



# HIGHLY SENSITIVE TOXIC GAS MONITOR

**FP—300**

**FP—300P**

**FP—301**

**FP—300A**

## **Request for the Customers**

- Read and understand this operating manual before using the gas monitor.
- Use the gas monitor in accordance with the operating manual.
- Regardless of warranty period, we shall not make any indemnification for accidents and damage caused by using this product.  
The indemnification shall be made only under the warranty policy of products or parts replacement.
- Because this is a safety unit, a regular maintenance for every six months and daily maintenance must be performed.
- If any abnormality was found in the gas monitor, notify them to RIKEN KEIKI immediately.

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This is important manual to operate the gas monitor FP-300 / FP-300P / FP-301 / FP-300A to keep the performance of the unit, to increase the reliability of the unit. The record of the checking result and the treatment of this should be kept and use them for next checking, planning for repair and improvement of the equipment. It is kindly requested to keep the safety enough consideration at instruction even when the work failure or accidents etc takes place by inadvertent factors and disconnection of power and signal cables.

• Identification of each cautionary marks

**▲ DANGER**

This mark means that it may occur serious damage on the human' s life or products if the unit is used in improper way.

**▲ WARNING**

This mark means that it may occur serious damage on human' s body or products if the unit is used in improper way.

**▲ CAUTION**

This mark means that it may occur some damage on the body or products if the unit is used in improper way.

**\* NOTE**

This mark means the advice on the operation/control of the unit.

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# 1. PRODUCT OUTLINE

## 1-1 SUMMARY

A good deal of specialty gases such as Phosphine ( $\text{PH}_3$ ), Silane ( $\text{SiH}_4$ ) and so on are used in semiconductor fabrication process.

These toxic gases are very danger to human body once they leak from such facilities.

The gas detection instrument to monitor trace amount of gas leakage from gas cylinder stock yard and manufacturing process shall be reliable one and has to keep long stability.

This unit is the most recommendable gas monitor to comply with these requirements.

The major functions of this unit are as follows.

- Two alarms- "WARNING" and "ALARM" -are provided.
- Easy to replace the gas detection cassette tape.
- The unit maintains required performance only replacing the cassette tape every one month.
- When the gas detection tape is exposed with gas that is sampled by the pump, depending on the gas concentration, the gas detection tape makes the color.  
And the unit detects the ratio of color changed and converts it to the gas concentration.
- Almost interference-free detection for alcohol, hydrogen, etc because of its detection principle.

## 1-2 CAUTION ITEMS

### **⚠WARNING**

#### Abnormal temperature, smoke, noise, smell

During the operation, if any unusual thing is caused, stop the operation immediately, and turn the power off. If the unit is operated continuously with this condition, it may cause the electrical shock or fire.

### **⚠CAUTION**

#### Contact with the metal edge

When move the unit, and it may be needed to touch the edge of the metal case or plastic parts, take care enough not to be injured by the edge of metal of plastic.

### **⚠WARNING**

#### Shock & damage by the drop

Do not drop or give the impact to the unit. This unit includes very sensible parts, so it may make the unit not to detect the gas leakage correctly.

### **⚠WARNING**

#### Use at the high temperature, high humidity or dusty place

- Do not use or store the unit at the place where may be high temperature, high humidity or dusty. It may cause the unusual operation of the unit or it may be source of the fire or electric shock. Use the unit within operating temperature and humidity specified in the specifications sheet.
- When the unit is moved from high temperature area to low temperature area, it may get the water condensation inside of the unit. If the unit is operated with this condition, the correct gas detection may not be performed. And it may be source of the malfunction. When the unit is moved, use the unit after keeping the unit in the same condition for several hours to be accustomed with the condition.

### **⚠CAUTION**

#### Operation at the unstable place

Do not install the unit at the bent position or there is vibration.  
During the operation, the unit may drop, and it may injure the human or broken.

### **⚠WARNING**

#### Connection of Earth(grounding)

To avoid electric shock, connect the earth wiring to the earth terminal.  
If not, it may make the electric shock.

### **⚠WARNING**

#### Treatment of power cable

Do not put any material on the power cable, or do not stretch the cable or bent.  
It may cause the fire or damage of the cable.

## **⚠ WARNING**

### Power source

Before power on, check that the power source voltage is within the given voltage. If not, it may damage the unit or source of the fire/electric shock.

## **⚠ WARNING**

### Multi-wiring

To the same power input, if many power plugs are connected, it may cause the fire, and it may cause the power shut down due to over loading. And it may make the unit to be affected by the electrical noise.

## **⚠ WARNING**

### Mixing in of a foreign articles to the inside of the unit

Do not mix metallic articles or foreign articles which are easy to burned the inside of the unit.

It may cause the bad performance, electric shock or fire.

## **⚠ WARNING**

### Put the articles on the unit

Do not put the container including water such as flower vase, potted plant etc, and small metallic articles such as pin, clip etc onto the unit.

If they are entered into the unit and used as it is, it is caused to the breakage of the unit, electric shock or fire.

## **⚠ CAUTION**

### Use of gas detection tape

- Store the gas detection tape in the bag in the refrigerator. Do not cut the bag during the storage. If the bag is cut, it expedite the change of the color of the tape and it can not be used any more. And use the gas detection tape within the storage period specified.
- If the gas detection tape is stored beyond the specified storage period, we can not assure the accuracy of the gas detection. To be safety, do not use the gas detection tape which is stored beyond specified storage period.
- The gas detection tape is painted with special material, do not touch with the fingers. It does not cause any influence on the human body, but it may cause the low accuracy of the gas detection or tape cut.
- The replacement period of the gas detection tape is one month at no gas condition. When the unit detect the gas, the gas detection tape must be replaced before one month.
- The gas detection tape is designed for this unit only, so do not use this gas detection for other unit. It may be source of the trouble.
- Depending on the kinds of the tape or storage condition, the gas detection tape may get the color slightly, but it does not affect on the gas detection.

## 2. PRODUCT FUNCTION

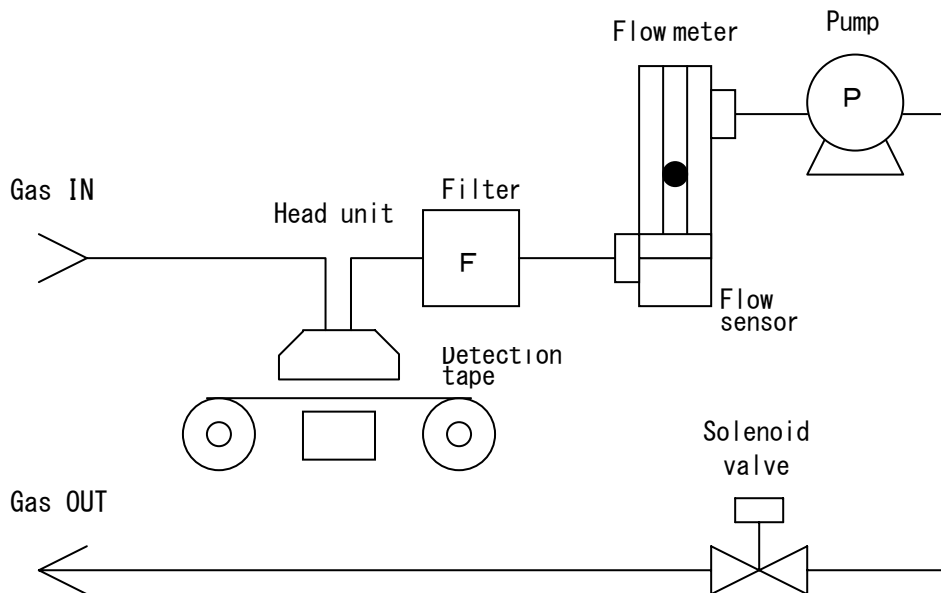
### 2-1 ACCESSORY LIST

This unit is accessory with the following and then check them when received.

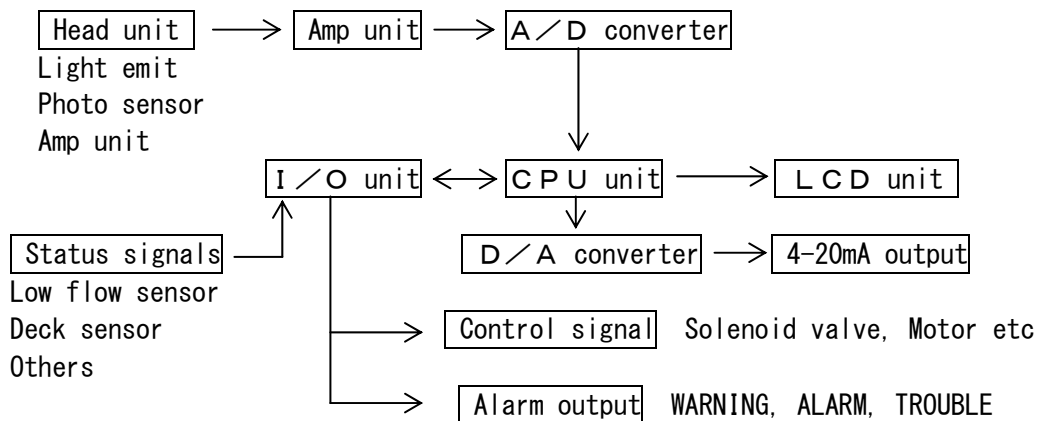
- Cassette tape : 1 pce
- Dust filter : 1 pce
- Instruction manual : 1 pce
- Fuse (Desk top type only) : 2 pcs

