



## Thermo Scientific Orion Dissolved Oxygen Probes

### Dissolved Oxygen Background

Dissolved oxygen is often referred to as DO. It is a measure of the amount of oxygen in a solution. While some gases react chemically with water to form new compounds, gases like nitrogen and oxygen dissolve in water, without a chemical reaction and exist as microscopic bubbles between water molecules.

Air has a constant percentage of oxygen, approximately 20.9 %. When air comes in contact with water, the oxygen in air will dissolve in the water. There are a number of factors that determines how much oxygen dissolves in water:

- Is there sufficient time and adequate mixing to fully saturate the water
- Are substances present in the water that consume the oxygen
- **Water Temperature:** The solubility of oxygen reduces as temperature increases. Therefore the colder the water, the more dissolved oxygen it contains
- **Air Pressure:** As atmospheric pressure decreases with altitude, the amount of dissolved oxygen in water decreases
- **Salt Content:** The amount of dissolved oxygen increases as salinity decreases. Therefore freshwater holds more oxygen than saltwater

Membrane electrodes have been used for a many years to measure DO in water but optical DO probes are becoming more widely used as they offer a number of benefits to the user.

### BOD Background

BOD (Biochemical Oxygen Demand) analysis is typically performed in wastewater plants. This analysis determines the amount of oxygen that microorganisms consume from water when they break down organic matter. The results of this analysis calculate the degree of water pollution and effectiveness of water treatment at wastewater or sewage plants. Properly treated wastewater will have a greatly reduced BOD value when being discharged from a treatment facility compared to when entering.

### Calibration

Calibration of polarographic or RDO optical DO probes can quickly and easily be performed using the water-saturated air method. DO probes are placed in a moist calibration sleeve. Under equilibrium, the partial pressure of oxygen in air-saturated water is equal to the partial pressure of oxygen in water-saturated air. Therefore, a DO probe calibrated in water-saturated air will read the partial pressure of oxygen in water samples. For low concentration samples, a second calibration with a zero standard is recommended.

### Storage

For storage of dissolved oxygen probes, they should be kept in a moist calibration sleeve. Polarographic probes should remain connected to the meter or it will need to be polarized again. For long term storage of polarographic probes, they should be disconnected from the meter, with the membrane cap removed and the sensor rinsed and kept dry.

Thermo Scientific Orion DO probes have calibration sleeves that can be used to protect the electrode between measurements as well as to perform calibrations. Protective guards are also available that will help protect the probe during field use and add weight to the probe to help submerge it when required.

### RDO vs. Polarographic

Polarographic DO probes are often referred to as the Clark cell after it's founder, Dr. Clark, and have been around for over 50 years. Polarographic probes require a voltage to operate from an external source such as your meter and require a polarization period before use. Optical dissolved oxygen is a newer method with some advantages over polarographic probes. There are a number of differences between the 2 measurements and you should evaluate your requirements when choosing which technology to use.

### Differences Between Thermo Scientific Orion Polarographic DO and Optical DO

	Polarographic Probe	Optical Probe
<b>Maintenance</b>	Replace electrolyte and polish cathode ~ every 2 months. Clean probe as needed	Clean, probe, cap and optical window as needed
<b>Storage</b>	In moist calibration sleeve, long term, remove membrane cap and store dry	In moist calibration sleeve
<b>Membrane</b>	Change as needed, ~ every 2 months	Must be replaced every 365 days – do not use with solutions that contain organic solvents
<b>Electrolyte</b>	Change as needed, ~ every 2 months	None required
<b>Warm-Time Required</b>	Required if just connected to meter (30-60 minutes)	None required
<b>Stirring</b>	Required	Not necessary
<b>Interferences</b>	Ozone, sulfides, sulfur dioxide, nitrous oxide and carbon monoxide	Alcohols greater than 5 %, hydrogen peroxide greater than 3 %, sodium hypochlorite greater than 3 %, gaseous sulfur dioxide and gaseous chlorine

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 for more product information.



