

Distributed by:



**Carl Stuart Limited**

ADVANCED APPLIED TECHNOLOGIES

**Contact Us:**

Irl Ph: 01 4523432

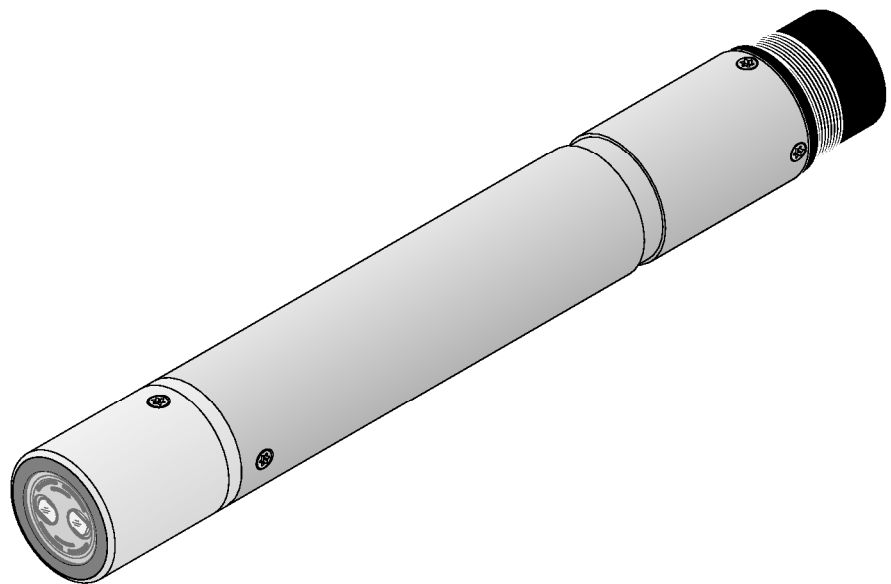
UK Ph: 08452 30 40 30

Web: [www.carlstuart.com](http://www.carlstuart.com)

Email: [info@carlstuart.com](mailto:info@carlstuart.com)

**Operating manual**

# VisoTurb<sup>®</sup> 700 IQ



**IQ SENSOR NET turbidity / suspended solids sensor**

**Accuracy when going to  
press**

The use of advanced technology and the high quality standard of our instruments are the result of continuous development. This may result in differences between this operating manual and your instrument. Also, we cannot guarantee that there are absolutely no errors in this manual. Therefore, we are sure you will understand that we cannot accept any legal claims resulting from the data, figures or descriptions.



**Note**

The latest version of the present operating manual can be found on the Internet under [www.WTW.com](http://www.WTW.com).

**Copyright**

© Weilheim 2006, WTW GmbH  
Reprinting - even as excerpts - is only allowed with the explicit written authorization of WTW GmbH, Weilheim.  
Printed in Germany.

## VisoTurb® 700 IQ - Contents

<b>1</b>	<b>Overview</b>	<b>1-1</b>
1.1	How to use this component operating manual	1-1
1.2	Structure of the VisoTurb® 700 IQ turbidity sensor	1-2
1.3	Recommended fields of application	1-2
1.4	Features of the VisoTurb® 700 IQ	1-3
<b>2</b>	<b>Safety instructions</b>	<b>2-1</b>
2.1	Authorized use	2-2
2.2	General safety instructions	2-2
<b>3</b>	<b>Commissioning</b>	<b>3-1</b>
3.1	Scope of delivery	3-1
3.2	Installation	3-1
3.2.1	General information	3-1
3.2.2	Flow direction	3-2
3.2.3	Sensor angle	3-2
3.2.4	Sensor orientation	3-3
3.2.5	Distances from the ground and wall	3-4
3.3	Installation examples	3-5
3.3.1	Measuring in an open basin or channel (range > 100 FNU)	3-5
3.3.2	Measuring in an open channel (range > 100 FNU)	3-6
3.3.3	Measurement in pipelines	3-7
3.4	Commissioning / Readiness for measuring	3-9
3.4.1	Connect the sensor	3-9
3.4.2	Setting tableVisoTurb® 700 IQ	3-11
<b>4</b>	<b>Measuring</b>	<b>4-1</b>
4.1	Measuring operation	4-1
4.2	Calibration	4-2
4.2.1	General information	4-2
4.2.2	Application offset	4-3
4.2.3	User calibration for measuring the total suspended solids (g/l TSS)	4-4
<b>5</b>	<b>Maintenance, cleaning, accessories</b>	<b>5-1</b>
5.1	General information	5-1
5.2	Cleaning the sensor shaft and sapphire disc	5-1
5.3	Accessories	5-3

- 6 What to do if ... 6-1**
- 7 Technical data 7-1**
  - 7.1 Measuring characteristics 7-1
  - 7.2 Application characteristics 7-2
  - 7.3 General data 7-3
  - 7.4 Electrical data 7-3
- 8 Indexes 8-1**
  - 8.1 Explanation of the messages 8-1
    - 8.1.1 Error messages 8-1
    - 8.1.2 Info messages 8-2
  - 8.2 Status info 8-3

# 1 Overview

## 1.1 How to use this component operating manual

### Structure of the IQ SENSOR NET operating manual

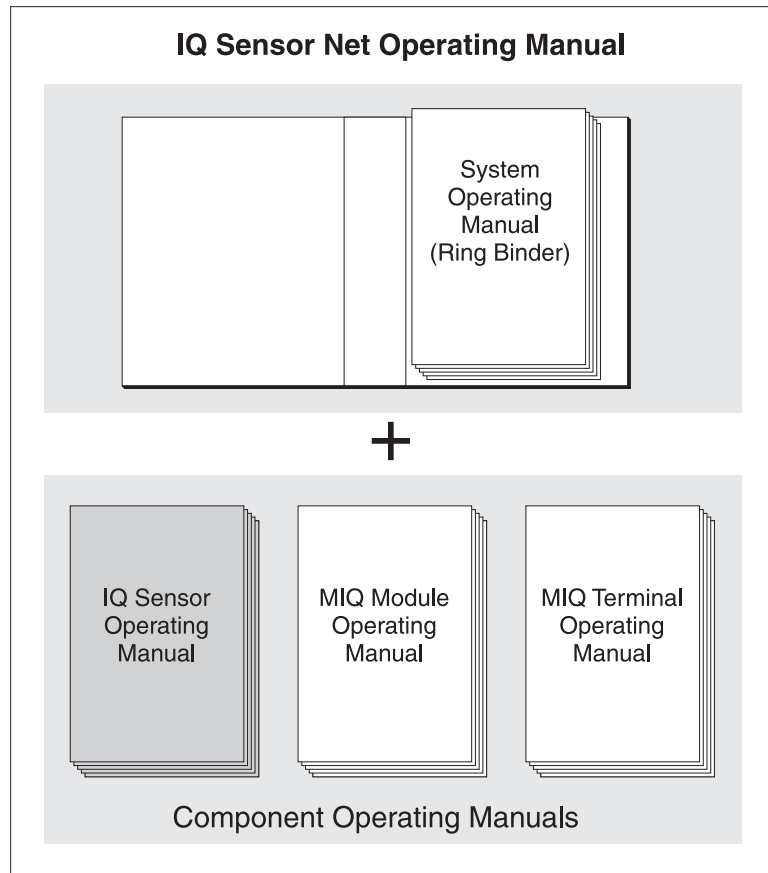


Fig. 1-1 Structure of the IQ SENSOR NET operating manual

The IQ SENSOR NET operating manual has a modular structure like the IQ SENSOR NET system itself. It consists of a system operating manual and the operating manuals of all the components used.

Please file this component operating manual into the ring binder of the system operating manual.

