PT3E-0460

RIKEN KEIKI

Optical Interferometric Gas Monitor

FI-815A

Operating Manual

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<Preface>

Thank you for choosing our optical interferometric gas monitor FI-815A.
This manual describes how to use FI-815A. Not only the first-time users but also the users who have already used the gas monitor must read and understand the operating manual before using this product.
Throughout this manual, the following indications are used to ensure safe and effective work.

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

<Contents>

<Outline of the Product>

This product is designed to perform continuous measurement and monitoring of the concentration of solvent vapor generated from drying equipment such as photogravure printing machine. The optical interferometric system has been adopted as a principle to provide highly accurate, stable measurements.

⚠ DANGER ⚠ WARNING

This product is not explosion-proof. Do not install or use this product in a location designated as a hazardous area (explosion-proof area).

Use the rated power supply specified for the gas monitor.

Ground the EARTH terminal ⏚ on the external terminal plate before use to avoid a risk of electric shock. Perform the grounding work while the gas monitor is not powered.

⚠ CAUTION

A low-volatile solvent that condenses (liquefies) within the gas monitor or within a tube connected to the gas monitor cannot be measured.

A gas with high humidity that causes condensation within the gas monitor or within a tube connected to the gas monitor cannot be measured.

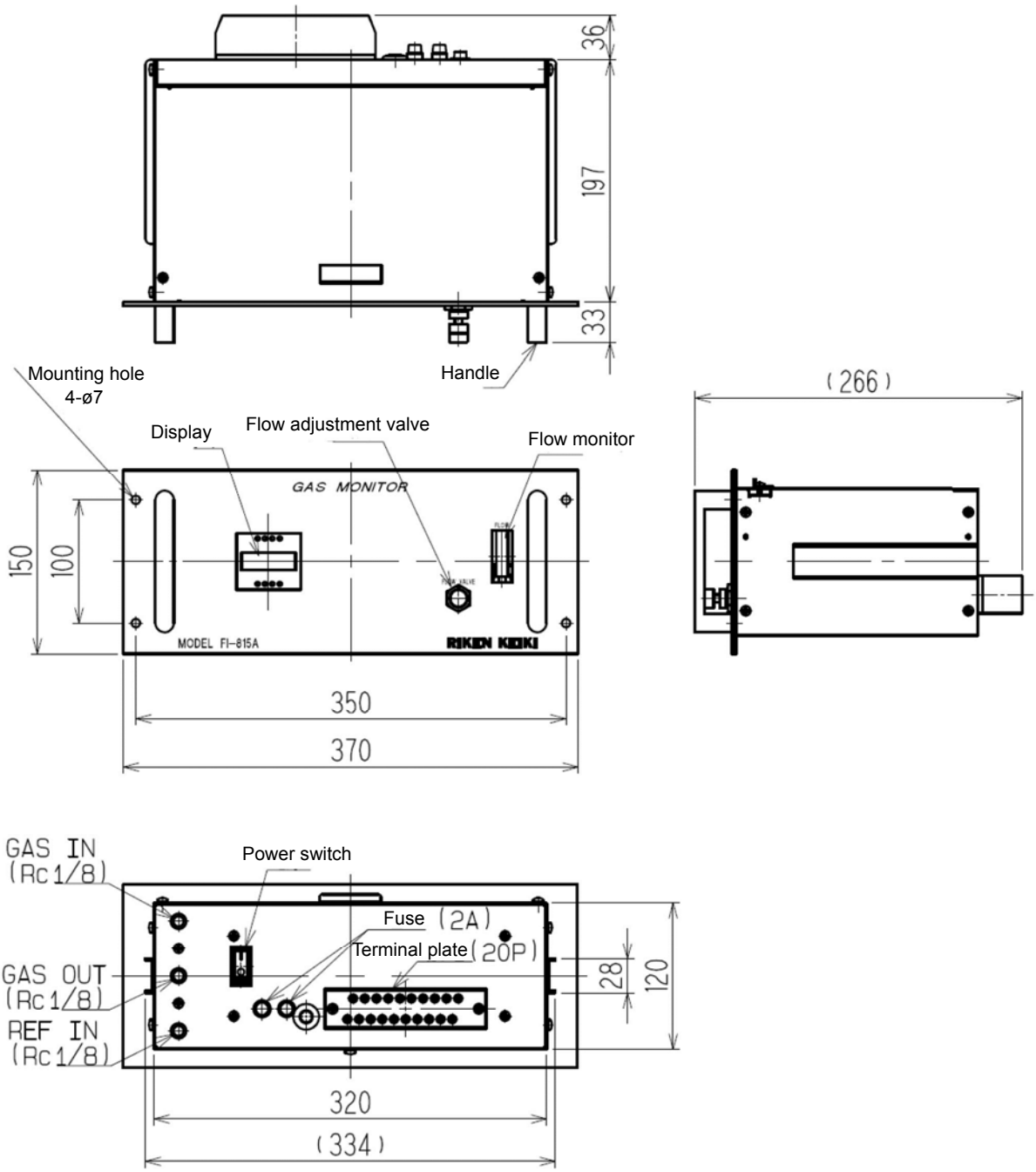
Do not use the gas monitor near a device that significantly disturbs the waveform of power supply such as electric welder. Also, do not use a power supply of the same system as a device that significantly disturbs the waveform of power supply.

Carefully manage the temperature around the gas monitor to prevent a measuring solvent from condensing (liquefying) within the gas monitor or tube connected to the gas monitor.

1

Product Functions

1-1. Outline drawing of the gas monitor



1-2. Accessories

- Control key ····· The supplied quantity depends on the number of units to be delivered.

1 to 10 units	One
11 to 20 units	Two
21 to 50 units	Three
Over 51 units	Four

△WARNING "Powerful Magnet"
△WARNING:MAGNET
MODEL TC-7
RIKEN KEIKI

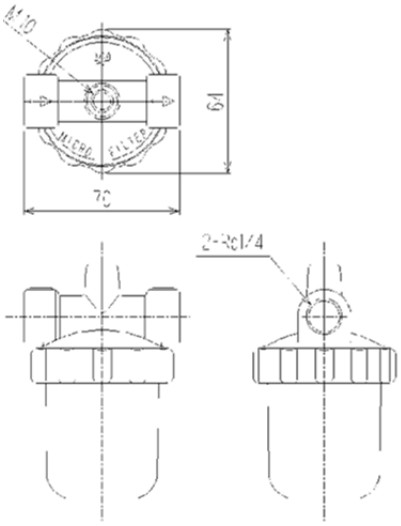
WARNING

Note that the control key used for adjustment is made of strong magnet. Putting it close to a magnetic product, such as a credit card and ID card, may damage the stored data.

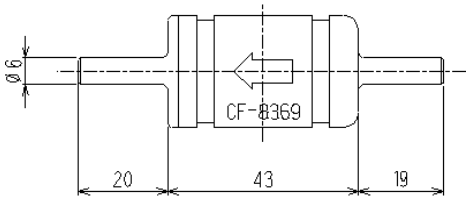
- FI-815A operating manual ····· 1
- Fuse (2A normal fusing type) · The supplied quantity depends on the number of units to be delivered.

1 to 10 units	Two
11 to 20 units	Four
21 to 50 units	Six
Over 51 units	Eight

- MC (ST) filter ····· 1 (GAS IN dust filter)

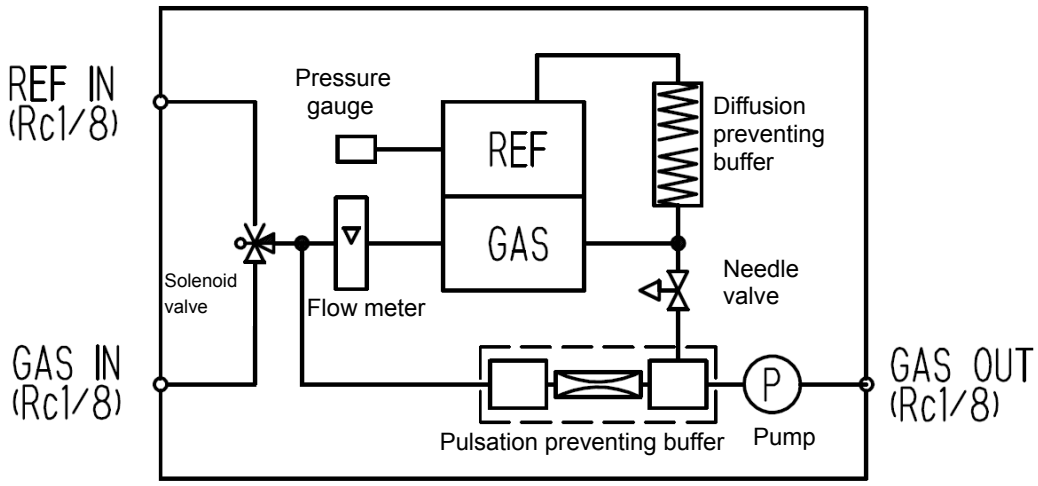


- Cylindrical filter CF-8369 ····· 1 (REF IN dust filter)

