Lab 960

Laboratory conductivity meter
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.

Copyright

© 2009, SI Analytics GmbH
Reprinting - even in the form of excerpts - is only allowed with the explicit written authorization of SI Analytics GmbH.
Printed in Germany.
KONFORMITÄTSERKLÄRUNG
DECLARATION OF CONFORMITY
DÉCLARATION DE CONFORMITÉ

Wir erklären in alleiniger Verantwortung, dass das Produkt

Konduktometer
Lab 960

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

Nous déclarons sous notre seule responsabilité que le produit

Conductivity meter
Lab 960

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

Conductimètre
Lab 960

auquel se réfère cette déclaration est conforme aux indications du chapitre

Technische Daten
Konduktometer Lab 960
30. Oktober 2009

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

30. Oktober, October 30, 30 octobre 2009
AGQSF 0000-A103-01/091030
Lab 960 - Contents

1 Overview ............................................................... 7
  1.1 Keypad .......................................................... 8
  1.2 Display .......................................................... 9
  1.3 Socket field ..................................................... 10

2 Safety ................................................................. 11
  2.1 Authorized use .................................................. 12
  2.2 General safety instructions ................................. 12

3 Commissioning ...................................................... 15
  3.1 Scope of delivery .............................................. 15
  3.2 Initial commissioning ........................................ 15

4 Operation .............................................................. 19
  4.1 Switching on the meter ........................................ 19
  4.2 General operating principles ............................ 20
    4.2.1 Operating modes ....................................... 20
    4.2.2 Operation ................................................ 20
  4.3 Measuring ....................................................... 21
    4.3.1 Measuring the conductivity ......................... 22
    4.3.2 Measuring the resistivity .......................... 22
    4.3.3 Measuring the salinity .............................. 23
    4.3.4 Measuring the total dissolved solids (TDS) .... 24
    4.3.5 Measuring with stability control ................. 25
  4.4 Determining/setting up the cell constant [C] .......... 26
    4.4.1 Determining the cell constant (calibration) .... 26
    4.4.2 Using the last calibrated cell constant .......... 29
    4.4.3 Setting the cell constant manually ............... 30
  4.5 Setting the temperature compensation TC ............ 34
  4.6 Memory ........................................................... 38
    4.6.1 Manual storage ......................................... 38
    4.6.2 Automatic storage at intervals ..................... 40
    4.6.3 Downloading the data storage ..................... 42
    4.6.4 Erasing the data memory ............................. 43
    4.6.5 Downloading calibration data ..................... 43
  4.7 Transmitting data .............................................. 44
    4.7.1 Options for data transmission ....................... 45
    4.7.2 Automatically downloading measurement datasets
      at intervals ................................................. 45
    4.7.3 Downloading stored measurement datasets ....... 46
4.7.4 Downloading calibration data ................................ 46
4.7.5 RS232 interface ................................................. 46
4.7.6 USB interface (device) ........................................... 47
4.7.7 Operation with MultiLab pilot .................................. 47
4.8 Settings ................................................................. 48
4.8.1 System settings ................................................. 49
4.8.2 Measurement settings ........................................... 51
4.8.3 Interval for automatic storing (AutoStore) ............... 53
4.8.4 Interval for automatic data transmission ................... 54
4.9 Reset ................................................................. 55
4.9.1 Resetting the cell constant .................................. 55
4.9.2 Resetting meter settings ...................................... 56
5 Maintenance, cleaning, disposal ................................. 59
5.1 Maintenance ......................................................... 59
5.1.1 Replacing the batteries ....................................... 59
5.2 Cleaning .............................................................. 60
5.3 Packing ............................................................... 60
5.4 Disposal ............................................................... 60
6 What to do if............................................................. 61
7 Technical data .......................................................... 63
7.1 General data ....................................................... 63
7.2 Measuring ranges, resolution, accuracy ....................... 65
8 Lists ................................................................. 67
1 Overview

The Lab 960 compact precision conductivity meter enables you to perform conductivity measurements quickly and reliably. The Lab 960 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.

<table>
<thead>
<tr>
<th>1</th>
<th>Keypad</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Display</td>
</tr>
<tr>
<td>3</td>
<td>Socket field</td>
</tr>
</tbody>
</table>

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_>).

