WTW

Operation Manuals

Microprocessor-Precision-Conductivity Meter

LF 539

Matrix Printer **P 500**

Standard Conductivity Cell
TetraCon 96

Special Conductivity Cell
TetraCon L

Conductivity Cell for
Ultrapure Water
LR 01/T

Trace Conductivity
Measuring Cell
LR 001/T

WISSENSCHAFTLICH - TECHNISCHE WERKSTÄTTEN G.M.B.H.
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BA SOLF539/6/92/2

Important Hints for the User



These notes must be read before the instrument is put into service!

This instrument has been built and tested according to the German safety regulations for electronic test instruments, and left the factory in a technically and operationally perfect condition.

In order to maintain this condition and guarantee safe operation the user must observe the references and warning statements.

- Before switching on the instrument, check that the mains voltage selected matches the mains supply voltage.

- The proper function and operational safety of this instrument are guaranteed only if the climatic conditions specified in the Technical Specifications in this manual are adhered to.

- Opening of the instrument, adjustment, maintenance, repair and exchange of parts should only be carried out only by authorized personnel or by WTW.

- The instrument no longer confirms to the safety regulations and a dangerous operation can be assumed when the instrument
  - has been visually damaged
  - no longer functions
  - was stored for a long period under unsuitable conditions
  - was subjected to bad transport conditions.

- If it is obvious that the instrument is dangerous to persons then take it out of service and secure against any further inadvertent use.
  In case of doubt send the instrument back to the manufacturer "Wissenschaftlich-Technische-Werkstätten GmbH" for repair or maintenance.

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User's instructions for Trace Conductivity Measuring Cell LR 001/T 49

User's Manual

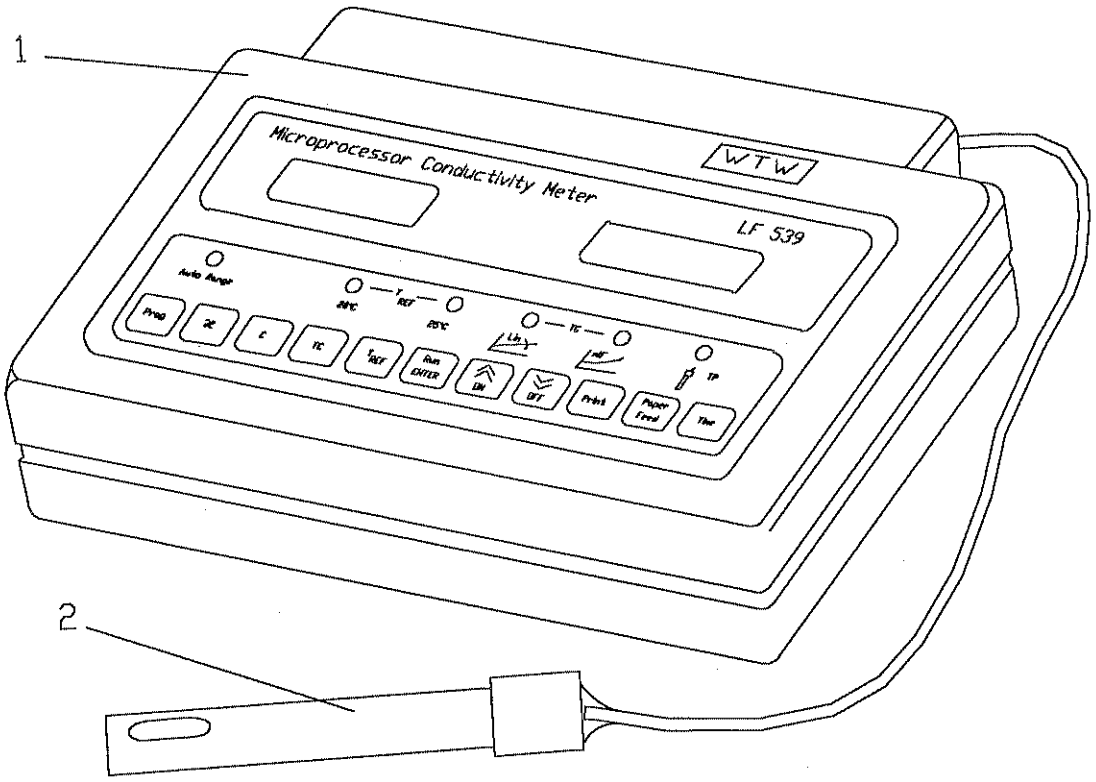
Microprocessor-Precision-Conductivity Meter

LF 539

Thank you for choosing the LF 539; a highly developed microprocessor-controlled conductivity meter that will satisfy all your requirements. This manual provides an overview of the many functions of the instrument and supports the user with detailed information. The many diagrams and illustrations describe the stages of operation clearly but the setting up and measured values shown are obviously only examples. Our technical customer advisory service is available for general questions about conductivity measuring techniques. We will gladly send the application reports described on request.

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Recommended Basic Equipment for Conductivity Measurement

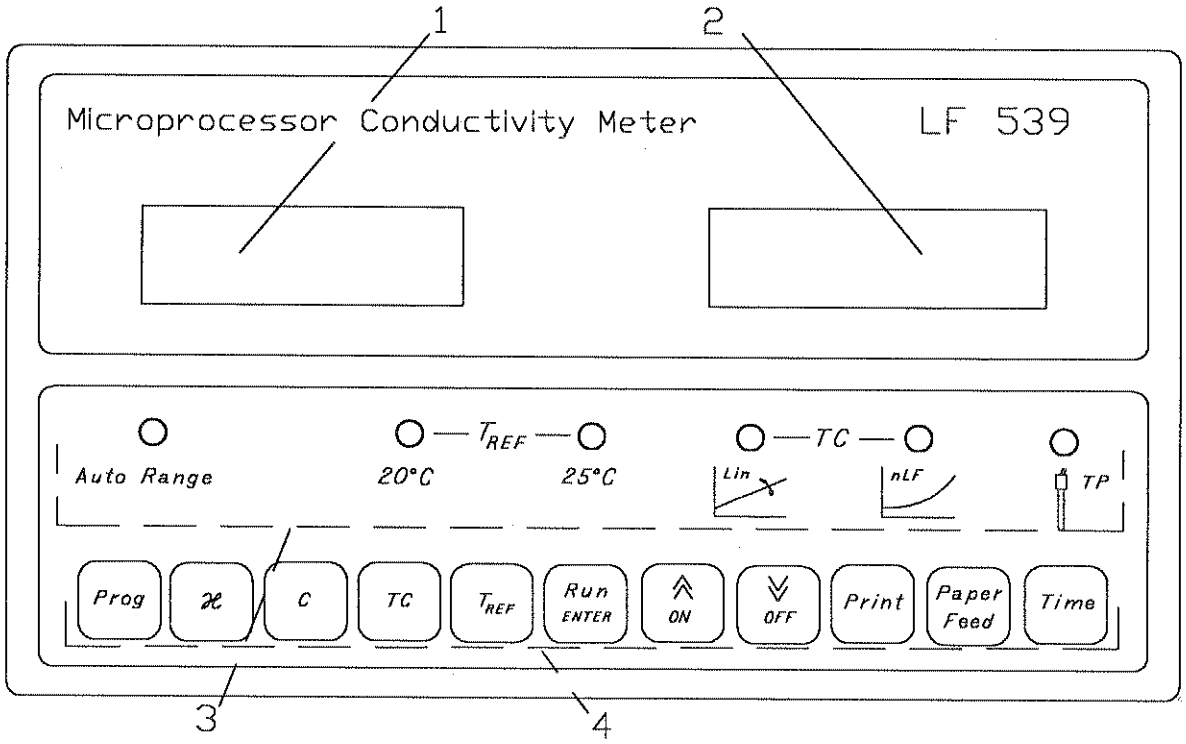


1 Conductivity meter LF 539

2 4-electrode-standard-measuring cell TetraCon 96

Display, Keys and Connections

Front view



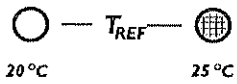
1 Display 1: Conductivity readings, user's instructions, data (e.g. time)

2 Display 2: Temperature of measuring solution, cell constant, temperature coefficient, user's instructions, data (e.g.time)

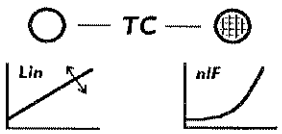
3 Status display



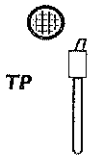
: Automatic range selection



: Reference temperature



: Temperature function



: Temperature sensor connected

Status LED illuminated

Status LED not illuminated

4 Foil keys

Scroll mode: Depress and hold the key until the required function is set.