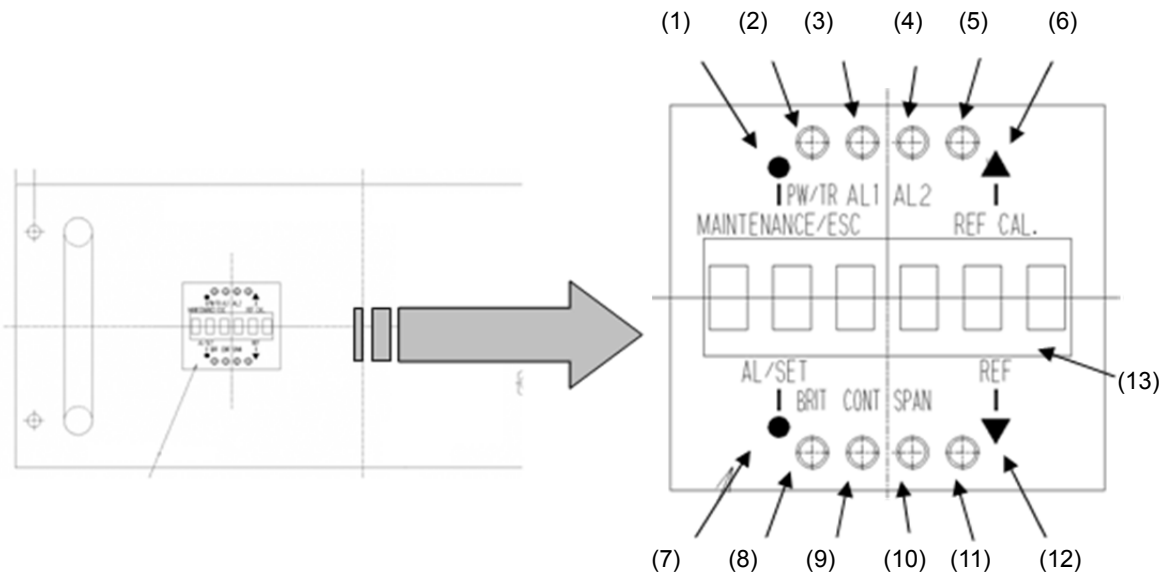


1-3. Block diagram

Tubing diagram



1-4. Descriptions of the LCD display



* Descriptions enclosed in the brackets [ ] indicate behaviors in the maintenance mode.

(1) MAINTENANCE/ESC switch	A switch for entering the maintenance mode. [It is used to stop processing and to do others.]
(2) PW/TR lamp	This is a power lamp that continuously lights up while the gas monitor is running. If abnormality occurs in the gas monitor, this will blink.
(3) AL1 lamp	This is an alarm lamp that blinks at the first gas alarm state.
(4) AL2 lamp	This is an alarm lamp that blinks at the second gas alarm state.
(5) REF CAL lamp	This lamp lights up while the zero adjustment is protected. It blinks in the maintenance mode.
(6) REF CAL./UP switch	This switch starts the zero adjustment. [It is used to increase numerical values.]
(7) AL./SET switch	A switch for checking alarm setpoints. [It is used to confirm processing and to do others.]
(8) BRIGHT lamp	This lamp lights up when the volume of light source for the interferometric sensor is dropped.
(9) CONT lamp	This lamp lights up when the contrast for the interferometric sensor is dropped.
(10) SPAN lamp	This lamp blinks while the sensor sensitivity (span) is being adjusted. It continuously lights up when the span is confirmed.
(11) REF lamp	This lamp lights up when the internal three-way solenoid valve is switched to REF.
(12) REF/DOWN switch	This switches the internal three-way solenoid valve. It is used to switch gas supplied to the sensor from the GAS IN to the REF IN. [It is used to decrease numerical values.]
(13) LCD	This displays error code etc. at the time of abnormality.

Use the attached control key to operate all the switches described in the above table. Holding the control key over the marks ● and ▼▲ for a few seconds will start the switches.
The description of "press the XXX switch" in this operating manual means holding the control key over the marks ● and ▼▲.

NOTE

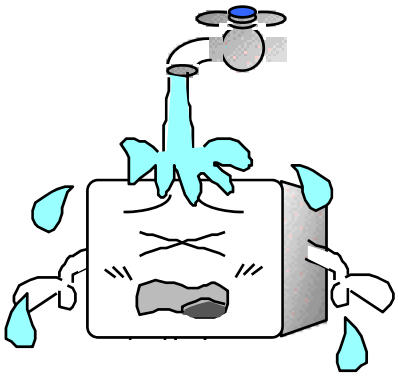
The zero adjustment (REF CAL) of the gas monitor automatically sets numerical values to zero.

2

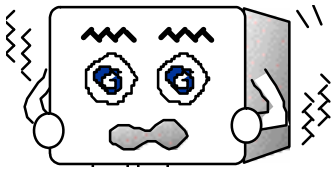
How to Install Gas Monitor

2-1. Precautions on installation site

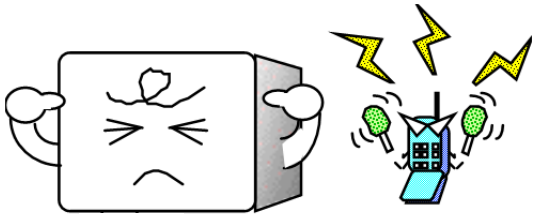
Do not install this product in any of the following locations.



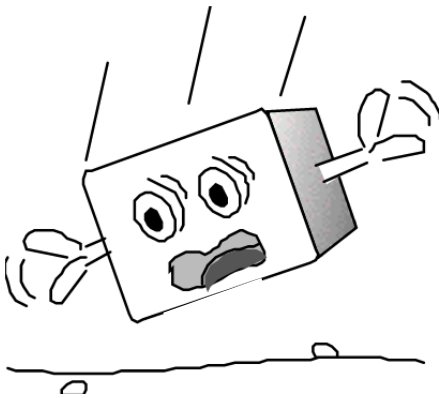
(1) Place exposed to water, oil or chemicals



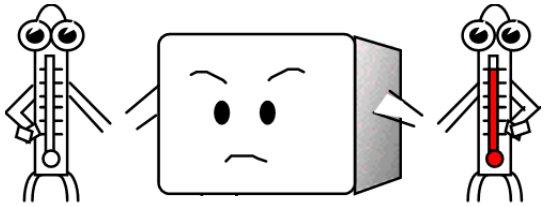
(2) Place with vibrations



(3) Place where radio wave or noise is generated



(4) Place where the gas monitor may drop or receive strong shock

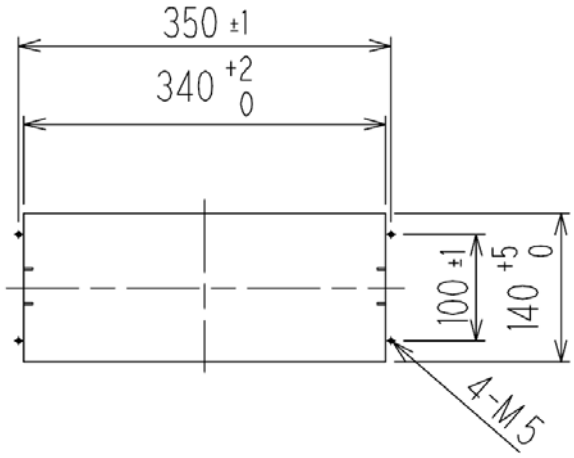


(5) Place where the temperature drops below -10ºC or rises over 50ºC. Also, place exposed to direct sunlight or radiant heat (infrared rays emitted from a high-temperature object)

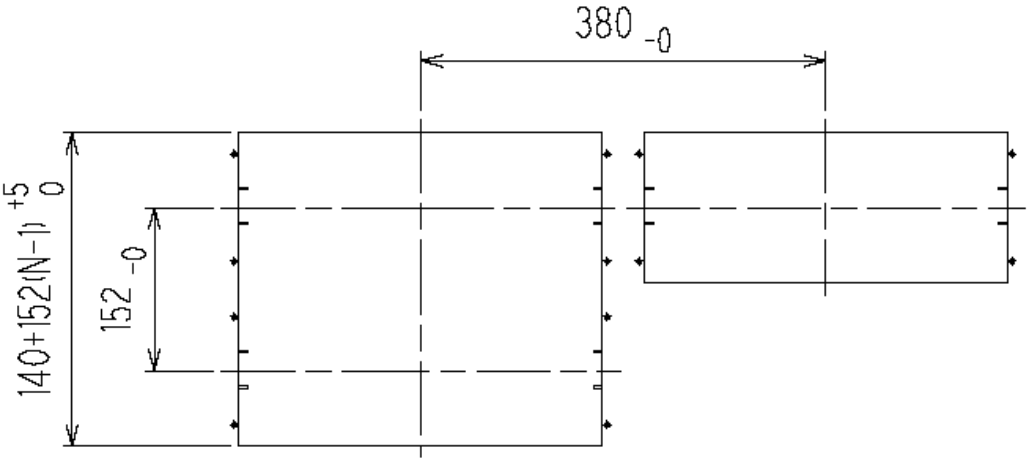
2-2. Installation and precautions

The structure of the gas monitor is a rack mounting type. To install it, a rack that matches the panel cutout dimensions shown in the figure below should be provided.

