Sampling type Gas Detector

(SI-H100)

Operating Manual

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1. Description

Sampling type Gas Detector (SI-H100) measures sample gas by sensor cartridge in the case upon suction remotely on a real time basis. It is a device that assists to prevent or control a variety of gas related accidents including suffocation, intoxication, fire, explosion, corrosion, and so on in multiple semiconductor or industrial sites.

SI-H100 measures the gas concentration on a real time basis constantly and shows alarm of dangerous concentration, fault situation, and so on, upon attaching on the wall.

By operating four buttons in the lower part of the screen, environmental setting of the device can be easily amended.

Measured gas concentration is transmitted with 4-20mA output on a real time basis and external operations according to the desired situations can be variously organized by three internal relays. In addition, it is possible to output MODBUS/TCP, and to solve data transmission and power at the same time only with a LAN cable (PoE).

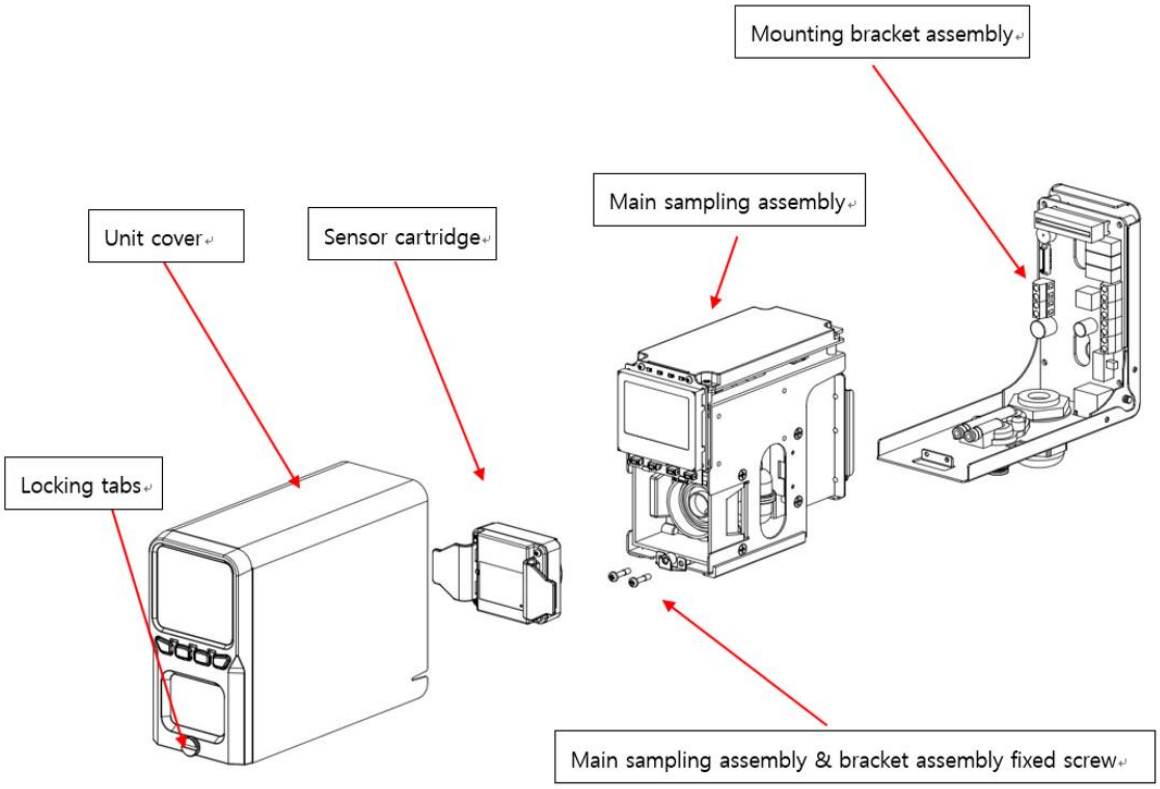
⚠WARNING

Please be aware of the manual before using the device. This device should be used and maintained according to the instruction and it may cause the damage of the device, or the user's injury or fatality in case not to conform the instruction.

2. Product composition

SI-H100 consists of four parts including case, sensor cartridge, main frame, and prob for installation.

Also, it contains the accessary of thermal decomposition module(Pyrolyzer) to be used upon additional purchasing to be able to detect and measure the gas by thermal decomposition in case of the materials without gas sensor such as NF3.



