



Dissolved Oxygen Measurement

Dissolved Oxygen

Dissolved oxygen is present in virtually every liquid. For example, at a temperature of 20 °C (68 °F) and an atmospheric pressure of 1013 mbar, saturated water contains about 9 mg/l oxygen. Ethanol can contain up to 40 mg/l, whereas glycerol only has about 2 mg/l.

Liquid absorbs oxygen until the partial pressure of oxygen in the liquid is in equilibrium with the air or gas in which it is in contact. The actual concentration of dissolved oxygen depends on a number of factors, such as temperature, air pressure, oxygen consumption by microorganisms in a biodegradation process or oxygen production by algae, etc.

The oxygen concentration is important for the:

- **Living conditions for fish and microorganisms in waters**
- **Degradation processes in wastewater treatment**
- **Corrosion processes in pipelines**
- **Shelf life of beverages, etc.**

The determination of the oxygen concentration was formerly carried out by the WINKLER titration method. Today, electrochemical measurement is a recognized method in numerous standard procedures.

In its simplest form a dissolved oxygen sensor contains a working electrode and a counter-electrode. Both electrodes are located in an electrolyte system which is separated from the sample by a gas-permeable membrane. The working electrode reduces the oxygen molecules to hydroxide ions. In this electrochemical reaction a current flows from the counter-electrode to the working electrode. The more oxygen present in the sample, the larger the current signal. The D.O. meter calculates the concentration of dissolved oxygen in the sample from this signal.

| Application Range Dissolved Oxygen Meters | | | | | | | |
|---|-------------------|-------------------|---------------------------|------------------------|-----------------|-------------|-------------|
| ● Recommended by WTW ○ Conditionally applicable – Not recommended | | | | | | | |
| Application Range | inoLab® | | | Profiline Oxi 1970i | Portable Meters | | |
| | Oxi 730/ 7300* | Oxi 740/ 7400* | BSB/ BOD 740/ 7400* | | Oxi 3205 | Oxi 3210 | Oxi 3310 |
| Routine measurement | - | - | - | - | ● | ● | - |
| Routine measurement with documentation | ● | ● | ● | ● | - | - | ● |
| AQA with documentation | ● | ● | ● | ● | - | - | ● |
| R&D high precision | ● | ● | ● | ● | - | ● | ● |
| Control measurements | ● | ● | ● | ● | ○ | ● | ● |
| LIMS connection | ● | ● | ● | ● | - | - | ○ |
| Quality assurance | ● | ● | ● | ● | - | ● | ● |
| Training | ● | ● | ● | ○ | ● | ● | ○ |
| Service | - | - | - | ● | ● | ● | ● |
| Laboratory measurements | ● | ● | ● | ● | - | - | ○ |
| Field measurements | - | - | - | ● | ● | ● | ● |
| Depth measurements | - | - | - | ● | - | - | - |
| External control/ PC connection/ PC control | ● ● - | ● ● ● | ● ● ● | ● ● - | - - - | - - - | - ● - |
| BOD measurements with self-stirring sensor | ● | ● | ● | ● | - | - | - |
| BOD measurements with assessment program | - | - | ● | - | - | - | - |
| <i>see page</i> | 44 | 45 | 80 | 46 | 47 | 48 | 48 |

For dissolved oxygen measurement with multi-parameter instruments, see pages 8 and 62

| Application Range Sensors | | | | | | |
|---|-----------------------------------|----------------------|--|-------------------------------------|-------------------------|-------------|
| Application Range | FDO® 925 | ConOx | DurOx® | CellOx® 325 | StirrOx® G | TA 197 Oxi |
| BOD measurements | ● | - | - | ○ | ● | - |
| Fish farming | ○ | ● | ● | ○ | - | - |
| Surface waters | ● | ● | ○ | ● | - | - |
| Ground water | ● | ○ | - | ○ | - | ● |
| Control measurements | ● | ● | ● | ● | ○ | - |
| Depth measurements | ● (25 m/82 ft.) | - | - | - | - | ● |
| Laboratory measurements | ● | ○ | - | ● | ○ | - |
| Pharmaceuticals | ● | ○ | ○ | ● | - | - |
| Biotechnology (non-autoclavable) | ● | ○ | ○ | ● | - | - |
| Wastewater treatment plant: aeration tank | ● | ○ | ● | ○ | - | - |
| <i>applicable instruments:</i> | MultiLine® 3410, 3420, 3430 | Multi 350i/3500i* | Oxi 3xxi/3xxx*, Profiline Oxi, Multi 350i/3500i* | all, except MultiLine® series | inoLab®, 1970i, 197i | 1970i, 197i |

* North American version



Parameter
pH
ORP
ISE
Dissolved Oxygen (D.O.)
Conductivity
Multi-parameter
Data logger/flow + level
BOD/Respiration
Photometers
Turbidity
Colony Counter
Software/Printers

Laboratory Dissolved Oxygen Meters

Dissolved oxygen is one of the most frequently measured parameters in the laboratory. It plays a large role in the degradation of substances and the growth of microorganisms, both in environmental technology and in biotechnology.

