

(様式 EO-H0525-09)



# PRODUCT SPECIFICATIONS

**POLAROGRAPH with POLYMERIC MEMBRANE TYPE  
DISSOLVED OZONE MONITOR**

**MODEL ELP-200**

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## 1 General description

This compact size dissolved ozone monitor has a polarograph with polymeric membrane sensor which has excellent selectivity, so that this monitor has resistant in principle to the influence of various metallic ions and their conductivity in sample water.

The monitor is composed of three units, one is a sensor which can detect ozone in the sample water and also can convert it to an electric signal, a Flow cell making the sample water to a constant condition and then the monitor itself (control unit) which can amplify a feeble electronic current from the sensor in steady state and will convert it to the display of ozone concentration, having some output signals.

As output signals of the monitor, the ozone generator control signals (contact output with built-in hysteresis function) and alarm signals for upper/lower concentration limit are provided as well as insulated 4-20 mA DC concentration signals. Therefore, the control system can be constructed at low cost without preparing a separate instrumentation device like setter.

## 2 Measuring principle

The theory of this polarograph with polymeric membrane type dissolved ozone monitor is generally used in the Electro chemistry analysis and has many using records.

Ozone is in water as ozone ions ( $O_3$ ), and will enter through the polymeric membrane into the working electrode, reacting the ions on its surface so as to occur equivalent reaction of oxidation on the surface of the counter electrode, thereby electric current proportional to the ozone concentrations generates between these two electrodes.

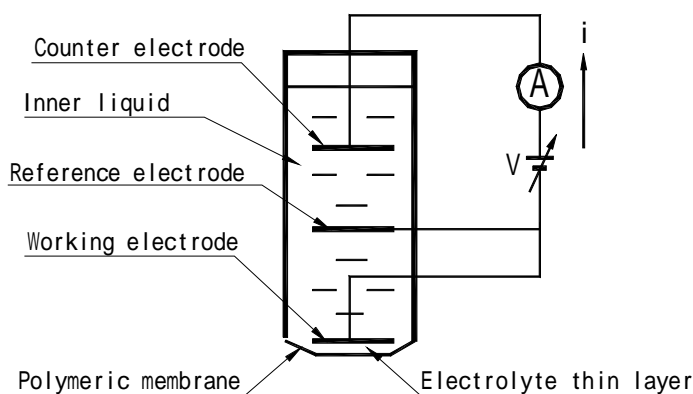


Figure-1 Measuring principle of the ozone sensor

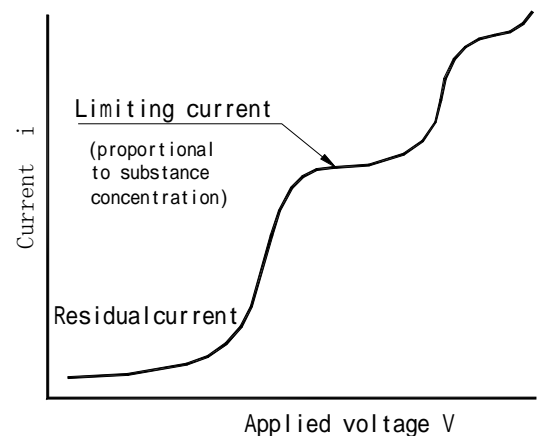


Figure-2 Voltage-current characteristics

The measuring principle of the polarograph with polymeric membrane type dissolved sensor is shown Figure-1 above.

When the sensor is immersed in the ozonized sample water, ozone proportional to the particle pressure on the dissolved ozone will pass through the membrane and when melted in the electrolyte thin layer (see Figure-1) which located between the working electrode and electrolyte thin layer, the reaction of electrolysis restoration will occur on the surface of the working electrode as the following.



And then, the electrolysis oxidation reaction of  $2\text{M} \rightarrow 2\text{M}^+ + 2\text{e}^-$  will occur at the counter electrode. The electronic current by this reaction, namely the quantities of electric current ( $i$ ) is indicated as shown in Figure-2, voltage-current characteristics curve made by voltage value  $V$  applying between the two electrodes.

This curve is called as polarograph wave and there is the current range that the current will not change even if voltage value  $V$  is increased. This phenomenon is called as Plateau characteristics and it will make the limiting current range.

The method determining a substance from the quantities of this limiting current ( $i$ ), and conducting the quantitative analysis from the level of the applied voltage is called as Polarography and the limiting current is shown by the following formula.

$$i = nFAD \frac{1}{\delta} C$$

where;

- $n$  = charged particle of reaction material
- $F$  = Faraday constant
- $D$  = diffusion coefficient of reaction material
- $A$  = area of working electrode
- $C$  = concentration of reaction material
- $\delta$  = thickness of diffusion layer

In the above formula, the value at the right side can be expressed as the following, because it can be treated to a constant value excepting the concentration of reaction material, if the structure of electrode and ambient condition were decided.

$$C = Ki$$

where;

- $K$  = proportion constant

That is, the concentration of a material can be obtained from measuring current value  $i$ .