### 1.2 Structure of the VisoTurb® 700 IQ turbidity sensor

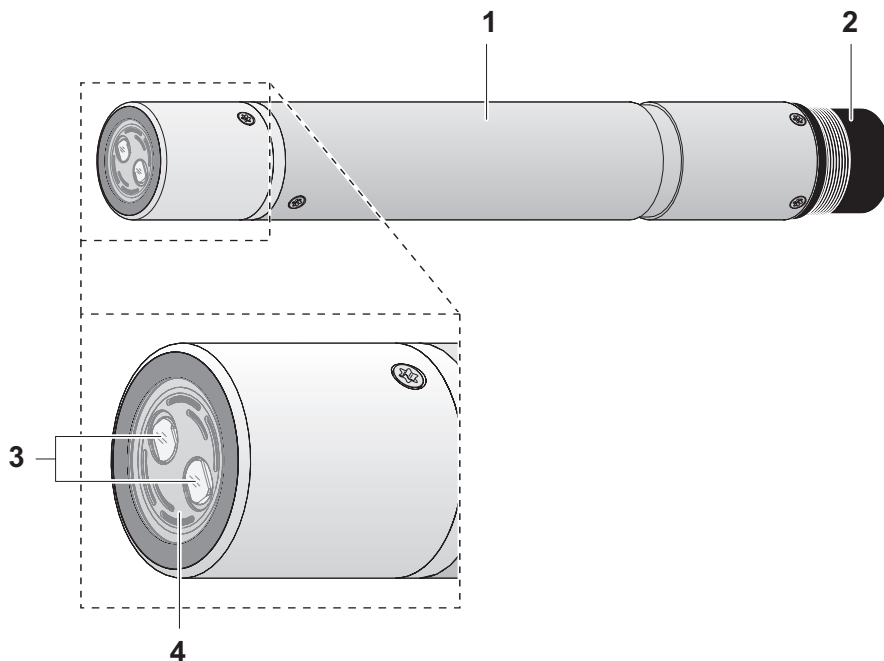


Fig. 1-2 Structure of the VisoTurb® 700 IQ

1	Shaft
2	Connection head
3	Optical measurement window
4	Sapphire disc with ultrasound cleaning system

### 1.3 Recommended fields of application

Stationary measurement of the turbidity or suspended solids concentration (total suspended solids - TSS) in water/wastewater applications.

The VisoTurb® 700 IQ is particularly well suited for applications in polluted measuring media, e.g. in wastewater treatment plants, thanks to its robust construction and its efficient ultrasound cleaning system. It provides very high measurement accuracy with low maintenance costs.

## 1.4 Features of the VisoTurb® 700 IQ

### **Turbidity measurement according to EN ISO 7027**

The turbidity measurement in aqueous media with the VisoTurb® 700 IQ is conducted nephelometrically in accordance with EN ISO 7027.

### **Total suspended solids measurement**

The turbidity/total suspended solids sensor can also be used to determine the total suspended solids content in the sample. The appropriate correlation for the given application can be determined via a reference measurement. After this adjustment, the turbidity value is converted into the concentration of total suspended solids.

### **Ultrasound cleaning system**

The ultrasound cleaning system ensures low maintenance and long-term reliable measurement operation.

The ultrasound source integrated in the sensor excites the sapphire disc at the tip to produce vibrations in the ultrasound range. The movement of the surface as a result of this prevents the growth of pollution in almost all cases and, thus, ensures reliable measured values during continuous operation.

### **AutoRange function**

The AutoRange function selects the optimum resolution for the respective measured value from the enormously large measuring range (0 - 4000 FNU).

### **SensCheck function**

This monitoring function that is integrated in the sensor is used to continually check the sensor function and to register any malfunctions caused by the measuring medium. The correct operation of the ultrasound cleaning system is also continuously monitored.





## 2 Safety instructions

This component operating manual contains special instructions that must be followed during the operation of the VisoTurb® 700 IQ turbidity sensor. Thus, it is essential to read this component operating manual before carrying out any work using this sensor. In addition to this manual, the SAFETY chapter of the IQ SENSOR NET system operating manual must be followed.

Always keep this component operating manual together with the system operating manual and any other component operating manuals in the vicinity of the IQ SENSOR NET system.

### Special user qualifications

The turbidity sensor was developed for applications in online measurement - essentially in the field of wastewater treatment. Thus, we assume that the operators are familiar with the necessary precautions to take when dealing with chemicals as a result of their professional training and experience.

### General safety instructions

Safety instructions in this operating manual are indicated by the warning symbol (triangle) in the left column. The signal word (e.g. "Caution") indicates the danger level:



#### Warning

indicates instructions that must be followed precisely in order to prevent serious dangers to personnel.



#### Caution

indicates instructions that must be followed precisely in order to avoid slight injuries to personnel or damage to the instrument or the environment.

### Other labels



#### Note

indicates notes that draw your attention to special features.



#### Note

indicates cross-references to other documents, e.g. operating manuals.

## 2.1 Authorized use

The authorized use of the VisoTurb® 700 IQ comprises its use as a turbidity sensor in the IQ SENSOR NET.

Please observe the technical specifications according to chapter 7 TECHNICAL DATA. Only operation according to the instructions in this operating manual is authorized.

Any other use is considered to be **unauthorized**. Unauthorized use invalidates any claims with regard to the guarantee.



### Caution

**The sensor warms up during operation in the air. Consequently, pollution can collect in the vicinity of the measurement window due to the evaporation of liquid. Therefore, avoid any lengthy operation in the air.**



### Caution

**Only connect and operate the sensor together with IQ SENSOR NET accessories.**

## 2.2 General safety instructions

The sensor left the factory in a safe and secure technical condition.

The failure-free function and operational safety of the sensor is only guaranteed if the generally applicable safety measures and the special safety instructions in this operating manual are followed during its use.

The failure-free function and operational safety of the sensor is only guaranteed under the environmental conditions that are specified in chapter 7 TECHNICAL DATA.

The specified temperature (chapter 7 TECHNICAL DATA) must be maintained during the operation and transport of the sensor.

### Caution

**The sensor may only be opened by specialists authorized by WTW.**



### Function and operational safety

**Safe operation**

If safe operation is no longer possible, the sensor must be taken out of operation and secured against inadvertent operation.

Safe operation is no longer possible if the sensor:

- has been damaged in transport
- has been stored under adverse conditions for a lengthy period of time
- is visibly damaged
- no longer operates as described in this manual.

If you are in any doubt, contact the supplier of your sensor.

**Obligations of the operator**

The operator of the sensor must ensure that the following rules and regulations are followed when dealing with hazardous substances:

- EEC directives for protective labor legislation
- National protective labor legislation
- Safety regulations
- Safety data sheets of the chemical manufacturer.



## 3 Commissioning

### 3.1 Scope of delivery

- VisoTurb® 700 IQ turbidity/total suspended solids sensor
- Operating manual

### 3.2 Installation

#### 3.2.1 General information

The measuring principle of the VisoTurb® 700 IQ (optical scattered light measurement) places particular requirements on the measurement location and on the installation of the sensor.

In slightly turbid test samples (< 100 FNU), infrared light penetrates the test sample deeply. Thus, the measuring environment can have a significant effect on the measured value displayed. Light that is reflected or scattered by the ground or wall can strike the detector in the sensor and, thus, simulate higher turbidity or an increased level of total suspended solids. Direct sunlight can easily interfere with the measurement.

Scattered light can be kept away from the measurement windows to a great extent by favorable positioning of the sensor. For this reason, the optimum installation position is especially important for measuring low turbidity values.



#### Note

Always maintain a distance of at least 10 cm from the ground and wall.

The following factors affect the measurement:

- Inclination of the sensor (see section 3.2.3)
- Sensor orientation around its longitudinal axis (see section 3.2.4)
- Distances from the ground and wall (see section 3.2.5)
- Light-colored, heavily light-scattering surfaces in the measuring vessel (e.g. vessel inner surfaces) or in the measuring environment.
- Unfavorable geometry of the measuring vessel or unfavorable positioning of the sensor in the measuring vessel.
- Air bubbles in the test sample
- Spatial proximity of two optical sensors
- Very bright ambient light at the measuring location, e.g. direct sunlight in the open channel

### 3.2.2 Flow direction

As a general rule, the sapphire disc should be positioned clearly against the current in flowing media (angle of attack approx. 20 to 45 °).

**Exception:** If there are high quantities of foreign bodies with fibrous or large surfaces, as for example hairs, strings or leaves, it may be of advantage to incline the sensor in the direction of the flow so that the sapphire disc does not face the flow.

