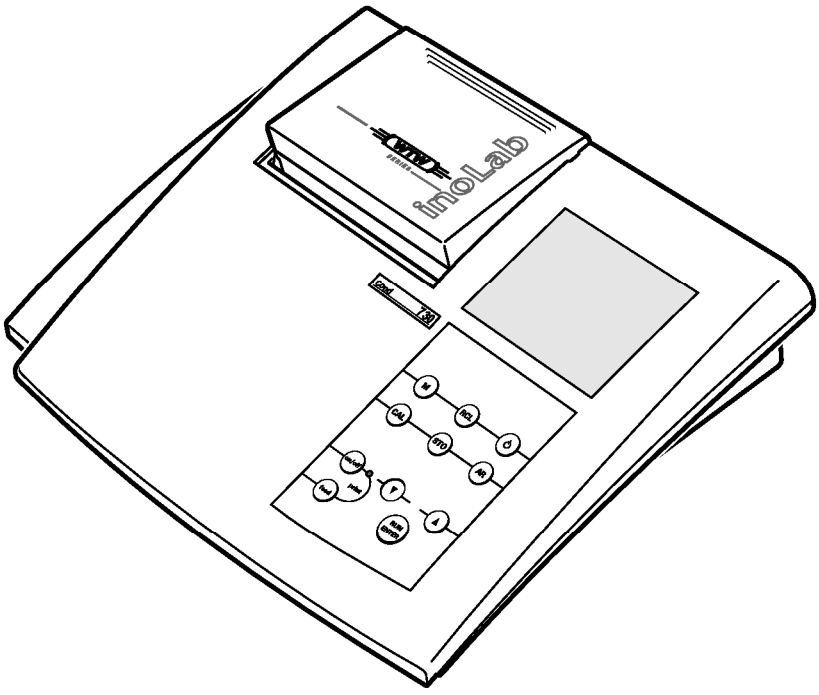
Operating manual

ba75445e

inoLab
Cond 730



Laboratory conductivity meter

ba75445e02 06/2004

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.
We cannot guarantee that there are absolutely no errors in this manual. We are sure you will understand that we cannot accept any legal claims resulting from the data, figures or descriptions.

Warranty declaration

The designated instrument is covered by a warranty of three years from the date of purchase.
The instrument warranty extends to manufacturing faults that are determined within the period of warranty.
The warranty excludes components that are replaced during maintenance such as batteries, etc.

The warranty claim extends to restoring the instrument to readiness for use but not, however, to any further claim for damages. Improper handling or unauthorized opening of the instrument invalidates any warranty claim.

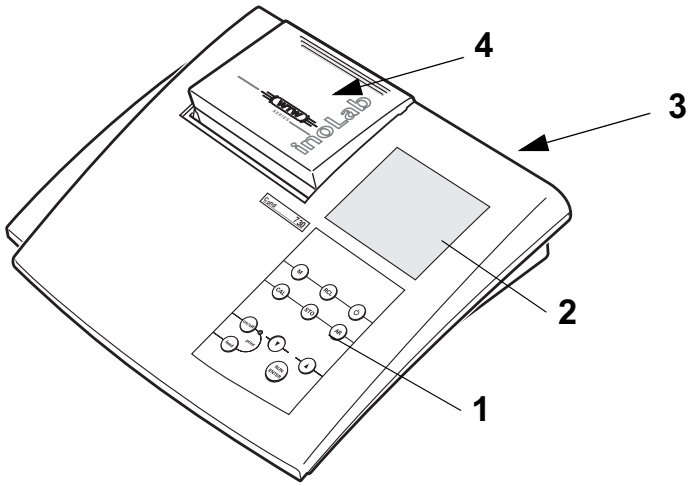
To ascertain the warranty liability, return the instrument and proof of purchase together with the date of purchase freight paid or prepaid.

Copyright

1 Overview

The compact inoLab Cond 730 precision conductivity meter lets you perform conductivity measurements rapidly and reliably.
The inoLab Cond 730 provides the highest degree of operating comfort, reliability and measuring safety for all applications.

The integrated printer* enables the measurements to be documented in compliance with GLP.
The proven procedures to determine or set up the cell constant support your work with the conductivity meter.

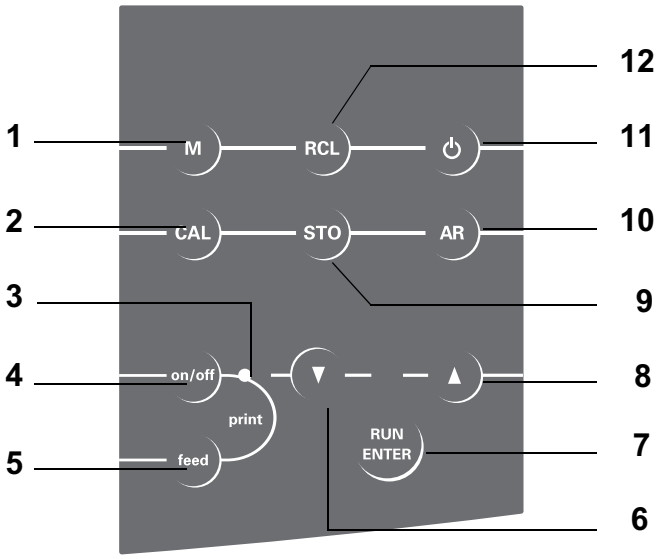


1	Keypad
2	Display
3	Sockets
4	Printer*

Note
The measuring instrument can also be delivered as part of a set.
Information on this and other accessories is available in the WTW catalog LABORATORY AND FIELD INSTRUMENTATION or via the Internet.

* only on the Cond 730 with integrated printer

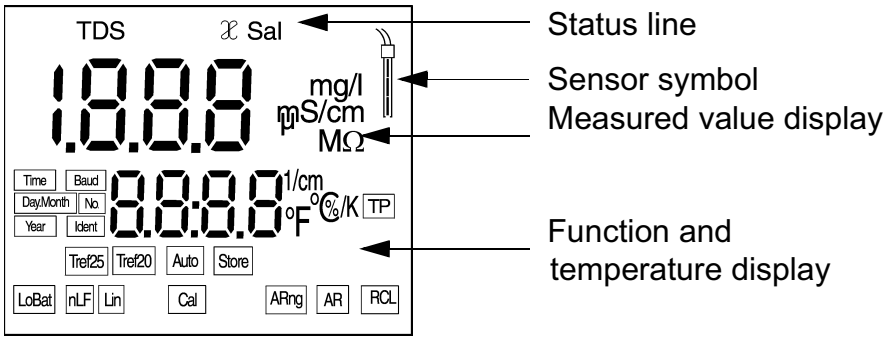
1.1 Keyboard



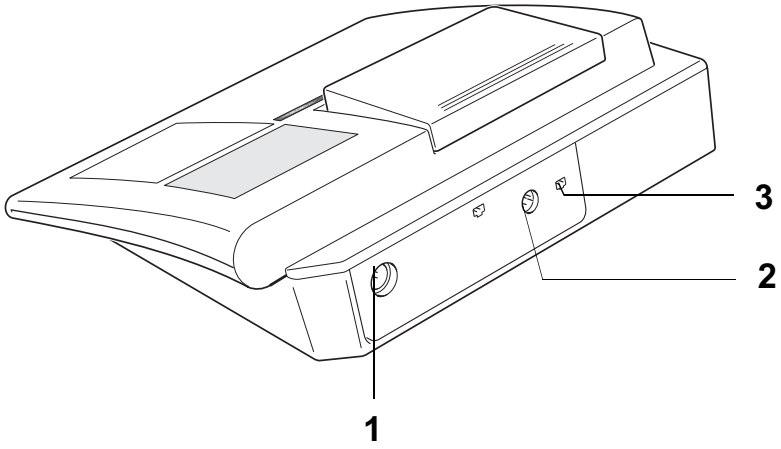
1	Select measuring mode
2	Set up or determine cell constant; select temperature compensation
3	Print LED * Red: printer off (offline) or malfunction Green: printer ready for operation (online)
4	Printer on/off *
5	Paper feed/line feed * (Only with the printer being off - Print LED lights up red)
6	Reduce values, scroll
7	Confirm inputs, start AutoRead
8	Increase values, scroll
9	Store measured value
10	Activate/deactivate AutoRead function
11	Measuring instrument ON/OFF
12	Display/transmit measured values

* only on the Cond 730 with integrated printer

1.2 Display



1.3 Sockets



Connectors:

1	Conductivity measuring cell
2	RS 232 interface/analog output
3	Plug-in power supply

Caution

Only connect measuring cells to the instrument that cannot feed excessive voltages or currents (> SELV and > circuit with current limiter). Almost all commercial measuring cells - especially WTW measuring cells - meet these requirements.

2 Safety

This operating manual contains basic instructions that you must follow during the commissioning, operation and maintenance of the instrument. Consequently, all responsible personnel must read this operating manual before working with the instrument.
The operating manual must always be available within the vicinity of the instrument.

Target group

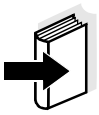
This measuring instrument was developed for use in the laboratory.
Thus, we assume that, as a result of their professional training and experience, the operators will know the necessary safety precautions to take when handling chemicals.

Symbols used

Caution
indicates instructions that have to be followed to prevent damage to your instrument.

Warning
indicates instructions that have to be followed to protect yourself and the instrument from dangerous electrical voltage.

Note
Indicates notes that draw your attention to special features.



Note
Indicates cross-references to other documents, e.g. application reports, operating manuals of measuring cells, etc.

2.1 Authorized use

This instrument is authorized exclusively for measuring the conductivity, salinity, temperature and TDS (total dissolved solids) in the laboratory.
The technical specifications as given in the chapter 7 TECHNICAL DATA must be observed. Only the operation and running of the measuring instrument according to the instructions given in this operating manual is authorized.
Any other use is considered **unauthorized**.