The inoLab® Oxi 740/7400* instrument is particularly suitable for monitoring such processes. For routine measurements the inoLab® Oxi 730/7300* is equipped with all the necessary functions required for documentation according to GLP.

inoLab® Oxi 730/7300*

- GLP documentation
- Comprehensive data logging (800 data sets)
- Interface for self-stirring DO sensor StirrOx® G

Compact and communicative

Standard laboratory dissolved oxygen meter with large multifunctional display for routine use in the laboratory. Automated functions such as air pressure correction, temperature compensation and OxiCal® rapid calibration make work easier. Data logger, analog and digital output RS 232, as well as the optional built-in printer, guarantee QA-compliant documentation.

Features

- Simplified operator convenience
- Easy-to-clean touch-sensitive keypad
- Optional built-in printer

The StirrOx® G can be operated by the inoLab® Oxi 730/7300* for BOD₅ determination according to DIN EN 1899-1 resp. DIN EN 1899-2 with manual start/stop functions.



* North American version

inoLab® Oxi 740/7400*

- Precision instrument
- Firmware/Software update
- External control (MultiLab® pilot)

Features

- Built-in digital recorder
- Graphic evaluation possible
- Connection for bar-code reader or PC keyboard
- Automatic memory function if bar-code reader is used
- User selectable languages
- Multi-level GLP functions (password-protected operator levels)
- Limit input with acoustic alarm
- Free-of-charge software downloads for MultiLab® pilot or terminal

inoLab® Oxi 740/7400* with terminal or PC software: flexible and powerful

High-performance dissolved oxygen meter with graphic display and digital recorder function for DO measurement in the laboratory. Automated functions such as air pressure correction, temperature compensation by the IMT method and OxiCal® rapid calibration make work easier. The built-in measurement store, the digital output RS 232 and the optional built-in printer (paper width 112 mm resp. 4.4") guarantee QA-compliant documentation.



Technical Data

| Model | Oxi 730/7300* | Oxi 740/7400* |
|--------------------------|---|---|
| Range/Resolution | O ₂ Conc. 0.00 ... 19.99 mg/l. 0.0 ... 90.0 mg/l** O ₂ saturation 0.0 ... 199.9%. 0 ... 600%** O ₂ part. pressure 0.0 ... 199.9 mbar. 0 ... 1250 mbar Temperature -5.0 ... +50.0 °C (23 ... 122 °F) | O ₂ Conc. 0.00 ... 20.00 mg/l, 0.0 ... 90.0 mg/l** O ₂ saturation 0.0 ... 200.0%. 0 ... 600%** O ₂ part. pressure 0.0 ... 200.0 mbar. 0 ... 1250 mbar Temperature -5.0 ... +50.0 °C (23 ... 122 °F) |
| Accuracy (±1 digit) | O ₂ Conc. ±0.5% of value O ₂ saturation ±0.5% of value Temperature ±0.1 K | |
| Temperature compensation | 0 ... +50 °C (32 ... 122 °F) automatic via IMT compensation | |
| Salinity correction | Automatic from 0.0 ... 70.0 adjustable via display | |
| Calibration | OxiCal® rapid calibration in OxiCal®-SL | |

Ordering Information

| inoLab® Laboratory Dissolved Oxygen Meter SETs – with universal power supply 100-240 VAC (50/60 Hz) included | Order No. |
|--|-----------|
| inoLab® Oxi 730P/7300P* SET 1 With built-in printer, including CellOx® 325, passive multi-function box and accessories | 1B21-0111 |
| inoLab® Oxi 740/7400* SET 1 Including terminal, PC software, CellOx® 325 and accessories | 1B30-0111 |



* North American version
** = depends on DO sensor and medium

Portable Dissolved Oxygen Meters

ProfiLine Dissolved Oxygen Field Meters

The WTW dissolved oxygen meter **ProfiLine Oxi 1970i**, supplied with integrated powerful NiMH rechargeable batteries, is both waterproof (IP 66) and submersible (IP 67). This easy-to-use meter conforms to GLP and has an 800 data point data logger and accurate recorder output.

