YSI

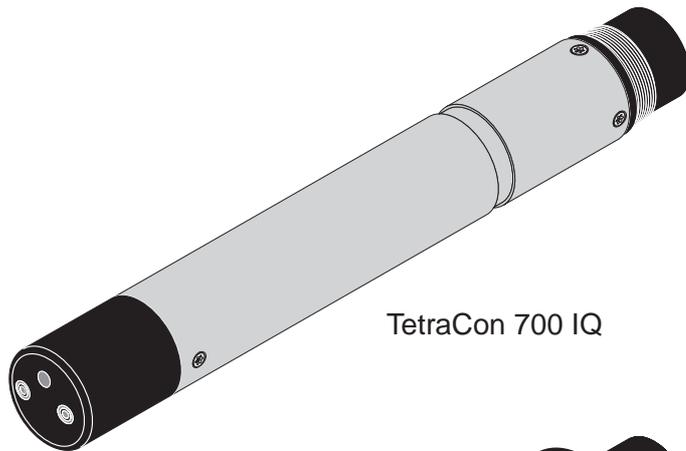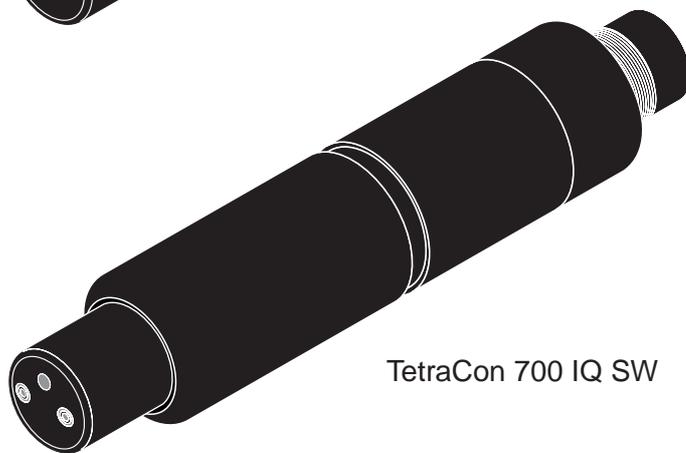a **xylem** brand

Operating manual

IQ SENSOR NET
TetraCon®
700 IQ (SW)

TetraCon 700 IQ

TetraCon 700 IQ SW

IQ SENSOR NET conductivity sensor

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	Note
🛈	For the most recent version of the manual, please visit www.ysi.com.

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TetraCon® 700 IQ (SW) - Contents

1 Overview

1.1 How to use this component operating manual

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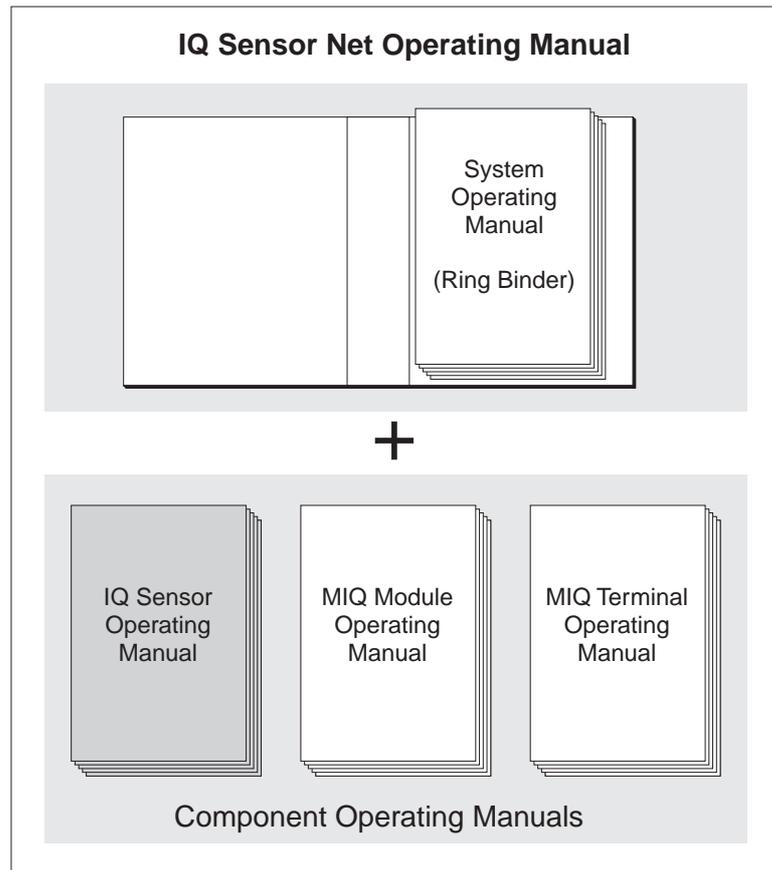
Fig. 1-1   Structure of the IQ SENSOR NET operating manual