3. Overview

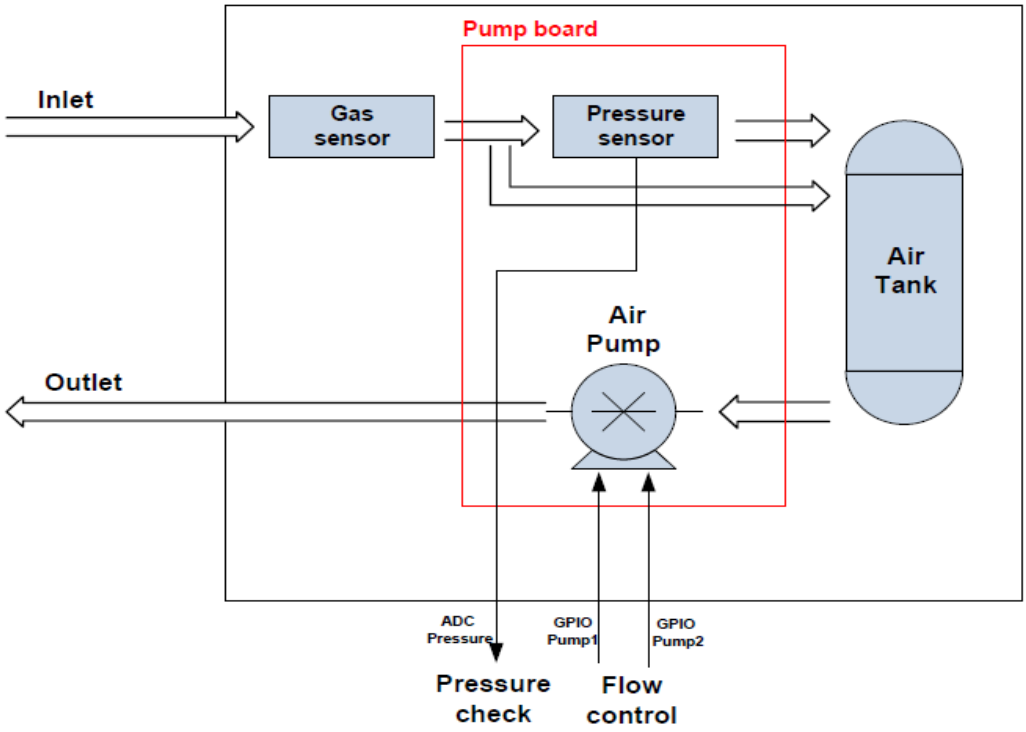


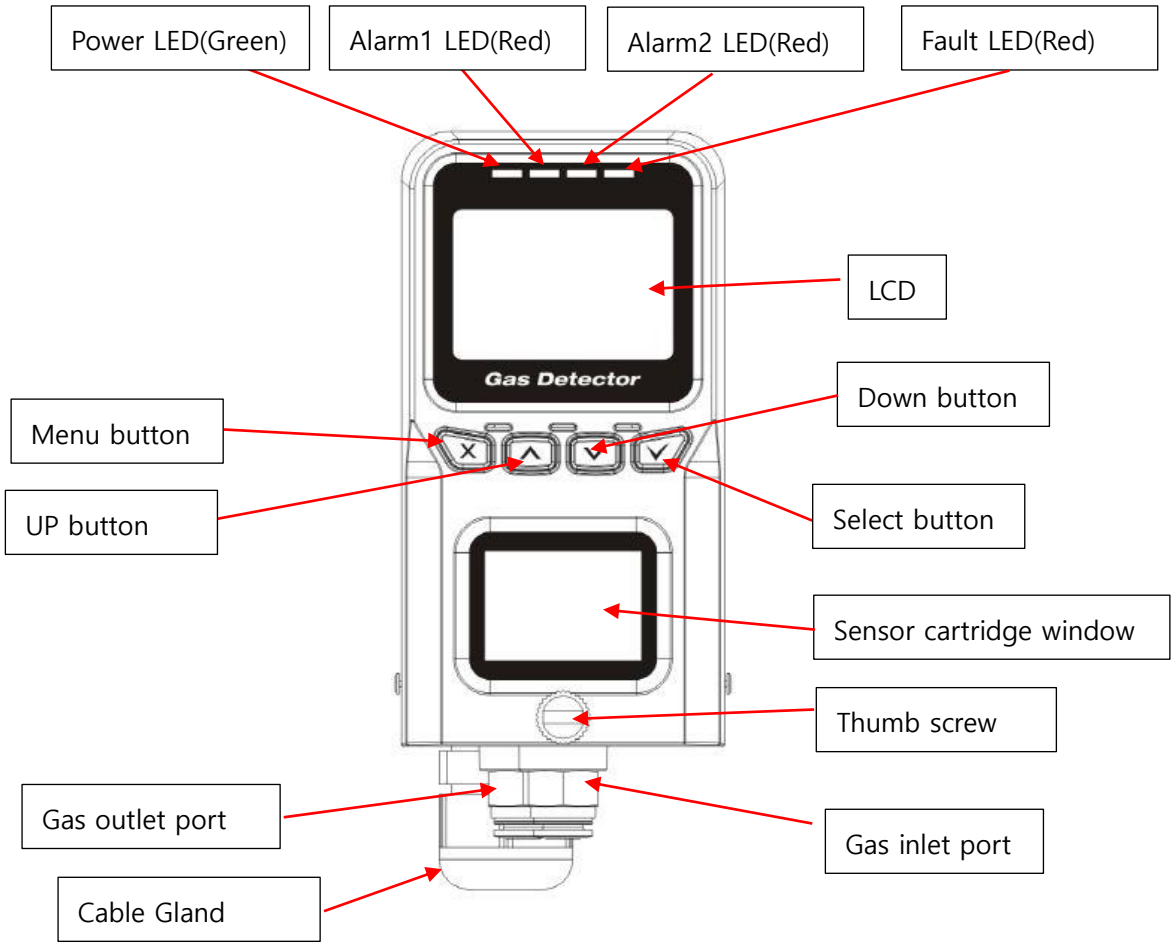
Figure 1 Overview

4. Specifications

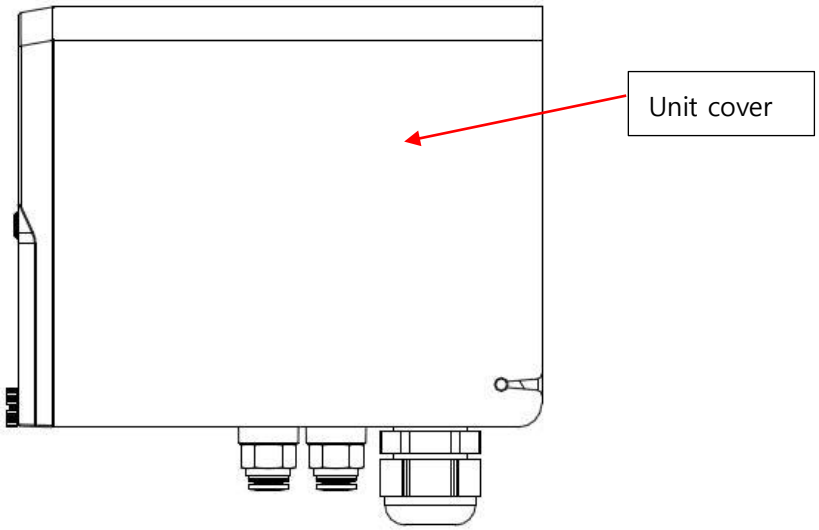
Item	Specification
Size	124mm(H) X 65mm(W) X 155mm(D)
Weight	2Kg
Operating voltage	DC : 24V ± 10% PoE : 36V~57V (Typical : 48V)
Flow rate	500mL/min (MAX 900)
Power consumption	Approximately 5.0W
Measurement display	Graphic LCD (160 X 100), gas concentration, flow rate, alarm, rear light, alarm, device abnormality
Relay	Primary Alarm, Secondary Alarm, Fault Alarm
Output signal	Analog, 4-20mA
Digital communication	RS-485, TCP Ethernet
Sampling distance	Length of input gas tube: up to 30m (FEP tube) Length of exhaust gas tube: up to 30m (FEP tube)
input/output tube	1/4" Teflon tube
Operating temperature	0°C ~40°C
Certification	CE
Control/Set	4 Button & RS485 & Ethernet
Warranty period of the device	2 years
Warranty period of sensor cartridge	1 year
Remote interface	Ethernet, RS-485
Wiring	4 to 20mA / DC power / Relay: up to 14 AWG

