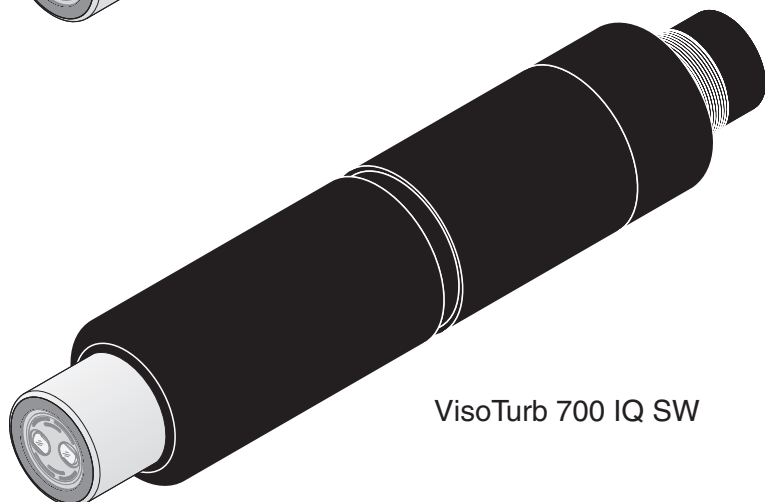


VisoTurb 700 IQ



VisoTurb 700 IQ SW

VisoTurb[®] 700 IQ (SW)

IQ SENSORNET TOTAL SUSPENDED SOLIDS SENSOR



a xylem brand



For the most recent version of the manual, please visit www.yssi.com.

Contact

YSI
1725 Brannum Lane
Yellow Springs, OH 45387 USA
Tel: +1 937-767-7241
800-765-4974
Email: environmental@ysi.com
Internet: www.yssi.com

Copyright

© 2015 Xylem Inc.

VisoTurb® 700 IQ (SW) - Contents

1	Overview	1-5
1.1	How to use this component operating manual	1-5
1.2	Structure of the VisoTurb® 700 IQ (SW) turbidity sensor	1-6
1.3	Recommended fields of application	1-6
1.4	Features of the VisoTurb® 700 IQ (SW)	1-7
2	Safety	2-8
2.1	Safety information	2-8
2.1.1	Safety information in the operating manual	2-8
2.1.2	Safety signs on the product	2-8
2.1.3	Further documents providing safety information	2-8
2.2	Safe operation	2-9
2.2.1	Authorized use	2-9
2.2.2	Requirements for safe operation	2-9
2.2.3	Unauthorized use	2-9
3	Commissioning	3-10
3.1	Scope of delivery	3-10
3.2	Installation	3-10
3.2.1	General information	3-10
3.2.2	Flow direction	3-11
3.2.3	Sensor angle	3-11
3.2.4	Sensor orientation	3-11
3.2.5	Distances from the ground and walls	3-12
3.3	Installation examples	3-13
3.3.1	Measuring in an open basin or channel (range > 100 FNU)	3-14
3.3.2	Measuring in an open channel (range < 100 FNU)	3-14
3.3.3	Measurement in pipelines	3-16
3.4	Commissioning / Readiness for measurement	3-18
3.4.1	Connect the sensor	3-18
3.4.2	Setting table for the VisoTurb® 700 IQ (SW)	3-20
4	Measuring	4-23
4.1	Measurement operation	4-23
4.2	Calibration	4-23
4.2.1	General information	4-23
4.2.2	Application offset	4-24

4.2.3	User calibration for measurement of the total suspended solids (g/l TSS)	4-26
5	Maintenance, cleaning, accessories	5-29
5.1	General information	5-29
5.2	Cleaning the sensor shaft and sapphire disc	5-29
5.3	Accessories	5-30
6	What to do if	6-32
7	Technical data	7-34
7.1	Measuring characteristics	7-34
7.2	Application characteristics	7-35
7.3	General data	7-36
7.4	Electrical data	7-37
8	Lists	8-38
8.1	Explanation of the messages	8-38
8.1.1	Error messages	8-38
8.1.2	Informative messages	8-39
8.2	Status info	8-40
9	Contact Information	9-41
9.1	Ordering & Technical Support	9-41
9.2	Service Information	9-41

