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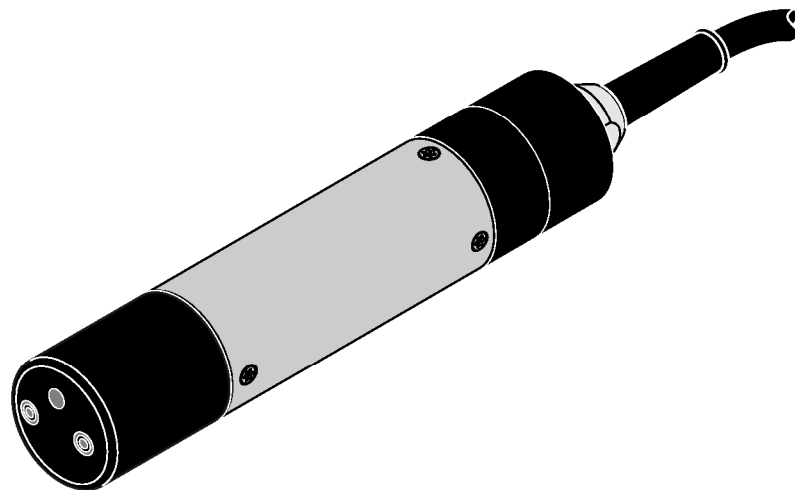
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**Operating manual**

ba55320e

# TetraCon 700



**Conductivity measuring cell,  
suitable for operation in potentially explosive areas\***

\*except for TetraCon 700-SO

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**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.

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# 1 Overview

## 1.1 Structure of the TetraCon 700 conductivity measuring cell

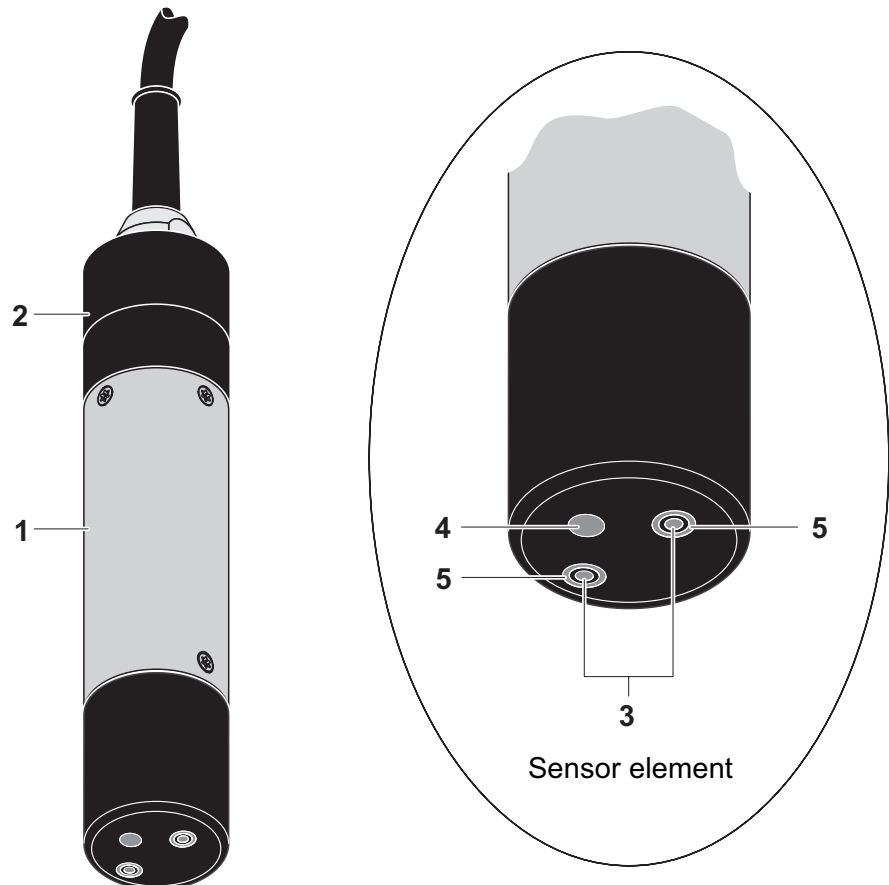


Fig. 1-1 Structure of the TetraCon 700 conductivity measuring cell

1	Shaft
2	Closing head with protective ring
3	Voltage electrodes
4	Temperature sensor
5	Current electrodes (ring)

### 1.2 Recommended fields of application

The TetraCon 700 conductivity measuring cell is suitable for stationary measurements in water/wastewater applications.