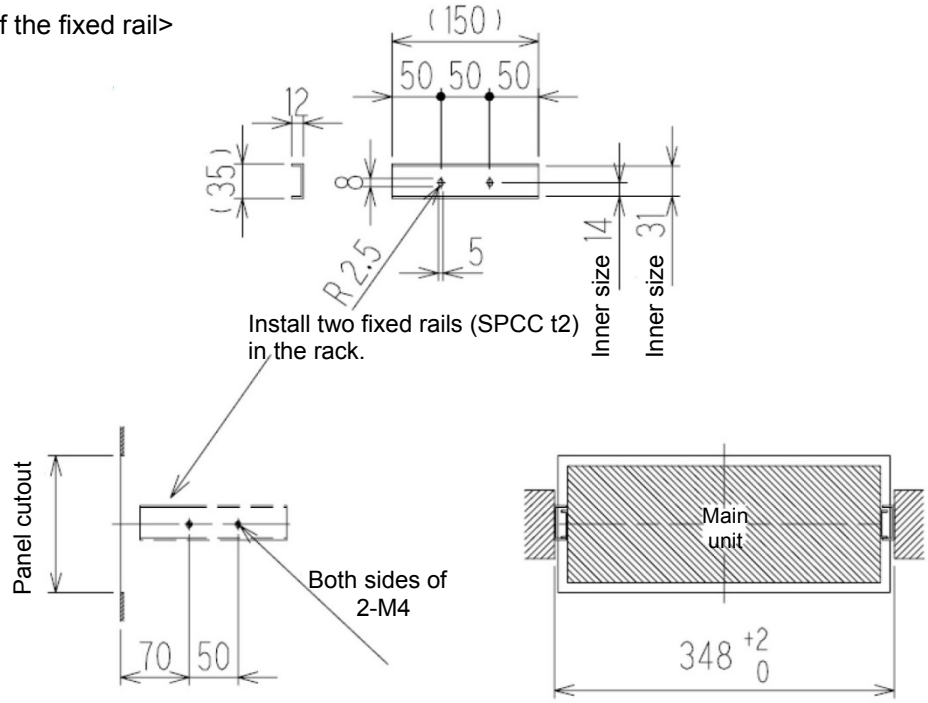
One point



Multi-point (N point)



<Installation dimensions of the fixed rail>
(when it is used)



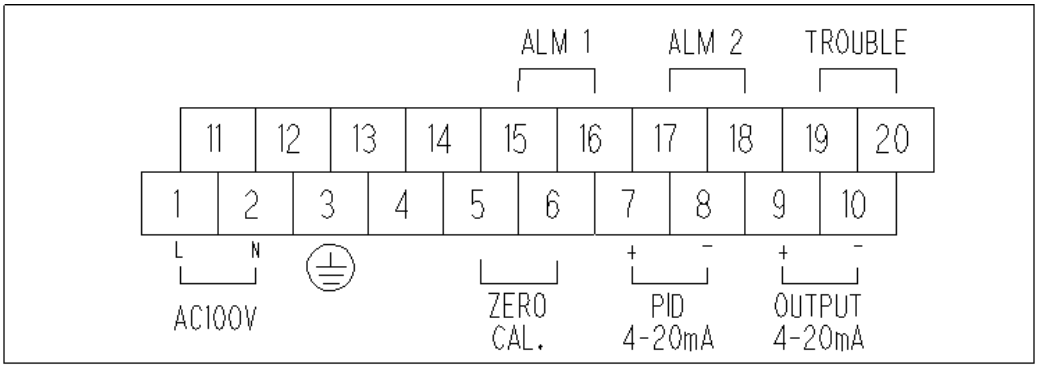
CAUTION

- Do not drop or give strong shock to the gas monitor during installation. Otherwise, the device may be damaged.
- When performing construction work, prevent dust from entering the inside of the gas monitor.
- When installing the gas monitor on a freestanding rack (fixed type), fix the rack with anchor bolts.
- Leave a space of at least 600 mm between the front/back side of the gas monitor and wall to secure maintenance space.
- When installing the gas monitor in an enclosed storage board, take a measure to prevent the temperature inside the storage board from rising over 50ºC.
- When installing the gas monitor on a storage board panel, leave sufficient length of wires and tubes so that maintenance can be performed with the unit pulled out by at least half the length of its depth without removing wires and tubes at the back.

3

How to Connect Wire

3-1. Descriptions of the terminal plate and how to connect the wire



1	IN 100 VAC 50/60 Hz	11	(Unused)
2		12	
3	Grounding D type grounding	13	
4	(Unused)	14	
5	Zero adjustment switch for remote control (Short-circuit will start the zero adjustment)	15	First alarm contact point (non-voltage contact) Contact capacity: 125 VAC, 1 A/30 VDC, 1 A (Resistance load)
6		16	
7	(Unused)	17	Second alarm contact point (non-voltage contact) Contact capacity: 125 VAC, 1 A/30 VDC, 1 A (Resistance load)
8		18	
9	4 - 20 mA	19	Fault alarm contact (non-voltage contact) Contact capacity: 125 VAC, 1 A/30 VDC, 1 A (Resistance load)
10		20	

The terminal screw of the terminal plate is a screw with a square washer (M3.5 x 8). Use the cable of 1.25 mm2 to attach a crimped terminal with insulating coating for M3.5 to the tip of it for wiring.

- Power supply/contact cable : Cable equivalent to CVV1.25 sq
- 4 -20 mA cable : Cable equivalent to CVVS1.25 sq

NOTE

When a recorder, external meter, etc. is connected to the output (9) or (10) (4 - 20 mA DC), make sure to install an isolator immediately after the terminal to avoid influence of noise induced by the connected cable.

3-2. Precautions on electrical work

The noise induced by an unstable power supply or cable may cause malfunctions, false alarms or failures.

1. Use a stable power supply for the system.

(1) The gas monitor must be provided with the following power supply.
Power voltage: 100 AC ±10%
Allowed time of momentary blackout: Less than approx. 50 msec
(A restart may be required to recover from the momentary blackout for 50 milliseconds or more.)
To ensure continuous operation and activation, install a UPS outside the gas monitor.

(2) Do not make the power supply line in parallel with another high-voltage/high-current line.

2. Take a measure against noise according to the installation environment.

(1) Measure against lightning surge
"Lightning" is a problem for the devices installed outdoors at plants, etc. Because lightning acts as a large emission source while cables act as a receiving antenna, the devices connected to the cables may be damaged. Cables installed in a metal conduit or under the ground cannot be completely protected from inductive lightning surge caused by lightning. However, the following protective measure can be taken. Take an appropriate measure before using the gas monitor.

<Provide protection by a lightning arrester (cable arrester)>
A lightning arrester may be installed before the field devices and central processing equipment in case of an inductive lightning surge transmitted through the cable. Insert lightning arresters to the points where the cables enter the building from outside. A lightning arrester has a circuit to remove a surge voltage which damages field devices to protect the devices.

(2) Measure against power line noise
The following measures can be taken to mitigate the influence of electromagnetic or electrostatic induction noise from the power line. Take an appropriate measure before using the gas monitor.

<Keep away from power line>
Keep enough distance between the signal and power lines, avoiding parallel layout if possible. If they need to intersect with each other, it should be done at a right angle.

<Install an electrostatic shield>
Use a shielded signal line and ground the shield. Also, take measures to make the electrical isolation such as using an iron raceway for the power line, installing a grounded metal partition plate between the lines and putting each line in an individual metal duct.
In addition to lightning, there are more sources of surge noise. To protect devices from these noise sources, the devices must be grounded.