2.2 General safety instructions

This instrument is constructed and tested in compliance with the EN 61010-1 safety regulations for electronic measuring instruments.
It left the factory in a safe and secure technical condition.

Function and operational safety

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

The smooth functioning and operational safety of the instrument can only be guaranteed under the climatic conditions specified in the chapter 7 TECHNICAL DATA.

If the instrument was transported from a cold environment to a warm environment, the formation of condensate can lead to the faulty functioning of the instrument. In this event, wait until the temperature of the instrument reaches room temperature before putting the instrument back into operation.

Caution
The instrument is only allowed to be opened by personnel authorized by WTW.

Safe operation

If safe operation is no longer possible, the instrument must be taken out of service and secured against inadvertent operation.
Safe operation is no longer possible if:

- the instrument has been damaged in transport
- the instrument has been stored under adverse conditions for a lengthy period of time
- the instrument is visibly damaged
- the instrument no longer operates as described in this manual

If you are in doubt contact the supplier of the instrument.

Obligations of the operator

The operator of this measuring instrument must ensure that the following laws and guidelines are observed when using dangerous substances:

- EEC directives for protective labor legislation
- National protective labor legislation
- Safety regulations
- Safety datasheets of the chemical manufacturer.

3 Commissioning

3.1 Scope of delivery

- Laboratory measuring instrument, inoLab Cond 730
- Plug-in power supply
- Operating manual and short manual
- 4 x type AA Mignon 1.5 V batteries

3.2 Initial commissioning

Perform the following activities:

- Set the date and time
- Connect the plug-in power supply (for printer functions).

Setting the date and time

1	Press and hold down the M key.
2	Press the ⏻ key. The *display test* appears briefly on the display. The measuring instrument then switches automatically to the setting of the baud rate.
3	Press the RUN ENTER key repeatedly until the date flashes on the display.
4	Set today's date by pressing ▲ ▼ Ø
5	Confirm with RUN ENTER. The date (month) flashes on the display.
6	Set the current month by pressing ▲ ▼ Ø
7	Confirm with RUN ENTER. The year appears on the display.
8	Set the current year by pressing ▲ ▼ Ø
9	Confirm with RUN ENTER. The hour field flashes on the display.
10	Set the current time by pressing ▲ ▼ Ø
11	Confirm with RUN ENTER. The minutes field flashes on the display.

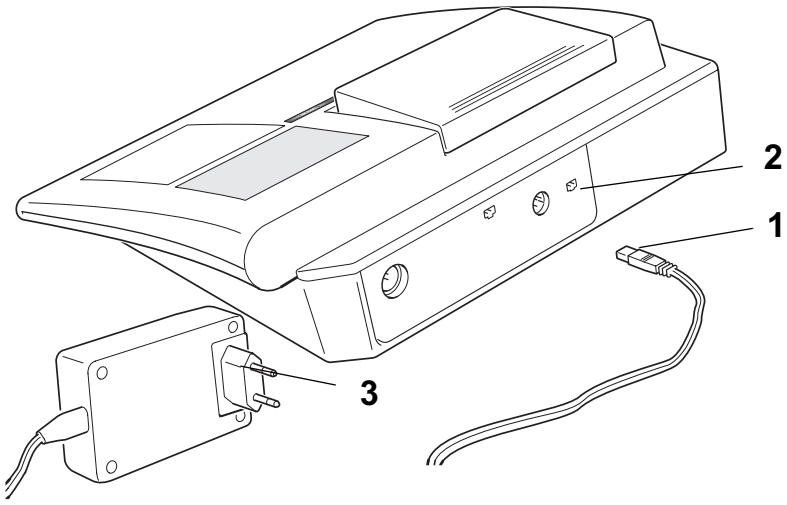
12	Set the current time by pressing ▲ ▼ Ø
13	Confirm with RUN ENTER. The measuring instrument then switches to the measuring mode.
14	Switch off the instrument by pressing ⏻.

Connecting the plug-in power supply

The measuring instrument works battery-powered. It can, however, also be supplied by the plug-in power supply which is available as an accessory.

Warning
The line voltage on site must lie within the input voltage range of the original plug-in power supply unit (see chapter 7 TECHNICAL DATA).

Caution
Use original plug-in power supplies only (see chapter 7 TECHNICAL DATA).



1	Insert the plug (1) into the socket (2) of the conductivity meter.

2 Connect the original WTW plug-in power supply (3) to an easily accessible mains socket.

Note
You can also perform measurements without a plug-in power supply. However, the functions of the integrated printer can only be used with connected plug-in power supply.

4 Operation

4.1 Switch on the instrument

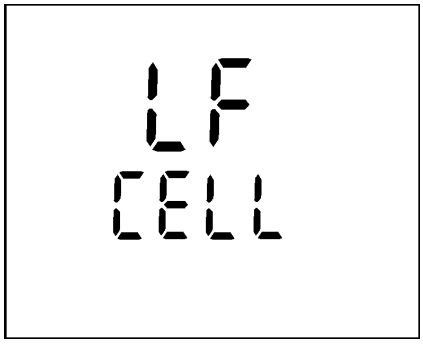
1	Place the instrument on a flat surface and protect it against intense light and heat.
2	Connect the conductivity measuring cell to the instrument.
3	Press the ⏻ key. The *display test* appears briefly on the display. The instrument then switches automatically to the previously selected measuring mode.
4	Check or determine the cell constant [C]. The procedure is described in section 4.3 on page 25.

Note
The instrument has an energy saving feature to avoid unnecessary battery depletion.
The energy saving feature switches the instrument off if no key has been pressed for an hour.
The energy saving feature is not active:

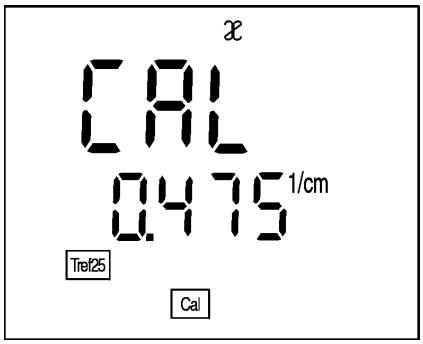
- if the power is supplied by the plug-in power supply
- if the *AutoStore* function is active
- if a PC is connected
- if the recorder cable is connected
- if the printer cable is connected
  (for external printers)

Checking the cell constant

1	Press the CAL key repeatedly until *LF CELL* is displayed.



2	Press the RUN ENTER key. The previously selected cell constant ist displayed, e. g. 0.475 cm^{-1}.



3	To return to the measuring mode: press the M key when the correct cell constant ist displayed.
4	If a different cell constant is to be set, proceed according to section 4.3 DETERMINING/SETTING UP THE CELL CONSTANT [C].

4.2 Measuring

Preparatory activities

Perform the following activities when you want to measure:

1	Connect the measuring cell to the instrument.
2	Adjust the temperature of the test solutions or measure the current temperature if the measurement is made without a temperature probe.
3	Calibrate the instrument with the measuring cell or check the cell constant set up.
4	Select the measuring mode by pressing (M).

Caution
When connecting an earthed PC/printer, measurements cannot be performed in earthed media as incorrect values would result.
The RS232 interface is not galvanically isolated.

Temperature probe

Measurements can be performed with and without a temperature probe. A connected temperature probe is indicated by TP on the display.
If you want to use a WTW conductivity measuring cell without a temperature probe, you have to connect it with an adapter (available at WTW).

Note
The conductivity meter automatically recognizes the type of the temperature probe used. As a result, you can connect electrodes with the NTC 30 or Pt 1000.

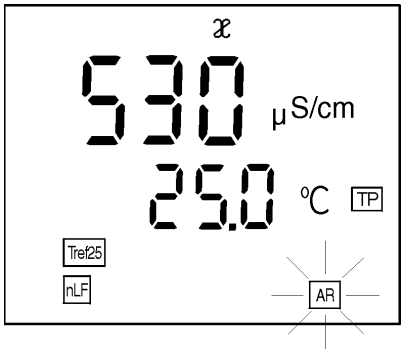
The temperature measurement is absolutely essential for a reproducible conductivity measurement. If the measurement is made without a temperature probe, proceed as follows:

1	Determine the current temperature using a thermometer.
2	Set up the temperature by pressing (▲)(▼).

AutoRead AR (Drift control)

The *AutoRead* function (drift control) checks the stability of the measurement signal. The stability has a considerable effect on the reproducibility of the measured value.

1	Call up the measuring mode by pressing (M).
2	Activate the AutoRead function by pressing (AR). The current measured value is frozen (Hold function).
3	Start the AutoRead function by pressing (RUN ENTER). *AR* flashes on the display until a stable measured value is reached. This measured value is transmitted to the printer/ interface.



4	If necessary, start the next AutoRead measurement by pressing (RUN ENTER).
5	To terminate the AutoRead function: Press the (AR) key.

Note
The current AutoRead measurement (with acceptance of the current value) can be terminated at any time by pressing (RUN ENTER).

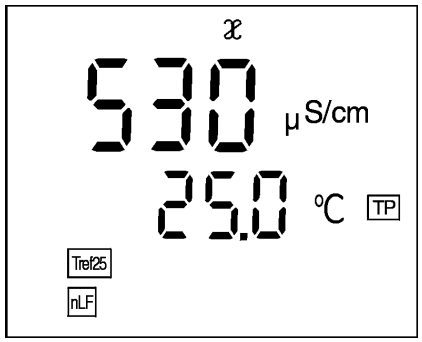
4.2.1 Conductivity / Specific resistance

Note
You can display measured values in the units µS/cm (conductivity) or MΩ·cm (specific resistance). This setting is described in Abschnitt 4.7 CONFIGURATION.