### 2-2 BLOCK DIAGRAM

Piping diagram



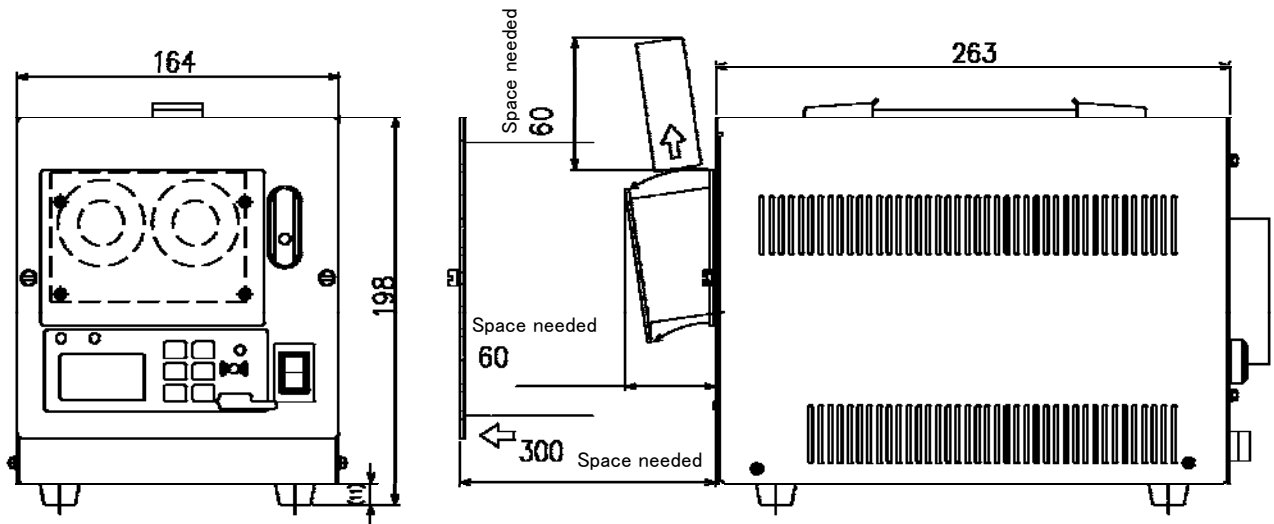
Electric block DWG



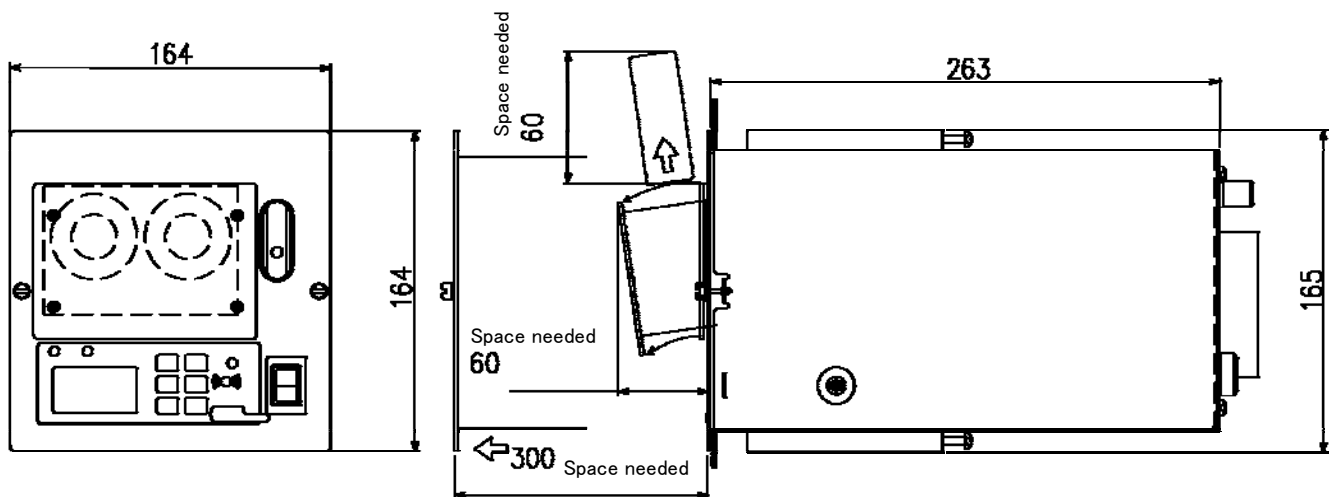


## 2-3 DRAWING

### Desk top type

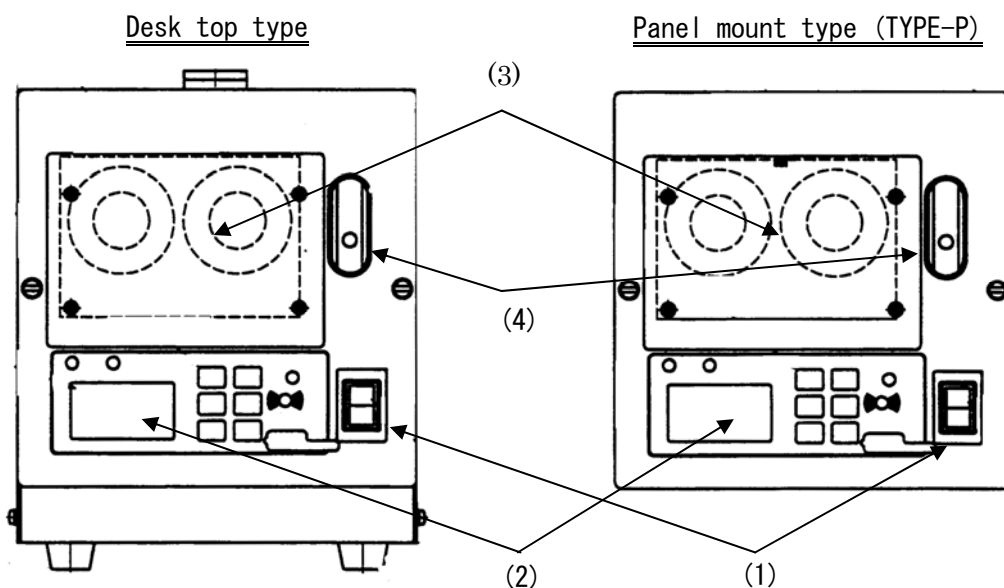


### Panel mount type (TYPE-P)



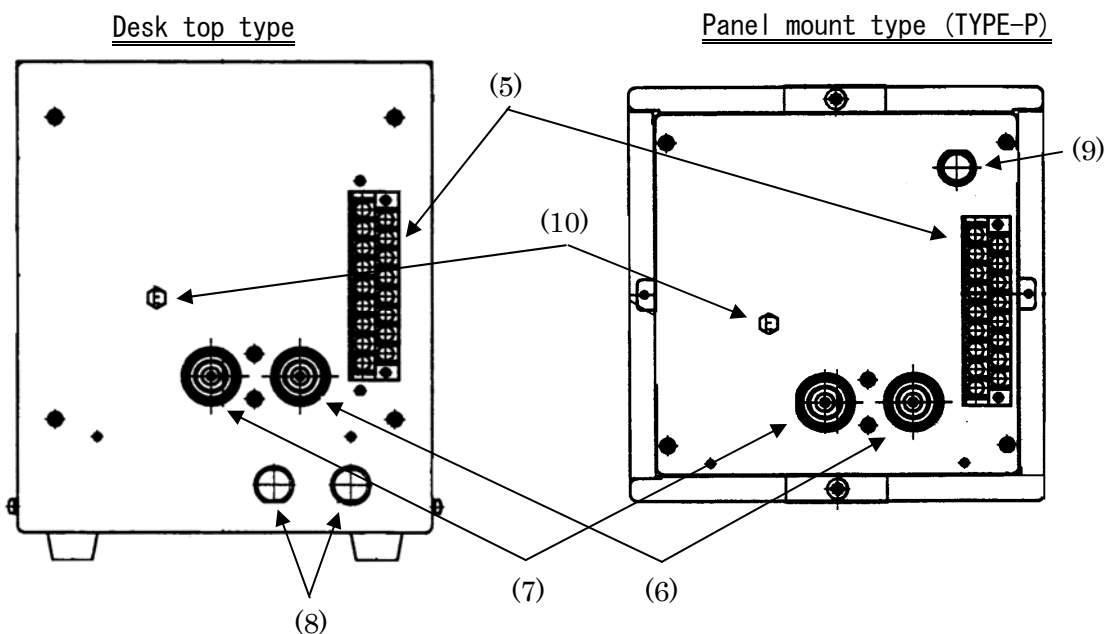
## 2-4 EACH NAME DESIGNATION

### 2-4-1 FRONT PANEL



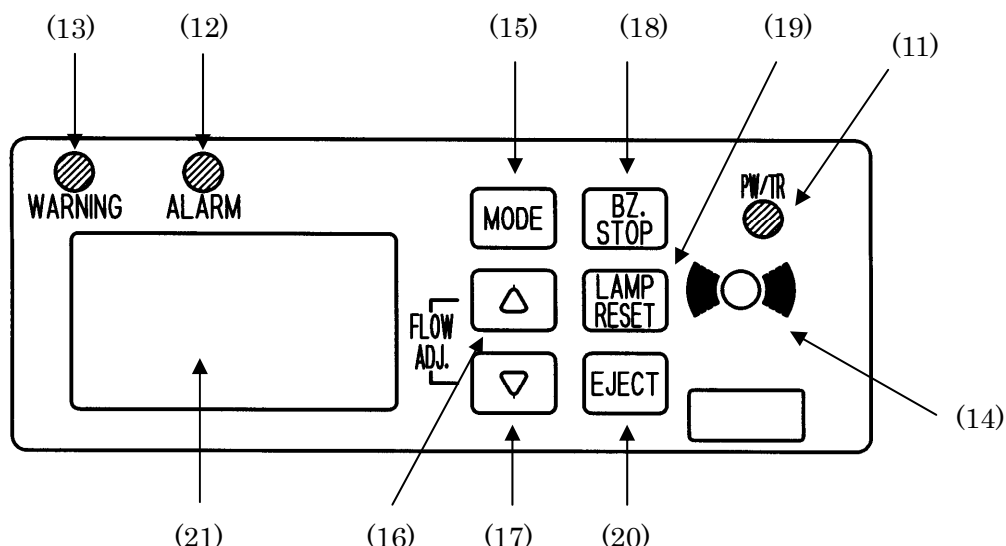
- (1) POWER switch : Power ON/OFF
- (2) Operation panel : Operate each and display. See 【2-4-3 OPERATION PANEL】
- (3) Cassette tray : Set the gas detection tape.
- (4) Flow monitor : Check the flow rate of sample gas.

