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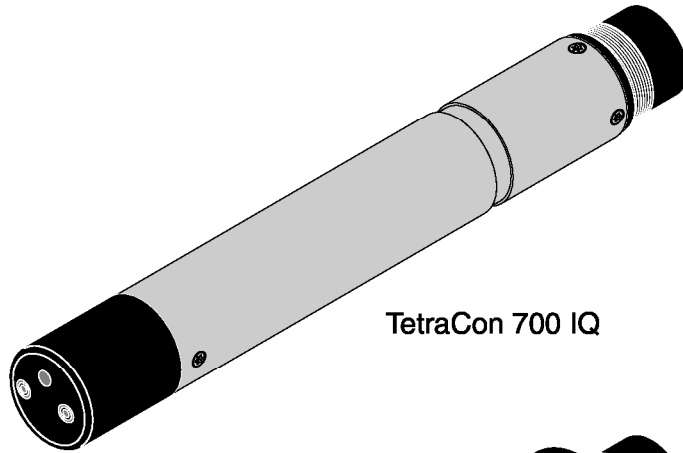
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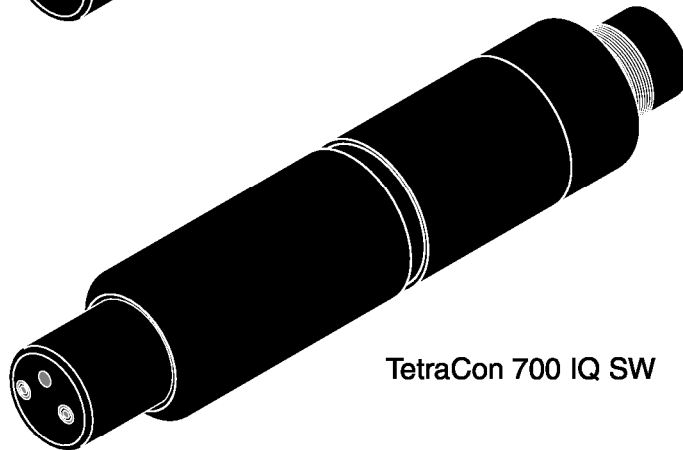
Operating manual

TetraCon[®] 700 IQ

TetraCon[®] 700 IQ SW



TetraCon 700 IQ



TetraCon 700 IQ SW

IQ SENSOR NET conductivity 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.

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1	Overview	2-1
1.1	How to use this component operating manual	2-1
1.2	Structure of the TetraCon® 700 IQ (SW)	2-2
1.3	Recommended fields of application	2-2
2	Safety	3-1
2.1	Authorized use	3-2
2.2	General safety instructions	3-2
3	Commissioning	4-1
3.1	Scope of delivery	4-1
3.2	Installation	4-1
3.3	Commissioning / Getting the instrument ready for measuring 4-2	
3.4	TetraCon® 700 IQ (SW) setting table	4-3
4	Measuring / Operation	5-1
4.1	Measuring	5-1
4.2	Application-dependent settings	5-2
4.2.1	General information	5-2
4.2.2	Determining the cell constant in a user-specific measuring environment	5-3
5	Maintenance, cleaning, disposal	6-1
5.1	General maintenance instructions	6-1
5.2	Cleaning	6-1
5.3	Disposal	6-2
6	What to do if...	7-1
7	Technical data	8-1
7.1	Measurement characteristics	8-1
7.2	Application characteristics	8-2
7.3	General data	8-3
7.4	Electrical data	8-4
7.5	Characteristic data on delivery	8-4
8	Indexes	9-1
8.1	Explanation of the messages	9-1
8.1.1	Error messages	9-1
8.2	Status info	9-1

