OPERATING MANUAL

ba77052d01 03/2014

pH/ION 3310

METER FOR pH/ORP/ISE

WTW

a xylem brand

For the most recent version of the manual, please visit www.WTW.com.

pH/ION 3310 - Contents

1 Overview

1.1 pH/ION 3310 meter

The pH/ION 3310 meter enables you to perform measurements (pH, U, ISE) quickly and reliably.

The pH/ION 3310 provides the maximum degree of operating comfort, reliability and measuring certainty for all applications.

1 Keypad
2 Display
3 Socket field

1.2 Sensors

A measuring system ready to measure consists of the pH/ION 3310 meter and a suitable sensor.

Information on available sensors is given on the Internet and in the WTW catalog, "Laboratory and field instrumentation".

2 Safety instructions

2.1 Safety information

2.1.1 Safety information in the operating manual

This operating manual provides important information on the safe operation of the meter. Read this operating manual thoroughly and make yourself familiar with the meter before putting it into operation or working with it. The operating manual must be kept in the vicinity of the meter so you can always find the information you need.

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

WARNING
indicates a possibly dangerous situation that can lead to serious (irreversible) injury or death if the safety instruction is not followed.

CAUTION
indicates a possibly dangerous situation that can lead to slight (reversible) injury if the safety instruction is not followed.

NOTE
indicates a possibly dangerous situation where goods might be damaged if the actions mentioned are not taken.

2.1.2 Safety signs on the meter

Note all labels, information signs and safety symbols on the meter and in the battery compartment. A warning symbol (triangle) without text refers to safety information in this operating manual.

2.1.3 Further documents providing safety information

The following documents provide additional information, which you should observe for your safety when working with the measuring system:

- Operating manuals of sensors and other accessories
- Safety datasheets of calibration or maintenance accessories (such as buffer solutions, electrolyte solutions, etc.)

2.2 Safe operation

2.2.1 Authorized use

Only the operation and running of the meter according to the instructions and technical specifications given in this operating manual is authorized (see section 13 TECHNICAL DATA, page 69).

Any other use is considered unauthorized.

2.2.2 Requirements for safe operation

Note the following points for safe operation:

- The meter may only be operated according to the authorized use specified above.
- The meter may only be supplied with power by the energy sources mentioned in this operating manual.
- The meter may only be operated under the environmental conditions mentioned in this operating manual.
- The meter may only be opened if this is explicitly described in this operating manual (example: Inserting the batteries).

2.2.3 Unauthorized use

The meter must not be put into operation if:

- it is visibly damaged (e.g. after being transported)
- it was stored under adverse conditions for a lengthy period of time (storing conditions, see section 13 TECHNICAL DATA, page 69).

3 Commissioning

3.1 Scope of delivery

- MeterpH/ION 3310
- 4 batteries 1.5 V Mignon type AA
- Short instructions
- CD-ROM with
  - USB drivers
  - detailed operating manual
  - Software MultiLab Importer

3.2 Power supply

The pH/ION 3310 is supplied with power in the following ways:

- Battery operation (4 x alkaline manganese batteries, type AA)
- USB operation via a connected USB-B cable

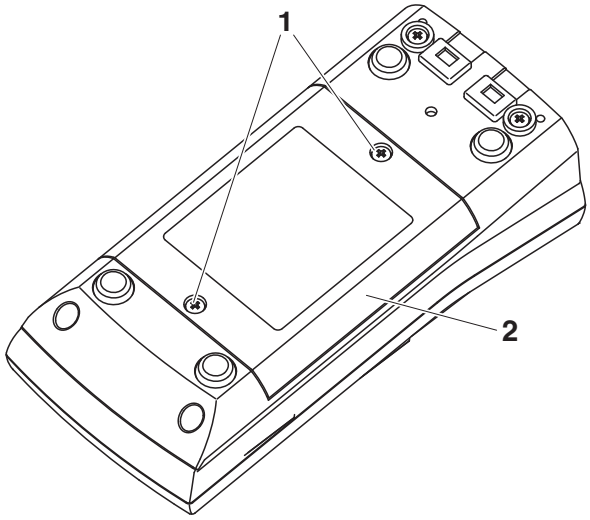
3.3 Initial commissioning

Perform the following activities:

- Insert the supplied batteries
- Switch on the meter (see section 4.2 SWITCHING ON THE METER, page 13)
- Set the date and time (see section 4.4.6 EXAMPLE 2 ON NAVIGATION: SETTING THE DATE AND TIME, page 18)

3.3.1 Inserting the batteries

You can operate the meter either with normal batteries or with rechargeable batteries (Ni-MH). In order to charge the batteries, an external charging device is required.



1 Screws
2 Battery compartment

1. Unscrew the two 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.

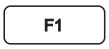
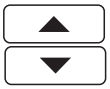
3. Place four batteries (type Mignon AA) in the battery compartment.
4. Close the battery compartment (2) and tighten the screws (1).
5. Set the date and time
(see section 4.4.6 EXAMPLE 2 ON NAVIGATION: SETTING THE DATE AND TIME, page 18).

4 Operation

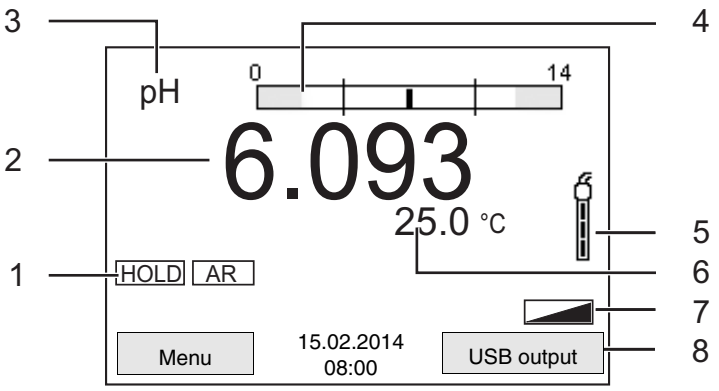
4.1 General operating principles

4.1.1 Keypad

In this operating manual, keys are indicated by brackets <..> .
The key symbol (e.g. **<ENTER>**) 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. **<ENTER__>**).

 	**<F1>**: **<F1__>**: **<F2>**: **<F2__>**:	Softkeys providing situation dependent functions, e.g.: **<F2>**/[USB output]: Outputs data to the USB interface **<F2__>**/[USB output]: Configures the automatic data output to the USB interface
	**<On/Off>**:	Switches the meter on or off
	**<M>**:	Selects the measured parameter / Quits the settings
	**<CAL>**: **<CAL__>**:	Calls up the calibration procedure Displays the calibration data
	**<STO>**: **<STO__>**:	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
	**<▲><▼>**: **<▲_><▼_>:**	Menu control, navigation Increments, decrements values Increments, decrements values continuously
	**<ENTER>**: **<ENTER__>**:	Opens the menu for measurement settings / confirms entries Opens the menu for system settings
	**<AR>**	Freezes the measured value (HOLD function) Switches the AutoRead measurement on or off

4.1.2 Display

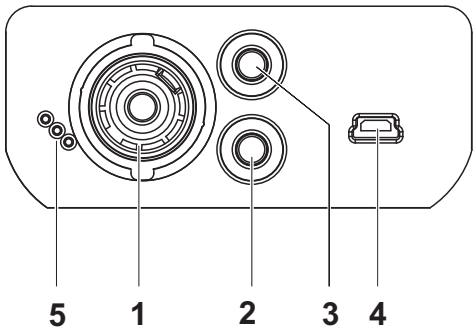


1 Status information (sensor)
2 Measured value (with unit)
3 Measured parameter
4 Continuous measurement control (CMC function)
5 Sensor symbol (calibration evaluation, calibration interval)
6 Measured temperature (with unit)
7 Status information (meter)
8 Softkeys and date + time

4.1.3 Status information (meter)

AR	Stability control (AutoRead) is active
HOLD	Measured value is frozen (**<AR>** key)
	Batteries are almost empty
	Data are automatically output to the USB-B interface at intervals

4.1.4 Socket field

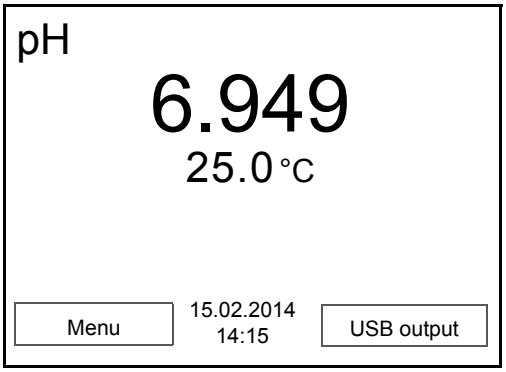


1 pH electrode
2 Reference electrode
3 Temperature sensor
4 Mini USB-B interface
5 Service interface

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 customary sensors fulfill these conditions.

4.2 Switching on the meter

1. Switch the meter on with **<On/Off>**.
   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.



4.3 Switching off

1. Switch the printer off with **<On/Off>**.

Automatic switch-off

The instrument has an automatic switch-off function in order to save the batteries (see section 8.2.1 SYSTEM, page 52). The automatic switchoff function switches off the meter if no key is pressed for an adjustable period.

The automatic switchoff 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 8.2.1 SYSTEM, page 52).

4.4 Navigation

The principles of navigation in menus and dialogs are explained in the following sections.

4.4.1 Operating modes

The instrument has the following operating modes:

Operating mode	Description
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
Storage in memory	The meter stores measuring data automatically or manually
Transmitting data	The meter transmits measuring data and calibration records to a USB-B interface automatically or manually.
Setting	The system menu or a sensor menu with submenus, settings and functions is displayed

Only those displays and functions are available in the active operating mode that are currently being required.

