

## 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.



## Dissolved Oxygen Meters

Application Range Dissolved Oxygen Meters								
● Recommended by WTW  ○ Conditionally applicable   – Not recommended								
	inoLab <sup>®</sup>				Portable Meters			
Application Range	Multi IDS 😘	Oxi 7310	ProfiLine Oxi 1970i	MultiLine® IDS	Oxi 3205	Oxi 3210	Oxi 3310	Oxi 3315
Routine measurement	0	-	-	О	•	•	-	0
Routine measurement with documentation	•	•	•	•	-	_	•	•
AQA with documentation	•	•	•	•	-	_	•	•
R&D high precision	•	•	•	•	-	•	•	•
Control measurements	•	•	•	•	0	•	•	•
LIMS connection	•	•	•	•	_	_	•	•
Quality assurance	•	•	О	•	_	•	•	•
Training	0	•	0	0	0	•	0	0
Service	-	-	•	•	•	•	•	•
Laboratory measurements	•	•	•	О	_	_	0	0
Field measurements	-	-	•	•	•	•	•	•
Depth measurements	-	-	•	•	-	-	-	•
External control/ PC connection/ PC control	- • -	•	•	- • -	-	_	- • -	- • -
BOD measurements with self- stirring sensor	-	•	•	-	-	-	-	_
BOD measurements with assessment program	-	-	-	-	-	_	-	_
see page	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>II</sup> <sub>IS</sub> FDO® 925	ConOx	DurOx®	CellOx® 325	StirrOx® G	TA 197 Oxi
BOD measurements	•	-	-	О	•	-
Fish farming	0	•	•	О	-	-
Surface waters	•	•	О	•	_	_
Ground water	•	0	_	0	_	•
Control measurements	•	•	•	•	О	_
Depth measurements	● (25 m/82 ft.)	-	_	-	_	•
Laboratory measurements	•	0	_	•	О	_
Pharmaceuticals	•	О	О	•	_	_
Biotechnology (non-autoclavable)	•	0	0	•	_	_
Wastewater treatment plant: aeration tank	•	0	•	О	-	-
applicable instruments:	Oxi 3315, MultiLine®	Multi 350i/	ProfiLine Oxi,	all, except	inoLab® Oxi	1970i
	3410, 3420, 3430	3500i*	Multi 350i/	MultiLine®,	7310, 1970i	
* North American version	inoLab® Multi IDS		3500i*	Oxi 3315		

## 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.





#### 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







#### **Digital Laboratory Meters**

#### **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<sub>90</sub> for different applications
- Measures partial pressure, concentration and saturation
- Salinity corrections
- Storage for large measuring batches

Technical Data	
Model	inoLab® Multi 9310 IDS 🗓
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 📲

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.

Order No. 1FD354

IP 43



inoLab® Multi 9310 IDS SET 4



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





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





Laboratory Meters



Model	inoLab® Oxi 7310
	All values ±1 digit
Concentration	0.00 20.00 mg/l ±0.5 % Mw. 0 90 mg/L ±0,5 %
Saturation	0.0 200.0 % ±0.5 % v. Mw. 0 600 % ±0.5 % v Mw.
Partial pressure	0 200.0 hPa, 0 to 1250 hPa
Temperature	-5.0 105.0 °C ±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

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inoLab® Laboratory Dissolved Oxygen Meter SETs		
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, galvanical 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





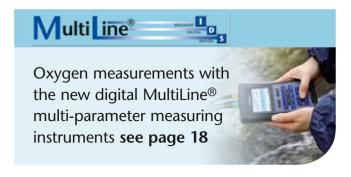


For other SETs or sensors in SET, see WTW Product Details

## 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.





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

... with the Multi 3410

General Features

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 🖳

- 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

- Adjustable t<sub>90</sub> for different applications
- Measures partial pressure, concentration and saturation
- Multi-parameter instrument
- Color display
- USB-A socket



GCIICI	ar react	1163		
Model		Multi 3410 🖳		
Data storage	•	manual 500/10000 automatic		
Data logger		manual/time-controlled		
Interface		USB-A and Mini USB	USB-A and Mini USB	
Power supply		Universal power supply with charging function or 4 x 1.2 V NiMH akku		
		rmation		
MultiLine® <sup>II</sup>	0 S		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.			
Multi 3410 SET 5	Same as 2FD454, probe FDO® 925-3	but with optical IDS DO 3.	2FD455	
IP 67 CETLUS 3 Year For other sensors in SET see WTW Product Details				

NEW

#### 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<sub>90</sub> for different applications
- Measures partial pressure, concentration and saturation
- Salinity corrections
- Storage for large measuring batches



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Model	Oxi 3315	9888	The state of the s
Display	LCD graphic, backlit		
Calibration	vapor-saturated air, if applicable against external standard		ENTER
Data storage	manual 500 data records; automatic 5 000 data records	<b>*</b>	
Data output	.csv or ASCII	100	
Measuring channel	1		
Logger	manual/time-controlled	Ox	3315
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		
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)



#### 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<sup>®</sup> Importer, included in the delivery scope or as download).

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





Portable Meters

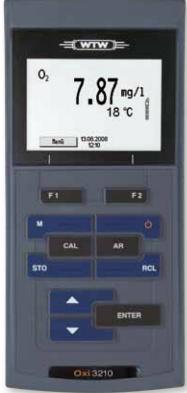
#### Measuring DO precisely...

#### ... 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

#### 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.

- 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).

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

Model	Oxi 3205	Oxi 3210	Oxi 3310
Resolution/ $O_2$ saturation Accuracy $O_2$ part. pressure	0.00 20.00 mg/l (20.0 mg/l*) ±0.5 % 0.0 200.0 % (200 %*) ±0.5 % of valuation of valuati	ue; $0 \dots 600 \% \pm 0.5 \%$ of value of value, $0 \dots 1250$ mbar $\pm 0.5 \%$ of valu	e
Temperature compensation	Better than 2% at 0 +40 °C (32 10	04 °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 ba	acklight	
Ordering Infor	mation		
ProfiLine Portable Dissolved Oxyg	gen Meter SETs		Order No
Oxi 3205 SET 3	Robust and waterproof portable dissolve DurOx® 325 and accessories	ed oxygen meter for battery operation, ca	ase set with 2BA10
Oxi 3210 SET 1	Robust and waterproof portable dissolve case set with CellOx® 325 and accessori	ed oxygen meter including memory, for bees	pattery operation, 2BA20
Oxi 3310 SET 1	Robust and waterproof portable dissolve B interface, for battery operation, case s	ed oxygen meter including memory, data	logger and USB mini 2BA30









Portable & Field 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 pressureresistant 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.

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

#### Ordering Information

Portable Dissolved Oxygen Field MeterOrder No.ProfiLine Oxi 1970iRobust, waterproof, submersible dissolved oxygen meter3830-010







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

## 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



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Dissolved Oxygen Sensors

#### 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 lenghts)
- 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.

Ordering Information			
Dissolved oxygen senso	rs (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