### 2-4-2 REAR PANEL



- (5) External terminal : See 【3-3-2 TERMINAL DRAWING】
- (6) Gas IN half union : Connect the PTFE tube  $\phi 6\text{mm O.D}$
- (7) Gas OUT half union : Connect the PTFE tube  $\phi 6\text{mm O.D}$
- (8) Fuse : 2A \* 2 pcs
- (9) Partial exhaust port :  $\phi 1/2$  inch O.D pipe
- (10) Earth terminal : Connect the earth wiring

## 2-4-3 OPERATION PANEL



- (11) POWER/TROUBLE lamp : Normal (Gas status) ... Green light on  
 Trouble ..... Green lamp blinking
- (12) ALARM lamp (Alarm) : Red lamp  
 Light out at gas detection.  
 When trigger alarm, it blinks or lights on.
- (13) WARNING lamp (Warning) : Orange lamp  
 Light out at gas detection.  
 When trigger alarm, it blinks or lights on.
- (14) Buzzer : Alarm ..... Continuous tone ( Pi )  
 Warning ..... Intermittent tone ( Pi, Pi, )  
 Switch on ..... Single tone ( Pi )
- (15) MODE switch : When press approx 3 sec at gas detection, it gets maintenance mode and can make alarm test etc.
- (16)  $\Delta$  (UP) switch :  
 • When press this switch at gas detection, the flow will go up.  
 • When this switch is pressed, mode can be selected.
- (17)  $\nabla$  (DOWN) switch :  
 • When press this switch at gas detection, the flow will go down.  
 • When press this switch at maintenance status, the mode can be selected.
- (18) BZ STOP switch : When press BZ STOP switch at gas detection status, the buzzer stops sounding and alarm lamps(12), (13) shall be changed from blinking to light on.
- (19) LAMP RESET switch :  
 • After press BZ STOP switch(18) at gas alarm status, press LAMP RESET switch at gas alarm. When it gets lower than alarm preset level, the alarm lamp(12), (13) will light out, the external alarm will be cancelled.  
 • When it gets to plural trouble status, the trouble can be checked in turn by pressing this switch.  
 See **【7-1 SELF-DIAGNOSIS】**  
 • When pressed at gas detection status, the alarm set value shall be displayed on LCD(21) for approx 2 sec.
- (20) EJECT switch : When unload the cassette tape, press and hold this switch for approx 2 sec and then, the cassette tray will open.
- (21) LCD : This shall show various comment such as gas reading.

## 3 . OPERATION

### 3-1 HANDLING

- ① For panel mount type, there is no handle. Then carry it with hands on to the bottom.

#### **▲ CAUTION**

Do not lift nor transport the in this unit by use of cassette tray. There are risks of breakage of cassette tray, breakage of the instrument or injury when the instrument is dropped.

- ② When install this unit, take caution to install where alarm can be checked easily, the reading is easy to see, the cassette tape is easy to replace, flow can easily be adjusted and it is easy to maintain.

#### **▲ WARNING**

Do not put the container including water such as flower vase, potted plant etc, and small metallic articles such as pin, clip etc onto this unit.

If they are entered into this unit and used as it is, it is caused to the breakage of this unit, electric shock or fire.

- ③ Do not install the following places where it will be cause for trouble and accident.
- Place where sun-drought is given.
  - Place where to be plenty of dust and full of humidity.
  - Place where direct wind is given.
  - Place where to be many of vibration.
  - Place where to be on unstable stool or slant.
  - Place where to be outdoor or plenty of water drops.

#### **▲ WARNING**

• Do not use or store in high temperature, high humidity and dusty places. It is caused to the abnormal action, electrical shock or fire.

• When this unit is moved the place from low temperature to high temperature, the surface or inner part will be condensed.

If it is used under such condition, correct detection cannot be performed.

Also it is caused to the trouble.

When this unit is moved, leave it for few hours at the place of use to equilibrate with environment temperature.

#### **▲ CAUTION**

Do not put this unit on unstable places such as slope, narrow space or vibrated places. It is afraid that this unit may drop or face during operation which caused to injury or breakage of this unit.

- ④ As this unit is composed of precision electronics parts, do not drop and crush and install where it is safe and horizontal.

### **▲WARNING**

Do not give a shock such as fall and hit to this unit.  
Since this unit applies precise electronics parts, normal operation or correct gas detection cannot be performed.

- ⑤ Keep it from the noise source where to be near from high capacity transducer, high noise of motor power source and high voltage generator.
- ⑥ To prevent the error of operation by electric radio interference, keep it at over 1m away from the walky-talky and hand-phone or mobile.

### 3-2 PIPING

- ① The piping between both IN/OUT should be within MAX 20m.
- ② The piping material should be used with a PTFE tube of  $\phi 6\text{mm}$  O.D.
- ③ For OUT side pipe, discharge to the given exhaust duct.
- ④ For GAS IN side, mount it by the accessory filter.

### **▲CAUTION**

- The length of piping depends on the kind of adsorptive gas.
- Contact our nearest agent or Riken Keiki for adsorptive gases and length of piping.

## 3-3 WIRING

### 3-3-1 CAUTION ITEMS

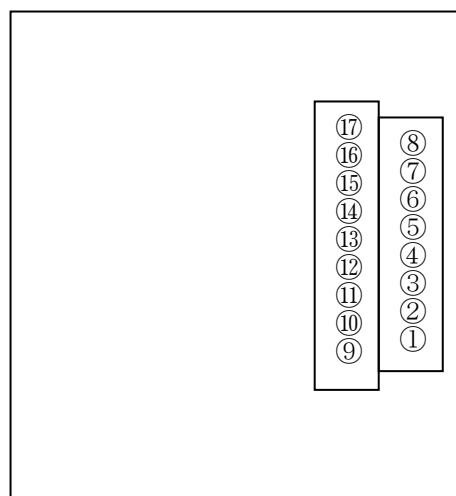
- ① The signal wire of current output should be used in the condition not to be affected by the noise through the shielded cable (CVVS cable etc).
- ② Wiring work should be used by switching OFF (O side) If it should be done under power charge condition, it may damage the unit by short circuit etc.

### 3-3-2 TERMINAL DRAWING

- ① AC220V (L) / DC24V (+) ] Power input
- ② AC220V (N) / GND (-) ] Power input
- ③ GND

- ④ 4-20mA (+) ] Current output
- ⑤ 4-20mA (-) ] Current output
- ⑥ No use
- ⑦ No use
- ⑧ No use

- ⑨ COM ]
- ⑩ a ] WARNING contact
- ⑪ b ]
- ⑫ COM ]
- ⑬ a ] ALARM contact
- ⑭ b ]
- ⑮ COM ]
- ⑯ a ] Trouble contact
- ⑰ b ]



- Power input  
Desk top type : AC100V-240V $\pm$ 10% · 50/60Hz  
Panel mount type : DC24V $\pm$ 10% (Check the polarity)

- Power output : 4-20mA (Take care of polarity)  
Output 0~F.S at linearity  
0 : 4.0 mA  
F.S. : 20.0 mA  
Trouble : 0.5 mA  
Initial : 2.5 mA  
For gas exceeding F.S, it indicates up to the output of 22mA.

The rating of alarm point each is 125V, 0.5A. It may have the case to need the protection spares such as spark killer by the connection load to keep the function.

### 3-4 GAS DETECTION CASSETTE TAPE

This gas detection cassette tape (FC TYPE) is for exclusive cassette tape.  
Use it by understanding all the below.

#### 3-4-1 HANDLING OF GAS DETECTION CASSETTE

##### **! CAUTION**

Do not touch with detection tape.

Special reagent is applied for detection tape and then, though it is not harmful to human, do not touch by hand. Because it may cause drop of detectability and the cut-out of tape.

##### **! WARNING**

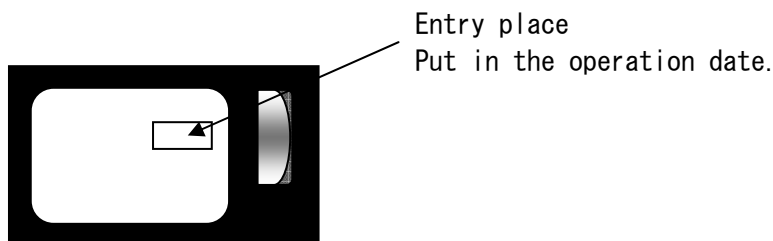
Do not use the detection cassette tape after passing its expiry date.

The operation time of cassette tape is one month and then, the tape passing over 1 month after opening cannot warrant the indication accuracy from the safety.

##### **\* NOTE**

When start to use the detection cassette tape, specify the start of operation date.

To grasp the replacement date of the detection tape, be sure to put the date of operation on the cassette tape.



##### **! CAUTION**

Use the designated model for the detection cassette tape.

The cassette tape is different from the measuring gas, check the model of it first and use it.

If the different model of cassette tape is used, it is impossible to detect the gas. Then, the cassette tape model name is displayed on LCD while the cassette loading tray is open.

## **▲CAUTION**

Check the contents in display every day and be sure to replace the cassette tape.

- The replacement frequency of cassette tape is 31 days under the condition that sample gas is free.  
If the sample gas is detected and the tape will go on faster.  
Then this replacement frequency is shorter.  
Then, the tape will be consumed if unloading on the way or turn on the power ON/OFF.  
Use the new cassette tape as long as it can and then, use it up to the end.
- When repeatedly unload the cassette tape on the way, the accuracy of tape reminder accuracy will be in accurate.
- When the reminder date display shows 2 days, the message [CHANGE TAPE] will be shown.  
POWER/TROUBLE lamp will flicker and the replacement of cassette tape will be blinking and expedite the replacement of the cassette tape.  
If the cassette tape is empty completely, it will show [TAPE END] and as the gas detection is stopped to operate and replace the tape immediately.
- When load the cassette tape on the unit, see [6-4 REPLACEMENT OF CASSETTE TAPE] when replace.

## **▲CAUTION**

Do not load cassette tape to the other unit than our specified gas monitor.

The gas detection cassette tape is for exclusive use (FC type) of unit.  
Do not load it to the other unit and not use it by turning back the tape.

## **▲CAUTION**

Do not give the force to the detection tape.

When turn the tape winding part by hand, do not give the force more than the required or strain the tape strongly. Do not wind the winding part basically.

## **▲CAUTION**

Some detection tape may change its color slightly when the storage bag is opened, depending on the storage condition.  
However, it does not affect to the gas sensitivity.



### 3-4-2 STORAGE FOR GAS DETECTION TAPE CASSETTE

#### **⚠CAUTION**

Preserve the cassette tape in refrigerator without opening a bag.  
Do not put it into freezer.

