

Conductivity measurement



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Applications and meters overview

The conductivity is a sum parameter, as all ions dissolved in the water contribute to the conductivity. It is detected with so-called measuring cells, which are immersed in the sample. Determining the ratio of applied voltage and flowing current in conjunction with a geometric factor resulting from the cell provides the desired measured value.

	Digital			Analogue		Digital			Analogue				
	Benchtop conductivity meters					Portable conductivity meters							
	inoLab® IDS			inoLab®		MultiLine® IDS			ProfiLine				
	Multi 9630	Multi 9620	Multi 9310	Cond 7310	Cond 7110	Multi 3630	Multi 3620	Multi 3510	Multi 3320	pH/Cond 3320	Cond 3310	Cond 3110	
2 parameters simultaneously	✓	✓				✓	✓		✓	✓			
3 parameters simultaneously	✓					✓							
Additional parameters	●	●	●			●	●	●	●	●			
Routine measurements	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Routine measurements with documentation	✓	✓	✓	✓	–	✓	✓	✓	✓	✓	✓	–	
AQA with documentation	✓	✓	✓	✓	–	✓	✓	✓	✓	✓	✓	–	
R&D High resolution and precision	✓	✓	✓	✓	–	✓	✓	✓	✓	✓	✓	–	
Control measurements	✓	✓	✓	✓	–	✓	✓	✓	✓	✓	✓	–	
LIMS connection	✓	✓	✓	✓	–	✓	✓	✓	✓	✓	✓	–	
Quality assurance	✓	✓	✓	✓	–	✓	✓	✓	✓	✓	✓	–	
Education	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Service	–	–	–	–	–	✓	✓	✓	✓	✓	✓	✓	
Laboratory measurements	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	–	
Field measurements	–	–	–	–	–	✓	✓	✓	✓	✓	✓	✓	
Depth measurements	–	–	–	–	–	✓	✓	✓	–	–	✓	✓	
PC connection	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓		
Memory	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓		
USB interface	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓		
Graphic display			✓	✓					✓	✓	✓		
Color graphic display	✓	✓				✓	✓	✓					
	Compatible sensos												
	Digital IDS electrodes												
IDS conductivity cells	34	✓	✓	✓			✓	✓	✓				
	Analogue electrodes												
Conductivity cells	106				✓	✓			✓	✓	✓	✓	
	Multi 9630	Multi 9620	Multi 9310	Cond 7310	Cond 7110	Multi 3630	Multi 3620	Multi 3510	Multi 3320	pH/Cond 3320	Cond 3310	Cond 3110	
	see page	40	40	41	98	99	44	45	46	49	50	103	104

Benchtop conductivity meters

The use of different conductivity cells is common in the laboratory. The IDS technology is showing clear advantages here: The error-free automatic transmission of cell constants and preset temperature compensation for reliable measurement results.

inoLab® IDS – digital



Conductivity measurement in the quality laboratory with the new digital multi-parameter measuring instruments inoLab® IDS

inoLab® Multi 9630 IDS: Measure three parameters simultaneously

The digital inoLab® multi parameter meters for IDS sensors for parallel measurement of the same or different parameters. Up to three sensors can be connected. The IDS conductivity cells cover a wide range of applications. Due to the galvanic isolation of the measuring channels, there is no interference between the connected sensors, e.g. IDS pH electrodes.



inoLab® Multi 9630 IDS

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inoLab® Multi 9620 IDS: Measure two parameters simultaneously

As inoLab® Multi 9630 IDS, but up to two sensors can be connected.



inoLab® Multi 9620 IDS

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inoLab® Multi 9310 IDS: Digital individual parameter solution

The inoLab® Multi 9310 IDS works with any IDS conductivity cell and can cover all laboratory related tasks.



inoLab® Multi 9310 IDS

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inoLab® - analogue

All benchtop meters are available in application-oriented sets with sensors and accessories.

