



# **INSTRUCTION MANUAL**

## **OZONE MONITORS**

### **MODEL 600 and 600Q SERIES**

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## Introduction

This time, we are pleased that you have purchased ozone monitors, Model 600 and/or Model 600Q series made by Ebara Jitsugyo Co., Ltd.

This instruction manual provides the latest information in order to install and to use the system-in type monitor, Model 600 series and dissolved type monitor, Model 600Q series correctly and safety, so that their important messages are described in this manual.

### Model 600 series

- Model EG-600 : Ozone gas monitor
- Model EL-600 : Dissolved Ozone monitor

### Model 600Q series

- Model EL-600Q-10 : Dissolved Ozone monitor (for 1 inch piping)
- Model EL-600Q-05 : Dissolved Ozone monitor (for 0.5 inch piping)




These products are the advanced instruments which are designed by microprocessor based techniques, and they can automatically measure ozone concentration in air or in liquid. And these monitors have two functions to make self-diagnosis on their operation and to supply output signals for processor control.

In the meanwhile, information stored in the non-volatile memory of these microprocessors are not protected so as not to rewrite them, but they do not need to be revised the information by user side.

And then, regarding precautions in the matter of safety, refer to the following marks and their descriptions, and also see giving attention to 'Dangerous Characteristics for Ozone Treatment' and 'Caution items when put the monitor (densitometer) in use'.

## Important Safety Message

The following safety messages and marks are the most important information for human bodies. Please ensure the safety of all users for our products by reviewing this information.

Mark	Description
 <b>DANGER</b>	<b>DANGER</b> indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.
 <b>WARNING</b>	<b>WARNING</b> indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.
 <b>CAUTION</b>	<b>CAUTION</b> indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.



## DANGER

### Dangerous Characteristics for Ozone Treatment

Ozone has powerful oxidation effect, and it is used for many kinds of substance by the reaction, such as Oxidation/Dissolution, Sterilization and etc, but it is also informed that Ozone has 'Toxicity' for human bodies. Therefore, any exposure by Ozone should be free from the leakage on the piping connections for Ozone sampling system and/or the wetted parts, and also the related equipments.

The following table shows the effects, for Ozone concentration to human bodies.

### Biological influences caused by ozone

Ozone concentration [ppm]	Influences
0.01 ~ 0.02	Sensible odor (with the sense of smell becoming gradually accustomed to the smell)
0.1	Strong odor stimulant to the nose and throat.
0.2 ~ 0.5	Eyesight weakens by 3 to 6 hour's exposure.
0.5	Apparently stimulant to the upper respiratory tract.
1 ~ 2	Exposure for 2 hours presents a headache, a pain in the chest, and thirsty at the upper respiratory tract and coughing. Repeatable exposures will lead to chronic toxicities.
5 ~ 10	Increase of pulses and pulmonary edema will be caused.
15 ~ 20	Small animals will die within 2 hours.
50	Life of man will be jeopardized in one hour.

'Report on Ozone Processing' by Japan Water Works Association, August 1984, P. 40

#### Threshold limit value:

Japan : 0.1 [ppm] (recommendation by Japan Association of Industrial Hygienists)(2006)  
USA : 0.1 [ppm] TLV of TWA by ACGIH (1993-1994) \*

\* TLV : Threshold limit value

TWA: Time Weighted Average Concentration

ACGIH: American Conference of Governmental Industrial Hygienists



## **DANGER**

**This equipment is not one of explosion-proof construction. If ozone monitor is used in the place which there is an explosive gas in the atmosphere, it can cause in trouble for making an explosion in the area. Do not use the ozone monitor in explosive environments.**



## **WARNINGS**

**If there is ozone smell, confirm whether the ozone monitor has an enclosure crack, piping damage and slackness on joints or not after when power switch turned off.**

**A high voltage power supply (Steady state: about 200 V ac and Starting state: about 1000 V ac in a moment) for the mercury lamp is built in the monitor, so that you may have an electrical shock when perform adjustment and repairing inside of the monitor. Do perform it with specialist.**

**If you opened the front panel under when an electric power is supplied, you may have a chance which can receive UV ray from the mercury lamp with burning light inside. Do wear glasses for protecting your eyes when you work on it.**



## CAUTIONS

Caution items when put the monitor (densitometer) in use

- Sealing materials such as joint, piping and packing etc. which are used in the monitor, are not intended to be effective permanently. These materials are deteriorated by ozone gas and other materials and this may cause in ozone gas leakage. Perform the increased tightening of the joints and check and replace these materials regularly (every 1~2 years) by our service man.
- Withstand pressure force in the monitor has its limit. Never supply a high pressure which is unnecessary into the monitor. Do confirm the monitor's specification and checking the monitor regularly.
- A low pressure mercury lamp as consumable part contains harmful component to the humans, so that the used lamp should be scrapped in accordance with your local regulations.
- In case of removing the monitor from the related device when maintenance and etc, confirm that there is not the residual ozone (the indicating value of the ozone concentration is 0) and perform the works after when the power supply shut down.
- If the sample gas contains materials other than ozone, such as hydrogen fluoride and moisture, the inner part of the monitor which is exposed to gas may be eroded, damaged, clouded or rusted. In case that the monitor had trouble and it becomes impossible to measure ozone by influence of another material, take care that the monitor will not be guaranteed, even if it is in the warranty term.
- Be sure to take a caution when working with the monitor under power supplying or soon after when power turned off, because surface of the part in the inside (including parts installed on PCB) is in high temperature.
- The parts used in the monitor has a life. If they are used in over than their exchanging term, this may have a chance which can cause in failure to other part. Make sure to have maintenance regularly.
- Do not affect a shock and/or vibration to this monitor, this instrument is a precise equipment.
- Regarding the failure and/or accident broken out from the remodeling and wrong use, we can not have these obligations under the warranty.
- If the interface cable is attached or removed, be sure to perform it after when the power supply was turned off.

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# 1 Summary

**OZONE MONITOR, Model EG/EL-600 and/or EL-600Q series (hereafter referred as the monitor) is the compact size and light-weight industrial instrument that has been developed and commercialized for mainly monitoring Ozone concentration so as to be used with ozone generator (ozone supplying device) for laboratory study or for production process. For old type ozone monitor, zero adjustment was needed every time when measuring the concentration, but this monitor can measure it in steady state by confirming or adjusting the zero point only 2 ~ 3 times a month, in condition that zero gas (water) is introducing after when turned on electric power to the monitor and that it is operated continuously. Furthermore, easy, periodical zero adjustment is also possible by means of the auto zero function via an external signal or pressing a switch on the front panel. This instrument can perform to correct zero point with no limit excepting a case of judging the monitor with error by self-diagnosis function.**

**For your information, this zero adjustment is backed up even if the power is turned off. Consequently, when the power is on next time, zero adjustment which was made in the preceding measurement is still valid. Also, an interval timer for auto zero is built in. That is, separate from the timer used when sucking in the zero gas, zero interval can be arbitrarily set. By self-diagnosis, abnormality of the monitor, if any, is detected and displayed.**

**This instrument is consisted with two units of ones of controller and detector. An optimum structure has been adopted for the monitor with detector separated from the controller which is located at the site of measurement because decomposition of ozone is likely to occur. A sample gas (water) may be readily introduced into the monitor via the piping connected to the inlet in the case that the sample has pressure itself. If not, conduct sampling by using a feed pump. Furthermore, regarding Model EG-600 series, temperature compensation is possible by setting a temperature sensor inside the monitor. Furthermore, as it is option, pressure compensation is also able to display gas pressure, compensating automatically to the atmospheric pressure, by setting a pressure sensor inside the detector and by setting pressure compensation mode of the controller. Communication with a host computer is also possible by making use of an optional serial port, through which data of higher accuracy will be obtained.**

**And then, ozone monitor, Model 600Q series can measure Ozone concentration in water automatically and operate continuously, being adopted to large flow rate, and also they are the latest ozone monitors which have functions for generating process control signal and for self-diagnosis. This instrument has developed and manufactured so as to mainly monitor Ozone concentration for installing it to the Ozone water supplying device as it is in-line system. The monitor is composed of a detector and a controller, so that the detector can be located in the most suitable measuring point by connecting them with cable wire. And then, this series have dissolved ozone monitors, EL-600Q-10 and EL-600Q-05, being adopted to large flow rate and piping size with 1 inch and 0.5 inch, even if ozone monitor for large flow-rate has construction which has small pressure loss.**

**Note: Concerning enclosure construction of detector unit, Model 600Q series is in compliance with JIS DRIP PLOOF II.**



## 2 Measuring principle

This monitor is a UV absorption type Dissolved ozone monitor which can detect and measures quantity of absorption of UV rays by ozone in the sample water introduced into the detector. A low-pressure mercury lamp (emission wavelength 253.7 nm) is used for the light source. As the quantum of light absorbed by ozone existing within the optical path 'T' obeys the Lambert-Beer's Law, concentration of ozone can be measured as follows.

$$C = \frac{A}{T} \times \log \left( \frac{I_o}{I_x} \right) \quad \dots\dots\dots \text{eq. 1}$$

- where : C = Ozone concentration
- A = Specific absorption coefficient
- T = Path length of cell
- I o = Light intensity through the sample free of Ozone
- I x = Light intensity passed through sample Ozone
- A = Constant

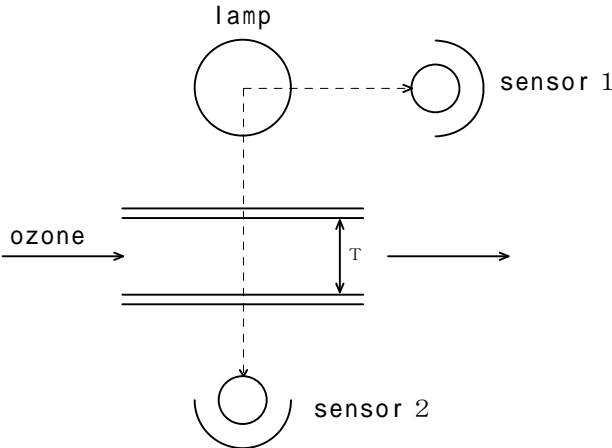


Figure- 1 Logic diagram

### 3 Specifications

#### 3.1 Model 600 series

- Model name** : EG-600 ···· Generated ozone gas or ozone gas (free from mixed impurities)  
 EL-600 ···· Liquid phase ozone (free from mixed impurities)
- Measuring principle** : UV absorption method
- Measuring range** : To be selected from among the following ranges. (\*Note 1)

##### Model EG-600

0 ~ 10.0 g/m <sup>3</sup> (N)	0 ~ 200 g/m <sup>3</sup> (N)
0 ~ 20.0 g/m <sup>3</sup> (N)	0 ~ 300 g/m <sup>3</sup> (N)
0 ~ 30.0 g/m <sup>3</sup> (N)	0 ~ 400 g/m <sup>3</sup> (N)
0 ~ 40.0 g/m <sup>3</sup> (N)	0 ~ 20.0 wt%
0 ~ 99.9 g/m <sup>3</sup> (N)	

##### Model EL-600

0 ~ 20.0 mg/L	0 ~ 60.0 mg/L
0 ~ 30.0 mg/L	0 ~ 99.9 mg/L
0 ~ 40.0 mg/L	0 ~ 120 mg/L
0 ~ 50.0 mg/L	

- Measuring interval** : Continuous measurement (\*Note 2)
- Sampling method** : By Gas(water) · pressure itself or by sucking pump
- Sample Flow rate** : EG-600 (G6SH type) 0.5 ~ 20 L/min (\*Note 3)  
 EG-600 (G6SM type) 0.5 ~ 10 L/min  
 EL-600 0.1 ~ 1.0 L/min
- Span drift** : within ± 1 % of Full Scale per month
- Zero drift** : EG-600 within ± 1 % of FS/month (\*Note 4)  
 EL-600 within ± 2 % of FS/month
- Linearity** : within ± 1 % FS (\*Note 5)
- Repeatability** : Less than ± 1 % FS
- Zero adjustment** : By auto-zero function
- Display** : Main indication Concentration in 3 figures  
 Sub indication Temperature  
 Pressure (in MPa[G] or hPa[A] ) (\*Note 6)
- Span adjustment** : Digital setting (in an increment of 0.1%)
- Monitor input** : Timing signal for automatic zero, photo-coupler driven
- output** : Output signal of controller unit  
 Digital output in 6 channels, all photo-coupler open collector outputs

	<b>Measurement signal</b>	<b>Output only under normal operation</b>
	<b>Monitor error signal</b>	<b>Output in case of abnormal monitor condition</b>
	<b>Concentration alarm</b>	<b>Arbitrary signal level alarm setting in 2 channels</b>
	<b>Pressure alarm setting</b>	<b>Arbitrary signal level alarm setting in 2 channels (*Note 6)</b>
<b>Analog output</b>	<b>:</b>	<b>0 ~ 1 V dc or 0 ~ 10 V dc (need to be specified before shipping from the factory) (*Note 7)</b>
<b>Control output of Detector unit</b>	<b>:</b>	<b>Control outputs of ‘a’ form contacts with rating of 100 V ac, 0.4 A for signals of pump operation and port change of solenoid valve.</b>
<b>Self-diagnostic function</b>	<b>:</b>	<b>Detection and display of abnormal operation on the light source, contamination of the cell, and any abnormal operation on electrical circuits</b>
<b>Test mode</b>	<b>:</b>	<b>Analog output test mode, solenoid valve test mode, and alarm contact test mode</b>
<b>Power supply</b>	<b>:</b>	<b>100~220 V ac ± 10%, 50/60 Hz or 24 ± 5 V dc, 0.5 A (optional)</b>
<b>Power consumption</b>	<b>:</b>	<b>50 VA max.</b>
<b>Outside dimension</b>	<b>:</b>	<b>Controller Vertical type 72 (W) × 200 (H) × 200 (D) mm Horizontal type 200 (W) × 72 (H) × 200 (D) mm Detector G6SH type 85 (W) × 160 (H) × 92 (D) mm G6(L6)SM type 100 (W) × 155 (H) × 135 (D) mm (*Note 8)</b>
<b>Panel cutout</b>	<b>:</b>	<b>Controller(vertical) 66 (W) × 180 (H) mm Controller (horizontal) 180 (W) × 66(H) mm Panel thickness 2~5 mm</b>
<b>Weight</b>	<b>:</b>	<b><u>Controller</u> :Approx. 1.6 kgf <u>Detector</u> G6SH : Approx. 1.6 kgf (under full attachment of optional accessories) G6(L6)SM : Approx. 1.6 kgf</b>
<b>Piping connector</b>	<b>:</b>	<b>G6SH 1/4 inch VCR joint (or equivalent) G6(L6)SM Flowell™ series 20, 1/4 inch (*Note 9)</b>
<b>Connection dimension (Joint face to face)</b>	<b>:</b>	<b>129.4 mm + 0, - 2 mm (in case of G6SH type with SUS piping)</b>
<b>Wetted parts</b>	<b>:</b>	<b>G6SH SUS 316(L) and Composed quartz, Fluorine gum G6(L6)SM PTFE, PFA and Composed quartz</b>

<b>Operating environment</b>	:	<b>EG-600: Temperature</b> <b>5 ~ 40</b> <b>(*Note 10)</b> <b>Humidity</b> <b>Less than 90% RH</b> <b>(no condensation)</b> <b>EL-600: Temperature</b> <b>5 ~ 40</b> <b>Humidity</b> <b>Less than 80% RH</b> <b>(no condensation)</b>
<b>Temperature of sample</b>	:	<b>5 ~ 40</b>
<b>Normal operating pressure</b>	:	<b>G6SH</b> <b>Less than 0.294 MPa(G)</b> <b>G6(L6)SM</b> <b>Less than 0.098 MPa(G)</b>
<b>Maximum withstand pressure</b>	:	<b>G6SH</b> <b>Less than 0.588 MPa(G)</b> <b>G6(L6)SM</b> <b>Less than 0.294 MPa(G)</b>
<b>Accessories</b>	:	<b>Connection cable, 1.5 m</b> <b>1 PC</b> <b>(*Note 11)</b>  <b>Withstand rush current type Fuse, 250 V ac, 1 A</b> <b>approved by UL standard</b> <b>1 PC</b>
<b>Temperature compensation</b>	:	<b>Temperature compensation;</b> <b>Measuring range</b> <b>5 ~ 45</b> <b>Compensation temperature</b> <b>0</b> <b>Accessory: Temperature sensor (built-in)</b> <b>(*Note 12)</b>
<b>Option</b>	:	<b>Current output 4 ~ 20 mA dc (isolated)</b> <b>(*Note 13)</b>  <b>Serial port ; Data transmission by RS232C</b> <b>Communication speed</b> <b>9600 bps</b> <b>Communication method</b> <b>Full duplex</b> <b>Data bit</b> <b>8 bits</b> <b>Stop bit</b> <b>1 bit</b> <b>Parity check</b> <b>None</b>  <b>Power supply of 24 V dc</b>  <b>Interface Cable 3, 5, 10, 15 m</b>  <b>Windows Communication Software for Ozone Monitor</b>  <b>Pressure compensation ;</b> <b>Measuring range</b> <b>0 ~ 0.294 MPa(G)</b> <b>Compensation pressure</b> <b>atmospheric pressure</b> <b>Accessory</b> <b>Pressure sensor</b> <b>(*Note 14)</b>  <b>G6(L6)SM</b> <b>Final lock 1/4 inch fitting</b>  <b>1/2 inch Flowell™ series 20 joint</b>  <b>Inlet port for dried air</b> <b>one touch coupling, O.D. 6 mm</b> <b>(L6SM only)</b>

## Supplementary information

- \* Note 1     **Range of 0 ~ 400 [g/m<sup>3</sup>(N)] is not applicable to model G6SM  
For your information, [wt %] is based on oxygen as the material for the  
generated ozone.**
- \* Note 2     **Confirm zero with the material gas (water) before supplying ozone gas (water).**
- \*Note 3     **Measurement with a flow rate of less than 0.5 L/min is also possible for EG-600,  
but at the sacrifice of response speed.**
- \*Note 4     **In one day after turning on the power, conduct zero adjustment once a day.**
- \*Note 5     **In case of ozone concentration is less than 300 g/m<sup>3</sup>(N) under a pressure 0.196  
MPa(G) applied.**
- \*Note 6     **In case of optional pressure compensation, only Model EG-600 can be equipped  
but EL-600 has not these options.**
- \*Note 7     **External resistance load connectable is more than 10 k $\Omega$ .**
- \*Note 8     **Protruding parts and detector legs are excluded.**
- \*Note 9     **When shipping, Final Lock 1/4 inch fitting can be installed as optional order.**
- \*Note 10    **But the monitor can not give a full performance when this operating  
temperature will change to a large degree in a moment.**
- \*Note 11    **The following four kinds of cable length are optionally available in addition to  
the standard cable length.     • 3, 5, 10, 15 m**
- \*Note 12    **The optional function can be applied to Model EG-600 only.**
- \*Note 13    **External resistance load connectable is less than 750 $\Omega$ .**
- \*Note 14    **An absolute pressure sensor, 0 ~ 1961 hPa(ABS) is optionally available.  
(Caution: For G6SH, the pressure sensor is built-in type, but for G6SM is one  
of outside.)**