1 Overview

1.1 How to use this component operating manual

Structure of the IQ SENSOR NET operating manual

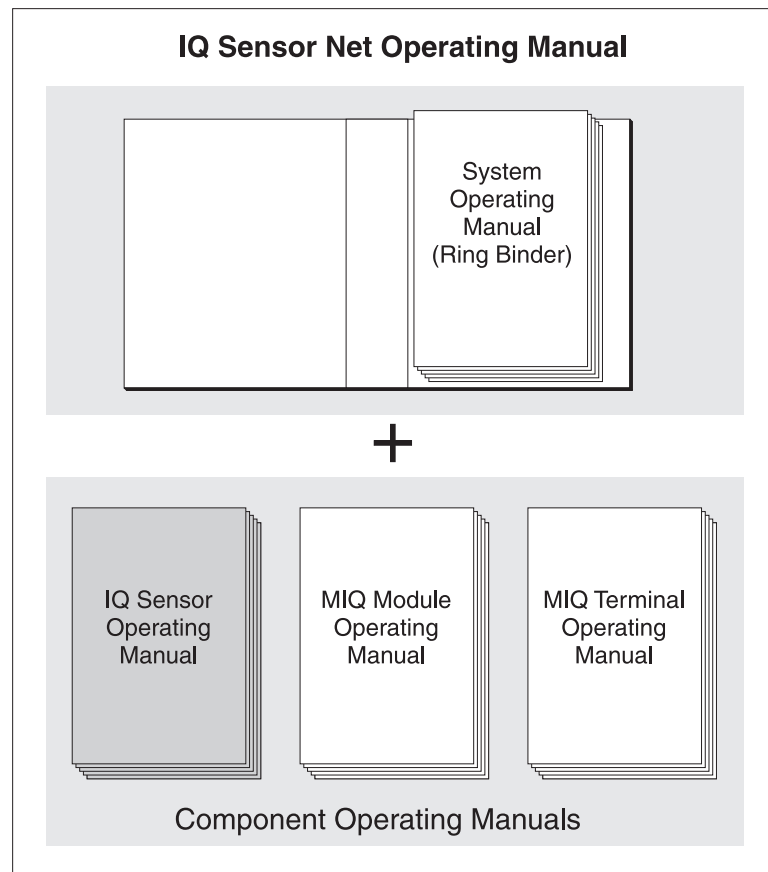


Fig. 1-1 Structure of the IQ SENSOR NET operating manual

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 in the ring binder of the system operating manual.

1.2 Structure of the TetraCon® 700 IQ (SW)

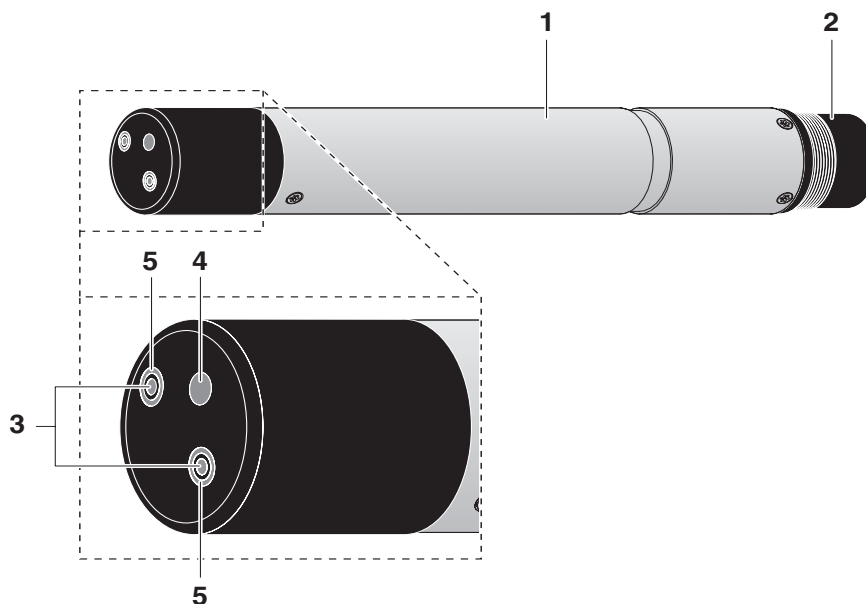


Fig. 1-2 Structure of the conductivity sensor (example: TetraCon® 700 IQ)

1	Shaft
2	Plug head connector
3	Voltage electrodes
4	Temperature sensor
5	Current electrodes (ring)

Characteristics

The principle of the measurement method makes it possible to avoid influences from primary or secondary polarization effects, which ensures a high degree of measuring accuracy.

A modern epoxy sealing technique reduces the chances of breakage of the sensor in the rough industrial environment.

1.3 Recommended fields of application

TetraCon 700 IQ

Stationary measurements in water/wastewater applications.

