PT5E-0521

RIKEN KEIKI

High Sensitivity Toxic Gas Monitor

FP-300AGZS

Operating Manual

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Preface

Thank you for choosing our high sensitivity toxic gas monitor FP-300AGZS.
Please read and understand this operating manual thoroughly before use to operate the gas monitor properly.
Note that the contents of this manual are subject to change without notice for product improvement. Also, any copying or reproduction of this manual, in whole or in part, without permission is prohibited.
This manual uses following symbols to describe the degree of danger or damage caused by improper handlings without adherence to instructions.

Definition of DANGER, WARNING, CAUTION, and NOTE

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>

1

Outline of the Product

1-1. Overview

Special material gases which are used in large quantities in semiconductor manufacturing process, are highly toxic. Because leakage of these gases poses a danger to human body, Security Regulation for General High-Pressure Gas requires facilities using these gases to install a gas detection and alarm system.
A gas detector used for continuous monitoring of slight gas leakage from a gas cylinder room or production line must be highly reliable and stable for a long time.
This gas monitor features highly reliable gas detection of low concentration gases and also long-term stability by resetting (zero level) after a gas detection.
Main functions and features of the gas monitor are as follows:

- The gas monitor adopts a two-step alarm system consisting of precautionary alarm and main alarm.
- A cassette type gas detection tape can provide easier replacement.
- The specified performance of the gas monitor can be maintained by just replacing a cassette type gas detection tape every other month.
- If the gas to be detected drawn by a pump makes contact with a gas detection tape, the tape will give a color reaction according to the gas concentration. The rate of change in produced color (optical reflectance change) before and after a gas contact is detected and converted into gas concentration.
- The gas monitor is little affected by interference gases like alcohol and hydrogen gas under its detection principle.

1-2. Precautions

WARNING

Abnormal heat, smoke, sound or odor

In case any abnormality occurs during use, stop using the gas monitor immediately and turn the power off. Continuing to use the gas monitor in such situations may cause electric shock or fire.

CAUTION

Contact with edges of metal, etc.

Be very careful when you need to touch the edges of steel sheets, plastic parts, etc. for relocation or other reasons.

WARNING

Shocks by dropping, etc.

Do not drop or give a shock by hitting, etc. to the gas monitor.
It may disturb the proper operation and gas detection of the gas monitor as it consists of precision electronic parts.

WARNING

Use in locations with high temperature/humidity or dusty places

- Do not store or use the gas monitor in locations with high temperature/humidity or dusty places. It may cause the gas monitor to malfunction, or electric shock or fire. Use the gas monitor within the operating temperatures and humidities.
- When the gas monitor is exposed to large temperature difference, such as when moved from a warm place to a cold place, condensation may be formed on the surface or inside the gas monitor. Using the gas monitor in such condition cannot provide correct detection. It may also result in failure. When the gas monitor is relocated, leave it in a new installation site for a few hours to adjust it to the ambient temperature.

CAUTION

Use in unstable location

Do not install the gas monitor under unstable conditions, such as on an inclined surface, in a narrow or vibrating area. It may cause the gas monitor to fall or topple during use, posing a risk of injury or damage to the gas monitor.

WARNING

Connection of grounding wire

Connect the grounding wire to the grounding terminal to avoid a risk of electric shock.
Ignoring this may cause electric shock.

WARNING

Power supply to be used

Make sure to use the gas monitor on the specified power voltage. Ignoring this may damage the gas monitor or cause electric shock or fire.

WARNING

Overloaded electrical outlet

Avoid connecting many power plugs to the same electrical outlet which can cause overloading. Not only does it pose a risk of fire, but it also affect other devices when the circuit breaker trips due to overloading. Also, it makes the gas monitor vulnerable to noise from power source, thus causing malfunction.

WARNING

Intrusion of foreign substances

Prevent metallic or flammable materials from entering inside of the gas monitor when replacing the cassette, etc. Using the gas monitor with such material entered inside may cause malfunction, electric shock or fire.

WARNING

Leaving object on gas monitor

For the tabletop type, do not place containers filled with water, such as vases and flower pots, or small metallic objects like pins and clips on the gas monitor. Using the gas monitor with such object entered inside may cause failure, electric shock or fire.

CAUTION

Use of gas detection tape cassette

- Store a gas detection tape cassette in the refrigerator without taking it out of the package. If it is taken out of the package to store or left attached to the main unit of the gas monitor, the tape may become discolored and unable to maintain the specified performance. After opening the package, use the gas detection tape cassette as soon as possible.
- Indication accuracy cannot be guaranteed for those with expired storage period. Also, for safety reasons, do not use such tape cassette.
- Since the special reagent is applied on the tape, do not touch it with bare hands. It does not affect human body, but may cause deterioration of the detection performance or cut of the tape.
- The tape replacement cycle is 62 days under no-gas conditions. The replacement cycle is shortened by detection of gas.
- The gas detection tape cassette is designed specifically for our gas monitors. Do not attempt to install it to other devices. It may result in failure.
- When opening the package, slight discoloration may be seen depending on the tape type, storage condition, etc., however, it does not affect the gas sensitivity.

CAUTION

Use after verifying that the reading on the flow rate indicator corresponds to the specified flow rate (flow rate lamp lights in green)

If it does not correspond to the specified flow rate, gas detection cannot be performed properly. Check if the flow rate is unstable or dropped.

WARNING

Condensation within tube

Condensation formed inside the tube causes clogging or gas adsorption, which may disturb accurate gas detection. Thus, condensation must be avoided. In addition to the installation environment, carefully monitor the temperature/humidity of the sampling point to prevent condensation inside the tube. In particular, when detecting a gas which is dissolved into water and corrodes contacted materials, such as a strong acid gas, the gas is undetectable and furthermore may corrode internal parts. Please observe the operating restrictions.

2

Product Functions

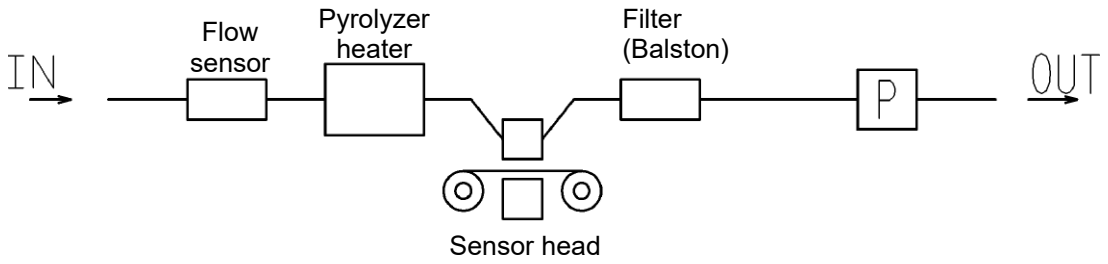
2-1. List of accessories

The gas monitor is accompanied by the following accessories. Check these items when the gas monitor is delivered.

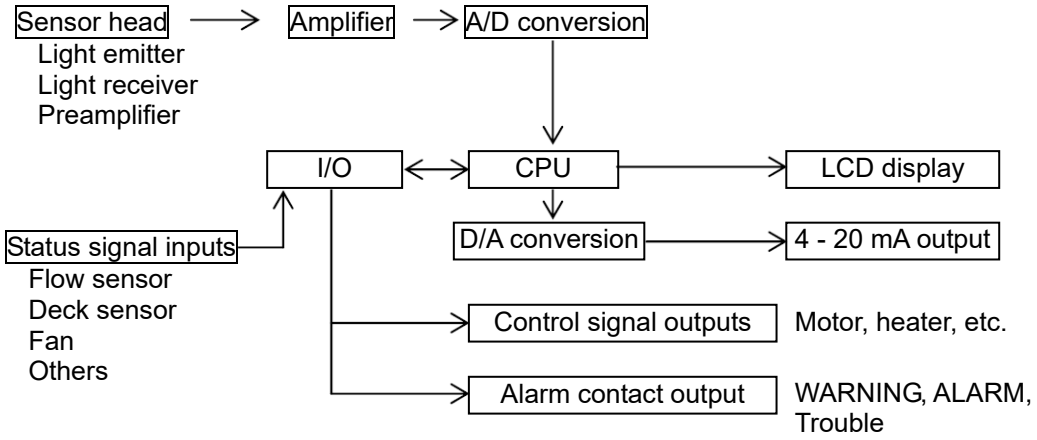
- Gas detection tape cassette: 1
- Dust filter: 1
- Operating manual : 1

