 Maintenance mode'.)

5-5-2 Switching to user mode

- 1 Hold down the MENU/ESC key (for approximately three seconds) in detection mode.



The product switches to user mode.



- 2 Press the ▲ or ▼ key to select the required item number, then press the SET key.



Display example: With setting display selected

The details corresponding to the item number selected are displayed.
Set or display individual items.



- 3 Once the operation is complete, hold down the MENU/ESC key (for approximately three seconds).
The product switches to detection mode.

WARNING

- Once the operation is complete, be sure to hold down the MENU/ESC key to return to detection mode. The product will not detect gases while in adjustment/setting state. If left in user mode, the product will take 10 hours to return to detection mode. Detection will not be available during this time, posing hazards.

5-6 Performing zero calibration

This performs the zero calibration required to ensure accurate measurement of gas concentrations.

Prepare the zero calibration gas, then connect to the product before starting zero calibration.

For information on zero calibration preparation, refer to '7-4-1 Calibration preparation'.



WARNING

- Before performing zero calibration for the surrounding atmosphere, confirm that the surrounding atmosphere contains clean air. Performing zero calibration in the presence of miscellaneous gases will prevent correct calibration and create safety hazards in the event of an actual gas leak.



CAUTION

- Perform zero calibration after supplying the zero calibration gas and waiting for the reading to stabilize.

- 1 Press the ▲ or ▼ key in user mode to select [1-1], then press the SET key.



- 2 Introduce the zero calibration gas, then press the SET key.



Zero calibration starts.



- 3 Check the zero calibration result.

If zero calibration is successful

[PASS] is displayed for three seconds before the display automatically returns to [1-1].



If zero calibration is unsuccessful

[FAIL] is displayed for three seconds before the display automatically returns to [1-1].



NOTE

- ▶ If zero calibration is unsuccessful because the zero point ([20.9] (vol%) in the case of oxygen) fluctuates significantly around zero, [FAIL] is displayed before the display returns to [1-1]. If this occurs, zero calibration was not performed.
 - ▶ [1-1] corresponds to span adjustment for the oxygen deficiency alarm specifications. Introduce clean air to adjust to [20.9] (vol%). For information on span adjustment, refer to '7-4-3 Performing span adjustment'.
-

5-7 Checking settings

Displays the alarm settings.

Item No.	Setting item	Remarks
1-2	Setting display	
1-2.0	Alarm setting display	Zero follower setting ON/OFF display: NC EC Sensitivity correction ON/OFF display: EC
1-2.1	-	This is not normally used by the user.

5-7-1 Checking alarm setpoints

Displays the various alarm settings, including first alarm setpoint, second alarm setpoint, and alarm delay time.

NOTE

- ▶ The zero follower setting ON/OFF display appears only with sensors that rely on the new ceramic (catalytic) or electrochemical detection principle. (Refer to '1-2-2 Detection principles and detection target gases for individual models'.)
- ▶ The sensitivity correction ON/OFF display appears only with sensors that rely on the electrochemical type detection principle. (Refer to '1-2-2 Detection principles and detection target gases for individual models'.)

1 Press the ▲ or ▼ key in user mode to select [1-2], then press the SET key.



2 Select [1-2.0], then press the SET key.



3 Check the individual alarm setpoints.

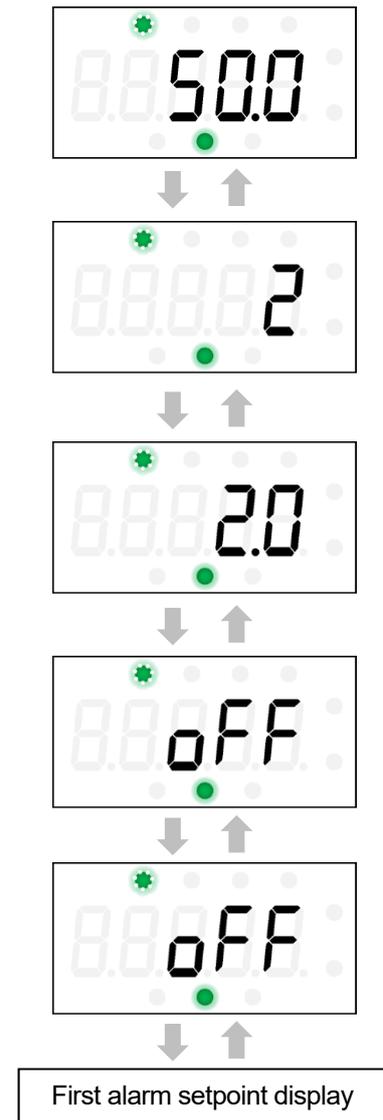
Press the ▲ or ▼ key to toggle between different setpoints.

- First alarm setpoint display
Displays the first alarm setpoint.



- **Second alarm setpoint display**
Displays the second alarm setpoint.
- **Alarm delay time**
Displays the alarm delay time (in seconds).
(There is not normally a need for end users to change these settings.)
- **Zero suppression value display**
Displays the positive side suppression value.
- **Zero follower ON/OFF display**
Displays whether the zero follower setting is on or off.
(This is not normally used by the user.)
- **Sensitivity correction ON/OFF display**
Displays whether sensitivity correction is on or off.
(This is not normally used by the user.)

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



4 Press the MENU/ESC key.

Returns to the [1-2.0] display.

NOTE

- ▶ The alarm setpoints and zero suppression value can be set in environmental settings 1 in maintenance mode. (Refer to '7-5 Setting environmental settings 1'.)

5-8 Shutting down

To shut down product operation, turn off the power supply (24 V DC) while in detection mode.



WARNING

- Shutting down product operation may activate an alarm in an upstream (central) system.
- Before shutting down product operation, make sure the INHIBIT setting is enabled (alarm processes are stopped) in the upstream (central) system. Also check the operation of any devices connected to the external output or external contact output terminal of the product to confirm shutting down the power will not cause problems.
- If using contacts (optional), the contacts may activate when the power supply is turned off.

6

Alarm Activation

6-1 Gas alarm activation

6-1-1 Alarm activation

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

NOTE

- ▶ The alarm setpoints (first and second alarms) and alarm pattern (auto reset or self-latching) are set at the factory before shipping.
- ▶ An alarm delay time (default setting: 2 seconds) is set to prevent accidental alarm activation.

<Gas concentration display>

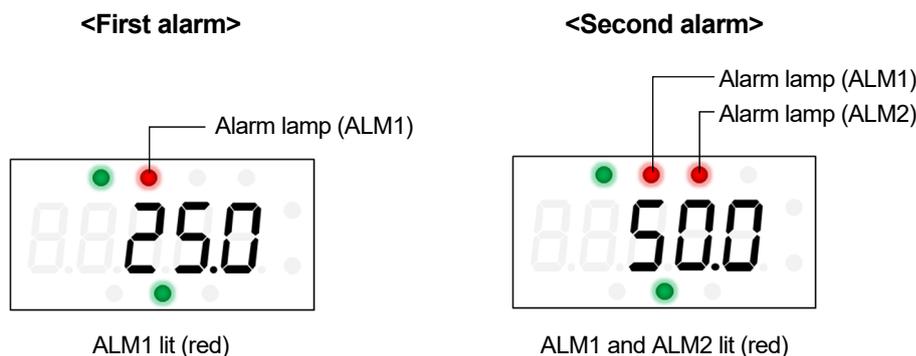
If the reading exceeds the detection range (full scale exceeded), "∞∞∞∞" appears on the LED display.

<Power/alarm lamp display>

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

The alarm lamps (ALM1 and ALM2) light up in red. The display appears as follows.

The power lamp (POWER) remains lit in green.



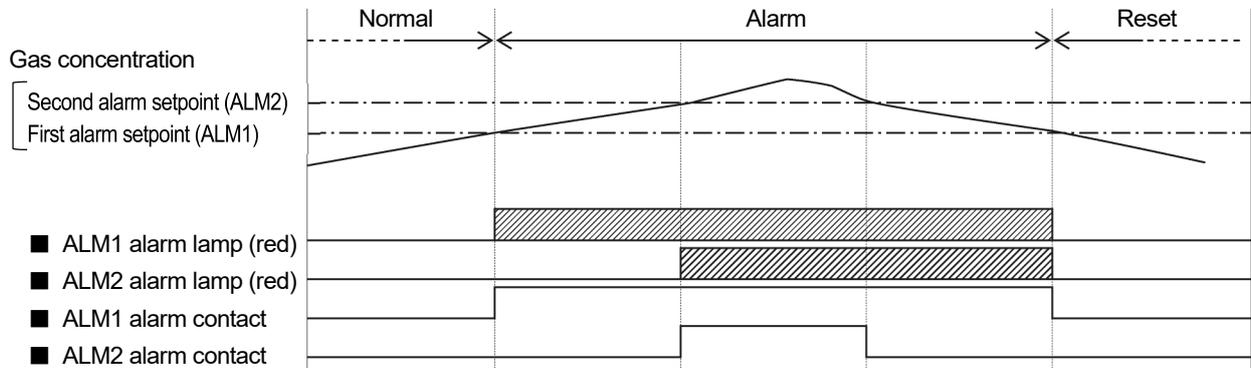
NOTE

- ▶ If the alarm pattern is set to self-latching, the alarm will continue even when the gas concentration falls below the alarm setpoint. Operate the keys to cancel the alarm state after confirming that there is no gas present in the vicinity.

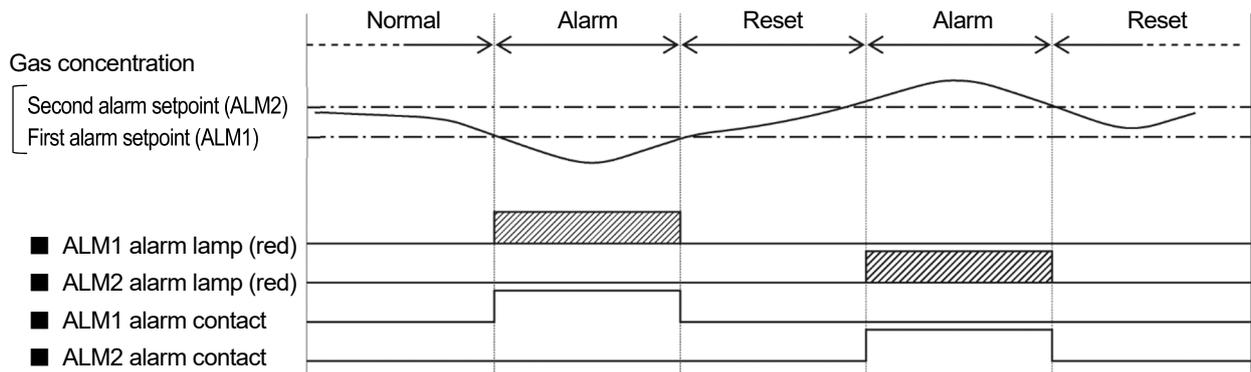
6-1-2 Contact operation (auto reset)

If auto reset is set, the contacts will activate when the gas concentration reaches or exceeds the alarm setpoint. The contact operation is automatically reset when the gas concentration falls below the alarm setpoint.

<Alarm pattern (H-HH)>

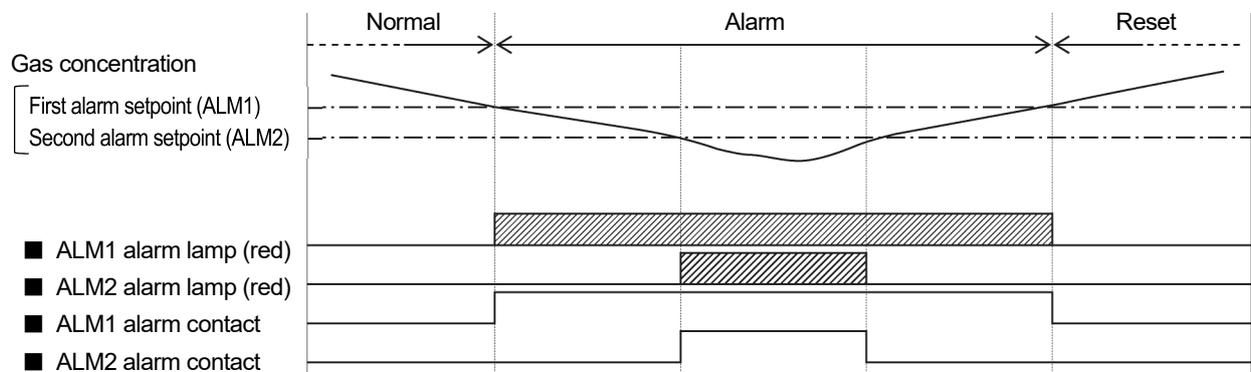


<Alarm pattern (L-H)>



<Alarm pattern (L-LL)>

(Oxygen deficiency alarm)



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

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

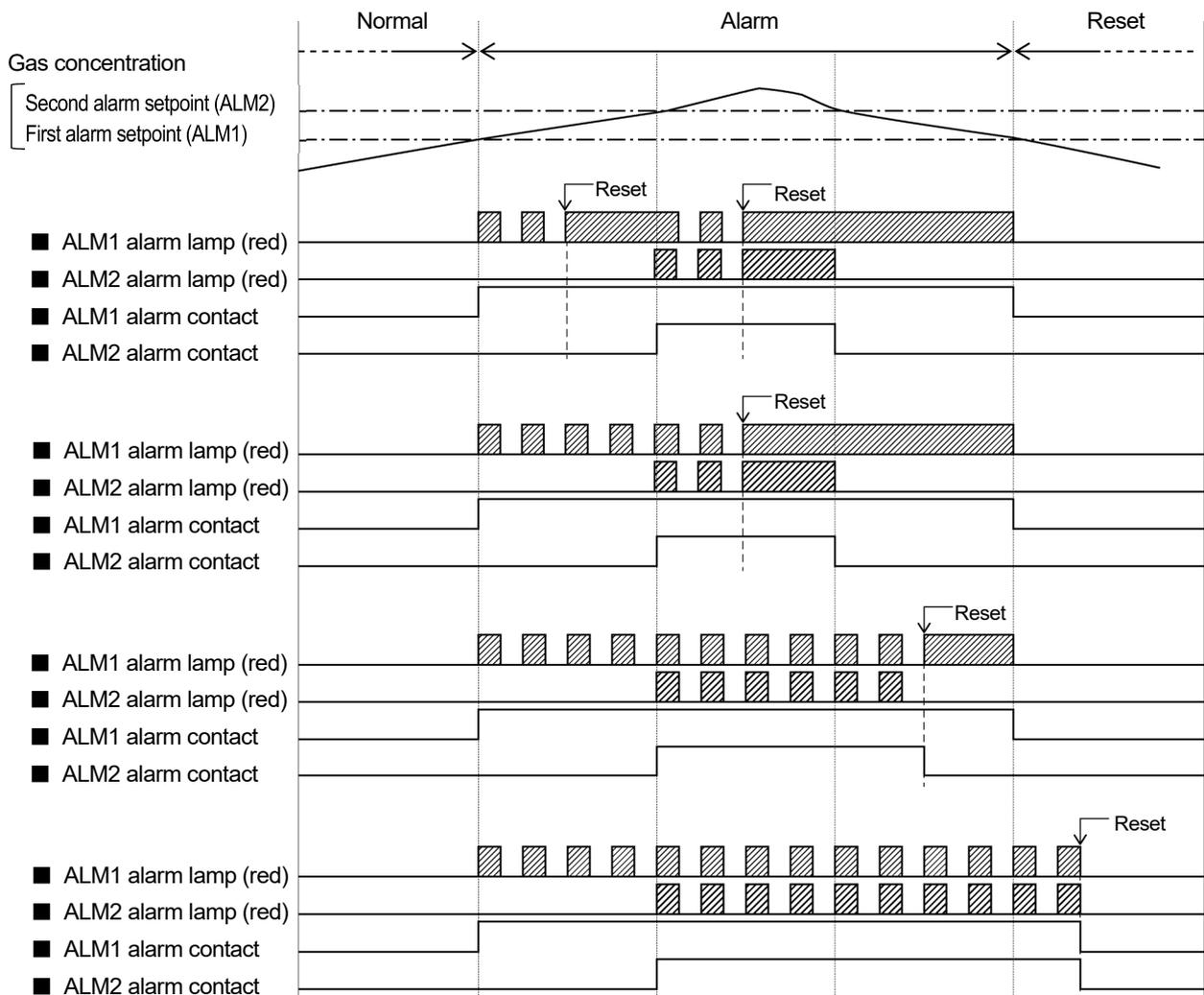
The contact operation is automatically reset when the gas concentration falls below the alarm setpoint after resetting.

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

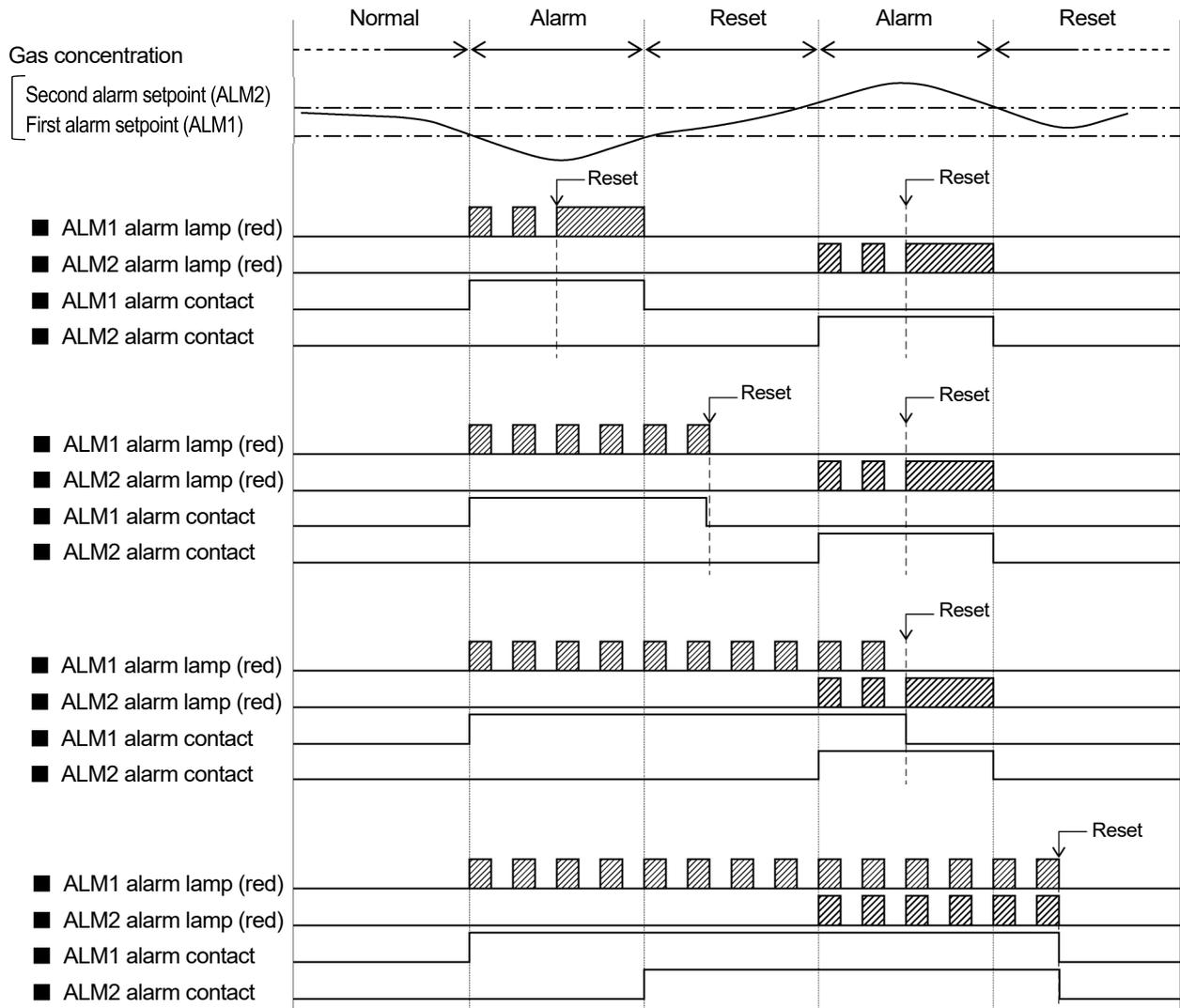
NOTE

▶ To cancel an alarm, press the MENU/ESC key, SET key, ▲ key, or ▼ key in detection mode.

<Alarm pattern (H-HH)>

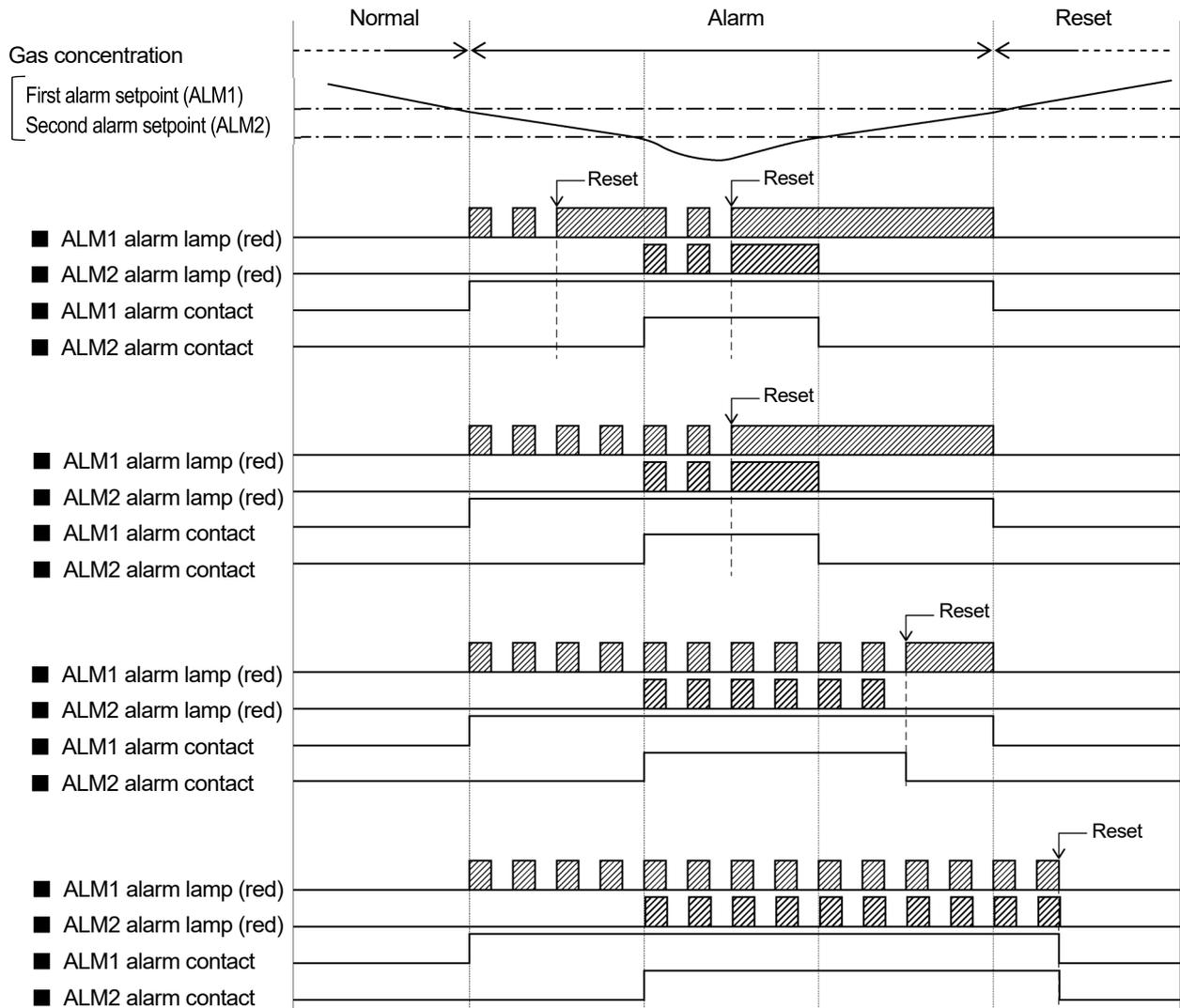


<Alarm pattern (L-H)>



<Alarm pattern (L-LL)>

(Oxygen deficiency alarm)



6-1-4 Alarm response

If an alarm is triggered, respond promptly in accordance with the user's management rules.

The typical procedures are as follows:

Step 1 Check the reading on the product.



- In the case of momentary gas leaks, the reading may have already dropped by the time the reading is checked. The reading may also drop while in a temporary alarm state due to factors other than gas alarms, such as noise or incidental conditions.

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

Step 3 If the concentration display continues, close the main valve for the gas involved and confirm that the gas concentration reading has fallen.

Step 4 Approach the gas leak location and use a portable gas detector to check for the presence of any remaining gas.



- To avoid hazards while carrying out this work, assume that the gas is still present and wear the appropriate gear.

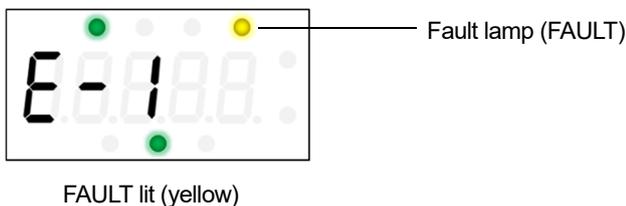
Step 5 Once you have determined that no hazard remains, take action to fix the gas leak.

