Operating manual

VWR® CO 3100 H - Conductivity Meter

EU cat. no   NA cat. no

663-0234   76460-508

CE

UK CA

Legal Address of Manufacturer:

Europe

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CO 3100 H - Contents

1   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 meter.

Target group   The meter was developed for work in the field and 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.
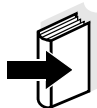
Note
indicates cross-references to other documents, e.g. operating manuals.

1.1   Authorized use

Authorized use of the meter consists exclusively of the measurement of conductivity, resistivity, salinity, TDS (total dissolved solids) and temperature in a laboratory or field environment.
The technical specifications as given in chapter 3 TECHNICAL DATA 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**.

1.2   General safety instructions

This meter 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 3 TECHNICAL DATA.

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

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

Safe operation   If safe operation is no longer possible, the meter 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   The purchaser of this meter must ensure that the following laws and
purchaser**   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.

Caution
**In addition to the safety instructions mentioned here, also follow
the safety instructions of the sensors used.**

2   Overview

The CO 3100 H compact precision conductivity meter enables you to perform conductivity measurements quickly and reliably.

The CO 3100 H 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 Connectors
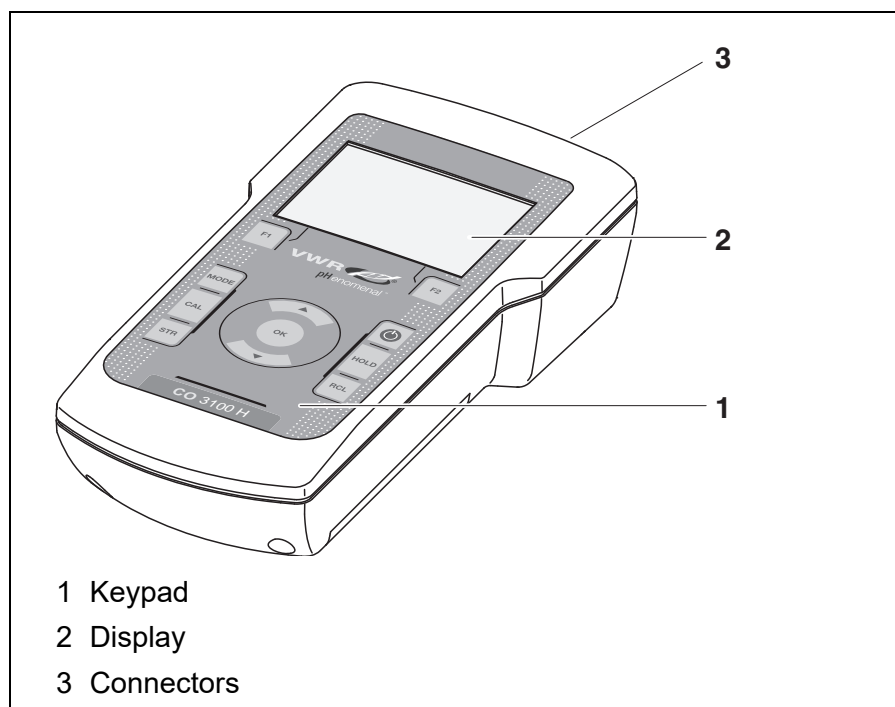
2.1   Keypad

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__ >).

<F1>: **<F1__>:** **<F2>:** **<F2__>:**	Softkeys providing situation dependent functions, e.g.: **<F1>**/[Menu]: Opens the menu for measurement settings **<F1__>**/[Menu]: Opens the menu for system settings
<On/Off>:	Switches the meter on or off
<MODE>:	Selects the measured parameter
<CAL>: **<CAL__>**:	Calls up the calibration procedure Displays the calibration data
<STR>: **<STR__ >**	Saves a measured value manually Opens the menu for the automatic save function
<RCL>: **<RCL__>**:	Displays the manually stored measured values Displays the automatically stored measured values
<▲ >:	Increments values, scrolls
<▼ >:	Decrements values, scrolls
<OK>: **<OK__ >**:	Opens the menu for measurement settings / confirms entries Opens the menu for system settings
<HOLD>	Freezes the measured value (HOLD function) Switches the AutoRead measurement on or off

2.2   Display

χ

1417 µS/cm

25.0 °C

[Tr25][nLF][0.840 1/cm]

HOLD

Menu   15.03.2014
              10:00   USB output

3

2

1

4

5

6

7

1 Status information

2 Measured value (with unit)

3 Measured parameter

4 Sensor symbol (calibration evaluation, calibration interval)

5 Measured temperature (with unit)

6 Status line

7 Softkeys and date + time
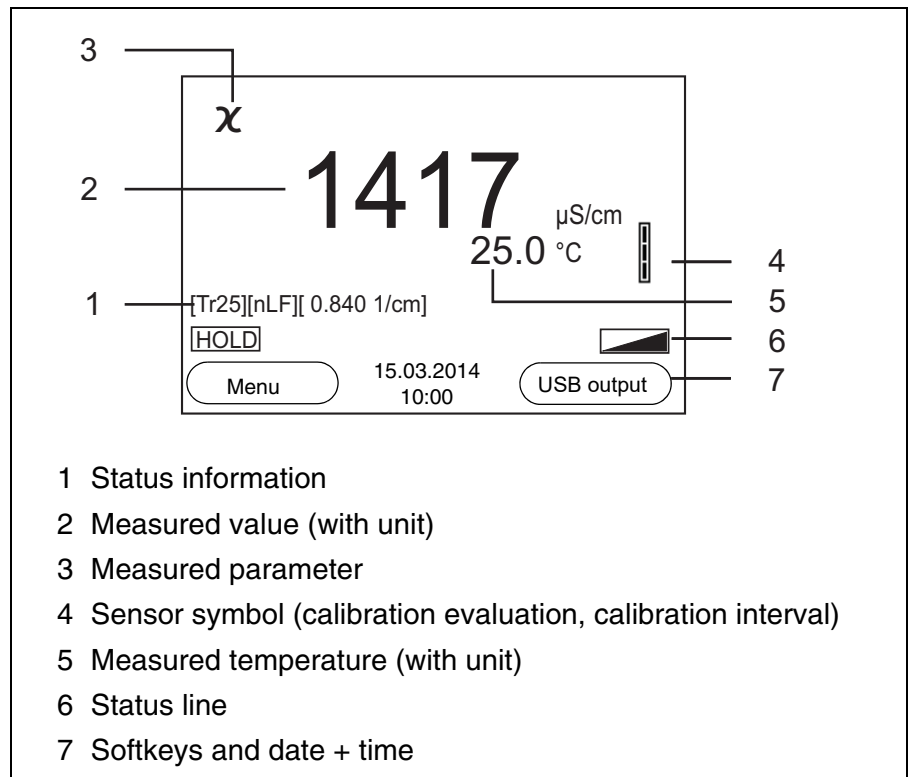
Function display indicators

Error	An error occurred during calibration
AR	Stability control (AutoRead) is active
HOLD	Measured value is frozen (**<HOLD>** key)
	Batteries are almost empty

2.3   Connectors

1   Conductivity measuring cell

2   USB B (device) interface

3   Service interface
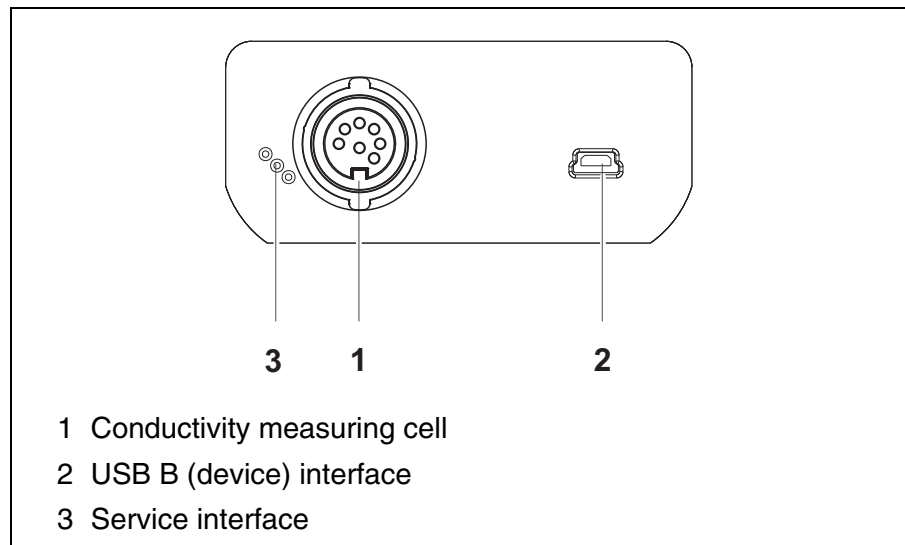
Caution
Only connect measuring cells to the meter that cannot return any voltages or currents that are not allowed (> SELV and > current circuit with current limiting).
Almost all customary measuring cells fulfill these conditions.