2-2. Block diagram

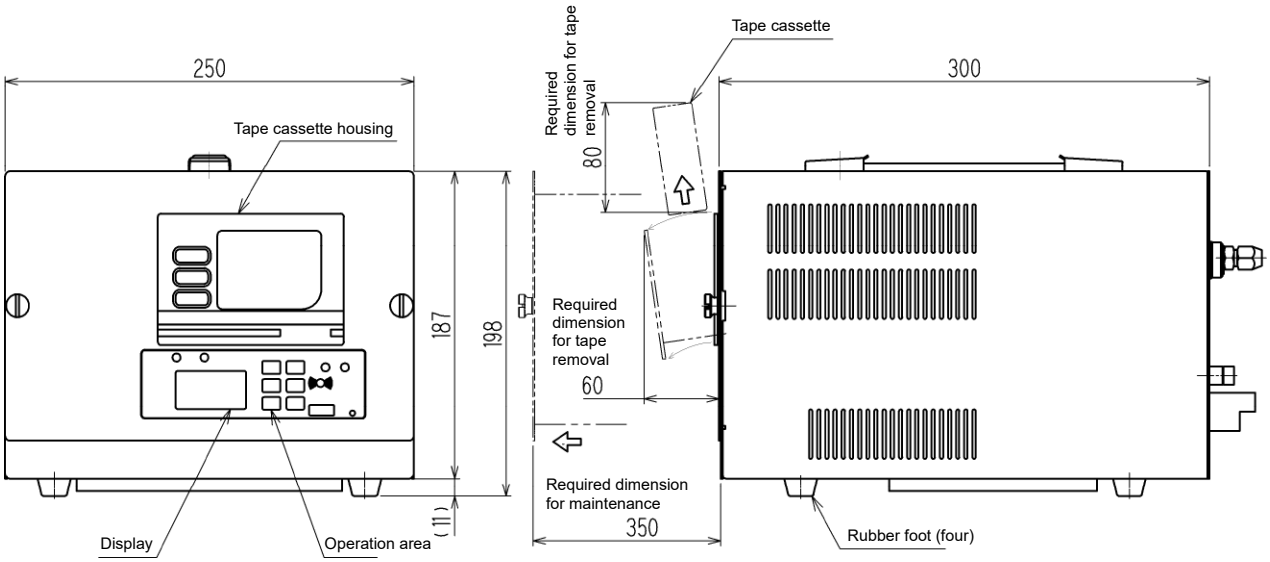
Tubing diagram



Electric block diagram

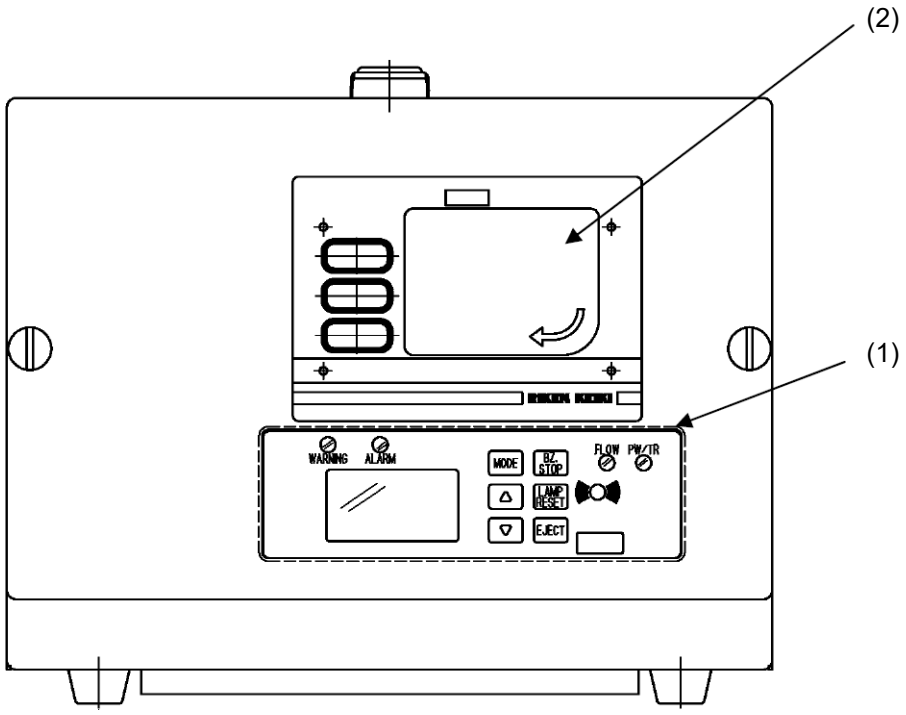


2-3. Outline drawing



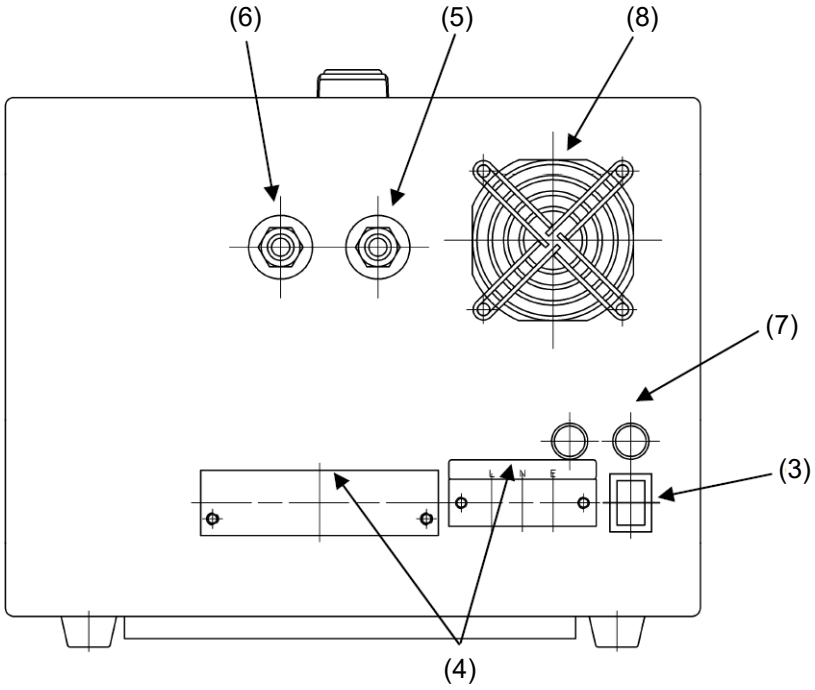
2-4. Part names

2-4-1. Front panel



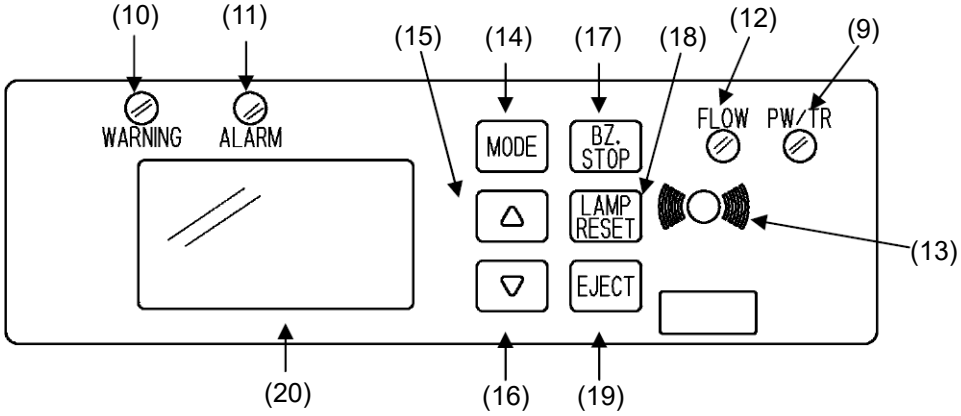
(1) Operation panel: Provide various operations and display. See "2-4-3. Operation panel".
(2) Cassette tray: Hold a gas detection tape cassette.

2-4-2. Rear panel



(3) POWER switch: Turn ON/OFF the power.
(4) Terminal plate for external connection: See “3-3-2. Terminal diagram”.
(5) GAS IN half-union: Connect an O.D Φ 6 mm Teflon tube.
(6) GAS OUT half-union: Connect an O.D Φ 6 mm Teflon tube.
(7) Fuse: 3A x 2 pcs
(8) Fan

2-4-3. Operation panel



(9) POWER/TROUBLE lamp: Green lamp
Lights up continuously in normal condition (gas detection state) and blink when a trouble occurs.

(10) WARNING lamp: Yellow lamp
(Precautionary alarm) Goes out in normal condition.
Blinks or lights up when alarm is triggered.

(11) ALARM lamp: Red lamp
(Main alarm) Goes out in normal condition.
Blinks or lights up when alarm is triggered.

(12) FLOW lamp: Green/orange/red lamp
Normal flow rate: Lights in green continuously
Unstable flow rate: Lights in orange continuously.
Flow rate dropped: Lights in red continuously.

(13) Buzzer: Main alarm: Continuous sound (continuous beep)
Precautionary alarm: Intermittent sound (beep, beep)
Switch operation: Single short sound (blip)

(14) MODE switch: When pressed and held over three seconds in gas detection state, the maintenance mode which provides alarm test, etc. is entered.

(15) △ (UP) switch:
- Increases the flow rate when pressed in gas detection state. (When the flow rate auto-adjustment is OFF)
- When pressed in maintenance state, the mode selection becomes available.

(16) ▽ (DOWN) switch:
- Decreases the flow rate when pressed in gas detection state. (When the flow rate auto-adjustment is OFF)
- When pressed in maintenance state, the mode selection becomes available.

(17) BZ STOP switch: When pressed after alarm is triggered, buzzer sound stops and the alarm lamps ((10), (11)) change from blinking to lighting up continuously.

(18) LAMP RESET switch:
- When pressed after pressing the buzzer stop switch ((17)) during an alarm activation, the alarm lamps ((10), (11)) go out with the gas concentration settles below the alarm setpoint and the external output contact is deactivated.
- When pressed while more than one trouble occurs on the gas monitor, details of the troubles can be checked in turn. (See “7-1. self-diagnostic function”.)
- When pressed in gas detection state, an alarm setpoint will be displayed on LCD ((20)).

(19) EJECT switch: Pressing and holding this switch for about two seconds opens the cassette tray on the front side of the main unit for removing/attaching a gas detection tape cassette.

(20) LCD: Displays various comments including detection gas concentration.

3

How to Use

3-1. Handling precautions for installation

(1) Hold the handle on the top to lift or carry the gas monitor.

CAUTION

Do not hold the cassette tray to lift or carry the gas monitor. It may damage the cassette tray and cause the gas monitor to fall, resulting in breakage or injury.