The polarograph with polymeric membrane sensor using this monitor makes to enable the measurement of ozone concentration by applying the most suitable applied voltage.

Moreover, the sensor has the three electrodes, so that its sensor can be avoid and save a by-product, occurring in the electrolyte reaction, which the product can cause in deterioration of the sensor characteristics and makes its measuring in steady state condition for its long usage and also makes a good linearity.

### 3 Specifications

#### MONITOR

<b>Model</b>	: ELP-200
<b>Service</b>	: Ozone in sample water
<b>Measuring principle</b>	: 3-electrode type polarograph (with polymeric membrane) method
<b>Measuring range</b>	: 0.00 – 1.00 mg/L or 0.0 – 10.0 mg/L (either to be specified)
<b>Display</b>	: LCD digital display with three digits <b>Minimum resolution</b> 0.01 mg/L (in case of Full scale 1.00 mg/L) 0.1 mg/L (in case of Full scale 10.0 mg/L)
<b>Accuracy</b>	: Within $\pm 2.5\%$ FS +1digit (steady state in temperature, flow rate, and pressure)
<b>Response time</b>	: 90% response within 60 seconds (excluding delay time in the piping)
<b>Sample water temperature</b>	: 5 – 30°C
<b>Temperature compensation</b>	: Automatic temperature compensation by thermistor (at calibrated temp. $\pm 5^\circ\text{C}$ )
<b>Analog output</b>	: 4 – 20 mA DC (isolated output), applicable maximum load resistance 500 $\Omega$
<b>Contact outputs</b>	: Upper limit (concentration) . . . . . “a” form contact (1 output) Lower limit (concentration) . . . . . “a” form contact (1 output) Hysteresis control . . . . . “a” form contact (1 output) Hysteresis range selection available by the control range setting slide switch (1) $\pm 10\%$ of full scale value with reference to control set value (2) $\pm 5\%$ of full scale value with reference to control set value (3) $\pm 2.5\%$ of full scale value with reference to control set value <b>Note</b> : A control value cannot be set to a value smaller than 10% of full scale value.
<b>Alarm stop</b>	: All contact outputs are disabled (OFF) by either of the following operations: 1) Pressing the “MAINT.” key on the operation panel ...reset by pressing the “MES.” key 2) Short circuiting across the external alarm stop trigger terminals (No. 8-9) ...reset by cancelling the short circuit across No.8-9 terminals (OFF) <b>Note</b> : Contact output, indication and analog output operations during alarm stop state vary depending on the DIP switch settings.
<b>Contact capacity</b>	: Rated control capacity (resistance load): 250V AC, 1A or 30V DC, 1A <b>Maximum allowable voltage and current:</b> 250V AC, 1A or 110V DC, 1A

<b>Power supply</b>	<b>: 100 – 220V AC ±10%, 50/60Hz</b>
<b>Power consumption</b>	<b>: About 5VA</b>
<b>System requirements</b>	<b>: 5 – 40°C, 90% RH or less (non condensation)</b>
<b>Installation method</b>	<b>: Wall mounting or JIS 50A pipe installation (but this pipe stand is optional.)</b>

**FLOW CELL**

<b>Model</b>	<b>: FC-28</b>
<b>Sample water flow rate</b>	<b>: 0.5 – 1.0 L/min. (in the range of this flow rate should be steady state condition.)</b>
<b>Installation method</b>	<b>: Already attached on the installation board.</b>
<b>Inlet of sample water</b>	<b>: Tube connector with O.D. 8mm and I.D. 6mm (Install a flow regulating valve at the inlet of Flow cell for sample water.)</b>
<b>Outlet of sample water</b>	<b>: Tube connector with O.D. 8mm and I.D. 6mm (The tube length should be within 3m and it must be installed below its outlet. And its pressure in the tube end must be same as value in the atmospheric pressure.)</b>
<b>Main material</b>	<b>: Hard polyvinyl chloride (PVC)</b>

**SENSOR**

<b>Model</b>	<b>: ZE-10-8</b>
<b>Sample water temperature</b>	<b>: 5 – 30°C</b>
<b>Temperature compensation</b>	<b>: Automatic temperature compensation by thermistor (calibrated at temp. ±5°C)</b>
<b>Installation method</b>	<b>: To be attached on model FC-28, Flow cell.</b>
<b>Main material</b>	<b>: Hard polyvinyl chloride (PVC)</b>

**SENSOR CABLE**

<b>Model</b>	<b>: CT4S-003N</b>
<b>Cable length</b>	<b>: 0.3 m</b>
<b>Cable connection</b>	<b>: connector method</b>