3   Technical data

3.1   General data

Dimensions	Approx. 180 x 80 x 55 mm	
Weight	Approx. 0.4 kg	
Mechanical structure	Type of protection	IP 67
Electrical safety	Protective class	III
Test certificates	CE	

Ambient conditions	Storage	- 25 °C ... + 65 °C
	Operation	-10 °C ... + 55 °C
	Admissible relative humidity	Yearly mean: < 75 % 30 days/year: 95 % Other days: 85 %

Power supply	Batteries	4 x 1.5 V alkali-manganese batteries, type AA
	Rechargeable batteries	4 x 1.2 V NiMH rechargeable batteries, type AA (no charging function)
	Operational life	Up to 800 h without / 100 h with illumination

USB interface	Type	USB 1.1 USB B (device), data output
	Baud rate	Adjustable: 1200, 2400, 4800, 9600, 19200 Baud
	Data bits	8
	Stop bits	2
	Parity	None
	Handshake	RTS/CTS
	Cable length	Max. 3 m

Guidelines and norms used	EMC	EU directive 2014/30/EU EN 61326-1 FCC Class A
	Meter safety	EU directive 2014/35/EU EN 61010-1
	IP protection class	EN 60529
	RoHS	EU directive 2011/65/EU

3.2   Measuring ranges, resolution, accuracy

Measuring ranges, resolution (depending on the sensor)

Variable	Measuring range	Resolution
χ[µS/cm]	0.000 ... 1.999* 0.00 ... 19.99** 0.0 ... 199.9 200 ... 1999	0.001 0.01 0.1 1
χ [mS/cm]	2.00 ... 19.99 20.0 ... 199.9 200 ... 1000	0.01 0.1 1
ρ (Resistivity) [Ohm*cm]	1.000 ... 1.999 2.00 ... 19.99 20.0 ... 199.9 200 ... 1999	0.001 0.01 0.1 1
ρ (Resistivity) [kOhm*cm]	2.00 ... 19.99 20.0 ... 199.9 200 ... 1999	0.01 0.1 1
ρ (Resistivity) [MOhm*cm]	2.00 ... 19.99** 20.0 ... 199.9*	0.01 0.1
SAL	0.0 ... 70.0 according to the IOT table	0.1
TDS	0 ... 1999 mg/l 2.00 ... 19.99 g/l 20.0 ... 199.9 g/l	1 0.01 0.1
T [°C]	-5.0 ... +105.0	0.1
T [°F]	+23.0 ... +221.0	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 ... 0.110 cm^{-1}

Cell constants

Cell constant C	Values
To be calibrated	0.450 ... 0.500 cm^{-1} 0.800 ... 0.880 cm^{-1}
Adjustable	0.010 cm^{-1} (fixed) 0.090 ... 0.110 cm^{-1} 0.250 ... 1.000 cm^{-1}

Reference temperature

Reference temperature	Values
Adjustable	20 °C (Tref20) 25 °C (Tref25)

Accuracy (± 1 digit)

Parameter	Accuracy	Temperature of the test sample
ϰ and ρ / temperature compensation		
None (Off)	± 0.5 %	
Nonlinear (nLF)	± 0.5 %	0 °C ... + 35 °C according to EN 27 888
	± 0.5 %	+ 35 °C ... + 50 °C enhanced nLF function
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]		
	± 0.5 %	
T [°C] / temperature sensor		
NTC 30	± 0.2	
PT 1000	± 0.3	

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

4   Commissioning

4.1   Scope of delivery

- Conductivity meter CO 3100 H
- 4 batteries 1.5 V Mignon type AA
- USB cable
- Short instructions
- CD-ROM with
  - USB drivers
  - detailed operating manual
  - Software MultiLab Importer

4.2   Initial commissioning

Perform the following activities:
- Insert the supplied batteries
- Switching on the meter
- Set the date and time

4.2.1   Inserting the batteries
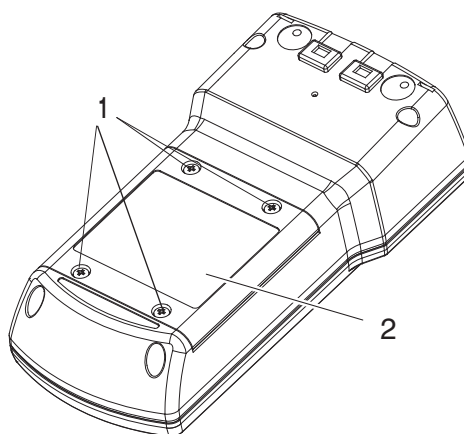
| 1 | Unscrew the screws (1) on the underside of the meter. |
| 2 | Open the battery compartment (2) on the underside of the meter. |

Caution
Make sure that the poles of the batteries are positioned correctly. The ± signs on the batteries must correspond to the ± signs in the battery compartment.

Note
Alternatively, you can also use Ni-MH rechargeable batteries (type Mignon AA). In order to charge the batteries, an external charging device is required.

3	Place four batteries (type Mignon AA) in the battery compartment.
4	Close the battery compartment.

4.2.2   Switching on the meter

1	Press the **<On/Off>** key. The meter performs a self-test. The display shows the manufacturer's logo while the self-test is being performed. Subsequently, the meter switches to the measuring mode (measured value display).

Note
The meter has an energy saving feature to avoid unnecessary battery depletion.
The energy saving feature switches off the meter if no key is pressed during the adjusted interval. (How to set the switch-off interval, see section 5.3.1).

4.2.3   Setting the date and time

1	See section 5.2.4

5   Operation

5.1   Switching on the meter

Switching on

Press the **<On/Off>** key.
The meter performs a self-test.
The display shows the manufacturer's logo while the self-test is being
performed.
The measured value display appears.

```
χ

          1417 μS/cm
           25.0 °C
 [Tr25][nLF][0.840 1/cm]


 ( Menu )     15.03.2014    ( USB output )
                10:00
```
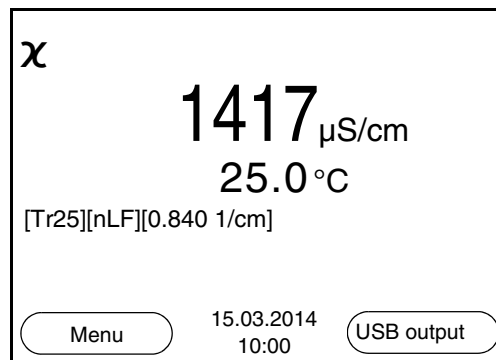
Switching off

Press the **<On/Off>** key.

**Automatic switch-off
function**

The instrument has an automatic switch-off function in order to save the
batteries (see section 5.3.1). The automatic switch-off function
switches off the meter if no key is pressed for an adjustable period.

The automatic switch-off function is not active

● if the communication cable is connected

● if the *Automatic data storage* function is active, or with automatic
   data transmission

Display illumination

The meter automatically switches off the display illumination if no key
is pressed for 30 seconds. The illumination is switched on with the next
keystroke again.

You can also generally switch the display illumination on or off (see
section 5.3.1).

5.2   General operating principles

This section contains basic information on the operation of the
CO 3100 H.

Operating elements,
display

An overview of the operating elements and the display is given in sec-
tion 2.1 and section 2.2.

Operating modes,
navigation

An overview of the operating modes and navigation of the CO 3100 H
is given in section 5.2.1 and section 5.2.2.