(2) For the gas monitor, select an installation site easily accessible and viewable during an alarm activation and comfortable for gas detection tape cassette replacement, flow adjustment and maintenance work.

WARNING

Do not place containers filled with water, such as vases and flower pots, or small metallic objects like pins and clips on the gas monitor. Using the gas monitor with such object entered inside may cause failure, electric shock or fire.

(3) Do not install the gas monitor in the following locations. Ignoring this may result in failure or accident.

- Places exposed to direct sunlight
- Dusty or dump places
- Places exposed to direct wind
- Places with frequent vibrations
- On unstable or inclined surfaces
- Outdoors or places exposed to water

WARNING

- Do not store or use the gas monitor in locations with high temperature/humidity or dusty places. It may cause the gas monitor to malfunction, or electric shock or fire.
- When the gas monitor is exposed to large temperature difference, such as when moved from a cold place to a warm place, condensation may be formed on the surface or inside of the gas monitor. Using the gas monitor in such condition cannot provide correct detection. It may also result in failure.
  When the gas monitor is relocated, leave it in a new installation site for a few hours to adjust it to the ambient temperature.

CAUTION

Do not install the gas monitor under unstable conditions, such as on an inclined surface, in a narrow or vibrating area. It may cause the gas monitor to fall or topple during use, posing a risk of injury or damage to the gas monitor.

(4) The gas monitor consists of precision electronic parts. Install it on a level surface in a safe place, with care not to drop or hit it against something.

WARNING

Do not drop or give a shock by hitting, etc. to the gas monitor. It may disturb the proper operation and gas detection of the gas monitor as it consists of precision electronic parts.

(5) Avoid noise from a large-capacity transformer, motor or driving power source, or devices generating high voltage.
(6) To prevent malfunction caused by radio disturbance, a transceiver or mobile phone should be used at least 1 m away from the gas monitor.

3-2. Tubing

(1) For both In and OUT, the tube must be no longer than 20 m.
(2) Use an O.D Φ 6 mm Teflon tube.
(3) The tube from GAS OUT must be connected to the specified exhaust duct.
(4) Attach the provided filter to GAS IN before connecting a tube.

CAUTION

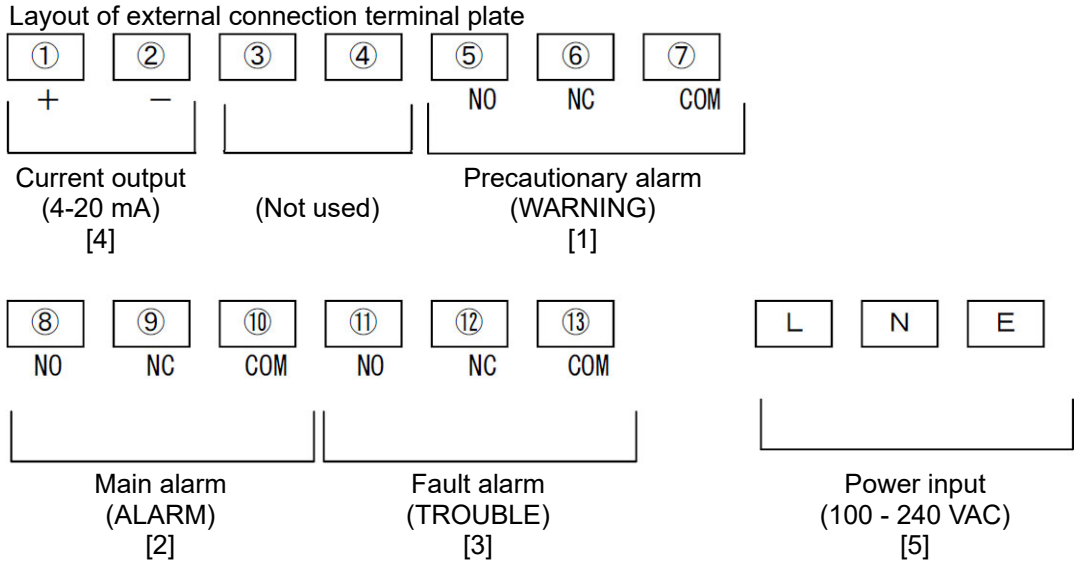
- For adsorptive gases, the appropriate tube length varies depending on the degree of adsorption.
- For more information about adsorptive property of gases and tube length, please contact RIKEN KEIKI.

3-3. Wiring

3-3-1. Precautions

(1) Use a shielded cable (CVVS cable, etc.) for signal cables like current output to minimize the influence of noise.
(2) Turn the power switch OFF (○ side) before wiring. If wiring is performed with the power switch turned on, the gas monitor may be damaged by short circuit, etc.

3-3-2. Terminal diagram



[1] Precautionary alarm (WARNING) output.....No-voltage contact ("c" contact)
[2] Main alarm (ALARM) output .....No-voltage contact ("c" contact)
[3] Fault alarm (TROUBLE) .....No-voltage contact ("c" contact)
[4] Current output (4 - 20 mA).....Pay attention to the polarity.
Concentrations between 0 and F.S. are output to the linear.
0: 4 mA
F.S.: 20 mA
Trouble: 0.5 mA
Initial clear: 2.5 mA
Maintenance: 2.5 mA
Gas concentrations over F.S. can be output up to 22 mA.
[5] Power input.....100 - 240 VAC

Each alarm contact is rated at 125 VAC 0.5 A. Depending on the load to be connected, a protective part like spark killer may be required to maintain the performance.

3-4. Gas detection tape cassette

The gas detection tape cassette (FC type) is designed specifically for the gas monitor.
Understand the following information thoroughly before use.

3-4-1. Handling gas detection tape cassette

CAUTION

Do not touch the detection tape.

Since the special reagent is applied on the detection tape, do not touch it with bare hands. It does not harm human body, but may cause deterioration of the detection performance or cut of the tape.

WARNING

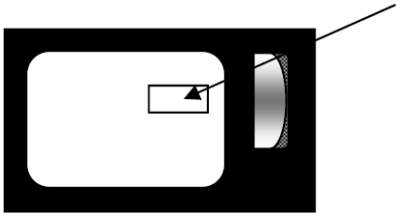
Do not use a gas detection tape cassette that has passed its expiration date.

The gas detection tape cassette should be used within two months. Indication accuracy of the detection tape after two months from opening the package cannot be guaranteed. For safety reasons, do not use such detection tape.

NOTE

Specify the start date of using a gas detection tape cassette.

Make sure to record the start date of use since it helps to remember the timing of detection tape replacement.



CAUTION

Use the gas detection tape cassette of the specified model.

The detection tape varies depending on the detectable gas. Check for the specified model of the detection tape before use.
Gas detection cannot be performed with a detection tape of inappropriate model.
The appropriate model of detection tape is displayed on LCD while the cassette tray is opened.

CAUTION

Check the display on the gas monitor every day to replace the gas detection tape cassette without fail.

- The replacement cycle of gas detection tape cassette is 62 days under no-gas conditions. The replacement cycle is shortened by detection of gas because tape feed is executed.
  Also, removing/attaching the gas detection tape cassette unnecessarily or turning ON/OFF the power consumes the tape, resulting in shortened replacement cycle. If possible, use a new gas detection tape cassette and use it up.
- Note that if the gas detection tape cassette is repeatedly removed and attached unnecessarily, the indication of remaining amount becomes inaccurate.
- When the indication of remaining days for the detection tape becomes two days, the message "CHANGE TAPE" is displayed on LCD, and the POWER/TROUBLE lamp blinks to prompt the operator to replace the detection tape. When the detection tape is used up completely, "TAPE END" is displayed. Since gas detection cannot be performed, replace the detection tape promptly.
- See "6-3 How to replace gas detection tape cassette" when attaching the gas detection tape cassette to the main unit.

CAUTION

Do not insert the gas detection tape cassette into devices other than the specified gas monitor.

The gas detection tape cassette (FC type) is designed specifically for the gas monitor.
Do not attach it to other devices. Also, do not rewind and use the gas detection tape cassette.

CAUTION

Do not apply excessive force to the detection tape.

When you turn the tape winding part with your hand to make the tape tight or for other reasons, be careful not to apply excessive force or stretch the tape too much. The detection tape may be cut. In principle, the tape winding part should not be turned.

CAUTION

When opening the package, slight discoloration may be seen depending on the detection tape type, storage condition, etc., however, it does not affect the gas sensitivity.

3-4-2. Managing gas detection tape cassette

CAUTION

Store a gas detection tape cassette in the refrigerator without taking it out of the package. Be careful not to put it in the freezer.

The detection tape is extremely delicate. Inappropriate management impairs the detection tape performance and disturbs accurate gas detection. Understand the following instructions for management thoroughly before storing the detection tape.

CAUTION

Once a gas detection tape cassette is taken out of the package, do not store it.

Even though a gas detection tape cassette, which has been taken out of the package, is returned in the package and stored in the refrigerator, do not use it after two months. The detection tape may be deteriorated and unable to maintain the specified performance.

CAUTION

Use the gas detection tape cassette within the specified storage period.

- Attach and use up the gas detection tape cassette within the storage period specified on the package. The detection tape with expired storage period may be deteriorated and unable to maintain the specified performance.
- If it is taken out of the package to store or left attached to the main unit of the gas monitor inadvertently or for storage purpose, the detection tape may become discolored and unable to maintain the specified performance. Therefore, after opening the package, use it as soon as possible.

3-4-3. Returning gas detection tape cassette

Please return the used tape with case to us. We dispose it properly at our end.

