

Optical and electrochemical D.O. sensors. Innovative and reliable solutions!

The right choice of measuring technology for D.O. is of essential importance for the performance of the wastewater plant. WTW offers well proven electrochemical and innovative optical D.O. sensors.

The optical sensor FDO® 700 IQ

FDO® 700 IQ

- No incident flow needed
- Insensitive against bubbles
- Low costs of ownership



*Detailed description of the used FDO® technology
is available on pages 10 and 11.*

FDO®: Fluorescence D.O. Measuring – What exactly does this mean?

The optical principle:

With the optical method a fluorescent dye is stimulated in the membrane of the FDO® 700 IQ by a short wave length lightsource. By falling back into the passive state, long wave light is emitted, which is recorded as a measurement signal. If oxygen contacts the dye by diffusing through the membrane the period of back scattering light is shortened according to the oxygen concentration of the sample. In principle the measurement of the fluorescent signal come back to a highly precise time measurement.

D.O. sensors of the first generation had a handful of technical issues to cope with.

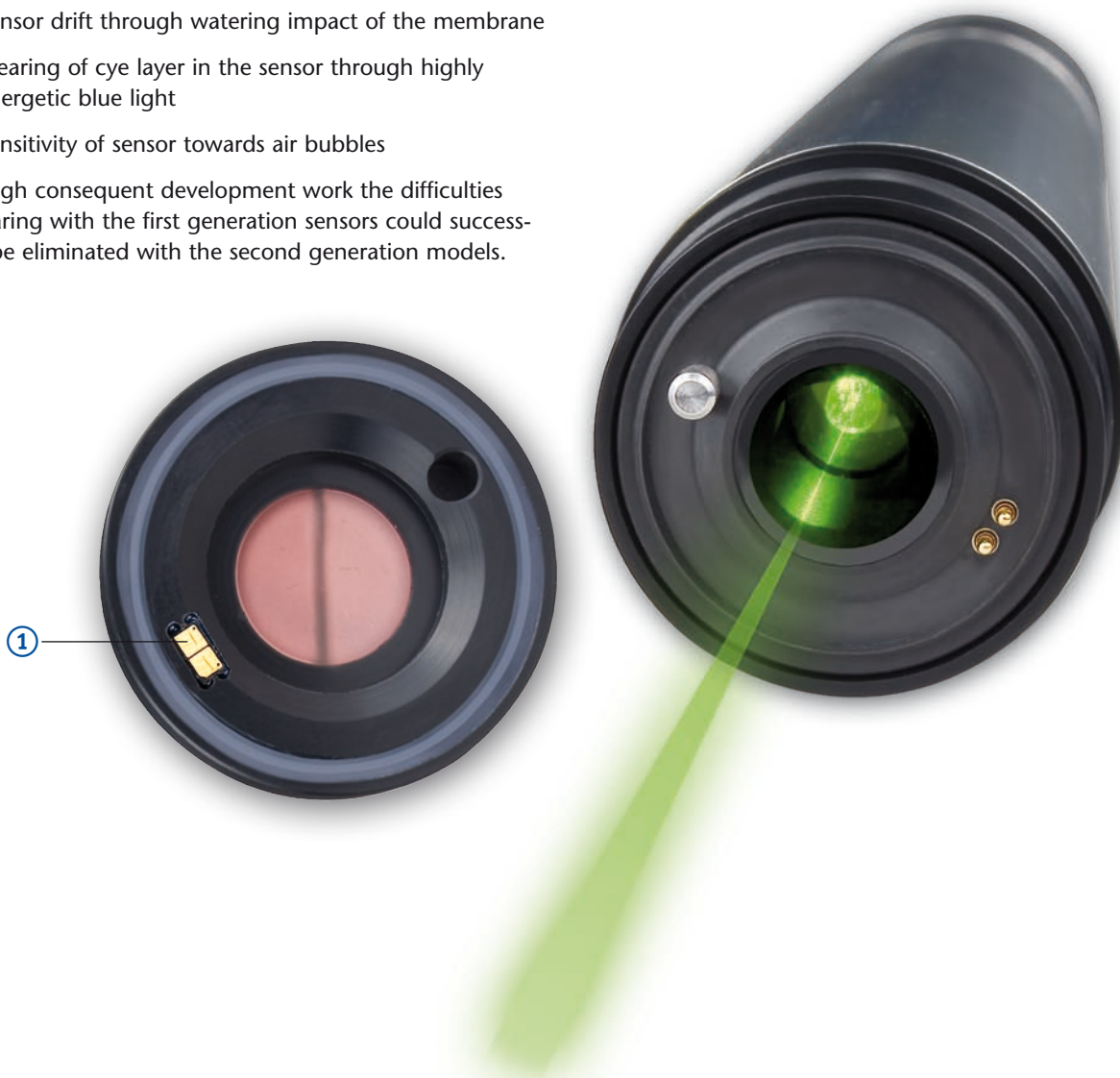
- Sensor drift through watering impact of the membrane
- Wearing of cye layer in the sensor through highly energetic blue light
- Sensitivity of sensor towards air bubbles