<table>
<thead>
<tr>
<th>Key Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;On/Off&gt;</td>
<td>Switch the meter on/off</td>
</tr>
<tr>
<td>&lt;On/Off_&gt;</td>
<td>Resetting the determined cell constant</td>
</tr>
<tr>
<td>&lt;MODE&gt;</td>
<td>Select measured parameter</td>
</tr>
<tr>
<td>&lt;MODE_&gt;</td>
<td>Open setting menu for calibration and measurement</td>
</tr>
<tr>
<td>&lt;CAL&gt;</td>
<td>Call up calibration procedure</td>
</tr>
<tr>
<td>&lt;CAL_&gt;</td>
<td>Call up calibration data</td>
</tr>
<tr>
<td>&lt;SC&gt;</td>
<td>Activate / deactivate stability control</td>
</tr>
<tr>
<td>&lt;SC_&gt;</td>
<td>Set the interval for data transmission</td>
</tr>
<tr>
<td>&lt;STO&gt;</td>
<td>Store measured value</td>
</tr>
<tr>
<td>&lt;STO_&gt;</td>
<td>Set the interval for automatic storing processes</td>
</tr>
<tr>
<td>&lt;RCL&gt;</td>
<td>Display / transmit measured values and calibration records</td>
</tr>
<tr>
<td>&lt;RCL_&gt;</td>
<td>Erase stored measured values</td>
</tr>
<tr>
<td>&lt;▲&gt;</td>
<td>Increment values, scroll</td>
</tr>
</tbody>
</table>
1.2 Display

Temperature display, function display indicators, status display indicators

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>[AR]</td>
<td>Stability control is active</td>
</tr>
<tr>
<td>[ARng]</td>
<td>Automatic range switch-over: meter measures with highest possible resolution</td>
</tr>
<tr>
<td>[Auto][Store]</td>
<td>Automatic storing is switched on</td>
</tr>
<tr>
<td>[Cal]</td>
<td>Calibration</td>
</tr>
<tr>
<td>[Lin]</td>
<td>Linear temperature compensation</td>
</tr>
<tr>
<td>[LoBat]</td>
<td>With battery operation: Batteries almost empty</td>
</tr>
<tr>
<td>[nLF]</td>
<td>Nonlinear temperature compensation</td>
</tr>
<tr>
<td>[RCL]</td>
<td>Memory display / memory download</td>
</tr>
<tr>
<td>[TP]</td>
<td>Temperature measurement active</td>
</tr>
<tr>
<td>[Tref20]</td>
<td>Reference temperature 20 °C</td>
</tr>
<tr>
<td>[Tref25]</td>
<td>Reference temperature of 25 °C</td>
</tr>
</tbody>
</table>
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 (> SELV and > current circuit with current limiting).
Almost all measuring cells - in particular SI Analytics GmbH 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 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 63) 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.

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 63).

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 960 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

<table>
<thead>
<tr>
<th></th>
<th>Open the battery compartment (1) on the underside of the meter.</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Place four batteries (type Mignon AA) in the battery compartment.</td>
</tr>
<tr>
<td>3</td>
<td>Close the battery compartment (1). The date (day) flashes in the display.</td>
</tr>
<tr>
<td>4</td>
<td>Set the date and time according to page 43.</td>
</tr>
</tbody>
</table>
CAUTION
Make sure that the poles of the batteries are the right way round. The ± signs on the batteries must correspond to the ± 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 49

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 63).

CAUTION
Use original power packs only (see page 63).

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

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Place the meter on a flat surface and protect it from intense light and heat.</td>
</tr>
</tbody>
</table>
| 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 49).  
The energy saving feature is not active:
- if the meter is supplied via the power pack or the USB interface
- if the automatic storing function is active (see page 40)
- if a PC is connected (with communication cable to RS232 interface)
- 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 960.

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

- **Storage in memory**
  The meter stores measuring data automatically or manually

- **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>.

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.

Temperature sensor

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 $\sigma$ with the unit mS/cm or $\mu$S/cm is displayed.
4. Wait for a stable measured value.

![Conductivity Measurement](image)

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 $\sigma$ with the unit MOhm is displayed.
4. Wait for a stable measured value.
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.

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 AR 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. The calibration data is stored in the meter.

You can determine the cell constant of the conductivity measuring cell in the ranges 0.450 ... 0.500 cm\(^{-1}\), 0.585 ... 0.715 cm\(^{-1}\) or 0.800 ... 1.200 cm\(^{-1}\) by calibrating in the 0.01 mol/l KCl control standard or set it manually in the range 0.250 ... 2.500 cm\(^{-1}\) or 0.090 ... 0.110 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 Cln 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 51).

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)
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 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 61).