4

How to Operate

4-1. Preparation

4-1-1. Check items

- Tubing: Check that the specified requirements (tube material, length, etc.) are observed. See "3-2 Tubing".
- Wiring: Check that the connection of external output, etc. is done correctly. See "3-3 Wiring".

4-1-2. Power input

Understand the following information thoroughly before turning on the power.

- Make sure that the power switch of the gas monitor is OFF (○ side).
- Make sure that the power voltage matches the power voltage specified on the gas monitor.

WARNING

Make sure to use the gas monitor on the specified power voltage. Ignoring this may damage the gas monitor or cause electric shock or fire.

WARNING

To prevent a risk of electric shock, ground the gas monitor using a grounding wire. Ignoring this may cause electric shock. Use the E bolt on the rear side of the main unit.

- Use the power supply away from devices consuming large amount of power such as large-scale motor.
- Avoid overloading electrical outlet.
- Avoid damage on the power cable. Also, do not bend, stretch or apply excessive force on the power cable.

4-1-3. Power-on

Turn the power switch of the gas monitor from OFF (○ side) to ON (I side).
The gas monitor is powered on and brought into detection state.

NOTE

After power-on, tape feed is always executed. Turning ON/OFF the power unnecessarily with the tape attached can shorten the tape life.

NOTE

If a high concentration gas is present after turning on the power with the detection tape attached, alarm will be triggered even before the gas monitor is brought into detection state. However, because the gas monitor is not in detection state yet, the concentration display cannot provide accurate information.

4-1-4. Attaching gas detection tape cassette

Attach the gas detection tape cassette suitable for the detectable gas.
Check that the tape model is appropriate for the detectable gas.
For details, see "6-3 How to replace gas detection tape cassette". After a gas detection tape cassette is attached (cassette tray is closed), the gas monitor enters detection state in approximately one minute.

NOTE

After the tape cassette is attached, tape feed is always executed once. Removing/attaching the tape unnecessarily can shorten the tape life.

NOTE

If a high concentration gas is present immediately after attaching the tape cassette, alarm will be triggered even before the gas monitor is brought into detection state. However, because the gas monitor is not in detection state yet, the concentration display cannot provide accurate information.

4-1-5. Flow rate

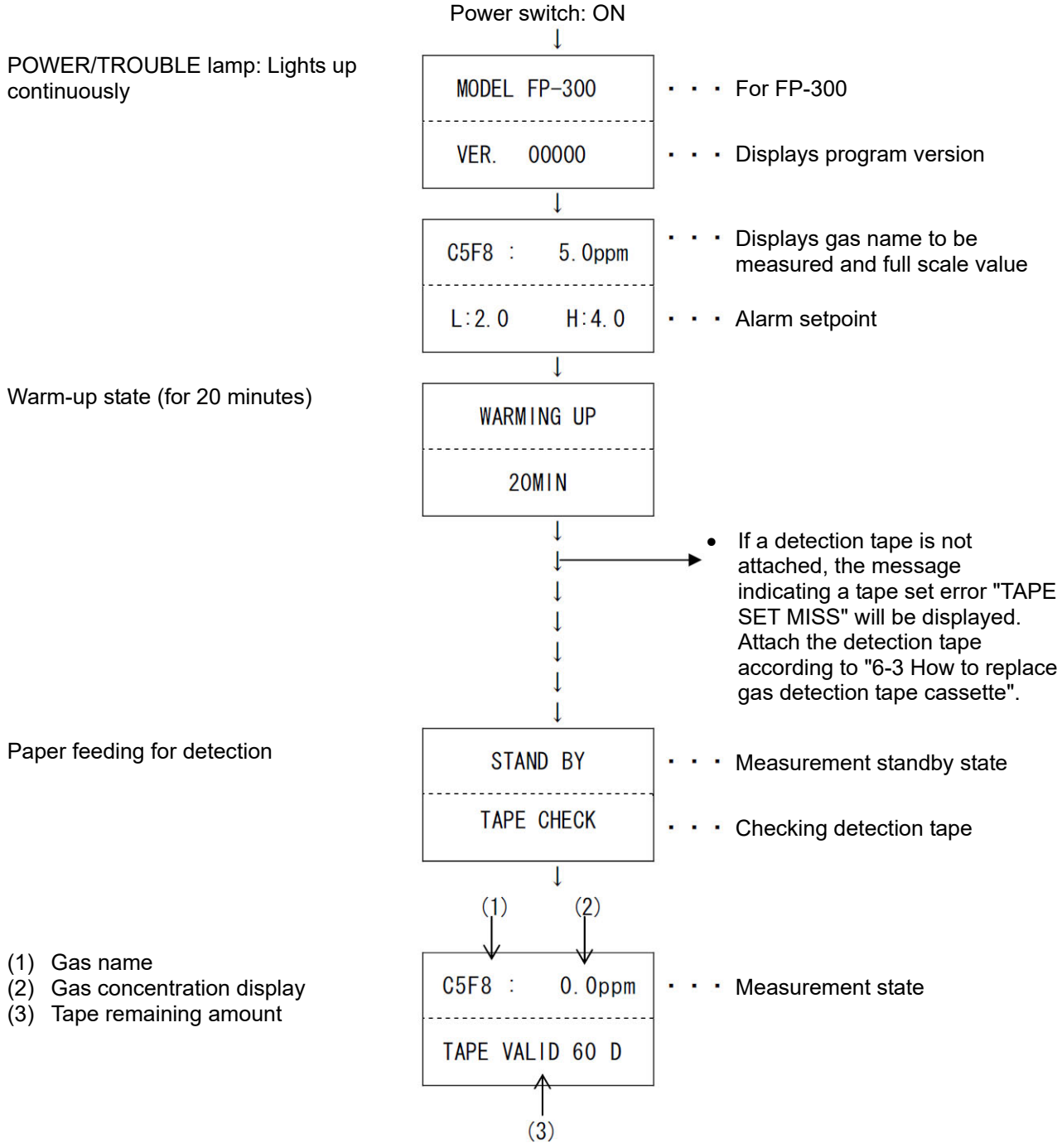
Because the suction flow rate of the gas monitor is automatically adjusted by the flow rate control function, the flow rate, in principle, does not need to be controlled. If the flow rate goes out of the specified flow rate for some reasons, the flow lamp turns from green to orange, but the flow rate will be adjusted automatically.

CAUTION

If the auto-adjustment cannot be performed (due to tube clogging, leak, etc.), the message indicating dropped flow rate "FAIL=FLOW" will be displayed. In this case, identify the cause and take appropriate actions.

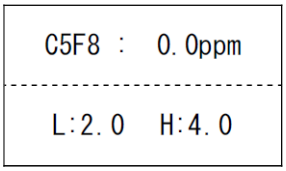
4-2. Operation

When the power switch on the front panel is turned ON (I side), the gas monitor performs function check and displays necessary information, and then enters detection state.



4-3. Simple check of alarm setpoint

Under normal measurement state, an alarm setpoint is displayed for about two seconds as shown below by pressing the LAMP RESET switch on the front panel.
Note that the normal measurement state means the state where no gas alarm or fault alarm is triggered.



- L: Precautionary alarm (WARNING)
- H: Main alarm (ALARM)

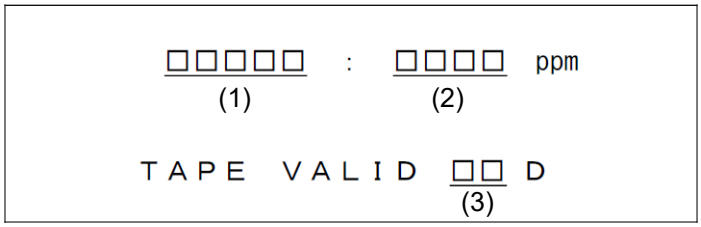
5

Functions

5-1. LCD display

5-1-1. Display format

The LCD display uses the following format.