4.4.2 Measured value display

In the measured value display, open the setting menus with **<ENTER>**. The current functions of the softkeys are shown on the display.

- Use **<ENTER>** (short pressure) to open the menu for calibration and measurement settings for the displayed measured parameter.
- Use **<ENTER__>** (long keystroke (approx. 2 s) to open the *Storage & config* menu with the sensor-independent settings.

Use the keys of the keypad to carry out further functions such as storage or calibration (see section 4.1.1 KEYPAD, page 11). These functions are not available in other operating situations.

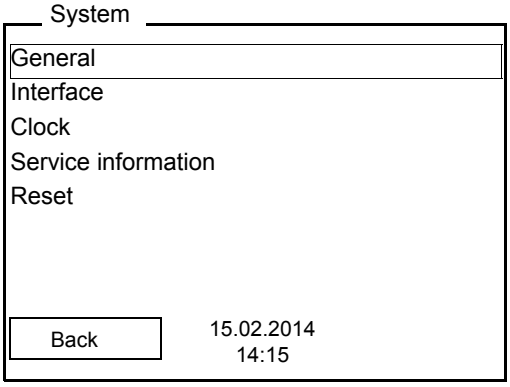
4.4.3 Menus and dialogs

The menus for settings and dialogs in procedures contain further subelements.

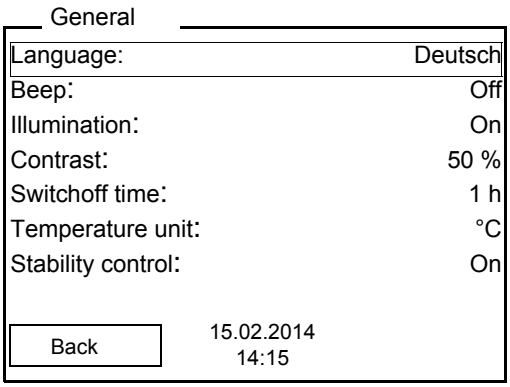
- To select a subelement, use the **<▲><▼>** keys. The current selection is displayed with a frame.
- To make further settings, switch to the next higher menu level with **<F1>**[Back].
- Use **<M>** to return to the measured value display.

4.4.4 Elements in menus and dialogs

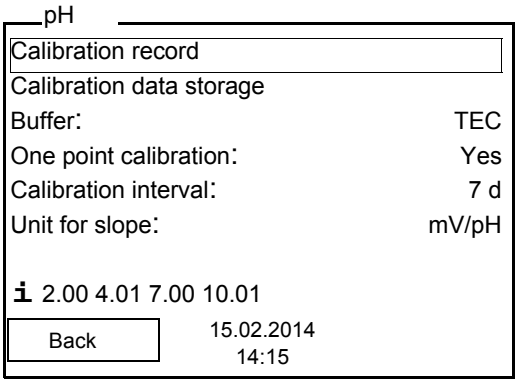
- Submenus
  The name of the submenu is displayed at the upper edge of the frame. Submenus are opened by confirming with **<ENTER>**. Example:



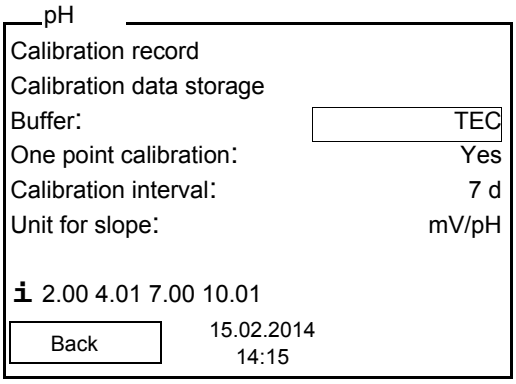
- Settings
  Settings are indicated by a colon. The current setting is displayed on the right-hand side. The setting mode is opened with **<ENTER>**. Subsequently, the setting can be changed with **<▲><▼>** and **<ENTER>**. Example:



- Functions
  Functions are designated by the name of the function. They are immediately carried out by confirming with **<ENTER>**.
  Example: Display the *Calibration record* function.

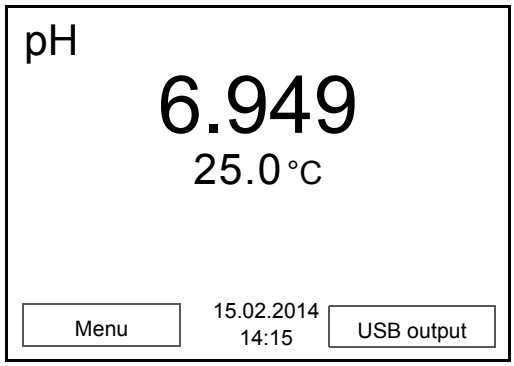


- Messages
  Information is marked by the **i** symbol. It cannot be selected. Example:

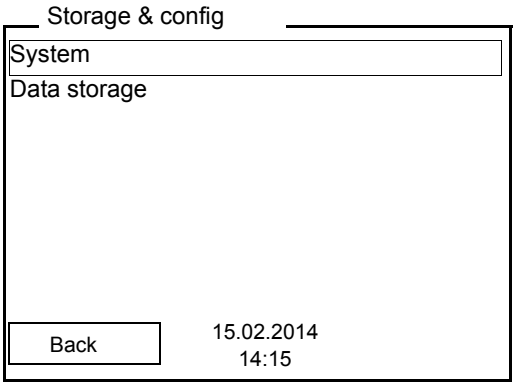


4.4.5 Example 1 on navigation: Setting the language

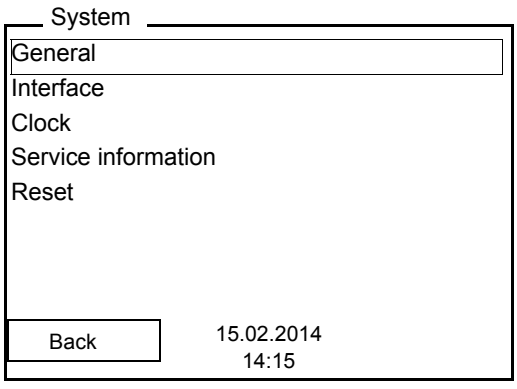
1. Press the **<On/Off>** key.
   The measured value display appears.
   The instrument is in the measuring mode.



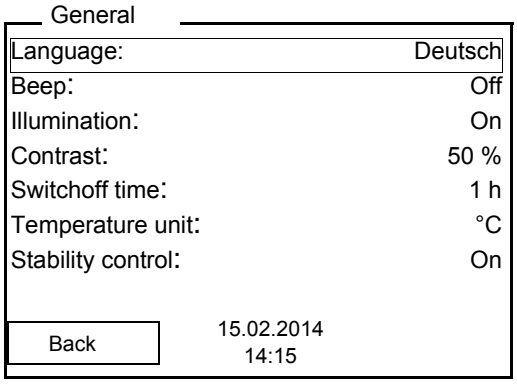
2. Using **<ENTER__>** (or **<F1__>**/*[Menu]*) , open the *Storage & config* menu.
   The instrument is in the setting mode.



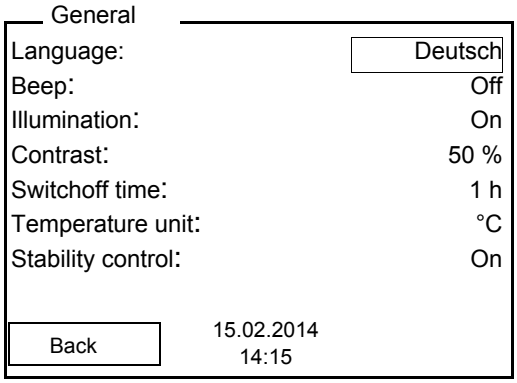
3. Select the *System* submenu with **<▲><▼>**.
   The current selection is displayed with a frame.
4. Open the *System* submenu with **<ENTER>**.



5. Select the *General* submenu with **<▲><▼>**.
   The current selection is displayed with a frame.
6. Open the *General* submenu with **<ENTER>**.



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



8. Select the required language with **<▲><▼>**.
9. Confirm the setting with **<ENTER>**.
   The meter switches to the measuring mode.
   The selected language is active.

4.4.6 Example 2 on navigation: Setting the date and time

The meter has a clock with a date function. The date and time are shown in 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:

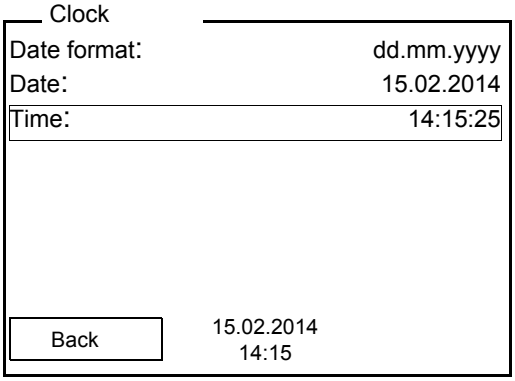
- Current date and time
- Calibration date
- Identification of stored measured values.

Therefore, check the time at regular intervals.

After a fall of the supply voltage (empty batteries), the date and time are reset to 01.01.2011 00, 00:00 hours.

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 **<ENTER__>** (or **<F1__>**/*[Menu]*) , open the *Storage & config* menu.
   The instrument is in the setting mode.
2. Select and confirm the *System* / *Clock* menu with **<▲><▼>** and **<ENTER>**.
   The setting menu for the date and time opens up.
3. Select and confirm the *Time* menu with **<▲><▼>** and **<ENTER>**.
   The hours are highlighted.



