

SCHOTT®
Instruments

Lab 970



**Laboratory conductivity meter
with automatic sensor recognition**

Accuracy when going to press

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

Warranty

We guarantee the instrument described for 3 years from the date of purchase.

The instrument warranty covers manufacturing faults that are discovered within the warranty period.

The warranty does not cover components that are replaced during maintenance work, e. g. batteries.

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.

**CE conformity
Radio data transmission**

SI Analytics GmbH hereby declares that the Lab 970 meter is in compliance with the essential requirements and the other relevant provisions of Directive 1999/5/EC.

The EC declaration of conformity can be requested from SI Analytics GmbH.

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**KONFORMITÄTSERKLÄRUNG
DECLARATION OF CONFORMITY
DÉCLARATION DE CONFORMITÉ**

Wir erklären in alleiniger
Verantwortung, dass das
Produkt

We declare under our sole
responsibility that the
product

Nous déclarons sous notre
seule responsabilité que le
produit

**Konduktometer
Lab 970**

auf das sich diese Erklärung
bezieht, übereinstimmt mit
den Angaben im Kapitel

**Conductivity meter
Lab 970**

to which this declaration
relates is in conformity with
the specifications in the
chapter

**Conductimètre
Lab 970**

auquel se réfère cette
déclaration est conforme aux
indications du chapitre

**Technische Daten
Konduktometer Lab 970
30. Oktober 2009**

**SI Analytics GmbH
Hattenbergstr. 10
D-55122 Mainz
Deutschland, Germany, Allemagne**

30. Oktober, October 30, 30 octobre 2005
AGQSF 0000-A104-01/091030

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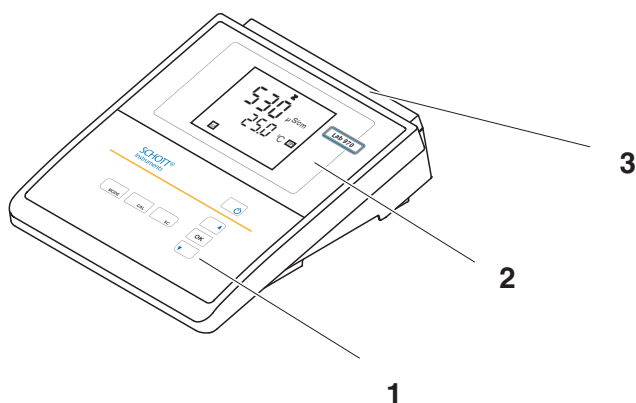
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1 Overview

The Lab 970 compact precision conductivity meter enables you to perform conductivity measurements quickly and reliably. The Lab 970 provides the maximum degree of operating comfort, reliability and measuring certainty for all applications.

The proven procedures for determining or adjusting the cell constant support your work with the conductivity meter.



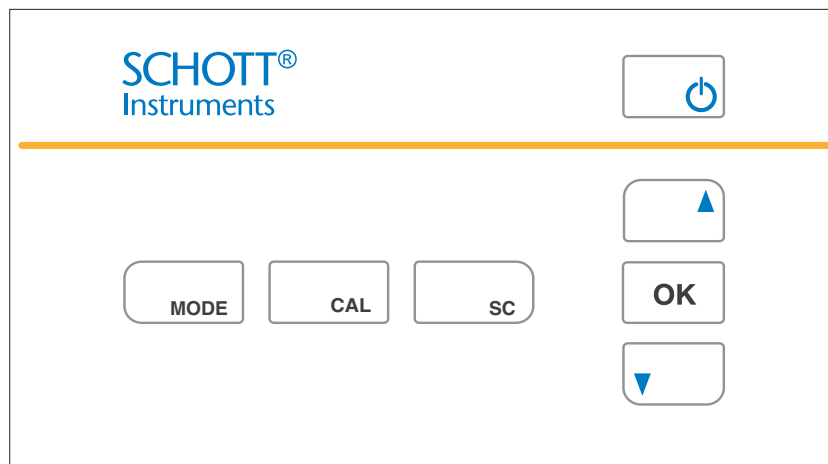
1	Keypad
2	Display
3	Socket field










Note

The meter is also available as part of an individual Set of equipment. You will find information on this and other accessories in the SI Analytics GmbH laboratory catalog or via the Internet.

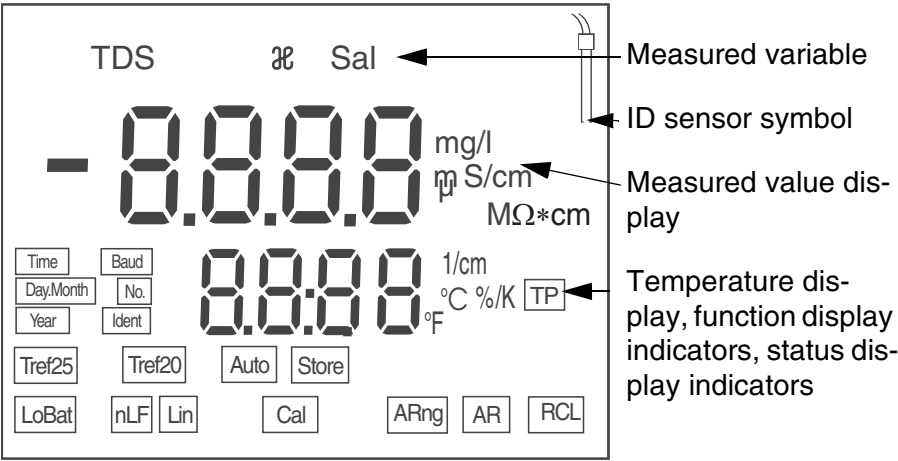
1.1 Keypad



In this operating manual, keys are indicated by brackets <...> . The key symbol (e.g. <OK>) generally indicates a short keystroke (under 2 sec) in this operating manual. A long keystroke (approx. 2 sec) is indicated by the underscore behind the key symbol (e.g. <OK__>).

	<On/Off>: Switch the meter on/off <On/Off__>: Resetting the determined cell constant
	<MODE>: Select measured parameter <MODE__>: Open setting menu for calibration and measurement
	<CAL>: Call up calibration procedure <CAL__>: Call up calibration data
	<SC>: Activate / deactivate stability control <SC__>: Set the interval for data transmission
	<▲>: Increment values, scroll
	<▼>: Decrement values, scroll
	<OK>: Confirm entries <OK__>: Open setting menu for system settings

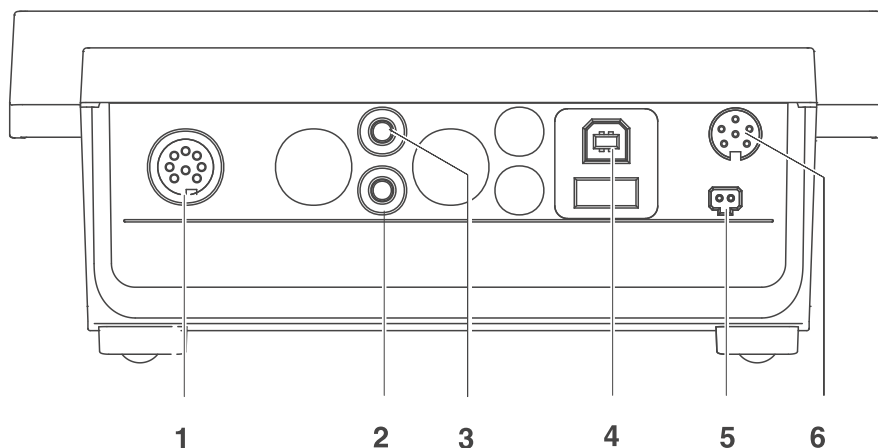
1.2 Display



Temperature display,
function display
indicators, status
display indicators

[AR]	Stability control is active
[ARng]	Automatic range switch-over: meter measures with highest possible resolution
[Cal]	Calibration
[Lin]	Linear temperature compensation
[LoBat]	With battery operation: Batteries almost empty
[nLF]	Nonlinear temperature compensation
[TP]	Temperature measurement active
[Tref20]	Reference temperature 20 °C
[Tref25]	Reference temperature of 25 °C

1.3 Socket field



Connectors:

1	Conductivity measuring cell
2	Temperature sensor
3	
4	USB interface
5	Power pack
6	RS 232 interface



CAUTION

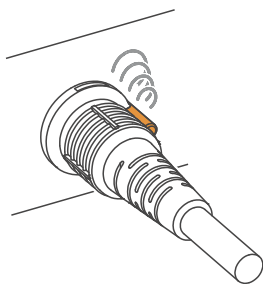
Only connect sensors to the meter that cannot return any voltages or currents that are not allowed ($> \text{SELV}$ and $> \text{current circuit with current limiting}$).