### 3.2 Model 600Q series

<b>Model name</b>	:	<b>EL-600Q-10</b> (piping size: 25.4 O.D. × 22.2 I.D. mm) <b>EL-600Q-5</b> (piping size: 12.7 O.D. × 9.5 I.D. mm)
<b>Measuring principle</b>	:	<b>UV absorption method</b>
<b>Service</b>	:	<b>Dissolved ozone in water</b>
<b>Measuring range</b>	:	<b>0~20.0, 0~30.0, 0~40.0, 0~50.0, 0~60.0, 0~100, 0~120 mg per liter</b>
<b>Measuring interval</b>	:	<b>Continuous measurement</b> (*Note 1)
<b>Sampling method</b>	:	<b>By Water-pressure itself or by suction pump</b>
<b>Sample Flow rate</b>	:	<b>EL-600Q-10</b> 10~40 L/min (velocity 0.5~1.8 m/sec) <b>EL-600Q-5</b> 2~10 L/min (velocity 0.5~2.4 m/sec) (*Note 2)
<b>Span drift</b>	:	<b>within ± 1 % of Full Scale per month</b>
<b>Zero drift</b>	:	<b>within ± 1 % of Full Scale per month</b> (*Note 3)
<b>Linearity</b>	:	<b>within ± 1 % FS</b>
<b>Repeatability</b>	:	<b>Less than ± 1 % FS</b>
<b>Zero adjustment</b>	:	<b>By auto-zero function</b>
<b>Display</b>	:	<b>Concentration in 3 figures</b>
<b>Span adjustment</b>	:	<b>Digital setting (in an increment of 0.1%)</b>
<b>Monitor input</b>	:	<b>Timing signal for automatic zero, photo-coupler driven</b>
<b>output</b>	:	<b>Output signal of controller unit</b>
		<b>Digital output in 6 channels, all photo-coupler open collector Outputs</b>
		<b>Measurement signal</b> <b>Output only under normal operation</b>
		<b>Monitor error signal</b> <b>Output in case of abnormal monitor condition</b>
		<b>Concentration alarm</b> <b>Arbitrary signal level alarm setting in 2 channels</b>
<b>Analog output</b>	:	<b>0 ~ 1 V dc or 0 ~ 10 V dc</b> <b>(need to be specified before shipping from the factory) (*Note 4)</b>
<b>Self-diagnostic function</b>	:	<b>Detection and display of abnormal operation on the light source, contamination of the cell, and any abnormal operation on electrical circuits</b>
<b>Test mode</b>	:	<b>Analog output test mode, solenoid valve test mode, and alarm contact test mode</b>
<b>Power supply</b>	:	<b>100~220 V ac ± 10%, 50/60 Hz or 24 ± 5 V dc, 0.5 A (optional)</b>
<b>Power consumption</b>	:	<b>50 VA max.</b>

**Outside dimension** : **Controller**  
 Vertical type..... 72 (W) × 200 (H) × 200 (D) mm  
 Horizontal type.....200 (W) × 72 (H) × 200 (D) mm  
**Detector**..... 142 (W) × 97 (H) × 123 (D) mm  
 (\*Note 5)

**Panel cutout** : **Controller(vertical)**.....66 (W) × 180 (H) mm  
 : **Controller (horizontal)** ..... 180 (W) × 66(H) mm  
 : **Panel thickness** 2~5 mm

**Weight** : **Controller:** Approx. 1.6 kgf  
**Detector:** Approx. 1.8 kgf

**Piping connector** : **EL-600Q-10**..... φ 25.4 mm O.D. × φ 22.2 mm I.D.  
 of Super PFA tube  
**EL-600Q-05**..... φ 12.7 mm O.D. × φ 9.5 mm I.D.  
 of Super PFA tube

**Connection dimension (Joint face to face)** : within 246 mm

**Wetted parts** : Composed quartz, PTFE, Super PFA (\*Note 6)

**Operating environment** : **Temperature**.....15 ~ 40°C (\*Note 7)  
**Humidity**..... Less than 90% RH(no condensation)

**Enclosure construction** : Compliance with JIS DRIP PLOOF II

**Temperature of sample** : 15 ~ 30°C

**Normal operating pressure** : Less than 0.4 MPa(G)

**Maximum withstand pressure** : Less than 0.6 MPa(G)

**Accessories** : **Connection cable, 3 m**.....1 PC (\*Note 8)  
**Withstand rush current type Fuse, 250 V ac, 1 A approved by UL standard**.....1 PC

**Option** : ① **Current output 4 ~ 20 mA dc (isolated)** (\*Note 9)  
 ② **Serial port ; Data transmission by RS232C**  
**Communication speed**.....9600 bps  
**Communication method**.....Full duplex  
**Data bit**.....8 bits  
**Stop bit**.....1 bit  
**Parity check**.....None  
 ③ **Power supply of 24 V ac**

**Interface Cable 1.5, 5, 10, 15 m**

**Windows Communication Software for Ozone Monitor**

**Port change signal for solenoid valve  
contact capacity with no voltage (c contact) 100 V ac,  
less than 1A**

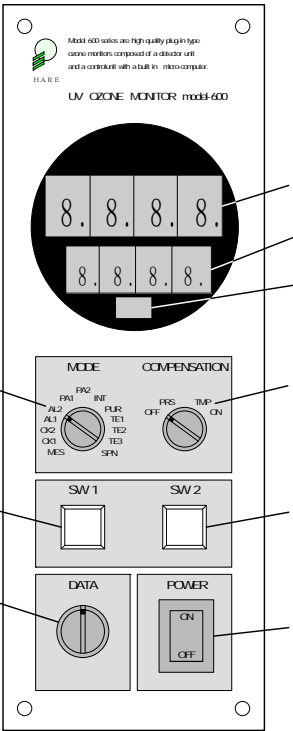
### **Supplementary information**

- \* Note 1**      **Confirm zero point with material water before supplying ozone water.**
- \* Note 2**      **Even if the flow rate is small, the monitor can measure the concentration, but the response becomes late.**
- \* Note 3**      **But, in case that zero point is adjusted once a day after one day from when power turned on, and moreover that variation of ambient temperature and the sample water should be in  $\pm 3$  .**
- \*Note 4**      **External resistance load connectable is more than 10 k .**
- \* Note 5**      **However, a projection and the leg of detector are not included.**
- \* Note 6**      **Regarding to wetted parts, material with ozone-resistant is used in the monitor, but is not intended to warrant that they are not corroded and deteriorated.**
- \* Note 7**      **The monitor may operate in this temperature range, but it is recommended that the ambient temperate should be made to be constant as much as possible.**
- \*Note 8**      **The following four kinds of cable length are optionally available in addition to standard one.    • 1.5, 5, 10, 15 m**
- \*Note 9**      **External resistance load connectable is less than 750 .**

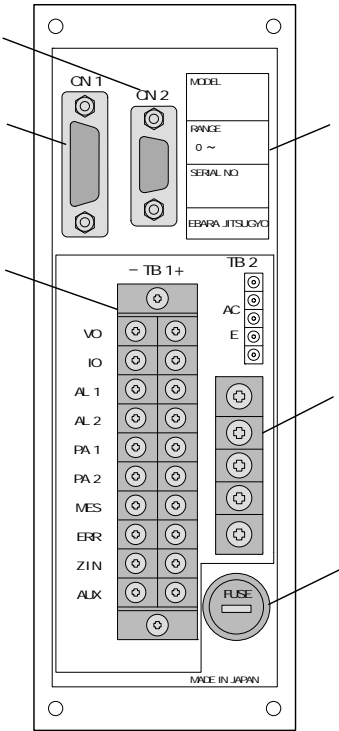


# 4 Description of position's name and functions

## 4.1 The controller

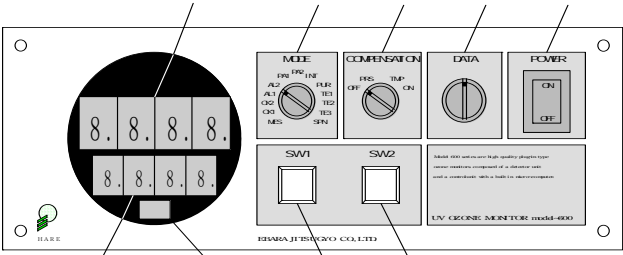


Front panel

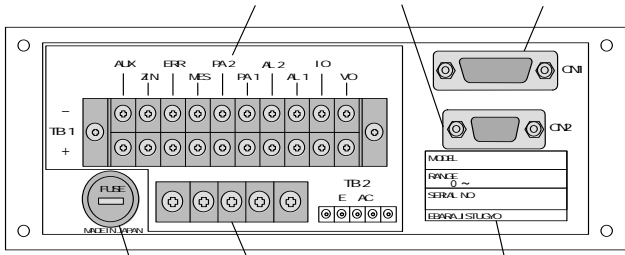


Rear panel

Figure- 2 Vertical type controller (Type 6CV)



Front panel



Rear panel

Figure- 3 Horizontal type controller (Type 6CH)

- ① Main LED
- ② Sub-LED
- ③ 3rd LED
- ④ Operation mode switch
- ⑤ Compensation mode switch
- ⑥ Setting switch 1
- ⑦ Setting switch 2
- ⑧ Data input dial
- ⑨ Power switch
- ⑩ Sensor unit interface connector
- ⑪ RS232C connector (optional)
- ⑫ Serial number plate
- ⑬ Signal terminal block
- ⑭ Power supply terminal block
- ⑮ Fuse holder

## **Functions**

### **Main LED (digital display)**

When measuring ozone concentrations, the monitor will display the concentration on the main LED. By mode switch, it is possible to display as error, each setting value and etc.

### **Sub-LED (digital display)**

This performed to display position of the mode switch. Moreover, ones of Model EG-600 series will also indicate temperature value when measuring ozone concentration. By optional, this will indicate pressure value when the monitor has a function of pressure compensation.

### **Condition LED (for displaying condition of the monitor)**

This LED is for displaying operating condition of the monitor. It lights up or blinks under the following condition.

- 1) It lights up when displaying temperature. (For EG-600 series)
- 2) The LED lights up when it is ready for inputting parameters for each input setting mode.
- 3) When the monitor is put in operation for auto-zeroing, the LED blinks under sucking zero gas (water).

### **Operation mode switch (MODE)**

This switch is used for selecting operation mode such as measurement, adjustment, alarm setting, etc. When other mode than the measurement mode (MES) is selected, the selected position number is indicated on the sub-LED. For changing parameters set for the monitor, refer to section 5.7 "Data set".

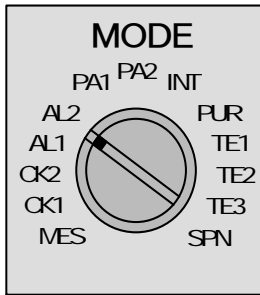


Figure- 4 MODE switch

Table 1 MODE switch

Position	Sub-LED	Functions	Output signal (photo-coupler)						Remarks
			MES	ERR	AL1·2	PA1·2	analog	SV	
MES		Measurement of ozone concentration	active	—	—	—	—	samp (ref)	
CK 1	1	Confirmation of light intensity for sensor 1	in-active	hold	hold	hold	hold	ref	
CK 2	2	Confirmation of light intensity for sensor 2	in-active	hold	hold	hold	hold	ref	
AL 1	3	Display and setting for alarm 1	in-active	hold	hold	hold	hold	samp	
AL 2	4	Display and setting for alarm 2	in-active	hold	hold	hold	hold	samp	
PA 1	5	Display and setting for pressure alarm 1	in-active	hold	hold	hold	hold	samp	
PA 2	6	Display and setting for pressure alarm 2	in-active	hold	hold	hold	hold	samp	
INT	7	Display and setting of interval time for auto-zero	in-active	hold	hold	hold	hold	samp	
PUR	8	Display and setting of gas purging time(time for sucking in the zero calibration gas)	in-active	hold	hold	hold	hold	samp	
TE 1	9	Test mode 1 (analog output test)	in-active	hold	hold	hold	—	samp	
TE 2	10	Test mode 2 (solenoid valve test)	in-active	hold	hold	hold	hold	—	
TE 3	11	Test mode 3 (alarm output test)	in-active	hold	—	hold	hold	samp	
SPN	12	Display and setting of span value	in-active	hold	hold	hold	hold	samp	

**Note:**

- Output signal excepting SV means that it is the signals from rear panel of control unit.
- SV is a signal from the detector unit (terminal block: 3 and 4) and it shows in case of connecting an electromagnetic valve (3-ways valve) for changing zero gas (water).
- Hyphen (—) means that the state is moving with changing value.
- Hold means that it is keeping its state in the before.

## Remarks

- I . This item is applicable to the monitor with optional function of pressure compensation, Model EG-600 only. The pressure units are MPa(G) for the gauge pressure sensor, and the one of absolute pressure is hPa(ABS). Refer to section 6.2 "Pressure compensation".
- II . This function is used for setting and indicating interval time regarding auto-zero. For further details, refer to section 5.3 "Interval timer."
- III . This function is used for setting time that zero gas (water) should be sucking, when zero calibration in auto-zero mode. The unit is second, and the setting is possible up to 90 seconds maximum. A proper duration of time should be set in consideration of the length of the tube to the detector.
- IV . Refer to section 5.5 "Test mode".
- V . This mode is one for setting and indicating span. It is adjusted to a calibrated value in the factory before dispatch. For further detail, refer to section 9 "Span calibration".

### Compensation mode switch (COMPENSATION)

(It not use other than EG -600 and EL -603.)

Selection of either temperature compensation or pressure compensation is made by this switch. For EG-600 series, as the monitor has a temperature compensation as standard function, switch position of [TMP] is effective always, but ones of [PRS] and [ON] positions are effective when the monitor has pressure compensation as optional function.

For further details, refer to section 5.8 "Temperature compensation" and section 6.2 "Pressure compensation".

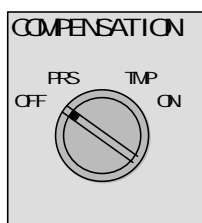


Figure- 5 COMPENSATION mode switch

- OFF :** Temperature compensation or pressure compensation is not performed. In analog output, uncompensated concentrations are output. The main LED displays uncompensated concentrations if the said operation mode switch is set at [MES].
- PRS :** Only pressure compensation is performed. In analog output, compensated concentrations are output (Not available for EL-600 by optional order).
- TMP:** Only temperature compensations are performed. In analog output, compensated concentrations are output.
- ON :** Temperature compensation and pressure compensation are performed. In analog output, compensated concentrations are output.

**Setting switch 1 (SW 1)**

This is used in the case of setting mode and test mode. Refer to section 5.7 “Data set”.

**Setting switch 2 (SW 2)**

This is used for changing display of temperature or pressure when the monitor has pressure compensation function. For pressure compensation, refer to section 6.2 “Pressure compensation”.

By pressing both SW1 and SW2 simultaneously for about one second, auto-zero can be made on manual mode. When performing auto-zero, keep only the zero calibration gas supplied and flowing. Don't perform zeroing when ozone gas (water) is supplying. Otherwise, zero level changes.

**Data input dial (DATA)**

This dial is used when entering data under setting mode. Refer to section 5.7 “Data set”.

**Power supply switch (POWER)**

This switch is used for switching [ON] and [OFF] the power supply.

**Interface connector of the detector (CN 1)**

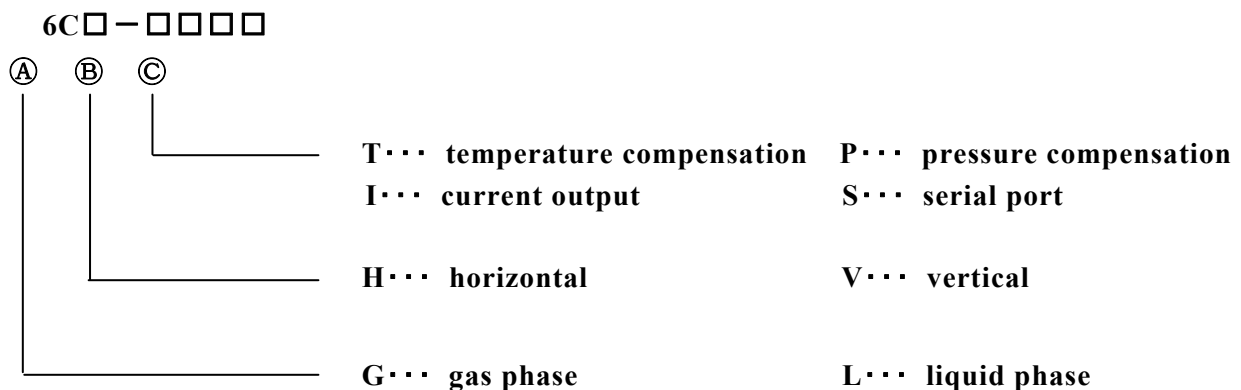
Interface connector for the detector. Connect the attached interface cable.

**Connector for RS232C (optional)**

Connector for serial port (optional) in compliance with RS232C

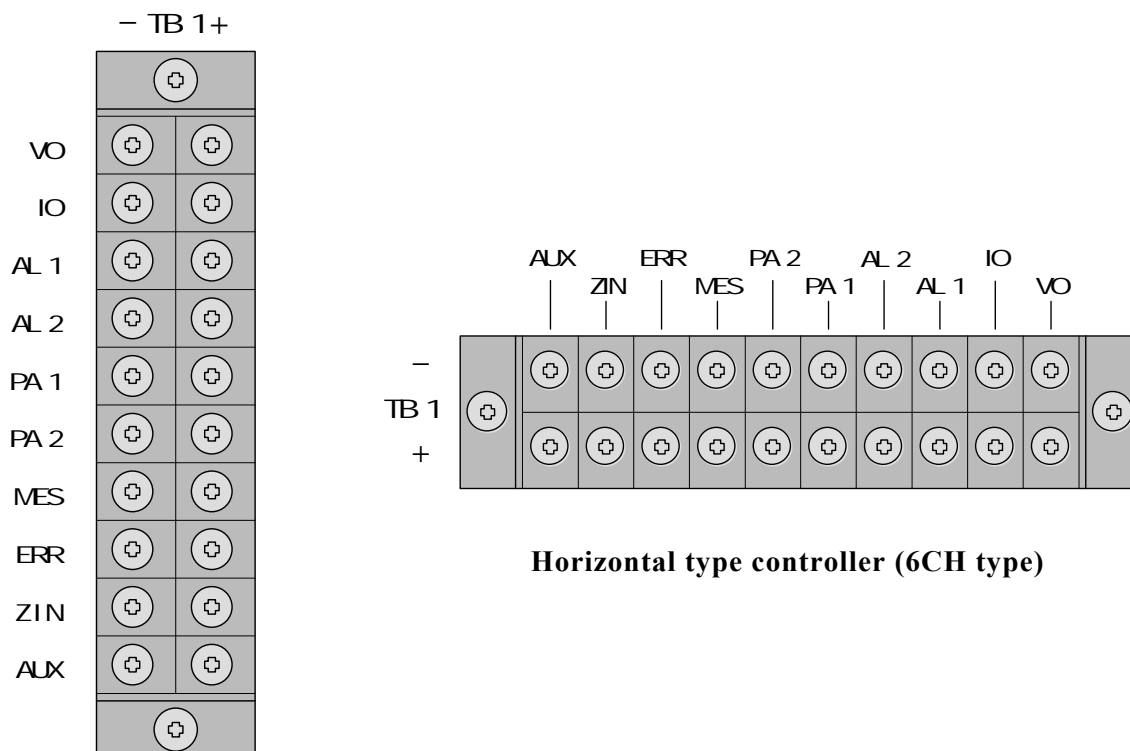
**Serial name plate for controller**

The form of the name plates are as shown below.



### Signal terminal block

Input and output signals as well as other optional signals are wired to the terminals on this terminal block. Refer to section 7.3. "How to connect external signals". If wrong polarity is set, it may lead to failure. For your information, the adaptable solderless terminals are for M3.



Horizontal type controller (6CH type)

### Vertical type controller (6CV type)

Figure- 6 Signal terminal blocks

- VO** : Analog voltage output  
 0~1 V dc or 0~10 V dc (setting in the factory before dispatch)  
 Connectable external load resistance is more than 10 k .
- IO** : Analog current output (optional) 4~20 mA dc  
 Connectable external load resistance is below 750 .
- AL1, AL2** : Alarm 1, 2 Photo-coupler output  
 An insulated open-collector, becoming active when a measured concentration, is above preset value.
- PA1, PA2** : Pressure alarm 1, 2 Photo-coupler output (optional)  
 An insulated open-collector, becoming active when a measured concentration is above preset value.
- MES** : Indicates measurement is being performed (Photo-coupler output)  
 This is an insulated open-collector, which becomes active under normal condition. Still more, if set the mode switch position excepting MES, it will become inactive state.