5.2.1   Operating modes

The instrument has the following operating modes:

● Measuring
  The measurement data of the connected sensor are shown in the
  measured value display

● Calibration
  The course of a calibration with calibration information, functions
  and settings is displayed

● Storing in memory
  The meter stores the measurement data manually or automatically

● Transmitting data
  The meter transmits measurement data and calibration records to
  the USB interface automatically or manually.

● Setting
  The system menu or a sensor menu with submenus, settings and
  functions is displayed

5.2.2   Navigation

Measured value display

In the measured value display, you can

● open the menu for calibration and measurement settings with **<F1>**
  (short keystroke)

● Open the *Storage & config* menu with the sensor-independent set-
  tings with **<F1___>** (long keystroke, approx. 2 s).

● Change the display in the measurement window by pressing
  <MODE> (e.g. conductivity –> resistivity –> –> –>).

Menus and dialogs

The menus for settings and dialogs in procedures contain further sub-
elements. The selection is made with the **<▲><▼>** keys. The current
selection is displayed with a frame.

● Submenus

The name of the submenu is displayed at the upper edge of the
frame. Submenus are opened by confirming with **<OK>**. Example:

```
 ┌──  System  ───────────────────┐
 │ ┌───────────────────────────┐ │
 │ │ General                   │ │
 │ └───────────────────────────┘ │
 │   Interface                   │
 │   Clock                       │
 │   Service information         │
 │   Reset                       │
 │                               │
 │                               │
 │                   15.03.2014  │
 │  ( Back )           10:00     │
 └───────────────────────────────┘
```
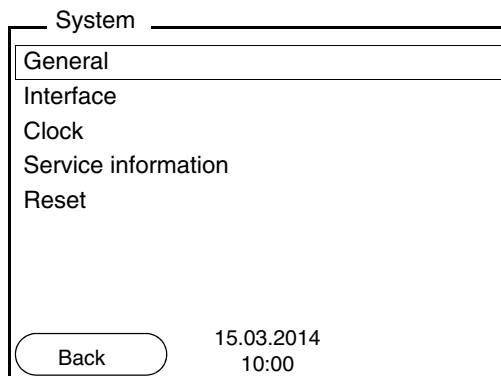
● <u>Settings</u>
   Settings are indicated by a colon. The current setting is displayed on
   the right-hand side. The setting mode is opened with **<OK>**. Subse-
   quently, the setting can be changed with **<▲><▼>** and **<OK>**.
   Example:

```
 ┌──  General  ──────────────────┐
 │ ┌───────────────────────────┐ │
 │ │ Language:          Deutsch│ │
 │ └───────────────────────────┘ │
 │   Beep:            Off         │
 │   Illumination:    On          │
 │   Contrast:        48 %        │
 │   Switchoff time:  30 min      │
 │                               │
 │                   15.03.2014  │
 │  ( Back )           10:00     │
 └───────────────────────────────┘
```
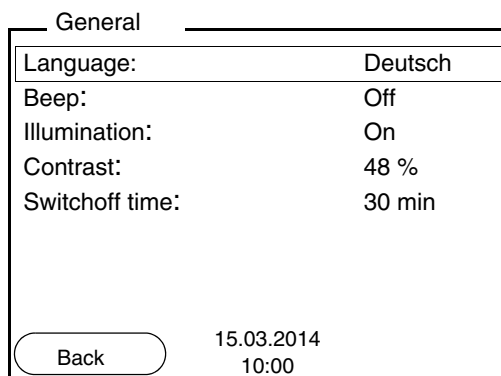
● <u>Functions</u>
   Functions are designated by the name of the function. They are
   immediately carried out by confirming with **<OK>**.
   Example: Display the *Calibration record* function.

```
  χ
┌─────────────────────────────────────┐
│ Calibration record                  │
│                                     │
│ Calibration data storage            │
│ Calibration interval:        150 d  │
│                                     │
│                                     │
│                                     │
│                                     │
│                                     │
│                                     │
│  ╭─────────╮    15.03.2014          │
│  │  Back   │       10:00            │
│  ╰─────────╯                        │
└─────────────────────────────────────┘
```
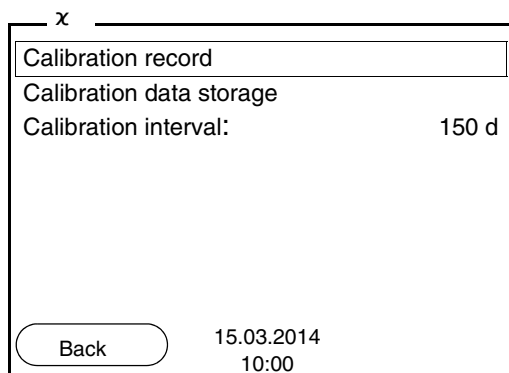
Messages   Information is marked by the **i** symbol. It cannot be selected. Example:

```
  χ
┌─────────────────────────────────────┐
│ Measuring cell                      │
│                                     │
│ Temp. comp. (TC)                    │
│ TDS factor                  1.00    │
│ Stability control             On    │
│ Temperature unit              °C    │
│                                     │
│  i   χ = 1413 µS/cm                 │
│                                     │
│  ╭─────────╮    15.03.2014          │
│  │  Back   │       10:00            │
│  ╰─────────╯                        │
└─────────────────────────────────────┘
```
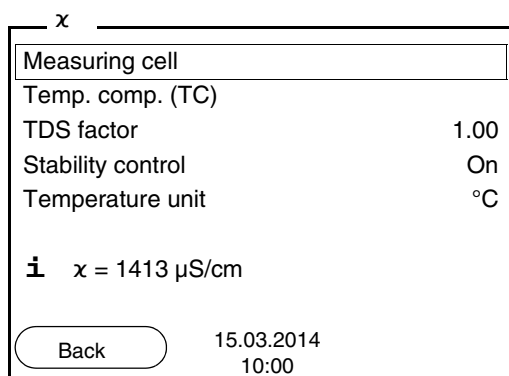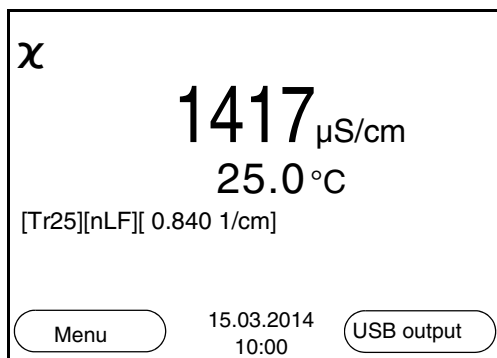
Note
The principles of navigation are explained in the two following sections by reference of examples:

● Setting the language (section 5.2.3)

● Setting the date and time (see section 5.2.4).

5.2.3   Navigation example 1:Setting the language

| 1 | Press the **<On/Off>** key.
The measured value display appears.
The instrument is in the measuring mode. |

χ

1417 μS/cm

25.0 °C

[Tr25][nLF][0.840 1/cm]

Menu   15.03.2014
              10:00   USB output

2	Using **<F1__>**/[Menu], open the *Storage & config* menu. The instrument is in the setting mode.

Storage & config

System
Data storage

Back   15.03.2014
              10:00
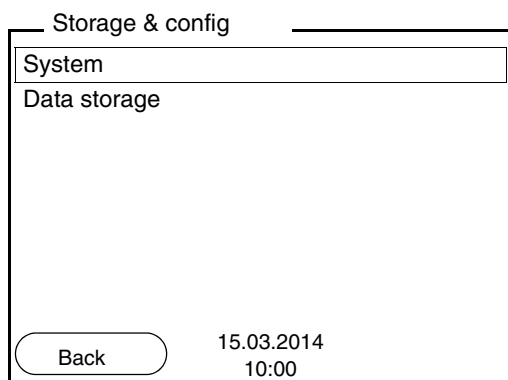
3	Select the *System* submenu with **<▲><▼>**. The current selection is displayed with a frame.
4	Open the *System* submenu with **<OK>**.

