GASTRON

Design, development, production, installation and supplementary services of gas leakage alarms

DOC NO.GT-07120052000

GTD-5000
Instruction Manual

Revision: 1.7

Please read this instruction manual carefully for proper use.

We sincerely thank you for purchasing the product of Gastron Co. Ltd.

As a company with expertise in the fields of gas detectors and gas monitoring systems, Gastron Co., Ltd. has been consistently recognized by many consumers for its top-notch quality and ease of use. Gastron is always trying to make it convenient for customers to find the products they want, and is constantly working to develop gas detectors fully meeting their needs. From now on, solve all your concerns about gas detectors with Gastron's products. Gastron will responsibly ensure that customers are satisfied with its products.

This instruction manual describes how to operate, manage, and repair the GTD-5000 Gas Detector, etc. in a simple and easy-to-understand manner. After reading this manual in detail first, keep it well, and refer to this manual to find answer to queries while using the product in years to come.

When abnormalities occur after purchasing the product, please feel free to contact us at the following address:

- Gastron Co., Ltd., 23, Gunpocheomdansaneop 1-ro, Gunpo-si, Gyeonggi-do, Republic of Korea
- Tel : 031-490-0800
- Fax : 031-490-0801
- **URL : www.gastron.com**
- **e-mail : gastron@gastron.com**

Caution

- **Lack of calibration can cause sensor aging and ultimately cause equipment malfunction.**
- **If disassembly of this equipment is required, such work needs to be conducted by those with expertise in the gas detector.**
- **For additional information as for the inspection and calibration of the gas detector, please contact our technical department via email or visit the company website.**

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1. Overview

Combustibility, toxicity, Freon, and gases with organic compound properties, etc. are used in various industrial sites, and gas detectors are installed and operated to prevent gas leakage accidents at these sites. Semiconductor production facilities, however, use different gas detectors for various gases such as C4F6, CH2F2, CH3F, C5F8, COS, CH4, and CO, making it difficult to purchase, install, and maintain each product. Furthermore, ethanol, isopropyl alcohol, and FC-3283, etc., commonly used as cleaning ingredients that cause interference in the measurement of gas detectors, have been pinpointed as the main culprit for malfunctioning the detectors. To solve this issue, the GTD-5000 (hereinafter referred to as the detector) is equipped with technology to accurately detect combustible, toxic, Freon, and organic compound gases while keeping the detector from malfunctioning due to interference gases, and it can thus safely detect various harmful gases at affordable prices.

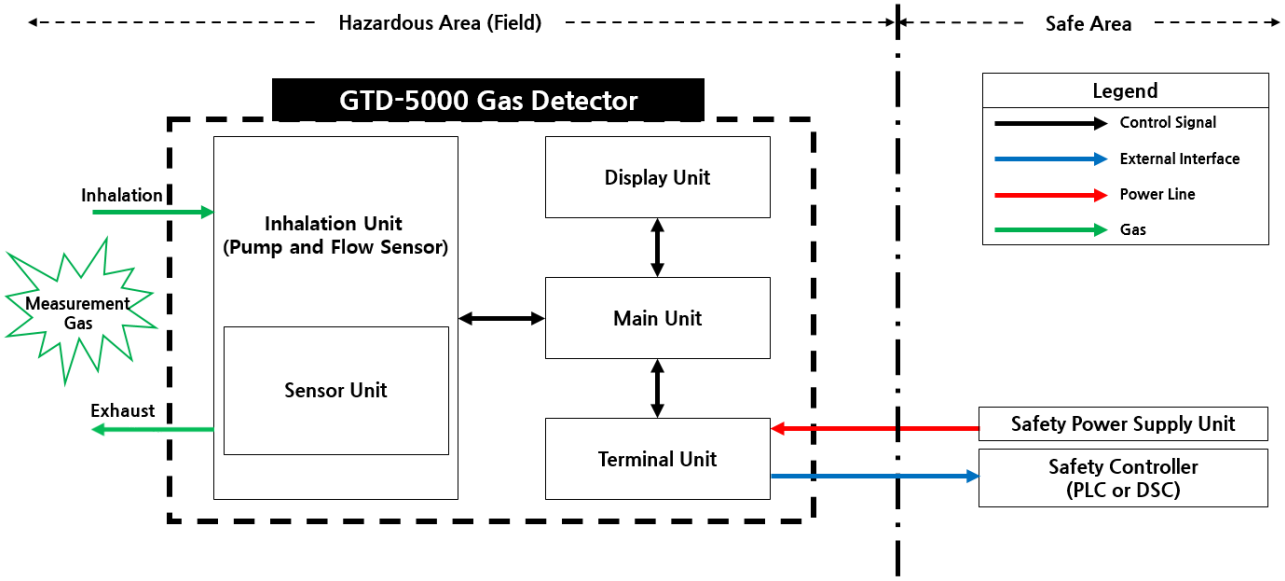
This product has the following features:

- Equipped with an algorithm that prevents interference gases (types of alcohol other than IPA, ethanol, and FC3283) other than those targeted for measurement from causing malfunction
- Detecting gas leaks promptly with its built-in high-performance pump
- Having a built-in function that automatically adjusts the flow rate
- Able to measure low to high concentrations of Freon, flammable, and toxic gases through a mechanism applied with various sensing techniques
- Utilizing a one-on-one interactive setting method based on the color graphic TFT LCD
- Having a built-in self-diagnosis function
- Mounted with a two-level gas alarm system, along with one fault indicator and relay contact outputs
- Installed with gas 4-20mA current interface outputs
- Easy to configure a monitoring system using the RS-485 Modbus and PoE Modbus TCP communication

[Figure 1. GTD-5000 Gas Detector]

2. Structure

The gas detectors can be installed in areas with a high risk of gas leakage. The internal diaphragm pump directly inhales gas from the hazardous areas into the detector sensing the gas through the sensor units, and is equipped with built-in flow sensors to maintain a constant flow rate set by the diaphragm pump.
The main unit inside the product performs all control and outputs gas concentration and other status information on the work site and surrounding area through both display units and terminal units. Depending on the interface type of a terminal unit, it is divided into the standard terminal unit capable of 4-20mA (Analog) RS-485 and the PoE terminal unit of an ethernet type.



[Figure 2. GTD-5000 Over View]

3. Specification

3.1. Specifications

I T E M S	SPECIFICATION
Measuring Type	Auto Sampling type
Measuring Type	2.0” Color TFT
Measuring Method	• Infrared / NDIR Module • Electrochemical / Cartridge • Catalytic / Cartridge • Semiconductor / Cartridge • Photoionization detector (PID) / Cartridge
Detectible Gas	• Combustible Gas • PFC (C4F6, CH2F2, CH3F, C5F8) • CO, COS and toxic gases
Measuring Range	• RANGE : 0 ~ 9999 • Refer to ‘[Table.17 Gas List]’ * Contact Gastron for gases not on the list
Accuracy	≤ ±3% / Full Range
Zero Drift	≤ 2% / Full Range
Response Time	Please contact Gastron
Pump Type	Diaphragm Pump
Flow Rate	Inlet: 100~ 1,000mL/min (Normal 500 mL/min)

Gas Sample Line		Within 30m (1/4" Tube)	
Approvals Classification			
Interface	**Standard**	Analog 4-20mA current interface, RS-485, Relay	
	PoE	PoE Interface, Relay	
Warranty		Transmitter	2Year
		Sensor	1Year

3.2. Mechanical Specifications

I T E M S	SPECIFICATION
Explosion Proof type	Non-explosion Proof type
Dimension	Standard type: 70(W) × 144(H) × 160(D) mm
Weight including Sensor	Standard type: 1.7kg
Mounting type	2" Pole mount, Wall mount
Tube **(Sample gas vent / inlet)**	1/4" Teflon Tube
Body material	Steel (Zn plating)

3.3. Electrical Specifications

3.3.1. Terminal Standard Unit

I T E M S	SPECIFICATION	
Input Voltage	Absolute min: Nominal: Absolute max: Ripple maximum allowed:	16V 24V 32V 1V pk-pk
Max Wattage	Max: Electrochemical Sensor Type: Catalytic Sensor Type: IR Sensor Type:	10W @+24 VDC 7.5W @+24VDC 8.8W @+24VDC 9.0W @+24VDC
Analog output Current	0-22mA(500 ohms max load) All readings ± 0.2mA Measured-value signal: 4mA(Zero) to 20mA(Full Scale)	
	Fault: 0-100% LEL: 100-109%LEL: Over 110% LEL: Maintenance:	0mA – 2.5mA 4mA – 20mA 20mA – 21.4mA 22.0mA 3mA
Analog output current ripple & noise max	±20uA	
Relay contact	Alarm1, Alarm2, Fault Relay Rated 2A @ 30V DC or 0.5A @ 125 V AC	
Wiring requirement	Analog: CVVS or CVVSB with shield RS485: STP (Shielded Twisted Pair)	
Cable Connection Length	Analog: 2500m RS485: 1000m	
EMC Protection:	Complies with EN50270	

3.3.2. Terminal PoE Unit

I T E M S	SPECIFICATION

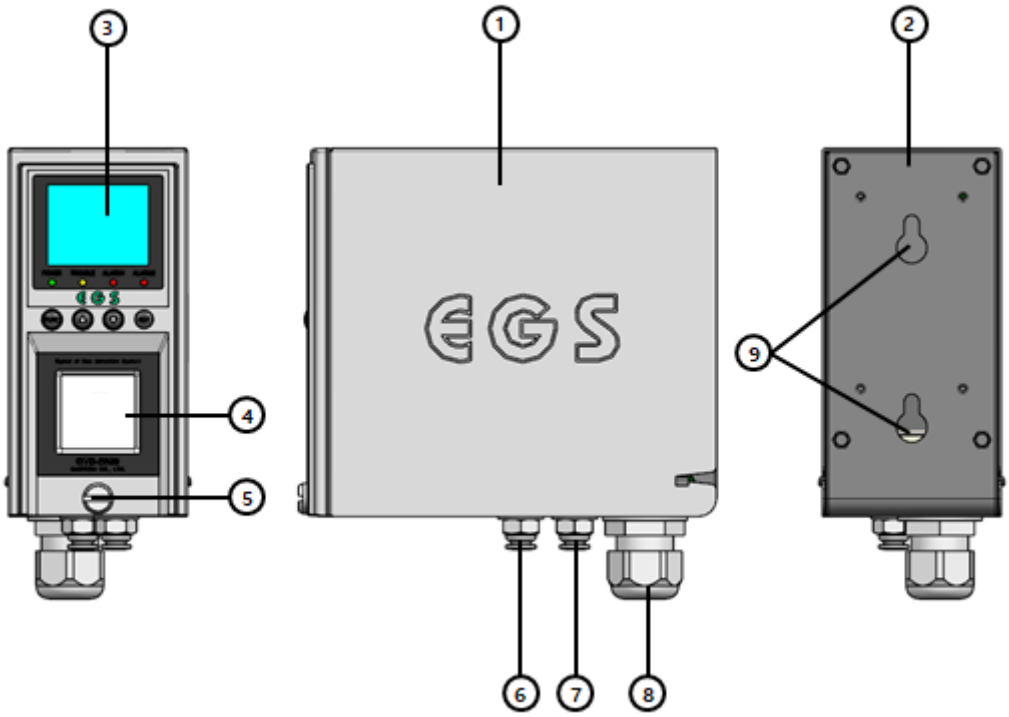
Input Voltage **48 VDC Power-over-Ethernet** **(IEEE 802.3af compliant)**	Absolute min: Nominal: Absolute max:	37V 48V 57V
Max Wattage	Max: Electrochemical Sensor Type: Catalytic Sensor Type: IR Sensor Type:	11.2W @+48 VDC 8.7W @+48VDC 9.6W @+48VDC 10.1W @+48VDC
Relay contact	Alarm1, Alarm2, Fault Relay Rated 2A @ 30V DC or 0.5A @ 125 V AC	
Wiring requirement	CAT5 cable or equivalent RJ45	
Cable Connection Length	100M (Max. Res: 20 Ω)	
EMC Protection:	Complies with EN50270	

3.4. Environmental Specifications

I T E M S	SPECIFICATION	
Operation Temperature	Body	-10 to 60℃
Storage Temperature	Body	-20 to 65℃
Operation Humidity	Body	30 to 85% RH (Non-condensing)
Pressure Range	90 to 110KPa	

4. Name and Description of Each Part

4.1. Components



[Figure 3. GTD-5000 components]

No	Name	Descriptions
1	Case cover	This protects against external configurational changes and shocks.
2	Case base	This includes mounting holes and cable glands, gas in/out ports, etc., needed to fix the case.
3	Front Display	This represents information about the state of the detector. (See 4.2 for details)
4	Sensor cartridge	This is for cartridge sensors. (Blank, at present)
5	Front cover fixed screw	This is a screw that fixes the main body case and the front cover case.
6	Gas inlet	It shows a sample gas inlet port. (1/4” Tube)
7	Gas outlet	This is a sample gas output port. (1/4” Tube)
8	Cable Gland	This shows the power and signal cable inlet.
9	Mount hole	This is a hole that holds the gas detector to a wall or other places.

[Table 1. Description of GTD-5000 components]

4.2. Configuration of the Front Display

[Figure 4. Configuration of the front display]

No.	Name	Descriptions
1	LCD Display	This shows the output of information such as gas concentration, current status, parameter setting, etc.
2	Power LED (Green)	This represents an LED showing information about the power supply status.
3	Trouble LED (Yellow)	This shows the LED illumination when Trouble is detected.
4	Alarm1 LED (Red)	This displays the LED illumination when detected by the Alarm 1 setting.
5	Alarm2 LED (Red)	This displays the LED illumination when detected by the Alarm 2 setting.
6	Function key	It shows the function of entering the menu, selecting individual modes, and storing the setting values.
7	Up key	This signifies both the selection of the upper part of the cursor and an increase in the value set in the individual mode.
8	Down key	This signifies both the selection of the lower part of the cursor and a decrease in the value set in the individual mode.
9	Reset key	This indicates that selecting the individual mode leads to entry to one step up and cancellation of the setting value.