TetraCon 700 IQ SW

Stationary measurements in seawater and brackish water, aquaculture.

2 Safety

This component operating manual contains special instructions that must be followed during the operation of the TetraCon® 700 IQ (SW) conductivity 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 sensor was developed for applications in online measuring technology - 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 can be recognized by the warning symbol (triangle) in the left column. The signal word (e. g. "Caution") indicates the level of the danger:



Warning

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



Caution

indicates instructions that must be followed precisely in order to avoid slight injuries 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 TetraCon® 700 IQ (SW) comprises its use as a conductivity sensor in the IQ SENSOR NET. The technical specifications according to chapter 7 TECHNICAL DATA must be observed. 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

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 range (chapter 7 TECHNICAL DATA) must be maintained during the application and transport of the sensor. Protect the sensor, particularly against frost or overheating.



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

- TetraCon® 700 IQ (SW)
- The sensor is fitted with protective caps
- Operating manual.

3.2 Installation

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 TetraCon® 700 IQ SW. Information on this and other IQ SENSOR NET accessories is given in the WTW catalog and on the Internet.



Are the plug connections dry?

Note

How to connect the SACIQ (SW) 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.

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 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 (SW) sensor connection cable and keep them safe.
2	Plug the jack 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.

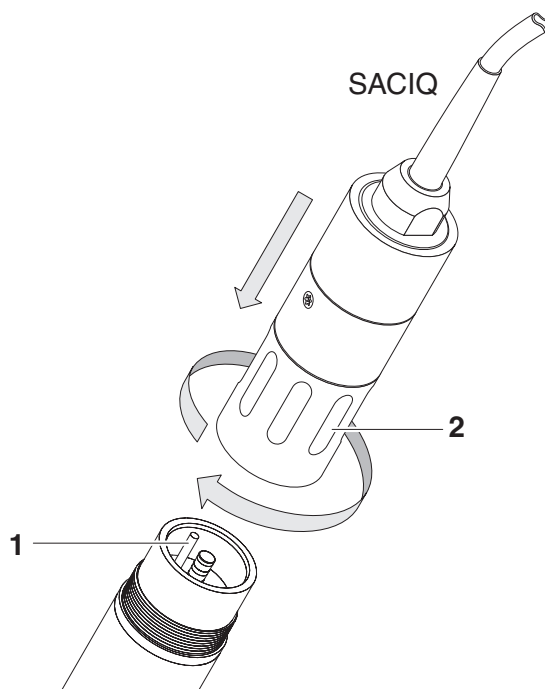


Fig. 3-1 Connecting the sensor

3.3 Commissioning / Getting the instrument ready for measuring


1	Pull the protective cap off the sensor.
2	If required, assign a user-defined name to the sensor (see relevant IQ SENSOR NET system operating manual).
3	Set the sensor (see section 3.4).

3.4 TetraCon® 700 IQ (SW) setting table

Menu item	Selection/values	Explanations
<i>Measuring mode</i>	<ul style="list-style-type: none"> ● Conductivity /cm ● <i>Salinity</i> ● TDS ● Conductivity /m 	Measured parameter in the measured value display (TDS = total dissolved solids)
<i>Measuring ranges with Measuring mode, Conductivity /cm</i>	<ul style="list-style-type: none"> ● <i>AutoRange</i> ● 0 .. 20.00 mS/cm ● 0 .. 200.0 mS/cm ● 0 .. 2000 mS/cm ● 0 .. 20.00 mS/cm ● 0 .. 200.0 mS/cm ● 0 .. 500.0 mS/cm 	These measuring ranges are available for selection. If the <i>AutoRange</i> menu item is selected, the measurement range selection and switchover is made automatically.
<i>Measuring ranges with Measuring mode, Conductivity /m</i>	<ul style="list-style-type: none"> ● <i>AutoRange</i> ● 0 .. 2.000 mS/m ● 0 .. 20.00 mS/m ● 0 .. 200.0 mS/m ● 0 .. 2000 mS/m ● 0 .. 20.00 S/m ● 0 .. 50.00 S/m 	
<i>Measuring range in Measuring mode Salinity</i>	0 .. 70	The measuring range is permanently set.
<i>Measuring range in Measuring mode TDS</i>	0 .. 2000 mg/l	The measuring range is permanently set.
<i>Temperature mode</i>	<ul style="list-style-type: none"> ● °C ● °F 	Unit of the measured temperature value (Celsius, Fahrenheit).
<i>Temp. compensation</i>	<ul style="list-style-type: none"> ● <i>none</i> ● <i>nonlinear</i> ● <i>linear with setting</i> 	<ul style="list-style-type: none"> ● For natural waters (groundwater, surface water, drinking water), salinity (seawater) according to IOT ● Other aqueous measuring solutions