Almost all measuring cells - in particular SI Analytics GmbH measuring cells - fulfill these conditions.

1.4 Automatic sensor recognition

The automatic sensor recognition function enables

- operation of a sensor with different meters without recalibration
- operation of different sensors with a meter without recalibration
- to assign measurement data to a sensor
 - measurement datasets are always downloaded to the interface along with the sensor type and sensor series number
- to assign calibration data to a sensor
 - calibration data is always downloaded to the interface along with the sensor type and sensor series number
- automatic activation of cell constants with conductivity sensors



To be able to use the automatic sensor recognition function, you need a meter that supports the automatic sensor recognition (e.g. Lab 970) and a sensor (ID sensor) that is suitable for sensor recognition.

In ID sensors, sensor data is stored that clearly identifies the sensor. The sensor data is automatically transmitted to the meter by radio and used for sensor identification there.

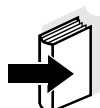


Note

You can also operate non-ID sensors with the Lab 970 meter. In this case, however, you will not be able to use the advantages of the sensor recognition function.

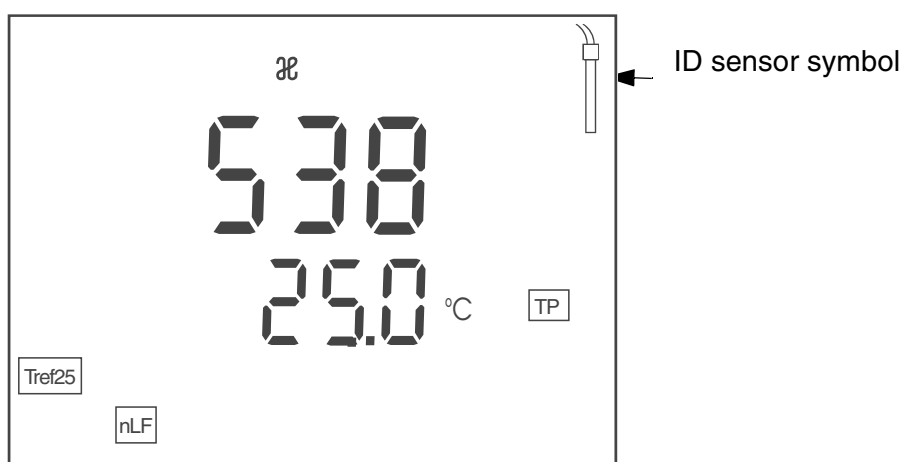
ID sensors

SI Analytics GmbH ID sensors support the automatic sensor recognition. "ID" is added to the designation of these sensors, e.g. electrode LF913T ID.

**Note**

Information on available ID sensors is given on the Internet or directly by SI Analytics.

ID sensors connected to the Lab 970 meter are identified by the ID sensor symbol on the display of the meter.

**Sensor data from ID sensors**

ID sensors transmit the following sensor data

- Sensor type
- Sensor series number
- Calibration data
 - Calibration date
 - Calibration characteristics
 - Calibration interval

The calibration data is updated in the ID sensor after each calibration procedure. The ID sensor symbol flashes while this is being done.

**Note**

The sensor must not be disconnected while the ID sensor symbol is flashing, as otherwise the calibration data will not be completely transmitted. The sensor will then have no valid calibration.

**Note**

If non-ID sensors are used, the calibration data is read out by the meter and stored in the meter.

2 Safety

This operating manual contains basic instructions that you must follow during the commissioning, operation and maintenance of the meter. Consequently, all responsible personnel must read this operating manual before working with the meter.

The operating manual must always be available within the vicinity of the instrument.

Target group

The meter was developed for work 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.

Safety instructions

Safety instructions in this operating manual are indicated by the warning symbol (triangle) in the left column. The signal word (e.g. "Caution") indicates the level of danger:



WARNING

indicates instructions that must be followed precisely in order to avoid possibly great dangers to personnel.



CAUTION

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

Authorized use of the meter consists exclusively of the measurement of conductivity, temperature, salinity and TDS (total dissolved solids) in a laboratory.

The technical specifications as given in chapter 7 TECHNICAL DATA (page 57) must be observed. Only the operation and running of the meter 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 IEC 1010 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 meter 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 meter can only be guaranteed under the environmental conditions that are specified in chapter 7 TECHNICAL DATA (page 57).

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 meter is only allowed to be opened by personnel authorized by SI Analytics GmbH.

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 meter:

- 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 meter.

Obligations of the purchaser

The purchaser of this meter 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

- Lab 970 laboratory meter
- Power pack
- 4 batteries 1.5 V Mignon type AA
- Z875 USB cable with A plug on B plug
- Transparent cover
- Operating manual
- CD-ROM with USB driver

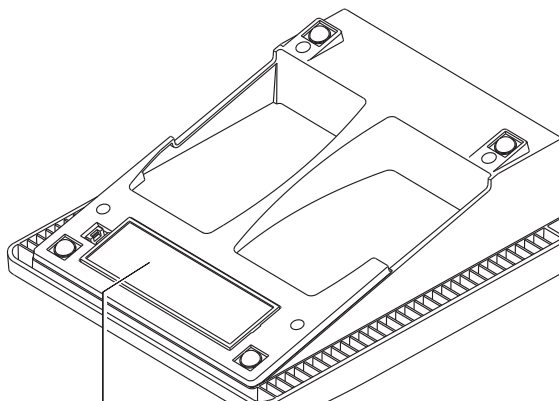
3.2 Initial commissioning

Perform the following activities:

- Insert batteries
- Switch on the meter
- Set the date and time
- Connect the power pack (for line power operation only).

Insert batteries

1	Open the battery compartment (1) on the underside of the meter.
2	Place four batteries (type Mignon AA) in the battery compartment.
3	Close the battery compartment (1). The date (day) flashes in the display.
4	Set the date and time according to page 42.

**CAUTION**

Make sure that the poles of the batteries are the right way round. The \pm signs on the batteries must correspond to the \pm signs in the battery compartment.

Only use leakproof alkaline manganese batteries.

Switching on the meter

- | | |
|---|---|
| 1 | Switch on the meter with <On/Off>. A display test is briefly displayed. |
|---|---|

Setting the date and time

- | | |
|---|-------------|
| 2 | See page 44 |
|---|-------------|

Connecting the power pack

You can either operate the measuring instrument with batteries or with the plug-in power supply. The plug-in power supply supplies the measuring instrument with low voltage (12 VDC). This saves the batteries.

**CAUTION**

The line voltage at the operating site must lie within the input voltage range of the original power pack (see page 57).

**CAUTION**

Use original power packs only (see page 57).

- | | |
|---|---|
| 3 | Insert the plug into the socket of the conductivity meter. |
| 4 | Connect the original power pack to an easily accessible power outlet. |

**Note**

You can carry out measurements without the power pack.

4 Operation

4.1 Switching on the meter

1	Place the meter on a flat surface and protect it from intense light and heat.
2	Press the <On/Off> key. A display test is briefly displayed. Subsequently, the meter switches to the measuring mode (measured value display).



Note

The meter has an energy saving feature to avoid unnecessary battery depletion during battery operation.

The energy saving feature switches off the meter if no key was pressed during the specified interval (setting the switch-off interval see page 44).

The energy saving feature is not active:

- if the meter is supplied via the power pack or the USB interface
- *automatic storing* if the printer cable is connected (for external printers).

4.2 General operating principles

This section contains basic information of the operation of the Lab 970.

4.2.1 Operating modes

The instrument has the following operating modes:

- Measuring
The display indicates the measurement data in the measured value display
- Calibration
The display guides you thru a calibration procedure with calibration information
- Transmitting data
The meter transmits measuring data and calibration records to a serial interface automatically or manually.
- Configuration
The system menu or a sensor menu with submenus, settings and functions is displayed

4.2.2 Operation

Keys The meter is operated via keys. The keys can have different functions with long or short keystrokes.

Functions Generally, with a short keystroke a function is carried out. A long keystroke opens a setting menu.

In a setting menu, settings are selected with the <▲><▼> keys. A setting is confirmed with <OK>. With confirming, the setting is finished and the next setting is displayed.

Representation In this operating manual, keys are indicated by brackets <.> . The key symbol (e.g. <OK>) generally indicates a short keystroke (under 2 sec) in this operating manual. A long keystroke (approx. 2 sec) is indicated by the underscore behind the key symbol (e.g. <OK__>).