System

General
Interface
Clock
Service information
Reset

Back   15.03.2014
              10:00
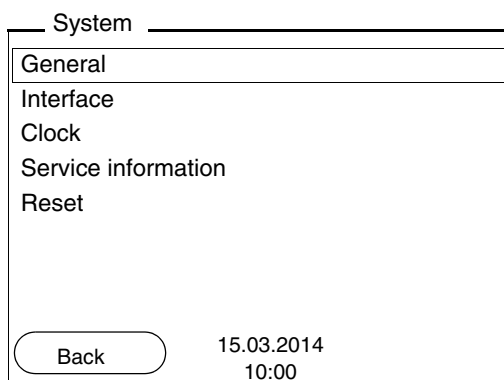
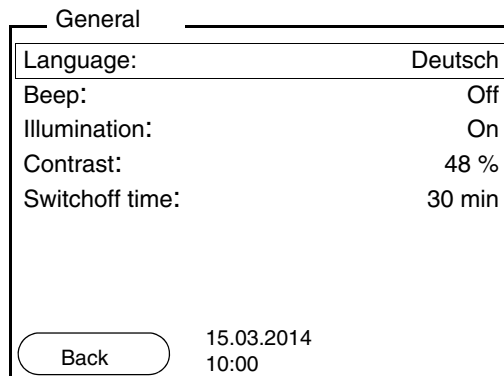| 5	Select the *General* submenu with **<▲><▼>**. The current selection is displayed with a frame.
6	Open the *General* submenu with **<OK>**.

```
 ┌── General ──────────────────┐
 │ ┌─────────────────────────┐ │
 │ │ Language:        Deutsch │ │
 │ └─────────────────────────┘ │
 │ Beep:                  Off  │
 │ Illumination:           On  │
 │ Contrast:             48 %  │
 │ Switchoff time:     30 min  │
 │                             │
 │                             │
 │              15.03.2014     │
 │ (  Back  )      10:00       │
 └─────────────────────────────┘
```

7	Open the setting mode for the *Language* with **<OK>**.

```
 ┌── General ──────────────────┐
 │ Language:       ┌─────────┐ │
 │                 │ Deutsch │ │
 │                 └─────────┘ │
 │ Beep:                  Off  │
 │ Illumination:           On  │
 │ Contrast:             48 %  │
 │ Switchoff time:     30 min  │
 │                             │
 │                             │
 │              15.03.2014     │
 │ (  Back  )      10:00       │
 └─────────────────────────────┘
```
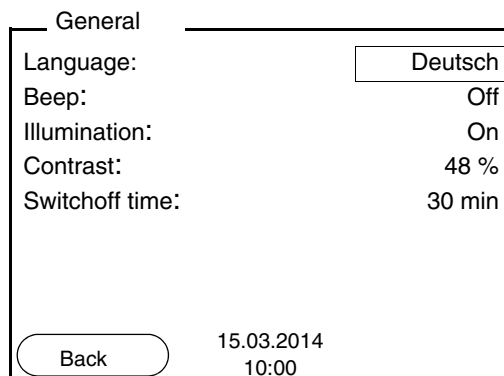
8	Select the required language with **<▲><▼>**.
9	Confirm the setting with **<OK>**. The meter switches to the measuring mode. The selected language is active.

5.2.4   Example 2 on navigation: Setting the date and time

The meter has a clock with a date function. The date and time are indicated in the status line of the measured value display.
When storing measured values and calibrating, the current date and time are automatically stored as well.

The correct setting of the date and time and date format is important for the following functions and displays:

● Current date and time

● Calibration date

● Identification of stored measured values
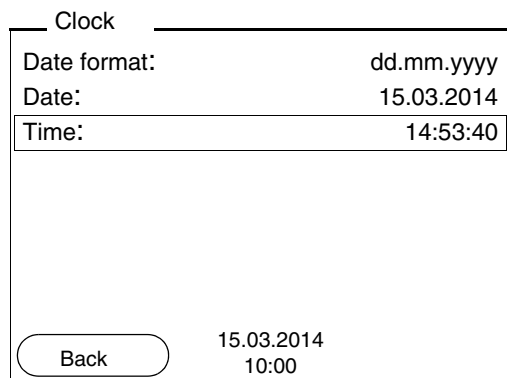
Therefore, check the time at regular intervals.

i

Note
The date and time are reset to default after a fall of the supply voltage (empty batteries).

Setting the date, time and date format

The date format can be switched from the display of day, month, year (*dd.mm.yyyy*) to the display of month, day, year (*mm/dd/yyyy* or *mm.dd.yyyy*).

1	In the measured value display: Using **<F1__>**/*[Menu]*, open the *Storage & config* menu. The instrument is in the setting mode.
2	Select and confirm the *System / Clock* menu with **<▲><▼>** and **<OK>**. The setting menu for the date and time opens up.
3	Select and confirm the *Time* menu with **<▲><▼>** and **<OK>**. The hours are highlighted.

```
___ Clock _____

Date format:                    dd.mm.yyyy
Date:                           15.03.2014
Time:                             14:53:40




       _____
      (  Back  )        15.03.2014
       ‾‾‾‾‾‾‾‾           10:00
```

4	Change and confirm the setting with **<▲><▼>** and **<OK>**. The minutes are highlighted.
5	Change and confirm the setting with **<▲><▼>** and **<OK>**. The seconds are highlighted.
6	Change and confirm the setting with **<▲><▼>** and **<OK>**. The time is set.

7	If necessary, set the *Date* and *Date format*. The setting is made similarly to that of the time.
8	To make further settings, switch to the next higher menu level with [Back]**<F1>**. or Switch to the measured value display with **<MODE>**. The instrument is in the measuring mode.

5.3 Sensor-independent settings

The *Storage & config* menu comprises the following settings:

- *System* (see section 5.3.1).
- *Data storage* (see section 5.3.2)

5.3.1 *System*

Overview

The following sensor-independent meter characteristics can be adjusted in the *Storage & config*/*System* menu:

- Menu language
- Beep on keystroke
- Illumination
- Display contrast
- Interval of the automatic switch-off function
- Data interface
- Clock and date function
- Reset of all sensor-independent system settings to the default condition

Settings

To open the *Storage & config* menu, press the **<F1__>**[Menu] key in the measured value display. After completing the settings, switch to the measured value display with **<MODE>**.

Menu item	Setting	Explanation
System / *General* / *Language*	*Deutsch* *English* (more)	Selects the menu language
System / *General* / *Beep*	*On* *Off*	Switches on/off the beep on keystroke
System / *General* / *Illumination*	*Auto* *On* *Off*	Switches the display illumination on/off
System / *General* / *Contrast*	0 ... 100 %	Changes the display contrast
System / *General* / *Switchoff time*	10 min ... 24 h	Adjusts the switch-off time
System / *Interface* / *Baud rate*	1200, 2400, 4800, 9600, 19200	Baud rate of the data interface

Menu item	Setting	Explanation
System / *Interface* / *Output format*	*ASCII* *CSV*	Output format for data transmission For details, see section 5.6
System / *Interface* / *Decimal separator*	*Dot (xx.x)* *Comma (xx,x)*	Decimal separator
System / *Interface* / *Output header*		Output of a header for *Output format*: CSV
System / *Clock*	*Time* *Datum* *Date format*	Settings of time and date. For details, see section 5.2.4
System / *Service information*		Hardware version and software version of the meter are displayed.
System / *Reset*	-	Resets the system settings to the default values. For details, see section 5.8.2

5.3.2 *Data storage*

This menu contains all functions to display, edit and erase stored measured values and calibration records.

Note
Detailed information on the memory functions of the CO 3100 H is given in section 5.5.

5.3.3 Automatic *Stability control*

The function, automatic *Stability control* (AutoRead) continually checks the stability of the measurement signal. The stability has a considerable impact on the reproducibility of measured values.

You can activate or switch off the automatic *Stability control* function (see section 5.4.4).

The measured parameter flashes on the display

● as soon as the measured value is outside the stability range

● when the automatic *Stability control* is switched off.

5.4   Conductivity

5.4.1   General information

You can measure the following parameters:

- Conductivity
- Specific resistance
- Salinity
- Total dissolved solids (TDS)

Attention
When a grounded PC is connected, measurements cannot be per-
formed in grounded media as incorrect values would result.
The USB interface is not galvanically isolated.

Temperature
measurement

The conductivity measuring cell CO 11 has an integrated temperature
sensor.