<i>Temp. compensation linear</i>	0.5 ... 3.0 %/K	Factor for linear temperature compensation. This menu item only appears if linear temperature compensation is selected.
<i>Reference temperature</i>	<ul style="list-style-type: none"> ● <i>Tref20</i> (20 °C) ● <i>Tref25</i> (25 °C) 	The reference temperature is the basis for calculating the temperature compensation.
<i>TDS factor</i>	0,40 .. 1,00	Factor for automatic calculation of the total dissolved solids by the sensor.
<i>Cell constant</i>	0.826 ... 1.008 cm ⁻¹	Here you can set the cell constant if this is necessary for a special application, e.g. when using a flow-thru vessel.
<i>Temperature adjustment</i>	-1.5 ... +1.5 K	Here you can balance the temperature sensor in the sensor against a reference temperature measurement.
<i>Save and quit</i>		The system confirms the saving of the settings and the display switches to the next higher level.
<i>Quit</i>		The display switches to the next higher level without saving the new settings.

Carrying out settings

Using , 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 SENSOR NET system operating manual.

4 Measuring / Operation

4.1 Measuring



Warning

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.).



Note

Please make sure that the sensor is surrounded by a gap of at least 5 cm at the base and sides (boundary fields) when measuring at the electrodes. If the gap is less than that, the cell constant changes. This leads to incorrect measurement results. If the gap cannot be maintained, e.g. in narrow pipes, the cell constant can be adjusted to suit the installation conditions (see section 4.2.2).

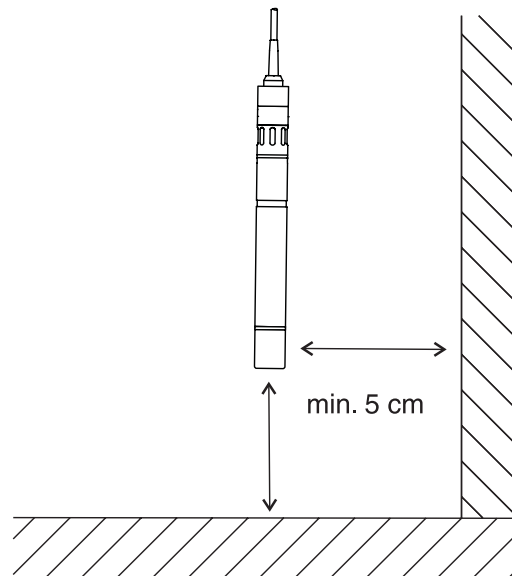


Fig. 4-1 Distance of the sensor from the edge

- | | |
|---|--|
| 1 | Immerse the sensor in the measuring medium. |
| 2 | The measured value is immediately available. |

4.2 Application-dependent settings

4.2.1 General information

The TetraCon® 700 IQ (SW) conductivity sensor is stable over the long term. When being used for the authorized use of the sensor in water/ wastewater applications, it is immediately ready for use.



Adapting the cell constant to the installation location

Note

Normally, the conductivity measuring cell does not age. Special measuring mediums (e.g. strong acids and bases, organic solvents) or temperatures that are too high may considerably reduce its lifetime or lead to damage. No warranty claims can be made for mechanical damage or any failure caused by these types of measuring mediums.

In the case of special installation conditions, it may be necessary to adapt the cell constant (due to the influence of the measuring environment, e.g. of boundary fields).



Cell constants with WTW installation accessories

Note

The cell constant is stored in the controller. It is automatically allocated to the substitute sensor when the sensor is exchanged.