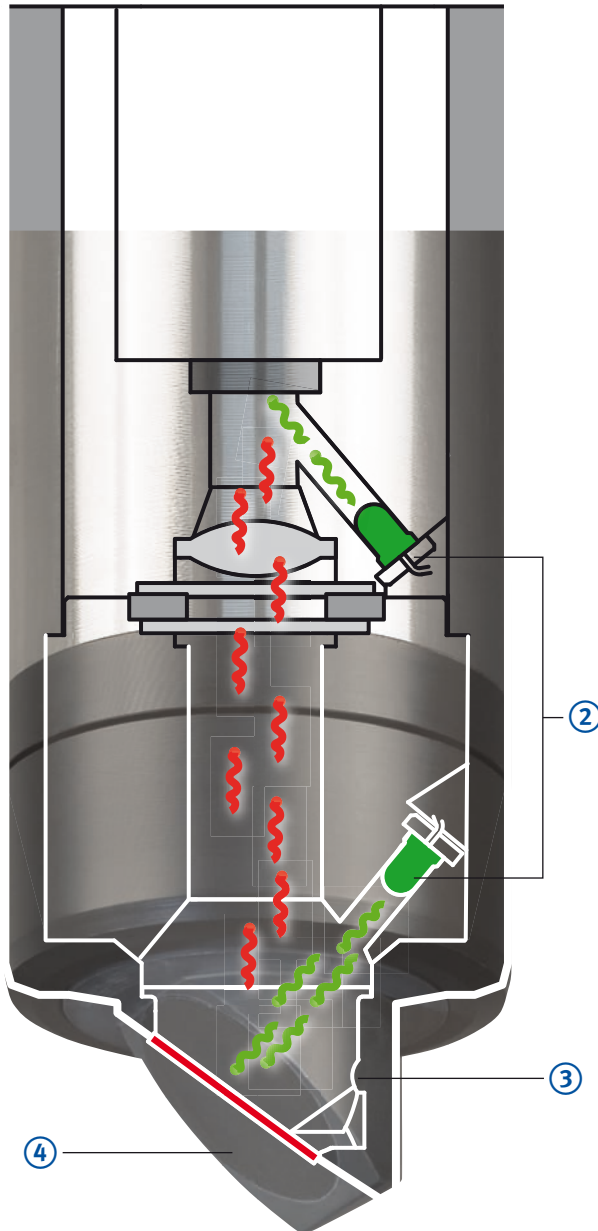
Through consequent development work the difficulties appearing with the first generation sensors could successfully be eliminated with the second generation models.

The following technologies are used:

① IQMC Technology

Each cap is individually factory calibrated. The calibration data are permanently stored on a chip which is installed in the membrane cap.





② EPRS = Equal Path Reference System

Measuring and reference path as well as optical components are identically designed with this sensor.

Natural aging processes of the optical components can therefore be compensated by the reference path and accordingly compensated in the measuring path. This causes a continuous high performance of the sensor.

③ GLT = Green-light Technology

By stimulating the fluorescent reaction in the membrane with low energetic green-light, a bleaching of the fluorescent dye in the sensor membrane is avoided. This leads to a membrane lifetime of min. 2 years.

④ 45° Technology

The membrane SC-FDO® has a horizontal slope of 45°. A congestion of air bubbles in front of the membrane, as experienced with the first-generation of optical D.O. sensors, is therefore avoided.

C² calibration:

The optical measuring technology is based on an attenuated fluorescent signal in a defined time frame. The D.O. measuring is more or less a highly precision time measurement. In order to process this time measurement as precise as possible, the sensor optics are calibrated to the speed of light. This natural constant "c" is defined as the time that a light beam needs to go from point A to point B – in short: the speed of light.

The sensor is precisely calibrated against a physical constant.

The interaction of these technologies makes the FDO® a non-calibration sensor.

