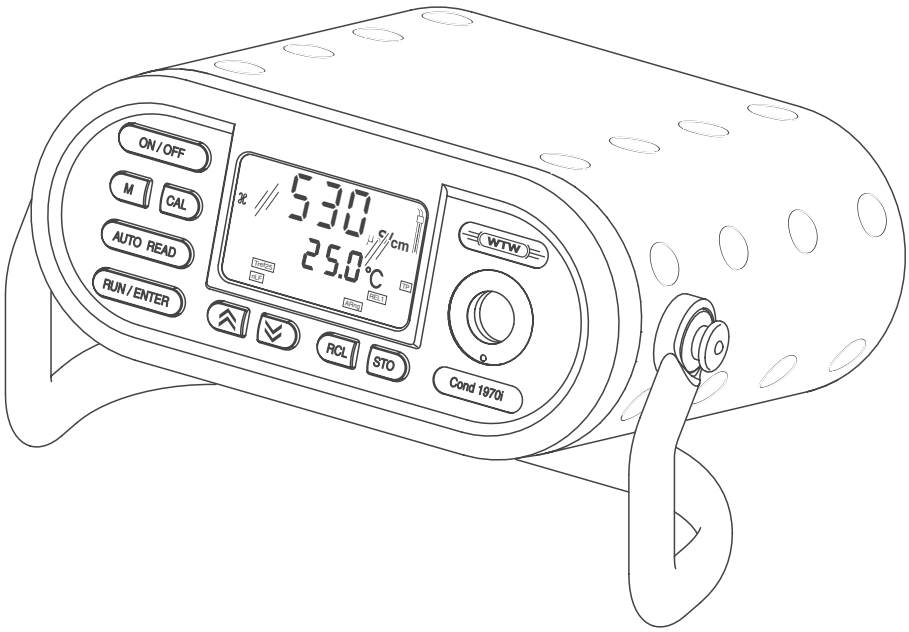
Operating manual

Cond 1970i



Portable conductivity measuring instrument

ba75692e01 01/2007

Accuracy when going to press

The use of advanced technology and the high quality standard of our instruments are the result of a continuous development. This may result in differences between this operating manual and your instrument. Also, we cannot guarantee that there are absolutely no errors in this manual. Therefore, we are sure you will understand that we cannot accept any legal claims resulting from the data, figures or descriptions.

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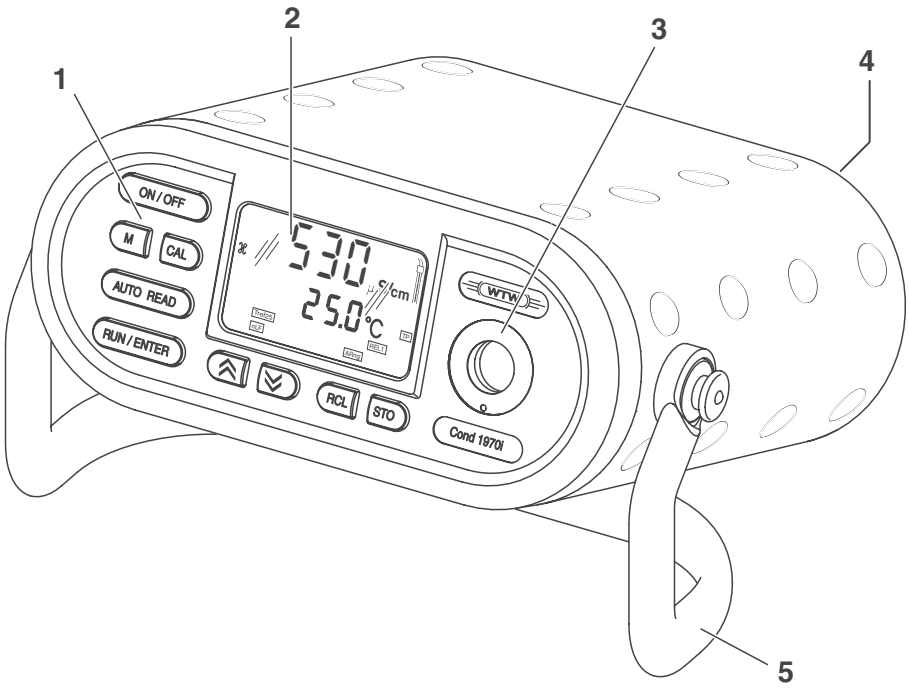
Cond 1970i - Contents

1 Overview

The portable Cond 1970i measuring instrument enables you to carry out conductivity measurements rapidly and reliably.
The Cond 1970i provides the maximum degree of operating comfort, reliability and measuring certainty for all applications.

The proven procedures to determine or set up the cell constant support you in your work with the measuring instrument. The special AutoRead function enables precise measurements.



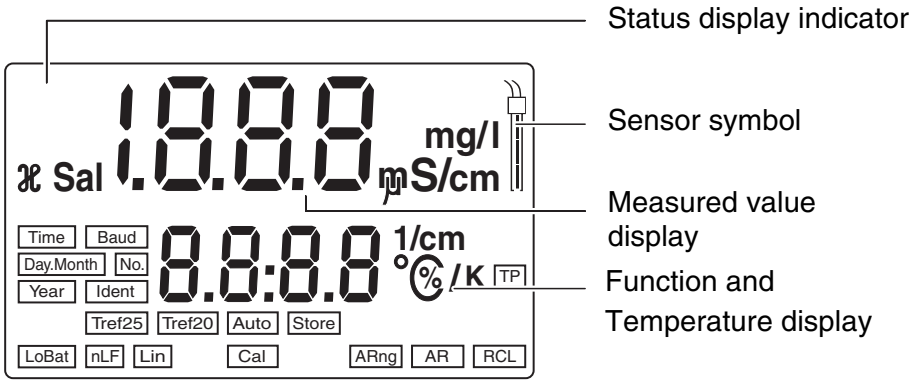
1	Keypad
2	Display
3	Integrated, exchangeable sensor quiver
4	Socket field
5	Carrying and positioning handle

Note
If you need further information or application notes, you can obtain the following material from WTW:

- Application reports
- Primers
- Safety datasheets.

You will find information on available literature in the WTW catalog or via the Internet.

1.1 Display



1.2 Keypad

Key functions

ON / OFF	Switch measuring instrument on/off **<ON/OFF>**
M	Select the measuring mode **<M>**: – Conductivity – Salinity – Total dissolved solids (TDS)
CAL	– Determine or set up the cell constant – Select temperature compensation **<CAL>**
AUTO READ	Activate/deactivate the AutoRead function **<AUTO READ>**
RUN / ENTER	Confirm entries, start AutoRead, output measured values **<RUN/ENTER>**
	Select the measuring mode, increase values, scroll **<▲ >**
	Select the measuring mode, decrease values, scroll **<▼ >**
RCL	Display/transmit measured values **<RCL>**
STO	Save a measured value **<STO>**

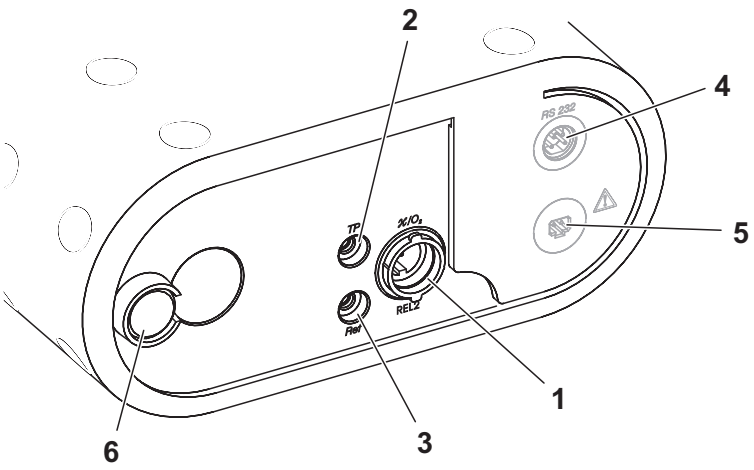
1.3 Socket field

Sensors

You can use the following sensors with the Cond 1970i:

- Conductivity depth armature
- Conductivity measuring cell
- Option: External temperature sensor

Connectors



Sensor / Instrument	Socket
Conductivity measuring cell or depth armature	**1**
Temperature sensor, external	**2** and **3**
Printer or PC (serial interface, RS232)	**4**
Plug-in power supply unit	**5**
Watertight valve for internal pressure equalization	**6**

Warning
Only connect conductivity measuring cells to the measuring instrument that cannot return any voltages or currents that are not allowed (> SELV and > current circuit with current limiting). Nearly all measuring cells - especially WTW measuring cells - fulfill these conditions.