The detection tape is so delicate.

If do not handle with care, the capability of tape will be lost and then, the accurate detection will not be available.

After having understood the following, store the detection tape.

#### **⚠CAUTION**

Do not store the cassette tape which has been opened once.

For the cassette tape which once opened, put it back into the pack and store it in the refrigerator. When one month has passed, do not use it because the given function of that tape may not maintain the original function due to the deterioration.

#### **⚠CAUTION**

Use up the cassette tape within the storage period.

- The gas detection tape must be used up in the storage period printed in the pack. If the detection tape has passed the storage period, it will be deteriorated and cannot maintain the original function.
- If stored after opening the pack and leave it with loading the cassette tape in the unit, the discolor of tape may take place and the original function of tape could not be maintained. Then, after opening, use it up at earliest.

### 3-4-3 RETURN OF GAS DETECTION TAPE

For outer cassette case used up, it is kindly requested to return back for recycling the natural resources.

## 4. OPERATION METHOD

### 4-1 PREPARATION

#### 4-1-1 CHECK ITEM

- Pipe : Check whether the given items are not wrong (Pipe material, length)  
See 【3-2 PIPING】
- Wire : Check whether the connection with external output is correct or not.  
See 【3-3 WIRING】

#### 4-1-2 POWER INPUT

After having understood the below, turn on the power.

- Check that the power switch is OFF side (O side) .
- Check that the power source is adjusted with the power displayed on the unit.

### **⚠ WARNING**

Do not supply the power source other than the specified voltage.  
The unit will be broken and it may cause of electrical shock or fire.

### **⚠ WARNING**

Make grounding the earth wire to prevent an electrical shock.  
Otherwise, you may have an electrical shock.  
Use the “E” terminal located at the rear of this unit.

- Use the power source by keeping it away from the high consumption of motor and high power source.
- Do not make multi-wire connection.
- Arrange not to damage the power cord. Do not bend the power cord or hook or pull out forcibly.

### 4-1-3 POWER ON

Change over the power switch from OFF ( O side) to ON side ( I side).  
After power on, this comes to the detection condition.

#### **\* NOTE**

The unit reels out the tape after power on.  
The life span of the tape will be shortened if the power ON/OFF is repeated rashly in tape loaded condition.

#### **\* NOTE**

If there are high concentration gases with detection tape loaded, it may give an alarm even if it is before detection condition.  
However, this is not a correct gas concentration because it is before detection condition.

### 4-1-4 LOADING OF DETECTION CASSETTE TAPE

Put in the detection cassette tape suited for the model to the detection gas.  
Check the detection tape and tape model.

In detail, see [6-4 REPLACEMENT OF CASSETTE TAPE] . After loading it,  
(after closing the cassette tray), it will be in detection condition in a minute.

#### **\* NOTE**

The tape is always fed once after loading the cassette tape.  
The life span of the tape will be shortened if the tape loading/unloading is repeated rashly.

#### **\* NOTE**

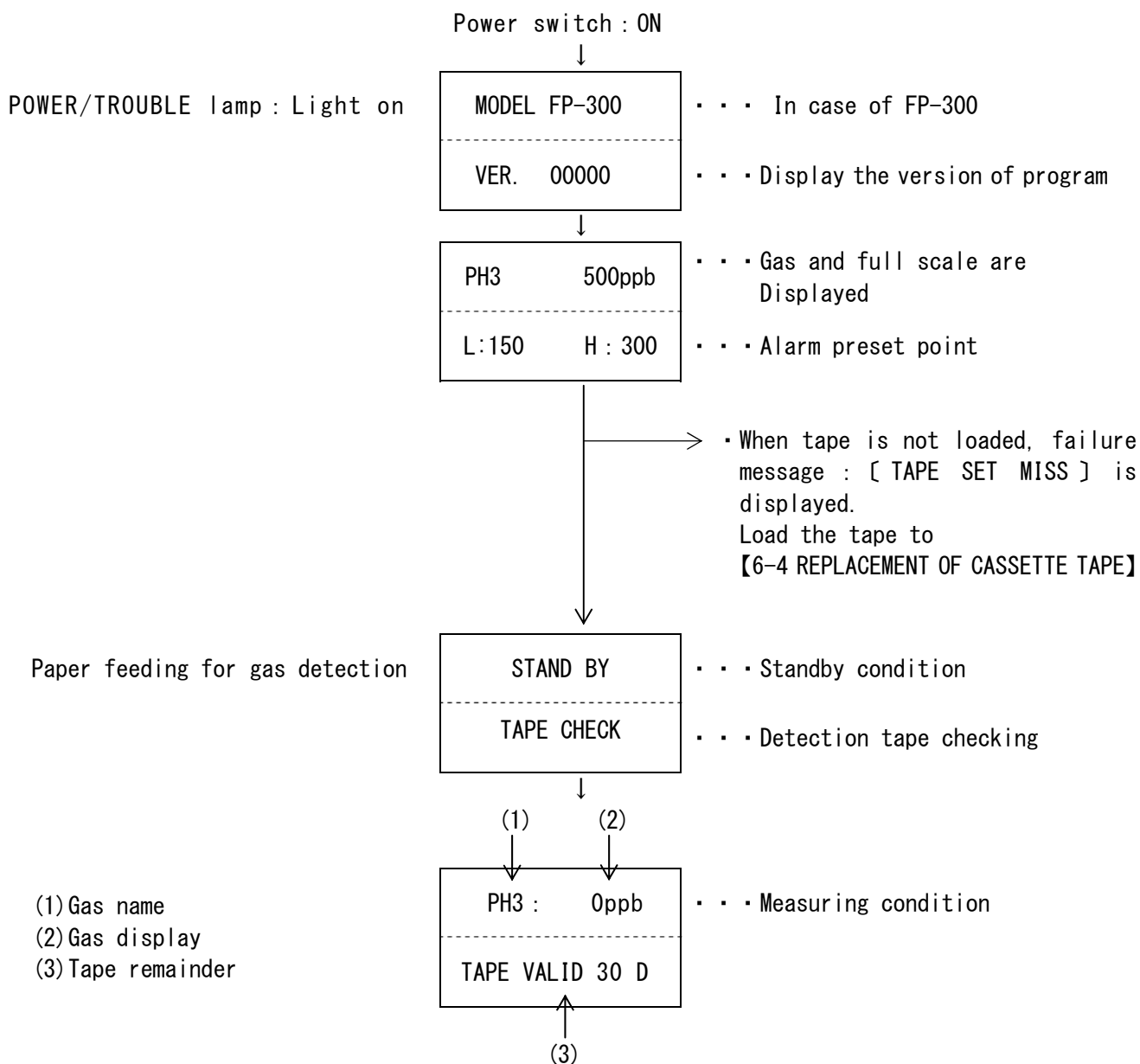
If there are high concentration gases with detection tape loaded, it may give an alarm even if it is before detection condition.  
However, this is not a correct gas concentration because it is before detection condition.

### 4-1-5 FLOW ADJUSTMENT

Check the sample gas flow rate. If the flow meter ball is out of range,  
see [6-3 FLOW ADJUSTMENT OF SAMPLE GAS] and adjust it.

## 4-2 OPERATION

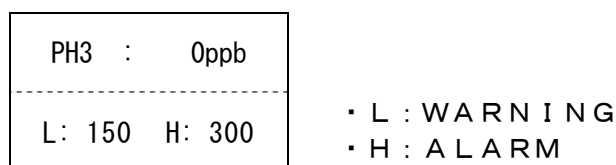
When make the power switch ON ( I side ) , it will proceed to the detection condition after displaying the necessary information and mechanical check.



## 4-3 SIMPLE CHECK FOR GAS ALARM PRESET POINT

When press "LAMP RESET" switch of the front panel on the measuring condition, the alarm point shall be displayed as follows.

However, the normal measuring condition means the condition in which gas alarm and trouble alarm do not trigger.

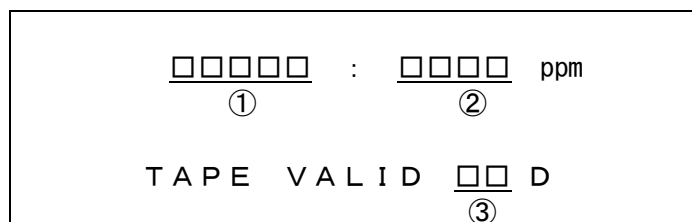


## 5. EACH FUNCTION

### 5-1 LCD DISPLAY

#### 5-1-1 DISPLAY FORMAT

LCD The display is formatted by the following.