**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.

<table>
<thead>
<tr>
<th>Display</th>
<th>Cell constant [cm⁻¹]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Status display indicator CAL</td>
<td>in the range</td>
</tr>
<tr>
<td>You are working with a correctly calibrated measuring cell.</td>
<td>0.450 ... 0.500 cm⁻¹</td>
</tr>
<tr>
<td></td>
<td>0.585 ... 0.715 cm⁻¹</td>
</tr>
<tr>
<td></td>
<td>0.800 ... 1.200 cm⁻¹</td>
</tr>
</tbody>
</table>

**E3**
Eliminate the error according to CHAPTER 6 WHAT TO DO IF... (PAGE 61).

Calibration record
When finishing a calibration, the new calibration values are stored.

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

Sample record:

```
16.09.2005 08:53:54
Lab 960 20320025

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

Downloading calibration data
You can download the calibration data:
- to the display (see page 43)
- to the interface (see page 45)
### 4.4.2 Using the last calibrated cell constant

<table>
<thead>
<tr>
<th>Step</th>
<th>Instruction</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Press <code>&lt;CAL&gt;</code> repeatedly until <code>CELL</code> is displayed.</td>
</tr>
<tr>
<td>2</td>
<td>Press <code>&lt;OK&gt;</code> or <code>&lt;CAL_&gt;</code> to confirm the selection of <code>CELL</code>.</td>
</tr>
<tr>
<td>3</td>
<td>If necessary, press <code>&lt;CAL&gt;</code> repeatedly until <code>CAL</code> and the last calibrated cell constant is displayed.</td>
</tr>
<tr>
<td>4</td>
<td>Confirm the selection with <code>&lt;OK&gt;</code>. The displayed cell constant is used. The meter switches to the measured value display.</td>
</tr>
</tbody>
</table>
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.
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.

5. Confirm the selection with <OK>.
   The new cell constant is used from now on.
   The meter switches to the measured value display.
Operation Lab 960

Selecting the cell constant 0.010 cm⁻¹

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

4. Set the cell constant to be used with <▲><▼>, 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.
2. Confirm the selection with <OK> or <CAL >.

3. Press <CAL> repeatedly until the cell constant $0.010 \text{ cm}^{-1}$ is displayed.

![Display Image]

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 48).

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**

<table>
<thead>
<tr>
<th>Test sample</th>
<th>Temperature compensation TC</th>
<th>Display indicator</th>
</tr>
</thead>
</table>
| 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 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 the adjustable linear temperature coefficient appears on the display.

4. Set the temperature coefficient with <▲><▼>, e.g. 1.880 %/K.
5 Confirm the selection with <OK>.
The linear temperature compensation is switched on.
The meter switches to the measured value display.
The selected temperature compensation appears as the status display.

### Switching off the temperature compensation

1 Press <CAL> repeatedly until tc is displayed.

2 Confirm the selection with <OK> or <CAL>.

3 Press <CAL> repeatedly until the following display appears.

4 Confirm the selection with <OK>.
The temperature compensation is switched off.
The meter switches to the measured value display.
4.6 Memory

The conductivity meter has an internal data memory. It can store up to 800 datasets.

A complete dataset consists of:
- Date/time
- Memory location number
- ID number
- Measured value
- Temperature
- Temperature measuring procedure (manual or automatic)

You can transmit measured values (datasets) to the data memory in two ways:
- Store manually (<STO>)
- Store automatically (<STO>).

4.6.1 Manual storage

1. Store the measurement dataset with <STO>. The consecutive number of the next free memory location is shown on the display.

2. Confirm with <OK>. The display switches to entering the ID number. The ID number that was set last is displayed.
### Message Sto Full

This message appears when all of the 800 memory locations are occupied.

When the memory is full, you can:

- press `<OK>` to store the current measured value. The oldest measured value (memory location 1) will be overwritten by this.
- press `<MODE>` to switch to the measured value display without storing.
- download the data memory (see page 42)
- clear the memory (see page 43).

<table>
<thead>
<tr>
<th>3</th>
<th>Using <code>&lt;▲&gt;&lt;▼&gt;</code>, enter the required ID number (1 ... 9999).</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Confirm with <code>&lt;OK&gt;</code>. The dataset is stored. The meter switches to the measuring mode.</td>
</tr>
</tbody>
</table>
