



IQ SENSOR NET – the range

SECURE. MODULAR. FLEXIBLE.



a xylem brand

IQ SENSOR NET – the System for Wastewater Treatment Plants and more applications

The digital and modular IQ SENSOR NET from WTW provides many unique advantages. Since 2001 our customers have enjoyed making the most of the IQ SENSOR NET modular design. It enables to easily expand the network with new members. This provides real flexibility and peace of mind that you are completely future proofed for all wastewater monitoring requirements.

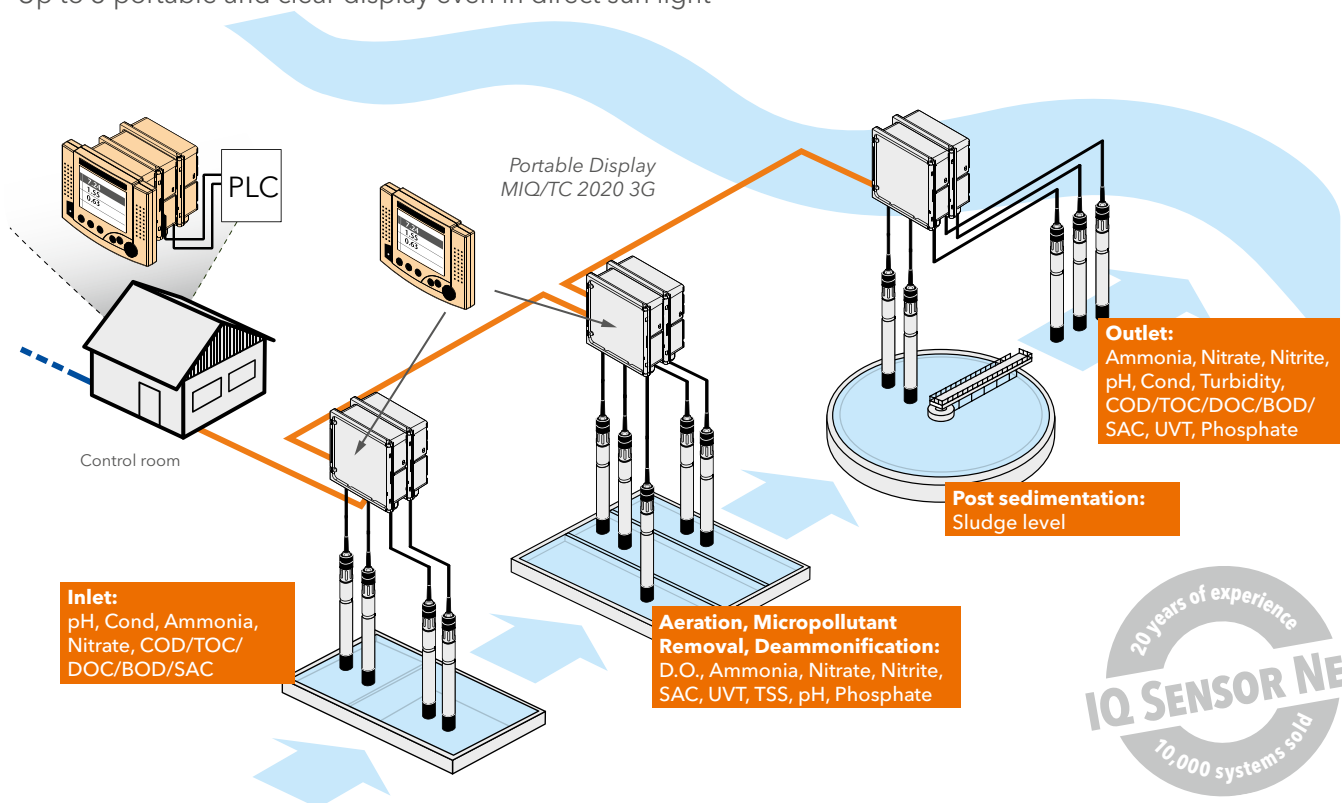
- Integrated overvoltage protection of all components (sensors, modules, cables)
- Reduce cost of installation with universal sensor connection and 2 wired cables rather than multiple power and output cables
- Intuitive design to operate and expand



At the beginning of your planning, make your decision between 3 systems:

1) IQ Sensor Network: System 2020 3G

- For up to 20 digital IQ sensors in any order
- Measuring network for large plants, BackUp controller function for higher operational safety
- Ethernet/LAN interface and integrated webserver for easy network connection
- Fast and easy saving of logbook data, measured values and configurations for additional safety and easy and safe software updates via USB stick
- Up to 3 portable and clear display even in direct sun light



Oxygen measurement with FDO® 700 IQ

- Calibration free sensor
- Reduces energy and operational costs
- Long lifetime of membrane cap
- Precise results without drift

Ammonia & Nitrate measurement with ISE sensors (e.g. VARiON®Plus 700 IQ)

- Easy and fast matrix adjustment
- Up to 2.000 mg/l NH₄
- Extremely robust electrodes
- Compensation with K and Cl

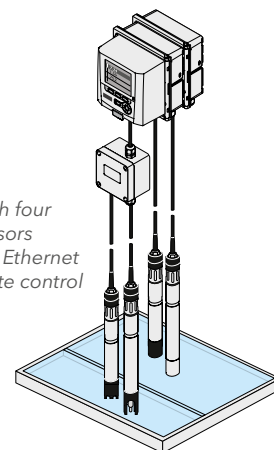
The wetchemistry revolution is now: Alyza IQ PO₄ and NH₄

- Minimized reagent consumption and waste
- Extremely low maintenance
- Reliable results also in low measuring ranges

2) Outstanding among the Compact: System 282/284

- Multi-channel controller for up to 4 IQ sensors provides easy and lowcost expansion
- Up to 20 parameters can be visualized at the same time
- Includes free-of-charge webserver for full remote control
- Perfectly suited to replace or add single measuring point
- Simple Data transfer and download with USB stick at every controller
- Optional: Ethernet and RS 485 interface for network connection and fieldbus communication (Profinet, etc.)

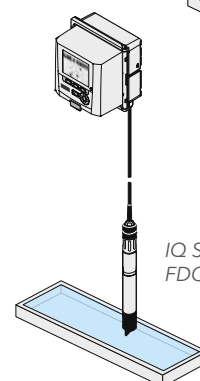
IQ System 284 with four connected IQ sensors (6x mA, 6x Relays, Ethernet interface for remote control as option)



3) The Single Parameter Measuring Point: System 281

- Low-cost entrance into the digital measuring technique
- For the parameters pH/ORP, Cond, D.O. and Turbidity
- Stable, robust and reliable measuring technique

IQ System 281 with FDO® 700 IQ



All Parameters at a Glance

Parameters	Sensors													
	TriOxmatic® 700 IQ	FDO® 700/701 IQ	Sensolyt® 700 IQ	TetraCon® 700 IQ	VisoTurb® 700 IQ	ViSolid® 700 IQ	AmmoLyt® 700 IQ	NitraLyt® 700 IQ	VARION® 700 IQ	NitraVis® 701/705 IQ (TS)	NitraVis® 701/705 IQ NI	CarboVis® 701/705 IQ (TS)	NiCaVis® 705 IQ (TS/SF)	NiCaVis® 701/705 IQ (NI) SF
Usable with System 2020 3G and 282/284	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Usable with System 281*	■	■	■	■	■									
Parameter	TD D2.01 to D2.26													
Temperature	■	■	■	■			■	■	■					
Dissolved Oxygen (electrochemical)	■													
Dissolved Oxygen (optical)		■												
pH/ORP			■											
Conductivity				■										
Salinity				■										
TDS				■										
Turbidity (optical)					■									
TSS (optical)					■	■				■		■		
Ammonia (ion-selective)							■		■					
Ammonia (optical/wetchemical)														■
Nitrate (ion-selective)								■	■					
Nitrate (optical/spectral)										■	■		■	†
Nitrite (optical/spectral)										■			■	
Potassium (ion-selective)							■		■					
Chloride (ion-selective)								■	■					
COD/BOD/TOC/DOC (optical/spectral)												■	■	■
SAC and UVT (optical/spectral)												■	■	■
Sludge Level														■
Orthophosphate (optical/wetchemical)														■

† Nitrite and Nitrate are included in the measured value.