6-2 Fault alarm activation

A fault alarm is triggered if an abnormality is detected in the product.

If a fault alarm occurs, the fault lamp (FAULT) illuminates in yellow, and an error code is displayed as follows:

<In case of sensor abnormality>



NOTE

- ▶ After the product has successfully recovered from the fault, it will initialize and restart.
- ▶ For more information on fault details (error codes) and appropriate corrective action, refer to '9. Troubleshooting'.
- ▶ If a fault alarm occurs, determine the cause and take appropriate action. If the product has problems and faults occur repeatedly, contact RIKEN KEIKI immediately.

6-3 Warning operation

If the product ambient temperature exceeds the specified operating temperature range, the concentration readout and warning number [E-27] are displayed alternately.

Gas can still be measured in this state, as this is not a product fault. The external output will also be output in the range 4 mA to 20 mA according to the target gas concentration. The fault lamp will not light up.

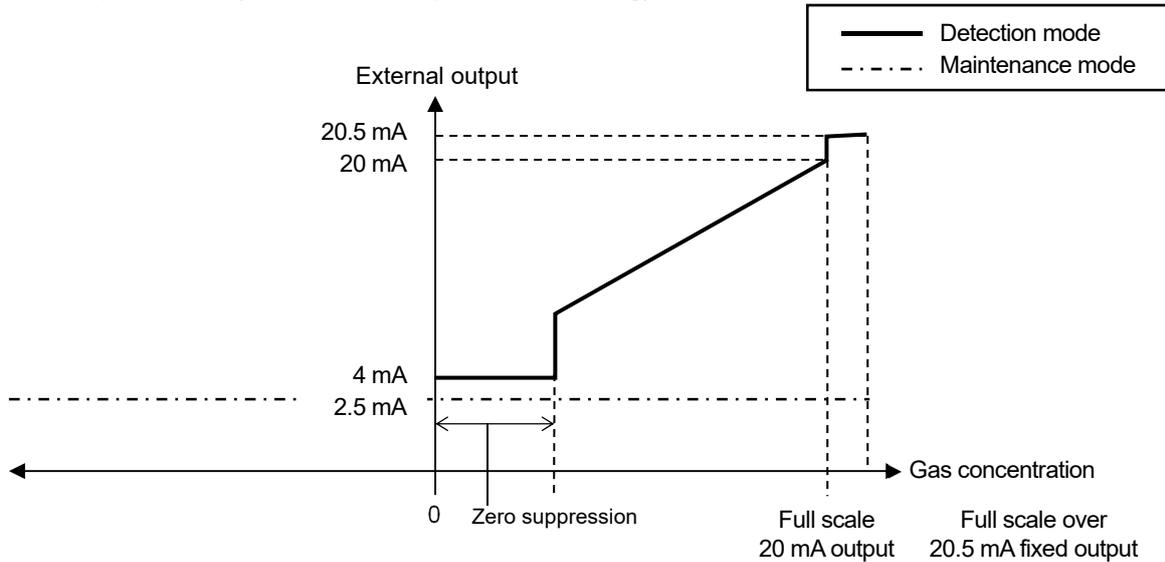
6-4 External output operation

6-4-1 For target gases other than oxygen

	Mode	4 - 20 mA (output value)
1	Power supply off	0 mA
2	Initialization	Depends on the settings for item 11. 2.5 mA setting: 2.5 mA 4 mA, HOLD, 4 - 20 mA setting: 4 mA
3	Detection mode (no alarm)	4 - 20 mA (concentration output)
4	Detection mode (gas alarm)	4 - 20 mA (concentration output)
5	Detection mode (full scale exceeded)	20.5 mA (fixed)
6	Outside operating temperature range	4 - 20 mA (concentration output)
7	Fault alarm	0.5 mA (fixed)
8	Inhibit	Depends on the settings for item 11. 2.5 mA setting: 2.5 mA 4 mA, HOLD, 4 - 20 mA setting: 4 mA
9	Alarm test mode	Output ON setting: 4 - 20 mA (concentration output) Output OFF setting: 4 mA
10	User mode	Depends on the settings for item 11. 2.5 mA setting: 2.5 mA 4 mA setting: 4 mA HOLD setting: Retains previous value. 4 - 20 mA setting: 4 - 20 mA (concentration output)
11	Maintenance mode	2.5 mA setting: 2.5 mA 4 mA setting: 4 mA HOLD setting: Retains previous value. 4 - 20 mA setting: 4 - 20 mA (concentration output)

<Gas concentration and external output example (with standard range)>

<4 - 20 mA specification (maintenance output: 2.5 mA setting)>



CAUTION

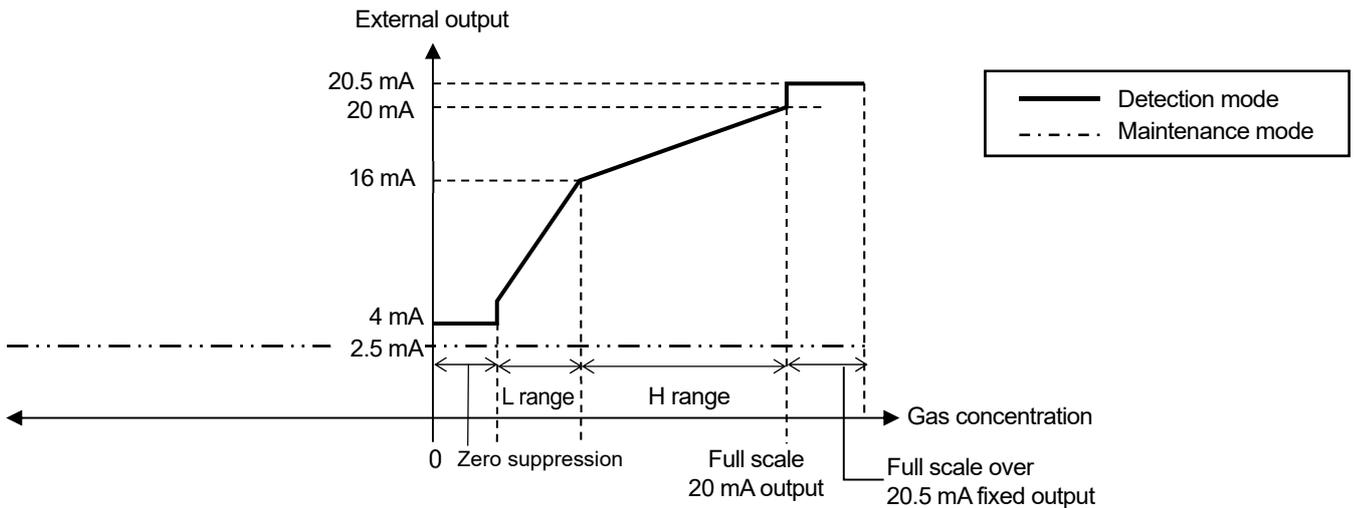
- The 4 - 20 mA output is already adjusted. When the full scale is exceeded, the output will not exceed approximately 20.5 mA.
- If the inhibit function is enabled or initialization is underway, the output follows the 4 - 20 mA output setting in maintenance mode. Special care is required when starting the product or after altering specifications.
- Make sure you fully understand the operation details. Take appropriate precautions where necessary to prevent false alarms on the receiving side.
- When the suppression function is canceled, the signal will be linearly output to 4 mA (equivalent to 0 %LEL).
- When the minus suppression function is canceled, the signal will be linearly output to 3.2 mA (equivalent to -5 %LEL).

<Gas concentration and external output example (with double range)> NC

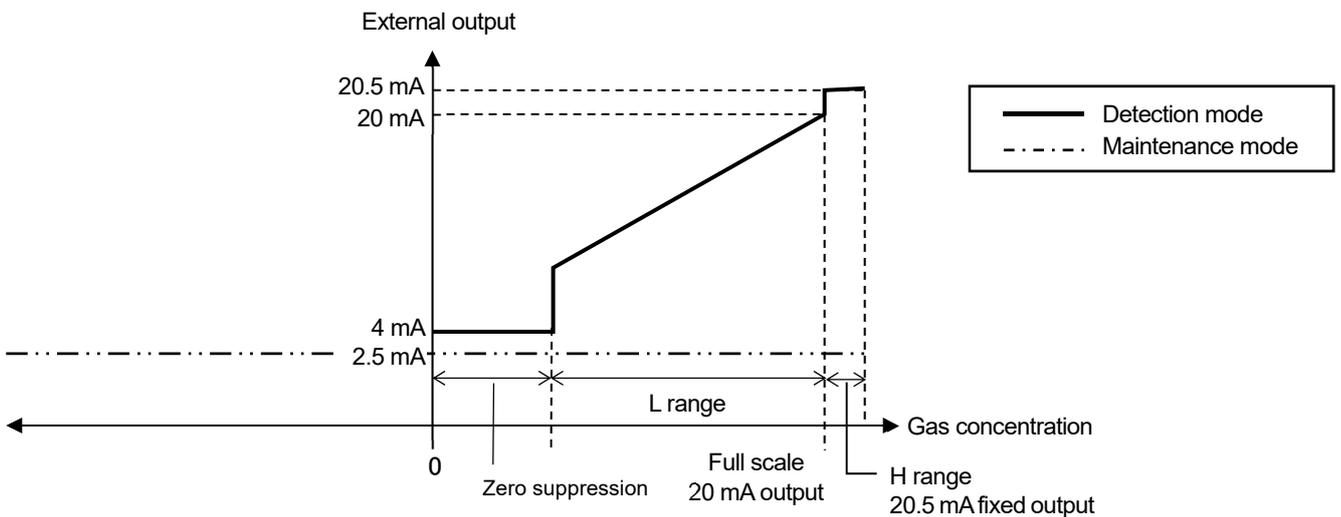
Two display ranges (L range and H range) are provided when using a new ceramic type (catalytic type) sensor. The display automatically switches to the H range if the combustible gas concentration reading exceeds the full scale of the L range. The range also automatically switches back to the L range when the gas concentration drops below the full scale of the L range.

For example, when the target gas is isobutane, readings between 0 and 2,000 ppm appear in the L range and the display switches to the H range for readings between 12.0 and 100.0 %LEL.

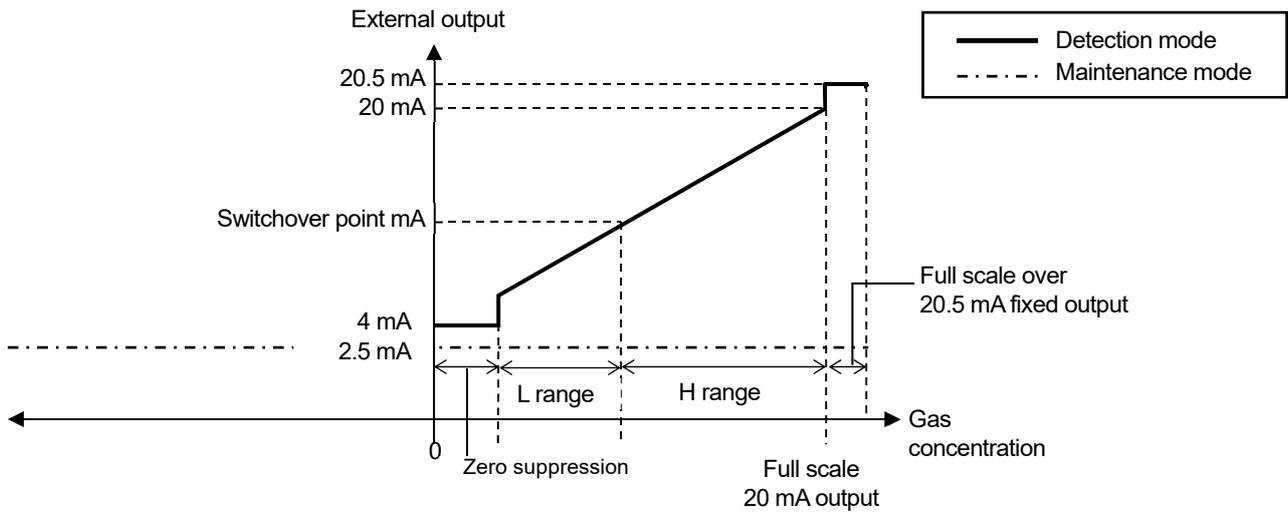
<4 - 16 mA (L range)/16 - 20 mA (H range) setting>



<4 - 20 mA (L range)/22 mA (H range) setting>



<4 - 20 mA (H range) setting>



6-4-2 When the target gas is oxygen

	Mode	4 - 20 mA (output value)
1	Power supply off	0 mA
2	Initialization	Depends on the settings for item 11. 2.5 mA setting: 2.5 mA 4 mA, HOLD, 4 - 20 mA setting: 4 mA [*]
3	Detection mode (no alarm)	4 - 20 mA (concentration output)
4	Detection mode (gas alarm)	4 - 20 mA (concentration output)
5	Detection mode (full scale exceeded)	20.5 mA (fixed)
6	Outside operating temperature range	4 - 20 mA (concentration output)
7	Fault alarm	0.5 mA (fixed)
8	Inhibit	Depends on the settings for item 11. 2.5 mA setting: 2.5 mA 4 mA, HOLD, 4 - 20 mA setting: 4 mA [*]
9	Alarm test mode	Output ON setting: 4 - 20 mA (concentration output) Output OFF setting: Retains previous value.
10	User mode	Depends on the settings for item 11. 2.5 mA setting: 2.5 mA 4 mA setting: 4 mA [*] HOLD setting: Retains previous value. 4 - 20 mA setting: 4 - 20 mA (concentration output)
11	Maintenance mode	2.5 mA setting: 2.5 mA 4 mA setting: 4 mA [*] HOLD setting: Retains previous value. 4 - 20 mA setting: 4 - 20 mA (concentration output)

^{*}ESF (detection target gas: oxygen 0 to 25 vol%) is air equivalent (20.9 vol% = 17.4 mA).



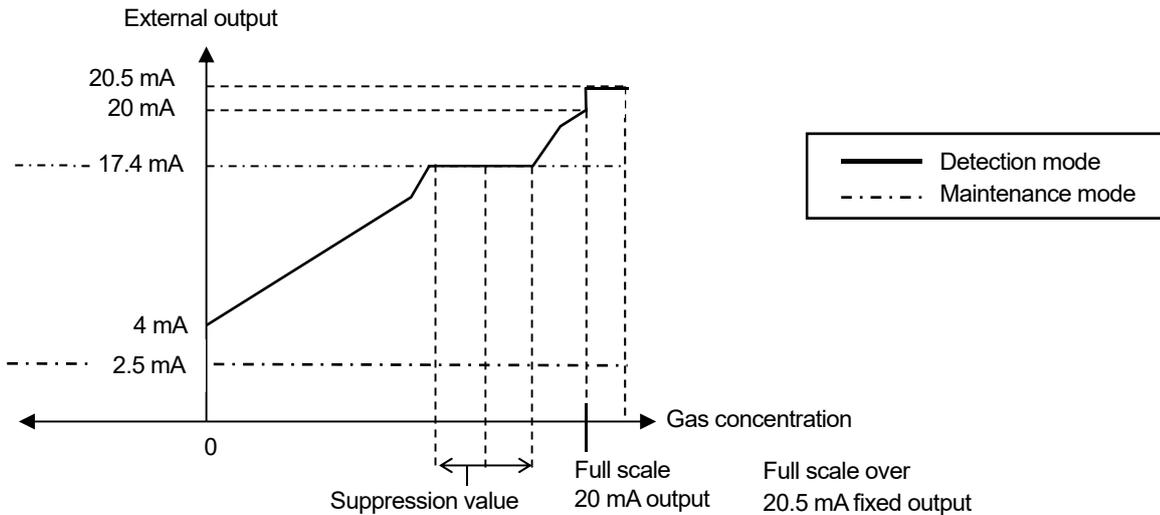
<With analog transmission (4 - 20 mA)>

- The 4 - 20 mA output is already adjusted. If the full scale is exceeded, the output will not exceed 20.5 mA.
- If the inhibit function is enabled or initialization is underway, the output follows the 4 - 20 mA output setting in maintenance mode. Note that the output may become low (e.g., 2.5 mA during initialization) when using ESF (detection target gas: oxygen). Special care is required when starting the product or after altering specifications.
- Make sure you fully understand the operation details and take appropriate precautions where necessary (e.g., setting to skip state) to prevent false alarms on the receiving side.
- Particular care is required in the following situations:

Examples where care is required	Analog transmission 4 - 20 mA specifications
Using ESF (detection target gas: oxygen) (L-LL, L-H)	A false alarm may occur upstream (L alarm) if 2.5 mA is output in maintenance mode or if the inhibit function is enabled.
Changed to ESF specifications (detection target gas: oxygen 0 - 25 vol%)	If changed from another principle (H-HH), 4 mA (equivalent to zero concentration) is output until the change is confirmed (until [C-02] is displayed).
Changed from ESF specifications (detection target gas: oxygen 0 - 25 vol%)	If changed from 0 to 25 vol% (L-LL, L-H), 17.4 mA (equivalent to approximately 84 %FS) is output until the change is confirmed (until [C-02] is displayed).

<Gas concentration and external output example>

0 - 25 vol% (oxygen deficiency alarm specification)

**CAUTION**

- The 4 - 20 mA output is already adjusted. When the full scale is exceeded, the output will not exceed approximately 20.5 mA.
- If the inhibit function is enabled or initialization is underway, the output follows the 4 - 20 mA output setting in maintenance mode. Special care is required when starting the product or after altering specifications.
- Make sure you fully understand the operation details. Take appropriate precautions where necessary to prevent false alarms on the receiving side.
- When the minus suppression function is canceled, the signal will be linearly output to 3.2 mA (equivalent to -5 %LEL).

6-5 Functions to ensure correct alarm activation

6-5-1 Zero suppression function

The sensors used in the product are susceptible to the effects of ambient fluctuations (e.g., temperature and humidity characteristics) and interference gases (interference characteristics), which affect the readings given by the product. Therefore, readings may fluctuate around zero levels even under normal conditions.

The zero suppression function is designed to minimize the effects of these ambient fluctuations and interference gases around the zero level. Use this function to suppress reading fluctuations below the preset value to give a zero reading (or [20.9] (vol%) for oxygen).

<Zero suppression function disabled>



The reading fluctuates around the zero level.

<Zero suppression function enabled>



Displays zero up to the preset value.

NOTE

- ▶ The standard preset value for the zero suppression function differs depending on sensor specifications.
- ▶ When the detection target gas is oxygen, enabling the zero suppression function will give a reading of [20.9] (vol%) for fluctuations in the vicinity of 20.9 vol% up to the preset value. Note that the standard preset value for the zero suppression function is ± 0.5 vol% (with respect to 20.9 vol%) when the detection target gas is oxygen.
- ▶ In user mode and maintenance mode, this function is disabled and reading fluctuations below the preset value are apparent.
- ▶ The zero suppression type is initially set to [CUT]. For information on how to change the zero suppression type, refer to '7-5-9 Zero suppression type setting'.
- ▶ The positive zero suppression value can be set within the range of 0 to 2/3 of the first alarm setpoint (if the first alarm setpoint is 25%LEL, up to 16%LEL). The negative zero suppression value can be set within the range of 0 to 5 % of full scale +1 digit (if the full scale is 100%LEL, -5%LEL+1 digit). (This is not normally used by the user.)



CAUTION

- The negative suppression value (below zero) is subject to suppression corresponding to 5 % of full scale. The error code "E-1" is displayed if the reading falls below 5% of full scale. Accurate gas detection is not possible in this state. Check to confirm that no miscellaneous gases are present, then perform zero calibration.

6-5-2 Automatic sensor recognition function

This product features a function that automatically recognizes the sensor after a sensor is replaced or specifications have been changed.

The display appears as follows to prevent incorrect mounting if a sensor with a different serial number, detection principle, or specifications is mounted:

<After sensor replacement>

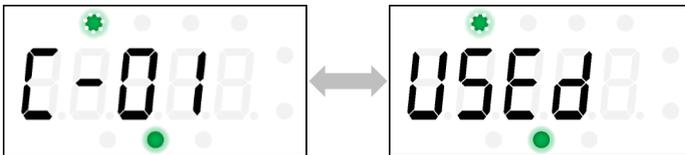
The display appears as follows when the sensor has been replaced with a sensor of the same specifications (e.g., detection principle and model)—for example at periodic replacement.

Pressing the MENU/ESC key makes the product recognize the sensor as a new sensor and start up.



If the sensor mounted after replacement has the same or an older manufacturing date than the sensor replaced, the display alternates between [C-01] and [USEd], as follows.

An old sensor may have been mounted by mistake. Check the sensor.



<After changing specifications>

The display appears as follows when the sensor has been replaced with a sensor of different specifications (e.g., detection principle and model).

Pressing the MENU/ESC key makes the product recognize the sensor as a sensor with new specifications and start up.

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



CAUTION

- Confirming changes in sensor specifications (e.g., detection principal, sensor type, detection target gas, and detection range) when [C-02] is displayed will reflect the changes in the specifications of the product as gas detector.
The following parameters will be reset to their initial values in addition to the alarm setpoints.
Change the parameters in maintenance mode if values other than the initial values are required.
 - Alarm delay
 - Zero suppression value
 - Alarm type
- Confirming the changes by pressing the MENU/ESC key when [C-02] is displayed will start initialization and switch the operation. The initialization output will also change at the same time.
- Settings such as external output are maintained at their previous settings in maintenance mode.
Particular care is required here.
- The ESF specifications include three different alarm types: L-LL, L-H, and H-HH.
The alarm directions will be reversed for changes from or to ESF (L-LL alarm).

7

Maintenance

The product is an important safety and disaster prevention device.

Perform product maintenance at regular intervals to ensure performance and to improve disaster prevention and safety reliability.

7-1 Maintenance intervals and items

The following items should be maintained regularly before using the product:

- Daily maintenance: Perform maintenance before commencing work.
- Monthly maintenance: Inspect the alarm circuit (alarm test) once a month.
- Regular maintenance: Check detection accuracy and perform calibration using a calibration gas.
<Recommended calibration interval>
 - ESF/IRF sensors: At least once every 6 - 12 months
 - NCF/SGF/SHF sensors: At least once every 4 - 6 months
 Perform calibration at least once a year to ensure adequate performance as a safety device.

Maintenance item	Maintenance details	Daily maintenance	Monthly maintenance	Regular maintenance
Power supply check	Check to confirm that the power lamp is lit.	○	○	○
Concentration display check	Check to confirm that the concentration reading is zero (or [20.9] (vol%) for oxygen). If the reading is offset, perform zero calibration after confirming that no miscellaneous gas is present in the vicinity.	○	○	○
Alarm test	Use the alarm test function to check the alarm circuit. If you use an optional alarm relay, check the relay at the same time.	—	○	○
Calibration	Perform sensitivity calibration using a calibration gas.	—	—	○
Gas alarm check	Check the gas alarm using a calibration gas.	—	—	○
Grounding cable check	To ensure EMC performance, check to confirm that the grounding cable connection is secure and free of corrosion.	—	—	○

<Maintenance services>

RIKEN KEIKI provides services related to regular maintenance including calibration, adjustments, and servicing. Preparing a calibration gas requires dedicated equipment, including gas cylinders of the specified concentration and gas sampling bags.

Our certified service engineers have expert knowledge of the dedicated tools and products. We recommend taking advantage of our maintenance service to ensure safe use of the product.

The main details of the maintenance services are as follows. Please contact RIKEN KEIKI for more information.

Service	Service details
Power supply check	<ul style="list-style-type: none"> ▪ Check the power supply voltage. ▪ Check to confirm that the power lamp is lit. (Confirm that the power lamp (POWER), alarm lamps (ALM1, ALM2), fault lamp (FAULT), unit lamps (PPM, %LEL, %) are clearly visible on the display.) ▪ Check the operation of the UPS (uninterruptible power system), if used.
Concentration display check	<p>Check to confirm that the concentration reading indicates zero using a zero calibration gas. Perform zero calibration if the reading is not zero.</p> <p>With the oxygen deficiency alarm specifications, introduce clean air and check that the concentration reading indicates [20.9] (vol%). Perform span adjustment if the reading is offset.</p>
Filter check	<p>Check to confirm that the dust filter is neither contaminated nor clogged.</p> <p>Replace the filter if the filter is dirty or clogged.</p>
Alarm test	<p>Use the alarm test function to inspect the alarm circuit.</p> <ul style="list-style-type: none"> ▪ Check alarm lamps. (Check the ALM1 and ALM2 operations.) ▪ Check external alarms. (Check the buzzer, reset signal, and other external alarm operations.)
Calibration	<p>Perform sensitivity calibration using a calibration gas.</p>
Gas alarm check	<p>Check the gas alarm using a calibration gas.</p> <ul style="list-style-type: none"> ▪ Check alarms. (Confirm alarm activation when alarm setpoint is reached.) ▪ Check delay time. (Check delay time until alarm activation.) ▪ Check alarm lamps. (Check the ALM1 and ALM2 operations.) ▪ Check external alarms. (Check the buzzer, reset signal, and other external alarm operations.)
Product cleaning and repair (visual inspection)	<p>Check the product exterior, cover, and interior for dirt and damage. Clean/repair problem areas.</p> <p>Replace cracked or damaged parts.</p>
Product operation check	<p>Operate the keys to check individual functions and parameters.</p>
Consumable part replacement	<p>Replace degraded components such as sensors and filters.</p>

7-2 Maintenance mode

Switching to maintenance mode lets you perform various tests, zero calibration, and span adjustment and configure various settings.