Preparatory activities

Perform the following preparatory activities when you want to measure:

| 1	Connect a conductivity measuring cell to the measuring instrument. The conductivity measuring screen is displayed.
2	Check whether the *Measuring cell* and cell constant settings are suitable for the connected conductivity measuring cell. If necessary, correct the settings.

Note
The selection of the measuring cell and the setting of the cell constant
is done in the measurement settings menu for conductivity (see section
5.4.4). The cell constant to be set must either be taken from the oper-
ating manual of the measuring cell or is printed on the measuring cell.

5.4.2   Measuring

You can carry out conductivity measurements as follows:

1	Perform the preparatory activities according to section 5.4.1.
2	Immerse the conductivity measuring cell in the test sample.

χ

$1417_{\mu S/cm}$

$25.0\,°C$

[Tr25][nLF][0.840 1/cm]

Menu   15.03.2014   USB output
                    10:00
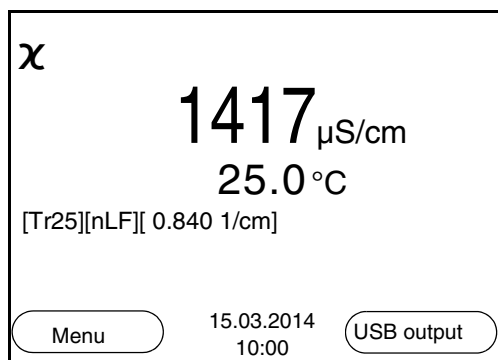
Selecting the displayed measured parameter

You can switch between the following displays with **<MODE>**:

● Conductivity [µS/cm] / [mS/cm]

● Resistivity [Ω·cm] / [kΩ·cm] / [MΩ·cm]

● Salinity SaL [ ]

● Total dissolved solids TDS [mg/l] / [g/l]

The factor to calculate the total dissolved solids is set to 1.00 in the factory. You can adjust this factor to meet your requirements in the range 0.40 ... 1.00. The factor is set in the *Measurement* menu for the parameter, TDS.

Stability control (AutoRead)

The stability control function (AutoRead) continually checks the stability of the measurement signal. The stability has a considerable impact on the reproducibility of measured values.

The measured parameter flashes on the display

● as soon as the measured value is outside the stability range

● when the automatic *Stability control* is switched off.

Criteria for a stable measured value

The *Stability control* function checks whether the measured values are stable within the monitored time interval.

Measured parameter	Time interval	Stability in the time interval
Conductivity $\varkappa$	10 seconds	Δ : better than 1.0% of measured value
Temperature	15 seconds	Δ : better than 0.5 °C

The minimum duration until a measured value is assessed as stable is the monitored time interval. The actual duration is mostly longer.

HOLD function

1	Freeze the measured value with **<HOLD>**. The [HOLD] status indicator is displayed. The HOLD function is active.
2	Release the frozen measured value again with **<HOLD>** or **<MODE>**. The [HOLD] status display disappears. The display switches back to the previous indication.

5.4.3   Temperature compensation

The calculation of the temperature compensation is based on the preset reference temperature, 20 °C or 25 °C. It appears on the display as *Tr20* or *Tr25*.

You can select one of the following temperature compensation methods:

● **Nonlinear temperature compensation** (*nLF*) according to EN 27 888

● **Linear temperature compensation (*Lin*)** with adjustable coefficient in the range 0.000 ... 10.000 %/K

● No temperature compensation (off)

Note
The reference temperature and temperature compensation are set in the *Measurement* menu for the parameter, conductivity (see section 5.4.4).

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

Test sample	Temperature compensation	Display indicator
Natural water (ground water, surface water, drinking water)	*nLF* according to EN 27 888	*nLF*
Ultrapure water	*nLF* according to EN 27 888	*nLF*
Other aqueous solutions	*Lin* Set linear temperature coefficient 0.000 ... 10.000 %/K	*Lin*
Salinity (seawater)	Automatic *nLF* according to IOT (International Oceanographic Tables)	*Sal*, *nLF*

5.4.4   Settings for conductivity measuring cells

Overview   The following settings are possible for conductivity measuring cells:

- Calibration record (display)

- Calibration interval

- Measuring cell/cell constant

- Reference temperature

- Temperature compensation

- TDS factor

- Unit of the temperature

- Automatic Stability control

Settings   The settings are made in the *Measurement* menu for the measured parameter, conductivity. To open the settings, display the required parameter in the measured value display and press the **<F1>**/[menu] or **<OK>** key. After completing the settings, switch to the measured value display with **<MODE>**.

Menu item	Possible setting	Explanation
Calibration / Calibration record	-	Displays the calibration record of the last calibration.
Calibration / Calibration data storage	-	Displays the last calibration records.
Calibration / Calibration interval	1 ... 999 d	*Calibration interval* for the measuring cell (in days). The meter reminds you to calibrate regularly by the flashing sensor symbol in the measuring screen.
Measurement / Measuring cell / Type		*Measuring cell* used
	Cal	Measuring cells the cell constant of which is determined by calibration in the KCL control standard solution. Calibration ranges: 0.450 to 0.500 cm^{-1} and 0.800 to 0.880 cm^{-1} The currently valid cell constant is displayed in the status line.
	C 0.100	Measuring cell C 0.100, nominal cell constant 0.100 cm^{-1}. The cell constant can be adjusted in the range from 0.090 to 0.110 cm^{-1}.
	C 0.010	Measuring cell C 0.010, nominal cell constant 0.010 cm^{-1}. The cell constant is permanently set.
	man	Any measuring cells with freely adjustable cell constants.
Measurement / Measuring cell / Cell const. man	0.250 ... 1.000 cm^{-1}	Display and setting option of the cell constant of any measuring cells (*man*).

Menu item	Possible setting	Explanation
Measurement / Measuring cell / Cell const. C 0.100	0.090 to 0.110 cm^{-1}	Display and setting options for the cell constant of the measuring cell C 0.100.
Measurement / Temp. comp. (TC) / Method	*nLF* *Lin* *Off*	Procedure for temperature compensation (see section 5.4.3). This setting is only available for the measured parameters, χ and ρ.
Measurement / Temp. comp. (TC) / Linear coeff.	0,000 ... 10,000 %/K	Coefficient of the linear temperature compensation. This setting is only available when the linear temperature compensation is set.
Measurement / Temp. comp. (TC) / Reference temp.	20 °C 25 °C	Reference temperature This setting is only available for the measured parameters, χ and ρ.
Measurement / TDS factor	0.40 ... 1.00	Factor for TDS value
Measurement / Stability control	*On / Off*	Switches on or off the automatic stability control during measurement (see section 5.3.3)
Measurement / Temperature unit	°C °F	Temperature unit, degrees Celsius or degrees Fahrenheit. All temperature values are displayed with the selected unit.
Reset	-	Resets all sensor settings to the delivery condition (see section 5.8.1).

5.4.5 Determining the cell constant (calibration in

control standard)

<table>
<tr>
<td>**Why determine the cell constant?**</td>
<td>Aging slightly changes the cell constant, e.g. due to coatings. As a result, an inexact measured value is displayed. The original characteristics of the cell can often be restored by cleaning the cell. Calibration determines the current value of the cell constant and stores this value in the meter.
Thus, you should calibrate at regular intervals (we recommend: every 6 months).</td>
</tr>
</table>

Procedure

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

- 0.800 ... 0.880 cm^{-1}
  (e.g. CO 11 with a nominal cell constant of 0.840 cm^{-1})

- 0.450 ... 0.500 cm^{-1}
  (e.g. conductivity measuring cells with a nominal cell constant of around 0.475 cm^{-1})

The cell constant is determined in the control standard, 0.01 mol/l KCl. Cell constants outside the ranges quoted above cannot be calibrated.

In the default condition, the calibrated cell constant of the meter is set to 0.845 cm^{-1} (conductivity sensor CO 11).

Stability control (AutoRead)

In calibration, the Stability control function (AutoRead) is automatically activated.

Display calibration data and output to interface

You can have the data of the last calibration displayed (see section 5.4.6). Subsequently, you can transmit the displayed calibration data to the interface, e.g. to a PC, with the **<F2>**/*[USB output]* key.