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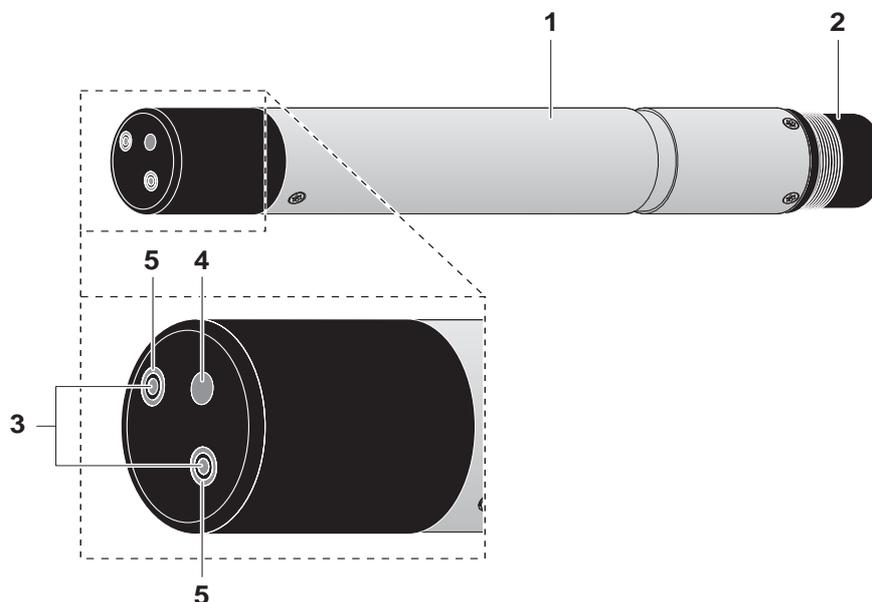
Fig. 1-2   Structure of the conductivity sensor (example: TetraCon®700 IQ)

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.

**Function and
operational safety**

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 YSI.

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 YSI catalog and on the Internet.

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.

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 armature.
Information on this and other IQ SENSOR NET 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 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.