inoLab
innovations that make sense

3 year warranty IP 43 CE



inoLab® Cond 7310 SET 1

Technical specifications: inoLab® analogue benchtop conductivity meters

	inoLab® Cond 7310 all values ±1 digit	inoLab® Cond 7110 all values ±1 digit
Conductivity	0 µS/cm ... 1000 mS/cm ± 0.5 % of measured value	0 µS/cm ... 1000 mS/cm ± 0.5 % of measured value
Salinity	0.0 ... 70.0 (according to IOT) 0.00 ... 20 MOhm cm	0.0 ... 70.0 (according to IOT) 0.00 ... 20 MOhm cm
TDS	1 ... 1999 mg/l, 0 to 199.9 g/l	0 ... 1999 mg/l
Temperature	-5.0 ... 105.0 °C ± 0.1 °C	-5.0 ... 105.0 °C ± 0.1 °C
Cell constants	Fix 0.01 cm ⁻¹ , can be calibrated 0.450...0.500 cm ⁻¹ , 0.800 to 0.880 cm ⁻¹ , adjustable 0.09 ... 0.110 cm ⁻¹ 0.250 ... 25.0 cm ⁻¹	0.450 ... 0.500 cm ⁻¹ 0.09 ... 0.110 cm ⁻¹ 0.800 to 0.880 cm ⁻¹ , 0.25 ... 2.5 cm ⁻¹ , fixed 0.01 cm ⁻¹
Calibration	1-point	1-point
Tref	20°C/25°C	20°C/25°C
Temperature compensation	nLF, linear 0.000 to 10.000 %, disengageable	nLF, linear 0.000 to 3000 %, disengageable

inoLab® Cond 7310: Reliable conductivity documentation



inoLab® Cond 7310

- **USB interface for rapid data transfer**
- **Data output in *.csv-Format or via optionally built-in printer**
- **Mains and battery operation inoLab® Cond 7310**

The inoLab® pH 7310 is perfectly suited for precision measurement and automatic GLP/AQA compliant documentation in quality laboratories of all industries. Also available with optionally installed printer.

Reliable measurements

- Repeatable measurement results due to active automatic AutoRead function for the detection of stable measured values
- The sensor symbol informs about the condition of the electrode
- Graphic display with plain text menus for convenient and safe operation

GLP/AQA compliant documentation

- Alphanumeric input of the conductivity cell serial number
- Transfer of all data in *.csv format via USB interface at the PC, formatted takeover into Excel (MultiLab® Importer)
- Output possible via optionally installed printer

Flexible and high performance:

- For all modern WTW conductivity cells
- Measures TDS, salinity and specific resistance
- Backlit graphics display for brilliant representation
- Suitable for measurements according to pharmacopoeia

inoLab® Cond 7110: Exact conductivity measurement



inoLab® Cond 7110

- **Simple, intuitive operation**
- **Measurement range up to 1000 mS/cm**
- **Including stand and sensor holder**

The inoLab® Cond 7110 is a laboratory routine conductivity meter with a large display and all functions that make accurate measurements easy.

Measuring certainty

- Repeatable measurement results due to active automatic AutoRead function with independent detection of stable measuring values
- Calibration timer for regularly checking the conductivity cells
- Precise measured value recording through high-quality electronics

Flexible and high performance:

- Measures conductivity, TDS and salinity
- Connection of special measuring cells possible
- Linear, non-linear (nlf) and selectable temperature compensation
- Simple, intuitive operation
- Measurement range up to 1000 mS/cm
- Including stand and sensor holder



Order information: inoLab® analogue benchtop conductivity meters

Model	Description	Order no.
inoLab® Cond 7110 SET 1	Simple, easy-to-use conductivity benchtop meter for routine measurements. In a set with conductivity cell TetraCon® 325	1CA101
inoLab® Cond 7310P	Comfortable, menu-controlled conductivity benchtop meter for measurements/GLP/AQA compliant documentation With built-in thermal printer Single instrument	1CA300P
inoLab® Cond 7310 SET 1	Convenient, menu-controlled conductivity benchtop meter for measurements/GLP/AQA compliant documentation In a set with conductivity cell TetraCon® 325	1CA301

For Accessories and cables, see price list or www.WTW.com/de

Portable conductivity meters

MultiLine® IDS - digital

Portable conductivity measurement in the process and in the field with the new digital MultiLine® multi-parameter instruments:



Multi 3630 IDS: Measure three parameters simultaneously

Three galvanically isolated measurement channels can be used for any combination of parameters. It enables conductivity measurement also in conjunction with a MPP IDS depth sonde. Galvanic isolation eliminates the possibility of interference with other sensors.