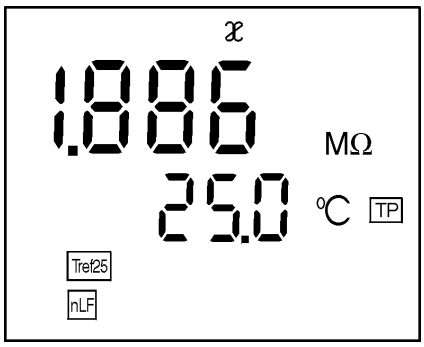
Thus, you can carry out conductivity measurements or measurements of the specific resistance:

1	Perform the preparatory activities according to section 4.2.
2	Immerse the conductivity measuring cell into the test sample.
3	Press the (M) key until 𝔵 appears in the status display. Depending on the setting, one of the following display indicators appears on the display:

Conductivity



Specific resistance

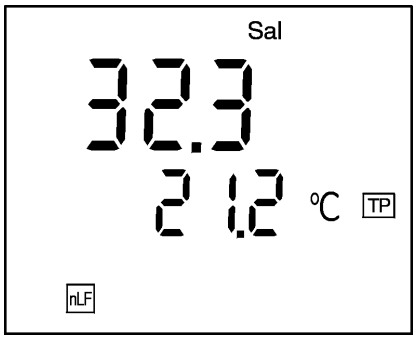


4	If necessary, set the temperature by pressing (▲)(▼) (see section 4.2 on page 19).
5	Wait for a stable measured value.

4.2.2 Salinity

To measure the salinity, proceed as follows:

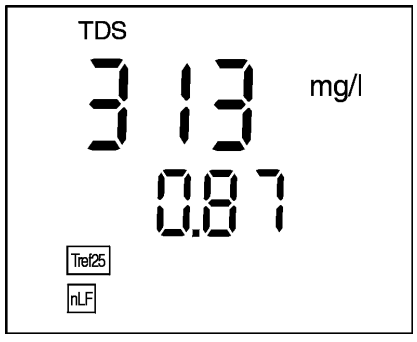
1	Perform the preparatory activities according to section 4.2.
2	Immerse the conductivity measuring cell into the test sample.
3	Press the M key repeatedly until *Sal* appears in the status line. The salinity value of the sample appears on the display.
4	If necessary, set the temperature by pressing ▲ ▼ (see section 4.2, page 19).
5	Wait for a stable measured value.



4.2.3 TDS (total dissolved solids)

To measure the TDS, proceed as follows:

1	Perform the preparatory activities according to section 4.2.
2	Immerse the conductivity measuring cell into the test sample.
3	When measuring with an integrated temperature probe continue with step 4. When measuring without temperature probe: – Determine the temperature of the test sample using a thermometer – Press the (M) key repeatedly until $\mathcal{x}$ appears in the status line. Enter the temperature using (▲)(▼).
4	Press the (M) key repeatedly until *TDS* appears in the status line. The TDS value of the sample appears.
5	Set up the TDS factor (0.40 ... 1.00) using (▲)(▼).



6	Wait for a stable measured value.

Note

Also refer to Application Report ... 084 KONDUCTOMETRICAL DETERMINATION OF THE TOTAL DISSOLVED SOLIDS (TDS).

4.2.4 Printing/transmitting measured values

Measured values (data records) can be:

- printed on the integrated printer* or
- transmitted to the interface

Note
To print, you must switch on the printer using the Print key (on/off) (Print LED lights up green)*.
To transmit to the interface, you must connect the interface cable. The integrated printer is then switched off automatically.

You can print/transmit measured values (data records) in 3 ways:

- Switch on the data transmission (Int 2) (see page 47)
  - After expiry of the selected interval, the current data record is sent to the printer/interface.
- Switch on AutoStore (Int 1) (see page 38)
  - After expiry of the selected interval, the current data record is sent to the printer/interface and in addition is stored in the data storage of the instrument
  - AutoStore (Int 1) covers the *data transmission* interval (Int 2).
- Press the (RUN ENTER) key
  This manually prints/transmits the current measured values at any time - independently of the selected intervals.

Note
If you connect a recorder (analog output), the output to the digital interface is switched off.

* only on the Cond 730 with integrated printer

4.3 Determining/setting up the cell constant [C]

Why determine/set up the cell constant?

Due to ageing, the cell constant slightly changes. As a result, an inexact measured value is displayed. Calibration determines the current value of the cell constant and stores this value in the instrument.
Thus, you should calibrate at regular intervals.

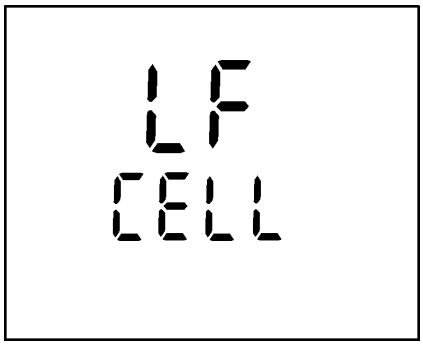
You can determine the cell constant of the conductivity measuring cell in the range 0.450 ... 0.500 cm^{-1} or 0.800 ... 1.200 cm^{-1} by calibrating in the control standard or set it up manually in the range 0.250... 2.500 cm^{-1}or 0,090 ... 0,110 cm^{-1}.
Additionally, you can select the fixed cell constant 0.010 cm^{-1}.

4.3.1 Determining the cell constant (calibrating)

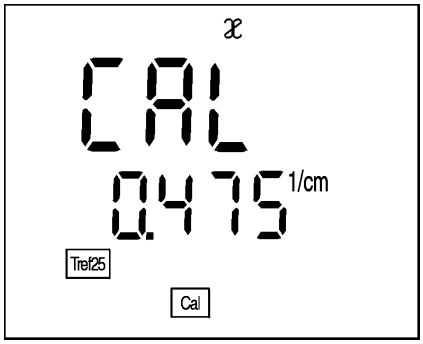
Determining the cell constant (calibration in control standard)

Determine the cell constant as follows:

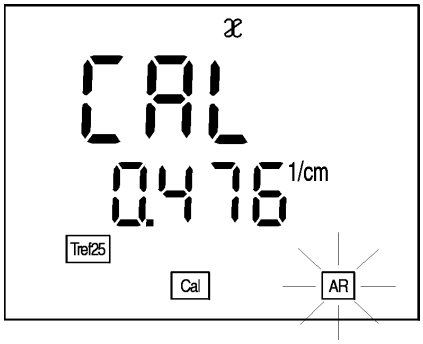
1	Press the CAL key repeatedly until *LF CELL* appears on the display.



2	Press the RUN ENTER key.
3	Press the CAL key repeatedly until the following is displayed.



4	Immerse the measuring cell into the 0.01 mol/l KCL control standard.
5	Press the RUN ENTER key. – If no temperature probe is connected, enter the current temperature of the solution using ▲▼ and confirm with RUN ENTER. – If a temperature probe is connected, the AR measurement to determine the cell constant starts. *AR* flashes until a stable signal is achieved. The determined cell constant ist displayed; the measuring instrument automatically stores the cell constant.



Note
If error message E3 appears see chapter 6 WHAT TO DO IF...

AutoRead During calibrating, the *AutoRead* function is automatically activated. The *AR* display flashes. The calibration procedure is finished when the *AR* display stops flashing.

Note
This method of automatically determining the cell constant by calibrating in the 0.01 mol/l KCL control standard can only be used for measuring cells with a cell constant in the range 0.450 ... 0.500 cm^{-1} or 0.800 ... 1.200 cm^{-1}.

Calibration evaluation

After calibrating, the instrument automatically evaluates the current condition of the calibration.
The evaluation appears on the display.

Display	Cell constant [cm^{-1}]
	0.450 ... 0.500 cm^{-1} 0.800 ... 1.200 cm^{-1}
E3 Perform error elimination according to chapter 6 WHAT TO DO IF...	outside of the ranges 0.450 ... 0.500 cm^{-1} or 0.800 ... 1.200 cm^{-1}

Calibration protocol

The calibration protocol contains the calibration data of the current calibration. You can call up the calibration protocol by outputting the data storage (section 4.5.3).

Note
You can automatically print out a calibration protocol after the calibration. To do so, switch on the printer (Print LED lights up green) before calibrating*. After a valid calibration, the protocol is printed.

```
CALIBRATION PROTOCOL
 14.04.99      11:37
Device No.: 99990000
CALIBRATION CONDUCTIVITY
Cal Time: 14.04.99 / 11:37
Cal Interval:  180d
Cal Std.:   0.01 mol/l KCL
            40.0 °C
Conduct./Tref25: 1413µS/cm
Cell Const :  0.975   1/cm
Probe :     +++
```

* only on the Cond 730 with integrated printer

Calibration interval (Int 3)

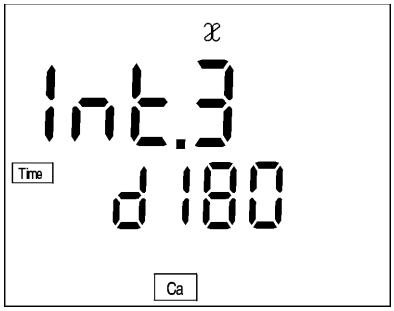
The flashing sensor symbol reminds you to calibrate regularly. After the selected calibration interval (Int 3) expires, the sensor symbol flashes. Measurements can continue.

Note
To ensure the high measuring precision of the measuring system, perform a calibration after the calibration interval expires.

Setting the calibration interval

The calibration interval (Int 3) is set to 180 days in the factory. The interval can be changed (1 ... 999 days):

1	Switch off the instrument.
2	Press (M) and hold down the key.
3	Press the (⏻) key. The *display test* appears briefly on the display. The instrument then switches automatically to the configuration level.
4	Press the (RUN ENTER) key until *Int 3* appears on the display.



5	Press (▲) (▼) to set the required time interval until the next calibration.
6	Confirm with (RUN ENTER).
7	Change to the measuring mode by pressing (M).

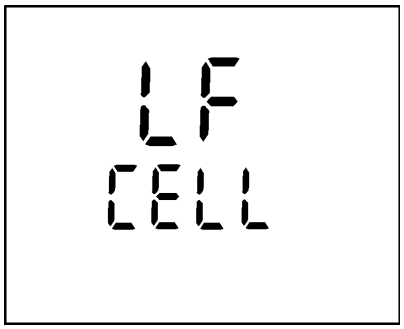
4.3.2 Setting the cell constant manually

Note
The cell constant to be set up must either be taken from the operating manual of the measuring cell or is printed on the measuring cell.