[Table 2. Brief details on configuration of the front display]

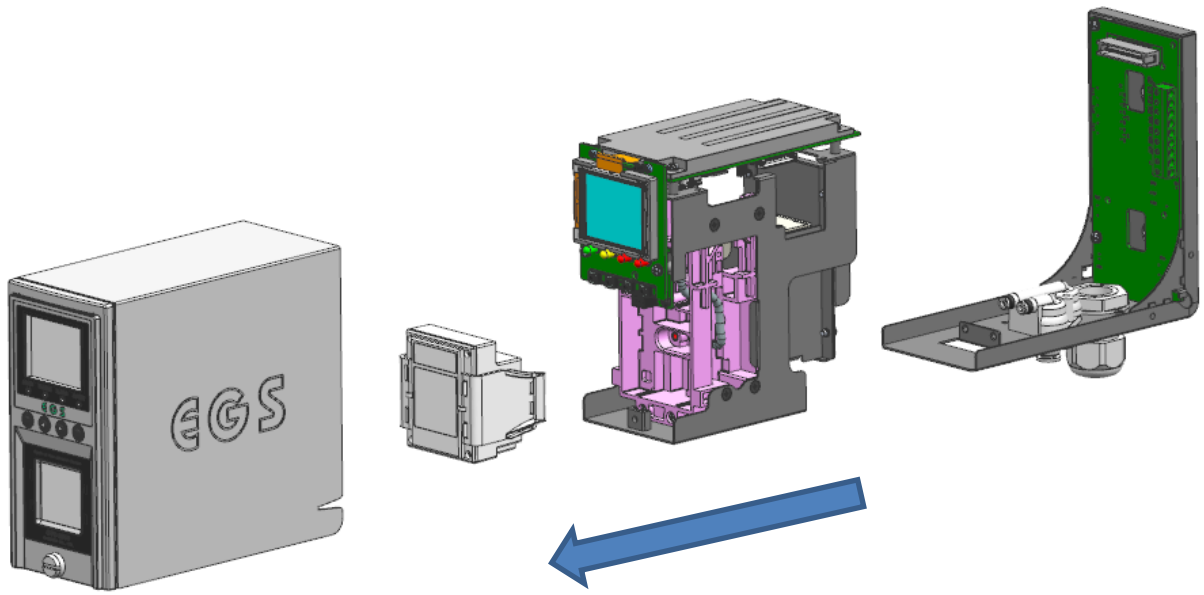
5. Installation

- Installation of the gas leakage detector at the work site or opening or operating the cover of the installed gas leakage detector must be done only by the authorized user or the person in charge of installation and repair of the headquarters. Otherwise, it would cause serious personal and property damage such as a fire or explosion accident. In addition, make sure to check for any explosive gas remaining or flammable substances around you and turn off the power before working.

⚠

➢ **CAUTION**: Special attention is required as malfunction and trouble may occur if the connection state of the cartridge (IR) differs from the value in which the configuration is set in the equipment.

5.1. A Diagram of and a Method for Disassembly

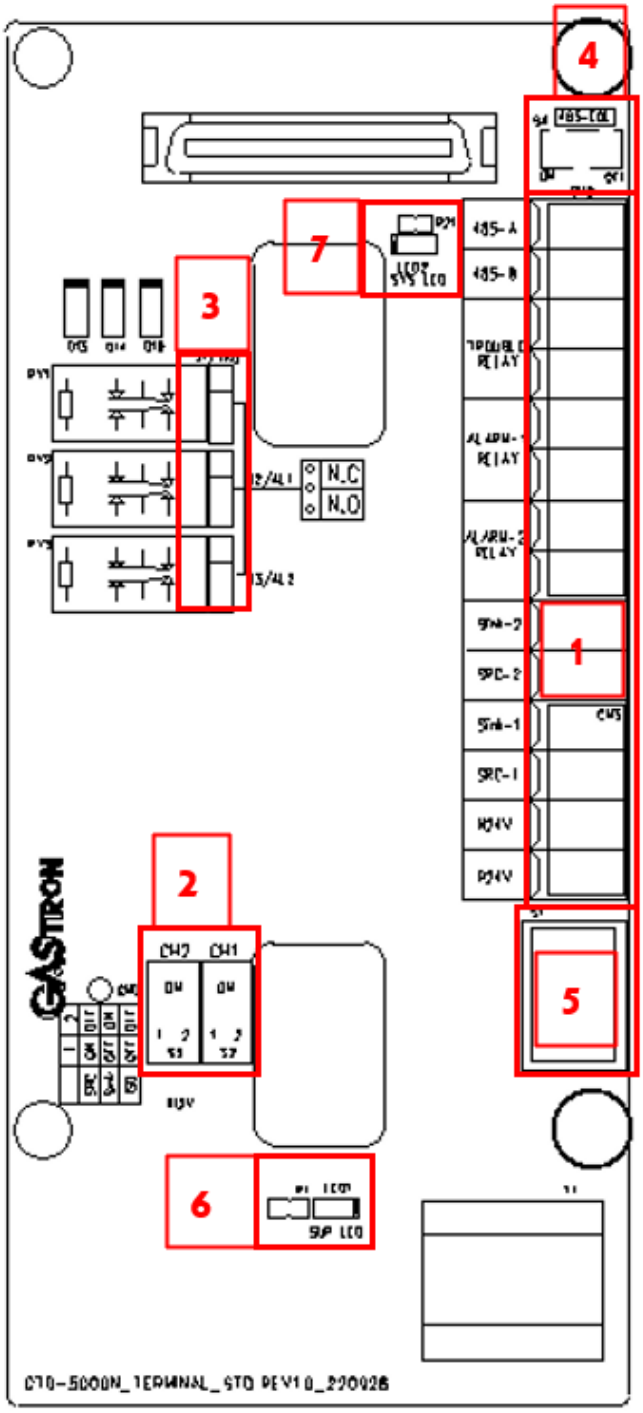


[Figure 5. Disassembly diagram]

① Loosen the fixed screws on the front cover counterclockwise, and then pull the front cover case forward to separate the case and the body.

② Unscrew the two screws fixed under the sampling body and pull them forward to separate the sampling body and the case base.

5.2. Structure of a Standard Terminal Unit

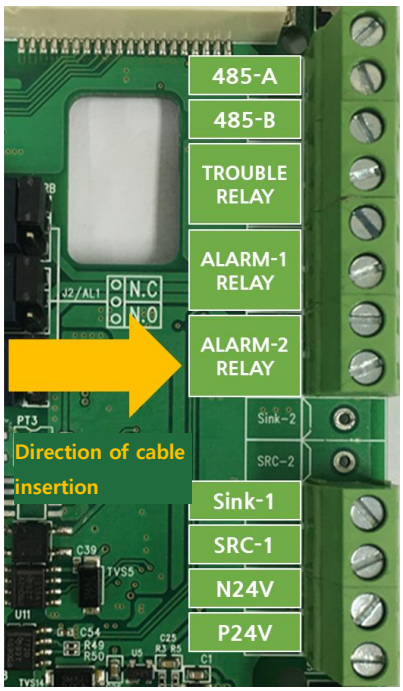


[Figure 6. A placement diagram of the standard terminal PCB]

No.	Description
1	External input/output terminal block
2	A switch for setting the current Interface(4-20mA) mode
3	A jumper for relay mode selection
4	A switch for selecting the RS-485 termination resistance
5	A switch for turning the system on/off
6	LED indicating the status of the external input voltage
7	LED showing the power supply status of the system

[Table 3: Information on the main parts of the standard terminal PCB]

5.2.1. Configuration of a Terminal Block

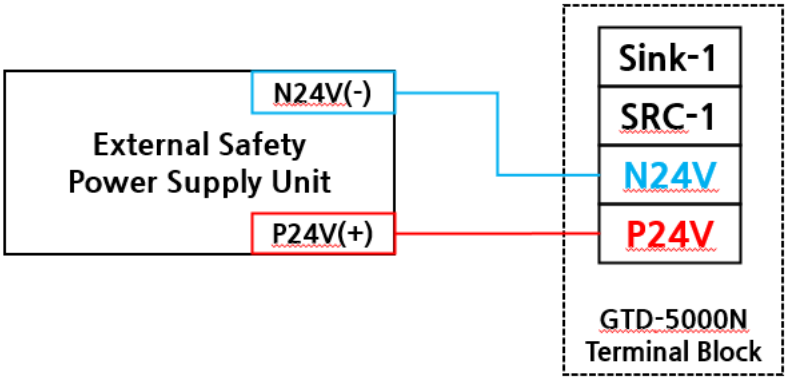


[Figure 7. A placement diagram of the standard terminal block]

Name	Description
485-A	• RS485(A) unit
485-B	• RS485(B) unit
TROUBLE RELAY	• Trouble relay output unit
ALARM-1 RELAY	• Alarm 1 relay output unit
ALARM-2 RELAY	• Alarm 2 relay Output unit
Sink-1	• CH1 4-20 mA sink mode output • CH1 4-20 mA isolation mode '+'
SRC-1	• CH1 4-20 mA source mode output • CH1 4-20 mA isolation mode '-'
P24V	• +24 V / power (+)
N24V	• GND / power (-)

[Table 4: Information on the main parts of the standard terminal PCB]

5.2.2. Configuration of a Standard Terminal



[Figure 8. A connection diagram of a standard terminal]

※ Disconnect power prior to connecting power terminals

- The input voltage of the detector is usually 24 volts (min 16V to max 32V).
- Connect the detector power line of the external supply as seen in [Figure 8].

5.2.3. Setting a 4-20mA Current Interface

As shown in [Figure 6], the current interface output can be set to Sink, Source, or Isolated, through a switch that sets a desired mode. How to set the setting method is given in [Table 5] below.

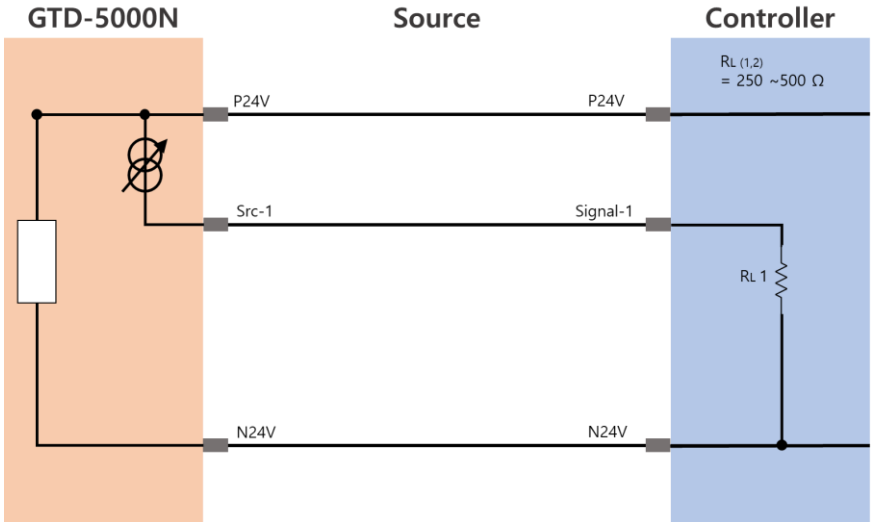
CH No. / Configuration	CH1		Switch
	1	2	
SRC(Source)	ON	OFF	
Sink	OFF	ON	
ISO	OFF	OFF	

[Table 5. Setting a current interface switch]

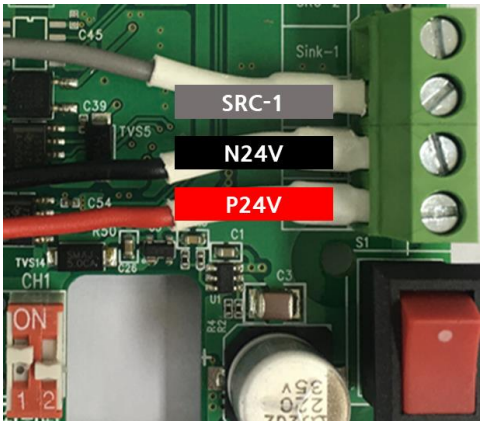
- 4-20mA setup and wiring sequence
  1. Verify that the controller is in 4-20mA mode.
  2. Check the mode status by referring to the diagrams seen in [Figure 9], [Figure 11], and [Figure 13], respectively.
  3. Set the mode of the switch with reference to [Table 5].
  4. Wire the terminal block based on [Figure 10], [Figure 12], and [Figure 14].

5.2.3.1. Setting an SRC (Source)

As shown in the diagram in [Figure 9], the setting of Switch 1 to the 'On' (Switch 2 to Off') state allows connection with the P24V, making the current suitable for the gas detector to flow through the signal line connected to the controller.