Systems in Detail

Module	 D1.01 to D1.10	MIO/PS	MIO/24V	MIO/C6	MIO/R6	MIO/CR3	MIO/IC2	MIO/3-MOD	MIO/3-PR	MIO/JB	MIO/JBR	MIO/WL PS (SET)	MIO/TC20203G	Terminal IQ	MIO/MC3	MIO/MC3-MOD	MIO/MC3-PR	Cleaning Air Box - 230 VAC	Cleaning Air Box - 115 VAC	MIO/CHV PLUS
Usable with System 2020 3G		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Usable with System 282/284		■	■	■	■	■	■			■		■						■	■	■
Available IQSN connectors		3	3	2	2	2	2	2	2	4	4	3	✗	✗	2	2	2	✗	✗	2
Module features																				
Power supply																				
100...240 V AC		■																		
24 V AC/DC			■																	
Analog outputs/relays																				
6 x 0/4...20 mA				■																
6 x Relais					■															
3 x 0/4...20 mA, 3 x Relais						■														
Analog inputs																				
2 x 0/4...20 mA							■													
Interfaces																				
MODBUS								■								■				
PROFIBUS									■								■			
USB							■	■	■			■	■	■	■	■	■			
Ethernet/LAN (Profinet, Ethernet/IP, Modbus TCP)															■	■	■			
Intra-system connectivity																				
4 available IQSN connectors										■										
4 available IQSN connectors including signal amplification for large distances											■									
Radio transmission												■								
Controller																				
Controller/Terminal (with Display)												■	■*							
Controller in standard IQ module without display															■	■	■			
Compensation																				
Air-pressure compensation for D.O. measurement															■	■	■			
Compressed air cleaning																				
Air compressor 230 VAC																		■		
Air compressor 115 VAC																			■	
Valve for automatic cleaning																				■

■ USB interface only for software updates

* No controller or controller backup functionality





Online D.O. Measurement

Measuring · Monitoring · Controlling

Reliable and continuous measurements of dissolved oxygen have become of vital importance in many areas of the water/wastewater treatment facilities. The availability of accurate and timely measured concentration values is an absolute need for process monitoring and dynamic process control to ensure an efficient plant operation.

For more than 50 years now, WTW has been recognized as a leader in the field of Dissolved Oxygen measurements. Innovative technologies, creative and continuous product development, and extensive application expertise have resulted in superior instruments and systems of outstanding performance, reliability and design for the most precise online measurements available. The optical D.O. sensor FDO® 700 IQ combines state-of-the-art technology with application applied benefits.

Online D.O. Measurement

- Water/Wastewater Treatment
- Water Pollution Control
- Fishfarming/Aquaculture

D.O. Monitoring and Control

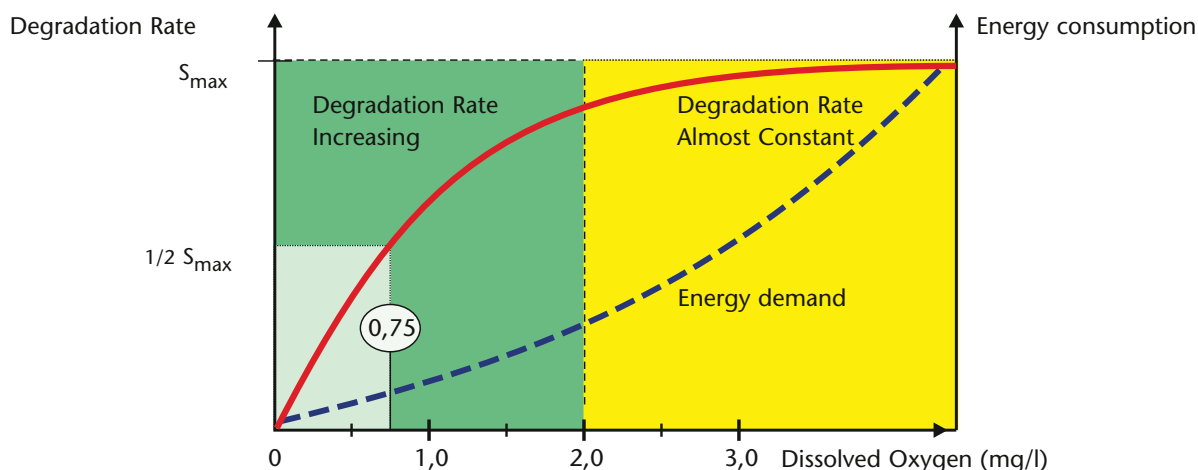
In the biological nutrient removal process of wastewater treatment plants, continuous and precise measurement of dissolved oxygen concentration is of vital importance to an optimal and trouble free operation of the water/wastewater treatment facility. The efficiency and energy demand of the purification process, either in the nitrification and denitrification phase, is mainly determined by the performance of the aeration control system; i.e., by a load-rate controlled oxygenation in the aeration basin.

In the presence of dissolved oxygen, the nitrifying bacteria convert ammonia to nitrate. The activity of the microorganisms depends on the oxygen concentration, with an economical limit at about 2 mg/l. Higher oxygen concentrations do not increase the rate of degradation, but requires significantly more energy for the oxygen blowers (see illustration).

Controlling the aerator operation to a minimum run time, depending on the required oxygen concentration, helps in saving energy and maintenance costs. This is because the aerator equipment is the most energy consuming part of a biological wastewater treatment plant.

The residual dissolved oxygen in the sludge, however, has a negative effect on the conditions in the denitrification stage. Due to this reason a minimal O_2 concentration in the denitrification is targeted. On the other hand in nitrification, the oxygen concentration is aimed for, ideally covering the requirements for biology. Only the use of precise and reliable on-line measuring instruments will ensure an efficient and energy saving control of the process.

NH_4 -N Degradation Rate vs. D.O. Concentration



WTW D.O. Measurement Systems

WTW has been continuously designing, manufacturing and satisfying the demands for reliable dissolved oxygen measurements with the most advanced online systems available anywhere.

The WTW product line includes a wide range of precision D.O. sensors and monitors as well as the revolutionary IQ SENSOR NET system so that the optimum system configuration can be chosen for the particular application.

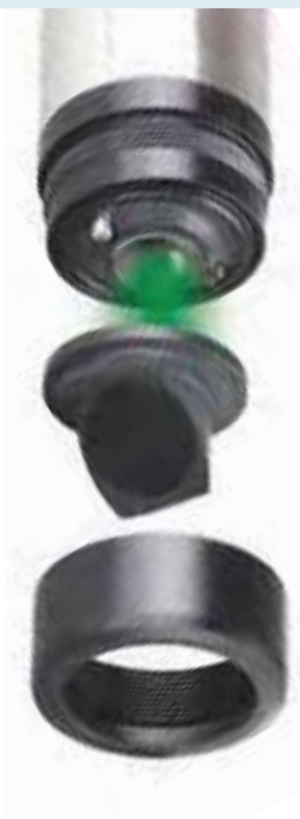
Optical and electrochemical D.O. sensors. Innovative and reliable solutions!

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.