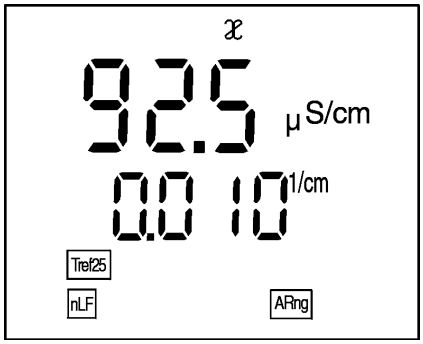
You can set the the cell constant manually as follows:

Setting the fixed cell constant 0.010 cm^{-1}

1	Press the CAL key repeatedly until *CELL* appears on the display.



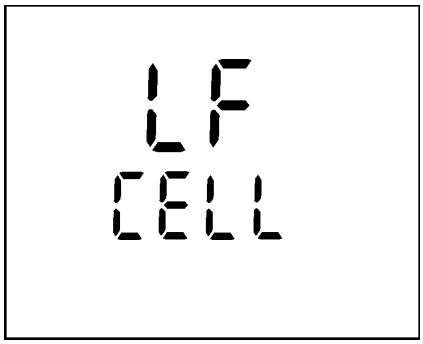
2	Press the RUN ENTER key.
3	Press the CAL key repeatedly until the cell constant 0.010 cm^{-1} appears on the display.



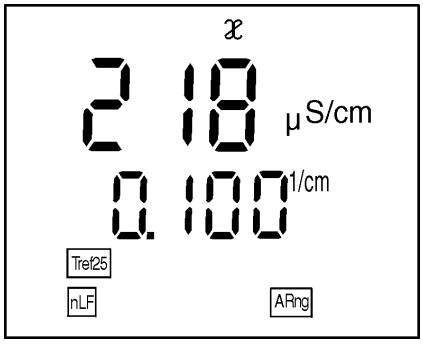
4	To return to the measuring mode: Press the M key. From now on, the cell constant 0.010 cm^{-1} will be used.

Range
0.090 ... 0.110 cm^{-1}

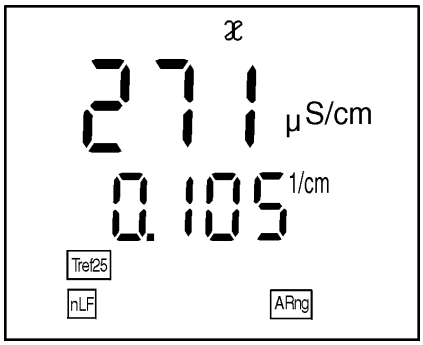
1	Press the CAL key repeatedly until *CELL* appears on the display.



2	Press the RUN ENTER key.
3	Press the CAL key repeatedly until a cell constant in the range 0.090 ... 0.110 cm^{-1} appears.



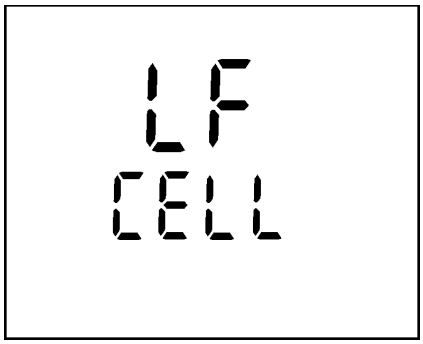
4	Set the cell constant to be used with ▲ ▼, e.g. 0.105 cm^{-1}.



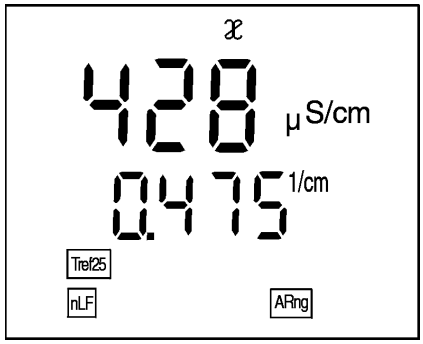
5	To return to the measuring mode: Press the M key. From now on, the new cell constant will be used.

Range
0.250 ... 2.500 cm^{-1}

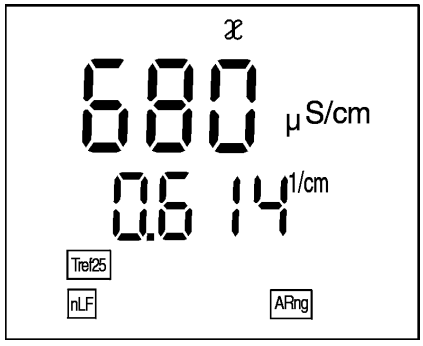
1	Press the CAL key repeatedly until *CELL* appears on the display.



2	Press the RUN ENTER key.
3	Press the CAL repeatedly until until a cell constant in the range 0.250 ... 2.500 cm^{-1} appears.



4	Set the cell constant to be used with ▲ ▼, e.g. 0.614 cm^{-1}.



5	To return to the measuring mode: Press the M key. From now on, the new cell constant will be used.

4.4 Setting up the temperature compensation TC

The calculation of the temperature compensation is based on the preset reference temperature, Tref 20 or Tref 25 (see section 4.7 CONFIGURATION).

You can select one of the following temperature compensations:

- **Non-linear temperature compensation "nLF"** according to DIN 38404 or EN 27 888
- **linear temperature compensation "Lin"** with a coefficient that can be set in the range 0.001 ... 3.000 %/K
- **no temperature compensation**

Note
Select the following temperature compensations to work with the test samples given in the table:

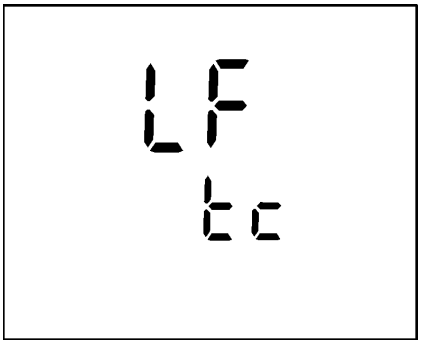
Application notes

Test sample	Temperature compensation TC	Display indicator
Natural water (ground water, surface water, drinking water)	nLF according to DIN 38404 EN 27 888	nLF
Ultrapure water	nLF according to DIN 38404 EN 27 888	nLF
Other aqueous solutions	Set linear temperature coefficient 0.001 ... 3.000 %/K	Lin
Salinity (seawater)	Automatically nLF according to IOT	Sal, nLF

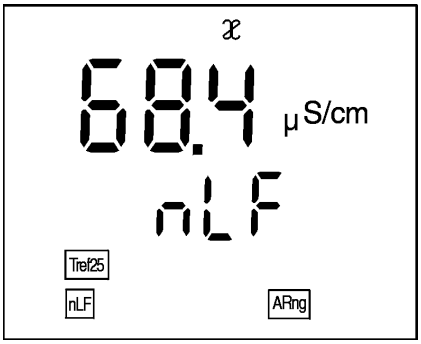
Selecting the non-linear temperature compensation

To select the non-linear temperature compensation proceed as follows:

1	Press the CAL key repeatedly until *LF tc* appears on the display.



2	Press the RUN ENTER key.
3	Press the CAL key repeatedly until *nLF* appears on the display.

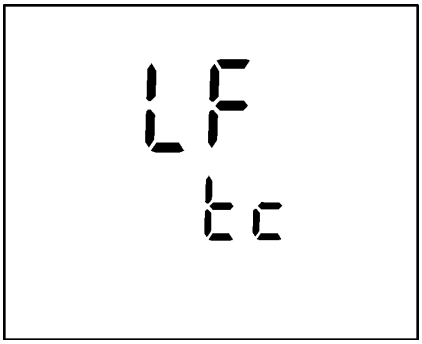


4	To return to the measuring mode: press the M key.

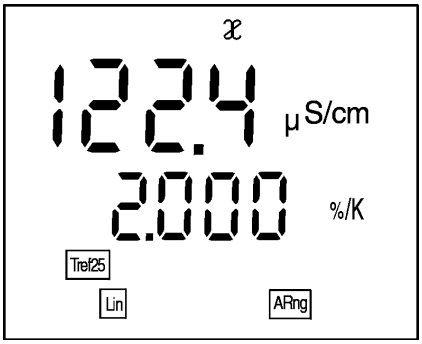
Selecting the linear temperature compensation

To select the linear temperature compensation proceed as follows:

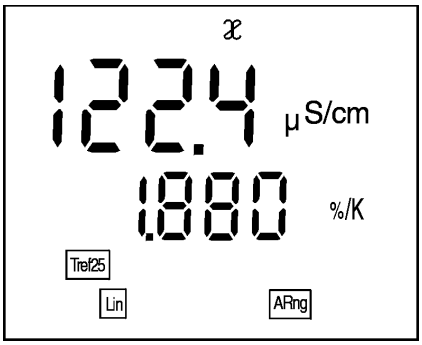
1	Press the CAL key repeatedly until *LF tc* appears on the display.



2	Press the RUN ENTER key.
3	Press the CAL key repeatedly until the adjustable linear temperature coefficient appears on the display.