7-2-1 Maintenance mode setting items

Item No.	Setting item	LED display	Details
2-0	Test mode		Performs the gas test, alarm test, fault test, LED test, and RAM test. (Refer to '7-3 Performing tests (test mode)').
2-1	Zero calibration		Performs zero calibration. (Refer to '7-4-2 Performing zero calibration'.)
2-2	Span adjustment		Performs span adjustment. (Refer to '7-4-3 Performing span adjustment'.)
2-3	Display		This is not normally used by the user.
2-4	Environmental settings 1		Configures settings such as alarm setpoints, alarm pattern, fault alarm pattern, zero suppression value, and the date and time. (Refer to '7-5 Setting environmental settings 1'.)
2-5	Environmental settings 2		This is not normally used by the user.
2-6	Environmental settings 3		Configures settings such as used contact settings and various external outputs. (Refer to '7-6 Setting environmental settings 3'.)
2-7	Communication settings		This is not normally used by the user.

Item No.	Setting item	LED display	Details
2-8	Factory mode selection		This is not normally used by the user.
2-9	User mode selection		Switches to user mode. (Refer to '5-5 User mode'.)

7-2-2 Switching to maintenance mode

- 1 Hold down the MENU/ESC key (for approximately three seconds) in detection mode.



The product switches to user mode.



- 2 Press the ▲ or ▼ key to select [1-3], then press the SET key.



The product switches to maintenance mode.

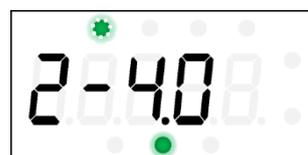


- 3 Press the ▲ or ▼ key to select the required item number, then press the SET key.



Display example: With environmental settings 1 selected

The details corresponding to the item number selected are displayed. Set individual items.



- 4 Once the operation is complete, hold down the MENU/ESC key (for approximately three seconds).**
The product switches to detection mode.

WARNING

- Once the operation is complete, be sure to hold down the MENU/ESC key to return to detection mode. The product will not detect gases while in adjustment/setting state. If left in maintenance mode, the product will take 10 hours to return to detection mode. Detection will not be available during this time, posing hazards.

NOTE

- ▶ If the password setting is enabled, the password must be entered to access maintenance mode.
- ▶ The password is set in advance by RIKEN KEIKI.
If you are unsure, contact RIKEN KEIKI.

<Switching from maintenance mode to user mode>

- 1 Press the ▲ or ▼ key in maintenance mode several times to select [2-9], then press the SET key.**



- 2 Press the SET key.**



The product switches to user mode.



7-3 Performing tests (test mode)

Test mode is used for performing various tests, such as gas tests and alarm tests.

Item No.	Setting item
2-0	Test mode
2-0.0	Gas test
2-0.1	Alarm test
2-0.2	Fault test
2-0.3	LED test
2-0.4	RAM test

7-3-1 Performing gas test

Perform a gas test.

Before starting the gas test, prepare the gas to be used and connect to the product.

For information on gas test preparation, refer to '7-4-1 Calibration preparation'.



- Depending on the settings, contact and gas concentration outputs may be activated during gas testing, even in maintenance mode. Take care during gas testing.

- Press the ▲ or ▼ key in maintenance mode several times to select [2-0], then press the SET key.



- Select [2-0.0], then press the SET key.



- Introduce the gas to be used in the gas test.



- Shut off the gas test gas once the gas concentration reading has stabilized.



- Once the reading has returned to [0.0] (or [20.9] (vol%) for oxygen), press the MENU/ESC key.



Returns to the [2-0.0] display.

7-3-2 Performing alarm test

Test to check whether an alarm is triggered when the reading reaches the alarm setpoint.



- Depending on the settings, contact and gas concentration outputs may be activated during alarm testing, even in maintenance mode. Take care during alarm testing.

NOTE

- The procedure in step 3 is required even if the product is a no alarm relay model. Note that the contact will not operate even when [on] is selected.

- Press the ▲ or ▼ key in maintenance mode several times to select [2-0], then press the SET key.



- Press the ▲ or ▼ key to select [2-0.1], then press the SET key.



- Press the ▲ or ▼ key to select [oFF] or [on], then press the SET key.

Select [on] if the setting for the contact used is alarm only or alarm or fault, or [oFF] if the setting is other than those.



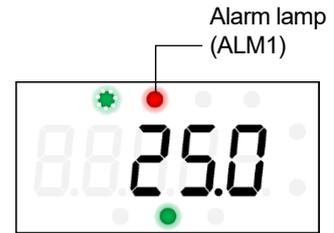
- Press the ▲ or ▼ key to increase or decrease the reading.



5 Check to confirm that an alarm is triggered.

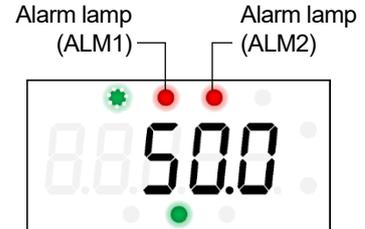
The first alarm is triggered when the reading reaches the first alarm setpoint.

The alarm lamp (ALM1) lights up (red) when the first alarm is triggered.



The second alarm is triggered when the reading reaches the second alarm setpoint.

The alarm lamps (ALM1 and ALM2) light up (red) when the second alarm is triggered.



6 Once the alarm test is complete, press the MENU/ESC key.

Returns to the [2-0.1] display.

7-3-3 Performing fault test

Test to check whether an alarm is triggered when a fault occurs in the product.



- Depending on the settings, contact and gas concentration outputs may be activated during fault testing, even in maintenance mode. Take care during fault testing.

- Press the ▲ or ▼ key in maintenance mode several times to select [2-0], then press the SET key.



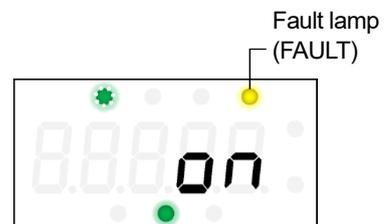
- Press the ▲ or ▼ key to select [2-0.2], then press the SET key.



- Press the ▲ or ▼ key to select [on], then press the SET key.



- Check to confirm that a fault alarm is triggered.
The fault lamp (FAULT) lights up (yellow) when a fault alarm is triggered.



- Once the fault test is complete, press the ▲ or ▼ key to select [oFF], then press the SET key.
The fault alarm is cleared. The fault lamp (FAULT) goes out.
Fault alarms can also be cleared by pressing the MENU/ESC key.



7-3-4 Performing LED test

Perform an LED display test.

- 1 Press the ▲ or ▼ key in maintenance mode several times to select [2-0], then press the SET key.



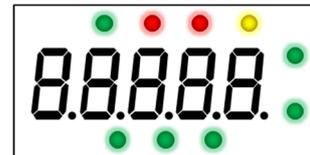
- 2 Press the ▲ or ▼ key to select [2-0.3], then press the SET key.



- 3 Press the ▲ or ▼ key to select [on], then press the SET key.



- 4 Check to confirm that all LEDs light up.



- 5 Once the LED test is complete, press the ▲ or ▼ key to select [off], then press the SET key.

The LED test ends.

The LED test can also be ended by pressing the MENU/ESC key.



7-3-5 Performing memory test (RAM test)

Perform a memory test.

- 1 Press the ▲ or ▼ key in maintenance mode several times to select [2-0], then press the SET key.



- 2 Press the ▲ or ▼ key to select [2-0.4], then press the SET key.



- 3 Press the SET key.



The memory test starts.



- 3 Check the memory test result.
No problems with memory:
[PASS] appears.



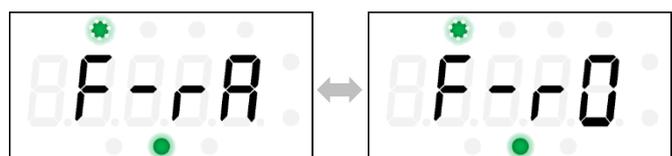
Problems with RAM:
[F-rA] appears.



Problems with ROM:
[F-rO] appears.



Problems with both RAM and ROM:
[F-rA] and [F-rO] are displayed alternately.



- 4 Once you have checked the result, press the SET key.
Returns to the [2-0.4] display.

7-4 Performing calibration

7-4-1 Calibration preparation

Before performing calibration (zero calibration and span adjustment), prepare the calibration gas.

Also connect the calibration equipment required to the product before starting.

- Zero calibration gas
- Span adjustment gas (in gas sampling bag or gas can)
- Gas sampling bag for exhaust gas
- Calibration adapter or splash guard

<List of adjustment jigs>

Item name	Applicable specifications	
Calibration adapter	For IRF sensors	Part No.: 4283 9011 00
	For NCF/SGF/SHF sensors	Part No.: 4283 9012 70
	For ESF sensors	Part No.: 4283 9013 40
Pump	One that can provide a flow rate of 0.5 mL or greater	
	Explosion-proof specifications	
Flowmeter	Measures tolerances to 0.1 ml.	
	Has passed regular inspection.	
Stopwatch	Has passed regular inspection.	
Piping	For general combustible gases	Material: Polyurethane Internal diameter: 4 mm Pipe length between gas and adapter: Within 1 m
	For organic solvents	Material: Teflon Internal diameter: 4 mm Pipe length between gas and adapter: Within 1 m
	For strongly adsorptive gases	Material: Teflon Internal diameter: 4 mm Pipe length between gas and adapter: Within 10 cm

<Zero calibration gas>

- The zero calibration gas is a gas for calibrating the zero point. The ambient air can be used as the zero calibration gas if there are no interfering impurities or target gases present. For O₂ and CO₂ sensors, nitrogen (N₂) is used.

- The span adjustment gas is a gas for calibrating the sensitivity of the sensors during span adjustment. The span adjustment gas is a gas of known concentration diluted with clean air or nitrogen. For O₂ sensors, the oxygen in the ambient atmosphere is used, so a span adjustment gas is not required.
- We recommend calibrating the device using the detection target gas (actual gas calibration). This method is more accurate than using a replacement gas. Use of a replacement gas for calibration is permissible in circumstances when it is not possible to use actual gas calibration.
- It is necessary to calibrate for methane and hydrogen using only the actual gases. Do not use replacement gases for calibration.
- Span adjustment must be performed within 24 hours of the most recent valid zero calibration.
- For managing the concentration of calibration gases, we recommend the use of a RIKEN KEIKI portable detector.
- Contact RIKEN KEIKI.

WARNING

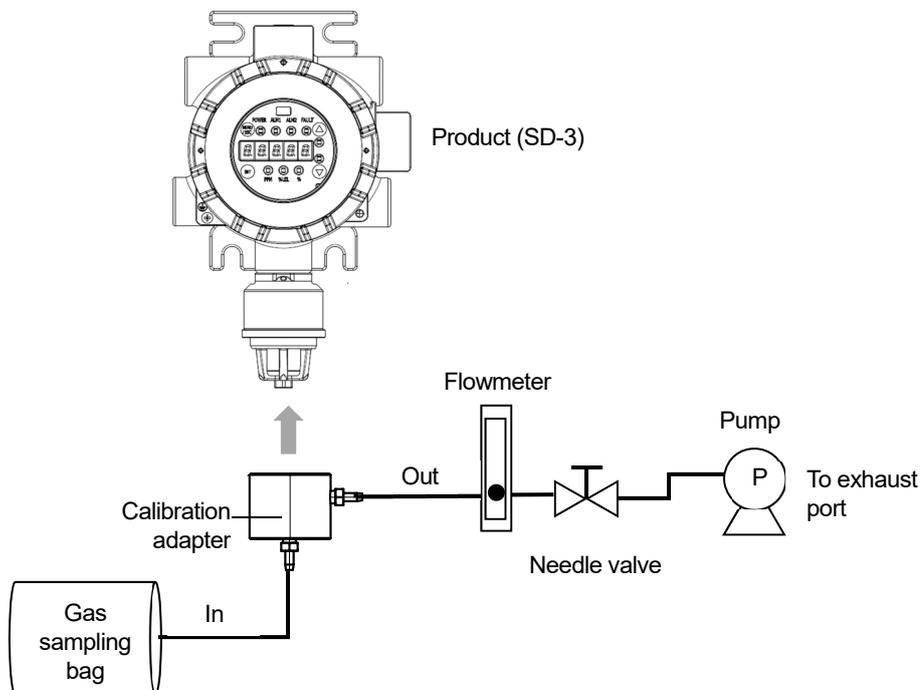
- Span adjustment gases include combustible gases and toxic gases. Never inhale the calibration gas. Accidental inhalation may be fatal or harmful to health.

<When using the calibration adapter>

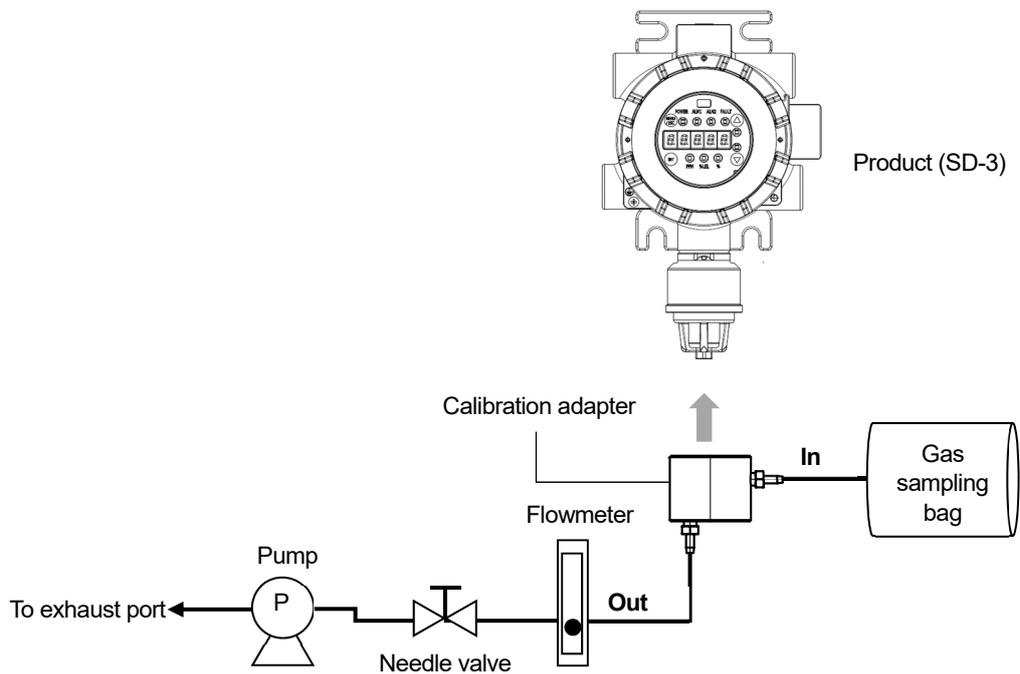
NOTE

- Use a flow rate of 0.5 L/min \pm 0.1 L/min when calibrating. Calibration accuracy may be impaired if calibration is performed using a different flow rate.
- Three types of calibration adapters are used according to the gas detector model: the calibration adapter for IRF sensors, that for NCF/SHF/SGF sensors, and that for ESF sensors. Note that the SD-3GHS, the SD-3DGHS, and the GD-3GHS use the IRF sensor adapter as an exception.
- Leaving the suction cap and calibration adapter attached in a windless state for 10 minutes or more may cause adsorbed gas to accumulate, which can cause the reading to rise (for oxygen, the pipes and adapter interior become oxygen deficient, causing the reading to fall). If this occurs, push clean air through to return the reading to zero. Furthermore, as the sensor will be shut off from the atmosphere, detection will not be possible in this state.

<Using a gas sampling bag>

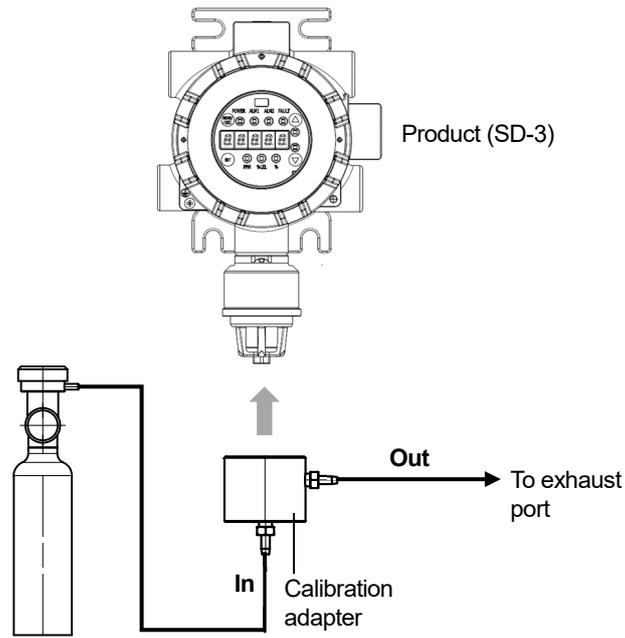


<Using a gas sampling bag> **NC** **GH** **SP**

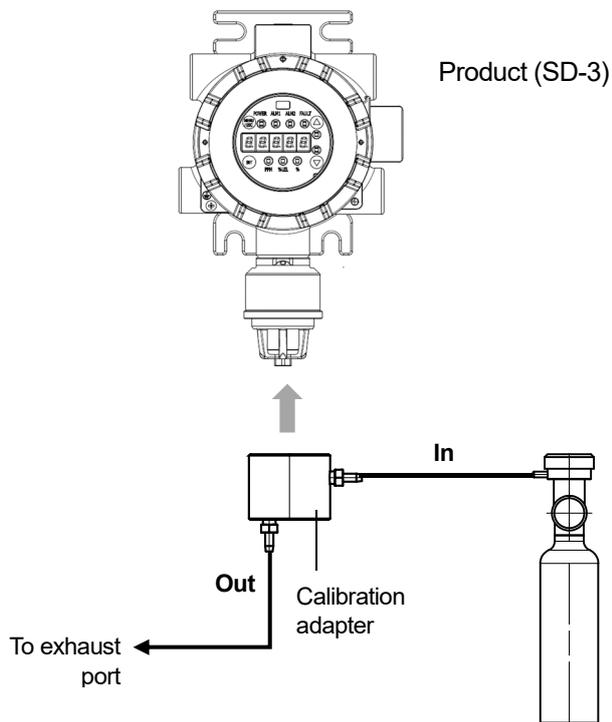


*The diagram illustrates the SD-3. The connection method for the remote sensor head (GD-3) is identical.

<Using a gas can> **RI** **EC**



<Using a gas can> **NC** **GH** **SP**



*The diagram illustrates the SD-3. The connection method for the remote sensor head (GD-3) is identical.

<When using the splash guard>



- Gas response times can be affected when a splash guard is used.
- The gas response time increases and this can increase the time until the alarm occurs.

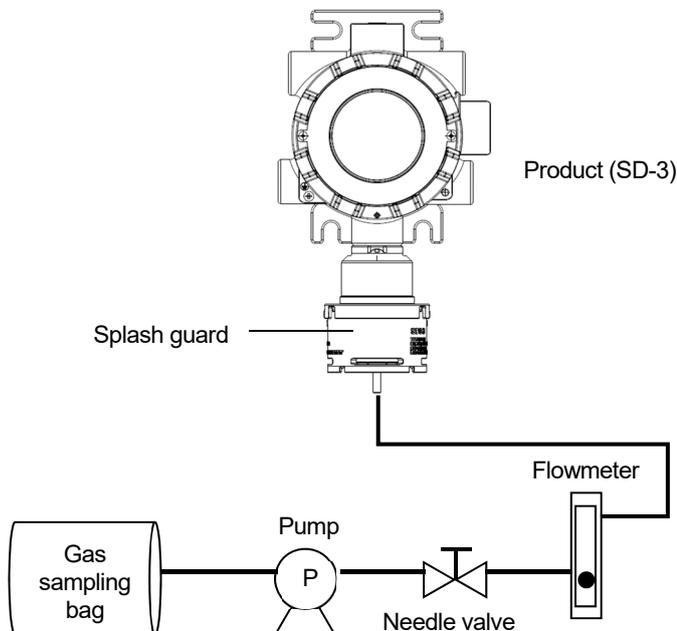
NOTE

- ▶ The calibration adapter is not required when using the splash guard.
- ▶ When using the splash guard, calibrate using the following wind speed:

Detection principle	Wind speed
Non-dispersive infrared absorption type (infrared type)	Max. 6 m/s
New ceramic type (catalytic type)	
Semiconductor type	
Hot-wire semiconductor type	Max. 1 m/s
Electrochemical type	

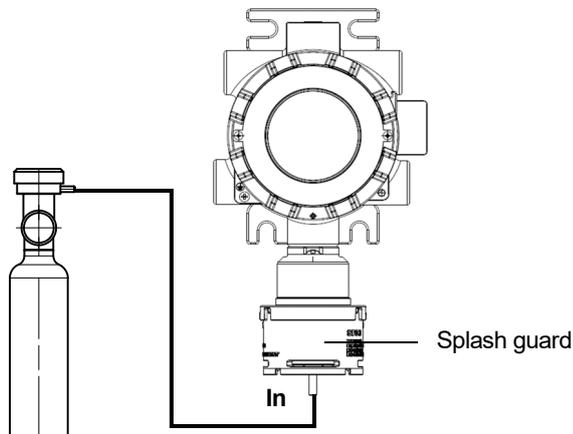
- ▶ If calibration is unsuccessful, fit the calibration adapter and calibrate again.
- ▶ When calibrating adsorptive gas, fit the calibration adapter.
- ▶ Use a flow rate of 0.5 L/min \pm 0.1 L/min when calibrating. Calibration accuracy may be reduced if calibration is performed using a different flow rate.

<Using a gas sampling bag>



*The diagram illustrates the SD-3. The connection method is the same for the remote sensor head (GD-3).

<Using a gas can>



* The diagram illustrates the SD-3. The connection method is the same for the remote sensor head (GD-3).

<When using filters>

**WARNING**

- Sensitivity, gas response times, and replacement gas sensitivity can be affected when a filter is attached.
 - The gas response time increases when a filter is used, and this can increase the time until the alarm occurs.
-

<When using a protective cover>

**WARNING**

- Sensitivity, gas response times, and replacement gas sensitivity can be affected when a protective cover is attached.
 - The gas response time increases when a protective cover is used, and this can increase the time until the alarm occurs.
-

7-4-2 Performing zero calibration

Gas concentrations cannot be accurately measured unless zero calibration is performed correctly.

Be sure to carry out zero calibration to ensure accurate measurement.

Prepare the zero calibration gas, then connect to the product before starting zero calibration.

For information on zero calibration preparation, refer to '7-4-1 Calibration preparation'.



WARNING

- Before performing zero calibration for the surrounding atmosphere, confirm that the surrounding atmosphere contains clean air. Performing zero calibration in the presence of miscellaneous gases will prevent correct calibration and create safety hazards in the event of an actual gas leak.



CAUTION

- Perform zero calibration after supplying the zero calibration gas and waiting for the reading to stabilize.

NOTE

- ▶ Perform zero calibration and span adjustment in the specified order. Sensor characteristics may be affected if adjustment is not performed in the correct order.
GHF sensors: Perform span adjustment first, followed by zero calibration.
Sensors other than GHF sensors: Perform zero calibration first, followed by span adjustment.

- 1 Press the ▲ or ▼ key in maintenance mode several times to select [2-1], then press the SET key.



- 2 Introduce the zero calibration gas, then press the SET key.



Zero calibration starts.



- 3 Check the zero calibration result.

If zero calibration is successful
[PASS] is displayed for three seconds before the display automatically returns to [2-1].



If zero calibration is unsuccessful
[FAIL] is displayed and the display returns to [2-1] when the SET key is pressed.



NOTE

- ▶ If zero calibration is unsuccessful because the zero point (N₂ in the case of oxygen) fluctuates significantly around zero, [FAIL] is displayed. If this occurs, zero calibration was not performed.

7-4-3 Performing span adjustment

Perform the span adjustment required to ensure accurate measurement of gas concentrations. Prepare the span adjustment gas, then connect to the product before starting span adjustment. For information on span adjustment preparation, refer to '7-4-1 Calibration preparation'.

NOTE

- ▶ Dedicated equipment is required for span adjustment. We recommend contacting RIKEN KEIKI to request the required equipment.

<With standard range>



- Perform span adjustment after supplying the span adjustment gas (at a concentration of 1.6 times the alarm setpoint value or 40 % of full scale) and waiting for the reading to stabilize.
- With the oxygen deficiency alarm specifications, introduce clean air to adjust to [20.9] (vol%).

- 1 Press the ▲ or ▼ key in maintenance mode several times to select [2-2], then press the SET key.



- 2 Introduce the span adjustment gas, then press the SET key. The SET key is disabled if the reading is less than 10 % of full scale.



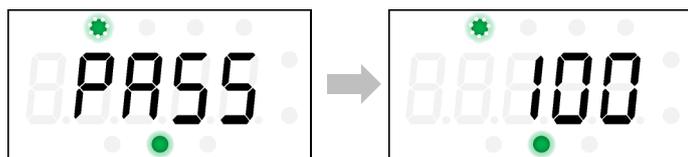
- 3 Press the ▲ or ▼ key to adjust the reading to match the concentration of the gas introduced, then press the SET key.



Span adjustment starts.



- 4 Check the span adjustment result. If span adjustment is successful [PASS] is displayed, followed by the calibration concentration upper limit.



If span adjustment is unsuccessful [FAIL] appears.



- 5 Press the SET key. Returns to the [2-2] display.