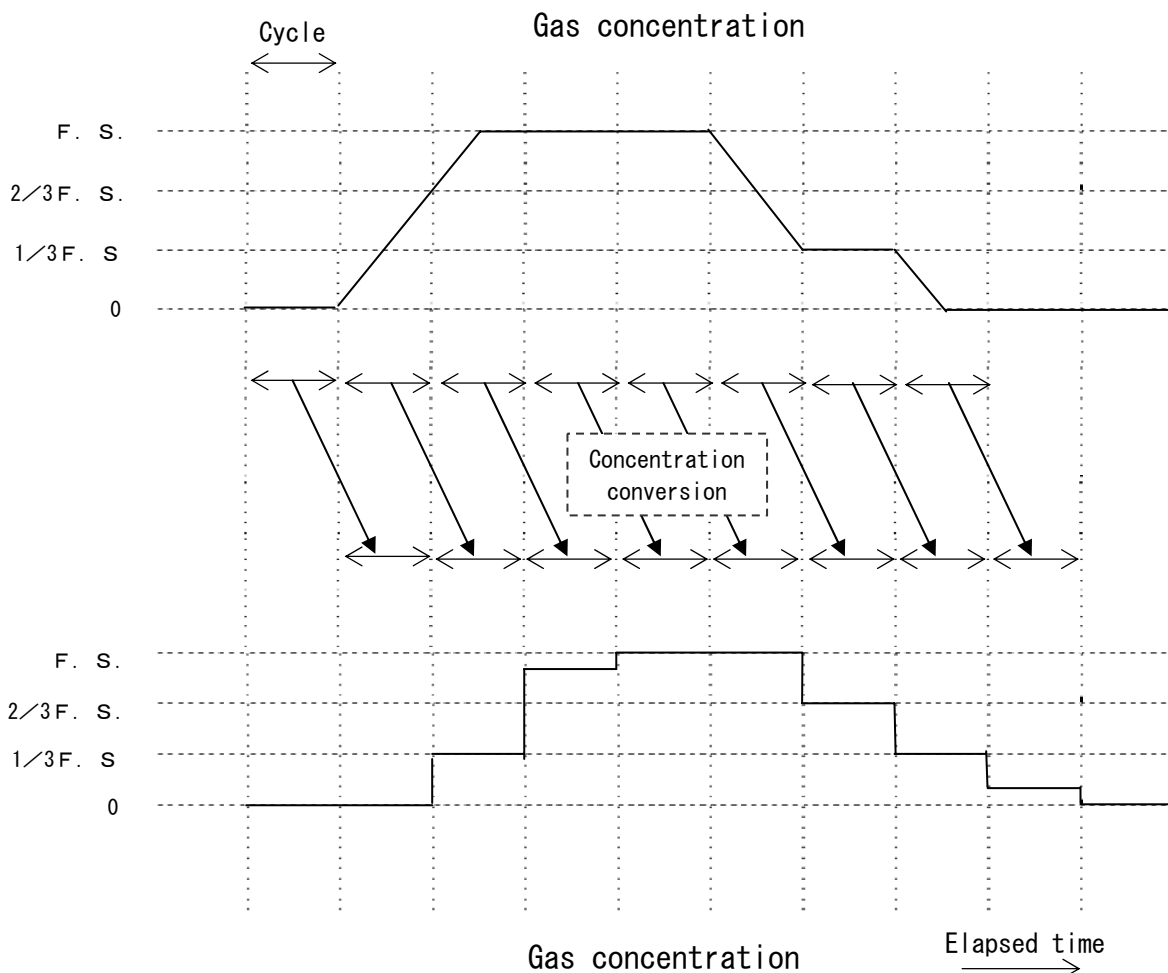


- ① Gas name is displayed as follows. .... Example) PH<sub>3</sub>
- ② Gas density is displayed. .... Displayed by ppm, ppb unit
- ③ Display the remainder of detection tape.

#### 5-1-2 GAS CONCENTRATION DISPLAY

The display of this gas concentration has the following feature.

- For gas concentration, the figure at each detection cycle is updated at each cycle.
  - For gas concentration, it will be the average within the time of detection cycle.
  - For gas display, the detection figure at previous detection cycle is outputted.
- The following drawing is the timing chart at the case of change with elapsed time.



## 5-2 ALARM FUNCTION

### 5-2-1 GAS ALARM

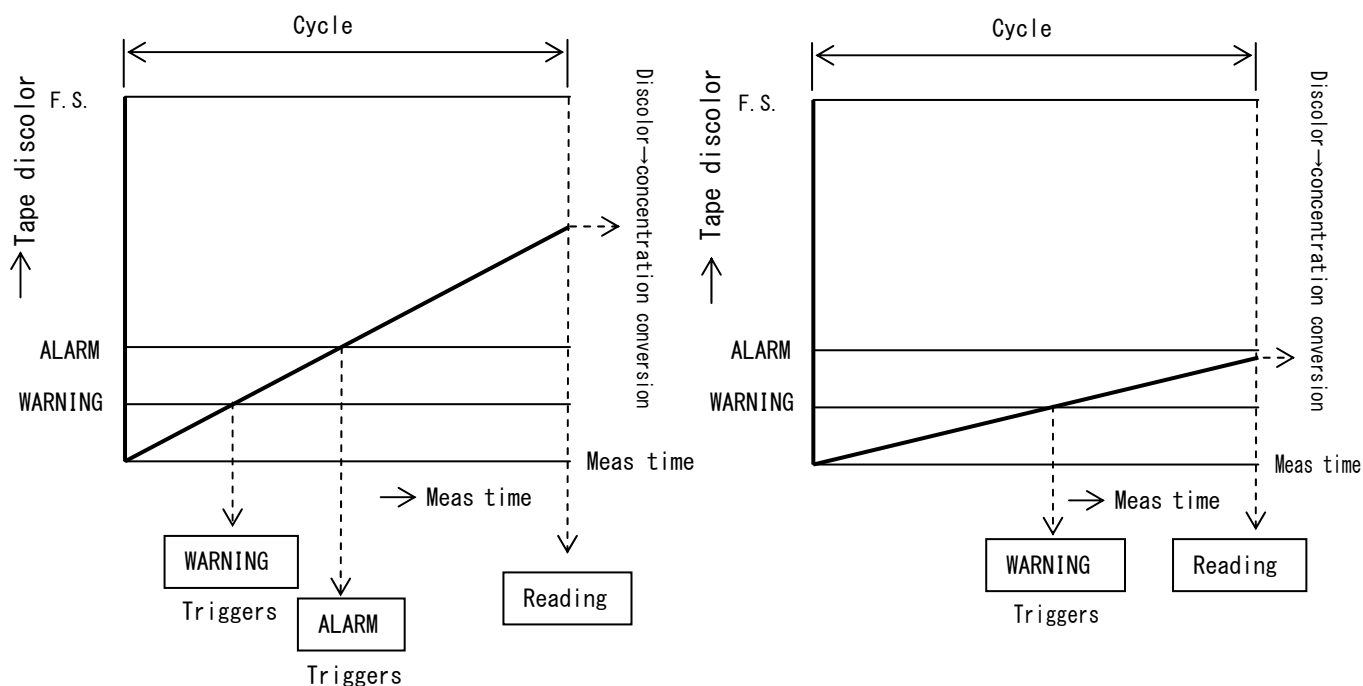
This unit is designed to detect the level of discolor by being exposed to the detection tape containing the special reagent within a unit of time. Namely, if a unit of time (detection cycle) has not passed, the accurate gas detection is not available.

On the other hand, when high concentration gas is generated, it is required to trigger alarm at the earliest.

The alarm activation of this unit is based on the following figure, the rapid measurements are available.

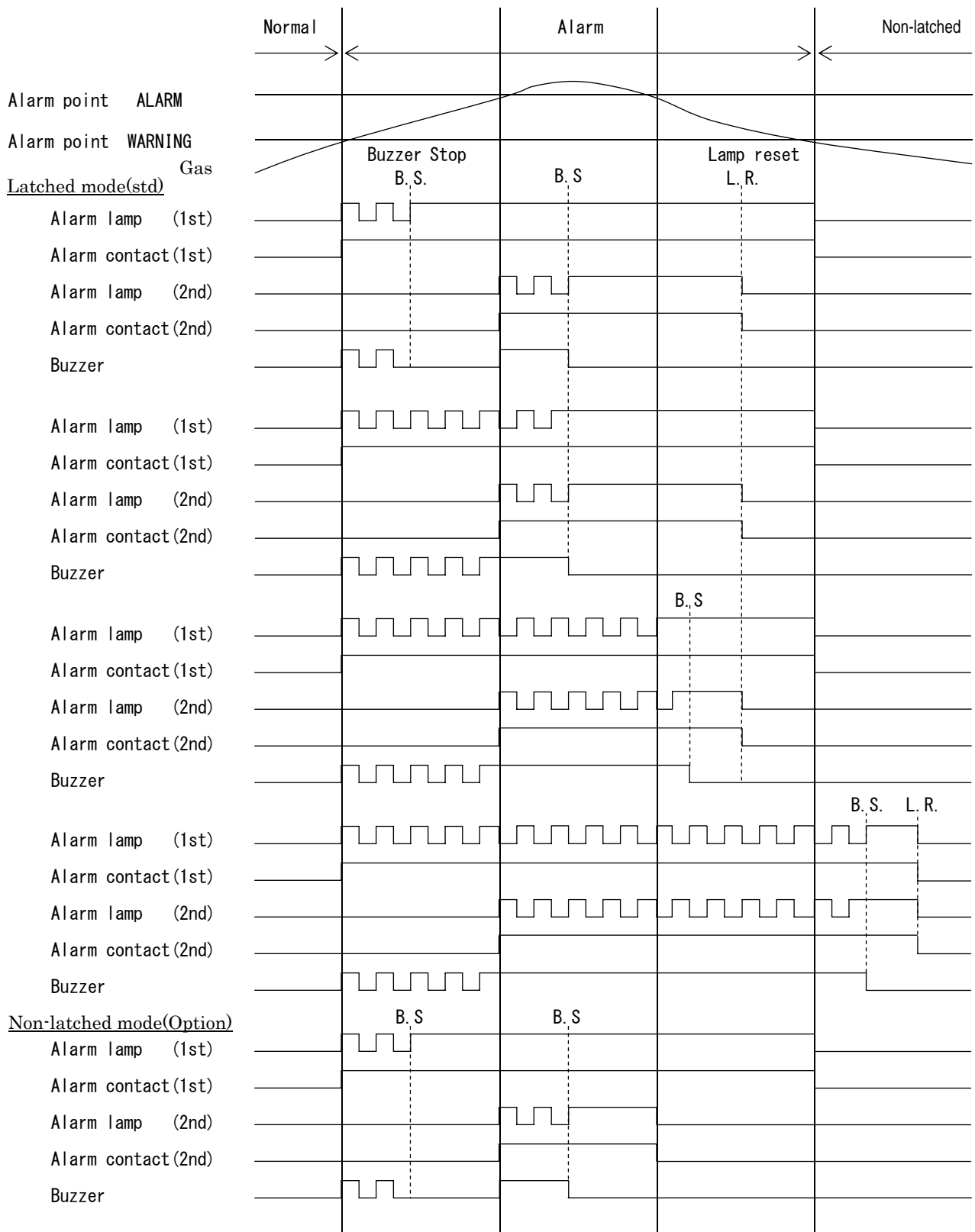
#### \* NOTE

The external output 4 - 2 0 mA is given later than the operation of alarm contact, because the gas concentration is displayed after every measuring cycle.



## 5-2-2. ALARM PERFORMANCE

### Timing chart



## 5-3. EXTERNAL OUTPUT

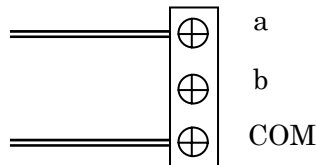
### 5-3-1 ALARM OUTPUT

This output will be non-latched mode after pushing the reset switch.