## Thermo Scientific Orion RDO Optical Dissolved Oxygen Probes

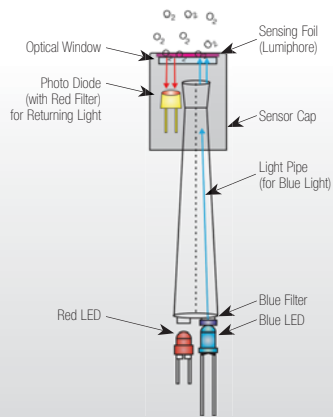
RDO technology meets the requirements of ASTM D888-05 Method C  
Measuring dissolved oxygen with a luminescence-based sensor

**Optical dissolved oxygen is a new technology with many advantages that is rapidly gaining acceptance.**

The Thermo Scientific Orion RDO® probe provides reliable measurements, no warm up time, no stirring, no maintenance (membranes or solution), no thermal shock and less interferences. The sensor cap requires easy annual replacement. The optical sensor cap is durable, able to withstand harsh environments without degradation or effect on performance. The cap has minimal hydration effects and is not prone to photo bleaching. Calibration information is stored in the sensor cap enhancing the ease of use.

All Thermo Scientific RDO probes come with a stainless steel guard and calibration sleeve and are intended for field use.

### Optical Sensor/Luminescence-Based Dissolved Oxygen Sensor



**Optical Probe/Luminescence-based Dissolved Oxygen (LDO) – Newest technology that monitors time to quench an excited lumiphore, which is inversely proportional to the concentration of oxygen**

**Rugged, low maintenance field probe**



**No membranes to change  
Sensor cap replaced annually**

Cat. No.	087010MD	087020MD	087030MD	087050MD	087100MD
<b>Description</b>	Rugged dissolved oxygen probe with 3 meter cable	Rugged dissolved oxygen probe with 6 meter cable	Rugged dissolved oxygen probe with 10 meter cable	Rugged dissolved oxygen probe with 15 meter cable	Rugged dissolved oxygen probe with 30 meter cable
<b>Accuracy</b>	±0.1 mg/L from 0 to 8 mg/mL and ±0.2 mg/L from 8 to 20 mg/mL				
<b>Response Time</b>	T90, 30 seconds and T95, 60 seconds				
<b>Operating Range</b>	0 to 20 mg/L and 0 to 200 %				
<b>Temperature Range</b>	0 to 50 °C				

Cat. No.	Recommended Accessories
087001	Replacement RDO sensor cap
087002	Stainless steel protective guard, for RDO probe
087003	Calibration sleeve for RDO probe

**For connector type information, refer to the RDO meter section to determine the correct meter for your application.**



## Thermo Scientific Orion Dissolved Oxygen Probe Families

A complete line of polarographic dissolved oxygen probes are available for BOD (Biochemical Oxygen Demand) analysis, beer and wine testing, rugged field applications, and water and wastewater analysis. All DO probes feature automatic temperature compensation and convenient screw on membrane caps that reduce probe servicing time and eliminate assembly problems.

The AUTO-STIR probe fits directly into a standard BOD bottle and has a built-in stirrer. This probe offers convenience, quick response, and long life between servicing.

See page 110 for a complete offering of accessories.

**Durable and accurate DO probes for the lab or field**



- 083005MD <sup>A</sup>  
083010MD <sup>A</sup>  
083025MD <sup>A</sup>  
083060MD <sup>A</sup>
- For lab and field applications
  - Cable lengths from 1.5 to 20 meters

**AUTO-STIR™ probe for BOD applications**



- 086030MD <sup>A, C</sup>  
086020A <sup>G</sup>
- For lab applications
  - Self-stirring with one-touch control