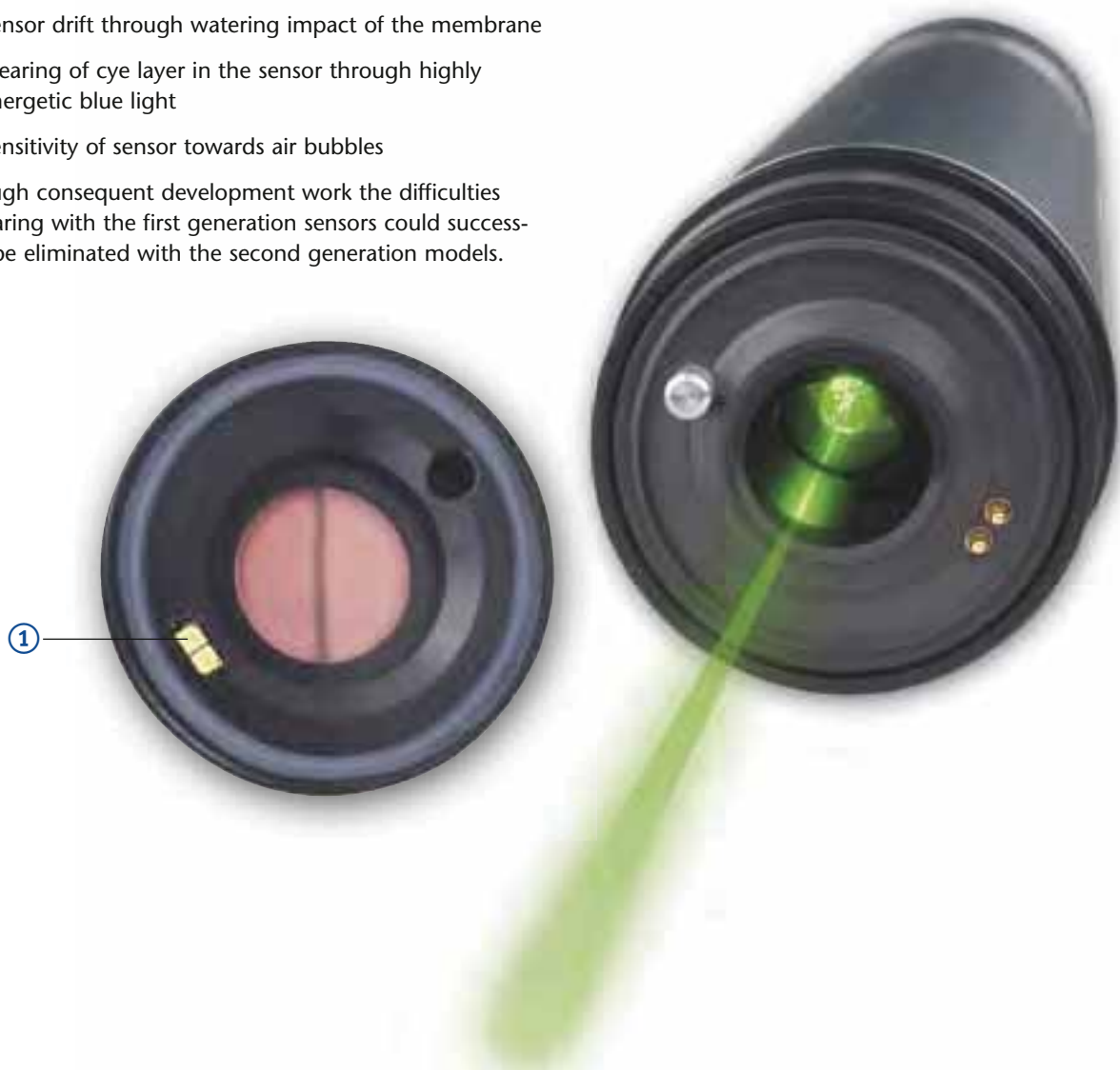
- Sensor drift through watering impact of the membrane
- Wearing of cye layer in the sensor through highly energetic blue light
- Sensitivity of sensor towards air bubbles

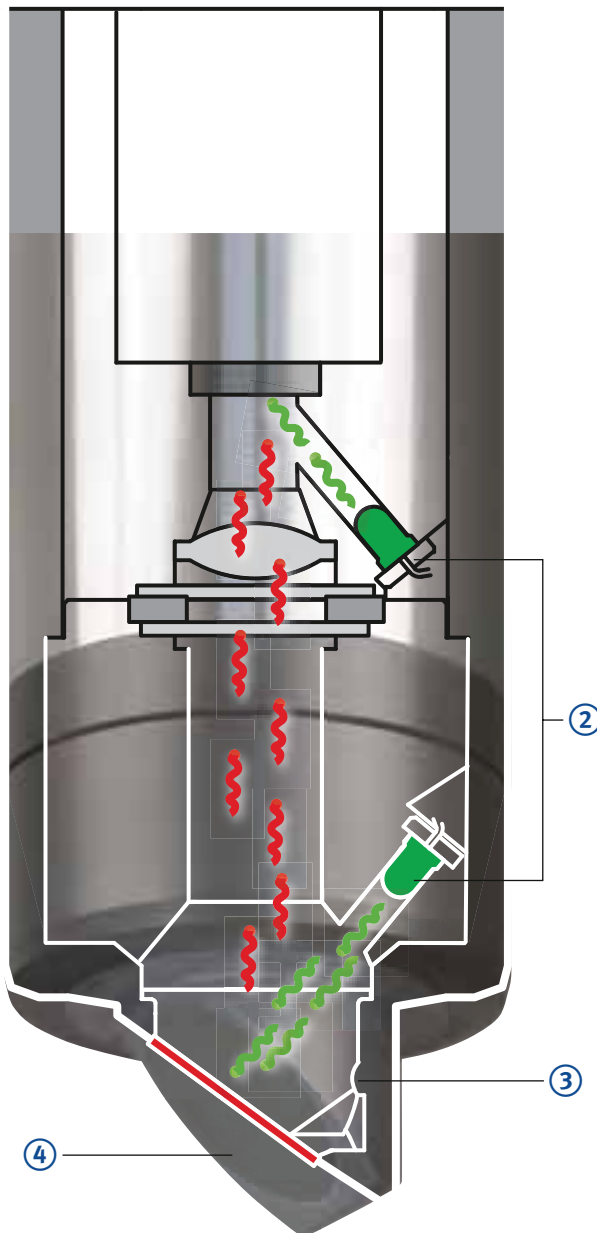
Through consequent development work the difficulties appearing with the first generation sensors could successfully be eliminated with the second generation models.

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 a 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.

Technical Data digital D.O. Sensors

Type	TriOxmatic® 700 IQ (SW*)	TriOxmatic® 701 IQ	TriOxmatic® 702 IQ	FDO® 700 IQ (SW*)	FDO® 701 IQ (SW*)
Measuring method	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 ... 2000 µg/l 0.00 ... 10.00 mg/l	0 ... 20.00 mg/l (0 ... 20.00 ppm)	
O ₂ saturation	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	0.001 mg/l 0.01 mg/l	0.01 mg/l (0.01 ppm)	
O ₂ saturation	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 : 30 s t ₉₉ : 110 s	t ₉₀ : <150 s t ₉₅ : <200 s	t ₉₀ : <60 s t ₉₅ : <80 s
Minimum flow rate	0.05 m/s	0.23 m/s	0.3 m/s	No drift required	
SensCheck	SensLeck (700 IQ) SensReg (700 IQ/ 700 IQ SW)	SensLeck SensReg	– SensReg	Monitoring of membrane function	
Signal output	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 ... 140 °F (-5 °C ... +60 °C)				
Temp. compensation	32 ... 140 °F (0 °C ... +60 °C)			23 ... 122 °F (-5 °C ... +50° C)	
Maximum pressure	10 bar (incl. sensor connection cable)				
Ambient conditions	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)	23 ... 104 °F (-5 °C ... +40 °C) -13 ... 104 °F (-25 °C ... +40 °C)
Electrical connections	2-wire shield cable with quick fastener to sensor				
Input power	Powered by IQ SENSOR NET				
Translet voltag protection	Yes				
EMI/RFI Conformance	EN 61326, Class B, FCC Class A; Intended for indispensable operation				
Certifications	CE, cETL, ETL				
Mechanical	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)	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)	
	incl. connection thread of SACIQ sensor connection cable				
Weight (Approx.)	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				



Online Conductivity Measurement

Measuring · Monitoring · Controlling

Conductivity is a well recognized, and sometimes indispensable, parameter of state-of-the-art water, wastewater and industrial process analysis. Continuous measuring systems are employed to monitor the salt load at the influent of wastewater treatment plants, to control quality of drinking water and ultra-pure water or to determine non-specific contaminants in industrial processes.