**ERR** : Error signal to be output on the photo-coupler  
In case of occurrence of abnormality on the monitor, it becomes active.  
This is an open collector which is separate and insulated.

note) With respect to connections of output signals from the photo-coupler, refer to section 7.3 “How to connect external signals”.

**ZIN** : Input pulse for auto-zero start  
Used for commanding auto-zero from outside.  
Refer to section 5.1 “Auto-zero”.

**AUX** : Auxiliary terminal  
As a general, this is not used, so do not connect any wires.

#### **Power supply terminal block**

Units scramble for connection on this block. For your information, the solderless terminal for M4 screw can be applicable.

**AC** : Power requirements ; 100~220 V  $\pm$  10% ac, 50/60 Hz

**FG** : Grounding

note) When power requirement is 24  $\pm$  5 V dc (optional), this terminal block should be used.

#### **Fuse / holder**

Fuse : 5.2 mm dia X 20 mm,

Withstand rush current type Fuse, 250 V ac, 1 A approved by UL standard

4.2 The Detector

4.2.1 The detector, Type G6SH and Type G6 (L6) SM

Regarding detailed dimensions etc, see attached drawing.

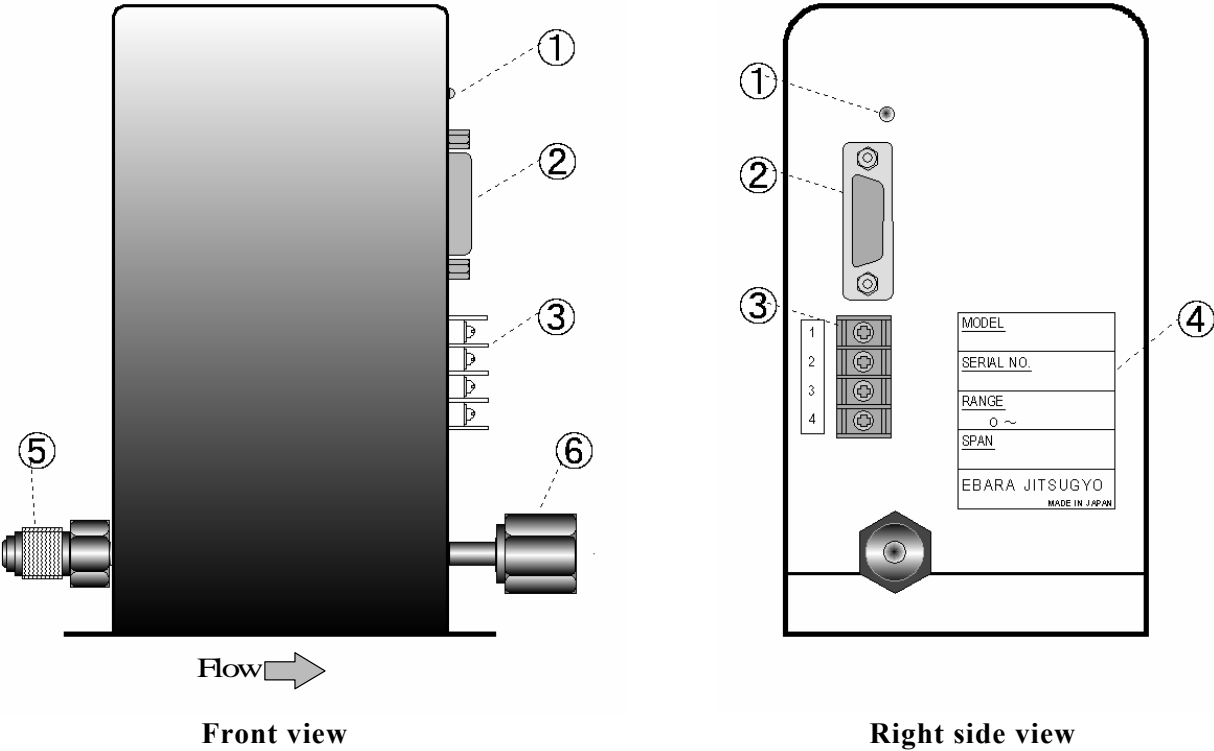


Figure- 7 The Detector, Type G6SH for Model EG-600

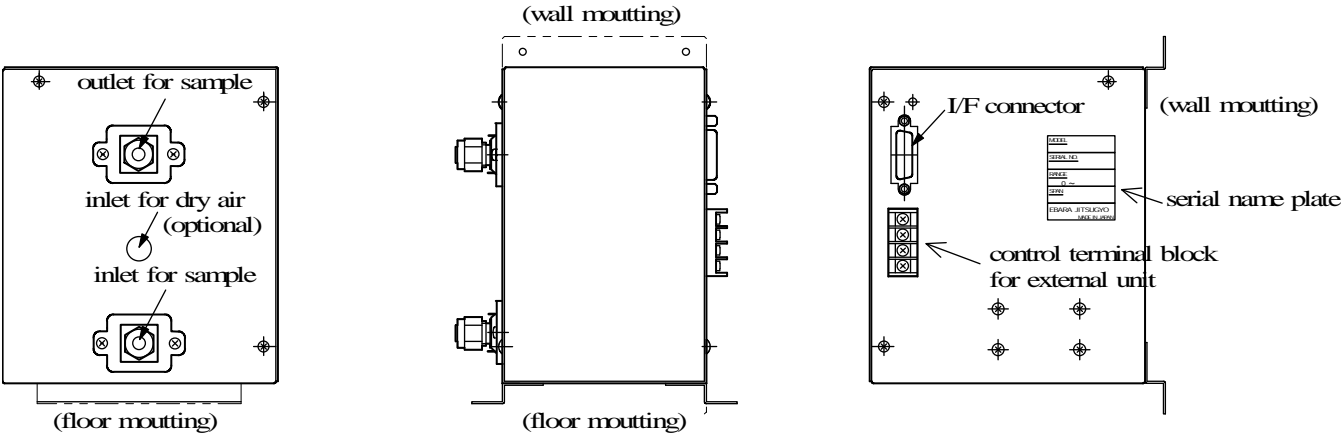


Figure- 8 The Detector, Type G6 (L6) SM



**Power supply lamp (LED)**

This lights up when the power of the controller is switched on.

**Connector**

Interface connector between the controller and the detector. Connect the cable included in the standard setup.

**Terminal block**

This is terminal block for control signals for external units such as a pump, solenoid valve and, etc. 1 and 2 are for connecting pumps. The power is turned on and off in connection with the controller. 3 and 4 are for connecting solenoid valves, becoming active only during sucking of the zero calibration gas (water) (purge time).

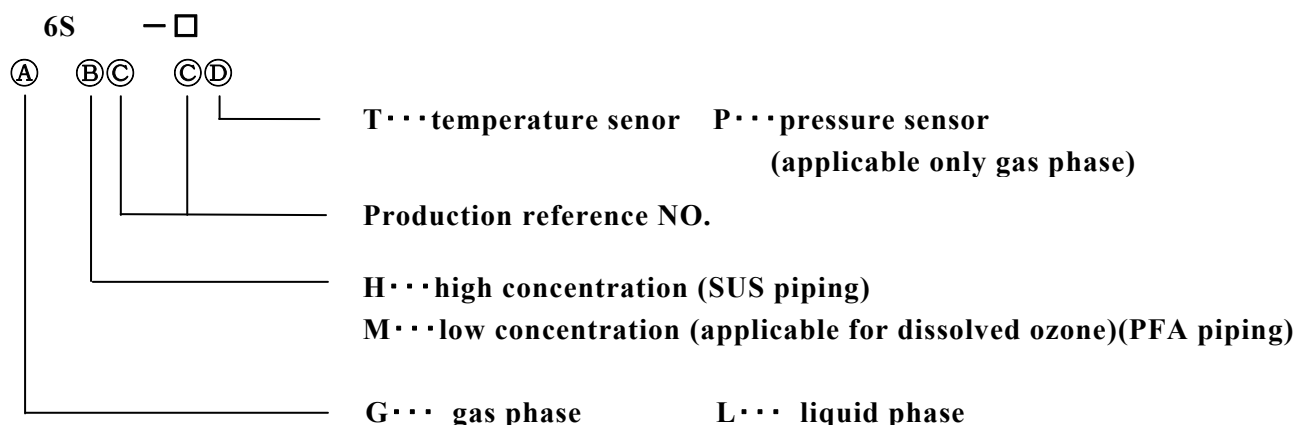
Only relay 'a' contact signal is available for each connection.

For connecting pumps and solenoid valves, an additional power supply is needed.

Capacity of the on-off contact points is 100 V ac, below 0.4 A.

**Serial number plate**

Span value calibrated before dispatch, type and measuring range are indicated on the serial number plate. Indication of the type is shown as below.



Pipe joint for the sample inlet    G6SH type            : 1/4 inch, male joint (equivalent to VCR)

G6(L6)SM type : 1/4 inch Flowell 20 series type fitting  
1/4 inch Final lock (optional)

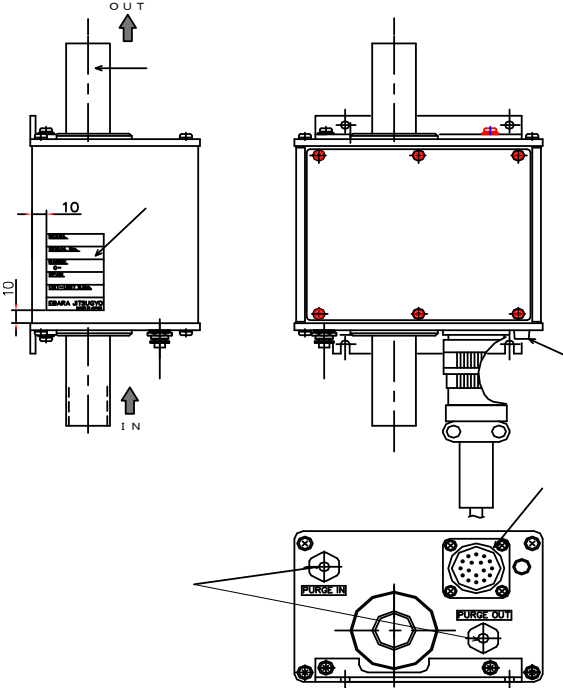
Pipe joint for the sample outlet    G6SH type            : 1/4 inch, female joint (equivalent to VCR)

G6(L6)SM type : 1/4 inch Flowell 20 series type fitting  
1/4 inch Final lock (optional)

⑦ Inlet port for dry air                      L6SM type            : 1/4 inch piping (optional)

Regarding Model EL-600, when temperature of sample is lower and suspects that it is wet with dew, supply a dry air into this inlet. For further detail, refer to section 6.6 "Inlet port for Dry air".

4.2.2 The detector, Type L6SQ



Regarding detailed dimension etc, refer to attached drawing.

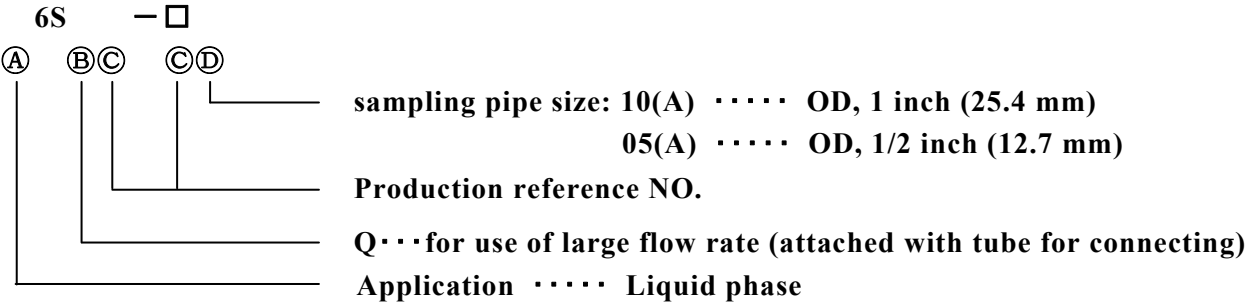
Figure- 9 The Detector, Type L6SQ for Model EL-600Q-10 and EL-600Q-05

**Lamp (LED) for power**  
This lights up when the power of the detector is switched on.

**Connector**  
Interface connector between the controller and the detector. Connect the cable included in the standard setup.

Serial number plate

Span value calibrated before dispatch, type and measuring range are indicated on the serial number plate. Type No. of this model is show as below.



Inlet and outlet for sample

- EL-600Q-10 ······ dia 25.4 mm O.D. ×dia 22.2 mm I.D.
- EL-600Q-05 ······ dia 12.7 mm O.D. ×dia 9.5 mm I.D.

These flow tubes are made up with Super PFA composed with its end type. These applicable Super PFA joints and etc. are on sale by many manufacturers, purchase the most suitable ones, thinking over the device which is connected to the joints and also serviceable one. And then, connect them.

Inlet/Outlet for purging air port

- Purge IN : Inlet for purging air
- Purge OUT: Outlet for purging air

When there is much temperature difference between environmental air and sample water, it may generate the dew-drop in the enclosure and it will be affected to shift (drift) the zero point indication. In this case, remove a stopper on the port for PURGE IN and supply dried air for purging with 0.5L/min by using tube of 6mm O.D.

## 5 Functions

### 5.1 Auto-zero

Zero drift may sometimes occur in the UV absorption type of ozone monitor due to very little change of component performance over many years of use. In the newly developed monitor, automatic zero adjustment is possible by means of switches on the front panel and also by external signals. Time interval for auto-zero can be set on the built-in timer or by attaching an external controller such as a sequencer.

Zero adjustment is possible excepting a case of a conspicuous decrease of light intensity. The relay contact signal for controlling the 3-ways solenoid valve is output from the detector. It enables therefore to supply zero calibration gas (water) by attaching a power supply unit and a solenoid valve. Operation time of the solenoid valve can be arbitrarily set in a step of 10 seconds between 0-90 seconds from the front panel. An appropriate interval time can be set in consideration of the length of the piping for the zero calibration gas to the Detector and flow rate. Auto-zero actually is operative at the termination of the time set on the timer. Refer to Fig.- 12 Auto-zero timing chart. When the timer is set to "0" second, auto zero becomes operative the instant the switch is [ON]. In this case, there is no output of solenoid valve control signals.

When performing auto-zero on manual mode on the front panel, press both SW1 and SW2 simultaneously for about one second. Note, however, that other mode than MES is selected on the "Operation mode switch", such as check mode, test mode or setting mode, auto-zero cannot be accepted. If entered it by mistake, it can be cancelled by entering auto-zero again during the sucking process of the zero calibration gas (water), unless sucking time of the zero calibration curve is set to "0". The current should be limited within the range of 10-20 mA.

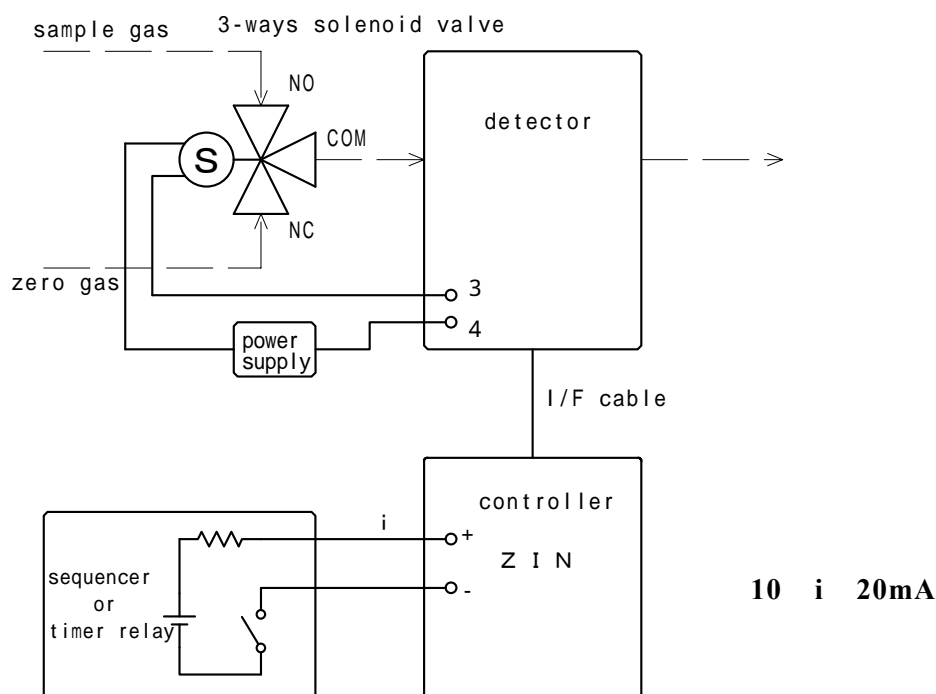


Figure- 10 Connection example 1

\*Note : Set [ON] time of the sequencer or timer relay to approximately 1 second.

If a controller signal for a sequencer and others is output on a transistor (open-collector), connect it as follows. Reversed polarity may cause trouble, so connect it carefully.

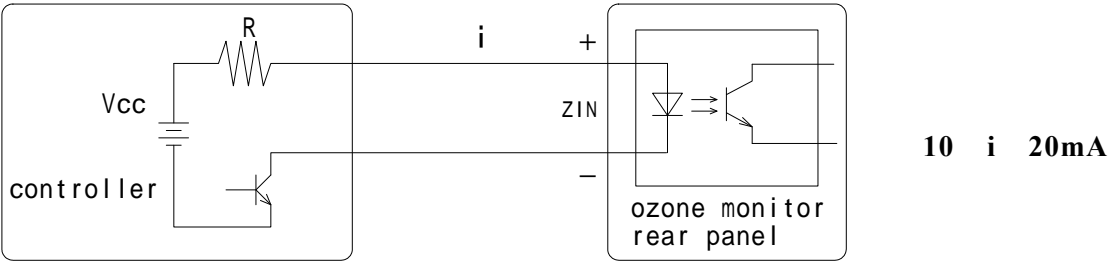


Figure- 11 Connection example 2

The adjusted value is stored in the memory even the power is turned off, and the value will be used as a reference when the power is switched on next time. Note, however, that in case the power is off for a considerably long duration of time, a drift of the compensated tune may sometimes occur. In such a case, perform auto-zero again.

5.2 Hold mode of the analog output

When auto-zero is performed, analog output is held for twice the sucking time of zero calibration gas (water). A related timing chart is shown below. Furthermore, concentration alarm is not affected during this period, for it is held and not operative. This purge time (sucking time of zero calibration gas (water)) "T" can be arbitrarily set in a step of 10 seconds during 0 ~ 90 seconds. For details on setting, refer to section 5.7 "Data set".

If it is set at 0 (T = 0), it is regarded that zero calibration time is zero and auto-zero is performed at once. This case, analog output hold is not effective.

Still more, to hold on an analog signal, is in case that the measuring signal (MES) becomes already to be in the operation state. In case that the mode switch was set to another position excepting MES position, it is not corresponded in the above.