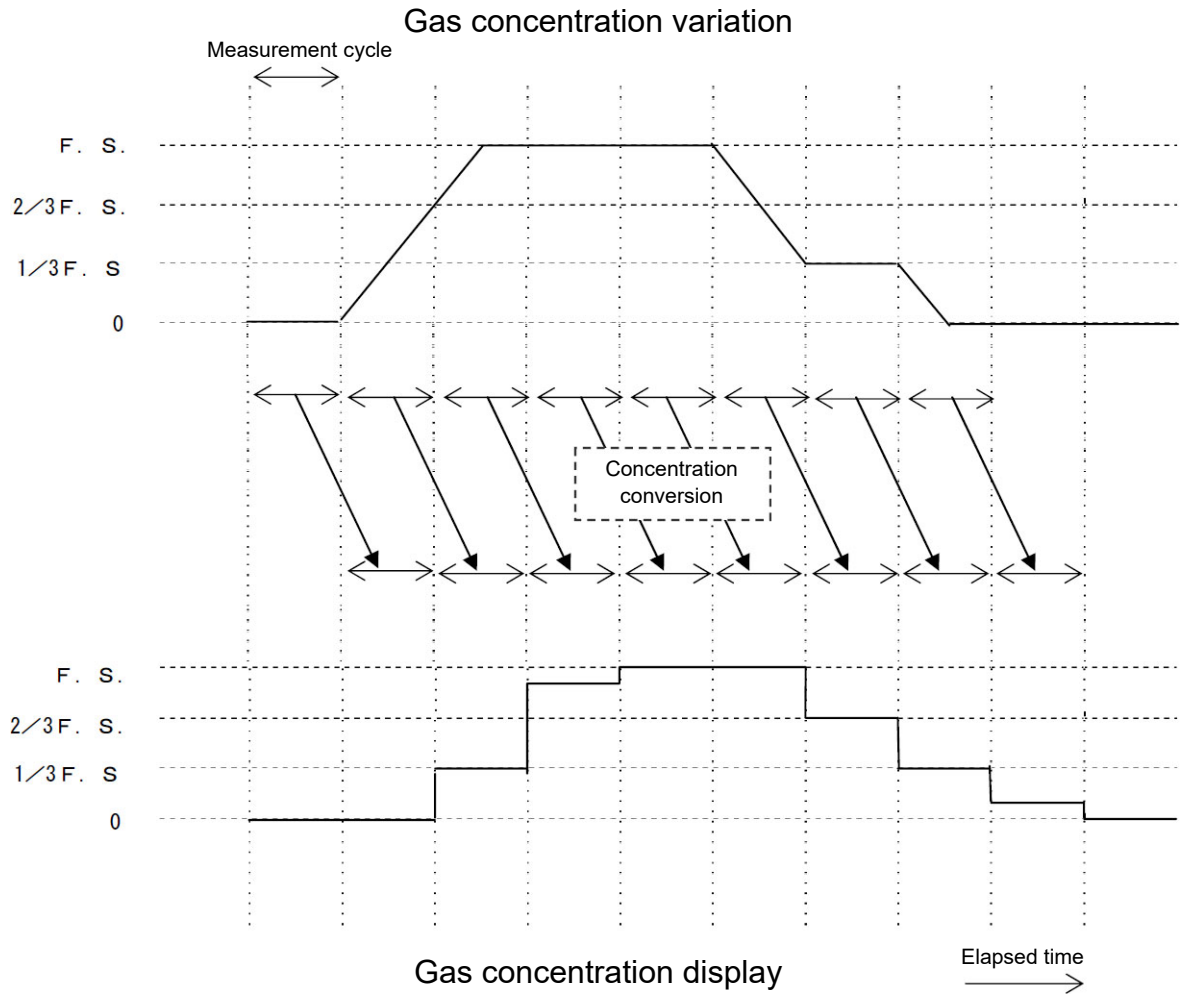
(1) Displays a gas name in chemical formula, etc. ..... Example) C5F8
(2) Displays a gas concentration. ..... Displayed in ppm.
(3) Displays remaining days for detection tape.

5-1-2. Gas concentration display

The gas monitor provides the following features of gas concentration display.

- The gas concentration display is updated at the end of each detection cycle.
- The gas concentration display indicates an average gas concentration within a detection cycle.
- The detection result (average value) from the previous detection cycle is output for the gas concentration display.

See the following chart that indicates the timing of concentration display for gas concentration varying with time.



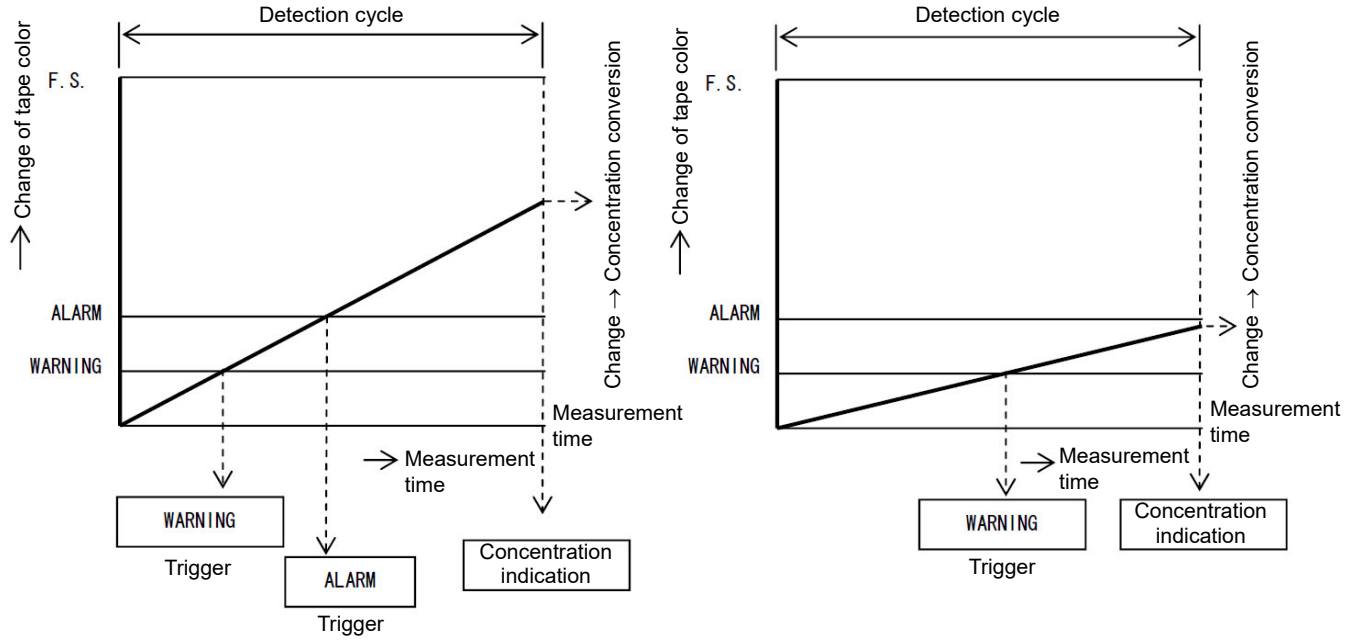
5-2. Alarm function

5-2-1. Gas alarm

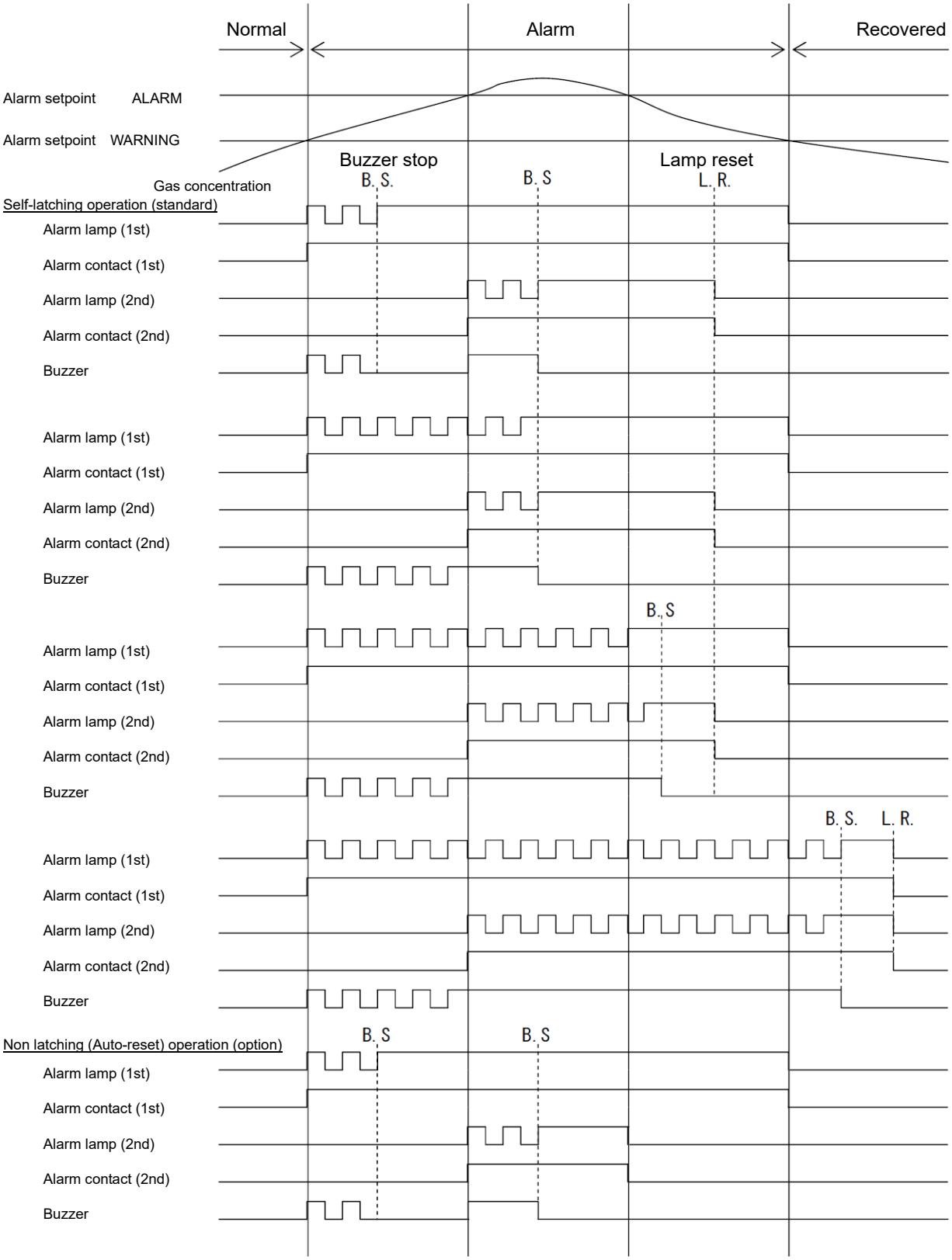
The gas monitor detects a gas from a change of color which occurs on the detection tape with special reagent applied on it when the detection tape contacts a specific amount of gas within a unit time. This means, the gas concentration display cannot provide accurate information unless a unit time (detection cycle) passes. However, in the event of a presence of high concentration gas, alarm must be triggered immediately.
The alarm activation of the gas monitor uses the theory shown in the following figure to enable quick response.