4.3 Measuring

Preparatory activities

Perform the following preparatory activities when you want to measure:

1	Connect a measuring cell to the meter.
2	Adjust the temperature of the test solutions and measure the current temperature if the measurement is made without a temperature sensor.
3	Calibrate or check the meter with the measuring cell.
4	Select the measured parameter with <MODE> .



Temperature sensor

CAUTION

When connecting an earthed PC/printer, measurements cannot be performed in earthed media as incorrect values would result. The RS232 and USB interfaces are not galvanically isolated.

The temperature measurement is absolutely essential for a reproducible conductivity measurement. If a temperature sensor is connected, it is indicated on the display by TP.

If you use a conductivity measuring cell without integrated temperature sensor, we recommend to use an external temperature sensor.

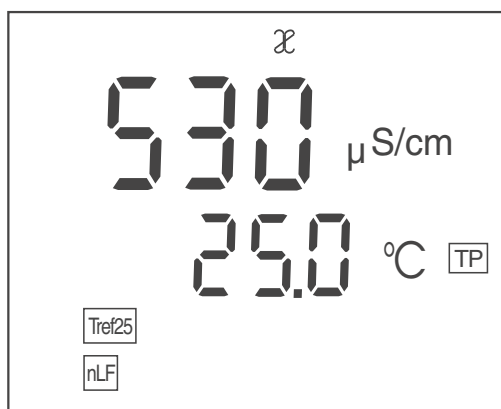


Note

The conductivity meter automatically recognizes the type of the temperature sensor used. Therefore, you can connect measuring cells with an NTC30 or Pt1000.

4.3.1 Measuring the conductivity

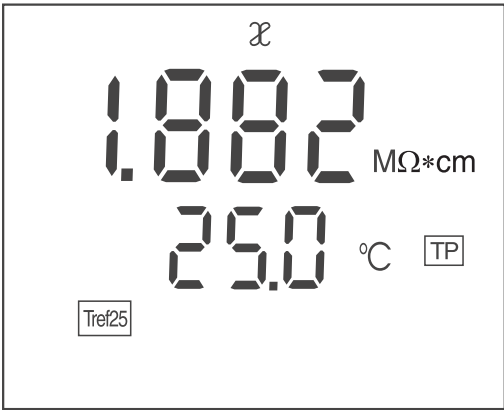
1	Perform the preparatory activities according to page 21.
2	Immerse the conductivity measuring cell in the test sample.
3	If necessary, scroll with <MODE> until the measured parameter Σ with the unit mS/cm or μ S/cm is displayed.
4	Wait for a stable measured value.



5	Measurement with stability control (see page 25).
---	---

4.3.2 Measuring the resistivity

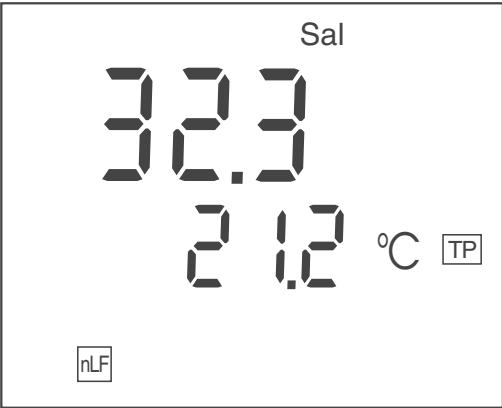
1	Perform the preparatory activities according to page 21.
2	Immerse the conductivity measuring cell in the test sample.
3	If necessary, scroll with <MODE> until the measured parameter Σ with the unit MOhm is displayed.
4	Wait for a stable measured value.



- | | |
|---|---|
| 5 | Measurement with stability control (see page 25). |
|---|---|

4.3.3 Measuring the salinity

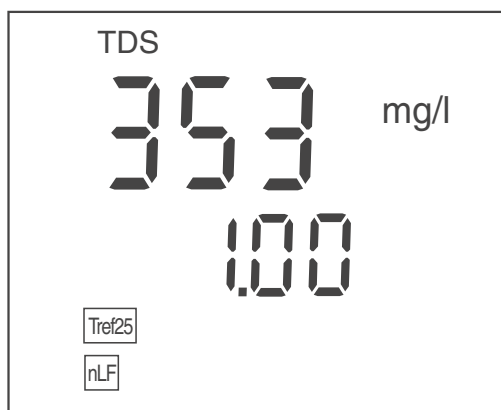
- | | |
|---|--|
| 1 | Perform the preparatory activities according to page 21. |
| 2 | Immerse the conductivity measuring cell in the test sample. |
| 3 | Using <MODE>, scroll as necessary until the measured parameter Sal is displayed. |
| 4 | Wait for a stable measured value. |



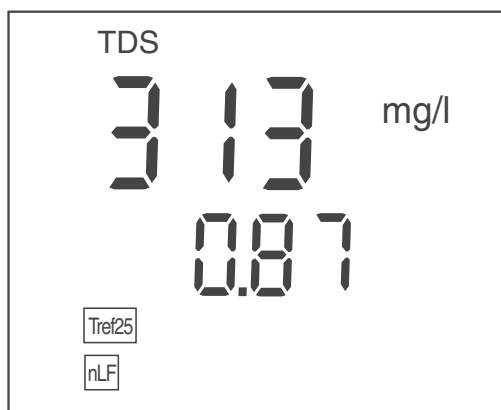
- | | |
|---|---|
| 5 | Measurement with stability control (see page 25). |
|---|---|

4.3.4 Measuring the total dissolved solids (TDS)

- | | |
|---|--|
| 1 | Perform the preparatory activities according to page 21. |
| 2 | Immerse the conductivity measuring cell in the test sample. |
| 3 | Using <MODE>, scroll as necessary until the measured parameter TDS is displayed. |
| 4 | Using <▲><▼>, set the TDS factor (0.40 ... 1.00). |



- | | |
|---|-----------------------------------|
| 5 | Wait for a stable measured value. |
|---|-----------------------------------|



- | | |
|---|---|
| 6 | Measurement with stability control (see page 25). |
|---|---|

4.3.5 Measuring with stability control

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

1	With <SC> , activate the stability control function. The <i>AR</i> function display indicator appears. The current measured value is frozen (hold function).
2	Start measurement with stability control with <OK> . An AutoRead measurement is carried out to control the stability of the measured value. The AR display indicator flashes until a stable value is measured. The calibration process is finished when AR stops flashing. This measured value is downloaded to the interface.
3	If necessary, start the next measurement with stability control with <OK> .
4	Press <MODE> or <SC> to terminate the stability control.

**Note**

The current measurement with stability control can be terminated at any time (accepting the current value) by pressing **<OK>**.

4.4 Determining/setting up the cell constant [C]

Why determine/set up the cell constant?

Due to aging, 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.

For non-ID sensors, the calibration data is stored in the meter. For ID sensors, the calibration data is stored in the sensor.

You can determine the cell constant of the conductivity measuring cell in the ranges $0.450 \dots 0.500 \text{ cm}^{-1}$, $0.585 \dots 0.715 \text{ cm}^{-1}$ or $0.800 \dots 1.200 \text{ cm}^{-1}$ by calibrating in the 0.01 mol/l KCl control standard or set it manually in the range $0.250 \dots 2.500 \text{ cm}^{-1}$ or $0.090 \dots 0.110 \text{ cm}^{-1}$. Besides, the fixed cell constant 0.010 cm^{-1} can be selected.

Cleaning interval (*Int.C*)

When the specified cleaning interval (*Int.C*) has expired, the *CIn* display indicator appears after the meter has been switched on and reminds you to clean the measuring cell. It is still possible to measure.

The cleaning interval (*Int.C*) is set to 180 days (d180) in the factory. You can change the interval (see page 46).



Note

In order to maintain the high measurement accuracy of the measuring system, clean the measuring cell and recalibrate after the cleaning interval has expired.

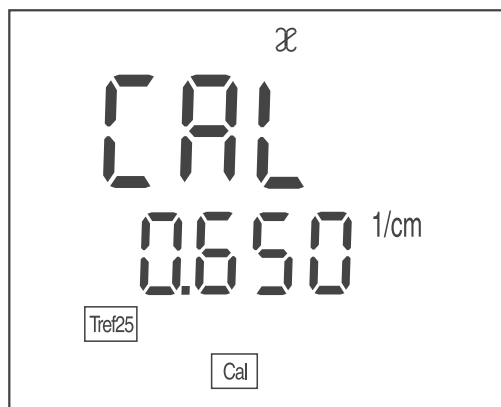
4.4.1 Determining the cell constant (calibration)

Determining the cell constant (calibration in control standard)

- 1 Press <CAL> repeatedly until *CAL CELL* is displayed.