CAUTION

Be careful not to damage the internal electronic circuit when wiring.

CAUTION

The "b" contact (break contact) under de-energized state may be opened momentarily by a physical shock, such as external force.
When the "b" contact is selected for the alarm contact, take appropriate actions to prepare for a momentary activation, for example, add signal delay operation (approximately one second) to the receiving side of the "b" contact.

3-3. Protective grounding

For stable operation of the gas monitor and safety, it must be connected to a grounding terminal. The grounding wire should be thick and short as much as possible to minimize grounding resistance. Use the EARTH terminal (terminal 3) of the terminal plate to ground the gas monitor.

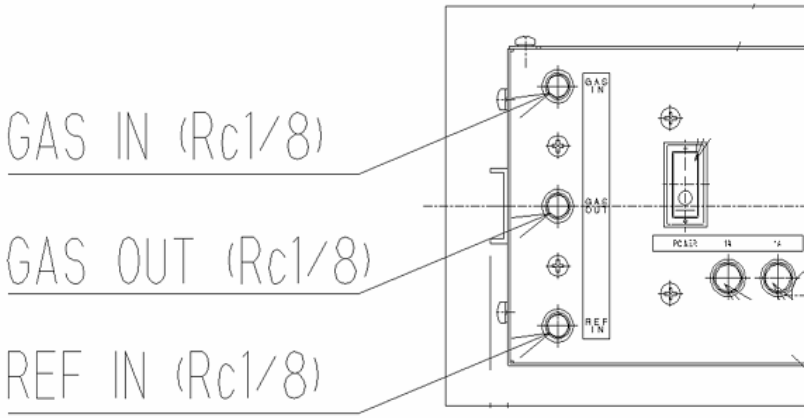
WARNING

- The grounding must be made as D type grounding (below 100 Ω of grounding resistance).
- Do not connect the grounding wire to a gas tube.

4

How to Tube

Use copper, stainless steel, and Teflon etc. for tube materials. Do not use any materials that may cause absorption and corrosion. Observe the following cautions in tubing.



GAS IN (Rc 1/8)	A supply port of sample gas. It draws sample gas at the flow rate of 1 L/min or more. This should be connected to the measurement point with a tube ø6 or more in internal diameter and 100 m or less in length.
GAS OUT (Rc 1/8)	A gas outlet. This should be connected to the exhaust line etc. at atmospheric pressure level with a tube ø6 or more in internal diameter and 50 m or less in length or a tube ø8 or more in internal diameter and 100 m or less in length.
REF IN (Rc 1/8)	A supply port of zero gas. Fresh air of zero (0% LEL) should be supplied.

(1) Make sure to connect the attached filters in the way of the tubing to remove dust.
GAS IN: MC (ST) filter
REF IN: Cylindrical filter CF-8369

(2) After the tube is cut, its cut point may have a smaller inner diameter. Use a file etc. to expand the inner diameter of the cut point. To remove cut-dust remaining inside of the tube, blow compressed air into the tube before connecting it to the gas monitor.

(3) The longer the tube of the GAS IN is, the longer it takes for a gas to be measured to reach the gas monitor. Because gases have a highly adsorptive property of solvents and vapors for the tube, resulting in a slow response and a lower reading than the actual value, the length of the GAS IN tube must be minimized.

(4) When the sample gas is hot, cool it until the same level as the ambient temperature of FI-815A.

(5) For gas sampling in high temperature and high humidity atmosphere or in the state near saturated vapor concentration, condensation in the sampling tube may disable measurement. Avoid a U-shaped or V-shaped tubing.

(6) Determine the inlet for the sample gas, considering the airflow of the sample gas line and the gas generating process. Also, avoid collecting a gas from the pipe, tank and the bottom of the device.

(7) As a general rule, exhaust should be atmosphere release. When the tip is outside, bend the shape of the tube into an inverted U to prevent rain from entering the tube. When it returns to the exhaust duct etc., keep the state within the atmosphere pressure of ±3 kPa, and the state that pressure fluctuation is not rapidly changed.

(8) For safety, to provide a flame arrestor for line, install it into each line of the GAS IN and GAS OUT.

CAUTION

FI-815A requires appropriate tubing works (selection of materials and other works) depending on types of sample gas and installation conditions. For questions about tubing works, please contact RIKEN KEIKI.

5

How to Operate

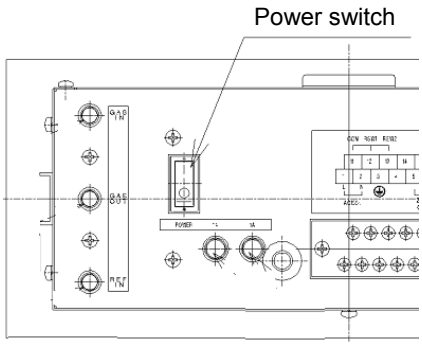
5-1. How to start the gas monitor

WARNING

- Check the wiring, tubing, and installation for errors.
- Make sure that supply power is rated (100 VAC±10%).

Turn on the power switch to start the gas monitor.

(1) The PW/TR LED lamp on the LCD display lights up and the self-diagnostic function starts.
(2) Verify that the upper level of the ball in the flow monitor indicates a flow rate of 300±25 mL/min. If necessary, use the flow adjustment valve to adjust the flow rate.
(3) After the reading is stable (about 60 seconds), perform zero adjustment.
(4) After the zero adjustment is complete, measurement is now possible.



CAUTION

Do not turn off the gas monitor at start-up (initial clear). Otherwise, a failure may be caused.

5-2. How to perform zero adjustment

Holding the control key over the REF CAL. switch on the LCD display for over five seconds or short-circuiting the terminal plates (5) and (6) for over five seconds will light up the REF CAL lamp and start the zero adjustment (about 90 seconds).

The zero adjustment of the gas monitor uses fresh air as zero gas. When this function is started, zero gas is supplied to the sample side to automatically adjust zero. During this operation, 4-20 mA output holds the last output value before the adjustment.

Perform the zero adjustment at start-up and also during operation as needed.

CAUTION

Make sure that zero gas is fresh air before performing the zero adjustment.

5-3. Alarm activation

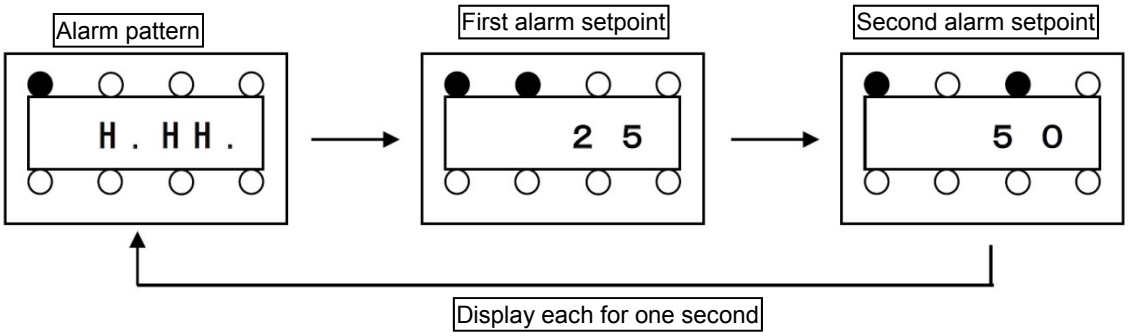
The alarm pattern of FI-815A is "H-HH alarm". The first alarm setpoint "AL1" and the second alarm setpoint "AL2" are used, and alarm activation is caused when the following condition is met. The X in the following table indicates the concentration of measuring gas.

Alarm pattern	First alarm condition	Second alarm condition
H-HH alarm	X ≥ AL1	X ≥ AL2

When a measuring gas concentration meets the first alarm condition, the first alarm contact is activated, causing the AL1 lamp to blink. When a measuring gas concentration no longer meets the first alarm condition, the first alarm contact is reset, causing the AL1 lamp to go out (non latching (auto-reset)). The second alarm is activated as in the case of first alarm.

5-4. How to check alarm setpoint

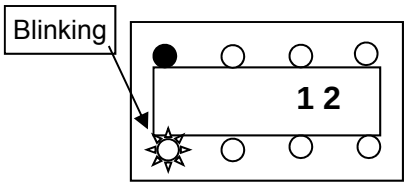
Press the ● mark of the AL./SET switch on the display for over five seconds. While pressing it, the LCD displays "alarm pattern", "first alarm setpoint" and "second alarm setpoint" in turn at one-second intervals (see the following figure). The AL1 lamp lights up while the first alarm setpoint is displayed. Likewise, the AL2 lamp lights up while the second alarm setpoint is displayed. When the control key is released, the concentration display returns automatically.
See "6-6. Setting alarm setpoint" in the maintenance mode for changing the first and second alarm setpoints "AL1" and "AL2".