ProfiLine Oxi 1970i

- High-precision, indestructible, waterproof
- Recorder output corresponding to display
- Depths measurement down to 100 m (330 ft)

External control via PC with MultiLab® pilot. They are equipped with a carrying/support handle and carrying strap. The Oxi 1970i is suitable for depth measurements down to 100 m (330 ft) in combination with the TA 197 Oxi depth armature.



TA 197 Oxi

Dissolved oxygen depth armature **TA 197 Oxi** with built-in temperature probe, up to 100 m (330 ft) cable with waterproof plug (IP 67), and pressure-resistant steel armor with screw-off protective hood. Fits into small boreholes (2" dia.).

BR 325

Battery-powered stirrer BR 325 for profile and depth measurements.

Technical Data

| | | |
|---------------------------|--|--|
| Model | ProfiLine Oxi 1970i | |
| Range/Resolution | O ₂ Conc. | 0.00 ... 19.99 mg/l (19.9 mg/l*), 0.0 ... 90.0 mg/l (90 mg/l*) |
| | O ₂ saturation | 0.0 ... 199.9% (199%*), 0 ... 600% |
| Accuracy (±1 digit) | O ₂ Conc. | ±0.5% of value |
| | O ₂ saturation | ±0.5% of value |
| | Temperature | ±0.1 K |
| Air pressure compensation | Automatic with built-in pressure sensor (500 ... 1100 hPa) | |
| Temperature compensation | <2% at 0 ... +40 °C (32 ... 104 °F) | |
| Salinity correction | Automatic from 0.0 ... 70.0, adjustable via display | |
| Calibration | OxiCal® rapid calibration in OxiCal®-SL or OxiCal®-D | |

Ordering Information

| | |
|--|-----------|
| Portable Dissolved Oxygen Field Meter | Order No. |
| ProfiLine Oxi 1970i Robust, waterproof, submersible dissolved oxygen meter | 3B30-010 |



* depends on DO sensor and medium
Depth armatures for measurements down to depths of 100 m (330 ft)
 see WTW Product Details

NEW

Portable Meters

ProfiLine 3000 Series

Dissolved oxygen measurements made easy: The Oxi 3205 is an easy-to-use, rugged and waterproof portable meter for the measurement of dissolved oxygen. It is suitable for galvanic DO sensors, with adjustable automatic salinity correction. The readings are displayed as saturation or concentration.

ProfiLine Oxi 3205

- Cellox® and DurOx® can be connected
- Backlit graphic display
- Automatic air pressure compensation



D.O. measurement with ProfiLine Oxi 3205 and DurOx® incl. protection cap in fish farming



- Parameter
- pH
- ORP
- ISE
- Dissolved Oxygen (D.O.)
- Conductivity
- Multi-parameter
- Data logger/flow + level
- BOD/Respiration
- Photometers
- Turbidity
- Colony Counter
- Software/Printers

NEW

ProfiLine Oxi 3210/3310

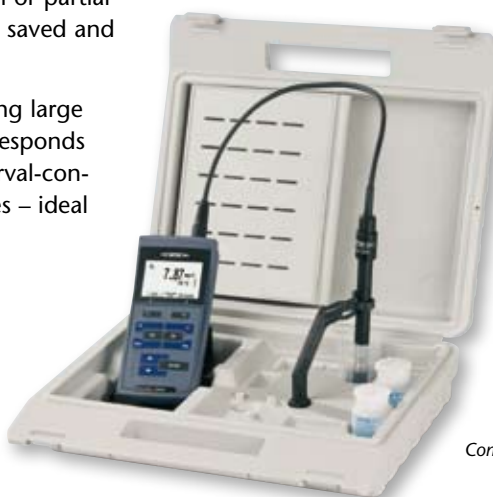
- Convenient user interface
- Manual memory
- Allows for calibration against external standards (Oxi 3310)



ProfiLine Oxi 3310

The **Oxi 3210** is a portable first class dissolved oxygen meter with intuitive, user-friendly interface. Measured values are displayed as concentration, saturation or partial pressure, individual values can also be manually saved and displayed on the screen.

Ideal for automatically recording and transmitting large amounts of data: The **Oxi 3310** technically corresponds with the Oxi 3210, with the addition of an interval-controlled data logger and memory for 5000 entries – ideal for automatic data collection in-the field.