5. Composition and name of each part

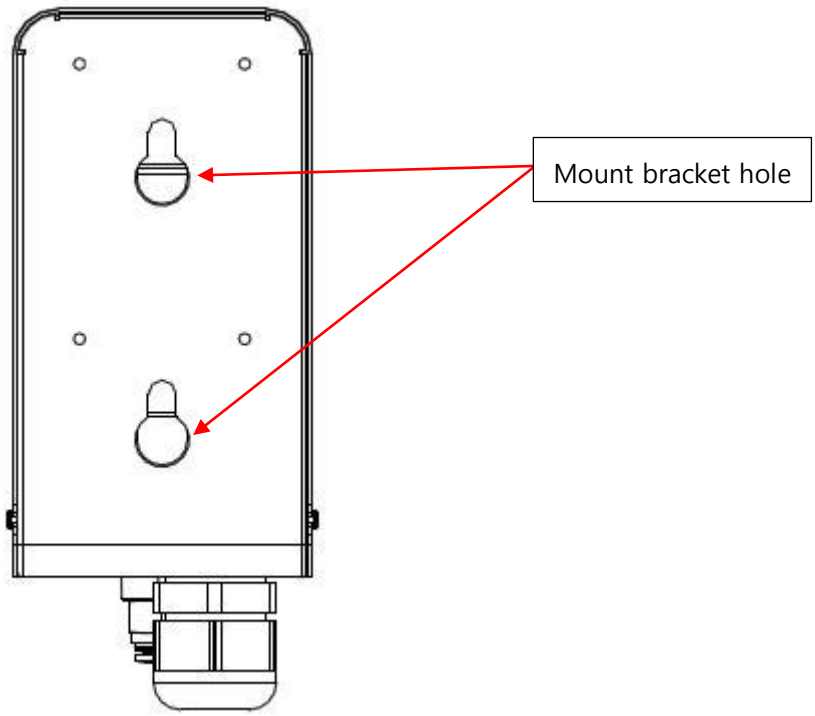
1) Front



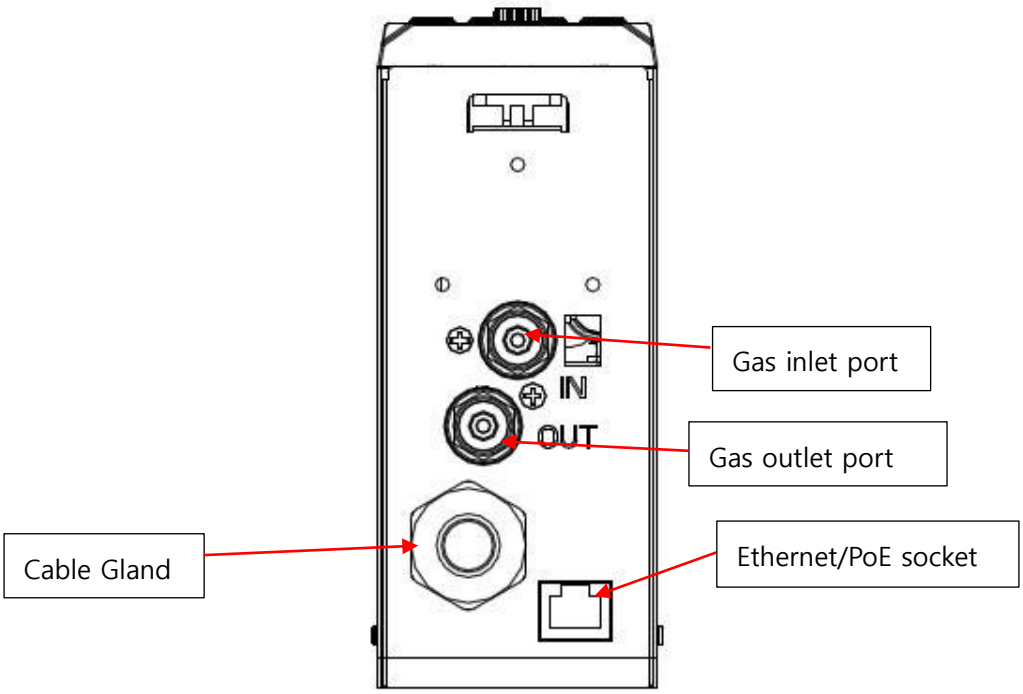
2) Side



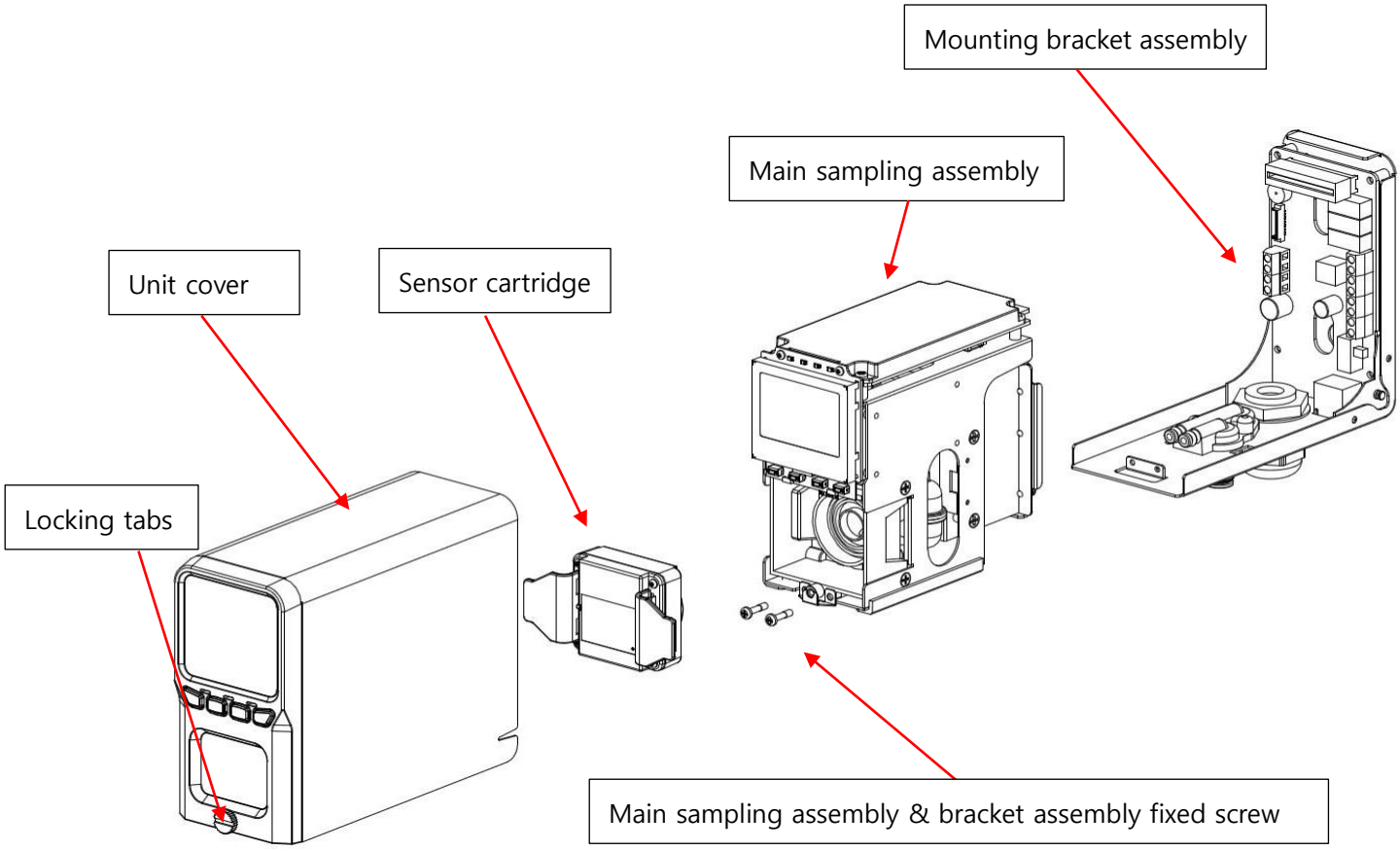
3) Rear



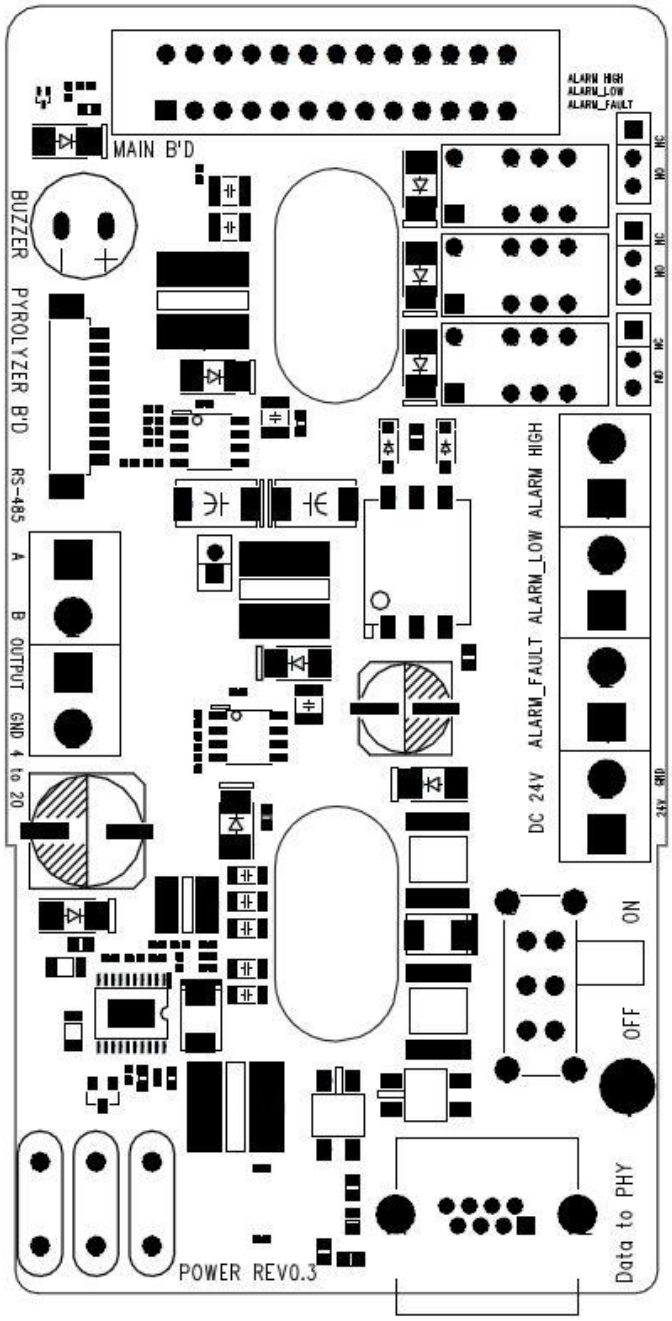
4) Bottom



5) Exploded view of the products



6. Cable connection (Power board)



RS-485 : A

RS-485 : B

4to20mA out : Signal

4to20mA out : Ground

High(2nd) Alarm Jumper : 1-2 :NC /2-3:NO

Low(1st) Alarm Jumper : 1-2 :NC /2-3:NO

Fault Jumper : 1-2 :NC /2-3:NO

ALARM HIGH(2nd) Relay

ALARM LOW(1st) Relay

Fault Relay

Power cable : Ground

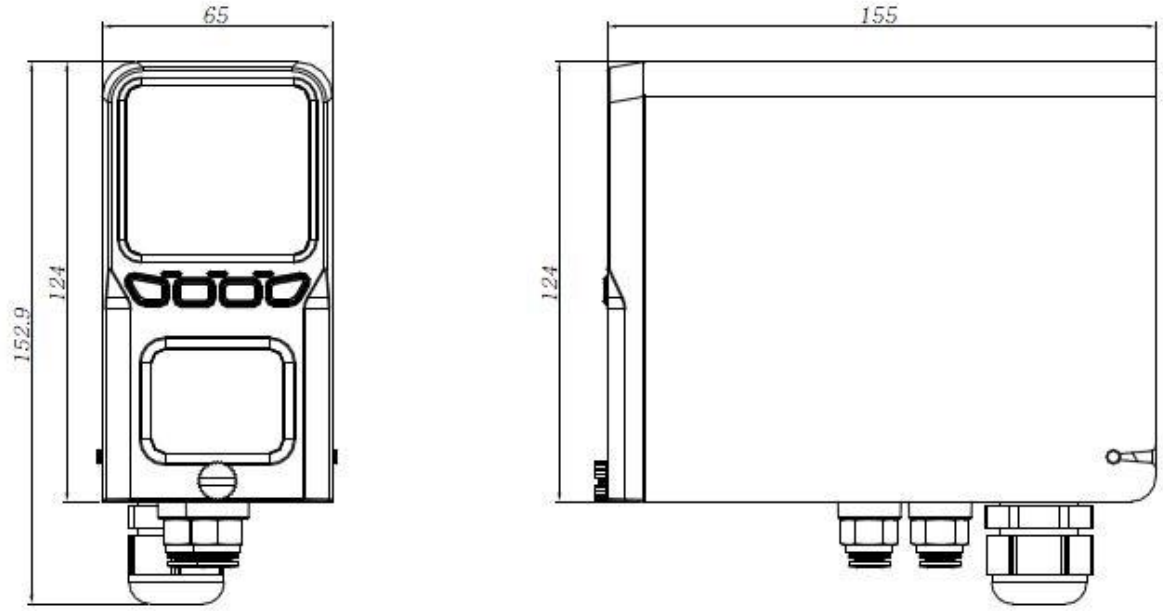
Power cable : DC 24V

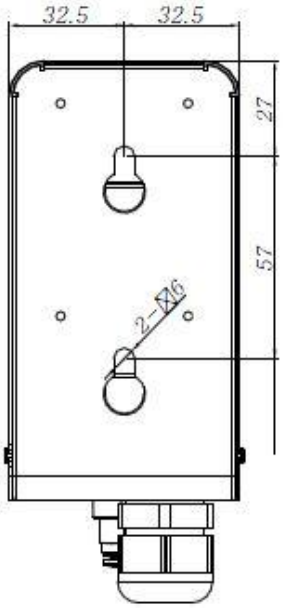
Power ON/OFF switch

Ethernet/PoE socket

In case of power supply with PoE, PoE switch hub should be used.