4	Set up the temperature coefficient, e. g. 1.880 %/K using ▲▼.

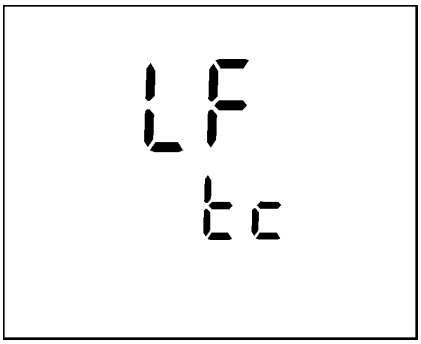


5	To return to the measuring mode: press the M key.

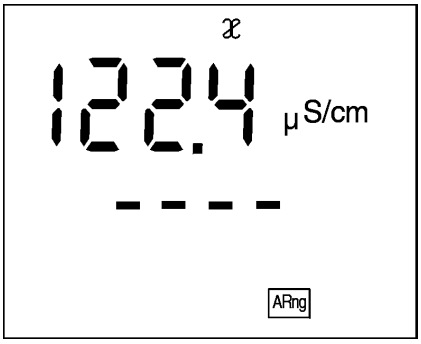
Switching off the temperature compensation

To switch off the temperature compensation proceed as follows:

1	Press the CAL key repeatedly until *LF tc* appears on the display.



2	Press the RUN ENTER key.
3	Press the CAL key repeatedly until the following display appears:



4	The temperature compensation has been switched off.
5	To return to the measuring mode: press the M key.

4.5 Storing

The conductivity meter has an internal data storage device. Up to 800 data records can be stored in it.
A complete data record consists of:

- Memory location
- Date
- Time
- Measured value
- Temperature
- I.D. number

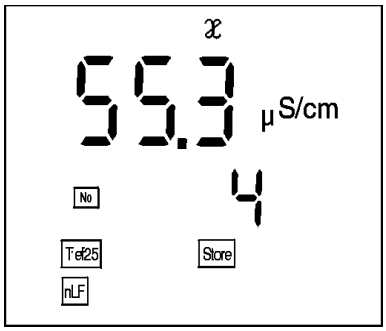
You can transmit measured values (data records) to the data storage in 2 ways:

- Manual storage
- Switching on the AutoStore function (Int 1), see page 38.

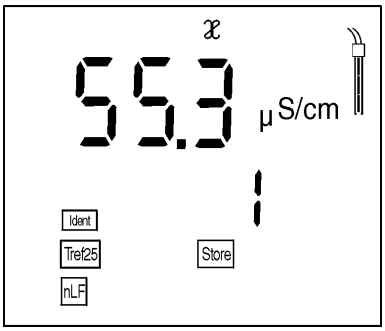
4.5.1 Manual storage

You can transmit a measured value to the data storage as follows:

1	Press the STO key. The current number of the next free memory location appears on the display.



2	Confirm with RUN ENTER. The display changes to the input of the I.D. number.



3	Enter the required I.D. number (1 ... 999) by pressing ▲▼.
4	Confirm with RUN ENTER. The instrument changes to the measuring mode.

StoFull message

This message appears if all 800 memory locations are full.

You have the following options:

Store the current measured value. The oldest measured value is over-written by this	Press RUN ENTER
Return to the measuring mode without storing	Press any key
Output the data storage	See page 40
Delete the data storage	See page 46

4.5.2 Switching on AutoStore (Int 1)

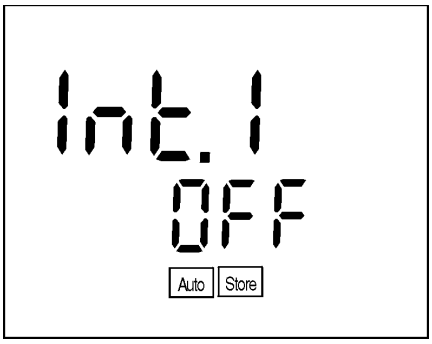
The storage interval (Int 1) determines the time interval between automatic storage processes.
After the time interval expires, the current data record is transmitted to the data storage and to the printer/interface.

The storage interval (Int 1) is set to OFF in the factory. Thus, the *AutoStore* function is switched off.
To switch the function on, set up a time interval (5 s, 10 s, 30 s, 1 min, 5 min, 10 min, 15 min, 30 min, 60 min).

Note
If the *AutoStore* function is active, the setting of the data transmission interval (int 2) is ineffective (see page 47).

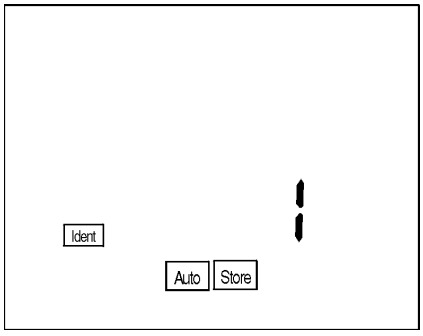
Setting the storage interval

1	Press and hold down the RUN/ENTER key.
2	Press the STO key. *Int 1* appears on the display.



3	Press the ▲ ▼ keys to set up the required time interval between storage processes.
4	Confirm with RUN/ENTER. The number of free memory locations appears on the display.

5	As soon as all 800 memory locations are full, the AutoStore function is terminated (Int 1 = OFF). If too few storage locations are available for your measurements: – backup the data storage (see page 40) and – clear the data storage (see page 46).
6	Confirm with RUN ENTER. The prompt for the I.D. number appears on the display.



7	Press ▲ ▼ to set the required I.D. number.
8	Confirm with RUN ENTER. The instrument changes to the measuring mode and starts the measuring and storage procedure. *AutoStore* flashes on the display.

Note
The *AutoStore* function is interrupted if you perform other functions, e.g. output data storage.
After completing the other function, the *AutoStore* function continues. However, as a result, gaps can occur in the recording of the measured values.

Switching off the AutoStore

Switch off the *AutoStore* function by:

- Setting the storage interval (Int 1) to OFF or
- Switch the conductivity meter off and on again.

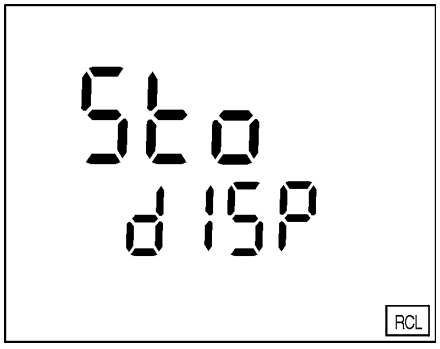
4.5.3 Outputting the data storage

The contents of the data storage can be output to the:

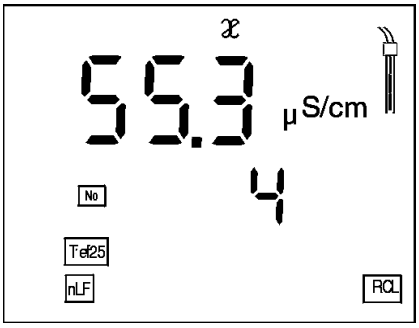
- display
- printer/interface

Outputting to the display

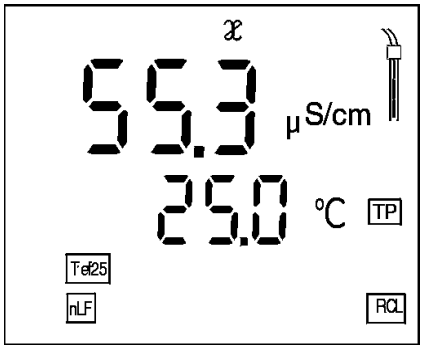
1	Press the RCL key repeatedly until *Sto disp* appears on the display.



2	Press the RUN ENTER key. A measured value appears on the display. The I. D. number of the data record appears for approx. 2 s.



3	After 2 s the respective temperature of the data record appears on the display. Stored data records are displayed together with the RCL display indicator.

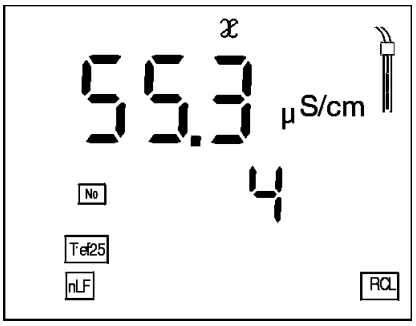


You can perform the following activities:

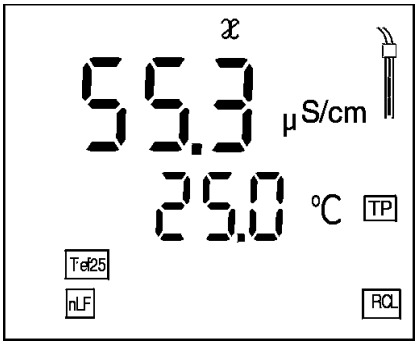
Display further parameters of the data record (I.D. no., date, time, memory location)	Press RUN ENTER
Advance one data record (memory location)	Press ▲
Go back one data record (memory location)	Press ▼

Note
If you want to find a specific parameter (e.g. date), proceed as follows:

1	Press the RCL key repeatedly until *Sto disp* appears on the display.
2	Press the RUN ENTER key. A measured value appears on the display. The I. D. number of the data record appears for approx. 2 s.



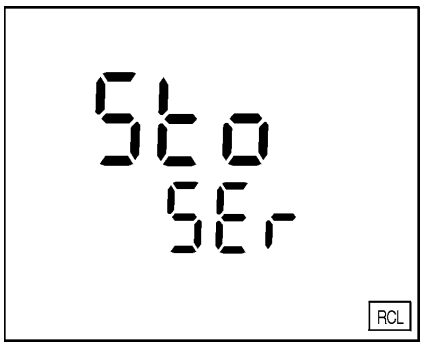
3	After 2 s the respective temperature of the data record appears on the display.



4	Select the parameter (e.g. date) by pressing RUN ENTER.
5	Press ▲ or ▼ repeatedly until the required date appears on the display. After approx. 2 s, the temperature of the displayed measured value appears.

Outputting to the interface

1	Press the RCL key repeatedly until *Sto SEr* appears on the display.



2	Press the RUN ENTER key. The protocol of the last calibration is transmitted to the printer/RS interface. In the meantime, *Sto CAL* appears on the display. Following the calibration protocol, the complete contents of the storage is transmitted to the interface.

Note
You can cancel the transmission by pressing M or RUN ENTER.