Complete as SET

Technical Data

| Model | Oxi 3205 | Oxi 3210 | Oxi 3310 |
|-----------------------------------|--|---|--|
| Range/ Resolution/ Accuracy | O ₂ Conc. 0.00 ... 20.00 mg/l (20.0 mg/l*) ±0.5 % of value; O ₂ saturation 0.0 ... 200.0 % (200 %*) ±0.5 % of value; O ₂ part. pressure 0.0 ... 200.0 mbar (200 mbar*) ±0.5 % of value, Temperature -5.0 ... +105.0 °C ±0,1 °C (23 ... 221 °F) | 0 ... 90 mg/l ±0.5 % of value | 0 ... 600 % ±0.5 % of value 0 ... 1250 mbar ±0.5 % of value |
| Temperature compensation | Better than 2% at 0 ... +40 °C (32 ... 104 °F) | | |
| Air pressure compensation | Automatic with built-in pressure sensor (500 ... 1100 mbar) | | |
| Salinity correction | 0 or 35solid | Automatic from 0.0 ... 70.0, adjustable via display | |
| Calibration | OxiCal® rapid calibration in OxiCal®-SL or OxiCal®-D | | |
| Memory/Logger | - | Manual 200 | Manual 200/5000 automatic |
| Display | LCD Graphic, backlit | | |
| Continuous operation | Up to 800 hrs. without/100 hrs. with backlight | | |

Ordering Information

| ProfiLine Portable Dissolved Oxygen Meter SETs | | Order No. |
|--|--|-----------|
| Oxi 3205 SET 3 | Robust and waterproof portable dissolved oxygen meter for battery operation, case set with DurOx® 325 and accessories | 2BA103 |
| Oxi 3210 SET 1 | Robust and waterproof portable dissolved oxygen meter including memory, for battery operation, case set with CelloX® 325 and accessories | 2BA201 |
| Oxi 3310 SET 1 | Robust and waterproof portable dissolved oxygen meter including memory, data logger and USB mini B interface, for battery operation, case set with CelloX® 325 and accessories | 2BA301 |



For other sensors in SET, see WTW Product Details
* if DurOx® DO sensor is used

Galvanic Dissolved Oxygen Sensors

WTW offers three types of galvanic dissolved oxygen sensors, none of which require polarization time prior to measurement as is the case with other D.O. sensors. WTW D.O. sensors are equipped with preassembled membrane caps preventing sensor prep errors caused by improper membrane installation, and have built-in temperature compensation capabilities.

Dissolved Oxygen Sensors

- **NEW:** Optical Dissolved Oxygen Sensor FDO® 925 *s. page 12*
- Immediately ready for measurement
- Simple air calibration using calibration vessel

DurOx® 325

Only for ProfiLine portable and field meters and Multi 350i/3500i*

Membrane covered galvanic dissolved oxygen sensor

- Membrane lasts up to 6 months
- Low approach flow (measurements obtained with minimal sample flow)
- Waterproof sensor (IP 68 – 2 bar)
- Includes **SK-D** protective sensor guard
- Includes calibration vessel **OxiCal®-D**



CellOx® 325

Membrane covered galvanic dissolved oxygen sensor

- Membrane lasts up to 6 months
- Features membrane leak monitoring
- High signal resolution (prevents weakened signal with longer cable lengths)
- Rapid measurement response
- Waterproof sensor (IP 68 – 2 bar)
- Includes calibration vessel **OxiCal®-SL**



StirrOx® G

For inoLab® Oxi 730/7300*, inoLab® Oxi 740/7400* and ProfiLine Oxi 1970i

Self-stirring dissolved oxygen sensor – simultaneous stirring and measurement

- Membrane lasts up to 6 months
- Features membrane leak monitoring
- Sensor includes automatic stirrer
- Waterproof sensor (IP 68 – 2 bar)
- Extremely low self-consumption of oxygen
- Includes calibration vessel **OxiCal®-ST**



Accessories

Various calibration and storage vessels are available for dissolved oxygen sensors.

see WTW Product Details

* North American version

Ordering Information

| Dissolved oxygen sensors (The sensor includes accessory case with spare parts and maintenance supplies) | | Order No. |
|---|---|-----------|
| StirrOx® G | Self-stirring dissolved oxygen sensor for oxygen determination in Karlsruhe bottles and Winkler bottles, with OxiCal®-ST calibration and storage vessel | 201 425 |
| CellOx® 325 | Galvanic dissolved oxygen sensor with OxiCal®-SL calibration and storage vessel, waterproof plug, cable length 1.5 m (4.92 ft) | 201 533 |
| DurOx® 325-3 | Galvanic dissolved oxygen sensor with OxiCal®-D calibration vessel, waterproof plug, cable length 3 m (9.84 ft) | 201 570 |

For calibration and storage vessels and other sensors and accessories, see WTW Product Details