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MultiLine® Multi 3630 IDS

Multi 3620 IDS: Measure two parameters simultaneously

Two galvanically isolated measurement channels can be used for any combination of parameters. Perfect for conductivity measurement in combination with pH measurement.



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MultiLine® Multi 3620 IDS

MultiLine® Multi 3510 IDS: Digital single parameter solution

The single channel multi-parameter meter Multi 3510 IDS is perfect for conductivity measurement of ultra-pure water up to concentrated solutions.



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MultiLine® Multi 3510 IDS

ProfiLine - analogue

All portable meters are available in application specific kits including sensors and accessories in a carrying case.



3 year warranty

IP 67

CE

ProfiLine Cond 3310 SET 1

Technical specifications: ProfiLine analogue portable conductivity meters

ProfiLine ...	Cond 3110	Cond 3310
Measuring ranges/resolution/accuracy	Conductivity 0,0 ... 1000 mS/cm ±0,5 % of the measured value	0,0 ... 1000 mS/cm ±0,5 % of the measured value 1.999 µS/cm (with K=0.01 cm ⁻¹) 0.00 ... 19.99 µS/cm (with K= 0.1 cm ⁻¹)
	Temperature 5.0 °C ... +105.0 °C ±0.1 °C	-5.0 °C ... +105.0 °C ±0,1 °C
	Salinity 0.0 ... 70.0 (as per IOT)	0.0 ... 70.0 (as per IOT)
	TDS	0 ... 1999 mg/l, 0 ... 199.9 g/l,
	Spec. resistance	0.00 ... 999 MΩcm
Reference temperature	selectable 20 °C or 25 °C	selectable 20 °C or 25 °C
Cell constant	fixed: 0.475 cm ⁻¹	0.475 cm ⁻¹ , 0.010 cm ⁻¹
	with calibration: 0.450 ... 0.500 cm ⁻¹ , 0.800 ... 0.880 cm ⁻¹	0.450 ... 0.500 cm ⁻¹ , 0.800 ... 0.880 cm ⁻¹
	adjustable: -	0.090 ... 0.110 cm ⁻¹ , 0.250 ... 25.000 cm ⁻¹
Temperature compensation	automatic	can be switched automatically/manually
Temperature coefficient	• Non-linear function of natural waters (nLF) as per EN 27 888	• Non-linear function of natural waters (nLF) as per EN 27 888 and ultra-pure water function
		• Linear compensation of 0.000 ... 10.000 %/K
		• No compensation
Data memory/logger	-	manual 200/5000 automatic
Display	7-Segment LCD, customized	LCD graphics, backlight
Permanent operation	up to 1000 hours	up to 800 h without/100 h with illumination

ProfiLine Multi 3320: The environment specialist

The Multi 3320 for the measurement of conductivity, pH, ISE, ORP, and dissolved oxygen is a perfect analogue meter for environmental monitoring with electrochemical sensors. With conductivity measurement, all applications can be covered with standard, special and ultra-pure water measuring cells.

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ProfiLine Multi 3320

ProfiLine pH/Cond 3320: Perfect in process

Conductivity, pH / ORP, ISE: the pH/Cond 3320 is a perfect meter also in portable process monitoring with electrochemical sensors. With conductivity measurement, all types of measurement can be covered with standard, special and ultra-pure water measuring cells, alone or in combination pH, ORP or ISE.