### 3.2.3 Sensor angle

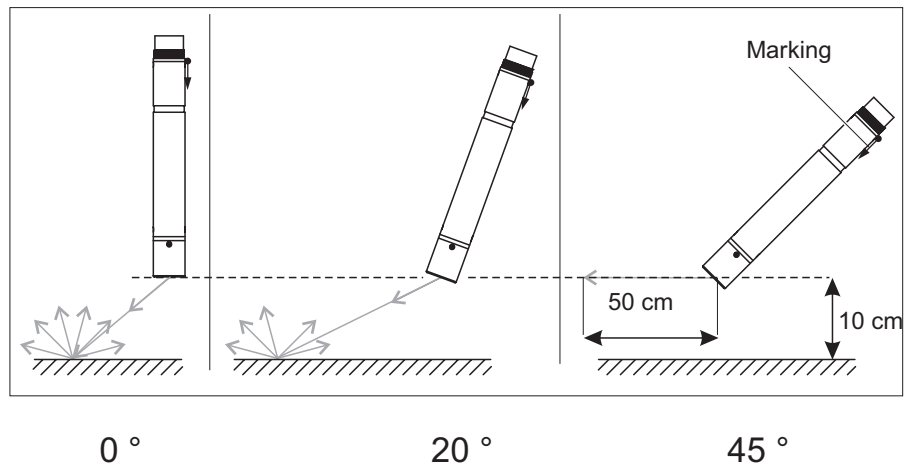


Fig. 3-1 Effect of the sensor angle on scattering and reflection from the ground and walls



#### Note

Scattering and reflection are lowest at a sensor angle of 45° and at a minimum distance of 10 cm to the ground and walls (see section 3.2.5).



#### Note

At a sensor angle of 45°, keep a minimum distance of 50 cm in the direction of the infrared beam.

### 3.2.4 Sensor orientation

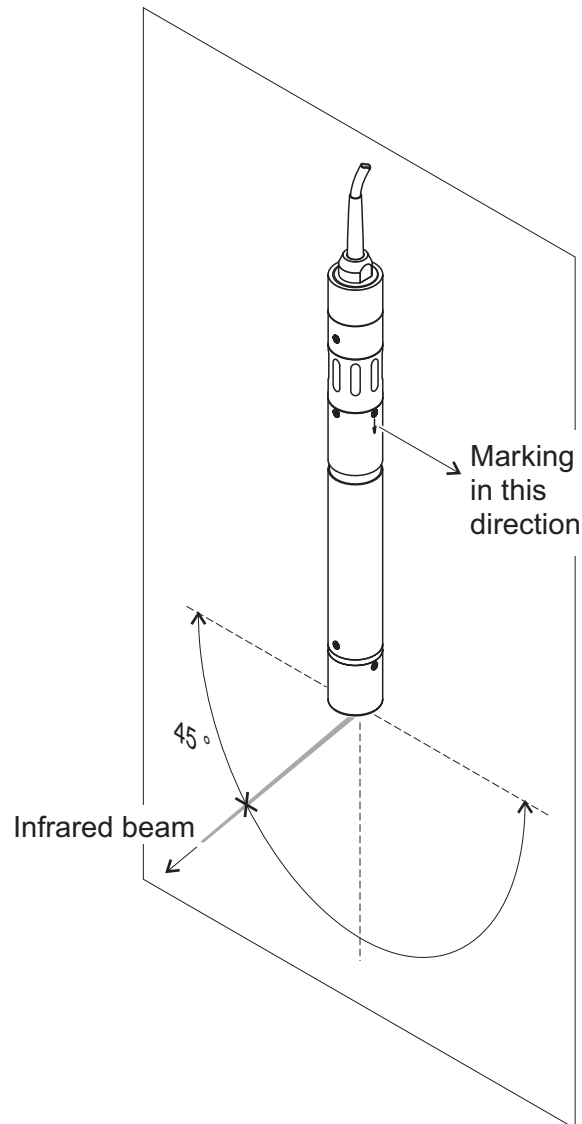
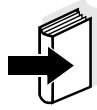


Fig. 3-2 Direction of the infrared beam relative to the arrow symbol on the shaft

The sensor has a marking (arrow symbol) on the shaft. The infrared beam emerges from the front of the sensor at an angle of  $45^\circ$  in the direction opposite the marking.

The angle of incidence to the ground and walls can be affected by rotating the sensor around its longitudinal axis. The sensor should be turned so that as little light as possible that is scattered or reflected by the wall or ground strikes the measurement window again.

### 3.2.5 Distances from the ground and wall



**Note**

In cases of low turbidity (< 100 FNU), the effect of the measuring environment can simulate higher turbidity or an increased level of total suspended solids. The effect of the measurement environment can be reduced by ensuring the optimum conditions (see section 3.2.1).

The following graphic indicates the minimum distances of the measurement windows to the ground or wall, which must be observed. The effect of the distances on the measured value was determined for various wall materials in the case of a sensor placed vertically to the wall in drinking water (see drawing).

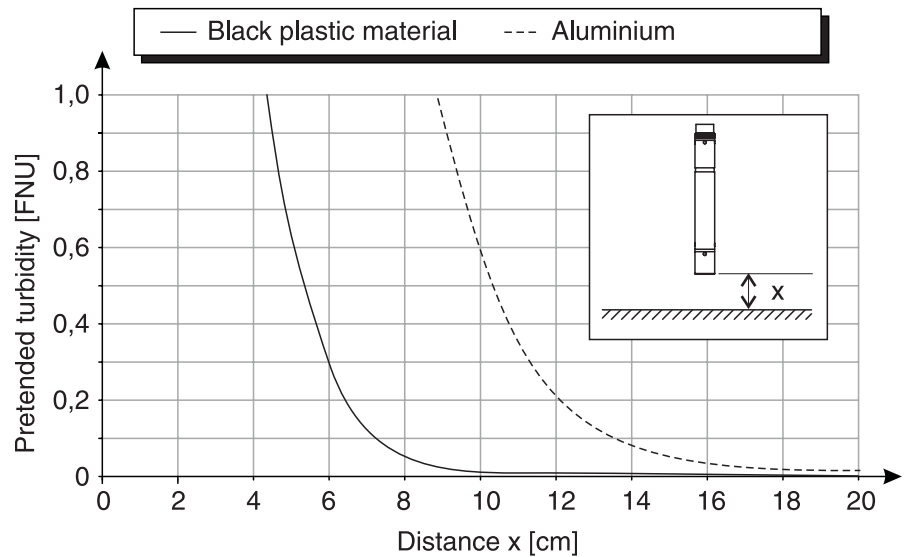


Fig. 3-3 Effect of ground and wall distances on the turbidity measurement



**Note**

At low levels of turbidity, a minimum distance of at least 10 cm must be kept from the ground or wall.



**Note**

If an optimum installation is not possible due to the structural conditions at the measuring location (e.g. in narrow pipelines), the effects of the measurement environment can be compensated by an application offset (see section 4.2.2).



### 3.3 Installation examples

As a rule, the VisoTurb® 700 IQ will measure interference-free when the distances and angles etc. specified are observed. However, interferences at the measuring location (see section 3.2.1) may require special adaptations of the installation.

#### 3.3.1 Measuring in an open basin or channel (range > 100 FNU)

**Example:  
Outlet of the  
preclarification stage**

The turbidity sensor can be immersed in the sample using a pendulum mounting assembly, e.g. pendulum mounting assembly EH/P 170, (pay attention to the minimum immersion depth).

Alternatively, the sensor can be suspended on a chain (e.g. with the EH/F 170 swing mounting assembly and EH/U 170 sensor holder). Make sure that the sensor cannot bump against any walls or obstacles.

**Example:**  
**Outlet of a waste water  
 treatment plant (open  
 channel, wall material:  
 concrete)**

### 3.3.2 Measuring in an open channel (range > 100 FNU)

In an open channel, the sensor can be immersed in the sample using a wall mounting assembly, e.g. EH/W 170 wall mounting assembly, (please note the minimum immersion depth).