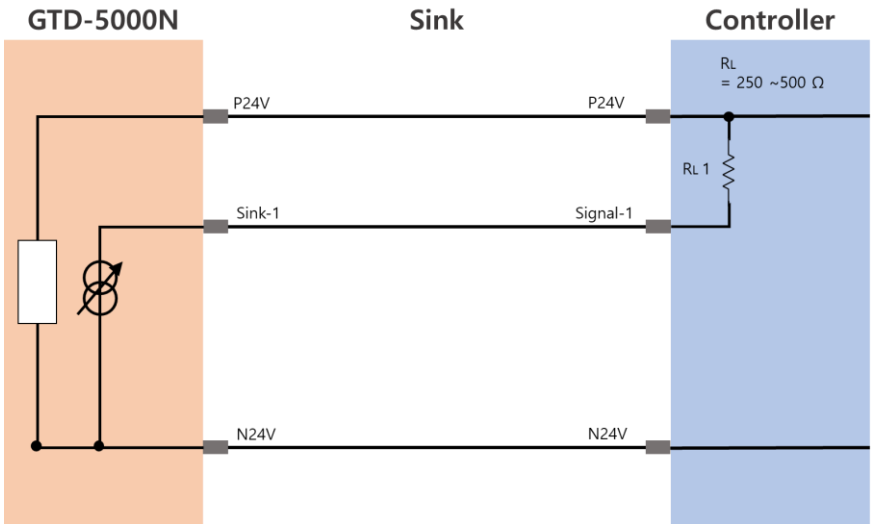
[Figure 9. Source Diagram]



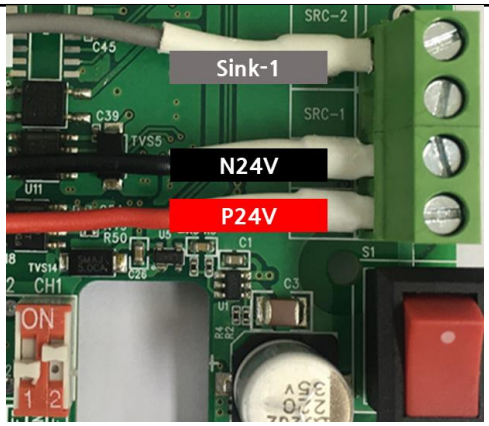
[Figure 10. Source wiring]

5.2.3.2. Setting a Sink

As seen in the diagram in [Figure 11], the setting of Switch 2 to the 'On' (Switch 1 to Off') state allows connection with the N24V, and thus, through the signal line linked to the controller, a current suitable for the detector flows to the internal N24V.



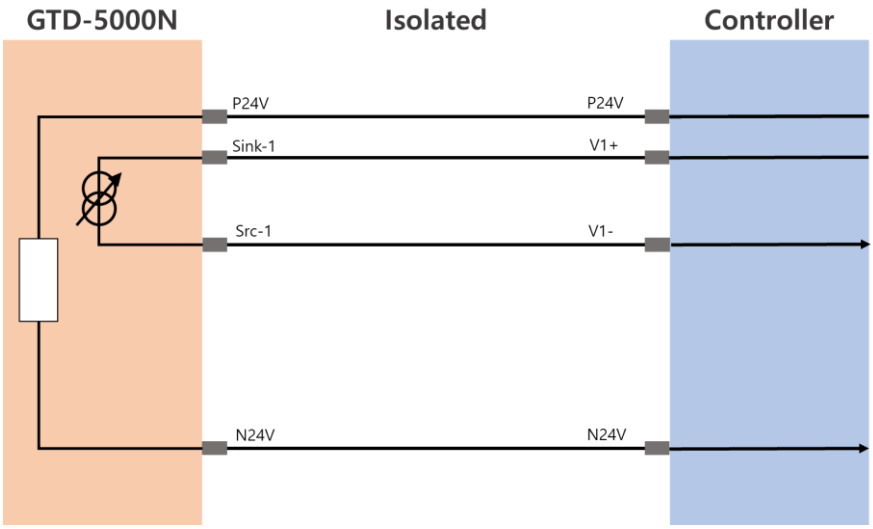
[Figure 11. Sink diagram]



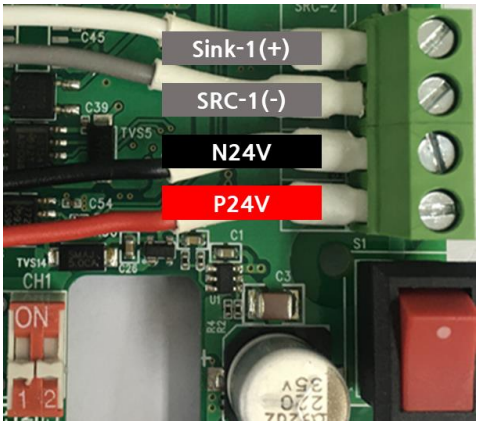
[Figure 12. Source wiring]

5.2.3.3. Setting an Isolated Mode

As shown in the diagram in [Figure 13], setting switches 1 and 2 to the 'off' state starts the insulation mode and causes the current of the controller's separately operated power to flow reflecting the state of the detector.



[Figure 13. Source Diagram]



[Figure 14. Source wiring]

5.2.3.4. 4-20mA Current Output Information

Status of the detector	4-20 mA Output
Fault	0mA
0 ~ 100%	4mA ~ 20mA
100% ~ 109%	20mA ~ 21.4mA
110% or more	22mA
Maintenance	3mA
※ 100% = High Scale (H/S)	

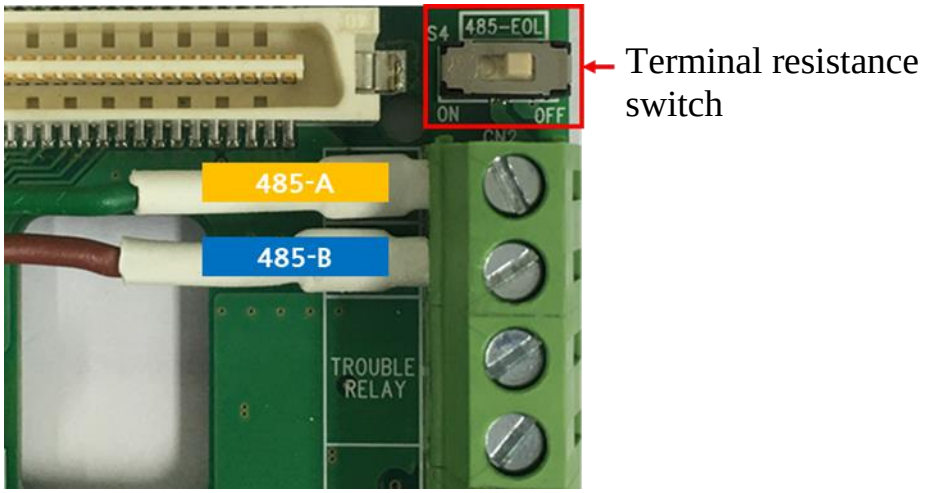
[Table 6. Current output information]

5.2.4. RS-485 Interface

- Wiring procedure
  1. Referring to [Figure 15] below, connect '485-A' and '485-B' to the terminal block unit.
  2. Based on [Table 7], make a link to the Modbus master terminal.
  3. When termination resistance is required because the detector is at both ends of the slave terminal, set the termination resistance switch shown in [Figure 15] to the 'On' state.

Terminal name of equipment	Master terminal name
485-A	'TRXD+' or 'A' or 'P'
485-B	'TRXD-' or 'B' or 'N'

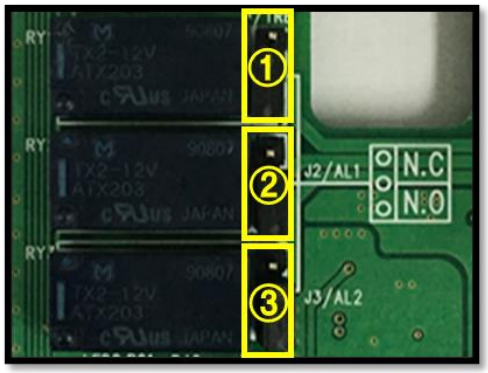
[Table 7. RS-485 terminal configuration]



[Figure 15. RS-485 wiring and the terminal resistance switch]

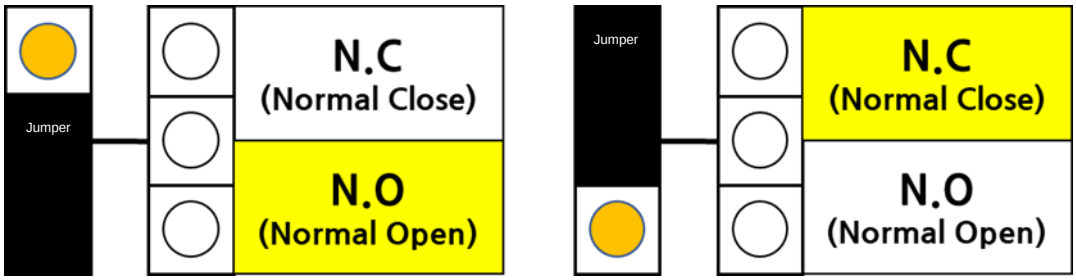
5.2.5. Alarm Relay

As seen in [Figure 16], the relay output comprises three types, i.e., Trouble, Alarm-1, and Alarm-2. A relay may be set to a normal open mode and a normal close mode in the '1 Form C' type, and such relay may be set to a desired mode according to the position of a jumper, as shown in [Figure 17]. The normal close mode is short at all times and open when a situation occurs, and conversely, the normal open mode is always in an open state and is closed when a situation arises.
The wiring work is carried out as shown in [Figure 18].

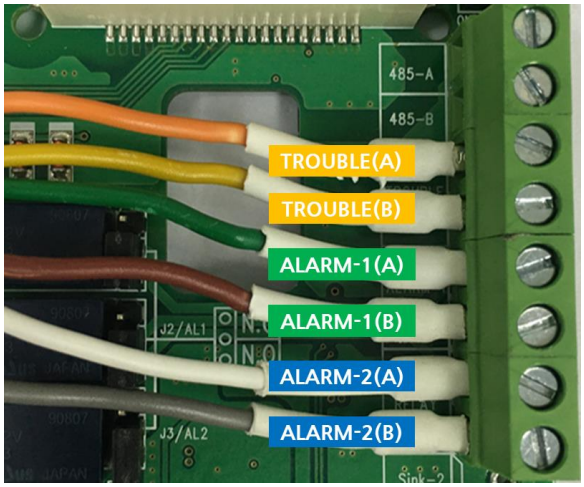


No.	A mode-setting relay
1	TROUBLE
2	ALARM-1
3	ALARM-2

[Figure 16. A relay setting a standard relay mode]



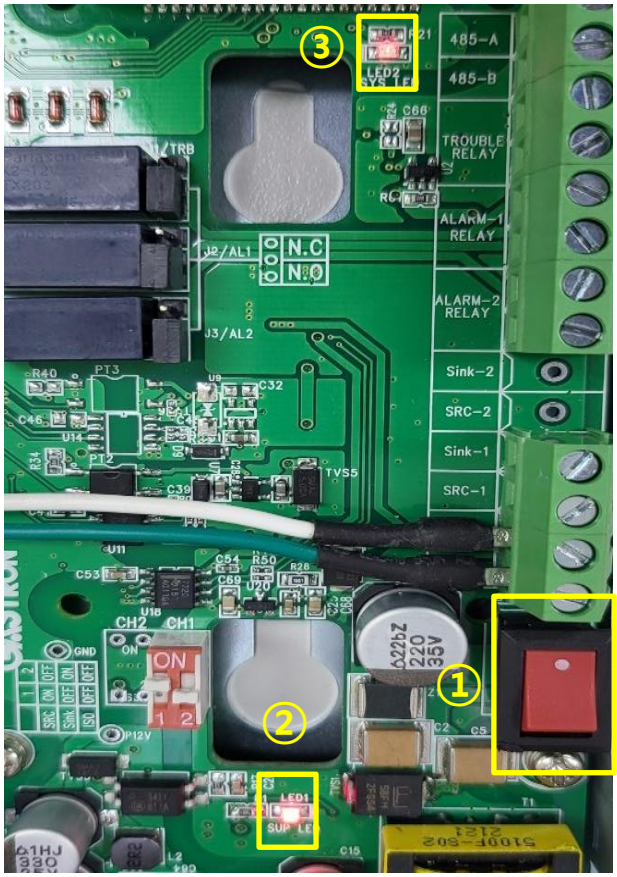
[Figure 17. A jumper output mode]



[Figure 18. Wiring of the standard relay]

5.2.6. Supplying Power and Checking Power Condition

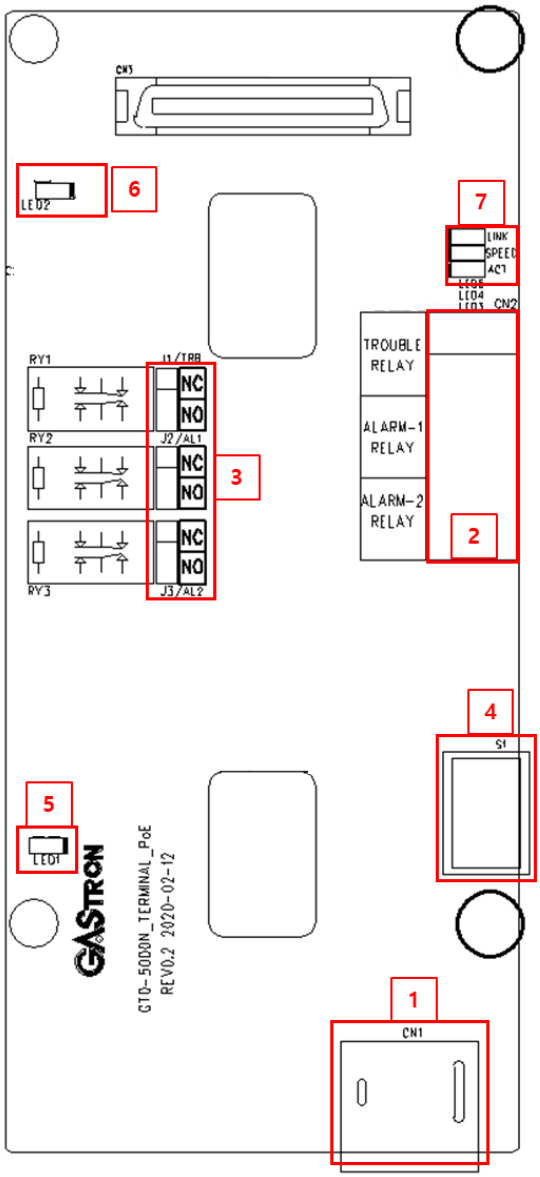
It is recommended to proceed after the wiring work is completed on the terminal block. As shown in [Figure 19], the detector can be turned on/off through the 'power on/off switch'. Whether the power supply is normal can be verified through the checking of both the input power LED and the system power LED, with the power switch on.



