



## 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.

**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. During the last years the optical measuring of dissolved oxygen has become more important.

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. As for optical measurements there are no chemical reactions involved. A special fluorescent dye is used instead, which is activated by light in the measuring membrane. In the presence of oxygen the fluorescence changes its character (quenching), this effect is used for the quantitative determination.

## Application Range Dissolved Oxygen Meters

● Recommended by WTW    ○ Conditionally applicable    – Not recommended

Application Range	inoLab®		ProfiLine Oxi 1970i	MultiLine® IDS <sup>1</sup>	Portable Meters			
	Multi IDS <sup>1</sup>	Oxi 7310			Oxi 3205	Oxi 3210	Oxi 3310	Oxi 3315
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>	56	58	65	60	64	63	62	61

For dissolved oxygen measurement with multi-parameter instruments, see pages 14 and 18

## Application Range Sensors

Application Range	<sup>1</sup> 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>	Oxi 3315, MultiLine® 3410, 3420, 3430 inoLab® Multi IDS	Multi 350i/ 3500i*	ProfiLine Oxi, Multi 350i/ 3500i*	all, except MultiLine®, Oxi 3315	inoLab® Oxi 7310, 1970i	1970i
* North American version						

**NEW**

## 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.



Dissolved oxygen measurements with new digital multi-parameter benchtop meters inoLab® IDS  
see page 14

### Determining dissolved oxygen ...

... with the innovative inoLab® Multi 9310 IDS

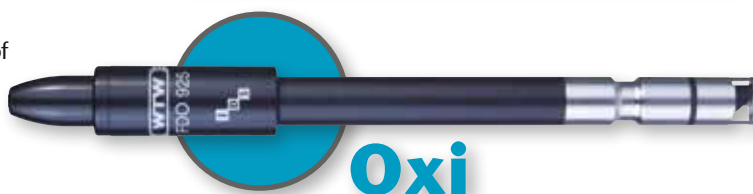
The new inoLab® Multi 9310 IDS is ideal for digital, optical DO measurements in the laboratory. The IDS technology perfectly supports measuring in the easiest way along with efficient documentation. Without self consumption and resistant against air bubbles, carbon dioxide and ethanol the optical DO sensor FDO® 925 is not only recommended for BOD measuring, but also for further applications throughout the laboratory.

#### inoLab® Multi 9310 IDS

- Measuring safety without compromises
- Digital sensor recognition
- Intelligent sensor rating

#### Measuring safety

- Through digital transmission of signals the sensor data is easily provided.
- Display of service information for supporting the ideal function
- Maintenance free measuring system without use of chemicals through factory calibrated sensor cap
- Automatic air pressure compensation for precise measuring results





### GLP/AQA documentation

- Automatic, digital recording of all sensor data for biunique traceability of measuring values
- User administration can be activated for allocation of user and measuring results
- Transfer of all data in .csv format via USB interface to PC, on demand formatted transfer into Excel (MultiLab® Importer, included in the delivery scope or as download)
- Data output via optional built-in printer possible

### Flexible and powerful:

- Adjustable  $t_{90}$  for different applications
- Measures partial pressure, concentration and saturation
- Salinity corrections
- Storage for large measuring batches

### Technical Data

Model	inoLab® Multi 9310 IDS $\mu_{\text{DO}}$
Measuring channel	1 (universal)
Display	LCD graphic, backlit
CMC/QSC	Yes/Yes
Data storage	Manual 500/5000 automatic
Logger	Manual/time-controlled
Interface	Mini USB
Printer (optional)	Thermo printer, width 58 mm
Power supply	Universal power supply 100 to 240 V, 50/60 Hz, 4 x 1,5 V AA or 4 x 1.2 V NiMH rechargeable batteries

### Ordering Information

Digital inoLab® multiparameter SETs $\mu_{\text{DO}}$	Order No.
inoLab® Multi 9310 IDS SET 4	1FD354
Digital multiparameter benchtop meter, set including IDS sensor, for measurements/documentation according GLP/AQA. With single channel input for pH/mV, dissolved oxygen and conductivity. Meter with universal power supply, stand and operation manual, optical IDS DO sensor FDO® 925, software and USB cable.	