**WEIGHT**

<b>Monitor</b>	<b>: 0.8 kg</b>
<b>Flow cell</b>	<b>: 0.3 kg</b>
<b>All-in-one unit</b>	<b>: 2.2 kg</b>
<b>Product after packing</b>	<b>: About 3 kg</b>

## 4 Component units

Monitor unit	: ELP-200	1 set
Flow cell	: FC-28	1 set
Ozone sensor	: ZE-10-8	1 pc.
Sensor cable	: CT4S-003N (already wired to the monitor)	1 pc.
Installation board	(for mounting the Monitor and Flow cell)	1 set
Standard accessories	(specified in the following standard accessories list)	1 set

## 5 Standard accessories list

Spuit (dropper) for electrolyte injection	.....	1 pc.
Electrolyte, EA-10WE (in a 100mL plastic bottle)	.....	1 btl.
Polymeric membrane set, RM-001-US5 (Refer to Note 1 below.)	.....	1 box
O-ring, JIS P28 (for sealing sample water)	.....	2 pcs.
Backup ring, JIS P26 bias cutting	.....	2 pcs.
Saddle band, for JIS 50A pipe	.....	2 pcs.
PVC bolt, M10 × 25 mm (for fixing the saddle band)	.....	4 pcs.
PTFE tube (8 mm O.D. and 6 mm I.D.)	.....	5 m
Slotted screwdriver for adjustment	.....	1 pc.
Instruction manual	.....	1 volume
Test results	.....	1 sheet

Note 1: Regarding Polymeric membrane set (RM-001-US5), a packet of 5 pcs. of O-rings, JIS P15 for the membrane unit (RM-001-U) and for sealing the electrolyte are composed.

Note 2: JIS means Japanese Industrial Standard

## 6 List of consumable parts, spare parts and option parts (optional)

	Sales unit
Electrolyte for sensor, EA-10WE (in a 100mL plastic bottle)	1 pc.
Polymeric membrane set, RM-001-US5 (Refer to Note below.)	1 box
O-ring, JIS P15 (for sealing electrolyte), 5 pcs.	1 set
O-ring, JIS P28 (for sealing sample water), 5 pcs.	1 set
Backup ring, 5 pcs./package kit (pkt)	1 set
Ozone sensor, ZE-10-8	1 pc.
Relay terminal box, JB-100	1 pc.
Special extension cable, S-10000	10 m
Sample water adjusting tank, FC-20A	1 set
Pipe stand (JIS 50A × 1500H, SUS304, pipe stand)	1 set

Note : Regarding Polymeric membrane set (RM-001-US5), a packet of 5 pcs. of O-rings, JIS P15 for the membrane unit (RM-001-U) and for sealing the electrolyte are composed.

## 7 Requirements of installation

In order to protect the monitor from any damage and to ensure its stable operation, the following precautions have to be kept accurately.

- (1) The monitor should be used under the conditions of ambient temperature 5 – 40°C, ambient humidity below 90% RH (with no condensation), and sample water temperature within the range of 5 – 30°C.
- (2) The monitor should not be used at places under direct sun shine.
- (3) Use of the monitor at places characteristic of strong vibrations or heavy intermittent vibrations should be avoided.
- (4) Installation of the monitor at places where any corrosive gas or flammable gas exist should be avoided.
- (5) There must not be such source of noises as a large current, the spark, and the electromagnetic wave, etc. in the same power supply line.
- (6) The monitor should be only for indoor use, and should be installed at places free from any disturbances such as splash of chemicals, etc.
- (7) The sensor cable and the special extension cable should be separated from the cable of the contact output, power cable, power wiring, etc. by 10 cm or more, or alternatively, should be isolated by being accommodated in rigid steel conduits.
- (8) Make sure to attach the regulating valve to the sample water inlet pipe of the flow cell for flow rate adjustment and sensor maintenance.
- (9) Supply sample water of flow rate within the range of 0.5 – 1.0 L/min to the sample water inlet of the flow cell during measurement.
- (10) The sample water outlet piping line of the flow cell must not be above the sample water outlet, and the tube end must be under the atmospheric pressure.
- (11) When installing the flow cell, make it sure that it should be installed at such a place as has no obstacle to hinder the smooth detaching of the sensor.
- (12) Installation at any process plant where explosive gas may be made up in the environment should be avoided.

## 8 Storage

In case that the monitor is not used for long term, it should be stocked under following condition.  
(The preservation period is included in the guaranteed term.)