NOTE

For 4 - 20 mA output, concentration indication is performed at the end of a measurement cycle. Therefore, the alarm level output lags behind the alarm triggered from alarm contact output.



5-2-2. Alarm activation timing chart



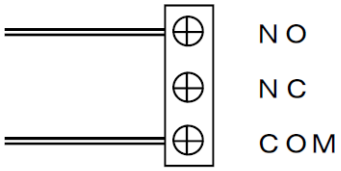
5-3. External output

5-3-1. External output contact

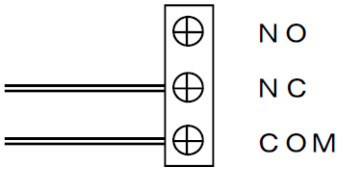
The external output contact of the gas monitor is reset automatically after performing a reset operation with self-latching function.

Precautionary alarm (WARNING) contact output:	No-voltage "c" contact, rating: 125 VAC, 0.5 A (resistant load)
Main alarm (ALARM) contact output:	No-voltage "c" contact, rating: 125 VAC, 0.5 A (resistant load)
Fault alarm (TROUBLE) contact output:	No-voltage "c" contact, rating: 125 VAC, 0.5 A (resistant load)

Connect to the terminal plate as shown below.
For "a" contact (NO)



For "b" contact (NC)



The alarm contact of the gas monitor is used to transmit signals to activate an external buzzer, alarm lamp, etc. Do not use the alarm contact for controlling purpose (e.g., controlling the shutdown valve).

CAUTION

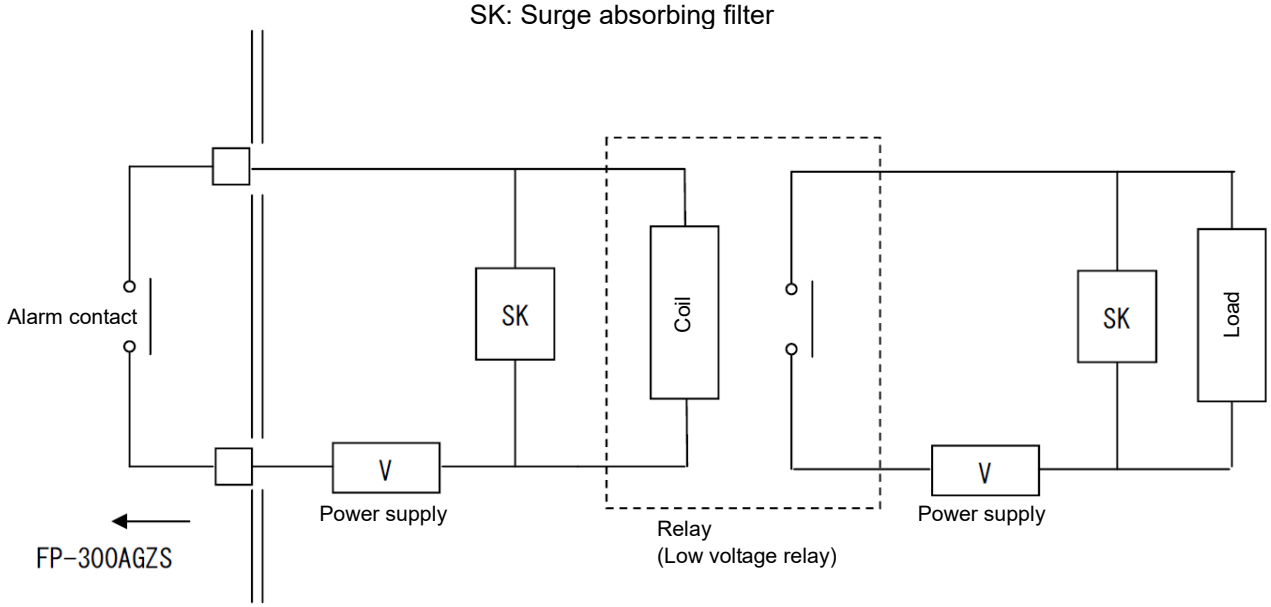
The "b" contact (break contact) under de-energized state may be opened momentarily by a physical shock, such as external force.
When the "b" contact is selected for the alarm contact, take appropriate actions to prepare for a momentary activation, for example, add signal delay operation (approximately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

When controlling external load, some load characteristics may adversely affect the gas monitor.
In such case, take the following measures to stabilize the operation and protect the contact.

- Add a low voltage relay to which the CR circuit (spark killer: SK) suitable for the relay coil (diode, etc. for DC) is directly connected.
- Add a CR circuit also to the loaded side of the relay as necessary.

Reference: It may be better to attach the CR circuit to the contact side for certain load conditions, however, it must be attached after checking the load operation.

SK: Surge absorbing filter



- Understanding of alarm contact on inductive load -

If inductive load is used at the alarm contact, the following errors may occur easily because very high counter electromotive voltage is generated.

- The relay contact melts and disables the contact activation.
- High voltage entered inside of the indicator damages any number of electric parts.
- Resulted large noise makes CPU out of control and behave abnormally.
- Unexpected noise may enter the contact regardless of inductive load, thus posing a risk of above errors.

To avoid above errors, the following preventive measures should be taken.

- In principle, inductive load should not be used. (Never use a fluorescent lamp, motor, etc.)
- External contact amplification is required to use inductive load. However, because an external relay coil is also regarded as inductive load, use a relay operated at low voltage (up to 100 VAC) and protect with an appropriate surge killer.
- Make sure to protect the contact with an appropriate surge killer to directly control a small inductive load. The rated specification of the contact in this case is 50% of resistance load or less.
  100 VAC 0.25 A or less

Followings are examples of inductive load.

- Revolving light, external relay, buzzer, siren, fan, fluorescent lamp, motor, etc.

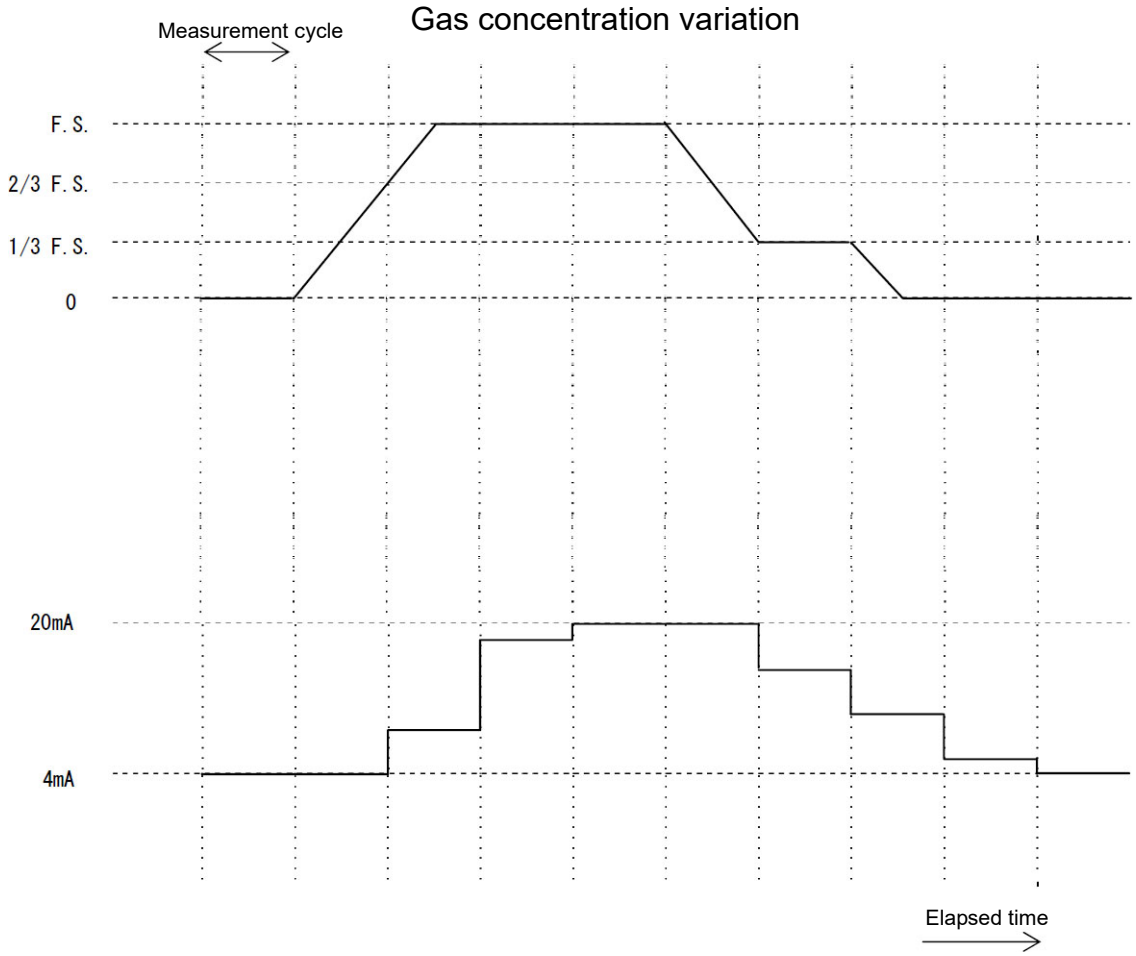
5-3-2. External signal output (4 - 20 mA)

The gas monitor provides 4 - 20 mA output that corresponds to the gas concentration display on LCD.

The 4 - 20 mA output on FP-300AGZS has the following features.

- The value is updated at the end of each detection cycle.
- The value indicates an average gas concentration within a detection cycle.
- The detection result (average value) from the previous detection cycle is output.

