

SOIL OXYGEN SENSOR MIJ-03 INSTRUCTION & MANUAL



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1.Installation procedure

1.1

Please check the output by using logger or tester after leave in the air for about 30 minutes. White and black cable is + and black cable is -. The output at this time is the span value and normally output will be shown between 50 and 70 mV. Please take notes for the value while checking the output; this is because the measured data will be calculated based on this span value.

The output of this sensor is linear and when there is no oxygen around then the output value is zero. Thus only do calibration for span value then we can obtain the arithmetic expression.

For instance, when leave the MIJ-03 to air and span value is 52.3mv but the oxygen concentration is steady (20.9%) so the arithmetic expression will be shown as below. But please calibrate at atmospheric pressure that does not greatly deviate from atmospheric pressure 1013hpa.

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

V: Sesor output

1.2

Bury 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

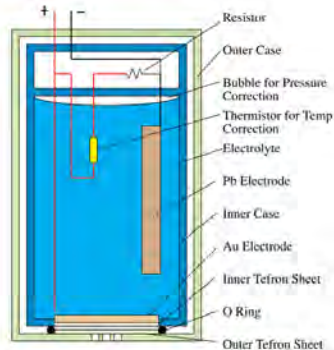


3.Principle of soil oxygen sensor

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 reaction are 1. Temperature fluctuations and 2. Pressure fluctuations: in contrast to 1, this sensor has a double-layered housing with gap and measures are taken by incorporating a thermistor for temperature compensation. Countermeasures against 2 are by installing bubbles for pressure compensation inside the solution.



Picture: 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 $\pm 0.5\%$. In a typical range of characteristics listed right table.

Characteristics items	Typical characteristics
Full scale	0~20.9 %
Response speed	240 \pm 30 sec
Output at 20.9% in air	45~68 mV
Operating temperature range	0~40°C
Storage temperature	-20~60°C
Life time	1,500,000 %h (70,000 hour at 20.9% Oxygen, 140,000 hour at 10% Oxygen)
Measurement accuracy	$\pm 0.5\%$

5.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.

WARNING!

The MIJ-03 Oxygen Sensor is self-powered and does not require a power supply. Applying a voltage to the sensor will damage the sensor and void warranty. Do not cross the wires and avoid the wires contacting each other.

INSTALLATION

The MIJ-03 sensor works via diffusion of oxygen from the atmosphere to the sensor. Therefore, the sensor can be installed in any orientation. However, the most common orientation, particularly in soils is vertical with the sensor well against the soil surface. The MIJ-03 can be installed to any soil depth. Auger a hole to the required depth, install the sensor with the sensor well facing downwards, then back fill the hole. The maximum water depth rating for the MIJ03 is 5m depth.

WIRING

Black – Ground
White/Black – Data Signal

MAINTENANCE

Once installed, the MIJ-03 sensor does not require any further maintenance. In certain environments, biofouling of the sensor gas porous membrane may occur. Clean the surface of the MIJ-03 with a nonabrasive material in soapy water.

CALIBRATION

The MIJ-03 requires a two-point calibration. The 0% O₂ value is 0 mV. To find the 20.9% O₂ value, use a voltmeter or multimeter to test the voltage output from the MIJ-03 wires. Apply the black test probe from the voltmeter to the black wire; and apply the red test probe from the voltmeter to the white/black wire. A millivolt (mV) reading will appear on the LCD of the voltmeter and this is the 20.9% O₂ value. The mV reading will vary from sensor to sensor but should be in the range 45 to 65 mV. The calibration curve is linear between O₂ and mV: $y = ax$; where y is O₂; x is mV and a is the slope of the calibration curve.

Specification

Theory	Galvanic Battery + Porous membrane sheet
Range	0 to 20.9 %
Accuracy	±0.1 %
Resolution	0.01 %
Output	Voltage only; 45 - 65mV at 20.9 % O ₂
Power Input	Non-polarised; no power requiredSpring Constant
Environmental Tolerance	Temperature: -20 to +60 °C; Depth Rating: 5m (~0.5 Bar)
Life Expectancy	5 to 10 yearsWaterproof