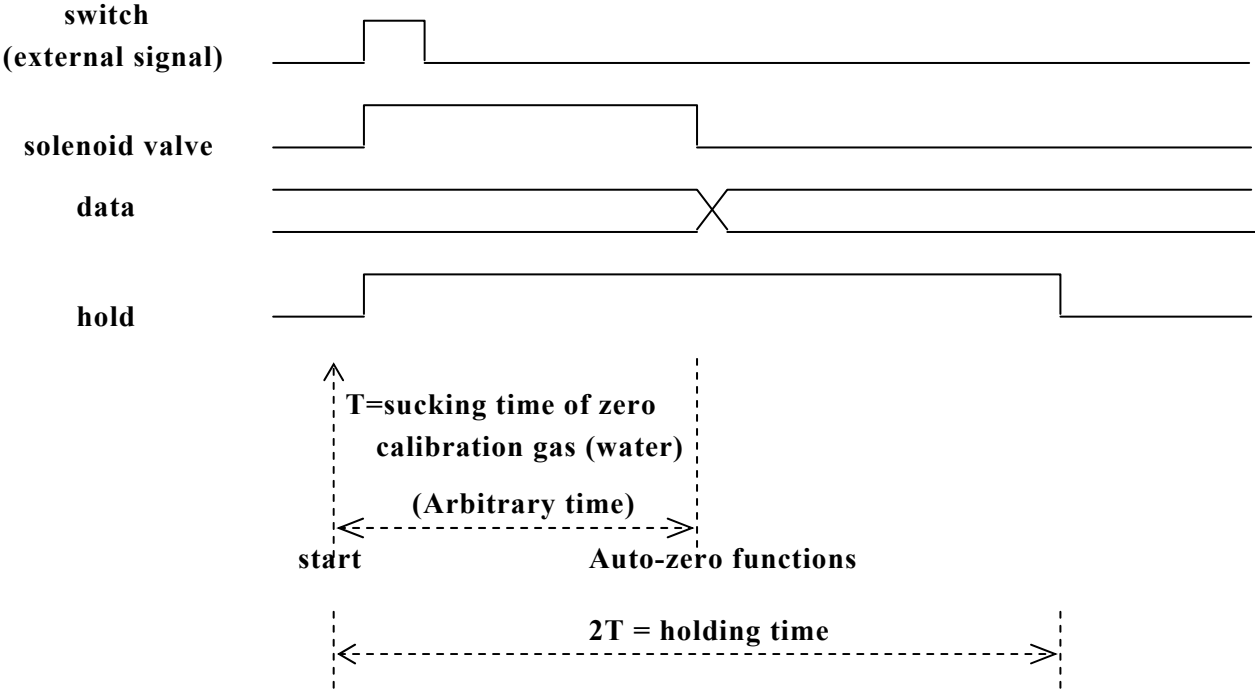


Figure- 12 Auto-zero timing chart

### 5.3 Interval timer

The monitor has a built-in interval timer for auto-zero. By this timer, separate from the timer for setting sucking time of zero calibration gas (water), intervals for auto-zero can be arbitrarily set. Intervals available are shown below. For discriminating time units for these intervals, units are shown in special letters at the top of the main LED.

[Interval]	[Unit]	[Special letters]
0, 30, 120, 300, 600	sec	Blank
1, 2, 5, 10	hour	H
1, 2, 5, 7, 14, 30	day	L

Fig.- 13 shows a timing chart.

Regarding first trigger for auto-zeroing, there are the three cases in the following when interval timer setting value is set in the limited one (except zero).

When the monitor operation had changed its mode from warming-up operation (UP 20) to measuring mode (MES).

When became measuring mode from check mode

When input a command forcibly to measuring mode from RS232C under warming-up operation (UP 20).

From the next time, zero point adjustment is performed at every time set on the interval timer.

In case that interval timer is set Optional ( $T_2=0$ ), zero point adjustment is performed in the following timing.

The switch 1 and 2 was pushed at the same time.

Auto-zero signal was supplied from outside.

A command for zero setting from RS232C

When interval timer is set in the limited value (except 0), it will not receive outside trigger in the everything, so that it is regarded as the monitor itself will control interval of zeroing. Here, for outside trigger, it means inputs by way of a switch on the front and also the terminal block, and command of serial port.

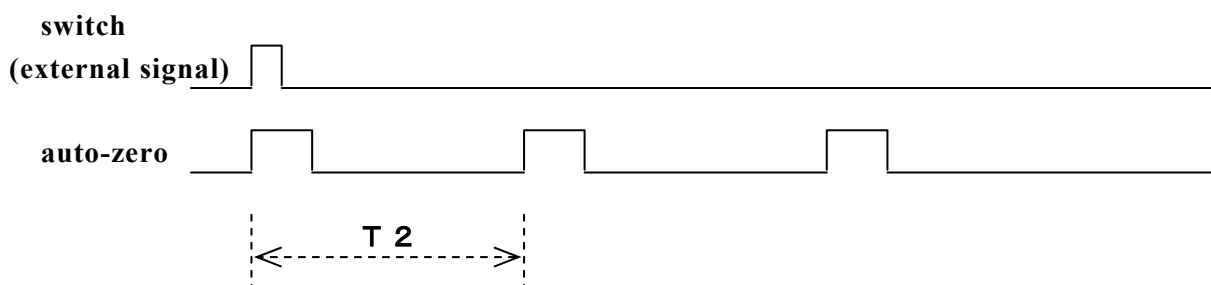


Figure- 13 Interval timer

## 5.4 Self-diagnosis and check mode

### 5.4.1 Self-diagnosis

In case of occurrence of some abnormal condition in the operation of the monitor, it is detected and displayed as an error by the main LED on the front panel. An error signal is also output from the terminal board. If this signal is active (error), it is regarded that something is wrong with the ozone monitor. In this case, normal measurement is not possible. For display of errors, refer to section 10.5 “Error display”.

### 5.4.2 Check mode

This mode is for checking the light intensity of the low-pressure mercury lamp. When the operation mode switch is set at CK1, signal intensity by the sensor 1 is displayed, and when set at CK2, signal intensity of the sensor 2. This function is conveniently applied when checking replacement time of the lamp which is a consumable part. For your information, when an external solenoid valve is used, if this check mode is selected, the solenoid valve is switched to zero calibration gas (water) line.

## 5.5 Test mode

This mode is for testing external signals from units connected to the monitor. The following 3 kinds of tests are available.

### 5.5.1 Test mode 1 (analog output test)

[Set the mode switch at TE1 to test analog output signals. Press the setting switch 1 [SW1] under this mode, and 0, 25, 50, 75, 100 % will be displayed in turn on the main LED. Analog output will change corresponding to respective full scale values.

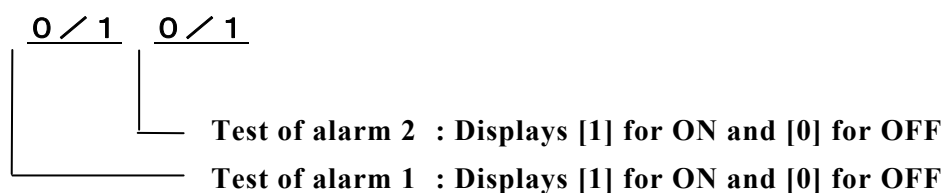
### 5.5.2 Test mode 2 (Solenoid valve test)

Set the operation mode switch to TE2 to perform function test of the solenoid valve used for the monitor. Press the setting switch SW1 under this mode, and the display on the main LED indicates in turn as follows, performing ON/OFF of the solenoid valve.

P : active (solenoid valve is ON state)  
S(5) : inactive (solenoid valve is OFF state)

### 5.5.3 Test mode 3 (alarm output test)

Set the operation mode switch to TE3 to perform function test of output signals of the concentration alarm. Under this mode, the setting switch 1 [SW1] and setting switch 2 [SW2] correspond to alarm 1 and alarm 2 respectively, enabling alarm output test to be made. If the switch was pushed once, operation of the monitor will be active (working), and twice will be inactive (not working). In this case, display on the main LED is as follows.



means blanked square put with number of [0] or [1] in the above test alarm 1 and 2.

## 5.6 Alarm setting

The monitor has two channels for alarms. As both channels function independently, it is possible to set two different values at the same time, for example a maximum value and a minimum value. These two alarm values may be entered for either alarm within the full scale range. If any detected concentration value exceeds the set value on the alarm, the alarm signal connected to the rear terminal board become operative.

Refer to next section 5.7 "Data set".

## 5.7 Data set

The monitor allows easy setting of various parameters by the users themselves including parameters for concentration alarm [AL1, AL2], pressure alarm [PA1, PA2] which are available only when pressure compensation is selected as an optional function, interval time [IN], sucking time of zero calibration gas (water) [PUR], and span value [SPN], 7 parameters of 5 kinds in all. These constants are held even if the power is turned off.

- (1) When setting the operation mode switch to each mode, a value currently set for each mode is displayed on the main LED.
- (2) Press the setting switch [SW1] just one time for the setting mode and the 3rd LED lights up.
- (3) Turn the data input dial, and the display on the main LED changes. When it is turned clockwise, the indicated value increases, and when turned counterclockwise, the value decreases.
- (4) Press the setting switch [SW1] again, and the entered value will be fixed. The 3rd LED goes out, and the input of parameters has been completed.
- (5) If the setting on the operation mode switch is changed under the above condition (2) or (3), previously set values are effective.

## 5.8 Temperature compensation

This function is built in to only model EG-600 of the monitor.

This gas monitor may sometimes have an effect on temperature of measuring gas, so that the monitor will automatically compensate it, using signal from temperature sensor, in order to minimize the measurement error.

To compensate or not, it can be performed by setting compensation mode switch on front panel. Refer to section 4 "Description of handling positions and explanation of functions". Temperature value is displayed on SUB-LED of front panel and the unit is [ °C ].

Compensation temperature range : 5 ~ 45  
 Compensated temperature : 0 ( 273 K )

Ozone concentration = Uncompensated ozone concentration  $\times \frac{\text{gas temperature} + 273}{273}$

..... eq.2

## 6 Optional functions

The following current output, pressure compensation and Serial port are functions optionally available for the monitor.

### 6.1 Current output

Isolated electrical current, 4~20 mA, is output from the terminal block on the rear panel. By connecting a precise resistor as standardization to the input terminal of an external unit to be connected, a voltage which is not affected by the cable length is obtainable, but this resistance attached externally should be less than 750 .

### 6.2 Pressure compensation (Model EG-600 only)

This function is one of EG-600 gas monitor only. In case of using the pressure compensation as optional function, pressure compensation and temperature and pressure compensations can be selectable. Selection to do compensation or not, and to adopt the compensation method can be set with Compensation mode switch on the front panel. Refer to section 4 “Description of position’s name and functions”.

#### 6.2.1 Pressure compensation

As this instrument which is designed as an in-line system type ozone monitor can be possible to measure the supplied ozone gas, its pressure may apply to the detector unit. As measured value of ozone gas concentrations are proportional to the pressure, conversion of the pressure around the detector to the atmospheric pressure is automatically carried out in accordance with the signals from the pressure sensor. Operating pressure sensors are available in two types, gauge pressure type and absolute pressure type, of which pressure ranges are set forth below, from which a suitable one is selectable when ordering the monitor. Pressure values are indicated on the sub-LED on the control panel. As for unit, [MPa (G) is the unit for the gauge pressure type and [hPa (ABS)] for the absolute pressure type.

Pressure compensation range: 0~0.294 MPa (G) [0~3 kgf/cm<sup>2</sup>(G)] gauge pressure  
0~1961 hPa (ABS) [0~2 kgf/cm<sup>2</sup>(ABS)] absolute pressure

Compensation pressure: Atmospheric pressure

$$\text{Ozone concentration} = \text{Uncompensated ozone concentration} \times \frac{\text{Atmospheric pressure}}{\text{Gas pressure}} \quad \dots\dots \text{eq.3}$$

#### 6.2.2 Temperature and pressure compensations

According to combination with both temperature compensation as standard function and pressure compensation as optional, the measured concentration value can be compensated to the correct value. Use formula, eq.2 described in Section 5.8 “Temperature compensation” and also formula, eq.3 in the above.

$$\text{Ozone concentration} = \text{Uncompensated ozone concentration} \times \frac{\text{gas temperature}+273}{273} \times \frac{\text{Atmospheric pressure}}{\text{Gas pressure}} \quad \dots\dots \text{eq.4}$$



## 6.3 Serial port

Basically, data exchange is made through interactive communication with the host computer. It is in response to commands from an external control apparatus (Data Terminal Equipment, DTE), and the monitor never provides data of itself without such commands. It is recommended principally to set the operation mode switch to MES and the compensation mode switch to a suitable mode to an appropriate mode according to required mode. Basically, functions of these switches are so made that they cannot be accessed for control from outside.

As regards cables, use of commercially available cables is recommended.

### 6.3.1 Basic specifications

Type of connector	: 9-pin D sub, female
	1: CD
	2: TD
	3: RD
	4: DTR
	5: GND
	6: DSR
	7: RTS
	8: CTS
	9: RI (open)

Note) Size of the set screw for fixing this connector is UNC#4-40 (inch screw).

Communication speed	: 9600 bps
Communication method	: Full duplex
Data bit	: 8 bit
Stop bit	: 1 bit
Parity	: None
X parameter	: Not used

### 6.3.2 Transfer format

For receiving and transferring, the following format is used in ordinary communication.

STX	data	ETX
(02h)		(03h)

For entering data, only *ASCII* capital letters are usable (small letters will not be accepted). Plural numbers need to be quoted with comma (,).

\* note: As words from STX to ETX become to be one sentence, it may have a case which its number of words will be changed. Take care of making Host software because it is not the fixed word length.

### 6.3.3 Data unit format

#### (1) Command

Commands from the host computer to the monitor are available in 4 kinds as follows. In principle, the monitor responds to these commands. Upon receipt of other commands than these, therefore, the monitor makes no response.

- . ! (21h) Data polling : Command for outputting measured data
- . S (53h) Sense : Command for outputting information on internal condition of the monitor
- . Z (5Ah) Zero set : Command for starting auto-zero
- . M(4Dh) Major set : Forcing command for starting measurement

When effecting auto-zero from the serial port, keep the internal timer for auto-zero off (by entering "0" to the timer). There is a possibility that the double time axis might cause error. If interval timer is set to effective value (is not 0), the monitor itself will consider as it makes to control the interval of 0 (zero), so that all of the outside triggers is not received. By changing the mode switch once, it comes to operation from UP20 to rst, but in control from outside, it is supported from [M] command.

#### (2) Response

Response means transmission of data from the monitor in response to the said commands, so that it responds to one command a time. Still more, response excepting data polling becomes fixed-word length. The following shows the details of response against each command.

Output of measuring data ! A (21h 41h), concentration, pressure, temperature, 0 / 1

0/1 at the end shows 0 if the measured data is free from error or 1 in case of error. In the case of the following, 1 is indicated for 0/1 at the end, with space (-) for other data including compression, etc.

In case the mode switch is set to the other mode besides EMS.

UP20, Err, and Auto Zero

Concentrations unit and rows are same in the indication, but take care that the number of letters which is transferred will change when there is number below the decimal point.

Example: 0000 ..... in case of 0 mg/L  
 0245 ..... in case of 245 g/m<sup>3</sup> (N)  
 015.1 ..... in case of 15.1 wt %

When concentration value becomes one of minus, the mark of minus (-) adds the value, but the row will not change.

Example: -00.1 ..... in case of -0.1 g/m<sup>3</sup>(N)  
 -001 ..... in case of -1 mg/L

When EG-600 has function of pressure compensation, output form of pressure value is as follows.

0.XXX ..... Unit is MPa(G) when gauge pressure.  
 XXXX ..... Unit is hPa(A) when Absolute pressure (option).

When EG-600 has function of temperature compensation, output form of temperature is as follows.

XXX.X ..... unit is

Switch for compensation is not supported, so that to set this switch has sometimes changed data which is transferred from serial interface port. In case you would like to take out the compensation data, put it to the setting position in your suitable mode.

Output of information on internal condition of the monitor SA (53h 41h), ??

The following letters will be output on the above position of ??.

For details of error condition, refer to section 10. 5 “Error display”.

OK : Concentration measurement  
 UP : Warming-up (under UP20)  
 NM : The operation mode switch is not set to MES.  
 ZR : Auto-zero working (analog hold)  
 E0~E6 : Error

Response to auto-zero start command

ZO (5Ah 4fh) OK (command accepted)  
 ZN (5Ah 4eh) NG (command not accepted)

Command for starting auto-zero is not accepted in case the monitor is in items of ~ (UP20 ~ error).

Forcing command for starting measurement

MO (4Dh 4fh) OK (command accepted)  
 MN (4Dh 4eh) NG (command not accepted)

This command is to provide a countermeasure in case of a quick return from electricity stoppage by omitting a warming-up operation (UP20). When the power is on after electricity cut off for longer than several minutes, don't use this function. In this case, warming up operation is needed as usual. Only for the warming up operation (UP20), the above forcing command may be accepted. In the other wards, this command can not be effective for other than UP20.

## 6.4 Windows<sup>®</sup> communication software

This software is one for Data Logging, and the data from monitor of Model 600 or 600Q series is transferred to the host computer through serial port (RS 232C) on the monitor. The collected data is saved and also is indicated on the display, as a file of CSV type. For detail, see another Instruction Manual of OZONE MONITOR COMMUNICATION SOFTWARE (book no. EOP-P61-016-7-002-E).

### SPECIFICATIONS

#### (1) Construction

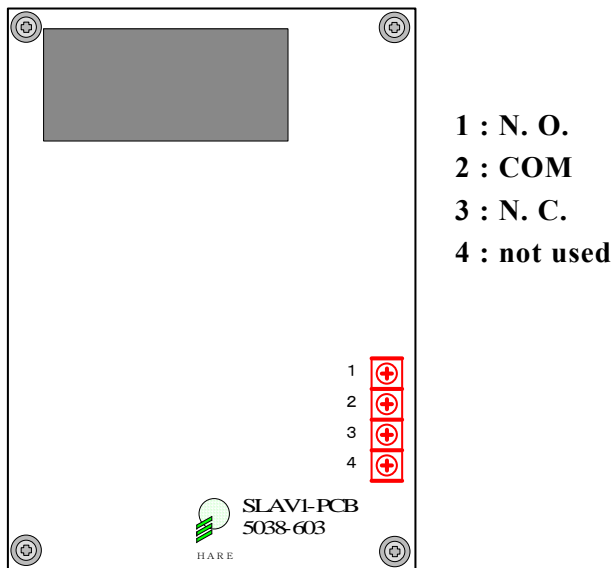
Personal computer with terminals through RS 232 C, can be connected.  
 CRT or display unit which has the same as its function (640 × 480, resolution of 256 colors or more than it.)  
 CD drive having speed which is four times over.  
 mouse

**(2) Operation**

OS : Windows R 95 (after OSR 2.×), 98, NT2000, ME, XP  
 personal computer : Windows machine same as DOSV compatible machine  
 main memory : over than 64 M bytes  
 non-storage capacity : over than 100 M bytes as working area

**6.5 Signal for operating the Solenoid valve**

From the internal terminal block for the detector of L6SQ type, a relay signal (C form contact, rating of 100 V ac 1 A) can obtain operating signal for exchanging port of electromagnetic valve.



**Figure- 14 Terminal block on the detector (Type L6SQ)**

**6.6 Inlet port for Dry air (Model EL-600 only)**

See Fig.-3, this inlet port is located at position of . When sample water supplying into L6SM type detector of EL-600 is lower temperature and it may make its dew-drop, supply Dry air to this inlet port. Regarding as the connecting piping, Quick fitting joint with O.D. 6 mm is to be used. The suitable air flow is about 0.1~1.0 liter per minute. More over, the compressor to supply this dry air should be oil-less constructions, having protector for dust and mist.

## 7 Requirements of installation and how to install

### 7.1 Requirements of installation

In order to protect the monitor from any damage and to ensure stable operation, installation at places as shown below should be avoided.