See the following chart that indicates the timing of 4 - 20 mA output for gas concentration varying with time.



4 - 20 mA output

5-3-3. External output operation

Output: 4 - 20 mA output
Load resistance: Below 300 Ω

4 mA .....Gas concentration indication 0
20 mA .....F.S.
22 mA .....Gas concentration over F.S.
0.5 mA .....During a time of trouble
2.5 mA .....After initial power-on (until the gas monitor enters detection state)
During maintenance

6

Maintenance

6-1. Daily maintenance

Perform the following daily maintenance to maintain the gas monitor performance.

(1) Check for the remaining amount of detection tape.
- Check it with the remaining days display "TAPE VALID ...D" in the lower section of LCD on the front panel.
- If the detection tape has reached the replacement time, replace it according to "6-3 How to replace gas detection tape cassette".

(2) Make sure that the sample gas flow rate is within the specified flow rate (flow lamp lights in green).
(3) Make sure that no fault alarm is triggered.
- If a fault alarm is triggered, recover the condition according to "7-2 Causes and remedies for failure".

6-2. Regular maintenance

We recommend a six-month regular maintenance to use the gas monitor for a long time.

6-3. How to replace gas detection tape cassette

Replace the gas detection tape cassette according to the following procedure.
(1) Check that the gas monitor is in detection state.
(2) Press and hold the EJECT key on the front panel for two or three seconds to open the cassette tray. At this time, buzzer sounds four times.

NOTE
- The EJECT key cannot be used during "TAPE CHECK".

(3) Take out the used gas detection tape cassette.
(4) Check that the tape model is appropriate and then insert a new tape in the correct direction. If the tape is directed wrongly, it cannot be inserted. Do not squeeze it.
The appropriate model of detection tape is displayed on LCD while the cassette tray is opened.

CAUTION

The model of detection tape varies depending on the gas to be measured. Use of an unspecified model of detection tape may disable gas detection. Also, using the detection tape that has passed its expiration date may disable gas detection.
Improper attachment of detection tape may cause troubles like a cut of the tape. Insert the gas detection tape cassette all the way properly.

(5) Push the SET PUSH part on the cassette tray to close it.
- When the cassette tray is closed, the gas monitor returns to detection state.
- Due to self-diagnosis, it takes approximately one minute to start detection.

CAUTION

Push the cassette tray into the gas monitor until it is locked securely. If the cassette tray opens halfway, the tape may be cut.

CAUTION

Always attach a new detection tape cassette. If a used detection tape cassette is attached, the tape ends (FAIL = TAPE) suddenly before the remaining days display reaches 0.
The same thing happens when the cassette tray is set immediately after ejecting it. Turning ON/OFF the power with the detection tape attached does not affect counting of the remaining days, however, if the gas monitor is stopped for a long time or 68 days have passed from the time of attachment, the expiration date of the detection tape passes and measurement becomes unavailable. In this case, replace the gas detection tape cassette with new one.

6-4. Maintenance mode

WARNING

After the adjustment, etc. is completed, never fail to press the MODE key to return to the detection mode.
(If the gas monitor remains in the maintenance mode, it automatically returns to the detection mode in ten hours.)

The maintenance mode provides the following items.

No.	Item	LCD display	Details
1	Alarm test	ALARM TEST ?	Perform the alarm test.
2	LCD contrast adjustment	LCD CONTRAST ?	Adjust the LCD contrast.
3	Pyrolyzer heater temperature setting	PL TEMP SET ?	Display the set temperature of the pyrolyzer heater.
4	Pyrolyzer heater temperature display	NOW PL TEMP ?	Display the current temperature of the pyrolyzer heater.
5	Flow rate/pump ratio display	NOW FLOW ?	Display the current flow rate and pump output.
6	Flow rate auto-adjustment setting	AUTO FLOW ?	Set the flow rate auto-adjustment to ON/OFF.
7	Flow rate adjustment	ADJ FLOW ?	Set the flow sensor with the flow rate at 0.5 L/min.
8	Pump ratio check setting	PUMP CHECK ?	Set the pump output to ON/OFF.
9	Light volume check	NOW POT ?	Display the current light level.

WARNING

Do not change the settings of pyrolyzer heater temperature, flow rate, etc. in the maintenance mode.
Ignoring this prevents the gas monitor from performing measurement properly.

<<Maintenance Mode>>

Detection Mode
Press the MODE key for three seconds.

C5F8 : 0.0ppm
TAPE VALID 60 D

MODE ↓ ↑ MODE

Alarm Test
Perform the alarm test.

C5F8 : 0.0ppm
ALARM TEST ?

BZ STOP ⇔ Alarm test ⇒ P. 35

△ ↓ ↑ ▽

LCD Contrast Adjustment
Adjust the contrast.

C5F8 : 0.0ppm
LCD CONTRAST ?

BZ STOP ⇔ LCD contrast ⇒ P. 36

△ ↓ ↑ ▽

Pyrolyzer Heater Temperature Setting
Set the pyrolyzer heater temperature. Do not change the setting when the gas monitor is used in a normal way.

C5F8 : 0.0ppm
PL TEMP SET ?

△ ↓ ↑ ▽

Pyrolyzer Heater Temperature Display
Display the current temperature of the pyrolyzer heater.

C5F8 : 0.0ppm
NOW PL TEMP ?

BZ STOP ⇔

C5F8 : 0.0ppm
PL TEMP : 500 c

△ ↓ ↑ ▽

Flow Rate/Pump Ratio Display
Display the current flow rate and pump output.

C5F8 : 0.0ppm
NOW FLOW ?

BZ STOP ⇔

C5F8 : 0.0ppm
0.50L/min 25P

△ ↓ ↑ ▽

Flow Rate Auto-adjustment Setting
Set the flow rate auto-adjustment to ON/OFF. Do not change the setting when the gas monitor is used in a normal way.

C5F8 : 0.0ppm
AUTO FLOW ?

△ ↓ ↑ ▽

Flow Rate Adjustment
Set the flow sensor. Do not change the setting when the gas monitor is used in a normal way.

C5F8 : 0.0ppm
ADJ FLOW ?

△ ↓ ↑ ▽

Pump Ratio Check Setting
Set the pump output to ON/OFF. Do not change the setting when the gas monitor is used in a normal way.

C5F8 : 0.0ppm
PUMP CHECK ?

△ ↓ ↑ ▽

Light Volume Check
Display the current light level.

C5F8 : 0.0ppm
NOW POT ?

BZ STOP ⇔

C5F8 : 0.0ppm
POT : 95

△ ↓ ↑ ▽

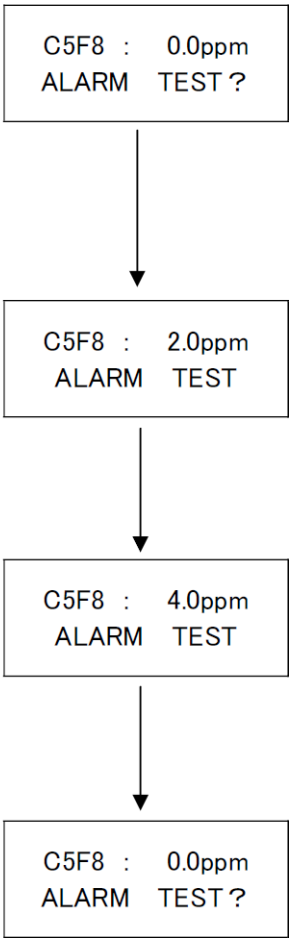
C5F8 : 0.0ppm
ALARM TEST?

6-4-1. Alarm test

WARNING

Before starting the alarm test, provide a notification to the related sections so that they can prepare for false abnormalities (external output signals and alarm contact). After the test is completed, never fail to press the MODE key to return to detection state.
(If the gas monitor remains in the alarm test mode, it automatically returns to detection state in ten hours.)

Alarm Test Mode
Press the BZ STOP key.
(To activate the contact during an alarm test, press the BZ STOP and LAMP RESET keys simultaneously.)
Increase the reading by pressing the △ key.



Precautionary Alarm
When the reading reaches the precautionary alarm point, the WARNING lamp starts blinking.
(When Contact ON is selected, the WARNING contact is activated.)

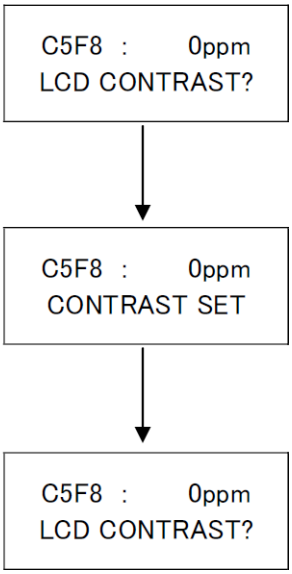
Main Alarm
When the reading reaches the main alarm point, the ALARM lamp starts blinking.
(When Contact ON is selected, the ALARM contact is activated.)
Decrease the reading by pressing the ▽ key.
When the reading reaches 0 ppm, the gas monitor returns to the menu screen.

NOTE

Releasing the △ key or pressing another key in the middle of the process stops the reading halfway or decreases it to 0.

6-4-2. LCD contrast adjustment

LCD Contrast Adjustment Mode
Press the BZ STOP key.



Adjustment
Pressing the △ key makes the display darker and pressing the ▽ key makes the display lighter.
When the BZ STOP key is pressed, the contrast level is determined and the gas monitor returns to the menu screen.