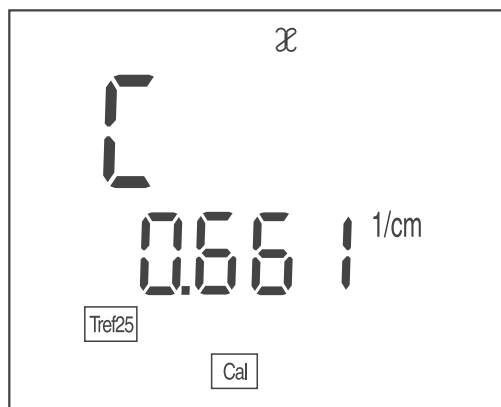


- 2 Press <OK> or <CAL__> to confirm the selection of *CAL CELL*.



- 3 Immerse the measuring cell in the control standard solution, 0.01 mol/l KCl.

- 4 Start the calibration with <OK>.
 The determination of the cell constant with stability control starts.
 The AR display indicator flashes until there is a stable signal.
 The determined cell constant is displayed for 10 seconds. The meter stores the cell constant automatically.
 After this the meter switches to the measuring mode.



Note

If the error message *E3* appears, refer to CHAPTER 6 WHAT TO DO IF... (PAGE 55).

Stability control

During calibration, the stability control is automatically activated.



Note

This method of automatically determining the cell constant by calibration in the 0.01 mol/l KCL control standard can only be used for measuring cells with cell constants in the ranges 0.450 ... 0.500 cm⁻¹, 0.585 ... 0.715 cm⁻¹ or 0.800 ... 1.200 cm⁻¹.

Calibration evaluation

After the calibration, the meter automatically evaluates the current status. The evaluation appears on the display.

Display	Cell constant [cm^{-1}]
Status display indicator <i>CAL</i> .	in the range 0.450 ... 0.500 cm^{-1} 0.585 ... 0.715 cm^{-1} 0.800 ... 1.200 cm^{-1}
<i>E3</i> Eliminate the error according to CHAPTER 6 WHAT TO DO IF... (PAGE 55).	outside the ranges 0.450 ... 0.500 cm^{-1} 0.585 ... 0.715 cm^{-1} or 0.800 ... 1.200 cm^{-1}

Calibration record

When finishing a calibration, the new calibration values are stored. For ID sensors, the calibration data is stored in the sensor (see page 11)

**Note**

The calibration record is automatically transmitted to the interface after calibrating.

Sample record:

```
16.09.2005 08:53:54
Lab 970 02320025

CALIBRATION COND
Cal Time      : 16.09.2005 08:22:14
Cal Interval: 180d
Cal Std.:    0.01 mol/l KCL
              40.0 °C
Conduct./Tref25: 1413µS/cm
Cell Const  : 0.975 1/cm
Probe      : +++
```

If an ID sensor is used, the calibration record additionally names the sensor type and sensor series number (see page 11).

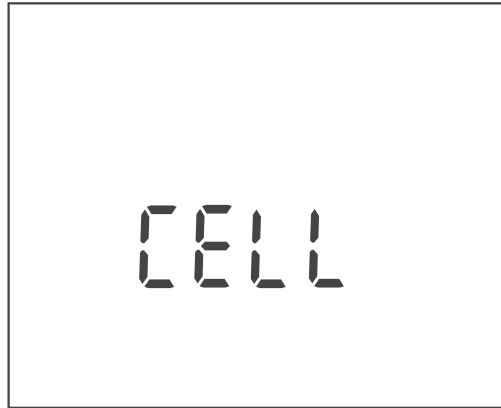
Downloading calibration data

You can download the calibration data:

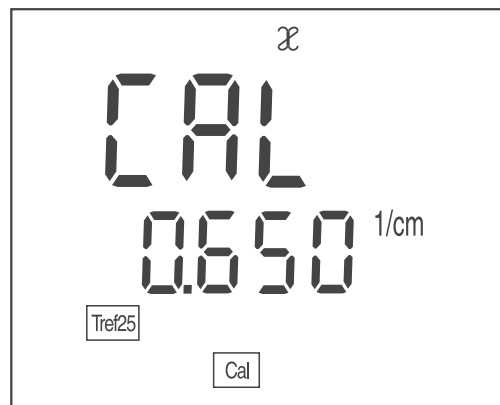
- to the display (see page 38)
- to the interface (see page 40)

4.4.2 Using the last calibrated cell constant

- 1 Press **<CAL>** repeatedly until *CELL* is displayed.



- 2 Press **<OK>** or **<CAL__>** to confirm the selection of *CELL*.
- 3 If necessary, press **<CAL>** repeatedly until *CAL* and the last calibrated cell constant is displayed.



- 4 Confirm the selection with **<OK>** .
The displayed cell constant is used.
The meter switches to the measured value display.

4.4.3 Setting the cell constant manually

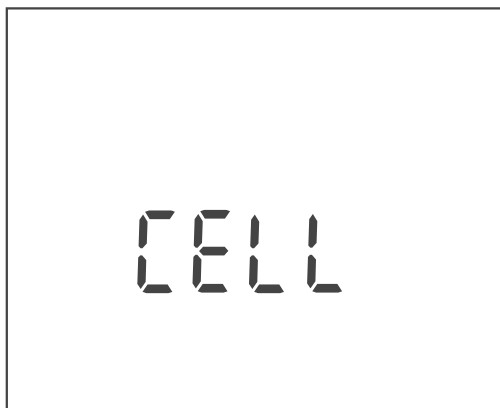


Note

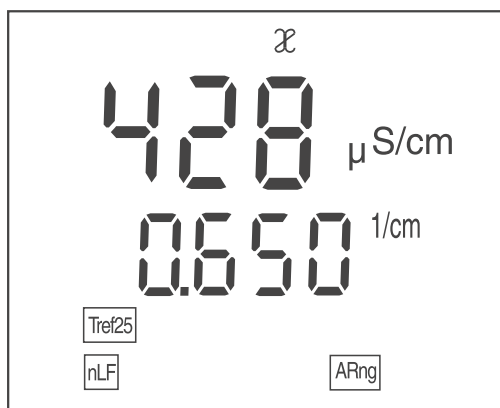
The cell constant to be set must either be taken from the operating manual of the measuring cell or is printed on the measuring cell.

Range
0.250 ... 2.500 cm⁻¹

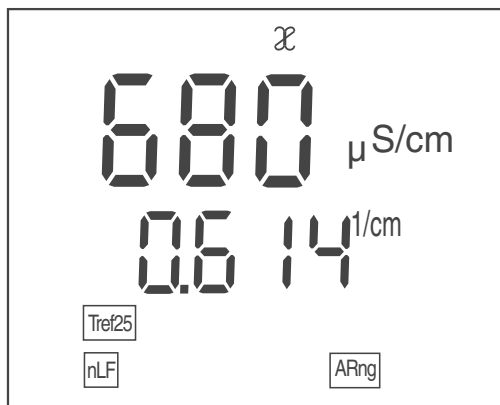
- 1 Press <CAL> repeatedly until *CELL* is displayed.



- 2 Confirm the selection with <OK> or <CAL__> .
The cell constant that was set last is displayed.
- 3 Press <CAL> repeatedly until a cell constant in the range 0.250 ... 2.500 cm⁻¹ is displayed.



- 4 Set the cell constant to be used with <▲><▼>, e.g. 0.614 cm⁻¹.



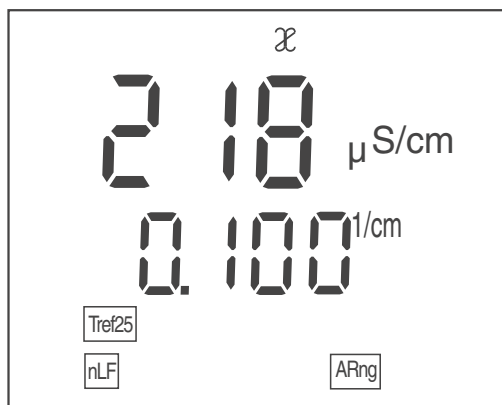
- 5 Confirm the selection with **<OK>** .
The new cell constant is used from now on.
The meter switches to the measured value display.