1 Overview

1.1 How to use this component operating manual

Structure of the IQ SENSORNET operating manual

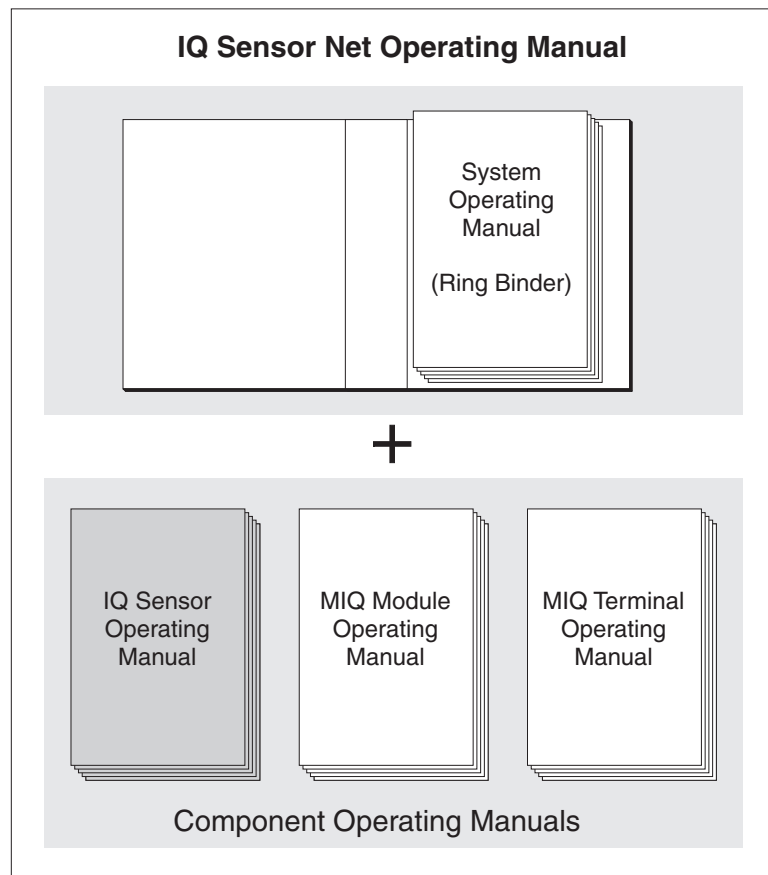


Fig. 1-1 Structure of the IQ SENSORNET operating manual

The IQ SENSORNET operating manual has a modular structure like the IQ SENSORNET 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 (SW) turbidity sensor

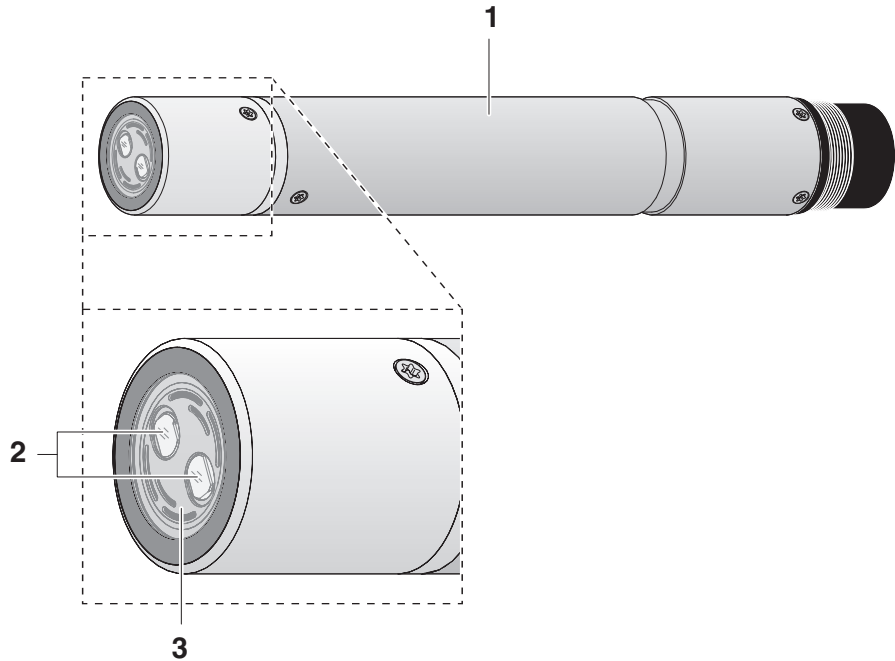


Fig. 1-2 Structure of the (Example: VisoTurb® 700 IQ (SW)) turbidity sensor

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

1.3 Recommended fields of application

VisoTurb® 700 IQ (SW)

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

**VisoTurb® 700 IQ (SW)
SW**

Stationary measurements in seawater and brackish water, aquaculture.

The VisoTurb® 700 IQ (SW) 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 (SW)

Turbidity measurement according to EN ISO 7027

The turbidity measurement in aqueous media with the VisoTurb® 700 IQ (SW) 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

2.1 Safety information

2.1.1 Safety information in the operating manual

This operating manual provides important information on the safe operation of the product. Read this operating manual thoroughly and make yourself familiar with the product before putting it into operation or working with it. The operating manual must be kept in the vicinity of the product so you can always find the information you need.

Important safety instructions are highlighted in this operating manual. They are indicated by the warning symbol (triangle) in the left column. The signal word (e.g. "CAUTION") indicates the level of danger:



WARNING

indicates a possibly dangerous situation that can lead to serious (irreversible) injury or death if the safety instruction is not followed.



CAUTION

indicates a possibly dangerous situation that can lead to slight (reversible) injury if the safety instruction is not followed.

NOTE

indicates a situation where goods might be damaged if the actions mentioned are not taken.

2.1.2 Safety signs on the product

Note all labels, information signs and safety symbols on the product. A warning symbol (triangle) without text refers to safety information in this operating manual.

2.1.3 Further documents providing safety information

The following documents provide additional information, which you should observe for your safety when working with the measuring system:

- Operating manuals of other components of the measuring system (Power supply units, controllers, accessories)
- Safety datasheets of calibration and maintenance equipment (e.g. cleaning solutions).

2.2 Safe operation

2.2.1 Authorized use

The authorized use of the VisoTurb® 700 IQ (SW) consists of its use as a sensor in the IQ SENSORNET. Only the operation and running of the sensor according to the instructions and technical specifications given in this operating manual is authorized (see chapter 7 TECHNICAL DATA). Any other use is considered unauthorized.

2.2.2 Requirements for safe operation

Note the following points for safe operation:

- The product may only be operated according to the authorized use specified above.
- The product may only be supplied with power by the energy sources mentioned in this operating manual.
- The product may only be operated under the environmental conditions mentioned in this operating manual.
- The product may not be opened.

2.2.3 Unauthorized use

The product must not be put into operation if:

- it is visibly damaged (e.g. after being transported)
- it was stored under adverse conditions for a lengthy period of time (storing conditions, see chapter 7 TECHNICAL DATA).