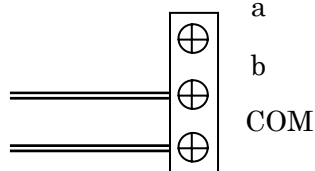
WARNING Contact : Dry "C" contact, Rating : AC 125V, 0.5A (Resistive load)  
ALARM Contact : Dry "C" contact, Rating : AC 125V, 0.5A (Resistive load)  
TROUBLE alarm Contact : Dry "C" contact, Rating : AC 125V, 0.5A (Resistive load)

The connection to terminal proceeds as follows.

"a" contact (N.O) case



"b" contact (N.C) case



Alarm contact is used as signal transmission media to activate the buzzer alarm rotation light. Do not use it for control purpose such as shutting off etc.

### **▲ CAUTION**

Normally-close contact (Break contact) at de-energized condition may change to open contact in a moment due to physical shock.

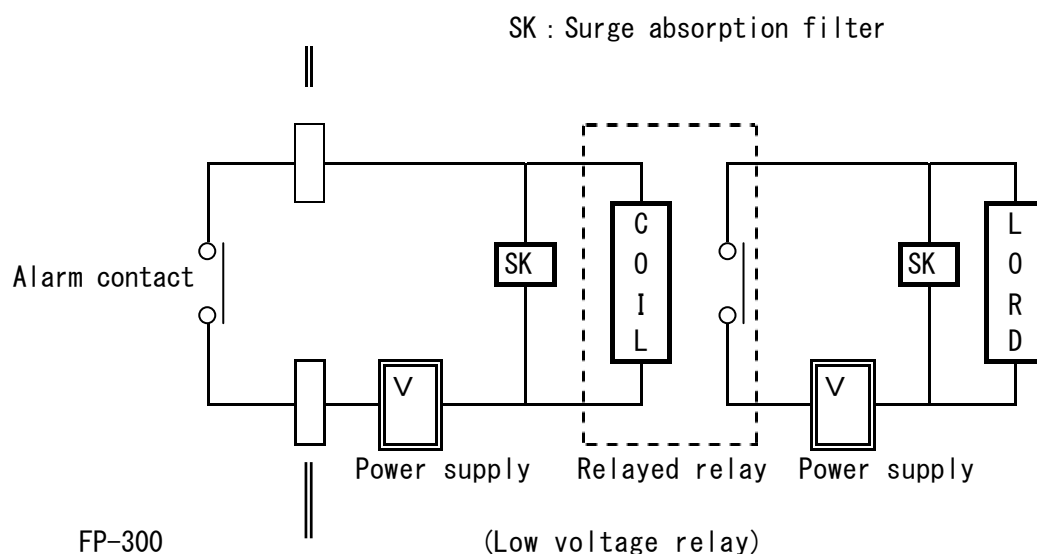
Whenever alarm contact is used with normally-close contact, please put delayed-circuit (for about one second) to receiver side of normally-close contact to avoid such phenomenon.

When control the external load, it may have the case to give the evil influence to the gas detector by load characteristic. In such case, let it make the performance stable and to protect the contact, it is requested to proceed to the following procedure.

- Mount and use CR circuit (Spark killer :SK) suited for relay coil by relaying via low voltage relay.  
In case of DC case, use it by mounting diode etc to the relay.
- Mount CR circuit to the load side of relayed relay on request.



Reference: By the condition of load, CR circuit may be better to install in the contact side but it is required to put in by checking the action of load.



—How to think alarm contacts against inductive load—

When use the inductive load for alarm contacts, the very high reverse electromotive voltage may be generated and the following trouble tends to be produced.

- Contact part of relay is melted adhesively and the contacts can not work.
- High voltage is put inside of detector unit and then, electrical parts may be damaged.
- As it is big noise, the trouble action may be taken by the reckless drive of CPU.
- Irrespective of inductive load, there is the possibility of unforeseeable noise instruction for contact above trouble may be generated.

To prevent the above difficulties in advance, it is required to have following preventions.

- The inductive load shall not be used in principle (Do not use fluorescent lamp, motor, etc.).
- When use the inductive load, make the contact amplification outside, but the outside relay coil belong, use the relay driven by the low voltage (within AC100V) and it is protected by an appropriate surge killer.
- When control the light inductive load directly, the contact shall be always protected with appropriate surge killer.

In this case, contact rating shall be below 50% of resistive load.

Below 0.25A at 100VAC

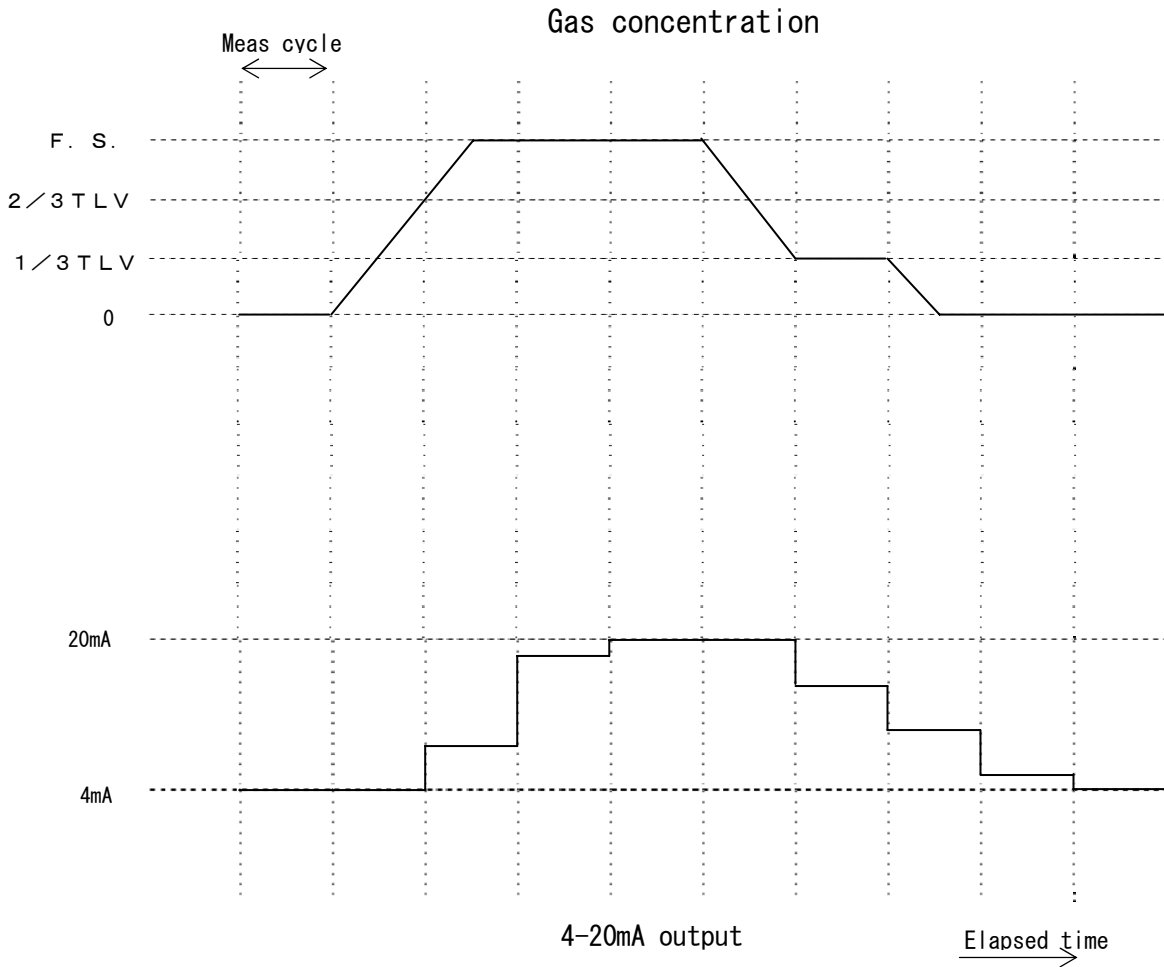
Below 0.75A at 30VDC

\* As the inductive load, there are following samples.

- Revolving light \* External relay \* Buzzer \* Siren \* Fan \* Fluorescent lamp \* Motor etc.

### 5-3-2 4-20mA OUTPUT

This unit is provided with 4-20mA output suited for LCD reading display.  
The following is a timing chart for 4-20mA output whenever the gas concentration is changed.



### 5-3-3 OUTPUT PERFORMANCE

Output : 4-20mA output  
Resistive load : Below 300Ω

- 4.0 mA ..... Gas concentration reading 0.0ppm
- 20.0 mA ..... F.S.
- 22.0 mA ..... Gas concentration exceeding F.S.
- 0.5 mA ..... Trouble alarm
- 2.5 mA ..... Elapsed time up to gas detection from power on at initial and maintenance time

## 6. MAINTENANCE CHECK

### 6-1 DAILY CHECK

Proceed to the following daily check procedure to maintain the function.

- ① Check the remainder of cassette tape.
  - Check it by the remainder display [ TAPE VALID ...D ] on the lower of front panel.
  - When the cassette tape is at prime time of replacement, replace it to follow the [6-4 REPLACEMENT OF CASSETTE TAPE] .
- ② Check that the sample gas flow is within the red lines.
  - When require flow adjustment, see [6-3 FLOW ADJUSTMENT OF SAMPLE GAS] for adjustment.
- ③ Check that there is no trouble alarm.
  - When the trouble alarm goes out, see [7-2 TROUBLE CAUSE AND MEASURES] and make resetting work.

### 6-2 REGULAR MAINTENANCE CHECK

6 months maintenance contract is recommended to use this unit for longer.

### 6-3 FLOW ADJUSTMENT OF SAMPLE GAS

The flow adjustment of sample gas shall proceed to the following.

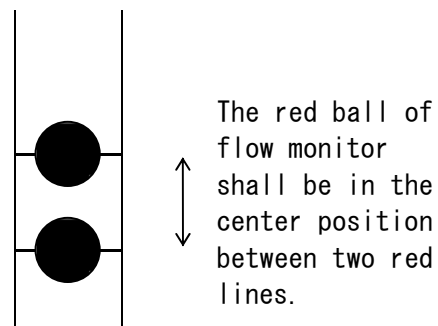
- ① Check that this unit is under operating condition.

#### \* NOTE

In case of low sample flow it will show the message [ FAIL = FLOW ] but proceed to the next.