No.	Name
1	Power ON/OFF switch
2	Input power LED
3	System Power LED

[Figure 19. The power on/off switch and the power LED]

5.3. Structure of a PoE Terminal Unit

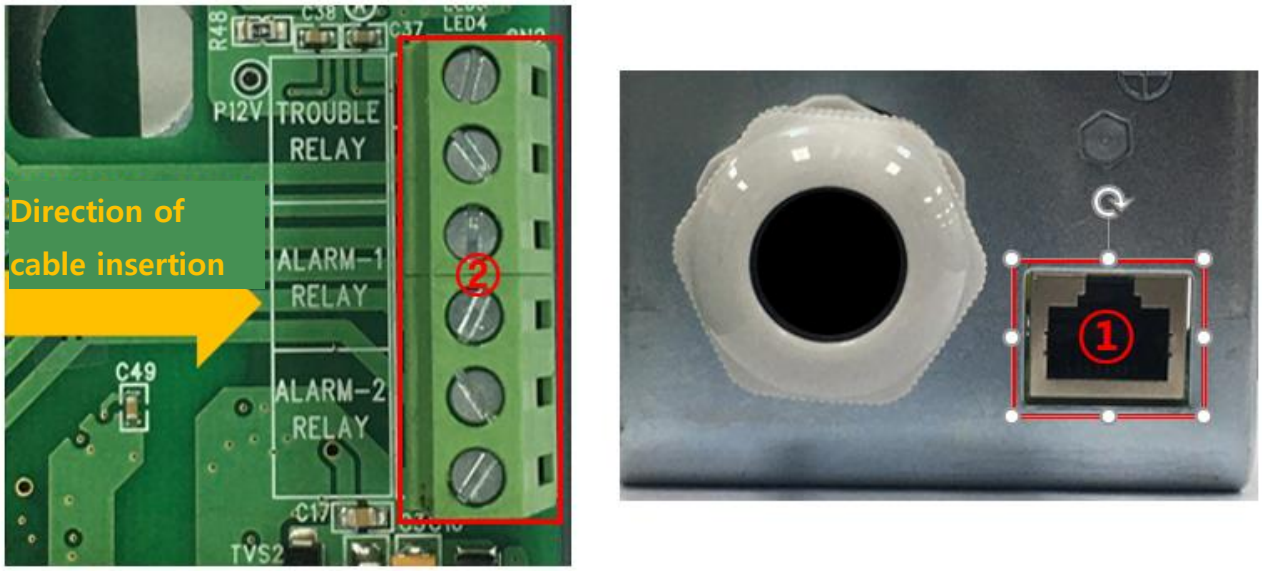


[Figure 20. A placement diagram of a PoE terminal PCB]

No.	Description
1	PoE Input Connector (RJ-45)
2	Relay Terminal Block
3	A jumper to select a relay mode
4	A system on/off switch
5	An LED indicating the status of the external input voltage
6	An LED showing the status of the system power supply
7	An LED illustrating the Ethernet status

[Table 8: Information on the main parts of a PoE terminal PCB]

5.3.1. Descriptions of a PoE Terminal Unit Pin-Map and a PoE Connector

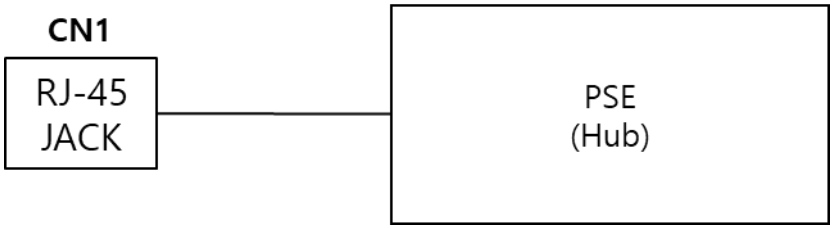


[Figure 21. A placement diagram of a PoE terminal unit]

No.	Name	Description
1	PoE Connector (RJ-45)	• Connect for Ethernet communication and power supply.
2	TROUBLE RELAY	• Trouble relay output terminal
	ALARM-1 RELAY	• Alarm 1 relay output terminal
	ALARM-2 RELAY	• Alarm 2 relay output terminal

[Table 9: Information on a PoE terminal unit]

5.3.2. Power Configuration



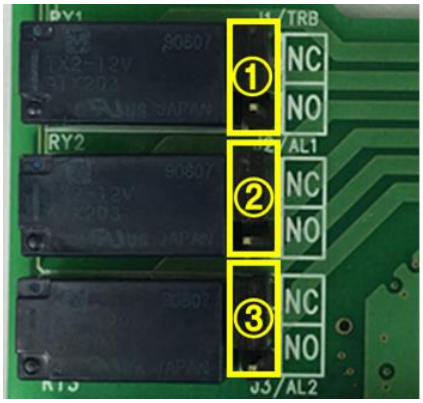
[Figure 22. A connectivity diagram on the power and communication of a PoE terminal]

※ Disconnect power prior to connecting power terminals.

- Connect the PSE and the detector using a LAN cable (cable CAT5 or equivalent cable RJ45).

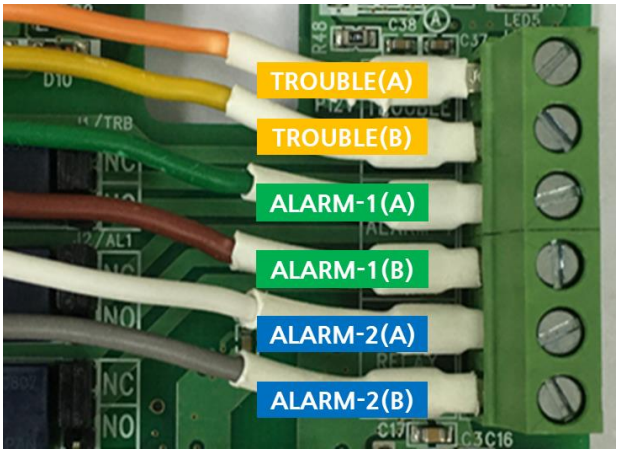
5.3.3. Composition of an Alarm Relay Terminal

As shown in [Figure 23], the relay output is composed of three types, inclusive of Trouble, Alarm-1, and Alarm-2. A relay may be set to a normal open mode and a normal close mode in the '1 Form C' type, and such relay may be set to a desired mode according to the position of a jumper, as shown in [Figure 17].
The normal close mode is short at all times and open when a situation occurs, and conversely, the normal open mode is always in an open state and is closed when a situation arises.
The wiring work is conducted as given in [Figure 24].



No.	A Mode-Setting Relay
1	TROUBLE
2	ALARM-1
3	ALARM-2

[Figure 23. A mode-setting PoE relay]



[Figure 24. Wring of a PoE relay]

5.3.4. Supplying Power and Checking Power Condition

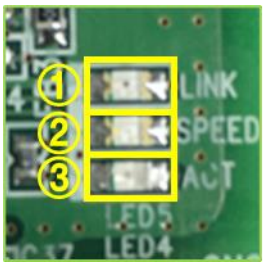
These tasks are recommended to be conducted after wiring is completed in the PoE terminal block. The detector can be turned on/off using the 'power on/off switch' described in [Figure 25]. If the PSE (hub) and detection are in operation without fault after the power switch is turned on, it can be confirmed that power is accurately supplied to both the input power LED and the system power LED.

No.	Name
1	The power on/off switch
2	Input power LED
3	System power LED

[Figure 25. A PoE power on/off switch and the power LED]

5.3.5. An LED Indicating the Ethernet Status

As in [Figure 26], there are three types of information that can be found on the LED indicating the Ethernet status, whose contents are shown in [Table 10].



No.	LED Name
1	LINK
2	SPEED
3	ACT

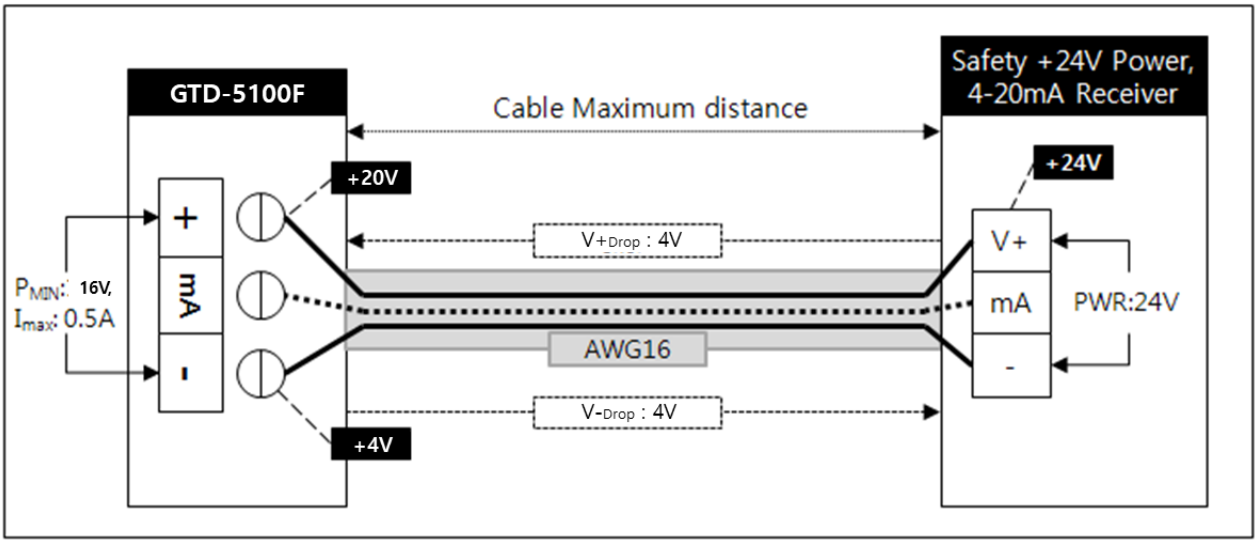
[Figure 26. LEDs indicating the Ethernet status]

No.	Description
LINK	An LED displaying the LNK status
SPEED	LED on: over 100Mbps; LED off: less than 10Mbps
ACT	Activity LED: An LED indicating data transmission and reception

[Table 10. Details on PoE Terminal units]

5.4. Lengths of Cables to be Installed

- The maximum length between the GTD-5000 and the power supply is set depending on the wire specification.
- Maximum length of installation = VMAXDROP ÷ IMAX ÷ WIRER/m ÷ 2
  - ✓ VMAXDROP: Maximum Power Loop Voltage Drop (= power supply voltage minus minimum operating voltage)
  - ✓ IMAX: Maximum current value of the GTD-5000
  - ✓ WIRER/m: The resistance of the wire (ohms/meter value available in wire manufacturer's specification data sheet),
- Examples of installation lengths utilizing a 24V power supply and a 16 AWG are given as follows.
  - ✓ GTD-5000 minimum operating voltage = 16 Vdc
  - ✓ VMAXDROP = 24 – 16 = 8V
  - ✓ IMAX = 0.5A (500mA)
  - ✓ 8 ÷ 0.5 ÷ 0.01318 ÷ 2 = 606.980m ≒ 600m



[Figure 27. Cable Max distance]

- The length required for power cable installation according to cable classification is shown in the table below.

AWG	mm^2	Copper resistance(ohms/m)	Meters	Feet
12	3.31	0.00521	1535	5036
14	2.08	0.00828	966	3169
16	1.31	0.01318	606	1988
18	0.82	0.02095	381	1250
20	0.518	0.0333	240	787

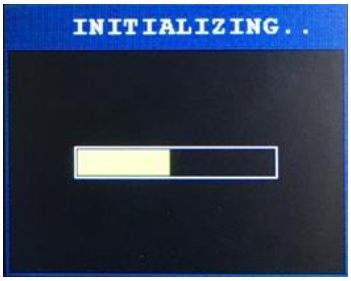
[Table 11. Power Cable maximum distance]

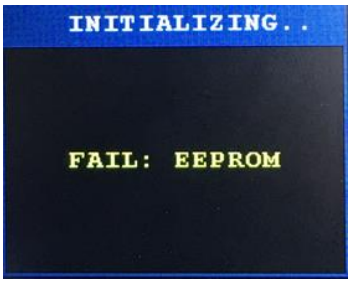
6. Operation

6.1. Power On

- Subsequent to checking both the cable connection and power voltage, assemble the product and turn on the power switch of the terminal unit.
- When the front PWR (power) LED turns green and the warm-up is completed after the phases of initialization, configuration, and self-test, the gas measurement mode is ready for use.
- The time required for warm-up of self-test is about 900 seconds.

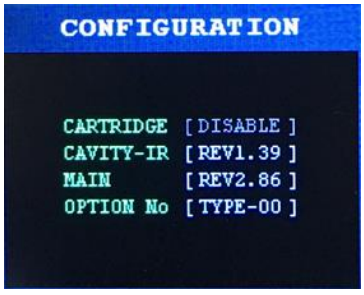
➢ When the power switch is turned on, the output screen is displayed for about three seconds.





