



INSTRUCTION MANUAL

OZONE GAS LEAK MONITOR

MODEL ELM1

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**EBARA JITSUGYO CO., LTD.
MEASURING INSTRUMENT
AND MEDICAL DIVISION**

SALES DEPARTMENT

EAST JAPAN SALES BRANCH : 3-12, Kurigi 2-Chome, Asao-ku,
Kawasaki-shi, Kanagawa, 215-0033 Japan
Tel. +81-44-981-0560 Fax. +81-44-981-0561
E-mail ej-ozone@ejk.co.jp

WEST JAPAN SALES BRANCH : 2-13, Hiranocho 3-Chome, Chuo-ku,
Osaka-shi, Osaka, 541-0046 Japan
Tel. +81-6-6231-3528 Fax. +81-6-6231-2929
E-mail ozon-osaka@ejk.co.jp

ENVIRONMENTAL MEASUREMENT TECHNOLOGY CENTER

3-12, Kurigi 2-Chome, Asao-ku,
Kawasaki-shi, Kanagawa, 215-0033 Japan
Tel. +81-44-981-9560 Fax. +81-44-981-0561
E-mail ejozndsn1@ejk.co.jp

Introduction

This time, we are pleased that you have purchased our ozone gas leak monitor, Model ELM1 made by Ebara Jitsugyo Co., Ltd. This instruction manual provides the latest information in order to install and to use this monitor correctly and safely, so that the important message is described in this manual. 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

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

Note 1: The serious injury indicates the injury such as sight loss, hurt, burn (hot or cold), electrical shock, fracture and toxic reaction which leaves after-effects or requires hospitalization or long-term outpatient treatment for cure.

Note 2: The minor or moderate injury indicates the injury such as burn and electrical shock which does not require hospitalization or long-term outpatient treatment for cure, and the material damage indicates the damage which may lead to property damage or product failure.



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 instrument is not designed to be explosion proof.

Using the ozone analyzer in a location where flammable or combustible gas is present can cause explosion. Never use the ozone analyzer in such locations.

**WARNING**

- 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 adjustmenting and repairing inside of the monitor. Do perform it with specialist.
- If you connect the connector and turn on the mercury lamp while the cover is detached, UV ray may leak and harm your eyes and skin. Also, do not attempt to look at UV ray while the low-pressure mercury lamp is turned on. Use protective glasses when working.

**CAUTION**

Caution items when put the monitor (densitometer) in use

- A consumable low-pressure mercury lamp contains harmful components to humans. When the lamp is replaced with new one, the old lamp must be disposed of appropriately.
- Make sure to turn off the power before relocating the instrument, replacing parts or arranging cables.
- This instrument is precision equipment. Do not subject it to shock or vibration.
- Note that any failure of the analyzer or measurement error resulting from a sample gas containing a substance other than ozone will not be covered by the warranty even in the warranty period.
- Exposing this instrument to high concentration ozone gas may damage the instrument.
Note that any failure resulting from this will not be covered by the warranty even in the warranty period.
- The internal parts of the instrument have their respective service life. Using these parts beyond their replacement cycle may cause breakage of the parts as well as inaccurate concentration measurement.
Perform maintenance periodically.
- Note that we assume no responsibility for any trouble or failure resulting from modification or change to this instrument even in the warranty period.
- The low-pressure mercury lamp is made of glass, therefore, be careful not to drop, hit against something (apply load), exert unbearable pressure or scratch it.

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1 General description

The ozone gas leak monitor, Model ELM1(hereafter referred as the monitor for short) which can measure Low Ozone concentration in environmental air condition . And it is a UV absorption product which has a small size and light weight. The analyzer keeps introducing zero gas to enable measurement of low concentration ozone, and performs zero point correction to provide stable ozone concentration measurement. For sampling, the analyzer takes in air from a place where the analyzer is installed and then performs measurement.

2 Measuring principle

This monitor is a UV absorption type ozone gas leak monitor which can detect and measure quantity of absorption of UV rays by ozone in the sample gas (ozone leakage) 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.

$$C = \frac{A}{\alpha T} \times \log\left(\frac{I_o}{I_x}\right)$$

where : C = Ozone concentration
 = 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

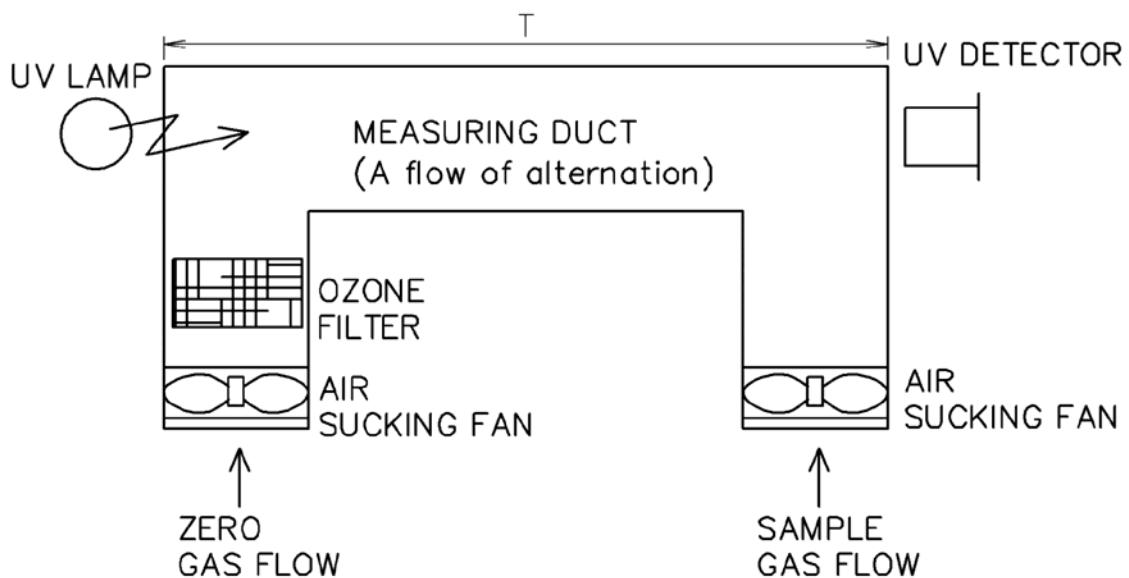
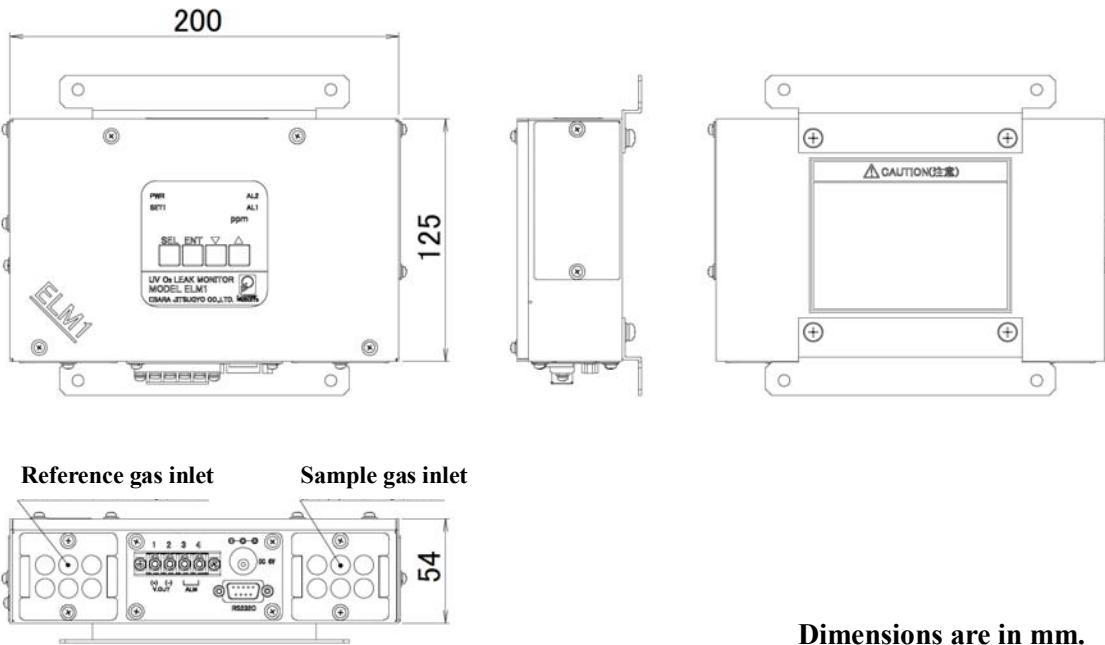


Figure- 1 : Measuring principle



Dimensions are in mm.

Figure- 2 : Outside appearance

3 Basic specifications

Model &

Product name : ELM1 Ozone gas leak monitor

Measuring principle : UV absorption method

Service : Ozone gas leaked in atmosphere

Measuring ranges : 0 ~ 1 ppm (* note 1)

Regarding indication, it will be shown from 0.00 to 0.99.