7. Outside view (Dimensions)





8. Key information

1) Key Description

Key	Name	Description
	Menu	Menu/Cancel & Return to Previous Step
	Up	Movement of List Focus and Value Change
	Up Long	Movement of Focus in Screen Setting
	Down	Movement of List Focus and Value Change
	Down Long	Movement of Focus in Screen Setting
	Select	Select and Save

2) Key State

State	Pressed Time	Description
Normal Key	100ms below	Menu and Set value Changes
Long Key	1000ms over	Movement of Focus Forward/Backward in Each Setting

9. Power On

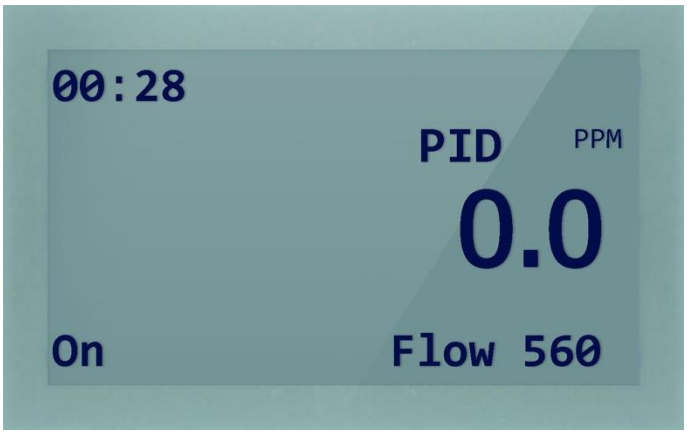
1) Connect the wire after checking power voltage

2) Transit into Measure state after turning on Power LED (Green) and Version information display

3) It takes about 15 seconds.