Red lettering: Call-up of second functions

Prog : Second funtion of the keys ⌀ Print Time

Gold lettering: Readings and constants

⌀ : Measure conductivity and temperature , select measuring range (scroll mode)

Prog ⌀ : Auto range selection (ON/OFF)

C : Cell constant

TC : Temperature function

T_{REF} : Reference temperature changeover

Beige lettering: Setting-up and acknowledgement



: Acknowledge inputs,
Fast run, on/off



: Set the higher numerical values ,
Printer functions or auto range selection on



: Set the lower numerical values,
Printer functions or auto range selection off

Green lettering: Printer and time



: Print the readings



: Set the printer function



: Initiate a line feed

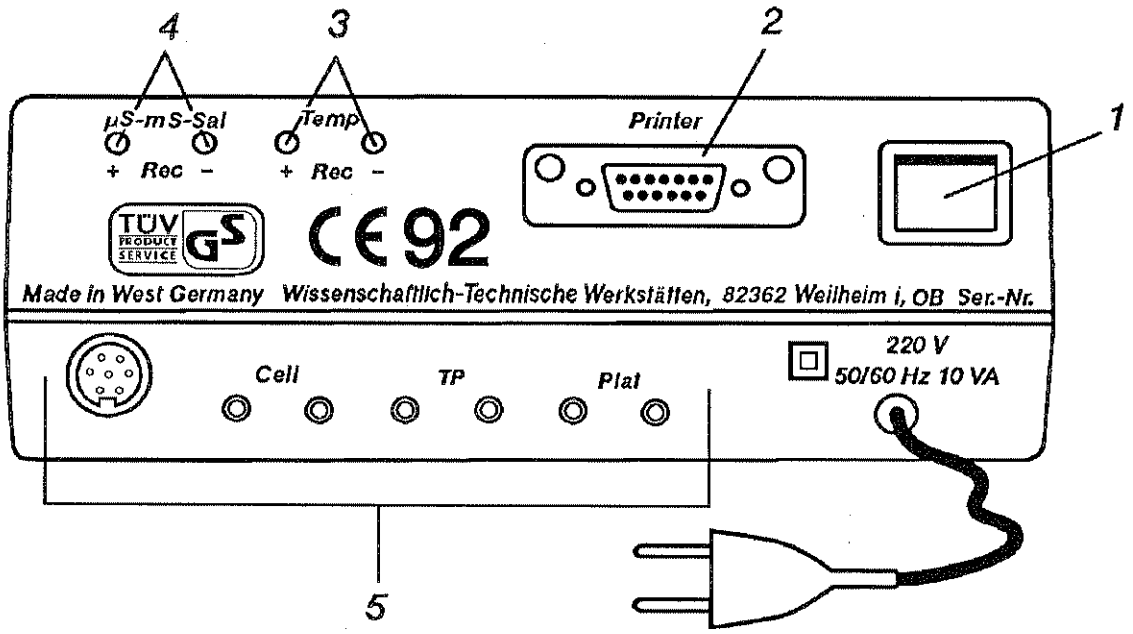


: Display date, time and print interval (scroll mode)



: Set time, date and print interval

Rear connections



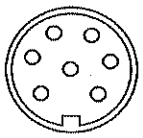
1 Mains supply switch, on/off

2 LF 539 : Printer interface for the P 500
LF 539 RS : V24/RS 232 C serial interface for a computer or printer

3 Temperature voltage output for laboratory recorder

4 Conductivity/salinity voltage output for laboratory recorder

5 Connections for conductivity measuring cells and temperature probe



: 2- or 4-electrode-conductivity cells with integrated temperature probe, 7-pin plug

Cell

: 2-electrode temperature probe, 4 mm banana plugs

TP

: Temperature probe, 4 mm banana plugs (TFK 150, Pt 1000)

Plat

: Connection for platinising glass platinum measuring cells, 4 mm banana plugs

Putting into Operation

- Connect the instrument to the mains supply.
- Connect the measuring cell with integrated temperature probe or measuring and temperature probe.
- Switch on the instrument with the ON/OFF pushbutton.

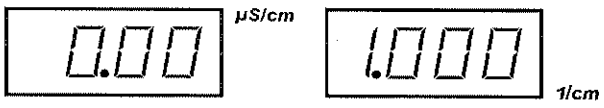
Proposals for familiarisation with the instrument

Initial set-up: depress **Prog** key and switch on simultaneously

Release the **Prog** key at display test

- Wait in display test until a signal sounds

The LF 539 is now ready for operation and set to the last operating mode used or to the initial set-up mode.



Conductivity, Salinity and Temperature Measurement

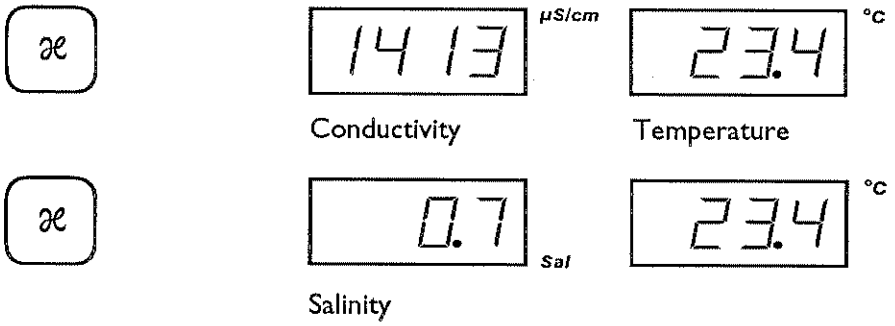
Measurement Setup	
Cell constant	in initial setup mode after switching on
	after measuring cell change

Setup determined by the type of measurement solution

● = Change or check setup

Temperature function	Measurement solution	**Reference temperature**
● nLF	Natural water (ground- , surface and drinking water)	●
● nLF	Water æ < 10 µS/cm	●
● (linear)	other aqueous solutions	●
Auto nLF, non-linear function for sea water	Salinity (sea water)	automatic, 20 °C
● ----	non-aqueous solutions	●

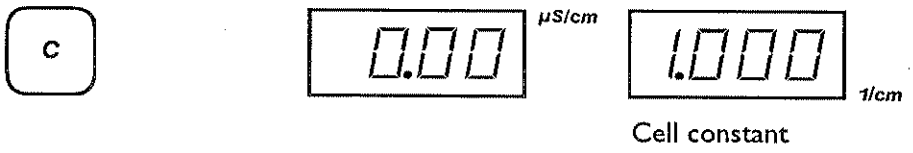
Immerse the measuring cell and temperature probe in measurement solution



General notes on salinity measurement:

Application report no.: 53021

Setting the cell constant (C)



Cell constant

Selectable range	for cell constants from approx.:
0.0100 ... 0.1500 /cm	0.01 /cm und 0.1 /cm
0.150 ... 1.500 /cm	1 /cm
1.50 ... 15.00 /cm	10 /cm
15.0 ... 200.0 /cm	100 /cm

The 4 digit display does not display the last digit of the value in the range 0.0100 ... 0.1500. A flashing decimal point indicates a digit change when setting the value.