- ② Check that the red ball in the flow monitor is within the red lines.

The red ball may goes up/down from the center between two red lines by the pipe load and cassette tape feeding. If it is within the center, it is no problem nor influence. If it is deviated from the red line, it must be adjusted in the center by turning  $\Delta$ / $\nabla$  flow adjuster.



#### \* NOTE

The red ball does not stay between two red lines during the tape loading since the gas is not supplied.

## 6-4 REPLACEMENT OF CASSETTE TAPE

This cassette tape replacement shall be carried out as below.

- ① Check that this unit is under detection condition.
- ② Press and hold EJECT key for about 2~3 sec on the front panel and open the cassette tape. At this time, the buzzer sounds for 4 times.

### \* NOTE

- When performing other actions than detection condition, you cannot operate EJECT key.
- You cannot operate EJECT key during [ TAPE CHECK ] .

- ③ Remove the cassette tape used up.
- ④ Put in the new tape not to be in wrong position by checking the tape model.  
If the position is wrong, it cannot be put in. Do not force to put in.  
Then, the cassette model name is displayed in the LCD while tray is open.

### ⚠ CAUTION

The model of detection tape is different from the measuring gas.  
If the different model is used, it may be impossible to detect the gas.  
Also, it may be impossible to detect the gas if the expired tape is used.  
Uncertain loading may cause a tape cut.  
The gas detection tape shall be loaded back of the tray firmly.

- ⑤ Press the SET PUSH of cassette tray to close it.
  - This will return to an automatic detection condition by closing the cassette tray.
  - It will take about 1 minute for self-diagnosis until the detection starts.

### ⚠ CAUTION

Press the cassette tray firmly until it is locked.  
If the cassette tray would be opened halfway, there is a possibility to cut the tape.

- ⑥ Check the sample gas flow rate. If deviated, adjust it.  
When required to adjust, see [6-3 FLOW ADJUSTMENT OF SAMPLE GAS] .

### ⚠ CAUTION

Always use the new detection tape. If the halfway tape is used, the tape will be cut (Tape end) suddenly before tape reminder display shows "0" .  
It becomes the same result if eject the cassette tray once and then, set it at once.  
It counts tape reminder correctly when putting power ON/OFF in tape loaded condition.  
However, the tape will be expired 38days after tape loading date if the power off condition continued for a long period.  
Then, replace the tape with new one.

## 6-5 ALARM TEST

The alarm test shall be made in the following procedure.

- ① Check that this is in the detection condition.
- ② Press and hold MODE key for about 3 sec.
  - Select Alarm test by  $\Delta$  key or  $\nabla$  key and press BZ STOP key.
  - Display [ ALARM TEST ] on LCD and the reading will increase every 1 digit while pressing  $\Delta$  key.  
Whenever exceed the preset alarm level, it triggers alarm.
  - At this time, no output contact works. If let the external output work, press BZ STOP key and LAMP RESET key simultaneously and start alarm test.

### \* NOTE

If  $\Delta$  key is released or other key is pressed during the above procedures, the reading will stop or it will decrease to 0(zero).

### ⚠ CAUTION

Signals corresponding to the LCD reading are output while in alarm test.  
When make alarm test, announce it to respective department beforehand.  
Carry it out after making proper treatment (External signal output, alarm contact).

- ③ Release  $\Delta$  key.
  - The gas concentration at display will stop.
- ④ Press  $\nabla$  key again.
  - Reading goes down every 1 digit.
  - When the display returns to 0, it will return to the set screen automatically.
- ⑤ Press and hold MODE key for about 3 minutes and it will be to the detection mode.

## 6-6 LCD CONTRAST ADJUSTMENT

LCD contrast adjustment shall be made with the following procedure.

- ① Check that this is under detection condition.
- ② Press and hold MODE key for about 3 sec.
- ③ Select LCD CONTRAST with  $\Delta$  key or  $\nabla$  key and press BZ STOP key.  
LCD CONTRAST is displayed on LCD and the contrast will be thicker by pressing  $\Delta$  key and thinner by pressing  $\nabla$  key.

PH3 : 0ppb
-----
L: 150 H: 300

PH3 : 0ppb
-----
L: 150 H: 300

- ④ When press BZ STOP key at visible condition, the set is completed and returns to the set screen.
- ⑤ Press and hold MODE key for about 3 sec and it will return to the detection condition.

## 6-7 RECOMMENDED SPARE PARTS LIST

No.	Name	Check cycle	Replacement cycle(year)	Q'ty/set
1	Pump(except diaphragm)	6 months	1~3	1
2	Diaphragm	6 months	1~2	1
3	Pump holder	1 year	3~6	1
4	Solenoid valve	---	5~8	1
5	Head	---	3~4	1 set
6	Inner pipe(Rubber)	6 months	1~3	1 set
7	Inner pipe(PTFE)	6 months	3~8	1 set
8	Elbow(F2)	6 months	1~3	5
9	Elbow	6 months	1~3	1
10	Filter holder (With O-ring)	1 year	3~6	1
11	Gear motor (Dec drive)	---	7~9	1
12	Gear motor (Tape winding)	---	7~9	1
13	Switching regulator	---	6~8	1
14	Main PCB	---	7~8	1
15	Switching PCB(LCD)	1 year	7~8	1
16	Fuse(2A)	---	8	2
17	Flow-monitor assy.	1 year	7~8	1
18	Inner filter(Balston)	---	3~5	1
19	External dust filter	6 months	0.5~1	1

### \* NOTE

- The above replacement cycle will be changed depending on operating conditions and it does not mean the guarantee period.
- The flow-monitor assy. (Item 17) contains a low flow sensor and O-ring.
- Replacement of PCB (Printed Circuit Board) is required due to the deterioration of capacitor.

## 7. TROUBLE CASE TREATMENT

### 7-1 SELF-DIAGNOSIS

Each diagnosis function in this unit is provided.

If trouble was found, the following message is shown and make the recovery procedure.

Self-diagnosis	LCD message	POWER/TROUBLE lamp	Alarm contact
Sensor failure	FAIL = SENSOR	Blinking	Alarm status
Low flow	FAIL = FLOW	Blinking	Alarm status
Tape damage	FAIL = TAPE	Blinking	Alarm status
Tap cassette pre-caution	CHANGE TAPE	Blinking	Normal status
Tape ending	TAPE END	Blinking	Alarm status
Tape fails	FAIL = TAPE LEVEL	Blinking	Alarm status
Tape set fails	TAPE SET MISS	Blinking	Alarm status
System trouble	FAIL = SYSTEM	Blinking	Alarm status
Motor trouble	FAIL = MOTOR	Blinking	Alarm status

#### \* NOTE

When encounter some troubles, [→] on the right of LCD will blink and when press [LAMP RESET] switch, another trouble content will be displayed.

## 7-2 TROUBLE CAUSE AND MEASURES

Trouble content	Main cause	Counter-measure
Sensor failure	Sensor disconnection or connector removal or output deterioration.	Sensor head is replaced by manufacturer.
	Measuring path(LED・sensor)part is extremely dirty.	Ditto
Low flow	Secular drop of pump or dust filth at flow path.	Adjusted by flow adjuster.
Tape breakage	Loading of tape cassette is not sure.	Make sure to set the new tape cassette.
	When load the cassette, it damaged the tape.	Ditto
Tape cassette change precaution	Nearly at tape ending.	Replace it with new tape cassette.
Tape ending	Tape ends	Replace it with new cassette.
Tape failure	It is when use the discolor tape than the regulated or the tape passing the life and that stored in the outside of refrigerator.	Replace it with new tape cassette.
Tape set failure	It is not to set the tape cassette. It may be some error of tape loading.	Load the tape cassette. Load it out and check the tape condition. If not in error, load it again.
System trouble	System trouble of instrument	Re-plug in the power. If it does not reset, contact the manufacturer.
Motor trouble	Trouble of gear motor	Contact manufacturer for repair.
Power cannot be on.	Power terminal is off.	Connect it to the terminal firmly.
	Fuse is disconnected. Or not connected.	Put in the rating fuse.
	No voltage is supplied.	Check the power voltage supply.



## 8. STOPPING THE OPERATION

When finish this operation, turn power switch of this unit to OFF(0) position.

### **⚠ CAUTION**

Do not store the unit in following places. It will be cause for trouble or accident.

- Place where sun-drought is given.
- Place where to be plenty of dust and high humidity.
- Place where direct wind is given.
- Place where to be many of vibration.
- Place where to be on unstable stand or slant.
- Place where to be outdoor or water drop.

### **⚠ CAUTION**

Do not store this unit with gas detection cassette loaded. The detection tape will be deteriorated at the time of re-use and the correct detection cannot be obtained.

## 9. LIST OF PRODUCT SPECIFICATIONS

### Standard specifications

#### 【FP-300】

Detection principle	Chemical Tape Method
Detectable gas	Toxic gas
Gas concentration display	LCD(digital)
Measuring range	Depend on Detectable gas
Measurement cycle	Depend on Detectable gas
Sampling method	Measure the value of integral within the period
Detection method	Pomp suction method
Suction flow	Approx. 0.5L/min
Alarm preset point	Depend on Detectable gas
Power indication	PW/TR lamp lighting(green)
Various indications	Gas/Tape reminder
Output	Gas concentration signal/Gas alarm contact/Trouble alarm contact
Alarm accuracy (under an identical condition)	Less than $\pm 20\%$ (against alarm preset point)
Alarm-delay time (under an identical condition)	Less than 60sec(when introducing 1.6 times thicker gas than alarm preset point) (at a measurement cycle) (without piping delay time)
Gas alarm type	Two-level alarm(H-HH)
Gas alarm indication	1st : WARNING lamp blinking or lighting(orange) · Buzzer 2nd : ALARM lamp blinking or lighting(red) · Buzzer
Gas alarm action	Latched or Auto-recover
Gas alarm contact	Each no-voltage contact 1C
Trouble alarm · Self diagnosis	Tape cut/Tape end notice/Tape end/Tape failure/Tape set failure
Trouble alarm indication	PW/TR lamp blinking(green)/content display
Trouble alarm action	Auto-recover
Trouble alarm contact	Each no-voltage contact 1C
Contact capacity	AC125V · 0.5A(resistive load)
Transmission scheme	Analog transmission
Specification of transmission	DC4~20mA(load resistance less than 300 $\Omega$ )
Power supply	Desk top type : AC100V~240V $\pm 10\%$ · 50/60Hz Panel mounting type : DC24V $\pm 10\%$
Power consumption	Desk top type : Approx. 16VA/MAX. 30VA (At tape feed) Panel mounting type : Approx. 10W/MAX. 20W (At tape feed)
Continuous operation time	Tape operation time : MAX. 1month(Without gas)
Piping port	Rc1/4 (PP half union<for 0. D $\phi$ 6-1t>is provided as standard accessories.)
Operating temperature	5~35°C (non-rapidly-vary)
Operating humidity	30~80%RH (non-condensing. It may differ depending on the tape which is used.)
Structure	Desk top type or Panel mounting type(TYPE-P)
Outer dimension	Desk top type : Approx. 164 (W) × 198 (H) × 263 (D)mm Panel mounting type : Approx. 164 (W) × 164 (H) × 263 (D)mm
Weight	Desk top type : Approx. 6.5kg Panel mounting type : 5.5kg
Color	Munsell 5Y8.4/0.5

※It will become excluded from the specification of alarm-delay time when the measurement cycle exceeds 60sec.