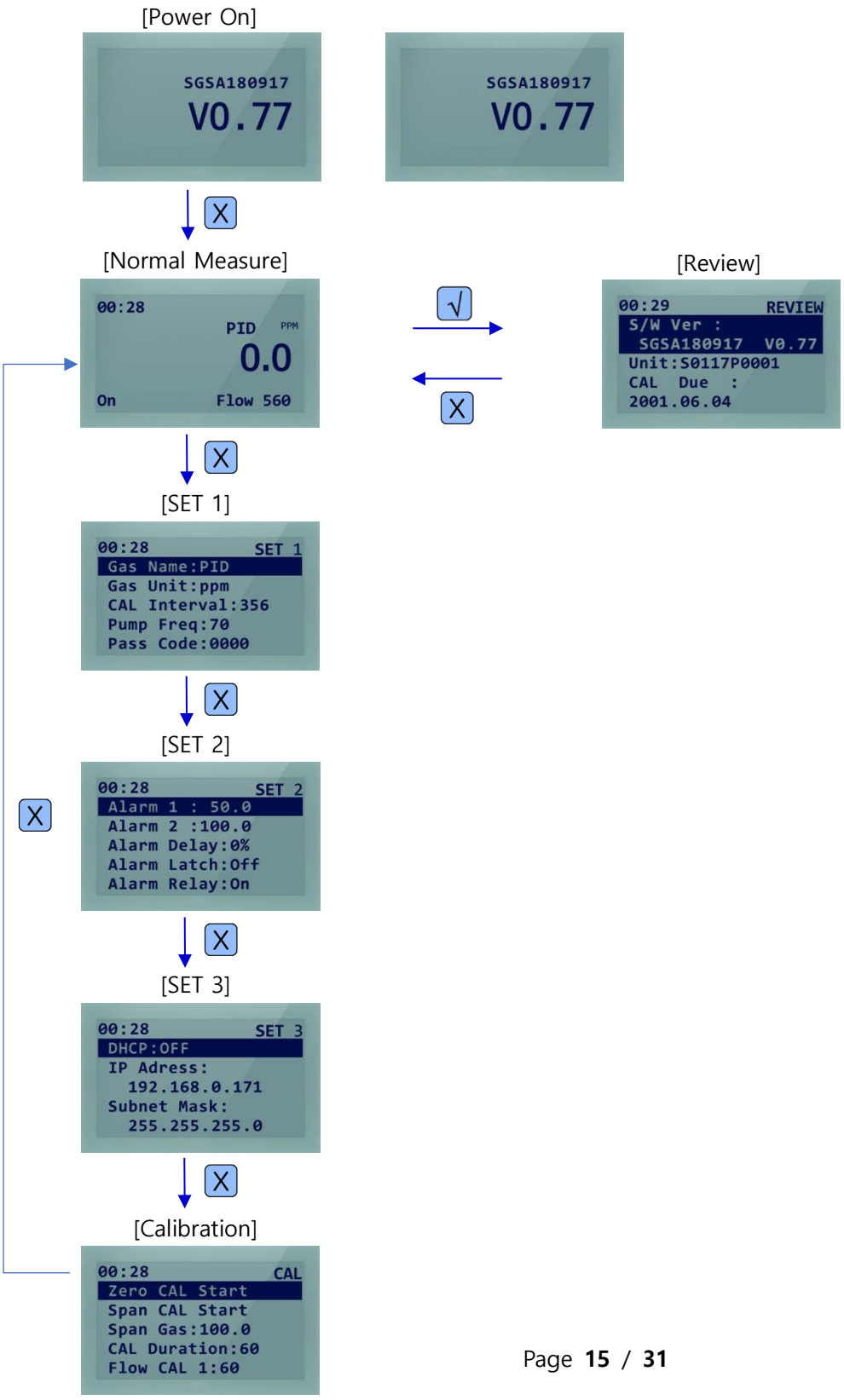
Booting and Warm up

Measurement

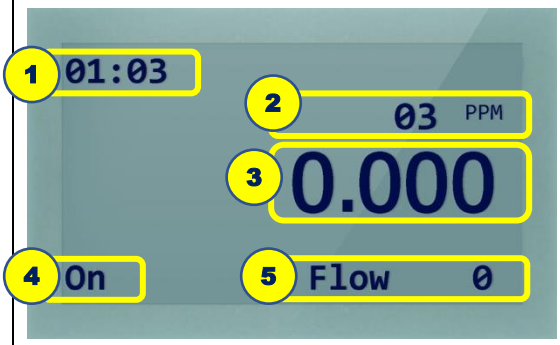


10. Operation Menu

- Pushing Menu key, change the circulation with Normal → SET 1 → SET 2 → SET 3 → CAL
- Enter Review with Select key in Normal, return to Normal with Menu key.

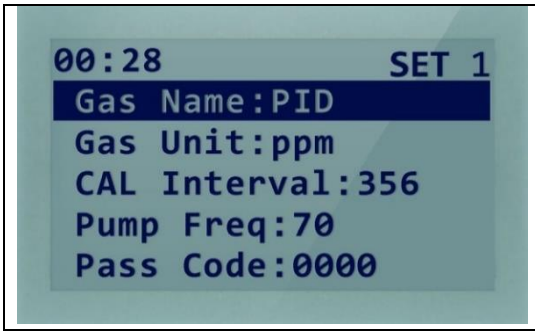


1) Normal Measurement Menu



❶Current time: display 24-hour system
❷Current sensor gas type / concentration unit - O3: gas type in the installed sensor - ppm: concentration unit
❸Concentration of measured gas - Decimal position is changed according to the measurement range of the sensor.
❹Sensor On/Off State
❺Pump flow rate - Current suction flow rate

2) Setup/Calibration/Review List Basic



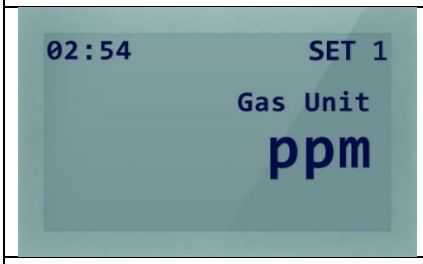
1. Current Menu display upper right
   - SET1, SET2, SET3, CAL, REVIEW
2. Move List Focus by Up/Down Key
3. Pushing Select key, enter the setting screen
   - In case the related setting is not possible, no screen change
4. Pushing Menu key, move the next Menu

3) Setup/Calibration Menu Change Basic

Menu with Focus		1. Change number 0-9 with Up/Down key 2. Move Focus by Up/Down long Key - Pushing Down Long key, Focus movement in the order of 3 → 6 → 5 → 3 3. If Focus is moved with the number over setting range, it is changed into Max value or effective value, automatically.
Menu without Focus		1. Change the number with Up/Down key 2. Input Up/Down Long key increases or decreases the number continuously.

4) SET 1

1) Gas Unit: Gas concentration unit
2) CAL Interval: Set calibration interval
3) Pump Freq: Control suction amount by setting Frequency of Gas Suction Pump
4) Pass Code: Set Setup and Calibration entry passcodes
5) Inhibit: Set items to inhibit
6) Buzzer: Buzzer On/Off in case of Alarm occurrences
7) Resp Factor: Value of fine control for Gas concentration
8) Sensor Off: Control the time from On to Off of Sensor automatically (for VOC sensor)
9) RS485 Addr: Set device address during RS485 communication

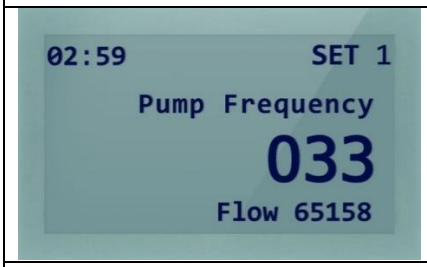


1) Gas Unit

- ▶ Adjust concentration unit with Up/Down key
- ▶ Cancel with Menu key, Save with Select key
- ▶ Possible to set ppm/ppb/Vol/LEL
- ▶ Default: ppm

2) CAL Interval

- ▶ Change number 0-9 with Up/Down key
- ▶ Move Focus with Up/Down Long key
  - Up Long: Move Focus left
  - Down Long: Move Focus right
- ▶ Cancel with Menu key, Save with Select key
- ▶ Possible to set up to 0 ~ 999 days
- ▶ Default: 365 days

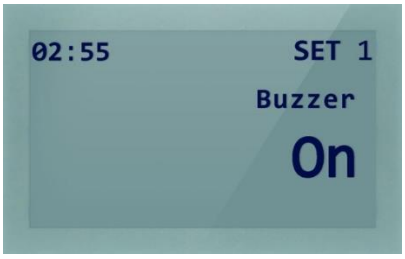
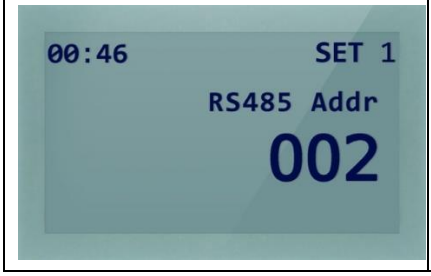


3) Pump Frequency

- ▶ Adjust number with Up/Down key
- ▶ Adjust number continuously with Up/Down Long key
- ▶ Cancel with Menu key, Save with Select key
- ▶ Flow : Display current flow rate
- ▶ Default : 60 Hz

4) Pass Code

- ▶ Adjust number (0-9) with Up/Down key
- ▶ Move Focus with Up/Down Long key
  - Up Long : Move Focus left
  - Down Long : Move Focus right
- ▶ Cancel with Menu key, Save with Select key
- ▶ Set only in case of input the same Pass Code twice
- ▶ In case of setting Pass Code with the value other than 0000, entry is possible only with input Pass Code upon entry to setting by Menu key.
- ▶ Default : 0000