### 1) Environmental condition

- Place in where corrosive gas is not existed.
- Temperature : in range of 0 – 40°C (non freezing)
- Humidity : 10 – 85%RH (non condensation)

### 2) Precaution storage for ozone sensor

- Period in 1 – 2 months :To prevent vaporizing of electrolytic solution from the sensor, this head (cover part) should be immersed in tap water or distilled water. Still more, take care that this water has no pollution.  
Make sure to direct the connector upward for storage.
- Period over 2 months : After removing the ozone sensor, remove the Polymeric membrane set. Clean the end electrode with tap water or distilled water carefully and let it dry naturally.  
The sensor should be stocked so as not to attach the dust.  
When using the sensor again, use new electrolytic solution and also new Polymeric membrane, and then it should be used after calibration with flowing the ozone water for 12 hours or more.

**Note :** When removing the sensor, the power supply should be turned off.

Take a preventive measure against contamination of the connectors at the cable and sensor sides.

## 9 Warranty

The warranty period for this product is 12 months from the delivery to the customer; provided, however, the warranty will not cover the following cases:

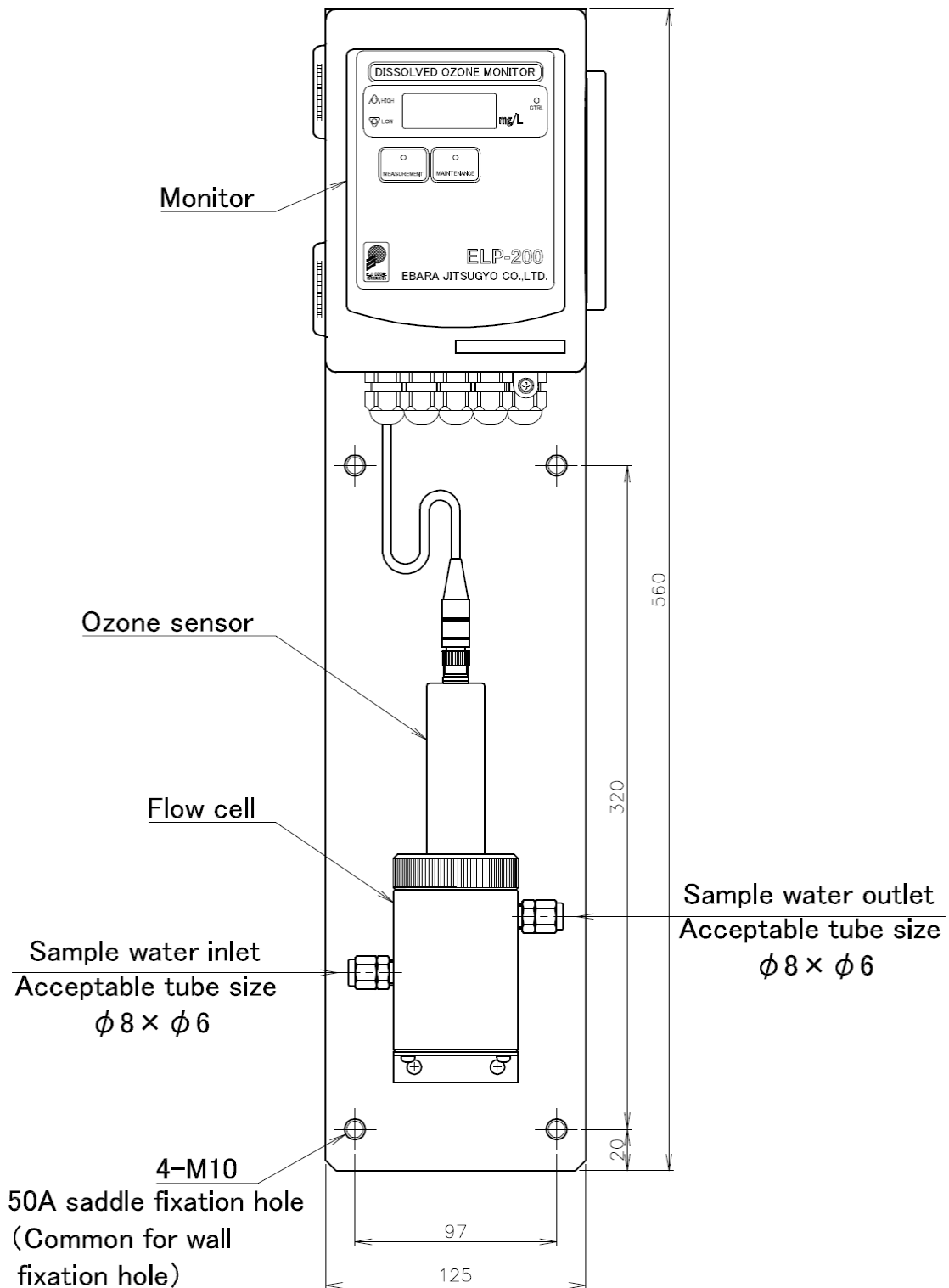
### Following events that occur during the warranty period

- (1) Failure due to inappropriate use
- (2) Failure due to inappropriate repair done without using genuine parts or other modifications, and consumable parts
- (3) Failure or damage resulting from dropping after delivery or accident during transportation
- (4) Failure or damage caused by fire, salt, gas, earthquake, wind and flood damage, lightening strike, abnormal voltage, or other acts of providence

The scope of the warranty shall be limited to this product during the warranty period. The company shall have no liability for any damage (such as lost earnings, personal injury, damage to other devices, etc.) resulting from the use of the product.