- Protect the measuring location and the environment against direct sunlight (sun shield or similar)
- Mount the sensor rigidly in the channel. At the same time, tilt the sensor approx. 20 to 45 ° against the direction of the flow.
- Install the sensor so that the marking on the shaft (arrow symbol) points towards the outlet of the channel.

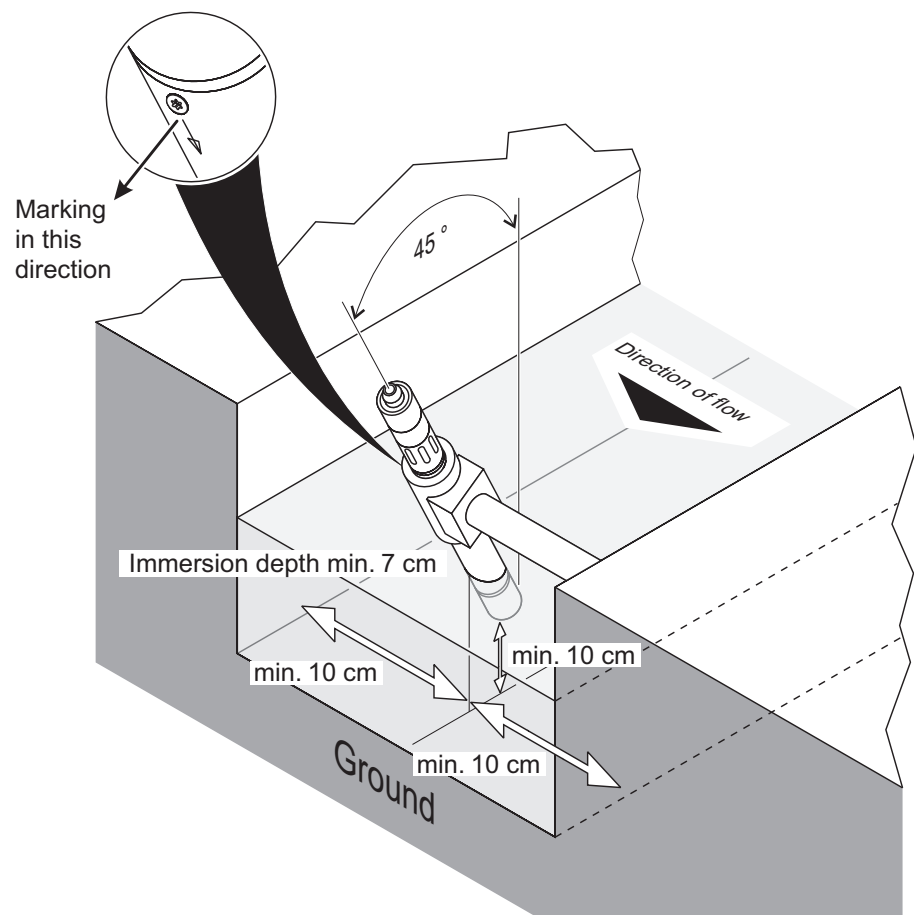


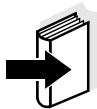
Fig. 3-4 Turbidity sensor in the open channel with EH/W 170 fixture assembly for direct wall mounting.



#### Note

Interferences at the measuring location (see section 3.2.1) may require special adaptations of the installation. For exceptions to the direction of flow, see section 3.2.2 FLOW DIRECTION.

### 3.3.3 Measurement in pipelines



**Note**

In cases of low turbidity (< 100 FNU), the effect of the measuring environment can simulate higher turbidity or an increased level of total suspended solids. The effect of the measurement environment can be reduced by ensuring the optimum conditions (see section 3.2.1).



**Note**

If an optimum installation is not possible due to the structural conditions at the measuring location (e.g. in narrow pipelines), the effects of the measurement environment can be compensated by an application offset (see section 4.2.2).

If deposits occur on the pipe walls, the application offset should be repeated at regular intervals.

**Example:  
45 ° pipe installation**

The pipe should be straight for a length of min. 50 cm beyond the installation location. Angled or tapered pipes can cause interference effects in the case of low turbidity.

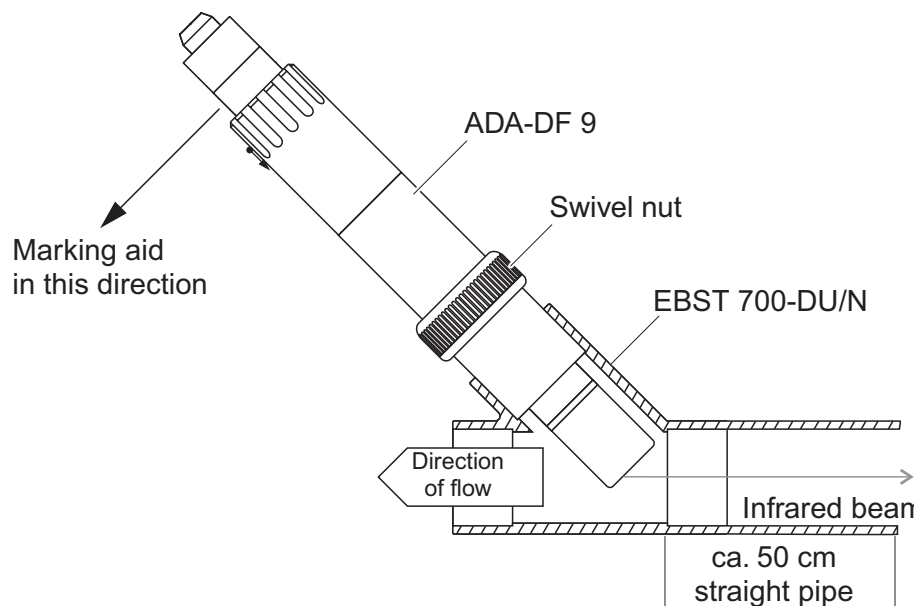


Fig. 3-5 Turbidity sensor in the pipe using EBST 700-DU/N flow-thru adapter

Fig. 3-5 shows the installation using the EBST 700-DU/N flow-thru adapter for installation in a straight pipeline (DN 50). The infrared beam is parallel to the pipeline axis and points in the opposite direction to the direction of flow. The marking on the sensor shaft points towards the pipeline (see Fig. 3-5).



**Note**

Interferences at the measuring location (see section 3.2.1) may require special adaptations of the installation. For exceptions to the direction of flow, see section 3.2.2 FLOW DIRECTION.

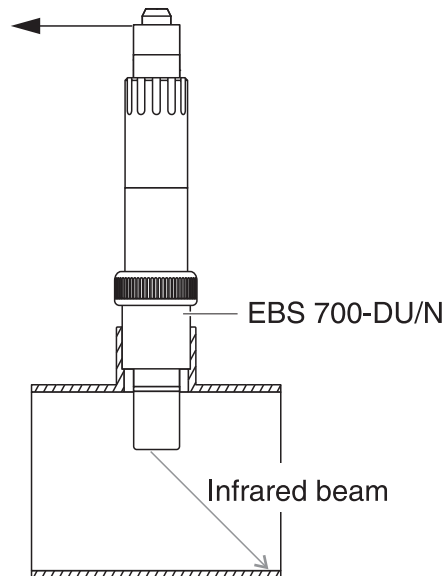
**Example:  
90 ° pipe installation**Marking aid  
in this direction

Fig. 3-6 Turbidity sensor in the pipe (90 °)

The following points must be observed for a right-angled installation in the pipe (Fig. 3-6):

- Rotate the sensor so that the marking on the shaft (arrow symbol) points in the direction of the pipe axis
- Select a position where the pipe diameter is as large as possible at the installation location (see section 3.2.5 DISTANCES FROM THE GROUND AND WALL).
- Before measuring, check whether an application offset is required in the case of lower turbidity values (see section 4.2.2).