➢ Initialize and inspect the hardware of the detector.

➢ If an abnormality is found during the hardware initialization, FAIL is displayed on the screen and a check is required.



➢ A firmware version of CARTRIDGE, CAVITY-IR, MAIN, etc., is displayed, and unconnected sensors are seen as DISABLE.

➢ Enter the corresponding type in OPTION No according to the setting of the option switch. (Not applicable)

➢ Perform functional assessment, i.e., SENSOR LEVEL, IR SRC POWER, and FLOW CONTROL, and then proceed with WARM-UP.

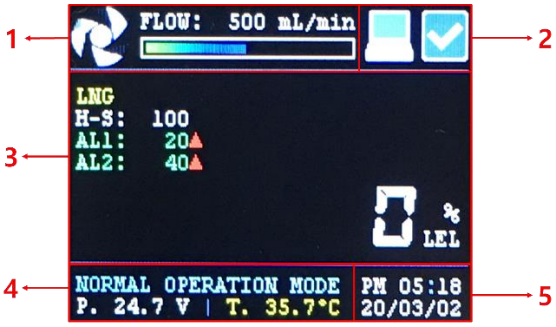
➢ If the menu turns red during the inspection and the progress halts, this is associated with abnormalities in the functions and needs to be promptly checked.

➢ When the stages of functional inspection and warm-up are completed, the screen enters the gas measurement mode.

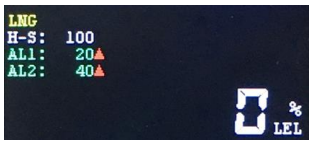
6.2. Gas Measurement Mode

6.2.1. Configuration of a Display LCD

- The gas measurement mode displays the measured gas value and various key information related to the operation of the detector in real time.



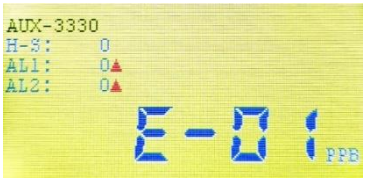
[Figure 28. Status indicating gas measurements]

No.	Figure	Name	Description
1		Flow Meter	• FLOW: It indicates the current flow rate. • Icon: It signifies that speed may vary with a flow rate. • Graph: This displays the flow rate used relative to the total flow rate.
2		An icon for system status	 • Status indicating normal operation  • Filtering in motion - When detecting interference gas - When outside ± 20% of the set flow rate - When the sensor is warming up - When there is a problem with the sensor signal - When the sensor temperature goes beyond the sensing range
		An icon for communication status	• The icon flashes during the Ethernet or RS-485 communication.
3		Details on gas	• Name of the gas being measured • H-S: High Scale • AL1: Primary alarm indicating operation, criteria, and direction • AL2: Secondary alarm indicating operation, criteria, and direction • Indicating the gas concentration being measured in real time
4		Operational mode, voltage, and temperature	• Status of operational mode - NORMAL OPERATION MODE: well-functioning status - LOCK MODE: Key lock • P. xx.xV: Information about the voltage input • T. xx.x°C: Information on the temperature inside the detector
5		Date and time	• The date and time of the system

[Table 12. Configuration of the screen showing the mode in which the gas is being measured]

6.2.2. Screen Configuration by Gas Concentration

	➢ Normal measurement status • Measured gas concentration value is below 0% to AL1

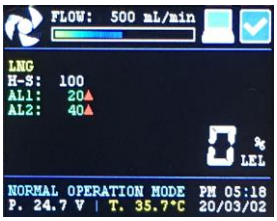
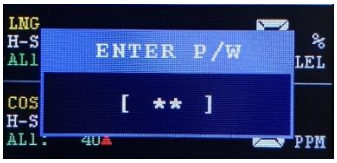
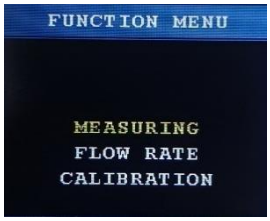
	➢ Alarm 1 has occurred: • This occurs when the measured gas concentration value is AL1 or higher. • The “AL1 LED” lights up.
	➢ Alarm 2 has occurred: ➢ This occurs when the measured gas concentration value is AL2 or higher. ➢ The “AL2 LED” lights up.
	➢ The “Over” status has occurred: • This occurs when the meausred gas concentration value is 110% or higher based on the High Scale. • The letter “OVER” is displayed.
	➢ The system error has occurred: • This occurs when there is something wrong with the sensor. • The letter “E-XX” is displayed, and the “TRB LED” is lit. (Refer to 8.1 Fault List)

6.3. Key-Lock Function and Fault

	➢ LOCK MODE • This is switched by pressing and holding the “Reset” key for 3 seconds in the gas measurement mode. • When this is executed, the external input key is not recognized. • This is released by pressing and holding the “Reset” key for 3 seconds in the LOCK MODE state.

➢ Faulty switch or loss of its function
- If the tact switch is kept in an operational (short) state for a certain period of time, e.g., for about 10 minutes or more, due to an external impact or a component defect, the device identifies it as a switch defect and forces the switch to lose its function.
- When the issue related to the input status is addressed, the function is automatically restored.

6.4. Function Menu and Control

	➢ Pressing and holding the "FUNC" key for two seconds while trying to measure the gas will display the step of requesting a password on the screen.
	➢ Steps requiring password entry • A pop up will appear requesting you to enter the password. • Factory-manufactured initial value is (** == 00), which can be changed within the range of "00 to 99." • Entering the password and pressing the 'FUNC' key allows you to move to the function setting menu.
	➢ Function setting menu • The cursor position is indicated in yellow. • If there is no input about 60 seconds after entering the menu, the screen returns to the gas measurement mode.

- Key input information required for menu control is as follows.

Switch Name	Short	Long
Function (FUNC)	• Enter the menu • Input (Enter) • Move cursor to the next position • Select and deselect	• Move cursor to the last position • Enter the configuration menu
Reset	• Return to the previous menu • Move cursor to the previous position	• Move cursor to the initial position
Up	• Move up in the menu (list) • Increase (number) • Change	• Rapidly increase the number
Down	• Move down in the menu (list) • Decrease (number) • Change	• Rapidly decrease the number

[Table 13. Switch control information]

7. A Setup Function

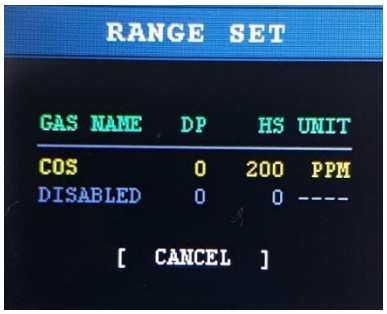
7.1. Configuration of a Setup Mode

Level 1	Level 2	Description
MEASURING	RANGE	Setting the height and unit of the scale for the gas to be measured
	ALARM	Adjusting 1st and 2nd alarm settings
	CROSS SCALE	Setting the relative sensitivity of the sensor
FLOW RATE	CALIBRATION	Adjusting the flow rate
	TARGET FLOW	Setting the output flow rate
	TROUBLE	Setting the FLOW TROUBLE occurrence time
INTERFACE	POE	Setting up an Ethernet configuration (PoE Terminal Unit Only)
	RELAY	Setting up a RELAY configuration
	RS485	Setting up an RS-485 configuration (Standard Terminal Unit Only)
	mA CALIBRATION	Calibrating the mA (Standard Terminal Unit Only)
	mA ZERO OFFSET	Performing zero offset correction of the mA (Standard Terminal Unit Only)
SYSTEM CONFIG	CALENDAR	Setting the date and time
	PASSWORD	Changing password
	DISPLAY	Adjusting the brightness of the display
TEST	mA OUTPUT	Testing the mA output (Standard Terminal Unit Only)
	RELAY	Testing the RELAY output
	DISPLAY	Inspecting an LCD screen
	GAS SIMULATION	Conducting a simulation test of gas detection
	MAX POWER	Outputting the maximum power
Factory	**Factory Mode**	

[Table 14. Configuration of internal settings]

7.2. Calibration of Measurements

7.2.1. Setting a Range (MEASURING → RANGE)



Setting the height and unit of the scale for the gas to be measured

Classification	Description
GAS NAME	➢ The name of the pre-selected gas to be measured
DP	➢ Decimal Point: Placing the decimal point of the gas concentration • Able to be set within the range of "0 to 3"
HS	➢ High Scale: Setting the maximum value of the range to be measured • The measurement range may vary depending on the decimal points.
UNIT	➢ Setting the unit to measure • Able to select from among the four units, i.e., "PPB, PPM, %LEL, and %VOL."

	➢ When setup is complete, change “CANCEL” to “SAVE,” and press “Save.” ➢ Refer to ‘[Table 17. Gas List]’ for initial values. **※ Altering the above settings is not recommended and may result in poor accuracy of measurement.**

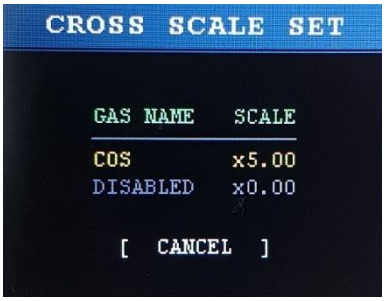
7.2.2. Setting an Alarm (MEASURING → ALARM)

Adjusting 1st and 2nd alarm settings

Classification	Description
GAS NAME	➢ The name of the gas to be measured
1’ST	➢ Setting 1st alarm conditions
2’ND	➢ Setting 2nd alarm conditions
LEVEL[xxx]	➢ Setting the alarm thresholds • Able to be set within the “1% to 100%” range based on the high scale
DEAD[%]	➢ Setting a dead band • Setting the hysteresis from the start to the end of the alarm • Able to be set within the “0% to 10%” range
DELAY[SEC]	➢ Setting the delay time for the alarm • Able to be set within the “0 sec to 30 sec” range
LATCH	➢ Enabling/disabling the function of a latch
DIRECTION	➢ Setting the direction where the alarm is triggered

➢ When setup is complete, change “CANCEL” to “SAVE,” and press “Save.”
➢ Refer to ‘[Table 17. Gas List]’ for initial values.

7.2.3. Setting a Cross Scale Mode (MEASURING → CROSS SCALE)



Setting the relative sensitivity of the sensor

Classification	Description
GAS NAME	➢ The name of the gas to be measured • When there are two gases to be measured, ‘DISABLED’ is activated.
SCALE	➢ Setting the magnification • Able to be set within the “x0.01 to x5.00” range

➢ After setup is complete, change “CANCEL” to “SAVE,” and select Save.
➢ E.g., to measure Isobutane when the pre-set gas is LNG, refer to the relative sensitivity ratio.

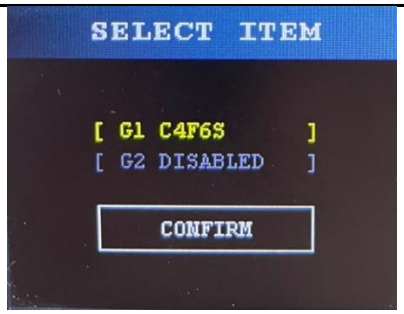
7.2.4. Setting the Name of Gas (MEASURING → GAS NAME → GAS1)

Setting the name of the gas to be measured

➢ How to change
1. Set the name of the gas to be changed for measurement
2. Change “CANCEL” to “SAVE,” and press “Save.”

7.2.5. Initializing the Name of Gas (MEASURING → GAS NAME → INIT)

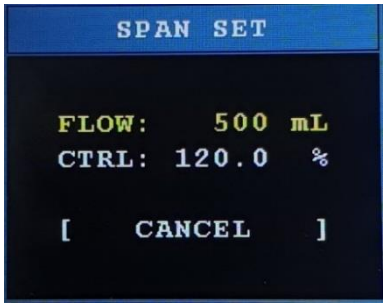
	Initializing the name of the gas to be measured



- How to change
  1. Select the name of the gas to be initialized for measurement
  2. Choose “CONFIRM,” change “NO” to “YES,” and then press “Save.”

7.3. A Flow Rate Mode

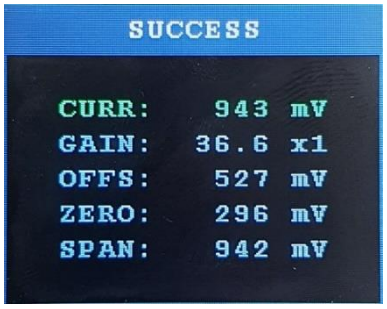
7.3.1. CALIBRATION (FLOW RATE - CALIBRATION)



Calibration of the flow rate

Classification	Description
FLOW	➢ Setting the calibrated flow rate • Able to be set within the "100mL to 1000mL" range
CTRL	➢ Setting the time constant for controlling the pump unit • Able to be set within the "0.0% to 30.0%" range

- How to conduct a calibration
  1. Connect the flow meter to the detector (INLET recommended).
  2. Set "FLOW" to the desired flow rate to be calibrated.
  3. Adjust the value of "CTRL" to the calibrated flow rate based on the flow meter.
  4. Change "CANCEL" to "PROGRESS," and conduct an automated flow calibration.



- A screenshot when calibration is complete
- The value of 'TARGET FLOW' is changed to the revised flow value.

7.3.2. Setting the Target Flow Rate (FLOW RATE – TARGET FLOW)

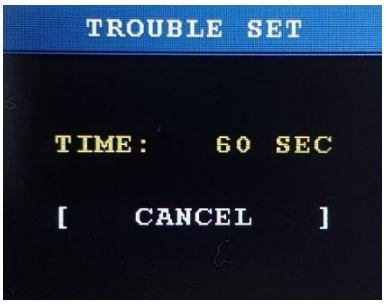
Setting the output flow rate

Classification	Description
FLOW	➢ Setting the targeted gas flow rate • Able to set within the "100 mL to 1000 mL" range

- After setup is complete, change "CANCEL" to "SAVE," and press "Save."
- After "Save" is complete, it is output at a set flow rate.