TriOxmatic® and FDO® in comparison

Analog (electrochemical)	
	TriOxmatic® 700 / 690 / 701
Measuring principle	Electrochemical
Membrane exchange	Yes – exchange of membrane and electrolyte
Calibration	Yes – rarely
Drift behavior	Yes
Sulfide and ionogenic substances	Influence
Measuring range	Up to 60 mg/l
Self-diagnosis system	Yes
Trace sensor	Yes
Investment costs	Reduced
Calibration data storage	No
Signal output	Analog
Integrated lightning protection	Yes

TriOxmatic® 700/700 IN

The standard Model TriOxmatic® 700 is a rugged dissolved oxygen sensor with a very durable 50 micron thick hydrophobic membrane, a minimal flow rate of 0.5 cm/sec and a medium response time of less than 180 sec. With these features, this membrane sensor is ideally suited for any D.O. measurement in biological purification stages of municipal waste water treatment plants; e.g. control of the oxygenation. The response of the sensor prevents signal disturbances due to rising air bubbles thus eliminating false readings and improved stability. This is specially important for measurements in aeration tanks.

TriOxmatic® 690

This cost-effective D.O. sensor offers the same specifications and features as the Model TriOxmatic® 700, except it does not have the sensor monitoring function. This unit is primarily designed for conventional D.O. measurements, where a continuous membrane check is not needed; e.g. general applications in water quality analysis.

TriOxmatic® 701

Equipped with a special 25 micron thick membrane, the Model TriOxmatic® 701 features an enhanced resolution and a faster response time. This sensor is ideally suited for low level concentration applications; e.g. measurements of residual oxygen in the denitrification of biological sewerage treatment.

Digital (electrochemical/optical)	
TriOxmatic® 700 IQ / 701 IQ / 702 IQ	FDO® 700 IQ
Electrochemical	Optical
Yes – exchange of membrane and electrolyte	Yes – exchange cap – self-recognition of cap via IQMC technology
Yes – rarely	No
Yes	No
Influence	No influence
Up to 60 mg/l	Up to 20 mg/l
Yes	No
Yes	No
Reduced	Higher
Yes	Yes (IQMC technology)
Digital	Digital
Yes	Yes

FDO® 700 IQ

Optical working D.O. sensor for the measuring and control of oxygen concentration in the biological cleaning process of wastewater plants, no flow required and H₂S insensitive. Digital sensor for connecting to the IQ SENSOR NET.

TriOxmatic® 700 IQ

Universal oxygen sensor for measuring and controlling oxygen input in biological sewage treatment processes in wastewater treatment plants. Membrane, flow rate and response times equivalent to TriOxmatic® 700, however as digital sensor with calibration value memory for connection to IQ SENSOR NET.

TriOxmatic® 701 IQ

O₂ sensor with increased resolution and improved response times. Technical specifications equivalent to TriOxmatic® 701, however as digital sensor with calibration value memory for connection to IQ SENSOR NET.

TriOxmatic® 702 IQ

Providing similar performance data as the TriOxmatic® 701, the 702 IQ model is specifically designed for trace level measurements in the ppb range. This sensor is ideally suited for use in ultra-pure water applications; e.g. monitoring of boiler feed water or drinking water purification. The applied digital technology permits integrated storage of calibration values and simple connection to IQ SENSOR NET.