4. Change and confirm the setting with **<▲><▼>** and **<ENTER>**.
   The minutes are highlighted.
5. Change and confirm the setting with **<▲><▼>** and **<ENTER>**.
   The seconds are highlighted.
6. Change and confirm the setting with **<▲><▼>** and **<ENTER>**.
   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 **<M>**.
   The instrument is in the measuring mode.

5 pH value

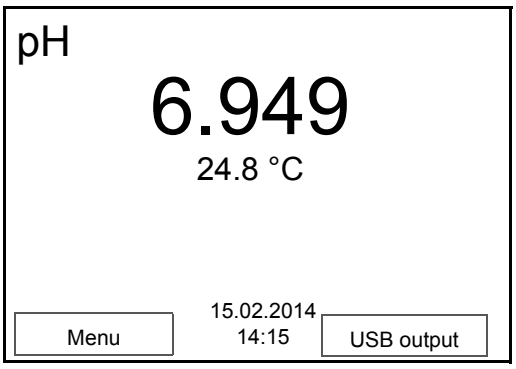
5.1 Measuring

5.1.1 Measuring the pH value

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

To ensure the high measurement accuracy of the measuring system, always measure with a calibrated electrode (see section 5.2 CALIBRATION, page 23).

1. Connect the pH electrode to the meter.
2. If necessary, select the measured parameter with **<M>**.
3. When measuring without temperature sensor:
   – Temper the test sample, or measure the current temperature.
   – Enter the temperature value with **<▲> <▼>**.
4. Immerse the pH electrode in the test sample.
   The measured value is checked for stability (automatic stability control).
   The display of the measured parameter flashes.
5. Wait for a stable measured value.
   The display of the measured parameter no longer flashes.



Stability control (AutoRead) & HOLD function

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.

You can activate or switch off the automatic *Stability control* function (see section 8.2.1 SYSTEM, page 52).

1. Freeze the measured value with **<AR>**.
   The [HOLD] status indicator is displayed.
   The HOLD function is active.

You can terminate the *Stability control* function and the HOLD function with **<AR>** or **<M>** at any time.

2. Using **<ENTER>**, activate the *Stability control* function manually.
   The [AR] status indicator appears while the measured value is assessed as not stable. A progress bar is displayed and the display of the measured parameter flashes.
   The [HOLD][AR] status indicator appears as soon as a stable measured value is recognized. The progress bar disappears and the display of the measured parameter stops flashing.
   The current measurement data is output to the interface. Measurement data meeting the stability control criterion is marked by AR.

You can prematurely terminate the *Stability control* function manually with **<ENTER>** at any time. If the *Stability control* function is prematurely terminated, the current measurement data are output to the interface without the AutoRead info.

3. Using **<ENTER>**, start a further measurement with stability control.
   or
   Release the frozen measured value again with **<AR>** or **<M>**.
   The [AR] status display disappears. The display switches back to the previous indication.

Criteria for a stable measured value

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

Measured variable	Time interval	Stability in the time interval
pH value	15 seconds	Δ : better than 0.01 pH
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.

5.1.2 Measuring the temperature

For reproducible pH measurements, it is essential to measure the temperature of the test sample.
You have the following options to measure the temperature:

- Automatic measurement of the temperature with the temperature sensor (NTC30 or Pt1000) integrated in the sensor.
- Measurement by an external temperature sensor.
- Manual determination and input of the temperature.

The measuring instrument recognizes whether a suitable sensor is connected and automatically switches on the temperature measurement.

The display of the temperature indicates the active temperature measuring mode:

Tempera-ture sensor	Resolution of the temp. dis-play	Temp. measurement
yes	0.1 °C	Automatic with temperature sensor
-	1 °C	Manual

If you wish to measure (or calibrate) without temperature sensor, proceed as follows:

1. Measure the current temperature of the test sample.
2. Set the temperature value with **<▲><▼>**.
   or
   In the **<ENTER>**/pH/*Man. temperature* menu, set the temperature value with **<▲><▼>**.

5.2 Calibration

5.2.1 Why calibrate?

pH electrodes age. This changes the zero point (asymmetry) and slope of the pH electrode. As a result, an inexact measured value is displayed. Calibration determines and stores the current values of the zero point and slope of the electrode.
Thus, you should calibrate at regular intervals.

5.2.2 When do you have to calibrate?

- After connecting a sensor
- Routinely within the framework of the company quality assurance
- When the calibration interval has expired

5.2.3 Automatic calibration (AutoCal)

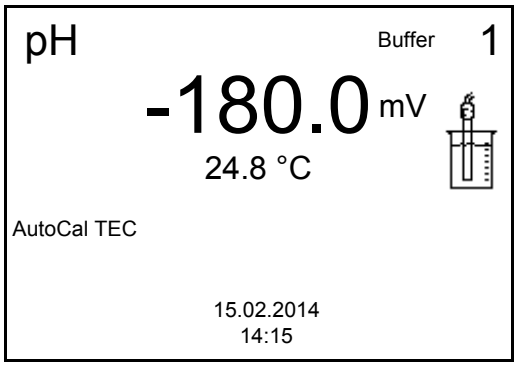
Make sure that in the sensor menu, *Buffer* menu, the buffer set is correctly selected (see 8.1.1 SETTINGS FOR PH MEASUREMENTS, PAGE 45).

Use any one to five buffer solutions of the selected buffer set in ascending or descending order.

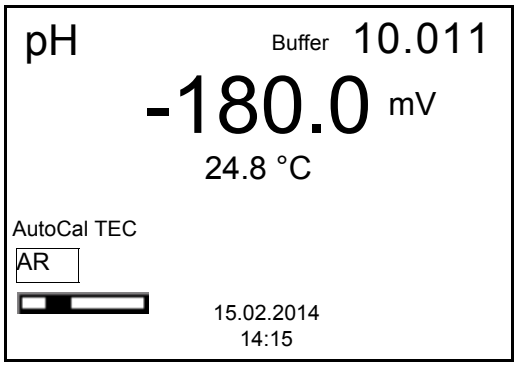
Below, calibration with Technical buffers (*TEC*) is described. When other buffer sets are used, other nominal buffer values are displayed. Apart from that, the procedure is identical.

If single-point calibration was set in the menu, the calibration procedure is automatically finished with the measurement of buffer solution 1 and the calibration record is displayed.

1. Connect the pH electrode to the meter.
2. When measuring without temperature sensor:
   – Temper the buffer solution, or measure the current temperature.
   – Enter the temperature value with **<▲> <▼>**.
3. In the measured value display, select the measured parameter pH or mV with **<M>**.
4. Start the calibration with **<CAL>**.
   The calibration display for the first buffer appears (voltage display).



5. Thoroughly rinse the electrode with deionized water.
6. Immerse the electrode in the first buffer solution.
7. When measuring without temperature sensor:
   – Temper the buffer solution, or measure the current temperature.
   – Enter the temperature value with **<▲> <▼>**.
8. Start the measurement with **<ENTER>**.
   The measured value is checked for stability (stability control). The [AR] status indicator is displayed. A progress bar is displayed and the display of the measured parameter flashes.



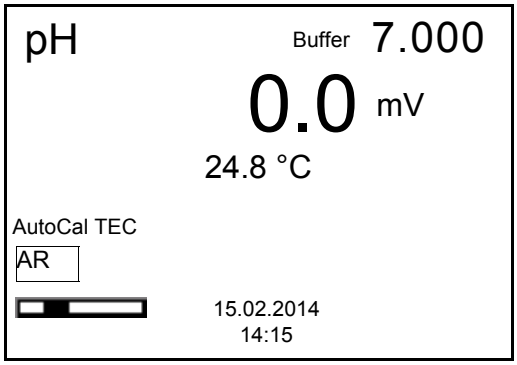
9. Wait for the end of the measurement with stability control or accept the calibration value with **<ENTER>**.
   The calibration display for the next buffer appears (voltage display).
10. If necessary, finish the calibration procedure as a single-point calibration with **<M>**.
    The calibration record is displayed.

For **single-point calibration**, the instrument uses the Nernst slope (-59.2 mV/pH at 25 °C) and determines the zero point of the electrode.

Continuing with two-point calibration

11. Thoroughly rinse the electrode with deionized water.
12. Immerse the electrode in the second buffer solution.

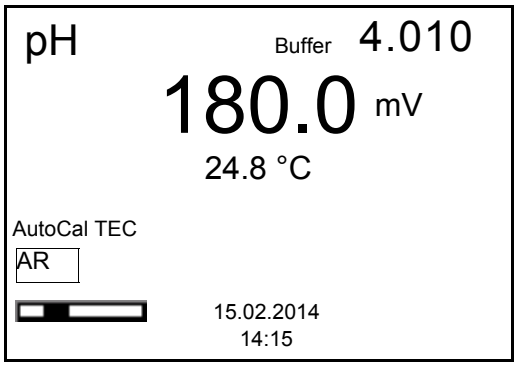
13. When measuring without temperature sensor:
    – Temper the buffer solution, or measure the current temperature.
    – Enter the temperature value with **<▲> <▼>**.
14. Start the measurement with **<ENTER>**.
    The measured value is checked for stability (stability control). The [AR] status indicator is displayed. A progress bar is displayed and the display of the measured parameter flashes.



15. Wait for the measurement with stability control to be completed or terminate the stability control and take over the calibration value with **<ENTER>**.
    The calibration display for the next buffer appears (voltage display).
16. If necessary, finish the calibration procedure as a two-point calibration with **<M>**.
    The calibration record is displayed.