4.6.2 Automatic storage at intervals

In order to store measured values automatically at certain time intervals, set the storage interval (Int. 1).

Setting the save interval

The default setting for the storage 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):

Note
When the AutoStore function is active, the automatic switchoff function is off.

1. Using <STO>, call up the setting menu for automatic storing (Int. 1).

2. Set the required interval with <▲><▼>.

3. Confirm with <OK>. Free, the number of free memory locations is displayed.
### Note

If there are not enough memory locations available for your measurements:

- Output and backup the data storage (see page 42) and
- Clear the memory (see page 43).

| 4 | Confirm with `<OK>`.  
    | **Ident** and the ID number that was last set is displayed. |

| 5 | Set the required ID number with `<▲>`<`▼>`.

| 6 | Confirm with `<OK>`.  
    | The meter switches to the measured value display and starts the measuring and storing procedure. 
    | AutoStore flashes on the display.

| 7 | As soon as all of the 800 memory locations are occupied, AutoStore is terminated (**Int.1 = OFF**).

### Switching off the automatic storing function

You can terminate the automatic storing function in the following ways:

- set the storage interval (**Int.1**) to **OFF**, or
- switch the meter off and then on again.
4.6.3 Downloading the data storage

You can download stored measurement datasets:

- to the display
- to the interface (see page 45)

**Download to the display**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Open the storage menu with &lt;RCL&gt;.</td>
</tr>
<tr>
<td>2</td>
<td>If necessary, scroll with &lt;RCL&gt; until Sto disp (measurement datasets) is displayed.</td>
</tr>
<tr>
<td>3</td>
<td>Press &lt;OK&gt; to display the dataset that was last stored. The memory location of the dataset is displayed for approx. 2 s, then the respective temperature appears.</td>
</tr>
</tbody>
</table>

While the memory is displayed you can:

- press <OK> to display further data of the dataset (ID number, date, time, memory location, temperature)
- use <▲> to display the next dataset
- use <▼> to display the previous dataset

**Note**

In order to search for certain data of the dataset, e.g. for the date, proceed as follows:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Use &lt;OK&gt; to scroll on until the required data of the dataset, e.g. the date, is displayed.</td>
</tr>
<tr>
<td>2</td>
<td>Use &lt;▲&gt; or &lt;▼&gt; to scroll until the required date is displayed. After approx. 2 s the display shows the respective temperature value.</td>
</tr>
</tbody>
</table>
4.6.4 Erasing the data memory

You can erase all stored measurement datasets.

1. Open the storage menu with <RCL>.
2. If necessary, scroll with <RCL> until Sto disp or Sto prt is displayed.
3. Press <RCL> to display the Clr All function.
4. Press <OK> to erase the entire contents of the memory.
   or
   Return to the measured value display with <MODE>.
   The stored data is retained.

4.6.5 Downloading calibration data

You can download calibration data:

- to the display
  - via the memory menu
  - via the calibration menu
- to the interface (see page 45)

Download to display via memory menu

1. Open the storage menu with <RCL>.
2. If necessary, scroll with <RCL> until CAL disp is displayed.
3. Press <OK> 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

**Download to display via calibration menu**

|   | 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:

<table>
<thead>
<tr>
<th>Data</th>
<th>Control</th>
<th>Operation / description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current measured values</td>
<td>manual</td>
<td>• With &lt;OK&gt;.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Simultaneously with every automatic storage process (<em>Int.1</em>) (see page 40).</td>
</tr>
<tr>
<td>automatic, at intervals</td>
<td></td>
<td>• With &lt;SC__&gt;. Then you can set the transmission interval (<em>Int.2</em>) (see page 45).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Simultaneously with every automatic storage process (<em>Int.1</em>) (see page 40).</td>
</tr>
<tr>
<td>automatic</td>
<td></td>
<td>• After each measurement with stability control.</td>
</tr>
<tr>
<td>Stored measured values</td>
<td>manual</td>
<td>• All datasets (see page 46).</td>
</tr>
<tr>
<td>calibration records</td>
<td>manual</td>
<td>• Without display indication (see page 46).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• During the display indication with &lt;CAL__&gt; (see page 43).</td>
</tr>
<tr>
<td>automatic</td>
<td></td>
<td>• On completion of a calibration procedure.</td>
</tr>
</tbody>