	**5) Inhibit** ▶ Set Inhibit item with Up/Down key ▶ Cancel with Menu key, Save with Select key ▶ None: No Inhibit Alm: Alarm Inhibit Alm&Flt: Alarm, Fault Inhibit Full: Inhibit all items ▶ Default: None
	**6) Buzzer** ▶ Set Buzzer On/Off with Up/Down key ▶ Cancel with Menu key, Save with Select key ▶ On: In case of Alarm, Buzzer sound Off: In case of Alarm, no Buzzer sound ▶ Default : On
	**7) Resp Factor** ▶ Adjust number (0-9) with Up/Down key ▶ Move Focus with Up/Down Long key - Up Long: Move Focus left - Down Long: Move Focus right ▶ Cancel with Menu key, Save with Select key ▶ It will be output by multiplying the final concentration. ▶ Default : 1.00
	**8) Sensor Off Time** ▶ Adjust number with Up/Down key ▶ Adjust number continuously with Up/Down Long key ▶ Cancel with Menu key, Save with Select key ▶ Automatic Off time: Off(Always On), 1~120 seconds - Menu only for VOC sensor (PID) - Sensor Power Off if the related time is passed ▶ Default : Off
	**9) RS485 Addr** ▶ Adjust number with Up/Down key ▶ Adjust number continuously with Up/Down Long key ▶ Cancel with Menu key, Save with Select key ▶ RS485 Address(ID) : 1 ~ 247 ▶ Default : 1

5) SET 2

1) Alarm 1: Set Alarm Level 1(Low)
2) Alarm 2: Set Alarm Level 2(High)
3) Alarm Delay: Alarm is occurred after the setting time in case achieving the concentration of Alarm 1, 2
4) Alarm Latch: Set whether to clear Automatic or Manual after Alarm occurrence
5) Alarm Relay: Set whether to operate Relay simultaneously in case of Alarm occurrence
6) Fault Latch: Set whether to clear Automatic or Manual after Fault occurrence
7) Fault Relay: Set whether to operate Relay simultaneously in case of Fault occurrence

1) Alarm 1

▶ Adjust number (0-9) with Up/Down key
▶ Move Focus with Up/Down Long key
- Up Long : Move Focus left
- Down Long : Move Focus right

▶ Cancel with Menu key, Save with Select key
▶ Alarm Level 1 : 0 ~ 9999.9 ppm
▶ Default : 50.0 ppm

2) Alarm 2

▶ Adjust number (0-9) with Up/Down key
▶ Move Focus with Up/Down Long key
- Up Long : Move Focus left
- Down Long : Move Focus right

▶ Cancel with Menu key, Save with Select key
▶ Alarm Level 2 : 0 ~ 9999.9 ppm
▶ Default : 100.0 ppm

3) Alarm Delay

▶ Adjust number (0-9) with Up/Down key
▶ Move Focus with Up/Down Long key
- Up Long : Move Focus left
- Down Long : Move Focus right

▶ Cancel with Menu key, Save with Select key
▶ Alarm Delay : 0 ~ 99 seconds
▶ Default : 0 second

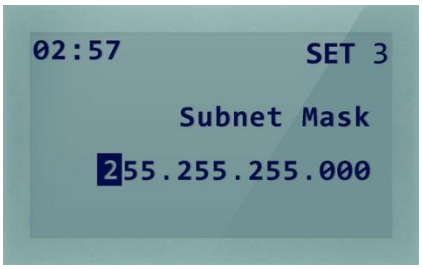
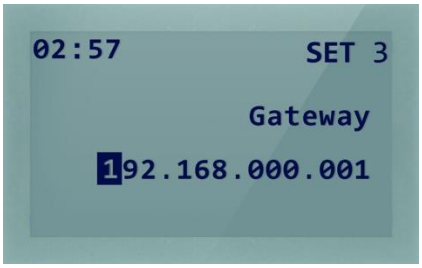
4) Alarm Latch

▶ Set Alarm Latch with Up/Down key
▶ Cancel with Menu key, Save with Select key
▶ On: Alarm is not cleared even if Alarm condition is cleared after Alarm occurrence
Off: Alarm is automatically cleared if Alarm condition is cleared after Alarm occurrence
▶ Default : Off

	**5) Alarm Relay** ▶ Set Alarm Relay with Up/Down key ▶ Cancel with Menu key, Save with Select key ▶ On: Operate Relay in case of Alarm occurrence Off: Do not operate Relay in case of Alarm occurrence ▶ Default : On
	**6) Fault Latch** ▶ Set Fault Latch with Up/Down key ▶Cancel with Menu key, Save with Select key ▶ On: Fault is not cleared even if Fault condition is cleared after Fault occurrence Off: Fault is automatically cleared if Fault condition is cleared after Fault occurrence ▶ Default : Off
	**7) Fault Relay** ▶ Set Fault Relay with Up/Down key ▶ Cancel with Menu key, Save with Select key ▶ On: Operate Relay in case of Fault occurrence Off : Do not operate Relay in case of Fault occurrence ▶ Default : On

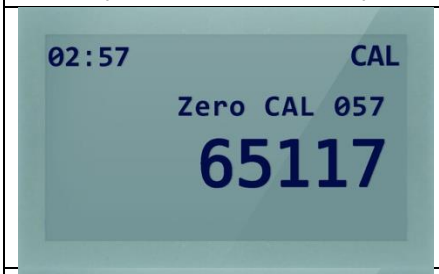
6) SET 3

1) DHCP: Set Network DHCP On/Off 2) IP Address: Set Network IP Address 3) Subnet Mask: Set Network Subnet Mask 4) Gateway: Set Network Gateway 5) Time: Set time and date 6) Backlight: Set Backlight in case of Alarm/Fault	
	**1) DHCP** ▶ Set DHCP with Up/Down key ▶ Cancel with Menu key, Save with Select key ▶ On: Automatically allocate Network IP Address Off: Manually allocate Network IP Address ▶ Default : Off

	**2) IP Address** ▶ Adjust number (0-9) with Up/Down key ▶ Move Focus with Up/Down Long key - Up Long: Move Focus left - Down Long: Move Focus right ▶ Cancel with Menu key, Save with Select key ▶ Default : 192.168.000.200
	**3) Subnet Mask** ▶ Adjust number (0-9) with Up/Down key ▶ Move Focus with Up/Down Long key - Up Long: Move Focus left - Down Long: Move Focus right ▶ Cancel with Menu key, Save with Select key ▶ Default : 255.255.255.000
	**4) Gateway** ▶ Adjust number (0-9) with Up/Down key ▶ Move Focus with Up/Down Long key - Up Long: Move Focus left - Down Long: Move Focus right ▶ Cancel with Menu key, Save with Select key ▶ Default : 192.168.000.001
	**5) Time** ▶ Adjust number (0-9) with Up/Down key ▶ Move Focus with Up/Down Long key - Up Long: Move Focus left - Down Long: Move Focus right ▶ Cancel with Menu key, Save with Select key ▶ Date : January 1, 2000 – December 31, 2099 Time : 00:00 ~ 23:59
	**6) Backlight** ▶ Set DHCP with Up/Down key ▶ Cancel with Menu key, Save with Select key ▶ Single: In case of Alarm/Fault, White Backlight Multi : Alarm 1(Green), Alarm 2(Orange) Fault(White + Green + Orange) ▶ Default : Off

7) Calibration

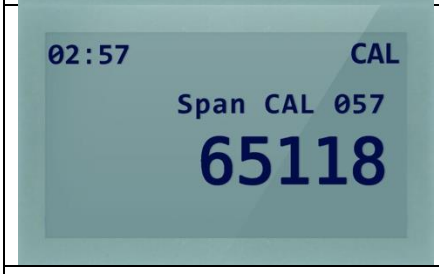
1) Zero CAL Start: Start Zero Calibration
2) Span CAL Start: Start Span Calibration
3) Span Gas: Set Span Calibration concentration
4) CAL Duration: Set Calibration operation time
5) Flow CAL 1: Set Flow Calibration 1
6) Flow CAL 2: Set Flow Calibration 2
7) 4mA CAL: 4mA Calibration of 4-20mA DAC
8) 20mA CAL: 20mA Calibration of 4-20mA DAC
9) Bump Test : Perform Bump Test



