STs Series Dissolved Oxygen

Quick Start Guide

Thank you for purchasing the pHionics STs Series™ Dissolved Oxygen (DO) sensor. By following these instructions, you will receive many years of reliable service. This quick start guide explains the basics of setup and caring for your sensor. For questions or detailed explanations, please see the manual or contact us.

The STs Series Dissolved Oxygen (DO) Sensor comes with the following:

- Cable
- Sensor
- Membrane Replacement Kit

Follow these instructions to assemble the sensor before moving onto other steps.

Preparing The Sensor

A new sensor requires an electrolyte solution to measure dissolved oxygen. Follow these steps before calibration and use:

Required Supplies

- pHionics STs Series Dissolved Oxygen Sensor
- STs Series Dissolved Oxygen Membrane Replacement Kit
- RO/DI or distilled water (approx. 50 mL)
- Container (to catch sodium chloride solution)
- Clean workstation

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Membrane Replacement Kit Contents

1. Replacement Membranes
2. Bottle of Electrolyte Salts (Reference Refill Bottle)
3. White Felt Pad
4. Grey Scouring Pad
5. Black Rubber Cap

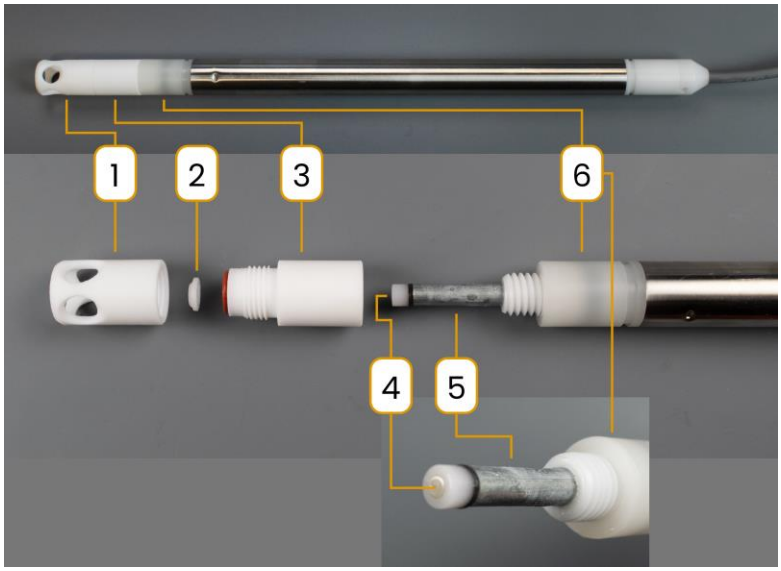
Follow our guide to safely replace an old membrane.



Electrode Anatomy

All sensor components are non-toxic unless ingested. Please don't put any parts of our sensors in your mouth.

1. Electrode Guard
2. Electrode Membrane
3. Electrode Chamber
4. Cathode Plate (Silver - Ag)
5. Anode Shaft (Zinc - Zn)
6. Electrode Body



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Instructions

1. Remove the tip of the STs Series Dissolved Oxygen Reference Solution (AKA Electrolyte Solution - found in Membrane Replacement Kit) and add 50 mL of RO/DI or distilled water to the bottle. Cap the bottle, then shake it until the salt (NaCl) in the bottle dissolves.
    a. The bottle tip comes off easily when pushed to the side.



Image 1. Removing bottle tip.

2. Grab the Electrode Chamber in one hand and the Electrode Body in the other, then fully unscrew the Electrode Chamber from the Electrode Body.
    a. Make sure the Electrode Guard stays tightly screwed onto the Electrode Chamber.
    b. Holding the sensor by the metal housing or the Electrode Guard may lead to the wrong piece being tightened or loosened. Doing so may expose the sensor to permanent damage.