Continuing with three- to five-point calibration

17. Thoroughly rinse the electrode with deionized water.
18. Immerse the electrode in the next buffer solution.
19. When measuring without temperature sensor:
    – Temper the buffer solution, or measure the current temperature.
    – Enter the temperature value with **<▲> <▼>**.
20. Start the measurement with **<ENTER>**.
    The measured value is checked for stability (stability control). The [AR] status indicator is displayed. A progress bar is displayed and the display of the measured parameter flashes.



21. Wait for the measurement with stability control to be completed or terminate the stability control and take over the calibration value with **<ENTER>**.
The calibration display for the next buffer appears (voltage display).

22. If necessary, use **<M>** to finish calibration or
Continue calibrating using the next buffer with **<ENTER>**.

Calibration is automatically completed after the last buffer of a buffer set has been measured. Then the calibration record is displayed.

The calibration line is determined by linear regression.

5.2.4 Manual calibration (ConCal)

Make sure that in the sensor menu, *Buffer* menu, the *ConCal* buffer set is selected (see section 8.1.1 SETTINGS FOR PH MEASUREMENTS, page 45).

Use any one to five buffer solutions in ascending or descending order.

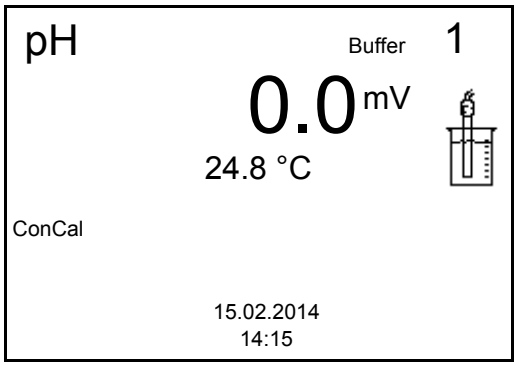
If single-point calibration was set in the menu, the calibration procedure is automatically finished with the measurement of buffer solution 1 and the calibration record is displayed.

1. Connect the pH electrode to the meter.
The pH measuring window is displayed.

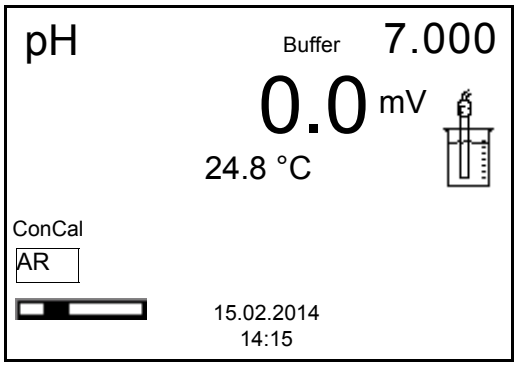
2. When measuring without temperature sensor:
   – Temper the buffer solution, or measure the current temperature.
   – Enter the temperature value with **<▲> <▼>**.

3. In the measured value display, select the measured parameter pH or mV with **<M>**.

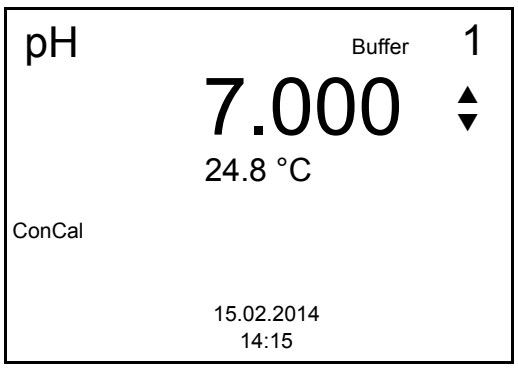
4. Start the calibration with **<CAL>**.
The calibration display appears (voltage display).



5. Thoroughly rinse the electrode with deionized water.
6. Immerse the electrode in the first buffer solution.
7. When measuring without temperature sensor:
   – Temper the buffer solution, or measure the current temperature.
   – Enter the temperature value with **<▲> <▼>**.
8. Start the measurement with **<ENTER>**.
   The measured value is checked for stability (stability control). The [AR] status indicator is displayed. A progress bar is displayed and the display of the measured parameter flashes.



9. Wait for the end of the measurement with stability control or accept the calibration value with **<ENTER>**.
   The calibration display for the setting of the nominal buffer value appears.



10. Set the nominal buffer value for the measured temperature with **<▲><▼>**.

11. Accept the set calibration value with **<ENTER>**.
The calibration display for the next buffer appears (voltage display).

12. If necessary, finish the calibration procedure as a single-point calibration with **<M>**.
The calibration record is displayed.

For **single-point calibration**, the instrument uses the Nernst slope (-59.2 mV/pH at 25 °C) and determines the zero point of the electrode.

Continuing with two-point calibration

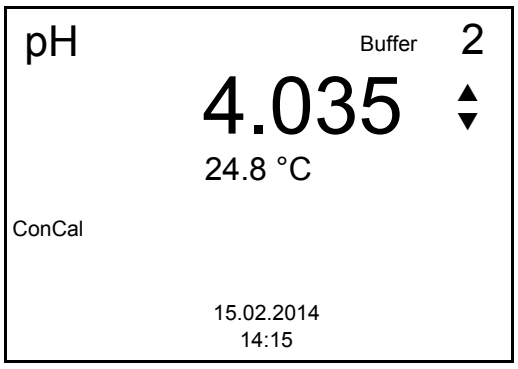
13. Thoroughly rinse the electrode with deionized water.

14. Immerse the electrode in the second buffer solution.

15. When measuring without temperature sensor:
    – Temper the buffer solution, or measure the current temperature.
    – Enter the temperature value with **<▲> <▼>**.

16. Start the measurement with **<ENTER>**.
The measured value is checked for stability (stability control). The [AR] status indicator is displayed. A progress bar is displayed and the display of the measured parameter flashes.

17. Wait for the measurement with stability control to be completed or terminate the stability control and take over the calibration value with **<ENTER>**.
The calibration display for the setting of the nominal buffer value appears.



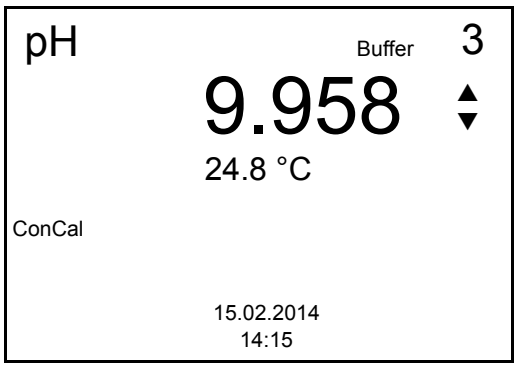
18. Set the nominal buffer value for the measured temperature with **<▲><▼>**.

19. Accept the set calibration value with **<ENTER>**.
The calibration display for the next buffer appears (voltage display).

20. Finish the calibration procedure as a two-point calibration with **<M>**.
The calibration record is displayed.

Continuing with three- to five-point calibration

21. Thoroughly rinse the electrode with deionized water.
22. Immerse the electrode in the next buffer solution.
23. When measuring without temperature sensor:
    – Temper the buffer solution, or measure the current temperature.
    – Enter the temperature value with **<▲> <▼>**.
24. Start the measurement with **<ENTER>**.
    The measured value is checked for stability (stability control). The [AR] status indicator is displayed. A progress bar is displayed and the display of the measured parameter flashes.
25. Wait for the measurement with stability control to be completed or terminate the stability control and take over the calibration value with **<ENTER>**.
    The calibration display for the setting of the nominal buffer value appears.



26. Set the nominal buffer value for the measured temperature with **<▲><▼>**.
27. Accept the set calibration value with **<ENTER>**.
    The calibration display for the next buffer appears (voltage display).
28. Use **<M>** to finish calibration or
    Continue calibrating using the next buffer with **<ENTER>**.

After the fifth buffer has been measured the calibration is automatically finished. Then the calibration record is displayed.

The calibration line is determined by linear regression.

5.2.5 Calibration points

Calibration can be performed using one to five buffer solutions in any order (single-point to five-point calibration). The meter determines the following values and calculates the calibration line as follows:

	Determined values	Displayed calibration data
1-point	*Asy*	● Zero point = *Asy* ● Slope = Nernst slope (-59.2 mV/pH at 25 °C)
2-point	*Asy* *Slp.*	● Zero point = *Asy* ● Slope = *Slp.*
3-point to 5-point	*Asy* *Slp.*	● Zero point = *Asy* ● Slope = *Slp.* The calibration line is calculated by linear regression.

You can display the slope in the units, mV/pH or % (see section 8.1.1 SETTINGS FOR PH MEASUREMENTS, page 45).

5.2.6 Calibration data

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

Displaying the calibration data

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

Subsequently, you can transmit the displayed calibration data to the interface, e.g. to a PC, with the **<F2>***[USB output]* key.

Displaying the calibration data storage

The calibration records of the last calibrations (up to 10) are given in the menu, **<ENTER>**/*Calibration* / *Calibration data storage*.

Menu item	Setting/function	Description
Calibration / *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 **<ENTER>**. ● Switch directly to the measured value display with **<M>**.
Calibration / *Calibration data storage* / *Output to USB*	-	Outputs the calibration records to the interface.

Calibration evaluation

After calibrating, the meter automatically evaluates the calibration. The zero point and slope are evaluated separately. The worse evaluation of both is taken into account. The evaluation appears on the display and in the calibration record.