Sample printout

```
CALIBRATION PROTOCOL
 14.04.99     11:37
Device No.: 99990000
CALIBRATION CONDUCTIVITY
Cal Time: 14.04.99 / 11:37
Cal Interval:  180d
Cal Std.:   0.01 mol/l KCL
            23.0 °C
Conduct./Tref25: 1413 µS/cm
Cell Const :  0.975    1/cm
Probe:      +++

No.    1:
 01.01.99       00:04
  2.40 mS/cm     25   °C
Tman
nLF
Tref25  C = 0.475 1/cm
Ident : 1

No.    2:
 10.01.99       10:09
  2.40 mS/cm     25.3 °C
Tauto
nLF
Tref25  C = 0.475 1/cm
Ident : 1

No.    3:
 12.01.99       01:48
  2.40 mS/cm     21.6 °C
Tauto
nLF
Tref25  C = 0.475 1/cm
Ident : 1
```

The printout contains:

- Calibration protocol:
  - Date/time of the printout
  - Instrument number (Device No.)
  - Date/time of the calibration (Cal Time)
  - Calibration interval (Cal Interval)
  - Calibration standard 0.01 mol/l KCL (Cal Std.) [°C/F]
  - Conductivity of the calibration standard at 25 °C (Conduct./Tref25)
  - Cell constant (Cell Const)
  - Probe evaluation (Probe)

- Contents of the measuring storage:
  - Number of the storage location (No.)
  - Date/time of measurement
  - Measured value/unit (mS/cm) [°C/F]
  - Automatic/manual temperature measurement (Tauto/Tman)
  - Temperature compensation (nLF)
  - Tref
  - Cell constant (1/cm)
  - AutoRead function (AR)
  - I.D. number (Ident)

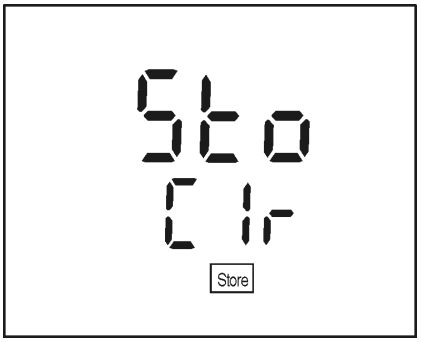
4.5.4 Clearing the storage

This function can erase the stored data records. 800 memory locations will then become available again.

Note
The *Clear store* function only appears if data records have already been stored in the storage. Otherwise, the conductivity meter automatically changes to the measuring mode.

In order to delete all the data records, proceed as follows:

1	Switch off the instrument.
2	Press and hold down the STO key.
3	Press the ⏻ key. The *display test* appears briefly on the display.



4	Confirm the clearing process by pressing RUN ENTER. Pressing any other key stops the clearing process and the data records remain in the storage.

Note
The calibration data remain in the storage and can be called up via the calibration protocol.

4.6 Data transmission

You can use the following options to transmit data:

- One of the following options:
  - The *AutoStore* function (page 38) is used to periodically (*Int 1* storage interval) save measured values internally and output them on the printer/ interface.
  - The *data transmission interval (Int 2)* function is used to periodically output measured values to the printer/ interface (see below).
- The *Output data store* function (page 40) is used to output calibration data and stored measured values to the printer/interface.
- The analog recorder output (page 49) is used to output measured values as voltages.

4.6.1 Data transmission interval (Int 2)

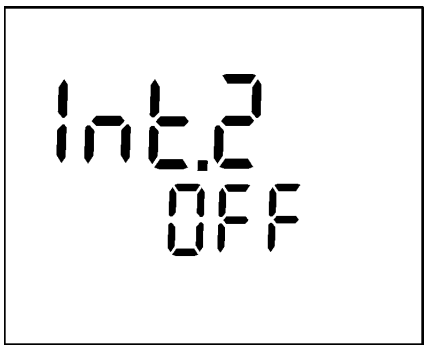
The interval for the data transmission (Int 2) determines the time interval between automatic data transmissions. After the time interval expires, the current data record is transmitted to the printer/interface.

Note
The setting of the interval (Int 2) only has an effect when the storage interval (*AutoStore* function) is switched off.

Setting the data transmission interval

The interval is set to OFF in the factory.
To start the data transmission, set up an interval (5 s, 10 s, 30 s, 1 min, 5 min, 10 min, 15 min, 30 min, 60 min):

1	Press and hold down the RUN/ENTER key.
2	Press the AR key. *Int 2* appears on the display.



3	Press ▲ ▼ to set up the required time interval between storage processes.
4	Confirm with RUN/ENTER. The instrument changes automatically to the measuring mode.

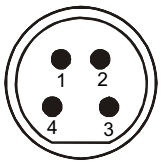
Note
If the *AutoStore* function is active, the data transmission is performed according to the setting of the storage interval (Int 1). Set the storage interval (Int 1) to OFF to activate the *data transmission* interval (Int 2).

Note
You can also set the *data transmission* interval (Int 2) in the *Configuration* menu (see page 52).

4.6.2 Recorder (analog output)

You can transmit the data to a recorder via the analog output. Connect the analog output to the recorder via the AK323 interface cable.
The data output switches automatically to recorder output.

Socket assignment



RS 232
REC

1 Free
2 Plug coding
3 Ground
4 Analog output
(internal resistance < 5 Ohm)

Note
Activate the analog output by connecting 2 and 3 or use the original cable.

The signal range of the analog output depends on the measured parameter and the measuring range:

Conductivity/ resistance

Measuring range	Voltage	Resolution
0.000 ... 1.999 µS/cm	0 ... 1999 mV	1 mV
0.00 ... 19.99 µS/cm	0 ... 1999 mV	1 mV
0.0 ... 199.9 µS/cm	0 ... 1999 mV	1 mV
0 ... 1999 µS/cm	0 ... 1999 mV	1 mV
0.00 ... 19.99 mS/cm	0 ... 1999 mV	1 mV
0.0 ... 199.9 mS/cm	0 ... 1999 mV	1 mV
0 ... 500 mS/cm	0 ... 500 mV	1 mV

Salinity

Measuring range	Voltage	Resolution
0 ... 70.0	0 ... 700 mV	1 mV

TDS

Measuring range	Voltage	Resolution
0 ... 1999 mg/l	0 ... 1999 mV	1 mV

4.6.3 PC/external printer (RS232 interface)

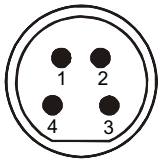
You can transmit data to a PC or an external printer via the RS232 interface.
Connect the interface to the instrument via the AK340/B cable (PC) or AK325/S cable (external printer).
The data output switches automatically to RS232.

Note
The RS232 interface is not galvanically isolated.
If it is connected to an earthed PC/printer, measurements cannot be made in earthed media as this would give incorrect results!

Set up the following transmission data on the PC/printer:

Baud rate	Selectable between: 1200, 2400, 4800, 9600
Handshake	RTS/CTS + Xon/Xoff
PC only:	
Parity	None
Data bits	8
Stop bits	1

Socket assignment

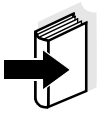


RS 232
REC

1 CTS
2 RxD
3 Ground
4 TxD

4.6.4 Operation with MultiLab pilot

With the aid of the MultiLab pilot software, you can record and evaluate measuring data with a PC. The data is transmitted after the measuring instrument is connected to the RS232 serial interface (COM interface) of a PC.



Note
More detailed information can be found in the MultiLab pilot operating manual.

4.7 Configuration

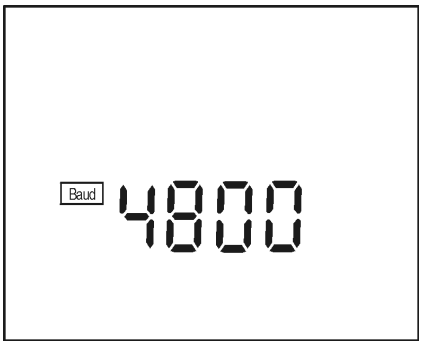
You can adapt the conductivity meter to your individual requirements. To do this, the following parameters can be called up/changed (the status on delivery is marked in bold):

Baud rate	1200, 2400, **4800**, 9600
Data transmission interval (Int 2)	**OFF**, 5 s, 10 s, 30 s, 1 min, 5 min, 10 min, 15 min, 30 min, 60 min
Calibration interval (Int 3)	1 ... **180** ... 999 d
AutoRange ARng	**yes**, no
TREF 25/TREF 20	t20 or **t25**
Measured values given as conductivity or resistance values	**S/cm** or MΩ
Temperature unit	**°C**, °F
Date/time	As required

Note
You can leave the configuration menu at any time. Parameters that have already been changed are stored.
To do this, press the (M) key.

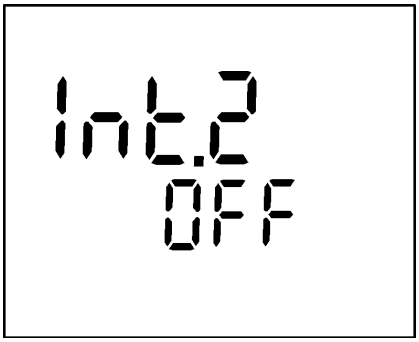
1	Switch off the instrument.
2	Press and hold down the (M) key.
3	Press the (⏻) key. *The display test* appears briefly on the display. The instrument then switches automatically to the setting of the baud rate.

Baud rate



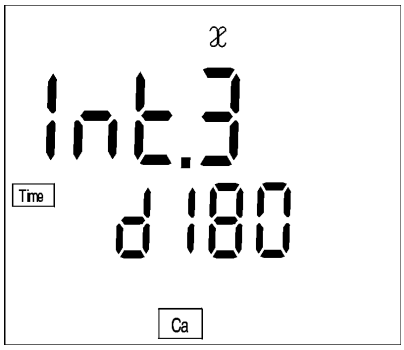
4	Set up the required baud rate by pressing ▲▼.
5	Confirm with RUN ENTER. *Int 2* appears on the display.