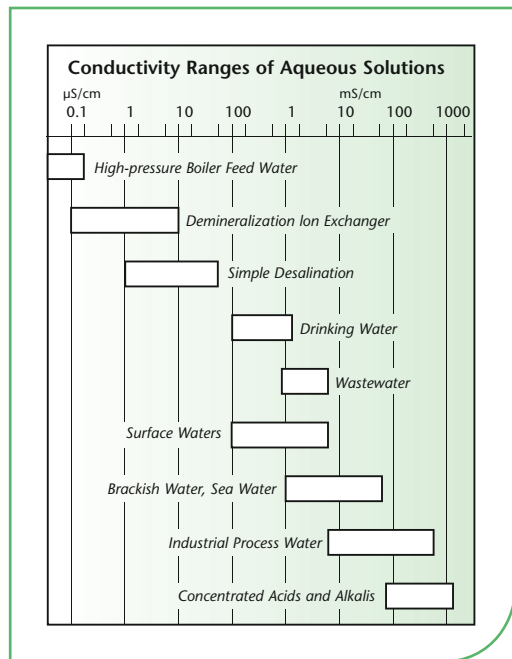
On-line Conductivity Measurements

- Municipal and Industrial Wastewater
- Water Treatment
- Surface Waters
- Sea Water, Brackish Water, Fishfarming
- Boiler Feed Water
- Demineralization
- Industrial Process Media

For more than 60 years, WTW has been one of the leading manufacturers of precision conductivity measurement systems, setting new standards with innovative sensor technology and fully evolved designs tailored to practical applications. WTW products meet the most stringent requirements set by industry for continuous on-line analysis instruments.

A special measuring transducer as well as sensors and accessories are available for use in explosion-proof areas (see brochure "Product Details").

Conductivity



Conductivity as a summation parameter is a measure of the level of ion concentration of a solution. The more salts, acids or bases are dissociated, the greater the conductivity of the solution. In water or wastewater it is mainly a matter of the ions of dissolved salts, and consequently the conductivity is an index of the salt load in wastewater or, respectively, the purity of potable water. The measurement of conductivity is also widely used in industrial production, such as process control in food and pharmaceutical industries.

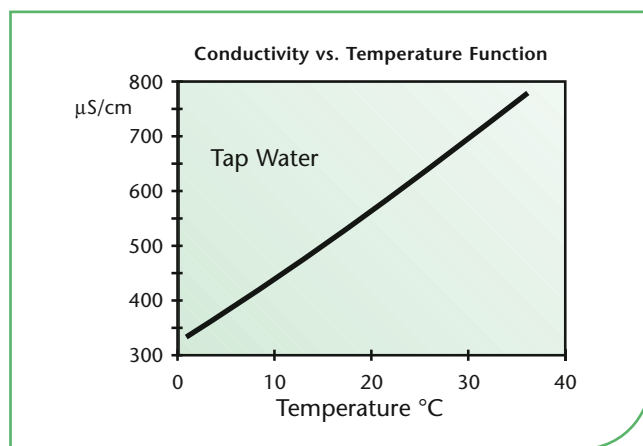
The measurement of conductivity is generally expressed in S/cm (or mS/cm) which is the product of the conductance of the test solution and the geometric factor of the measuring cell. The scale for aqueous solutions starts at a conductivity of 0.05 μS/cm (at 77 °F/25 °C) for ultrapure water. The conductivity of natural waters, such as drinking water or surface water is typically in range of 100 - 1000 μS/cm. The upper End of the scale is reached by some acids and alkalis.

Temperature Compensation

The conductivity of a solution is critically dependent on temperature. Therefore, the conductivity readings must be referred to a common reference temperature (77 °F/25°C) for comparability. The term "temperature compensation" is used in the sense of a mathematical conversion; i.e. a measured conductivity $\kappa(\vartheta)$ at any given temperature to the corresponding conductivity value that would be taken at the reference temperature $\kappa(77\text{ °F}/25\text{ °C})$.

The conductivity of most aqueous solutions varies more or less linearly with temperature ϑ . In these cases, a linear correction function to compensate for the influence of temperature can be used. For example, the correction coefficient for sewage is approx. 2%/K.

WTW monitors automatically calculate the corrected conductivity values based on the selected temperature coefficient. For the compensation of natural water a non-linear function (nLF) (i.e., built-in table for natural water properties) is available.



TetraCon® Conductivity Cells

TetraCon® 700/700 IQ

- 4-electrode Design
- Extremely robust and durable
- Large measuring range with only a single cell
- Highly resistant to fouling



TetraCon® 700 IQ

Compared to the 2-electrode sensors, the TetraCon® 4-electrode measuring procedure offers considerable application targeted advantages, especially in the area of higher conductivities.

TetraCon® 700 conductivity sensors are especially suitable for use in wastewater treatment plants dealing with highly loaded sewage. Due to the special measuring technique employed, severe influences from polarization effects are eliminated, resulting in improved accuracy of the sensor. Provided the devices are installed in accordance with the manufacturer's instructions, errors due to the distortion of the current and voltage fields are also avoided.

The special cell geometry of the TetraCon® 700 makes it impervious to fouling, and the abrasion resistant carbon electrodes are also easy to clean. The modern epoxy resin encapsulation technique used diminishes the likelihood of sensor breakage in harsh industrial environments.

The TetraCon® 700 as digital model TetraCon® 700 IQ is also available for connection to IQ SENSOR NET. This version is specially featured by a larger measuring range (10 μ S/cm ... 500 mS/cm).

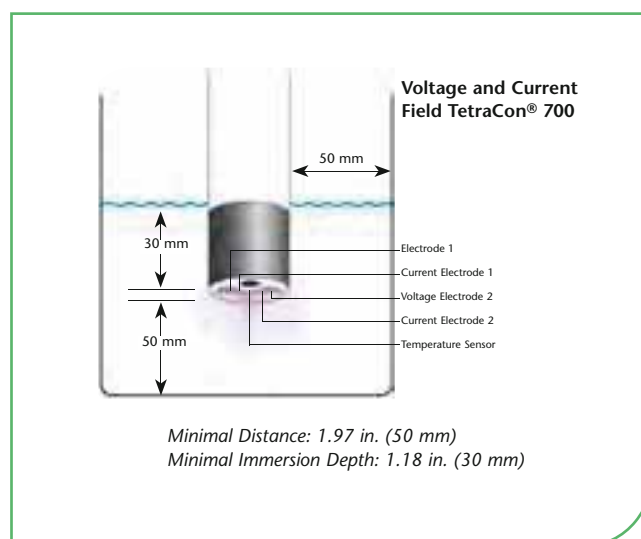
Furthermore, TetraCon® 700 SW seawater model for fish-farming has proven quality for harsh weather conditions, in salt water and with wave action.

TetraCon® 4-electrode Design

The conductivity of a given electrolyte is determined by an electro-chemical resistance measurement. In its simplest configuration, the measuring cell uses two electrodes to which an alternating voltage is applied. The electric current which is directly proportional to the free ions in the electrolyte is measured. The electronic instrument then calculates the conductivity of the solution, taking into account the absolute cell constant of the sensor.

With the TetraCon® 4-electrode design, two separate electrode pairs are used whereby the currentless voltage electrodes produce a stable and constant reference potential. The voltage drop at the current electrodes is regulated via a potentiostat circuit.

The advantage of this technique is that it eliminates measurement errors usually caused by polarization effects which most likely build up at higher conductivity levels. Contact resistance problems caused by contaminated electrodes is also largely avoided by this design.



WTW Conductivity Sensors

TetraCon® 700

Rugged conductivity sensor (4-electrode design), with integrated dual thermistor, abrasion resistant carbon electrodes and break-proof epoxy body; measuring range 10 $\mu\text{S}/\text{cm}$ to 1000 mS/cm .

Submersible sensor assembly specially designed for use in wastewater treatment plants.

TetraCon® 325

4-electrode conductivity cell with graphite electrodes, integral temperature probe; measuring range 1 $\mu\text{S}/\text{cm}$ - 2000 mS/cm . Suitable for universal applications.

TetraCon® DU/T

4-electrode conductivity cell with integral flow-thru chamber (7 ml volume), built-in temperature sensor; measuring range 1 $\mu\text{S}/\text{cm}$ to 2000 mS/cm . Recommended for standard industrial applications.

TetraCon® 700 IQ

Digital 4-electrode conductivity cell (same as TetraCon® 700). In addition to the general preferences of IQ technology the TetraCon® 700 IQ offers the benefit of a larger measuring range (10 $\mu\text{S}/\text{cm}$... 500 mS/cm).