※ It is recommended to proceed with detailed calibration since setting the target flow rate may cause reduced accuracy.

7.3.3. TROUBLE (FLOW RATE – TROUBLE)



Setting the FLOW TROUBLE occurrence time

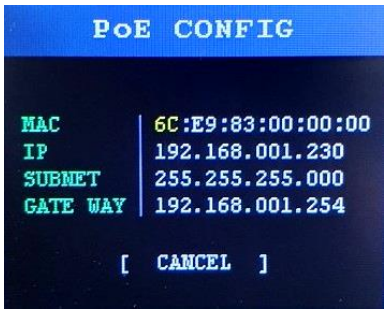
Classification	Description	Initial value
TIME	➢ Set the amount of time to hold until a trouble occurs. • Able to be set within the range of "5 to 60 seconds"	30 sec

- ➢ If the current flow rate is outside the ±20% range of the preset flow rate and remains above the set time, a "TROUBLE" occurs.
- ➢ When the current flow rate returns to within ±20% of the set flow rate subsequent to the occurrence of the "TROUBLE," the "TROUBLE" is automatically eliminated.
- ➢ After setup is complete, change "CANCEL" to "SAVE," and press "Save."

7.4. An Interface Mode

- A menu that applies the Standard Terminal Unit: RELAY, RS485, mA CALIBRATION, and mA ZERO OFFSET
- A menu that applies the PoE Terminal Unit: PoE, and RELAY

7.4.1. PoE (INTERFACE → PoE)

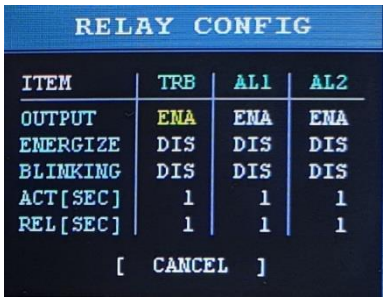


Setting an Ethernet configuration (PoE Terminal Unit Only)

Classification	Description
MAC	➢ No changes allowed. (Pre-set at production completion)
IP	➢ Setting an IP Address • Able to be set within the "0 to 255" range
SUBNET	➢ Setting a Subnet Mask • Able to be set within the "0 to 255" range
GATE WAY	➢ Setting a Gate Way • Able to be set within the "0 to 255" range

➢ After setup is complete, change "CANCEL" to "SAVE," and press "Save."

7.4.2. RELAY (INTERFACE → RELAY)

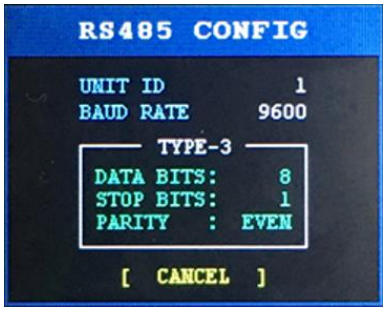


Setting a RELAY configuration

Classification	Description	Initial value
TRB	➢ Setting a Trouble RELAY	
AL1	➢ Setting the first alarm RELAY	
AL2	➢ Setting the second alarm RELAY	
OUTPUT	➢ Enabling or disabling the RELAY	Enable
ENERGIZE	➢ Selecting whether to apply "ENERGIZE" ➢ "Relay Coil" operates depending on the application mentioned above. • Enable: Normal "ON", Event "OFF" • Disable: Normal "OFF", Event "ON"	Disable
BLINKING	➢ Enabling or disabling the flashing of a RELAY signal when an EVENT occurs	Disable
ACT[SEC]	➢ When BLINKING is enabled, set "RELAY ON TIME" • Able to be set within the "1 sec to 60 sec" range	1 sec
REL[SEC]	➢ When BLINKING is enabled, set "RELAY OFF TIME" • Able to be set within the "1 sec to 60 sec" range	1 sec

➢ After setup is complete, change "CANCEL" to "SAVE," and press "SAVE."

7.4.3. RS485 (INTERFACE → RS485)

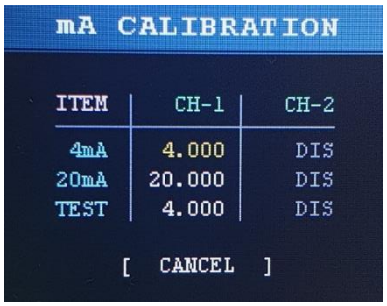


Setting a RS-485 configuration (Standard Terminal Only)

Classification	Description	Initial value
UNIT ID	➢ Setting a UNIT ID • Able to be set within the "1 to 247" range	1
BAUD RATE	➢ Set communication speed • Able to select from among "2400, 4800, 9600, 19200, 38400, 57600, and 115200" • The initial value is "9600."	9600
TYPE	➢ Setting a structure for communication data • Divided into six types depending on the number of STOP BITS and PARITY • STOP BIT: "1 or 2" • PARITY: "NONE, ODD, or EVEN"	TYPE-3 Data: 8 Stop: 1 EVEN

➢ After setup is complete, change "CANCEL" to "SAVE," and press "SAVE."

7.4.4. mA CALIBRATION (INTERFACE → mA CALIBRATION)

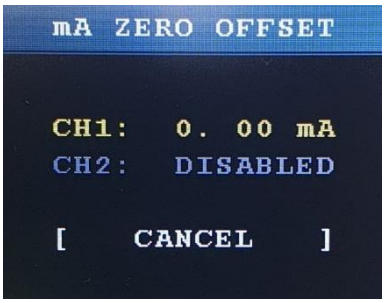


mA calibration (STD Only)

➢ How to calibrate
1. Configure the mA circuit (Refer to '5.4. 4-20mA Current Interface Configuration')
2. After selecting "4mA," set the input value of the controller.
3. After selecting "20mA," set the input value of the controller.
4. After changing the "TEST" value, compare it with the input value of the controller.
5. Change "CANCEL" to "SAVE," and press "SAVE."

➢ When there are two gasses to be measured, "CH-2" is enabled.

7.4.5. mA ZERO OFFSET (INTERFACE→mA OFFSET)



mA OFFSET configuration (STD Only)

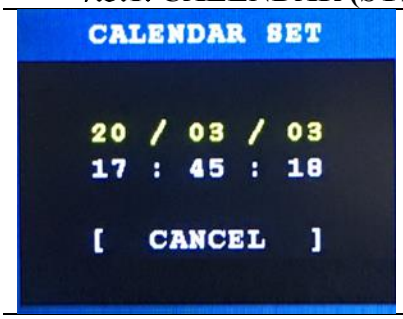
➢ Set when OFFSET compensation is needed. (Recommended to proceed before mA calibration)

➢ How to calibrate
1. Select the compensation value by checking the value of the controller. Ranges to be set: "-2.000 mA to 2.000mA"
2. Doublecheck the value of the controller after changing the setting value.
3. Change "CANCEL" to "SAVE," and press "SAVE."

➢ When there are two gasses to be measured, "CH-2" is enabled.

7.5. A System Mode

7.5.1. CALENDAR (SYSTEM → CALENDAR)



Setting the Date and Time

- How to change
  1. Set to the current date and time
  2. Change “CANCEL” to “SAVE,” and press “SAVE.”

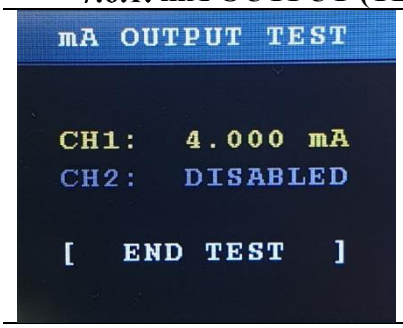
7.5.2. PASSWORD (SYSTEM → PASSWORD)

Setting a password

- How to change
  1. Choose one among “00 ~ 99” and set it to a new password value.
  2. Change “CANCEL” to “SAVE,” and press “SAVE.”

7.6. A Test Mode

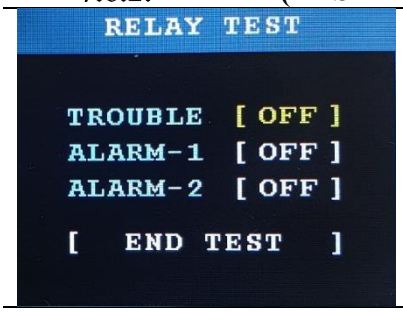
7.6.1. mA OUTPUT (TEST → mA OUTPUT)



An mA Output Test (Standard Terminal Only)

- Setting the mA output in the menu is available.
  The range to which the output can be set: “0.500mA to 22.000 mA.”
- When there are two gasses to be measured, “CH-2” is enabled.

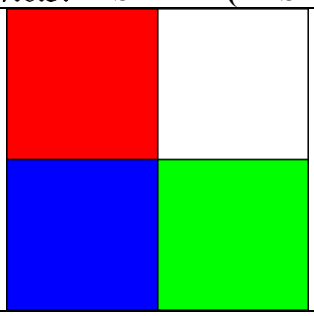
7.6.2. RELAY (TEST → RELAY)



A Relay Output Test

- Ensure a relay is operating normally.
  Change “ON/ OFF” to verify the operation of the relay.

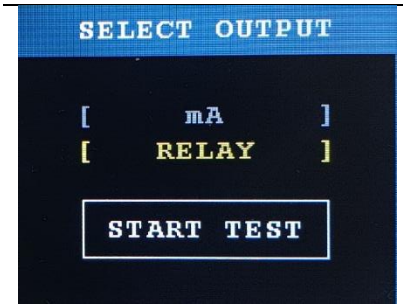
7.6.3. DISPLAY (TEST → DISPLAY)



An Examination of the LCD Screen

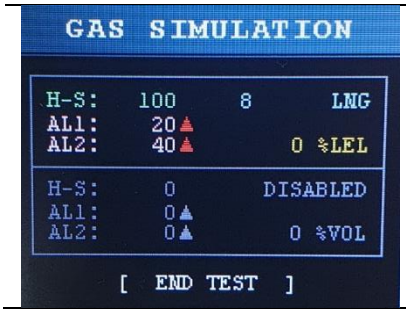
- Checking the pixel and color status of the display (LCD).
- When the “FUNC” key is pressed, R (red), G (green), B (blue), and W (white) are displayed sequentially.
- Press the “Reset" key to exit the DISPLAY TEST MODE.

7.6.4. GAS SIMULATION (TEST – GAS SIMULATION)



A Gas Simulation Test

- How to test
  1. Select an item to be output (mA, RELAY)
     - When an item is selected, blue background color is displayed.
     - mA is disabled on the PoE Terminal Unit.
     - LEDs (TRB, AL1, and AL2) are displayed by default.
  2. Press “START TEST.”



- Range of settings:
  - Adjustable in units of 10% based on H/S
  - OVER
  - ERROR
- Confirmation of selected output based on concentration settings
  - 4 ~ 22 mA
  - RELAY (TRB,AL1,AL2)
  - LED (TRB,AL1,AL2)

7.7. A Factory Setting Mode

⚠

- **CAUTION**: When it comes to the Factory Setting Mode, the Factory Manual must be strictly followed. If a user arbitrarily modifies the mode, it is highly likely that the detector may malfunction.

8. Troubleshooting

- **CAUTION**: In the case of a component malfunction or mechanical failure, the staff of the Gastron company or the experts certified by Gastron are eligible for carrying out the relevant repairs.

8.1. Fault List

[Table 15: The Table of the Fault Codes and the Recovery List]

Fault	Description & Condition
E-1	Impossible to control an internal system
E-7	Degraded output of the IR sensor due to contaminated optical paths
E-11	Poor communication of the IR Sensor Unit
E-13	Inaccurate data of EEPROM communication
E-21	When flow rate is maintained below 80% of the pre-set flow rate
E-22	When flow rate is maintained in excess of 120% of the pre-set flow rate
E-30	When a gas measurement value is -10% or less
E-31	Defective power supply
E-40	Poor IR source output status
E-41	State of overload with minimum/maximum IR sensor output
E-42	Output of the IR sensor in an offset drift state
E-43	Below or above the appropriate temperature for the IR sensor unit to operate
E-47	Unstable signals from the IR sensor
E-50	Long-sustained unmeasurable conditions

8.2. A Recovery List

Fault	Maintenance Guide
E-1	Replace the main frame.
E-7	Replace an IR sensor unit.
E-11	Check the status of cable connection or find an open circuit.
E-13	If symptoms repeat after reboot, replace the main frame.
E-21	Check if the inside of either dust filers or flow paths is clogged, and replace the main frame if no problem is found in the flow paths.
E-22	Carry out the flow calibration once again for assessment, and if symptoms persist, replace the main frame.
E-30	Conduct the gas calibration again, and if symptoms reappear, the IR sensor unit needs to be replaced.
E-31	If no problem is found after checking the power supply, replace the main frame.
E-40	Have the IR sensor unit replaced.
E-41	Have the IR sensor unit replaced.
E-42	Have the IR sensor unit replaced.
E-43	The temperature suitable for operation should be considered for installation. If no problem is found in the environment, replace the IR sensor unit.
E-47	Identify the cause of the filtering occurrence.
E-50	After identifying the cause of the unmeasurable condition, take necessary actions.