**Marking aid**

- |   |  |
|---|--|
| 1 | Connect the SACIQ sensor connection cable to the plug head connector of the sensor and screw it tight (see section 3.4.1).                 |
| 2 | Attach a marking aid (adhesive strips or similar) in the same position as the arrow symbol on the sensor shaft to the plug head connector. |

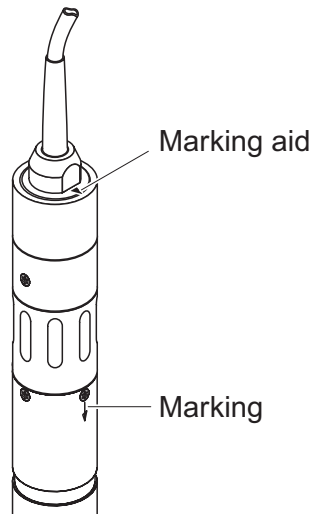


Fig. 3-7 Marking aid

- |   |   |
|---|---|
| 3 | Install the sensor in the flow-thru adapter with the aid of the ADA-DF 9 adapter (see operating manual of the adapter). To ensure the correct position, loosen the coupling ring on the EBST 700-DU/N somewhat and align the marking aid as shown in Fig. 3-5. Then, tighten the coupling ring. |
|---|---|

**3.4 Commissioning / Readiness for measuring**

**3.4.1 Connect the sensor**

**Connection cable**

An SACIQ type sensor connection cable is required to connect the sensor. Information on this and other IQ SENSOR NET accessories is given in the WTW catalog and on the Internet.



**Note**

How to connect the SACIQ sensor connection cable to the terminal strip of an MIQ module is described in chapter 3 INSTALLATION of the IQ SENSOR NET system operating manual.

**Are the plug connections dry?**

Before connecting the sensor and sensor connection cable, please make sure that the plug connections are dry. If moisture gets into the plug connections, first dry the plug connections (dab them dry or blow them dry using compressed air).



**Note**

Do not suspend the sensor on the sensor connection cable. Use a sensor holder or an armature. Information on this and other IQ SENSOR NET accessories is given in the WTW catalog and on the Internet.

**Connecting the sensor to the sensor connection cable**

1	Take the protective caps off the plug connections of the sensor and the SACIQ sensor connection cable and keep them safe.
2	Plug the jack of the SACIQ sensor connection cable onto the plug head connector of the sensor. At the same time, rotate the socket so that the pin in the plug head connector (1) clicks into one of the two holes in the jack.
3	Then, screw the coupling ring (2) of the sensor connection cable onto the sensor up to the stop.

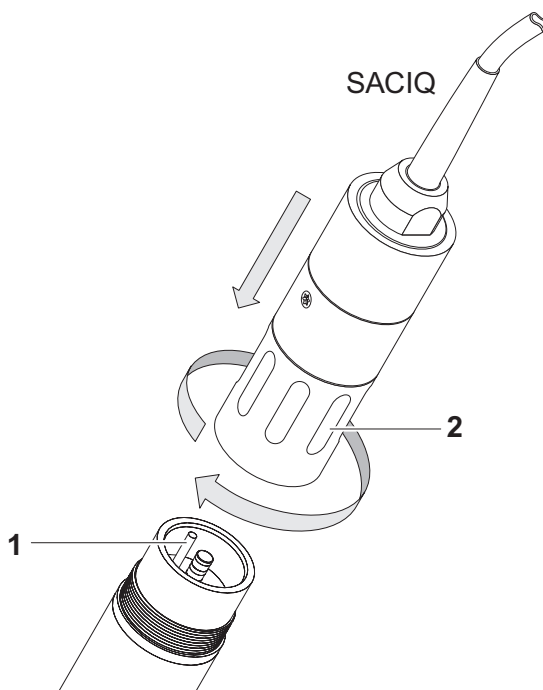


Fig. 3-8 Connect the sensor



**Note**

The sensor is provided with a long-term stable factory calibration for turbidity measurement and is immediately ready to carry out measurements.

## 3.4.2 Setting table VisoTurb® 700 IQ

Setting	Selection/values	Explanation
<i>Measuring mode</i>	<ul style="list-style-type: none"> <li>● <i>FNU</i></li> <li>● <i>NTU</i></li> <li>● <i>TEF</i></li> <li>● <i>mg/l SiO<sub>2</sub></i></li> <li>● <i>ppm SiO<sub>2</sub></i></li> <li>● <i>g/l TSS</i></li> </ul>	<ul style="list-style-type: none"> <li>– Turbidity unit <b>Formazine Nephelometric Units</b></li> <li>– Turbidity unit <b>Nephelometric Turbidity Units</b></li> <li>– <b>Turbidity Unit Formazine</b></li> <li>– Concentration of SiO<sub>2</sub> in mg/l</li> <li>– Concentration of SiO<sub>2</sub> in ppm</li> <li>– Conc. of total suspended solids in g/l (for details, see section 4.2.3).</li> </ul>
<i>Measuring range</i>	<ul style="list-style-type: none"> <li>● <i>AutoRange</i></li> <li>● <i>0 ... 0.400 FNU</i></li> <li>● <i>0 ... 4.00 FNU</i></li> <li>● <i>0 ... 40.0 FNU</i></li> <li>● <i>0 ... 400 FNU</i></li> <li>● <i>0 ... 4000 FNU</i></li> </ul>	Measuring ranges for the <i>FNU</i> measuring mode  ( <i>AutoRange</i> = automatic changeover of the measuring range)
	<ul style="list-style-type: none"> <li>● <i>AutoRange</i></li> <li>● <i>0 ... 0.400 NTU</i></li> <li>● <i>0 ... 4.00 NTU</i></li> <li>● <i>0 ... 40.0 NTU</i></li> <li>● <i>0 ... 400 NTU</i></li> <li>● <i>0 ... 4000 NTU</i></li> </ul>	Measuring range for the measuring mode <i>NTU</i>  ( <i>AutoRange</i> = automatic changeover of the measuring range)
	<ul style="list-style-type: none"> <li>● <i>AutoRange</i></li> <li>● <i>0 ... 0.400 TEF</i></li> <li>● <i>0 ... 4.00 TEF</i></li> <li>● <i>0 ... 40.0 TEF</i></li> <li>● <i>0 ... 400 TEF</i></li> <li>● <i>0 ... 4000 TEF</i></li> </ul>	Measuring range for the measuring mode <i>TEF</i>  ( <i>AutoRange</i> = automatic changeover of the measuring range)
	<ul style="list-style-type: none"> <li>● <i>AutoRange</i></li> <li>● <i>0 ... 0.400 mg/l</i></li> <li>● <i>0 ... 4.00 mg/l</i></li> <li>● <i>0 ... 40.0 mg/l</i></li> <li>● <i>0 ... 400 mg/l</i></li> <li>● <i>0 ... 4000 mg/l</i></li> </ul>	Measuring range for the measuring mode <i>mg/l SiO<sub>2</sub></i>  ( <i>AutoRange</i> = automatic changeover of the measuring range)


Setting	Selection/values	Explanation
	<ul style="list-style-type: none"> <li>● <i>AutoRange</i></li> <li>● <i>0 ... 0.400 ppm</i></li> <li>● <i>0 ... 4.00 ppm</i></li> <li>● <i>0 ... 40.0 ppm</i></li> <li>● <i>0 ... 400 ppm</i></li> <li>● <i>0 ... 4000 ppm</i></li> </ul>	<p>Measuring range for the measuring mode <i>ppm SiO<sub>2</sub></i></p> <p>(<i>AutoRange</i> = automatic changeover of the measuring range)</p>
	<ul style="list-style-type: none"> <li>● <i>AutoRange</i></li> <li>● <i>0 ... 0.400 mg/l</i></li> <li>● <i>0 ... 4.00 mg/l</i></li> <li>● <i>0 ... 40.0 mg/l</i></li> <li>● <i>0 ... 400 mg/l</i></li> <li>● <i>0 ... 4.00 g/l</i></li> <li>● <i>0 ... 40.0 g/l</i></li> <li>● <i>0 ... 400 g/l</i></li> </ul>	<p>Measuring range for the measuring mode <i>g/l TSS</i></p> <p>(<i>AutoRange</i> = automatic changeover of the measuring range)</p>
<i>TSS range</i>		Adjustment values from the reference measurement for determining the amount of total suspended solids. Only displayed if the <i>g/l TSS</i> measuring mode was selected (for details, see section 4.2.3).
<i>TSS value</i>		
<i>Turbidity range</i>		
<i>Turbidity value</i>		
<i>Signal averaging</i>	<i>1 ... 600 secs</i>	<p>Response time of the signal filter. Depending on the sample matrix, the measured values may oscillate more or less (e.g. due to foreign bodies or air bubbles). The signal filter reduces the limits of variation of the measured value. The signal filter is characterized by the signal averaging time. This is the time after which 90 % of a signal change is displayed.</p>
<i>Application offset</i>	<i>-20.00 ... +20.00 (units depend on measuring mode)</i>	<p>Correction value for compensation of environmentally-dependent interferences. The value is added to the measured value (for details, see section 4.2.2).</p>
<i>Ultrasonic cleaning</i>	<ul style="list-style-type: none"> <li><i>On</i></li> <li><i>Off</i></li> <li><i>Pulse</i></li> </ul>	<p>Switch on or off the ultrasound cleaning function (<i>Pulse</i> = pulse operation).</p>
<i>Save and quit</i>		<p>The system confirms the saving of the settings and the display switches to the next higher level.</p>