Cell constants

Displacement of the decimal point of the cell constants:
Depress button several times

- 0.100 /cm
- 1.000 /cm
- 10.00 /cm
- 100.0 /cm

Fine setting



Cell constant

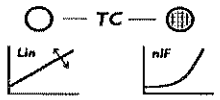
Set the value of the cell constant

General notes for determing the cell constants of conductivity measuring cells can be found in Application Report no. : 53023

Setting the temperature function (TC)

TC

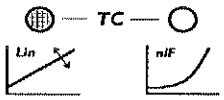
0.00 µS/cm nLF %/K



Non-linear function for natural water up to pure water

TC

0.00 µS/cm 2.000 %/K



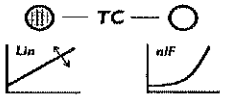
Linear temperature coefficient

Linear temperature compensation. A non-linear function is taken into account for the conductivity part of the pure water as against the total conductivity of the measuring solution, even if the linear temperature coefficient is set to 0.000 .

Setting range: 0.000 ... 3.500 %/K

ON OFF

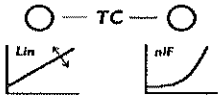
0.00 µS/cm 1.880 %/K



Set the linear temperature coefficient

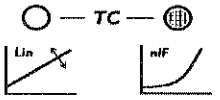
TC

0.00 µS/cm ---- %/K



No temperature compensation. The conductivity is related to the temperature of the measuring solution.

0.0 Sal 23.4 °C

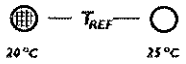


Non-linear function for sea-water. The instrument automatically switches on this function for the measurement of salinity.

General notes on temperature compensation during conductivity measurement can be found in Application Report no.: 53022

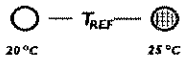
Selecting the reference temperature

T_{REF}



Set the reference temperature to 20° C

T_{REF}



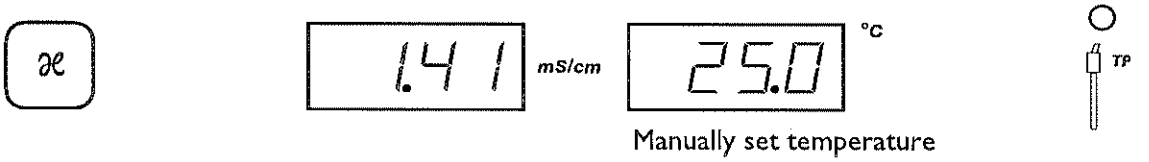
Set the reference temperature to 25° C

Temperature coefficient: Auto calculation of the selected reference temperature.

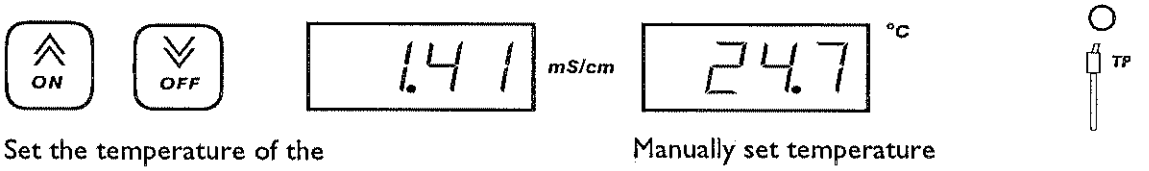
Meeasurement of salinity: Auto set to 20° C.

Measuring without a Temperature Probe

For measuring cells without integrated temperature probe



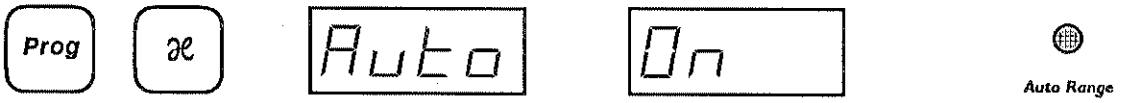
Manually set temperature



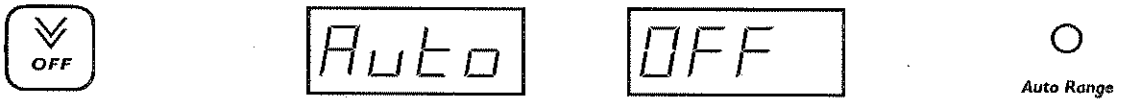
Set the temperature of the measuring solution manually

Manually set temperature

Automatic and Manual Range Selection



Auto range selection on



Switch on manual range selection



Switch on auto range selection

Ranges in manual range selection

Select range



Conductivity/salinity

until the required range is set

Possible measuring ranges		
Conductivity	Function display	Recommended measuring cell
0.000 ... 3.000	µS/cm	LR 01/T / LR 001/T
0.00 ... 30.00	µS/cm	LR 01/T / TetraCon L TetraCon 96
0.0 ... 300.0 0 ... 3000 0.00 ... 30.00 0.0 ... 300.0 0 ... 3000	µS/cm µS/cm mS/cm mS/cm mS/cm	TetraCon L TetraCon 96
Salinity		
0.0 ... 70.0	Sal	TetraCon L TetraCon 96

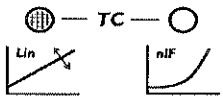
Fast Run

During cell constant, linear temperature coefficient and manual temperature setting.

Example: Temperature coeffient

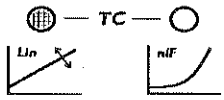
TC

0.00 µS/cm 1.880 %/K



ON OFF

0.00 µS/cm 1.881 %/K

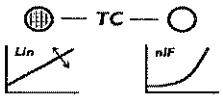


Changes start with the last decimal place

Run ENTER Switch on fast run

ON OFF

0.00 µS/cm 1.891 %/K



Changes begin with the penultimate decimal place. The last decimal place remains unchanged.

Run ENTER Switch off fast run

Time, Date and Print Period Time

Set time, date and print period for the printer

Prog → Time → 00.00. (hours minutes) Time 05 (Seconds) → ON / OFF (Set the flashing digit)

Run ENTER

- Hours
- Minutes
- Seconds

01.01. (Day Month) Date 00 (Year) → ON / OFF (Set the flashing digit)

Run ENTER

- Day
- Month
- Year

00.00. (Hours Minutes) Time 05 (Seconds) → ON / OFF (Set the flashing digit (5 sec . . . 24 hours))

Print period time: Status display "Time" is flashing.

Run ENTER

- Minutes
- Hours
- Seconds

Time — Leave the setting mode

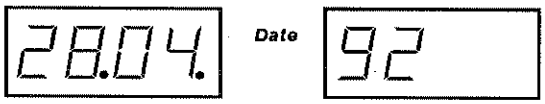
Read time, date and print period

Time



Hours Minutes Seconds

Time



Day Month Year

Time



Hours Minutes Seconds

Time interval: function indicator "Time" is flashing.

Printer Operation

Connections

Instrument version: LF 539, "Printer" interface	WTW-Printer P 500
Instrument version: LF 539 RS, "539 RS" interface	Printer with RS 232 C serial interface and IBM character set

Functions

Single printout



printout of the measured values

Line feed



one line feed - depress key once

several line feeds - hold key depressed

Printer functions









Functions ON Functions OFF

Event controlled printout

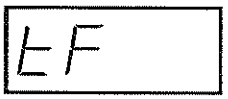


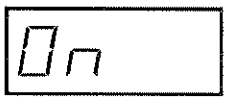


Log printout only after setting the printer functions



Time controlled printout



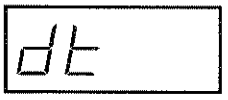


Time controlled printout of values

Set time interval as in "Set the print period" page 17

Run ENTER

Date and time with single printout

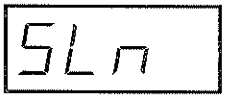


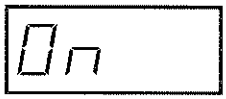


Logs of time or event controlled printouts always start with date and time

Run ENTER

Reset line numbering to 1





The line number is reset to 1 at:

- start of time controlled printout
- single printout, pressing the "Prog" and "Print" keys

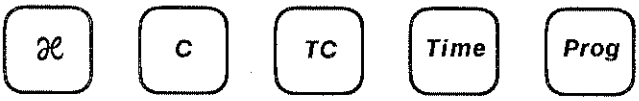




Line numbering is continuous up to 999, resets to 1 if power is removed.

