



## 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

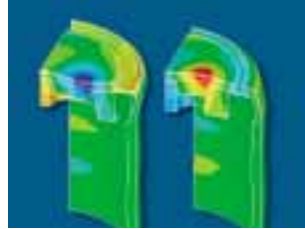
The online-sensors from WTW are precisely factory calibrated with a "multi-point" calibration. The calibration is very stable – so further calibration is not needed. Formazine is used as a calibration standard – it is diluted to the necessary concentrations.

#### 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 an 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 SiO<sub>2</sub>), 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



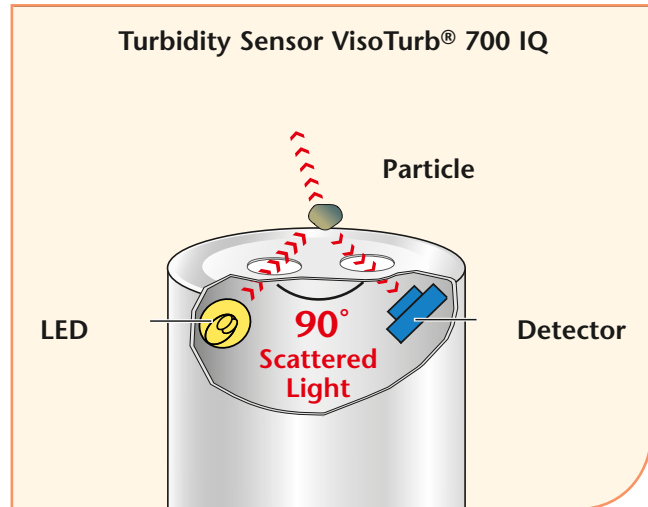
### Extremely low maintenance

- 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 <sub>2</sub> ; ppm SiO <sub>2</sub>	g/l TSS
Measuring Range	0.05 ... 4000 FNU	0.1 ... 4000 mg/l SiO <sub>2</sub>	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 <sub>2</sub>	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		

### Ordering Information

		Order No.
VisoTurb® 700 IQ	Turbidity sensor for water/wastewater with ultrasound cleaning system	600 010
SACIQ-7,0	Sensor connection cable for all IQ sensors, cable length 23 ft. (7.0 m)	480 042



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

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

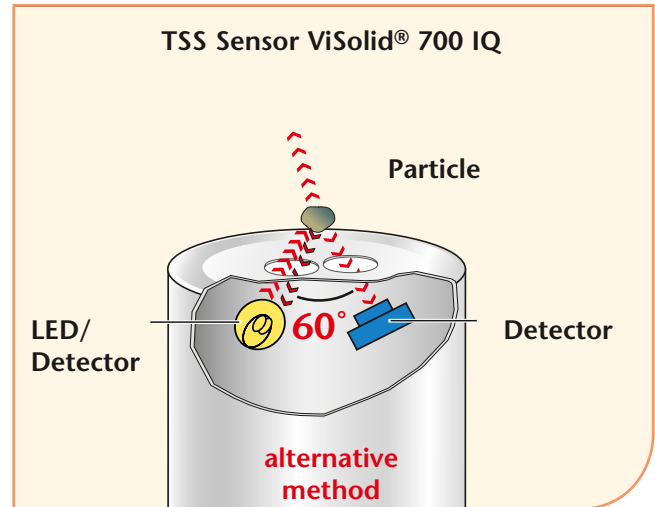


## Suspended Solids Sensor ViSolid®

### Measuring Principle of Suspended Solids

With increasing concentration of suspended solids, particles will interfere with each other. With this increasing number, not every particle is reached by the light source or the reflected light is not detected by the receiving device – thus incorrect values are measured. So the 90 degree scattered light method used for the turbidity measurement can only be used for lower concentrations.

For this reason WTW uses two methods of measurement – depending on the concentration. For lower concentrations, a scattered light method is used, in case of higher concentrations, the backscatter method is the better choice.



### Technical Data ViSolid® 700 IQ (SW\*)

Parameter	g/l SiO <sub>2</sub> / % SiO <sub>2</sub>	g/l TSS / % TSS
Measuring Range	0.01 ... 300 g/l 0.001 ... 30% SiO <sub>2</sub>	0.003 ... 1000 g/l TSS 0.0003 ... 100% TSS
Typical Applications	Matrix type 1: aeration basin of waste water plants even with >3 g/l TSS; return-sludge Matrix type 2: digested sludge	
Calibration	Typical sludge characteristics stored: matrix type 1, matrix type 2 Calibration by user: adjustment via correction factor, 1-point or multi-point calibration possible	
Process variation coefficient according to DIN 38402 part 51	<2% for matrix type 1, <4% for matrix type 2	
Resolution	Automatic according to measuring range 0.1 mg/l ... 0.1 g/l	0.1 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) Storage temperature: 23 ... 149 °F (-5 ... +65 °C)	
Mechanical Components	Measuring 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	

### Ordering Information

		Order No.
ViSolid® 700 IQ	Suspended solids sensor for water/wastewater with ultrasound cleaning system	600 012
SACIQ-7,0	Sensor connection cable for all IQ sensors, cable length 23 ft. (7.0 m)	480 042



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

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