**Reliable DO probes for the lab or field**



- 081010MD <sup>A</sup>
- For lab and field applications
  - Rugged epoxy body

**Rugged DO probes plus probe guard**



- 080510MD <sup>A</sup>
- For field applications
  - Includes probe guard

**Convert any pH meter into a DO meter**



- 970899WP <sup>1</sup>
- For lab applications
  - Works on pH meters with BNC



1 BNC Waterproof



A MiniDIN



C 3.5 mm Phono Tip Stirrer Jack



G 13 Pin DIN

### Key Information

**1** BNC Waterproof Connector

**A** MiniDIN Connector

**C** 3.5 mm Phono Tip Stirrer Jack Connector

**G** 13 Pin DIN Connector

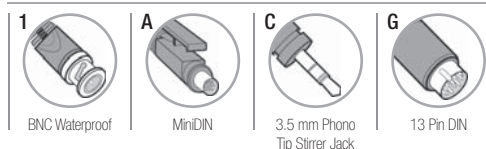


## Thermo Scientific Orion Dissolved Oxygen Probe Selection Guide

### Polarographic Dissolved Oxygen Probes

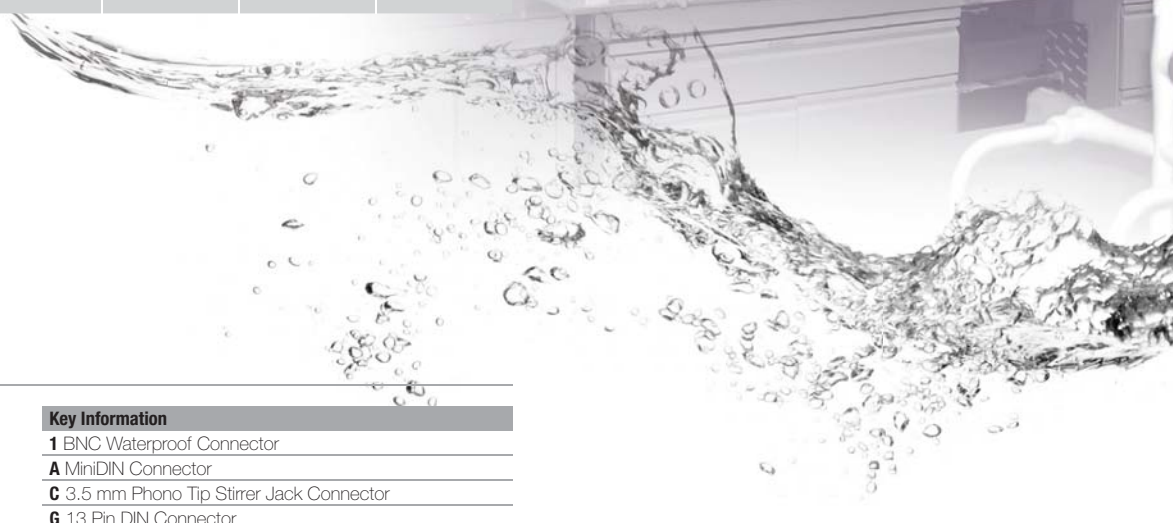
Cat. No.	Cable Length	Meter Compatibility	Application	Response Time	Minimum Sample Flow	Oxygen Consumption	Maximum Allowed Overpressure	Sample Temperature
<b>083005MD</b> <sup>A</sup>	1.5 m	Star series	Laboratory / field	90 % of final value in 10 seconds; 95 % of final value in 15 seconds; 99 % of final value in 60 seconds	10 cm/sec	0.008 µg/h (mg/L) <sup>-1</sup> at 20 °C	6 BAR	0 to 50 °C
<b>083010MD</b> <sup>A</sup>	3 m	Star series						
<b>083025MD</b> <sup>A</sup>	10 m	Star series						
<b>083060MD</b> <sup>A</sup>	20 m	Star series						
<b>086020A</b> <sup>E</sup>	2 m	862A	Laboratory	90 % of final value in 10 seconds; 95 % of final value in 15 seconds; 99 % of final value in 60 seconds	10 cm/sec	0.008 µg/h (mg/L) <sup>-1</sup> at 20 °C	6 BAR	0 to 50 °C
<b>086030MD</b> <sup>A,C</sup>	2 m	Star series, benchtop models						
<b>081010MD</b> <sup>A</sup>	3 m	Star Series	Laboratory / field	90 % of final value in 10 seconds; 95 % of final value in 16 seconds; 99 % of final value in 60 seconds	20 cm/sec	–	–	0 to 50 °C
<b>080510MD</b> <sup>A</sup>	3 m	Star Series	Field	90 % of final value in 10 seconds; 95 % of final value in 18 seconds; 99 % of final value in 60 seconds	10 cm/sec	0.008 µg/h (mg/L) <sup>-1</sup> at 20 °C	10 BAR	0 to 50 °C
<b>970899WP</b> <sup>**</sup>	1 m	pH meters with BNC connector	Laboratory	96 % response in less than 30 seconds between oxygen-free and air saturated water at 22 °C	–	0.1 mg/hr	–	0 to 45 °C