6-5. List of recommended regular replacement parts

No.	Item	Maintenance intervals	Replacement intervals (year)	Quantity (pieces/unit)
1	Pump (diaphragm excluded)	6 months	1 - 3	1
2	Diaphragm	6 months	1 - 2	1
3	Pump holder	1 year	3 - 6	1
4	Sensor head	---	2 - 4	1 set
5	Internal tube (rubber)	6 months	1 - 3	1 set
6	Internal tube (Teflon)	6 months	3 - 8	1 set
7	Filter holder (with O-ring)	1 year	3 - 6	1
8	Geared motor (for deck driving)	---	7 - 9	1
9	Geared motor (for tape winding)	---	7 - 9	1
10	Switching regulator (for main unit)	---	4 - 6	1
11	Switching regulator (for pyrolyzer heater)	---	2 - 4	1
12	Main PCB	---	7 - 8	1
13	Terminal plate PCB	---	7 - 8	1
14	Switch PCB (LCD)	1 year	7 - 8	1
15	Fuse (3A)	---	8	2
16	Flow sensor	1 year	5	1
17	Fan	1 year	2 - 4	1
18	SSR	---	7 - 8	1
19	Catalyst tube	6 months	1	1
20	O-ring for catalyst tube	---	3 - 6	2
21	Internal filter (Balston)	---	2 - 4	1
22	External dust filter	6 months	6 months - 1 year	1

NOTE

- 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. The result of the regular maintenance may determine when to replace the parts.
- PCB replacement is required due to deterioration of capacitor.

7

Measures for Abnormalities

7-1. Self-diagnostic function

The gas monitor is equipped with various self-diagnostic functions.
When an abnormal condition is detected, the gas monitor displays the following message and takes corresponding action. Perform a recovery operation.

Self-diagnosis	LCD message	POWER/TROUBLE lamp	Alarm contact
Sensor failure	FAIL = SENSOR	Blinking	Alarm state
Flow rate drop	FAIL = FLOW	Blinking	Alarm state
Flow sensor failure	FAIL = FLOW SENS	Blinking	Alarm state
Tape breakage	FAIL = TAPE	Blinking	Alarm state
Tape cassette replacement notice	CHANGE TAPE	Blinking	Normal state
Tape end	TAPE END	Blinking	Alarm state
Tape error	FAIL = TAPE LEVEL	Blinking	Alarm state
Tape setting error	TAPE SET MISS	Blinking	Alarm state
System abnormality	FAIL = SYSTEM	Blinking	Alarm state
Motor abnormality	FAIL = MOTOR	Blinking	Alarm state
Heater abnormality (low temperature)	FAIL = HEATER(L)	Blinking	Alarm state
Heater abnormality (high temperature)	FAIL = HEATER(H)	Blinking	Alarm state
Fan abnormality	FAIL = FAN	Blinking	Alarm state

NOTE

When more than one trouble occurs on the gas monitor, "→" is displayed on the right side of LCD.
Press the "LAMP RESET" switch on the front panel to display the contents of another trouble.

7-2. Causes and remedies for failure

Type of failure	Major cause	Remedial action
Sensor failure FAIL=SENSOR	Open circuit on the sensor (detection part), disconnected connector, decreased output, etc.	Ask the manufacturer for repair.
	The measurement light path (LED/sensor) is soiled significantly.	Same as above
Flow rate drop FAIL=FLOW	Aging deterioration of the pump or dust clogging the flow path.	Replace the filter. If it does not improve the situation, ask the manufacturer for repair.
Flow sensor failure FAIL=FLOW SENS	Abnormal flow sensor	Same as above
Tape breakage FAIL=TAPE	The detection tape cassette is not attached properly.	Attach a new detection tape cassette properly.
	The detection tape is damaged while attaching the detection tape cassette.	Same as above
Tape cassette replacement notice CHANGE TAPE	The detection tape nears its end.	Replace the detection tape cassette with new one.
Tape end TAPE END	The detection tape has ended.	Replace the detection tape cassette with new one.
Tape error FAIL=TAPE LEVEL	Detection is attempted with a tape whose color has been changed more than the specified level. A tape that has passed the expiration date or that has been left outside of the refrigerator is used.	Replace the detection tape cassette with new one.
	The volume of light source (LED) is dropped.	Ask the manufacturer for repair.
Tape setting error TAPE SET MISS	The detection tape cassette is not attached. Or some kind of attachment error occurs.	Attach the detection tape cassette. Take out the tape cassette, check the tape condition and then attach it again if there is no problem.
System abnormality FAIL=SYSTEM	Gas monitor system abnormality	Cycle the power. If it does not recover the system, ask the manufacturer for repair.
Motor abnormality FAIL=MOTOR	Geared motor failure, etc.	Ask the manufacturer for repair.
Heater abnormality (low temperature) FAIL=HEATER(L)	The heater is not warmed. Internal power failure	Ask the manufacturer for repair.
	Abnormal low temperature around the heater	Move the gas monitor to a place with higher ambient temperature.
	Insufficient warm-up time	If the heater does not recover after energizing it for one hour or more, ask the manufacturer for repair.
Heater abnormality (high temperature) FAIL=HEATER(H)	Abnormal overheating around the heater The gas monitor is installed in a place with abnormally high ambient temperature or subjected to radiant heat from an electric furnace, etc.	Move the gas monitor to a place with lower ambient temperature or place not subjected to direct radiant heat.
Fan abnormality FAIL=FAN	Fan failure Internal power failure	Ask the manufacturer for repair.
The power cannot be turned on.	The power terminal is disconnected.	Make sure to connect to the terminal plate.
	The fuse is blown or not installed.	Install a fuse with the specified rating.
	Voltage is not supplied from the power supply.	Check the power supply voltage.

8

How to Stop Operation

Turn the power switch of the gas monitor from ON (I side) to OFF (○ side).

CAUTION

Avoid the following locations to store the gas monitor. Ignoring this may result in failure or accident.

- Places exposed to direct sunlight
- Dusty or dump places
- Places exposed to direct wind
- Places with frequent vibrations
- On unstable or inclined surfaces
- Outdoors or places exposed to water

CAUTION

Do not store the gas monitor with the gas detection tape cassette inserted. The detection tape may be deteriorated and the gas monitor may become unable to perform accurate gas detection when used again.

9

Disposal of Products

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

10

Product Specifications

Standard specifications

Detection principle	Detection tape photoelectric photometry
Gas to be detected	C5F8/C4F6
Concentration display	LCD digital display
Detection range	C5F8: 0 - 5 ppm C4F6: 0 - 5 ppm
Measurement cycle	C5F8: 20 seconds C4F6: 20 seconds
Measurement method	Integration value measurement within a time frame
Detection method	Pump suction type/pyrolysis type
Suction flow rate	Approx. 0.5 L/min
Alarm setpoint	C5F8: 2 ppm (1st)/4 ppm (2nd) C4F6: 2 ppm (1st)/4 ppm (2nd)
Power display	PW/TR lamp on (green)
Displays	Gas name/tape remaining amount display
External output	Gas concentration signal/gas alarm contact/fault alarm contact
Alarm accuracy (under the same conditions)	Within ±30% to the alarm setpoint value
Response time (under the same conditions)	Within 60 seconds after providing a gas 1.6 times the alarm setpoint (Within a single measurement cycle. Delay in the tube excluded.)
Gas alarm type	Two-step alarm (H-HH)
Gas alarm display	1st: WARNING lamp blinks or lights up(orange)/buzzer 2nd: ALARM lamp blinks or lights up (red)/buzzer
Gas alarm pattern	Self-latching or non latching (Auto-reset)
Gas alarm contact	No-voltage contact 1C
Fault alarm/self diagnosis	System abnormality/sensor failure/flow rate drop/motor abnormality/tape breakage/tape cassette replacement notice/tape end/tape error/tape setting error/heater abnormality/fan abnormality
Fault alarm display	PW/TR lamp blinks (green)/contents display (LCD message)
Fault alarm pattern	Non latching (Auto-reset)
Fault alarm contact	No-voltage contact 1C
Contact capacity	125 VAC, 0.5 A (resistance load)
Transmission system	Analog transmission
Transmission specifications	4 - 20 mA DC (load resistance under 300 Ω)
Power supply	100 - 240 VAC ±10%, 50/60 Hz
Power consumption	Max. 150 VA
Continuous operating time	Detection tape life: Max. two months (under no-gas condition)
Tube connecting hole	Rc1/4 (O.DΦ6-1t, half-union for Teflon tube <PP> supplied)
Warm-up time	Approx. 20 minutes
Operating temperatures	5 to 35 °C (at a constant condition)
Operating humidities	30 to 90%RH (Non-condensing)
Structure	Tabletop type

External dimensions	Approx. 250 (W) x 198 (H) x 300 (D) mm (projection portions excluded)
Weight	Approx. 9.5 kg
Outer color	Munsell 5Y8.4/0.5

* Specifications subject to changes without notice.

Standard accessories

- Gas detection tape cassette 1
- Dust filter 1
- Operating manual 1

Optional parts

- Gas detection tape cassette
- Dust filter
- Fuse

11

Detection Principle

A gas to be measured is passed through a pyrolyzer heater to have pyrolytic decomposition and generate a gas that reacts with color-producing reagent. Then this pyrolytically generated gas is passed through a cellulose tape impregnated with color-producing reagent. The reflection light from the color formed on the tape by reaction is measured electrically to detect very low concentration toxic gases quantitatively.
The gas chamber that introduces a gas to the tape is a light-resistant container containing light-emitting and light-receiving elements.
The degree of color forming is recognized as a change in the amount of reflection light from the tape. The change ratio of this reflection light intensity is called response value to gas concentration. With a standard curve obtained in advance, concentration can be determined from a response value of detection gas.

Structure diagram