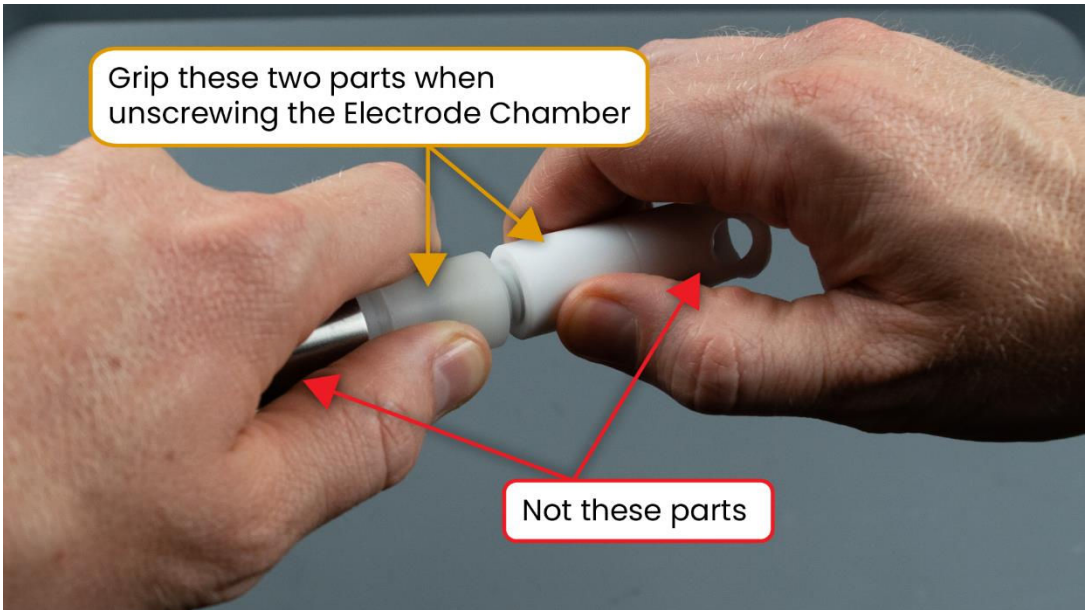


Image 2. Where to grip to safely unscrew the Electrode Chamber.

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3. Hold the Electrode Chamber + Electrode Guard (ECEG) with the Electrode Guard pointed down, then squirt the Electrolyte Solution into the Electrode Chamber. Fill it approximately ¾ full.
    a. ***It is always better to overfill the chamber rather than underfill it.*** Underfilling will cause more oxygen to be trapped inside, which will take multiple hours to burn off before calibration can be performed.



Image 3. Filling up the Electrode Chamber in Step 3.

4. Keeping the open end of the ECEG pointing up, screw it onto the Electrode Body.
    a. Electrolyte Solution should squeeze out as the parts are tightened together. If it does not, then unscrew the ECEG and add more Electrolyte Solution. If Electrolyte Solution does not squeeze out while tightening, then there is excess air left in the Electrode Chamber that may take several hours to burn off before the sensor starts working again.



Image 4. Screwing the ECEG fully onto the Electrode Body.

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5. Let the sensor sit for 30 minutes before attempting to calibrate.
    a. Even when the chamber is overfilled, there is always a small amount of excess oxygen trapped in a newly filled electrode. The trapped oxygen burns off within 30 minutes, but the sensor may read higher than expected until trapped oxygen is entirely gone.

Once the sensor is filled with the electrolyte solution, it is active whether the sensor is powered or not. While active, the Anode Shaft reacts with oxygen, forming an oxide layer that reduces measurement sensitivity over time – typically over several months. This oxide layer may be cleaned off using the grey scouring pad provided in the Membrane Replacement Kit.

Dissolved Oxygen Calibration Steps

Please see this document to learn why calibration is required and how to create a calibration schedule.