2 Safety

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

Target group

The measuring instrument was developed for work in the field and in the laboratory.
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.

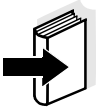
Safety instructions

The individual chapters of this operating manual use safety instructions such as the label shown below to indicate various hazards or dangers:

Warning
indicates instructions that must be followed precisely in order to avoid the possibility of slight injuries or damage to the instrument or the environment.

Further notes

Note
indicates notes that draw your attention to special features.



Note
indicates cross-references to other documents, e.g. operating manuals.

2.1 Authorized use

The authorized use of the measuring instrument consists exclusively of the measurement of conductivity, salinity, temperature and TDS (total dissolved solids) in the field and laboratory.
The technical specifications as given in 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 to be **unauthorized**.

2.2 General safety instructions

This instrument is built and inspected according to the relevant guidelines and norms for electronic measuring instruments (see chapter 7 TECHNICAL DATA).
It left the factory in a safe and secure technical condition.

Function and operating safety

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

The smooth functioning and operational safety of the measuring instrument can only be guaranteed under the environmental conditions that are specified in 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.

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 measuring instrument:

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

If you are in any doubt, please contact the supplier of the instrument.

Obligations of the purchaser

The purchaser of the 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 manufacturers.

3 Commissioning

3.1 Scope of delivery

- Portable measuring instrument, Cond 1970i with integrated rechargeable battery
- Carrying and positioning handle
- Carrying strap
- Sensor quiver
- Plug-in power supply unit
- Operating manual

3.2 Power supply

Mains operation and charging the battery

You can either operate the measuring instrument with the integrated rechargeable battery or with the plug-in power supply. The plug-in power supply supplies the measuring instrument with low voltage (12 V DC). At the same time, the rechargeable battery is charged.

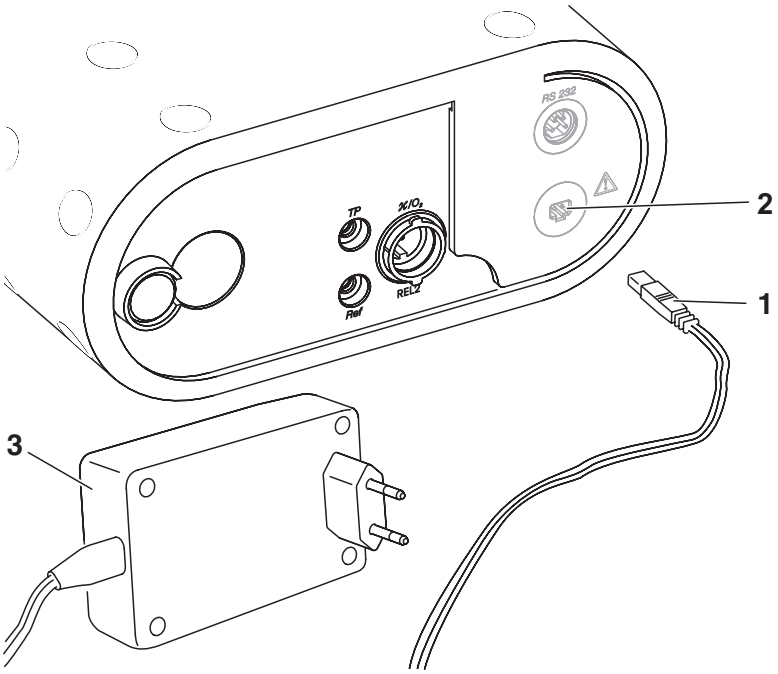
Charging time of the battery

approx. 16 hours. The battery is charged even when the instrument is switched off. The *LoBat* display indicator appears when the battery is nearly empty and has to be charged as soon as possible.

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

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

Connecting the plug-in power supply unit



1	Connect the plug (1) to the socket (2) of the measuring instrument.
2	Connect the original WTW plug-in power supply (3) to an easily accessible mains socket.

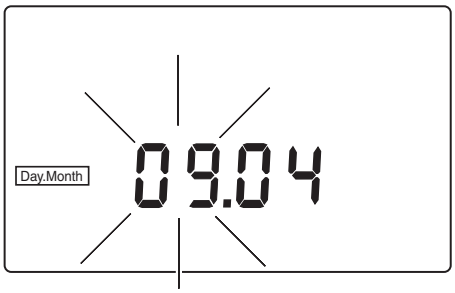
3.3 Initial commissioning

Perform the following activities:

- For mains operation and charging the battery: Connect the plug-in power supply (see section 3.2 POWER SUPPLY).
- Set the date and time.

Setting the date and time

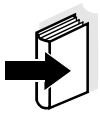
1	Press the **<M>** key and hold it down.
2	Press the **<ON/OFF>** key. The display test appears briefly on the display.
3	Press the **<RUN/ENTER>** key repeatedly until the date flashes on the display (*Day.Month* display indicator).



4	Set the date of the current day with **<▲> <▼>**.
5	Confirm with **<RUN/ENTER>**. The date (month) flashes in the display.
6	Set the current month with **<▲> <▼>**.
7	Confirm with **<RUN/ENTER>**. The year appears on the display.
8	Set the current year with **<▲> <▼>**.
9	Confirm with **<RUN/ENTER>**. The hours flash on the display.
10	Set the current time with **<▲> <▼>**.
11	Confirm with **<RUN/ENTER>**. The minutes flash on the display.
12	Set the current time with **<▲> <▼>**.
13	Confirm with **<RUN/ENTER>**. The instrument switches to the measuring mode.

3.4 Sensor quiver

To store the sensors during field operation and to keep the sensor element moist, the quiver tip contains a sponge rubber insert that can be moistened with deionized water.



Note
For further details on proper storage, refer to the operating manual of the sensor.

Moistening the quiver insert

1	Press the quiver out of the holder from the back side of the instrument and pull it out completely.
2	Pull off the quiver tip and moisten the sponge rubber with deionized water.

4 Operation

4.1 Switching on the measuring instrument

1	Connect a conductivity measuring cell to the measuring instrument.
2	Press the **<ON/OFF>** key. The display test appears briefly on the display. Subsequently, the selected cell constant and the temperature compensation that was set up appear for approx. one second one after the other. The measuring instrument then automatically switches to the measuring mode that was last selected.

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

The energy saving feature is also not active

- if the power is supplied by the plug-in power supply,
- if the communication cable and a PC with a running communication program are connected,
- if the recorder cable is connected,
- if the printer cable is connected (for external printers).

4.2 Measuring

4.2.1 General information

You can measure the following variables:

- Conductivity
- Salinity
- Total dissolved solids (TDS)

The measuring instrument is supplied with the following functions:

- AutoRange (automatic switchover of the measurement range). If a measuring range is exceeded, AutoRange causes the measuring instrument to change automatically to the next higher measuring range and back again. Therefore, the instrument always measures in the measuring range with the highest possible resolution. The function can be switched off.
- The AutoRead function (drift control) for checking the stability of the measurement signal. This ensures the reproducibility of the measuring signal. For details of how to switch the AutoRead function on/off, see page 20.

Preparatory activities

Perform the following preparatory activities when you want to measure:

1	Connect a conductivity measuring cell to the measuring instrument.
2	Calibrate or check the measuring instrument with the measuring cell. How to calibrate is described in section 4.3.
3	Select the measuring mode with **<M>**.

Warning
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 compensation and reference temperature Tref

The calculation of the temperature compensation is based on the preset reference temperature, 20 °C or 25 °C. For more detailed information concerning the temperature compensation, see section 4.4 on page 28.