[Table 16. A recovery list]

9. A List of Gases and Initial Setting Values

No.	GAS NAME	High Scale	Unit	AL1 value	AL2 value	Flow Rate (mL/min)	Filtering Interference Gas
1	LNG	100	%LEL	20	40	500	O
2	CH4	100	%LEL	20	40	500	O
3	COS	200	PPM	25	100	500	O
4	C4F8	2000	PPM	500	1000	500	O
5	C5F8	2000	PPM	500	1000	500	O
6	C4F6	2000	PPM	500	1000	500	O
7	CH2F2	2000	PPM	500	1000	500	O
8	TEOS	100	PPM	10	20	700	O
9	CH3F	2000	PPM	500	1000	500	O
10	SFA-1	100	%LEL	25	50	500	O
11	IPA	3000	PPM	200	400	500	O
12	IPA	100	%LEL	20	40	500	O
13	OMCTS	75.0	PPM	10.0	20.0	700	O
14	GMP-02	3000	PPM	100	200	500	O
15	C4H2F6	1000	PPM	140	280	500	O
16	4MS	100	%LEL	25	50	500	O
17	C4F6S	2000	PPM	500	1000	500	O
18	ECH	100	%LEL	25	50	500	O
19	NF3	200	PPM	10	20	700	O
20	N2O	4000	PPM	500	2000	500	X
21	C4H10	100	%LEL	20	40	500	X
22	Toluene	100	%LEL	20	40	500	X
23	CO	5.00	%VOL	1.00	2.00	500	X
		2.00		0.40	0.80		
		1.00		0.20	0.40		
24	CO2	5.0	%VOL	1.0	2.0	500	X
		1.0		0.25	0.5		
		5000	PPM	1000	2000		

[Table 17. A list of gases]

10. Interface

10.1. MODBUS RTU & TCP Address Map

Address	Register Name	Data Type	Description	
Read & Write Coils				
1	CH1 Remote Test Mode Reset	bit	1 = Test Mode End (Resume Detecting)	
2	CH1 Remote Test Mode Set	bit	1 = Test Mode Start (fixed High Scale)	
3	CH2 Remote Test Mode Reset	bit	1 = Test Mode End (Resume Detecting)	
4	CH2 Remote Test Mode Set	bit	1 = Test Mode Start (fixed High Scale)	
Read Discrete Input				
10001	CH1 Alarm-1 Active	bit	1 = True, 0 = False	
10002	CH1 Alarm-2 Active	bit	1 = True, 0 = False	
10003	CH1 Trouble(Fault) Active	bit	1 = True, 0 = False	
10004	CH1 Maintenance Mode	bit	1 = True, 0 = False	
10005	CH1 Test Mode	bit	1 = True, 0 = False	
10006	CH1 Calibration Mode	bit	1 = True, 0 = False	
10007	Reserved	bit	Always '1'	
10008	CH1 Toggle bit	bit	Repeat when requested, 0 -> 1 -> 0 -> 1 -> 0 -> 1 ·····	
10009	CH2 Alarm-1 Active	bit	1 = True, 0 = False	
10010	CH2 Alarm-2 Active	bit	1 = True, 0 = False	
10011	CH2 Trouble(Fault) Active	bit	1 = True, 0 = False	
10012	CH2 Maintenance Mode	bit	1 = True, 0 = False	
10013	CH2 Test Mode	bit	1 = True, 0 = False	
10014	CH2 Calibration Mode	bit	1 = True, 0 = False	
10015	Reserved	bit	Always '1'	
10016	CH2 Toggle bit	bit	Repeat when requested, 0 -> 1 -> 0 -> 1 -> 0 -> 1 ·····	
Read Input Registers				
30001	CH1 Detector Status-1	unsigned int	BIT0	Self-test (1 = True, 0 = False)
			BIT1	Warm-up (1 = True, 0 = False)
			BIT2	Normal Operation (1 = True, 0 = False)
			BIT3	Maintenance Mode (1 = True, 0 = False)
			BIT4	Test Mode (1 = True, 0 = False)
			BIT5	Trouble (Fault) Active (1 = True, 0 = False)
			BIT6	Trouble (Fault) Relay Energized (1 = True, 0 = False)
			BIT7	Reserved
			BIT8	Alarm-1 Active (1 = True, 0 = False)
30001	CH1 Detector Status-1	unsigned int	BIT9	Alarm-1 Relay Energized (1 = True, 0 = False)

			BIT10	Alarm-2 Active (1 = True, 0 = False)
			BIT11	Alarm-2 Relay Energized (1 = True, 0 = False)
			BIT12	Range Over (1 = True, 0 = False)
			BIT13	Interference Gas Detection (1 = True, 0 = False)
			BIT14	Reserved
			BIT15	Reserved
30002	CH1 Trouble (Fault) Code	unsigned int	BIT 0~7	0 = Normal State, 1~255 = Trouble (Fault) State
			BIT 8~15	Reserved
30003	CH1 Decimal Point & Unit	unsigned int	BIT0	xxxx
			BIT1	xxx.x
			BIT2	xx.xx
			BIT3	x.xxx
			BIT4	PPB
			BIT5	PPM
			BIT6	%LEL
			BIT7	%VOLUME
			BIT 8~15	Gas Number (0 to 255)
30004	CH1 Measured Gas Concentration Lower Word	float		
30005	CH1 Measured Gas Concentration Upper Word	float		
30006	CH1 Measured Gas Concentration	unsigned int	(Ex: 30.0 %VOL = 300)	
30007	CH1 Alarm-1 Set Point Lower Word	float		
30008	CH1 Alarm-1 Set Point Upper Word	float		
30009	CH1 Alarm-1 Set Point	unsigned int	(Ex: 30.0 %VOL = 300)	
30010	CH1 Alarm-2 Set Point Lower Word	float		
30011	CH1 Alarm-2 Set Point Upper Word	float		
30012	CH1 Alarm-2 Set Point	unsigned int	(Ex: 30.0 %VOL = 300)	
30013	CH1 High Scale Lower Word	float		
30014	CH1 High Scale Upper Word	float		
30015	CH1 High Scale	unsigned int	(Ex: 30.0 %VOL = 300)	
30016	CH1 Reserved			
30017	CH1 Reserved			
30018	CH1 Reserved			
30019	CH1 Reserved			

30020	CH1 Reserved			
30021	CH2 Detector Status-1	unsigned int	BIT0	Self-test (1 = True, 0 = False)
			BIT1	Warm-up (1 = True, 0 = False)
			BIT2	Normal Operation (1 = True, 0 = False)
			BIT3	Maintenance Mode (1 = True, 0 = False)
			BIT4	Test Mode (1 = True, 0 = False)
			BIT5	Trouble (Fault) Active (1 = True, 0 = False)
			BIT6	Trouble (Fault) Relay Energized (1 = True, 0 = False)
			BIT7	Reserved
			BIT8	Alarm-1 Active (1 = True, 0 = False)
			BIT9	Alarm-1 Relay Energized (1 = True, 0 = False)
			BIT10	Alarm-2 Active (1 = True, 0 = False)
			BIT11	Alarm-2 Relay Energized (1 = True, 0 = False)
			BIT12	Range Over (1 = True, 0 = False)
			BIT13	Interference Gas Detection (1 = True, 0 = False)
			BIT14	Reserved
			BIT15	Reserved
30022	CH2 Trouble (Fault) Code	unsigned int	BIT 0~7	0 = Normal State, 1~255 = Trouble (Fault) State
			BIT 8~15	Reserved
30023	CH2 Decimal Point & Unit	unsigned int	BIT0	xxxx
			BIT1	xxx.x
			BIT2	xx.xx
			BIT3	x.xxx
			BIT4	PPB
			BIT5	PPM
			BIT6	%LEL
			BIT7	%VOLUME

			BIT 8~15	Gas Number (0 to 255)
30024	CH2 Measured Gas Concentration Lower Word	float		
30025	CH2 Measured Gas Concentration Upper Word	float		
30026	CH2 Measured Gas Concentration	unsigned int	(Ex: 30.0 %VOL = 300)	
30027	CH2 Alarm-1 Set Point Lower Word	float		
30028	CH2 Alarm-1 Set Point Upper Word	float		

30029	CH2 Alarm-1 Set Point	unsigned int	(Ex: 30.0 %VOL = 300)	
30030	CH2 Alarm-2 Set Point Lower Word	float		
30031	CH2 Alarm-2 Set Point Upper Word	float		
30032	CH2 Alarm-2 Set Point	unsigned int	(Ex: 30.0 %VOL = 300)	
30033	CH2 High Scale Lower Word	float		
30034	CH2 High Scale Upper Word	float		
30035	CH2 High Scale	unsigned int	(Ex: 30.0 %VOL = 300)	
30036	CH2 Reserved			
30037	CH2 Reserved			
30038	CH2 Reserved			
30039	CH2 Reserved			
30040	CH2 Reserved			
30041 ~ 30084	Reserved			
30085	CH1 Detector Status-2	unsigned int	BIT0	Trouble (Fault) (1 = True, 0 = False)
			BIT1	Sensor Cartridge Error (1 = True, 0 = False)
			BIT2	Flow Error (1 = True, 0 = False)
			BIT3	Internal Communication Error (1 = True, 0 = False)
			BIT 4~15	Reserved
30086	CH2 Detector Status-2	unsigned int	BIT0	Trouble (Fault) (1 = True, 0 = False)
			BIT1	Sensor Cartridge Error (1 = True, 0 = False)
			BIT2	Flow Error (1 = True, 0 = False)
			BIT3	Internal Communication Error (1 = True, 0 = False)
			BIT 4~15	Reserved
30087 ~ 30088	Reserved			
30089	Heart beat	unsigned int	Increase when requested, 0 -> 1 -> 2 -> 3 ····· -> 65535 -> 0 -> 1 ·····	
30090	Reserved			
30091	Detector Serial Number-1	unsigned int	BIT0~7	1'st Character (Ex: GTD-5100FN = 'G' = 0x47)
			BIT8~15	2'nd Character (Ex: GTD-5100FN = 'T' = 0x54)
30092	Detector Serial Number-2	unsigned int	BIT0~7	3'rd Character (Ex: GTD-5100FN = 'D' = 0x44)
			BIT8~15	4'th Character (Ex: GTD-5100FN = '-' = 0x2D)
30093	Detector Serial Number-3	unsigned int	BIT0~7	5'th Character (Ex: GTD-5100FN = '5' = 0x35)
			BIT8~15	6'th Character (Ex: GTD-5100FN = 'x' = 0x78)
30094	Detector Serial Number-4	unsigned int	BIT0~7	7'th Character (Ex: GTD-5100FN = '0' = 0x30)

			BIT8~15	8'th Character (Ex: GTD-5100FN = '0' = 0x30)
30095	Detector Serial Number-5	unsigned int	BIT0~7	9'th Character (Ex: GTD-5100FN = '(' = 0x28)
			BIT8~15	10'th Character (Ex: GTD-5100FN = 'F' = 0x46)
30096	Detector Serial Number-6	unsigned int	BIT0~7	11'th Character (Ex: GTD-5100FN = ')' = 0x29)
			BIT8~15	Reserved
Read & Write Holding Registers				
40001	CH1 Detector Status-1	unsigned int	BIT0	Self-test (1 = True, 0 = False)
			BIT1	Warm-up (1 = True, 0 = False)
			BIT2	Normal Operation (1 = True, 0 = False)
			BIT3	Maintenance Mode (1 = True, 0 = False)
			BIT4	Test Mode (1 = True, 0 = False)
			BIT5	Trouble (Fault) Active (1 = True, 0 = False)
			BIT6	Trouble (Fault) Relay Energized (1 = True, 0 = False)
			BIT7	Reserved
			BIT8	Alarm-1 Active (1 = True, 0 = False)
			BIT9	Alarm-1 Relay Energized (1 = True, 0 = False)
			BIT10	Alarm-2 Active (1 = True, 0 = False)
			BIT10	Alarm-2 Active (1 = True, 0 = False)
			BIT11	Alarm-2 Relay Energized (1 = True, 0 = False)
			BIT12	Range Over (1 = True, 0 = False)
			BIT13	Interference Gas Detection (1 = True, 0 = False)
			BIT14	Reserved
			BIT15	Reserved
40002	CH1 Trouble(Fault) Code	unsigned int	BIT 0~7	0 = Normal State, 1~255 = Trouble (Fault) State
			BIT8~15	Reserved
40003	CH1 Decimal Point & Unit	unsigned int	BIT0	xxxx
			BIT1	xxx.x
			BIT2	xx.xx
			BIT3	x.xxx
			BIT4	PPB
			BIT5	PPM
			BIT6	%LEL
			BIT7	%VOLUME
			BIT8~15	Gas Number (0 to 255)

40004	CH1 Measured Gas Concentration Lower Word	float	
40005	CH1 Measured Gas Concentration Upper Word	float	
40006	CH1 Measured Gas Concentration	unsigned int	(Ex: 30.0 %VOL = 300)
40007	CH1 Alarm-1 Set Point Lower Word (able to Write)	float	
40008	CH1 Alarm-1 Set Point Upper Word (able to Write)	float	
40009	CH1 Alarm-1 Set Point (able to Write)	unsigned int	(Ex: 30.0 %VOL = 300)
40010	CH1 Alarm-2 Set Point Lower Word (able to Write)	float	
40011	CH1 Alarm-2 Set Point Upper Word (able to Write)	float	
40012	CH1 Alarm-2 Set Point (able to Write)	unsigned int	(Ex: 30.0 %VOL = 300)
40013	CH1 High Scale Lower Word	float	
40014	CH1 High Scale Upper Word	float	
40015	CH1 High Scale	unsigned int	(Ex: 30.0 %VOL = 300)
40016	CH1 Reserved		