3 Commissioning

3.1 Scope of delivery

- VisoTurb® 700 IQ (SW) turbidity/total suspended solids sensor
- The sensor is fitted with protective caps
- Operating manual

3.2 Installation

3.2.1 General information

The measuring principle of the VisoTurb® 700 IQ (SW) (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 the favorable positioning of the sensor. For this reason, the optimum installation position is especially important for measuring low turbidity values.



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

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 walls (see section 3.2.5)
- Light-colored, heavily light-scattering surfaces in the measuring vessel (e.g. 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

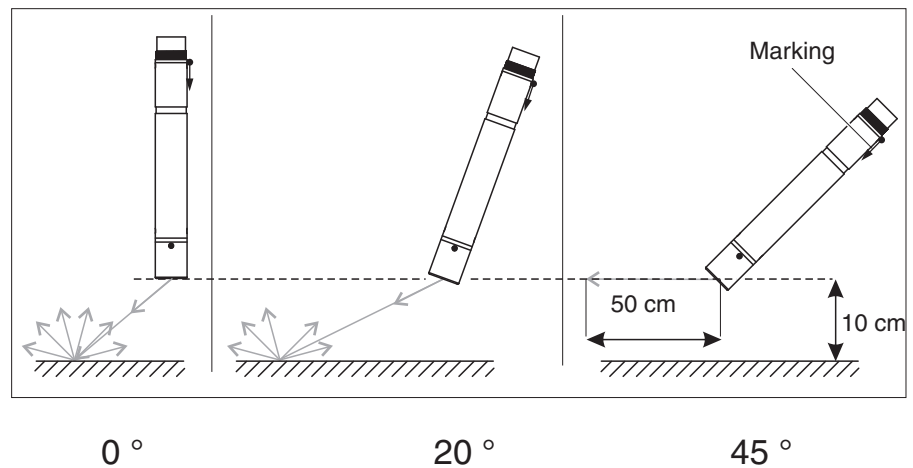


Fig. 3-1 Effect of the sensor angle on scattering and reflection from the ground and walls



At a sensor angle of 45° and a minimum distance of 10 cm towards the ground and walls (see section 3.2.5), the scattering and reflexion are lowest.

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

The sensor has a marking (arrow symbol on the shaft or glue dot on the plug head). The infrared beam emerges from the front of the sensor at an angle of 45 ° in the direction opposite the marking.

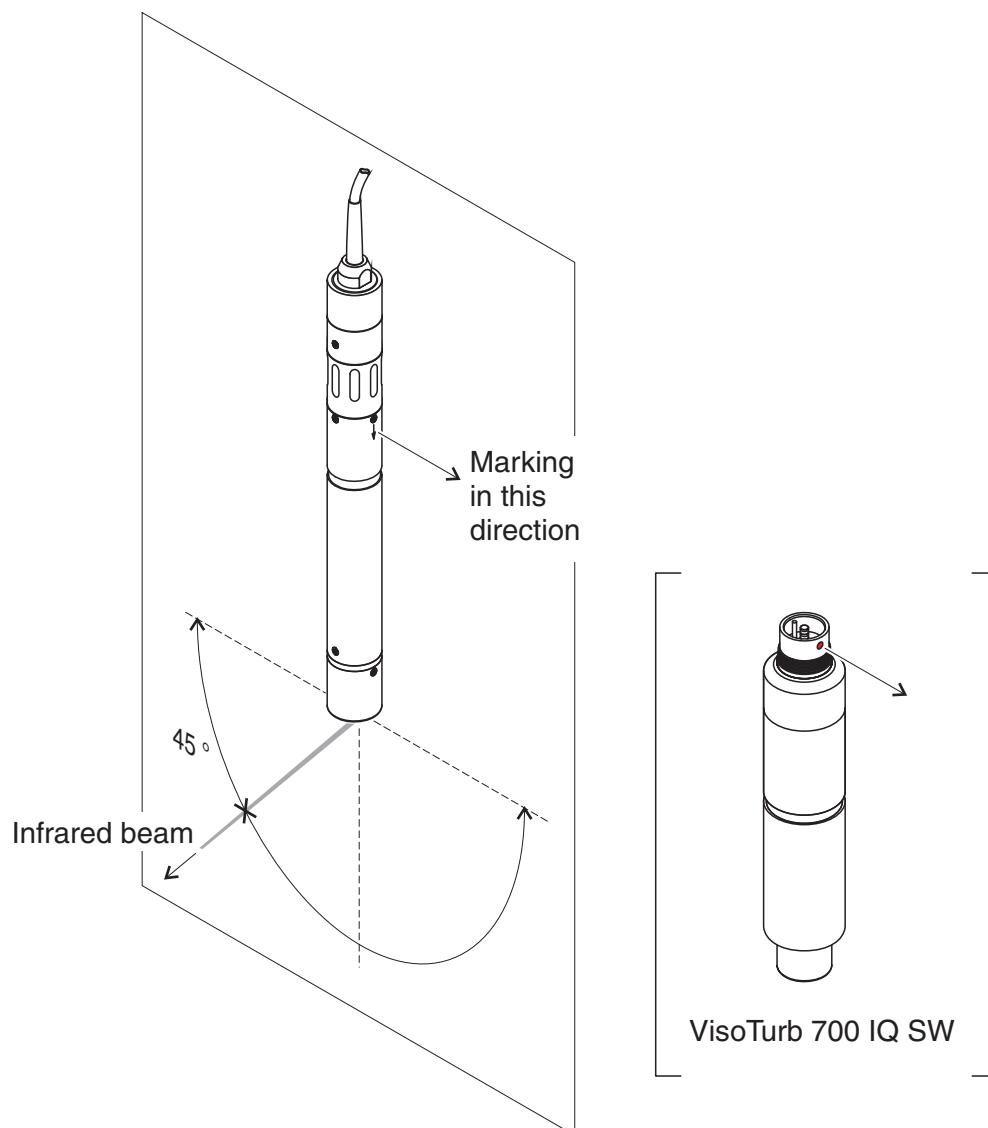


Fig. 3-2 Direction of the infrared beam in relation to the marking

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 walls or ground strikes the measurement window again.