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

Sample record:

```
CO 3100 H
Ser. no. 08502113

CALIBRATION Cond
15.03.2014 16:13:33

Cell constant            0.841 1/cm
Temperature              25.0 °C
Sensor                   +++
```

Calibration evaluation

After calibration, the meter automatically evaluates the current status of the calibration. The evaluation appears on the display and in the cali-

bration record.

Display	Calibration record	Cell constant [cm^{-1}]
	+++	within the ranges 0.450 ... 0.500 cm^{-1} or 0.800 ... 0.880 cm^{-1}
Error Eliminate the error according to chapter 7 WHAT TO DO IF...	*Error*	outside the ranges 0.450 ... 0.500 cm^{-1} or 0.800 ... 0.880 cm^{-1}

Determining the cell constant

For this calibration procedure, the *Measuring cell* setting must be set to cal in the *Measurement* menu. Proceed as follows to determine the cell constant:

1	Connect a conductivity measuring cell to the measuring instrument.
2	In the measured value display, select the conductivity parameter with **<MODE>**.
3	Start the calibration with **<CAL>**. The cell constant that was calibrated last is displayed.
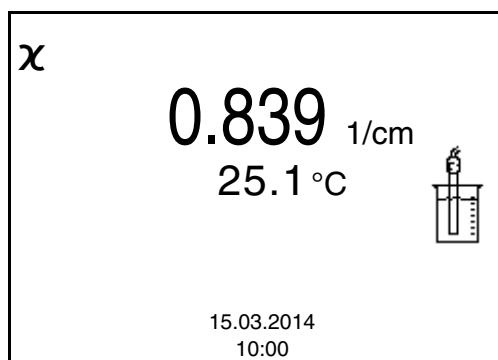
4	Immerse the conductivity measuring cell in the control standard solution, 0.01 mol/l KCl.
5	Start the measurement with **<OK>**. The [AR] status indicator is displayed. The measured parameter flashes.
6	Wait for the end of the AutoRead measurement or accept the calibration value with **<OK>**. The calibration record is displayed and output to the interface.

7	Using **<F1>**/*[Continue]* or **<OK>**, switch to the measured value display.

5.4.6 Displaying calibration records

The calibration data can be displayed and then output to the interface.

Displaying the calibration record

The calibration record of the last calibration is to be found under the menu item, *Calibration* / *Calibration record*. To open it in the measured value display, press the **<CAL__>** key.

The calibration records of the last calibration procedures are available in the **<F1>**/[Menu] / *Calibration* / *Calibration data storage* and **<F1__>**/[Menu] / *Storage & config*/*Data storage* / *Calibration data storage* menu.

Menu item	Setting/function	Explanation
Calibration / *Calibration data storage* / *Display* or *Data storage* / *Calibration data storage* / *Display*	-	Displays the calibration record. Further options: ● Scroll through the calibration records with **<▲><▼>**. ● Output the displayed calibration record to the interface with **<F2>**/ *[USB output]*. ● Quit the display with **<F1>**/*[Back]* or **<OK>**. ● Switch directly to the measured value display with **<MODE>**.
Calibration / *Calibration data storage* / *Output to USB* or *Data storage* / *Calibration data storage* / *Output to USB*	-	Outputs the calibration records to the interface.

Example

```
CO 3100 H
Ser. no. 08502113

CALIBRATION Cond
15.03.2014 16:13:33

Cell constant          0.841 1/cm
Temperature            25.0 °C
Sensor                 +++
```

5.5   Data memory

You can transmit measured values (datasets) to the data memory:

● Manual memory (see section 5.5.1)

● Automatic storing at intervals (see section 5.5.2)

Each data storing process transmits the current dataset to the interface at the same time.

Measurement dataset   A complete dataset consists of:

● ID number

● Date/time

● Measured value of the connected sensor

● Measured temperature value of the connected sensor

● AutoRead info: *AR* appears with the measured value if the Auto-Read criterion was met while storing (stable measured value). Otherwise, the *AR* display is missing.

● Calibration evaluation: +++, ++, +, -, or no evaluation

Memory locations   The CO 3100 H meter has two measurement data memories. The measured values recorded either manually or automatic are stored separately in individual measurement data memories.

Data memory	Maximum number of datasets
Manual data storage	200
Automatic data storage	5000

5.5.1 Manual storage

You can store a measurement dataset to the data memory as follows. The dataset is at the same time output to the interface:

1	Press the **<STR>** key <u>shortly</u>. The menu for manual data storage appears.

```
┌─── Manual data storage 4 von 200 ───┐
│                                       │
│  15.03.2014  07:00:00                 │
│  𝔁 1415 µS/cm   24.8 °C  AR  +++      │
│                                       │
│                                       │
│  ID number:              1            │
│ ┌───────────────────────────────────┐ │
│ │ Continue                          │ │
│ └───────────────────────────────────┘ │
│  ╭──────────╮    15.03.2014          │
│  │  Back    │         10:00          │
│  ╰──────────╯                        │
└───────────────────────────────────────┘
```

2	If necessary, change and confirm the ID number (1 ... 10000) with **<▲><▼>** and **<OK>**. The dataset is stored. The meter switches to the measured value display.

If the memory is full   The following window appears if all 200 storage locations are occupied:

```
┌─── Warning ───┐
│                                       │
│  Data storage full. Erase?            │
│                                       │
│                                       │
│                                       │
│  Yes                                  │
│ ┌───────────────────────────────────┐ │
│ │ No                                │ │
│ └───────────────────────────────────┘ │
│  ╭──────────╮    15.03.2014          │
│  │  Back    │         10:00          │
│  ╰──────────╯                        │
└───────────────────────────────────────┘
```
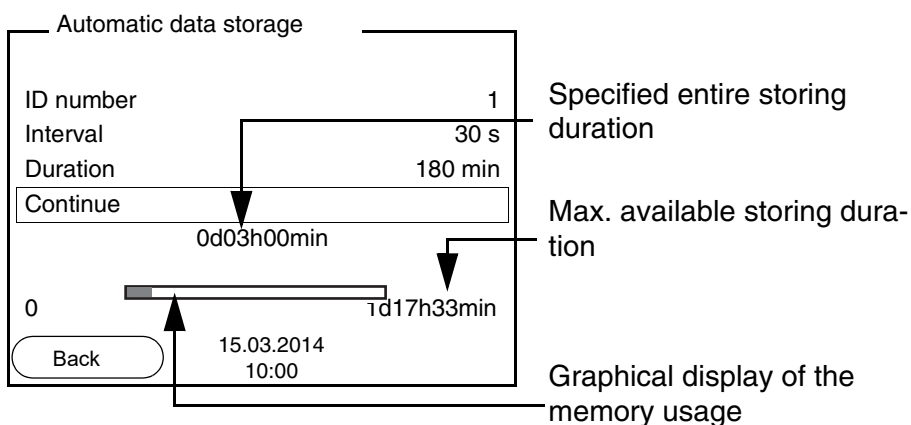
You have the following options:

● To erase the entire memory, confirm *Yes*.

● To cancel the storing process and switch to the measured value display, confirm *No*. Then you can e.g. store the data from the memory to a PC (see section 5.5.3) and subsequently erase the memory (see section 5.5.4).

5.5.2 Automatic storing at intervals

The storing interval (*Interval*) determines the time interval between automatic data storing processes. Each data storing process transmits the current dataset to the interface at the same time.

Configuring the automatic memory function

| 1 | Press the **<STR__ >** key. The menu for automatic data storing appears. |

Automatic data storage

ID number   1
Interval   30 s
Duration   180 min
Continue
         0d03h00min

0   1d17h33min

Back   15.03.2014
              10:00

Specified entire storing duration

Max. available storing duration

Graphical display of the memory usage

Settings You can configure the automatic data storing function with the following settings:

Menu item	Possible set-ting	Explanation
ID number	1 ... 10000	ID number for the dataset series.

Menu item	Possible setting	Explanation
Interval	1 s, 5 s, 10 s, 30 s, 1 min, 5 min, 10 min, 15 min, 30 min, 60 min	Storing interval. The lower limit of the storing interval can be restricted by the number of free memory locations. The upper limit is restricted by the storing duration.
Duration	*1 min* ... x min	Storing duration. Specifies after which time the automatic data storing should be terminated. The lower limit of the storing duration is restricted by the storing interval. The upper limit is restricted by the number of free memory locations.