Furthermore, the TetraCon 700 is suitable for use in potentially explosive areas.

**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.

The modern epoxy casting technique reduces the danger of breaking the conductivity measuring cell in rough industry use.

### 1.3 Variants and identification

**Variants**

The following variants of the TetraCon 700 conductivity measuring cell are available:

<b>Explosion-protected variants</b>	<b>Cable length</b>
TetraCon 700-1,5	1.5 m
TetraCon 700-7	7.0 m
TetraCon 700-15	15.0 m

<b>Variants that are <u>not</u> explosion-protected</b>	<b>Cable length</b>
TetraCon 700-SO	Special lengths

**Instrument identification**

The instrument designation is printed on the plug-sided end of the cable. The series number is engraved in the closing head. Have these designations ready in case of queries to the WTW service department.

## 2 Safety

### 2.1 General information on safety

These safety instructions contain all instructions that have to be followed for a safe operation of the TetraCon 700 conductivity measuring cell. Before starting any work with the TetraCon 700, carefully read the safety instructions and strictly follow all protective measures mentioned.

Always store and make available these safety instructions together with the operating manual in the vicinity of the place of installation as possible.

#### 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.

### 2.2 Authorized use

Authorized use of the TetraCon 700 consists of stationary conductivity measurement in the following areas:

- Water and wastewater
- Environment
- Industry.

Please note the technical specifications given in chapter 8 TECHNICAL DATA. Only operation according to the instructions given in this operating manual is considered to be authorized.

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

### Explosion protection

All variants of the TetraCon 700 that are listed in the declaration of conformity concerning explosion protection in the appendix of this operating manual are intrinsically safe "simple apparatuses". They are suitable for the operation in potentially explosive areas.



#### Warning

**The variant with special cable lengths, TetraCon 700-SO, may not be used in potentially explosive areas.**

### 2.3 General safety instructions

#### Function and operational safety

The conductivity measuring cell left the factory in a safe and secure technical condition.

The smooth functioning and operational safety of the conductivity measuring cell can only be guaranteed if the generally applicable safety measures and the specific safety instructions in this operating manual are followed during operation.

The smooth functioning and operational safety of the conductivity measuring cell can only be guaranteed under the environmental conditions that are specified in chapter 8 TECHNICAL DATA.

The specified temperature (chapter 8 TECHNICAL DATA) must be maintained during the application and transport of the conductivity measuring cell. Protect the measuring cell, particularly against frost or overheating.

**Safe operation**

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

Safe operation is no longer possible if the conductivity measuring cell:

- 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 conductivity measuring cell.

**Obligations of the operator**

The operator of the conductivity measuring cell 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.

**Caution**

**All changes of the TetraCon 700 that exceed the work described in this operating manual are not allowed. Repair work may only be carried out by WTW Weilheim.**



## 3 Commissioning

### 3.1 Scope of delivery

- TetraCon 700
- The measuring cell is fitted with protective caps
- Operating manual.

### 3.2 Installation

#### 3.2.1 Connection to the measuring transmitter (areas that are not potentially explosive)



#### **Warning**

**This paragraph exclusively refers to operation in areas that are not potentially explosive. For potentially explosive areas observe the section 3.2.2.**

The TetraCon 700 connection cable has a cable plug to be connected to the Cond input socket of a measuring transmitter. It is connected to the terminal strip of measuring transmitters without a Cond input socket via the ADA/AMPH-LF adapter (see chapter 7 REPLACEMENT PARTS AND ACCESSORIES).

For detailed information please refer to the operating manual of the measuring transmitter.

### 3.2.2 Connection to the measuring transmitter (potentially explosive areas)



#### Warning

In potentially explosive areas, only explosion-protected variants of the TetraCon 700 may be used (see declaration of conformity in the appendix). The variant with special cable lengths, TetraCon 700-SO, may not be used in potentially explosive areas.



#### Warning

The TetraCon 700 conductivity measuring cell may not be used in areas that are continuously, for long periods or frequently potentially explosive (zone 0). Before installing the measuring cell, the potential explosiveness of the installation location must be assessed and the suitability of the TetraCon 700 must be determined.



