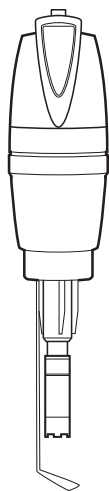


User Guide

BOD AUTO-STIR™
DO Probe



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This publication supersedes all previous publications on this subject.

Introduction

The Thermo Scientific Orion Dissolved Oxygen AUTO-STIR probe is a polarographic probe used for measuring dissolved oxygen in the determination of Biochemical Oxygen Demand (BOD). The AUTO-STIR probe fits directly into a BOD bottle and uses a motorized stirrer to properly measure dissolved oxygen.

The polarographic sensor is composed of a gold cathode and silver anode that create an electrolytic cell. The preassembled membrane cap creates a barrier between the probe and the environment, but allows oxygen to pass through for reduction at the cathode. The electrolyte is used as the electrochemical link between the anode and the cathode. The probe also includes a temperature sensor, which accurately measures the temperature of the solution for reliable DO measurement.

Note: *The BOD AUTO-STIR probe is intended for laboratory use only and field use is not recommended. The probe should never be immersed beyond the interface into the BOD bottle.*

Star Series BOD AUTO-STIR Probe, Cat. No. 086030MD

The Star Series BOD AUTO-STIR probe has 9 pin MiniDIN and 3.5 mm phono tip connectors that ensure waterproof and secure connections when used with the Orion Star Series benchtop dissolved oxygen meters.

862A BOD AUTO-STIR Probe, Cat. No. 086020A

The 862A BOD AUTO-STIR probe has a 13 pin DIN connector that is designed for use with the Orion 862A benchtop dissolved oxygen meter.

Required Equipment

1. Thermo Scientific Orion benchtop DO meter, such as the 3-Star benchtop DO meter, 4-Star benchtop pH/DO meter or the 5-Star benchtop pH/ISE/DO/conductivity meter.
2. Thermo Scientific Orion BOD AUTO-STIR Probe.
3. Polarographic electrolyte solution, Cat. No. 080514.
4. Membrane caps, Cat. No. 080515.
5. Polishing disks.
6. DO probe maintenance kit, Cat. No. 080513.
7. Calibration sleeve or BOD bottle.
8. Beakers.
9. Distilled or deionized water.

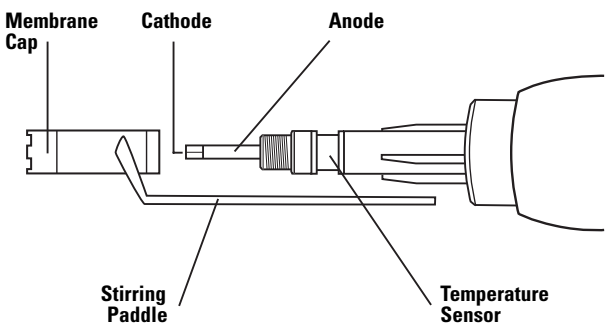


Figure 1:
BOD AUTO-STIR Probe

DO Probe Preparation

1. Remove the stir paddle by firmly grasping it and pulling it out straight.
2. Unscrew the membrane cap from the probe and remove any electrolyte solution from the cap. Rinse the inside and outside of the cap with distilled water and blot dry.
3. Rinse the probe anode/cathode assembly with distilled water and blot dry.
4. Fill the membrane cap about $\frac{3}{4}$ full with new electrolyte solution.
5. Screw the membrane cap onto the probe until the cap is hand tight.
6. Replace the stir paddle by aligning it in the hole and firmly pushing it into place.
7. Polarize the probe.

The probe must be polarized before use. To polarize a new probe, attach the probe to the meter, connect the meter to a power supply, and wait 30 to 60 minutes. The probe is continuously polarized when it is connected to the meter, so this process does not need to be repeated unless probe maintenance is performed or the probe is disconnected from the meter for more than an hour. If the probe is disconnected from the meter for less than an hour, allow the probe to polarize for 5 to 25 minutes before use.

Note: A DO reading of zero and no change in temperature may indicate that the DO probe is not fully connected to the meter. Firmly reconnect the DO probe to the meter and take a new measurement.

DO Probe Calibration

The BOD AUTO-STIR probe comes with a calibration chamber and stand for calibration or storage when the probe is not in use. Calibration of a polarographic DO probe can be done quickly and conveniently using the water-saturated air method. Under equilibrium conditions, the partial pressure of oxygen in air-saturated water is equal to the partial pressure of oxygen in water-saturated air, i.e. air at 100% relative humidity. This means that a probe calibrated in water-saturated air will correctly read the partial pressure of oxygen in a water sample. Since the diffusion rate of oxygen in water and air differs slightly, meters apply a correction factor to the water-saturated air calibration value to obtain the correct air-saturated water value. The correction factor is 102.3%. When measuring a low concentration sample (less than 2 ppm), a second calibration point for a zero oxygen standard is often recommended.