3.2.5 Distances from the ground and walls



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 walls, 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 walls in drinking water (see drawing).

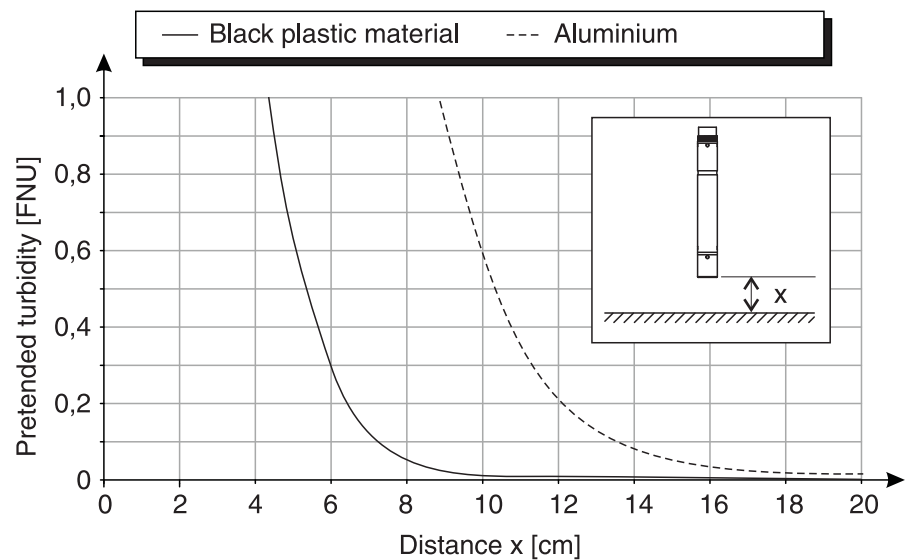


Fig. 3-3 Effect of ground and wall distances on the turbidity measurement



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

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 (SW) 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.

**Example:
Outflow of
preclarification**

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

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.

3.3.2 Measuring in an open channel (range < 100 FNU)

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

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 sensor points towards the outlet of the channel.

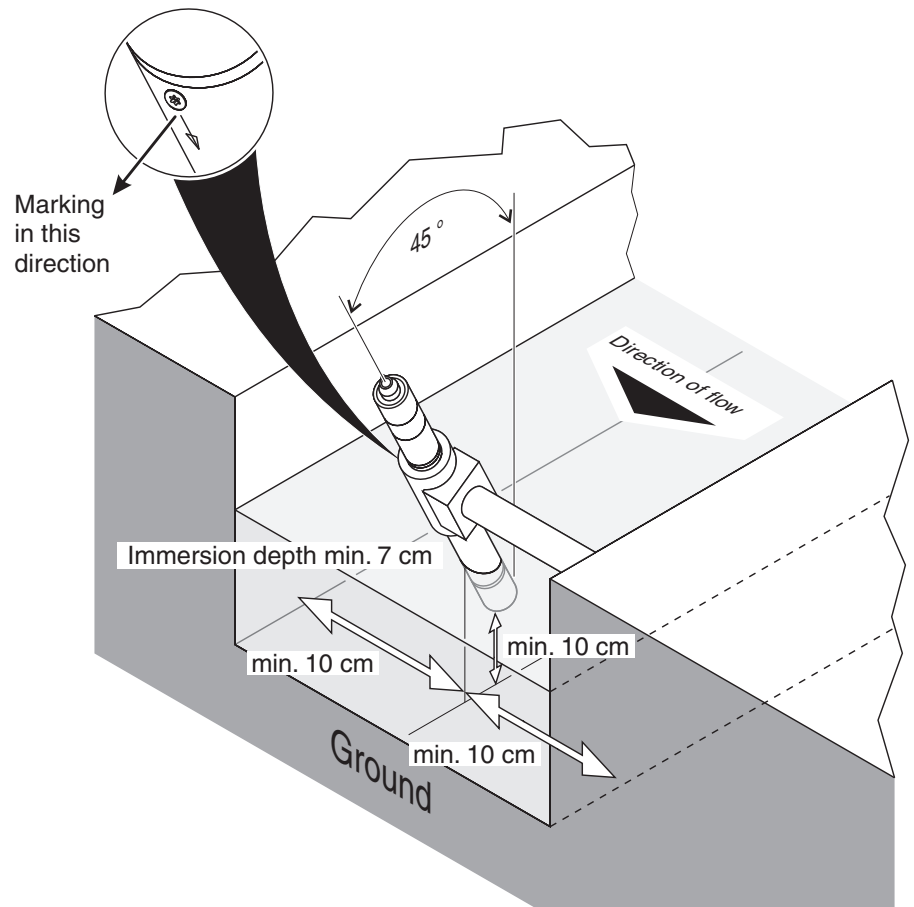


Fig. 3-4 Turbidity sensor in the open channel with EH/W 170 fixture assembly for direct wall mounting.



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



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).

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 for 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.