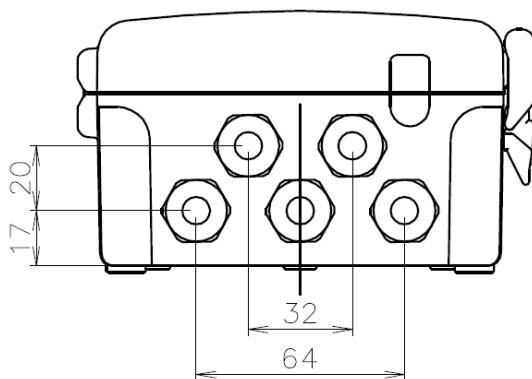
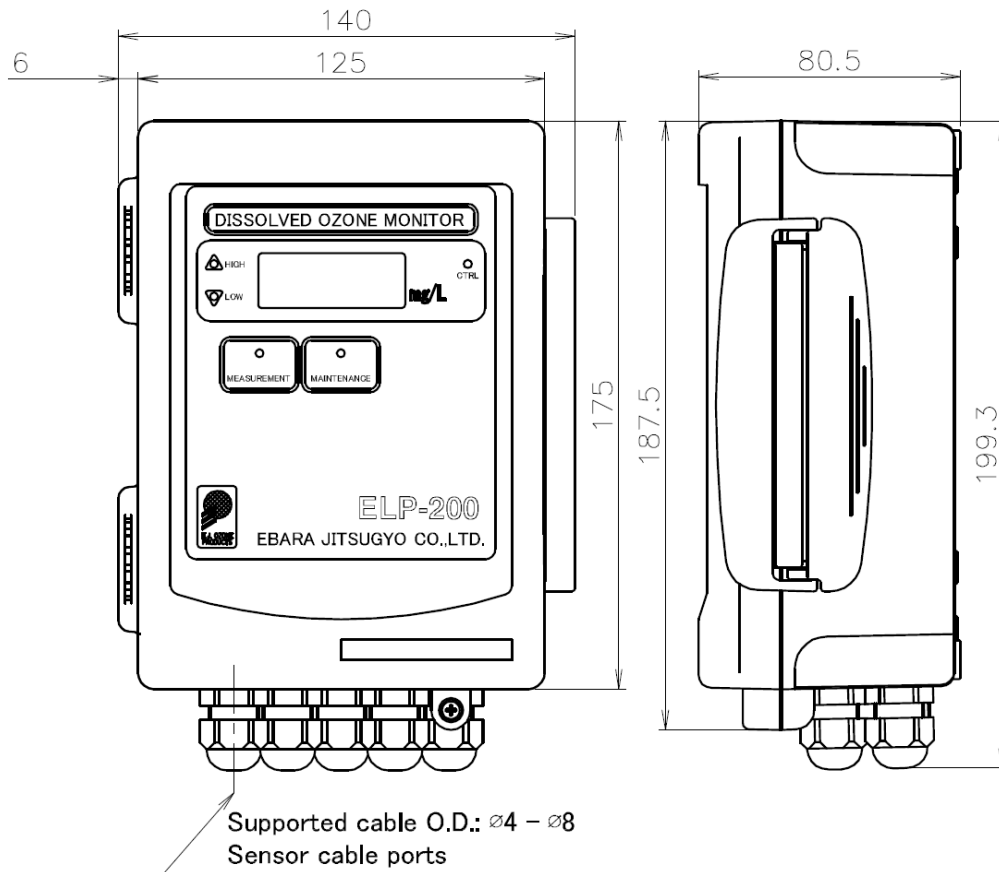
The specifications of this product are subject to change without notice for product modification or improvement.