Minus (-) values are not displayed.

Note : Deterioration or contamination of the material which is caused by ozone is not covered by the warranty.

Measuring method : interval measurement (20 seconds cycle)

Sampling method : by sucking with air fan

Span drift : within \pm 5 % FS/month (* note 2)

Zero drift : within \pm 5 % FS/month (* note 2)

Linearity : within \pm 5 % FS (* note 2)

Repeatability : less than 5 % FS (* note 2)

Display : In 3 digits such as 0.00 ~ 0.99

Span adjustment : By digital 3digits (0.000 ~ 1.999) supporting LED use

Self-diagnostic function : Detecting and displaying abnormality of light intensity, computation in the circuit and flow-rate etc.

Environment : 5 ~ 40 °C, 80% RH below (No condensation, no wind blow)

Power supply : 90 ~ 242V AC(50 ~ 60Hz), approx. 0.3 A (dedicated adapter used)

Weight	: 1.5 kg (typical)
Monitor output	: Concentration alarm signal, PhotoMOS relay contact (24 V AC/DC, 0.1A without polarity) of one system synchronized with AL2
Analog output	: Voltage output 0 ~ 1 V DC, resolution of 8 bits (non-isolated) Minus (-) value output unavailable. (* note 3)
Communication interface	: RS232C,without flow control (asynchronous system) 9600bps
Outside dimension	: 200 W×125 H ×54 D mm
Installation pitch	: See Figure-4
Accessories	: AC adapter for private use 1 pc HQ air filter 2 pc Mounting plate (attached to the body) 1 set Clip for Protecting to pull out the DC cable and mounting screw of M3x8 with washer 1 set

Supplementary information

* note 1 : Please use the monitor in the place where the ozone concentrations is less than 0.05 ppm under environmental condition.

If used at environmental condition, this will make the consumable parts to short the life time or could result in trouble.

This value is based on the condition when ambient temperature.

* note 2 : variation is less than ±3 °C and when one of sample gas temperature is also less than ±3 °C.

Please avoid to install the monitor in the place near of the air conditioner or under direct sunshine.

* note 3 : Allowable load resistance is over than 10k .

According limitation based on the resolution, this accuracy may have error of max 100mV.

4 Description of each portion and functions

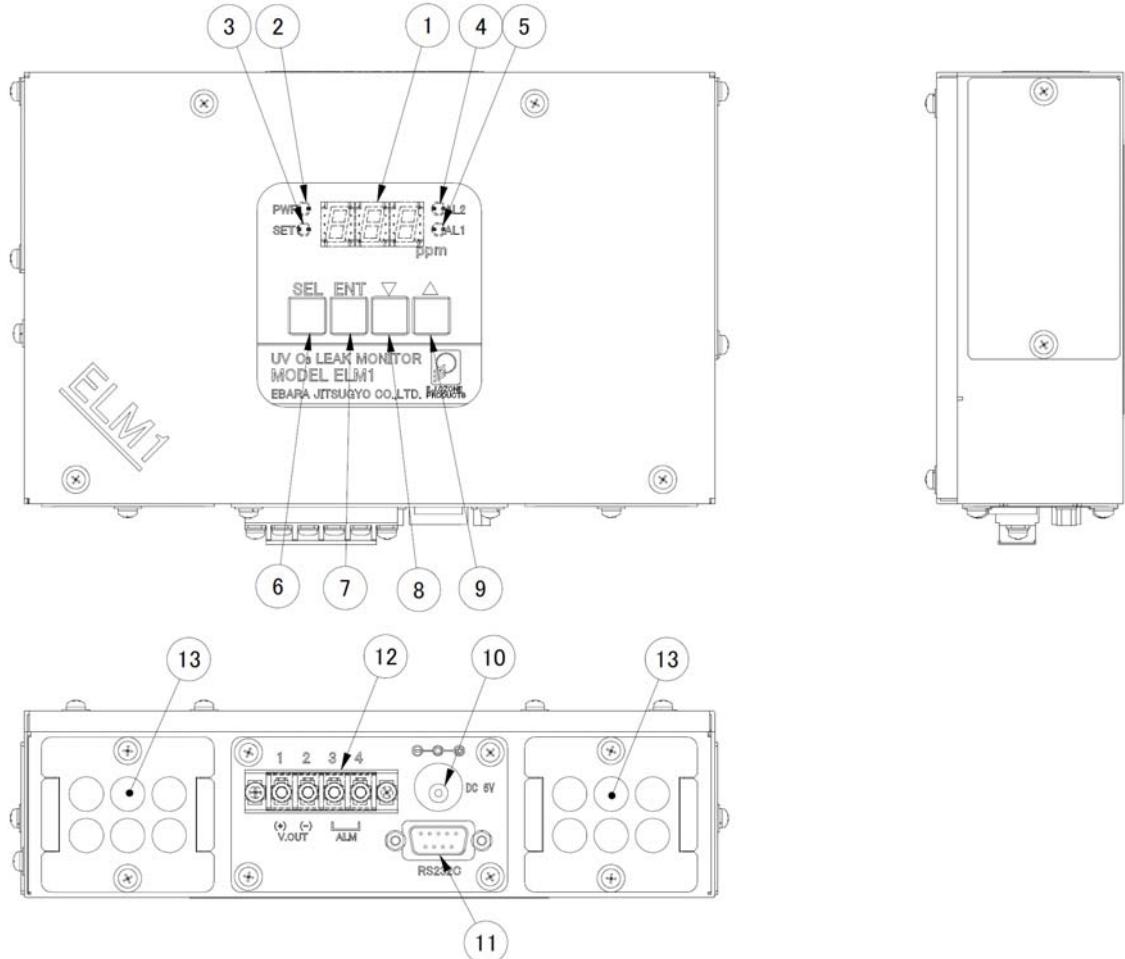


Figure- 3 : Operating portions of the device

Display

Measured ozone concentration is shown on the display. For details, please refer item 4.1

“Mode switch and each setting”.

(The control software version is indicated in the first place.)

Power LED(PWR)

This LED is turned on when supplied the electric power.

~ In order to measure in steady state ~

10 minutes for warming-up operation is the minimum required time till a low-pressure mercury lamp in the ozone gas leak monitor, Model ELM1 becomes to be in steady state.

In case it is required to measure and detect the concentration in more steady state, it should be started after 3 hours over from when power was turned on.

When taking in an output of this device to the sequencer, do perform it after when the warming- up operation was done for one more hour. Still more, when the monitor is not used for long term, it is recommended that the monitor is always operated as it is, excepting in out of the condition.

Auxiliary LED (SET 1)

This LED(red) is turned on and off in condition synchronized with measuring interval.

This is used to supplement (display minus (-) sign, etc.) a value expressed by the 7-segment LED on each setting menu.

ALARM LED2 (AL2)

When measured value has exceeded the upper limit of the setting concentration value, it will turn on the LED (Regarding contact of photoMOS relay, its contact will be closed between NO.3-4 of terminal block at the point in time of which exceeded continuously when exceed the setting Hn + one time)

ALARM LED1 (AL1)

When measured value has exceeded the upper limit of the setting value, it will turn on the LED (there is not a contact output)

SELECT button (SEL)

When transfer to the setting mode or when return to the measuring mode, this is used.

ENTER button(ENT)

When select item and figure number, this is used.

DOWN button ()

In case of the numerical value, this is decreased by pushing the button.

UP button ()

In case of the numerical value, this is increased by pushing the button.

DC Jack (6V DC)

This is a Jack which is one of AC adaptor for private use in order to put into the monitor.

RS232C connector

This is a connector for communicating the monitor .Please use RS232C cable for 9pin(socket contact) of the cross connecting.

Terminal block

This is use for alarm signal and analog output.

terminal NO.1 :0 – 1V OUTPUT(+) (non-isolated)

No minus (-) value output

terminal NO.2 :0 – 1V OUTPUT(-) (GND)

terminal NO.3,4 :Contact output of concentration alarm without polarity and insulated from enclosure and internal circuit.

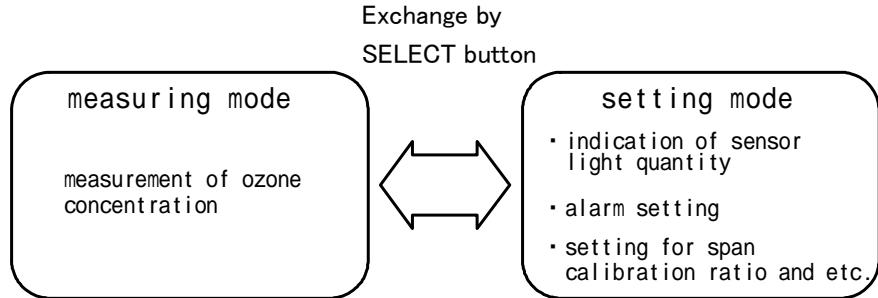
Gas introducing inlet

This is a gas inlet (outlet) for measurement. The filter is already attached in the vent.

If a filter is stained, please change it.