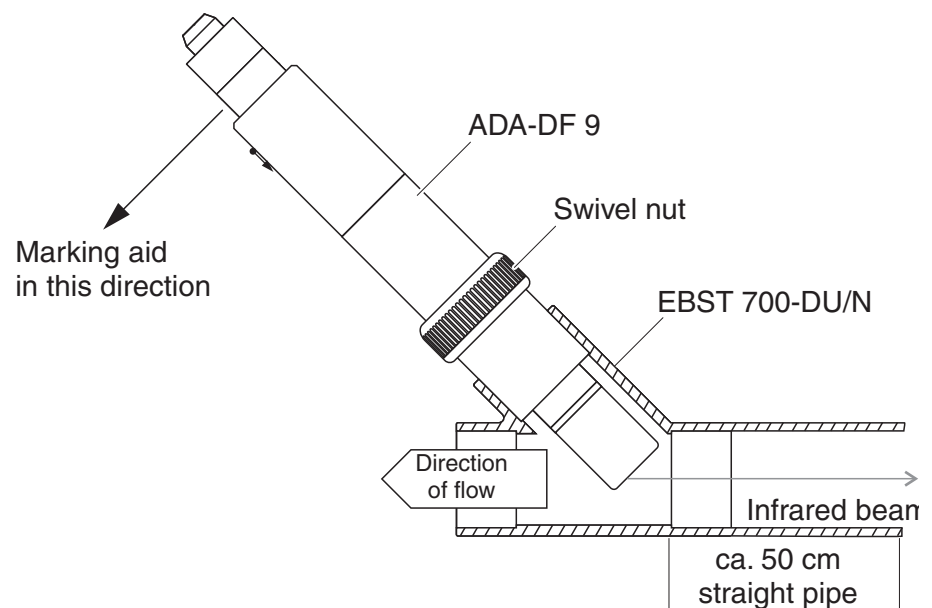


Fig. 3-5 Turbidity sensor in the pipe using EBST 700-DU/N flow-thru adapter

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 points towards the pipeline (see Fig. 3-5).



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

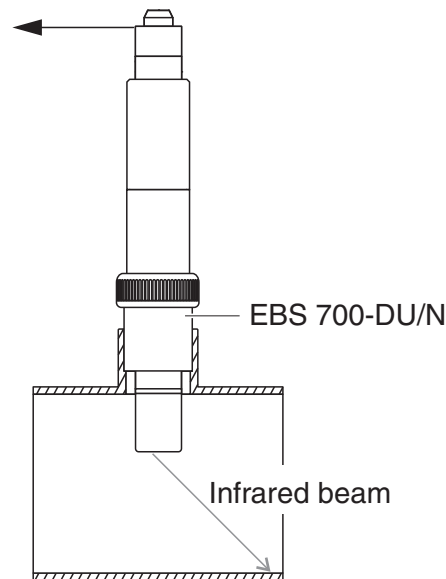


Fig. 3-6 Turbidity sensor in the pipe (90 °)

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 sensor points in the direction of the pipe axis
- Select a position as the installation location where the pipe diameter is as large as possible (see section 3.2.5 DISTANCES FROM THE GROUND AND WALLS).
- 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 (SW) 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 strip or similar) to the protective ring in the same position as the marking on the sensor.

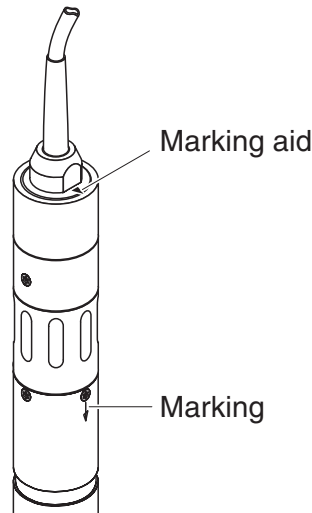


Fig. 3-7 Marking aid

- 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 correctly position the coupling ring on the EBST 700-DU/N, loosen it somewhat and line up the marking aid as shown in Fig. 3-5. Then, tighten the coupling ring.

3.4 Commissioning / Readiness for measurement

3.4.1 Connect the sensor

Connection cable

A sensor connection cable of the SACIQ or SACIQ SW type is required to connect the sensor. The cable is available in different lengths. Compared to the standard model SACIQ, the SACIQ SW sensor connection cable is optimized regarding its corrosion resistance in seawater and brackish water and adapted for use in conjunction with the VisoTurb® 700 IQ SW. Information on this and other IQ SENSORNET accessories is given in the YSI catalog and on the Internet.



How to connect the sensor connection cable to the terminal strip of an MIQ module is described in chapter 3 INSTALLATION of the IQ SENSORNET 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).



Do not suspend the sensor on the sensor connection cable. Use a sensor holder or armature. Information on this and other IQ SENSORNET accessories is given in the YSI 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 (SW) sensor connection cable and keep them safe.
2	Plug the socket of the SACIQ (SW) 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.