Measuring the temperature

For the temperature compensation, it is required to measure the temperature of the test sample.
You have the following possibilities of measuring the temperature:

- The temperature sensor integrated in the sensor measures the temperature automatically (example: TetraCon 325).
- Automatic temperature measurement by the external temperature sensor (accessory) NTC30 or Pt1000. This method is required when using conductivity measuring cells without integrated temperature sensor. Connection of the temperature sensor, see section 1.3 SOCKET FIELD.
- You measure and enter the temperature manually.

Note
The instrument automatically recognizes the type of the used temperature sensor (NTC30 or Pt1000). The temperature sensor is shown on the display by *TP*.

If you use a conductivity measuring cell electrode without a temperature sensor, proceed as follows:

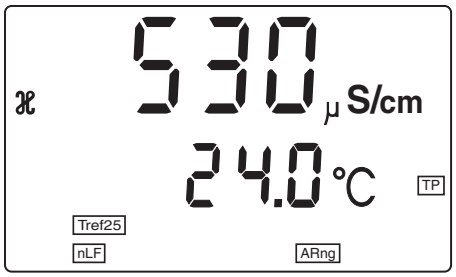
1	Measure the current temperature of the test sample using a thermometer.
2	Enter the temperature on the instrument: Set the temperature value of the test sample using **<▲ > <▼>**.

Note
When determining the cell constant without a temperature sensor, also set the current temperature of the control standard manually using the **<▲ > <▼>** keys.

4.2.2 Conductivity

You can carry out the conductivity measurements as follows:

1	Perform the preparatory activities according to section 4.2.1.
2	Immerse the conductivity measuring cell in the test sample.
3	Press the **<M>** key until κ appears in the status display. Depending on the setting, one of the following display indicators appears on the display:

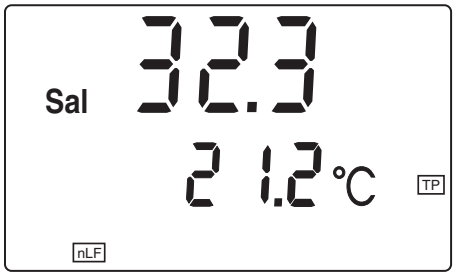


4	Wait for a stable measured value.

4.2.3 Salinity

You can carry out the salinity measurements as follows:

1	Perform the preparatory activities according to section 4.2.1.
2	Immerse the conductivity measuring cell in the test sample.
3	Press the **<M>** key repeatedly until the *Sal* status display appears. The salinity value appears on the display.

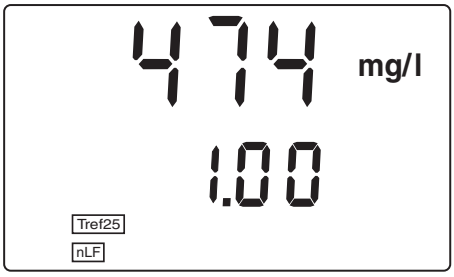


4	Wait for a stable measured value.

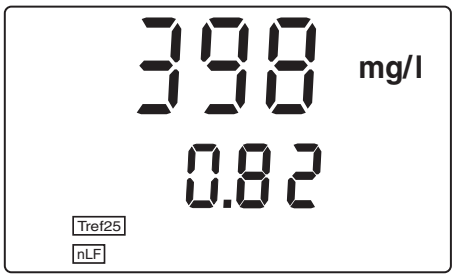
4.2.4 TDS (Total dissolved solids)

You can measure the total dissolved solids as follows:

1	Perform the preparatory activities according to section 4.2.1.
2	Immerse the conductivity measuring cell in the test sample.
3	Press the **<M>** key until the unit mg/l appears. The value of the total dissolved solids appears in the upper display line. The TDS factor appears in the lower display line.



4	Using **<▲> <▼>**, set the TDS factor (0.40 ... 1.00). (The TDS factor has to be determined by a comparative measurement before.)



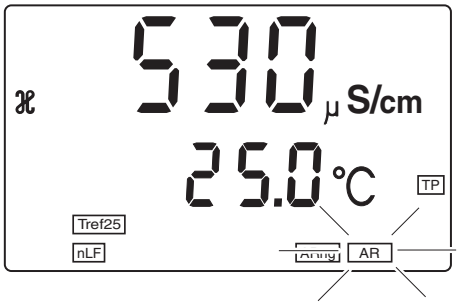
5	Wait for a stable measured value.

4.2.5 AutoRead AR (drift control) and hold function

The AutoRead function (drift control) checks the stability of the measurement signal. The stability has a considerable impact on the reproducibility of the measured values. With the aid of the hold function the measured value display is frozen.

Use the AutoRead function and hold function like this:

1	Select the required measuring mode with **<M>**.
2	Activate the AutoRead function with **<AR>**. The current measured value is frozen (hold function).
3	Start AutoRead with **<RUN/ENTER>**. *AR* flashes until a stable measured value is reached.



4	If necessary, start the next AutoRead measurement with **<RUN/ENTER>**.
5	To terminate AutoRead: Press the **<AR>** key.

Note
The current AutoRead measurement can be terminated at any time (accepting the current value) by pressing **<RUN/ENTER>**.

4.3 Determining/setting up the cell constant [C]

Why determine/set up the cell constant?

Aging slightly changes the characteristics of the cell, e. g. by coatings. As a result, an inexact measured value is displayed. The original characteristics of the cell can often be restored by cleaning the cell. Calibration determines the current cell constant and stores it in the instrument. Thus, you should calibrate at regular intervals (we recommend: every 6 months).

Procedure

The cell constant is determined in the control standard, 0.01 mol/l KCl.

You can determine the actual cell constant of the conductivity measuring cell by calibrating with the control standard in the following ranges:

- 0.450 ... 0.500 cm^{-1}
  (e.g. TetraCon, nominal cell constant 0.475)
- 0.800 ... 1.200 cm^{-1}
  (cells with a cell constant of approx. 1)

Besides, you can set the cell constant manually in the following ranges:

- 0.090 ... 0.110 cm^{-1}
- 0.250 ... 2.500 cm^{-1}

The fixed cell constant, 0.010 cm^{-1} can also be selected. It is not necessary to calibrate or adjust it.

Cell constants outside the above mentioned ranges cannot be calibrated.

Calibration interval

The interval for the determination of the cell constant (Int 3) is set to 180 days in the factory. You can select the interval in the range of 1 ... 999 days.

AutoRead

The calibration procedure automatically activates the *AutoRead* function.

Displaying the adjusted cell constant

Each time the instrument is switched on, the adjusted cell constant and temperature compensation are shown on the display for a short time (see section 4.1 SWITCHING ON THE MEASURING INSTRUMENT). In order to view the data, switch the measuring instrument off and switch it on again.

Printing the calibration protocol

The calibration protocol contains the calibration data of the current calibration. You can transmit the calibration protocol to a printer via the serial interface (see page 39).

Note
You can automatically print a calibration protocol after the calibration. To do so, connect a printer to the interface according to section 4.6.3 before calibrating. After a valid calibration, the record is printed.

Sample printout:

```
CALIBRATION PROTOCOL
 14.04.02      11:37
Device No.: 99990000
Calibration Conductivity
Cal time: 14.04.02 / 11:37
Cal interval:  180d
Cal Std.:   0.01 mol/l KCL
            40.0 °C
Conduct./Tref25: 1413µS/cm
Cell Const :  0.478   1/cm
Probe :     +++
```

Calibration evaluation

After the calibration, the measuring instrument automatically evaluates the current status of the calibration. The evaluation appears on the display.