4.1 Mode switch and each setting

The instrument is composed of 2 modes concerning ones of measuring and setting, and to push SELECT button for 5 seconds over as it is, can be transferred to the setting mode. When returned from this setting mode to the measuring mode, this is returned by pushing SELECT button after finished the setting item. (When returned to the measuring mode, this mode will make the monitor to warming-up operation)



(1) Measuring mode

The measuring mode repeats to turn on and turn off this LED (SET1) under left side of the concentrations display, according to gas replacing period.

Ozone concentration is indicated on the display and the monitor will generate an analog output compared with Ozone concentration from the signal terminal block. (Minus (-) values are not displayed or output.)

Regarding the instrument, the sample gas is replaced every 10 seconds and this measuring result will indicate on it term of 20 seconds.

The analog value of this result is generated from the terminal block as one of 0 – 1 V.

(2) Setting mode

Setting and confirmation items become 6 kinds as follows.

Transfer method to the setting mode:

When pushing SELECT button for 5 seconds over, it becomes the setting mode and is appeared as “AL1” on the display.

Every pushing the button, the setting item (indicator) will be changed repeating the order of AL1 AL2 Hn OFF SP LA (To push button, this may make
 ↑ return to AL1 it to the opposite direction).

In condition that the setting item is indicating, you can choose your suitable item by pushing ENTER button. Pushing SEL button after setting enables change to another item. Push ▼ or ▲ button to change the setting item.

Furthermore, returned to a measurement mode by pushing SELECT button. (When returned to the measuring mode, this mode will make the monitor to warming-up operation)

· ALARM(AL1 & AL2) setting:

Figure of the setting is shifted every pushing ENTER button.

Regarding or button, numerical value indicated on the display is decreased or increased whenever you push this one.

The setting is in range of 0.00 ~ 1.00. However, in case alarm setting value of AL1 or AL2 is set to numeric 0.00 or 1.00, this concentration alarm is not generated.

- AL1 : When alarm 1 have exceed the setting value, LED(yellow) located on the lower right of the concentration display is turned on.
- AL2 : When alarm 2 have exceed the setting value, LED(red) located on the upper right of the concentration display is turned on and this will close a circuit connected to the terminal block NO.3 and NO.4 of Alarm contact at the same time.

----- Regarding point on the alarm setting -----

This instrument has much quantity of regulation of Zero drift etc .in comparison the piping type densitometer as usual model, so that you should set the value with its margin.

- Hn : Hysteresis number of times is a setting order to decide the contact output to ON state, how many times of measure value had exceed the setting value AL2 continuously.
Default value of Hn = 3, in case of 4 times over it makes contact output ON state.
However, in the default setting, it becomes ON state if the measure value had exceeded about 80 seconds over continuously.
- OFFSET : Regarding offset a numerical value which is set to connection value calculated with the monitor, is added and indicate it on the display and also its analog output will generate.
When an auxiliary LED(SET1) on lower left of the concentration display is switching the light, this means minus (-) value .On the other hand, when turned it off, this means (+) value.
Pushing ENT button moves the digit to be set. The setting range is -1.00 to +1.00.
- SPAN : In this place, a numerical value which is set with calibration result obtained from one of Span calibration ratio is inputted, so that please use this value as it is.
When an auxiliary LED(SET1) is turned on, it is 1.* * * (* * * is indication of the display).
When an auxiliary LED(SET1) is turned off, it is 0.* * * (* * * is indication of the display).
- LA(Light receiving value) :
This will indicate a sensor output value. (indication only)
In case value of sensor can not keep the prescribed accuracy, it is needed to replace the mercury lamp (when become less than 0.7, the display will indicate Er3)

5 Functions

5.1 Alarm

Ozone leak monitor, ELM1 has an alarm (synchronized with AL2) based on one system. PhotoMOS relay output (non polarity) with rating of 24V AC /DC 0.1A isolated with housing and internal circuit.

5.2 Monitor error

Six types of error display are used.

Er0 (error 0)

This message appears when indication of measured value had exceeded the measuring range.

Still more, this measuring operation is continuously performed and it can return to normal condition when this exceeded value has decreased within the range.

Er1 (error 1)

This indicated when sensor light quantity in the monitor comes to the high value, and then if the value is returned into the proper range, it returns to measuring operation automatically.

Er2 (error 2)

This is not used.

Er3 (error 3)

When sensor light quantity has decreased, this is indicated. The life of the mercury lamp and an internal dirt are thought about.

Er4 (error 4)

This is not used.

Er5 (error 5)

When the internal setting value is abnormal (device error), this is indicated.

Er6 (error 6)

There is one of an air fan problem, and it means that fan has possibility for its broke down.

Er7 (error 7)

This message is indicated when the setting item is not correct (by EEPROM check sum error).

5.3 Offset

This instrument can be easily set 0 (Zero) point of offset value from a switch on the front panel . Please use this offset in case that there is an interference component.

Regarding setting method, it is described in section of 4.1(2).

Offset is not reflected immediately after setting was changed to concentration.

It takes about 3 minutes till the offset value is completely reflected.

Notice :

Be careful so as not to forget that its offset had input.

When measuring environment and gas component changed, the concentration may sometimes not show its correct value with that offset value.

You should return the setting to its previous the value and use it after your confirmation.

In addition, if minus (-) value as offset input was applied with large numeric, this will affect that the measuring value is placed under 0 (Zero) point, so that indication of ozone concentration is indicating zero as it is.

5.4 Communication

By connecting RS232C cross cable with 9 pin socket to a connection port on the personal computer, calculation result from the monitor can be obtained.

This communication has a performance as follows ; bit rate 9600bps, a synchronized method and none flow control.

Interruption method :

Integration hours with 10 digits from start time of measurement and 4 digits of integer portion for concentration value, but the value less than decimal point is 6 digits.

An example regarding 0000000124 and 0000.581216 it means that the passed time of 124 seconds and concentration of 0.581216ppm.

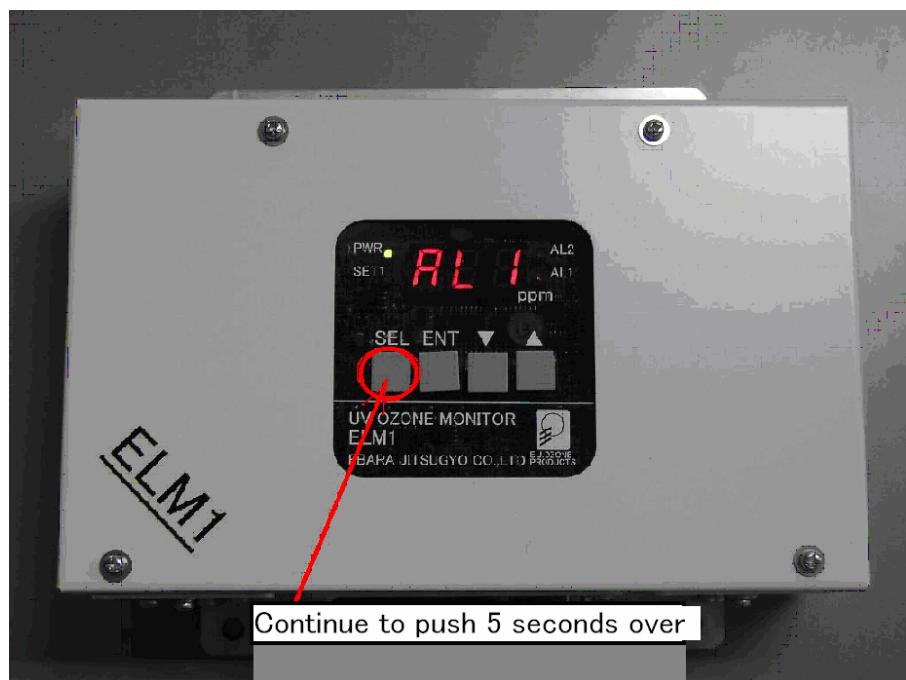
(Note) Effective digits united with the display is only decimal point of 2 digit below.

(Minus (-) value output available)

6 Change an example of the setting value

Concerning a change method, this explains how to use AL2 (connected with contact output) as example.

Continue to push SEL (select) button more than 5 seconds (See Picture-1).