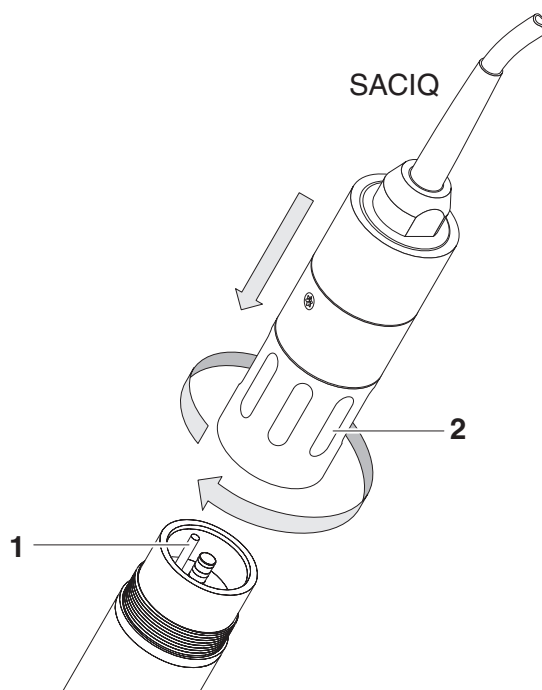


Fig. 3-8 Connecting the sensor



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 for the VisoTurb® 700 IQ (SW)

Carrying out settings

Using <S>, switch from the measured value display to the main menu of the settings. Then navigate to the setting menu (setting table) of the sensor. The exact procedure is given in the relevant IQ SENSORNET system operating manual.

Setting	Selection/values	Explanation
<i>Measuring mode</i>	<ul style="list-style-type: none"> ● <i>FNU</i> ● <i>NTU</i> ● <i>TEF</i> ● <i>mg/l SiO₂</i> ● <i>ppm SiO₂</i> ● <i>g/l TSS</i> 	<ul style="list-style-type: none"> – Turbidity unit Formazine Nephelometric Units – Turbidity unit Nephelometric Turbidity Units – Turbidity Unit Formazine – Concentration of SiO₂ in mg/l – Concentration of SiO₂ in ppm – Conc. of total suspended solids in g/l (for details, see section 4.2.2).
<i>Measuring range</i>	<ul style="list-style-type: none"> ● <i>AutoRange</i> ● <i>0 ... 0.400 FNU</i> ● <i>0 ... 4.00 FNU</i> ● <i>0 ... 40.0 FNU</i> ● <i>0 ... 400 FNU</i> ● <i>0 ... 4000 FNU</i> 	Measuring ranges for the <i>FNU</i> measuring mode (<i>AutoRange</i> = automatic changeover of the measuring range)
	<ul style="list-style-type: none"> ● <i>AutoRange</i> ● <i>0 ... 0.400 NTU</i> ● <i>0 ... 4.00 NTU</i> ● <i>0 ... 40.0 NTU</i> ● <i>0 ... 400 NTU</i> ● <i>0 ... 4000 NTU</i> 	Measuring ranges for the <i>NTU</i> measuring mode (<i>AutoRange</i> = automatic changeover of the measuring range)
	<ul style="list-style-type: none"> ● <i>AutoRange</i> ● <i>0 ... 0.400 TEF</i> ● <i>0 ... 4.00 TEF</i> ● <i>0 ... 40.0 TEF</i> ● <i>0 ... 400 TEF</i> ● <i>0 ... 4000 TEF</i> 	Measuring ranges for the <i>TEF</i> measuring mode (<i>AutoRange</i> = automatic changeover of the measuring range)

Setting	Selection/values	Explanation
	<ul style="list-style-type: none"> ● <i>AutoRange</i> ● 0 ... 0.400 mg/l ● 0 ... 4.00 mg/l ● 0 ... 40.0 mg/l ● 0 ... 400 mg/l ● 0 ... 4000 mg/l 	<p>Measuring ranges for the measuring mode <i>mg/l SiO₂</i></p> <p>(<i>AutoRange</i> = automatic changeover of the measuring range)</p>
	<ul style="list-style-type: none"> ● <i>AutoRange</i> ● 0 ... 0.400 ppm ● 0 ... 4.00 ppm ● 0 ... 40.0 ppm ● 0 ... 400 ppm ● 0 ... 4000 ppm 	<p>Measuring ranges for the measuring mode <i>ppm SiO₂</i></p> <p>(<i>AutoRange</i> = automatic changeover of the measuring range)</p>
	<ul style="list-style-type: none"> ● <i>AutoRange</i> ● 0 ... 0.400 mg/l ● 0 ... 4.00 mg/l ● 0 ... 40.0 mg/l ● 0 ... 400 mg/l ● 0 ... 4.00 g/l ● 0 ... 40.0 g/l ● 0 ... 400 g/l 	<p>Measuring ranges 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 4.2.2).
<i>TSS value</i>		
<i>Turbidity range</i>		
<i>Turbidity value</i>		
<i>Signal averaging</i>	1 ... 600 secs	Response time of the signal filter. Depending on the sample matrix, measured values can vary more or less strongly (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.

Setting	Selection/values	Explanation
<i>Application offset</i>	<i>-20.00 ... +20.00 (units depend on measuring mode)</i>	Correction value for compensation of environmentally-dependent interferences. The value is added to the measured value (for details, see section 4.2.2).
<i>UICleaning/ SensCheck</i>	<i>On / On Off / On Pulse / On On / Off Off / Off Pulse / Off</i>	Switch on or off the ultrasound cleaning and SensCheck function (<i>Pulse</i> = pulse operation).
<i>Save and quit</i>		The settings are stored. The display switches to the next higher level.
<i>Quit</i>		The settings are not stored. The display switches to the next higher level.

4 Measuring

The turbidity measurement in aqueous media with the VisoTurb® 700 IQ (SW) 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 Measurement operation

1	Submerge the sensor in the sample.
2	Read the measured value on the terminal of the IQ SENSORNET.



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.

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 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 ensur-

ing 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.



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 (SW), 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 (SW), 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 for by a measured value correction.