---

Setting	Selection/values	Explanation
<i>Quit</i>		The display switches to the next higher level without saving the new settings.

**Carrying out settings**

Switch to the main settings menu from the measured value display with . Then navigate to the setting menu (setting table) of the sensor. The exact procedure is described in the relevant IQ SENSOR NET system operating manual.



## 4 Measuring

The turbidity measurement in aqueous media with the VisoTurb® 700 IQ is conducted nephelometrically in accordance with EN ISO 7027.

The turbidity/total suspended solids sensor can also be used to determine the total suspended solids content in the sample. The appropriate correlation for the given application can be determined via a reference measurement. After this adjustment, the turbidity value is converted into the concentration of total suspended solids.

### 4.1 Measuring operation

1	Immerse the sensor in the sample.
2	Read the measured value on the terminal of the IQ SENSOR NET system.

**Note**

Large differences between the temperature of the sensor and sample can falsify the measurement result. Thus, as a precaution during commissioning, wait for 15 minutes before using the measured value.

**Note**

The allowed temperature of the measuring medium is 0 ... 60 °C. The ultrasound cleaning system switches itself off automatically if the temperature of the measuring medium is above 40 °C. When the temperature decreases below 40 °C, it switches itself on again. The switching off above 40 °C prevents an overheating, for example if the minimum immersion depth of the sensor is not maintained.

## 4.2 Calibration

### 4.2.1 General information

#### Why calibrate?

The following factors can change with time and affect the measurement results:

- the optical characteristics, e.g. color and particle size, and the density of the measuring medium (e.g. dependent on the season)
- the conditions at the measuring location (e.g. due to growing deposits on the ground and walls)

The effect of the measurement environment can be reduced by ensuring the optimum conditions (see section 3.2.1) and can be compensated by an application offset (see section 4.2.2).

For measurements of the total suspended solids, a user calibration is always required (see section 4.2.3).

#### When to calibrate?

A new user calibration is required if there is any change of the characteristics of the measuring medium or any change of the environment at the measuring location.



#### Note

Values of the user calibration that have been entered are saved in the controller and thus assigned to the measuring location (not to the sensor). Therefore, if the sensor is exchanged, no new user calibration is required.

#### How is a calibration carried out?

The actual level of total suspended solids of your measuring medium is determined by a reference measurement (e.g. gravimetric according to DIN 38414).

If the reference measurements do not deviate from the optically determined measured value of the VisoTurb® 700 IQ, the sensor is already optimally adapted to the measuring situation.

If the reference measurements do deviate from the optically determined measured value of the VisoTurb® 700 IQ, proceed as follows:

- Optimize the conditions at the measuring location (see section 3.2.1)
- Perform a user calibration (see section 4.2.3) if you measure the total suspended solids.
- Perform an application offset (see section 4.2.2), if the measuring environment affects the measured values

#### 4.2.2 Application offset

In an optimum installation (sufficient distance to the walls, walls made of dark material), the effect of the measurement environment is negligibly small. If an optimum installation is not feasible due to local circumstances, interference effects can be compensated by a measured value correction.



##### Note

Depending on the test sample, the optical characteristics of the vessel inner surface can change greatly with time (biological films, lime deposits). This can affect the turbidity measurement. Repeat the application offset from time to time as well as to check the effect of the surfaces if excessive turbidity values are suspected.

##### Determining the correction value

The determination of the correction value can be carried out using normal drinking water. Two measurements are performed:

1. Measurement in an environment that is as ideal as possible (reference value).
2. Measurement in the actual measurement environment.

The correction value is calculated from the two measurements as follows (the correction value is usually negative):

$$\text{Correction value} = \text{turbidity value (ideal)} - \text{turbidity value (real)}$$

##### Entering the correction value for the measurement

The correction value is entered in the setting table of the turbidity sensor in the *Application offset* field (see section 3.4.2).

##### Ideal measurement environment

An ideal measurement environment for the application offset can be set up with the following simple accessories:

- Bucket made of black plastic, with a capacity of at least 10 l
- Holding device for the sensor, e. g. laboratory stand
- Shading against direct sunlight (cardboard or similar).

Position the sensor as shown in the following diagram:

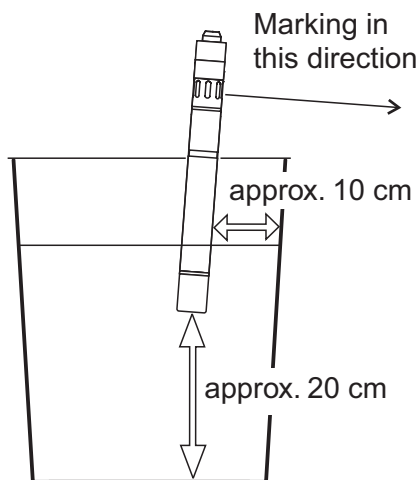


Fig. 4-1 Ideal measurement environment for the application offset

### 4.2.3 User calibration for measuring the total suspended solids (g/l TSS)

The turbidity values of the TSS measurement are converted into FNU units for the concentration of dry substance. The g/l TSS measuring mode displays the turbidity value as a secondary measured value in FNU.

The correlation between the FNU units and the concentration of dry substance is achieved via a user calibration. At the point of time of the user calibration, the test sample should be in a state representative of the later measurement (type and amount of total suspended solids, coloration, etc.). The results of the user calibration are input manually in the setting table of the VisoTurb® 700 IQ (see section 3.4.2).

#### Setting for total suspended solids measurement

1	Bring the sensor into the measuring position.
2	In the setting table of the turbidity sensor, select the g/l TSS measuring mode and the <i>AutoRange</i> measuring range (see section 3.4.2).
3	Switch to the measured value display with $\text{M}$ .
4	When the measured value is stable, read and record the FNU value (secondary measured value).
5	If possible, take a sample at the same time as the turbidity measurement and, if possible, directly at the measurement windows.





6	Determine and note the concentration of total suspended solids in the sample according to a reference procedure (e.g. gravimetric according to DIN 38414).
7	Switch to the setting table of the turbidity sensor.
8	Select the value range for the total suspended solids contents determined during the reference measurement in the <i>TSS range</i> field.
9	Select the value range for the turbidity determined during the reference measurement in the <i>Turbidity range</i> field.
10	Enter the values for the concentration of total suspended solids and turbidity obtained from the reference measurement.