1) Zero CAL Start

▶ Cancel Zero Calibration with Menu key

▶ If CAL Duration time is passed, Zero Calibration is completed automatically and return to previous Menu



2) Span CAL Start

▶ Cancel Span Calibration with Menu key

▶ If CAL Duration time is passed, Span Calibration is completed and return to previous Menu

3) Span Gas

▶ Adjust number (0-9) with Up/Down key

▶ Move Focus with Up/Down Long key

- Up Long : Move Focus left
- Down Long : Move Focus right

▶ Cancel with Menu key, Save with Select key

▶ Span Gas concentration: 0 ~ 999.9 ppm

▶ Default : 10 ppm

4) CAL Duration

▶ Adjust number (0-9) with Up/Down key

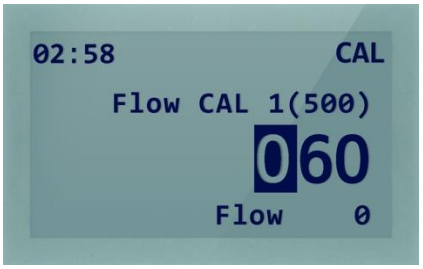
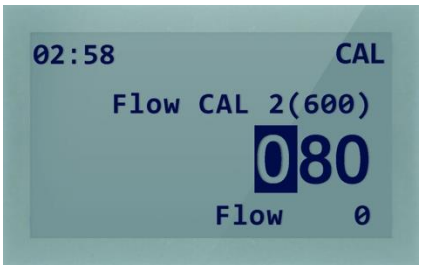
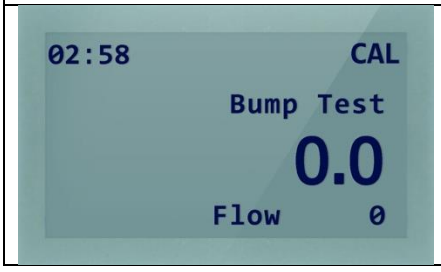
▶ Move Focus with Up/Down Long key

- Up Long : Move Focus left
- Down Long : Move Focus right

▶ Cancel with Menu key, Save with Select key

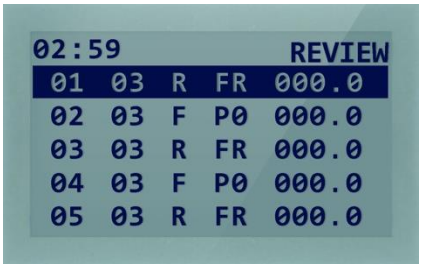
▶ Calibration Duration : 0 ~ 999 seconds

▶ Default : 60 seconds

	**5) Flow CAL 1** ▶ Adjust number with Up/Down key ▶ Adjust number continuously with Up/Down Long key ▶ Cancel with Menu key, Save with Select key ▶ Flow : Display current flow rate Save setting upon arriving 500 cc/min ▶ Default : 60 Hz
	**6) Flow CAL 2** ▶ Adjust number with Up/Down key ▶ Adjust number continuously with Up/Down Long key ▶ Cancel with Menu key, Save with Select key ▶ Flow : Display current flow rate Save setting upon arriving 600 cc/min ▶ Default : 80 Hz
	**7) 4mA CAL** ▶ Adjust number (0-9) with Up/Down key ▶ Move Focus with Up/Down Long key - Up Long : Move Focus left - Down Long : Move Focus right ▶ Cancel with Menu key, Save with Select key ▶ 4mA Calibration : 0 ~ 9999 Adjust to be measured with 4mA by ammeter ▶ Default : 1000
	**8) 20mA CAL** ▶ Adjust number (0-9) with Up/Down key ▶ Move Focus with Up/Down Long key - Up Long : Move Focus left - Down Long : Move Focus right ▶ Cancel with Menu key, Save with Select key ▶ 20mA Calibration : 0 ~ 9999 Adjust to be measured with 20 mA by ammeter ▶ Default : 1000
	**9) Bump Test** ▶ Alarm/Fault and concentration display checking test Require Test Gas input

8) Review

1) S/W Ver: MAIN Firmware Version information of the device 2) Unit: Version information of Cartridge 3) CAL Due: Display the date required for Calibration 4) Cartridge Expire: Time of Cartridge expiry (not related to shelf life of sensor, significantly) 5) Last CAL: Time to perform final Calibration 6) Event Log: Recent 10 Event Log List occurred in the device 7) Zero ADC: Zero Calibration ADC value of the installed smart sensor 8) Span ADC: Span Calibration ADC value of the installed smart sensor



▶ Move to List with Up/Down key
▶ Return to previous Menu with Menu key
▶ Number of sensor type
Ex) 03 → O3 sensor
▶ Event Type
R: Power On/Alarm/Fault Reset occurrence
A: Alarm occurrence
F: Fault occurrence
I: Information of sensor detection and so on
▶ Event State
PO : Power On
RA : Reset All(Factory Reset)
A1 : Alarm 1
A2 : Alarm 2
AR : Alarm Reset
FR : Fault Reset
JS : Sensor detection
▶ Event Gas concentration: Gas concentration in case of event occurrence

11. MODBUS RS485 Address Map

11.1 Interface setting

- Baud rate: 9600 bps
- Data Format: RTU
- Data bits: 8bits
- Stop bit: 1bits
- Parity: None

11.2 MODBUS RS485 Register

Item	Address	Bits	Description
Concentration of measured gas	30001	BIT15~0	Measured gas value (Require Integer/Decimal Point application)
Gas Range	30002	BIT15~0	Gas Range (Require Integer/Decimal Point application)
Set value of Alarm 1	30003	BIT15~0	Set value of Alarm 1 (Integer/Require Decimal Point application)
Set value of Alarm 2	30004	BIT15~0	Set value of Alarm 2 (Require Integer/Decimal Point application)
Alarm 1 Active	10001	BIT7~0	Alarm 1 Active state
Alarm 2 Active	10002	BIT7~0	Alarm 2 Active state
Fault Active	10003	BIT7~0	Fault Active state
Maintenance Mode	10004	BIT7~0	Maintenance Mode state
Test Mode	10005	BIT7~0	Test Mode state
Calibration Mode	10006	BIT7~0	Calibration Mode state
Decimal Point	10007	BIT7~0	Decimal Point(0~3)
Heartbeat	10008	BIT7~0	Heartbeat Bit(Toggle with 2 second interval)

12. MODBUS TCP Address Map

12.1 Interface setting

- Data Format: RTU
- Baud rate: 9600 bps
- Data bits: 8bits
- Stop bit: 1bits
- Parity: Even

12.2 MODBUS TCP Register

- 3000X Register Read

Item	Address	Bits	Description
Concentration of measured gas	30001	BIT15~0	Measured gas value (Require Integer/Decimal Point application)
Gas Range	30002	BIT15~0	Gas Range (Require Integer/Decimal Point application)
Set value of Alarm 1	30003	BIT15~0	Set value of Alarm 1 (Require Integer/Decimal Point application)
Set value of Alarm 2	30004	BIT15~0	Set value of Alarm 2 (Require Integer/Decimal Point application)
Alarm 1 Active	10001	BIT7~0	Alarm 1 Active state
Alarm 2 Active	10002	BIT7~0	Alarm 2 Active state
Fault Active	10003	BIT7~0	Fault Active state
Maintenance Mode	10004	BIT7~0	Maintenance Mode state
Test Mode	10005	BIT7~0	Test Mode state
Calibration Mode	10006	BIT7~0	Calibration Mode state
Decimal Point	10007	BIT7~0	Decimal Point(0~3)
Heartbeat	10008	BIT7~0	Heartbeat Bit(Toggle with 2 second interval)