Depending on the test sample, the optical characteristics of the inner surface of the vessel can change greatly with time (biological films, lime deposits). This can affect the turbidity measurement. Repeat the application offset from time, also 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:

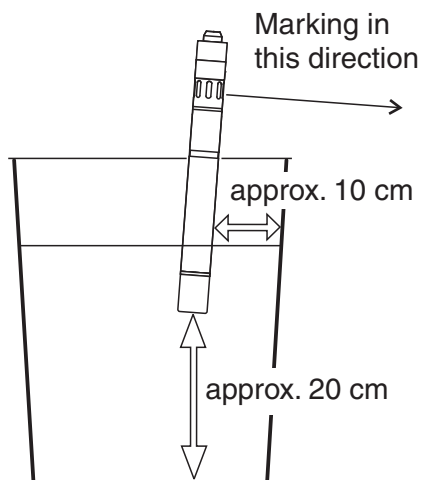


Fig. 4-1 Ideal measurement environment for the application offset

4.2.3 User calibration for measurement of the total suspended solids (g/l TSS)

The turbidity values of the total suspended solids 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 (SW) (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 <i>g/l TSS</i> measuring mode and the <i>AutoRange</i> measuring range (see section 3.4.2).
3	Switch to the measured value display with <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.



To measure the solids, 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"> ● 0 ... 0,400 mg/l ● 0 ... 4.00 mg/l ● 0 ... 40.0 mg/l ● 0 ... 400 mg/l ● 0 ... 4.00 g/l ● 0 ... 40.0 g/l ● 0 ... 400 g/l 	<p>Range for entering the total suspended solids contents. 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 field <i>TSS value</i>: 35.8 mg/l</p>
<i>TSS value</i>		Concentration of total suspended solids in <i>g/l TSS</i> determined using the reference procedure. The input precision depends on the setting in the field <i>TSS range</i> .

Setting	Selection/values	Explanation
<i>Turbidity range</i>	<ul style="list-style-type: none"> ● 0 ... 0,400 FNU ● 0 ... 4.00 FNU ● 0 ... 40.0 FNU ● 0 ... 400 FNU ● 0 ... 4000 FNU 	<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 field <i>Turbidity range</i>.</p>

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



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



CAUTION

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

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



We recommend to clean 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
Slurry 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.



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 (SW) 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 tapwater, wash it off with a hose or wipe it off with a cloth).
- Unscrew the sensor from the SACIQ (SW) sensor connection cable.
- Place a protective cap on the sensor plug head connector and on the SACIQ (SW) sensor connection cable each time so that no moisture or dirt can get on the contacting surfaces.
- In a corrosive environment, close the socket of the sensor connection cable (while it is dry) with the screw-on dust cover SACIQ-Plug to protect the electrical contacts against corrosion. The dust cover is available as an accessory (see section 5.3 ACCESSORIES). It is included in the standard scope of delivery of the SACIQ SW sensor connection cable.

NOTE

The sensor warms up during operation in the open 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 open 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, Seite 29.
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



Information on other IQ SENSOR NET accessories is given in the YSI 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 the cleaning system is switched on, communication with the controller is interrupted.	Remedy – Install another power supply module as close as possible to the VisoTurb® 700 IQ (SW)
Mechanical damage to the sensor	Cause	Remedy Return the sensor
Display of <i>OFL</i>	Cause Measuring range exceeded	Remedy See log book
Display of "----"	Cause Measured value invalid	Remedy See log book
Measured values fluctuating heavily	Cause Gas bubbles in the medium are in front of the sapphire disc Signal averaging time too short for low values of turbidity	Remedy Check the mounting position of the sensor (see section 3.2 and section 3.3) Increase signal averaging time
Measured values too low	Cause Sapphire disc polluted	Remedy Clean sapphire disc (see section 5.2)

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

7 Technical data

7.1 Measuring characteristics

Measuring principle

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

- 90 ° measuring angle
- Measurement in formazine nephelometric units, FNU

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 ₂	0 ... 0.400	0.001
	0 ... 4.00	0.01
	0 ... 40.0	0.1
	0 ... 400	1
	0 ... 4000	1
ppm SiO ₂	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

Accuracy	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.

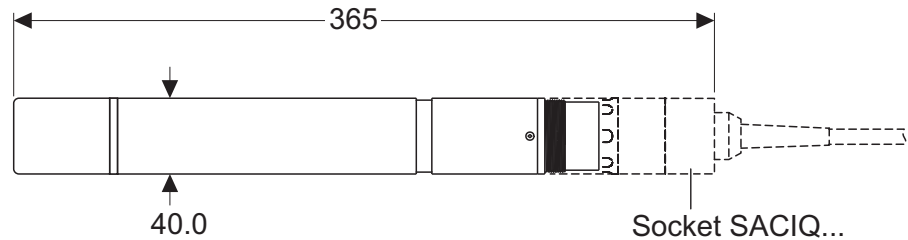
7.2 Application characteristics

Allowed temperature range	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 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 ⁶ Pa (10 bar)
	Max. allowed negative pressure	For a short time 5 x 10 ⁴ Pa (0.5 bar)
	The sensor meets all requirements according to article 3(3) of 97/23/EG ("pressure equipment directive").	
Type of protection	Sensor with connected SACIQ (SW) sensor connection cable: IP 68, 10 bar (10 ⁶ Pa)	
Depth of immersion	min. 10 cm; max. 100 mdepth	
Operating position	See section 3.2 INSTALLATION	
Fields of application	Water and wastewater monitoring	