Range
0.090 ... 0.110 cm⁻¹

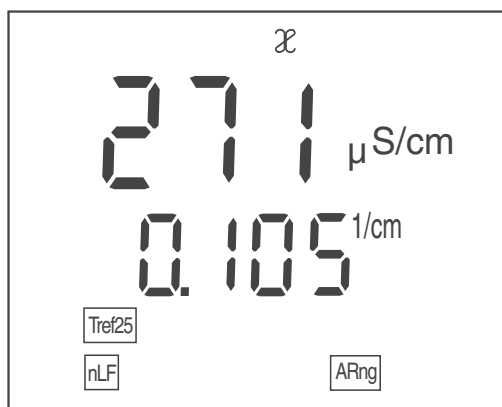
- 1 Press the **<CAL>** key repeatedly until *CELL* is displayed.



- 2 Confirm the selection with **<OK>** or **<CAL__>** .
- 3 Press **<CAL>** repeatedly until a cell constant in the range 0.090 ... 0.110 cm⁻¹ is displayed.



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



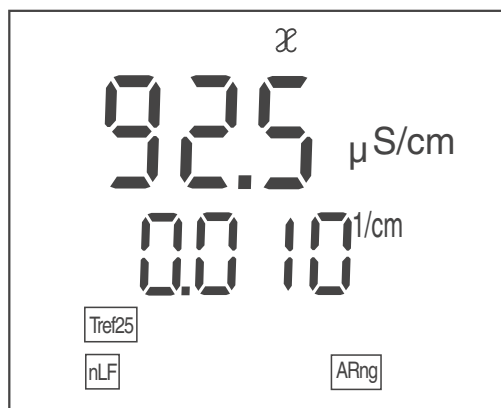
- 5 Confirm the selection with OK .
The new cell constant is used from now on.
The meter switches to the measured value display.

Selecting the cell constant 0.010 cm^{-1}

- 1 Press the CAL key repeatedly until CELL is displayed.



- 2 Confirm the selection with **<OK>** or **<CAL__>** .
- 3 Press **<CAL>** repeatedly until the cell constant 0.010 cm^{-1} is displayed.



- 4 Confirm the selection with **<OK>** .
The meter switches to the measured value display.

4.5 Setting the temperature compensation TC

The calculation of the temperature compensation is based on the preset reference temperature, Tref 20 or Tref 25 (see page 43).

You can select one of the following temperature compensations:

- **Nonlinear temperature compensation "nLF"**
according to DIN 38404 or EN 27 888
- **Linear temperature compensation "Lin"**
with adjustable coefficient in the range 0.001 ... 3.000 %/K
- **No temperature compensation**



Note

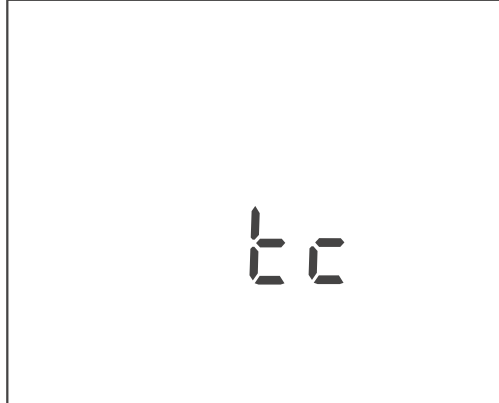
Select the following temperature compensations given in the table according to the respective test sample:

Application tips

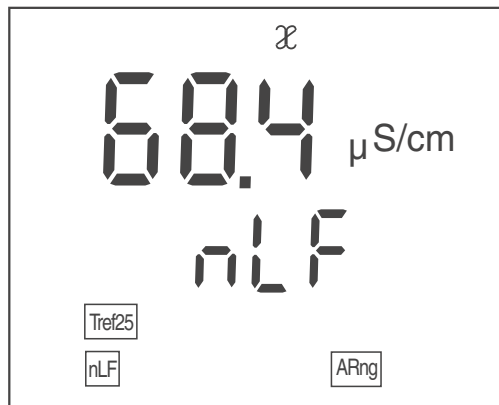
Test sample	Temperature compensation TC	Display indicator
Natural water (ground water, surface water, drinking water)	nLF according to DIN 38404 EN 27 888	nLF
Ultrapure water	nLF according to DIN 38404 EN 27 888	nLF
Other aqueous solutions	Set linear temperature coefficient 0.001 ... 3.000 %/K	Lin
Salinity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

**Selecting the nonlinear
temperature
compensation**

- 1 Press **<CAL>** repeatedly until *tc* is displayed.



- 2 Confirm the selection with **<OK>** or **<CAL__>** .
The temperature compensation that was set last is displayed.
- 3 Press **<CAL>** repeatedly until *nLF* is displayed.



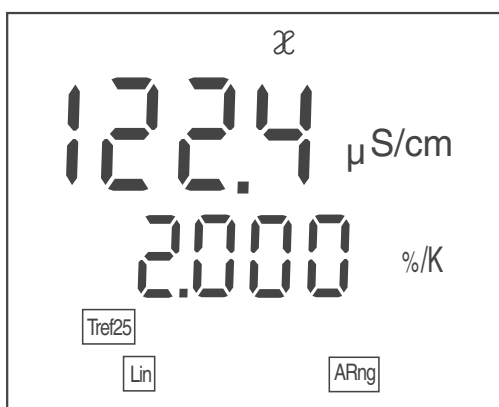
- 4 Confirm the selection with **<OK>** .
The nonlinear temperature compensation is switched on.
The meter switches to the measured value display.
The selected temperature compensation appears as the status display.

Selecting the linear temperature compensation

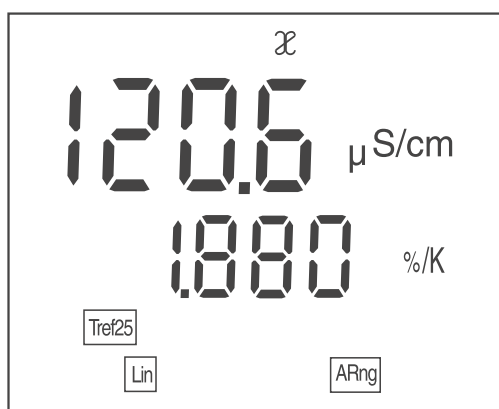
- 1 Press **<CAL>** repeatedly until t_c is displayed.



- 2 Confirm the selection with **<OK>** or **<CAL__>**. The temperature compensation that was set last is displayed.
- 3 Press **<CAL>** repeatedly until the adjustable linear temperature coefficient appears on the display.



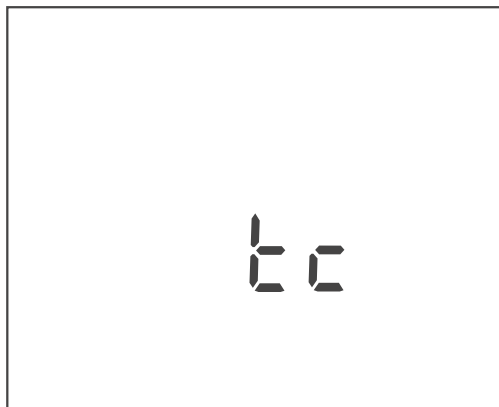
- 4 Set the temperature coefficient with **<▲>****<▼>**, e. g. 1.880 %/K.



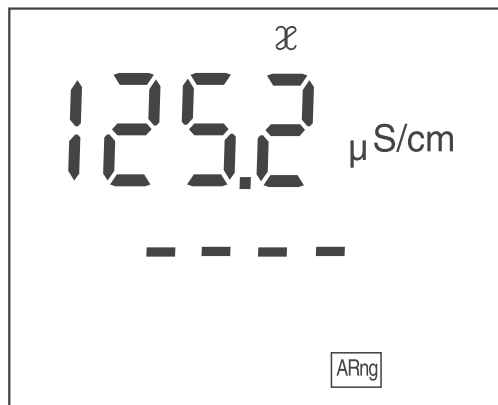
- | | |
|---|---|
| 5 | <p>Confirm the selection with <OK> .</p> <p>The linear temperature compensation is switched on.</p> <p>The meter switches to the measured value display.</p> <p>The selected temperature compensation appears as the status display.</p> |
|---|---|

Switching off the temperature compensation

- | | |
|---|---|
| 1 | Press <CAL> repeatedly until <i>tc</i> is displayed. |
|---|---|



- | | |
|---|--|
| 2 | Confirm the selection with <OK> or <CAL__> . |
| 3 | Press <CAL> repeatedly until the following display appears. |

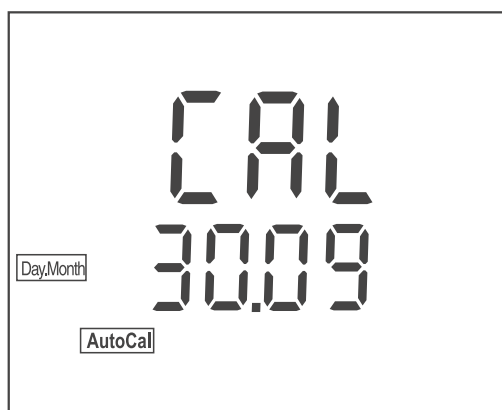


- | | |
|---|---|
| 4 | <p>Confirm the selection with <OK> .</p> <p>The temperature compensation is switched off.</p> <p>The meter switches to the measured value display.</p> |
|---|---|

4.6 Downloading calibration data

You can download calibration data:

- to the display
- to the interface (see page 40)



While the calibration data is being displayed you can:

- press **<OK>** to display further calibration data (calibrated cell constant)

Download to display via calibration menu

- | | |
|---|--|
| 1 | Press <CAL__> to display the calibration data. The calibration date and calibrated cell constant are displayed consecutively for approx. 10 seconds each. |
|---|--|

While the calibration data is being displayed you can:

- press **<OK>** to display further calibration data (calibrated cell constant)
- press **<CAL__>** to download the calibration data to the interface

4.7 Transmitting data

The meter has two interfaces:

- RS232 interface (serial port)
- USB interface (device)

Via both interfaces, you can transmit data to a PC and update the meter software.