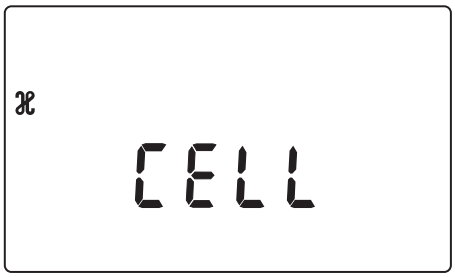
Display	Cell constant [cm^{-1}]
	0.450 ... 0.500 cm^{-1} 0.800 ... 1.200 cm^{-1}
E3 Eliminate the error according to chapter 6 WHAT TO DO IF...	outside the ranges 0.450 ... 0.500 cm^{-1} or 0.800 ... 1.200 cm^{-1}

4.3.1 Determining the cell constant (calibrating)

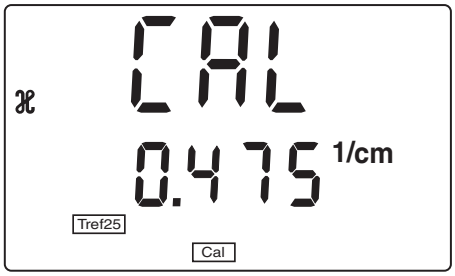
Note
This method of automatically determining the cell constant by calibration with the 0.01 mol/l KCL standard solution can only be used for measuring cells with cell constants in the range 0.450 ... 0.500 cm^{-1} or 0.800 ... 1.200 cm^{-1}.

This is how you can determine the cell constant:

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

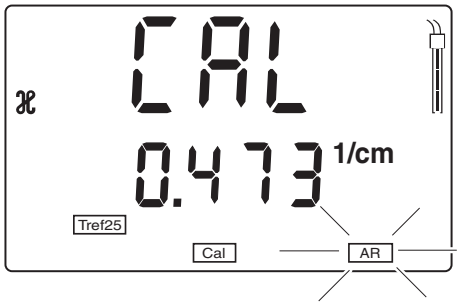


2	Press the **<RUN/ENTER>** key.
3	Press the **<CAL>** repeatedly, until the calibrated cell constant appears on the display: *CAL* appears on the display.



4	The displayed value is the current calibrated cell constant. You can: – accept this setting for measuring with **<M>** or – continue with step 5 and start a new calibration.
5	Immerse the measuring cell in the control standard solution, 0.01 mol/KCl.

6	Press the **<RUN/ENTER>** key. – If no temperature sensor is connected, enter the current temperature of the solution with **<▲> <▼>** and confirm with **<RUN/ENTER>**. – If a temperature sensor is connected, the AR measurement to determine the cell constant starts. The *AR* display indicator flashes until a stable signal is reached. The cell constant determined is displayed. The measuring instrument automatically stores the cell constant.



Note
If the error message E3 appears, refer to chapter 6 WHAT TO DO IF...

4.3.2 Setting the cell constant manually

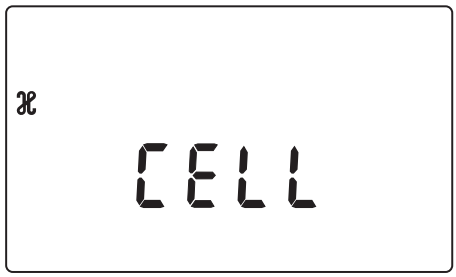
Note
The cell constant to be set must either be taken from the operating manual of the measuring cell or is printed on the measuring cell.

You can set the cell constant manually as follows:

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

You can set the fixed value 0.010 cm^{-1} for the cell constant as follows:

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

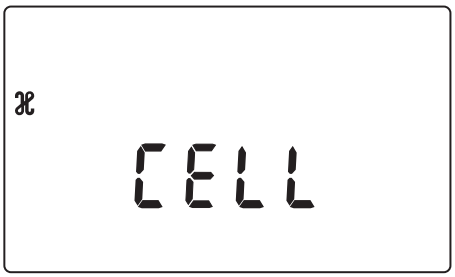


2	Press the **<RUN/ENTER>** key.
3	Press the **<CAL>** key repeatedly until the cell constant 0.010 cm^{-1} appears on the display.

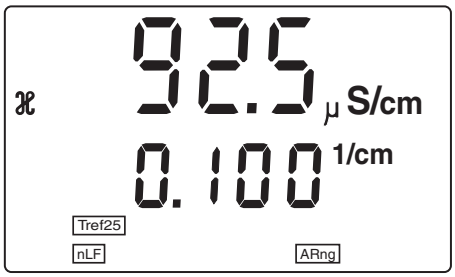
4	To return to the measuring mode: Press the **<M>** key. From now on, the cell constant 0.010 cm^{-1} will be used.

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

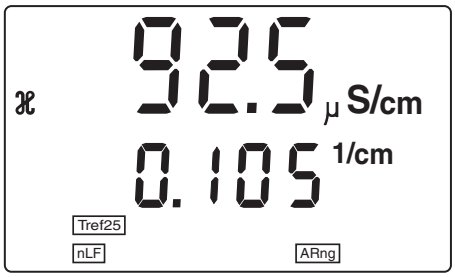
1	Press the **<CAL>** key repeatedly until *CELL* appears on the display.



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 on the display.



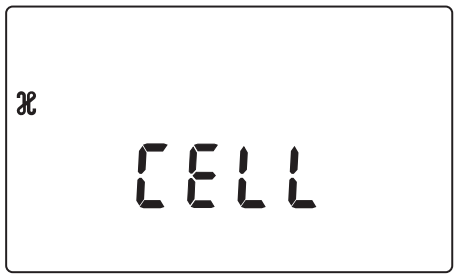
4	Set the cell constant to be used with **<▲> <▼>**, e.g. 0.105 cm^{-1}.



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

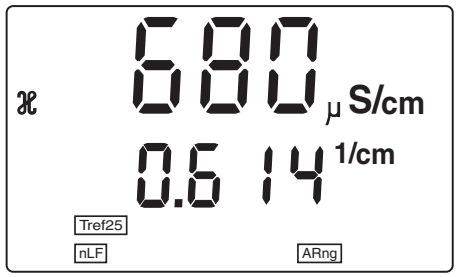
Range
0.250 ... 2.500 cm^{-1}

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 the temperature compensation TC

The calculation of the temperature compensation is based on the preset reference temperature, 20 °C or 25 °C. It appears on the display as *Tref20* or *Tref25*. To switch over the reference temperature, see section 4.7 CONFIGURATION.

You can select one of the following temperature compensation methods:

- **Nonlinear temperature compensation (*nLF*)**
  according to EN 27 888
- **Linear temperature compensation (*Lin*)**
  with selectable coefficients of 0.001 ... 3.000 %/K
- **No temperature compensation (- - - -)**

Adjusted temperature compensation

Each time the instrument is switched on, the adjusted cell constant and temperature compensation are shown on the display for a short time (see section 4.1 SWITCHING ON THE MEASURING INSTRUMENT). In order to view the data, switch the measuring instrument off and switch it on again.

Note
Select the following temperature compensations given in the table according to the respective test sample:

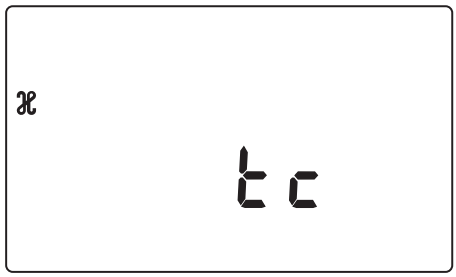
Application tips

Sample	Temperature compensation	Display indicator
Natural water (ground water, surface water and 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*

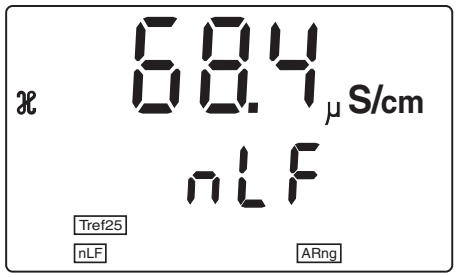
4.4.1 Selecting the nonlinear temperature compensation

You can select the nonlinear temperature compensation as follows:

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



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

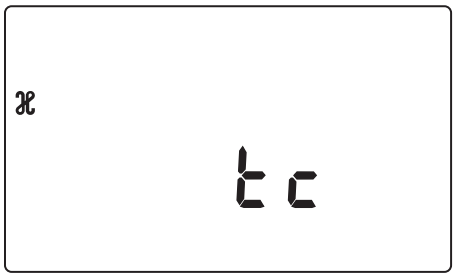


4	To return to the measuring mode: Press the **<M>** key. From now on, nLF will be used for the temperature compensation.