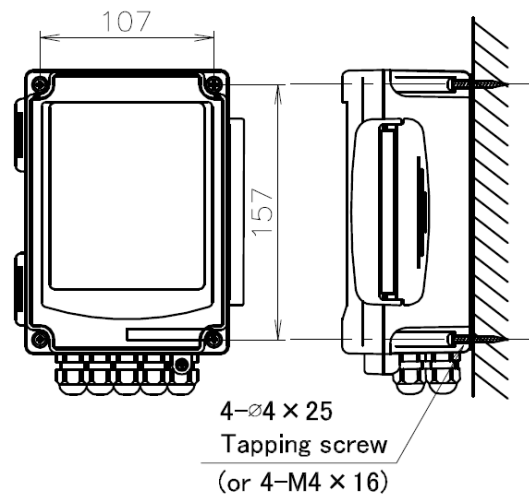


[Unit: mm]

**ELP-200 Dissolved Ozone Monitor  
Entire Outline Drawing**

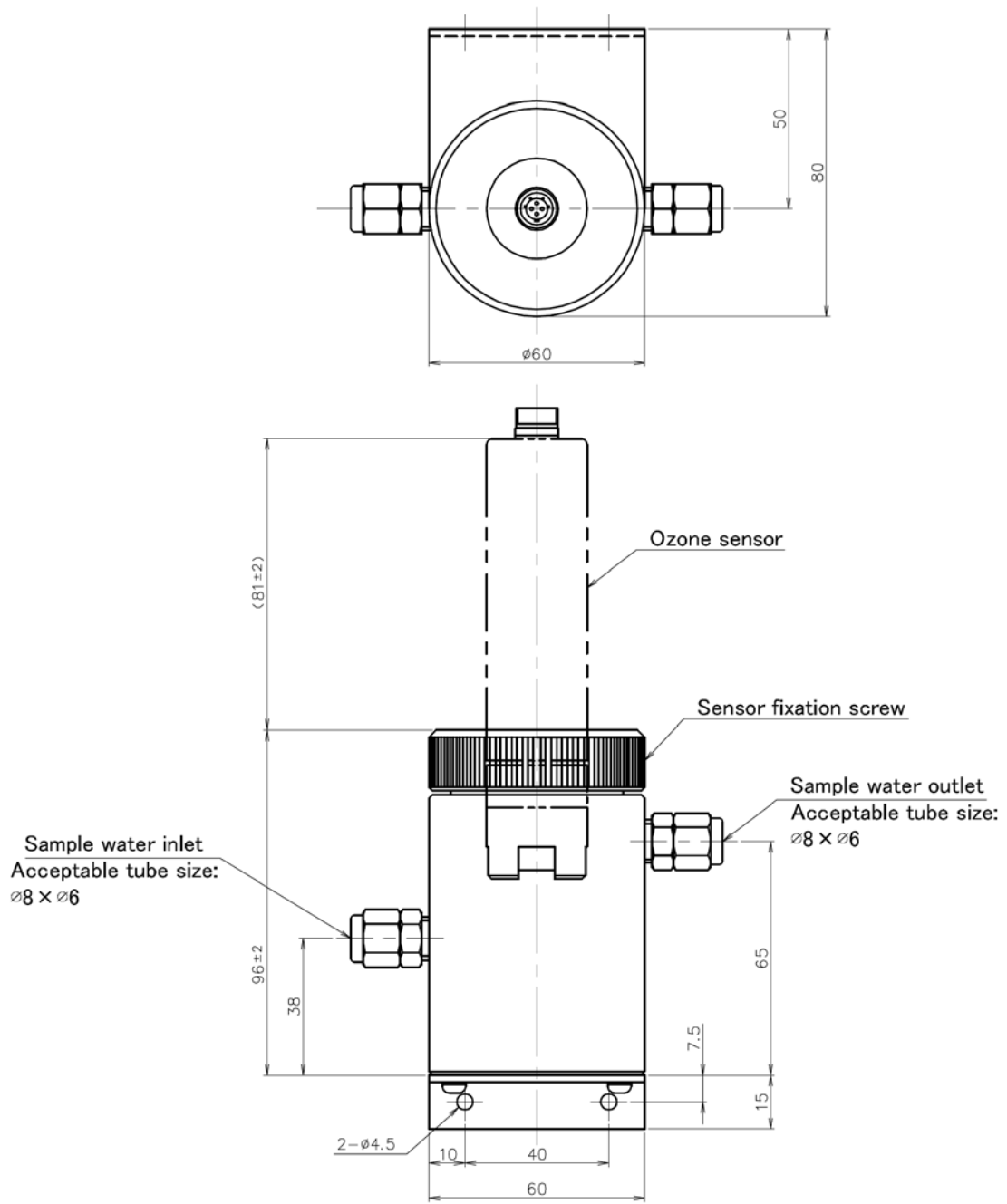


Installation dimensions