Supplies

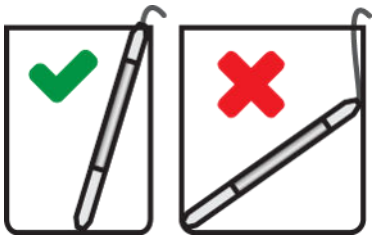
- pHionics STs Series Dissolved Oxygen Sensor
- STs Series Dissolved Oxygen Membrane Replacement Kit
- 4-20 mA measurement system (PLC, Onset RX3000, etc.)
    - You may also connect the sensor in series between an 8-40 VDC power supply and a multimeter capable of reading mA.
    - Do not turn on the power yet.
- Tap water
- Tall container (Graduated cylinder or similar to hold sensor upright)
- Clean workstation

Instructions

1. Retrieve the black rubber cap and the white felt pad (found in the replacement membrane bag) from the Membrane Replacement Kit.
    a. Be careful not to puncture the replacement membranes with sharp fingernails when reaching into the bag.

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2. Wet the white felt pad with water, then place it at the bottom of the black rubber cap.
3. Put the black rubber cap on over the Electrode Guard.
    a. After 5-10 minutes, the wetted pad creates a small area of 100% humidity around the electrode membrane. This gives you the **calibration high point**.
4. Place the sensor electrode-end down into the Tall Container.



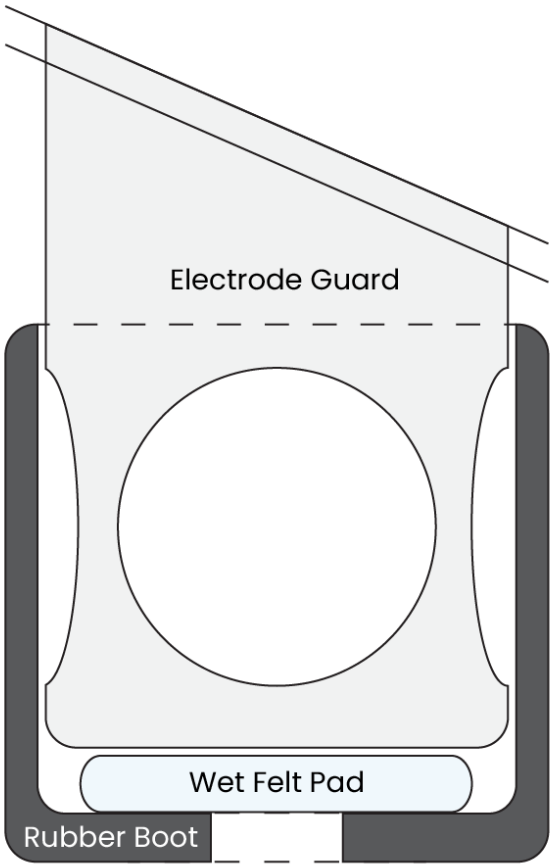


Image 5. Labelled calibration setup after Step 3.

5. Let the sensor sit for 10 minutes.
6. During this wait period, connect the sensor to your 4-20 mA measurement system.
    a. Connect the tinned lead of the red wire to the power supply, and the tinned lead of the black wire to the 4-20 mA input on your system or multimeter.
    b. Do not turn on the power supply yet. Doing so will cause some internal heating in the sensor that may affect calibration. This internal heat dissipates when the sensor is placed underwater during real use.
7. Once the sensor sits for 10 minutes or more, turn on the power supply and record the mA output. This is your calibration High Point.
    a. This output is typically 9-11 mA, depending on temperature and pressure.
8. Record the room temperature and elevation, then use those values to calculate the oxygen concentration at 100% saturation with the blue table

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below or using an online (e.g. The sensor is calibrated in a 20°C room at sea level. The oxygen concentration is 9.1 mg/L).

9. Use the mA output (the Real High value) and calculated oxygen concentration (the Scaled High value) to scale the datalogger, PLC, or RTU.
10. The Low Point of these sensors is very consistent, so you may use 4 mA (Real Low value) and 0 mg/L (Scaled Low value) for the second calibration point.