Calibration Chamber or BOD Bottle Preparation

To prepare the calibration chamber, unscrew the bottom of the chamber from the stand and remove the sponge inside the chamber. Saturate the sponge with distilled water and then squeeze all the excess water out of the sponge. Place the sponge back into the bottom of the chamber and screw the chamber back onto the stand.

To prepare a BOD bottle, fill the bottle with about 50 mL of distilled water. Insert the probe into the BOD bottle. Make sure the probe is suspended about half an inch above the distilled water and there is no water on the surface of the DO probe.

Note: *When performing an air calibration, ensure that there are no water droplets on the surface of the membrane. Water droplets on the membrane will cause inaccurate calibration results.*

Polarization

A new probe must be polarized before calibration. To polarize a new probe, attach the probe to the meter, connect the meter to a power supply, and wait 30 to 60 minutes. The DO probe is continuously polarized when it is connected to the meter, so this process does not need to be performed unless probe maintenance is performed or the probe is disconnected from the meter for more than an hour. If the probe is disconnected from the meter for less than an hour, allow the probe to polarize for 5 to 25 minutes before use.

Dissolved Oxygen Measurement Hints

Stirring

Consumption of oxygen by the probe can cause a lowering of the oxygen concentration at the boundary layer between the sample and the probe membrane. For this reason, sample stirring is required.

Membranes

Two types are commonly used, loose membranes, and membrane cap assemblies. While loose membranes are less expensive, they are more difficult to install, and will give lower precision results. The stretch of the membrane determines how thick the electrolyte layer adjacent to the cathode is, which affects the time response of the probe. **Thermo Scientific precision manufactured membrane cap assemblies give a reproducible electrolyte layer thickness, speed up probe servicing, and eliminate assembly problems.**

Electrolyte

The electrolyte in any polarographic dissolved oxygen probe must be replaced periodically, after its capacity to reduce oxygen is depleted. The time the electrolyte lasts depends on the rate at which oxygen is reduced. Probes with a very small diameter cathode will typically have very low current, resulting in low oxygen consumption by the probe. This results in low stir sensitivity, as well as very long electrolyte life. Dissolved oxygen probes require electrolyte replacement every two weeks to six months, depending on usage and sample type.

DO Probe Maintenance

Membrane maintenance should be performed when readings become unstable or slow. Maintenance should be performed every one to three months, depending on usage and sample type.

1. Disconnect the probe from the meter.
2. Remove the stir paddle by firmly grasping it and pulling it straight out. See **Figure 1**.
3. Unscrew the membrane cap from the probe (see **Figure 2**), dispose of the electrolyte solution and membrane cap, and then rinse the probe with distilled water for a few seconds to remove any contaminants (see **Figure 3**).

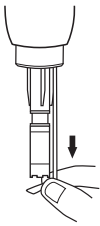


Figure 1

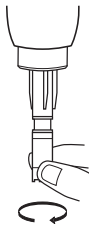


Figure 2

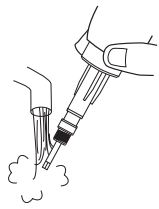


Figure 3

- 4a. If the cathode appears to have a dull finish, clean it with a polishing disk (see **Figure 4**). Follow the procedure in step 4b. If the cathode has a bright finish, rinse it with distilled water, blot dry with a lint-free tissue and proceed to step 5.
- 4b. Place a few drops of distilled water on a polishing disk. Polish the probe by gently rubbing the surface of the cathode on the wet polishing disk in a circular motion for 10 seconds (see **Figure 5**). Once the probe is polished, rinse it with distilled water (see **Figure 6**) and blot dry with a lint-free tissue.

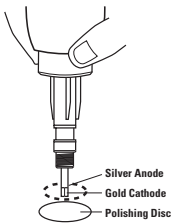


Figure 4

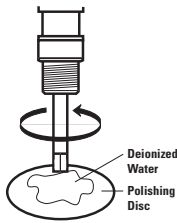


Figure 5

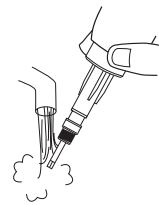


Figure 6

5. Fill a new membrane cap about $\frac{3}{4}$ full with the electrolyte solution (see **Figure 7**). Ensure that the inner surface of the membrane does not have bubbles on it. To remove bubbles, hold the membrane cap and tap the side of the cap with your finger. This should cause any bubbles to rise to the surface and away from the membrane.
6. Screw the new membrane cap onto the probe until the membrane cap is finger tight (see **Figure 8**). Wipe off any displaced electrolyte solution on the probe.
7. Replace the stir paddle by aligning it in the hole and firmly pushing it into place (see **Figure 9**).