Data transmission interval



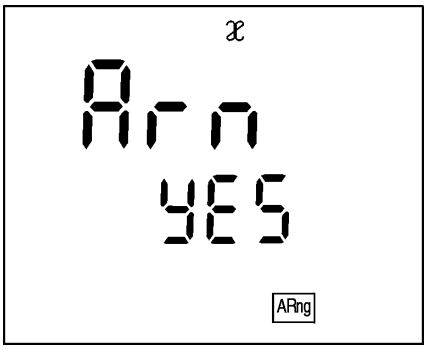
6	Set up the required time interval by pressing ▲▼.
7	Confirm with RUN ENTER. *Int 3* appears on the display.

Calibration interval



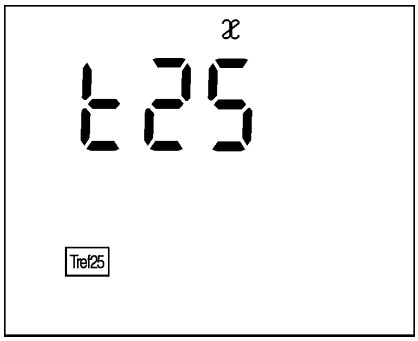
8	Set up the required time interval by pressing ▲▼.
9	Confirm with RUN ENTER. *ARng* appears on the display.

ARng (AutoRange)



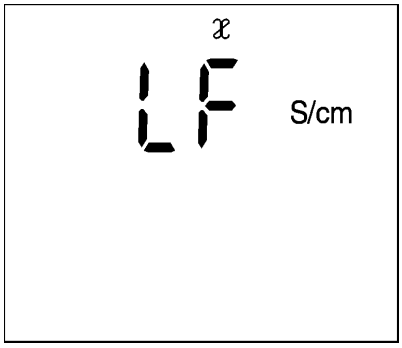
10	With ▲ ▼ select between *YES* and *no*.
11	Confirm with RUN ENTER. *t25* appears on the display.

Reference temperature



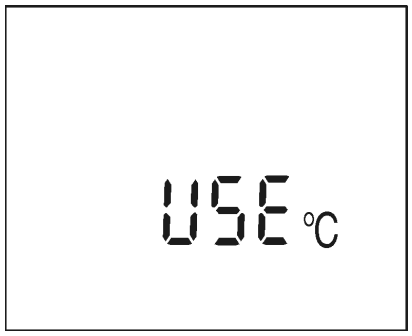
12	With ▲ ▼ select between *t25* Tref25 and *t20* Tref20 .
13	Confirm with RUN ENTER. *LF* appears on the display.

Conductivity



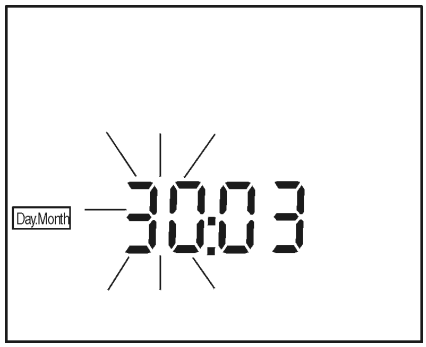
14	With ▲ ▼ select between *S/cm* and *MΩ*.
15	Confirm with RUN ENTER. *USE °C* appears on the display.

Temperature unit

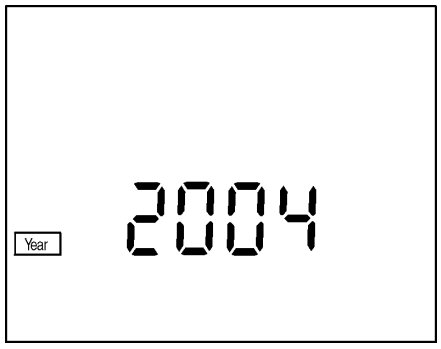


16	Select between *°C* and *°F* by pressing ▲ ▼.
17	Confirm with RUN ENTER. The date flashes on the display.

Date and time



18	Set today's date by pressing ▲ ▼.
19	Confirm with RUN ENTER. The date (month) flashes on the display.
20	Set the current month by pressing ▲ ▼.
21	Confirm with RUN ENTER. The year appears on the display.



22	Set the current year by pressing ▲▼.
23	Confirm with RUN ENTER. The hours flash on the display
24	Set the current time by pressing ▲▼.
25	Confirm with RUN ENTER. The minutes flash on the display.
26	Set the current time by pressing ▲▼.
27	Confirm with RUN ENTER. The instrument changes automatically to the conductivity measuring mode.

4.8 Reset

You can reset (initialize) measuring and configuration parameters separately from one another.

Measuring parameters

The following measuring parameters (Cond InI) are reset to the values they had on delivery:

Measuring mode	$\mathcal{X}$
Cell constant	0.475 cm^{-1} (calibrated) 0.475 cm^{-1} (set up)
Temperature compensation	nLF
Reference temperature	Tref25
Temperature coefficient of the linear temperature compensation	2.000 %/K
TDS factor	1.00

Note
When the measuring parameters are reset, the calibration data are lost. After the parameters have been reset, calibrate!

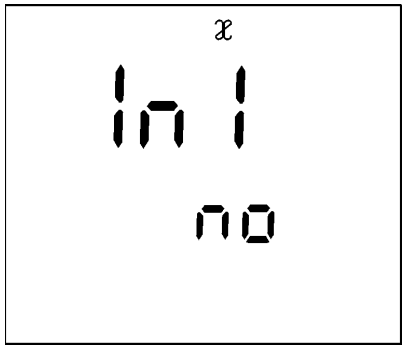
Configuration parameters

The following configuration parameters (InI) are reset to the values they had on delivery:

Baud rate	4800
Interval 1 (automatic storing)	OFF
Interval 2 (for data transmission)	OFF

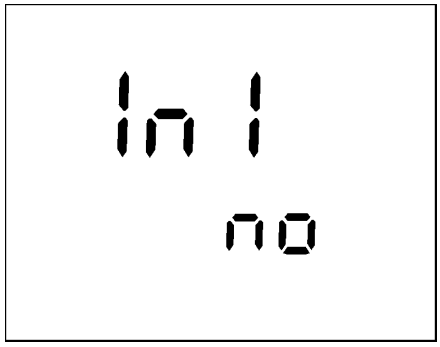
Resetting measuring parameters

1	Press and hold down the RUN/ENTER key.
2	Press the CAL key.



3	Use ▲ ▼ to toggle between *no* and *YES*. yes: reset measuring parameters. no: retain settings.
4	Confirm with RUN/ENTER. The instrument changes to the configuration parameters.

Resetting configuration parameters



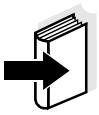
5	Toggle between no and yes by pressing ▲ ▼. yes: reset configuration parameters. no: retain settings.
6	Confirm with RUN/ENTER. The instrument changes automatically to the conductivity measuring mode.

5 Maintenance, cleaning, disposal

5.1 Maintenance

The maintenance tasks are restricted to the following activities:

- replacing the batteries and
- replacing the roll of printer paper*.

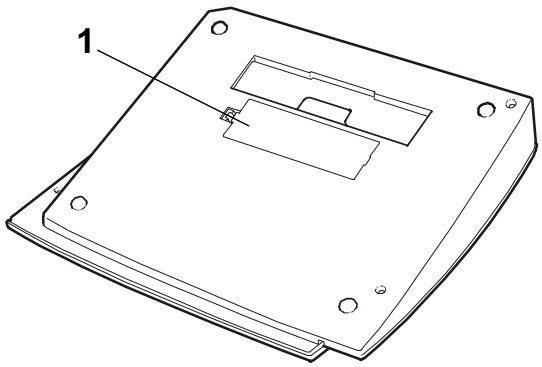


Note
See the relevant operating manual of the measuring cell for instructions on maintenance.

* only on the Cond 730 with integrated printer

5.1.1 Changing the batteries

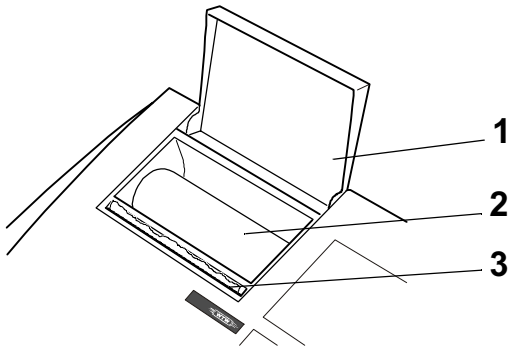
1	Open the battery compartment (1) on the underside of the instrument.
2	Remove the four batteries from the battery compartment.
3	Insert four new batteries (Type Mignon AA) into the battery compartment.
4	Close the battery compartment (1). The date (day) flashes on the display.
5	Set up the date and time according to section 3.2.



Caution
Make sure that the poles of the batteries are the right way round.
The ± signs in the battery compartment must correspond to the ± signs on the batteries.
Only use leakproof alkaline manganese batteries.

5.1.2 Replacing the roll of printer paper *

1	Switch off the printer (Print LED lights up red).
2	Open the lid of the printer (1).
3	Remove the empty roll of paper (2).
4	Insert the new roll of paper: – Fold the leading edge of the paper inwards and thread it into the printer (3) from underneath. – Press the (feed) Print key (paper feed).
5	Close the lid of the printer (1).



Note
Only use original WTW rolls of printer paper. Information on this is given in the WTW catalog, LABORATORY AND FIELD INSTRUMENTATION or via the Internet.
You can also use HQ thermal paper that remains legible for at least 10 years.

* only on the Cond 730 with integrated printer

5.2 Cleaning

Occasionally wipe the outside of the measuring instrument with a damp, lint-free cloth. Disinfect the housing with isopropanol as required.

Caution
The housing is made of synthetic material (ABS). Thus, avoid contact with acetone or similar detergents that contain solvents. Remove any splashes immediately.

5.3 Disposal

Packing

The measuring instrument is sent out in a protective transport packing.
We recommend: Keep the packing material. It protects the instrument against damage during transport.