Display	Calibration record	Zero point [mV]	Slope [mV/pH]
	+++	-15 ... +15	-60.5 ... -58.0
	++	-20 ... <-15 or >+15 ... +20	>-58.0 ... -57.0
	+	-25 ... <-20 or >+20 ... +25	-61.0 ... <-60.5 or >-57.0 ... -56.0
	-	-30 ... <-25 or >+25 ... +30	-62.0 ... <-61.0 or >-56.0 ... -50.0
Clean the electrode according to the electrode operating manual			
Error	*Error*	<-30 or >+30	<-62.0 or >-50.0
Error elimination (see section 12 WHAT TO DO IF..., page 65)			

Calibration record (example)

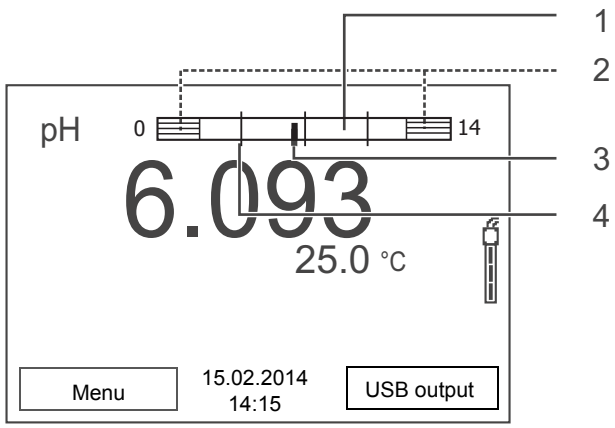
```
pH/ION 3310
Ser. no. 11292113

CALIBRATIONpH
15.02.2014 15:55

AutoCal TEC
Buffer 1                4.01
Buffer 2                7.00
Buffer 3                10.01
Voltage 1               184.0 mV
Voltage 2               3.0 mV
Voltage 3               -177.0 mV
Temperature 1           24.0 °C
Temperature 2           24.0 °C
Temperature 3           24.0 °C
Slope                   -60.2 mV/pH
Asymmetry               4.0 mV
Sensor                   +++

etc...
```

5.2.7 Continuous measurement control (CMC function)

The Continuous Measurement Control (CMC function) facilitates to evaluate the current measured value instantly and definitely.

After each successful calibration the scale of the pH measuring range is displayed in the measured value display. Here you can very clearly see whether or not the current measured value is in the calibrated part of the measuring range.

The following information is displayed:



1 Measuring range for which a valid calibration is available (white). Measured values in this range are suitable for documentation.

2 Measuring range for which no valid calibration is available (shaded). Measured values in this range are not suitable for documentation. If necessary, calibrate the meter with buffers covering this measuring range.
If the current measured value is outside the calibrated range, this area is shaded stronger.
If a measured value is outside the measuring range pH 0 - 14, overflow arrows are displayed at the left or right edge of the measuring range.

3 Currently measured pH value (needle)

4 Marking lines for all nominal buffer values used with the last valid calibration

The limits of the calibrated range are determined by the buffers used for calibration:

Lower limit:	Buffer with lowest pH value - 2 pH units
Upper limit:	Buffer with highest pH value + 2 pH units

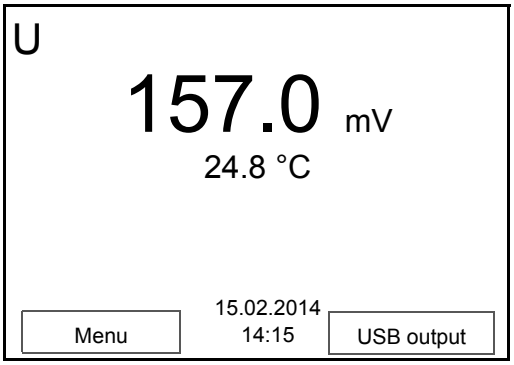
6 ORP voltage

6.1 Measuring

6.1.1 Measuring the ORP

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

1. Connect the ORP electrode to the meter.
2. If necessary, select the U (mV) display with **<M>**.
3. When measuring without temperature sensor:
   – Temper the test sample, or measure the current temperature.
   – Enter the temperature value with **<▲> <▼>**.
4. Rinse the ORP electrode and immerse it in the test sample.
   The measured value is checked for stability (automatic stability control).
   The display of the measured parameter flashes.
5. Wait for a stable measured value.
   The display of the measured parameter no longer flashes.



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.

You can activate or switch off the automatic *Stability control* function (see section 8.2.1 SYSTEM, page 52).

The measured parameter flashes on the display

- as soon as the measured value is outside the stability range
- when you switch over between the measured parameters with **<M>**.
- 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 variable	Time interval	Stability in the time interval
ORP	15 seconds	Δ : better than 0.3 mV
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.

Manually starting the stability control

Irrespective of the setting for automatic *Stability control* (see section 8.2.1 SYSTEM, page 52) in the *System* menu, you can start the *Stability control* function manually at any time.

1. Freeze the measured value with **<AR>**.
   The [HOLD] status indicator is displayed.
2. Using **<ENTER>**, activate the *Stability control* function manually.
   The [AR] status indicator appears while the measured value is assessed as not stable. A progress bar is displayed and the display of the measured parameter flashes.
   The [HOLD][AR] status indicator appears as soon as a stable measured value is recognized. The progress bar disappears and the display of the measured parameter stops flashing.
   The current measurement data is output to the interface. Measurement data meeting the stability control criterion is marked by AR.

You can prematurely terminate the *Stability control* function manually with **<ENTER>** at any time. If the *Stability control* function is prematurely terminated, the current measurement data are output to the interface without the AutoRead info.

3. Using **<ENTER>**, start a further measurement with *Stability control*.
   or
   Release the frozen measured value again with **<AR>**.
   The display switches to the measured value display.
   The [AR][HOLD] status display disappears.

Freezing the measured value (HOLD function)

With the HOLD function, you can freeze the current measured value. The displayed measured value stops changing until you switch the HOLD function off.

If the HOLD function is active, you can, e.g. start a manual measurement with stability control.

1. Freeze the measured value with **<AR>**.
   The [HOLD] status indicator is displayed.
2. Release the frozen measured value again with **<AR>**.
   The HOLD function is switched off.
   The [HOLD] status display disappears.

6.1.2 Measuring the temperature

For reproducible ORP measurements, it is essential to measure the temperature of the test sample.
You have the following options to measure the temperature:

- Automatic measurement of the temperature by the temperature sensor (NTC30 or Pt1000) integrated in electrode.
- Measurement by an external temperature sensor.
- Manual determination and input of the temperature.

The measuring instrument recognizes whether a suitable sensor is connected and automatically switches on the temperature measurement.

The display of the temperature indicates the active temperature measuring mode:

Temperature sensor	**Resolution of the temp. display**	**Temp. measurement**
yes	0.1 °C	Automatic with temperature sensor
-	1 °C	Manual

If you wish to measure without temperature sensor, proceed as follows:

1. Measure the current temperature of the test sample.
2. Set the temperature value with **<▲><▼>**.
   or
   In the **<ENTER>**/U/*Man. temperature* menu, set the temperature value with **<▲><▼>**.

6.2 ORP calibration

ORP electrodes are not calibrated. You can, however, check ORP electrodes by measuring the ORP of a test solution and comparing the value with the nominal value.

7 Ion concentration

7.1 Measuring

7.1.1 Measuring the ion concentration

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

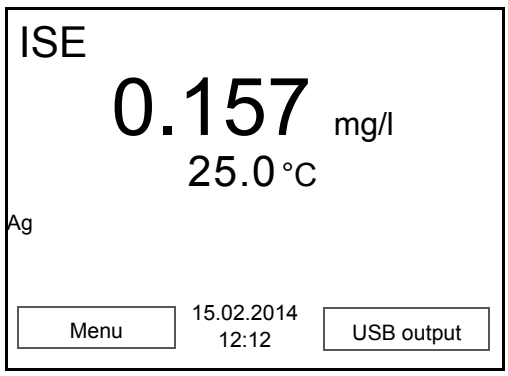
Incorrect calibration of ion sensitive electrodes will result in incorrect measured values. Calibrate regularly before measuring.

For precise ISE measurements the temperature difference between measurement and calibration should not be greater that 2 K. Therefore, adjust the temperature of the standard and measuring solutions accordingly. If the temperature difference is greater the *[TempErr]* warning appears in the measured value display.

1. Connect the ISE combination electrode to the meter.
   The pH/U/ISE measuring window is displayed.
2. If necessary, select the ISE display (unit, mg/l) with **<M>**.
3. When measuring without temperature sensor:
   – Temper the test sample, or measure the current temperature.
   – Enter the temperature value with **<▲> <▼>**.
4. Calibrate or check the meter with the electrode.

While no valid calibration is available, e.g. in the delivery condition, "Error" appears in the measured value display.

5. Immerse the electrode in the test sample.



Stability control (AutoRead) & HOLD function

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.

You can activate or switch off the automatic *Stability control* function (see section 8.2.1 SYSTEM, page 52).

1. Freeze the measured value with **<AR>**.
   The [HOLD] status indicator is displayed.
   The HOLD function is active.

You can terminate the *Stability control* function and the HOLD function with **<AR>** or **<M>** at any time.

2. Using **<ENTER>**, activate the *Stability control* function manually.
   The [AR] status indicator appears while the measured value is assessed as not stable. A progress bar is displayed and the display of the measured parameter flashes.
   The [HOLD][AR] status indicator appears as soon as a stable measured value is recognized. The progress bar disappears and the display of the measured parameter stops flashing.
   The current measurement data is output to the interface. Measurement data meeting the stability control criterion is marked by AR.