\*Accuracy – ±0.05 ppm or 2 % of reading, whichever is greater  
 Battery Life – One year based on 4 hours/day operation





Temperature Sensor	Drift	Electrolyte lifetime	Storage Temperature	Membrane Cap and Solution	Maintenance Kit
Dual, thermally separated	Approximately 0.1 % per day	180 days	-5 to 50 °C	Membrane cap - 080515 Solution - 080514	080513
Dual, thermally separated	Approximately 0.1 % per day	180 days	-5 to 50 °C	Membrane cap - 080515 Solution - 080514	080513
Single thermally separated	< 1 % per day	180 days	-5 to 50 °C	Membrane cap - 081003 Solution - 080514	080113
Dual, thermally separated (080510MD has a single temperature sensor)	Approximately 0.1 % per day	180 days	-5 to 50 °C	Membrane cap for 080510MD - 081003 Membrane cap for 081010F & 083010F - 080515 Solution - 080514	Kit for 080510MD - 080113  Kit for 081010F & 083010F - 080513
Dual, thermally separated	–	–	–	Pre-filled membrane cap - 970801	–



**Key Information**

**1** BNC Waterproof Connector

**A** MiniDIN Connector

**C** 3.5 mm Phono Tip Stirrer Jack Connector

**G** 13 Pin DIN Connector





## Polarographic Dissolved Oxygen Solutions and Accessories

Cat. No.	Description
087001	Replacement RDO optical cap
087002	Stainless steel protective probe guard for RDO probes
087003	Calibration sleeve for RDO probes
080513	Maintenance kit, includes electrolyte solution, polishing disk and 2 membrane caps for 083005MD, 083010MD, 083025MD, 083060MD, 086030MD, 083005A, 083010A, 083005D, 086020A, 081010F
080113	Maintenance kit, includes electrolyte solution, polishing disk and 2 membrane caps for 080510MD, 081010MD, 081010
080515	1 membrane cap for 083005MD, 083010MD, 083025MD, 083060MD, 086030MD, 083005A, 083010A, 083005D, 086020A, 081010F
081003	3 membrane caps for 080510MD, 081010MD, 081010
970801	1 pre-filled membrane cap for 970899WP, 970800
080514	Polarographic electrolyte solution for 083005MD, 083010MD, 083025MD, 083060MD, 086030MD, 083005A, 083010A, 083005D, 086020A, 081010F, 080510MD, 081010MD, 081010
080017	Calibration sleeve for all DO probes excluding AUTO-STIR probes and RDO probe
086021A	Calibration chamber/stand for 086020A, 086030MD AUTO-STIR probes
080360	BOD adapter for 083005MD, 083010MD, 083025MD, 083060MD, 083005A, 083010A, 083005D
080160	BOD adapter for 081010MD, 081010
970802	BOD stir funnel for 970899WP, 970800
970803	2 batteries for 970899WP, 970800
080045	Stainless steel and plastic protective probe guard for 080510MD, 083005MD, 083010MD, 083025MD, 083060MD, 083005A, 083005D, 083010A
081045	Plastic protective probe guard for 080510MD, 083005MD, 083010MD, 083025MD, 083060MD, 083005A, 083005D, 083010A

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