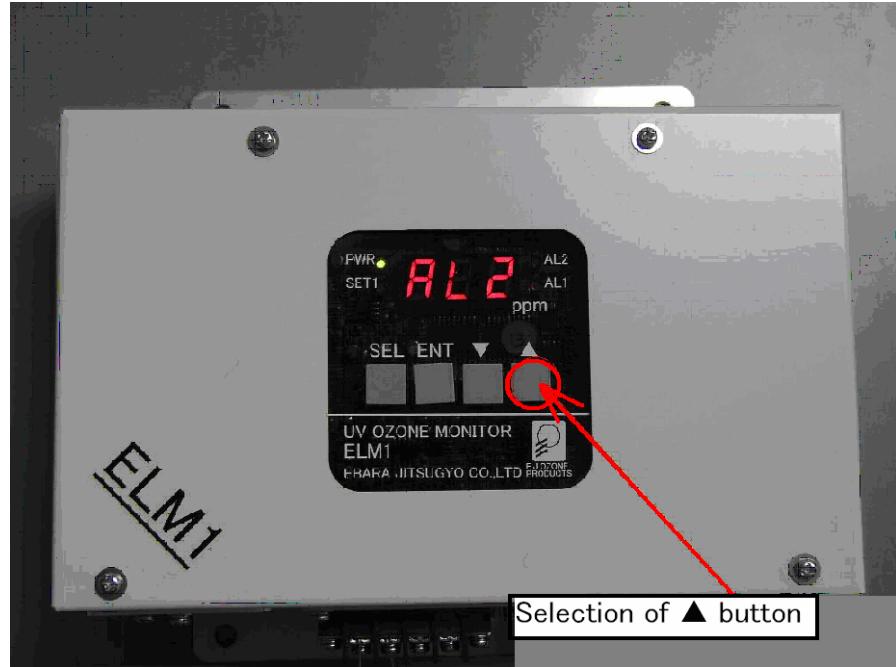


Picture- 1 : A shift to the setting mode

As shown on the above Picture-1, AL1 indication is appeared.

However, The setting item is AL2, this should be indicated as one of AL2 by pushing button (See Picture-2).

From this indication, you should change the setting value of AL2.

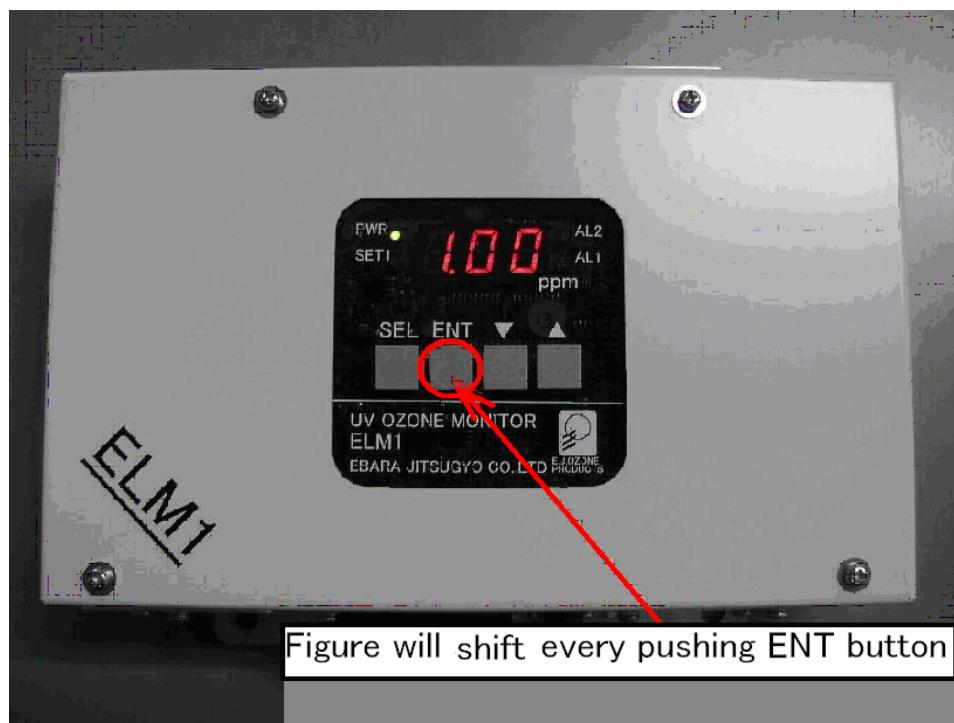


Picture- 2 : The movement of the setting items

As shown on the Picture -3, push ENT button slightly.

According this action, the maximum digits will turn on and off its position of LED (See Picture-3).

Figure is switching the light, is possible to change it. In the first stage condition, as this indication is in the value of 1.00, this should be performed so that the numerical value will become its change condition as this maximum digits are 0 (Zero).



Picture- 3 : Choice of setting items

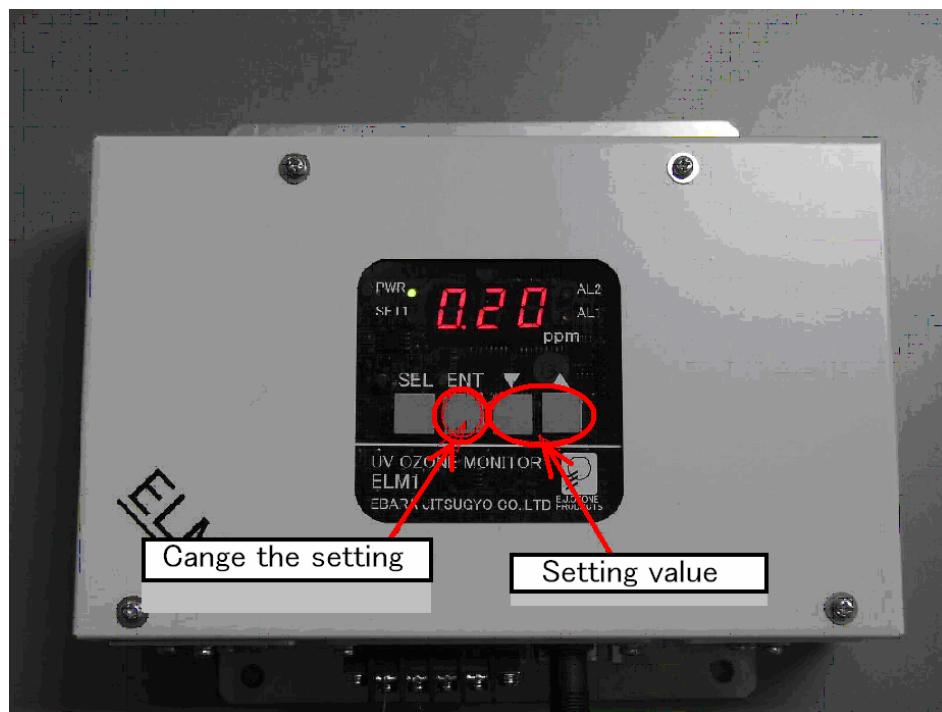
In the first place, pushed button in order to make the maximum figure to zero (See Picture-4).



Picture- 4 : Change of max digit for the setting

Changed digits in this time, is a first position from decimal point, so that it will shift by pushing this button once.

At the next stage, this indication should make it to the prescribed value by pushing **SEL** or **ENT** button in order to change the setting value (See Picture-5).



Picture- 5 : Change of the setting value

If finished the above, push "SEL" button once, this becomes a condition which can shift to the other item. When pushed "SEL" button once more, this will be shifted to a measuring mode and indicate UP and 10 (warming-up operation) alternately.

7 Installation

7.1 Requirement for installation

In order to protect the instrument from any damage and to ensure to be stable operation, installation at the place as shown below should be avoid.

- (1) **The places with much dust or the other place where such corrosive gases as gas, sulfuric acid, or halogen gas are floating in the atmosphere.**
Notice : In case of ozone, use the monitor in condition that the condition is less than 0.05ppm.
- (2) **The place having high temperature & high humidity, and / or radical temperature change.**
- (3) **The place with receiving a impact or the continuous or intermittent vibration.**
- (4) **The place under direct sunshine.**
- (5) **Near the source of a strong magnetic or electric field.**
- (6) **The place without space for maintaining and checking the monitor.**
- (7) **Process plant where explosive gas may be generated in the environment.**

7.2 Installation method

Please use the Ozone leak monitor, Model ELM1 by mounting it on the wall as basic method.

Regarding mounting pitch, it is shown on Figure-4.

The peripheral space to introduce Ozone gas should be about 100mm over.