The meter is supplied with power via the USB interface.

The RS232 interface enables to transmit data to an external printer.

**Note**

The relevant interface cable has to be connected if you want to download data to an interface (USB or RS232).

It is not possible to download data to both interfaces (USB and RS232) at the same time. After connecting a meter to the USB socket the RS232 interface is inactive. The RS232 interface is active if no meter is connected to the USB interface.

**CAUTION**

The interfaces are not galvanically separated.

When connecting an earthed PC/printer, measurements cannot be performed in earthed media as incorrect values would result.

4.7.1 Options for data transmission

Via the USB interface you can transmit data to a PC. Via the RS 232 interface, you can transmit data to a PC or an external printer.

The following table shows which data are transmitted to the interface in which way:

Data	Control	Operation / description
Current measured values	manual	● With <OK>.
	automatic, at intervals	● With <SC __>. Then you can set the transmission interval (<i>Int.2</i>) (see page 40).
	automatic	● After each measurement with stability control.
calibration records	manual	● During the display indication with <CAL __> (see page 38).
	automatic	● On completion of a calibration procedure.

4.7.2 Automatically downloading measurement datasets at intervals

In order to automatically download to the interface measured values at certain time intervals, set the download interval (*Int.2*).

Setting the download interval

The default setting for the download interval (*Int.2*) is 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):

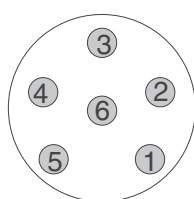
1	Press <SC __> to open the setting of the <i>Int.2</i> interval.
2	If necessary, set an interval with <▲><▼>.
3	Close the setting with <OK>. The download to the interface takes place at the specified interval.

4.7.3 RS232 interface

1	Connect the interface to the PC or printer via the cable Z390 (PC) or Z393 (ext. printer).
---	--

2	If necessary, disconnect a connected USB cable from the meter.
3	Set up the following transmission data on the PC/printer: <ul style="list-style-type: none"> – Baud rate: selectable from 1200, 2400, 4800, 9600, – Handshake: RTS/CTS + Xon/Xoff PC only: <ul style="list-style-type: none"> – Parity: none – Data bits: 8 – Stop bits: 1

Socket assignment (RS232)



RS 232

- 1 *
- 2 RxD
- 3 TxD
- 4 *
- 5 SGnd
- 6 CTS

* not used

4.7.4 USB interface (device)

Connect the interface to the PC via the supplied Z875 USB cable. The data output automatically switches to *USB*. The RS232 interface is deactivated.

Installation of the USB driver on the PC

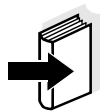
System requirements of the PC for installation of the USB driver:

- PC with Pentium processor or higher with at least one free USB connection and CD-ROM drive
- Windows 2000, XP, Vista.

1	Insert the supplied installation CD in the CD drive of your PC.
2	Install the USB driver on the PC. Follow the Windows installation instructions as necessary.
3	The meter is listed as a virtual COM interface among the connections in the Windows instrument manager.

4.7.5 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 meter is connected to the RS232 serial interface or USB interface of a PC.

**Note**

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

4.8 Settings

You can adapt the meter to your individual requirements. The settings are done in the following menus:

- System settings (<OK__>)
 - Baud rate (*Baud*)
 - Switch-off interval (*tOff*)
 - Date (*Day.Month*)
 - Date (Year)
 - Time (*Time*)
- Calibration and measurement settings (<MODE__>)
 - Reference temperature (*Tref25* or *Tref20*)
 - Temperature unit ($^{\circ}\text{C}$ / $^{\circ}\text{F}$)
 - Cleaning interval (*Int.C* [0 ... 999])



Note

You can exit the setting menu at any time by pressing <MODE>. Settings already modified and confirmed with <OK> are stored.

4.8.1 System settings

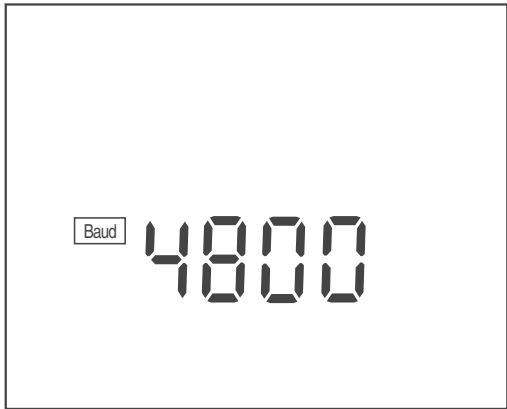
The default setting is printed in bold.

Baud rate (<i>Baud</i>)	1200, 2400, 4800 , 9600
Switch-off interval (<i>.OFF</i>)	10, 20, 30, 40, 50 min, 1, 2, 3, 4, 5, 10, 15, 20, 24 h
Date (<i>Day.Month</i>)	Any
Date (Year)	Any
Time (<i>Time</i>)	Any

- 1

Open the menu for system settings with <OK__>. The first system setting is displayed.

Baud rate (*Baud*)

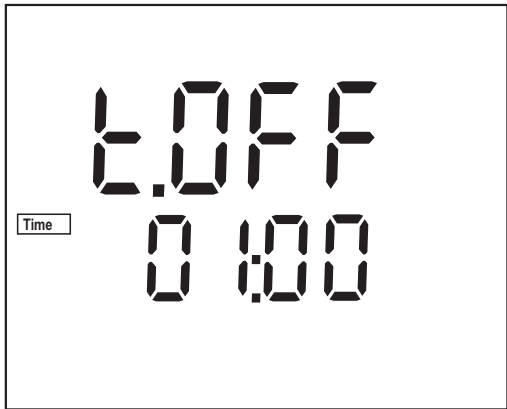


- 2

Set the required baud rate with <▲><▼> .
- 3

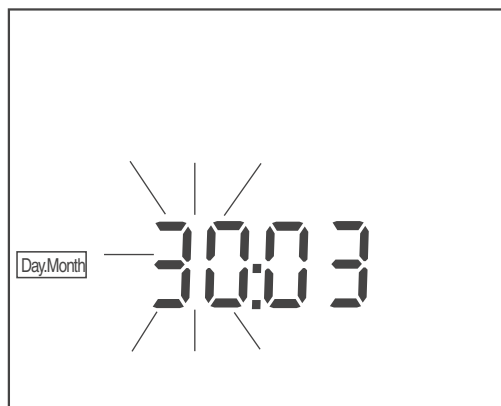
Confirm with <OK>. .OFF, the setting of the switch-off interval is displayed.

Switch-off interval (*.OFF*)



4	Set the switch-off interval with $\blacktriangle < \blacktriangledown$.
5	Confirm with <OK> . <i>Day.Month</i> , the setting of the date is displayed. The day display flashes.

Date and time



6	Set the date of the current day with $\blacktriangle < \blacktriangledown$.
7	Confirm with <OK> . The month display flashes.
8	Set the current month with $\blacktriangle < \blacktriangledown$.
9	Confirm with <OK> . <i>Year</i> , the setting of the year is displayed.
10	Set the year with $\blacktriangle < \blacktriangledown$.
11	Confirm with <OK> . The setting of the time is displayed. The hour display flashes.
12	Set the current hour with $\blacktriangle < \blacktriangledown$.
13	Confirm with <OK> . The minute display flashes.
14	Set the current minute with $\blacktriangle < \blacktriangledown$.
15	Confirm with <OK> . The system settings are completed. The meter switches to the measuring mode.