In chapter 7 TECHNICAL DATA of this operating manual you will find the correct values to set for some products of the WTW accessory program that require a correction of the cell constant (if it is possible to give fixed values at all). If necessary, special installation recommendations for the TetraCon® 700 IQ (SW) can be found in the accessory operating manual. In case of doubt it is necessary to determine the cell constant according to section 4.2.2.



Note

The setting of the cell constant is made in the setting menu of the sensor according to section 3.4.

4.2.2 Determining the cell constant in a user-specific measuring environment

1	Immerse the operable conductivity sensor in the test sample in the measuring environment and wait until the measured value is stable.
2	Read the conductivity on the display and note it down (-> χ_D).
3	Take a representative sample simultaneously with the conductivity measurement and from the immediate vicinity of the sensor if possible.
4	<p>Determine the conductivity of the sample without the influence of boundary fields (-> χ_X). The measurement can, for example, be performed as follows:</p> <ul style="list-style-type: none"> ● Measuring in the laboratory using a laboratory conductivity measuring cell ● Measuring using the TetraCon® 700 IQ (SW) while observing the bottom and lateral gaps according to section 4.1 MEASURING. <p><u>Attention:</u> Set the same procedure for the temperature compensation as for measuring the χ_D!</p>
5	Read and note down the currently set cell constant in the setting menu of the sensor (see section 3.4) (-> K_A).
6	<p>Calculate the new cell constant K_N according to:</p> $K_N = (\chi_X / \chi_D) \cdot K_A$
7	Set and store the new cell constant K_N (see section 3.4).

5 Maintenance, cleaning, disposal

5.1 General maintenance instructions



Maintenance condition

Warning

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.).

We recommend to switch on the maintenance condition each time before removing the sensor from its measuring position. This avoids unintended reactions of linked outputs. For more detailed information on the maintenance condition please refer to the respective IQ SENSOR NET system operating manual.

Maintenance-free operation

The TetraCon® 700 IQ (SW) conductivity sensor operates without the need for any maintenance.

5.2 Cleaning

If the sensor is heavily contaminated, this can affect the measuring accuracy. Therefore, we recommend to clean the sensor regularly according to visual checks. Thorough cleaning of the sensor is particularly recommended before measuring lower values of conductivity, as well as before adjusting the measured value.



Note

We do not recommend to unscrew the sensor from the sensor connection cable in order to clean it. 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.
- Always place a protective cap on the plug head of the sensor and on the SACIQ (SW) sensor connection cable so that no moisture or dirt can get into the contacting surfaces.
- In corrosive environments close the dry socket of the sensor connection cable with the SACIQ-Plug protective screw cap in order

to protect the electrical contacts from corrosion. The protective cap is available as an accessory under the order number 480 065. It is included in the standard scope of delivery of the SACIQ SW sensor connection cable.

Cleaning	Contamination	Cleaning agents	Reaction time at room temperature
	Water-soluble substances	Tap water	Any
	Fats and oils	<ul style="list-style-type: none"> – Warm water and household detergent; – In the case of heavy contamination: Methylated spirits 	<ul style="list-style-type: none"> – Any – Maximum of 5 minutes
	Lime and hydroxide deposits	Acetic acid (10 %)	max. 5 minutes

5.3 Disposal

We recommend to dispose of the sensor as electronic refuse.

6 What to do if...

No temperature display and/or no conductivity display	Cause	Remedy
	<ul style="list-style-type: none"> – System setting incorrect – Temperature sensor or conductivity sensor defective 	<ul style="list-style-type: none"> – Correct the system setting – Return the conductivity sensor
Measurement does not function	Cause	Remedy
	<ul style="list-style-type: none"> – Protective cap still on conductivity sensor – System setting incorrect 	<ul style="list-style-type: none"> – Pull off protective cap – Correct the system setting
Measurement provides implausible measured values	Cause	Remedy
	<ul style="list-style-type: none"> – Conductivity sensor heavily contaminated 	<ul style="list-style-type: none"> – Clean conductivity sensor
	<ul style="list-style-type: none"> – Boundary field not maintained 	<ul style="list-style-type: none"> – The conductivity sensor must be surrounded by a gap of at least 5 cm at the base and sides when measuring at the electrodes. Otherwise, the cell constant can change (see section 4.2.2)
	<ul style="list-style-type: none"> – Electrodes damaged 	<ul style="list-style-type: none"> – Return the sensor
	<ul style="list-style-type: none"> – System setting incorrect 	<ul style="list-style-type: none"> – Correct the system setting
	<ul style="list-style-type: none"> – Measuring range exceeded 	<ul style="list-style-type: none"> – Make sure the correct sensor is being used for the application
<ul style="list-style-type: none"> – The sensor was installed in an armature and the boundary field is not sufficient 	<ul style="list-style-type: none"> – Set the cell constant to the value of the installed state (if known) – If the cell constant of the sensor in the installed state is not known, set the measured value to the nominal value of a sample (see section 4.2 APPLICATION-DEPENDENT SETTINGS) 	