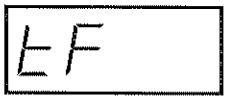
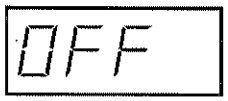
End with

Run ENTER

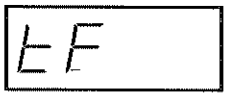
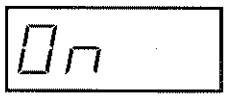


Activation of time controlled printout

Prog Print

Run ENTER to  

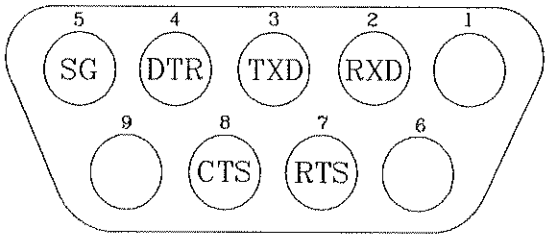
Switch on time controlled printout

ON  

Start: Print

Stop: Print

Computer Connection (LF 539 RS only)



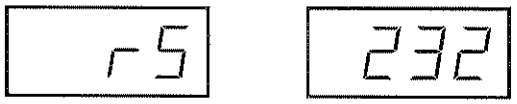
Pin connections		
LF 539	Computer 9 Pin 25 Pin	Printer with RS232 interface
RXD 2	3 TXD 2	TXD
TXD 3	2 RXD 3	RXD
DTR 4	6 DSR 6	-
SG 5	5 SG 7	SG
RTS 7	8 CTS 5	-
CTS 8	7 RTS 4	DTR, when not available, short cct CTS and RTS

V24/RS 232 C interface (rear side of instrument)

Commands

Command	Function
" "	- Start communication with the first Carriage Return (CHR$(13))
"CLOC"	- Reverts LF 539 to normal operation
Measure conductivity and temperature	
"CLF1A"	- Switch on Auto Range, call up conductivity and temperature values
"CLF12"	- 0.000 ... 3.000 µS/cm measuring range(only with cell constant ≤ 0.150 /cm)
"CLF13"	- 0.00 ... 30.00 µS/cm measuring range
"CLF14"	- 0.0 ... 300.0 µS/cm measuring range
"CLF15"	- 0 ... 3000 µS/cm measuring range
"CLF16"	- 0.00 ... 30.00 mS/cm measuring range
"CLF17"	- 0.0 ... 300.0 mS/cm measuring range
"CLF18"	- 0 ... 3000 mS/cm measuring range
Measure salinity and temperature	
"CSAL"	- 0.0 ... 70.0 measuring range
Readout of input values	
"RC"	- read cell constants
"RTC"	- read temperature coefficients
"RREF"	- read reference temperature

Operation

Computer	LF 539
Start of transfer	
↓	
Open serial port	
↓	
Send Carriage Return	
↘	
↙	Keyboard inhibited
"LF539 >" received	
↓	
Transfer: Send commands	
↘	
↑	Process commands
↙	
Receive text, values or dimensions	
Terminator: "LF539 >"	
↓	
End of transfer	
↓	
Send "CLOC"	
↘	
↙	Keyboard enabled
Receive "LF539 >"	
Close file	

Software for IBM compatible computers, e.g.: TELEMATE V2.11
Terminal program for the simple operation of the conductivity meter, available from: Microserve, Postfach 1368, W-2804 Lilienthal

PRINT DAT V.1
Sample program for the data transfer triggered by the test instrument, available from: Wissenschaftlich-Technische Werkstätten GmbH, Dr.-Karl-Slevogt-Str. 1, D-82362 Weilheim

Program example for **IBM** compatible computers (GW Basic)

```
10 OPEN "COM1:1200,n,8,1" AS #1
100 REM ----------Enter command and send
110 PRINT : INPUT "command: ", BE$
120 IF BE$ = "e" THEN CLOSE #1:END
130 PRINT#1, BE$: GOSUB 1000
140 GOTO 110
1000 REM ----------Receive data and output
1010 Y$=""
1020 INPUT#1,X$
1030 Y$=Y$+X$+", "
1040 IF X$ ="LF539 >" THEN PRINT "Received data: ";Y$:RETURN
1050 GOTO 1020
```

Line 10 : opens the interface

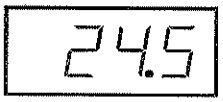
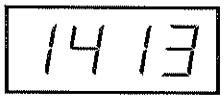
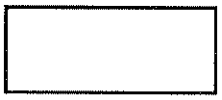
Line 110 ... 140 : The instrument can receive after the first "Carriage Return" has been transferred. Any previous characters have no effect.
The "e" and "Return" keys end the program.

Line 1010 ... 1050 : Reads the data sent from the instrument and displays them on the screen.

Output format:
- ASCII characters (IBM character code)
- Character strings consist of one or more fields
- Fields are separated with a comma
- Text, values or dimensions are shown in one field
- A dimension is always given with a value

Error Messages

Display

Cause	Action
  Conductivity or salinity measuring range exceeded.	Select another range or set "Auto Range"-function to "On".
  Temperature of measuring solution less than -5°C or greater than +110°C.	Keep the measuring solution's temperature between -5°C and +110°C.
  Faulty temperature compensation (mathematically non-definable range at extremely low conductivity).	Change the temperature of the measured material slightly.
  Defective electronic part or loss of internal compensating and calibrating data.	Set the instrument to the normal mode (see "Putting into operation"). If "DATA LOST" re-occurs, the instrument must undergo repair at WTW.

RS 232 C Interface

Cause	Action
"INVALID COMMAND"	Check the syntax and enter command again.
"INVALID RANGE" Conductivity range 0 ... 3.000 µS/cm and cell constant greater than 0.15 /cm.	Set the cell constant value to $\leq$ 0.15 /cm or select another range.
"OFL" in character string Conductivity or salinity range exceeded. Temperature < -5°C resp. > 110°C.	Select another range or set the temperature of the measuring solution between -5°C and +110°C.

Cause	Action
"E1" in character string Faulty temperature compensation (mathematically non-definable range at extremely low conductivity).	Change temperature of measuring sample slightly.

Voltage outputs	
Maximum voltage at range excess > 2000 mV	
Cause	Action
Conductivity/Salinity	
Conductivity and salinity range exceeded.	Select another range or set "Auto Range"-function to "On".
Temperature	
Temperature of measuring solution less than -5°C or grater than +110°C.	Keep the measuring solution's temperature between -5°C and +110°C.

Technical Data LF 539

Parameters, Ranges, Accuracy	æ : 0.000 µS/cm ... 3000 mS/cm ± 2 Digit, ± 0.5 % from mean value Sal: 0.0 ... 70.0 ± 0.1 in the range 0.0 ... 42.0 at 5 ... 25°C ± 0.2 in the range 0.0 ... 42.0 at 0 ... 25°C ± 0.1 in the range 0.0 ... 42.0 at 25 ... 30°C better than 3% of mean value in the range 42.0 ... 70.0 °C: - 5.0°C ... +110°C ± 0.1 K
Ranges of adjustment	Cell constants: 0.0100 /cm ... 200.0 /cm Temperature coeffcient (linear): 0.000 %/°C ... 3.500 %/°C Reference temperature: 20°C or 25°C Temperature (manually): -20°C ... +130°C
Measuring frequency	85 Hz in the range 0 µS/cm ... 20 µS/cm 170 Hz in the range 20 µS/cm ... 200 µS/cm 400 Hz in the range 0.2 mS/cm ... 20 mS/cm 1000 Hz in the range 20 mS/cm ... 2000 mS/cm
Displays	Display 1: 4 digit LED, red, 7 segment, 14 mm high Luminous fields for µS/cm, mS/cm, Sal Display 2: 4 digit LED, red, 7 segment, 14 mm high Luminous fields for °C, %/K, 1/cm Luminous fields for "Date" and "Time" Status display: LED red
Inputs/Outputs	Measuring cells: 7-pin diode socket for multiple electrode measuring cells and 2-electrode measuring cells with integrated temperature probe 4 mm socket for 2-electrode measuring cells Temperature probe: 4 mm socket Recorder outputs: æ/Sal - 4 mm socket °C - 4 mm socket

