1. Installation procedure

1.1
Please check the output of MIJ-03 by using logger or tester after leaving MIJ-03 in the air for about 15 to 30minutes. White and black cable indicate as + and solid black cable indicate as -.Usually the output will be between 50 and 70 mV. Please take notes for the output value.This output value will be used for span value caluculation.The output of this sensor is linear and when there is no oxygen around then the output will be zero.Thus, only do calibration for span value then we can obtain the arithmetic expression.
eg:
Assume the span value was 52.3mv.
Oxygen concentration is steady (20.9%) so the arithmetic expression will be shown as below

$$O_2(\%) = 20.9(\%) \times \frac{V(mV)}{52.3(mV)} \qquad V : \text{Sensor output}$$

Note
Please calibrate at atmospheric pressure that does not greatly deviate from atmospheric pressure 1013hpa

1.2
Insert MIJ-03 into the ground at your ideal depth but please make sure the cable part is vertically
(the hole on the bottom of sensor faces downward).

1.3
Connect the black and white line at the sensor end to logger, etc.

2.Precaution

・Gas permeable membrane set inside the oxygen detection hole at the bottom of the sensor so please do not poke the hole by needle, etc. If did so the sensor floods during installation.

・Bottom of sensor must be aim to downward for long-term storage or use.

Soil Surface

MIJ-03 Label

Arrow mark indicated cable side must aim to upward.
In other ward bottom of sensor must aim to downward
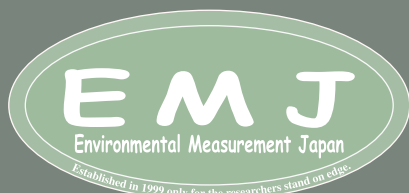
3. Principle of soil oxygen sensor

It consists of an oxygen/lead battery with a gold electrode as the positive electrode and a Pb electrode as the negative electrode. Outer Teflon sheet separates the outside from the inside and the inner solution is kept by inner Teflon sheet.An electrolytic reduction reaction occurs in Au Electrode depending on the concentration of oxygen molecules passing through both Teflon sheet by diffusion. At that time, the weak current generated in the circuit is converted into a voltage by the resistor, which becomes the sensor output.

Factors that affect the reactions are **1. Temperature fluctuations** and **2. Pressure fluctuations.**

As a countermeasure against Temperature fluctuations this sensor has a double-layered housing with gap and measures are taken by incorporating a thermistor for temperature compensation. Countermeasures against Pressure fluctuations is by installing bubbles for pressure
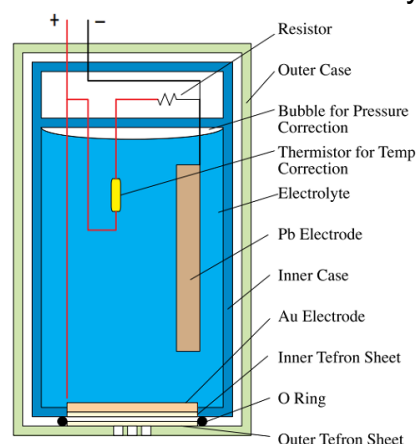

MIJ-03 Soil Oxygen sensor schematic

4. Accuracy of soil oxygen sensor

Full scale of oxygen concentration in soil is 0 to 20.9%. In other words, it does not exceed the oxygen concentration in the outside air. Thus, the full scale of this sensor can be treated as 0 to 20.9%.
The measurement accuracy on this scale is ±0.5%. In a typical range of characteristics listed below table.

Characteristics items	Typical characteristics
Full scale	0〜20.9 %
Response speed	240±30 sec
Output at 20.9% in air	45〜68 mV
Operating temperature range	0〜40℃
Storage temperature	-20〜60℃
Life time	1,500,000 %h (70,000 hour at 20.9% Oxygen, 140,000 hour at 10% Oxygen)
Measurement accuracy	±0.5%
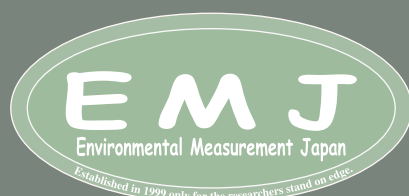
5. Temperature compensation

As Specification sated that temperature range 0~40℃ but you can use -10~60℃ with temperature compensation. Meaning of temperature range 0~40℃ is without using temperature but gives you precise oxygen value(%). User may want to use at low or high soil temperature then please use below temperature compensation formula.

Compensated Oxygen value (%) = Measured Oxygen (%) *(1.00479-0.001914*Temp)

eg:
If use use MIJ-03 at soil temperature 60℃ and the oxygen value was 20%.
20*(1.00479-0.001914*60)=20*0.88995=17.799(%)

6. Characteristic of soil oxygen sensor

Output in the atmosphere:
Since the contact area between the electrode and the solution or the state of solution may cause some errors during manufacturing; thus, output variation occurs when viewed through multiple sensors. However, this variation is not the one that is disturbed according to time and installation environment. Therefore, perform each span calibration before installation will lead sufficient adjustments in data handling.

Set and Storage:
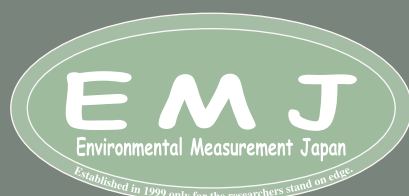Bubbles are installed inside the solution for the purpose of pressure compensation.
This bubble is in contact with the Au electrode, that is, with the detection part facing up, the reaction may be hindered, which may result in measurement failure. If this phenomenon is observed, it will be restored by leaving the detector facing downward and leaving it in the air for several hours. Similar precautions are required when storing. Store the detector facing down or horizontally.

Disposal:
The internal solution is weakly acidic, so there is no risk of ignition if leaked and left unattended but it is dangerous to swallow it accidentally or get it in your eyes. If the internal solution leaks, put it in a plastic bag etc. If the product has reached the end of its life, please send it back to us so we can dispose it. If this is not the case, entrust it to a lead-acid battery disposal specialist.

7. Interfering GAS

Interfering Gas	Interfering Gas Concentration	Effect to Out put of MIJ-03 O_2%
CO	0 to 100%	No Effect
CO_2	0 to 100%	No Effect
NO	0 to 1%	No Effect
NO_2	0 to 1%	No Effect
SO_2	0 to 3%	+3%
H_2S	0 to 3%	No Effect
NH_3	0 to 3%	+1%
H_2	0 to 100%	No Effect
HCL	0 to 3%	+1%
C_6H_6	0 to 100ppm	+1%
CH_4	0 to 100%	No Effect
$C_6H_5CH_3$	Atmospheric saturated vapor pressure	Material deterioration
H_2O	0 to 100%	No Effect