7 Technical data

7.1 Measurement characteristics

Measuring principle

Conductivity sensor with 4-electrode measuring cell;
Integrated microprocessor electronics, shielded 2-wire connection for power and data transmission.

Measuring ranges and resolutions

Measuring mode	Measuring range	Resolution
Conductivity in S/cm	10.00 µS/cm ... 500.0 mS/cm	
	Display ranges (manual or automatic with <i>AutoRange</i>):	
	0.00 ... 20.00 µS/cm	0.01 µS/cm
	0.0 ... 200.0 µS/cm	0.1 µS/cm
	0 ... 2000 µS/cm	1 µS/cm
	0.00 ... 20.00 mS/cm	0.01 mS/cm
	0.0 ... 200.0 mS/cm	0.1 mS/cm
Conductivity in S/m	1.000 mS/m ... 50.00 S/m	
	Display ranges (manual or automatic with <i>AutoRange</i>):	
	0.000 ... 2.000 mS/m	0.001 mS/m
	0.00 ... 20.00 mS/m	0.01 mS/m
	0.0 ... 200.0 mS/m	0.1 mS/m
	0 ... 2000 mS/m	1 mS/m
	0.00 ... 20.00 S/m	0.01 S/m
0.00 ... 50.00 S/m	0.01 S/m	
Salinity	0.0 ... 70.0	0.1
TDS	0 ... 2000 mg/l	1 mg/l

Adjustable temperature compensation

Compensation	Temperature range
Linear	0 °C ... + 60 °C (32 ... 140 °F)
Nonlinear	+ 5 °C ... + 35 °C (41 ... 95 °F) according to DIN 38404
	+ 35 °C ... + 60 °C (95 ... 140 °F) according to WTW procedure
None	

Temperature measurement	Temperature sensor	integrated NTC
	Measuring range	- 5 °C ... + 60 °C (23 ... 140 °F)
	Accuracy	± 0.5 K
	Resolution	0.1 K
	Response time t_{90}	< 60 s
	Response time t_{95}	< 120 s

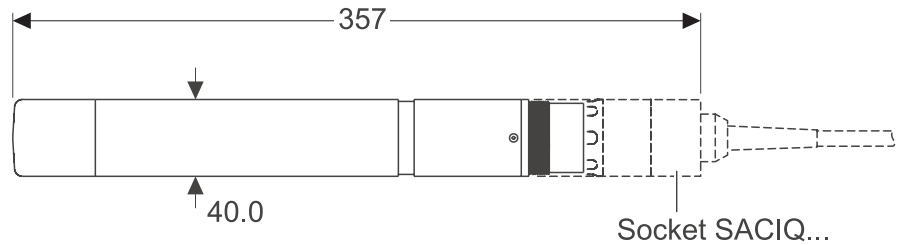
7.2 Application characteristics

Allowed temperature range	Measuring medium	- 5 °C ... + 60 °C (23 ... 140 °F)
	Storage/transport	- 5 °C ... + 65 °C (23 ... 149 °F)
Allowed pH range of the test sample	4 ... 12	
Pressure resistance	Sensor with connected SACIQ (SW) sensor connection cable:	
	Max. allowed overpressure	10 ⁶ Pa (10 bar)
	The sensor meets all requirements according to article 3(3) of 97/23/EC ("pressure equipment directive").	
Type of protection	Sensor with connected SACIQ (SW) sensor connection cable: IP 68, 10 bar (10 ⁶ Pa)	
Immersion depth	min. 10 cm; max. 100 m depth	
Operating position	Any	
Approach flow	No minimum approach flow required	
Fields of application	TetraCon 700 IQ	Stationary measurements in water/wastewater applications
	TetraCon 700 IQ SW	Stationary measurements in seawater and brackish water, aquaculture