Recorder output

	measuring range	potential
conductivity		(0 ... 2000 mV)
	0.000 ... 3.000 µS/cm	666 mV/(µS/cm)
	0.00 ... 30.00 µS/cm	66.6 mV/(µS/cm)
	0.0 ... 300.0 µS/cm	6.66 mV/(µS/cm)
	0 ... 3000 µS/cm	0.666 mV/(µS/cm)
	0.00 ... 30.00 mS/cm	66.6 mV/(mS/cm)
	0.0 ... 300.0 mS/cm	6.66 mV/(mS/cm)
	0 ... 3000 mS/cm	0.666 mV/(mS/cm)
salinity	0.0 ... 70.0	(0 ... 700 mV) 10 mV
temperature	-5.0°C ... +110°C	(-50 ... 1100 mV) 10 mV/°C

Platinum output

6 mA ± 1 mA

Digital interfaces

LF 539:
Printer, 15 pin for plug-on printer P 500

LF 539 RS:
V24/RS 232 C, 9 pin for computer or printer, galvanically isolated
Baud rate: 1200
Data bits : 8
Stop bits: 1
Parity: no parity
Handshake: hardware
Max. cable length: 15 m
Display format: ASCII character string, IBM character code
separation by comma

Clock and calendar

Battery:
Lithium 1.7 Ah

Life:
10 years minimum

Accuracy:
$1 * 10^{-4}$

Power supply

230 V / 50 Hz (-15%/6%)

Power consumption 10 VA

Fuses
1 fuse insert DIN 41 571 - M0.1
3 fuse inserts DIN 41 571 - M0.4

Data protection	All manual settings are stored for an unlimited period when the instrument is switched off or at a power supply failure. After switching on the instrument switches automatically to the last selected operation mode.
Housing	Insulation: IP 40 according to DIN 40 050 IP 54 for operating level according to DIN 40 050 Insulation class: II (DIN VDE 0411/10.73) Inputs/Outputs correspond to the requirements of the low voltage safety regulations (SELV) Isolation group: B (DIN VDE 0110/11.72) Climate class: 2 (VDI/VDE 3540) Ambient temperature: Storage: -25°C to +65°C Operation: +5°C to +40°C relative humidity: Yearly mean: ≤ 75 % 30 days/year: 95 % remaining days: 85 % light dew: yes
Electromagnetic compatibility (EMC) see test certificates	Emission: Class B (EN 55022) Class A (FCC) Immunity: ESD (IEC 801-2) RF (IEC 801-3) BURST (IEC 801-4) Test security levels see test certificates
Dimensions / Weight	270 x 120 x 220 mm / ca. 1.8 kg

SENTON
■ EMV-Prüfzentrum ■ EMI/EMC-Testcenter ■

CERTIFICATE of EXPERT OPINION

(Radio Frequency Interference Test)

for

Kind of product	:	**Conductivity Meter**
Type	:	**LF 539**
Manufacturer	:	**WTW GmbH**
Applicant	:	**WTW GmbH**
Date effected	:	**October 14, 1992**

We hereby certify, that the above mentioned model has been tested and found to be in compliance with the following regulation(s):

EN 55022 Limit Class B
FCC Part 15, Subpart B Limit Class A
IEC 801-2 Test Severity Level 2
IEC 801-3 Test Severity Level 1
IEC 801-4 Test Severity Level 2

Remarks:
All tests have been performed with a P 500 printer connected to the LF 539.

Senton GmbH

Johann Roidt

SENTON GmbH · EMI-Laboratories · Aeussere Fruehlingsstrasse 45 · W 8440 Straubing · 09421/42081

CE 92

Test certificate: Electromagnetic compatibility EMC

SENTON
• EMV-Prüfzentrum • EMI/EMC-Testcenter •

CERTIFICATE of EXPERT OPINION

(Radio Frequency Interference Test)

for

Kind of product	:	**Conductivity Meter**
Type	:	**LF 539 RS**
Manufacturer	:	**WTW GmbH**
Applicant	:	**WTW GmbH**
Date effected	:	**September 18, 1992**

We hereby certify, that the above mentioned model has been tested and found to be in compliance with the following regulation(s):

EN 55022 Limit Class B
FCC Part 15, Subpart B Limit Class A
IEC 801-2 Test Severity Level 2
IEC 801-3 Test Severity Level 2
IEC 801-4 Test Severity Level 2

Senton GmbH

Johann Roidt

SENTON GmbH · EMI-Laboratories · Aeussere Fruehlingsstrasse 45 · W 8440 Straubing · 09421/42081

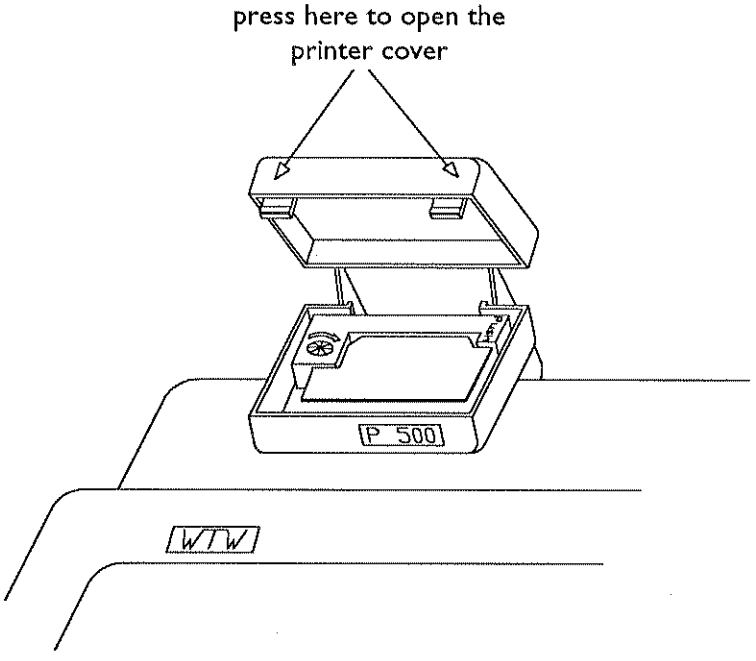
CE 92

User's instructions

Dot Printer

P 500

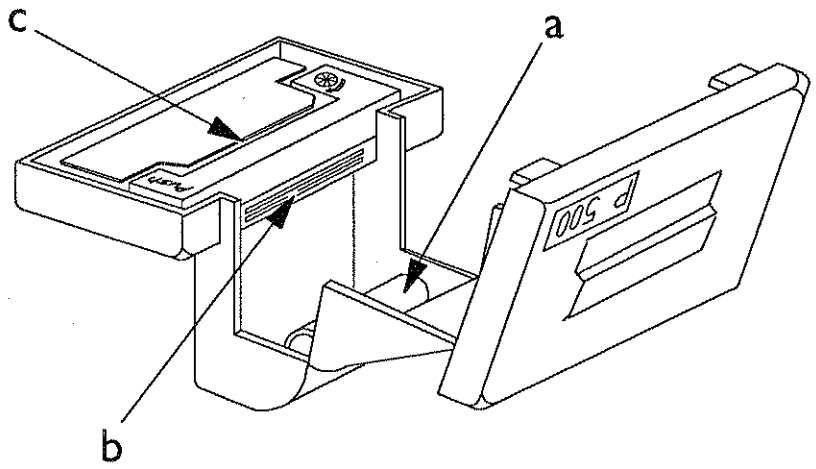
The P 500 is a mini printer used with the WTW measuring instruments via a special printer interface. The printer can only be used in conjunction with the instrument. The printer functions are dependent upon and can be controlled from the instrument (see the measuring instrument instructions).