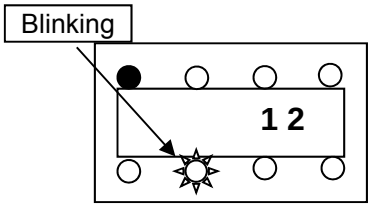
5-5. Caution for sensor deterioration

When sensor deterioration is detected by self diagnosis or during measurement, the BRIGHT or CONT lamp blinks as shown in the lower right figure to display caution for sensor deterioration. Although measurement can be performed with the caution displayed, the system is put into a troubled state when the deterioration state gets worse.

Blinking BRIGHT lamp
Indicates a caution for low light volume. This indicates that the volume of light source for the interferometric sensor has been dropped. Replacement or repair of the interferometric sensor is recommended before measurement becomes unavailable.

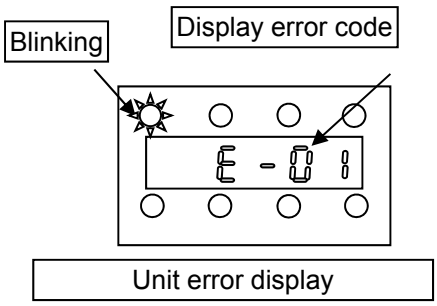


Blinking CONT lamp
Indicates a caution for low contrast. This indicates that the interferometric sensor is heavily contaminated. Replacement or repair of the interferometric sensor is recommended before measurement becomes unavailable.



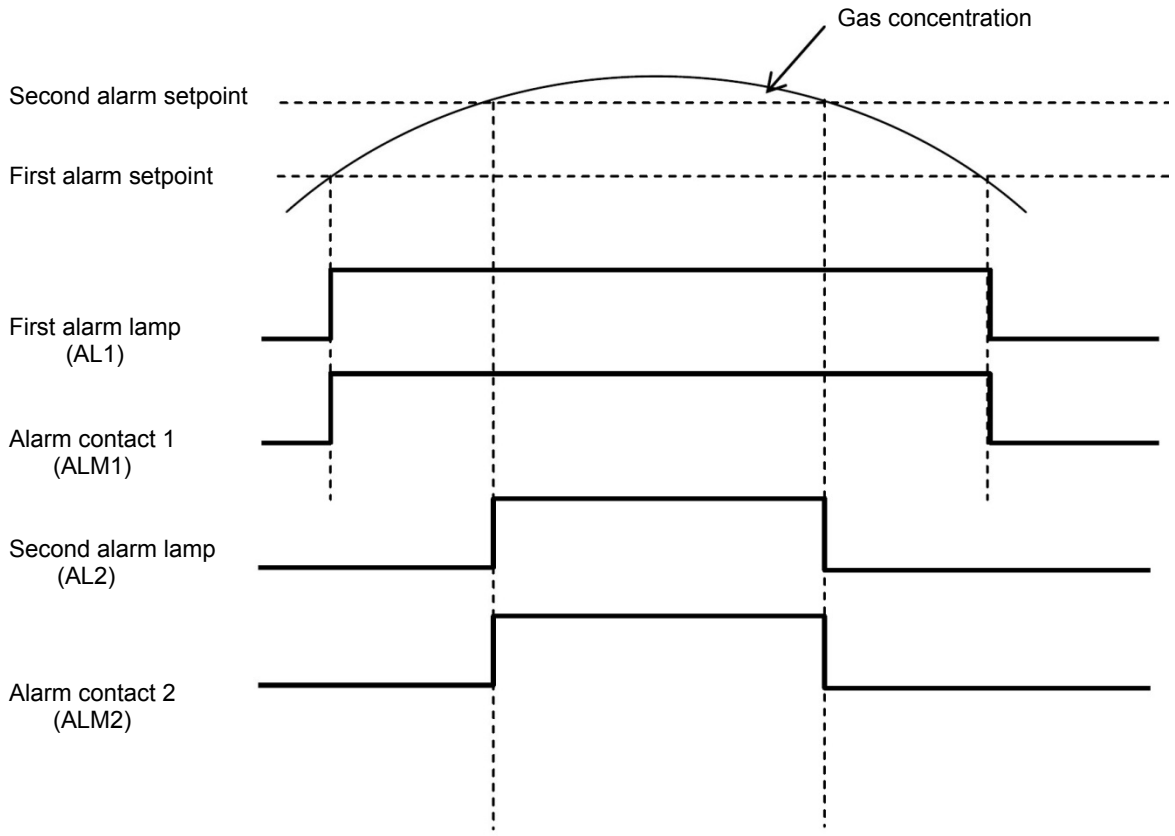
5-6. Error display and remedial actions

When an error (trouble) of the unit is detected, the PW/TR lamp blinks as shown in the right figure, and the fault alarm contact is activated.
At this time, an error code appears on the display, and the 4-20 mA external output is fixed to 0.5 mA.
When an error code appears on the display, measurement cannot be continued. Take a required remedial action promptly.

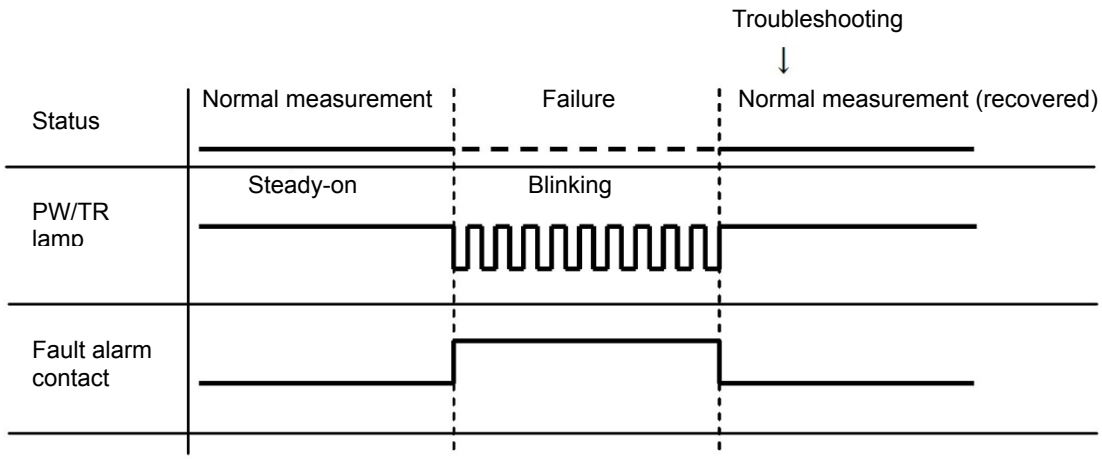


Error code	Error detail and required remedial action
E-00	Abnormality occurs in the system. Repair/replacement of the main PCB is required.
E-01	This indicates that the deterioration state of the interferometric sensor gets worse and measurement is no longer available. The blinking BRIGHT lamp and CONT lamp indicate a significant drop in the volume of light source and a significant drop in contrast, respectively. Both cases require repair/replacement of the interferometric sensor.
E-02	This indicates that the data, such as alarm setpoint, sensor sensitivity and display coefficient, may be damaged. Reset of data or repair/replacement of the main PCB is required.
E-05	This indicates that the flow rate of the measuring gas supplied to the sensor has become zero. Pump failure or clogging in a tube may be a cause.

5-7. Gas alarm pattern (H-HH alarm)



5-8. Trouble alarm pattern

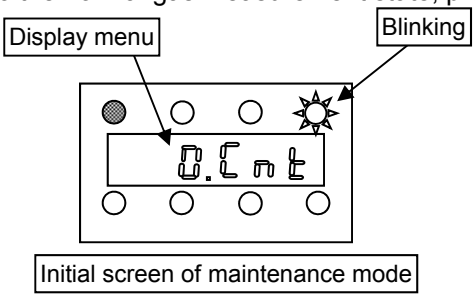


6

How to Operate in Maintenance Mode

6-1. Overview of maintenance mode and each menu

Press the ● mark of the MAINTENANCE switch on the display for over five seconds to enter the maintenance mode. To exit the maintenance mode and return to the normal gas measurement state, press the ● mark of the MAINTENANCE switch for over five seconds again.
When the maintenance mode is entered, the 4-20 mA output holds the last output value before entering the mode and the REF CAL lamp blinks.
Also, the menu shown in the right figure appears on the LCD display when the maintenance mode is entered.
Press the ▼/▲ mark of the UP/DOWN switch to change the menu and press the ● mark of the SET switch to confirm it and proceed to the contents of the selected menu.