LRD 01

316 Ti stainless steel conductivity cell for installation in pipes. Built-in temperature sensor (266 °F/130 °C max.), measuring range 0.01 to 200 $\mu\text{S}/\text{cm}$, pressure resistant up to 14 bar, 1/2 inch NPT thread.

LRD 325

Conductivity measuring cell for installation in pipes. With built-in temperature sensor (up to 212 °F/100 °C). Measuring range 1 $\mu\text{S}/\text{cm}$ to 2 S/cm , pressure resistant up to 10 bar. 1/2 inch NPT thread.

LR 325/01

Low-level conductivity cell with flow-thru chamber, integrated temperature sensor; measuring range 0.001 to 300 $\mu\text{S}/\text{cm}$. For use in ultra-pure water applications; e.g., boiler feed water.

LR 325/001

Like Model LRD 325/01, but with higher resolution; measuring range 0.0001 to 30 $\mu\text{S}/\text{cm}$. Sensor is especially designed for trace measurement in both aqueous and non-aqueous or partially aqueous media.

Technical Data Conductivity Cells				
Model	Digital	Analog		
	TetraCon® 700 IQ (SW**)	TetraCon® 700 (SW**)	LRD 01	LRD 325
Sensor Type	4-electrode cell	4-electrode cell	2-electrode cell	4-electrode cell
Measuring Range	10 µS/cm - 500 mS/cm SAL: 0 ... 70 TDS: 0 ... 2000 mg/l	10 µS/cm ... 1000 mS/cm * SAL: 0 ... 70	0.001 ... 200 µS/cm	1 µS/cm ... 2 S/cm
Cell Constants	K=0.917 cm ⁻¹ , ±1.5% (in free solution) K=0.933 cm ⁻¹ , with EBST 700- DU/N flow-thru adapter	K=0.917 cm ⁻¹ , ±1.5% (in free solution) K=0.933 cm ⁻¹ , with EBST 700- DU/N flow-thru adapter	0.1 cm ⁻¹ , ±2%	0.475 cm ⁻¹ , ±1.5%
Signal Output	Digital	Analog	Analog	Analog
Power Consumption	0.2 Watt	—	—	—
Temperature Sensor	Integrated NTC	Integrated NTC	Integrated NTC	Integrated NTC
Temp. Measuring	23 ... 140 °F (-5 ... +60 °C)	32 ... 122 °F (0 ... +50 °C), ±0.2 K	32 ... 266 °F (0 ... +130 °C), ±0.2 K	32 ... 212 °F (0 ... +100 °C), ±0.2 K
Maximum Pressure	10 bar	10 bar (at 68 °F/20 °C)	14 bar (at 68 °F/20 °C)	10 bar (at 68 °F/20 °C)
Electrical Connections	2-wire shielded cable with quick fastener to sensor	Integrated PU connection cable with fitted 7-pole screw connector (IP 65)		
Certifications	CE, cETL, ETL	CE		
Mechanical	Sensor head: PVC Body: 316 Ti stainless steel Protection rating IP 68	Sensor head: PVC Body: 316 Ti stainless steel Protection rating: IP 68	Cell body: 316 Ti stainless steel Threaded 1/2 inch NPT Isolator material: PEEK Protection rating/Electrode: IP 68	Measuring cell: Epoxy / Graphit Thread: 316 Ti stainless steel Protection rating/Electrode head: IP 68
Dimensions (length x diameter)	14.06 x 1.57 in. (357 x 40 mm, incl. connection thread of SACIQ sensor connection cable) SW: 14.06 x 2.34 in. (357 x 59,5 mm)	7.72 x 1.57 in. (196 x 40 mm) SW: 8.78 x 2.34 in. (223 x 59,5 mm)	5.24 x 0.98 in. (133 x 25 mm)	5.24 x 0.98 in. (133 x 25 mm)
Weight (without cable)	Approx. 1.46 lb (660 g) SW: approx. 2.58 lb (1.170 g)	Ca. 660 g; SW: ca. 860 g	Approx. 0.77 lb (350 g)	Approx. 0.66 lb (300 g)
Guaranty	2 years for defects of quality	2 years for defects of quality	2 years for defects of quality	2 years for defects of quality
Technical Data Conductivity Cells for Special Purposes				
Model	TetraCon® 325	TetraCon® DU/T	LR 325/01	LR 325/001
Sensor Type	4-electrode cell	4-electrode cell	2-electrode cell	2-electrode cell
Electrode	Carbon	Carbon	316 Ti stainless steel	316 Ti stainless steel
Measuring Range	1 µS/cm ... 2 S/cm	1 µS/cm ... 2 S/cm	0.001 µS/cm ... 200 µS/cm	0.0001 µS/cm ... 30 µS/cm
Cell Constant	K=0.475 cm ⁻¹	K=0.778 cm ⁻¹	K=0.1 cm ⁻¹	K=0.01 cm ⁻¹
Temperature Sensor	Integrated	Integrated	Integrated	Integrated
Flow-thru Measurement	Yes, with additional flow chamber D 201	yes	Yes, with additional flow chamber D01/T	Yes, with integrated flow chamber
Length / Diameter	4.72 in. (120 mm)/ 0.62 in. (15.7 mm)	6.10 in. (155 mm)/ 0.39 in. (10 mm)	4.72 in. (120 mm)/ 0.47 in. (12 mm)	4.72 in. (120 mm)/ 0.79 in. (20 mm)
Guaranty	2 years for defects of quality	2 years for defects of quality	2 years for defects of quality	2 years for defects of quality



On-line pH/ORP Measurement

Measuring · Monitoring · Controlling

pH is one of the most important analysis parameters measured throughout the water, wastewater and many process industries. In the biological treatment of wastewaters, for example, the acidic or alkaline condition of the mixed liquor has an essential influence on the activity of the microorganisms; i.e., continuous on-line pH control is required. Precise and reliable systems for pH monitoring and control are also necessary in drinking water plants and in a variety of industrial process technologies.

Over the last 50 years, WTW have been designing and manufacturing precision systems for pH measurement. WTW's technical expertise and long experience in this field are the reason that our on-line pH instruments are now recognized for their excellent performance, reliability and product quality.

On-line pH/ORP

- Wastewater Treatment Facilities
- Water Treatment Utilities
- Neutralization Plants
- Surface Waters and Groundwater
- Food Industry
- Chemical Production
- Industrial Processes



Neutralization/Precipitation/Detoxification

Both in water and wastewater treatment and also in industrial processes pH is of great practical importance. The acidity or alkalinity of a process medium plays a key role in many chemical or biological reactions as well as in mechanical/ physical actions. A number of reactions – in precipitation and detoxification, for example – may only take place if the pH condition is properly controlled. A “misadjusted” pH can cause a variety of serious effects, of which corrosion is the most common. Therefore, at a low or high pH **neutralization** treatment often is required.



In the area of **municipal and industrial wastewater** treatment extreme pH conditions may result in the following harmful effects:

- Microorganisms in biological purification processes are sensitive to acidic and alkaline conditions. Therefore, the pH of the sewage is supposed to be in the neutral range of pH 7. At pH levels of less than 5 or larger than 10 the activity of the bacteria practically ceases.
- pH values of 6.5 and lower result in gradual destruction of metallic materials and mechanical components, and even in damage of the sewer network.
- The solubility of many substances varies with the pH level and temperature. Undesirable and obstructive precipitation of solids may be the result.

Today's legislative regulations and environmental directives in many countries already require that trade effluents may only be discharged into municipal sewer systems if the pH is between 6.5 and 8.5. For this reason, industrial dischargers, for instance, breweries and dairies, often have to pre-treat its effluent in a **neutralization** plant.

pH Control System

Neutralization, precipitation and detoxification not only require continuous pH measurement but also an efficient pH control system. In less demanding applications, such as stable processes with slowly changing conditions, a simplified 2-point logic control may be adequate. In many cases, however, a proportional control loop is considerably more efficient and also economical with regard to dosing of flocculants or neutralization chemicals.



pH measuring technology by WTW

WTW's complete line of pH/ORP instrumentation comprises sensor assemblies, monitors and system components for a wide range of applications.

In addition to the well proven SensoLyt® sensor assemblies, which are widely used in wastewater facilities, the product line includes ruggedized sensor assemblies for in-line measurements in industrial processes.