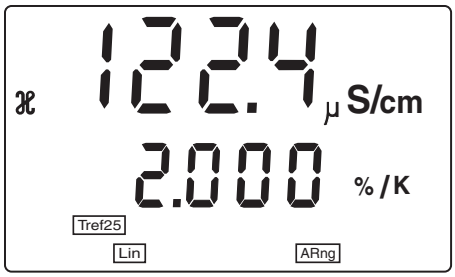
4.4.2 Selecting the linear temperature compensation

You can select the linear temperature compensation as follows:

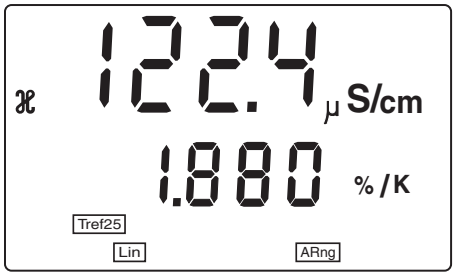
1	Press the **<CAL>** key repeatedly until *tc* appears on the display.



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



4	Set the temperature coefficient with **<▲> <▼>**, e.g. 1.880 %/K.

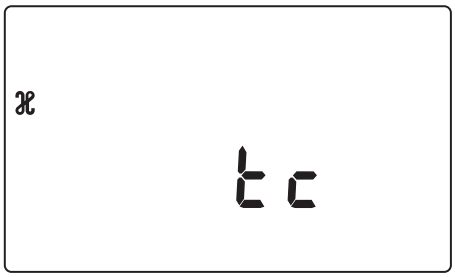


5	To return to the measuring mode: Press the **<M>** key. From now on, the adjusted linear temperature coefficient will be used for the temperature compensation.

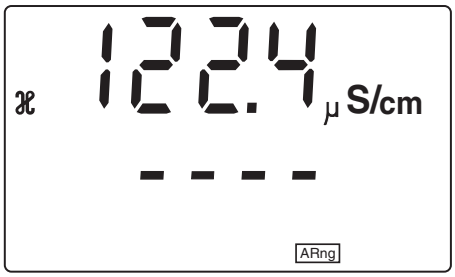
4.4.3 Switching the temperature compensation off

You can switch off the temperature compensation as follows:

1	Press the **<CAL>** key repeatedly until *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 is switched off.
5	To return to the measuring mode: Press the **<M>** key. From now on, the instrument will measure without temperature compensation.

4.5 Saving

The measuring instrument has an internal data memory. It can store up to 500 datasets.
A complete data record consists of:

- Storage location
- Date/time
- Measured value
- Temperature
- Temperature measuring procedure
- ID number

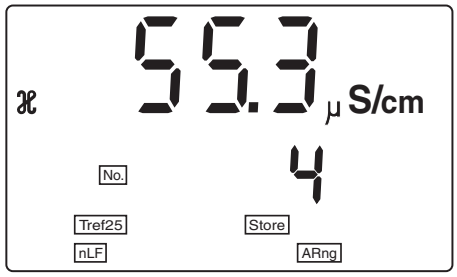
You can transmit measured values (data records) to the data storage in two ways:

- Save manually
- Switch on AutoStore (Int 1).

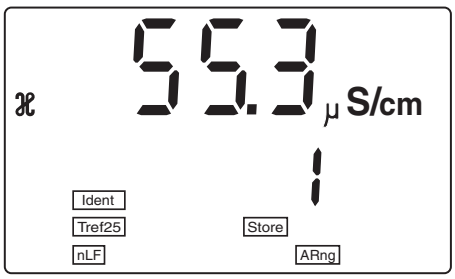
4.5.1 Saving manually

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

1	Press the **<STO>** key. The current number (location number *No.*) of the next free storage location appears under the current measured value on the display.



2	Confirm with **<RUN/ENTER>**. The display switches to entering the ID number.



3	Using **<▲> <▼>**, enter the required ID number (1 ... 999).
4	Confirm with **<RUN/ENTER>**. The instrument changes to the measuring mode.

Message StoFul

This message appears when all of the 500 storage locations are occupied.

You have the following options:

Saving the current measured value. The oldest measured value (storage location 1) will be overwritten by this	Press **<RUN/ENTER>**
Returning to the measuring mode without saving	press any key
Outputting the data storage	see section 4.5.3
Clearing the memory	see section 4.5.4

4.5.2 Saving automatically

The save interval (Int 1) determines the chronological interval between automatic save processes.
After the fixed interval has expired, the current data record is transmitted to the storage and to the interface.

Setting the save interval:

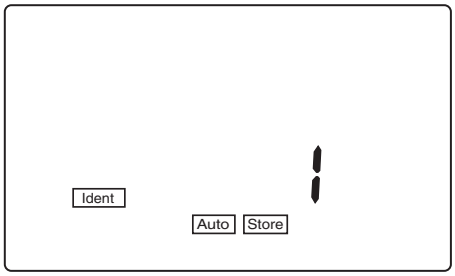
The default setting for the save interval (Int 1) is OFF.
By this, the AutoStore function is switched off.
To switch the function on, set an interval (5 s, 10 s, 30 s, 1 min, 5 min, 10 min, 15 min, 30 min, 60 min):

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

3	Set the required interval between the saving procedures with **<▲> <▼>**.
4	Confirm with **<RUN/ENTER>**. The number of free memory locations appears on the display.

5	As soon as all of the 500 storage locations are occupied, *AutoStore* is terminated (Int 1 = OFF). If there are not enough storage locations available for your measurements: – Output and backup the data storage (see page 36) and – clear the memory (see page 40).

6	Confirm with **<RUN/ENTER>**. The prompt for the ID number appears on the display.



7	Set the required ID number with **<▲> <▼>**.
8	Confirm with **<RUN/ENTER>**. The instrument switches to the measuring mode and starts the measuring and saving process. *AutoStore* flashes on the display.

Note
The AutoStore function is interrupted if you start other functions, e.g. output the data storage.
After the function is finished, the AutoStore function is continued. By this, however, temporal gaps in the recording of the measured values will occur.

Switching off AutoStore

Switch AutoStore off by:

- setting the save interval (Int 1) to OFF, or
- switching the measuring instrument off and then on again.

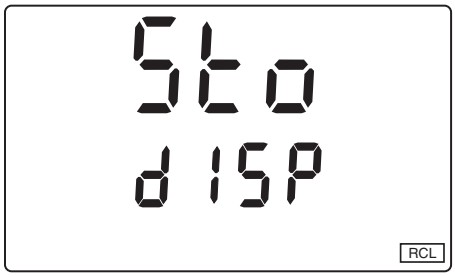
4.5.3 Outputting the data storage

You can output the contents of the data storage:

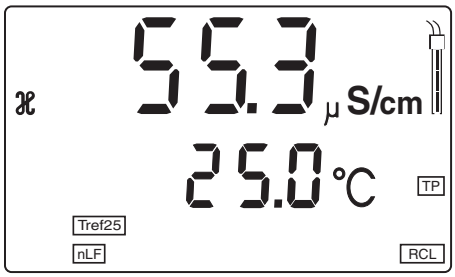
- Stored data on the display
- Calibration data on the display
- Stored data on the serial interface
- Calibration protocol on the interface

Outputting stored data on 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 storage location of the data record is displayed for approx. 2 s, then the respective temperature appears.



You can perform the following activities:

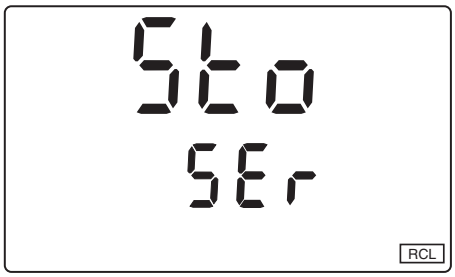
Display further elements of the data record (ID number, date, time, storage location)	Press **<RUN/ENTER>**
Advance one data record (storage location)	Press **<▲>**
Go back one data record (storage location)	Press **<▼>**

Note
If you want to search for a certain element (e.g. date), proceed as follows:

1	Using **<RUN/ENTER>**, select the element (e.g. date).
2	Press **<▲>** or **<▼>** repeatedly until the required date appears on the display. After approx. 2 s the temperature of the displayed measured value appears.