CAUTION

Do not turn off the power when the mode is changed. Otherwise, a failure may be caused.

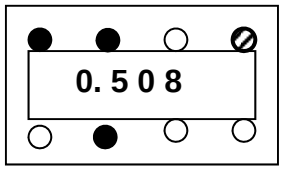
See the following table for each menu item and the process. The detailed description for each menu item is provided in the subsequent pages.

LCD display	Menu detail
0.Cnt	Display contrast of the interferometric sensor
1.bri	Display light volume of the interferometric sensor
2.out	Adjust 4-20 mA external output
3.SPn	Adjust sensor sensitivity (span)
4.AL	Set alarm setpoint
5.tSt	Alarm Test
6.ACC	Set AUTO REF CAL CYCLE
7.Prg	Display ROM number
8.SPE	Display specification number

LCD display	Menu detail
A.CH.P	Display pressure at sensor part
b.CH.t	Display temperature at sensor part

6-2. Displaying contrast of the interferometric sensor

When the SET switch is pressed while the LCD displays 0.Cnt, LEd.1 appears for about one second. After that, the CONT and AL1 lamps light up as shown in the right figure and the contrast of interferometric sensor measured by the light source 1 is displayed.



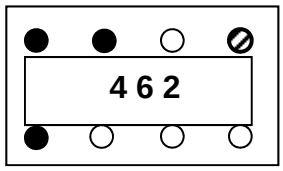
When the ▼/▲ switch is pressed, LEd.2 is displayed and then the contrast of interferometric sensor measured by the light source 2 is displayed.

The contrast is an index of degree of contamination of the interferometric sensor. The value is decreased as the degree of contamination rises. When the contrast falls below 0.35, the CONT lamp blinks during measurement. If it falls to or below 0.30, the system is put into a troubled state (see "5-6. Error display and remedial actions").
Check this value regularly to estimate the extent of contamination or rough replacement timing of the interferometric sensor.

When the ● mark of the MAINTENANCE switch is pressed, 0.Cnt returns on the display.

6-3. Displaying light volume of the interferometric sensor

When the SET switch is pressed while the LCD displays 1.bri, LEd.1 appears for about one second. After that, the BRIGHT and AL1 lamps light up as shown in the right figure and the light volume of light source 1 is displayed.

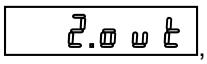


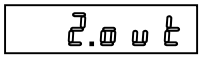
When the ▼/▲ switch is pressed, LEd.2 is displayed and then the light volume of light source 2 is displayed.

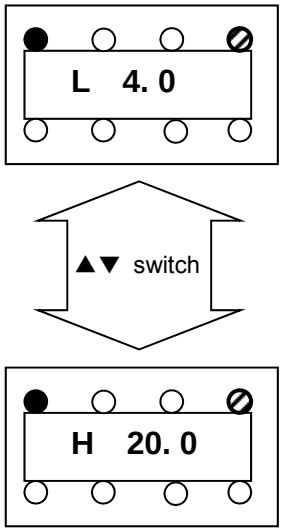
These values are indexes of deterioration of respective light sources. When a light source with the light volume below 256 is detected, the BRIGHT lamp blinks during measurement. If the light volume falls to or below 128, the system is put into a troubled state (see "5-6. Error display and remedial actions").
Check this value regularly to estimate rough replacement timing of the interferometric sensor.

When the ● mark of the MAINTENANCE switch is pressed, 1.bri returns on the display.

6-4. Adjusting 4-20 mA external output

When the SET switch is pressed while the LCD displays  , the display changes as shown in the right figure and a test signal (4 mA) of the minimum scale (0% LEL) is output.
The test signal is changed to that of the full scale (20 mA) and output by pressing the ▼/▲ switch.
When the SET switch is pressed after outputting each test signal, the LCD display blinks. Then press the ▼/▲ switch to adjust each signal level. Press the SET switch to confirm the adjusted value.

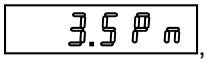
When the ● mark of the MAINTENANCE switch is pressed,  returns on the display.



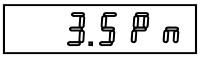
NOTE

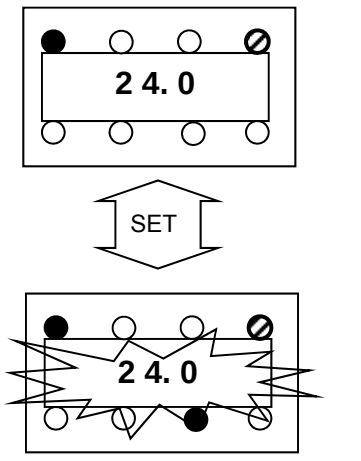
The gas monitor has been adjusted prior to shipment so that the external output becomes 4 - 20 mA. However, the zero point or full scale may slightly vary depending on the condition of the receiver such as a recorder prepared by the customer. Use the method described here to adjust the difference between the output and receiver.
If the difference is significant, check the setting of the receiver.

6-5. Adjusting sensor sensitivity (span)

When the SET switch is pressed while the LCD displays  , the measurement result of the gas supplied from GAS IN is displayed.
When the SET switch is pressed, the display blinks and "SPAN LED" lights up, making the sensor sensitivity adjustment available.

Flow a gas with known concentration, and press the ▼/▲ switch to match the display value with actual value and then press the SET switch to confirm the sensor sensitivity.

When the ● mark of the MAINTENANCE switch is pressed,  returns on the display.

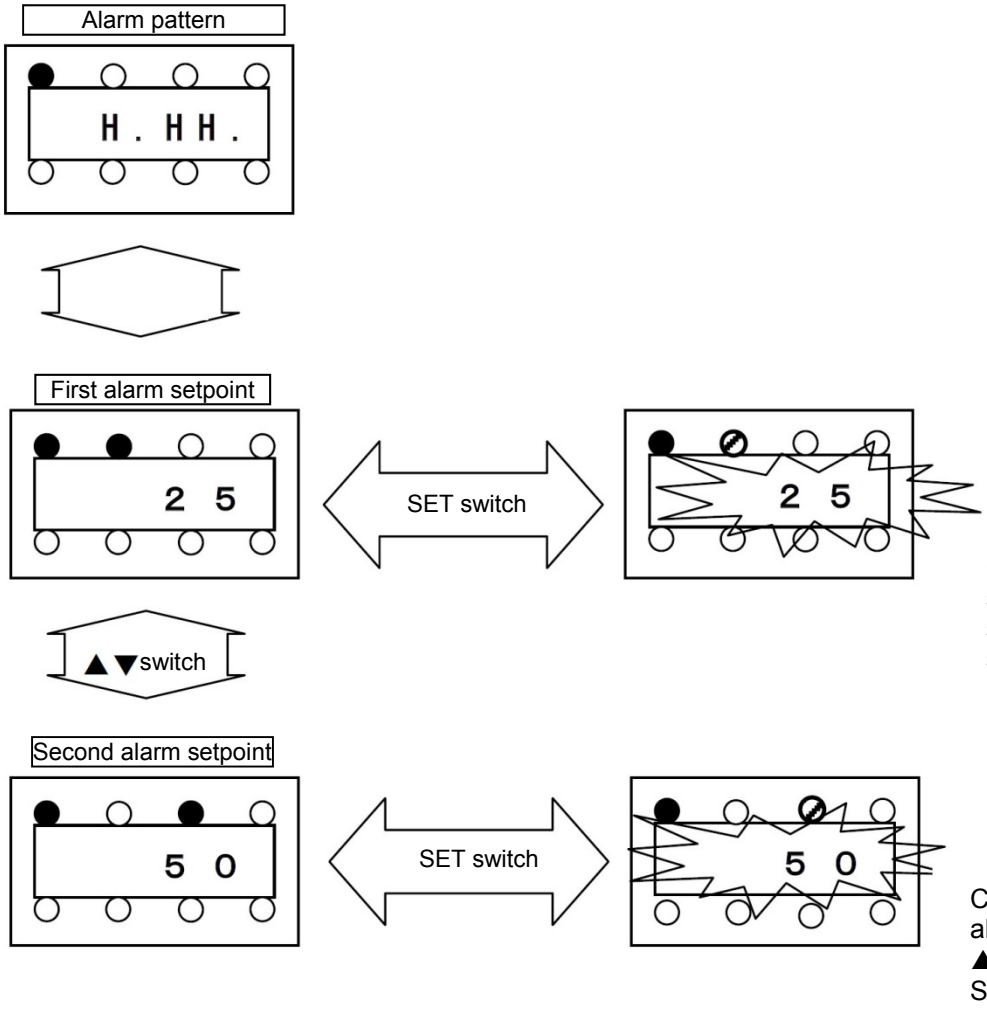


Adjust sensor sensitivity while display is blinking and press SET switch to confirm

6-6. Setting alarm setpoint

When the SET switch is pressed while the LCD displays 4.AL, the alarm pattern of FI-815A used is displayed. When the ▼/▲ switch is pressed next, "first alarm setpoint" and "second alarm setpoint" are displayed. The AL1 lamp lights up while the first alarm setpoint is displayed. Likewise, the AL2 lamp lights up while the second alarm setpoint is displayed.
When the SET switch is pressed while the first alarm setpoint or second alarm setpoint is displayed, the LCD display blinks, allowing a setting change with the ▼/▲ switch. After changing the setting, press the SET switch to confirm it.