**Note**

To measure the TSS contents, both values of the reference measurement (total suspended solids content and the corresponding turbidity value) must be entered. The following table shows the possible settings:

Setting	Selection/values	Explanation
<i>TSS range</i>	<ul style="list-style-type: none"> <li>● 0 ... 0.400 mg/l</li> <li>● 0 ... 4.00 mg/l</li> <li>● 0 ... 40.0 mg/l</li> <li>● 0 ... 400 mg/l</li> <li>● 0 ... 4.00 g/l</li> <li>● 0 ... 40.0 g/l</li> <li>● 0 ... 400 g/l</li> </ul>	<p>Range for entering the total suspended solids contents.</p> <p>The setting range is subdivided because it is so large.</p> <p>Select the smallest possible range in order to enter the value in the <i>TSS value</i> field as precisely as possible.</p> <p><u>Example:</u>            Concentration of total suspended solids = 35.76 mg/l            – Smallest possible settings range:              0 ... 40.0 mg/l.            – Entry in the <i>TSS value</i> field:              35.8 mg/l</p>
<i>TSS value</i>		Concentration of total suspended solids in g/l / TSS as it was determined using the reference procedure. The input precision depends on the setting in the <i>TSS range</i> field.

Setting	Selection/values	Explanation
<i>Turbidity range</i>	<ul style="list-style-type: none"> <li>● 0 ... 0.400 FNU</li> <li>● 0 ... 4.00 FNU</li> <li>● 0 ... 40.0 FNU</li> <li>● 0 ... 400 FNU</li> <li>● 0 ... 4000 FNU</li> </ul>	<p>Range for the entry of the turbidity value.</p> <p>Select the smallest possible range in order to enter the turbidity value in the <i>Turbidity value</i> field as precisely as possible.</p> <p><u>Example:</u>                      Reading of the turbidity value= 38.2 FNU                      – Smallest possible settings range:                          0 ... 40.0 FNU.                      – Entry in the <i>Turbidity value</i> field:                          38.2 FNU</p>
<i>Turbidity value</i>		<p>Turbidity value as it was determined with the turbidity sensor. The input precision depends on the setting in the <i>Turbidity range</i> field.</p>

- |    |  |
|----|--|
| 11 | Make the sensor settings with  and confirm each of them with  .  |
| 12 | Select the <i>Save and quit</i> menu item with  and confirm with  . The new settings are stored in the sensor. The turbidity sensor is calibrated for the measurement of total suspended solids. |



**Note**

The total suspended solids measurement is even more precise, the better the current status of the sample corresponds to the status at the time of the user calibration. If there is a fundamental change of the characteristics of the sample, a new user calibration may be necessary.



## 5 Maintenance, cleaning, accessories

### 5.1 General information



**Warning**

**Contact with the sample can be dangerous for the user! Depending on the type of sample, suitable protective measures must be taken (protective clothing, protective goggles, etc.).**

The VisoTurb® 700 IQ sensor does not usually require any maintenance. The continuously running ultrasound system prevents the accumulation of pollution in almost all cases.



**Note**

We recommend cleaning the shaft and the sapphire disc if the sensor has remained in the sample in a non-operative condition for any lengthy period of time.

### 5.2 Cleaning the sensor shaft and sapphire disc

During normal operation (e.g. municipal wastewater), cleaning is recommended:

- if there is any pollution (according to visual check)
- if the sensor was not in operation for a lengthy period of time but was immersed in the measuring medium
- if the measured values are suspected of being incorrect (usually too low)
- if the SensCheck message appears in the log book

**Cleaning agents**

Contamination	Cleaning agents
Sludge and loosely adhering dirt or biological films	Soft cloth or soft brush, warm tap water with detergent
Salt and / or lime deposits	Acetic acid (volume percentage = 20 %), soft cloth or soft sponge



**Caution**

**Acetic acid irritates the eyes and the skin. When handling acetic acid, always wear protective gloves and protective goggles.**



**Note**

We do not recommend to unscrew the sensor from the sensor connection cable when cleaning the sensor shaft and membrane. Otherwise, moisture and/or dirt can get into the plug connection where they can cause contact problems.

If you would like to disconnect the sensor from the sensor connection cable, please note the following points:

- Before disconnecting the sensor from the SACIQ sensor connection cable, remove any larger pieces of contamination from the sensor, particularly in the area of the plug connection (brush it off in a bucket of tap water, wash it off with a hose or wipe it off with a cloth).
- Unscrew the sensor from the SACIQ sensor connection cable.
- Always place a protective cap on the sensor plug head connector and on the SACIQ sensor connection cable so that no moisture or dirt can get into the contacting surfaces.
- In corrosive environments, close the socket of the sensor connection cable with the screwable SACIQ-Plug when it is dry in order to protect the electrical contacts from corrosion. The protective plug is available as an accessory (see section 5.3 ACCESSORIES).



**Caution**

**The sensor warms up during operation in the air. Consequently, pollution can collect in the vicinity of the measurement window due to the evaporation of liquid. Therefore, avoid any lengthy operation in the air.**

**Cleaning**

1	Pull the sensor out of the sample.
2	Remove any coarse pollution from the sensor (by brushing it off in a bucket of tapwater, spraying it off with a hose or wiping with a cloth).
3	Clean the sensor shaft and the sapphire disc as specified in the section CLEANING AGENTS.
4	Then, rinse it thoroughly with tap water.

### 5.3 Accessories

Description	Model	Order no.
Screwable plug for sensor connection cable	SACIQ-Plug	480 065

**Note**

Information on other IQ SENSOR NET accessories is given in the WTW catalog and on the Internet.



## 6 What to do if ...

**The sensor automatically switches itself on and off periodically after commissioning**

### Cause

- The available power is sufficient for the initialization of the sensor, but not for the operation of the cleaning system. As soon as this is switched on, communication with the controller is interrupted.

### Remedy

- Install another power supply module as close as possible to the VisoTurb® 700 IQ

**Mechanical damage to the sensor**

### Cause

### Remedy

- Return the sensor

**Display of *OFL***

### Cause

### Remedy

- Measuring range exceeded

- See log book

**Display of "----"**

### Cause

### Remedy

- Measured value invalid

- See log book

**Measured value fluctuating heavily**

### Cause

### Remedy

- Gas bubbles in the medium are in front of the sapphire disc
- Signal averaging time too short for low values of turbidity

- Check the installation position of the sensor (see section 3.2 and section 3.3)
- Increase signal averaging time

**Measured values too low**

### Cause

### Remedy

- Sapphire disc polluted

- Clean sapphire disc (see section 5.2)

Measured values too high	Cause	Remedy
	<ul style="list-style-type: none"> <li>- Gas bubbles in the medium are in front of the sapphire disc</li> </ul>	<ul style="list-style-type: none"> <li>- Check the installation position of the sensor (see section 3.2 and section 3.3)</li> </ul>
	<ul style="list-style-type: none"> <li>- Light scattering on the walls</li> </ul>	<ul style="list-style-type: none"> <li>- Check the installation position of the sensor (see section 3.2 and section 3.3)</li> <li>- If necessary, compensate for effects that cannot be removed with the aid of the application offset function</li> </ul>
Measured value flashes	Cause	Remedy
	<ul style="list-style-type: none"> <li>- Maintenance condition is switched on</li> </ul>	<ul style="list-style-type: none"> <li>- if the maintenance condition was switched on manually (e.g. by pressing the <b>Ⓢ</b> key): Switch off the maintenance condition manually in the <i>Display/Options</i> menu (see system operating manual)</li> <li>- if the maintenance condition was switched on automatically (e.g. by the cleaning system): The maintenance condition will be terminated automatically</li> </ul>

## 7 Technical data

### 7.1 Measuring characteristics

#### Measuring principle

Procedure for measuring scattered light measurement in accordance with EN ISO 7027 (DIN EN 27027 or ISO 7027):

- 90 ° measuring angle
- Measurement in formazine nephelometric units, FNU
- Conversion of the values to:
  - NTU
  - TEF
  - mg/l SiO<sub>2</sub>
  - ppm SiO<sub>2</sub>
  - g/l TSS (total suspended solids)

#### Measuring ranges and resolutions

Measuring mode	Measuring ranges	Resolution
FNU, NTU, TEF	0 ... 0.400	0.001
	0 ... 4.00	0.01
	0 ... 40.0	0.1
	0 ... 400	1
	0 ... 4000	1
mg/l SiO <sub>2</sub>	0 ... 0.400	0.001
	0 ... 4.00	0.01
	0 ... 40.0	0.1
	0 ... 400	1
	0 ... 4000	1
ppm SiO <sub>2</sub>	0 ... 0.400	0.001
	0 ... 4.00	0.01
	0 ... 40.0	0.1
	0 ... 400	1
	0 ... 4000	1
TSS	0 ... 0.400 mg/l	0.001 mg/l
	0 ... 4.00 mg/l	0.01 mg/l
	0 ... 40.0 mg/l	0.1 mg/l
	0 ... 400 mg/l	1 mg/l
	0 ... 4.00 g/l	0.01 g/l
	0 ... 40.0 g/l	0.1 g/l
	0 ... 400 g/l	1 g/l

<b>Accuracy</b>	Process variation coefficient according to DIN 38402 part 51	< 1 % in the range to 2000 FNU
	Repeatability limit or repeatability according to DIN ISO 5725 or DIN 1319 respectively	< 0.015 % or min. 0.006 FNU.