NOTE

- ▶ If span adjustment is unsuccessful because the reading fluctuates significantly compared to the concentration of the gas introduced, [FAIL] appears. If this occurs, span adjustment was not performed.
- ▶ If span adjustment was unsuccessful, check whether the correct concentration span adjustment gas was supplied and confirm that there are no leaks in the gas calibration equipment. If span adjustment was not performed correctly, repeat span adjustment.
- ▶ If span adjustment was performed correctly or if span adjustment fails even when repeated, the gas sensor may have reached the end of its service life. Turn off the power and contact RIKEN KEIKI.

<With double range> **NC**


CAUTION

- Perform span adjustment after supplying the span adjustment gas and waiting for the reading to stabilize.
- For double range span adjustment, perform span adjustment first for the L range, followed by the H range in succession. If span adjustment was aborted midway, repeat from the L range.

- 1 Press the ▲ or ▼ key in maintenance mode several times to select [2-2], then press the SET key.**



- 2 Introduce the span adjustment gas, then press the SET key.**
The SET key is disabled if the reading is less than 10 % of full scale.



- 3 Press the ▲ or ▼ key to adjust the reading to match the concentration of the gas introduced, then press the SET key.**



Span adjustment starts for the L range.



- 4 Check the L range span adjustment result.**

- If L range span adjustment is successful
[PASS] is displayed, followed by the calibration concentration upper limit, after which H range span adjustment automatically starts.



- If L range span adjustment is unsuccessful
[FAIL] appears, and the product automatically proceeds to H range span adjustment.



5 Introduce the span adjustment gas, then press the SET key.

The SET key is disabled if the reading is less than 10 % of full scale.



6 Press the ▲ or ▼ key to adjust the reading to match the concentration of the gas introduced, then press the SET key.



Span adjustment starts for the H range.



7 Check the H range span adjustment result.

- If H range span adjustment is successful
[PASS] is displayed, followed by the calibration concentration upper limit.



- If H range span adjustment is unsuccessful
[FAIL] appears.



8 Press the SET key.

Returns to the [2-2] display.

NOTE

- ▶ If span adjustment is unsuccessful because the reading fluctuates significantly compared to the concentration of the gas introduced, [FAIL] appears. If this occurs, span adjustment was not performed.
- ▶ If span adjustment was unsuccessful, check whether the correct concentration span adjustment gas was introduced and confirm that there are no leaks in the gas calibration equipment. If span adjustment was not performed correctly, repeat span adjustment.
- ▶ If span adjustment was performed correctly or if span adjustment fails even when repeated, the gas sensor may have reached the end of its service life. Turn off the power and contact RIKEN KEIKI.

7-5 Setting environmental settings 1

The following items can be set in environmental settings 1:

Item No.	Setting item	Remarks
2-4	Environmental settings 1	
2-4.0	Inhibit setting	
2-4.1	Alarm setpoint setting	
2-4.2	Alarm delay setting	This is not normally used by the user.
2-4.3	Alarm pattern setting	This is not normally used by the user.
2-4.4	Alarm setpoint limiter setting	This is not normally used by the user.
2-4.5	Alarm type setting	This is not normally used by the user.
2-4.6	Fault alarm pattern setting	This is not normally used by the user.
2-4.7	Zero suppression value setting	
2-4.8	Zero suppression type setting	
2-4.9	Password	
2-4.A	Date and time setting	

7-5-1 Inhibit setting

Enabling the inhibit setting prevents alarms from being issued externally even when the gas concentration is displayed in detection mode. This setting is primarily used when testing and maintaining the product.

The default setting is disabled.

- 1 Press the ▲ or ▼ key in maintenance mode to select [2-4], then press the SET key.
- 2 Select [2-4.0], then press the SET key.
- 3 Press the ▲ or ▼ key to select [oFF] or [on], then press the SET key.



Returns to the [2-4.0] display.

NOTE

- ▶ Enabling the inhibit setting causes the LED display to alternate between [InHI.] and [0.0] (gas concentration) when in detection mode.

7-5-2 Alarm setpoint setting

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

Set each alarm setpoint within the following range:

Alarm setpoint	Alarm setpoint range	
First alarm setpoint ([AL1])	0 - 10 % of full scale (H-HH)	
Second alarm setpoint ([AL2])	Combustible gas	First alarm setpoint to 60 % of full scale (H-HH)
	Other gases	First alarm setpoint to full scale (H-HH)

- 1 Press the ▲ or ▼ key in maintenance mode to select [2-4], then press the SET key.



- 2 Press the ▲ or ▼ key to select [2-4.1], then press the SET key.



- 3 Press the ▲ or ▼ key to select [AL1] or [AL2], then press the SET key.

To set the first alarm setpoint, select [AL1]. To set the second alarm setpoint, select [AL2].



- 4 Press the ▲ or ▼ key to set the alarm setpoint, then press the SET key.



The display returns to [AL1] or [AL2].

NOTE

- ▶ The alarm setpoints can be checked by displaying the settings in user mode. (Refer to '5-7-1 Checking alarm setpoints'.)

7-5-3 Zero suppression value setting

Set the positive and negative zero suppression values.

Set the zero suppression values within the following ranges:

- Positive suppression value setting ([P-SuP]): 0 to 2/3 of first alarm setpoint
- Negative suppression value setting ([n-SuP]): 0 to 5 % of full scale + 1 digit

NOTE

- ▶ For more information on the zero suppression function, refer to '6-5-1 Zero suppression function'.

- 1 Press the ▲ or ▼ key in maintenance mode to select [2-4], then press the SET key.



- 2 Press the ▲ or ▼ key to select [2-4.7], then press the SET key.



- 3 Press the ▲ or ▼ key to select [P-SuP] or [n-SuP], then press the SET key.

To set the positive zero suppression value, select [P-SuP]. To set the negative zero suppression value, select [n-SuP].



- 4 Press the ▲ or ▼ key to set the zero suppression value, then press the SET key.



The display returns to [P-SuP] or [n-SuP].

7-5-4 Zero suppression type setting

Set the zero suppression type.

Select one of the following:

- Cut type ([Cut]): Values that exceed the zero suppression value are displayed unchanged.
- Slope type ([SLOPE]): Values that exceed the zero suppression value are displayed smoothly.

The default setting is cut type ([Cut]).

- 1 Press the ▲ or ▼ key in maintenance mode to select [2-4], then press the SET key.



- 2 Press the ▲ or ▼ key to select [2-4.8], then press the SET key.



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



The display returns to [2-4.8].

7-5-5 Password setting

Set a password for accessing maintenance mode.

If you enable password setting, the product will display a password input screen to access maintenance mode.

The default setting is enabled.

NOTE

- ▶ The password is set beforehand by RIKEN KEIKI.
If you are unsure, please contact RIKEN KEIKI.

- 1 Press the ▲ or ▼ key in maintenance mode to select [2-4], then press the SET key.



- 2 Press the ▲ or ▼ key to select [2-4.9], then press the SET key.



- 3 Press the ▲ or ▼ key to select [on] or [oFF], then press the SET key.



The display returns to [2-4.9].

7-5-6 Date and time setting

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

- 1 Press the ▲ or ▼ key in maintenance mode to select [2-4], then press the SET key.



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



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

The selected item (last two digits of the year) flashes.



- 4 Press the ▲ or ▼ key to set the month, then press the SET key.

The selected item (month) flashes.



- 5 Press the ▲ or ▼ key to set the date, then press the SET key.

The selected item (day) flashes.



- 6 Press the ▲ or ▼ key to set the hours (24-hour format), then press the SET key.

The selected item (hour) flashes.



- 7 Press the ▲ or ▼ key to set the minutes, then press the SET key.

The selected item (minutes) flashes.



Returns to the [2-4.A] display.

7-6 Setting environmental settings 3

The following items can be set in environmental settings 3:

Item No.	Setting item	Remarks
2-6	Environmental settings 3	
2-6.0	Used contact setting	This is not normally used by the user.
2-6.1	Energized/de-energized setting	This is not normally used by the user.
2-6.2	Maintenance external output setting	This is not normally used by the user.
2-6.3	External output adjustment (4 - 20 mA)	This is not normally used by the user.
2-6.4	Alarm test external output	This is not normally used by the user.
2-6.5	Fault alarm external output setting	This is not normally used by the user.
2-6.6	Double range external output setting	NC

7-6-1 Double range external output setting **NC**

Sets the double range external output range. (Refer to <Gas concentration and external output example (with double range)> in '6-3 External output operation'.)

Select one of the following:

- 4 - 20 mA (L range)/22 mA (H range) ([L4-20])
- 4 - 20 mA (H range) ([H4-20])
- 4 - 16 mA (L range)/16 - 20 mA (H range) ([4-16])

The default setting is 4 - 16 mA (L range)/16 - 20 mA (H range) ([4-16]).

NOTE

- ▶ The double range external output setting can be set only with sensors that rely on the new ceramic detection principle. (Refer to '1-2-2 Detection principles and detection target gases for individual models'.)

- 1 Press the ▲ or ▼ key in maintenance mode to select [2-6], then press the SET key.



- 2 Press the ▲ or ▼ key to select [2-6.6], then press the SET key.



- 3 Press the ▲ or ▼ key to select [4-16], [L4-20], or [H4-20], then press the SET key.



Returns to the [2-6.6] display.

7-7 Parts replacement

7-7-1 Sensor replacement

A functional check by a qualified maintenance engineer (or similarly qualified technician) is required after sensor replacement. To ensure safety and the stable operation of the product, request checking by a qualified maintenance engineer. Contact RIKEN KEIKI to request checking.

<Sensor replacement intervals>

Sensor model	Gas types	Chemical formula	Detection concentration	Sensor replacement interval
IRF	—	—	—	5 years
NCF	—	—	—	3 years
SHF	—	—	—	3 years
SGF	—	—	—	3 years
ESF-A ^{*1}	—	—	—	3 years
ESF-B ^{*2}	—	—	—	3 years ^{*5}
ESF-C ^{*3}	—	—	—	3 years
ESF-X ^{*4}	—	—	—	3 years

*1: ESF-A refers to the type of sensor starting with "ESF-A".

*2: ESF-B refers to the type of sensor starting with "ESF-B".

*3: ESF-C refers to the type of sensor starting with "ESF-C".

*4: ESF-X refers to the type of sensor starting with "ESF-X".

*5: 3 years for use in a room temperature environment, and 2 years for use under other conditions.



- Be sure to turn OFF the power supplied to the sensor before replacing the sensor.
- Refer to '4-8 Mounting the sensor' for instructions on how to mount the sensor.
- Perform zero calibration and span adjustment after replacing the sensor.
- The sensor can be replaced in zones classified as hazardous without turning off the main unit power supply.
- If the same type of sensor (the same part number) was previously installed, the particular configurations of the device (detection target gas, measurement range, alarm setpoints, zero suppression, etc.) are maintained. In other cases, the default factory settings of the new sensor are uploaded, overwriting the current configurations. The sensor is recognized by the automatic sensor recognition function. Refer to '6-5-2 Automatic sensor recognition function' for information on the automatic sensor recognition function.
- Use the "Sensor replacement" item from the sensor replacement function menu to replace the sensor without triggering a fault signal on the main unit.

NOTE

- ▶ Please contact RIKEN KEIKI to request sensor replacement. Calibration using a calibration gas is required after sensor replacement.

7-7-2 Replacement of periodic replacement parts

The product periodic replacement parts are as follows. The parts should be replaced at the recommended replacement intervals.

<Recommended periodic replacement parts list>

Name	Recommended check interval	Recommended replacement interval	Quantity (per unit)	Remarks
Sensor guard (for SD-3RI/GHS)	6 months	3 - 8 years	1	
Sensor guard (for SD-3NC/GH/SP)				
Sensor guard (for SD-3EC/ECS/ECB)				
Silicone removal filter		1 year		Product No.: 4283 0030 20
Activated carbon filter		1 year		Product No.: 4283 0040 10

NOTE

- ▶ The above replacement intervals are guidelines only. Replacement intervals may vary depending on actual operating conditions. These intervals do not constitute warranty periods. Replacement intervals may vary depending on the results of regular maintenance.

8

Storage, Relocation, and Disposal

8-1 Procedures for storage or when not in use for extended periods

The product must be stored in the following environment:

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

<Storage conditions (Sensor)>

Model	Storage limit (years)	Temperature (°C)		Humidity*1 (% RH)		Pressure (kPa)		Remarks
	—	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum	
SGF	0.5	-10	40	0	90	80	120	<ul style="list-style-type: none"> • The sensor must be stored in the specified packing case. • Store in a location away from direct sunlight. • Store in an environment free of corrosive gas, vibration, and dust. • Avoid condensation and moisture. • Store in an environment free of gases that may act as a catalyst poison (e.g., silicone, chlorine, sulfur gases).
SHF	0.5	-10	40	0	90	80	120	
NCF	0.5	-10	40	0	90	80	120	
IRF	0.5	-10	40	0	90	80	120	<ul style="list-style-type: none"> • The sensor must be stored in the specified packing case. • Store in a location away from direct sunlight. • Store in an environment free of corrosive gas, vibration, and dust. • Avoid condensation and moisture.
ESF	0.5	-10	40	0	90	80	120	<ul style="list-style-type: none"> • The sensor must be stored in the specified packing case. • Store in a location away from direct sunlight. • Store in an environment free of corrosive gas, vibration, and dust. • Avoid condensation and moisture. • Store in an environment free of gases that may act as a catalyst poison (e.g., silicone, chlorine, sulfur gases).

*1: Maximum humidity corresponds to an absolute humidity of 33 g/m³ (33.6 °C, 90 %RH) or less.

<Storage conditions (Sensor-fitted SD-3)>

Model	Storage limit (years)	Temperature (°C)		Humidity*1 (% RH)		Pressure (kPa)		Remarks
	—	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum	
SGF	0.5	-10	40	0	90	80	120	<ul style="list-style-type: none"> Store in a location away from direct sunlight. Store in an environment free of corrosive gas, vibration, and dust. Avoid condensation and moisture. Store in an environment free of gases that may act as a catalyst poison (e.g., silicone, chlorine, sulfur gases).
SHF	0.5	-10	40	0	90	80	120	
NCF	0.5	-10	40	0	90	80	120	
IRF	0.5	-10	40	0	90	80	120	<ul style="list-style-type: none"> Store in a location away from direct sunlight. Store in an environment free of corrosive gas, vibration, and dust. Avoid condensation and moisture.
ESF-A*2	0.5	-10	40	20	90	80	120	<ul style="list-style-type: none"> Store in a location away from direct sunlight. Store in an environment free of corrosive gas, vibration, and dust. Avoid condensation and moisture. Store in an environment free of gases that may act as a catalyst poison (e.g., silicone, chlorine, sulfur gases).
ESF-X*3								
ESF-B*4	0.5	-10	40	30	80	80	120	
ESF-C*5								Open the dedicated container just before use, remove the sensor, and mount in the detector.

*1: Maximum humidity corresponds to an absolute humidity of 33 g/m³ (33.6 °C, 90 %RH).

*2: ESF-A refers to sensor model names starting with "ESF-A".

*3: ESF-X refers to sensor model names starting with "ESF-X".

*4: ESF-B refers to sensor model names starting with "ESF-B".

*5: ESF-C refers to sensor model names starting with "ESF-C".

*6: If not stored in the container, fluid leakage may occur under high humidity conditions of 90 %RH or more. Fluid shortage may occur with the ESF-B under low humidity conditions.



- This product is very heavy and features various projections. Damage to this product and accompanying parts may result if they are packaged in general packaging materials. When storing or returning the product to RIKEN KEIKI for any reason, use the packaging in which the product was shipped. If the original packaging is no longer available, wrap twice and place hard objects in the spaces within the packaging to ensure that the product will not shift inside the packaging. Avoid packaging fragile items.

8-2 Procedures for relocation or reuse

Before relocating and resuming use of the product, refer to '4-1 Installation precautions' for information on relocation locations.

For information on installation procedures, refer to '4. Installation'.

CAUTION

- Calibration must always be performed before resuming use of the product that has been relocated or previously stopped and stored. Contact RIKEN KEIKI for information on readjustment procedures, including calibration.

8-3 Product disposal

- Dispose of the product as industrial waste (incombustible) in accordance with local regulations.
- Used sensor units must be returned to RIKEN KEIKI. Submit returns to RIKEN KEIKI.
- Avoid direct contact with any fluid that may leak from electrochemical type sensors (ESF sensors). Place the unit in a plastic bag and make sure the fluid cannot leak out.
- The product and ESF sensor contain button-type batteries. These batteries must be properly separated before disposal. Contact your nearest sales office for advice.

<SD-3 main unit>

Button-type lithium battery specifications

Item name	Lithium battery
Nominal voltage	3.0 V
Nominal capacity	48 mAh

Removal method

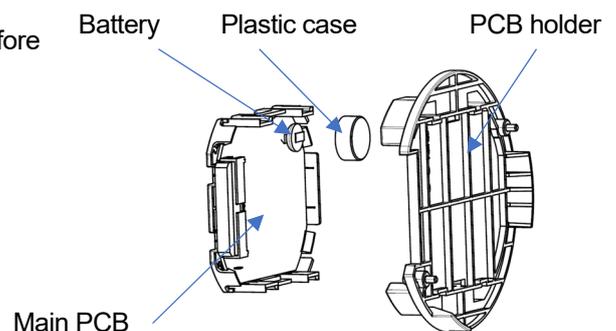
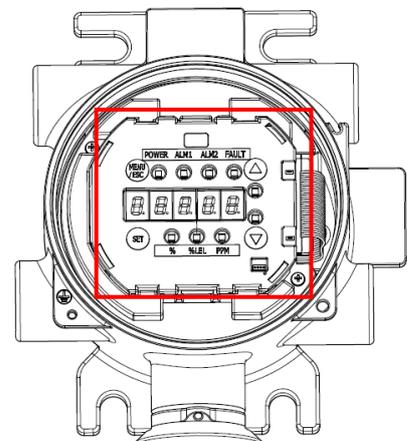
Remove the main PCB unit indicated by the red box in the figure to the right. Remove the PCB holder.

The battery is located on the underside of the main PCB (on the rear of the 7-segment LCD).

The battery is covered by a plastic case. The plastic case is attached to the PCB. Remove the case using pliers or a flathead screwdriver.

Cut the terminals on both sides of the battery using nippers, then remove.

Wrap the removed battery in tape to prevent short-circuiting before disposal.



<ESF Sensor>

Button-type lithium battery specifications

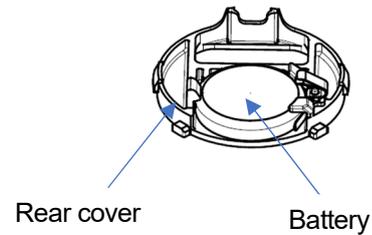
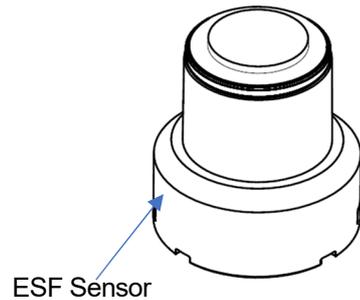
Item name	Lithium manganese dioxide battery
Nominal voltage:	3.0 V
Nominal capacity	140 mAh

Removal method

Remove the ESF sensor rear cover (white cover).

Remove the battery from the rear cover.

Wrap the removed battery in tape to prevent short-circuiting before disposal.

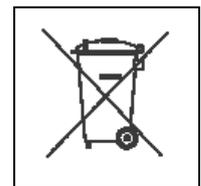


WARNING

- Never attempt to disassemble ESF sensors. They contain electrolyte. Blistering may result if the electrolyte comes into contact with the skin. Contact with eyes may result in blindness. Discoloration or holes may result if contact with clothing occurs. If contact with electrolyte occurs, rinse the area immediately with plenty of water.

NOTE

- ▶ The product contains a battery.
- ▶ Crossed-out recycle dustbin mark
This pictogram is affixed to products containing batteries to which EU Battery Directive 2006/66/EC applies.
Such batteries must be disposed of appropriately.
This pictogram means batteries must be separated from ordinary waste and disposed of appropriately.



9

Troubleshooting

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

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

9-1 Product abnormalities

Symptom/display	FAULT lamp	Cause	Action
The power cannot be turned on.	—	The wires are incorrectly connected.	Wire correctly.
		The wires are detached from the terminal plate.	Connect correctly.
		Abnormalities or instantaneous interruptions in the power supply circuit	Check to confirm that the rated voltage is supplied. Consider use of an uninterruptible power system, power supply line filter, or insulated transformer, and add such devices where appropriate.
		Cable abnormality (Disconnection, cable not connected, short circuit)	Check the wiring for the product and peripheral devices.
		Fuse blown	Replacement required. Contact RIKEN KEIKI.
		Internal circuit abnormality	Replacement required. Contact RIKEN KEIKI.
Abnormal operation	—	Disturbances due to sudden noise, etc.	Turn off the power and restart. If similar symptoms recur frequently, take appropriate measures to address the noise source. If the problem persists even with noise prevention measures, contact RIKEN KEIKI.
Sensor abnormality (E-1)	 (lit)	The sensor is not connected or connected improperly.	Turn off the power and check the sensor connection.
		A sensor fault has occurred.	Replace with a new sensor.
		Effects of sudden surge noise	Turn off the power and restart. If similar symptoms recur frequently, take appropriate measures to address the noise source. If the problem persists even with noise prevention measures, contact RIKEN KEIKI.
		The main unit (SD-3/SD-3SC) or remote sensor head (GD-3) internal wiring is connected incorrectly.	Connect internal wiring of the main unit (SD-3/SD-3SC) or remote sensor head (GD-3) correctly.

Symptom/display	FAULT lamp	Cause	Action
		Cable abnormality between the main unit (SD-3SC) and remote sensor head (GD-3)	Check the cable between the main unit (SD-3SC) and remote sensor head (GD-3).
Sensor abnormality (E-1)	 (lit)	A main unit (SD-3/SD-3SC) or remote sensor head (GD-3) fuse has blown.	Replacement required. Contact RIKEN KEIKI.
		Main unit (SD-3/SD-3SC) or remote sensor head (GD-3) internal circuit abnormality	Replacement required. Contact RIKEN KEIKI.
System abnormality (E-9)	 (lit)	4 - 20 mA output disconnection	Turn off the power and check the 4 - 20 mA output connection.
		Internal ROM, RAM, or EEPROM fault	Turn off the power and restart. If the problem persists, replacement is necessary. Contact RIKEN KEIKI.
GD-3 abnormality (E-1A)	 (lit)	The sensor is not connected or connected improperly.	Turn off the power and check the sensor connection.
		A sensor fault has occurred.	Replace with a new sensor.
		Effects of sudden surge noise	Turn off the power and restart. If similar symptoms recur frequently, take appropriate measures to address the noise source. If the problem persists even with noise prevention measures, contact RIKEN KEIKI.

9-2 Reading abnormalities

Symptom/display	FAULT lamp	Cause	Action
<ul style="list-style-type: none"> • The reading rises (or drops) and remains unchanged. • A gas alarm is triggered despite the absence of a gas leak or any other abnormalities at the detection area. • Response is slow. 	—	The sensor zero or span has altered (drifted).	Perform zero calibration or span adjustment.
		Presence of interference gases	Check for the presence of interference gases such as solvents and take appropriate action.
		Slow leakage	Trace amounts of detection target gas may be leaking. Leaving this unresolved may lead to hazardous conditions. Take the same action as for gas alarms.
		Environmental fluctuations	Perform zero calibration or span adjustment.
		Effects of noise	Turn off the power and restart. If similar symptoms recur frequently, take appropriate measures to address the noise source. If the problem persists even with noise prevention measures, contact RIKEN KEIKI.

Symptom/display	FAULT lamp	Cause	Action
		Sudden environmental changes	Alarm indications may be issued by the product due to sudden environmental fluctuations (e.g., temperature). The product cannot be used in locations where sudden environmental changes occur frequently. The user should take appropriate measures.
		The sensor sensitivity has degraded.	Replace with a new sensor.
		The calibration gas concentration is inappropriate.	Prepare the correct calibration gas.
		The sensor sensitivity has degraded.	Replace with a new sensor.
System abnormality (E-9)	—	Clock abnormality	Set the date and time. Correction may not function correctly if the EC sensitivity correction function is enabled. If similar symptoms recur frequently, the internal clock may be defective. Replace with a new internal clock. Contact RIKEN KEIKI.
Outside operating temperature range (E-27)	—	Ambient temperatures at the location where the product is installed are outside the operating temperature range.	The product operating temperature range varies with the specific detection principle. The product cannot be used outside the operating temperature range. The user should take appropriate measures.
Sensor life expiration warning (E-8)	—	The sensor is approaching the end of its service life.	We recommend sensor replacement. Contact RIKEN KEIKI.
Sensor warning (E-1)	—		Contact RIKEN KEIKI.

