

Dissolved Oxygen in Surface Fresh Water

Key Words

- Dissolved Oxygen (DO)
- Surface Fresh Water
- Lake Water
- River Water
- Dissolved Oxygen Probe

Introduction

The analysis for dissolved oxygen (DO) is a key test in water pollution control activities. This procedure describes a field method for measuring DO in natural water. DO concentration is determined with a temperature-compensating meter that works with a polarographic membrane-type DO sensor. The membrane probe procedure is based on the rate at which oxygen molecules diffuse (or pass through) a membrane covering a set of electrodes. The oxygen molecules react with an internal filling solution to develop a small electrical charge between the electrodes, which can be read on a meter. The readings on the meter correspond directly to the amount of DO present in the sample.

Recommended Equipment

DO Application Kit (includes listed items with a Cat. No.)

	Cat. No.
1. 3-Star Plus portable DO meter	1010121
2. Dissolved oxygen probe	1213000
3. Calibration sleeve	083010MD
4. Membrane cap	080017
5. Hard meter field case	080515
6. Electrode storage sleeve	1210004
	1210003

Required Solutions

	Cat. No.
1. Polarographic electrolyte solution	080514
2. Deionized water	

Calibration Standard Preparation

1. Remove the cap from the bottom of the calibration sleeve.
2. Remove the sponge from the calibration sleeve and saturate the sponge with deionized water. Squeeze any excess water out of the sponge before replacing it in the calibration sleeve. Position the sponge in the calibration sleeve so it cannot touch the probe membrane when the probe is inserted into the calibration sleeve.
3. Re-attach the cap to the bottom of the calibration sleeve.
4. Insert the probe into the calibration sleeve.
5. The assembled calibration sleeve and stand provides a 100 % humidified environment for the probe to calibrate in air. Wait 10 to 15 minutes before using the calibration sleeve and stand for the sleeve to reach the proper humidity.

Sample Preparation

1. Field dissolved oxygen measurements can be performed by immersing the probe directly in the body of water.

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Results

The surface fresh water of a local stream was measured for dissolved oxygen. The data in the table below is representative of the results expected for DO in surface fresh water.

Surface Fresh Water	Dissolved Oxygen (mg/L)
Sample # 1:	12.33
Sample # 2:	12.30
Sample # 3:	12.36
Sample # 4:	12.37
Sample # 5:	12.41
Mean:	12.35
Standard Deviation:	0.04
%CV:	0.34

Note: During measurements, the temperature of the stream ranged from 3.2 to 3.4 °C.

Electrode Storage

For short-term storage, the probe should be stored in a humidified environment, such as the calibration sleeve.

For long-term storage, disconnect the probe from the meter, remove the membrane cap, clean and dry the probe and calibration sleeve and store the probe in the dry calibration sleeve.

Equipment Setup

Electrode Setup – Dissolved Oxygen Probe

Note: DO probes are shipped with a membrane caps, electrolyte solution and polishing strips.

1. 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.
2. Rinse the probe anode/cathode assembly with distilled water and blot dry.
3. Fill the membrane cap about $\frac{3}{4}$ full with new electrolyte solution.
4. Screw the membrane cap onto the probe until the cap is hand tight.
5. The probe must be polarized before use. To polarize a new probe, attach the probe to the meter, insert new batteries into the meter and wait 30 to 60 minutes. The probe is continuously polarized when it is connected to the meter, so this step does not need to be repeated unless probe maintenance is performed or the probe is disconnected from the meter for more than an hour.

Meter Setup – 3-Star Plus Portable Dissolved Oxygen Meter

For initial meter setup, follow the steps in the quick start guide that is included with the meter. The quick start guide also contains a layout of the meter keypad for reference. The words in all capital letters, such as POWER, indicate a key on the meter and words in quotations, such as “UnIt”, indicate a display on the meter screen.

1. Connect the DO probe to the meter.

2. Press the POWER key on the meter to turn the meter on.

3. Note that the arrow icon on the left of the screen indicates the active line. If the bottom line is not active, press the LINE SELECT key to change the selected line to the bottom line. Press the UP or DOWN ARROW key to change the measurement mode of the bottom line to mg/L for dissolved oxygen.

4. Press the SETUP key. Press the UP or DOWN ARROW key until “dO” is displayed on the top line.

5. Press the LINE SELECT key to select the middle line. Press the UP or DOWN ARROW key to select “rES” with “mg/L” displayed on the bottom line, which is for dissolved oxygen resolution and the number of significant digits that will be displayed on the meter. Press the LINE SELECT key to select the bottom line. Press the UP or DOWN ARROW key to select “0.01” for “rES” “mg/L”. Press the LINE SELECT key to accept the setting.

6. Press the LINE SELECT key to select the middle line. Press the UP or DOWN ARROW key to select “SALF”, which is for the manual salinity correction factor. Press the LINE SELECT key to select the bottom line. Press the DIGIT key and UP and DOWN ARROW keys to enter “0000” for “SALF”. Press the DIGIT key until the first digit to be changed is flashing, press the UP and DOWN ARROW keys to change the value of the flashing digit and continue to change the digits until the meter displays the correct value. Press the LINE SELECT key to accept the setting.

7. Press the LINE SELECT key to select the middle line. Press the UP or DOWN ARROW key to select “bAr”, which is for the manual or automatic barometric pressure compensation type. Press the LINE SELECT key to select the bottom line. Press the UP and DOWN ARROW keys to select “AUtO” for “bAr” to use the internal meter barometer. Press the LINE SELECT key to accept the setting.

8. Press the LINE SELECT key to select the middle line. Press the UP or DOWN ARROW key to select “CALt”, which is for the dissolved oxygen calibration type. Press the LINE SELECT key to select the bottom line. Press the UP or DOWN ARROW key to select “AIr” for “CALt”. Press the LINE SELECT key to accept the value.

9. Press the MEASURE key to return to the measurement mode.

10. If all steps were followed correctly, the meter display will show two digits after the decimal place in the bottom line and “mg/L” to the right of the bottom line. The meter and probe are now ready for calibration.

Calibration and Analysis

1. 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 step does not need to be repeated unless probe maintenance is performed or the probe is disconnected from the meter for more than an hour.
2. Place the probe into the calibration sleeve, make sure that the sponge is damp and wait 5 to 10 minutes for the calibration sleeve to reach equilibrium.
3. Allow all the standards and the samples to attain room temperature for precise measurements, since dissolved oxygen measurements are is temperature sensitive.
4. Press the CALIBRATE key to begin the calibration.
5. When the reading stabilizes, the meter will display "102.3 % sat" and return to the measurement mode.
6. Rinse the probe thoroughly with deionized water. Gently remove excess solution from the membrane of the probe by dabbing it with a lint-free tissue. Do not wipe or rub the probe membrane.
7. Place the probe directly into the body of water with the probe tip fully immersed.
8. Swirl the probe to provide sufficient sample flow across the membrane surface to prevent erratic readings.
9. Press the MEASURE key on the meter. The mg/L icon will flash as the measurement is being made. The mg/L icon will become solid and the display value will freeze when a stable reading is achieved.
10. Repeat steps 6 through 9 for additional samples. When all samples have been measured, rinse the probe with deionized water and store the probe according to the Probe Storage section.

References

1. Environmental Protection Agency Standard. Surface Fresh Water Sampling. SOP#:2013; 11/17/94.

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