Starting the automatic storing function

To start the automatic storing function, select *Continue* with **<▲><▼>** and confirm with **<OK>**. The meter switches to the measured value display.

Remaining storing duration

Graphical display of the storing duration
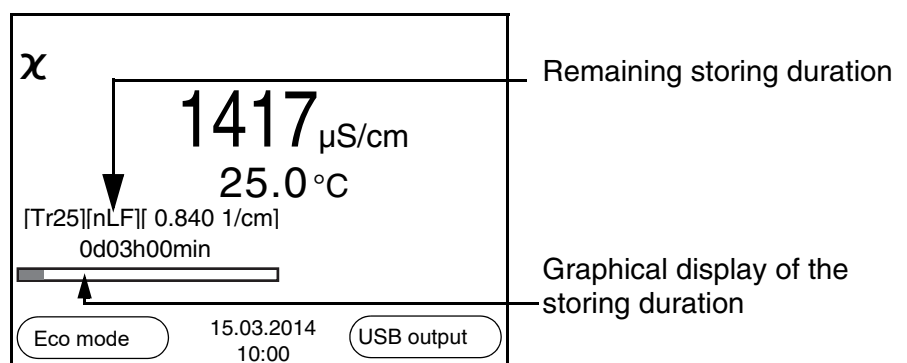
The active automatic data storing function can be recognized by the progress bar in the status line. The progress bar indicates the remaining storing duration.

Note
If the automatic storing function is activated, only the following keys are active: Softkeys, **<MODE>**, **<STR__ >** and **<On/Off>**. The other keys and the automatic switch-off function are deactivated.
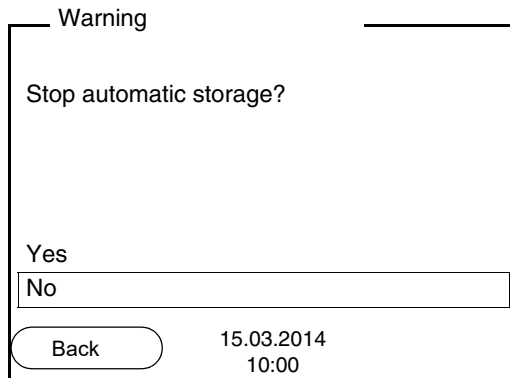
Energy saving mode ([Eco mode])	If the automatic storing function is active, the meter provides an energy saving mode ([Eco mode]) to avoid unnecessary energy consumption. The energy saving mode switches off functions of the meter that are not required for the automatic storing of measurement data (such as the display). By pressing any key the energy saving mode is switched off again.

Terminating the automatic memory function prematurely	Proceed as follows to switch off the automatic data storing function before the adjusted storing duration has expired:

1	Press the **<STR__ >** key. The following window appears.

```
┌─ Warning ──────        ────────────┐
│                                    │
│  Stop automatic storage?           │
│                                    │
│                                    │
│                                    │
│  Yes                               │
│ ┌────────────────────────────────┐ │
│ │ No                             │ │
│ └────────────────────────────────┘ │
│  ╭──────────╮    15.03.2014        │
│  │  Back    │        10:00         │
│  ╰──────────╯                      │
└────────────────────────────────────┘
```

2	Using **<▲><▼>**, select *Yes* and confirm with **<OK>**. The meter switches to the measured value display. The automatic data storing function is terminated.

5.5.3 Displaying and editing the measurement data memory

The contents of the manual or automatic measurement data memory can be shown on the display.

Each of the measurement data memories has a function to erase the entire contents.

The contents of the manual or automatic measurement data memory can be shown on the display and output to the interface.

Editing the data memory	The memory is edited in the menu, *Storage & config*/ *Data storage*. To open the *Storage & config* menu, press the **<F1__>**/[Menu] key in the measured value display.Open the manual or automatic storage directly with the **<RCL>** or **<RCL__>** key.

Note
The settings are explained here using the manual data memory as an example. The same settings and functions are available for the automatic data memory.

Settings

Menu item	Setting/func-tion	Explanation
Data storage / *Manual data storage /* *Display*	-	Displays all measurement datasets page by page. Further options: ● Scroll through the data-sets with **<▲><▼>**. ● Output the displayed dataset to the interface with **<F2>**/*[USB output]*. ● Quit the display with **<F1>**/*[Back]*.
Data storage / *Manual data storage /* *Erase*	-	Erases the entire manual measurement data memory. Note: All calibration data remain stored when this action is performed.
Data storage / *Manual data storage /* *Output to USB*	-	Outputs all stored measurement data to the interface.

Display presentation of a dataset

Manual data storage   3 of 64

15.03.2014 07:00:00   ID number: 1

χ 1415 µS/cm   25.1 °C AR +++
C = 0.840 1/cm, Tref 25, nLF

Back   15.03.2014
                  10:00

Example

```
15.03.2014 09:27:20
CO 3100 H
Ser. No. 12345678

ID number 1
𝛘 99.8 µS/cm    25.0 °C  AR  +++
─────────────────────────────────────

15.03.2014 09:56:24
CO 3100 H
Ser. No. 12345678

ID number 1
𝛘 99.9 µS/cm    25.0 °C  AR  +++
─────────────────────────────────────
```

Quitting the display

To quit the display of stored measurement datasets, you have the fol-
lowing options:

● Switch directly to the measured value display with **<MODE>**.

● Quit the display and move to the next higher menu level with **<F1>**/
[Back].

5.5.4 Erasing the measurement data memory

How to erase the measurement data memory is described in section
5.5.3 DISPLAYING AND EDITING THE MEASUREMENT DATA MEMORY.

5.6 Transmitting data (USB interface)

5.6.1 Options for data transmission

Via the USB interface you can transmit data to a PC. The following
table shows which data are transmitted to the interface in which way:

Data	Control	Operation / description
Current mea-sured values of all connected measuring cells	Manual	● With **<F2>**/*[USB output]*. ● Simultaneously with every manual storing process (see section 5.5.1).
	Automatic, at intervals	● With **<F2__>**/*[USB output]*. Then you can set the trans-mission interval. ● Simultaneously with every automatic storing process (see section 5.5.2).

Stored measured values	Manual	• Displayed dataset with **<F2>**/*[USB output]* after calling up from the memory. • All datasets with the *Output to USB* function. For details, see section 5.5.3.
Calibration records	Manual	• Calibration record with **<F2>**/*[USB output]*. For details, see section 5.6.
	Automatic	• At the end of a calibration procedure.

Note
The following rule applies: With the exception of the menus, shortly pressing the **<F2>**/*[USB output]* key generally outputs the display contents to the interface (displayed measured values, measurement datasets, calibration records).

5.6.2 Connecting a PC

Connect the CO 3100 H to the PC via the USB interface.

Attention
The USB interface is not galvanically isolated.
When a grounded PC is connected, measurements cannot be performed in grounded media as incorrect values would result.

Installation of the USB driver on the PC

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

• PC with USB port and CD-ROM drive

• Microsoft Windows
(for details, see enclosed installation CD, *Driver* directory)

1	Insert the supplied installation CD in the CD drive of your PC.
2	Install the driver from the CD. Follow the Windows installation instructions as necessary.
3	Connect the CO 3100 H to the PC via the USB interface. The meter is listed as a virtual COM interface among the connections in the Windows instrument manager.

5.7   MultiLab Importer

With the aid of the MultiLab Importer software, you can record and eval-
uate measurement data with a PC.

> More detailed information can be found in the MultiLab
> Importer operating manual.

5.8   Reset

You can reset (initialize) all sensor settings and sensor-independent
settings separately from each other.

5.8.1   Resetting the measurement settings

Note
The calibration data are reset to the default settings together with the
measuring parameters. Recalibrate after performing a reset.