10

Product Specifications

10-1 SD-3 specifications

10-1-1 SD-3 (model without EC barrier)

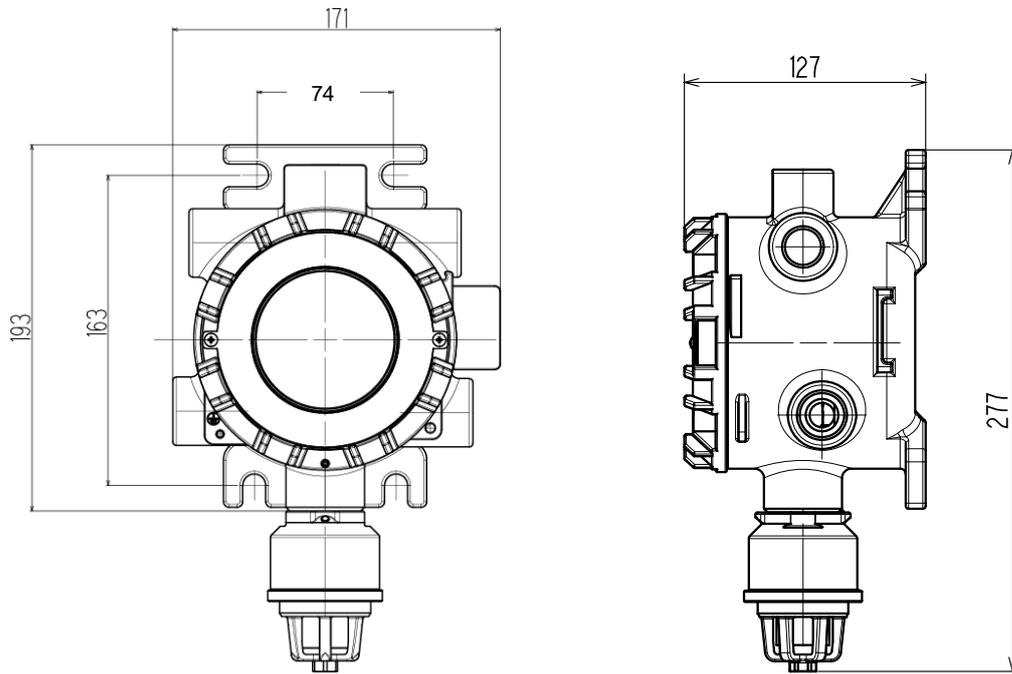
Model	SD-3	SD-3 (contact model)
Specifications	Standard	Contact
Display	7-segment LED (5 digits)	
Sensor	F sensor (RIKEN KEIKI)	
Detection principle	Infrared/electrochemical/new ceramic (catalytic)/semiconductor/hot-wire semiconductor	
Detection target gas	Depends on sensor specifications.	
Detection range	Depends on sensor specifications.	
Sampling method	Diffusion type/suction type (introduced via external unit)	
Set flow rate	0.4 - 1.5 L/min	
Power supply indication	Power lamp lit (green)	
External output	Gas concentration signal (4 - 20 mA DC + HART output)	
Alarm setpoints	Depends on sensor specifications.	
Alarm accuracy	Depends on sensor specifications.	
Alarm delay time	Depends on sensor specifications.	
Repeatability (for identical conditions)	Depends on sensor specifications.	
Indication accuracy (for identical conditions)	Depends on sensor specifications.	
Gas alarm type	Two-step alarm (H-HH, H-L, or L-LL)	
Gas alarm indication	Alarm lamp lit (red)	
Gas alarm reset operation	Auto reset or self-latching	
Fault alarm/self diagnosis	System abnormality (E-9)/sensor abnormality (E-1)	
Fault alarm indication	Fault lamp lit (yellow)/error code display	
Fault alarm reset operation	System abnormality: Self-latching Sensor abnormality: Auto reset (self-latching if sensor is disconnected)	
Contact operation	—	SPDT (× 3): 2 alarms, 1 fault output 250 V AC, 2 A; 30 V DC, 1 A (resistance load) Minimum load 5 V DC, 0.1 A
Warnings	Sensor life assessment/clock abnormality diagnosis/communication diagnosis/sensor warning	
Warning display	Blinking display alternating between gas concentration and error code	
Warning operation	Same as normal operation	

Model	SD-3	SD-3 (contact model)
Functions	Alarm delay/suppression/HART communication	
Transmission method (4 - 20 mA)	3-wire analog transmission (common power supply <power supply, signal, common>) or 2-wire analog transmission (current source)	
Transmission specifications (4 - 20 mA)	4 mA - 20 mA DC (non-insulated linear output) Maximum load resistance 600 Ω (with derating depending on power supply voltage) Resolution: max. 250 divisions (depending on specifications)	
Transmission cable (4 - 20 mA)	Shielded cable 1.25 sq (1.308 mm ² /AWG16) or 2.0 sq (2.08 mm ² /AWG14) (same as power supply cable) *To ensure explosion protection, use a cable designed for use in temperatures at least 5 °C above the maximum anticipated ambient temperature.	
Transmission distance (4 - 20 mA)	For 1.25 sq (1.308 mm ² /AWG16): Not exceeding 1.25 km For 2.0 sq (2.08 mm ² /AWG14): Not exceeding 2 km (with derating depending on supply voltage)	
Power source	24 V DC (18 V - 30 V DC) *Use a power supply capable of minimum temporary output of 2.5 A to ensure that fuses blow normally in the event of a product abnormality.	
Power supply cable	Shielded cable 1.25 sq (1.308 mm ² /AWG16) or 2.0 sq (2.08 mm ² /AWG14) (same as transmission cable) *To ensure explosion protection, use a cable designed for use in temperatures at least 5 °C above the maximum anticipated ambient temperature.	
Power consumption	Refer to '10-1-3 Electrical ratings (SD-3)'.	
Cable connectors	M25 × 1.5	
Operation method	Dedicated magnet control key	
Operating temperature range	-40 °C - +70 °C (no sudden changes) In accordance with sensor specifications if restrictions apply due to sensor specifications	
Operating humidity range	0 %RH - 95 %RH (no condensation) In accordance with sensor specifications if restrictions apply due to sensor specifications	
Housing material	Stainless steel (SCS14)	
Protection level	IP66/67 equivalent	
Installation type	Wall mounting (standard)/2B pole mounting (optional)	
Explosion-proof construction	Flame-proof construction	
Explosion-proof class	Varies depending on model. Refer to <Explosion-proof performance data> in '2-4 Safety information'.	
External dimensions	Diffusion type: Approx. 171 mm (W) × 277 mm (H) × 127 mm (D) (excluding projections) Suction type: Approx. 171 mm (W) × 289 mm (H) × 127 mm (D) (excluding projections)	
Weight	Diffusion type: approx. 6.7 kg/Suction type: approx. 7.0 kg	

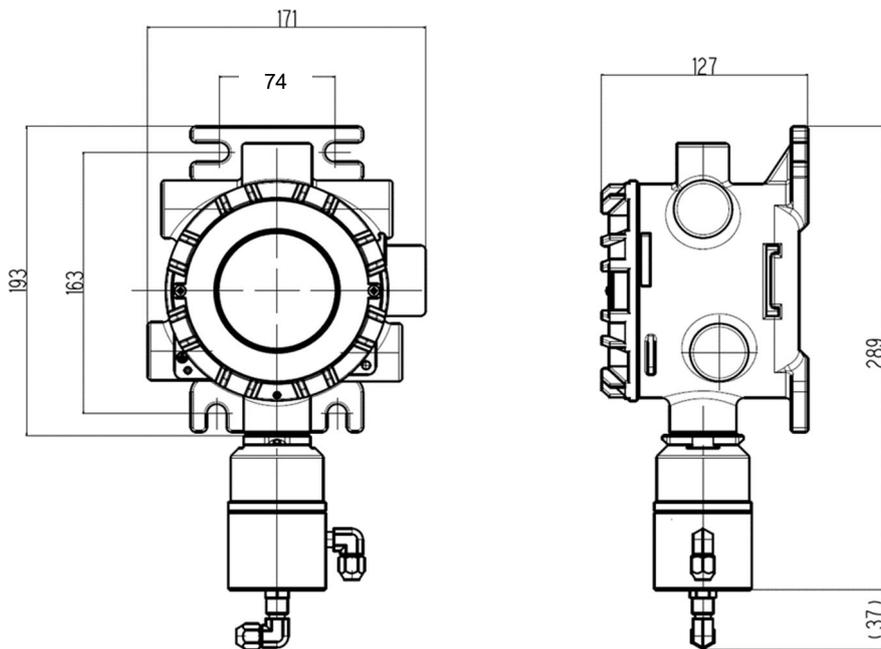
*When used with the contacts closed, the contacts may seize due to vibration. Keep this precaution in mind.

<Dimensional drawings (SD-3 (model without EC barrier))>

<Diffusion type>



<Suction type>



10-1-2 SD-3 (model with EC barrier)

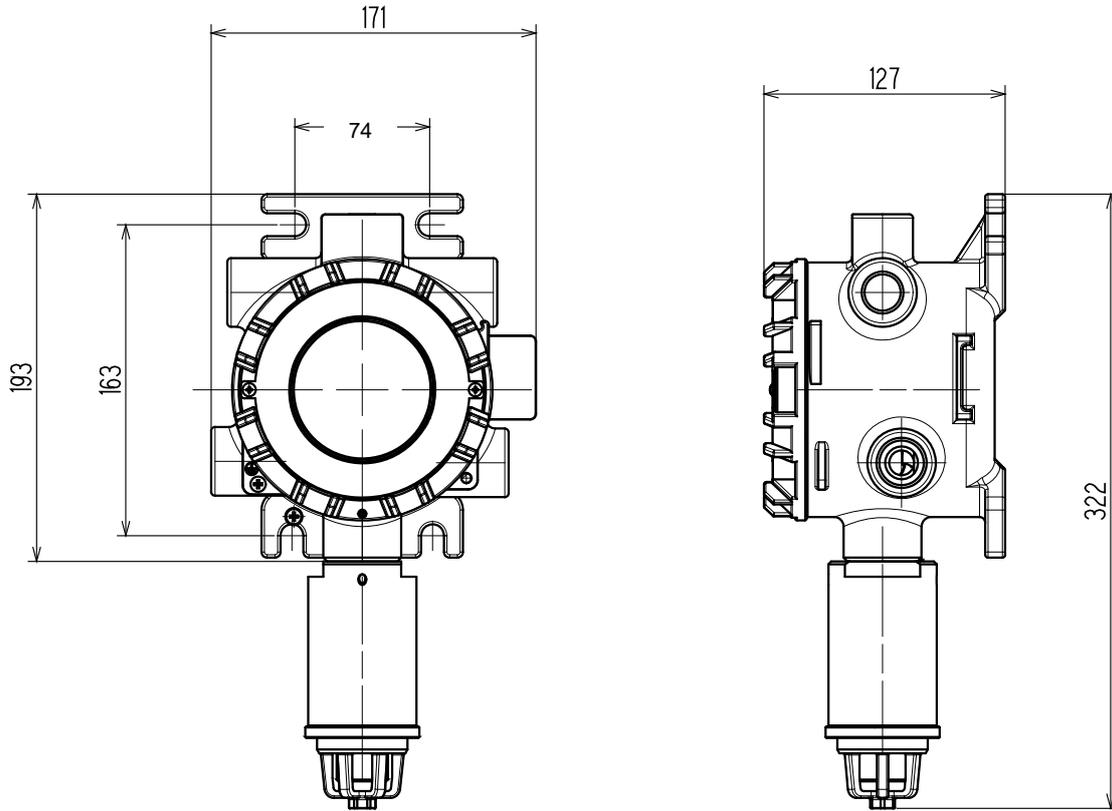
Model	SD-3	SD-3 (contact model)
Specifications	Standard	Contact
Display	7-segment LED (5 digits)	
Sensor	F sensor (RIKEN KEIKI)	
Detection principle	Electrochemical type	
Detection target gas	Depends on sensor specifications.	
Detection range	Depends on sensor specifications.	
Sampling method	Diffusion type/suction type (introduced via external unit)	
Set flow rate	0.4 - 1.5 L/min	
Power supply indication	Power lamp lit (green)	
External output	Gas concentration signal (4 - 20 mA DC + HART output)	
Alarm setpoints	Depends on sensor specifications.	
Alarm accuracy	Depends on sensor specifications.	
Alarm delay time	Depends on sensor specifications.	
Repeatability (for identical conditions)	Depends on sensor specifications.	
Indication accuracy (for identical conditions)	Depends on sensor specifications.	
Gas alarm type	Two-step alarm (H-HH, H-L, or L-LL)	
Gas alarm indication	Alarm lamp lit (red)	
Gas alarm reset operation	Auto reset or self-latching	
Fault alarm/self diagnosis	System abnormality (E-9)/sensor abnormality (E-1)	
Fault alarm indication	Fault lamp lit (yellow)/error code display	
Fault alarm reset operation	System abnormality: Self-latching Sensor abnormality: Auto reset (self-latching if sensor is disconnected)	
Contact operation	—	SPDT (× 3): 2 alarms, 1 fault output 250 V AC, 2A; 30 V DC, 1 A (resistance load) Minimum load 5 V DC, 0.1 A
Warnings	Sensor life assessment/clock abnormality diagnosis/communication diagnosis/sensor warning	
Warning display	Blinking display alternating between gas concentration and error code	
Warning operation	Same as normal operation	
Functions	Alarm delay/suppression/HART communication	
Transmission method (4 - 20 mA)	3-wire analog transmission (common power supply <power supply, signal, common>) or 2-wire analog transmission (current source)	
Transmission specifications (4 - 20 mA)	4 mA - 20 mA DC (non-insulated linear output) Maximum load resistance 600 Ω (with derating depending on power supply voltage) Resolution: max. 250 divisions (depending on specifications)	
Transmission cable (4 - 20 mA)	Shielded cable 1.25 sq (1.308 mm ² /AWG16) or 2.0 sq (2.08 mm ² /AWG14) (same as power supply cable) *To ensure explosion protection, use a cable designed for use in temperatures at least 5 °C above the maximum anticipated ambient temperature.	
Transmission distance (4 - 20 mA)	For 1.25 sq (1.308 mm ² /AWG16): Not exceeding 1.25 km For 2.0 sq (2.08 mm ² /AWG14): Not exceeding 2 km (with derating depending on supply voltage)	

Model	SD-3	SD-3 (contact model)
Power source	24 V DC (18 V - 30 V DC) *Use a power supply capable of minimum temporary output of 2.5 A to ensure that fuses blow normally in the event of a product abnormality.	
Power supply cable	Shielded cable 1.25 sq (1.308 mm ² /AWG16) or 2.0 sq (2.08 mm ² /AWG14) (same as transmission cable) *To ensure explosion protection, use a cable designed for use in temperatures at least 5 °C above the maximum anticipated ambient temperature.	
Power consumption	Refer to '10-1-3 Electrical ratings (SD-3)'.	
Cable connectors	M25 × 1.5	
Operation method	Dedicated magnet control key	
Operating temperature range	-40 °C - +70 °C (no sudden changes) In accordance with sensor specifications if restrictions apply due to sensor specifications	
Operating humidity range	0 %RH - 95 %RH (no condensation) In accordance with sensor specifications if restrictions apply due to sensor specifications	
Housing material	Stainless steel (SCS14)	
Protection level	IP66/67 equivalent	
Installation type	Wall mounting (standard)/2B pole mounting (optional)	
Explosion-proof construction	Flame-proof construction + intrinsically safe explosion-proof construction	
Explosion-proof class	Varies depending on model. Refer to <Explosion-proof performance data> in '2-4 Safety information'.	
External dimensions	Diffusion type: Approx. 171 mm (W) × 322 mm (H) × 127 mm (D) (excluding projections) Suction type: Approx. 171 mm (W) × 334 mm (H) × 127 mm (D) (excluding projections)	
Weight	Diffusion type: approx. 7.3 kg/Suction type: approx. 7.6 kg	

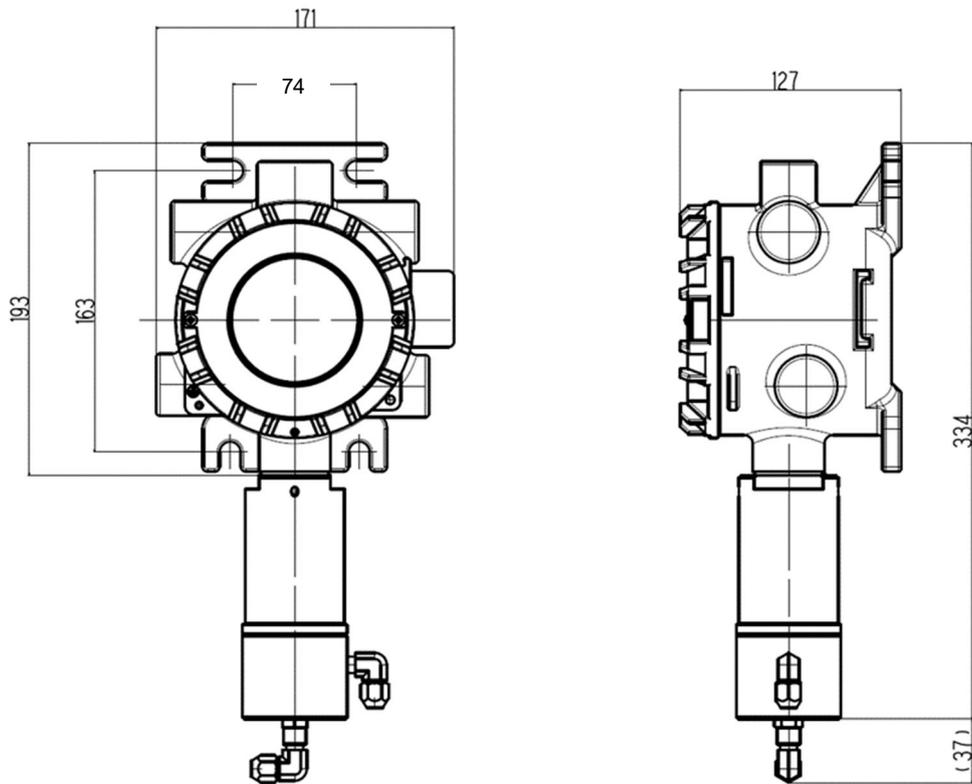
*When used with the contacts closed, the contacts may seize due to vibration. Keep this precaution in mind.

<Dimensional drawings (SD-3 (model with EC barrier))>

<Diffusion type>



<Suction type>



10-1-3 Electrical ratings (SD-3)

Model	Power supply	Power consumption
SD-3RI	24 V DC (18 V - 30 V DC)	Max. 3.8 W
SD-3GH	24 V DC (18 V - 30 V DC)	Max. 4.5 W
SD-3GHS	24 V DC (18 V - 30 V DC)	Max. 4.5 W
SD-3NC	24 V DC (18 V - 30 V DC)	Max. 4.5 W
SD-3SP	24 V DC (18 V - 30 V DC)	Max. 3.5 W
SD-3EC	24 V DC (18 V - 30 V DC)	Max. 2.8 W
SD-3ECS	24 V DC (18 V - 30 V DC)	Max. 2.8 W
SD-3ECB	24 V DC (18 V - 30 V DC)	Max. 3.1 W

10-2 SD-3SC + GD-3 specifications

10-2-1 SD-3SC + GD-3 (model without EC barrier)

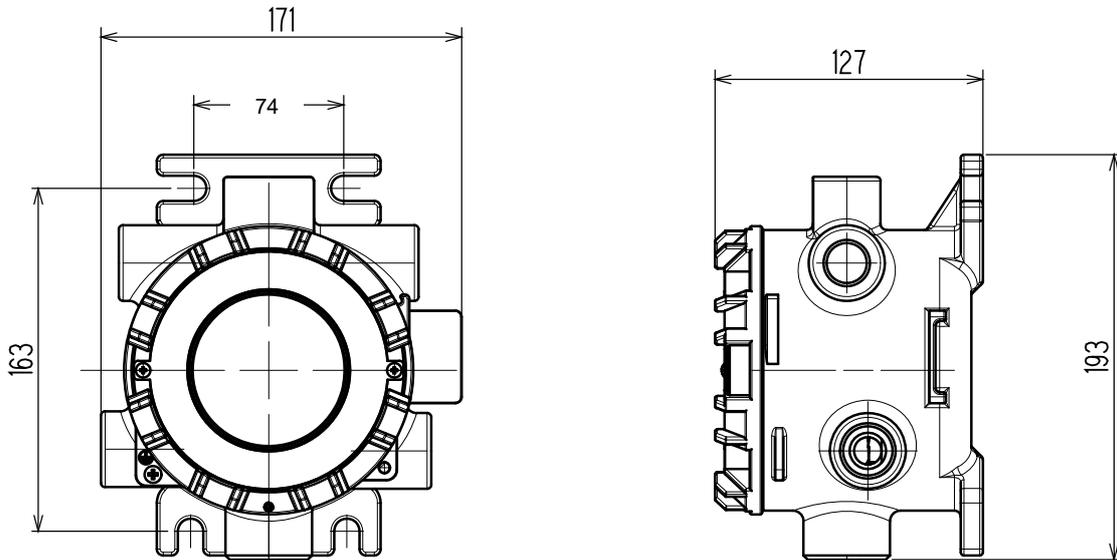
Model	SD-3SC + GD-3	SD-3SC (contact model) + GD-3
Specifications	Standard	Contact
Display	7-segment LED (5 digits)	
Sensor	F sensor (RIKEN KEIKI)	
Detection principle	Infrared/electrochemical/new ceramic (catalytic)/semiconductor/hot-wire semiconductor	
Detection target gas	Depends on sensor specifications.	
Detection range	Depends on sensor specifications.	
Sampling method	Diffusion type	
Power supply indication	Power lamp lit (green)	
External output	Gas concentration signal (4 - 20 mA DC + HART output)	
Alarm setpoints	Depends on sensor specifications.	
Alarm accuracy	Depends on sensor specifications.	
Alarm delay time	Depends on sensor specifications.	
Repeatability (for identical conditions)	Depends on sensor specifications.	
Indication accuracy (for identical conditions)	Depends on sensor specifications.	
Gas alarm type	Two-step alarm (H-HH, H-L, or L-LL)	
Gas alarm indication	Alarm lamp lit (red)	
Gas alarm reset operation	Auto reset or self-latching	
Fault alarm/self diagnosis	System abnormality (E-9)/sensor abnormality (E-1)	
Fault alarm indication	Fault lamp lit (yellow)/error code display	
Fault alarm reset operation	System abnormality: Self-latching Sensor abnormality: Auto reset (self-latching if sensor is disconnected)	
Contact operation	—	SPDT (× 3): 2 alarms, 1 fault output 250 V AC, 2A; 30 V DC, 1 A (resistance load) Minimum load 5 V DC, 0.1 A
Warnings	Sensor life assessment/clock abnormality diagnosis/communication diagnosis/sensor warning	
Warning display	Blinking display alternating between gas concentration and error code	
Warning operation	Same as normal operation	
Functions	Alarm delay/suppression/HART communication	
Transmission method (4 - 20 mA)	3-wire analog transmission (common power supply <power supply, signal, common>) or 2-wire analog transmission (current source)	
Transmission specifications (4 - 20 mA)	4 mA - 20 mA DC (non-insulated linear output) Maximum load resistance 600 Ω (with derating depending on power supply voltage) Resolution: max. 250 divisions (depending on specifications)	

Model	SD-3SC + GD-3	SD-3SC (contact model) + GD-3
Transmission cable (4 - 20 mA)	Shielded cable 1.25 sq (1.308 mm ² /AWG16) or 2.0 sq (2.08 mm ² /AWG14) (same as power supply cable) *To ensure explosion protection, use a cable designed for use in temperatures at least 5 °C above the maximum anticipated ambient temperature.	
Transmission distance (4 - 20 mA)	For 1.25 sq (1.308 mm ² /AWG16): Not exceeding 1.25 km For 2.0 sq (2.08 mm ² /AWG14): Not exceeding 2 km (with derating depending on supply voltage)	
Transmission cable (between GD-3 units)	Shielded twisted pair cable 1.25 sq (1.308 mm ² /AWG16) *To ensure explosion protection, use a cable designed for use in temperatures at least 5 °C above the maximum anticipated ambient temperature.	
Transmission distance (between GD-3 units)	20 m (maximum)	
Power source	24 V DC (18 V - 30 V DC) *Use a power supply capable of minimum temporary output of 2.5 A to ensure that fuses blow normally in the event of a product abnormality.	
Power supply cable	Shielded cable 1.25 sq (1.308 mm ² /AWG16) or 2.0 sq (2.08 mm ² /AWG14) (same as transmission cable) *To ensure explosion protection, use a cable designed for use in temperatures at least 5 °C above the maximum anticipated ambient temperature.	
Power consumption	Refer to '10-2-3 Electrical ratings (SD-3SC + GD-3)'.	
Cable connectors	M25 × 1.5	
Operation method	Dedicated magnet control key	
Operating temperature range	-40 °C - +70 °C (no sudden changes) In accordance with sensor specifications if restrictions apply due to sensor specifications	
Operating humidity range	0 %RH - 95 %RH (no condensation) In accordance with sensor specifications if restrictions apply due to sensor specifications	
Housing material	Stainless steel (SCS14)	
Protection level	IP66/67 equivalent	
Installation type	Wall mounting (standard)/2B pole mounting (optional)	
Explosion-proof construction	Flame-proof construction	
Explosion-proof class	Varies depending on model. Refer to <Explosion-proof performance data> in '2-4 Safety information'.	
External dimensions (SD-3SC)	Diffusion type: Approx. 171 mm (W) × 193 mm (H) × 127 mm (D) (excluding projections)	
Weight (SD-3SC)	Approx. 6.0 kg	
External dimensions (GD-3)	Approx. 125 mm (W) × 195 mm (H) × 88 mm (D) (excluding projections)	
Weight (GD-3)	Approx. 3.0 kg	

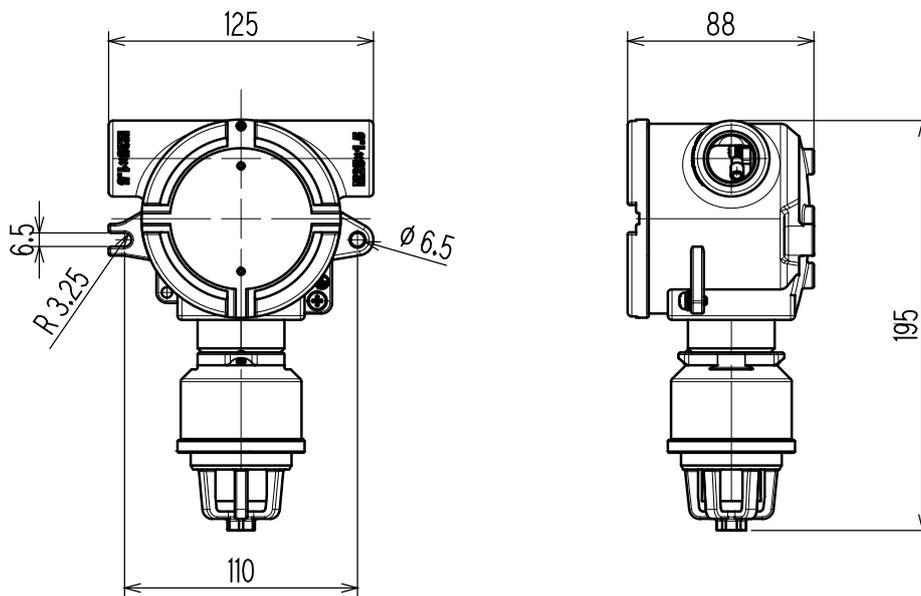
*When used with the contacts closed, the contacts may seize due to vibration. Keep this precaution in mind.