**When use the mounting metal, please install them to hole with pitch of 130mm x 150mm.
(screw of M5)**

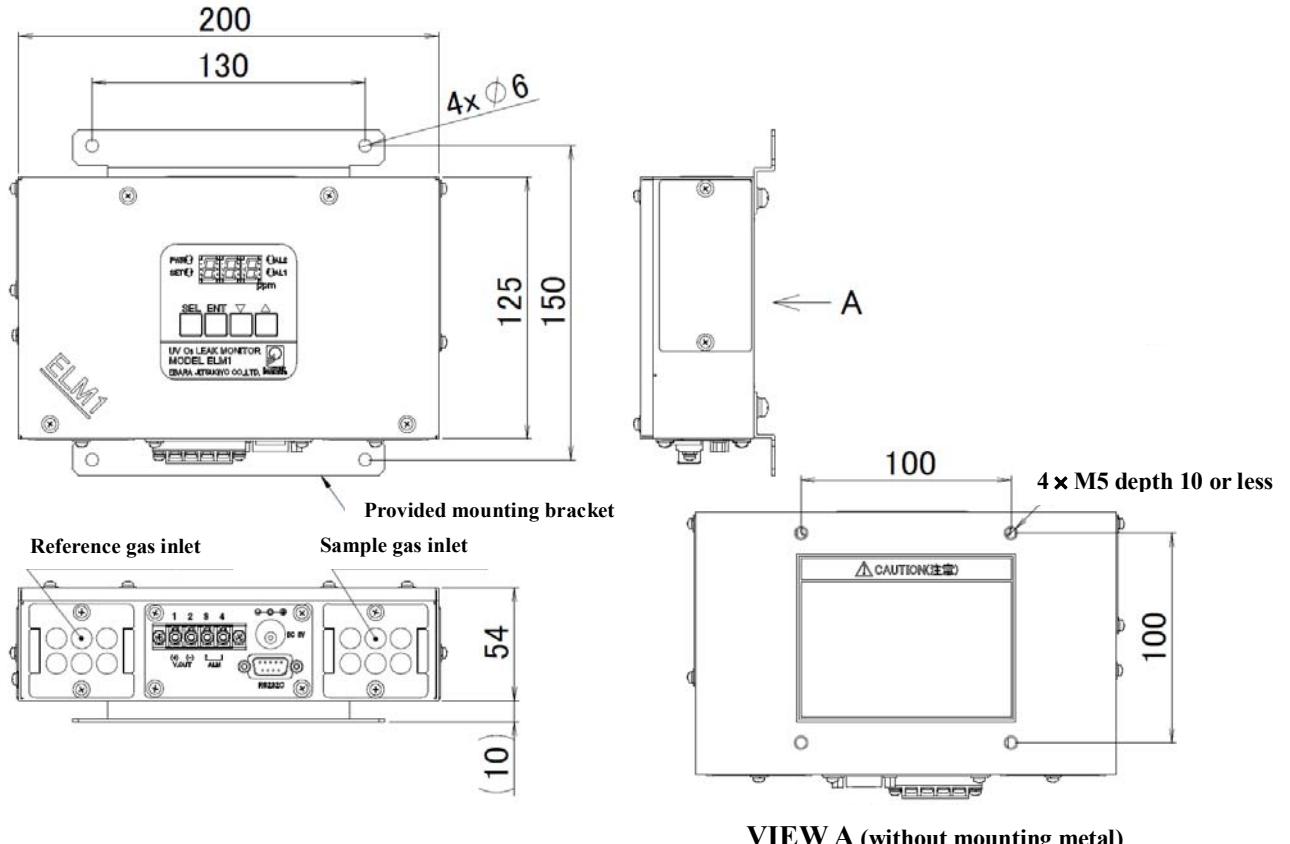
In addition, the body should be installed on the place where it can be removed.

When the body is directly attached without the mounting metal, this pitch is 100mm x 100mm, and the screw is M5.

Regarding mounting direction, it should be installed so as to become horizontal according to figure-4.

Notice : Do not take out M5 screw of the body even if not used.

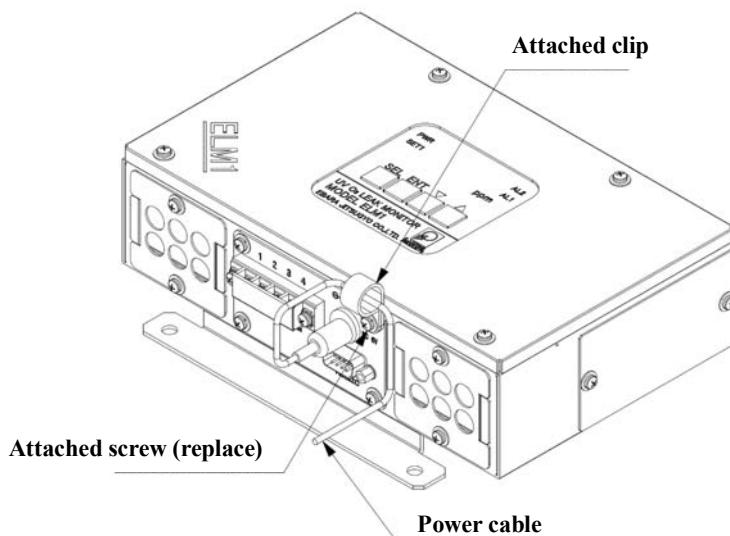
For inserting depth of M5 screw to the body, use one of it being less than 10mm.

**Figure- 4 : Mounting dimensions***** Maintenance space**

Please secure a maintenance tool space in order to taking out the instrument from the wall.
Maintenance of the instrument removed from the wall is recommended to perform it at horizontal place.

*** Countermeasure for pulling out the power cable**

According to dispose of the cable as Figure-5, DC plug can not be pulled out with this measures(Please perform this if needs).

**Figure- 5 : Countermeasure of anti-loosing for power cable**

7.3 Wiring method



CAUTION

Perform the wiring to the terminal block after the confirmation that the electric power is surely not supplied.
And then, if the wiring is connected by mistake, it can cause damage to the instrument and also is much risky.

(1) The connection of the power supply

By inserting DC plug of AC adapter for private use into DC jack on the body, an electric power can be supplied.



WARNING

If the covers etc. are opened under condition of supplying the electric power, you may sometimes have a chance of leaking UV ray from the mercury lamp which is lighting in the housing. When work with the monitor, use the anti-UV ray glasses.
Also, to avoid the risk of electric shock or harm to human body, make sure to turn off the power before opening the cover.

(2) Connecting the signal output

The detail drawing for signal terminal block is shown on the following Figure-6.

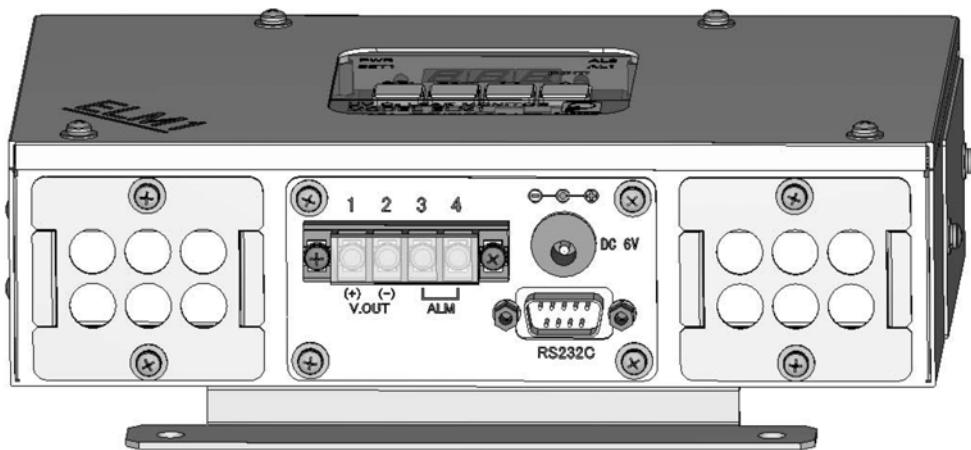


Figure- 6 : Detail of terminal block for signal use

V.OUT (analog voltage) output terminal (non-isolated)

Voltage output (0 - 1V DC) is supplied from terminals, terminal No. 1 (+) and No. 2 (-).

External load resistance can be connected with value more than 10kΩ.

No minus (-) value output

An AL2 (alarm) output terminal

Terminal No.3 and No.4 connected to a circuit in the instrument, is operated its internal circuit as ON, OFF action.

This circuit with photoMOS relay is closed when Ozone connection increases the value than one of the setting and also it is opened when decreased.

The setting of Alarm value can be performed with switch on the front panel.

This capacity of rating is 24V AC or DC, 0.1A (without polarity).

8 Measuring procedure

8.1 Preparations for measurement

- (1) DC plug of the private AC adapter use, inserted into its DC Jack on the instrument and its AC plug is inserted to the consent for 100V AC power supply.
- (2) The display indicates “UP” and “10” alternatively and warming up operation is started for 10 minutes.
Number of “10” is decreasing it every “1” from the number and this operation will finish when put indication of 1 out.

Notice :

The monitor, Model ELM1 indicates “---” at the starting time of its measurement till the needed information for calculation can be obtained and it indicates ozone concentration after obtained that the information.

In addition, there is a case that it takes a long time till the lamp becomes steady state if the monitor is in environment with the low temperature radically.

In this case, as this indication of “---” is leaved it alone, this is not trouble.

~ In order to measure in steady state ~

10 minutes for the warming-up operation is the minimum required time which the lamp in the monitor, Model ELM1 becomes to be steady state.

If you would like to measure and to detect ozone concentration under more stable condition, you have to measure the concentration after operating it for three hours.

We recommend that the electric power is always supplying to the monitor excepting a case that the monitor is not used for long term.

8.2 Measurement

- (1) LED located on the left side below is turn on with a gas exchange period after when warming-up operation had finished and the monitor begins the measurement automatically.
- (2) Value of the ozone gas concentration is shown on the display. (No minus (-) value display)
- (3) And then, also analog outputs (voltage) is generated as one of value corresponding ozone gas concentration. (No minus (-) value output)
- (4) The accumulated time from when turn on a electric power and concentration are supplied from RS232C. (Minus (-) value display available)
- (5) Output terminals for AL2(alarm contact) is closed when exceeded the setting value of AL2 had exceeded 4 times (the first value) continually.