You can prematurely terminate the *Stability control* function manually with **<ENTER>** at any time. If the *Stability control* function is prematurely terminated, the current measurement data are output to the interface without the AutoRead info.

3. Using **<ENTER>**, start a further measurement with stability control.
   or
   Release the frozen measured value again with **<AR>** or **<M>**.
   The [AR] status display disappears. The display switches back to the previous indication.

Criteria

The AutoRead criteria affect the reproducibility of the measured values. The following criteria can be adjusted:

- *high*: highest reproducibility
- *medium*: medium reproducibility
- *low*: lowest reproducibility

Increasing reproducibility also causes the response time to increase until a measured value is evaluated as stable.

7.1.2 Measuring the temperature

For reproducible ion-selective measurements, it is essential to measure the temperature of the test sample.
You have the following options to measure the temperature:

- Measurement by an external temperature sensor.
- Manual determination and input of the temperature.

The measuring instrument recognizes whether a suitable sensor is connected and automatically switches on the temperature measurement.

The display of the temperature indicates the active temperature measuring mode:

Tempera-ture sensor	Resolution of the temp. dis-play	Temp. measurement
yes	0.1 °C	Automatic with temperature sensor
-	1 °C	Manual

If you wish to measure (or calibrate) without temperature sensor, proceed as follows:

1. Measure the current temperature of the test sample.
2. When measuring without temperature sensor:
   – Temper the test sample, or measure the current temperature.
   – Enter the temperature value with **<▲> <▼>**.

7.2 Calibration

7.2.1 Why calibrate?

Ion-selective electrodes age and are temperature-dependent. This changes the slope. As a result, an inexact measured value is displayed. Calibration determines the calibration line of the electrode and stores this value in the meter.
Thus, you should calibrate before each measurement and at regular intervals.

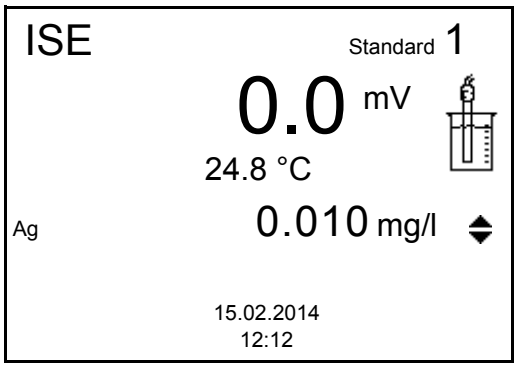
7.2.2 When to calibrate?

- Before any measurement if possible
- After connecting another ISE electrode
- When the sensor symbol flashes, e.g. after a voltage interruption (empty batteries)

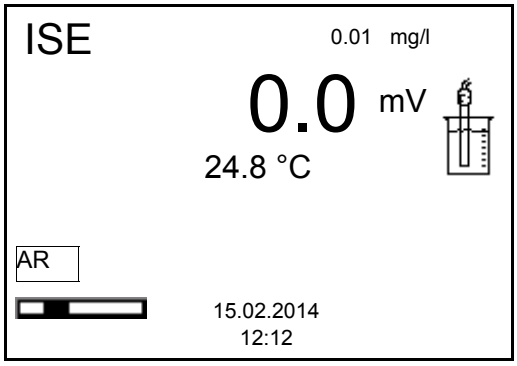
7.2.3 Calibration (ISE Cal)

ISE Cal is the conventional **two-point** to **seven-point calibration procedure** that uses 2 to 7 freely selectable standard solutions. The concentration expected in the measurement determines the concentration of the calibration standards.

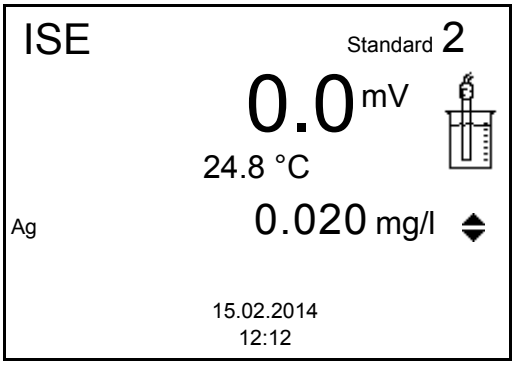
1. Connect the ISE combination electrode to the meter.
   The pH/U/ISE measuring window is displayed.
2. Keep the standard solutions ready.
3. When measuring without temperature sensor:
   – Temper the test sample, or measure the current temperature.
   – Enter the temperature value with **<▲> <▼>**.
4. In the measured value display, select the ISE measuring window with **<▲> <▼>** and **<M>**.
5. If necessary, change the unit of the measurement result and calibration standards in the *ISE setup*/*Unit* menu.
6. Start the calibration with **<CAL>**.
   The calibration display appears.



7. Thoroughly rinse the electrode with distilled water.
8. Immerse the electrode in standard solution 1.
9. When calibrating without temperature sensor:
   - Measure the temperature of the standard solution using a thermometer.
   - Use **<F2>**/[⇅] to select the setting of the temperature.
   - Use **<▲> <▼>** to set the temperature.
   - Use **<F2>**/[⇅] to select the setting of the concentration.
10. Set the concentration of the standard solution with **<▲> <▼>** and press **<ENTER>**.
    The standard solution is measured.
    The measured value is checked for stability (AutoRead).



11. Wait for the end of the AutoRead measurement or accept the calibration value with **<ENTER>**.
    The calibration display for the next standard solution appears.

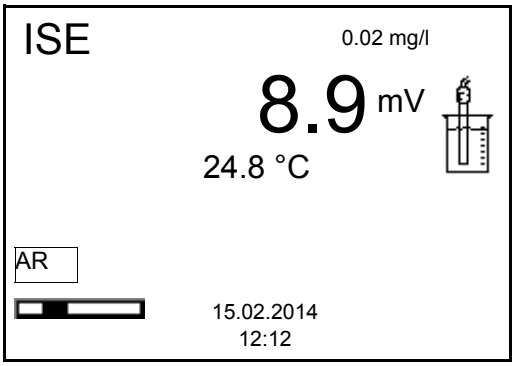


Continuing with two-point calibration

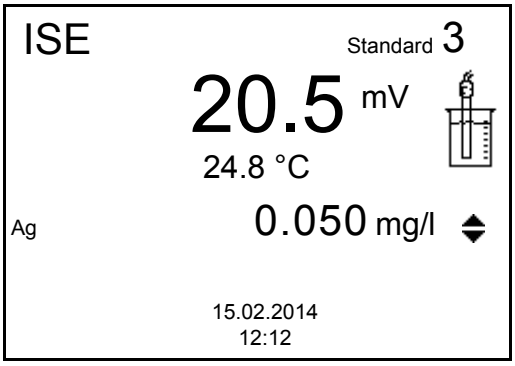
12. Thoroughly rinse the electrode with distilled water.
13. Immerse the electrode in standard solution 2.

14. When calibrating without temperature sensor:
    - Measure the temperature of the standard solution using a thermometer.
    - Use **<F2>**/[⇅] to select the setting of the temperature.
    - Use **<▲> <▼>** to set the temperature.
    - Use **<F2>**/[⇅] to select the setting of the concentration.

15. Set the concentration of the standard solution with **<▲> <▼>** and press **<ENTER>**.
    The standard solution is measured.
    The measured value is checked for stability (AutoRead).



16. Wait for the end of the AutoRead measurement or accept the calibration value with **<ENTER>**.
    The calibration display for the next standard solution appears.



17. Press **<ENTER>** to continue with three-point calibration.
    or
    Finish the calibration procedure as a two-point calibration with **<M>**.
    The new calibration values are displayed.

Continuing with three- to seven-point calibration

Repeat the steps 12 to 17 in the same way with the third and further standard solutions as necessary. The new calibration values are displayed after the last calibration step was completed.

Based on the calibration data, the calibration curve is determined in sections, according to the Nernst equation modified by Nikolski.

7.2.4 Calibration standards

Use two to seven different standard solutions. The standard solutions have to be selected in either increasing or decreasing order.

Select the unit of the standard solution and measurement result in the *ISE setup*/*Unit* menu.

Standard solution (Std 1 - 7)	**Values**
Unit [mg/l]	0.010 ... 500.000
Unit [mol/l]	0.100 ... 5.000 µmol/l 10.00 ... 5.000 mmol/l
Unit [mg/kg]	0.010 ... 500.000
Unit [ppm]	0.010 ... 500.000
Unit [%]	0.001 ... 50.000

The measurement precision is also dependent on the selected standard solutions. Therefore, the selected standard solutions should cover the value range expected of the following concentration measurement.

If the measured electrode potential is outside the calibrated range, the *[ISEErr]* warning is displayed.

7.2.5 Calibration data

Displaying the calibration data

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

Subsequently, you can transmit the displayed calibration data to the interface, e.g. to a PC, with the **<F2>***[USB output]* key.

Displaying the calibration data storage

The calibration records of the last calibrations (up to 10) are given in the menu, **<ENTER>**/*Calibration* / *Calibration data storage*.

Menu item	Setting/function	Description
Calibration / *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 **<ENTER>**. ● Switch directly to the measured value display with **<M>**.
Calibration / *Calibration data storage* / *Output to USB*	-	Outputs the calibration records to the interface.

Calibration evaluation

After calibrating, the meter automatically evaluates the calibration.