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ProfiLine pH/Cond 3320



ProfiLine Cond 3310: Reliable conductivity measurement with documentation



ProfiLine Cond 3310

- **Waterproof USB interface for rapid data transfer**
- **Data output in *.csv-Format**
- **Measuring range 0.001 µS/cm to 1000 mS/cm**

The Cond 3310 is a combination of a robust portable meter and a data logger for anyone who wants to record measured data automatically and evaluate them based on EDP.

Reliable measurements

- Repeatable measurement results due to active automatic AutoRead function with detection of stable measuring values
- Automatic temperature compensation, also disengageable, linear compensation up to 10%/K
- Silicon keyboard with tactile key click and optional protection for field use

GLP/AQA compliant documentation

- Large memory for 500 manual and 5000 automatically generated entries
- Transfer of all data in *.csv format via USB interface at the PC; formatted takeover into Excel (MultiLab® Importer)

Flexible and high performance:

- Measures conductivity, salinity, TDS and specific resistance
- Data transfer directly in Excel
- Suitable for measurements according to pharmacopoeia



ProfiLine Cond 3110: Easy conductivity measurement



ProfiLine Cond 3110

- **Compatible with TetraCon® 325 or KLE 325**
- **Automatic temperature compensation**
- **Salinity**

The Cond 3110 is a simple, reliable conductivity meter with automatic nIF temperature compensation according to DIN EN 27888 for routine measurement in natural waters and wastewater.

Reliable measurement

- Repeatable measurement results due to active automatic AutoRead function for the detection of stable measured values
- Secure operation: Automated functions reduce the number of keys (6)
- A waterproof 8-pin socket enables reliable measurement also in a humid environment.

Easy and reliable:

- Easily readable display for measured value and temperature
- Silicon keyboard with tactile key click, also operable with gloves
- Sets for field use with proven electrodes and carrying case
- Suitable for TetraCon® 325 or KLE 325
- Automatic temperature compensation
- Salinity

Order information: Conductivity meters

Model	Description	Order no.
Cond 3110 SET 1	Easy-to-use, robust conductivity meter with large LCD display, for mobile routine measurement of 2- and 4 electrode cells, set with TetraCon® 325.	2CA101
Cond 3310 SET 1	Professional, field-proven conductivity meter with backlit LCD graphic display for mobile measurement, with data logger, USB interface. Set with TetraCon® 325	2CA301

For additional accessories and cables, see price list or www.WTW.com/de

Conductivity cells

Depending on the application, we provide electrodes made of graphite or stainless steel to ensure that they do not chemically react with the measured sample.

Four electrode conductivity cells

- Universal application area due to wide measuring range between 1 $\mu\text{S}/\text{cm}$ and 2000 mS/cm
- Only one calibration point required due to linearity over the entire measuring range
- Measuring cells in different designs for almost all applications
- Highest accuracy through high-precision manufacturing
- Large application range in aqueous solutions through unique electrode technology

Two electrode measuring cells made of stainless steel

- Optimised measuring cells, especially for use in ultra-pure water measurement
- No disturbances due to CO_2 introduction with stainless steel measuring cells with flow-through vessels
- Precise measurement in the lower measuring range due to optimised geometry
- Suitable for ultra-pure water measurement according to pharmacopoeia

Two electrode measuring cell made of graphite

- Robust measuring cell for simple measurements and in teaching and training
- Robust design with durable epoxy shaft
- For all aqueous samples
- For all current conductivity meters

IDS Conductivity cells – digital



A selection of two electrode and four electrode conductivity cells for covering a wide range of applications, from ultra-pure water to viscous samples can be found in the chapter “Multi-parameter measurement”.