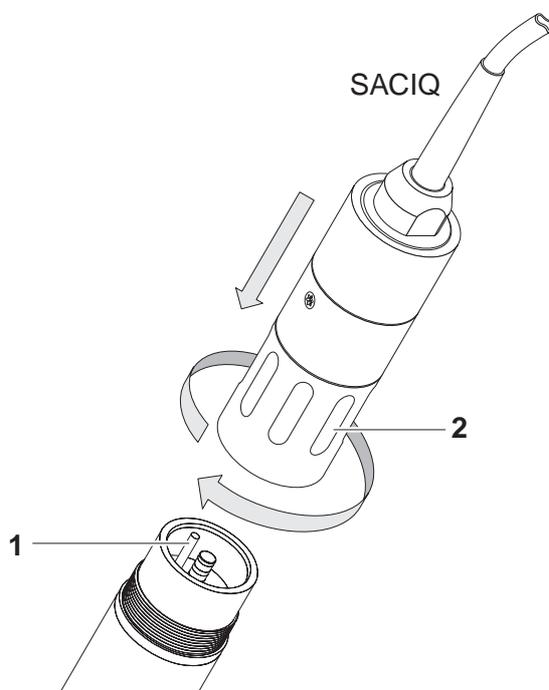*Fig. 3-1   Connecting the sensor*

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
Measuring mode	• Conductivity /cm • *Salinity* • TDS • Conductivity /m	Measured parameter in the measured value display (*TDS* = total dissolved solids)
Measuring ranges with *Measuring mode*, *Conductivity /cm*	• *AutoRange* • *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 *AutoRange* menu item is selected, the measurement range selection and switchover is made automatically.
Measuring ranges with *Measuring mode*, *Conductivity /m*	• *AutoRange* • *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*	
Measuring range in *Measuring mode Salinity*	*0 .. 70*	The measuring range is permanently set.
Measuring range in *Measuring mode TDS*	*0 .. 2000 mg/l*	The measuring range is permanently set.
Temperature mode	• *°C* • *°F*	Unit of the measured temperature value (Celsius, Fahrenheit).
Temp. compensation	• *none* • *nonlinear* • *linear with setting*	 • For natural waters (groundwater, surface water, drinking water), salinity (seawater) according to IOT • Other aqueous measuring solutions

Temp. compensation linear	*0.5 ... 3.0 %/K*	Factor for linear temperature compensation. This menu item only appears if linear temperature compensation is selected.
Reference temperature	● *Tref20* (20 °C) ● *Tref25* (25 °C)	The reference temperature is the basis for calculating the temperature compensation.
TDS factor	*0,40 .. 1,00*	Factor for automatic calculation of the total dissolved solids by the sensor.
Cell constant	*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.
Temperature adjustment	*-1.5 ... +1.5 K*	Here you can balance the temperature sensor in the sensor against a reference temperature measurement.
Save and quit		The system confirms the saving of the settings and the display switches to the next higher level.
Quit		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
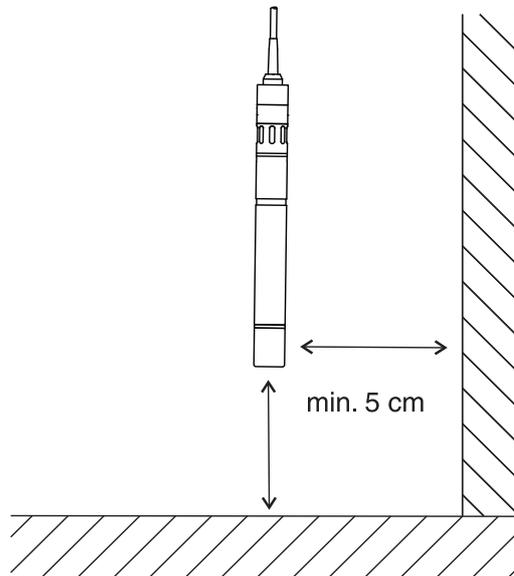suit the installation conditions (see section 4.2.2).

min. 5 cm

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.

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.

Adapting the cell constant to the installation location

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).

Note

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

Cell constants with YSI installation accessories

In chapter 7 TECHNICAL DATA of this operating manual you will find the correct values to set for some products of the YSI 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	Determine the conductivity of the sample **without the influence of boundary fields** (-> χ_X). The measurement can, for example, be performed as follows: ● 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. <u>Attention:</u> Set the same procedure for the temperature compensation as for measuring the χ_D!
5	Read and note down the currently set cell constant in the setting menu of the sensor (see section 3.4) (-> **K_A**).
6	Calculate the new cell constant **K_N** according to: $$K_N = (\chi_X/\chi_D) \cdot K_A$$
7	Set and store the new cell constant **K_N** (see section 3.4).

5   Maintenance, cleaning, disposal

5.1   General maintenance instructions

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.).

Maintenance condition
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

5 - 2

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	– Warm water and household detergent; – In the case of heavy contamination: Methylated spirits	– 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
– System setting incorrect	– Correct the system setting
– Temperature sensor or conductivity sensor defective	– Return the conductivity sensor

Measurement does not function

Cause	Remedy
– Protective cap still on conductivity sensor	– Pull off protective cap
– System setting incorrect	– Correct the system setting