#### Warning

Incorrect installation or operation of the TetraCon 700 conductivity measuring cell can affect its explosion protection and thus cause an explosive atmosphere to detonate. Therefore, the following points must be strictly observed when using the measuring cell in potentially explosive areas:

- The TetraCon 700 may be installed in potentially explosive areas by specialist electricians only, according to the relevant regulations and the instructions in this operating manual, especially the technical data concerning explosion protection in chapter 8 TECHNICAL DATA.
- In potentially explosive areas, the TetraCon 700 may exclusively be operated with the Stratos 2211 X Cond measuring transmitter and the WG 20 A2 power supply/isolator (identical in construction: WTW SG 20 A2). The installation, commissioning and operation of these instruments must be carried out according to the instructions in the relevant operating manuals.
- In potentially explosive areas, the TetraCon 700 may only be installed and operated with accessories that comply with the valid explosion protection regulations.
- The metallic shaft of the TetraCon 700 need not and may not be connected to the potential equalization system.
- To avoid electrostatic charge, the TetraCon 700 including the connection cable may be cleaned with a damp cloth only.
- To connect the TetraCon 700 to the Stratos 2211X Cond measuring transmitter, use the ADA/AMPH-LF adapter (see chapter 7 REPLACEMENT PARTS AND ACCESSORIES).

**Connection to the measuring transmitter**

The connection is made via the ADA/AMPH-LF adapter to the terminal strip of the measuring transmitter. For detailed information please refer to the operating manual of the measuring transmitter.

The connection to the Stratos 2211 X Cond measuring transmitter can be taken from the following wiring table:

**Stratos 2211 X Cond wiring table**

ADA/AMPH-LF wire color	Function	Stratos 2211 X Cond terminal no.
Pink	Current electrode 1	1
Gray	Voltage electrode 1	2
Yellow	Voltage electrode 2	3
Green	Current electrode 2	4 (bridge with 5)
Transparent	Shield	5
Brown	NTC	7
White	NTC	8

**Note**

For all further steps please refer to the operating manual of the measuring transmitter.

## 4 Measuring / Operation

### 4.1 Measuring



**Warning**

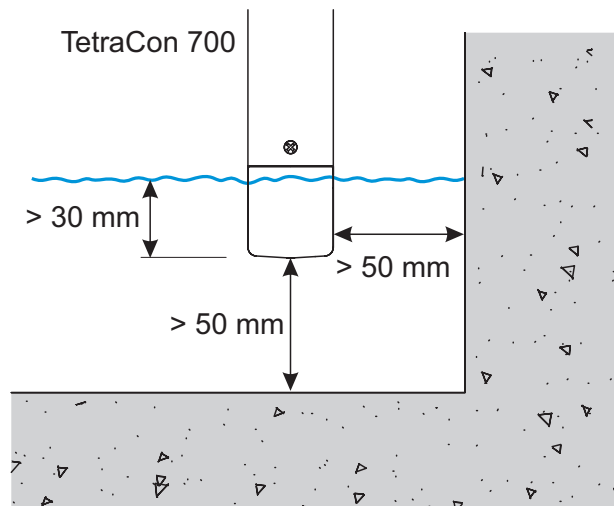
Contact with the sample can lead to danger to the user! Depending on the type of sample, suitable protective measures must be taken (protective clothing, protective goggles, etc.).

**Minimum immersion depth**

Please observe the minimum immersion depth of the conductivity measuring cell (> 30 mm).

**Spacing**

Please make sure that the conductivity measuring cell is surrounded by a gap of at least 5 cm at the base and sides (boundary fields) when measuring at the electrodes.



**Measuring at a narrow location**

If the gap is less than that, the cell constant changes. This leads to inexact measurement results. Normally, measuring transmitters have a correction function that can compensate for this influence. This procedure determines a new cell constant for the system consisting of conductivity measuring cell + measuring environment. For more detailed information, refer to section 4.2 APPLICATION-DEPENDENT SETTINGS.



**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.

## 4.2 Application-dependent settings

The TetraCon 700 conductivity measuring cell is stable over the long term. When being used for the authorized use of the measuring cell in water/wastewater applications, it is immediately ready for use.

### 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).

In chapter 6 WHAT TO DO IF... 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 can be found in the accessory operating manual.



#### Note

Details on how to determine and set the cell constant can be taken from the operating manual of the measuring transmitter.

## 5 Maintenance, cleaning, disposal

### 5.1 Maintenance

The TetraCon 700 conductivity measuring cell does not require maintenance.

### 5.2 Cleaning



**Warning**

Contact with the measuring solution or cleaning solution can endanger the user! Take protective measures suitable for the kind of measuring solution or cleaning solution (protective clothes, eye protectors etc.).



**Warning**

To avoid electrostatic charge, the TetraCon 700 including the connection cable may be cleaned with a damp cloth only in possibly explosive areas.