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BA P500/5/92/1

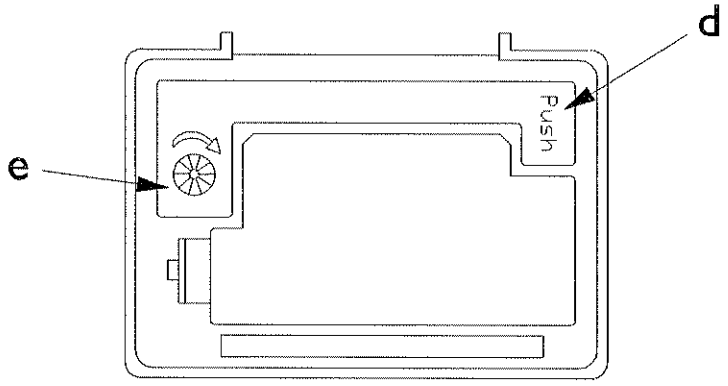
Attention: Plug the printer into the interface only when the instrument is switched off

Fitting a new paper roll



- Open the printer
- Remove the empty cardboard roller (a)
- Open the new roll of paper and fit
- Insert the start of the roll in the slot (b)
- Depress the "Paper Feed" key on the instrument until approx. 5 cm of paper is shown (c)
- Feed the paper through the slit in the cover when closing

Changing the print ribbon



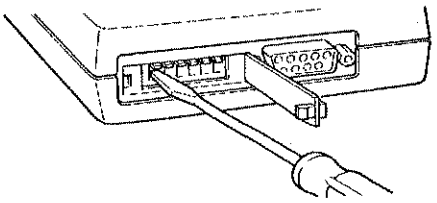
- Open the printer
- Depress PUSH (d) and remove the ribbon
- Tension the new ribbon with the knob (e)
- Insert the paper between the ribbon and the cassette housing
- Insert the printer ribbon
- Pull in the ribbon by turning the knob (e)
- Feed the paper through the slit in the cover when closing

Technical Specifications P 500

Printing method	7 dot printer
Print format	dots per line: 144 characters per line: 24
Printing speed	approx. 150 ms/1-dot line approx. 0.7 lines/sec
Character format	character size 1.7 (B) x 2.4 (H) mm distance between dots horizontal: 0.33 mm vertical: 0.33 mm
Ribbon	Model FBK 500
Paper	Model RP 500 wood-free paper width: 58 mm roll diameter: max. 30 mm
Dimensions	100 x 70 x 100 mm
Weight	approx. 0.25 kg

Instructions Dip-Switch positions for the Printer P 3000

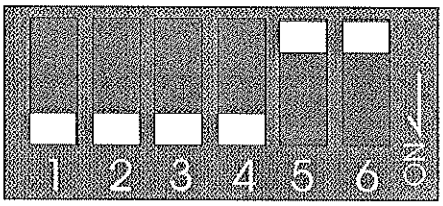
Configurate Dip-switch for WTW-instruments



1. Switch off printer

2. Open cover of Dip-switch

3. Set switch position



4. Close cover

5. Switch on printer

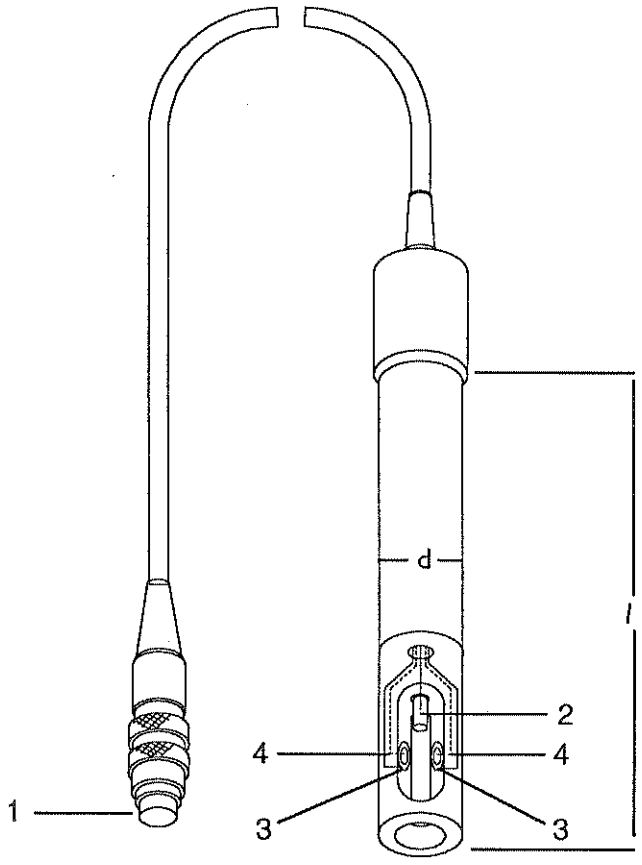
Interface configuration for printer with RS 232 C/V 24 interface

1200 baud; 8 bit; parity none; parity odd

User's instructions

Standard Conductivity Measuring Cell

TetraCon 96



1 7-pin diode plug

2 Temperature probe

3 Current electrodes

4 Potential electrodes

Operation range:

0.01 µS/cm ... 2 S/cm

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BA TetraCon96/12/92/1

Cleaning

Remove soluble substances by rinsing with de-ionised water.

Other contaminations:

Impurity	Cleaning solution	Reaction period
Grease and oil	Warm water and household washing liquid	arbitrary
Calcerous and hydroxide deposits	Acetic acid (10%)	arbitrary

Ageing of the TetraCon 96 measuring cell

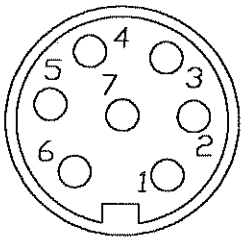
Fundamentally, the conductivity cell does not age. The cell life is considerably shortened or the cell damaged by excessive temperatures or special measuring solutions (e.g. strong acids, leaching solutions or organic solvents). We give no warranty for defects caused by the measuring medium.

Technical Data TetraCon 96

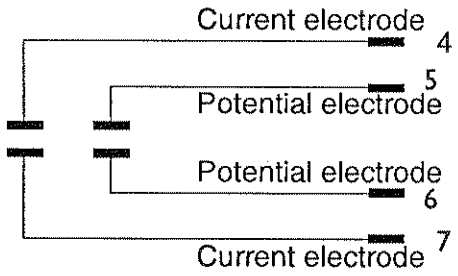
Measured variables	Conductivity, temperature
Measuring principle	4-electrode system
Temperature stability	-5 ... +90°C
Response	t_{99} < 12 sec.
Cell constant	0.609 /cm ± 1.5 %
Min. immersion depth	40 mm
Schaftlänge (l)	120 mm
Shaft diameter (d)	21 mm
Cable length	1 m
Material	Shaft: Epoxy Electodes: Graphite Temperature probe: VA steel 1.4571
Storage medium	Air