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from left to right: the digital IDS sensors (1) TetraCon® 925, (2) LR 925/01, (3) TetraCon® 925 / C, (4) TetraCon® 925 / LV; the wireless ready IDS plug head electrodes (5) TetraCon® 925-P, (6) TetraCon® 925 / LV-P, (7) LR 925/01-P

Conductivity cells - analogue

For every application



Technical specifications: Conductivity cells - analogue

Universal applications

	TetraCon® 325	TetraCon® 325-3	TetraCon® 325-6	TetraCon® 325-10	TetraCon® 325-15	TetraCon® 325-20
Order no.	301960	301970	301971	301972	301973	301974
Type	4 electrode	4 electrode	4 electrode	4 electrode	4 electrode	4 electrode
Electrode material	Graphite	Graphite	Graphite	Graphite	Graphite	Graphite
Flow-through vessel	-	-	-	-	-	-
Shaft material	Epoxy	Epoxy	Epoxy	Epoxy	Epoxy	Epoxy
Shaft length	120 mm	120 mm	120 mm	120 mm	120 mm	120 mm
Cell constant	0.475 cm ⁻¹	0.475 cm ⁻¹	0.475 cm ⁻¹	0.475 cm ⁻¹	0.475 cm ⁻¹	0.475 cm ⁻¹
Diameter	15.3 mm	15.3 mm	15.3 mm	15.3 mm	15.3 mm	15.3 mm
Cable length	1.5 m	3 m	6 m	10 m	15 m	20 m
Measuring range	1 µS/cm to 2000 mS/cm	1 µS/cm to 2000 mS/cm	1 µS/cm to 2000 mS/cm	1 µS/cm to 2000 mS/cm	1 µS/cm to 2000 mS/cm	1 µS/cm to 2000 mS/cm
Temperature sensor	0 to 100 °C	0 to 100 °C	0 to 100 °C	0 to 100 °C	0 to 100 °C	0 to 100 °C
min./max. immersion depth	36/120 mm	36/120 mm	36/120 mm	36/120 mm	36/120 mm	36/120 mm

Special applications

	TetraCon® 325/C	TetraCon® 325/S
Order no.	301900	301602
Type	4 electrode	4 electrode
Electrode material	Graphite	Graphite
Shaft material	Epoxy	Epoxy
Shaft length	120 mm	120 mm
Cell constant	0.475 cm ⁻¹	0.491 cm ⁻¹
Diameter	15.3 mm	15.3 mm
Cable length	1.5 m	1.5 m
Measuring range	1 µS/cm ... 2000 mS/cm	1 µS/cm ... 2000 mS/cm
Temperature range	0 ... 100 °C	0 ... 100 °C
Temperature probe	NTC 30 kOhm	NTC 30 kOhm
min./max. immersion depth	36/120 mm	40/120 mm

Low conductivities

	LR 325/01	LR 325/001
Order no.	301961	301963
Electrode material	Stainless steel	Stainless steel
Flow-through vessel	Glass	Stainless steel
Shaft material	Stainless steel	Stainless steel
Shaft length	120 mm	120 mm
Cell constant	0.1 cm ⁻¹	0.01 cm ⁻¹
Diameter	12 mm	20 mm
Cable length	1.5 m	1.5 m
Measuring range	0.001 ... 200 µS/cm	0.0001 µS ... 30 µS/cm
Temperature range	0 ... + 100 °C	0 ... + 100 °C
Temperature probe	NTC 30 kOhm	NTC 30 kOhm
Filling volume	17 ml (without sensor)	Approx. 10 ml (without sensor)
min./max. immersion depth	30/120 mm	40/120 mm

Simple applications and flow-through measurement in the laboratory

	KLE 325	TetraCon® DU/T or DU/TH
Order no.	301995	301252 or 301254
Type	2 electrode	4 electrode
Electrode material	Graphite	Graphite
Flow-through vessel	-	Epoxy
Shaft material	Epoxy	-
Shaft length	120 mm	-
Cell constant	0.84 cm ⁻¹	0.778 cm ⁻¹
Diameter	15.3 mm	-
Cable length	1.5 m	-
Measuring range	1 µS/cm to 20 mS/cm	10 µS/cm to 1000 mS/cm
Temperature range	0 to 80 °C	0 to 60 °C
Temperature probe	NTC 30 kOhm	NTC 30 kOhm
min./max. immersion depth	36/120 mm	-

Four-electrode conductivity cells



TetraCon® 325

Graphite measuring cells for universal use

- TetraCon® 325

Suitable for almost all conductivity measurements in aqueous samples; for outdoor use available with cable lengths up to 20 m.