The proven monitors of the 170 and 296 series have a PIF control algorithm. A special measuring transducer as well as sensors and accessories are available for use in explosion-proof areas (see brochure “Product Details”).

The IQ Sensor Net and the IQ sensors open up a whole new realm of technology with features such as an immense degree of flexibility and “sensors which can be pre-calibrated in the laboratory”.



SensoLyt® pH/ORP Sensor Systems

- Sensor check function for glass breakage detection
- Robust mechanical design
- Simple change of pH electrode
- Pre-calibration of sensor possible (SensoLyt® 700 IQ)

SensoLyt® System Design

For continuous pH/ORP measurement, especially under the difficult conditions very often found in sewage treatment facilities, very high demands are made concerning the reliability and operating safety of the systems employed.

Designed specifically for these harsh applications, the SensoLyt® sensors are precision engineered assemblies, which consist of a submersible housing with a built-in preamplifier and the appropriate combination pH or ORP electrode. In combination with our high-performance monitors, the sensors constitute an integrated, extremely reliable pH/ORP measuring system which represents the highest standard, state-of-the-art technology with regard to accuracy, EMC noise immunity and economy.

The digital technology of the IQ sensors, which can store calibration values directly in the sensor, offer particular advantages. This feature allows the user to calibrate the sensor in the laboratory and then return it to its location of use. This provides a certain independency, especially in winter or with bad weather conditions. Its sensor's quick coupler permits direct reintegration into the system.

*SensoLyt® 700**SensoLyt® 700 IQ**IQ Sensor connection*

Parameter section

Dissolved Oxygen

pH/ORP

Conductivity

Turbidity/
Suspended Solids

Nitrogen

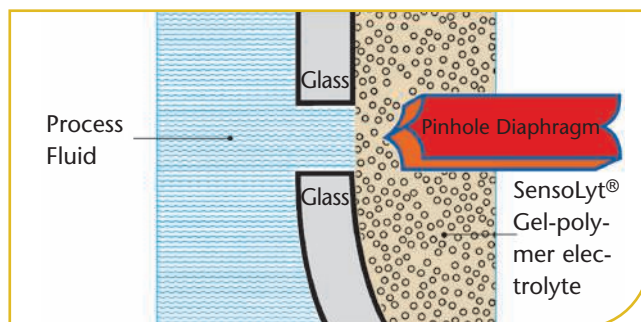
Phosphate

Carbon: COD/TOC/
DOC/BOD/SAC



SensoLyt® Combination Electrodes

- Reliable
- Stable against interference
- Easy to maintain



The reliability of pH and ORP measurements are determined to a large extent by the quality of the pH/ORP electrode which commonly is exposed to extreme conditions; particularly in many industrial applications.

The design of the applied reference system used is crucial to the overall performance of an electrode. In SensoLyt® combination electrodes the reference is a conventional Ag/AgCl/Cl electrode system, completely embedded in a pressure resistant solid gel-polymer electrolyte. As concentration changes in gel-type electrolyte occur very slowly, i.e. the electrochemical characteristic of the cell is unchanged, a stable and constant reference potential will be achieved.

With this electrode design, the polymer matrix/process fluid interphase consists of a pinhole diaphragm; i.e. an electrical flux is established through two fine holes in the cell of the reference system. Such a diaphragm especially reduces the risk of failures.

In addition, SensoLyt® combination electrodes require very little maintenance as there is no electrolyte replacement.



SensoLyt® SEA-HP

SensoLyt® SEA / SE*

This pressure and temperature resistant combination pH electrode incorporates a double pin-hole diaphragm and a gel polymer solid electrolyte, which is AgCl free and therefore resistant to sulfides.

Measuring range: pH 2 ... 12

- Highly contaminated sewage
- Emulsions and suspensions
- Media containing proteins and sulfides

SensoLyt® SEA-HP

Analog SensoLyt® SEA version, with optimized armoring for use under high pressure / temperature conditions.

Measuring range: pH 4 ... 12

- Inline measurement in pipes

SensoLyt® DWA / DW*

Especially its long service life and precise measurement make it stand out from the crowd, in particular for measurements of drinking water with low conductivity.

Measuring range: pH 0 ... 14

- Drinking water

SensoLyt® ECA / EC*

This combination pH electrode has a single pin-hole diaphragm and a gel electrolyte. With its long-term stability it provides an economical solution, particularly in most wastewater facilities.

Measuring range: pH 2 ... 12

- Normally polluted wastewater

SensoLyt® PtA / Pt*

This ORP electrode is also fitted with a pin-hole diaphragm, and is primarily recommended for applications in heavily contaminated wastewater.

Measuring range: ± 2000 mV

- Municipal and industrial sewage
- Emulsions and suspensions
- Media containing proteins and sulfides

** electrode without armor for direct use in flow-thru vessels*



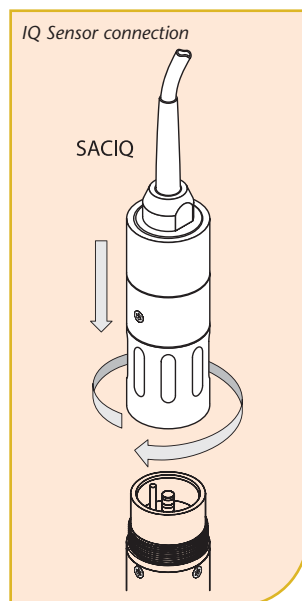
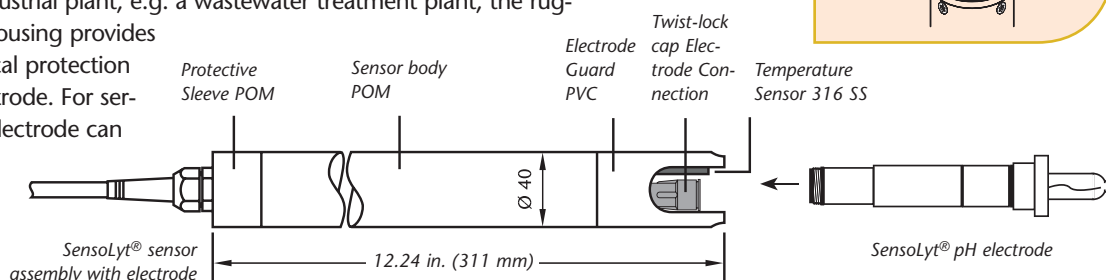
SensoLyt® Sensor Assemblies

SensoLyt® sensor assemblies perform multiple functions:

- **preamplification** of the electrode signal
- holder for an integrated NTC sensor for **temperature measurement**
- reliable **protection** of the installed pH-electrodes against mechanical damage
- Digital signal processing with calibration value storage (IQ sensors)

The very low voltage signal delivered by the pH/ORP electrode is very susceptible to noise and ground-loop interferences. For this reason WTW has integrated a preamplifier in the sensor assemblies. Its amplification and impedance conversion assure low-impedance and thus reliable signal transmission over long distances; e.g. required for operation with remotely installed monitors.

SensoLyt® sensor assemblies feature a built-in NTC thermistor for temperature measurement and automatic temperature compensation. This enables both pH or ORP and temperature to be measured simultaneously with a single probe. Under the rigorous operating conditions of an industrial plant, e.g. a wastewater treatment plant, the rugged design of the housing provides important mechanical protection of the glass pH electrode. For service purposes, the electrode can be replaced in the field without tools.



Analogue

SensoLyt® 700

The SensoLyt® 700 standard assembly incorporates an integrated preamplifier and a built-in stainless steel NTC temperature sensor. When using a WTW monitor, a special circuitry allows the pH electrode to be monitored for glass breakage. In addition, the SensoLyt® 700 offers as a standard feature an efficient lightning protection system. The SensoLyt® 700 sensor assembly can be fitted with any combination electrode of the SensoLyt® series. It is compatible with all WTW monitors of the EcoLine and QuadroLine® Series.

SensoLyt® 690

Same as SensoLyt® 700, but without the SensCheck function.

SensoLyt® 650

The SensoLyt® 650 unit is a passive assembly without preamplifier; i.e., it is designed for "high-impedance operation" with the electrode connected directly to the monitor input. The assembly is directly compatible with the high-impedance input of following WTW monitors: pH 170 and pH 296 or Stratos 2211 X pH models.