</table>

### 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 *Int.2* interval.
4.7.3 Downloading stored measurement datasets

1. Open the storage menu with <RCL>.
2. If necessary, scroll with <RCL> until Sto Prt is displayed.
3. Press <OK> to download the calibration data to the interface.

4.7.4 Downloading calibration data

1. Open the storage menu with <RCL>.
2. If necessary, scroll with <RCL> until CAL Prt is displayed.
3. Press <OK> to download the calibration data to the interface.

4.7.5 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:
   - Baud rate: selectable from 1200, 2400, 4800, 9600,
   - Handshake: RTS/CTS + Xon/Xoff
   - PC only:
     - Parity: none
     - Data bits: 8
     - Stop bits: 1
4.7.6 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.

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

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.

4.7.7 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 (°C / °F)
  - Cleaning interval (Int.C [0 ... 999])
- Setting and starting automatic storing processes (<STO__>, see page 40)
  - AutoStore interval (Int.1)
- Setting and starting the data download to the interface (<SC__>, see page 45)
  - Data download interval (Int.2)

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.

<table>
<thead>
<tr>
<th>Setting</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baud rate (Baud)</td>
<td>1200, 2400, <strong>4800</strong>, 9600</td>
</tr>
<tr>
<td>Switch-off interval (OFF)</td>
<td>10, 20, 30, 40, 50 min, 1, 2, 3, 4, 5, 10, 15, 20, 24 h</td>
</tr>
<tr>
<td>Date (Day.Month)</td>
<td>Any</td>
</tr>
<tr>
<td>Date (Year)</td>
<td>Any</td>
</tr>
<tr>
<td>Time (Time)</td>
<td>Any</td>
</tr>
</tbody>
</table>

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

2. Set the required baud rate with <▲><▼>.

3. Confirm with <OK>. 
   .OFF, the setting of the switch-off interval is displayed.
4 Set the switch-off interval with <▲><▼>.

5 Confirm with <OK>.

*Day.Month*, the setting of the date is displayed.
The day display flashes.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Set the switch-off interval with &lt;▲&gt;&lt;▼&gt;.</td>
</tr>
</tbody>
</table>
| 5 | Confirm with <OK>.  
*Day.Month*, the setting of the date is displayed.  
The day display flashes. |

6 Set the date of the current day with <▲><▼>.  

7 Confirm with <OK>.  
The month display flashes.

8 Set the current month with <▲><▼>.  

9 Confirm with <OK>.  
*Year*, the setting of the year is displayed.

10 Set the year with <▲><▼>.  

11 Confirm with <OK>.  
The setting of the time is displayed.  
The hour display flashes.

12 Set the current hour with <▲><▼>.  

13 Confirm with <OK>.  
The minute display flashes.

14 Set the current minute with <▲><▼>.  

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).

<table>
<thead>
<tr>
<th>Reference temperature</th>
<th>t25, t20</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature unit (Uni)</td>
<td>°C, °F</td>
</tr>
<tr>
<td>Cleaning interval (Int.C)</td>
<td>0 ... 180 ... 999 d</td>
</tr>
</tbody>
</table>

**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>.
   *Int.C*, the setting of the cleaning interval is displayed.

**Cleaning interval (Int.C)**

![Image of the Int.C setting](image)

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 storing (AutoStore)

After setting the interval for automatic storing the current measurement dataset is stored at the specified interval.

AutoStore interval (Int. 1)  | OFF, 5 s, 10 s, 30 s, 1 min,  
5 min, 10 min, 15 min, 30 min, 60 min

1 Press <STO> to open the setting for the storage interval.  
Int. 1, the setting of the storage interval is displayed.

2 Press <▲><▼> to select an interval.

3 Confirm with <OK>.  
FrEE, the number of free memory locations is displayed.

4 Confirm with <OK>.  
The setting of the storage interval is completed.  
The meter switches to the measuring mode.
4.8.4 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 (Int.2) | 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. Int.2, the setting of the transmission interval is displayed.

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 49 |
| Measurement settings | page 51 |

The following settings are also reset to the default condition:

<table>
<thead>
<tr>
<th>Setting</th>
<th>Default settings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measured variable</td>
<td>mS/cm or µS/cm</td>
</tr>
<tr>
<td>Adjusted cell constant</td>
<td>0,650 1/cm</td>
</tr>
<tr>
<td>Temperature compensation</td>
<td>nLF</td>
</tr>
<tr>
<td>Temperature coefficient of the linear temperature compensation</td>
<td>2.000 %/K</td>
</tr>
<tr>
<td>TDS factor</td>
<td>1.00</td>
</tr>