Measurement provides implausible measured values

Cause	Remedy
– Conductivity sensor heavily contaminated	– Clean conductivity sensor
– Boundary field not maintained	– 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)
– Electrodes damaged	– Return the sensor
– System setting incorrect	– Correct the system setting
– Measuring range exceeded	– Make sure the correct sensor is being used for the application
– The sensor was installed in an armature and the boundary field is not sufficient	– 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 *AutoRange*): 0.00 ... 20.00 µS/cm 0.0 ... 200.0 µS/cm 0 ... 2000 µS/cm 0.00 ... 20.00 mS/cm 0.0 ... 200.0 mS/cm 0.0 ... 500.0 mS/cm	 0.01 µS/cm 0.1 µS/cm 1 µS/cm 0.01 mS/cm 0.1 mS/cm 0.1 mS/cm
Conductivity in S/m	1.000 mS/m ... 50.00 S/m Display ranges (manual or automatic with *AutoRange*): 0.000 ... 2.000 mS/m 0.00 ... 20.00 mS/m 0.0 ... 200.0 mS/m 0 ... 2000 mS/m 0.00 ... 20.00 S/m 0.00 ... 50.00 S/m	 0.001 mS/m 0.01 mS/m 0.1 mS/m 1 mS/m 0.01 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 YSI 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

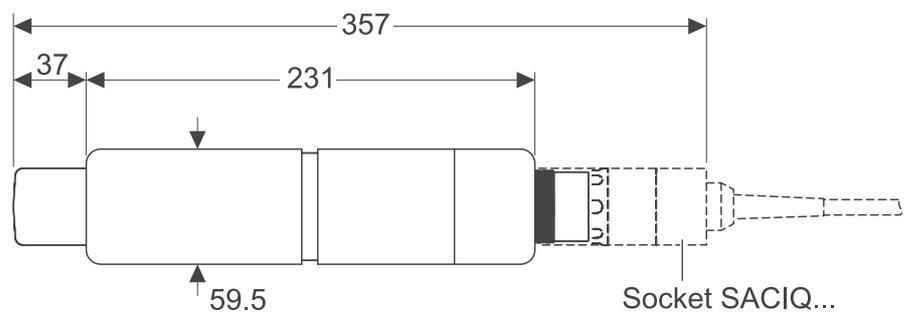| Fields of application	TetraCon 700 IQ	Stationary measurements in water/wastewater applications
	TetraCon 700 IQ SW	Stationary measurements in seawater and brackish water, aquaculture

7.3   General data

Dimensions   TetraCon 700 IQ:

357

40.0

Socket SACIQ...

TetraCon 700 IQ SW:

357

37   231

59.5

Socket SACIQ...
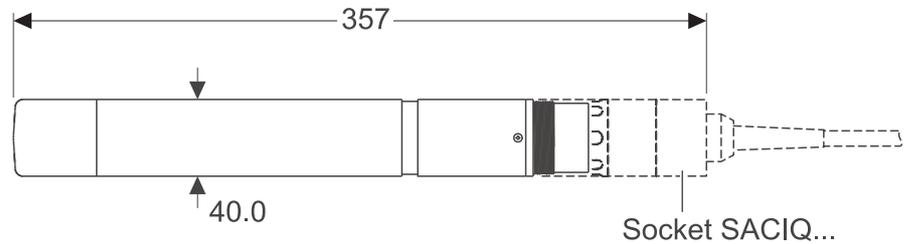
Weight (without sensor connection cable)		
TetraCon 700 IQ	approx. 660 g
TetraCon 700 IQ SW	approx. 1170 g

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	– EN 61010-1
		– UL 3111-1
		– CAN/CSA C22.2 No. 1010.1

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	$K = 0.917 \text{ cm}^{-1} \pm 1.5 \text{ \%}$
In a flow-thru system, e.g. EBST 700-DU/N	$K = 0.933 \text{ cm}^{-1} \pm 1.5 \text{ \%}$

8   Contact Information

8.1   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

8.2   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.

9   Indexes

9.1   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.

9.1.1   Error messages

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

9.2   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.

```
0  1  2  3  4  5  6  7    8  9 10 11 12 13 14 15
```

Status info,
general structure

```
1 0 0 0 0 0 0 0   0 0 0 0 0 0 0 0   (general)

0 0 0 0 0 0 0 0   0 0 0 0 0 0 0 0   (internal)
```

```
16 17 18 19 20 21 22 23   24 25 26 27 28 29 30 31
```

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	*Component hardware defective*
Bit 1-31	-

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