TetraCon® S

Graphite measuring cells for special applications

- TetraCon® 325 S

With shovel-shaped electrode holder, especially suitable for measuring in pasty samples.



TetraCon® 325/C

Graphite measuring cells for special applications

- TetraCon® 325/C

This measuring cell is designed for measurement in acidic samples.

Flow-through measuring cells in the laboratory

- TetraCon® 325 DU

Four-electrode flow-through conductivity cell, (also with Hansen connector, DU / TH), for standard applications. Requires separate connection cable KKDU 325.



TetraCon® DU, DU/TH

Two-electrode conductivity cells with stainless steel and graphite electrodes



LR 325/01



LR 325/001



KLE 325

Two electrodes ultra-pure water measuring cells

- LR 325/01

Two electrode measuring cell with concentric stainless steel electrodes and glass flow-through vessel for measuring low conductivities up to 200 $\mu\text{S}/\text{cm}$.

Two electrodes pure-water measuring cells

- LR 325/001

Two electrode measuring cell with concentric stainless steel electrodes and glass flow-through vessel for measuring trace conductivities up to 30 $\mu\text{S}/\text{cm}$.

Simple two electrode graphite LF measuring cell

- KLE 325

Graphite-based two-electrode measuring cell for medium measuring ranges up to 20 mS/cm for simple applications, also in training and education.

Calibration and test means



6R/SET/Lab 1 Test resistance set

Kit for pure water measurement according to pharmacopoeia

This kit includes LR 325/01 ultra-pure water cell, flow-through vessel D 01 / T made of glass (USP-KIT 1) or stainless steel (USP-KIT 2) NIST traceable 5 μ S standard with accuracy \pm 2% and 6R/SET/Lab 1 test resistance set.



Calibration standard 5 μ S/cm

Calibration standard 100 μ S/cm

Shelf life 2 years, NIST traceable with accuracy \pm 3%

Calibration standard 5 μ S/cm

Shelf life 1 year, NIST traceable with accuracy \pm 2%

Order information: Calibration and test means

Model	Description	Order no.
USP Kit 1	Kit for conductivity measurement according to pharmacopoeia, consisting of: LR 325/01 Purest water cell, D 01/T flow-through vessel, NIST traceable 5 μ S/cm standard with accuracy \pm 2% and 6R/SET/Lab 1 testing resistance set	300569
USP Kit 2	as USP Kit 1, but stainless steel flow-through vessel instead of D 01/T	300568
Calibration means		
KS 100μS	Calibration standard 100 μ S/cm, shelf life 2 years, NIST traceable with accuracy \pm 3% (300 ml)	300578
KS 5μS	Calibration standard 5 μ S/cm, shelf life 1 year, NIST traceable with accuracy \pm 2% (300 ml)	300580
E-SET Trace	Calibration set (6 bottles at 50 ml calibration and control standard, KCl 0.01 mol/l), NIST traceable with accuracy \pm 0.5%	300572

For accessories & cables, see price list or www.WTW.com/de

Flow-through vessels

With WTW conductivity cells, there are different possibilities to measure in the flow.

Ultra-pure water measuring cells are offered with a compatible measuring vessel, as impurities by introducing carbon dioxide must also be absolutely excluded.

For conductivity cells with a diameter of 12 mm, a flow-through measuring vessel is also available. For standard measuring cells with a diameter of 15.3 mm, there is the D 201, which ensures a trouble-free conductivity measurement.



Trace conductivity cell LR 325/001 with stainless steel flow-through vessel



Flow-through measuring cell for four pole conductivity cell

Order information: Flow-through vessels

Model	Description	Order no.
D 201	Flow-through vessel of PMMA, internal diameter 18 mm, V*=13 ml (To TetraCon® 325)	203730
D 01/T	Flow-through vessel of glass, internal diameter 18 mm, V*=17 ml (Replacement measuring vessel for LR 325/01)	302750

For accessories & cables, see price list or www.WTW.com

V* = Filling quantity without sensor