Pin connections TetraCon 96

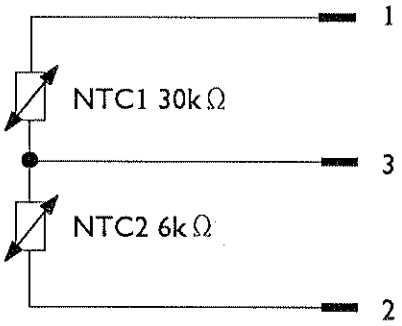
Wired side of the plug



Measuring cell



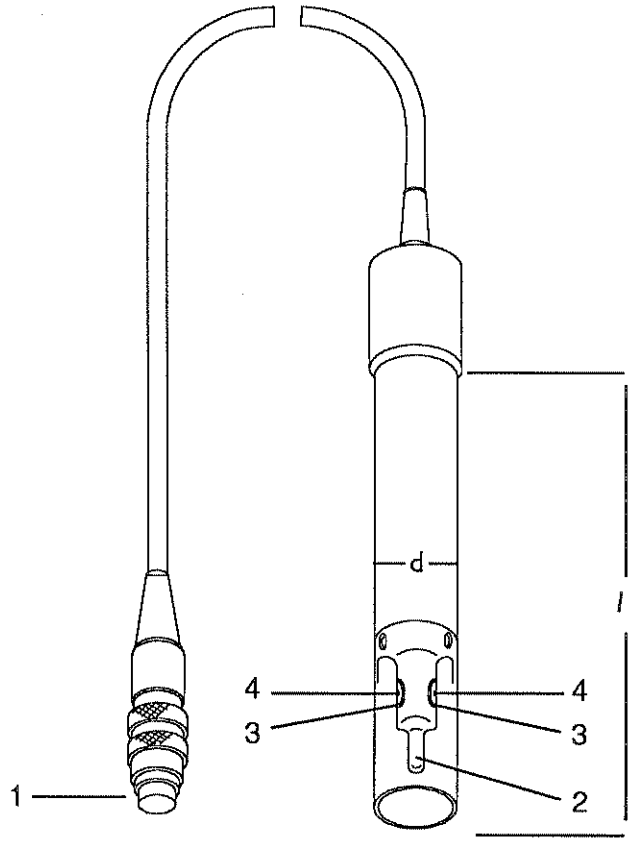
Temperature probe



User's instructions

Special Conductivity Measuring Cell

TetraCon L



1 7-pin diode plug

2 Temperature probe

3 Current electrodes

4 Potential electrodes

Operation range :

0.01 µS/cm ... 1 S/cm

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BA TetraConL/12/92/1

Cleaning

Remove soluble substances with de-ionised water.

Other contaminations:

Impurity	Cleaning solution	Reaction period
Grease and oil	Warm water and household washing liquid	Arbitrary
Calcerous and hydroxide deposits	Acetic acid (10%)	Shaft: arbitrary Connection head: just clean

Ageing of the TetraCon L - measuring cell

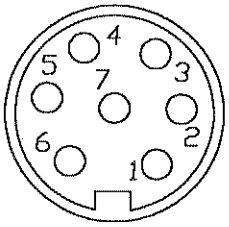
Fundamentally, the conductivity measuring cell does not age. The cell life is considerably shortened or the cell damaged by excessive temperatures or chemicals that chemically change the glass or platinum. We give no warranty for mechanical damage or defects caused by the measuring medium.

Technical Data TetraCon L

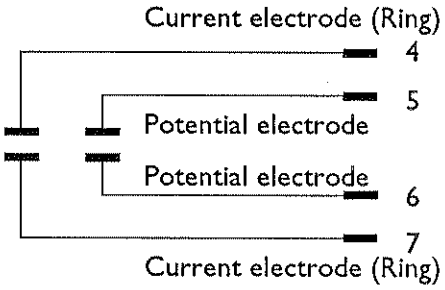
Measured variables	Conductivity, temperature
Measuring principle	4-electrode system
Temperature stability	-5 ... +90°C
Response NTC	t_{99} < 70 sec.
Cell constant	approx. 1 cm^{-1}
Min. immersion depth	45 mm
Shaft length (l)	120 mm
Shaft diameter (d)	20 mm
Cable length	1 m
Material	Shaft: Glass Electrode: Platinum
Storage medium	Air

Pin connections of the TetraCon L

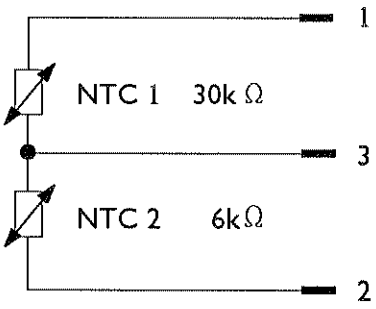
Wired side of the plug



Measuring cell



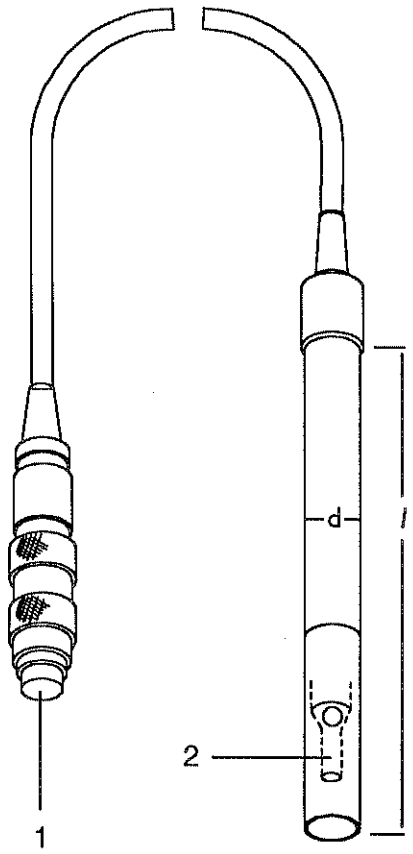
Temperature probe



User's instructions

Measuring Cell for Ultrapure Water

LR 01 / T



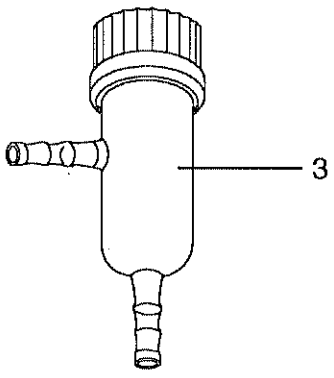
Operation range:

0.001 µS/cm ... 300 µS/cm

1 7-pin diode plug

2 Temperature probe

3 Flow-through vessel D 01 / T



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BA LR01T/12/92/1

Cleaning

Remove soluble substances by rinsing with de-ionised water.,

Other contaminations:

Impurity	Cleaning solution	Reaction period
Grease and oil	Warm water and household washing liquid	arbitrary
Calcerous and hydroxide deposits	Acetic acid (10%)	1 hour

Ageing of the LR 01/T

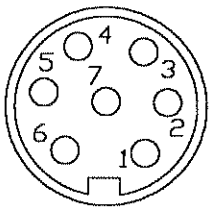
Fundamentally, the conductivity measuring cell does not age. The cell life is considerably shortened or the cell damaged by excessive temperatures or special solutions (e.g. hydrofluoric acid). We give no warranty for defects and mechanical damage caused by the measuring medium.

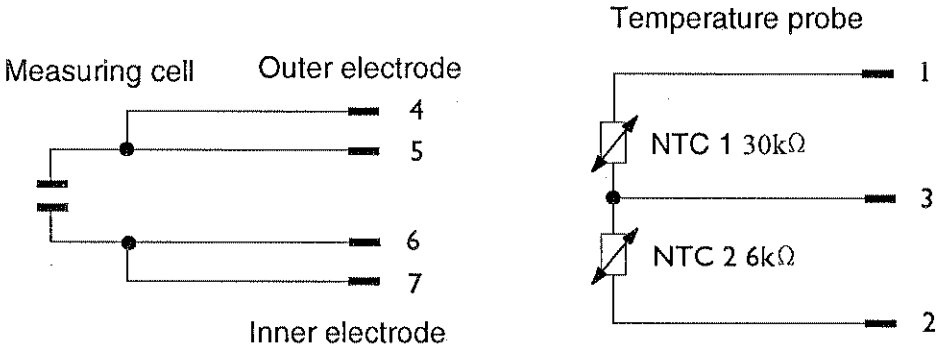
Technical Data LR 01/T

Measured variables	Conductivity, temperature
Measuring principle	2-electrode system
Temperature stability	0 ... +90°C
Cell constant	0.1 /cm ± 2%
Min. immersion depth	35 mm
Shaft length (l)	120 mm
Shaft diameter (d)	12 mm
Cable length	1 m
Material	VA-steel 1.4571
Storage medium	Air