If the conductivity measuring cell is heavily contaminated, this can affect the measuring accuracy. Therefore, we recommend cleaning the conductivity measuring cell regularly according to visual checks. Especially before measuring low conductivity values, we recommend to clean the measuring cell thoroughly.

Cleaning procedure	Contamination	Cleaning agents	Reaction time at room temperature
	Water-soluble substances	Tap water	any
	Slurry and loosely adhering dirt or biological films	Soft brush, warm tap-water with detergent	any
	Fats and oils	– Warm water and household detergent – In case of heavy contamination: methylated spirit	– any  – 5 minutes maximum
	Lime and hydroxide deposits	Acetic acid (10 %)	any

### 5.3 Disposal

We recommend to dispose of the conductivity measuring cell as electronic waste.

## 6 What to do if...

**Measurement delivers no or wrong measured values**

Cause	Remedy
– Conductivity measuring cell not correctly connected	– Check connection to measuring transmitter
– Cable damaged	– Check cable. If it is defective, send conductivity measuring cell to WTW
– Measuring range exceeded	– Select larger measuring range or set automatic selection of the measuring range

**Measurement provides implausible measured values**

Cause	Remedy
– Conductivity measuring cell is heavily contaminated	– Clean the conductivity measuring cell
– Boundary fields not observed	– The conductivity measuring cell 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 will change (see section 4.1 MEASURING)
– Electrodes damaged	– Send the measuring cell to WTW
– System setting incorrect	– Correct the system setting
– Measuring range exceeded	– Observe the range of application
– The measuring cell was installed in a flow-through device 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 measuring cell in the installed state is not known, adjust the measured value to the nominal value of a measuring solution (see operating manual of the measuring transmitter)



## 7 Replacement parts and accessories

### 7.1 General accessories

Adapter	Model	Order no.
	ADA/AMPH-LF	303 215



**Note**

Information on further accessories is given in the WTW catalog and in the Internet.

### 7.2 Suitable electrical equipment for a potentially explosive area

Measuring transmitter	Model	Order no.
	Stratos 2211 X Cond	300 966

Power supply/isolator for measuring transmitter	Model	Order no.
	WG 20 A2	109 343



**Note**

Information on further accessories is given in the WTW catalog and in the Internet.

## 8 Technical data

### 8.1 General features

<b>Measuring range</b>	10 µS/cm ... 1000 mS/cm at 0 °C ... + 50 °C	
<b>Measuring principle</b>	Four-electrodes measurement	
<b>Temperature sensor</b>	Integrated NTC 30 (30 kΩ / 25 °C)	
<b>Dimensions</b>	Length	196 mm (without screwed cable gland)
	Shaft diameter	40 mm
<b>Weight</b>	approx. 660 g (without sensor connection cable)	
<b>Material</b>	Probe head	PVC, epoxy (filling material)
	Electrodes, housing of the temperature sensor	Graphite
	Shaft	Stainless steel 1.4571
	Closing head	POM
	Protection ring	POM
	Cable screw joint	Stainless steel 1.4571
	Cable coating	PUR
<b>Connection cable</b>	Length	Depending on variant: – 1.5 m – 7.0 m – 15.0 m – Special lengths on customer request up to 100 m
	Diameter	8.8 mm
	Smallest allowed bend radius	Permanent bend: 180 mm Short time bend: 90 mm
	Connection	Screw plug, 7 poles (IP 65)

**Explosion protection**

The TetraCon 700 conductivity measuring cell is suitable for operation in potentially explosive areas. More detailed information can be found in the conformity declaration in the appendix of this operating manual.