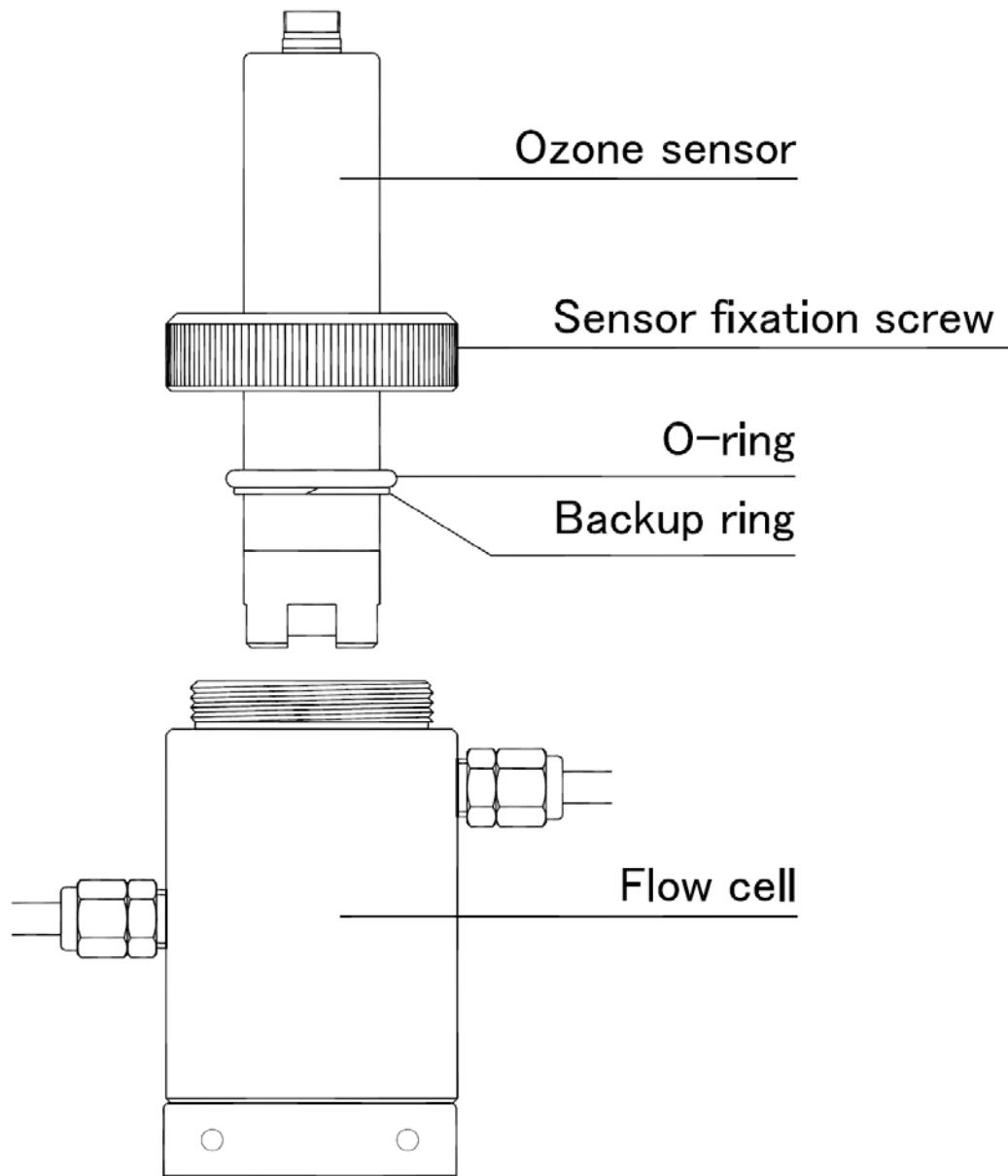
[Unit: mm]

**ELP-200 Dissolved Ozone Monitor  
Outline Drawing of Monitor Unit**

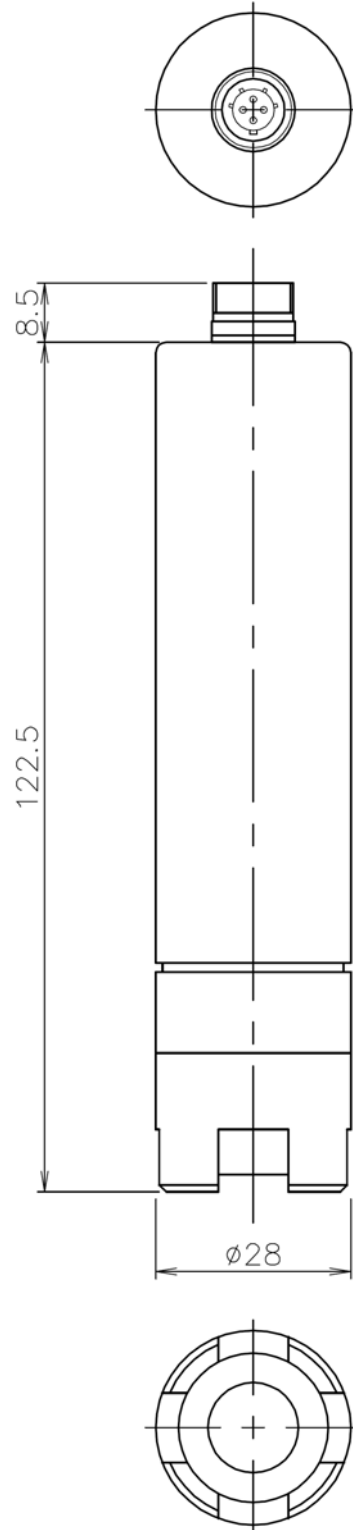


[Unit: mm]