100% Dissolved Oxygen Concentration (mg/L) at Different Temperatures and Elevations

TEMP	Elevation (Feet above sea level)						
°C	0	1000	2000	3000	4000	5000	6000
0	14.6 mg/L	14.1	13.6	13.2	12.7	12.3	11.8
2	13.8	13.3	12.9	12.4	12.0	11.6	11.2
4	13.1	12.7	12.2	11.9	11.4	11.0	10.6
6	12.4	12.0	11.6	11.2	10.8	10.4	10.1
8	11.8	11.4	11.0	10.6	10.3	9.9	9.6
10	11.3	10.9	10.5	10.2	9.8	9.5	9.2
12	10.8	10.4	10.1	9.7	9.4	9.1	8.8
14	10.3	9.9	9.6	9.3	9.0	8.7	8.3
16	9.9	9.7	9.2	8.9	8.6	8.3	8.0
18	9.5	9.2	8.7	8.6	8.3	8.0	7.7
20	9.1	8.8	8.5	8.2	7.9	7.7	7.4
22	8.7	8.4	8.1	7.8	7.7	7.3	7.1
24	8.4	8.1	7.8	7.6	7.3	7.1	6.8
26	8.1	7.8	7.6	7.3	7.0	6.8	6.6
28	7.8	7.5	7.3	7.0	6.8	6.6	6.3
30	7.5	7.2	7.0	6.8	6.5	6.3	6.1 mg/L

Temperature Sensor Calibration

The temperature sensor does not require calibration. Use 4 mA (Real Low value) for 0°C (32°F) (Scaled Low value) and 20 mA (Real High value) for 50°C (122°F) (Scaled High value) when scaling the output.

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Maintenance

Calibration is generally not required for months at a time but the sensor may become inaccurate due to debris build-up. Typically, this is fixed by membrane replacement and/or electrolyte solution replacement.

Read this document to learn how to safely replace the electrode membrane and electrolyte solution.

Occasionally, the sensor benefits from further cleaning. For general cleaning, soak the tip of the electrode in 0.1M HCl for up to 20 minutes. Only clean the electrode by chemical means. The electrode tip will tear if brushed or rubbed hard. Please see our cleaning guide for more information and cleaning options.

Storage

The main concerns when storing the STs Series Dissolved Oxygen Sensor are preserving the membrane, the Cathode Plate, and the Anode Shaft.

When left fully assembled for months on end, a functional membrane stretches and may become unusable.

If the Anode Shaft and Cathode plate are exposed to the electrolyte solution or moisture for long periods of time, then they will oxidize and may corrode. Buildup may be removed with the grey scouring pad provided in the Membrane Replacement Kit but corrosion may permanently affect electrode performance.

To avoid these problems, always dump out the electrolyte solution, dry off the Cathode Plate, Anode Shaft, and the internal part of the Electrode Chamber with a paper towel, then screw the Electrode Chamber *partially* onto the Electrode Body. With the Electrode Chamber only partially screwed on, the Cathode Plate should not press against the installed membrane so it will not be stretched out.

Troubleshooting

- A torn membrane tends to show a low reading (8 mA or less). This can be fixed by replacing the membrane.

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- If the Anode Shaft is rotated or pulled, it may disconnect from the rest of the electronics. This results in an output that varies between extremely high and low values
- **Please do not remove the electrode or cable without first contacting customer support or watching our troubleshooting video**. Fragile components can be damaged if proper precautions are not taken.
- If pHionics support recommends disassembly of the sensor, always dry off the sensor beforehand and reapply grease to any O-rings exposed during the process.
- All parts are easily replaceable. If damage occurs, please reach out to us for replacement parts.

Thank you for choosing pHionics. Please reach out to our customer support if you have any questions or feedback. We are always happy to help or hear recommendations for how we can provide an even better customer experience.

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