Outputting stored data to the interface

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



2	Press the **<RUN/ENTER>** key. The complete storage content is transmitted to the interface; during the data transmission the numbers of the currently transmitted storage locations run through. After the data transmission, the measuring instrument automatically switches to the measuring mode.

Note
You can cancel the transmission with **<M>** or **<RUN/ENTER>**.

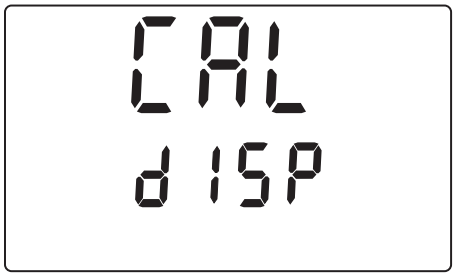
After the instrument number, the printout contains the complete storage contents in ascending order of the storage location numbers.

Sample printout:

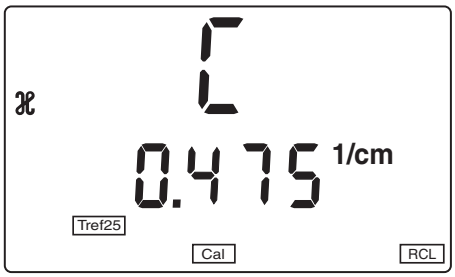
```
Device No.: 99990000

No.    1:
 01.01.02       00:04
  2.40 mS/cm     25   °C
Tman
nLF
Tref25  C = 0.475 1/cm
Ident : 1

No.    2:
 10.01.02       10:09
  2.40 mS/cm     25.3 °C
Tauto
nLF
Tref25  C = 0.475 1/cm
Ident : 1

No.    3:
 12.01.02       01:48
  2.40 mS/cm     21.6 °C
Tauto
nLF
Tref25  C = 0.475 1/cm
Ident : 1
...
```

Outputting the calibration data on the display

1	Press the **<RCL>** key repeatedly until *CAL dISP* appears on the display.



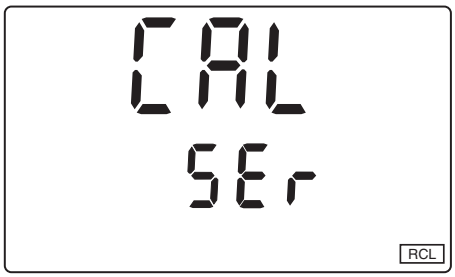
2	Press the **<RUN/ENTER>** key. The cell constant appears on the display, but the *CAL* display only appears when the displayed value was determined by calibrating the measuring cell.



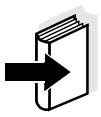
3	Using **<M>** or **<RUN/ENTER>,** you can switch back to the measuring mode.

Outputting the calibration protocol on the interface

1	Press the **<RCL>** key repeatedly until *CAL SEr* appears on the display.



2	Press the **<RUN/ENTER>** key. The calibration protocol is transmitted to the interface. After the data transmission, the measuring instrument automatically switches to the measuring mode.



Note
You will find a sample calibration protocol in PRINTING THE CALIBRATION PROTOCOL, page 22.

4.5.4 Clearing the memory

With this function, you can delete the stored data records. 500 storage locations will then be available again.

Note
The *Clear memory* function only appears when there are data records stored in the memory. Otherwise, the measuring instrument automatically switches to the measuring mode.

Proceed as follows to clear all data records:

1	Switch off the measuring instrument.
2	Press the **<STO>** key and hold it down.
3	Press the **<ON/OFF>** key. The display test appears briefly on the display. Subsequently, *Sto CLr* appears.

4	Confirm the clearing process with **<RUN/ENTER>**. Pressing any other key prevents the clearing, the data records will remain stored.

Note
The calibration data remain stored and can be called up.

4.6 Transmitting data

You have the following possibilities of transmitting data:

- One of the following options:
  - With the *AutoStore* function (page 34), measured values are periodically saved internally (save interval Int 1) and output on the interface.
  - With the *Data transmission interval* function (Int 2), measured values are periodically output on the interface (see below).
- With the *Output data storage* function (page 36), calibration data or saved measured values are output on the interface.
- Via the analog recorder output (page 43), measured values are output as voltage values.
- With the KOM pilot communication kit (accessory), data can be transmitted bidirectionally (page 45).

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

4.6.1 Data transmission interval (Int 2)

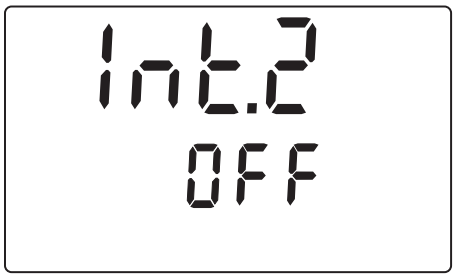
The interval for the data transmission (Int 2) determines the chronological interval between automatic data transmissions. After the selected interval expires, the current data record is transmitted to the interface.

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

Setting the Data transmission interval

The default setting for the interval is OFF.
To start the data transmission, set an interval (5 s, 10 s, 30 s, 1 min, 5 min, 10 min, 15 min, 30 min, 60 min):

1	Press the **<RUN/ENTER>** key and hold it down.
2	Press the **<RCL>** key. *Int 2* appears on the display.

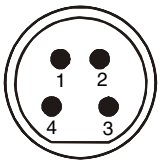


3	Set the required interval between the saving procedures with **<▲> <▼>**.
4	Confirm with **<RUN/ENTER>**. The measuring instrument automatically switches to the measuring mode.

4.6.2 Recorder (analog output)

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

Socket assignment



RS 232
REC

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

Note
The analog output is activated automatically in the cable by connecting 2 and 3.

The output on the analog output corresponds to the value shown on the display.

Signal range

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

Conductivity

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)

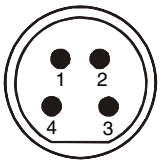
Via the RS 232 interface, you can transmit the data to a PC or an external printer.
Use the AK340/B (PC) or AK325/S (ext. printer) cable to connect the interface to the devices.
The data output automatically switches to the RS*232* interface.

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

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

Baud rate	selectable between: 1200, 2400, **4800**, 9600
Handshake	RTS/CTS + Xon/Xoff
Parity	none
Data bits	8
Stop bits	1

Socket assignment



RS 232
REC

1 CTS
2 RxD
3 Ground
4 TxD

4.6.4 Remote control

The measuring instrument can be remotely controlled from a PC. This requires the KOM pilot communication kit. It is available as an accessory.
The instrument is then controlled via commands that simulate keystrokes and request the current display contents.

Note
A more detailed description is provided within the scope of delivery of the communication kit.

4.7 Configuration

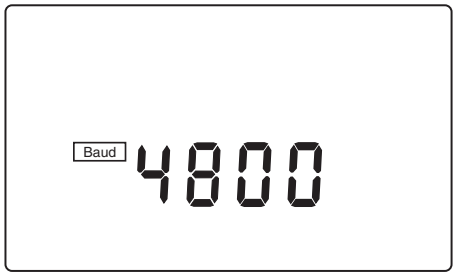
You can adapt the measuring instrument to your individual requirements. To do this, the following parameters can be changed (the status on delivery is marked in bold):

Baud rate	1200, 2400, **4800**, 9600
Calibration interval (Int 3)	1 ... **180** ... 999 d
AutoRange ARng	**On** or off
Reference temperature	– **25 °C (TREF25)** – 20 °C (TREF20)
Date/time	Any

Note
You can leave the configuration menu at any time with **<M>** . The parameters that have already been changed are stored.

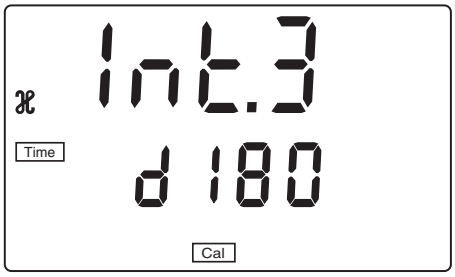
1	Switch off the measuring instrument.
2	Press the **<M>** key and hold it down.
3	Press the **<ON/OFF>** key. The display test appears briefly on the display. The measuring instrument then switches automatically to the setting of the baud rate.