- (1) Dusty place or any place where such corrosive gas as hydrogen nitride gas, sulfurous gas, or halogen gas is floating in the atmosphere.
- (2) A place having characteristic of high temperatures, high humidity, or a place of radical temperature changes.
- (3) A place with characteristic of strong vibrations or heavy intermittent vibrations.
- (4) Places under direct sun shine.
- (5) A place close to the source of generation of a strong electromagnetic field, electric field, or a high frequency.
- (6) A place lacking a sufficient space for maintenance and/or inspection of the monitor.
- (7) Process plant where explosive gas may be made up in the environment.
- (8) Places where is affected by rainfall.



**DANGER**

**Do not use this monitor in the environment where explosive gas and vapor may generate or exist, because it has not one of explosion-proof construction.**

## 7.2 How to install the monitor

### 7.2.1 The controllers (6CV/6CH types)

#### How to fix the vertical type controller

As shown in Fig.-15, fix the controller with set screws included in the standard setup, and the mounting holes are one of M4 screw size. The panel thickness is 2 ~ 5 mm suitable and the cut dimension is 66 (W) × 180 (H) mm. Regarding installation pitches for screws are as follows.

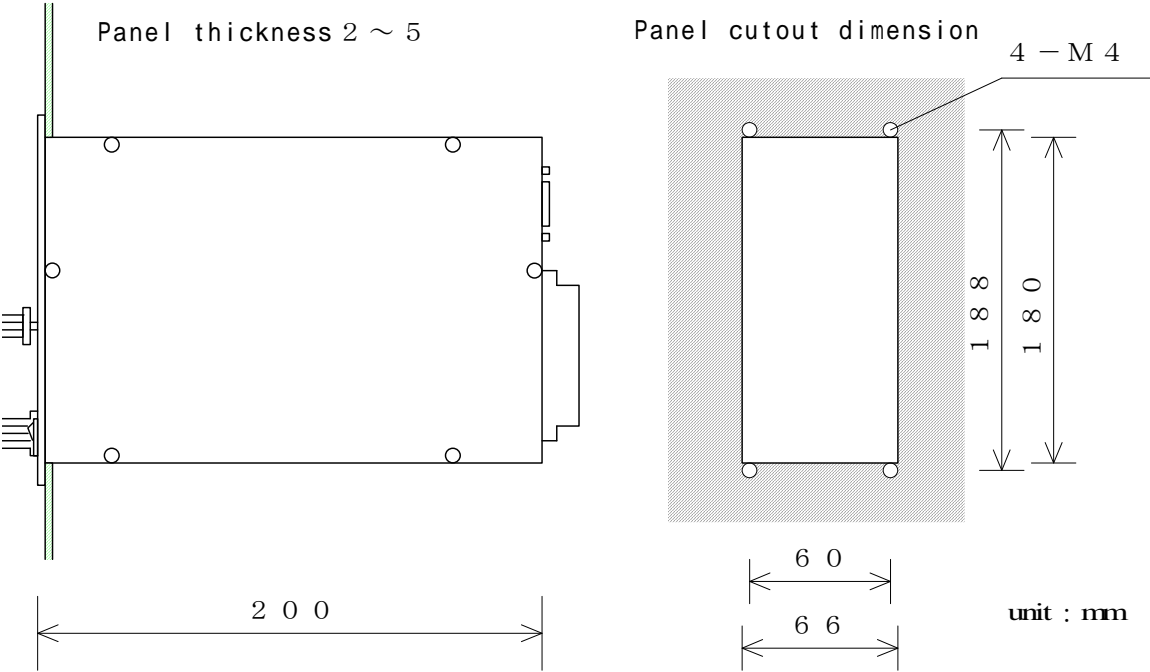


Figure- 15 Installation of the vertical type controller (Type 6CV)

#### How to fix a horizontal type controller

As shown in Fig.-16, fix the controller using set screws included in the standard setup, and the mounting holes are made up with one of M4 screw size. The panel thickness is 2 ~ 5 mm suitable and the cut dimension is 180 (W) × 66 (H) mm. Regarding installation pinches for screws are as follows.

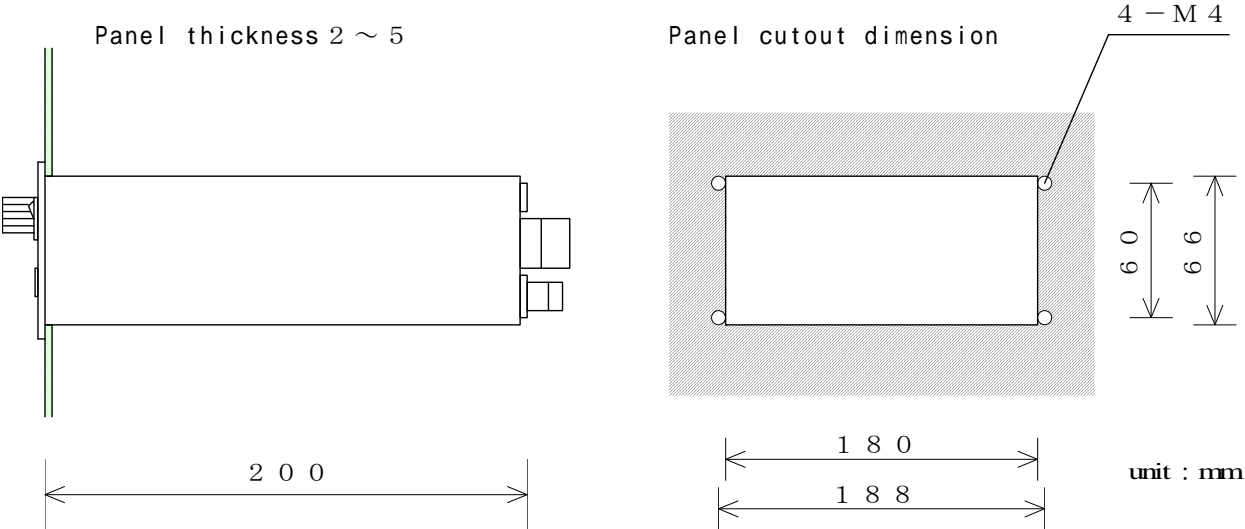



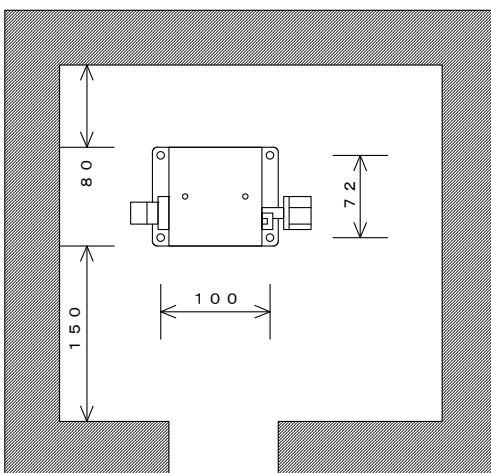
Figure- 16 Fixing method of the horizontal controller (Type 6CH)

### 7.2.2 Supply of electric power

Concerning the power supply for the monitor, use of the power supply for instrumentation is recommended. If an inductive load or a large capacity load is connected, it may have Surge or Noise and it will result sometimes in disturbing the measurement or in making the component failures. For safety, don't forget to connect the grounding wire to the monitor. A power supply cable is not included. (It is to be prepared by the user uses themselves)

	<h2>WARNINGS</h2>
<p><b>Do not modify the monitor and also do not use it out of the specifications. We can not take the responsibility on the monitor, if it has affected an accident, or had failed itself.</b></p>	

### 7.2.3 Fixing and piping the detector unit, type G6SH



#### (1) Installation

Install the detector at a spacious place where utility such as piping and wiring is available. The required mounting pitch for fixing the monitor is 100 x 72 mm. The adaptive mounting hole for the fixing is M3 screw.

As illustrated in Fig.-17, a space for maintenance should be provided around the monitor.

To facilitate maintenance, keep the cover for the control easily and removable any time.

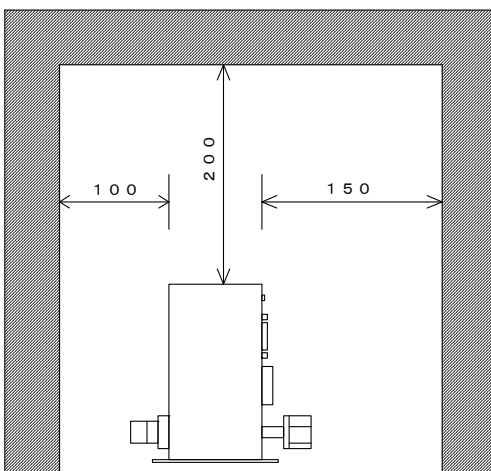


Figure- 17 Fixing method of the detector (Type G6SH)

## (2) Connecting the sampling pipings

In connection side, VCR joint of 1/4 inch equivalent should be used. Still more, regarding connecting 1/4 inch or 6 mm pipes, union type fitting is used.

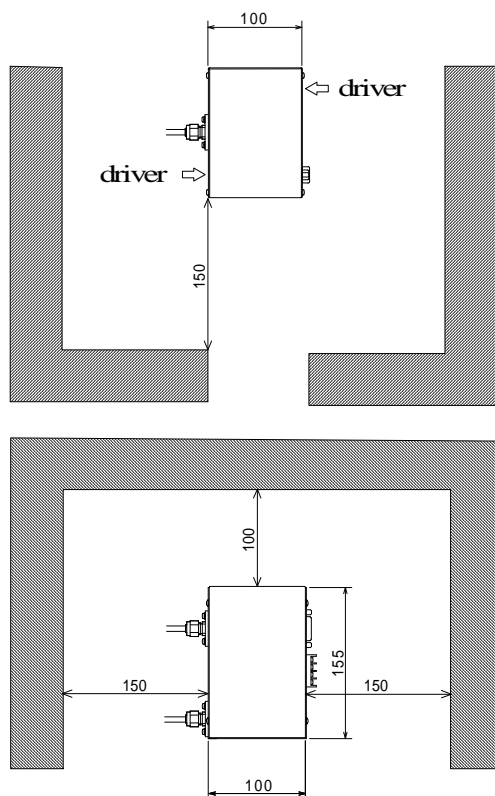
Provide a stop valve between the main flow pipe and the inlet junction for the detector so that stop, flow rate adjustment, etc, can be facilitated. Provision of a flow meter, if available, would be convenient for checking ready checking of the flow rate of the gas. A filter if available would prevent intrusion of dust into the system, and is expected to minimize the occurrence of trouble.

Concerning the piping and valves, use ones made of ozone resistant material. The piping should desirably be as short as possible within a necessary length and with minimum bending positions.

Measurement values will be affected by the pressure of the sample gas and an error occurs in case of an excessive deviation from a reasonable pressure. As the sample gas should be open to the atmosphere at the sample gas outlet, it is essential to remove the exhaust gas by some appropriate means.

If moisture is contained in the sample to some considerable extent, lead the sample gas to the monitor after letting it pass through a dehumidifying process.

### 7.2.4 Fixing and piping of the detector unit, Type G6(L6)SM



#### (1) Installation

Install the detector, taking care of the following items as inspections and removing the detector can be performed easily.

Top and front surfaces are prepared to facilitate the maintenance of the detector.

The mercury lamp (consumable part) builds in the interior.

Right and left side are surfaces to connect the pipings for sample and reference water, and they are attached with driver

The piping should be performed as the tension will not affect to the joints.

Do not install the detector under or near piping of water to prevent it to be submerged.

Do not do wiring of electrical equipment under the detector in order to prevent electrical short by the water leakage.

Figure- 18 Fixing method of the detectors, Types G6(L6)SM

Regarding the detector unit should be fixed in the place where the piping and wiring can be done easily. The mounting holes are one of M3 screw size. Prepare a maintenance space as shown on Fig.-18 and put the cover on this detector unit in condition that it is possible to be removed easily. Ensure the space which should make a bending portion for the piping, and also ensure the space which should remove the interface cable.



**(2) Connecting the sampling pipings**

Regarding the pipings, Flowell R tube fitting, 20 series are installed on the detector so as to connect 1/4 inch sampling pipings.

Install a stop valve between a sample port of the main flow piping and inlet of the detector so that you can stop the gas (water) flow and can also adjust its flow-rate. If attach the flow-meter, it is convenience to confirm its flow-rate. To attach the filter makes to prevent contamination and failure of the monitor itself.

Concerning the piping and valve, use ones made of ozone resistant material. The piping should desirably be as short as possible within a necessary length and with minimum bending positions.

When measured ozone gas, having over pressure than one of atmosphere, it may make a trouble of measuring error. Ozone destructor should be equipped so as to open pressure from the sampling outlet to atmosphere, if the monitor has not the function of pressure compensation. Refer to Fig.-23.

### 7.2.5 An example for piping the detectors

The following sketch is an example of the detector's application.

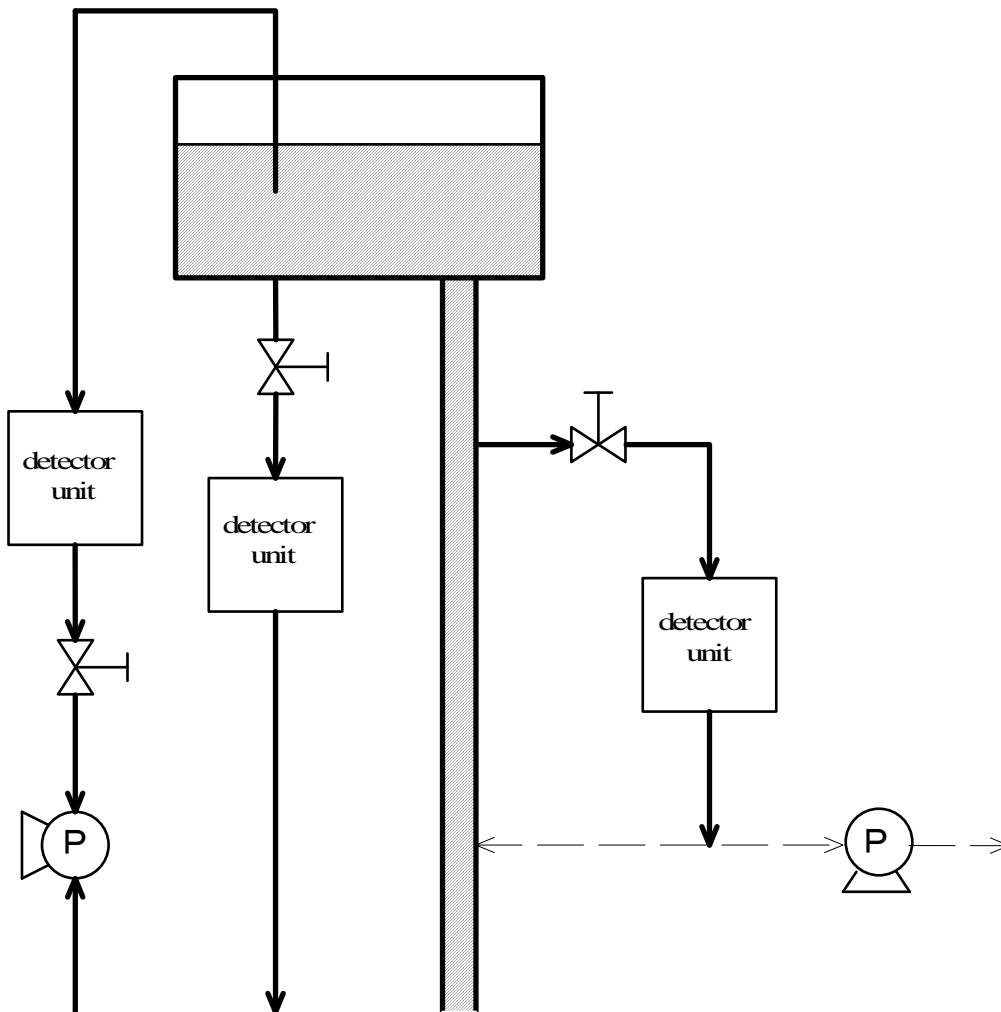


Figure-19 Example of the pipings

When sample gas (water) has not pressure itself, a pump is needed.

When sample gas (water) has pressure itself, a pump is not needed.

When the detector is used at a divided point of the main piping, or of the above methods can be used.

- Note (1)** Adjust the flow-rate by using a needle valve in condition the sample gas (water) is supplying by referring indication of the valve. When perform a sampling using a sucking pump, outside needle valve is attached to outlet piping and in case of using gas (water) pressure itself, attach it to inlet piping. In case of ozone water, this will prevent to generate air bubble. If there is any air bubble in the sample water, it will cause pulse noise, so remove air bubble when introducing it. Moreover, introducing much more flow rate make air bubble and cause pulse noise. Please measure under appropriate flow rate.
- Note (2)** If flow-rate of the sampling gas (water) is less than the specified range, as ozone in the piping will be decomposed, take care that the corrected concentration value can not be obtained in the measurement.

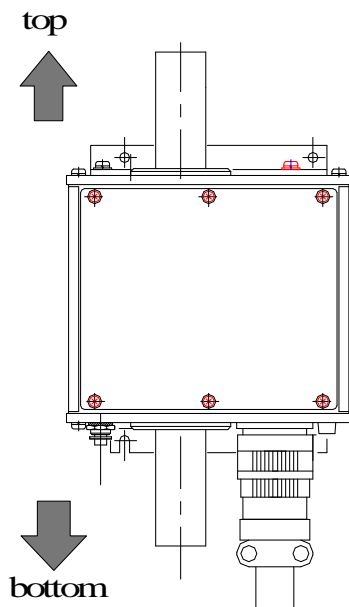
- Note (3)** When material water was changed, calibrate zero point periodically by supplying zero gas (water).
- Note (4)** When sampling water is too lower degree (5 ) than the ambient temperature, the display on the monitor may be disturbed for the optical cell with dew dropped on the surface. In this state, perform to rise up the water temperature or let down the room humidity so as not to make these dew-drops.

**7.2.6 Fixing method of the detector unit, type L6SQ**

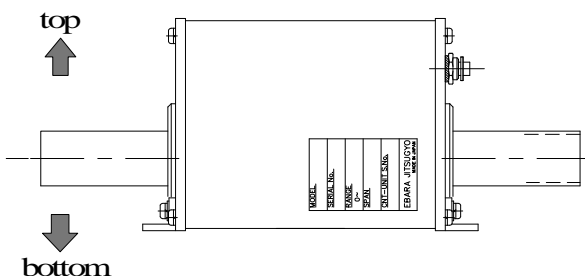
**(1) Installation**

This detector should be installed as the following sketch shown below.

**note:** Please study to the utmost so that piping of the monitor may install toward vertical position.

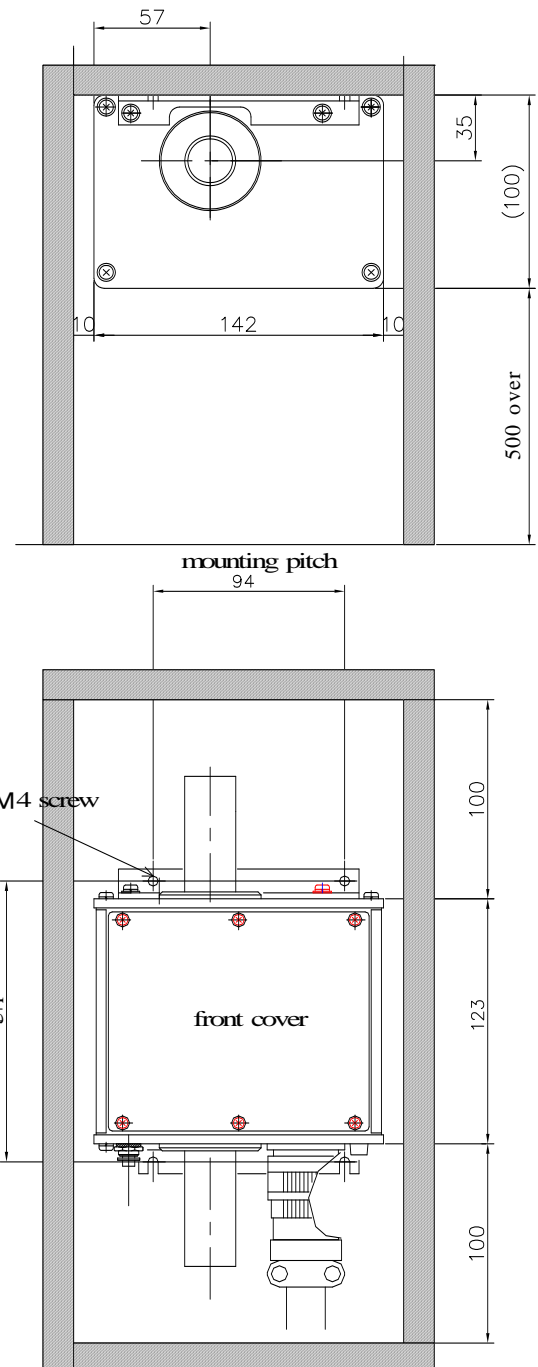


**Vertical piping (recommendation)**



**Horizontal piping**

**Figure- 20** Fixing posture of the detector unit, Type L6SQ



**Figure- 21** Mounting dimension of the detector unit, Type L6SQ

**(2) Ensuring the maintenance space**

Ensure the maintenance space as Fig.-21, so as to perform inspection or remove easily taking care of the followings.