Figure 7

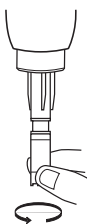


Figure 8

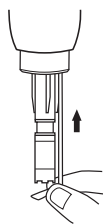


Figure 9

8. Polarize the probe

The probe must be polarized before use. To polarize a new probe, attach the probe to the meter, connect the meter to a power supply, and wait 30 to 60 minutes. The probe is continuously polarized when it is connected to the meter, so this process does not need to be repeated unless probe maintenance is performed or the probe is disconnected from the meter for more than an hour. If the probe is disconnected from the meter for less than an hour, allow the probe to polarize for 5 to 25 minutes before use.

DO Probe Storage

For short term storage:

Between measurements and overnight the probe should remain connected to meter and kept in the calibration chamber or a BOD bottle with about 50 mL of distilled water in the bottle.

For long-term storage:

Disconnect the probe from the meter, unscrew the membrane cap, remove any electrolyte solution from the cap, rinse the probe anode/cathode assembly with distilled water and blot dry, and screw the membrane cap onto the probe until the membrane cap is hand tight. Do not fill the membrane cap with electrolyte solution; the probe should be stored dry.

Troubleshooting

The most important principle in troubleshooting is to isolate the components of the system and check each in turn.

Meter

The meter is the easiest component to eliminate as a possible cause of error. Thermo Scientific Orion meters include an instrument checkout procedure in the meter user guide. Consult the manual for complete instructions and verify that the instrument operates as indicated and is stable in all steps.

Probe

Rinse the probe thoroughly with distilled water and follow the cleaning procedure in the **DO Probe Maintenance** section. If readings continue to be unstable, replace the membrane cap, replenish electrolyte or polish the cathode with a polishing disk.

Sample

If the probe works properly in standards but not in the sample, look for possible interferences or substances that could alter probe response or physically damage the probe. If possible, determine the composition of the samples and check for problems.

Technique

Check that the method of analysis is compatible with the sample.

Troubleshooting Chart

Issue	Recommended Action
Unable to calibrate	Ensure that probe is fully polarized. See DO Probe Preparation section.
	Verify that no water droplets are on the membrane and there are no bubbles inside the membrane.
	Perform probe maintenance. See DO Probe Maintenance section.
Unstable measurements	Check that the solution is being stirred and the stir rate is sufficient.
	Measurements may take longer if the solution temperature is unstable.
	Ensure that probe is fully polarized. See DO Probe Preparation section.
	Perform probe maintenance. See DO Probe Maintenance section.
Measured value too low	Interfering substance may be present.
	Salt may be present in the sample. Set the salinity factor in the meter.
	Check that the solution is being stirred and the stir rate is sufficient
Wrong temperature displayed	Perform probe maintenance. See DO Probe Maintenance section.
	Verify that probe is properly connected to the meter
Bad zero point calibration	Contact Technical Support
	The probe must be immersed in an oxygen-free solution for at least five minutes.
Loud Motor	Verify that the stir paddle is properly installed and nothing is blocking it
	Contact Technical Support

Interfering Substances

Substances such as ozone, sulfides, sulfur dioxide, nitrous oxide and carbon monoxide may interfere with dissolved oxygen measurements. If the measurements are unstable and other troubleshooting procedures do not correct the problem, there may be interfering substances present in the solution.

Assistance

After troubleshooting all components of your measurement system, contact Technical Support. Within the United States call 1.800.225.1480 and outside the United States call 978.232.6000 or fax 978.232.6031. In Europe, the Middle East and Africa, contact your local authorized dealer. For the most current contact information, visit www.thermo.com/water.

Warranty

For the most current warranty information, visit www.thermo.com/water.

Notes

Ordering Information

Cat. No.	Description
086030MD	BOD AUTO-STIR probe with calibration chamber and stand, 9 pin MiniDIN and phono tip connectors
086020A	BOD AUTO-STIR probe with calibration chamber and stand, 13 pin DIN connector
080513	Maintenance kit for 086030MD and 086020A probes, includes (2) membrane caps, electrolyte solution and polishing disk
080515	(1) Membrane cap for 086030MD and 086020A probes
080514	Polarographic electrolyte solution
086021A	Calibration chamber and stand for 086030MD and 086020A probes

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