9 Span calibration

Ozone leak monitor, Model ELM1 is performed in its span calibration at the shipping from the factory, and it is designed and produced taking into consideration of high stability on the electric circuit, so that change and adjustment of calibration ratio for span is not necessary to perform it again.

In case the indicated value is different by analyzing ozone gas and when it is adjusted to the analyzing result, please perform its calibration according to the following procedure.

- (1) Prepare a chamber with capacity of 0.3 m³ over which was shielded up (install a fan as agitator inside).
- (2) Put the instrument into this chamber and perform well warming-up operation.
- (3) Supply ozone gas to the shield chamber.
- (4) Record the indicated value after indication of the monitor becomes steady state.
- (5) Perform the analysis of ozone gas and adjust the indication of monitor one of analyzed result.

For detail, please refer to the following.

Still more, this adjustable span range is ‘0.000’ ~ ‘1.999’ and its adjustable minimum value is 0.1 % notch of full scale.

Example

Where;

Monitor indication value	0.20 ppm
Analyzed value	0.25 ppm
Span calibration ratio when shipping	1.277

$$\text{Thus, new span calibration ratio} = \frac{0.25}{0.20} \times 1.277 = 1.596.$$

In this case, span calibration ratio of this monitor should be revised it to 1.596.

- (6) The span calibrated ratio of this equipment when shipping is described on upper side of the body and the inspection sheet

Setting method on the span calibrated ratio

By using a switch on the front panel, it is possible to change the calibration ratio.

Refer to “Mode switches and each setting” of Section 4.1.

10 Maintenance and inspection

10.1 Daily inspection

Table- 1 : Inspection item

Inspection item: the choked filter	Inspection term
Air filter contamination If the analyzer is used in a dusty environment, the filter is contaminated in a short term and it may prevent the analyzer from performing accurate measurement. Inspect the air filter periodically for contamination.	at any time (about every week)

In environment with flowing much dust, the fan should be checked frequently and it is needed to replace it.

10.2 Periodical check

When zero gas filter is exposed continuously by ozone, function of this filter is deteriorate, so that it dose not come to measure the ozone .

Please confirm this function whether it is working or not by using a portable type ozone generator (Aim of checking the filter is every 6 month and its replacing is one year period). When confirming the works, you should perform it in condition that the generator is arranged at the same distance from two vents of gas input and output of monitor (when ozone gas is supplied only to one side of the vent for introducing ozone gas, this can not confirm the function as a zero gas filter).

10.3 Consumable parts

The component parts used in the monitor have an operating life. And then, deterioration and/or corruption of materials by ozone reaction are out of our duty for warranty.

Replacing criteria of the main parts are as follows. Warranty terms of every consumable parts are one year after shipping.

Table- 2 : List of consumable parts

Product name	Goods code	Quantity / unit	Replacement term	Remarks	Working level
Consumable supplies set	BZ079A	1 set	---	For details, refer to the followings individual column	See the following

Consumable supplies set list

Name	Goods code	Quantity/ unit	Replacement term	Remarks	
UV lamp	E0021A	1 pc	every 1 year	The UV lamp has an operating life and also the case that light quantity decreases or that it stops the light .	
absorption fan	EM106A	1 set (Two fans)	every 1 year	Bearings of the fan is increases the deterioration together with its used time and this does not become to get a flow rate . When error Er6, it is necessary to replace it.	possible to replace by user
HQ Air filter	NF029A	10 pc (For 5 times exchange)	as needed	According to environment where the monitor is used, if a contamination is choked in the filter, this does not come to obtain the flow rate .	
zero gas filter	NC024A	1 pc	every 1 year	As this is deteriorating with together with its used time. it becomes so as not to measure ozone .	

Change by use environment at the exchange time, but when use it in general atmosphere environment, filter it in the ratio once in 2-3 months, and please change it.



CAUTION

Note that any failure of the analyzer or measurement error resulting from a sample gas containing a substance other than ozone will not be covered by the warranty even in the warranty period.

10.4 Replacing the consumable parts



WARNING

- The monitor has a high voltage power source for igniting the mercury lamp use (normal condition: typical 200 V AC and when ignition: typical 1000 V AC at a moment). As you may have an electric shock when adjusting and/or repairing the monitor, it is recommended to perform its works with a specialist.
- UV rays emitted from the low-pressure mercury lamp may harm your eyes and skin.
Do not attempt to take the low-pressure mercury lamp out of the holder or look at it while it is turned on.



CAUTION

- Make sure to turn off the power before replacing consumable parts or wiring.
- The low-pressure mercury lamp maintains high temperature right after turning off the power. Handle it accordingly with care.
- The surfaces of internal parts of the analyzer (including the parts mounted on the board) become extremely hot.
Pay careful attention when you open the front door while the power is turned on or right after turning off the power.
- A consumable low-pressure mercury lamp contains harmful components to humans.
When the lamp is replaced with new one, the old lamp must be disposed of appropriately.
- The low-pressure mercury lamp is made of glass, therefore, be careful not to drop, hit against something (apply load), exert unbearable pressure or scratch it.
- Do not touch a broken lamp with bare hands. If you do, rinse off adherents with clean water and then wash your hands with soap well.
- The internal parts of the instrument have their respective service life. Using these parts beyond their replacement cycle may lead to breakage of other parts. Perform maintenance periodically.

(1) Replacement of the mercury lamp

- 1) Make sure to turn off the power before starting replacement work. See Figure-7 for replacing the mercury lamp.

Remove 4 screws that fix the body cover and detach the cover.

Disconnect the connector located at the upper side of the circuit board which connects the inverter power supply with the lamp.

Remove 2 screws that fix the mercury lamp cover and detach the cover.

- 1 Take off a screw attaching a lamp holder cover and take off a lamp holder cover.

Remove 2 screws that fix the mercury lamp.

Pull out the mercury lamp cable from the body.

If this is difficult, cut the mercury lamp (old one) cable and pull it out.

- 2) To attach a mercury lamp, reverse the above procedure starting from the step 5.

Draw the cable of a new mercury lamp into the body and then insert the pin into the connector.

- 3) Adjustment of light intensity is not required after replacing the lamp with new one, however, if the light intensity of the lamp is out of the following range, adjust the volume of the sensor board to be within the range of 1.35 to 1.40 using a precision screwdriver (edge width: 1 mm).



Volume adjustment
(View from A of figure -7)

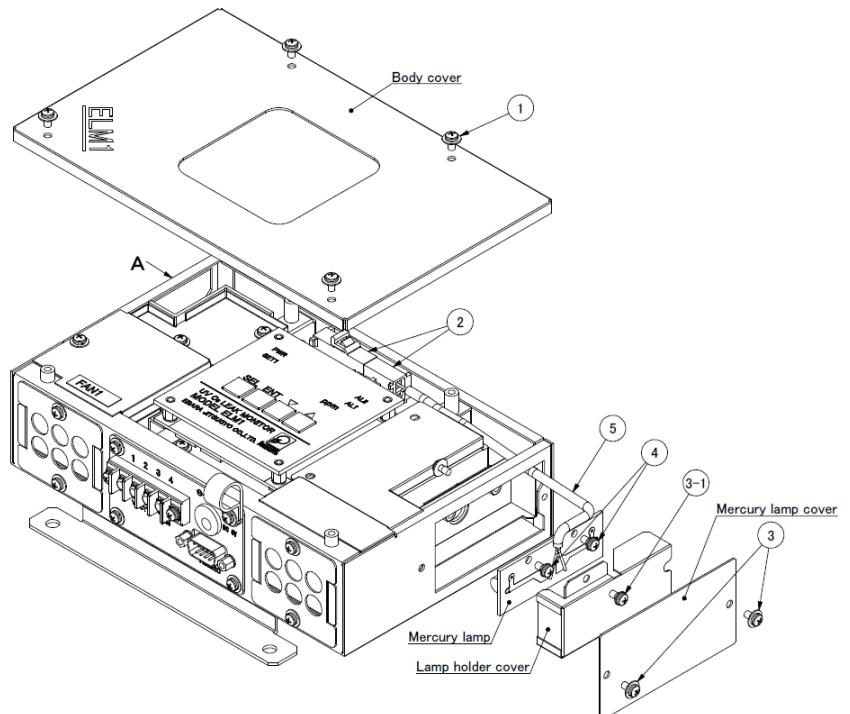


Figure- 7 : Replacement of the mercury lamp

Notice :

- If the light intensity of the lamp stays within the range of 1.00 to 1.40 when at least 3 hours of warm-up operation is completed after replacing the lamp, it is considered a normal condition (with an ambient temperature of $25\pm2^{\circ}\text{C}$). The lamp intensity depends highly on ambient temperature.
- The service life of the low-pressure mercury lamp is about 1 year when used continuously. Repeating on/off operation will reduce the service life.
- If the lamp is turned on after a long time of no use, measurement value may vary for a while after a warm-up operation.
- Storing the lamp for a long time may deteriorate it. Periodic replacement is recommended.
- Dispose of old mercury lamps appropriately.