The front cover side (see Fig.-21) is mainly maintenance space, and it needs to replace the mercury lamp (consumable port) and to adjust the PCB, so that it should be endured enough.

An axial direction according to the inlet and outlet pipes is the maintenance space for fitting the sampling pipings and for connecting a signal cable wire with the connector. These spaces should be endured enough so that the fitting and connector can be connected and disconnected.

**(3) Fixing the detector with screws**

Mounting pitch is  $94 \times 141$  mm as shown on Fig.-21. Fixing screw is one of M4 size, so that a mounting panel should be over than 2 mm thickness.

## 7.2.7 Piping of the detector unit, Type L6SQ

### (1) Connecting the joint

As it is described on the above section 4.2 “The detector”, this unit has the pipes for connecting to outside joints. So, connect the suitable joints, referring the instruction manual published from its manufacturer after due selection.

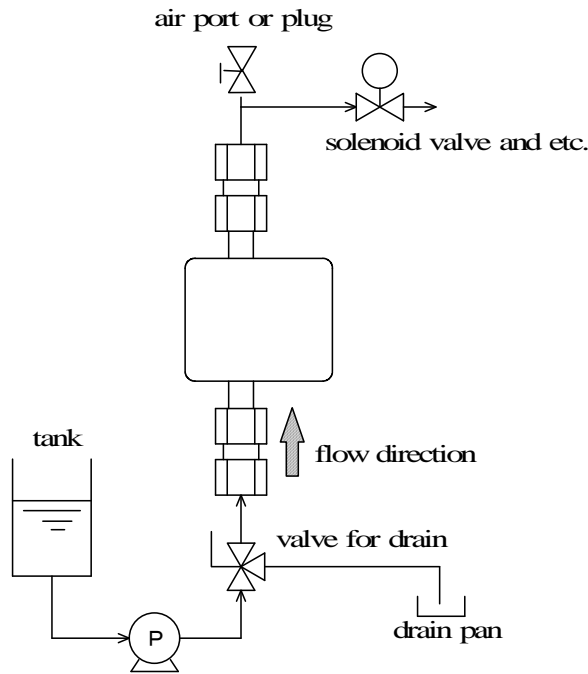


Figure- 22 An example for piping the detector, Type L6SQ

### (2) Connecting the sampling pipings

Example of the piping is shown on Fig.-22. To perform precise measurement and also carry out maintenance easily, consider the following items.

In case that mixing condition of liquid phase and gas phase are in the inside of a detecting cell, it may have a chance which a stable measurement can not be performed. Accordingly the above matters, make the direction so that sample water may always be filled up in the cell.

Consider a maintenance chance in order to replace the cell also to remove whole of the detector unit. When stopped the device, we recommend that tank filled with ozone water was installed below than the detector unit so that the sample may be emptied in the piping of detector unit. Return the residual water to the tank in condition of opening air port or install a valve for drained it when sample water is remained according shutting the valve located in the piping line.

As this instrument is possible to measure concentration in wide flow range (for detail, see section 3 “Specifications”, install flowmeter if necessary. Then, as concerns the water quality, study to install a filter.

Regarding the piping and valve, use ones made of ozone resistant material.

The piping should desirably be as short as possible within a necessary length and with minimum bending positions.

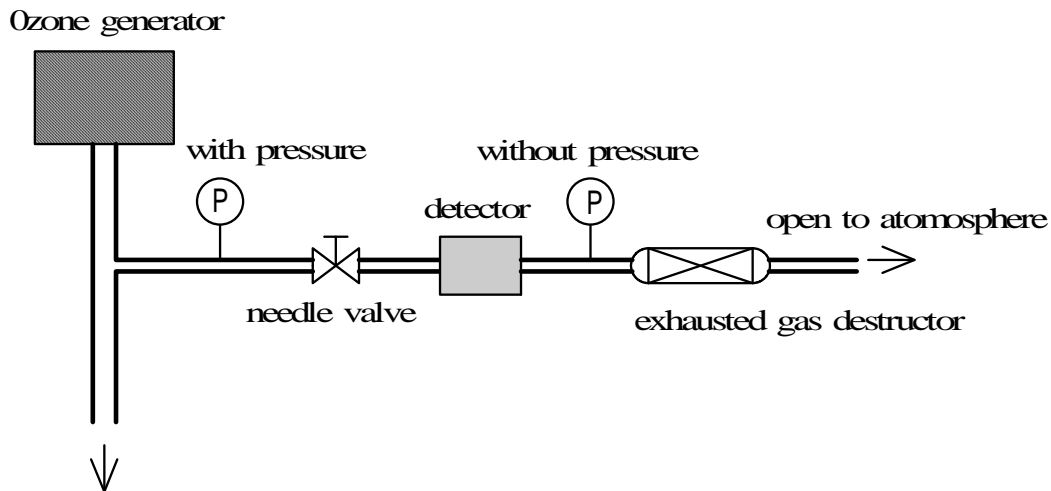


Figure- 23 An example of flow diagram

### 7.2.8 Connection between the controller and the detector

Connect both the connectors attached on rear face of the controller unit and also on side face of detector unit by using the optional interface cable. The standard cable length for ozone monitors, Model EG-600 and EL-600, are about 1.5m but one of Model EL-600Q is 3 m. Regarding your option, you can select a cable from the following four kinds of length.

Model EG-600 and EL-600	3, 5, 10, 15 m
Model EL-600Q	1.5, 5, 10, 15 m

- (1) When shipping from the factory, the interface cable is made by your suitable length.  
If you need to change the length after your delivery, you should be requested to readjust the product to us.
- (2) Do not use Interface cable over than 15 m in length for keeping its performance.  
And then, use one of having a suitable standard.

## 7.3 How to connect external signals

### 7.3.1 Connecting output signal

Digital signal outputs from the monitor are all insulated by the photo-coupler. The photo-coupler used in the monitor is TLP521 (Toshiba) or its equivalent which is an open-collector type. Applicable signals are the following 4 systems, 6 kinds. Regarding the recommended circuit is shown on Fig. - 17.

Decide [R] so as to become to be in 1 i 10 mA. Still more, when each signal becomes effective, position of dot "a" comes to [L].

- (1) Concentration alarm (AL1, AL2)
- (2) Pressure alarm (PA1, PA2 optional setting)
- (3) Error signal
- (4) Measurement signal

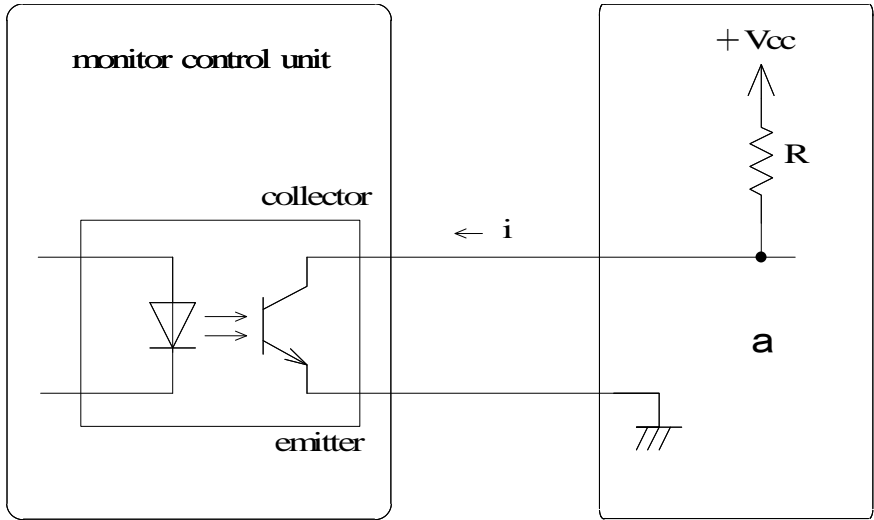


Figure- 24 Equivalent circuit

Make an entry of values on [R] in the following formula and define current [i] so as to flow 1~10 mA.

$$i = \frac{+V_{cc}}{R} \text{ [A]}$$

For example, in case that +Vcc equals 5V and R is 1 k , [i] comes to 5 mA. And then, the circuit, in when relay is used, is shown below.

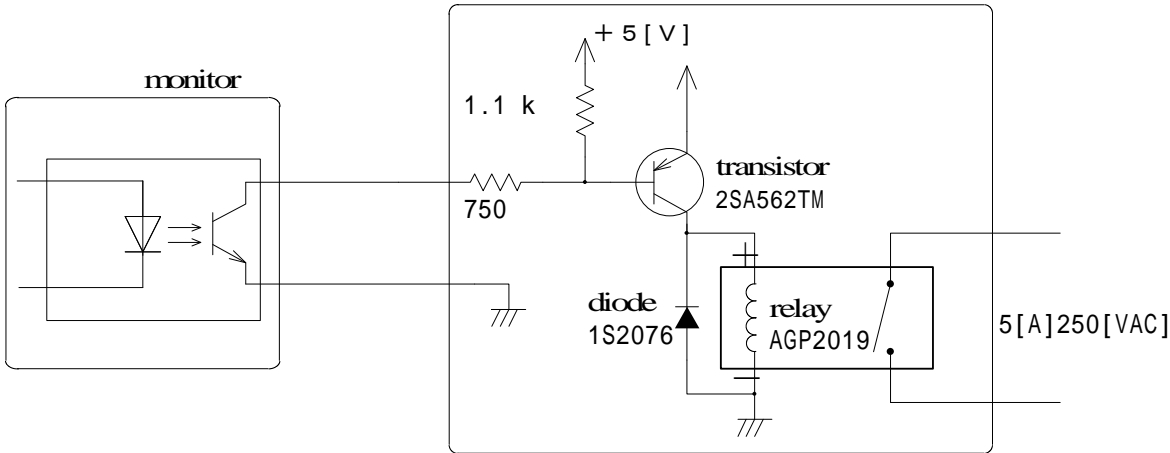


Figure- 25 Example circuit of connection

Moreover, define restricted [R] that the condition is satisfied. Regarding setting etc, if you are unfamiliar, please consult it with our company.

### 7.3.2 Connecting input signal

Digital signal transferred into the monitor (triggered with auto-zero) is insulated by photo-coupler and semiconductor used in the circuit is one of TLP521 type or its equivalent. Its input is composed of LED.

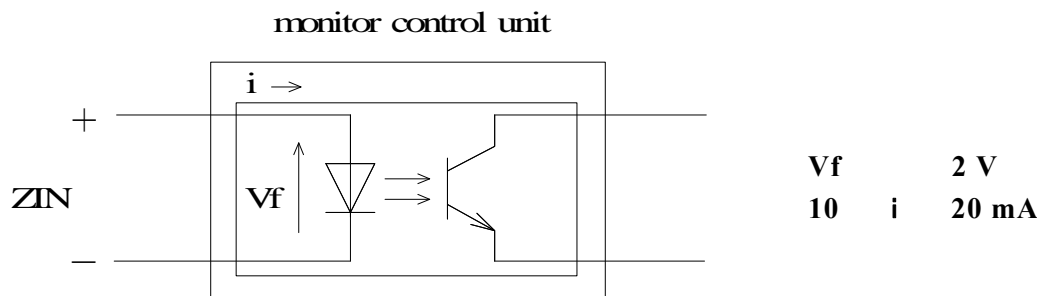


Figure- 26 Input equivalent circuit

Saturation voltage ( $V_f$ ) of the internal LED is about 2 volts. Restrict its current of LED as it is shown in the above circuit.

## 8 Measurement procedures

### 8.1 Preparation for measurement

- (1) Set the operation mode switch at [MES], turn the power switch to [ON], and continue warming-up operation for about 20 minutes. Countdown starts from 2000 on the main LED. The indication XX means in minute and YY means in second.
- (2) Before ozone gas (water) is fed, check the following items by supplying only the zero calibration gas (water).

Set the operation mode switch at [CK1] (sensor 1, light intensity), and check if the main LED indicates a value within 1000~3200. If the indication is not within this range, refer to section 10. 4 “Sensor adjustment” and adjust it accordingly.

Set the operation mode switch at [CK2] (Sensor 2, light intensity) and make sure that the same value as indicated for [CK1] is indicated.

Set the operation mode switch at [MES] and make sure that [0] is indicated on the main LED. If not, let auto-zero be started from the front panel.

### 8.2 Measurement

- (1) Set the operation mode switch at [MES].
- (2) Concentration of ozone contained in the sample gas (water) is measured and the measured value is indicated on the display. At the same time, analog output of voltage proportional to concentration of ozone gas (water) is made.



### 8.3 Restart

When restarting measurement in some time after switching off the power, turn on the power switch, continue warming up for several minutes, confirm zero level while the zero calibration gas (water) is being fed, then start measurement again.

\* In the case measurement is restarted after a while, indication differs in the beginning, but in a short time, it will return to normal indication.

## 9 Span calibration

In designing the monitor, since much consideration was given to providing a high stability of the electrical circuits, it is assumed that possibility of change or adjustment is small. Anyhow, the following is how to perform sensitivity compensation.

- (1) Conduct zero-adjustment in accordance to section 8.1 "Preparation for measurement".
- (2) Generated ozone gas (water) and feed it to the monitor.
- (3) As soon as the indication on the monitor has stabilized, start measurement of the sample gas (water), set the operation mode switch at [SPN], and based on the result of measurement, correct the indication of the monitor.

Before dispatch from the factory, correction and adjustment of span of the monitor was carried out at the factory. In case there is a deviation between the result of sampling and the result of measurement, apply the following equation to the present concentration indication on the monitor, and enter the span value from the front panel.

### Example of calculation

Where,

Monitor indication value at present	120 g/m <sup>3</sup> (N)
Analyzed value (customer side)	110 g/m <sup>3</sup> (N)
Span calibration ratio when shipping	0.962

$$\text{Thus, new span calibration ratio} = \frac{110}{120} \times 0.962 = 0.882$$

Enter the new span value [0.882], which is equal to 8% less than the initial setting.

- (4) As methods of analysis of ozone gas (water), the followings are available.

Look for concentration by performing the chemical analysis

- Ⓐ Collect sample used to be for chemical analysis. And at the same time, record indication on the control unit of monitor.
- Ⓑ Perform chemical analysis of collected sample by using Iodometric method or another one.

Measuring instrument (standard unit) that the chemical analysis performed and also confirmed is put in the same flow channel and fit the indicating value on the monitor to one of this standard unit.

- (5) Span calibration and adjustment was made for the monitor in the factory before dispatch, but in case the initial span value is lost due to frequent calibration work, refer to the name plate on the sensor unit where the initial span value is indicated.

\*note: The span adjustment range for the monitor is 0.001~2.000 in which span is adjustable with an increment of 0.1%.

## 10 Maintenance and inspection

### 10.1 Items of inspection

Table 2 Inspection items

Items of inspection	Inspection time
Check of light intensity of low pressure mercury lamp (CK1)	any time
Zero level check	1. once a day 2. AT starting operation after the power is on.
Span check	arbitrary

The light intensity of the low pressure mercury lamp will decrease over time of use, eventually presenting such a symptom that zero level adjustment is no more possible or unstable indications. It is so adjusted that immediately after the delivery of the monitor to the user or just after the replacement of the low pressure mercury lamp, the indication of [CK1] mode is within 2400~3200. If the indication of the light intensity of the lamp on [CK1] mode is above 600 approximately, there is no problem. If not, the low pressure mercury lamp needs to be exchanged for a new one as soon as possible. Refer to section 10.3 "Replacement of consumable parts".

In case the light intensity of the low pressure mercury lamp drops extremely, it is detected by the function of self-diagnosis, which presents an error signal. It is recommended to take two years representing a total integrated time of use of the low pressure lamp as a time limit for replacement.

### 10.2 Trouble shooting

Table 3 Trouble shooting

Symptom	Conceivable cause of trouble	Treatment
Zero point adjustment is not possible. (Zero point is unstable.)	1. burning-out of low pressure mercury lamp 2. insufficient light intensity of low pressure mercury lamp 3. contaminated cell	1. replacement of low pressure mercury lamp 2. adjustment of sensor output 3. cleaning of cell
Unstable indication	defect of low pressure mercury lamp	Replacement of low pressure mercury lamp
The measured value is extremely different.	The auto-zeroing switch was pushed by mistake under measurement.	readjustment of zero point
Power can be not applied.	1. fuse burned out 2. not supplying of electricity from power source	1. fuse replacement 2. voltage check

### 10.3 Replacement of consumable parts

The consumable parts that needs to be replaced periodically, is usually a low pressure mercury lamp basically. But, according its using condition, it may corrode or deteriorate. In this case, it is needed to replace the following parts. However, to replace the parts difficult excepting the mercury lamp, please return us this instrument because its replacement can not be performed by customer.

- (1) Mercury lamp..... recommended for two years (warranty term is one year)
- (2) O-ring ..... every time for deterioration itself and decomposing the detector unit  
(recommended for two – four years)
- (3) Optical cell ..... when it deteriorates by Corrosion (for measuring ozone gas with moisture)
- (4) Fuse..... withstand rush current type fuse, 250 V ac 1A approved by UL  
(Accessory) standard

Replace the low pressure mercury lamp every two years as a criterion. Still more, set the low pressure mercury lamp according the following sketch because it has a range below.

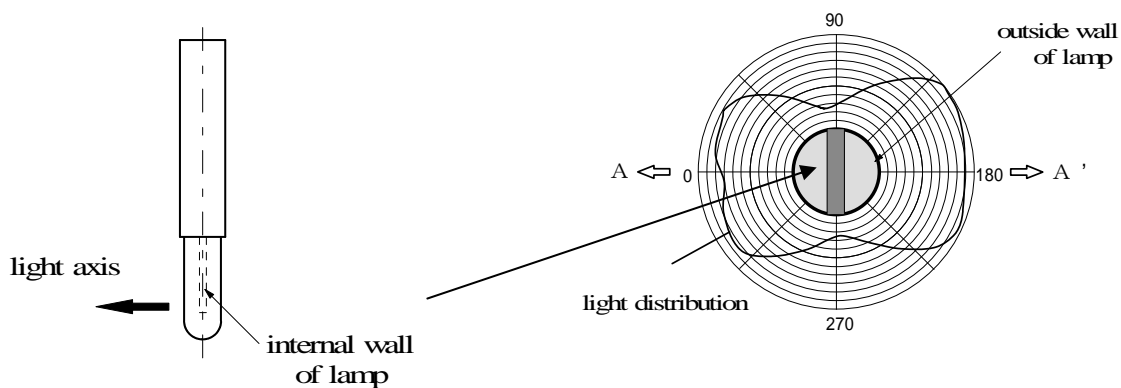


Figure- 27 Section of the low mercury lamp and the light distribution



## CAUTION

- The UV rays emitted from the low pressure mercury lamp may sometimes be harmful to the eyes and the skin. Refrain from taking out a lighting mercury lamp from the holder or gazing at a lighting mercury lamp.
- A low pressure mercury lamp as consumable part contains harmful component to the humans, so that the used lamp should be scrapped in accordance with your local regulations.