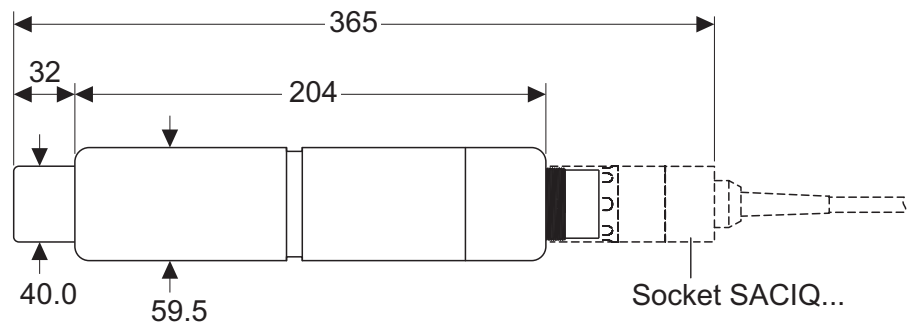
7.3 General data

Dimensions

VisoTurb 700 IQ:



VisoTurb 700 IQ SW:



Weight (without sensor connection cable)

VisoTurb® 700 IQ	approx. 990 g
VisoTurb® 700 IQ SW	approx. 1420 g

Connection technique

Connection via SACIQ (SW) sensor connection cable

Material

Shaft:	
– VisoTurb® 700 IQ	V4A stainless steel 1.4571 *
– VisoTurb® 700 IQ SW	POM
Sensor head:	
– VisoTurb® 700 IQ	V4A stainless steel 1.4571 *
– VisoTurb® 700 IQ SW	Titanium
Measurement window	Sapphire
Plug head connector housing	POM
Plug, 3-pole	ETFE (blue) Tefzel®

* Stainless steel can be corrodible if there are chloride concentrations of 500 mg/L or more. For applications in such media we recommend using the SW sensors.

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

- EN 61010-1
- UL 61010-1
- CAN/CSA C22.2#61010-1

7.4 Electrical data

Nominal voltage

(Details see chapter TECHNICAL DATA of the IQ SENSORNET system operating manual)

Power consumption

1.5 W

Protective class

III

8 Lists

8.1 Explanation of the messages

This chapter contains a list of all the message codes and related message texts for the VisoTurb® 700 IQ (SW) sensor.



Information on

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

See IQ SENSORNET system operating manual, chapter LOG BOOK.

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

8.1.1 Error messages

Message code	Message text
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>
EI3341	<i>Operational voltage too low</i> <i>* Check installation and cable lengths, Follow installation instructions</i> <i>* Power supply module overloaded</i> <i>* Check terminal and module connections</i> <i>* Defective component, replace components</i>

Message code	Message text
EI4341	<i>Operational voltage too low, no operation possible</i> <i>* Check installation and cable lengths, Follow installation instructions</i> <i>* Power supply module overloaded</i> <i>* Check terminal and module connections</i> <i>* Defective component,</i> <i>replace components</i>
ES1341	<i>Component hardware defective</i> <i>* Contact service</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>

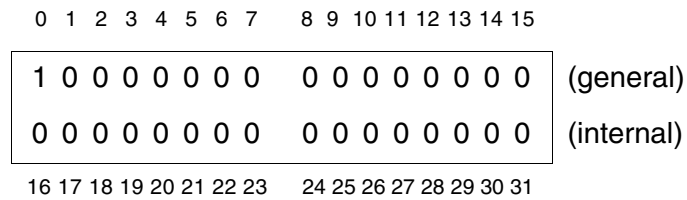
8.1.2 Informative messages

Message code	Message text
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 coded piece of information on the current status of a sensor. Each sensor sends this status info to the controller of the IQ SENSORNET. 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 *Einstellungen/Setup/Service/List of all components* menu (see system operating manual)
- by an automated query
 - from a superordinate process control (e. g. when connected to the Profibus)
 - from the IQ Data Server (see IQ SENSORNET Software Pack operating manual)



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

**Status info
VisoTurb® 700 IQ (SW)**

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

9 Contact Information

9.1 Ordering & Technical Support

Telephone: (800) 897-4151
(937) 767-7241
Monday through Friday, 8:00 AM to 5:00 PM ET

Fax: (937) 767-1058

Email: environmental@ysi.com

Mail: YSI Incorporated
1725 Brannum Lane
Yellow Springs, OH 45387
USA

Internet: www.ysi.com

When placing an order please have the following information available:

YSI account number (if available)	Name and Phone Number
Model number or brief description	Billing and shipping address
Quantity	Purchase Order or Credit Card

9.2 Service Information

YSI has authorized service centers throughout the United States and Internationally. For the nearest service center information, please visit www.ysi.com and click 'Support' or contact YSI Technical Support directly at 800-897-4151.

When returning a product for service, include the Product Return form with cleaning certification. The form must be completely filled out for an YSI Service Center to accept the instrument for service. The Product Return form may be downloaded at www.ysi.com and clicking on the 'Support' tab.

Xylem |'zīləm|

- 1) The tissue in plants that brings water upward from the roots;
- 2) a leading global water technology company.

We're 12,500 people unified in a common purpose: creating innovative solutions to meet our world's water needs. Developing new technologies that will improve the way water is used, conserved, and re-used in the future is central to our work. We move, treat, analyze, and return water to the environment, and we help people use water efficiently, in their homes, buildings, factories and farms. In more than 150 countries, we have strong, long-standing relationships with customers who know us for our powerful combination of leading product brands and applications expertise, backed by a legacy of innovation.

For more information on how Xylem can help you, go to www.xylem.com



a **xylem** brand

YSI
1725 Brannum Lane
Yellow Springs, OH 45387
Tel: +1 937-767-7241; 800-765-4974
Fax: +1 937-767-1058
Email: environmental@ysi.com
Web: www.ysi.com

©Xylem Inc