For other SETs or sensors in SET, see WTW Product Details

## Reliable DO documentation...

... with the inoLab® Oxi 7310

The new inoLab® Oxi 7310 is the perfect laboratory meter for measuring DO with the proven galvanic DO sensors. With automatic GLP/AQA documentation it supports traceability not only in the environmental laboratory. On demand also available with built-in printer.

### inoLab® Oxi 7310

- USB interface for fast data transfer
- Data output in .csv format or via optional built-in printer
- Connection for self-stirring DO sensor StirrOx® G

### Measuring safety

- Repeatable measuring results provided by the active, automatic AutoRead function with recognition of stable end values
- Automatic air-pressure compensation
- Graphic display with plain text menu for convenient and secure operation

### GLP/AQA documentation

- Alphanumeric entry of electrode serial number
- Transfer of all data in .csv format via USB interface to PC, on demand formatted transfer into Excel (MultiLab® Importer, included in the delivery scope or as download).
- Data output via optional built-in printer possible



### Flexible and powerful:

- Measures partial pressure, concentration and saturation
- Salinity corrections
- Storage for large measuring batches





Parameter

Multi-parameter

pH

ORP

ISE

Dissolved Oxygen (D.O.)

Conductivity

Data logger/flow + level

BOD/Respiration

Photometers

Turbidity

Colony Counter

Software/Printers

## Technical Data

Model	inoLab® Oxi 7310 All values $\pm 1$ digit
Concentration	0.00 ... 20.00 mg/l $\pm 0.5$ % Mw. 0 ... 90 mg/L $\pm 0.5$ %
Saturation	0.0 ... 200.0 % $\pm 0.5$ % v. Mw. 0 ... 600 % $\pm 0.5$ % v Mw.
Partial pressure	0 ... 200.0 hPa, 0 to 1250 hPa
Temperature	-5.0 ... 105.0 °C $\pm 0.1$ °C
Calibration	1-point air-calibration or versus external standard
Calibration storage	up to 10 calibrations
Display	LCD graphic, backlit
Data storage	manual 500/5000 automatic
Logger	manual/time-controlled
Interface	Mini USB
Printer (optional)	thermal printer, width 58 mm
Power supply	Universal power supply 100 to 240 V, 50/60 Hz, 4 x 1,5 V AA or 4 x 1.2 V NiMH rechargeable batteries

## Ordering Information

inoLab® Laboratory Dissolved Oxygen Meter SETs		Order No.
inoLab® Oxi 7310 SET 1	Professional dissolved oxygen meter, menu controlled, for measurements/documentation according GLP/AQA. Set including galvanic DO sensor. Meter with universal power supply, stand and operation manual, galvanic DO sensor CellOx® 325, polishing stripe, electrolyte, cleaning solution, replacement caps, CD-ROM incl. software, USB cable.	1BA301
inoLab® Oxi 7310P SET 4	Professional dissolved oxygen meter, menu controlled, for measurements/documentation according GLP/AQA, with integrated thermal printer. Set including galvanic DO sensor. Meter with universal power supply, stand and operation manual, self stirring galvanic DO sensor StirrOx® G, polishing stripe, electrolyte, cleaning solution, replacement caps, CD-ROM incl. software, USB cable.	1BA304P

IP 43

CE

cETLUS

3 Year Warranty

For other SETs or sensors in SET, see WTW Product Details

**NEW**

# Portable Dissolved Oxygen Meters

Dissolved oxygen is an important parameter in environmental analytics. It is therefore commonly used for field operation. Its determination is processed in fish farming as well as in wastewater plants for monitoring the stationary measuring technology.



Oxygen measurements with the new digital MultiLine® multi-parameter measuring instruments see page 18



**Not only dissolved oxygen is determined securely...**

**... with the Multi 3410**

The Multi 3410 is a portable single channel multi-parameter instrument for the digital measuring of dissolved oxygen. The IDS technology supports optimal measuring in the easiest way along with efficient documentation. Without self consumption and resistant against air bubbles, carbon dioxide and ethanol the optical DO sensor FDO® 925 is not only recommended for BOD measuring, but also for further applications throughout the laboratory. The Multi 3410 also allows connecting further sensors and parameters.