Batteries

This note refers to the battery regulation that applies in the Federal Republic of Germany. We would ask end-consumers in other countries to follow their local statutory provisions.

Note
In compliance with §14 of the BATTERY REGULATION, we would like to point out that this instrument contains batteries. Batteries that have been removed must only be disposed of at the recycling facility set up for this purpose or via the retail outlet.
It is illegal to dispose of them in household refuse.

Measuring instrument

Dispose of the measuring instrument as electronic waste at an appropriate collection point. It is illegal to dispose of it in household refuse.

6 What to do if...

Error message, OFL

Cause	Remedy
The measured value is outside the measuring range	
– Measuring cell not connected	– Connect measuring cell
– Cable broken	– Replace electrode

Error message, E3

Cause	Remedy
– Measuring cell contaminated	– Clean measuring cell; if necessary, replace it
– Unsuitable calibration solution	– Check calibration solutions

LoBat

Cause	Remedy
– Batteries almost depleted	– Replace batteries (see section 5.1.1 CHANGING THE BATTERIES)

Instrument does not react to keystroke

Cause	Remedy
– Operating state undefined or EMC electric stress unallowed	– Processor reset: Press the (AR) key and switch on instrument

You would like to know which software version is in the instrument

Cause	Remedy
– e.g. question of the WTW service department	– Press the (AR) key and switch on instrument. The software version is displayed.

to display

Cause	Remedy
– Timeout of the interface	– Check connected instrument

StoFull message

Cause	Remedy
– All 800 memory locations are full	– Output data storage and clear data storage

Integrated printer does not print *

Cause	Remedy
– Printer switched off	– Switch on printer
– No mains power supply connected	– Connect mains power supply
– Interface cable connected	– Unplug cable
– No paper available	– Replace roll of paper
– *AutoStore* function is switched on with a longer interval duration (Int 1)	– Switch off *AutoStore* function

Integrated printer prints automatically *

Cause	Remedy
– *AutoStore* function (Int 1) or *Data transmission* (Int 2) is switched on	– Switch off functions

Print key (feed) does not react *

Cause	Remedy
– Printer is switched on	– Switch off printer
– Interface cable connected	– Unplug cable

Printer operating - paper not being printed *

Cause	Remedy
– Paper inserted with wrong side upwards	– Turn the roll of paper around and insert it with the other side upwards

* only on the Cond 730 with integrated printer

7 Technical data

Ambient temperature

Storage temperature	- 25 °C ... + 65 °C
Operating temperature	0 °C ... + 55 °C
Allowable relative humidity	Annual mean: < 75 % 30 days/year: 95 % Other days: 85 %

Measuring ranges and resolution

κ [µS/cm]	0.000 ... 1.999 (only with 0.010 cm^{-1} cell constant) 0.00 ... 19.99 (only with 0.010 cm^{-1} constant and 0.090 ... 0.110 cm^{-1} cell constant) 0.0 ... 199.9 0 ... 1999
κ [mS/cm]	0.00 ... 19.99 0.0 ... 199.9 0 ... 500
Spec. resistance [MΩ*cm]	0.000 ... 1.999 0.00 ... 19.99 0.0 ... 199.9 0 ... 1999
SAL	0.0 ... 70.0 according to the IOT table
TDS [mg/l]	0 ... 1999 Factor can be set in the range 0.40 ... 1.00
T [°C]	– 5.0 ... + 105.0
T [°F]	+ 23.0 ... + 221.0

Accuracy (± 1 digit)	$\varkappa$	No compensation: Accuracy ± 0.5 % Non-linear compensation nLF : Accuracy Test sample temperature ± 0.5 % 0 °C ... 35 °C according to EN 27 888; ± 0.5 % 35 °C ... 50 °C extended nLF function according to WTW measurements Linear compensation Lin : Accuracy Test sample temperature ± 0.5 % 10 °C ... 75 °C (the accuracy percentage always refers to the measured value!)
	SAL	Range 0.0 ... 42.0 Accuracy Test sample temperature ± 0.1 5 °C ... 25 °C ± 0.2 25 °C ... 30 °C
	TDS [mg/l]	1
	T [°C]	NTC 30: Accuracy ± 0.1 PT 1000: Accuracy Operating temperature ± 0.5 0 °C ... 15 °C ± 0.1 15 °C ... 35 °C ± 1 35 °C ... 55 °C
	T [°F]	NTC 30: Accuracy ± 0.2 PT 1000: Accuracy Operating temperature ± 0.9 32 °F ... 59 °F ± 0.2 59 °F ... 95 °F ± 1.8 95 °F ... 131 °F

Cell constant, to be set	C [cm^{-1}]	0.010 0.090 ... 0.110 0.250 ... 2.500
Cell constant, calibrated	C [cm^{-1}]	0.450 ... 0.500 0.800 ... 1.200
Reference temperature, selectable	T_{REF} [°C]	20 25
Temperature input	Manual [°C]	- 5 ... +100

Dimensions and weight	Length [mm]	230
	Width [mm]	300
	Height [mm]	70
	Weight [kg]	Approx. 1.3 (without plug-in power supply unit)

Analog output

Automatic switch-over when the AK 323 recorder cable is connected.

Signal range	0 ... 1,999 V for the range 0 ... 1999 digits
Accuracy	± 0,5 % of diplayed value ± 0,1 (% saturation) or ± 0,5 %of displayed value ± 0.01 mg/l
Internal resistance	< 5 ohms (current limitation to max. 0.2 mA output current)

Serial interface

Automatic switch-over when the AK 340/B or AK 325/S cable is connected.

Type	RS 232, data output
Baud rate	can be set to 1200, 2400, 4800, 9600 Baud
Data bits	8
Stop bit	1
Parity	none
Handshake	RTS/CTS+Xon/Xoff
Cable length	max. 15m

Energy supply	Batteries	4 x 1.5 V AA type alkaline manganese batteries
	Runtime	Approx. 3000 operating hours
	Power supply	Plug-in power supply (Connection max. overvoltage category II) Plug-in power supply unit (Euro, US, UK, Australian plug) FRIWO FW7555M/09, 15.1432 Friwo Part. No. 1822089 Input: 100 ... 240 V ~ / 50 ... 60 Hz / 400 mA Output: 9 V = / 1,5 A
Guidelines and norms used	EMC	E.C. guideline 89/336/EEC EN 61326-1:1997 EN 61000-3-2 A14:2000 EN 61000-3-3:1995 FCC Class A
	Instrument safety	E.C. guideline 73/23/EEC
	Protective class	3, EN 61010-1 A2:1995
	Climatic class	2, VDI/VDE 3540
Test marks	UL/CUL, CE	

FCC Class A Equipment Statement

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

8 Lists

This chapter provides additional information and orientation aids.

Abbreviations The list of abbreviations explains abbreviations that appear on the display or when dealing with the instrument.

Specialist terms The glossary briefly explains the meaning of the specialist terms. However, terms that should already be familiar to the target group are not described here.

Index The index helps you find the topics that you are looking for.

Abbreviations

$\mathcal{X}$	Conductivity value
ABS	Plastic housing
AR	AutoRead (drift control)
ARng	Automatic range switching Measuring instrument measures with highest resolution
AutoStore	Automatic storing
Baud	Baud rate
C	Cell constant cm^{-1}
Cal	Calibration
CELL	Cell constant
disp	Display Output of the data storage on the display
E3	Error message (see chapter 6 WHAT TO DO IF...)
Ident	I. D. number
InI	Initialization Resets individual basic functions to the status they had on delivery
Int	Interval
Lin	Linear temperature compensation
LoBat	Low Battery Batteries are almost empty
nLF	Non-linear temperature compensation
OFL	Overflow Display range exceeded
Sal	Salinity
SELV	Safety Extra Low Voltage
Sto Clr	Clear storage

Sto disp	Output of the data storage on the display
Sto Full	Memory full
Sto SEr	Output of the data storage to the printer/ interface
Tauto	Automatic temperature measurement
TC	Temperature coefficient
TDS	Total dissolved solids
TP	Temperature Probe Temperature measurement active
Tref 20/T20	Reference temperature 20 °C
Tref 25/T25	Reference temperature 25 °C
°C	Temperature unit °Celsius
°F	Temperature unit Fahrenheit

Glossary

AutoRead

Monitors the electrode drift and releases the measured value only after the stability criterion has been reached. In this way, this procedure ensures the highest degree of precision and reproducibility.

Calibration

The cell constant is determined through calibration. To do so, the conductivity measuring cell is immersed into a series of aqueous salt solutions with exactly known electric conductivity. The relevant conductivity values are determined using the conductivity measuring instrument.

Cell constant

Linear factor describing the geometrical dimensions of a measuring cell and its electrodes.

- With the value of the cell constant you can roughly describe the application range of a conductivity measuring cell.
- The cell constant is determined through calibration in one or several calibration solutions.

Conductivity

The conductivity value is a sum parameter for the ion concentration of a test sample.

Control standard solution

Solution with a known conductivity to determine or check the conductivity.

Drift control

See AUTOREAD.

Reference temperature

In order to compare values measured at different temperatures, the values have to be converted to a fixed temperature. This temperature is 25 °C, or, as an exception, 20 °C.

Resistance

All substances (solids, liquids, or gases) with mobile charge carriers like for example electrons or ions have a finite ohmic resistance, which means they have an electric conductance that can be measured or an electric conducitivtiy.

Salinity

The salinity is a sum parameter especially for seawater; it gives the salt content of seawater.

Temperature compensation (TC)

The temperature has a very strong impact on the electrical conductivity. To be able to compare measured values, it is necessary to temper or convert the test sample to a reference temperature.

Test sample

The sample to be measured. It can be liquid or solid.

Total dissolved solids (TDS)

Mass that remains of the substances dissolved in an aqueous solution after a fixed filtering and drying procedure, as far as these substances are not volatile under the conditions of this procedure. The total dissolved solids refer to the volume of the filtered aqueous sample used und are given in mg/l.

Index

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S

T