When the ● mark of the MAINTENANCE switch is pressed, 4.AL returns on the display.



Change the first alarm setpoint with the ▲/▼ switch. Press the SET switch to confirm.

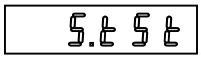
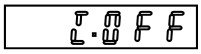
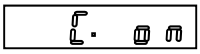
Change the second alarm setpoint with the ▲/▼ switch. Press the SET switch to confirm.

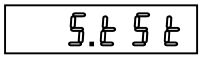
6-7. Conducting alarm activation test

The alarm activation of the unit can be checked.

CAUTION

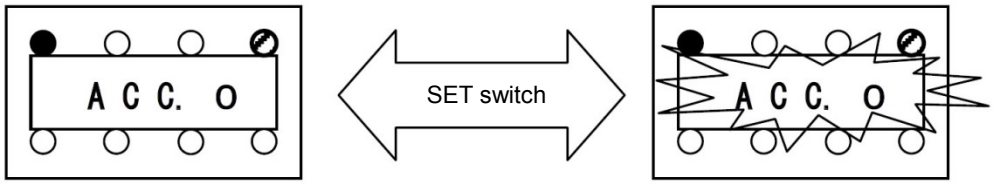
- Since the test involves alarm contact, provide a notification to the related sections and take appropriate actions to avoid affecting the control equipment with false alarms before starting the alarm (transmission) test.

(1) Press the SET switch while the LCD displays  .
(2) Select whether to activate the alarm contact with the ▼/▲ switch and then press the SET switch to confirm it.
 (Not activated) <=>  (Activated)
(3) When the alarm test mode is entered, the test level (zero value) blinks on the LCD display. At this time, the CONT and SPAN lamps start blinking simultaneously when "Activated" is selected for the alarm contact.
(4) Press the ▲/▼ switch to change the test level between 0 and full scale, and over scale.
(The 4-20 mA output level varies with the indication.)
(5) The first alarm activation is caused when the test level meets the first alarm condition.
(The AL1 lamp blinks when the alarm delay time has passed. The first alarm contact is also activated when "Activated" is selected in the step (2).)
(6) The second alarm activation is caused when the test level meets the second alarm condition.
(The AL2 lamp blinks when the alarm delay time has passed. The second alarm contact is also activated when "Activated" is selected in the step (2).)

When the ● mark of the MAINTENANCE switch is pressed,  returns on the display.

6-8. Setting AUTO REF CAL CYCLE

When the SET switch is pressed while the LCD displays 6.ACC, the execution cycle of automatic zero adjustment (REF CAL) is displayed.



Select 0 to 7 with the ▲/▼ switch. Press the SET switch to confirm.

Setting and duration of AUTO REF CAL CYCLE

ACC value	Duration of AUTO REF CAL CYCLE
ACC.0	REF CAL is not executed automatically. (Standard)
ACC.1	Executes zero adjustment automatically every three hours.
ACC.2	Executes zero adjustment automatically every six hours.
ACC.3	Executes zero adjustment automatically every 12 hours.
ACC.4	Executes zero adjustment automatically every day.
ACC.5	Executes zero adjustment automatically every two days.
ACC.6	Executes zero adjustment automatically every seven days.
ACC.7	Executes zero adjustment automatically every 28 days.

6-9. Displaying ROM number

When the SET switch is pressed while the LCD displays 7.Pr6, the program number (manufacturer's reference number) written to FI-815A and sum value are displayed alternately. This function is used by a service engineer for the purpose of checking and not especially important for the customer to use FI-815A normally.

When the ● mark of the MAINTENANCE switch is pressed, 7.Pr6 returns on the display.

6-10. Displaying specification number

When the SET switch is pressed while the LCD displays 8.SPE, the specification number (manufacturer's reference number) of FI-815A used is displayed. This function is used by a service engineer for the purpose of checking and not especially important for the customer to use FI-815A normally.

When the ● mark of the MAINTENANCE switch is pressed, 8.SPE returns on the display.

6-11. Displaying pressure/temperature at sensor part

When the SET switch is pressed while the LCD displays A.CH.P or b.CH.t, the gas pressure (kPa, absolute pressure) or temperature (ºC) around the sensor part is displayed.

7

Maintenance

This product is supposed to be operated continuously over a long period of time. Regular maintenance is necessary to maintain the appropriate performance during the period of use.

- Maintenance Contract -

We recommend you to conclude a maintenance contract with us for regular maintenance including span adjustment, adjustment, maintenance etc. to ensure stable operation and accuracy of the gas monitor. Please contact RIKEN KEIKI for more information on a maintenance contract.

7-1. Maintenance intervals and items

There are various types of maintenance: daily and monthly maintenance performed by the customer once a day and once a month, respectively, and half-yearly and yearly maintenance performed by a specialist from the manufacturer (service engineer).

Daily maintenance

Maintenance item	Detail and judgment
"PW/TR" LED lamp (power lamp)	Check that the lamp lights up continuously. The blinking or extinguished lamp indicates some sort of trouble. Take an appropriate action according to "Troubleshooting".
Reading	If the reading indicates a negative value or clearly abnormal value, execute zero adjustment as needed.
Flow rate	Check that the flow rate is 300 ±25 mL/min and adjust it as needed.
"CONTRAST" LED lamp "BRIGHT" LED lamp	Check that these lamps are off. Blinking lamps indicate that the deterioration state of the interferometric sensor gets worse. If the sensor is further deteriorated, the system is put into a troubled state. Replace the interferometric sensor before measurement becomes unavailable.

Monthly maintenance

Maintenance item	Detail and judgment
Interferometric sensor deterioration	Display contrast of the interferometric sensor and light volume of the interferometric sensor Compare them with the past results and estimate the rate of deterioration or replacement timing of the interferometric sensor.
Filter contamination	Check the degree of contamination of the filter. If it is heavily contaminated, replace the element.
Alarm activation	Conduct an alarm activation test to see if the alarm lamp lights up and the alarm contact is activated.

When monthly maintenance is performed, perform daily maintenance as well.

Half-yearly/yearly maintenance

Maintenance area/item	Detail and judgment
Span adjustment	After performing zero calibration, supply a gas with known concentration from GAS IN and check if the reading is correct. Adjust sensor sensitivity (span) as needed.

When half-yearly/yearly maintenance is performed, daily and monthly maintenance items are checked as well.

Half-yearly/yearly maintenance includes the followings as needed.

(1) Unit cleaning (2) Replacement of parts (3) Replacement of external tubing parts
(4) Function check (5) Others

WARNING

The gas monitor may measure a hazardous gas such as explosive gas continuously for a long period of time. Never fail to perform half-yearly and yearly maintenance to ensure safety.

NOTE

Before starting span adjustment or alarm activation test, provide a notification to the related sections.

7-2. How to replace the fuse

(1) Turn off the power switch of the main unit.

(2) Replace the attached fuse (2A normal fusing type) with new one.

(3) Turn on the power switch and check that the unit operates normally.

CAUTION

The part around the fuse is made of glass. Applying excessive force to it may cause breakage of glass and injury.

7-3. Procedures to store the gas monitor or leave it for a long time

(1) To store the gas monitor, expel the gas from the tubes inside the unit using fresh air, nitrogen etc. so that no measuring gas (especially solvent) remains.

(2) Storage conditions
The gas monitor must be stored under the following environmental conditions.
- In a dark place under the normal temperature and humidity away from direct sunlight
- In a place where gases, solvents or vapors are not present

7-4. List of recommended regular replacement parts

No.	Name	Maintenance intervals	Replacement intervals (year)	Quantity (pieces/unit)
1	MC (ST) filter cartridge (external GAS side)	1 year	1 to 2	1
2	Cylindrical filter CF-8369 (external REF side)	1 year	1 to 4	1
3	Pump	1 year	1 to 2	1
4	Interferometric sensor	1 year	2 to 8	1
5	LCD PCB	- - -	5 to 6	1
6	Main PCB	- - -	7 to 8	1
7	I/O PCB	- - -	7 to 8	1
8	Fuse (2A)	- - -	8	2 pcs
9	Three-way solenoid valve	1 year	7 to 8	1
10	Other tubing parts (including flow meter and low flow sensor)	1 year	7 to 8	2 sets

*1: The above replacement intervals are recommendation only. The intervals may change depending on the operating conditions.
These intervals do not mean the warranty periods either.