Baud rate



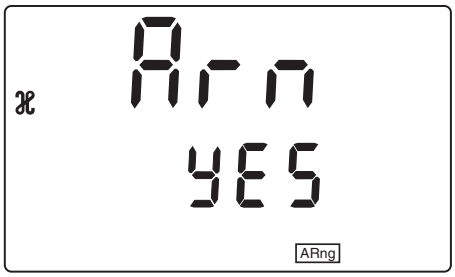
4	Select the required baud rate with **<▲> <▼>**.
5	Confirm with **<RUN/ENTER>**. *Int 3* appears on the display.

Calibration interval



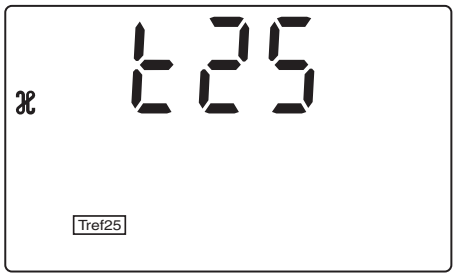
6	Set the required interval in days (d) with **<▲> <▼>**.
7	Confirm with **<RUN/ENTER>**. ARng appears on the display.

AutoRange automatic selection of the measurement range



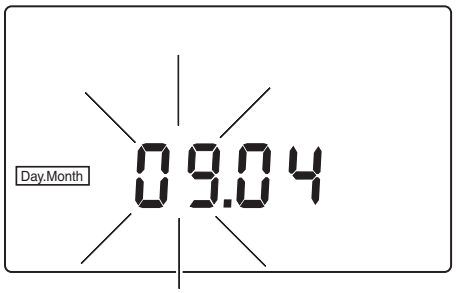
8	Using **<▲> <▼>**, switch between *no* and *YES*. *YES*: Switch on AutoRange. *no*: Switch off AutoRange.
9	Confirm with **<RUN/ENTER>**. The adjusted reference temperature appears on the display.

Switching over the reference temperature



10	Using **<▲> <▼>**, toggle between 25 °C *(Tref25)* and 20 °C *(Tref20)*.
11	Confirm with **<RUN/ENTER>**. The date (day) flashes in the display.

Date and time



12	Set the date of the current day with **<▲> <▼>**.
13	Confirm with **<RUN/ENTER>**. The date (month) flashes in the display.
14	Set the current month with **<▲> <▼>**.
15	Confirm with **<RUN/ENTER>**. The year appears on the display.
16	Set the current year with **<▲> <▼>**.
17	Confirm with **<RUN/ENTER>**. The hours flash on the display.
18	Set the current time with **<▲> <▼>**.
19	Confirm with **<RUN/ENTER>**. The minutes flash on the display.
20	Set the current time with **<▲> <▼>**.
21	Confirm with **<RUN/ENTER>**. The measuring instrument automatically switches to the measuring mode.

4.8 Reset

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

Measurement parameters

The following measured parameters (ℜ InI) are reset to the default condition:

Measuring mode	ℜ
Cell constant	0.475 cm^{-1} (calibrated) 0.475 cm^{-1} (set up)
Temperature compensation	nLF
Reference temperature	25 °C (TREF25)
Temperature coefficient of the linear temperature compensation	2.000 %/K
TDS factor	1.00

Note
The calibration data gets lost when the measuring parameters are reset. Recalibrate after performing a reset.

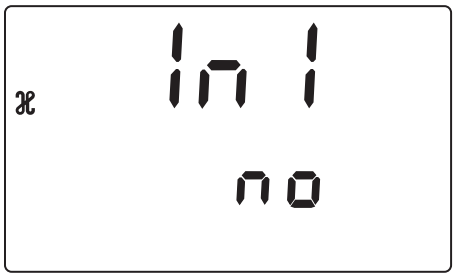
Configuration parameters

The following configuration parameters (*Inl*) are reset to the delivery status:

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

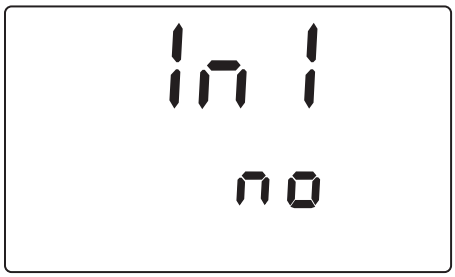
Resetting the measuring parameters

1	Press the **<RUN/ENTER>** key and hold it down.
2	Press the **<CAL>** key.



3	Using **<▲> <▼>**, switch between *no* and *YES*. *YES*: Resetting the measuring parameters *no*: Retaining settings.
4	Confirm with **<RUN/ENTER>**. The measuring instrument switches to the configuration parameters.

Resetting the configuration parameters



5	Using **<▲> <▼>**, switch between *no* and *YES*. *YES*: Resetting the configuration parameters *no*: Retaining settings.
6	Confirm with **<RUN/ENTER>**. The measuring instrument automatically switches to the measuring mode.

5 Maintenance, cleaning, disposal

5.1 Maintenance

The measuring instrument is maintenance-free.

5.2 Cleaning

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

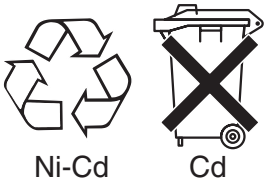
Warning
The housing components are made out of synthetic materials (polyurethane, ABS and PMMA). Thus, avoid contact with acetone and similar detergents that contain solvents. Remove any splashes immediately.

5.3 Disposal

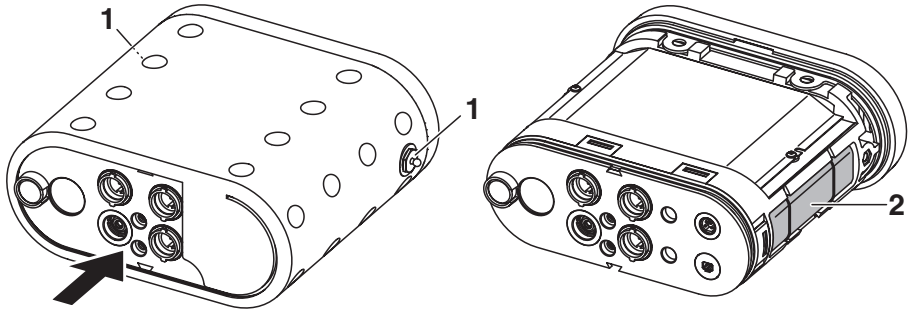
Packing

This measuring instrument is sent out in a protective transport packing. We recommend: Keep the packing material. The original packing protects the measuring instrument from transport damages.

Rechargeable battery



Remove the rechargeable battery from the instrument and dispose of it at a suitable facility according to local legal requirements. It is illegal to dispose of the rechargeable battery with household refuse. Proceed as follows to disassemble the rechargeable battery:



1	Remove the carrying and positioning handle or the carrying strap.
2	Unscrew the fixing elements (1) using a hexagon key.
3	Remove the instrument from the enclosure by vigorously pressing against the socket field.
4	Take out the rechargeable battery (2) and cut off the battery cable.

Measuring instrument, Dispose of the measuring instrument without the rechargeable battery as electronic waste at an appropriate collection point.

6 What to do if...

Display LoBat

Cause	Remedy
– Battery almost empty	– Charge the battery (see section 3.2)

Instrument does not react to keystroke

Cause	Remedy
– Operating condition undefined or EMC load unallowed	– Processor reset: Press the **<RCL>** and **<ON/OFF>** keys at the same time and release them again. The software version is displayed.

Error message OFL

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

Error message E3

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

Display to

Cause	Remedy
– Time-out of the interface	– Check the instrument connected

Sensor symbol flashes

Cause	Remedy
– Calibration interval expired	– Recalibrate the measuring system

Message StoFul

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

You want to know which software version is in the instrument

Cause	Remedy
– E. g., a question by the WTW service department	– Simultaneously press the **<CAL>** and **<ON/OFF>** keys and release them again. The software version is displayed.