- (1) Turn off the power of the control unit of the monitor.  
(Never proceed to the next step before turning off the power.)**
- (2) Remove the cover of the detector. Loosen and remove the screw on the top or front of the cover, then lift the cover.**
- (3) Detach the connector between the low pressure mercury lamp and the power supply.**
- (4) Loosen the screw of the lamp holder in the sensor cell compartment and draw it out.  
It is very hot just after the power is turned off. Handle it carefully.**
- (5) Insert a connector of the pressure mercury lamp into the holder (socket) till end of it.**
- (6) The low pressure mercury lamp is characteristic of emission intensity range as shown in Fig.-27. Fix the lamp so that the light axis of the lamp may consistent with the direction of A - A'. In the concrete, fix the lamp turning and adjusting its set position so that the light intensity may display the indication value of 2400~3200 at mode switch [CK1] after the warming-up operation had performed 20 minutes from the power switch was pushed on.**
- (7) Install the cover on the detector and tighten the mounting screws with driver.**
- (8) Check and adjust the detector according as section 8.1 "Preparation for measurement".**

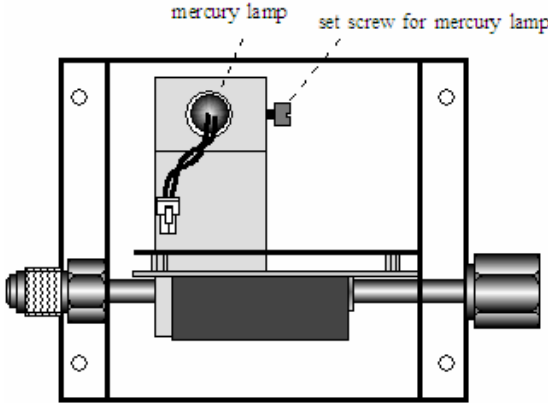


Figure- 28 Inside of the detector, Type G6SH

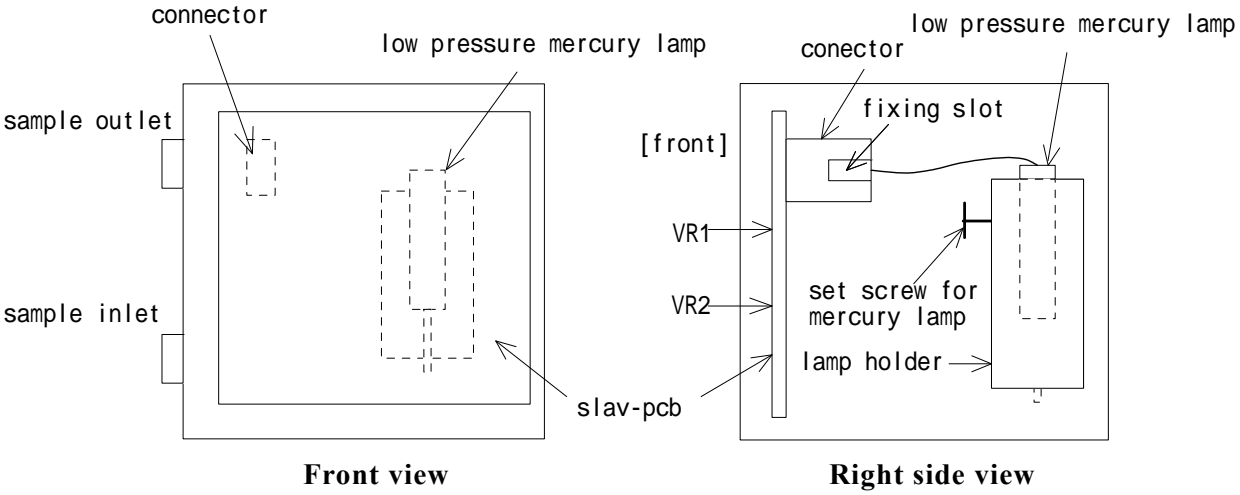


Figure- 29 Inside of the detector, Type G6 (L6) SM

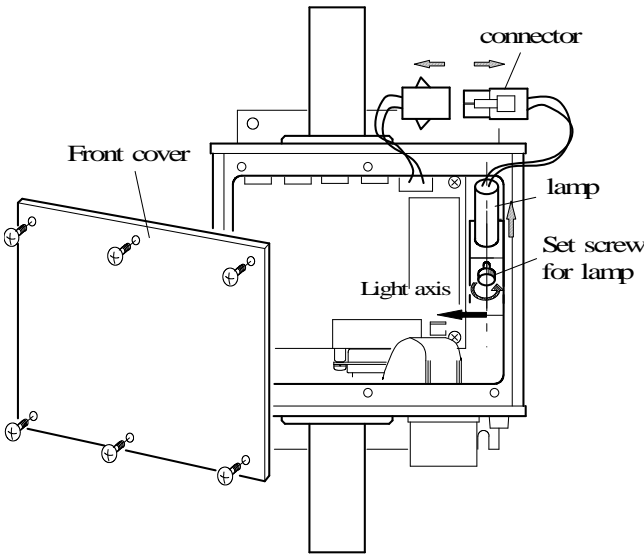


Figure- 30 Inside of the detector, Type L6SQF

## 10.4 Sensor adjustment

(1) In case any of the following symptoms is present, conduct sensor adjustment.

When the operation mode switch was set at [CK1] mode (sensor 1, light intensity) or [CK2] (sensor 2, light intensity) after sufficient warming-up with the zero calibration gas (water) being fed just after installation, the indication was not within the stipulated range of 1000~3200.

Auto-zero does not function properly in this case to provide a correct zero level.

After replacing the low pressure mercury lamp.

After washing the cell.

(2) How to adjust

Set the operation mode switch at [MES], turn on the power, and continue warming-up operation for about 20 minutes.

Feed flow the zero calibration gas (water) to the sensor unit.

Set the operation mode switch at [CK1], and adjust the trimmer (VR1) for sensor 1 on the PC board inside of the sensor unit so that the indication is within the range of 1000~3200 (In case of a new lamp, the range is 2400~3200).

Set the operation mode switch to [CK2], and adjust using the trimmer (VR2) for sensor 2 in the same way as above so that the indication is within the range of 1000~3200 (In case of a new lamp, the range is 2400~3200).

Perform zero level adjustment by auto-zero.

Set the operation mode switch at [MES] and make sure that the indication is [0].

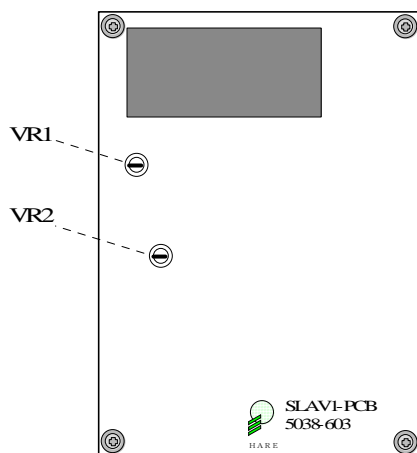


Figure- 31 PC board in the detector unit



### CAUTION

When performing sensor adjustment, don't fail to feed the zero calibration gas (water). If it is performed when the ozone gas (water) is being fed, it may reduce adjustment impossible or may present abnormality in measured values.

Use basically the material gas as the zero calibration gas (water).

When perform the sensor adjustments (VR 1 and VR 2), it is no problem that they are not always to be the same values. However these values should be in the specified range.

## 10.5 Error display

When abnormal condition of the monitor is detected by the self-diagnosis function, an error message is displayed. Practically, it functions when any of the following conditions is detected. In case of occurrence of an error,  $E \square \square X$  is displayed on the main LED and simultaneously error message from the terminal board becomes active. Note, however, that  $\square$  is blank. Only on MES mode, these blanks may have an opportunity of being filled in. Error messages for external units continue to be active unless cancelled. In other mode, indication of itself is preferentially displayed. In case of the occurrence of an error, monitor output signal MES (under measurement) becomes inactive.

### (1) E 0

This message appears when the measured value comes to out of the indication range. Still more, the measurement is operating continuously and if the measured value will be returned within the indication range, the monitor will perform measurement normally. In case that this instrument is used with pair units differed from when shipping the factory, it may have a unit failure, so that do not perform this matter. In this case, perform zero point adjustment.

### (2) E 1

Indicated value of the sensor 2 is in normal condition, but this will indicate when the one of sensor 1 is judged with the lower value. In the concrete, it will indicate when the indicated value of sensor 1 had become one of 1/8 compared with sensor 2. As the monitor is continuously operated, the analog data can be used. And then, if the light intensity had increased, the monitor will return automatically in normal condition. This error will appear when any failure is in the sensor side.

### (3) E 2

When adjusting zero position (when sucking zero gas or zero water), indication value of the sensor 1 is in normal condition, but this will indicate when the one of sensor 2 is judged with the lower value. It may happen when cell was dirty or also when any failure had happened in sensor 2 side. In the concrete, it will appear when the indicate value of sensor 2 had become one of 1/8 compared with sensor 1 under zero adjusting (when sucking zero gas or zero water). As the monitor is continuously operated, the analog data can be used. And then, if the light intensity had increased, the monitor will return automatically in normal condition. This error will appear when any failure is in the sensor side.

### (4) E 3

This will indicate when both indicated values of the sensor 1 and sensor 2 are judged with lower value. This error will appear when the lamp will not light. In the concrete, This error will appear when it had become less than about 512 as the conversion rate at check mode of light intensities of sensor 1 and sensor 2. As the monitor is continuously operating, it will come to mode of warming-up operation (UP 20), if the light intensity increases.

### (5) E 4

This message is displayed in case internal setting switches are not set correctly. It appears when any impractical mode under the present condition has been set. It returns to normal condition by resetting switches, etc. correctly and by turning off and on of the power.

**(6) E 5**

This message appears in case of any irrational setting of conditions by the user. For example, it will happen that interval has been set less than the zero gas (water) sucking time of zero calibration  $\times 2$  (analog hold time), or setting of alarm has exceeded the full scale value. Moreover, if internal related parameters are changed, the alarm value exceeds full scale and it may make the message to be E 5. In this case, to reset the hold time correctly, it returns to normal condition.

**(7) E 6**

In case of device error, this message is displayed as it contains the following two kinds of trouble.

When data in the memory has vanished, the message appears.

Input of the A/D converter is in condition of the range over, such as the following.

- An interface cable between the detector and controller is not connected.
- Negative pressure is applying to the gauge pressure sensor (optional function of pressure compensation).
- The monitor (detector) is not using under condition of the specified temperature/pressure ranges.
- Adjusting the light intensity is not suitable value after replacing the mercury lamp, the lamp is not lighted up or has not well the light intensity.

**Note :** When the display indicates E 6, confirm connection of the interface cable, or verify the light intensity in condition that the monitor is in CHECK MODE.

In gas phase monitor, when has the functions of temperature and pressure compensations, confirm the values of temperature and pressure.

In the detail, the error message will display in the following conditions.

- Sensor 1 or sensor 2 is in less than 250 or over than 4000.
- In case that gas temperature is lower than 0 or over than 85 .
- When gauge pressure sensor is used in minus pressure position or is applied with more than 0.647 MPa(G) (6.6 kgf/cm<sup>2</sup>)
- By using an absolute pressure sensor, when pressure over than 0.43 MPa(G) was applied to the sample.

When the monitor could not be worked by supplying electric power again after confirming above error items or if you are unfamiliar with the monitor or how to follow the equipment service from outside JAPAN, please dial or send your E-mail to our offices of the following.



Table 4 Trouble shooting chart

<b>Display</b>	<b>Confirmation item</b>	<b>Corrective action</b>
<b>E 0</b>	<b>Confirm light intensity, temperature and pressure values.</b>	<b>Calibrate zero point, supplying zero gas (water) to the detector. If you can not take a corrective action, please consult the above offices.</b>
<b>E 1</b>	<b>Verify the light intensity.</b>	
<b>E 2</b>		
<b>E 3</b>		<b>Replace the mercury lamp.</b>
<b>E 4</b>	<b>It is needed to confirm the internal setting of switches.</b>	<b>Reset these switches to the correct positions.</b>
<b>E 5</b>	<b>Verify the outside setting in the followings.</b> <ul style="list-style-type: none"> <li>▪ <b>INT time an PUR time</b></li> <li>▪ <b>Concentration ALM value</b></li> <li>▪ <b>Pressure ALM value</b></li> </ul>	<b>Set the values again to each correct one.</b>
<b>E 6</b>	<b>Confirm the light intensity, temperature and pressure values, connection of I/F cable.</b>	<b>If they have no problem in spite of the check of these items, please and also consult the above offices.</b>

## **11 Warranty**

**Our products are warranted for 12 months from the date of delivery. However, note that the following cases are not covered by this warranty.**

**Following failures or damages occurred within the warranty period.**

**Failure caused by misuse.**

**Failure caused by inappropriate repair or modification using non-genuine parts.**

**Failure or damage occurred during transportation or by drop after delivery.**

**Failure or damage resulting from fire, brine, gas, earthquake, wind, flood, lightning, abnormal voltage or other natural disasters.**

**Failure caused by degradation of consumable parts (packings or seals).**

**Well, we can not warrant you for defects of the related devices, injury of human body and your any loosed profits even if when their in and out of guarantee terms.**

### **Others**

**(1) Contact the dealer when repair is needed.**

**(2) This instrument is repaired at our side after it is sent from the user.**

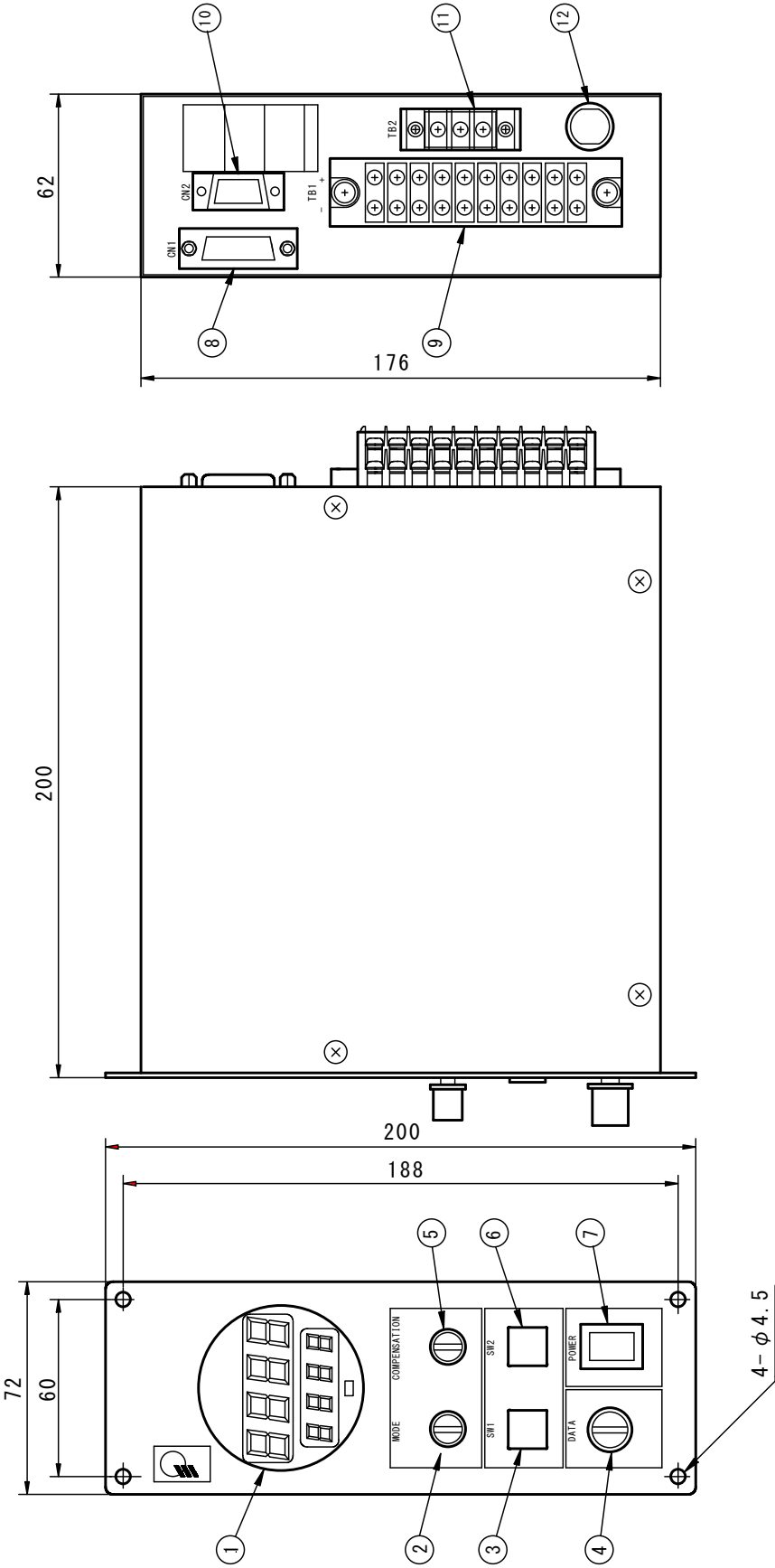
**(3) The minimum storage period of repair parts and necessary parts for this instrument is seven years after discontinuation of the instrument's production.**

**\* The “repair parts and necessary parts” stated here means the parts required to keep the product performance.**

**(4) The coverage of warranty for any event that has not occurred in the past is discussed as it arises.**

**The specification may have to change without its announcement for improving and remodeling the equipment.**

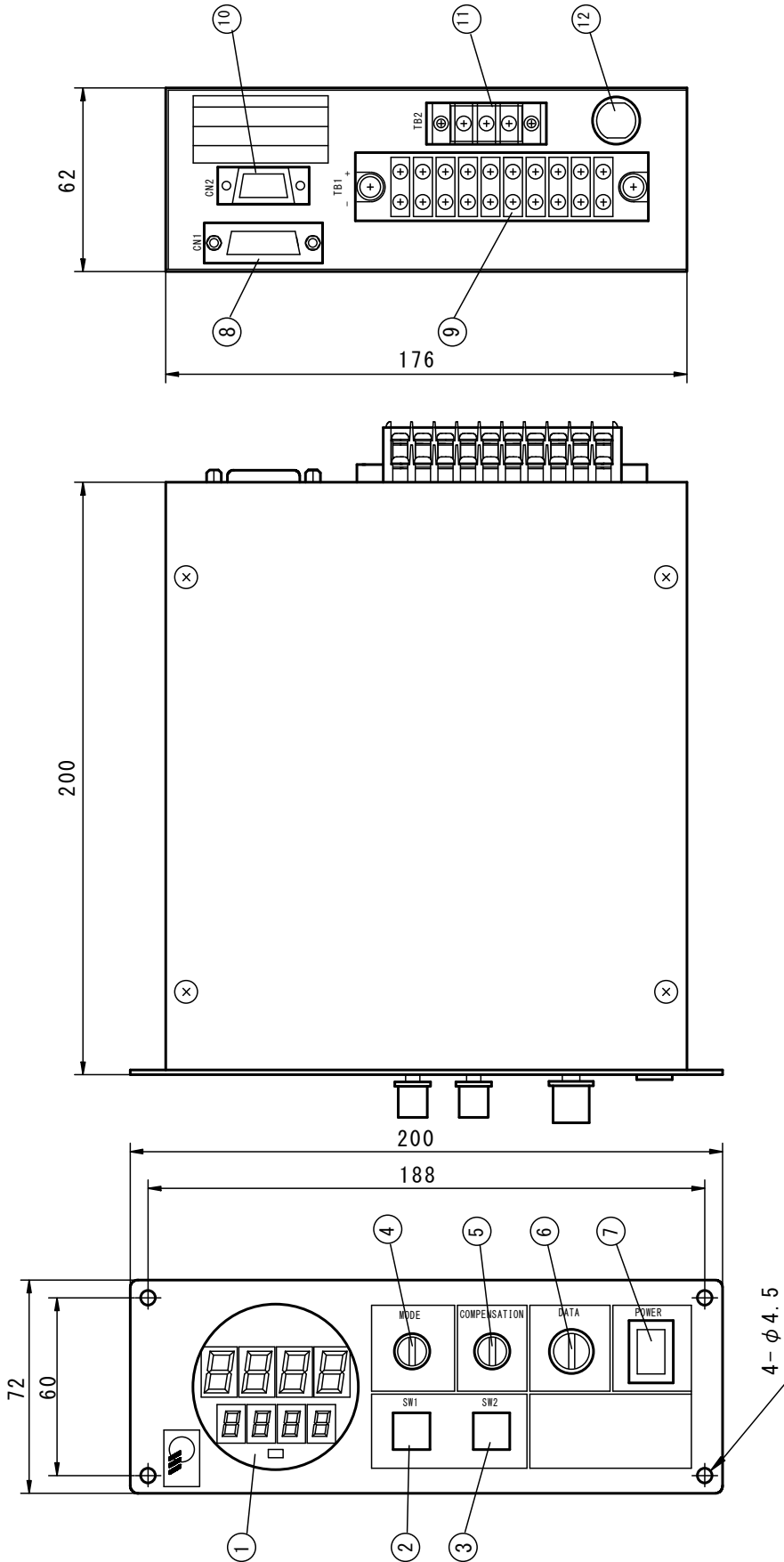
Attached drawing 1 Outline drawing of the Vertical type controller