- 4000X Register Read

Item	Address	Bits	Description
Monitoring Status	40001	BIT0~3	0 : Warmup
			1 : Measure Mode
			2 : Inhibit Alarm
			3 : Inhibit Alarm/Fault
			4 : Inhibit Full

			5 : Reserved
			6 : Test Mode
			7 : 4-20mA Calibration Mode
			8 : Flow Calibration Mode
			9-15 : Reserved
		BIT4	Fault Active Status
		BIT5	Reserved
		BIT6	Alarm 1 Active
		BIT7	Alarm 2 Active
		BIT8	Alarm 1 Relay energized
		BIT9	Alarm 2 Relay energized
		BIT10	Fault Relay energized
		BIT11	Heartbeat Bit(Toggle with 2 second interval)
		BIT12~15	Reserved
Cartridge Selection	40002	BIT0~7	Gas ID(Sensor Type)
		BIT8~15	Reserved
Measured gas concentration (real number)	40003	BIT0~15	Measured value of gas concentration with real number(Upper 2 byte)
	40004	BIT0~15	Measured value of gas concentration with real number(Lower 2 byte)
Measured gas Concentration (Integer)	40005	BIT0~15	Measured value of gas concentration with integer
Fault Code	40006	BIT0~15	Fault Code
Decimal Point and Units	40007	BIT0~2	Decimal Point Indicator(0~3)
		BIT3~7	Reserved
		BIT8~15	1 : ppm(concentration unit)
			2 : ppb(concentration unit)
			3 : % volume(concentration unit)
			4 : %LEL(concentration unit)
			16 : mA
Measured value of temperature	40008	BIT0~15	Measured value of temperature(Signed 16bit Integer)
Reserved	40009	BIT0~15	Reserved
Reserved	40010	BIT0~15	Reserved
Flowrate	40011	BIT0~15	Flowrate(cc/min)
Reserved	40012	BIT0~15	Reserved
Set value of Alarm 1 (real number)	40013	BIT0~15	Set value of Alarm 1 with real number (upper 2byte)
	40014	BIT0~15	Set value of Alarm 1 with real number (lower 2byte)
Set value of Alarm 2 (real number)	40015	BIT0~15	Set value of Alarm 2 with real number (upper 2byte)
	40016	BIT0~15	Set value of Alarm 2 with real number (lower 2byte)
state value	40017	BIT0	Alarm 1 Active

		BIT1	Alarm 2 Active
		BIT2	Fault Active
		BIT3	Maintenance Mode
		BIT4	Test Mode
		BIT5	Calibration Mode
		BIT6~15	Reserved
Reserved	40018	BIT0~15	Reserved
Gas Range(real number)	40019	BIT0~15	Gas Range with real number (upper 2byte)
	40020	BIT0~15	Gas Range with real number (lower 2byte)

- 4000X Register Write

Item	Address	Bits	Description
Set Alarm 1	40021	BIT15~0	Set value of Alarm 1 (No Integer/Decimal Point)
Set Alarm 2	40022	BIT15~0	Set value of Alarm 2 (No Integer/Decimal Point)
Reset Alarm & Fault	40023	BIT0	Reset Alarms and Faults
		BIT1~15	Reserved

13. Length of installed cable

- Maximum length between SI-H100 and power supply is determined by specification of the wire.
  - Maximum installation length = VMAXDROP ÷ IMAX ÷ WIRER/m ÷ 2

  ✓ VMAXDROP: Maximum Power Loop Voltage Drop (=Power Supply voltage – min operating voltage)
  ✓ IMAX: Maximum current value of SI-H100
  ✓ WIRER/m: The resistance of the wire (ohms/meter value available in wire manufacturer's specification data sheet)

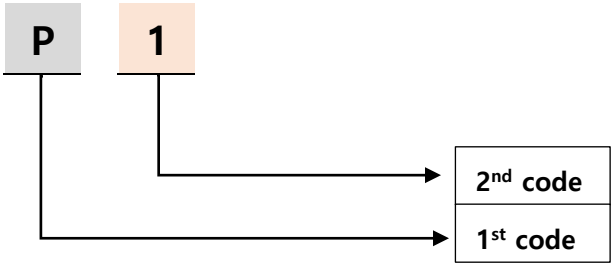
  Ex) The example of installed length using 24V power supply and 16AWG is as follows.
  ✓ SI-H100 minimum operating voltage = 18 Vdc
  ✓ VMAXDROP = 24 – 18 = 6V
  ✓ IMAX = 0.4A(400mA)

■ Installed lengths of power cables by cable categories are as follows.

AWG	mm^2	Copper resistance (ohms/m)	Meters
12	3.31	0.00521	1439
14	2.08	0.00828	905
16	1.31	0.01318	569
18	0.82	0.02095	357
20	0.518	0.0333	225

14. Error Code

Ex) Error Display Code



No	1st Code	2nd Code	Reason	Solution
1	B	0	Firmware Version is unusual	Firmware Update
2	B	1	Firmware Tag with unusual Data	Firmware Update
3	B	2	Firmware CRC with unusual Data	Firmware Update
4	B	3	EEPROM Read/Write Failure	Exchange MAIN Board
5	B	4	RTC Access Failure	Exchange MAIN Board
6	B	5	Reserved	
7	Y	0	Reserved	
8	S	0	Smart Sensor Communication Failure	Check or exchange Smart Sensor connector
9	S	1	Receiving unusual data from Smart Sensor	Check or exchange Smart Sensor connector
10	S	2	Expiry of Smart Sensor shelf life	Exchange Smart Sensor
11	S	3	Smart Sensor concentration is unusually low.	Check the assembly of Smart Sensor or exchange
12	S	4	Smart Sensor concentration is unusually high.	Check the assembly of Smart Sensor or exchange
13	S	5	Sensor Error within Smart Sensor (only for PID Sensor)	Check or exchange Sensor state within Smart Sensor
14	S	6	Smart Sensor Zero CAL Failure	Check or exchange Sensor state within Smart Sensor
15	P	0	Pump is not connected or unusual operation	Check Pump connection state
16	P	1	Pump pressure is unusually low.	Check Pump connection and piping tube
17	P	2	Pump pressure is unusually high.	Check Pump connection and piping tube
18	R	0	unusual operation of RS485	Check connection of RS485

15. Warranty

Senko Co. Ltd. guarantees all the products for 24 months from the delivery date and any products with abnormality within the guaranteed period shall be fixed or changed without charge by Senko. However, the parts that their shelf life become shorter according to the usages such as sensor (1 year), battery, lamp, and so on will not be applied by this warranty period. Fixing or change for free of charge is not possible in case that the product is purchased through the channels Senko does not allow; physical damage and transformation of the product are occurred due to the misuse of the users; and the failures occurred due to missing adjustment or part exchange according to the product information. Also, in case that product defect or quality issue is occurred during the warrantee period, it should be immediately notified to the manufacturer and Senko will absorb all the costs except for transportation. For the products after warranty period or the costs for part fixing, exchange, transportation, and so on, they shall be covered by the users. Senko shall not be liable to any indirect or unexpected accidents or loss caused during the usage of the product, and warranty is limited for the exchanges of parts and products. This warranty is possible only for the users who purchase the products from the official sales offices or delegates designated by Senko, and warranty maintenance should be performed by the designated aftersales service center of Senko where the skilled technicians are.

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16. Amendment history

No	Item	Details	Revision	Amendment date
1	First preparation		Rev 1.0	2018.10.30
2	1st amendment		Rev 2.0	2018.12.24