<Dimensional drawings (SD-3SC + GD-3 (model without EC barrier))>

<Main unit (SD-3SC)>



<Remote sensor unit (GD-3 (model without EC barrier))>



10-2-2 SD-3SC + GD-3 (model with EC barrier)

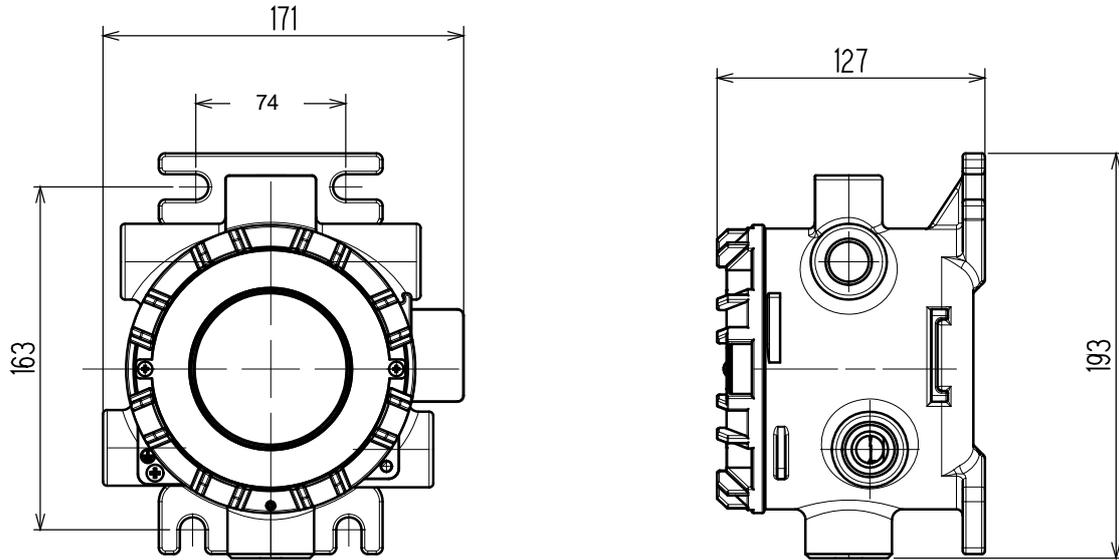
Model	SD-3SC + GD-3	SD-3SC (contact model) + GD-3
Specifications	Standard	Contact
Display	7-segment LED (5 digits)	
Sensor	F sensor (RIKEN KEIKI)	
Detection principle	Electrochemical type	
Detection target gas	Depends on sensor specifications.	
Detection range	Depends on sensor specifications.	
Sampling method	Diffusion type	
Power supply indication	Power lamp lit (green)	
External output	Gas concentration signal (4 - 20 mA DC + HART output)	
Alarm setpoints	Depends on sensor specifications.	
Alarm accuracy	Depends on sensor specifications.	
Alarm delay time	Depends on sensor specifications.	
Repeatability (for identical conditions)	Depends on sensor specifications.	
Indication accuracy (for identical conditions)	Depends on sensor specifications.	
Gas alarm type	Two-step alarm (H-HH, H-L, or L-LL)	
Gas alarm indication	Power lamp lit (red)	
Gas alarm reset operation	Auto reset or self-latching	
Fault alarm/self diagnosis	System abnormality (E-9)/sensor abnormality (E-1)	
Fault alarm indication	Fault lamp lit (yellow)/error code display	
Fault alarm reset operation	System abnormality: Self-latching Sensor abnormality: Auto reset (self-latching if sensor is disconnected)	
Contact operation	—	SPDT (× 3): 2 alarms, 1 fault output 250 V AC, 2A; 30 V DC, 1 A (resistance load) Minimum load 5 V DC, 0.1 A
Warnings	Sensor life assessment/clock abnormality diagnosis/communication diagnosis/sensor warning	
Warning display	Blinking display alternating between gas concentration and error code	
Warning operation	Same as normal operation	
Functions	Alarm delay/suppression/HART communication	
Transmission method (4 - 20 mA)	3-wire analog transmission (common power supply <power supply, signal, common>) or 2-wire analog transmission (current source)	
Transmission specifications (4 - 20 mA)	4 mA - 20 mA DC (non-insulated linear output) Maximum load resistance 600 Ω (with derating depending on power supply voltage) Resolution: max. 250 divisions (depending on specifications)	
Transmission cable (4 - 20 mA)	Shielded cable 1.25 sq (1.308 mm ² /AWG16) or 2.0 sq (2.08 mm ² /AWG14) (same as power supply cable) *To ensure explosion protection, use a cable designed for use in temperatures at least 5 °C above the maximum anticipated ambient temperature.	

Model	SD-3SC + GD-3	SD-3SC (contact model) + GD-3
Transmission distance (4 - 20 mA)	For 1.25 sq (1.308 mm ² /AWG16): Not exceeding 1.25 km For 2.0 sq (2.08 mm ² /AWG14): Not exceeding 2 km (with derating depending on supply voltage)	
Transmission cable (between GD-3 units)	Shielded twisted pair cable 1.25 sq (1.308 mm ² /AWG16) *To ensure explosion protection, use a cable designed for use in temperatures at least 5 °C above the maximum anticipated ambient temperature.	
Transmission distance (between GD-3 units)	20 m (maximum)	
Power source	24 V DC (18 V - 30 V DC) *Use a power supply capable of minimum temporary output of 2.5 A to ensure that fuses blow normally in the event of a product abnormality.	
Power supply cable	Shielded cable 1.25 sq (1.308 mm ² /AWG16) or 2.0 sq (2.08 mm ² /AWG14) (same as transmission cable) *To ensure explosion protection, use a cable designed for use in temperatures at least 5 °C above the maximum anticipated ambient temperature.	
Power consumption	Refer to '10-2-3 Electrical ratings (SD-3SC + GD-3)'.	
Cable connectors	M25 × 1.5	
Operation method	Dedicated magnet control key	
Operating temperature range	-40 °C - +70 °C (no sudden changes) In accordance with sensor specifications if restrictions apply due to sensor specifications	
Operating humidity range	0 %RH - 95 %RH (no condensation) In accordance with sensor specifications if restrictions apply due to sensor specifications	
Housing material	Stainless steel (SCS14)	
Protection level	IP66/67 equivalent	
Installation type	Wall mounting (standard)/2B pole mounting (optional)	
Explosion-proof construction	Flame-proof construction + intrinsically safe explosion-proof construction	
Explosion-proof class	Varies depending on model. Refer to <Explosion-proof performance data> in '2-4 Safety information'.	
External dimensions (SD-3SC)	Diffusion type: Approx. 171 mm (W) × 193 mm (H) × 127 mm (D) (excluding projections)	
Weight (SD-3SC)	Approx. 6.0 kg	
External dimensions (GD-3)	Approx. 125 mm (W) × 240 mm (H) × 88 mm (D) (excluding projections)	
Weight (GD-3)	Approx. 4.0 kg	

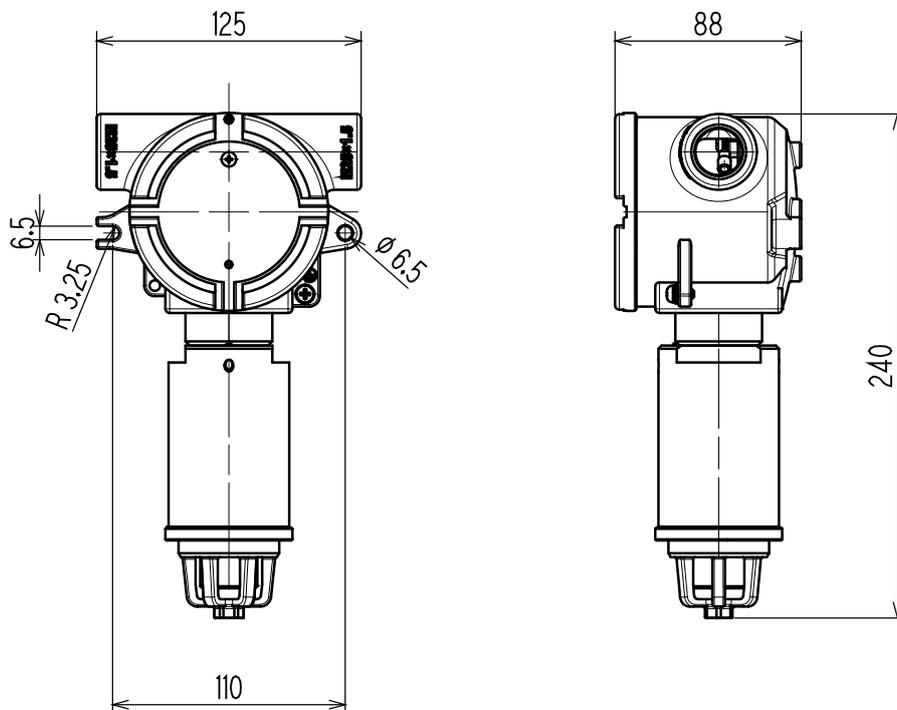
*When used with the contacts closed, the contacts may seize due to vibration. Keep this precaution in mind.

<Dimensional drawings (SD-3SC + GD-3 (model with EC barrier))>

<Main unit (SD-3SC)>



<Remote sensor unit (GD-3 (model without EC barrier))>



10-2-3 Electrical ratings (SD-3SC + GD-3)

Model	Power supply	Power consumption
SD-3SC	24 V DC (18 V - 30 V DC)	Max. 5 W
GD-3RI	24 V DC (18 V - 30 V DC)	Max. 1.2 W
GD-3GH	24 V DC (18 V - 30 V DC)	Max. 2 W
GD-3GHS	24 V DC (18 V - 30 V DC)	Max. 2 W
GD-3NC	24 V DC (18 V - 30 V DC)	Max. 2 W
GD-3SP	24 V DC (18 V - 30 V DC)	Max. 1 W
GD-3EC	24 V DC (18 V - 30 V DC)	Max. 1 W
GD-3ECS	24 V DC (18 V - 30 V DC)	Max. 1 W
GD-3ECB	24 V DC (18 V - 30 V DC)	Max. 1 W

10-3 Detection target gases for individual detection principles

10-3-1 Non-dispersive infrared absorption type (Infrared type)

Sensor model	Gas name	Gas symbol	F.S.	1 digit	First Alarm setpoint	Second Alarm setpoint	Calibration gas (alternative gas)	Operating temperature range (no sudden changes)	Operating humidity range (no condensation)	Years of warranty
IRF-1301*	Methane	CH ₄	100 %LEL	0.5 %LEL	25 %LEL	50 %LEL	CH ₄	-40 - 70 °C	95 %RH or less	3 years
IRF-1303*	Isobutane	i-C ₄ H ₁₀	100 %LEL	0.5 %LEL	25 %LEL	50 %LEL	i-C ₄ H ₁₀			
IRF-1317*	Propane	C ₃ H ₈	100 %LEL	0.5 %LEL	25 %LEL	50 %LEL	C ₃ H ₈ (i-C ₄ H ₁₀)			
IRF-1435	Carbon dioxide	CO ₂	2,000 ppm	1 ppm	1,000 ppm	-	CO ₂			
IRF-1436	Carbon dioxide	CO ₂	5,000 ppm	10 ppm	1,000 ppm	-	CO ₂			
IRF-1433	Carbon dioxide	CO ₂	10,000 ppm	10 ppm	1,000 ppm	-	CO ₂			
IRF-1437	Carbon dioxide	CO ₂	2 vol%	0.005 vol%	1 vol%	-	CO ₂			
IRF-1438	Carbon dioxide	CO ₂	5 vol%	0.010 vol%	1 vol%	-	CO ₂			
IRF-1439	Carbon dioxide	CO ₂	10 vol%	0.01 vol%	1 vol%	-	CO ₂			
IRF-1334*	Methane	CH ₄	100 vol%	0.5 vol%	25 vol%	50 vol%	CH ₄			
IRF-1316*	Ethylene	C ₂ H ₄	100 %LEL	0.5 %LEL	25 %LEL	50 %LEL	C ₂ H ₄ (CH ₄)			
IRF-1340*	Isobutylene	i-C ₄ H ₈	100 %LEL	0.5 %LEL	25 %LEL	50 %LEL	i-C ₄ H ₈ (i-C ₄ H ₁₀)			
IRF-1308*	N-hexane	n-C ₆ H ₁₄	100 %LEL	0.5 %LEL	25 %LEL	50 %LEL	n-C ₆ H ₁₄ (i-C ₄ H ₁₀)			
IRF-1332*	Butadiene	C ₄ H ₆	100 %LEL	0.5 %LEL	25 %LEL	50 %LEL	C ₄ H ₆ (CH ₄)			

*Interference occurs due to other hydrocarbon gases.

NOTE

- ▶ Install in a location with stable conditions within the specified operating temperature range and free of sudden fluctuations.
- ▶ When calibrating, allow the product to warm up for at least 10 minutes before performing zero calibration and span adjustment.
- ▶ Ensure identical temperatures, humidity, and pressure in the calibration and measurement environments. (Readings may fluctuate due to temperature, humidity, and pressure characteristics. In some cases, readings may exceed the zero suppression value due to sensor characteristics.)
- ▶ For low gas sensitivity ethylene and butadiene, we recommend using with the alarm settings at 25 %LEL or greater.
- ▶ If the composition of the base gas differs greatly for calibration and measurement—for example, if an air base is used for calibration but a CO₂ base is used for measurement—reading may differ due to infrared adsorption characteristics, even if the concentration of the target gas is the same.
- ▶ Perform maintenance if a warning appears while the life assessment or self-diagnostic function is active.
- ▶ Use the IRF sensor adapter when calibrating. Calibration accuracy may be impaired without the IRF sensor adapter.
- ▶ The warranty period for IRF sensors is three years, regardless of detection target gas.

10-3-2 New ceramic type (catalytic type)

Sensor model	Gas name	Gas symbol	F.S.	1 digit	First Alarm setpoint	Second Alarm setpoint	Calibration gas	Operating temperature range (no sudden changes)	Operating humidity range (no condensation)	Years of warranty
NCF-6318	Methane	CH ₄	100 %LEL	0.5 %LEL	25 %LEL	50 %LEL	CH ₄ *2	-40 - 70 °C	0 - 95 %RH*1	3 years
NCF-6319	VCM	VCM	100 %LEL	0.5 %LEL	25 %LEL	50 %LEL	i-C ₄ H ₁₀			
NCF-6320	Hydrogen	H ₂	100 %LEL	0.5 %LEL	25 %LEL	50 %LEL	H ₂ *3			

*1: Absolute humidity not exceeding 46 g/m³ (equivalent to 37 °C, 95 %RH)

*2: Use the NCF-6318 if methane calibration is required or when the detection target gas is methane, propane, or ethane. The detection target gas overlaps for the NCF-6318 and NCF-6319. Use the NCF-6319 in cases other than the above.

*3: Use the NCF-6320 if hydrogen selectivity is required.

NOTE

- ▶ Install in a stable location within the specified operating temperature range and free of sudden temperature fluctuations.
- ▶ Sensor characteristics may degrade significantly in the presence of silicone gases (organic silicone gases), the various types of halogen gases, sulfide gases, or acidic gases.
- ▶ A silicone removal filter and activated carbon filter are available as options.
- ▶ For models with a F.S. of 5,000 ppm or less, allow the product to warm up for at least 120 minutes in clean air before performing zero calibration and span adjustment.
- ▶ For models with a F.S. of 5,000 ppm or less, the effects of ambient humidity and temperature fluctuations will become more significant, and the zero point may drift. If so, turn the zero follower function ON. However, we recommend using a sensor with a different detection principle. The zero follower function is not available if gases are always present.
- ▶ Readings may be affected by combustible gases other than the detection target gas.
- ▶ When oxygen concentrations fall, the readings may also fall.
- ▶ Some interference may occur in the presence of highly thermally conductive gases such as CO₂, Ar, and He in high concentrations as base gases.
- ▶ When low vapor pressure gases are detected by aspiration, the gas may condense when aspirated from warmer areas and detected in cooler areas, or blockages may occur in sintered alloy. Keep vapor pressure in mind when using the product.
- ▶ Perform maintenance if a warning appears while the life assessment or self-diagnostic function is active.
- ▶ Use the combustible gas sensor adapter when calibrating. Calibration accuracy may be impaired without the combustible gas sensor adapter.
- ▶ Indication accuracy may degrade in situations in which temperatures fluctuate significantly (± 40 °C or greater) above or below the ambient temperature in which zero calibration or span adjustment was performed. If this occurs, repeat zero calibration or span adjustment.
- ▶ There may be fluctuations in readings if the product receives strong shocks from outside or is subjected to vibrations. If this occurs, perform zero calibration and span adjustment.
- ▶ The zero point may fluctuate if the sensor is in continuous contact with high-concentration gas of 100 %LEL or more for extended periods. If this occurs, perform zero calibration and span adjustment.
- ▶ The sensor may be hot during replacement. Be careful to avoid burns when replacing the sensor. If the sensor is hot, turn off the power and wait for it to cool.
- ▶ There is a Teflon film on the top of the sensors. The performance of the sensor may be affected if this Teflon film is damaged. Avoid applying excessive pressure or sharp objects to the Teflon film.
- ▶ The warranty period for NCF sensors is three years, regardless of detection target gas.

10-3-3 Semiconductor type

Sensor model	Gas name	Gas symbol	F.S.	1 digit	First alarm setpoint	Second alarm setpoint	Calibration gas	Operating temperature range (no sudden changes)	Operating humidity range (no condensation)	Warranty period
SGF-8562	Carbon disulfide	CS ₂	200 ppm	1 ppm	50 ppm	100 ppm	CS ₂	-20 - 65 °C	20 - 95 %RH*	3 years
SGF-8563	Ethylene oxide	EO	100 ppm	1 ppm	25 ppm	50 ppm	EO			
SGF-8562	Hydrogen sulfide	H ₂ S	100 ppm	1 ppm	25 ppm	50 ppm	H ₂ S			

*Absolute humidity not exceeding 46 g/m³ (equivalent to 37 °C, 95 %RH)

NOTE

- ▶ Sensor characteristics may degrade significantly in the presence of silicone gases (organic silicone gases), the various types of halogen gases, sulfide gases, or acidic gases.
- ▶ A silicone removal filter and activated carbon filter are available as options.
- ▶ Select the calibration gas after accounting for typical humidity in the operating environment.
- ▶ When calibrating, allow a warmup time depending on the unpowered period in clean air before proceeding with the zero calibration and span adjustment. Refer to '<Warmup times for semiconductor type sensors>' below for warmup times.
- ▶ Readings may be affected by combustible gases other than the detection target gas.
- ▶ Readings may fluctuate in the presence of fluctuations (e.g., temperature and humidity) in the installation location.
- ▶ When oxygen concentrations fall, the readings may also fall.
- ▶ Some interference may occur in the presence of highly thermally conductive gases such as CO₂, Ar, and He in high concentrations as base gases.
- ▶ When low vapor pressure gases are detected by aspiration, the gas may condense when aspirated from warmer areas and detected in cooler areas, or blockages may occur in sintered alloy. Keep vapor pressure in mind when using the product.
- ▶ Perform maintenance if a warning appears while the life assessment or self-diagnostic function is active.
- ▶ Use the combustible gas sensor adapter when calibrating. Calibration accuracy may be impaired without the combustible gas sensor adapter.
- ▶ Indication accuracy may degrade in situations in which temperatures fluctuate significantly (± 20 °C or greater) above or below the ambient temperature in which zero calibration or span adjustment was performed. If this occurs, repeat zero calibration or span adjustment.
- ▶ There may be fluctuations in readings if the product receives strong shocks from outside or is subjected to vibrations. If this occurs, perform zero calibration and span adjustment.
- ▶ The zero point may fluctuate if the sensor comes into contact with high-concentration gas continuously for extended periods. If this occurs, perform zero calibration and span adjustment.
- ▶ Readings may fall in environments where gas is continuously present.
- ▶ The sensor may be hot during replacement. Be careful to avoid burns when replacing the sensor. If the sensor is hot, turn off the power and wait for it to cool.
- ▶ There is a Teflon film on the top of the sensors. There may be an impact on the performance of the sensor if this Teflon film is damaged. Avoid applying excessive pressure or sharp objects to the Teflon film.
- ▶ Calibration is not possible if the reading during calibration does not exceed the zero suppression value. If the reading is below the zero suppression value when the desired calibration gas is introduced for calibration, first calibrate using a gas that gives a reading higher than the zero suppression value, then calibrate using the desired calibration gas.
- ▶ Depending on the conditions and length of time for which the power was turned off, the reading may change when the power is turned on, even after the warmup time (three minutes) has elapsed. If this occurs, wait until the reading returns to zero.
- ▶ The warranty period for SGF sensors is three years, regardless of detection target gas.

<Semiconductor type sensor warmup times>

Unpowered period	Warmup time
Within 10 minutes	30 minutes or more
Within 1 hour	2 hours or more
Within 24 hours	4 hours or more
Within 72 hours	24 hours or more
Within 10 days	2 days or more
Less than 1 month	7 days or more
1 month to less than 3 months	14 days or more
3 months or more	1 month or more

10-3-4 Hot-wire semiconductor type

Sensor model	Gas name	Gas symbol	F.S.	1 digit	First alarm setpoint	Second alarm setpoint	Calibration gas	Operating temperature range (no sudden changes)	Operating humidity range (no condensation)	Warranty period
SHF-8601	Methane	CH ₄	5,000 ppm	25 ppm	2,000 ppm	4,000 ppm	CH ₄	-30 - 70 °C	20 - 95 %RH*	3 years
SHF-8601	Carbon monoxide	CO	1,000 ppm	10 ppm	250 ppm	500 ppm	CO	0 - 70 °C		
SHF-8602	Isobutane	i-C ₄ H ₁₀	2,000 ppm	10 ppm	500 ppm	1,000 ppm	i-C ₄ H ₁₀	-30 - 70 °C		
SHF-8603	Hydrogen	H ₂	2,000 ppm	10 ppm	500 ppm	1,000 ppm	H ₂	-30 - 70 °C		

*Absolute humidity not exceeding 46 g/m³ (equivalent to 37 °C, 95 %RH)

NOTE

- ▶ Sensor characteristics may degrade significantly in the presence of silicone gases (organic silicone gases), the various types of halogen gases, sulfide gases, or acidic gases.
- ▶ A silicone removal filter and activated carbon filter are available as options.
- ▶ Select the calibration gas after accounting for typical humidity in the operating environment.
- ▶ When calibrating, allow a warmup time depending on the unpowered period in clean air before proceeding with the zero calibration and span adjustment. Refer to '<Warmup times for hot-wire semiconductor type sensors>' below for warmup times.
- ▶ The reading may change even for combustible gases other than the detection target gas.
- ▶ Readings may fluctuate in the presence of fluctuations (e.g., temperature and humidity) in the installation location.
- ▶ When oxygen concentrations fall, the readings may also fall.
- ▶ Some interference may occur in the presence of highly thermally conductive gases such as CO₂, Ar, and He in high concentrations as base gases.
- ▶ When low vapor pressure gases are detected by aspiration, the gas may condense when aspirated from warmer areas and detected in cooler areas, or blockages may occur in sintered alloy. Keep vapor pressure in mind when using the product.
- ▶ Perform maintenance if a warning appears while the life assessment or self-diagnostic function is active.
- ▶ Use the combustible gas sensor adapter when calibrating. Calibration accuracy may be impaired without the combustible gas sensor adapter.
- ▶ Indication accuracy may degrade in situations in which temperatures fluctuate significantly (± 20 °C or greater) above or below the ambient temperature in which zero calibration or span adjustment was performed. If this occurs, repeat zero calibration or span adjustment.
- ▶ There may be fluctuations in readings if the product receives strong shocks from outside or is subjected to vibrations. If this occurs, perform zero calibration and span adjustment.
- ▶ The zero point may fluctuate if the sensor comes into contact with high-concentration gas continuously for extended periods. If this occurs, perform zero calibration and span adjustment.
- ▶ Readings may fall in environments where gas is continuously present.
- ▶ The calibration value may become offset if gas is detected at levels exceeding the F.S. value. Enabling the sensor protection function will help minimize these effects if there is any possibility of exposure to gas at levels exceeding the F.S. value. However, if the sensor protection function is enabled, detection is not possible after the F.S. value has been exceeded until it is reset, as the power to the sensor is cut off. Reset from the sensor protection state in an environment with clean air.
If the sensor protection state is left in place for extended periods (one day or longer), warm up for a period of time corresponding to the sensor protection period. (Enabling the sensor protection function also enables the over locking function.)
- ▶ The sensor may be hot during replacement. Be careful to avoid burns when replacing the sensor. If the sensor is hot, turn off the power and wait for it to cool.
- ▶ Depending on the conditions and length of time for which the power was turned off, the reading may change when the power is turned on, even after the warmup time (three minutes) has elapsed. If this occurs, wait until the reading returns to zero.
- ▶ The warranty period for SHF sensors is three years, regardless of detection target gas.