## Multi 3410 <sup>IDS</sup>

- Measuring safety without compromises
- Digital, optical DO measuring
- Multi-parameter instrument

### Measuring safety

- Through digital transmission of signals the sensor data is easily provided.
- Display of service information for supporting the best function
- Maintenance free measuring system without use of chemicals through factory calibrated sensor cap
- Automatic air pressure compensation for precise measuring results

### GLP/AQA documentation

- Automatic, digital recording of all sensor data for traceability of measuring values
- User administration can be activated for allocation of user and measuring results
- Transfer of all data in .csv format via USB interface to PC, on demand formatted transfer into Excel (MultiLab® Importer, included in the delivery scope or as download).
- Data output via optional built-in printer possible

### Flexible and powerful:

- Adjustable  $t_{90}$  for different applications
- Measures partial pressure, concentration and saturation
- Multi-parameter instrument
- Color display
- USB-A socket



## General Features

Model	Multi 3410 <sup>IDS</sup>
Data storage	manual 500/10000 automatic
Data logger	manual/time-controlled
Interface	USB-A and Mini USB
Power supply	Universal power supply with charging function or 4 x 1.2 V NiMH akku

## Ordering Information

MultiLine® <sup>IDS</sup>		Order No.
Multi 3410 SET 4	Professional digital multi meter for portable field measurement, with single channel input, color graphic display incl. data logger and USB interfaces. DO case set with optical IDS DO probe FDO® 925, short instruction manual, stand, beaker, CD-ROM, driver software for USB, rechargeable batteries, cable, universal power supply and accessories.	2FD454
Multi 3410 SET 5	Same as 2FD454, but with optical IDS DO probe FDO® 925-3.	2FD455

IP 67

CE

GETLUS

**3 Year Warranty**

For other sensors in SET see WTW Product Details



## ProfiLine 3000 Series

### Determining dissolved oxygen...

... with the latest ProfiLine Oxi 3315 and the optical IDS oxygen sensor FDO® 925

The new Oxi 3315 is a portable instrument for digital measuring of optical DO. The IDS technology supports ideal measuring in the easiest way along with efficient documentation. Without self consumption and resistant against air bubbles, carbon dioxide and ethanol the optical DO sensor FDO® 925 is not only recommended for BOD measuring, but also for field and process applications.

#### ProfiLine Oxi 3315

- Digital, optical DO measurements
- Measuring safety without compromises
- Complete documentation

#### Measuring reliability

- Through digital transmission of signals the sensor data is easily provided.
- Increased solution of measuring concentration 1 mg per 0.001 mg/l for trace measurements
- Maintenance-free measuring system through factory calibrated sensor cap
- Automatic air-pressure compensation

#### GLP/AQA documentation

- Automatic, digital recording of all sensor data for traceability of measuring values
- Transfer of all data in .csv format via USB interface to PC

#### Flexible and powerful:

- Adjustable  $t_{90}$  for different applications
- Measures partial pressure, concentration and saturation
- Salinity corrections
- Storage for large measuring batches



#### Technical Data

Model	Oxi 3315
Display	LCD graphic, backlit
Calibration	vapor-saturated air, if applicable against external standard
Data storage	manual 500 data records; automatic 5 000 data records
Data output	.csv or ASCII
Measuring channel	1
Logger	manual/time-controlled
Interface	Mini USB
Power supply	4 x 1.5 V AA or 4 x 1.2 V NiMH rechargeable batteries or via USB

#### Ordering Information

ProfiLine Portable Dissolved Oxygen Meter SET		Order No.
Oxi 3315 SET 1	Professional, field proven DO meter for digital IDS DO sensors with backlit graphic display for portable application including data logger and USB interface. Case set including optical IDS DO sensor FDO® 925, stand, beaker. Including short instruction manual CD-ROM, batteries, driver software for USB, cable.	2BD351
Oxi 3315 SET 5	Meter see above, but with optical IDS DO sensor FDO® 925 and Bev kit (containing panel with meter holder, flow through vessel, tube, tube adapter, meter armor SM Pro), without portable case.	2BD355



For other sensors in Sets see WTW Product Details



## Reliable DO documentation...

... with the ProfiLine Oxi 3310

The Oxi 3310 is a combination of a robust portable meter and data logger for gathering measuring data automatically and PC supported evaluation.