</tbody>
</table>

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 49.

CAUTION
Make sure that the poles of the batteries are the right way round. The ± signs on the batteries must correspond to the ± 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...

<table>
<thead>
<tr>
<th>Error message</th>
<th>Cause</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>$E_1$</td>
<td>Measured value outside the measuring range</td>
<td>Use suitable measuring cell</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Error message, $E_3$</th>
<th>Cause</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Measuring cell contaminated</td>
<td>Clean cell and replace it if necessary</td>
</tr>
<tr>
<td></td>
<td>Unsuitable calibration solution</td>
<td>Check calibration solutions</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Display of $C_{ln}$</th>
<th>Cause</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Cleaning interval expired</td>
<td>Recalibrate the measuring system</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Display, $LoBat$</th>
<th>Cause</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Batteries almost empty</td>
<td>Replace the batteries (see page 59)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Display to</th>
<th>Cause</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Time-out of the interface</td>
<td>Check the instrument that is connected</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Instrument does not react to keystroke</th>
<th>Cause</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Operating condition undefined or EMC load unallowed</td>
<td>Processor reset: Press and hold the $&lt;SC&gt;$ key and switch the meter on</td>
</tr>
<tr>
<td><strong>You want to know which software version is in the instrument</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Cause</strong></td>
<td><strong>Remedy</strong></td>
<td></td>
</tr>
<tr>
<td>– E. g., a question by the service department</td>
<td>– Switch on the meter. During the display test, display the software version with <strong>&lt;OK&gt;</strong>.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Message StoFull</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cause</strong></td>
</tr>
<tr>
<td>– All 800 memory locations are full</td>
</tr>
</tbody>
</table>
## 7 Technical data

### 7.1 General data

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>approx. 240 x 190 x 80 mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight</td>
<td>approx. 1.0 kg (without power pack, without stand)</td>
</tr>
<tr>
<td>Mechanical structure</td>
<td>Type of protection IP 43</td>
</tr>
<tr>
<td></td>
<td>Protective class III</td>
</tr>
<tr>
<td>Test certificates</td>
<td>cETLus</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Ambient conditions</strong></td>
<td></td>
</tr>
<tr>
<td>Storage</td>
<td>- 25 °C ... + 65 °C</td>
</tr>
<tr>
<td>Operation</td>
<td>0 °C ... + 55 °C</td>
</tr>
<tr>
<td>Climatic class</td>
<td>2</td>
</tr>
<tr>
<td><strong>Power supply</strong></td>
<td></td>
</tr>
<tr>
<td>Batteries</td>
<td>4 x 1.5 V alkali-manganese batteries, Type AA</td>
</tr>
<tr>
<td>Operational life</td>
<td>Approx. 1000 operating hours</td>
</tr>
<tr>
<td>Power pack</td>
<td>FRIWO FW7555M/09, 15.1432.500-00</td>
</tr>
<tr>
<td>(charging device)</td>
<td>Friwo Part. No. 1883259</td>
</tr>
<tr>
<td></td>
<td>Input: 100 ... 240 V ~ / 50 ... 60 Hz / 400 mA</td>
</tr>
<tr>
<td></td>
<td>Output: 9 V = / 1.5 A</td>
</tr>
<tr>
<td></td>
<td>Connection max. overvoltage category II</td>
</tr>
<tr>
<td></td>
<td>Primary plugs contained in the scope of delivery: Euro, US, UK and Australian.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Serial interface</th>
<th>Baud rate adjustable: 1200, 2400, 4800, 9600 Baud</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Type RS232, bidirectional</td>
</tr>
<tr>
<td></td>
<td>Data bits 8</td>
</tr>
<tr>
<td></td>
<td>Stop bits 2</td>
</tr>
<tr>
<td></td>
<td>Parity None</td>
</tr>
<tr>
<td></td>
<td>Handshake RTS/CTS+Xon/Xoff</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>USB interface</th>
<th>Automatic switch-over when a USB cable is connected.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Type USB 1.1 (device)</td>
</tr>
<tr>
<td></td>
<td>Cable length max. 3 m</td>
</tr>
</tbody>
</table>
### Guidelines and norms used

<table>
<thead>
<tr>
<th></th>
<th>EMC</th>
<th>Instrument safety</th>
<th>Climatic class</th>
<th>IP protection class</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>EC guideline 2004/108/EC</td>
<td>EC guideline 2006/95/EC</td>
<td>VDI/VDE 3540</td>
<td>EN 60529</td>
</tr>
<tr>
<td></td>
<td>EN 61326-1 Class B</td>