Grading of explosion protection | EEx ib IIB T6

**Guidelines and norms used**

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

Explosion protection | – DIN EN 50014  
 – DIN EN 50020

**Test certificates**

UL, cUL

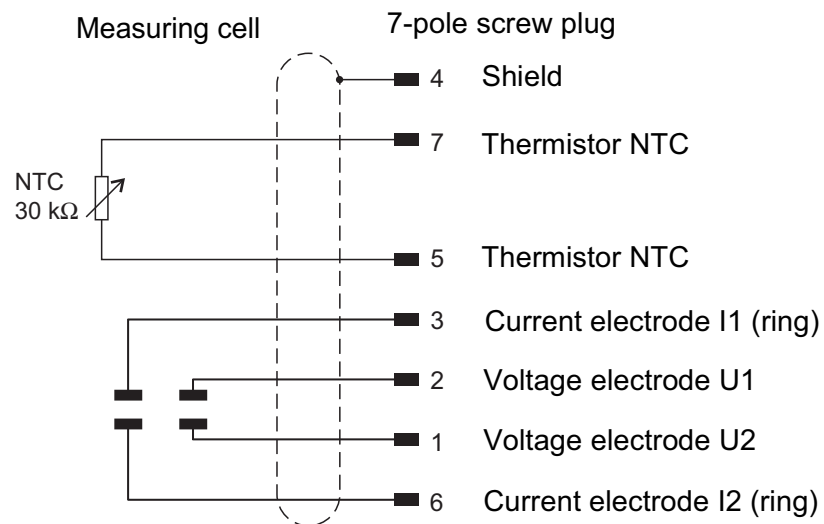
**8.2 Electrical data**



**Warning**

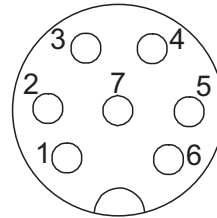
All voltages must be protective low voltages or safety extra low voltages without hazard of contact according to E 61010-1 or UL 3111-1.

**Wiring diagram**



Pin assignment	Pin	Assign- ment	Wire color	Max. voltage	Max. current
	1	U2	Yellow	---	---
	2	U1	Gray	---	---
	3	I1	Pink	1 V	5 mA
	4	Shield	Transparent	---	---
	5	NTC	Brown	3.5 V	0.15 mA
	6	I2	Green	1 V	5 mA
	7	NTC	White	3.5 V	0.15 mA

Plug from the front:



### 8.3 Measurement conditions

<b>Temperature range</b>	Measuring medium	0 °C ... + 50 °C
	Storage/transport	- 5 °C ... + 65 °C (storage in air recommended)
<b>Immersion depth</b>	min. 30 mm	
<b>Operating position</b>	any	
<b>Approach flow</b>	not required	
<b>Pressure resistance</b>	Conductivity measuring cell including connection cable:	
	Max. admissible overpressure	10 <sup>6</sup> Pa (10 bar)
	Type of protection	IP 68 (10 <sup>6</sup> Pa or 10 bar)
	7-pole screw plug:	
	Type of protection	IP 65

The TetraCon 700 meets the requirements according to article 3(3) of the directive, 97/23/EC ("pressure equipment directive").

### 8.4 Characteristics when delivered

<b>Temperature measurement</b>	Probe accuracy	± 0.2 K
	Response time	t <sub>90</sub> (90 % of the final value display after) < 60 s t <sub>95</sub> (95 % of the final value display after) < 120 s
<b>Cell constant</b>	In free solution, i.e. base and side clearance > 5 cm	K = 0.917 cm <sup>-1</sup> ± 1.5 %
	In a flow-thru system, e.g. EBST 700-DU/N	K = 0.933 cm <sup>-1</sup> ± 1.5 %



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## Declaration of Conformity on Explosion Protection

Document no. **Ex002\_TC700**  
 Product designations **TetraCon 700-1,5; item no. 302 314**  
**TetraCon 700-7; item no. 302 316**  
**TetraCon 700-15; item no. 302 318**  
**(each with adapter ADA/AMPH-LF; item no. 303 215)**

The designated products are in compliance with the provisions of the following standards:

**EN 50014:2000**  
**EN 50020:2003**

Classification of the products *Intrinsically safe "Einfache elektrische Betriebsmittel / Simple Apparatuses" according to EN 50020. As such, they are excluded from the application of the European Directive 94/9/EC ("Explosion protection") according to the guideline EN/TRIG/3/DE D(2003). Therefore, they do not have to be certified and designated concerning explosion protection technique.*

Explosion protection characteristics **EEx ib IIB T6**

Maximum permissible ambient temperature **60 °C**

Electrical data Measuring circuits:  
 Current electrodes *Wire colors, pink + green*  
 Voltage electrodes *Wire colors, gray and yellow*  
 Temperature *Wire colors, brown + white*  
 measuring circuit

Applicable for all measuring circuits:  
*In type of protection, "Intrinsic Safety" EEx ib IIB only suitable for the connection to an intrinsically safe circuit.*

The following maximum values are applicable for all measuring circuits:

$U_i = 12\text{ V}$   $C_i = \text{negligibly small}$   
 $I_i = 25\text{ mA}$   $L_i = \text{negligibly small}$   
 $P_i = 25\text{ mW}$

Protection against electrostatic charge *In case of usage according to regulations, the constructive design avoids explosion risks caused by electrostatic charge.*

Installation instructions:

- *The measuring circuits are to be regarded as connected to each other.*
- *The metallic shaft of the products does not have to and may not be connected to the potential equalization system.*

Weilheim, January 22, 2004

Head of Research and Development