**ELP-200 Dissolved Ozone Monitor  
Outline Drawing of Flow Cell**

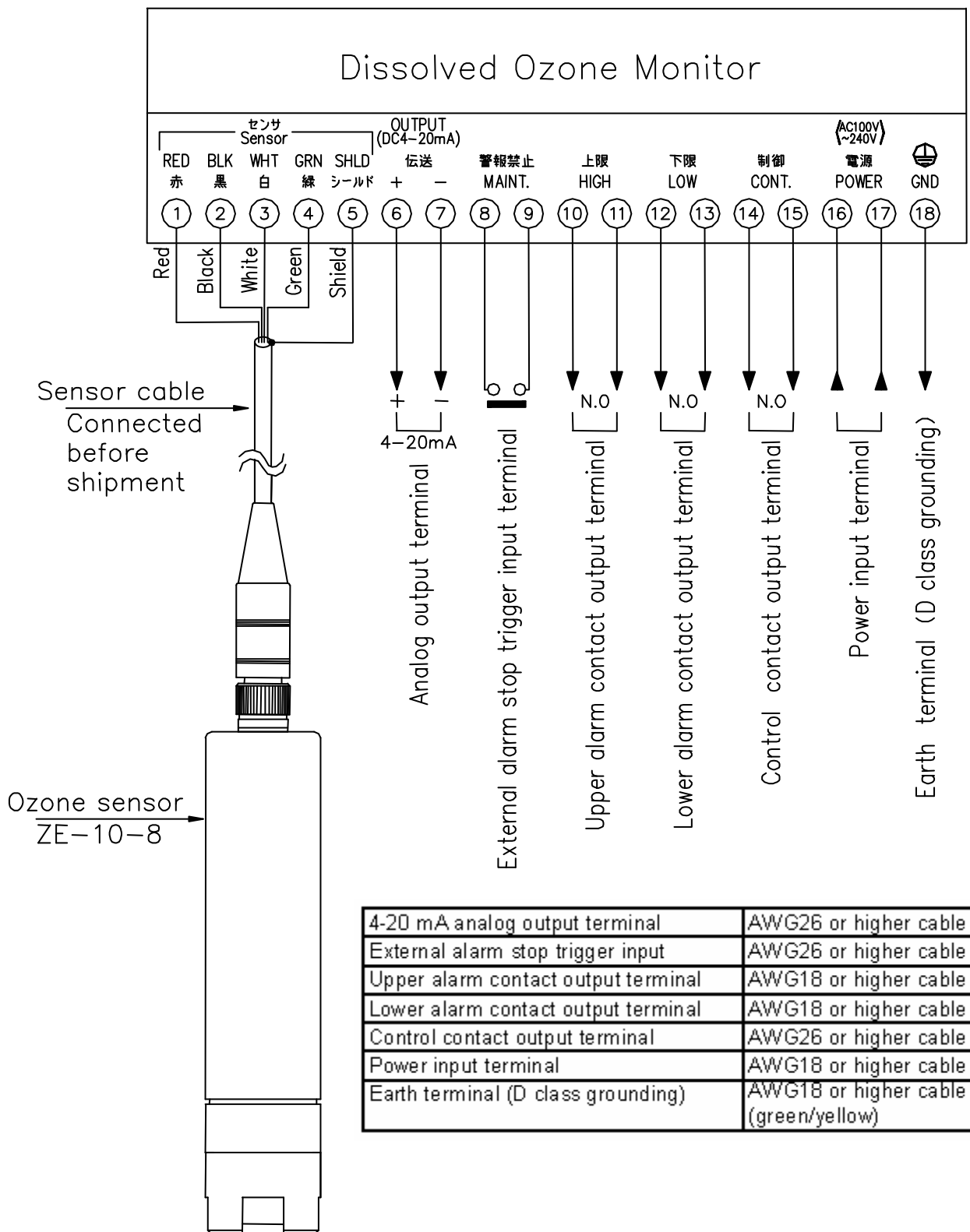


**ELP-200 Dissolved Ozone Monitor  
Mounted Sensor View**



[Unit: mm]

**ELP-200 Dissolved Ozone Monitor  
Sensor Outline Drawing**



**ELP-200 Dissolved Ozone Monitor  
Terminal Connection Diagram**

**MEMO**

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