【FP-300P】

Detection principle	Chemical Tape Method
Detectable gas	COCL <sub>2</sub>
Gas concentration display	LCD(digital)
Measuring range	0~300ppb
Measurement cycle	60sec
Sampling method	Measure the value of integral within the period
Detection method	Pomp suction method
Suction flow	Approx. 0.5L/min
Alarm preset point	50ppb(1st)/100ppb(2nd)
Power indication	PW/TR lamp lighting(green)
Various indications	Gas/Tape reminder
Output	Gas concentration signal/Gas alarm contact/Trouble alarm contact
Alarm accuracy (under an identical condition)	Less than ±20%(against alarm preset point)
Alarm-delay time (under an identical condition)	Less than 60sec(when introducing 1.6 times thicker gas than alarm preset point) (at a measurement cycle) (without piping delay time)
Gas alarm type	Two-level alarm(H-HH)
Gas alarm indication	1st : WARNING lamp blinking or lighting(orange)・Buzzer 2nd : ALARM lamp blinking or lighting(red)・Buzzer
Gas alarm action	Latched or Auto-recover
Gas alarm contact	Each no-voltage contact 1C
Trouble alarm・Self diagnosis	Tape cut/Tape end notice/Tape end/Tape failure/Tape set failure
Trouble alarm indication	PW/TR lamp blinking(green)/content display
Trouble alarm action	Auto-recover
Trouble alarm contact	Each no-voltage contact 1C
Contact capacity	AC125V・0.5A(resistive load)
Transmission scheme	Analog transmission
Specification of transmission	DC4~20mA(load resistance less than 300Ω)
Power supply	Desk top type : AC100V~240V±10%・50/60Hz Panel mounting type : DC24V±10%
Power consumption	Desk top type : Approx. 16VA/MAX. 30VA(At tape feed) Panel mounting type : Approx. 10W/MAX. 20W(At tape feed)
Continuous operation time	Tape operation time : MAX. 1month(Without gas)
Piping port	Rc1/4(PP half union<for 0. Dφ6-1t>is provided as standard accessories.)
Operating temperature	5~35°C(non-rapidly-vary)
Operating humidity	30~80%RH(non-condensing)
Structure	Desk top type or Panel mounting type(TYPE-P)
Outer dimension	Desk top type : Approx. 164(W)×198(H)×263(D)mm Panel mounting type : Approx. 164(W)×164(H)×263(D)mm
Weight	Desk top type : Approx. 6.5kg Panel mounting type : 5.5kg
Color	Munsell 5Y8.4/0.5

【FP-301P】

Detection principle	Chemical Tape Method
Detectable gas	H <sub>2</sub> Se/AsH <sub>3</sub>
Gas concentration display	LCD(digital)
Measuring range	H <sub>2</sub> Se : 0~200ppb AsH <sub>3</sub> : 0~15ppb
Measurement cycle	H <sub>2</sub> Se : 60sec AsH <sub>3</sub> : 180sec
Sampling method	Measure the value of integral within the period
Detection method	Pomp suction method
Suction flow	Approx. 0.5L/min
Alarm preset point	H <sub>2</sub> Se : 50ppb(1st)/100ppb(2nd) AsH <sub>3</sub> : 5ppb(1st)/10ppb(2nd)
Power indication	PW/TR lamp lighting(green)
Various indications	Gas/Tape reminder
Output	Gas concentration signal/Gas alarm contact/Trouble alarm contact
Alarm accuracy (under an identical condition)	Less than ±20%(against alarm preset point)
Alarm-delay time (under an identical condition)	Less than 60sec(when introducing 1.6 times thicker gas than alarm preset point) (at a measurement cycle) (without piping delay time)
Gas alarm type	Two-level alarm(H-HH)
Gas alarm indication	1st : WARNING lamp blinking or lighting(orange) · Buzzer 2nd : ALARM lamp blinking or lighting(red) · Buzzer
Gas alarm action	Latched or Auto-recover
Gas alarm contact	Each no-voltage contact 1C
Trouble alarm · Self diagnosis	Tape cut/Tape end notice/Tape end/Tape failure/Tape set failure
Trouble alarm indication	PW/TR lamp blinking(green)/content display
Trouble alarm action	Auto-recover
Trouble alarm contact	Each no-voltage contact 1C
Contact capacity	AC125V · 0.5A(resistive load)
Transmission scheme	Analog transmission
Specification of transmission	DC4~20mA(load resistance less than 300Ω)
Power supply	Desk top type : AC100V~240V±10% · 50/60Hz Panel mounting type : DC24V±10%
Power consumption	Desk top type : Approx. 16VA/MAX. 30VA(At tape feed) Panel mounting type : Approx. 10W/MAX. 20W(At tape feed)
Continuous operation time	Tape operation time : MAX. 1month(Without gas)
Piping port	Rc1/4(PP half union<for 0. Dφ6-1t>is provided as standard accessories.)
Operating temperature	5~35°C(non-rapidly-vary)
Operating humidity	30~80%RH (non-condensing. It may differ depending on the tape which is used.)
Structure	Desk top type or Panel mounting type(TYPE-P)
Outer dimension	Desk top type : Approx. 164(W) × 198(H) × 263(D)mm Panel mounting type : Approx. 164(W) × 164(H) × 263(D)mm
Weight	Desk top type : Approx. 6.5kg Panel mounting type : 5.5kg
Color	Munsell 5Y8.4/0.5

※It will become excluded from the specification of alarm-delay time when AsH<sub>3</sub> gas

【FP-300A】

Detection principle	Chemical Tape Method
Detectable gas	HBr/HF
Gas concentration display	LCD(digital)
Measuring range	HBr : 0~2ppm HF : 0~3ppm
Measurement cycle	HBr : 30sec HF : 30sec
Sampling method	Measure the value of integral within the period
Detection method	Pump suction method
Suction flow	Approx. 1.2L/min
Alarm preset point	HBr : 0.5ppm(1st)/1ppm(2nd) HF : 0.5ppm(1st)/1ppm(2nd)
Power indication	PW/TR lamp lighting(green)
Various indications	Gas/Tape reminder
Output	Gas concentration signal/Gas alarm contact/Trouble alarm contact
Alarm accuracy (under an identical condition)	Less than $\pm 30\%$ (against alarm preset point)
Alarm-delay time (under an identical condition)	Less than 60sec(when introducing 1.6 times thicker gas than alarm preset point) (at a measurement cycle) (without piping delay time)
Gas alarm type	Two-level alarm(H-HH)
Gas alarm indication	1st : WARNING lamp blinking or lighting(orange)・Buzzer 2nd : ALARM lamp blinking or lighting(red)・Buzzer
Gas alarm action	Latched or Auto-recover
Gas alarm contact	Each no-voltage contact 1C
Trouble alarm・Self diagnosis	Tape cut/Tape end notice/Tape end/Tape failure/Tape set failure
Trouble alarm indication	PW/TR lamp blinking(green)/content display
Trouble alarm action	Auto-recover
Trouble alarm contact	Each no-voltage contact 1C
Contact capacity	AC125V・0.5A(resistive load)
Transmission scheme	Analog transmission
Specification of transmission	DC4~20mA(load resistance less than 300 $\Omega$ )
Power supply	Desk top type : AC100V~240V $\pm 10\%$ ・50/60Hz Panel mounting type : DC24V $\pm 10\%$
Power consumption	Desk top type : Approx. 20VA/MAX. 30VA(At tape feed) Panel mounting type : Approx. 10W/MAX. 20W(At tape feed)
Continuous operation time	Tape operation time : MAX. 1month(Without gas)
Piping port	Rc1/4(PP half union<for 0. D $\phi$ 6-1t>is provided as standard accessories.)
Operating temperature	5~35 $^{\circ}$ C(non-rapidly-vary)
Operating humidity	30~80%RH (non-condensing. It may differ depending on the tape which is used.)
Structure	Desk top type or Panel mounting type(TYPE-P)
Outer dimension	Desk top type : Approx. 164(W) $\times$ 198(H) $\times$ 263(D)mm Panel mounting type : Approx. 164(W) $\times$ 164(H) $\times$ 263(D)mm
Weight	Desk top type : Approx. 6.5kg Panel mounting type : 5.5kg
Color	Munsell 5Y8.4/0.5

Standard accssirues

- Gas detection tape cassette..... 1pce
- Dust filter ..... 1pce
- Instruction manual..... 1vol
- Fuse (Desk top type)..... 2pcs

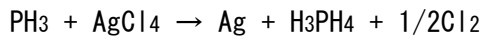
## 10. DETECTION PRINCIPLE

The structure of detection part applied in this unit is shown below figure.

There is a gas chamber made of shaded container to take the target gas onto the tape, and luminous element and photo-sensor are arranged in there.

When the target gas passes through the cellulose tape impregnated with coloring agent, it produces color by chemical reaction.

For example, when phosphine (PH<sub>3</sub>) gas contacts the tape, it generates a silver colloid as shown below chemical equation and changes the color of the tape from white to black.



The degree of this coloring is taken as the change of light reflection amount to the tape.

The variation ratio of intensity for this reflection amount shall be called as response value to gas concentration.

By calculating the calibration curve beforehand, the gas concentration can be determined from response value.