Installation on the Panel  
 Cut out : 66W x 180H  
 Thickness : 2~5mm

- | No. | Parts name               |
|-----|--------------------------|
| 1   | Display unit             |
| 2   | Switch 1                 |
| 3   | Switch 2                 |
| 4   | Measuring mode switch    |
| 5   | Compensation mode switch |
| 6   | Data switch              |
| 7   | Power switch             |
| 8   | Connector 1              |
| 9   | Terminal block 1         |
| 10  | Connector 2              |
| 11  | Terminal block 2         |
| 12  | Fuse holder              |

Attached drawing 2 Outline drawing of the Horizontal type detector

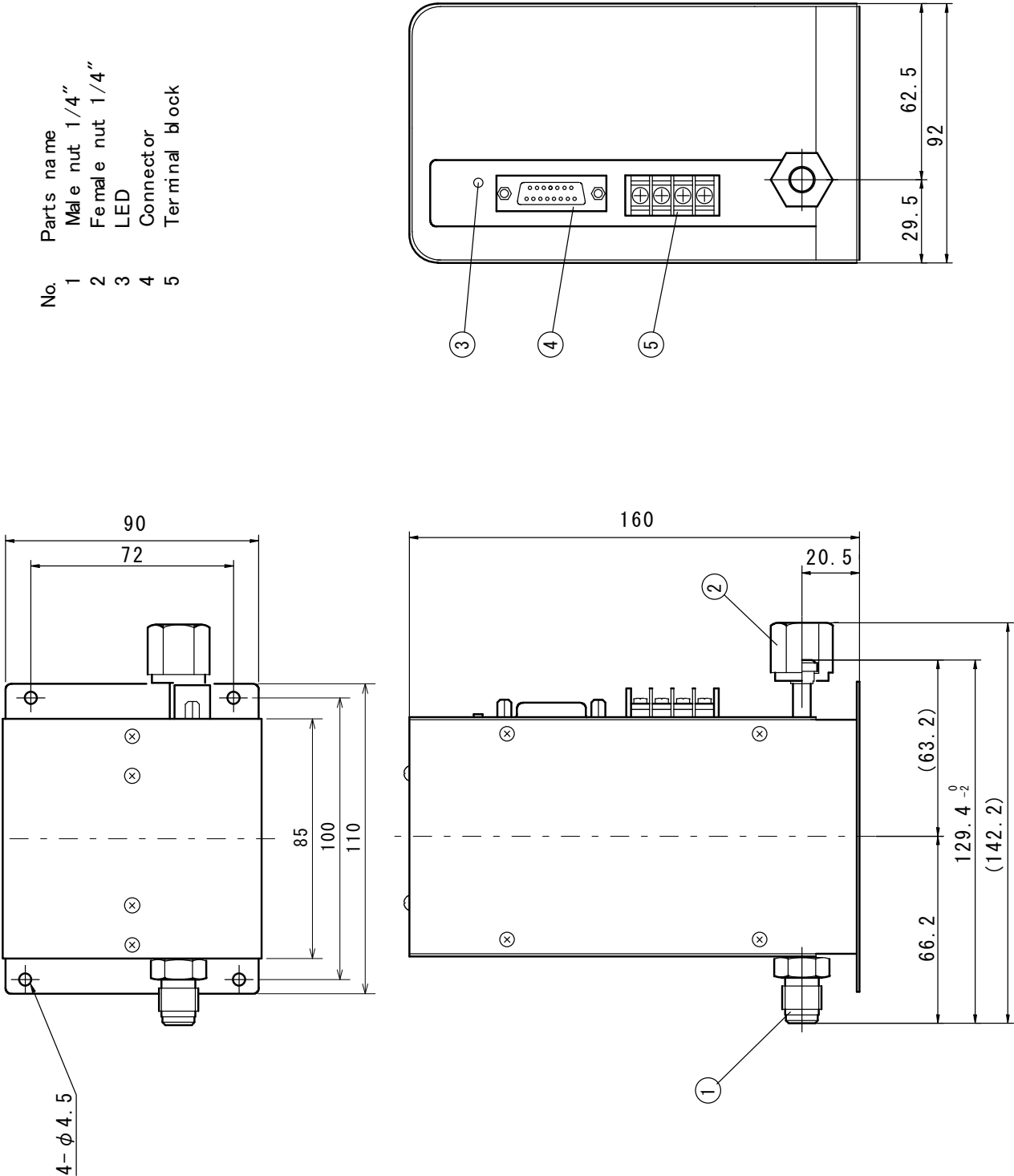


Installation on the Panel  
 Cut out : 180W x 66H  
 Thickness : 2~5mm

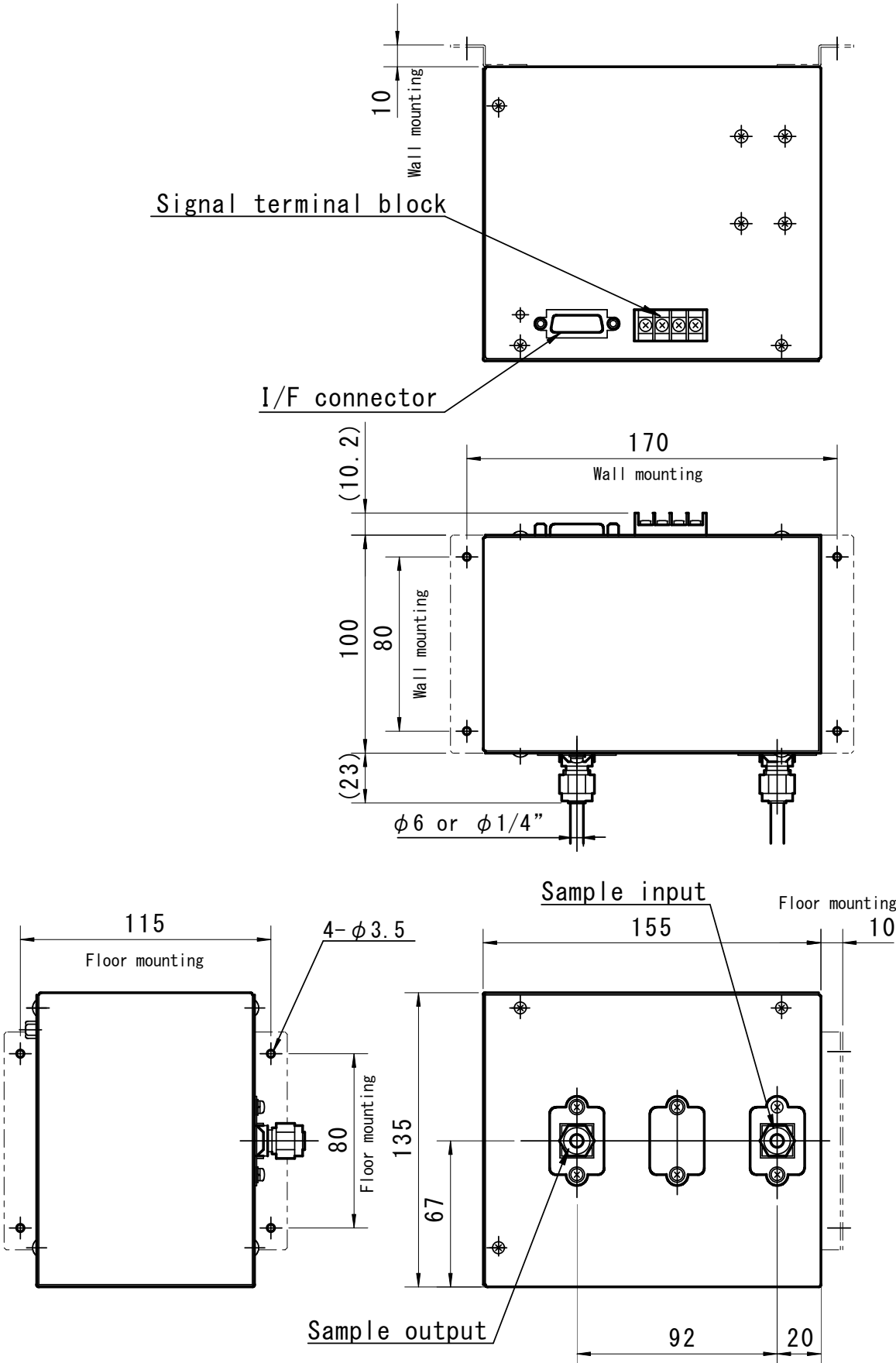
No.	Parts name
1	Display unit
2	Switch 1
3	Switch 2
4	Measuring mode switch
5	Compensation mode switch
6	Data switch
7	Power switch
8	Connector 1
9	Terminal block 1
10	Connector 2
11	Terminal block 2
12	Fuse holder

Attached drawing 3 Outline drawing of the detector, Type G6SH

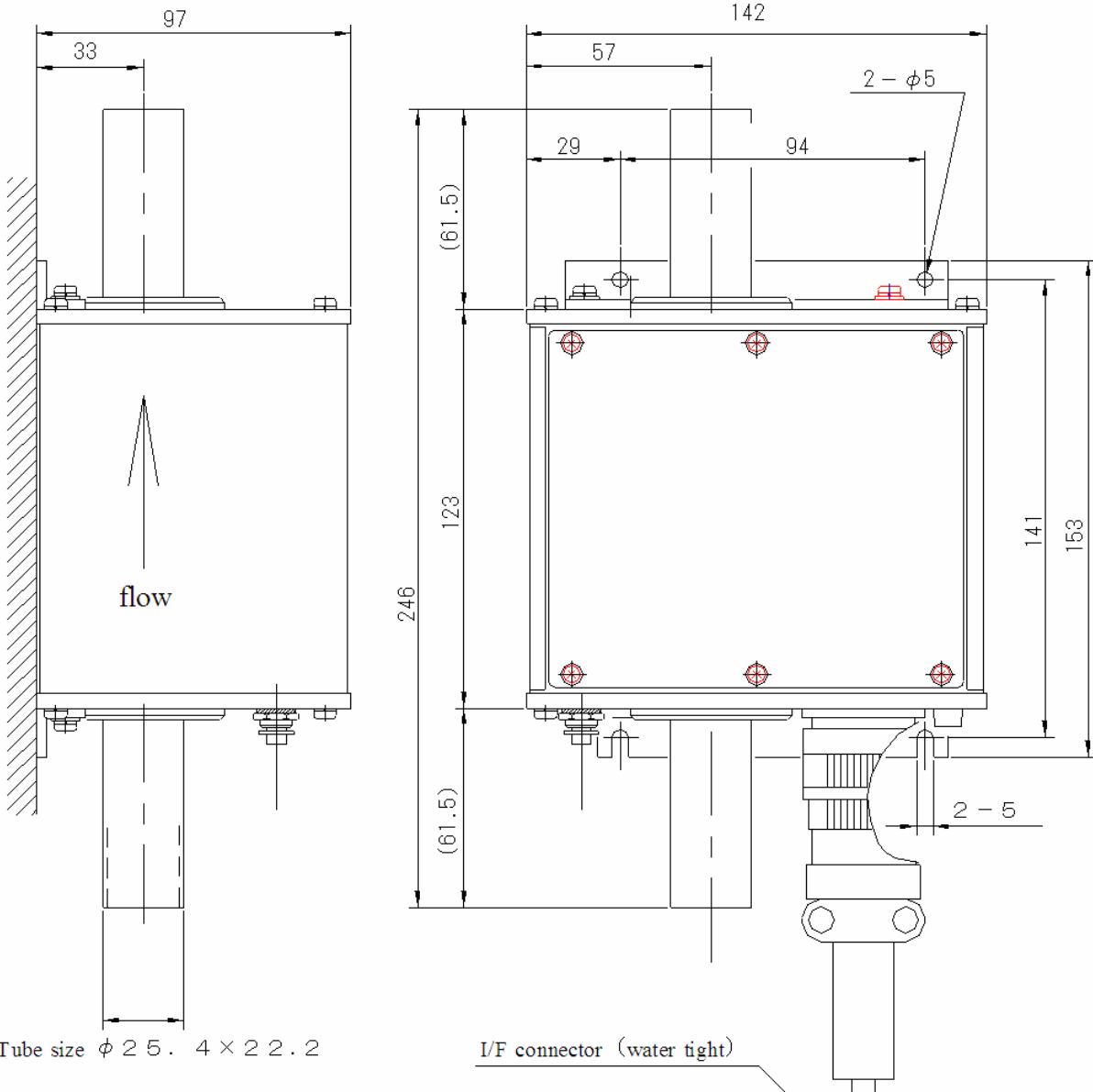
No.	Parts name
1	Male nut 1/4"
2	Female nut 1/4"
3	LED
4	Connector
5	Terminal block



Attached drawing 4 Outline drawing of the detector, Type G6SM

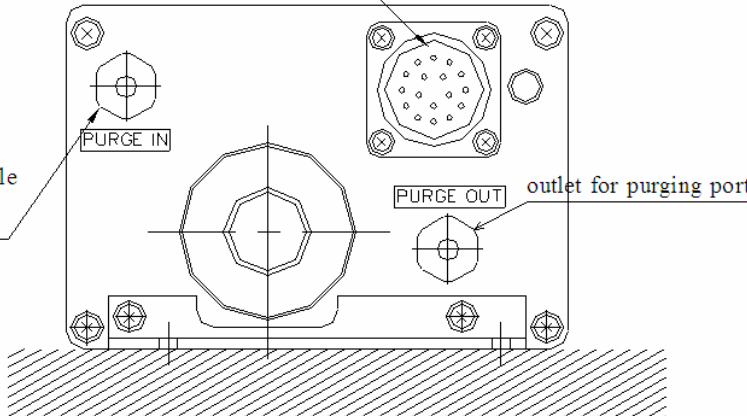


Attached drawing 5 Outline drawing of the detector, Type L6SQ-10

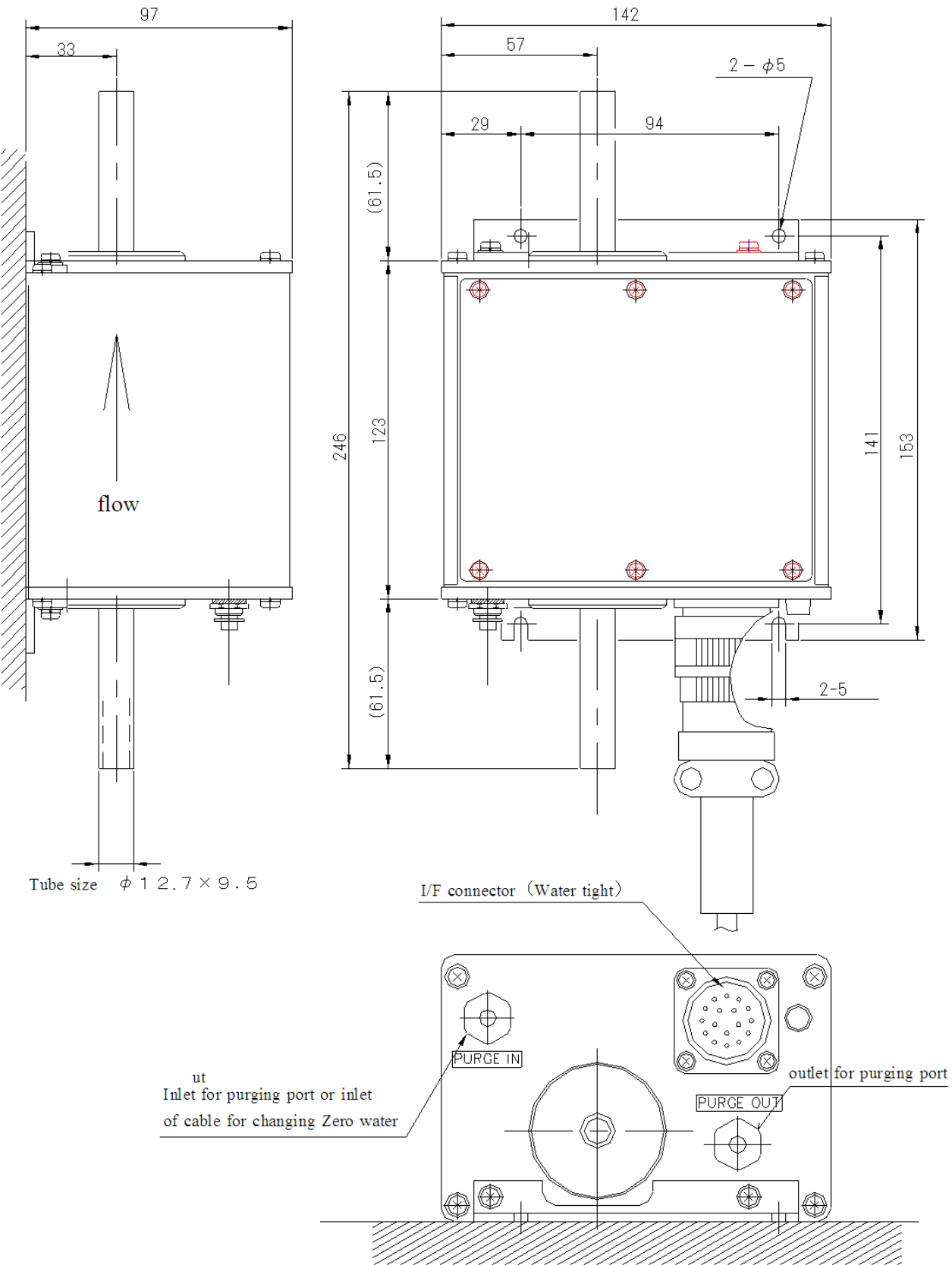


Tube size  $\phi 25 . 4 \times 2 2 . 2$

Inlet for purging port or inlet of cable for changing output of Zero water



Attached drawing 6 Outline drawing of the detector, Type L6SQ-05







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