Display	Calibration record	Magnitude of the slope [mV]
	+++	50.0 ... 70.0 or 25.0 ... 35.0
Error Error elimination (see section 13 WHAT TO DO IF..., page 89)	*Error*	< 50 or > 70 or < 25 or > 35

Calibration record (example)

```
pH/ION 3310
Ser. no. 12345678

CALIBRATIONISE
15.02.2014 08:09:10

Standard 1              0.010 mg/l
Standard 2              0.020 mg/l
Voltage 1               38.5 mV
Voltage 2               58.0 mV
Temperature 1           24.0 øC
Temperature 2           24.0 øC
Ion type                Ag
Slope                   64.7 mV
Sensor                   +++
_____________________________________
```

8 Settings

8.1 Measurement settings

8.1.1 Settings for pH measurements

The settings for pH measurements are made in the menu for calibration and measurement settings of the pH/ORP measurement. To open the settings, display the required measured parameter in the measured value display and press the **<ENTER>** (or **<F1>**/*[Menu]*) key. After completing the settings, switch to the measured value display with **<M>**.

In the following table, only those settings are listed that concern the pH measurement.

Default settings are printed in **bold**.

Menu item	Possible setting	Description
Calibration / *Calibration record*	-	Displays the calibration record of the last calibration.
Calibration / *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]*. ● Output all calibration records to the interface with **<F2__>***[USB output]*. ● Quit the display with **<F1>**/ *[Back]* or **<ENTER>**. ● Switch directly to the measured value display with **<M>**.
Calibration / *Calibration data storage* / *Output to USB*	-	Outputs the calibration records to the interface.
Calibration /*Buffer*	***TEC*** *NIST/DIN* *ConCal* *...*	Buffer sets to be used for pH calibration (see section 5.2 CALIBRATION, page 23).
Calibration /*One point calibration*	*Yes* ***No***	Quick calibration with 1 buffer
Calibration /*Calibration interval*	*1 ...* ***7*** *... 999 d*	*Calibration interval* for the pH electrode (in days). The meter reminds you to calibrate regularly by the flashing sensor symbol in the measuring screen.

Menu item	Possible setting	Description
Calibration /Unit for slope	**mV/pH** *%*	Unit of the slope. The % display refers to the Nernst slope of -59.2 mV/pH (100 x determined slope/Nernst slope).
Alternative temperature	*On* ***Off***	Takes the temperature value from the 2nd sensor.
Man. temperature	*-25 ...* **+25** *... +130 °C*	Entry of the manually determined temperature. For measurements without temperature sensor only.
Resolution pH	**0.001** *0.01* *0.1*	Resolution of the pH display
Reset	-	Resets all sensor settings to the delivery condition (see section 8.3.1 RESETTING THE MEASUREMENT SETTINGS, page 53).

8.1.2 Buffer sets for calibration

You can use the buffer sets quoted in the table for an automatic calibration. The pH values are valid for the specified temperature values. The temperature dependence of the pH values is taken into consideration during the calibration.

No.	Buffer set *	pH values	at
1	*ConCal*	Any	Any
2	*NIST/DIN* DIN buffers according to DIN 19266 and NIST Traceable Buffers	1.679 4.006 6.865 9.180 12.454	25 °C
3	*TEC* WTW Technical buffers	2.000 4.010 7.000 10.011	25 °C
4	*Merck 1**	4.000 7.000 9.000	20°C
5	*Merck 2 **	1.000 6.000 8.000 13.000	20°C

No.	Buffer set *	pH values	at
6	*Merck 3 **	4.660 6.880 9.220	20°C
7	*Merck 4 **	2.000 4.000 7.000 10.000	20°C
8	*Merck 5 **	4.010 7.000 10.000	25 °C
9	*DIN 19267*	1.090 4.650 6.790 9.230	25 °C
10	*Mettler Toledo USA **	1.679 4.003 7.002 10.013	25 °C
11	*Mettler Toledo EU **	1.995 4.005 7.002 9.208	25 °C
12	*Fisher **	2.007 4.002 7.004 10.002	25 °C
13	*Fluka BS **	4.006 6.984 8.957	25 °C
14	*Radiometer **	1.678 4.005 7.000 9.180	25 °C
15	*Baker **	4.006 6.991 10.008	25 °C
16	*Metrohm **	3.996 7.003 8.999	25 °C
17	*Beckman **	4.005 7.005 10.013	25 °C
18	*Hamilton Duracal **	4.005 7.002 10.013	25 °C

No.	Buffer set *	pH values	at
19	*Precisa* *	3.996 7.003 8.999	25 °C
20	*Reagecon TEC* *	2.000 4.010 7.000 10.000	25 °C
21	*Reagecon 20* *	2.000 4.000 7.000 10.000 13.000	20°C
22	*Reagecon 25* *	2.000 4.000 7.000 10.000 13.000	25 °C
23	*Chemsolute* *	2.000 4.000 7.000 10.000	20°C
24	*USABlueBook* *	4.000 7.000 10.000	25 °C
25	*YSI* *	4.000 7.000 10.000	25 °C

The buffers are selected in the menu, pH / **<ENTER>** / *Calibration* / *Buffer* (see 8.1.1 SETTINGS FOR PH MEASUREMENTS, PAGE 45).

8.1.3 Calibration interval

The calibration evaluation is displayed as a sensor symbol.

The sensor symbol flashes after the adjusted calibration interval has expired. It is still possible to measure.

To ensure the high measuring accuracy of the measuring system, calibrate after the calibration interval has expired.

Setting the calibration interval

The calibration interval is set to 7 days in the factory.
You can change the interval (1 ... 999 days):

1. Using **<ENTER>** (or **<F1>**/*[Menu]*), open the menu for the measurement settings.
2. In the *Calibration* / *Calibration interval* menu, set the calibration interval with **<▲><▼>**.
3. Confirm the setting with **<ENTER>**.
4. Quit the menu with **<M>**.

8.1.4 Settings for ORP measurements

The settings for ORP measurements are made in the menu for calibration and measurement settings of the pH/ORP measurement. To open the settings, display the required measured parameter in the measured value display and press the **<ENTER>** (or **<F1>**/*[Menu]*) key. After completing the settings, switch to the measured value display with **<M>**.

In the following table, only those settings are listed that influence the ORP measurement.

Default settings are printed in **bold**.

Menu item	Possible setting	Description
Man. temperature	*-25 ...* ***+25*** *... +130 °C*	Entry of the manually determined temperature. For measurements without temperature sensor only.
Resolution mV	**0.1** *1*	Resolution of the mV display
Reset	-	Resets all sensor settings to the delivery condition (see section 8.3.1 RESETTING THE MEASUREMENT SETTINGS, page 53).

8.1.5 Settings for ISE measurements

The settings for ISE measurements are made in the menu for calibration and measurement settings of the ISE measurement.
To open the settings, display the required measured parameter in the measured value display and press the **<ENTER>** (or **<F1>**/*[Menu]*) key. After completing the settings, switch to the measured value display with **<M>**.

In the following table, only those settings are listed that influence the ISE measurement:

Menu item	Possible setting	Description
Calibration / *Calibration record*	-	Displays the calibration record of the last calibration.
Calibration / *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]*. ● Output all calibration records to the interface with **<F2__>***[USB output]*. ● Quit the display with **<F1>**/*[Back]* or **<ENTER>**. ● Switch directly to the measured value display with **<M>**.
Calibration / *Calibration data storage* / *Output to USB*	-	Outputs the calibration records to the interface.
Man. temperature	*-25 ...* ***+25*** *... +130 °C*	Entry of the manually determined temperature. For measurements without temperature sensor only.
ISE setup / *AutoRead criterion*	*low* ***medium*** *high*	Selection of the AutoRead criteria (see section 7.1.1 MEASURING THE ION CONCENTRATION, page 37).

Menu item	Possible setting	Description
ISE setup / *Ion type*	Ag, Br, Ca, Cd, Cl, CN, Cu, F, I, K, Na, NO3, Pb, S, NH3, NH4, CO2, ION	Selection of the ion type to be measured. An ion that is not included in the list can be measured with the setting, ION.
	* Measuring with the NH 500 electrode: The NH4 setting is not suitable for the gas-sensitive electrode NH 500. Select the following settings: *Ion type* "ION", *Valency* "-1".	
ISE setup / *Unit*	mg/l µmol/l mg/kg ppm %	Selection, with which unit the measurement result and calibration standards should be displayed.
ISE setup / *Ion type*/ION	*Valency* *Molar mass*	Set the valence (*Valency*) and molar weight (*Molar mass*) for the ion.
ISE setup / *Density*	0.001 ... 9.999 g/ml or kg/l	Adjustable density of the test sample (only with *Unit*: mg/kg, ppm, %)

8.2 Sensor-independent settings

8.2.1 *System*

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

Default settings are printed in **bold**.

Menu item	Possible setting	Description
System / *General* / *Language*	*Deutsch* ***English*** *(further)*	Selects the menu language
System / *General* / *Beep*	***On*** *Off*	Switch on/off the beep on keystroke
System / *General* / *Illumination*	***Auto*** *On* *Off*	Switches the display illumination on/off
System / *General* / *Contrast*	*0 ...* ***50*** *... 100 %*	Changes the display contrast
System / *General* / *Switchoff time*	*10 min ...* ***1h*** *... 24 h*	Adjusts the switch-off time
System / *General* / *Temperature unit*	***°C*** *°F*	Temperature unit, degrees Celsius or degrees Fahrenheit. All temperature values are displayed with the selected unit.
System / *General* / *Stability control*	***On*** *Off*	Switches on or off the automatic stability control during measurement
System / *Interface* / *Baud rate*	*1200, 2400,* ***4800****, 9600, 19200*	Baud rate of the data interface
System / *Interface* / *Output format*	***ASCII*** *CSV*	Output format for data transmission (see section 10 TRANSMITTING DATA (USB INTERFACE), page 61)
System / *Interface* / *Decimal separator*	***Dot (xx.x)*** *Comma (xx,x)*	Decimal separator
System / *Interface* / *Output header*		Output of a header for *Output format*: *CSV*

Menu item	Possible setting	Description
System /*Clock*	*Date format* *Datum* *Time*	Time and date settings (see section 4.4.6 EXAMPLE 2 ON NAVIGATION: SETTING THE DATE AND TIME, page 18)
System /*Service information*		Hardware version and software version of the meter are displayed.
System /*Reset*	-	Resets the system settings to the delivery condition (see section 8.3.2 RESETTING THE SYSTEM SETTINGS, page 54).