*2: The result of the regular maintenance may determine when to replace the parts.

*3: Replacement of main PCB, display PCB or interferometric sensor is required due to deterioration of the capacitor on PCB, etc.

*4: For the interferometric sensor, the rate of deterioration may be increased by contaminants included in a measuring gas.

*5: Use adjusted unit parts and PCB parts.

8

Troubleshooting

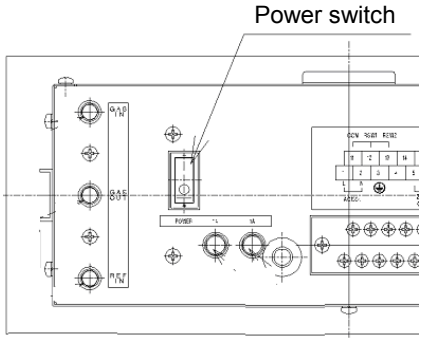
The troubleshooting does not explain the causes of all the malfunctions which occur on the gas monitor. This simply helps to find the causes of malfunctions which most frequently occur.

Symptoms	Causes	Actions
The power cannot be turned on.	Appropriate power is not supplied to the gas monitor.	Supply the rated AC power.
	The internal power switch is not turned on.	Turn on the power switch inside the gas monitor.
	The fuse has blown out.	Replace it with the rated fuse.
Abnormal concentration reading	Zero adjustment was performed wrongly.	Make sure that zero gas is fresh air before performing the zero adjustment.
	An interference gas (other than measuring and base gases) was contained.	The gas monitor cannot measure a gas containing interference gases.
	Dew condensation was caused by water vapor in a tube and a measuring gas was dissolved in the moisture.	Move the gas monitor (including external tubes) into a warmer room, etc. to prevent water vapor from causing dew condensation inside a tube. Note that the gas monitor cannot measure a gas with high humidity which causes dew condensation at a room temperature.
	A measuring gas (especially solvent) condensed (liquefied) in a tube.	Move the gas monitor (including external tubes) into a warmer room, etc. to prevent a measuring gas from condensing. Note that the gas monitor cannot measure a gas which condenses at a room temperature.

9

How to exit

Organic solvent vapor such as toluene has a high adsorptive property. Do not turn off the power in the state with it remaining in the tubing. Make sure that the measurement value returns to zero, clean the tube sufficiently, and then turn off the power switch in the rear of the gas monitor.
Also, check that waterdrops or solvents are attached inside the glass cup of the MC (ST) filter in the gas sampling line. If so, remove the cup for cleaning.



10

Definition of Terms

The terms used in this manual are defined as follows.

Lower explosive limit	The lowest concentration of a combustible gas in air capable of causing explosion when ignited.
%LEL	A percentage unit of the concentration of a combustible gas assuming the lower explosive limit (LEL) of the combustible gas as 100.
vol%	Concentration of gases, etc. indicated in the unit of one-hundredth of the volume.
Grounding	Connect the grounding terminal of the gas monitor to the specified equipment to avoid a risk of electric shock.
Measuring gas	A gas targeted for measurement which is contained in a sample gas.
Base gas	The gas other than the measuring gas in a sample gas. Basically, the gas monitor performs measurement in the atmosphere. Therefore the base gas for the gas monitor is AIR (fresh air).
Reference gas	A gas used as a reference for measuring concentration (reference for refractive index). The gas monitor uses air as a reference gas.

11

Disposal of Product

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

12

Product Specifications

12-1. Standard specifications

Measuring principle	Optical Interferometric Method
Measuring gas	Solvent vapor in atmosphere
Concentration display	LCD digital display
Measuring range	0 - 100% LEL
Display resolution	1% LEL
Sampling method	Sample-drawing
Suction flow rate	1 L/min or more (Open flow rate)
Setting flow rate for measuring gas	300±25 L/min
Accuracy of the reading (under the same conditions)	±3% LEL
Response time (under the same conditions)	90% response within 15 seconds (excluding delay time in the tube)
Gas alarm type	Two-step alarm (H-HH)
Gas alarm display	1st: AL1 lamp on/2nd: AL2 lamp on
Gas alarm pattern	Non latching (auto-reset)
Gas alarm contact	No-voltage contact 1a or 1b De-energized (energized at an alarm) or energized (de-energized at an alarm)
Fault alarm/self diagnosis	Low flow rate/low light volume/low contrast
Contact capacity	125 VAC, 1 A/30 VDC, 1 A (Resistance load)
Contact cable	Equivalent to CVV1.25 sq
Transmission system	Analog transmission system
Transmission specifications	4 - 20 mA DC (Source current, load resistance under 300 Ω, minimum resolution under 0.01 mA)
Transmission cable	Equivalent to CVVS1.25 sq
Power supply cable	Equivalent to CVV1.25 sq
Power supply	100 VAC±10%, 50/60 Hz
Power consumption	Max. 17 VA
Tube connecting port	Rc1/8
Operating temperature	-10 - +50ºC
Operating humidities	Below 95% RH (Non-condensing)
Structure	Rack mounting type (Multi-stage installation possible)
Dimensions	Approx. 370 (W) x 150 (H) x 266 (D) mm
Weight	Approx. 6 kg

* Specifications subject to changes without notice.

* Gas condensed inside the gas monitor is not possible to be measured.

12-2. Standard accessories

- Control key ····· The supplied quantity depends on the number of units to be delivered.

1 to 10 units	One
11 to 20 units	Two
21 to 50 units	Three
Over 51 units	Four

- FI-815A operating manual ····· 1
- Fuse (2A normal fusing type) · The supplied quantity depends on the number of units to be delivered.

1 to 10 units	Two
11 to 20 units	Four
21 to 50 units	Six
Over 51 units	Eight

- MC (ST) filter ····· 1
- Cylindrical filter CF-8369 ····· 1

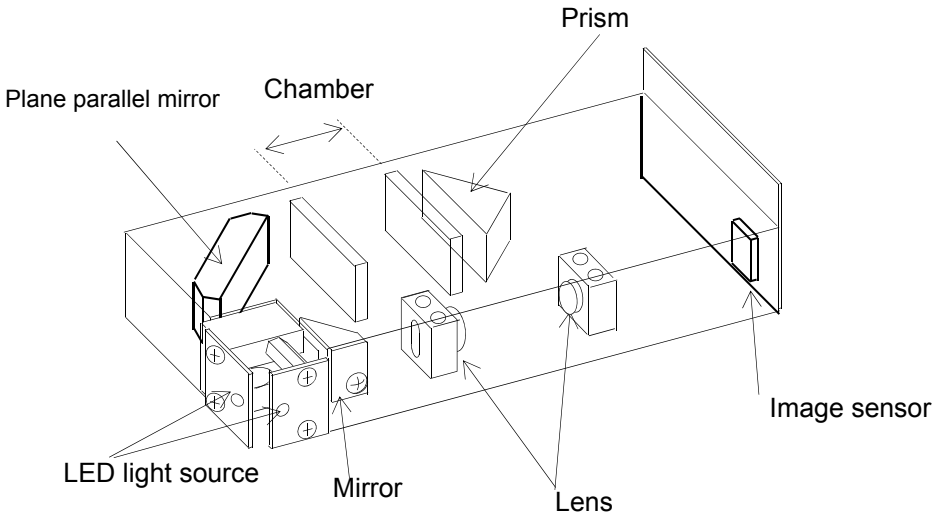
12-3. Measuring principle

The refractive index of gases is determined by the types of composing gases and the mix ratio. When a mixed gas consists of two different gases and the types are known, the mix ratio (concentration) can be obtained by measuring the refractive index.

The optical interferometric sensor used for the concentration meter forms an "interference fringe" that moves in proportion to changes in refractive index on the image sensor. Then the interference fringe is captured by the image sensor and converted into a refractive index after calculating the move amount of interference fringes with a high degree of accuracy through the fast Fourier analytical processing.

The "concentration" display of various mixed gases is enabled by inputting the data such as type and refractive index of "measuring gas" and "base gas" that compose a mixed gas to the "refractive index" calculated with high accuracy.

The sensitivity of optical interferometric sensor depends on the length of the chamber that flows gases. Because the chamber length is physically unchangeable, high accuracy is maintained over a long period of time.



Schematic view of optical interferometric sensor