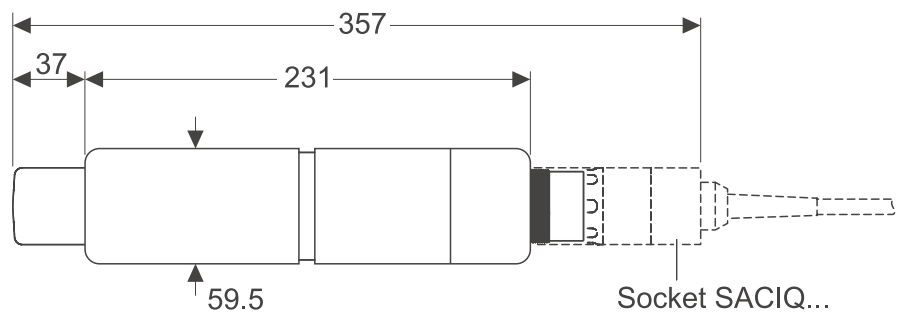
7.3 General data

Dimensions

TetraCon 700 IQ:



TetraCon 700 IQ SW:



Weight (without sensor connection cable)

TetraCon 700 IQ	approx. 660 g
TetraCon 700 IQ SW	approx. 1170 g

Connection technique

Connection via the SACIQ or SACIQ SW sensor connection cable

Material

Shaft:	
– TetraCon 700 IQ	V4A stainless steel 1.4571
– TetraCon 700 IQ SW	POM
Sensor head	PVC, epoxy (filler)
Electrodes, housing of the temperature sensor	Graphite
Plug head connector housing	POM
Plug, 3-pole	ETFE (blue) Tefzel®

Instrument safety

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

Nominal voltage	Max. 24VDC via the IQ SENSOR NET (for more details, see chapter TECHNICAL DATA of the IQ SENSOR NET system operating manual)
Power consumption	0.2 W
Protective class	III

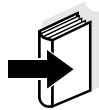
7.5 Characteristic data on delivery

Cell constant	In free solution, i.e. bottom and side gap > 5 cm	$K = 0.917 \text{ cm}^{-1} \pm 1.5 \%$
	In a flow-thru system, e.g. EBST 700-DU/N	$K = 0.933 \text{ cm}^{-1} \pm 1.5 \%$

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 TetraCon® 700 IQ (SW) sensor.



Note

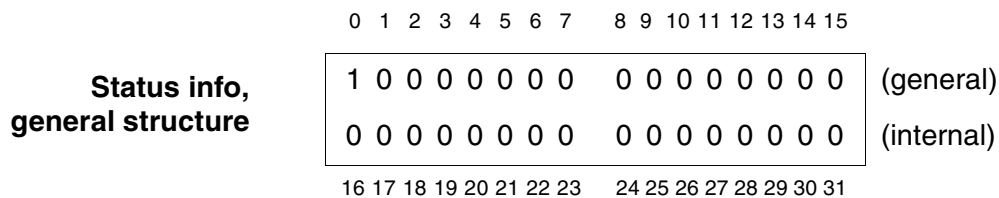
Information on the contents and structure of the log book, and how to call it up, is given in the LOG BOOK chapter of the IQ SENSOR NET system operating manual.

8.1.1 Error messages

Message code	Message text
EA13xx	<i>Meas. range exceeded or undercut</i> * Check process * Select other meas. range
EA23xx	<i>Sensor temperature too high!</i> * Check process and application
EA33xx	<i>Sensor temperature too low!</i> * Check process and application
ES13xx	<i>Component hardware defective</i> * Contact WTW

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. The status info of sensors consists of 32 bits, each of which can have the value 0 or 1.



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/Settings/Service/List of all components* menu (see system operating manual)
- via an automated query
 - from a superordinate process control (e. g. when connected to the Profibus)
 - from the IQ Data Server (see IQ SENSOR NET Software Pack operating manual)



Note

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
TetraCon® 700 IQ (SW)**

Status bit	Explanation
Bit 0	<i>Component hardware defective</i>
Bit 1-31	-



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