(2) Replacement of zero gas filter

Make sure to turn off the power before starting replacement work. See Figure-8 for replacing the zero gas filter.

Remove 4 screws that fix the body cover and detach the cover.

Remove a screw that fixes the zero gas filter and detach the zero gas filter cover.

Remove the zero gas filter.

To attach the zero gas filter, reverse the above procedure.

Notice :

- Handle the zero gas filter carefully since it can be broken by being dropped.
- When attaching the zero gas filter, do not rub it since it produces powder.
- Be careful not to squeeze the fan cable when attaching the zero gas filter cover.

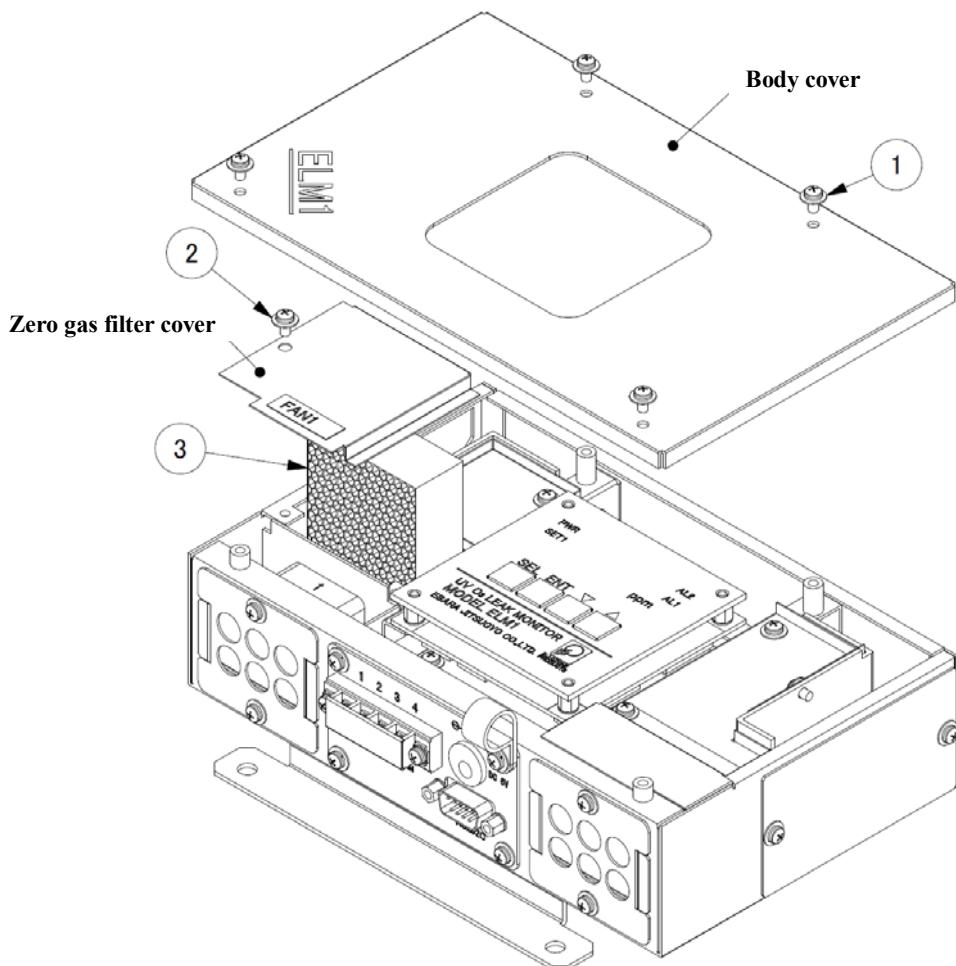


Figure- 8 : Replacement of Zero gas filter

(3) Replacement of HQ air filter

Figure-9 shows an exploded view of the HQ air filter.

(The procedure for attaching and removing the filter is the same for the reference gas inlet and sample gas inlet.)

Remove the screws at the upper and lower sides of the filter frame and remove the frame.
Take out the HQ air filter and filter holder.

Set a new HQ air filter in the filter holder. With the folded part of the filter holder inserted into the filter frame, attach it to the body with screws. (See “Attached view” in Figure-9.) At this time, make sure that the filter holder is inserted into the ventilation opening of the body properly.

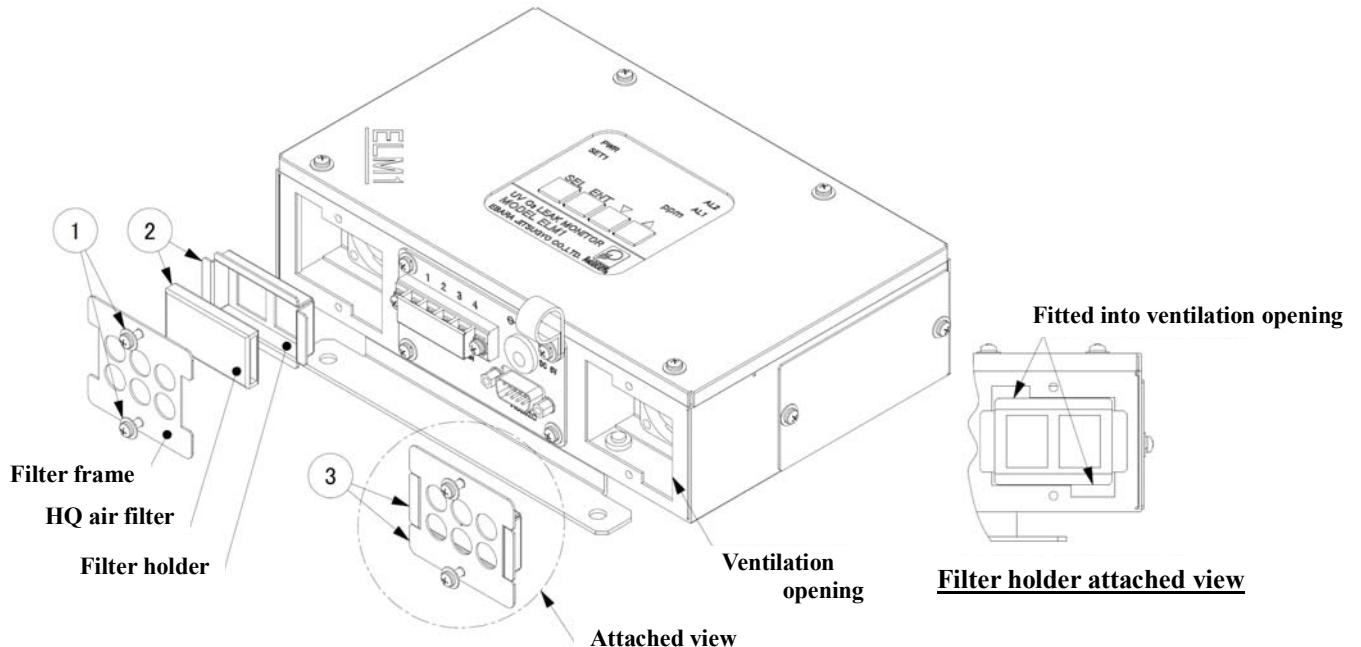


Figure- 9 : Replacement of HQ air filter

Notice :

- The replacement cycle depends on the usage environment, however, the filter should be replaced every two or three months in a normal air environment, or whenever it is contaminated heavily.
- Make sure to turn off the power before starting replacement work.

(4) Replacement of fan

Make sure to turn off the power before starting replacement work. See Figure-10 for an exploded view.

Remove 4 screws that fix the body cover and detach the cover.

Remove a screw that fixes the zero gas filter and detach the zero gas filter cover.

Remove a screw that fixes the right fan cover and detach the cover.

Remove the screws at the upper and lower sides of the filter frame and remove the filter frame, HQ air filter and filter holder (both sides).

Remove 2 screws that fix the fan (both sides).

Remove the fan (both sides).

Remove the acrylic board at the display.

Remove spacers and washers that fix the display (be careful not to lose washers).

Turn over the display.

Remove the fan connector located on the back of the display. See Picture-6.

Reverse the above procedure for attaching the fan. Make sure to attach the fan in the correct direction.

As shown in Figure-10, draw the fan cable under the folded part inside of the case. Make sure to attach the zero gas filter cover and right fan cover properly and not to squeeze the fan cable. Also, be careful not to damage other cables when attaching the fan.