### ProfiLine Oxi 3310

- Waterproof USB interface for fast data transfer
- Data output in .csv format
- Calibration versus external standard possible (Winkler-titration)

ProfiLine Oxi 3310



Complete as SET

### Measuring safety

- Repeatable measuring results provided by the active, automatic AutoRead function with recognition of stable end values
- Automatic air-pressure compensation
- Silicone keypad with tangible key click, optional protective armor for field operation

### GLP/AQA documentation

- Transfer of all data in .csv format via USB interface to PC, on demand formatted transfer into Excel (MultiLab® Importer, included in the delivery scope or as download).

### Flexible and powerful:

- Measures partial pressure, concentration and saturation
- Salinity corrections
- Storage for large measuring batches



## Measuring DO precisely...

... with the ProfiLine Oxi 3210

The ProfiLine Oxi 3210: A top-class portable DO measuring instrument - with modern, user-friendly interface.

### ProfiLine Oxi 3210

- Convenient user guidance
- Manual storage function
- For galvanic DO sensors



ProfiLine Oxi 3210

Parameter

Multi-parameter

pH

ORP

ISE

Dissolved Oxygen (D.O.)

Conductivity

Data logger/flow + level

BOD/Respiration

Photometers

Turbidity

Colony Counter

Software/Printers

### Measuring safety

- Repeatable measuring results provided by the active, automatic AutoRead function with recognition of stable end values
- Automatic air-pressure compensation
- Silicone keypad with tangible key click, optional protective armor for field operation

### GLP/AQA documentation

- Storage with data output display or occasional documentation.

### Flexible and powerful:

- Measures partial pressure, concentration and saturation
- Salinity corrections
- Storage for large measuring batches



## Measuring DO easily...

... with the ProfiLine Oxi 3205

The Oxi 3205 is an easy-to-use, reliable measuring instrument for routine measurements.

### ProfiLine Oxi 3205

- Suitable for CellOx® or DurOx® sensors
- Backlit graphic display
- Automatic air-pressure compensation



#### Measuring safety

- Repeatable measuring results provided by the active, automatic AutoRead function with recognition of stable end values
- Safe operation: Automatic functions reduce the number of keys (6).
- OxiCal® air-calibration
- Waterproof 8-pin socket for measurements in the field.

#### GLP/AQA documentation

- Transfer of all data in .csv format via USB interface to PC, on demand formatted transfer into Excel (MultiLab® Importer, included in the delivery scope or as download).

#### Flexible and powerful:

- Silicone keypad with tangible key click, can be operated with gloves
- For field operation available in a case set with proven sensors

### Technical Data

Model	Oxi 3205	Oxi 3210	Oxi 3310
Range/ Resolution/ Accuracy	O <sub>2</sub> Conc. 0.00 ... 20.00 mg/l (20.0 mg/l*) ±0.5 % of value; O <sub>2</sub> saturation 0.0 ... 200.0 % (200 %*) ±0.5 % of value; O <sub>2</sub> 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
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 35 fixed	Automatic from 0.0 ... 70.0, adjustable via display	
Calibration	OxiCal® rapid calibration in OxiCal®-SL or OxiCal®-D		
Memory/Logger	–	Manual 200	Manual 500/5000 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

## 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 <sub>2</sub> Conc.	0.00 ... 19.99 mg/l (19.9 mg/l*), 0.0 ... 90.0 mg/l (90 mg/l*)
	O <sub>2</sub> saturation	0.0 ... 199.9% (199%*), 0 ... 600%
Accuracy (±1 digit)	O <sub>2</sub> Conc.	±0.5% of value
	O <sub>2</sub> 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



## 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 DO sensors. WTW DO sensors are equipped with preassembled membrane caps preventing sensor prep errors caused by improper membrane installation, and have built-in temperature compensation capabilities.



### Galvanic Dissolved Oxygen Sensors

- 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**



*\* North American version*

## StirrOx® G

For all inoLab® Oxi 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



## 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



## Accessories

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

see WTW Product Details

Parameter

Multi-parameter

pH

ORP

ISE

Dissolved Oxygen (D.O.)

Conductivity

Data logger/flow + level

BOD/Respiration

Photometers

Turbidity

Colony Counter

Software/Printers

## 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