Digital

SensoLyt® 700 IQ

Digital pH/ORP armature with integrated preamplifier and lightning protection as well as digital signal processing and integrated temperature probe for connection to an IQ SENSOR NET. A special circuiting permits glass breakage detection monitoring. Due to the integrated calibration value memory, a "pre-calibrated pH measurement", the value of which is stored in the sensor, can be set in the laboratory. The sensor's quick release coupling allows the user to remove it from the location of use and return it after successful calibration in the laboratory. With an IQ connection in the laboratory, inconvenient field calibration under adverse conditions can be completely eliminated.



Technical Data SensoLyt® Sensor Assemblies

Type	Analog			Digital
	SensoLyt® 700 (SW*)	SensoLyt® 690	SensoLyt® 650	SensoLyt® 700 IQ (SW*)
Integrated Preamplifier	Yes	Yes	No	Yes
Signal output	Low impedance, analog	Low impedance, analog	High impedance	Digital
Sensor check funktion	Yes	No	No	Yes
Sensor memory for calibration values	—			Yes
Power consumption	—			0.2 Watt
Temperature measurement	Integrated NTC, 32 ... 140 °F (0 ... +60 °C)			Integrated NTC, 23 ... 140 °F (-5 ... +60 °C)
Ambient conditions	Operating temperature: 32 ... 140 °F (0 ... +60 °C)			Operating temperature: 32 ... 140 °F (0 ... +60 °C)
Electrical connections	integrated PU connecting cable with fitted 7-pole screw connector (IP 65)		Integral PU connection cable with bare cable ends	2-wire shielded cable with quick fastener to sensor
Transient voltage 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	Sensor body: POM Protective cap: PVC Protection rating: IP 68			Sensor body: 316 Ti stainless steel Protection cap: PVC Sensor holder: POM Protection rating: IP 68
Dimensions (L x D)	12.24 x 1.57 in. (311 x 40 mm); SW: 15.52 x 2.34 in. (318 x 59.5 mm)			20 x 1.57 in. (508 x 40 mm); SW: 20.78 x 2.34 in. (515 x 59.5 mm)
Weight (without cable)	Approx. 0.71 lb (320 g); SW: approx. 1.94 lb (880 g)			2.14 lb (970 g) SW: approx. 3.97 lb (1.800 g)
Guaranty	2 years for defects of quality			2 years for defects of quality

Technical Data SensoLyt® Combination Electrodes

Type	SEA/SE**	SEA-HP	DWA/DW**	ECA/EC**	PtA/Pt**
Electrode type	Gel-polymer solid electrolyte double pinhole diaphragm		Modified gel electrolyte single pinhole diaphragm	Gel electrolyte single pinhole diaphragm	Gel-polymer solid electrolyte double pinhole diaphragm
Operation conditions (Overpressure/temperature)	10 bar/68 °F (20 °C) 1 bar/140 °F (60°C)	10 bar/140 °F (60°C)	6 bar / 68 °F (20 °C) 1 bar / 140 °F (60°C)	6 bar / 68 °F (20 °C) 1 bar / 140 °F (60°C)	10 bar / 68 °F (20 °C) 1 bar / 140 °F (60°C)
Measuring range	32...140 °F (0...60 °C)	32...140 °F (0...60 °C)	32 ... 140 °F (0 ... 60 °C)	32 ... 140 °F (0 ... 60 °C)	32 ... 140 °F (0 ... 60 °C)
	2 ... 12 pH	4 ... 12 pH	0 ... 14 pH	2 ... 12 pH	±2000 mV***
Mechanical	Cylindrical glass membrane, armored version with PVC armouring (SEA-HP: POM), 2 Viton O-ring seals for mounting into SensoLyt® sensor assemblies				
Dimensions	Length 4.72 in./120 mm (without plug head)				
Electrical connections	watertight plug head connector				
Guaranty	6 months for defects of quality				



Turbidity and Suspended Solids

Turbidity

Smell, taste and turbidity are the most important indicators for the quality of potable water.

At the effluent of a waste water treatment plant, turbidity is a quantitative measure of remaining undissolved solids, indicating malfunctions within the treatment process. Turbidity can be measured relatively simple on-line with optical methods. Therefore, turbidity is extremely suitable for measuring the cleaning efficiency of wastewater treatment plants.

Turbidity is typically determined using 90 degree scattered light principle in compliance with EN ISO 7027.

Measuring principle

By the passing of optical radiation through a dispersing system, dispersed solids reduce radiation power by transforming it into another form of energy. This effect is called absorption. The ratio of penetrating to emitting light beams is measured as turbidity.

Factory calibration

The online-sensors from WTW are precisely factory calibrated with a "multi-point" calibration. The calibration is very stable – so further calibration is not needed. Formazine is used as a calibration standard – it is diluted to the necessary concentrations.

Turbidity and Suspended Solids

- Effluent measurement of sewage treatment plants
- Sludge concentration
- Monitoring/controlling of sludge cycle
- Drinking water



Optical unit with ultrasonic cleaning system



Maximum amplitude at the optical windows

Cleaning system

A number of parameters can have a large impact on the measured value and are automatically compensated. An effective compensation takes into account the influence of a secondary light source, the coloration of particles and the medium. The fouling of the optical path requires an effective cleaning system realised by WTW using a unique Ultrasonic System.

This ultrasonic module, integrated in the VisoTurb® 700 IQ and in the ViSolid® 700 IQ, causes a permanent oscillation on the optical windows avoiding biological fouling.

Pictures show the same sensor with ultrasonic cleaning system switched-off and switched-on in a typical waste water application.

The sensor with switched-off cleaning system (left picture) is completely covered with a biological layer. The sensor with working ultrasonic cleaning system (right) shows no adverse effect.

Suspended Solids

A continuous gravimetric analysis is not possible in waste water treatment process – therefore indirect methods like turbidity measurement are used. The concentration of suspended solids is a very important process parameter for today's sludge treatment. Total suspended solids can be determined online using scattered light or light absorbance. Under normal conditions there is a good correlation to gravimetric analysis.

For the most important sludge characteristics, WTW has defined so called matrix types – with this stored data, even without customer specific calibration a good correlation to total suspended solids concentrations can be achieved.

However, sludges can be totally different – concerning coloration, particle size and structure. Therefore of course a "multi-point" user calibration is possible. This can be done also with the mandatory required gravimetric determination of total suspended solids.

Without ultrasound cleaning system



With ultrasound cleaning system



Application on waste water treatment plants

In order to get a sufficient degree of nitrification, a certain sludge age should not be exceeded. This is significantly influenced by the flow of the surplus sludge and the concentration of TSS in the biological tank measured by the suspended solids sensor. Also the denitrification (N-elimination) and partially the biological P-elimination can be improved by a higher amount of TSS.



Parameter section

Dissolved Oxygen

pH/ORP

Conductivity

Turbidity/
Suspended Solids

Nitrogen

Carbon: COD/TOC/
DOC/BOD/SAC

Phosphate

Sludge level

General Features of Sensors

On-line Turbidity and Suspended Solids Measurement using revolutionary technology

Continuous turbidity and suspended solids measurement are of great importance in analytic measurement in modern wastewater treatment plants. Optical infrared scattered light sensors are established for online measurement of this measuring parameter in treatment plants.



A clean sensor – prerequisite for reliable measurements

In optical systems, contamination falsifies readings of turbidity or suspended solids by an indeterminate amount. Once contamination of the optical system has begun, further build-up of particles progresses at an accelerated rate. Especially under the extreme conditions that prevail in wastewater treatment plants, the accumulation of microorganisms represents a genuine problem for the otherwise reliable optical measurement method. Therefore, additional manual cleaning is usually indispensable – despite conventional methods of compensation or cleaning using available wiper systems.

Revolutionary Technology

- Non-mechanical ultrasound cleaning
- Low Maintenance
- Factory Calibrated
- Long-term stability (SensorCheck function)

VisoTurb® and ViSolid® – new sensors for turbidity and suspended solids measurement

With the VisoTurb® 700 IQ and ViSolid® 700 IQ sensors, WTW presents a family of optical sensors for turbidity and suspended solids measurement. These sensors incorporate a ultrasound cleaning system that guarantees low maintenance and long-term reliability of the sensors. Turbidity measurements in aqueous media with VisoTurb® are carried out nephelometrically in compliance with EN ISO 7027. Solid matter measurement with ViSolid® is performed according to the principle of scattered light measurement.