<Hot-wire semiconductor type sensor warmup times>

Time turned off	Warmup time	
	SHF-8603	Other SHF sensors
Under 10 minutes	At least 10 minutes	At least 1 hour
Under 1 hour	At least 30 minutes	At least 2 hours
Under 24 hours	At least 1 hour	At least 4 hours
Under 72 hours	At least 4 hours	At least 24 hours
Under 10 days	At least 2 days	At least 2 days
Under 1 month	At least 7 days	At least 7 days
Under 3 months	At least 14 days	At least 14 days
3 months or more	At least 1 month	At least 1 month

*Note that warmup times differ between the SHF-8603 and other SHF sensors.

10-3-5 Electrochemical type

Sensor model	Gas name	Gas symbol	F.S.	1 digit	First Alarm setpoint	Second Alarm setpoint	Calibration gas	Operating temperature range (no sudden changes)	Operating humidity range (no condensation)	Years of warranty
ESF-A24A	Nitrogen dioxide	NO ₂	15 ppm	0.1 ppm	5.0 ppm	10.0 ppm	NO ₂	-40 - 70 °C	20 - 90 %RH	3 years
ESF-A24P	Carbon monoxide	CO	150 ppm	1 ppm	50 ppm	100 ppm	CO	-40 - 70 °C	20 - 90 %RH	3 years
ESF-A24R	Hydrogen sulfide	H ₂ S	100 ppm	1 ppm	20 ppm	40 ppm	H ₂ S	-40 - 70 °C	20 - 90 %RH	3 years
ESF-A24RH ^{*1}	Hydrogen sulfide	H ₂ S	30 ppm	0.2 ppm	10 ppm	20 ppm	H ₂ S	-40 - 70 °C	40 - 95 %RH	3 years
ESF-B22	Ammonia	NH ₃	75 ppm	0.5 ppm	25 ppm	50 ppm	NH ₃	-40 - 70 °C	30 - 80 %RH	3 years ^{*2}
ESF-B22	Ammonia	NH ₃	150 ppm	0.5 ppm	50 ppm	100 ppm	NH ₃	-40 - 70 °C	30 - 80 %RH	3 years ^{*2}
ESF-B22	Ammonia	NH ₃	400 ppm	1 ppm	25 ppm	300 ppm	NH ₃	-40 - 70 °C	30 - 80 %RH	3 years ^{*2}
ESF-X24P2	Oxygen	O ₂	25 %	0.1 %	18.0 %	18.0 %	N ₂	-40 - 70 °C	20 - 90 %RH	3 years
ESF-C92	Chlorine	CL ₂	1.5 ppm	0.01 ppm	0.5 ppm	1.0 ppm	CL ₂	-20 - 70 °C	30 - 80 %RH	3 years
ESF-C92	Chlorine	CL ₂	3 ppm	0.02 ppm	1 ppm	2 ppm	CL ₂	-20 - 70 °C	30 - 80 %RH	3 years
ESF-C92	Chlorine	CL ₂	10 ppm	0.1 ppm	3 ppm	10 ppm	CL ₂	-20 - 70 °C	30 - 80 %RH	3 years

*1: Sensor for high humidity.

*2: 3 years for use in a room temperature environment, and 2years for use under other conditions.

NOTE

- ▶ (1) Precautions for product storage and distribution
 - Store the sensor in the sensor container.
- ▶ (2) Precautions for calibration
 - Use the calibration cap for SD-3EC/ECS/ECB.
 - Keep the flow rate at 0.5±0.1L/min.
 - Perform zero and span calibration in a normal atmosphere.
 - Use air or N₂ as balance gas.
 - Use N₂ for zero calibration of the O₂ sensor.
- ▶ (3) General operating precautions
 - If the sensor is to be used for a long period of time in an environment outside the -25 to 55°C range, allow it to fully acclimate to the operating environment before calibrating it.
 - Indicator accuracy may be degraded when used in a high or low humidity environment.
 - The response may become slow at low temperatures.
 - The temperature range of 55 to 70°C should be used for a total of one week.
 - When calibrated at high or low temperatures, large temperature changes may cause a drop in indication accuracy.
 - Sudden changes in temperature, humidity, or pressure may cause fluctuations in the indication.
 - Diffusion type detectors may be affected by wind velocity due to the characteristics of the gas.
 - If a warning message is displayed while using the life-time diagnosis or self-diagnostic function, maintenance should be performed.
- ▶ • The warranty period for ESF sensors varies for each sensor model. Refer to the table above.

11

Appendix

11-1 Detection principle

11-1-1 Non-dispersive infrared absorption type (Infrared type)

<Sensor overview>

This gas detection sensor relies on the fact that many gases absorb infrared radiation. It detects the presence of a detection target gas by irradiating a measurement cell with infrared and detecting variations caused by target gas absorption of infrared. It continuously detects all infrared within a specific waveband without dividing (dispersing) infrared into differing wavelengths.

<Sensor structure and principle>

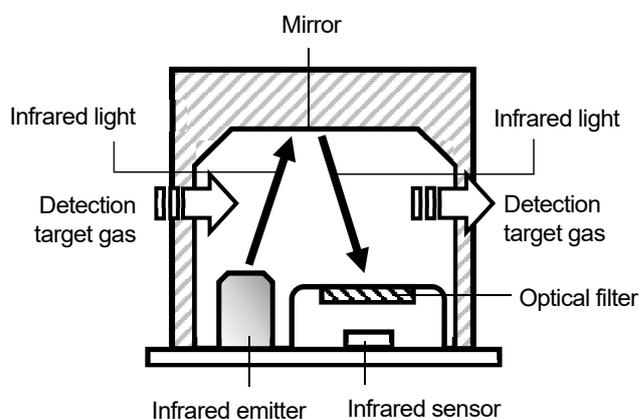
- Structure

A measurement cell and optical filter are positioned between the infrared emitter and the infrared sensor. Infrared light from the infrared emitter passes through the measurement cell and optical filter before being detected by the infrared sensor. The optical filter selectively allows the passage of infrared light in the waveband absorbed by the detection target gas.

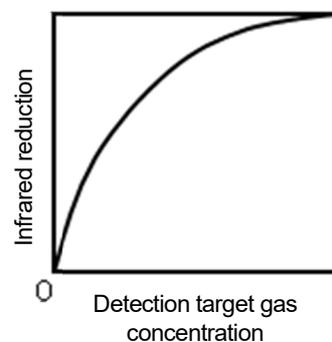
- Principle

When the detection target gas is introduced into the measurement cell, it absorbs infrared light, reducing the amount of infrared light detected at the infrared sensor. Based on this principle, a number of samples of detection target gas of known concentration is introduced to calculate the correlation (calibration curve) between infrared reduction and the concentration of the detection target gas. The calibration curve can be used to determine the gas concentration from the measured infrared reduction when an unknown concentration of detection target gas is introduced.

<Structure diagram>



<Calibration curve (example)>



11-1-2 New ceramic type (catalytic type)

<Sensor overview>

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

<Sensor structure and principle>

• Structure

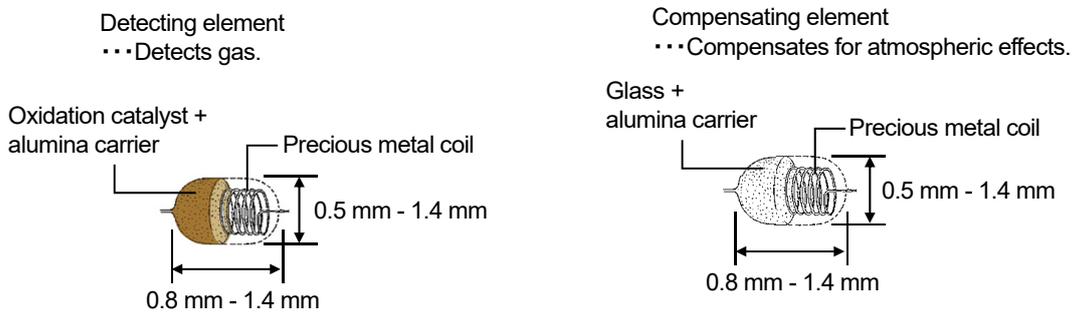
The new ceramic sensors consist of a detecting element and a compensating element. (Some sensors do not have a compensating element.) The detecting element consists of an ultrafine particle oxidation catalyst (new ceramic) that reacts with combustible gases sintered on top of a precious metal coil. This undergoes a combustion reaction in the presence of the detection target gas.

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

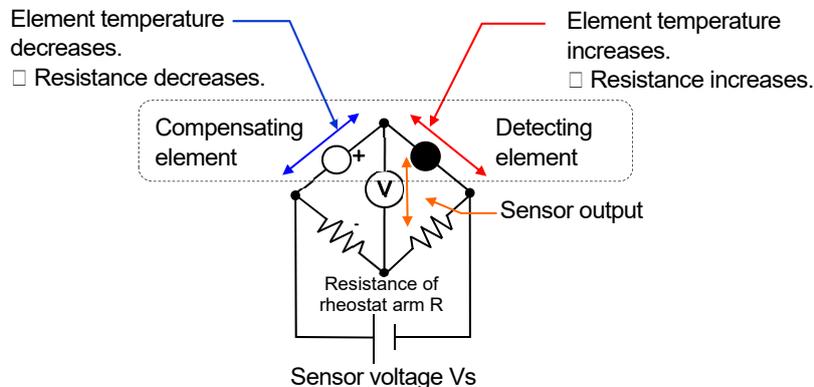
• Principle

When combustible gas burns on the surface of the detecting element heated to between 300 °C and 450 °C by the precious metal coil, this increases the temperature of the element. This temperature variation results in changes in the resistance of the precious metal coil that makes up the element. These variations in resistance are essentially proportional to gas concentrations. The resistance variation can be extracted as a voltage using a bridge circuit to calculate the gas concentration.

<Sensor element diagram>



<Bridge circuit>



11-1-3 Semiconductor type

<Sensor overview>

This method detects gas concentrations from variations in resistance that occur when a metal oxide semiconductor comes into contact with the detection target gas. This general-purpose gas detector sensor is ideal for detecting a wide range of gases, from toxic gases to combustible gases.

<Sensor structure and principle>

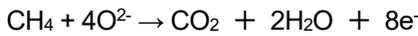
• Structure

The sensor consists of a metal oxide semiconductor (SnO₂) formed around a heater coil and alumina tube. The alumina tube has two gold electrodes at each end to measure semiconductor resistance.

• Principle

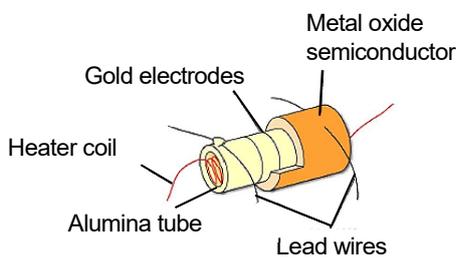
Oxygen from the atmosphere is adsorbed as O⁻ and O²⁻ to the surface of the metal oxide semiconductor heated to between 350 °C and 400 °C by the heater coil. The semiconductor maintains a constant resistance. If a methane or other such gas comes into contact with this surface and becomes chemically adsorbed, the oxygen is oxidized and released by the adsorbed O²⁻ ions.

The following chemical reaction occurs here at the sensor surface:

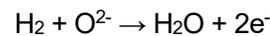
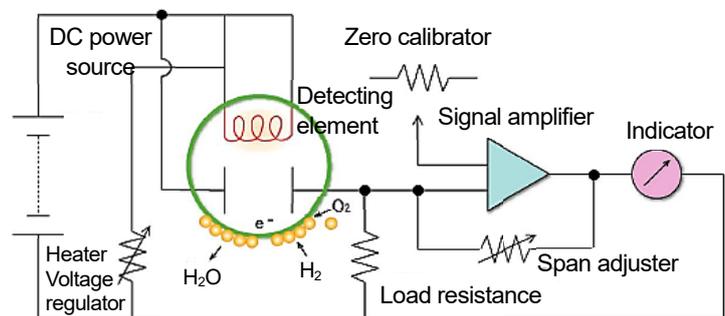


In other words, as methane gas is adsorbed to the sensor surface removing adsorbed oxygen, the increase in free electrons inside the sensor reduces the resistance. This variation in resistance can be measured and used to calculate the gas concentration.

<Sensor element diagram>



<Drive circuit>



11-1-4 Hot-wire semiconductor type

<Sensor overview>

This sensor type detects gas concentrations based on variations in the resistance of a platinum coil integrated with a metal oxide semiconductor whose resistance changes when it comes into contact with a gas. The high-sensitivity low-concentration detection gas sensor is configured simply as a detecting element of metal oxide semiconductor sintered around a platinum coil.

<Sensor structure and principle>

- Structure

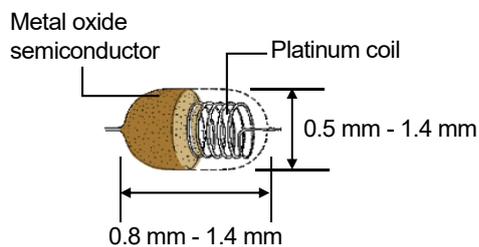
The sensor consists simply of a detecting element formed of a metal oxide semiconductor sintered around a platinum coil.

- Principle

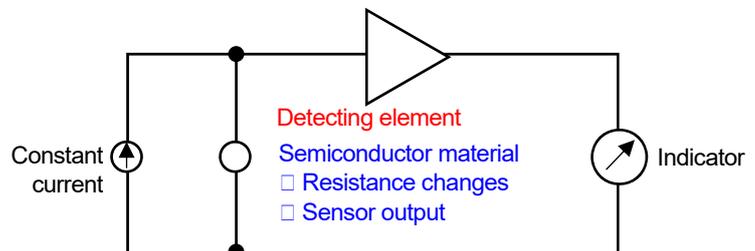
The resistance (R) of the detecting element is the combined resistance of the semiconductor resistance (R_S) and the platinum coil resistance (R_H).

The detecting element is heated to between 300 °C and 400 °C by the platinum coil and maintains constant resistance. If methane or another such gas comes into contact with the detecting element, oxygen adsorbed to the surface of the metal oxide semiconductor is released, increasing the number of free electrons inside the semiconductor and reducing the resistance of the semiconductor. This reduces the resistance of the entire detecting element. These variations in resistance are measured as a voltage and used to calculate gas concentrations.

<Detecting element diagram>



<Drive circuit>



11-1-5 Electrochemical type

<Sensor overview>

This sensor type detects a gas concentration in the form of a current generated when the detection target gas is electrolyzed on electrodes maintained at constant potential. This is the most effective gas sensor for detecting toxic gas. Gases can be selectively detected by selecting a specific potential.

<Sensor structure and principle>

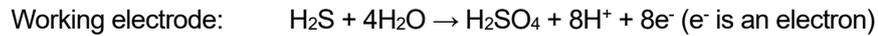
- Structure

The sensor consists of an electrode (working electrode) formed of a precious metal catalyst on a gas permeable membrane, a reference electrode, and a counter electrode, all enclosed in a plastic container filled with electrolyte solution.

- Principle

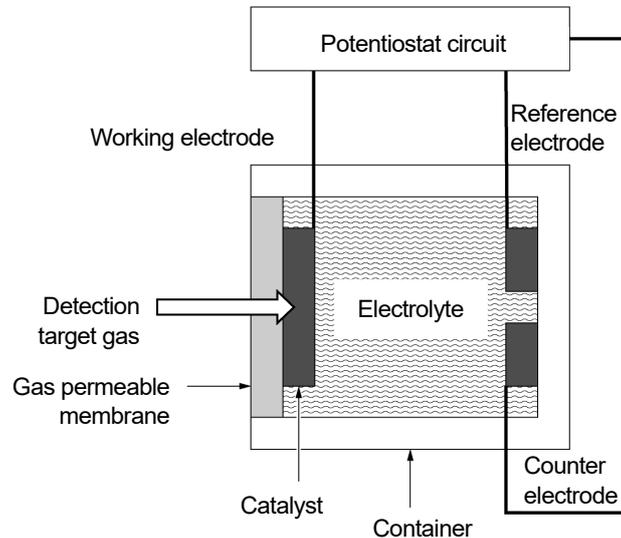
A potentiostat circuit is used to maintain a constant potential between the working electrode and reference electrode. The detection target gas passes through the gas permeable membrane and undergoes electrolysis reaction on reaching the working electrode. A side reaction also occurs at the counter electrode so that the same amount of electric current flows through it as that produced at the working electrode.

Example: In the case of hydrogen sulfide (H₂S), the following chemical reaction occurs:



The current generated here is proportional to the gas concentration. The gas concentration can therefore be determined by measuring the current flowing through the working electrode

<Structure diagram>



11-2 Terminology

Term	Definition
Initialization	<p>This function prevents alarms from being issued for a while after the power is turned on.</p> <p>This prevents alarms from being issued, as the output from the detector fluctuates for a while after the power is turned on.</p>
Full scale	The maximum value of the detection range
Calibration	<p>This refers to the process of checking the product reading against a calibration gas.</p> <p>The process includes adjusting the product reading to match the concentration of the calibration gas.</p>
Zero suppression	This function is used to hide (suppress) reading fluctuations below a set lower limit to minimize sensor output fluctuations not caused by gas, such as temperature and humidity fluctuations and noise effects.
Alarm delay time	This function temporarily suspends immediate alarm activation to prevent false alarms caused by external noise, even if the reading reaches an alarm setpoint.
Inhibit	This function pauses gas detection—for example, when the product is undergoing maintenance. It is also sometimes referred to as point skipping.
%	Unit used to express the percentage of a target gas contained in a given volume
ppm	Unit used to express the parts per million of a target gas contained in a given volume
%LEL	Unit for combustible gases in which the lower explosive limit (LEL) of the target gas is set to 100 % (Example: For methane, 5 % concentration by volume corresponds to 100 %LEL.)

Product warranty

1. If a fault occurs with the product within three years of the purchase date, with use under normal conditions in compliance with precautions indicated in the operating instructions or on labels affixed to the main unit, repairs will be cost free.
2. Contact our sales department or your nearest sales office for information on repairs, maintenance, or after-sales service.
3. You will be charged for costs incurred as the result of service rendered in remote locations.
4. Fees will be charged for repairs in the following cases, even during the warranty period:
 - (a) Fault or damage is attributable to incorrect use or improper repairs or modifications.
 - (b) Fault or damage following repairs or modifications made at locations other than Riken Keiki or a service agent specified by Riken Keiki.
 - (c) Fault or damage is attributable to moving, transporting, falling, dropping, or improper storage occurring after purchase.
 - (d) Fault or damage is attributable to external factors, including natural phenomena such as fire, earthquake, flood, or lightning; pollution; abnormal voltage; use of power sources outside of rated ranges (voltage, frequency), etc.
 - (e) The fault is attributable to a factor external to this product.
 - (f) When replacing consumables (batteries, fuses, etc.).

Sensor warranty

1. Replacements will be provided at no charge if a fault occurs within three years of the purchase date or the date on which a sensor was replaced for a fee (excluding certain sensors), with use under normal conditions in compliance with precautions indicated in the operating instructions or on labels affixed to the main unit. For information on the length of the warranty for each sensor model, refer to '10- 3 Detection target gases for individual detection principles'.
A precondition of the warranty for sensors requires sensors to be serviced once or more a year from the purchase date or the date on which a sensor was replaced for a fee.
2. Contact our sales department or your nearest sales office for information about repairs, maintenance, or after-sales service.
3. You will be charged for costs incurred as the result of replacements performed in remote locations.
4. Fees will be charged for replacements made in the following cases, even during the warranty period.
 - (a) If the product is used in disregard of the precautions provided in the operating instructions, on labels affixed to the main unit, or elsewhere.
 - (b) Fault or damage following repairs or modifications made at locations other than Riken Keiki or a service agent specified by Riken Keiki.
 - (c) Fault or damage is attributable to moving, transporting, falling, dropping, or improper storage occurring after purchase.
 - (d) Fault or damage is attributable to external factors, including natural phenomena such as fire, earthquake, flood, or lightning; pollution; abnormal voltage; use of power sources outside of rated ranges (voltage, frequency), etc.
 - (e) The fault is attributable to a factor external to this product.
 - (f) Changes in the gas sensitivity of the sensor, fault, or damage are due to the effects of coexisting gases (acidic gases, alkaline gases, alcohol, silicone, etc.) in the installation environment.

Revision History

Issue	Revision details	Issue date
0	First issue (PT2E-2874)	7/14/2023
1	1-2-1 Modification of models and codes 3-1-5 Addition and correction of special accessories (optional) 4-1-2 Added description of cable and power supply installation 6-4-1, 6-4-2 Correction of external output operation table 7-7, 8-1, 10-3-5 Modifications due to addition of ESF sensor lineup	9/5/2023
2	3-1-5 Addition of tag plate with wire chain 4-11 Adding a lightning arrestor installation	12/26/2023



EU-Declaration of Conformity

Document No.: 320CE22125



We, RIKEN KEIKI Co., Ltd. 2-7-6, Azusawa, Itabashi-ku, Tokyo, 174-8744, Japan declare under our sole responsibility that the following product conforms to all the relevant provisions.

Product Name: Gas Detector with Signal Converter
Model: SD-3RI, SD-3DRI, GD-3RI

Council Directives		Applicable Standards
2014/30/EU	EMC Directive	EN 50270:2015
2014/35/EU	LVD Directive	EN 61010-1:2010+A1:2019
2014/34/EU	ATEX Directive	EN IEC 60079-0:2018 EN 60079-1:2014
2011/65/EU ^[1]	RoHS Directive	EN IEC 63000:2018

^[1]Including substances added by Commission Delegated Directive (EU) 2015/863

EU-Type examination Certificate No.

Presafe 20 ATEX 69725 X

Notified Body for ATEX

DNV Product Assurance AS (NB 2460)
Veritasveien 1
1363 Høvik
Norway

Auditing Organization for ATEX

DNV Product Assurance AS (NB 2460)
Veritasveien 1
1363 Høvik
Norway

The marking of the product shall include the following:



II 2 G Ex db IIC T6/T5 Gb

Alternative Marking:

- T6: -50°C ≤ Ta ≤ +60°C
- T5: -50°C ≤ Ta ≤ +70°C

Place: Tokyo, Japan

Date: Nov. 22, 2022

Takakura Toshiyuki
General manager
Quality Control Center



EU-Declaration of Conformity

Document No.: 320CE22126



We, RIKEN KEIKI Co., Ltd. 2-7-6, Azusawa, Itabashi-ku, Tokyo, 174-8744, Japan declare under our sole responsibility that the following product conforms to all the relevant provisions.

Product Name: Gas Detector with Signal Converter
Model: SD-3GH, SD-3DGH, GD-3GH

Council Directives		Applicable Standards
2014/30/EU	EMC Directive	EN 50270:2015
2014/35/EU	LVD Directive	EN 61010-1:2010+A1:2019
2014/34/EU	ATEX Directive	EN IEC 60079-0:2018 EN 60079-1:2014
2011/65/EU ^[1]	RoHS Directive	EN IEC 63000:2018

^[1]Including substances added by Commission Delegated Directive (EU) 2015/863

EU-Type examination Certificate No.

Presafe 20 ATEX 69725 X

Notified Body for ATEX

DNV Product Assurance AS (NB 2460)
Veritasveien 1
1363 Høvik
Norway

Auditing Organization for ATEX

DNV Product Assurance AS (NB 2460)
Veritasveien 1
1363 Høvik
Norway

The marking of the product shall include the following:

 II 2 G Ex db IIC T5/T4 Gb

Alternative Marking: - T5: -50°C ≤ Ta ≤ +44°C
- T4: -50°C ≤ Ta ≤ +70°C

Place: Tokyo, Japan

Date: Nov. 22, 2022

Takakura Toshiyuki
General manager
Quality Control Center



EU-Declaration of Conformity

Document No.: 320CE22127



We, RIKEN KEIKI Co., Ltd. 2-7-6, Azusawa, Itabashi-ku, Tokyo, 174-8744, Japan declare under our sole responsibility that the following product conforms to all the relevant provisions.