40017	CH1 Reserved			
40018	CH1 Reserved			
40019	CH1 Reserved			
40020	CH1 Reserved			
40021	CH2 Detector Status-1	unsigned int	BIT0	Self-test (1 = True, 0 = False)
			BIT1	Warm-up (1 = True, 0 = False)
			BIT2	Normal Operation (1 = True, 0 = False)
			BIT3	Maintenance Mode (1 = True, 0 = False)
			BIT4	Test Mode (1 = True, 0 = False)
			BIT5	Trouble (Fault) Active (1 = True, 0 = False)
			BIT6	Trouble (Fault) Relay Energized (1 = True, 0 = False)
			BIT7	Reserved
			BIT8	Alarm-1 Active (1 = True, 0 = False)
			BIT9	Alarm-1 Relay Energized (1 = True, 0 = False)
			BIT10	Alarm-2 Active (1 = True, 0 = False)
			BIT11	Alarm-2 Relay Energized (1 = True, 0 = False)
			BIT12	Range Over (1 = True, 0 = False)
			BIT13	Interference Gas Detection (1 = True, 0 = False)
			BIT14	Reserved
			BIT15	Reserved

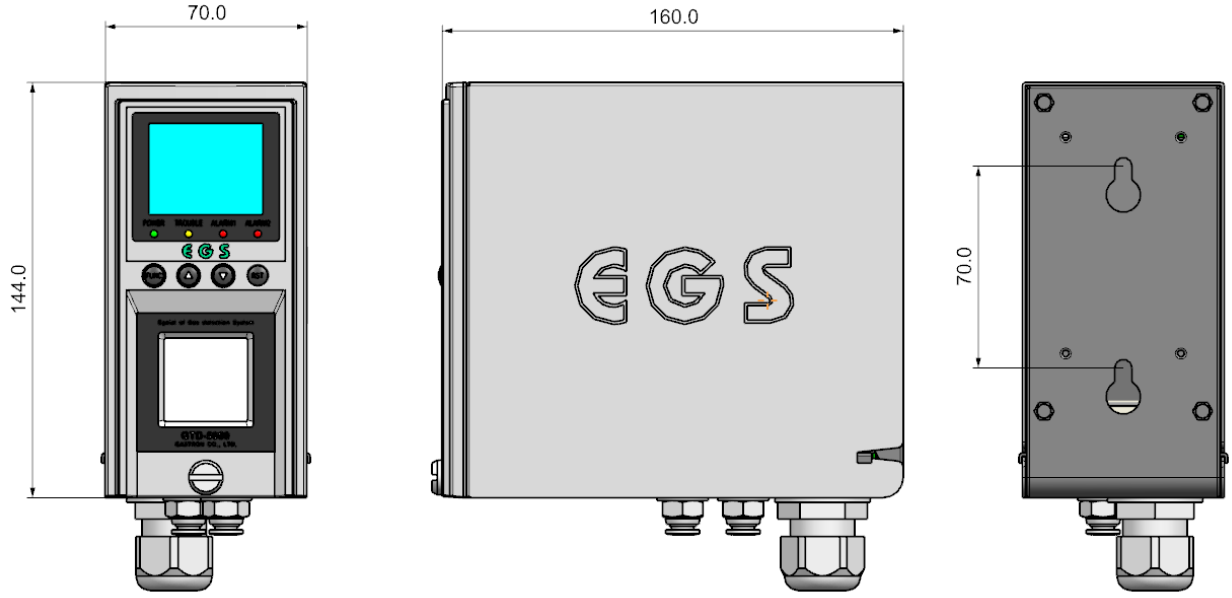
40022	CH2 Trouble(Fault) Code	unsigned int	BIT0~7	0 = Normal State, 1~255 = Trouble (Fault) State
			BIT8~15	Reserved
40023	CH2 Decimal Point & Unit	unsigned int	BIT0	xxxx
			BIT1	xxx.x
			BIT2	xx.xx
			BIT3	x.xxx
			BIT4	PPB
			BIT5	PPM
			BIT6	%LEL
			BIT7	%VOLUME
			BIT8~15	Gas Number (0 to 255)
40024	CH2 Measured Gas Concentration Lower Word	float		
40025	CH2 Measured Gas Concentration Upper Word	float		
40026	CH2 Measured Gas Concentration	unsigned int	(Ex: 30.0 %VOL = 300)	
40027	CH2 Alarm-1 Set Point Lower Word (able to Write)	float		
40028	CH2 Alarm-1 Set Point Upper Word (able to Write)	float		
40029	CH2 Alarm-1 Set Point (able to Write)	unsigned int	(Ex: 30.0 %VOL = 300)	
40030	CH2 Alarm-2 Set Point Lower Word (able to Write)	float		
40031	CH2 Alarm-2 Set Point Upper Word (able to Write)	float		
40032	CH2 Alarm-2 Set Point (able to Write)	unsigned int	(Ex: 30.0 %VOL = 300)	
40033	CH2 High Scale Lower Word	float		
40034	CH2 High Scale Upper Word	float		
40035	CH2 High Scale	unsigned int	(Ex: 30.0 %VOL = 300)	
40036	CH2 Reserved			
40037	CH2 Reserved			
40038	CH2 Reserved			
40039	CH2 Reserved			
40040	CH2 Reserved			
40041 ~ 40084	Reserved			
40085	CH1 Detector Status-2	unsigned int	BIT0	Trouble(Fault) (1 = True, 0 = False)
			BIT1	Sensor Cartridge Error (1 = True, 0 = False)
			BIT2	Flow Error (1 = True, 0 = False)
			BIT3	Internal Communication Error (1 = True, 0 = False)

			BIT4~15	Reserved
40086	CH2 Detector Status-2	unsigned int	BIT0	Trouble(Fault) (1 = True, 0 = False)
			BIT1	Sensor Cartridge Error (1 = True, 0 = False)
			BIT2	Flow Error (1 = True, 0 = False)
			BIT3	Internal Communication Error (1 = True, 0 = False)
			BIT4~15	Reserved
40087 ~ 40088	Reserved			

40089	Heart beat	unsigned int	Increase when requested, 0 -> 1 -> 2 -> 3 ····· -> 65535 -> 0 -> 1 ·····	
40090	Reserved			
40091	Detector Serial Number-1	unsigned int	BIT0~7	1'st Character (Ex: GTD-5100FN = 'G' = 0x47)
			BIT8~15	2'nd Character (Ex: GTD-5100FN = 'T' = 0x54)
40092	Detector Serial Number-2	unsigned int	BIT0~7	3'rd Character (Ex: GTD-5100FN = 'D' = 0x44)
			BIT8~15	4'th Character (Ex: GTD-5100FN = '-' = 0x2D)
40093	Detector Serial Number-3	unsigned int	BIT0~7	5'th Character (Ex: GTD-5100FN = '5' = 0x35)
			BIT8~15	6'th Character (Ex: GTD-5100FN = 'x' = 0x78)
40094	Detector Serial Number-4	unsigned int	BIT0~7	7'th Character (Ex: GTD-5100FN = '0' = 0x30)
			BIT8~15	8'th Character (Ex: GTD-5100FN = '0' = 0x30)
40095	Detector Serial Number-5	unsigned int	BIT0~7	9'th Character (Ex: GTD-5100FN = '(' = 0x28)
			BIT8~15	10'th Character (Ex: GTD-5100FN = 'F' = 0x46)
40096	Detector Serial Number-6	unsigned int	BIT0~7	11'th Character (Ex: GTD-5100FN = ')' = 0x29)
			BIT8~15	Reserved

[Table 18. MODBUS RTU & TCP address map]

11. Drawing and Dimensions



[Figure 29. Drawing and Dimension]

12. Precautions prior to Installation

12.1. Selection of Installation Sites (in accordance with the Occupational Safety and Health Act of the Republic of Korea)

The places where gas leakage perception alarms need to be installed are given as follows:

- In and around the chemical installations and their auxiliary devices with a significant probability of gas leakage, such as compressors, valves, reactors, and piping connections, which handle combustible and toxic substances installed in and outside of the facilities
- Places where gas easily stays around manufacturing facilities equipped with ignition sources such as heating furnaces
- Close to the connecting ports of facilities to which combustible and toxic substances are to be refueled
- Substations, switchboard rooms, control rooms, etc., located inside explosion-proof areas
- Other places where gas is particularly easy to stay

12.2. Selection of Installation Locations (in accordance with the High-Pressure Gas Safety Control Act of the Republic of Korea)

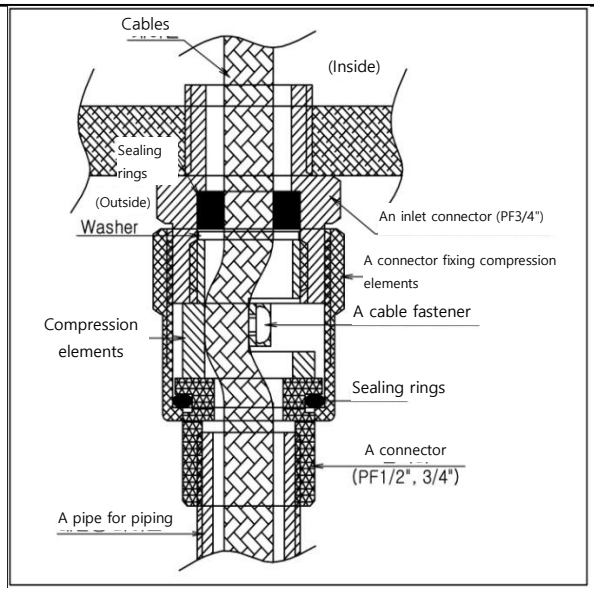
It is highly important that the gas detectors of the gas leakage perception alarms are installed as close as possible to the leakage area where the gas is feared to leak. Furthermore, in places where substantial amount of gas leaks from the surrounding areas are likely to accumulate, despite there not being direct gas leaks, gas detectors need to be installed at the locations recommended below:

- Gas leakage perception alarms to be installed outside the building need to be located at points where gas is easy to stay in consideration of the direction and speed of winds, and specific gravity of a gas, etc.
- Gas leakage perception alarms for the building need to be installed in the lower part of the building if the specific gravity of the detected gas is heavier than air, and if lighter than air, they need to be installed around the vent of the building or on the upper part of the building.
- Alarms perceiving the gas leakage need to be installed both where gas detectors are put in place and where workers spend majority of their time.

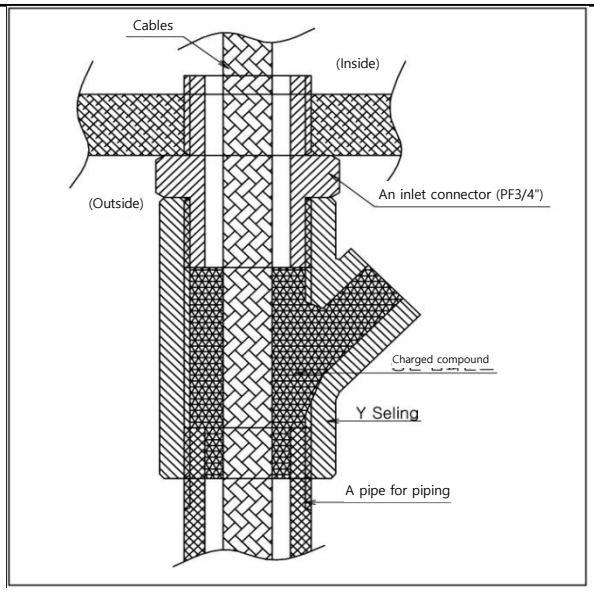
12.3. Installation Precautions

Gas leakage alarms need to be installed to avoid locations that may cause electrical abnormalities due to rainwater or the like, and it is highly recommended to install them in a place where access for additional work is easy because periodic maintenance is bound to be needed. Since places in which vibration or shock occurs could have a misleading impact on the output values of gas leakage alarms, gas leakage alarms need to be installed to ensure that their sensors are mounted toward the direction of gravity.

- Comprised of a pressure-resistant explosion-proof structure, this gas leakage alarm belongs to Group II for gas and steam in general workplaces and chemical plants, and it can be used for types 1 and 2 danger zones in Zones 1 and 2, respectively.
- The allowable temperature is below 85℃, corresponding to T6.
- The ambient temperature suitable for the use of this gas leakage alarm ranges from -10℃ to 60℃.
- Permissible height for this gas leakage alarm to be installed: not more than 1,000 meters above sea level
- Relative humidity for proper use: 5% up to 99% (non-condensing)
- Locations for installation: both in indoor and outdoor environments
- Explosive ignition rating of target gas or steam: Ex d IIC T6
- In a situation where an explosion-proof cable ground is used at the cable inlet or where wiring is carried out with metal wire pipes, it is quite important that the wire conduits are tightly sealed to prevent gas, etc., from moving through the wire conduits of 50 mm or less, or suppress the spread of flames in the event of an explosion. It is also of paramount importance to use safety-certified products for all materials and especially materials used for doing the finishing work on unused wire entry points.
- When connecting this gas leakage alarm and the wire tube, tightening the screw threads by 5 or more is required.
- It is required that work be implemented under conditions that meet the requirements set forth by [The Standards for Selection, Installation, Repair, etc., of Explosion-proof Structural, Electrical, Mechanical, Equipment, Wiring, etc. at Workplaces].



[Figure 30. A method for packing internal pressure]



[Figure 31. Y sealing compound]

13. History of Revisions

Version	Contents	Date
1.0	First revision made	Jun 1, 2020
1.1	Contents partially revised	Aug 21, 2020
1.2	Logo and some contents revised	Feb 25, 2021
1.3	Functions in the Gas Name added	Apr 23, 2021
1.4	Information regarding the list of measurable gases and error codes partially revised	Apr 14, 2022
1.5	Revisions made on: the changes and measurements of Terminal Board; the list of measurable gases; and configuration of the internal environments	Dec 28, 2022
1.6	Contents partially revised	Dec 18, 2023
1.7	Contents partially revised	Jul 15, 2024