Because of the enormously wide measuring ranges of VisoTurb® (0 – 4000 FNU) and ViSolid® (0 – 300 g/l SiO₂), the best resolution for each measured value can be selected using an AutoRange function. Thus, only two sensors are required to cover almost all applications ranging from drinking water to highly concentrated sludge.

Integrated, wear-free automatic cleaning system

The ultrasound source integrated in the sensor generates high-frequency vibrations of the optical windows in the micrometer range. The maximum vibration amplitudes are at the center of the measurement windows, so that the largest displacement can be found at this location. This prevents accumulation of any kind of contamination from the very start, and thus provides for reliable measurements for continuous operation.

Robust, scratch-proof sapphire measuring window

The sapphire measuring windows are particularly scratch-proof and guarantee accurate measuring results even with permanent use under rough ambient conditions.

Sensor without and with ultrasound cleaning system after 30 days



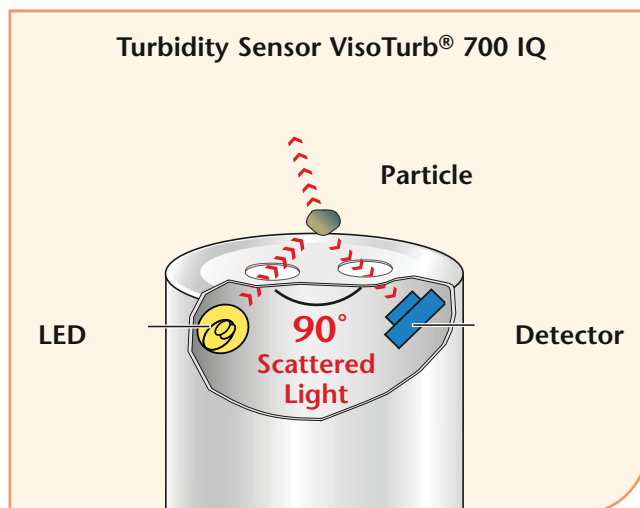
Extremely low maintenance

- In contrast to traditional sensors equipped with wipers and jutting corners, the exceptionally smooth sensor surface provides a minimum of surfaces on which deposits may accumulate.
- The continuously active ultrasound system inhibits the deposit of all kinds of contamination from the start.
- Thus, the sensor can be operated in a wide variety of applications over several weeks without maintenance.
- Thanks to their robust design and the efficient ultrasound cleaning system, **VisoTurb® 700 IQ** and **ViSolid® 700 IQ** are particularly suitable for applications with extreme conditions, e.g. wastewater treatment plants. They provide the user with a very high degree of measurement accuracy at an exceptionally low maintenance rate.

Turbidity Sensor VisoTurb®

Turbidity Measurement according to the Nephelometric Principle

Using this principle, scattered light is measured at an angle of 90 degree. This method is ideal for low and medium range turbidity up to 4000 FNU. In compliance with EN 27027 and ISO 7027, infra red light with a wavelength of 860 nm is used. This wavelength is outside of the visible range – thus potential coloration of the sample does not effect the measurements.



Technical Data VisoTurb® 700 IQ (SW*)

Parameter	FNU; NTU; TEF	mg/l SiO ₂ ; ppm SiO ₂	g/l TSS
Measuring Range	0.05 ... 4000 FNU	0.1 ... 4000 mg/l SiO ₂	0.0001 ... 400 g/l TSS
Typical Applications	Drinking water, surface water, waste water plant: effluent, aeration basin ≤3 g/l TSS		
Calibration	Factory calibration with formazine	Factory calibration with SiO ₂	Calibration by user, (TSS regulations in compliance with DIN 38414)
Process variation coefficient according to DIN 38402 part 51	<1 % (in the range up to 2000 FNU)		
Repeatability according to DIN ISO 5725 or DIN 1319	<0,015 % or ≥0,006 FNU		
Resolution	Automatic according to measuring range 0.001 ... 1 FNU	0.001 mg/l ... 1 mg/l	0.001 mg/l ... 1 g/l
Cleaning System	Ultrasound cleaning system		
SensCheck	Contamination detection of optical window; failure of cleaning system		
Ambient Conditions	Operating temperature: 32 ... 140 °F (0 ... 60 °C); ultrasonic cleaning system: 32 ... 104 °F (0 ... 40 °C) (overheating protection) Storage temperature: 23 ... 149 °F (-5 ... +65 °C)		
Mechanical Components	Measurement window: Sapphire Sensor body: V4A stainless steel 1.4571 Protection rating: IP 68		
Pressure Resistance	Maximum 10 bar (incl. sensor connection cable)		
Power Consumption	1.5 Watt		
Dimensions	14.37 x 1.57 in. (365 x 40 mm, length x diameter), incl. sensor connection cable SACIQ		
Weight	Approx. 2.18 lb (990 g, without cable)		
Guaranty	2 years for defects of quality		



Cleaning System

Some applications, in particular in the wastewater treatment, require special precautions for permanent and interference-free operation.

Cleaning System

- Solutions for all plants
- Controllable via any WTW monitor
- Compressed air cleaning – winterized and interference-free



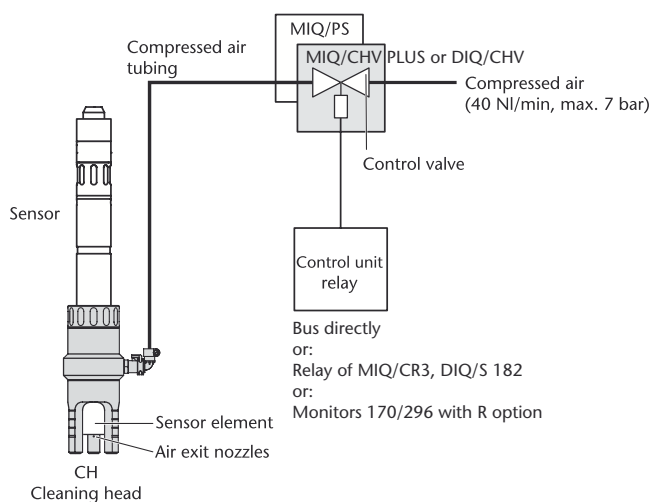
Efficient compressed air cleaning put into practice:

For a continuous compressed-air cleaning system there are two options:

Option 1:

Compressed-air supply is provided at the plant. You require the following components

- Cleaning head CH
- Valve module (MIQ/CHV PLUS or DIQ/CHV with MIQ/PS)

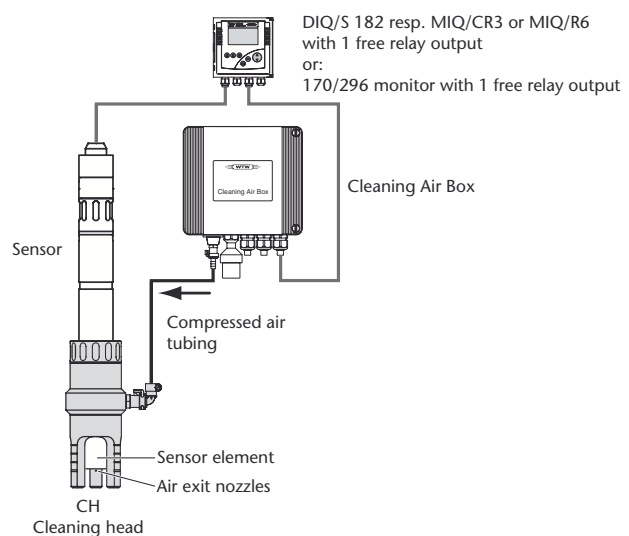


Option 2:

Compressed-air supply is not provided at the plant. You require the following components

- Cleaning head CH
- Cleaning Air Box
- Monitor with relay output

NEW



For cleaning, compressed air is blown at the sensor element (from external source) freeing it from pollutants. The compressed air from the cleaning air box or installation to the sensor is switched on or off electronically by an activated control valve or relay. The control is regulated by a timer via the IQ SENSOR NET or via a relay of the measuring system.