4.8.2 Measurement settings

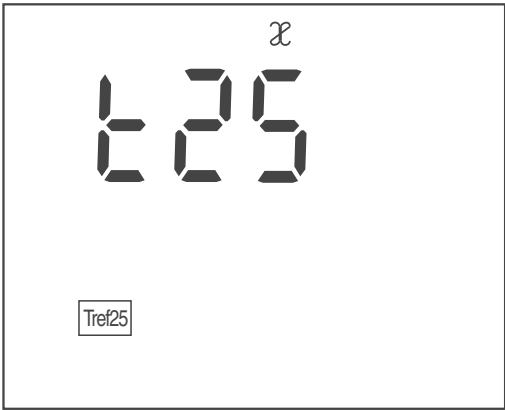
These settings apply to the determination of the cell constant and measurement (the default condition is printed in bold).

Reference temperature	<i>t25, t20</i>
Temperature unit (<i>Uni</i>)	°C, °F
Cleaning interval (<i>Int.C</i>)	0 ... 180 ... 999 d

Reference temperature

- 1

Open the menu for measurement settings with <MODE__>. *t25*, the adjusted reference temperature is displayed.

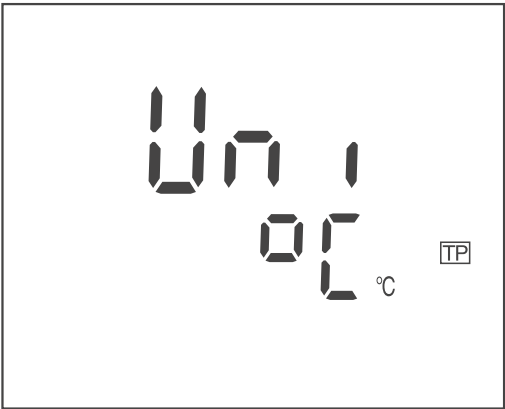


- 2

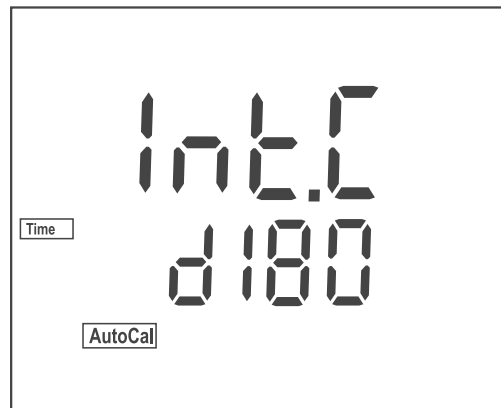
Select the reference temperature with <▲><▼> .
- 3

Confirm with <OK>. *Uni*, the setting of the unit of the temperature value is displayed.

Temperature unit (*Uni*)



- | | |
|---|---|
| 4 | Using <▲><▼>, toggle between °C and °F. |
| 5 | Confirm with <OK>.
<i>Int.C</i> , the setting of the cleaning interval is displayed. |

Cleaning interval (*Int.C*)

- | | |
|---|--|
| 6 | Set the interval with <▲><▼>. |
| 7 | Confirm with <OK>.
The measurement settings are completed.
The meter switches to the measuring mode. |

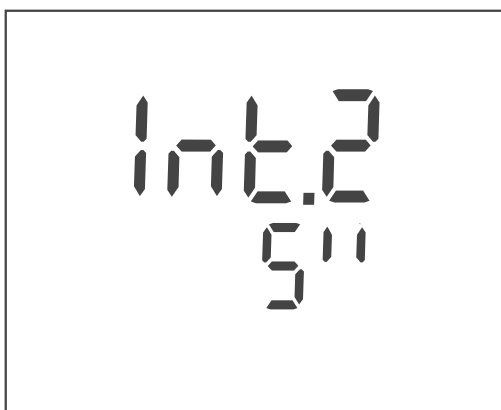
4.8.3 Interval for automatic data transmission

The interval for automatic data transmission serves to transmit the current measurement dataset to the interface at the specified interval.

Data transmission interval (<i>Int.2</i>)	OFF , 5 s, 10 s, 30 s, 1 min, 5 min, 10 min, 15 min, 30 min, 60 min
--	---

- | | |
|---|---|
| 1 | Press <SC__> to open the setting for the transmission interval.
<i>Int.2</i> , the setting of the transmission interval is displayed. |
|---|---|

**Data transmission
interval**



- | | |
|---|---|
| 2 | Press <▲><▼> to select an interval. |
| 3 | Confirm with <OK> .
The setting of the interval for the data transmission to the interface is completed.
The meter switches to the measuring mode. |

4.9 Reset

4.9.1 Resetting the cell constant

This function serves to erase the last determined cell constant. Subsequently, the meter uses the last manually adjusted cell constant. All other meter settings are retained.

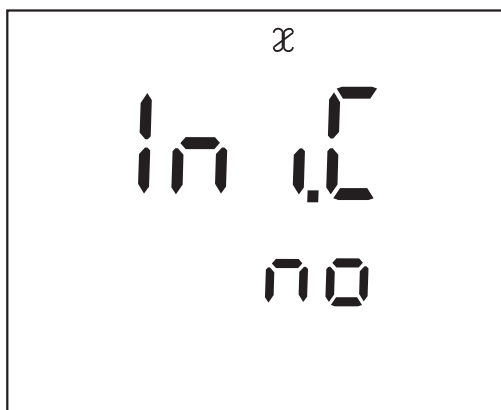


Note

The measuring system is possibly not calibrated after a reset. Before measuring, make sure the meter uses the cell constant suitable for the measuring cell.

Resetting the cell constant

- 1 Press <On/Off__> to open the menu for the reset of the cell constant.
Ini.C is displayed.



- 2 Press <▲><▼> to display *no* or *YES*.
YES: Reset the cell constant.
no: Retain the cell constant.
- 3 Confirm with <OK>.
The menu is finished.
The meter switches to the measuring mode.

4.9.2 Resetting meter settings

This function resets to the default condition meter settings. The relevant values are given on the following pages:

System settings	page 44
Measurement settings	page 46

The following settings are also reset to the default condition:

Setting	Default settings
Measured variable	∞ mS/cm or μ S/cm
Adjusted cell constant	0,650 1/cm
Temperature compensation	nLF
Temperature coefficient of the linear temperature compensation	2.000 %/K
TDS factor	1.00

Resetting the meter settings

- 1 Switch on the meter with **<On/Off>**.
The display test appears briefly on the display.
- 2 During the display test, press **<MODE>** to open the menu for the reset of the meter settings.
Init is displayed.



- 3 Press **<▲><▼>** to display *no* or *YES*.
YES: Reset the meter settings.
no: Retain the meter settings.

- 4 | Confirm with **<OK>**.
The menu is finished.
The meter switches to the measuring mode.

**Note**

The measuring system is possibly not calibrated after a reset. Before measuring, make sure the meter uses the cell constant suitable for the measuring cell.

5 Maintenance, cleaning, disposal

5.1 Maintenance

The only maintenance activity required is replacing the batteries.

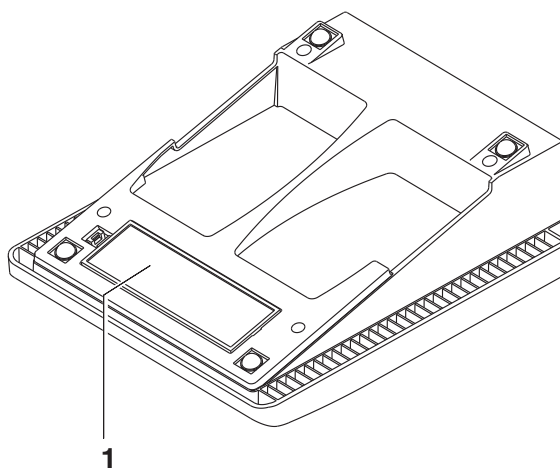


Note

See the relevant operating manuals of the measuring cells for instructions on maintenance.

5.1.1 Replacing the batteries

1	Open the battery compartment (1) on the underside of the meter.
2	Remove the four batteries from the battery compartment.
3	Place four new batteries (type Mignon AA) in the battery compartment.
4	Close the battery compartment (1). The date (day) flashes on the display.
5	Set the date and time according to page 44.



CAUTION

Make sure that the poles of the batteries are the right way round. The \pm signs on the batteries must correspond to the \pm signs in the battery compartment.

Only use leakproof alkaline manganese batteries.

5.2 Cleaning

Occasionally wipe the outside of the meter 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 Packing

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

5.4 Disposal

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

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 as household refuse.