<td>EN 61010-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>FCC Class A</td>
<td>ANSI/UL 61010-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>CAN/CSA-C22.2 No. 61010-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### 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.
### 7.2 Measuring ranges, resolution, accuracy

<table>
<thead>
<tr>
<th>Measuring ranges, resolution</th>
<th>Variable</th>
<th>Measuring range</th>
<th>Resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>ße [µS/cm]</td>
<td>0.000 ... 1.999*</td>
<td>0.001</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.00 ... 19.99**</td>
<td>0.01</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.0 ... 199.9</td>
<td>0.1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0 ... 1999</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>ße [mS/cm]</td>
<td>0.00 ... 19.99</td>
<td>0.01</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.0 ... 199.9</td>
<td>0.1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0 ... 500</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Resistivity [MOhm*cm]</td>
<td>0.00 ... 19.99</td>
<td>0.01</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.0 ... 199.9</td>
<td>0.1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0 ... 1999</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>SAL</td>
<td>0.0 ... 70.0</td>
<td>0.1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>according to the IOT table</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TDS [mg/l]</td>
<td>0 ... 1999</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Factor can be set between 0.40 and 1.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T [°C]</td>
<td>−5.0 ... +120.0</td>
<td>0.1</td>
<td></td>
</tr>
<tr>
<td>T [°F]</td>
<td>+23.0 ... +248.0</td>
<td>0.1</td>
<td></td>
</tr>
</tbody>
</table>

* 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 ... 0.110 cm⁻¹

<table>
<thead>
<tr>
<th>Cell constants</th>
<th>Cell constant C</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Can be calibrated in the ranges</td>
<td>0.450 ... 0.500 cm⁻¹</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.585 ... 0.715 cm⁻¹</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.800 ... 1.200 cm⁻¹</td>
<td></td>
</tr>
<tr>
<td>Adjustable</td>
<td>0.250 ... 2.500 cm⁻¹</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.090 ... 0.110 cm⁻¹</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.010 cm⁻¹ (fixed)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Reference temperature</th>
<th>Reference temperature</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adjustable</td>
<td>20 °C (Tr20)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>25 °C (Tr25)</td>
<td></td>
</tr>
</tbody>
</table>
### Accuracy (± 1 digit) | Variable | Accuracy | Temperature of the test sample
--- | --- | --- | ---
### æ/ Temperature compensation
None (Off) | ± 0.5 % | 0 °C ... + 35 °C
Nonlinear (nLF) | ± 0.5 % | + 35 °C ... + 50 °C
| ± 0.5 % | Extended nLF function according to WTW measurements
Linear (lin) | ± 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 |
PT 1000 | ± 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

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\mathcal{R}$</td>
<td>Conductivity value</td>
</tr>
<tr>
<td>°C</td>
<td>Temperature unit °Celsius</td>
</tr>
<tr>
<td>°F</td>
<td>Temperature unit, °Fahrenheit</td>
</tr>
<tr>
<td>AR</td>
<td>AutoRead An AutoRead measurement is carried out for stability control (SC).</td>
</tr>
<tr>
<td>ARng</td>
<td>Automatic range switch-over: meter measures with highest possible resolution</td>
</tr>
<tr>
<td>AutoStore</td>
<td>Automatic storage in memory</td>
</tr>
<tr>
<td>Baud</td>
<td>Baud rate</td>
</tr>
<tr>
<td>C</td>
<td>Cell constant cm$^{-1}$</td>
</tr>
<tr>
<td>Cal</td>
<td>The measuring system is being calibrated or works with a calibrated cell constant.</td>
</tr>
<tr>
<td>CELL</td>
<td>Cell constant</td>
</tr>
<tr>
<td>disp</td>
<td>Display Data memory is displayed</td>
</tr>
<tr>
<td>E1</td>
<td>Overflow Display range exceeded</td>
</tr>
<tr>
<td>E3</td>
<td>Error message see <a href="#">CHAPTER 6 WHAT TO DO IF... (PAGE 61)</a></td>
</tr>
<tr>
<td>Ident</td>
<td>ID number</td>
</tr>
<tr>
<td>InI</td>
<td>Initialization Resets individual basic functions to the status they had on delivery</td>
</tr>
<tr>
<td>Int</td>
<td>Interval</td>
</tr>
<tr>
<td>IOT</td>
<td>International Oceanographic Tables</td>
</tr>
<tr>
<td>Lin</td>
<td>Linear temperature compensation</td>
</tr>
<tr>
<td>LoBat</td>
<td>Low Battery Batteries are almost empty</td>
</tr>
<tr>
<td>nLF</td>
<td>Nonlinear temperature compensation</td>
</tr>
<tr>
<td>RCL</td>