Product Name: Gas Detector with Signal Converter
Model: SD-3GHS, SD-3DGHS, GD-3GHS

Council Directives		Applicable Standards
2014/30/EU	EMC Directive	EN 50270:2015
2014/35/EU	LVD Directive	EN 61010-1:2010+A1:2019
2014/34/EU	ATEX Directive	EN IEC 60079-0:2018 EN 60079-1:2014
2011/65/EU ^[1]	RoHS Directive	EN IEC 63000:2018

^[1]Including substances added by Commission Delegated Directive (EU) 2015/863

EU-Type examination Certificate No.

Presafe 20 ATEX 69725 X

Notified Body for ATEX

DNV Product Assurance AS (NB 2460)
Veritasveien 1
1363 Høvik
Norway

Auditing Organization for ATEX

DNV Product Assurance AS (NB 2460)
Veritasveien 1
1363 Høvik
Norway

The marking of the product shall include the following:

 II 2 G Ex db IIC T6/T4 Gb

Alternative Marking:

- T6: -50°C ≤ Ta ≤ +47°C
- T4: -50°C ≤ Ta ≤ +70°C

Place: Tokyo, Japan

Date: Nov. 22, 2022

Takakura Toshiyuki
General manager
Quality Control Center



EU-Declaration of Conformity

Document No.: 320CE22128



We, RIKEN KEIKI Co., Ltd. 2-7-6, Azusawa, Itabashi-ku, Tokyo, 174-8744, Japan declare under our sole responsibility that the following product conforms to all the relevant provisions.

Product Name: Gas Detector with Signal Converter
Model: SD-3NC, SD-3DNC, GD-3NC

Council Directives		Applicable Standards
2014/30/EU	EMC Directive	EN 50270:2015
2014/35/EU	LVD Directive	EN 61010-1:2010+A1:2019
2014/34/EU	ATEX Directive	EN IEC 60079-0:2018 EN 60079-1:2014
2011/65/EU ^[1]	RoHS Directive	EN IEC 63000:2018

^[1]Including substances added by Commission Delegated Directive (EU) 2015/863

EU-Type examination Certificate No.

Presafe 20 ATEX 69725 X

Notified Body for ATEX

DNV Product Assurance AS (NB 2460)
Veritasveien 1
1363 Høvik
Norway

Auditing Organization for ATEX

DNV Product Assurance AS (NB 2460)
Veritasveien 1
1363 Høvik
Norway

The marking of the product shall include the following:



II 2 G Ex db IIC T5/T4 Gb

Alternative Marking:

- T5: $-50^{\circ}\text{C} \leq T_a \leq +44^{\circ}\text{C}$
- T4: $-50^{\circ}\text{C} \leq T_a \leq +70^{\circ}\text{C}$

Place: Tokyo, Japan

Date: Nov. 22, 2022

Takakura Toshiyuki
General manager
Quality Control Center



EU-Declaration of Conformity

Document No.: 320CE22129



We, RIKEN KEIKI Co., Ltd. 2-7-6, Azusawa, Itabashi-ku, Tokyo, 174-8744, Japan declare under our sole responsibility that the following product conforms to all the relevant provisions.

Product Name: Gas Detector with Signal Converter
Model: SD-3SP, SD-3DSP, GD-3SP

Council Directives		Applicable Standards
2014/30/EU	EMC Directive	EN 50270:2015
2014/35/EU	LVD Directive	EN 61010-1:2010+A1:2019
2014/34/EU	ATEX Directive	EN IEC 60079-0:2018 EN 60079-1:2014
2011/65/EU ^[1]	RoHS Directive	EN IEC 63000:2018

^[1]Including substances added by Commission Delegated Directive (EU) 2015/863

EU-Type examination Certificate No.

Presafe 20 ATEX 69725 X

Notified Body for ATEX

DNV Product Assurance AS (NB 2460)
Veritasveien 1
1363 Høvik
Norway

Auditing Organization for ATEX

DNV Product Assurance AS (NB 2460)
Veritasveien 1
1363 Høvik
Norway

The marking of the product shall include the following:



II 2 G Ex db IIC T5/T4 Gb

Alternative Marking:

- T5: -50°C ≤ Ta ≤ +55°C
- T4: -50°C ≤ Ta ≤ +70°C

Place: Tokyo, Japan

Date: Nov. 22, 2022

Takakura Toshiyuki
General manager
Quality Control Center



EU-Declaration of Conformity

Document No.: 320CE22130



We, RIKEN KEIKI Co., Ltd. 2-7-6, Azusawa, Itabashi-ku, Tokyo, 174-8744, Japan declare under our sole responsibility that the following product conforms to all the relevant provisions.

Product Name: Gas Detector with Signal Converter
Model: SD-3EC, SD-3DEC, GD-3EC

Council Directives		Applicable Standards
2014/30/EU	EMC Directive	EN 50270:2015
2014/35/EU	LVD Directive	EN 61010-1:2010+A1:2019
2014/34/EU	ATEX Directive	EN IEC 60079-0:2018 EN 60079-1:2014
2011/65/EU ^[1]	RoHS Directive	EN IEC 63000:2018

^[1]Including substances added by Commission Delegated Directive (EU) 2015/863

EU-Type examination Certificate No.

Presafe 20 ATEX 69725 X

Notified Body for ATEX

DNV Product Assurance AS (NB 2460)
Veritasveien 1
1363 Høvik
Norway

Auditing Organization for ATEX

DNV Product Assurance AS (NB 2460)
Veritasveien 1
1363 Høvik
Norway

The marking of the product shall include the following:

 II 2 G Ex db IIC T4 Gb

Place: Tokyo, Japan

Date: Nov. 22, 2022

Takakura Toshiyuki
General manager
Quality Control Center



EU-Declaration of Conformity

Document No.: 320CE22131



We, RIKEN KEIKI Co., Ltd. 2-7-6, Azusawa, Itabashi-ku, Tokyo, 174-8744, Japan declare under our sole responsibility that the following product conforms to all the relevant provisions.

Product Name: Gas Detector with Signal Converter
Model: SD-3ECS, SD-3DECS, GD-3ECS

Council Directives		Applicable Standards
2014/30/EU	EMC Directive	EN 50270:2015
2014/35/EU	LVD Directive	EN 61010-1:2010+A1:2019
2014/34/EU	ATEX Directive	EN IEC 60079-0:2018 EN 60079-1:2014
2011/65/EU ^[1]	RoHS Directive	EN IEC 63000:2018

^[1]Including substances added by Commission Delegated Directive (EU) 2015/863

EU-Type examination Certificate No.

Presafe 20 ATEX 69725 X

Notified Body for ATEX

DNV Product Assurance AS (NB 2460)
Veritasveien 1
1363 Høvik
Norway

Auditing Organization for ATEX

DNV Product Assurance AS (NB 2460)
Veritasveien 1
1363 Høvik
Norway

The marking of the product shall include the following:

 II 2 G Ex db IIC T4 Gb

Place: Tokyo, Japan

Date: Nov. 22, 2022

Takakura Toshiyuki
General manager
Quality Control Center



EU-Declaration of Conformity

Document No.: 320CE22118



We, RIKEN KEIKI Co., Ltd. 2-7-6, Azusawa, Itabashi-ku, Tokyo, 174-8744 Japan declare under our sole responsibility that the following product conforms to all the relevant provisions.

Product Name: Gas Detector with Signal Converter
Model: SD-3ECB, SD-3DECB, GD-3ECB

Council Directives		Applicable Standards
2014/30/EU	EMC Directive	EN 50270:2015
2014/35/EU	LVD Directive	EN 61010-1:2010+A1:2019
2014/34/EU	ATEX Directive	EN IEC 60079-0:2018 EN 60079-1:2014 EN 60079-11:2012
2011/65/EU ^[1]	RoHS Directive	EN IEC 63000:2018

^[1]Including substances added by Commission Delegated Directive (EU) 2015/863

EU-Type examination Certificate No.

Presafe 20 ATEX 69725 X

Notified Body for ATEX

DNV Product Assurance AS (NB 2460)
Veritasveien 1
1363 Høvik
Norway

Auditing Organization for ATEX

DNV Product Assurance AS (NB 2460)
Veritasveien 1
1363 Høvik
Norway

The marking of the product shall include the following:

 II 2 G Ex db ia IIC T4 Gb

Place: Tokyo, Japan

Date: Jun. 29, 2022

Takakura Toshiyuki
General manager
Quality Control Center



EU-Declaration of Conformity

Document No.: 320CE22132



We, RIKEN KEIKI Co., Ltd. 2-7-6, Azusawa, Itabashi-ku, Tokyo, 174-8744, Japan declare under our sole responsibility that the following product conforms to all the relevant provisions.

Product Name: Gas Detector with Signal Converter
Model: SD-3SC

Council Directives		Applicable Standards
2014/30/EU	EMC Directive	EN 50270:2015
2014/35/EU	LVD Directive	EN 61010-1:2010+A1:2019
2014/34/EU	ATEX Directive	EN IEC 60079-0:2018 EN 60079-1:2014
2011/65/EU ^[1]	RoHS Directive	EN IEC 63000:2018

^[1]Including substances added by Commission Delegated Directive (EU) 2015/863

EU-Type examination Certificate No.

Presafe 20 ATEX 69725 X

Notified Body for ATEX

DNV Product Assurance AS (NB 2460)
Veritasveien 1
1363 Høvik
Norway

Auditing Organization for ATEX

DNV Product Assurance AS (NB 2460)
Veritasveien 1
1363 Høvik
Norway

The marking of the product shall include the following:

 II 2 G Ex db IIC T6/T5/T4 Gb

Alternative Marking:

- T6/T5/T4, $-50^{\circ}\text{C} \leq T_a \leq +47^{\circ}\text{C}/+55^{\circ}\text{C}/+70^{\circ}\text{C}$: combined with GD-3GHS, GD-3SP, GD-3NP, GD-3EC, GD-3ECS
- T5/T4, $-50^{\circ}\text{C} \leq T_a \leq +44^{\circ}\text{C}/+70^{\circ}\text{C}$: combined with GD-3GH GD-3NC
- T6/T5, $-50^{\circ}\text{C} \leq T_a \leq +60^{\circ}\text{C}/+70^{\circ}\text{C}$: combined with GD-3RI
- T4, $-40^{\circ}\text{C} \leq T_a \leq +70^{\circ}\text{C}$: combined with GD-3ECB

Place: Tokyo, Japan

Date: Nov. 22, 2022

Takakura Toshiyuki
General manager
Quality Control Center



UK-Declaration of Conformity

Document No.: 320UK22046



We, RIKEN KEIKI Co., Ltd. 2-7-6, Azusawa, Itabashi-ku, Tokyo, 174-8744, Japan declare under our sole responsibility that the following product conforms to all the relevant provisions.

Product Name: Gas Detector with Signal Converter
Model: SD-3RI, SD-3DRI, GD-3RI

Regulations	UK designated Standards
Electromagnetic Compatibility Regulations 2016 (S.I. 2016/1091)	BS EN 50270:2015
The Electrical Equipment (Safety) Regulations 2016 (S.I. 2016/1101)	BS EN 61010-1:2010 +A1:2019
The Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres Regulations 2016 (S.I. 2016/1107) (UKEX)	BS EN IEC 60079-0:2018 BS EN 60079-1:2014
The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012 (S.I. 2012/3032)	BS EN IEC 63000:2018

UK-Type examination Certificate No.

DNV 22 UKEX 25924X

Approved Body for UKEX

DNV Business Assurance UK Ltd (AB8501)
4th Floor Vivo Building, 30 Stamford Street,
London SE1 9LQ, United Kingdom

Auditing Organization for UKEX

DNV Business Assurance UK Ltd (AB8501)
4th Floor Vivo Building, 30 Stamford Street,
London SE1 9LQ, United Kingdom

The marking of the product shall include the following:

 II 2 G Ex db IIC T6/T5 Gb

Alternative Marking: - T6: $-50^{\circ}\text{C} \leq \text{Ta} \leq +60^{\circ}\text{C}$
- T5: $-50^{\circ}\text{C} \leq \text{Ta} \leq +70^{\circ}\text{C}$

Place: Tokyo, Japan

Date: Nov. 18, 2022

Takakura Toshiyuki
General manager
Quality Control Center



UK-Declaration of Conformity

Document No.: 320UK22047



We, RIKEN KEIKI Co., Ltd. 2-7-6, Azusawa, Itabashi-ku, Tokyo, 174-8744, Japan declare under our sole responsibility that the following product conforms to all the relevant provisions.

Product Name: Gas Detector with Signal Converter
Model: SD-3GH, SD-3DGH, GD-3GH

Regulations	UK designated Standards
Electromagnetic Compatibility Regulations 2016 (S.I. 2016/1091)	BS EN 50270:2015
The Electrical Equipment (Safety) Regulations 2016 (S.I. 2016/1101)	BS EN 61010-1:2010 +A1:2019
The Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres Regulations 2016 (S.I. 2016/1107) (UKEX)	BS EN IEC 60079-0:2018 BS EN 60079-1:2014
The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012 (S.I. 2012/3032)	BS EN IEC 63000:2018

UK-Type examination Certificate No.

DNV 22 UKEX 25924X

Approved Body for UKEX

DNV Business Assurance UK Ltd (AB8501)
4th Floor Vivo Building, 30 Stamford Street,
London SE1 9LQ, United Kingdom

Auditing Organization for UKEX

DNV Business Assurance UK Ltd (AB8501)
4th Floor Vivo Building, 30 Stamford Street,
London SE1 9LQ, United Kingdom

The marking of the product shall include the following:



II 2 G Ex db IIC T5/T4 Gb

Alternative Marking:

- T5: $-50^{\circ}\text{C} \leq \text{Ta} \leq +44^{\circ}\text{C}$
- T4: $-50^{\circ}\text{C} \leq \text{Ta} \leq +70^{\circ}\text{C}$

Place: Tokyo, Japan

Date: Nov. 18, 2022

Takakura Toshiyuki
General manager
Quality Control Center



UK-Declaration of Conformity

Document No.: 320UK22048



We, RIKEN KEIKI Co., Ltd. 2-7-6, Azusawa, Itabashi-ku, Tokyo, 174-8744, Japan declare under our sole responsibility that the following product conforms to all the relevant provisions.

Product Name: Gas Detector with Signal Converter
Model: SD-3GHS, SD-3DGHS, GD-3GHS

Regulations	UK designated Standards
Electromagnetic Compatibility Regulations 2016 (S.I. 2016/1091)	BS EN 50270:2015
The Electrical Equipment (Safety) Regulations 2016 (S.I. 2016/1101)	BS EN 61010-1:2010 +A1:2019
The Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres Regulations 2016 (S.I. 2016/1107) (UKEX)	BS EN IEC 60079-0:2018 BS EN 60079-1:2014
The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012 (S.I. 2012/3032)	BS EN IEC 63000:2018

UK-Type examination Certificate No.

DNV 22 UKEX 25924X

Approved Body for UKEX

DNV Business Assurance UK Ltd (AB8501)
4th Floor Vivo Building, 30 Stamford Street,
London SE1 9LQ, United Kingdom

Auditing Organization for UKEX

DNV Business Assurance UK Ltd (AB8501)
4th Floor Vivo Building, 30 Stamford Street,
London SE1 9LQ, United Kingdom

The marking of the product shall include the following:

 II 2 G Ex db IIC T6/T4 Gb

Alternative Marking: - T6:-50°C≤Ta≤+47°C
- T4:-50°C≤Ta≤+70°C

Place: Tokyo, Japan

Date: Nov. 18, 2022

Takakura Toshiyuki
General manager
Quality Control Center



UK-Declaration of Conformity

Document No.: 320UK22049



We, RIKEN KEIKI Co., Ltd. 2-7-6, Azusawa, Itabashi-ku, Tokyo, 174-8744, Japan declare under our sole responsibility that the following product conforms to all the relevant provisions.

Product Name: Gas Detector with Signal Converter
Model: SD-3NC, SD-3DNC, GD-3NC

Regulations	UK designated Standards
Electromagnetic Compatibility Regulations 2016 (S.I. 2016/1091)	BS EN 50270:2015
The Electrical Equipment (Safety) Regulations 2016 (S.I. 2016/1101)	BS EN 61010-1:2010 +A1:2019
The Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres Regulations 2016 (S.I. 2016/1107) (UKEX)	BS EN IEC 60079-0:2018 BS EN 60079-1:2014
The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012 (S.I. 2012/3032)	BS EN IEC 63000:2018

UK-Type examination Certificate No.

DNV 22 UKEX 25924X

Approved Body for UKEX

DNV Business Assurance UK Ltd (AB8501)
4th Floor Vivo Building, 30 Stamford Street,
London SE1 9LQ, United Kingdom

Auditing Organization for UKEX

DNV Business Assurance UK Ltd (AB8501)
4th Floor Vivo Building, 30 Stamford Street,
London SE1 9LQ, United Kingdom

The marking of the product shall include the following:

 II 2 G Ex db IIC T5/T4 Gb

Alternative Marking: - T5: $-50^{\circ}\text{C} \leq \text{Ta} \leq +44^{\circ}\text{C}$
- T4: $-50^{\circ}\text{C} \leq \text{Ta} \leq +70^{\circ}\text{C}$

Place: Tokyo, Japan

Date: Nov. 18, 2022

Takakura Toshiyuki
General manager
Quality Control Center



UK-Declaration of Conformity

Document No.: 320UK22050



We, RIKEN KEIKI Co., Ltd. 2-7-6, Azusawa, Itabashi-ku, Tokyo, 174-8744, Japan declare under our sole responsibility that the following product conforms to all the relevant provisions.

Product Name: Gas Detector with Signal Converter
Model: SD-3SP, SD-3DSP, GD-3SP

Regulations	UK designated Standards
Electromagnetic Compatibility Regulations 2016 (S.I. 2016/1091)	BS EN 50270:2015
The Electrical Equipment (Safety) Regulations 2016 (S.I. 2016/1101)	BS EN 61010-1:2010 +A1:2019
The Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres Regulations 2016 (S.I. 2016/1107) (UKEX)	BS EN IEC 60079-0:2018 BS EN 60079-1:2014
The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012 (S.I. 2012/3032)	BS EN IEC 63000:2018

UK-Type examination Certificate No.

DNV 22 UKEX 25924X

Approved Body for UKEX

DNV Business Assurance UK Ltd (AB8501)
4th Floor Vivo Building, 30 Stamford Street,
London SE1 9LQ, United Kingdom

Auditing Organization for UKEX

DNV Business Assurance UK Ltd (AB8501)
4th Floor Vivo Building, 30 Stamford Street,
London SE1 9LQ, United Kingdom

The marking of the product shall include the following:

 II 2 G Ex db IIC T5/T4 Gb

Alternative Marking: - T5: $-50^{\circ}\text{C} \leq \text{Ta} \leq +55^{\circ}\text{C}$
- T4: $-50^{\circ}\text{C} \leq \text{Ta} \leq +70^{\circ}\text{C}$

Place: Tokyo, Japan

Date: Nov. 18, 2022

Takakura Toshiyuki
General manager
Quality Control Center



UK-Declaration of Conformity

Document No.: 320UK22051



We, RIKEN KEIKI Co., Ltd. 2-7-6, Azusawa, Itabashi-ku, Tokyo, 174-8744, Japan declare under our sole responsibility that the following product conforms to all the relevant provisions.

Product Name: Gas Detector with Signal Converter
Model: SD-3EC, SD-3DEC, GD-3EC

Regulations	UK designated Standards
Electromagnetic Compatibility Regulations 2016 (S.I. 2016/1091)	BS EN 50270:2015
The Electrical Equipment (Safety) Regulations 2016 (S.I. 2016/1101)	BS EN 61010-1:2010 +A1:2019
The Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres Regulations 2016 (S.I. 2016/1107) (UKEX)	BS EN IEC 60079-0:2018 BS EN 60079-1:2014
The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012 (S.I. 2012/3032)	BS EN IEC 63000:2018

UK-Type examination Certificate No.

DNV 22 UKEX 25924X

Approved Body for UKEX

DNV Business Assurance UK Ltd (AB8501)
4th Floor Vivo Building, 30 Stamford Street,
London SE1 9LQ, United Kingdom

Auditing Organization for UKEX

DNV Business Assurance UK Ltd (AB8501)
4th Floor Vivo Building, 30 Stamford Street,
London SE1 9LQ, United Kingdom

The marking of the product shall include the following:

 II 2 G Ex db IIC T4 Gb $-50^{\circ}\text{C} \leq \text{Ta} \leq +70^{\circ}\text{C}$

Place: Tokyo, Japan

Date: Nov. 18, 2022

Takakura Toshiyuki
General manager
Quality Control Center



UK-Declaration of Conformity

Document No.: 320UK22052



We, RIKEN KEIKI Co., Ltd. 2-7-6, Azusawa, Itabashi-ku, Tokyo, 174-8744, Japan declare under our sole responsibility that the following product conforms to all the relevant provisions.

Product Name: Gas Detector with Signal Converter
Model: SD-3ECS, SD-3DECS, GD-3ECS

Regulations	UK designated Standards
Electromagnetic Compatibility Regulations 2016 (S.I. 2016/1091)	BS EN 50270:2015
The Electrical Equipment (Safety) Regulations 2016 (S.I. 2016/1101)	BS EN 61010-1:2010 +A1:2019
The Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres Regulations 2016 (S.I. 2016/1107) (UKEX)	BS EN IEC 60079-0:2018 BS EN 60079-1:2014
The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012 (S.I. 2012/3032)	BS EN IEC 63000:2018

UK-Type examination Certificate No.

DNV 22 UKEX 25924X

Approved Body for UKEX

DNV Business Assurance UK Ltd (AB8501)
4th Floor Vivo Building, 30 Stamford Street,
London SE1 9LQ, United Kingdom

Auditing Organization for UKEX

DNV Business Assurance UK Ltd (AB8501)
4th Floor Vivo Building, 30 Stamford Street,
London SE1 9LQ, United Kingdom

The marking of the product shall include the following:



II 2 G Ex db IIC T4 Gb -50°C ≤ Ta ≤ +70°C

Place: Tokyo, Japan

Date: Nov. 18, 2022

Takakura Toshiyuki
General manager
Quality Control Center



UK-Declaration of Conformity

Document No.: 320UK22053



We, RIKEN KEIKI Co., Ltd. 2-7-6, Azusawa, Itabashi-ku, Tokyo, 174-8744, Japan declare under our sole responsibility that the following product conforms to all the relevant provisions.

Product Name: Gas Detector with Signal Converter
Model: SD-3ECB, SD-3DECB, GD-3ECB

Regulations	UK designated Standards
Electromagnetic Compatibility Regulations 2016 (S.I. 2016/1091)	BS EN 50270:2015
The Electrical Equipment (Safety) Regulations 2016 (S.I. 2016/1101)	BS EN 61010-1:2010 +A1:2019
The Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres Regulations 2016 (S.I. 2016/1107) (UKEX)	BS EN IEC 60079-0:2018 BS EN 60079-1:2014 BS EN 60079-11:2012
The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012 (S.I. 2012/3032)	BS EN IEC 63000:2018

UK-Type examination Certificate No.

DNV 22 UKEX 25924X

Approved Body for UKEX

DNV Business Assurance UK Ltd (AB8501)
4th Floor Vivo Building, 30 Stamford Street,
London SE1 9LQ, United Kingdom

Auditing Organization for UKEX

DNV Business Assurance UK Ltd (AB8501)
4th Floor Vivo Building, 30 Stamford Street,
London SE1 9LQ, United Kingdom

The marking of the product shall include the following:

 II 2 G Ex db ia IIC T4 Gb -40°C ≤ Ta ≤ +70°C

Place: Tokyo, Japan

Date: Nov. 18, 2022

Takakura Toshiyuki
General manager
Quality Control Center



UK-Declaration of Conformity

Document No.: 320UK22054



We, RIKEN KEIKI Co., Ltd. 2-7-6, Azusawa, Itabashi-ku, Tokyo, 174-8744, Japan declare under our sole responsibility that the following product conforms to all the relevant provisions.

Product Name: Gas Detector with Signal Converter
Model: SD-3SC

Regulations	UK designated Standards
Electromagnetic Compatibility Regulations 2016 (S.I. 2016/1091)	BS EN 50270:2015
The Electrical Equipment (Safety) Regulations 2016 (S.I. 2016/1101)	BS EN 61010-1:2010 +A1:2019
The Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres Regulations 2016 (S.I. 2016/1107) (UKEX)	BS EN IEC 60079-0:2018 BS EN 60079-1:2014
The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012 (S.I. 2012/3032)	BS EN IEC 63000:2018

UK-Type examination Certificate No.

DNV 22 UKEX 25924X

Approved Body for UKEX

DNV Business Assurance UK Ltd (AB8501)
4th Floor Vivo Building, 30 Stamford Street,
London SE1 9LQ, United Kingdom

Auditing Organization for UKEX

DNV Business Assurance UK Ltd (AB8501)
4th Floor Vivo Building, 30 Stamford Street,
London SE1 9LQ, United Kingdom

The marking of the product shall include the following:



II 2 G Ex db IIC T6/T5/T4 Gb

Alternative Marking:

- T6/T5/T4, -50°C ≤ Ta ≤ +47°C/+55°C/+70°C: combined with GD-3GHS, GD-3SP, GD-3NP, GD-3EC, GD-3ECS
- T5/T4, -50°C ≤ Ta ≤ +44°C/+70°C: combined with GD-3GH, GD-3NC
- T6/T5, -50°C ≤ Ta ≤ +60°C/+70°C: combined with GD-3RI
- T4, -40°C ≤ Ta ≤ +70°C: combined with GD-3ECB

Place: Tokyo, Japan

Date: Nov. 18, 2022

Takakura Toshiyuki
General manager
Quality Control Center