6 What to do if...

Error message <i>E1</i>	Cause <ul style="list-style-type: none"> – Measured value outside the measuring range 	Remedy <ul style="list-style-type: none"> – Use suitable measuring cell
Error message, <i>E3</i>	Cause <ul style="list-style-type: none"> – Measuring cell contaminated – Unsuitable calibration solution 	Remedy <ul style="list-style-type: none"> – Clean cell and replace it if necessary – Check calibration solutions
Display of <i>Cln</i>	Cause <ul style="list-style-type: none"> – Cleaning interval expired 	Remedy <ul style="list-style-type: none"> – Recalibrate the measuring system
Display, <i>LoBat</i>	Cause <ul style="list-style-type: none"> – Batteries almost empty 	Remedy <ul style="list-style-type: none"> – Replace the batteries (see page 53)
Display <i>to</i>	Cause <ul style="list-style-type: none"> – Time-out of the interface 	Remedy <ul style="list-style-type: none"> – Check the instrument that is connected
Instrument does not react to keystroke	Cause <ul style="list-style-type: none"> – Operating condition undefined or EMC load unallowed 	Remedy <ul style="list-style-type: none"> – Processor reset: Press and hold the <SC> key and switch the meter on

**You want to know which
software
version is in the
instrument**

Cause

- E. g., a question by the service department

Remedy

- Switch on the meter.
During the display test,
display the software version
with **<OK>**.

Translation of the legally binding German version

Stand October 30, 2009

7 Technical data

7.1 General data

Dimensions	approx. 240 x 190 x 80 mm	
Weight	approx. 1.0 kg (without power pack, without stand)	
Mechanical structure	Type of protection	IP 43
Electrical safety	Protective class	III
Test certificates	cETLus	
Ambient conditions	Storage	- 25 °C ... + 65 °C
	Operation	0 °C ... + 55 °C
	Climatic class	2
Power supply	Batteries	4 x 1.5 V alkali-manganese batteries, Type AA
	Operational life	Approx. 500 operating hours
	Power pack (charging device)	FRIWO FW7555M/09, 15.1432.500-00 Friwo Part. No. 1883259 Input: 100 ... 240 V ~ / 50 ... 60 Hz / 400 mA Output: 9 V = / 1.5 A Connection max. overvoltage category II Primary plugs contained in the scope of delivery: Euro, US, UK and Australian.
USB interface	Automatic switch-over when a USB cable is connected.	
	Type	USB 1.1 (device)

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**Guidelines
and norms used****EMC**

EC guideline 2004/108/EC
EN 61326-1 Class B
FCC Class A

Instrument safety

EC guideline 2006/95/EC
EN 61010-1
ANSI/UL 61010-1
CAN/CSA-C22.2 No. 61010-1

**Radio data
transmission**

EC guideline 1999/5/EC
EN 300 330-2
EN 50364
EN 60950-1

Climatic class

VDI/VDE 3540

IP protection class

EN 60529

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.

Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

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7.2 Measuring ranges, resolution, accuracy

Measuring ranges, resolution	Variable	Measuring range	Resolution
	κ [$\mu\text{S}/\text{cm}$]	0.000 ... 1.999*	0.001
		0.00 ... 19.99**	0.01
		0.0 ... 199.9	0.1
		0 ... 1999	1
	κ [mS/cm]	0.00 ... 19.99	0.01
		0.0 ... 199.9	0.1
		0 ... 500	1
	Resistivity [$\text{M}\Omega\cdot\text{cm}$]	0.00 ... 19.99	0.01
		0.0 ... 199.9	0.1
		0 ... 1999	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 and 1.00	1
	T [$^{\circ}\text{C}$]	- 5.0 ... + 120.0	0.1
	T [$^{\circ}\text{F}$]	+ 23.0 ... + 248.0	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 $0.090 \dots 0.110\text{ cm}^{-1}$

Cell constants	Cell constant C	Values
	Can be calibrated in the ranges	0.450 ... 0.500 cm^{-1} 0.585 ... 0.715 cm^{-1} 0.800 ... 1.200 cm^{-1}
	Adjustable	0.250 ... 2.500 cm^{-1} 0.090 ... 0.110 cm^{-1} 0.010 cm^{-1} (fixed)
Reference temperature	Reference temperature	Values
	Adjustable	20 $^{\circ}\text{C}$ (Tr20) 25 $^{\circ}\text{C}$ (Tr25)

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Accuracy (± 1 digit)**Variable****Accuracy****Temperature of the test sample*****æ*** / Temperature compensation

<i>None (Off)</i>	$\pm 0.5 \%$	
<i>Nonlinear (nLF)</i>	$\pm 0.5 \%$	0 °C ... + 35 °C according to EN 27 888
	$\pm 0.5 \%$	+ 35 °C ... + 50 °C Extended nLF function according to WTW measurements
<i>Linear (lin)</i>	$\pm 0.5 \%$	+ 10 °C ... + 75 °C

SAL / range

<i>0.0 ... 42.0</i>	± 0.1	+ 5 °C ... + 25 °C
	± 0.2	+ 25 °C ... + 30 °C

TDS [mg/l]

	± 1	
--	---------	--

T [°C] / temperature sensor

<i>NTC 30</i>	± 0.1	
<i>PT 1000</i>	± 0.3	

**Note**

The accuracy values specified here apply exclusively to the meter. The accuracy of the measuring cell also has to be taken into account.

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 to find the topics that you are looking for.

Abbreviations

κ	Conductivity value
°C	Temperature unit °Celsius
°F	Temperature unit, °Fahrenheit
AR	AutoRead An AutoRead measurement is carried out for stability control (SC).
ARng	Automatic range switch-over: meter measures with highest possible resolution
AutoStore	Automatic storage in memory
Baud	Baud rate
C	Cell constant cm^{-1}
Cal	The measuring system is being calibrated or works with a calibrated cell constant.
CELL	Cell constant
disp	Display Data memory is displayed
E1	Overflow Display range exceeded
E3	Error message see CHAPTER 6 WHAT TO DO IF... (PAGE 55)
Ident	ID number
InI	Initialization Resets individual basic functions to the status they had on delivery
Int	Interval
IOT	International Oceanographic Tables
Lin	Linear temperature compensation
LoBat	<i>Low Battery</i> Batteries are almost empty
nLF	Nonlinear temperature compensation
SAL	Salinity
SC	Stability control (drift control)
SELV	Safety Extra Low Voltage

Sto Clr	Clearing the memory
Sto disp	Download data memory to display
Sto Full	Memory location occupied
Sto Prt	Download data memory to printer/interface
Tauto	Automatic temperature measurement
TC	Temperature coefficient
TDS	Total dissolved solids
TP	<i>Temperature Probe</i> ; Temperature measurement active
Tref 20/T20	Reference temperature 20 °C
Tref 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.
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 corresponds to the reciprocal value of the resistivity. 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.
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).
Measured variable	The measured parameter is the physical dimension determined by measuring, e. g. pH, conductivity or DO concentration.
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 electrolytic resistivity. 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 according to IOT 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.
Stability control	Function to control the measured value stability.

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 Calculation: TDS (mg/l) = conductivity (μS) * TDS factor (mg/l*μS)
Temperature coefficient	Value of the slope α of a linear temperature function. $x_{T_{Ref}} = x_{Meas} * \frac{1}{1 + \alpha * (T - T_{Ref})}$
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.
Test sample	Designation of the test 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.

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Appendix: Firmware update

General information

With the "Update_Labxxx_MxxxP" program and a PC you can update the firmware of the Lab 970 to the newest version.

- a free RS232 interface on your PC
- the RS232 cable Z390.

Program installation

Install the firmware update program on your PC with the "Install_Update_Labxxx_MxxxP_Vx_yy_English.exe" installation program.

Program start

Start the "Update_Labxxx_MxxxP" program from the Windows start menu. The selected interface is displayed on the left side of the status bar at the lower edge of the window.

You can change the language via the language menu.

Firmware update

Proceed as follows:

1	Using the Z390 interface cable, connect the Lab 970 to the serial interface (COM port) of the PC.
2	Make sure the Lab 970 is switched on.
3	To start the update process click the OK button. The program automatically recognizes the used interface.
4	To go on, follow the instruction of the program. During the programming process, a corresponding message and a progress bar (in %) appear. The programming process takes approx. two minutes. A terminatory message is displayed after a successful programming process. The firmware update is now completed.
5	Disconnect the meter from the PC. The instrument is ready for operation.

After switching the meter off and on you can check whether the meter has taken over the new software version (see page 56).

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