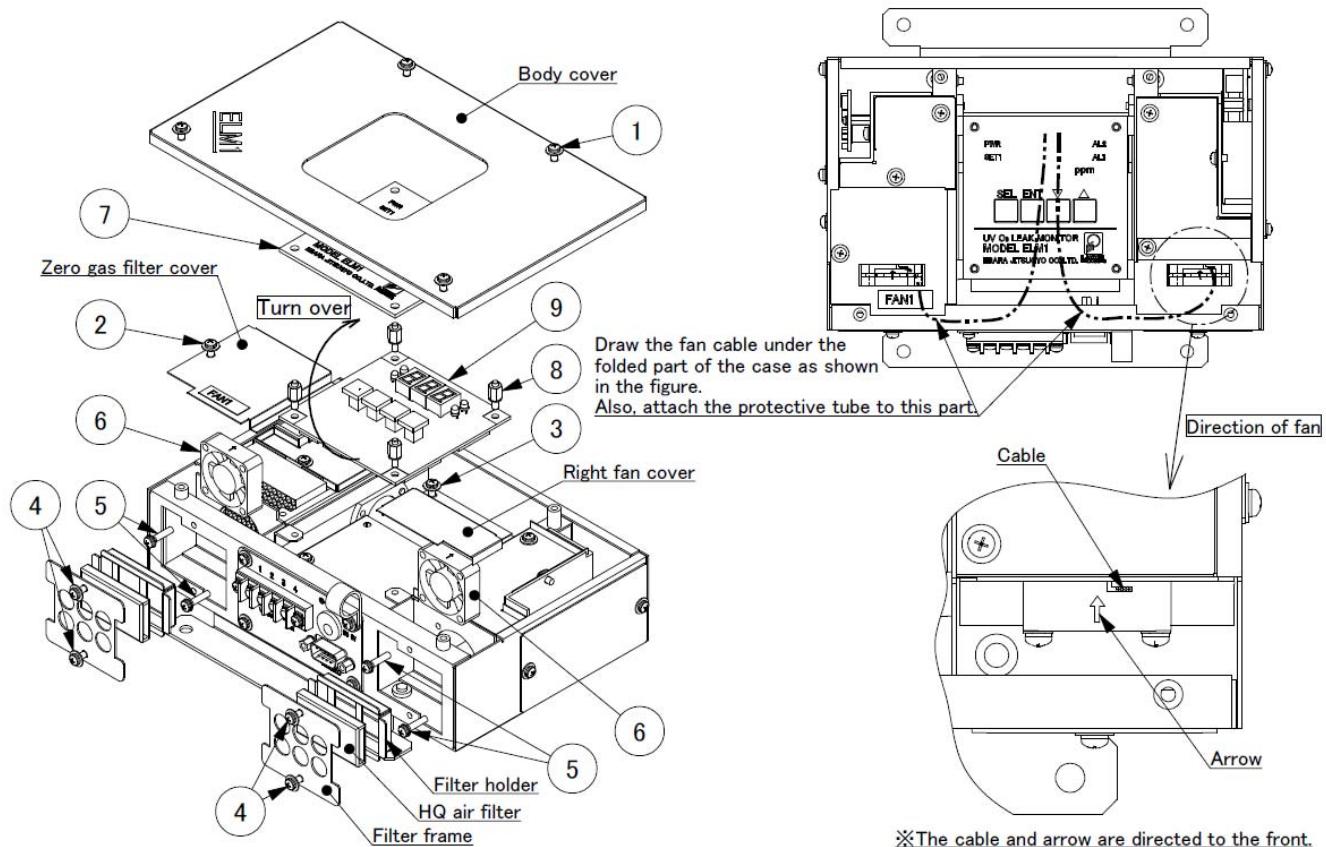
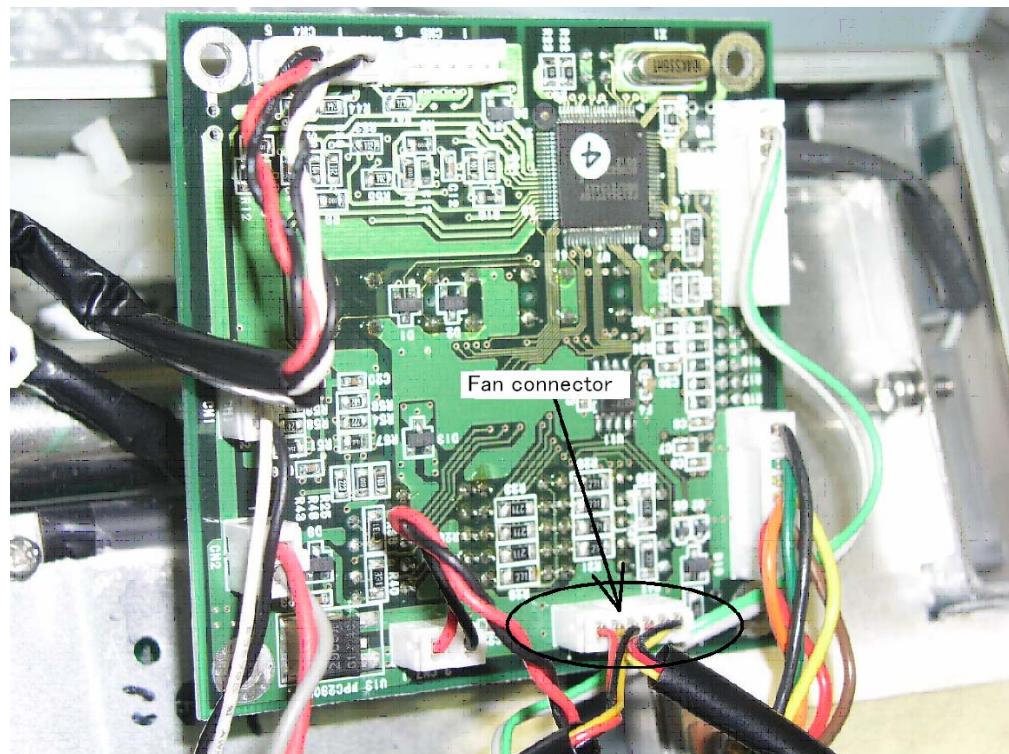


Figure- 10 : Replacement of the fan



Picture- 6 : Position of connector for fan use

10.5 Troubleshooting

Table- 3 : Troubleshooting

Symptom	A cause	Confirmation / measures method
Though there is not ozone, the indicated value does not become 0(Zero).	<ul style="list-style-type: none"> ·Heat source (cooling) is near the instrument, so that this will affect it without stable condition.. ·Wind is flowing against the instrument . ·Receiving influence of direct sunshine or infrared ray. 	Confirm it whether the indicated value is in steady state in condition that the monitor is put in the sealed vessel.
Instructions value is not in stable state .	<ul style="list-style-type: none"> ·Failure condition when turned on the mercury lamp . ·The monitor is not steady in thermal condition . 	<p>Confirm the indicated value in condition that the monitor is in the atmosphere without ozone gas ;</p> <p><u>In case</u> the value is in stable condition It is thought that actual ozone concentration is changing.</p> <p><u>In case</u> the value is not in stable condition It may have a possibility that the lamp is lighting in unstable state.</p> <p>Check it whether this lamp had already exceeded its replace term.</p> <p>The mercury lamp is reducing its light quantity (intensity) with the operating time, so that burning of the lamp becomes difficult.</p> <p>Replace it with a new lamp. (Still more, in case the burning is not in steady state, if you operate again the monitor after several minutes from when its power plug had pull out, this becomes steady state.)</p> <p>If the instrument is placed near an air conditioner or outlet, accurate indication cannot be made due to variation in light intensity of the lamp.</p> <p>Relocate the instrument to avoid wind blow or heat source.</p>
Error code is shown on the display.	Refer to the following “list of error correction, table-4”	Regarding this corrective action, perform it according Section 5.2 .

Table- 4 : List of error correction

error code	Trouble condition	Corrective action
Er0	This is appear when measuring value of concentration exceeded from the indication range, but if returned in the range, its error indication has not come to indicate.	Use the monitor under concentration of which can be measured. Parts of the monitor are deteriorated, so that you should take the corrective action immediately.
Er1	Value of light quantity is too high.	Adjusting the light quantity value is necessary. Consult us with it.
Er3	Value of light quantity is too low.	Light quantity has decreased extremely. It is thought that the mercury lamp is deteriorated. Replace the lamp with new one.
Er5	The setting point of inside is abnormal.	This has a possibility which setting value or device is abnormal. When you can not resolve this abnormal condition, even if turn on the electric power again, consult us with it.
Er6	Stopping of the fan.	It seems to be fan defective, so that replace it.
Er7	Setting point is abnormal. (EEPROM error)	In case you can not resolve this problem, even if turn on the electric power again, consult us with it.

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.

MEMO

荏原実業株式会社

計測器・医療本部

計測器営業部

■東日本営業課：〒215-0033

神奈川県川崎市麻生区栗木2丁目3番12号
TEL 044-981-0560 FAX 044-981-0561
E-mail ej-ozone@ejk.co.jp

■西日本営業課：〒541-0046

大阪市中央区平野町3丁目2番13号
平野町中央ビル5階
TEL 06-6231-3528 FAX 06-6231-2929
E-mail ozon-osaka@ejk.co.jp

技術部：〒215-0033

神奈川県川崎市麻生区栗木2丁目3番12号
TEL 044-981-0560 FAX 044-981-0561
E-mail ejozndsh1@ejk.co.jp

取扱店：