## 7.2 Application characteristics

<b>Allowed temperature range</b>	Measuring medium	0 °C ... + 60 °C (32 ... 140 °F) Operation with ultrasound cleaning system possible up to 40 °C  <u>Note:</u> The ultrasound cleaning system automatically switches off and on again. The switching off above 40 °C prevents an overheating, for example if the minimum immersion depth of the sensor is not maintained.
	Storage/transport	- 5 °C ... + 65 °C (23 ... 149 °F)

**Allowed pH range of the measuring medium** 4 ... 12

**Pressure resistance** Sensor with connected SACIQ (SW) sensor connection cable:

Max. allowed overpressure | 10<sup>6</sup> Pa (10 bar)

The sensor fulfills all requirements according to article 3(3) of the directive 97/23/EC ("pressure equipment directive").

**Type of protection** Sensor with connected SACIQ (SW) sensor connection cable:  
IP 68, 10 bar (10<sup>6</sup> Pa)

**Depth of immersion** min. 10 cm; max. 100 m depth

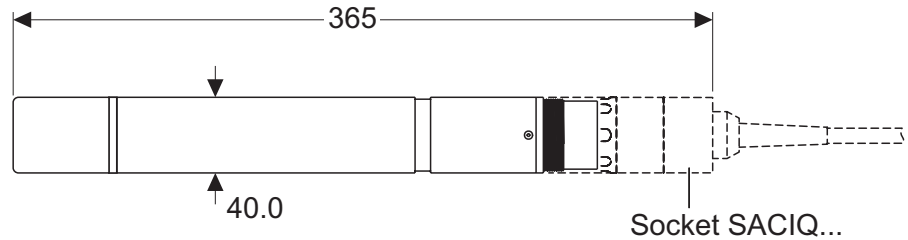
**Operating position** see section 3.2 INSTALLATION

**Fields of application** Water and wastewater monitoring



### 7.3 General data

**Dimensions**



**Weight (without sensor connection cable)**

approx. 990 g

**Connection technique**

Connection using SACIQ (SW) sensor connection cable

**Material**

Shaft	V4A stainless steel 1.4571
Measurement window	Sapphire
Plug head connector housing	POM
Plug, 3-pole	ETFE (blue) Tefzel®

**Cleaning system**

Ultrasound principle

**Automatic sensor monitoring (SensCheck function)**

- Recognition of a measurement malfunction
- Identification of any failure of the cleaning system

**Instrument safety**

Applicable norms	<ul style="list-style-type: none"> <li>- EN 61010-1</li> <li>- UL 3111-1</li> <li>- CAN/CSA C22.2 No. 1010.1</li> </ul>
------------------	---

### 7.4 Electrical data

Nominal voltage	max. 24 VDC via the IQ SENSOR NET (details see chapter TECHNICAL DATA of the IQ SENSOR NET system operating manual)
Power consumption	1.5 W
Protective class	III



## 8 Indexes

### 8.1 Explanation of the messages

This chapter contains a list of all the message codes and related message texts that can occur in the log book of the IQ SENSOR NET system for the VisoTurb® 700 IQ sensor.



#### Note

Information on

- the contents and structure of the log book and
- the structure of the message code

is given in the LOG BOOK chapter of the IQ SENSOR NET system operating manual.



#### Note

All message codes of the VisoTurb® 700 IQ end with the number "341".

#### 8.1.1 Error messages

<b>Message code</b>	<b>Message text</b>
EA2341	<i>Sensor temperature too high!</i> <i>* Check process and application</i>
EA3341	<i>Sensor temperature too low!</i> <i>* Check process and application</i>
EA6341	<i>Meas. range exceeded or undercut</i> <i>* Check process</i> <i>* Select other meas. range</i> <i>* Submerge sensor in sample</i> <i>* Select bubble-free spot for measurement</i> <i>* Remove any foreign matter from sensor</i> <i>* Avoid influence of large foreign matter</i> <i>* Clean sensor</i> <i>* Increase signal average time</i>
EA7341	<i>Ultrasound cleaning system switched off</i> <i>* Check sample temperature</i> <i>* Submerge sensor in sample</i>
EI1341	<i>Operational voltage too low</i> <i>* Check installation and cable lengths, Follow installation instructions</i> <i>* Power unit(s) overloaded, add power unit(s)</i> <i>* Defective components, replace components</i>

---

<b>Message code</b>	<b>Message text</b>
EI2341	<i>Operational voltage too low, no operation possible</i> <i>* Check installation and cable lengths, Follow installation instructions</i> <i>* Power unit(s) overloaded, add power unit(s)</i> <i>* Check terminal and module connections</i> <i>* Defective components, replace components</i>
ES1341	<i>Component hardware defective</i> <i>* Contact WTW</i>
ESD341	<i>SensCheck: Measurement interfered</i> <i>* Submerge sensor in sample</i> <i>* Select bubble-free spot for measurement</i> <i>* Remove any foreign matter from sensor</i> <i>* Avoid influence of large foreign matter</i> <i>* Clean sensor</i> <i>* Increase signal average time</i>
ESE341	<i>SensCheck: Ultrasound cleaning system has failed</i> <i>* Return sensor for repair</i>

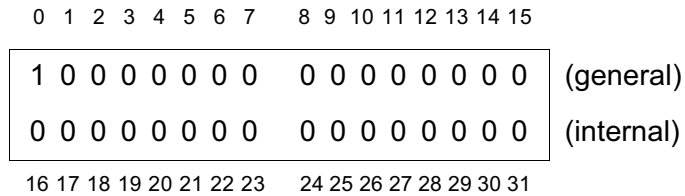
### 8.1.2 Info messages

<b>Message code</b>	<b>Message text</b>
IA1341	<i>Ultrasound cleaning system switched on</i> <i>* Check sensor visually</i> <i>* Clean sensor if necessary</i>

## 8.2 Status info

The status info is a piece of coded information about the current state of a sensor. Each sensor sends this status info to the controller. The status info of sensors consists of 32 bits, each of which can have the value 0 or 1.

Status info,  
general structure



The bits 0 - 15 are reserved for general information.  
The bits 16 - 21 are reserved for internal service information.

You obtain the status info:

- via a manual query in the menu, *Einstellungen/Setup/Service/List of all components* (see system operating manual)
- via an automated query
  - of a superordinate process control (e. g. when connected to the Profibus)
  - of the IQ Data Server (see operating manual of the IQ SENSOR NET software pack)



**Note**

The evaluation of the status info, e.g. in the case of an automated query, has to be made individually for each bit.

VisoTurb® 700 IQ

Status info

Status bit	Explanation
<b>Bit 0</b>	<i>Component hardware defective</i>
<b>Bit 1</b>	<i>SensCheck: Measurement interfered</i>
<b>Bit 2</b>	<i>SensCheck: Ultrasound cleaning system has failed</i>
<b>Bit 3-31</b>	-







## **Wissenschaftlich-Technische Werkstätten GmbH**

Dr.-Karl-Slevogt-Straße 1  
D-82362 Weilheim

Germany

Tel: +49 (0) 881 183-0  
+49 (0) 881 183-100  
Fax: +49 (0) 881 183-420  
E-Mail: [Info@WTW.com](mailto:Info@WTW.com)  
Internet: <http://www.WTW.com>