Technical Data						
Type	Analog		Digital			
	TriOxmatic® 690/700 (SW*)/700 IN	TriOxmatic® 701	TriOxmatic® 700 IQ (SW*)	TriOxmatic® 701 IQ	TriOxmatic® 702 IQ	FDO® 700 IQ (SW*)
Measuring method	Electrochemical	Electrochemical	Electrochemical	Electrochemical	Electrochemical	Optical
Measuring range (25 °C)						
O ₂ concentration	0.0 ... 60.0 mg/l	0.00 ... 20.00 mg/l 0.0 ... 60.0 mg/l	0.0 ... 60.0 mg/l	0.00 ... 20.00 mg/l 0.0 ... 60.0 mg/l	0 ... 2000 µg/l 0.00 ... 10.00 mg/l	0 ... 20.00 mg/l (0 ... 20.00 ppm)
O ₂ saturation	0 ... 600% <i>(depending upon the selected monitor model)</i>	0.0 ... 200.0% 0 ... 600%	0 ... 600%	0.0 ... 200.0% 0 ... 600%	0 ... 110%	0 ... 200.0 %
Resolution						
O ₂ concentration	0.1 mg/l	0.01 mg/l 0.1 mg/l	0.1 mg/l	0.01 mg/l 0.1 mg/l	0.001 mg/l 0.01 mg/l	0.01 mg/l (0.01 ppm)
O ₂ saturation	1%	0.1 % 1%	1%	0.1% 1%	0.1%	0.1 %
Response time at 25 °C	t ₉₀ : 180 s	t ₉₀ : 30 s t ₉₉ : 90 s	t ₉₀ : 180 s	t ₉₀ : 30 s t ₉₉ : 90 s	t ₉₀ : 30 s t ₉₉ : 110 s	t ₉₀ : < 150 s t ₉₅ : < 200 s
Minimum flow rate	0.05 m/s	0.23 m/s	0.05 m/s	0.23 m/s	0.3 m/s	No drift required
SensCheck	SensLeck (700/700 IN) SensReg (700/700 SW)	SensLeck SensReg	SensLeck (700 IQ) SensReg (700 IQ/ 700 IQ SW)	SensLeck SensReg	– SensReg	Monitoring of membrane function
Signal output	Analog	Analog	Digital	Digital	Digital	Digital
Sensor memory for calibration values	–	–	Yes	Yes	Yes	Yes (factory calibrated)
Power consumption	–	–	0.2 Watt	0.2 Watt	0.2 Watt	0.7 Watt
Temp. measurement	Integrated NTC, 23 ... 122 °F (-5 °C ... +50 °C)		Integrated NTC, 23 ... 140 °F (-5 °C ... +60 °C)			
Temp. compensation	32 ... 122 °F (0 °C ... +50 °C)		32 ... 140 °F (0 °C ... +60 °C)			23 ... 122 °F (-5 °C ... +50 °C)
Maximum pressure	10 bar		10 bar (incl. sensor connection cable)			
Ambient conditions	Operating temperature: 32 ... 122 °F (0 °C ... +50 °C) Storage temperature: 32 ... 122 °F (0 °C ... +50 °C)		Operating temperature: 32 ... 140 °F (0 °C ... +60 °C) Storage temperature: 32 ... 149 °F (0 °C ... +65 °C)			23 ... 122 °F (-5 °C ... +50 °C) -13 ... 122 °F (-25 °C ... +50 °C)
Electrical connections	Integrated PU connection cable with fitted 7-pole screw connector (IP65)		2-wire shield cable with quick fastener to sensor			
Input power	Power by WTW D.O. monitor		Powered by IQ SENSOR NET			
Translet voltag protection	Yes		Yes			
EMI/RFI Conformance	EN 61326 Class B, FCC Class A		EN 61326, Class B, FCC Class A; Intended for indispensable operation			
Certifications	CUL, UL		CE, cETLus			
Mechanical	Membrane head assembly, locking cap: POM Sensor body: 316 Ti stainless steel Protection rating: IP 68		Membrane head assembly, locking cap: POM Sensor body: 316 Ti stainless steel Protection rating: IP 68			Sensor cap, fixation: POM, PVC, silicone, PMMA housing shaft: VA steel 1.4571 protection type IP 68
Dimensions (length x diameter)	7.83 x 1.57 in. (199 x 40 mm) SW: 8.90 x 2.34 in. (226 x 59.5 mm)		14.17 x 1.57 in. (360 x 40 mm); SW: 14.17 x 2.34 in. (360 x 59.5 mm)			15.75 x 1.57 in. (400 x 40 mm) SW: 15.75 x 2.34 in. (400 x 59.5 mm)
Weight (Approx.)	1.46 lb (660 g); SW: 1.90 lb (860 g)		1.46 lb (660 g, without sensor connection cable); SW: 2.58 lb (1,170 g)			1.98 lb (900 g) SW: 3.31 lb (1.5 kg)
Guaranty	2 years for sensor acc. § 10 AGB		2 years for sensor acc. § 10 AGB			

Ordering Information

Dissolved Oxygen Sensors	Order No.
TriOxmatic® 700-7	D.O. sensor for water/wastewater; oxygenation determination; cable length 23 ft. (7.0 m) 201 670
TriOxmatic® 690-7	Same as model 700-7, but without SensCheck function; cable length 23 ft. (7.0 m) 201 690
TriOxmatic® 701-7	D.O. sensor for water/wastewater; oxygenation/residual oxygen determination; cable length 23 ft. (7.0 m) 201 678
TriOxmatic® 700 IN-7	D.O. sensor for highly polluted industrial wastewater; cable length 23 ft. (7.0 m) 201 695
TriOxmatic® 700 IQ	D.O. sensor for water/wastewater; oxygenation determination 201 640
TriOxmatic® 701 IQ	D.O. sensor for water/wastewater; oxygenation/residual oxygen determination 201 644
TriOxmatic® 702 IQ	D.O. sensor, ppb measuring range; ultrapure water/boiler feedwater 201 646
FDO® 700 IQ	Digital calibration-free optical O ₂ sensor for water/wastewater, determination of oxygen concentration 201 650
FDO® 700 IQ SW	Digital calibration-free optical O ₂ sensor for water/wastewater, determination of oxygen concentration in sea water 201 652
SACIQ-7,0	Sensor connection cable for all IQ sensors, cable length 23 ft. (7.0 m) 480 042



Further cable lengths and special seawater/brackwater designs see brochure "Product Details"

* SW: Sensor in sea water design (with plastic armouring (POM))