Pin connections of the LR 01/T

Wired side of the plug

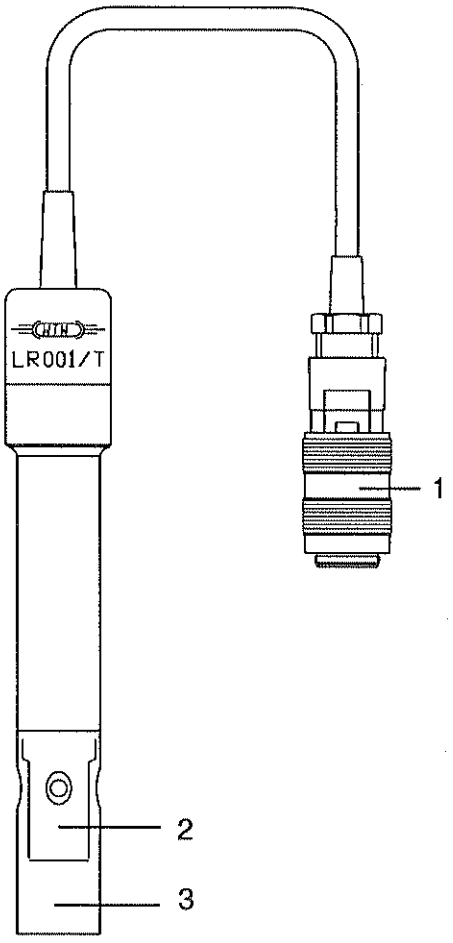




User's instructions

Trace Conductivity Measuring Cell

LR 001/T

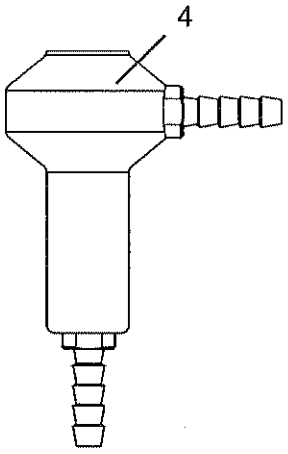


1 water diode plug (7- pin)

2 Inner electrode with integrated temperature probe

3 Outer electrode - Immersion cell (AE 001)

4 Outer electrode - Flow-through cell (D 001/T)



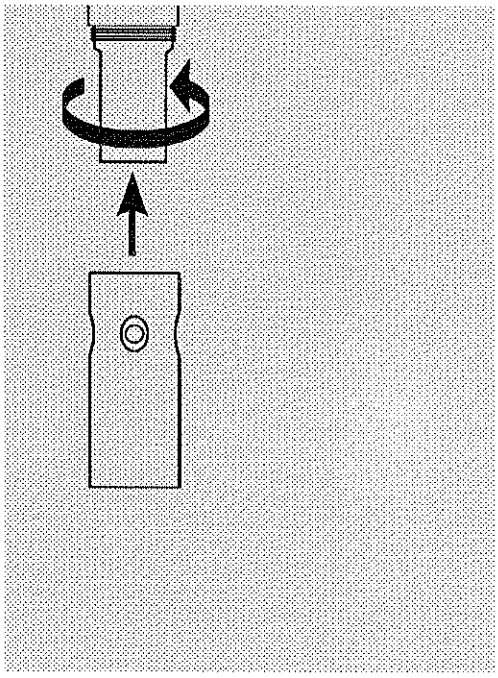
Operation range:

0.0001 µS/cm ... 30 µS/cm

WISSENSCHAFTLICH - TECHNISCHE WERKSTÄTTEN G.M.B.H.
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BA LR 001/T TM; Mai/Pla 22.12.1992

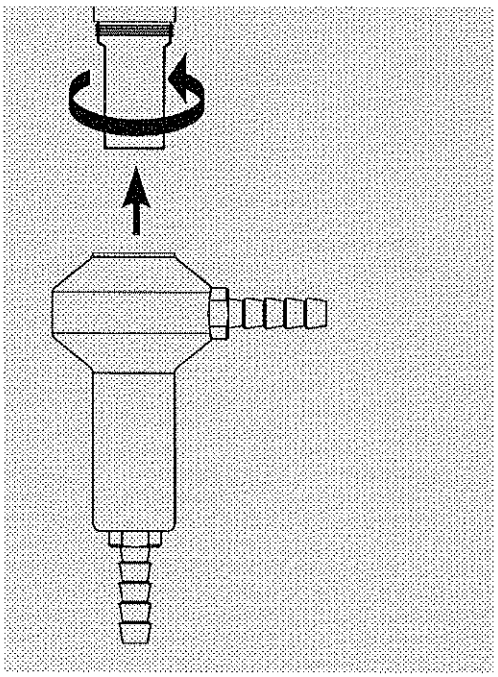
Application

as immersion cell

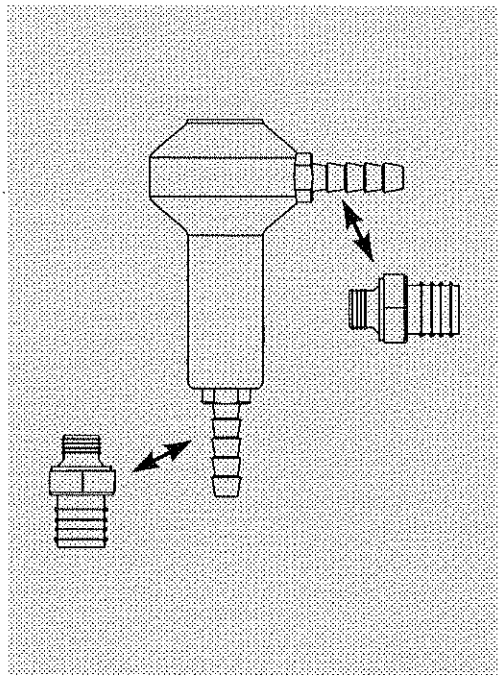


Tight outer electrode up to stop

as flow cell



Tight flow-through electrode up to stop



Thread for screw pipe joint

Cleaning

Remove soluble substances by rinsing with de-ionised water.

Other contaminations:

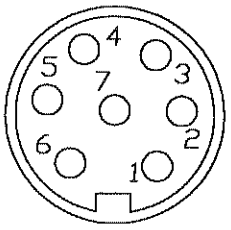
Impurity	Cleaning solution	Reaction period
Grease and oil	Warm water and household washing liquid	arbitrary
Calcerous and hydroxide deposits	Acetic acid (10%)	Shaft: 1 hour Connection head: just clean

Ageing of the LR 001/T - measuring cell

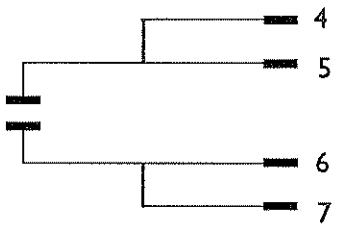
Fundamentally, the conductivity measuring cell does not age. The cell is considerably shortened or the cell damaged by excessive temperatures or special measuring solutions (e.g. hydrofluoric acid). We give no warranty for defects and mechanical damage caused by the measuring medium.

Pin connection of the LR 001/T

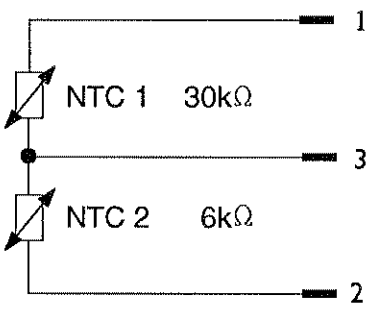
Wired side of the plug



Measuring cell



Temperature probe



Technical Data LR 001/T

Measured variables	Conductivity, temperature
Measuring principle	2-electrode system
Application range	Conductivity measurement in the trace range for ultrapure water, partly or non-aqueous
Measuring range	Resolution corresp. to the meter, upper limit 20 µS/cm
Temperature stability	0 ... +100°C
Response time NTC	t_{99} < 100 sec.
Cell constant	0.01 cm^{-1} ± 2%
Min. immersion depth	min. 40 mm, max. full shaft length
Shaft length (l)	120 mm
Shaft diameter (d)	20 mm
Cable length	1.5 m
Plug	watertight diode plug 7-pin, protection class IP65
Material	Shaft: stainless steel (1.4571) Electrodes: stainless steel (1.4571) Isolator: POM O-Ring: NBR
Pressure resistance	2 bar
Storage medium	Air