<td>Recall (memory download)</td>
</tr>
<tr>
<td>SAL</td>
<td>Salinity</td>
</tr>
<tr>
<td>SC</td>
<td>Stability control (drift control)</td>
</tr>
<tr>
<td>Abbreviation</td>
<td>Description</td>
</tr>
<tr>
<td>--------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>SELV</td>
<td>Safety Extra Low Voltage</td>
</tr>
<tr>
<td>Sto</td>
<td>Store (memory)</td>
</tr>
<tr>
<td>Sto Clr</td>
<td>Clearing the memory</td>
</tr>
<tr>
<td>Sto disp</td>
<td>Download data memory to display</td>
</tr>
<tr>
<td>Sto Full</td>
<td>Memory location occupied</td>
</tr>
<tr>
<td>Sto Prt</td>
<td>Download data memory to printer/interface</td>
</tr>
<tr>
<td>Tauto</td>
<td>Automatic temperature measurement</td>
</tr>
<tr>
<td>TC</td>
<td>Temperature coefficient</td>
</tr>
<tr>
<td>TDS</td>
<td>Total dissolved solids</td>
</tr>
<tr>
<td>TP</td>
<td>Temperature Probe; Temperature measurement active</td>
</tr>
<tr>
<td>Tref 20/T20</td>
<td>Reference temperature 20 °C</td>
</tr>
<tr>
<td>Tref 25/T25</td>
<td>Reference temperature of 25 °C</td>
</tr>
</tbody>
</table>
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.
<table>
<thead>
<tr>
<th><strong>Standard solution</strong></th>
<th>The standard solution is a solution where the measured value is known by definition. It is used to calibrate a measuring system.</th>
</tr>
</thead>
</table>
| **TDS**               | Total dissolved solids  
Calculation: TDS (mg/l) = conductivity (µS) * TDS factor (mg/l*µS) |
| **Temperature coefficient** | Value of the slope $\alpha$ of a linear temperature function.  
$$\alpha_{T_{\text{Ref}}} = \frac{\alpha_{\text{Meas}} \cdot 1}{1 + \alpha \cdot (T - T_{\text{Ref}})}$$ |
| **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. |
Index

A
Authorized use .......................... 12

B
Battery compartment ........................ 15, 59
Baud rate setting .......................... 49

C
Calibration .......................... 26
Calibration evaluation .................. 28
Cell constant .......................... 26
Cleaning interval ......................... 26
Connect the power pack .................. 16

D
Dataset .................................. 38

E
Energy saving feature .................... 19
Error message .......................... 61

F
Firmware update ........................ 75

I
Initial commissioning .................... 15
Interval
  Calibration .......................... 26

K
Keys .................................. 8

L
LoBat .................................. 61

M
Measurement accuracy .................... 26
MultiLab pilot .......................... 47

N
Nonlinear
  Temperature compensation .......... 34, 35

O
Operation location ...................... 19
Operational safety ...................... 12
ORP voltage .......................... 23

P
Precautions .......................... 11
Print .................................. 45

R
Reset .......................... 55
  all meter settings .................. 56
  Cell constant ........................ 55
Resolution setting ...................... 51
RS232 interface ......................... 47

S
Safety .......................... 11
Sample display ........................ 9
Scope of delivery ...................... 15
Select a linear
  Temperature compensation .......... 34, 36
Setting the date ......................... 16, 50
Setting the time ......................... 16, 50
Socket field .......................... 10
Stability control ....................... 25
Storage interval ....................... 40

T
TDS .......................... 24
Temperature compensation ............ 34
  Nonlinear .......................... 34
  Select a linear ....................... 34
  Switch off .......................... 34, 37
Temperature sensor .................... 21
Total dissolved solids .................. 24
Appendix: Firmware update

General information
With the "Update_Labxxx_MxxxP" program and a PC you can update the firmware of the Lab 960 to the newest version.

For the update you can connect the meter to a PC via the USB or RS232 interface.

For the update via the USB interface, the following is required:
- a free USB interface (virtual COM port) on your PC
- the driver for the USB interface (installation see page 47)
- the USB cable Z875 (included in the scope of delivery of the Lab 960).

For the update via the RS232 interface, the following is required:
- 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 USB interface cable Z875, connect the Lab 960 to an USB interface (virtual COM port) of the PC.
   or
   Using the Z390 interface cable, connect the Lab 960 to the serial interface (COM port) of the PC.

2. Make sure the Lab 960 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 62).