The following settings for conductivity measurements are reset to the
default settings with the *Reset* function:

Setting	Default settings
Cal. interval	150 d
Measured parameter	$\varkappa$
Cell constant (c)	calibrated: 0,840 adjusted: The meter uses the last manually adjusted cell constant in the range 0.800 ... 1.200 cm-1.
Temperature compensation	nLF
Reference temperature	25 °C
Temperature coefficient (TC) of the linear temperature compensation	2.000 %/K
TDS factor	1.00
Stability control	On
Temperature unit	°C

The sensor settings are reset under the *Reset* menu item in the menu for calibration and measurement settings. To open the settings, activate the relevant measuring window in the measured value display and press the **<F1>**/[Menu] key <u>shortly</u>.

5.8.2   Resetting the system settings

The following system settings can be reset to the default status:

Setting	Default settings
Language	English
Beep	On
Baud rate	4800 Baud
Output format	ASCII
Contrast	50 %
Illumination	Auto
Switchoff time	1 h

The system settings are reset in the menu, *Storage & config* / *System / Reset*. To open the *Storage & config* menu, press the **<F1__>**/[Menu] key in the measured value display.

6 Maintenance, cleaning, disposal, accessories

6.1 Maintenance

The only maintenance activity required is replacing the batteries.
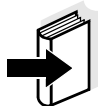
Note
See the relevant operating manuals of the measuring cells for instructions on maintenance.

6.1.1 Replacing the batteries
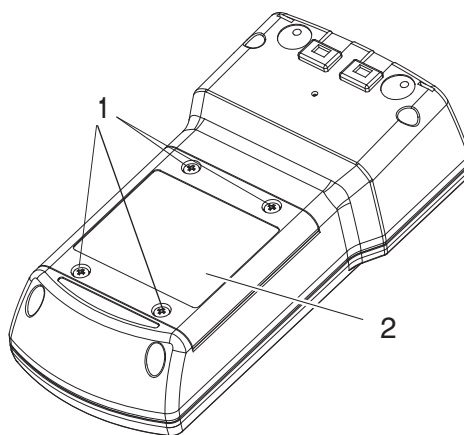
1	Unscrew the screws (1) on the underside of the meter.
2	Open the battery compartment (2) on the underside of the meter.
3	Remove the batteries from the battery compartment.

Caution
Make sure that the poles of the batteries are positioned correctly. The ± signs on the batteries must correspond to the ± signs in the battery compartment.

Note
Alternatively, you can also use Ni-MH rechargeable batteries (type Mignon AA). In order to charge the batteries, an external charging device is required.

4	Place four batteries (type Mignon AA) in the battery compart-ment.
5	Close the battery compartment.

6.2   Cleaning

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

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

6.3   Packing

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

6.4   Disposal

This equipment is marked with the crossed out wheeled bin symbol to indicate that this equipment must not be disposed of with unsorted waste.

Instead it's your responsibility to correctly dispose of your equipment at lifecycle -end by handling it over to an authorized facility for separate collection and recycling. It's also your responsibility to decontaminate the equipment in case of biological, chemical and/or radiological contamination, so as to protect from health hazards the persons involved in the disposal and recycling of the equipment.

For more information about where you can drop off your waste of equipment, please contact your local dealer from whom you originally purchased this equipment.

By doing so, you will help to conserve natural and environmental resources and you will ensure that your equipment is recycled in a manner that protects human health.

Thank you

6.5   Accessories

Measuring cells	Order no. (Catalogue No.)	
	EU	**NA**
pHenomenal CO 11 CONDUCTIVITY SENSOR PHENO-MENAL 1,5M 8PIN	663-0147	76470-822

Solutions	EU	NA
KCl 0,01 mol/l: 1,413 mS/cm, 100 ml	83607.180	-
KCl 0,01 mol/l: 1,413 mS/cm, 500 ml	83607.290	89236-544
KCl 0,1 mol/l: 12,8 mS/cm, 500 ml	83608.260	89236-546

Accessories	EU	NA
COMMUNICATION KIT (CD-ROM, USB cable, Manual)	662-1225	76470-840

7   What to do if...

Error message
OFL, UFL

Cause	Remedy
– Measured value outside the measuring range	– Use suitable measuring cell

Error message,
Error

Cause	Remedy
– Measuring cell contaminated	– Clean cell and replace it if necessary
– Calibration solution not suitable	– Check the calibration solutions
– Measuring cell not connected	– Connect the measuring cell

Sensor symbol flashes

Cause	Remedy
– Calibration interval expired	– Recalibrate the measuring system

Display

Cause	Remedy
– Batteries almost empty	– Replace the batteries (see section 6.1 MAINTENANCE)

Meter does not react to keystroke

Cause	Remedy
– Operating condition undefined or EMC load unallowed	– Processor reset: Press the **<OK>** and **<On/ Off>** key simultaneously

You want to know which software version is in the meter

Cause	Remedy
– E.g., a question by the service department	– Switch on the meter. Open the menu, **<F1__>**[Menu] / *Storage & config* / *System* / *Service information*. The instrument data are displayed.

8 Firmware update

General information

Available firmware updates are provided on the Internet.
With the "Firmware Update " program and a PC you can update the
firmware of the CO 3100 H to the newest version.

For the update you have to connect the meter to a PC.

For the update via the USB interface, the following is required:

● a free USB interface (virtual COM port) on the PC

● the driver for the USB interface (on the enclosed CD-ROM)

● the USB cable (included in the scope of delivery of the CO 3100 H).

Program installation

1	Install the downloaded firmware update on a PC. An update folder is created in the Windows start menu. If an update folder already exists for the meter (or meter type), the new data is displayed there.

Program start

2	In the windows start menu, open the update folder and start the firmware update program.

Firmware update

3	Using the USB interface cable, connect the CO 3100 H to a USB interface (virtual COM port) of the PC.
4	Switch on the CO 3100 H.
5	In the firmware update program, start the update process with OK.
6	Follow the instructions of the firmware update program. During the programming process, a corresponding message and a progress bar (in %) are displayed. The programming process takes approx. three minutes. A ter-minatory message is displayed after a successful programming process. The firmware update is completed.
7	Disconnect the CO 3100 H from the PC. The CO 3100 H is ready for operation again.

After switching the meter off and on you can check whether the meter
has taken over the new software version .

9   Lists

This chapter provides additional information and orientation aids.

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

Index   The index will help you to find the topics that you are looking for.

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

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

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

Reference temperature	Fixed temperature value to compare temperature-dependent measured values. For conductivity measurements, the measured value is converted to a conductivity value at a reference temperature of 20 °C or 25 °C.
Reset	Restoring the original condition of all settings of a measuring system.
Resistance	Short name for the specific electrolytic resistance. It corresponds to the reciprocal value of the electrical conductivity.
Resolution	Smallest difference between two measured values that can be displayed by a meter.
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.

Temperature coefficient

Value of the slope α of a linear temperature function.

$$\varkappa_{T_{Ref}} = \varkappa_{Meas} * \frac{1}{1 + \alpha * (T - T_{Ref})}$$

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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10   Technical service

Web resources

Visit the VWR website at www.vwr.com for:

● Complete technical service contact information

● Access to VWR's Online Catalogue, and information about accesso-
ries and related products

● Additional product information and special offers

Contact us:
For information or technical assistance contact your local VWR repre-
sentative or visit www.vwr.com.

11   Warranty

VWR warrants that this product will be free from defects in material and
workmanship for a period of three (3) years from date of delivery. If a
defect is present, VWR will, at its option and cost, repair, replace, or
refund the purchase price of this product to the customer, provided it is
returned during the warranty period. This warranty does not apply if the
product has been damaged by accident, abuse, misuse, or misapplica-
tion, or from ordinary wear and tear. If the required maintenance and
inspection services are not performed according to the manuals and
any local regulations, such warranty turns invalid, except to the extent,
the defect of the product is not due to such non performance.

Items being returned must be insured by the customer against possible
damage or loss. This warranty shall be limited to the aforementioned
remedies. IT IS EXPRESSLY AGREED THAT THIS WARRANTY
WILL BE IN LIEU OF ALL WARRANTIES OF FITNESS AND IN LIEU
OF THE WARRANTY OF MERCHANTABILITY.

12   Compliance with local laws and regula-
tions

The customer is responsible for applying for and obtaining the neces-
sary regulatory approvals or other authorizations necessary to run or
use the product in its local environment. VWR will not be held liable for
any related omission or for not obtaining the required approval or
authorization, unless any refusal is due to a defect of the product.

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