7 Technical data

7.1 General data

Test certificates cETLus, CE

Dimensions approx. 90 x 200 x 190 mm

Weight approx. 1.5 kg (without plug-in power supply)

Mechanical structure Type of protection: IP 67

Electrical safety Protective class: III

Ambient conditions

Operation	-10 °C ... + 55 °C
Storage	- 25 °C ... + 65 °C
Climatic class	2

Power supply

Rechargeable battery	Nickel-cadmium (NiCad) rechargeable battery
Operational life	approx. 600 hours with one charging
Plug-in power supply unit (charging device)	The following applies to all plug-in power supplies: Connection max. Overvoltage category II Plug-in power supply unit (Euro, US , UK, Australian plug) FRIWO FW7555M/09, 15.1432 Friwo Part. No. 1883259 Input: 100 ... 240 V ~ / 50 ... 60 Hz / 400 mA Output: 9 V = / 1,5 A

Serial interface

Automatic switchover when a PC or a printer is connected via the cable, AK 340/B or AK 325/S.

Type	RS232, data output
Baud rate	Can be set to 1200, 2400, 4800, 9600 Baud
Data bits	8
Stop bits	2
Parity	None
Handshake	RTS/CTS + Xon/Xoff
Cable length	Max. 15m

Analog output (AK 323/ S cable)

Automatic switchover when the recorder is connected by the cable, AK 323/S.

pH output signal	-200 ... +1999 mV for the range - 2.00 ... + 19.99
mV output signal	-1999 ... +1999 mV for the range -1999 ... +1999 mV for the range
Accuracy	± 0.5 % of display value
Internal resistance	< 5 Ohm (current limited to max. 0.2 mA output current)

Output signal	0 ... 1.999 V for range 0 ... 1999 digits
Accuracy	± 0.5 % of display value
Internal resistance	< 5 Ohm (current limited to max. 0.2 mA output current)

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 EN 61010-1 A2:1995

Climatic class	VDI/VDE 3540
IP protection	EN 60529:1991

7.2 Measuring ranges, resolutions, accuracies

Measuring ranges and resolutions

Variable	Measuring range	Resolution
ϰ [µS/cm]	0.000 ... 1.999 * 0.00 ... 19.99 ** 0.0 ... 199.9 0 ... 1999	0.001 0.01 0.1 1
ϰ [mS/cm]	0.00 ... 19.99 0.0 ... 199.9 0 ... 500	0.01 0.1 1
SAL	0.0 ... 70.0 according to the IOT table	0.1
TDS [mg/l]	0 ... 1999 Factor can be set between 0.40 ... 1.00	1
T [°C]	– 5.0 ... + 105.0	0.1

** only possible with cells of the cell constant 0.010 cm^{-1}*
*** only possible with cells of the cell constant 0.010 cm^{-1}* or *0.100 cm^{-1}*

Manual temperature input

Variable	Range	Increment
T_{manual} [°C]	- 20 ... + 130	1

Cell constants

Cell constant C	Values
Can be calibrated in the ranges	0.450 ... 0.500 cm^{-1} 0.800 ... 1.200 cm^{-1}
adjustable	0.010 cm^{-1} (fixed) 0.090 ... 0.110 cm^{-1} 0.250 ... 2.500 cm^{-1}

Reference temperature

Reference temperature	Values
adjustable	20 °C (TREF20) 25 °C (TREF25)

Accuracy (± 1 digit)

Variable	Accuracy	at test sample temperature
κ, temperature compensation (TC)		
none	± 0.5 %	
Nonlinear	± 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	± 0.5 %	+ 10 °C ... + 75 °C
***SAL** / Range*		
0.0 ... 42.0	± 0.1	+ 5 °C ... + 25 °C
	± 0.2	+ 25 °C ... + 30 °C
TDS [mg/l]		
	± 1	
***T [°C]** / Temperature sensor*		
NTC 30	± 0.1	0 °C ... + 55 °C
PT 1000	± 0.5 ± 0.1 ± 0.5	0 °C ... + 15 °C + 15 °C ... + 35 °C + 35 °C ... + 55 °C

8 Lists

This chapter provides additional information and orientation aids.

Abbreviations The list of abbreviations explains the indicators and the abbreviations that appear on the display and in the manual.

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 to find the topics that you are looking for.

Abbreviations

$\mathcal{X}$	Conductivity value (international γ)
AR	AutoRead (drift control)
ARng	Automatic range switching Measuring instrument measures with highest resolution
C	Cell constant [cm^{-1}] (internat. k)
°C	Temperature unit, degrees Celsius
Cal	Calibration
InI	Initialization Resets individual basic functions to the status they had on delivery
Lin	Linear temperature compensation
LoBat	Battery almost empty (Low Battery)
nLF	Nonlinear temperature compensation
OFL	Display range exceeded (Overflow)
SELV	Safety Extra Low Voltage
TC	Temperature coefficient (internat. α)
TDS	Total Dissolved Solids
TP	Temperature measurement active (Temperature Probe)
T_{Ref} 20/T20	Reference temperature of 20 °C
T_{Ref} 25/T25	Reference temperature of 25 °C

Glossary

Adjusting To manipulate a measuring system so that the relevant value (e. g. the displayed value) differs as little as possible from the correct value or a value that is regarded as correct, or that the difference remains within the tolerance.

AutoRange Name of the automatic selection of the measuring range.

AutoRead WTW name for a function to check the stability of the measured value.

Calibration Comparing the value from a measuring system (e. g. the displayed value) to the correct value or a value that is regarded as correct. Often, this expression is also used when the measuring system is adjusted at the same time (see adjusting).

Cell constant, k Characteristic quantity of a conductivity measuring cell, depending on the geometry.

Conductivity Short form of the expression, specific electrical conductivity. It is a measured value of the ability of a substance to conduct an electric current. In water analysis, the electrical conductivity is a dimension for the ionized substances in a solution.

Conductometry Name of the conductivity measuring technique.

Measured parameter The measured parameter is the physical dimension determined by measuring, e. g. pH, conductivity or D. O. concentration.

Measured value The measured value is the special value of a measured parameter to be determined. It is given as a combination of the numerical value and unit (e. g. 3 m; 0.5 s; 5.2 A; 373.15 K).

Measuring system The measuring system comprises all the devices used for measuring, e. g. measuring instrument and sensor. In addition, there is the cable and possibly an amplifier, terminal strip and armature.

Molality Molality is the quantity (in Mol) of a dissolved substance in 1000 g solvent.

Reference temperature Fixed temperature value to compare temperature-dependent measured values. For conductivity measurements, the measured value is converted to a conductivity value at a reference temperature of 20 °C or 25 °C.

Reset Restoring the original condition of all settings of a measuring system.

Resistance Short name for the specific electrolytic resistance. It corresponds to the reciprocal value of the electrical conductivity.

Resolution Smallest difference between two measured values that can be displayed by a measuring instrument.

Salinity	The absolute salinity S_A of seawater corresponds to the relationship of the mass of dissolved salts to the mass of the solution (in g/Kg). In practice, this dimension cannot be measured directly. Therefore, the practical salinity is used for oceanographic monitoring. It is determined by measuring the electrical conductivity.
Salt content	General designation for the quantity of salt dissolved in water.
Sample	Designation of the sample ready to be measured. Normally, a test sample is made by processing the original sample. The test sample and original sample are identical if the test sample was not processed.
Slope	The slope of a linear calibration function.
Standard solution	The standard solution is a solution where the measured value is known by definition. It is used to calibrate a measuring system.
TDS	Total dissolved solids
TDS factor	In conductometric measurements, the measuring instrument calculates the total dissolved solids (TDS) from the electric conductivity of the test sample. For the calculation, a simple multiplication factor between 0.4 and 1.0 suffices. The exact factor depends on the quality of the water to be examined and has to be determined for each water type.
Temperature coefficient	Value of the slope of a linear temperature function.
Temperature compensation	Name of a function that considers the temperature influence on the measurement and converts it accordingly. Depending on the measured parameter to be determined, the temperature compensation functions in different ways. For conductimetric measurements, the measured value is converted to a defined reference temperature. For potentiometric measurements, the slope value is adjusted to the temperature of the test sample but the measured value is not converted.
Temperature function	Name of a mathematical function expressing the temperature behavior of a test sample, a sensor or part of a sensor.

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