8.2.2 *Data storage*

This menu contains all functions to display, edit and erase stored measured values and calibration records (see section 9 DATA STORAGE, page 55).

8.3 Reset

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

8.3.1 Resetting the measurement settings

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

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

pH

Setting	Default settings
Buffer	*TEC*
Calibration interval	7 d
Unit for slope	mV/pH
Measured parameter	pH
Resolution pH	0.001
Resolution mV	0.1
Asymmetry	0 mV

Setting	Default settings
Slope	-59.2 mV
Man. temperature	25 °C
One point calibration	No

The sensor settings are reset under the *Reset* menu item in the menu for calibration and measurement settings. To open it in the measured value display, press the **<ENTER>** (or **<F1>**/*[Menu]*) key.

8.3.2 Resetting the system settings

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

Setting	Default settings
Language	English
Beep	On
Baud rate	4800 Baud
Output format	ASCII
Decimal separator	Dot (xx.x)
Contrast	50 %
Illumination	Auto
Switchoff time	1 h
Stability control	On
Temperature unit	°C

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

9 Data storage

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

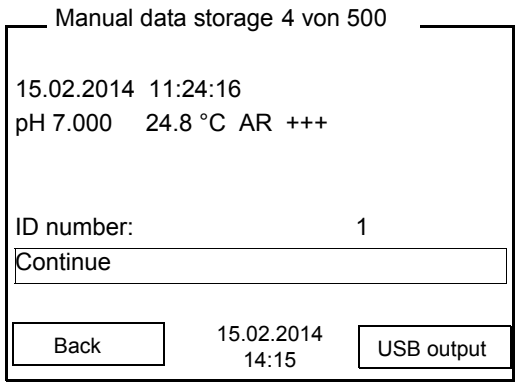
- Manual data storage (see section 9.1 MANUAL STORAGE, page 55)
- Automatic storage at intervals (see section 9.2 AUTOMATIC DATA STORAGE AT INTERVALS, page 56)

With each data storage process, the current datasets of the sensors indicated on the display are transmitted to the interface at the same time.

9.1 Manual storage

You can transmit a measurement dataset to the data storage as follows.
Bei jedem Speichervorgang werden die aktuellen Datensätze der im Display angezeigten Sensoren gleichzeitig auf die Schnittstelle übertragen.

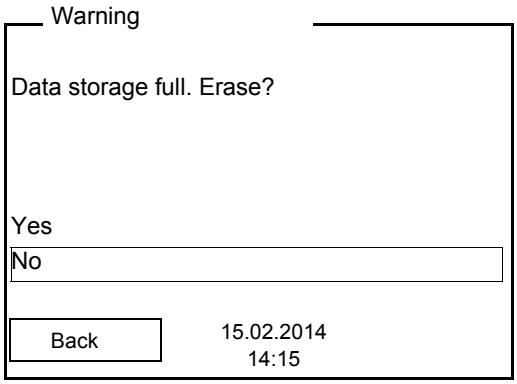
1. Press the **<STO>** key shortly.
   The menu for manual data storage appears.



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

If the storage is full

The following window appears if all 500 storage locations are occupied:



You have the following options:

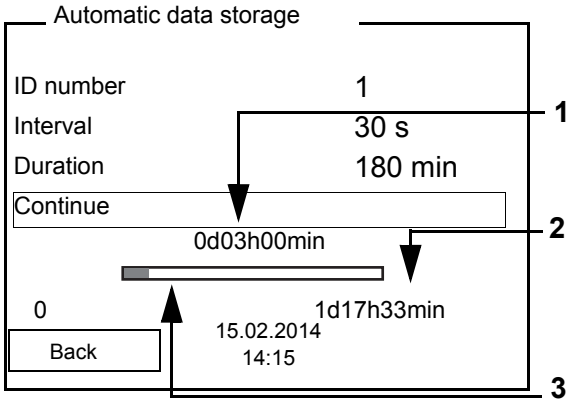
- To erase the entire storage, confirm *Yes*.
- To cancel the storage process and switch to the measured value display, confirm *No*. Then you can e.g. transmit the stored data to a PC (see section 9.3.1 EDITING THE MEASURED VALUE STORAGE, page 58) and subsequently erase the data storage (see section 9.3.2 ERASING THE MEASUREMENT DATA STORAGE, page 60).

9.2 Automatic data storage at intervals

The storage interval (*Interval*) determines the time interval between automatic data storage processes. With each data storage process, the current datasets of the sensors indicated on the display are transmitted to the interface at the same time.

Configuring the automatic storage function

1. Press the **<STO__>** key.
   The menu for automatic data storage appears.



1 Adjusted entire storage duration
2 Max. available storage duration
3 Graphical display of the storage usage

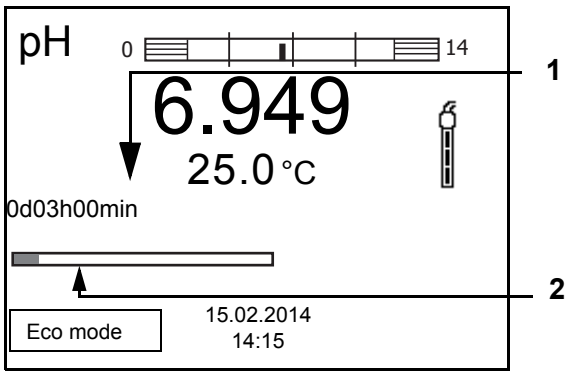
Settings

You can configure the automatic data storage function with the following settings:

Menu item	Possible setting	Description
ID number	*1 ... 10000*	ID number for the dataset series.
Interval	*1 s, 5 s, 10 s, 30 s, 1 min, 5 min, 10 min, 15 min, 30 min, 60 min*	Storage interval. The lower limit of the storage interval can be restricted by the number of free storage locations. The upper limit is restricted by the storage duration.
Duration	*1 min ... x min*	Storage duration. Specifies after which time the automatic data storage should be terminated. The lower limit of the storage duration is restricted by the storage interval. The upper limit is restricted by the number of free storage locations.

Starting the automatic storage function

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



1 Remaining storage duration

2 Graphical display of the storage duration

The active automatic storage function can be recognized by the progress bar in the function display. The progress bar indicates the remaining storage duration.

If the automatic storage function is activated, only the following keys are active: Softkeys, **<M>**, **<STO__>** and **<On/Off>**. The other keys and the automatic switch-off function are deactivated.

Energy saving mode ([Eco mode])

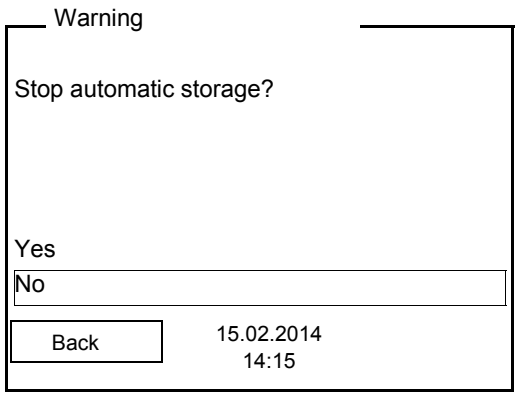
If the automatic storing function is active, the meter provides an energy saving mode ([Eco mode]) to avoid unnecessary energy consumption. The energy

saving mode switches off functions of the meter that are not required for the automatic storage of measurement data (such as the display). By pressing any key the energy saving mode is switched off again.

Terminating the automatic storage function prematurely

Proceed as follows to switch off the automatic data storage function before the adjusted storage duration has expired:

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



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

9.3 Measurement data storage

9.3.1 Editing the measured value storage

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

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

Editing the data storage

The storage is edited in the menu, *Storage & config*/ *Data storage*. To open the *Storage & config* menu in the measured value display, press the **<ENTER__>** (or **<F1__>**/*[Menu]*) key.

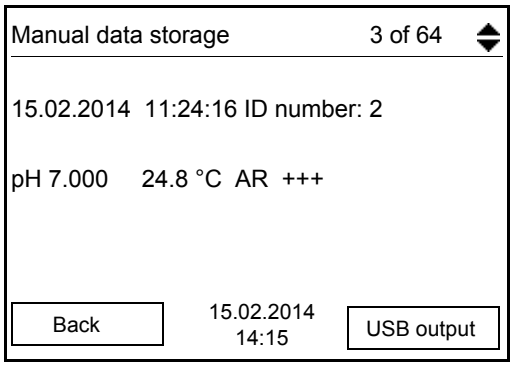
Open the manual or automatic storage directly with the **<RCL>** or **<RCL__>** key.

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

Settings

Menu item	Setting/ function	Description
Data storage / *Manual data storage* / *Display*	-	Displays all measurement datasets page by page. Further options: ● Scroll through the datasets 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 storage. 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



Representation of a dataset (USB output)

```
15.02.2014 09:56:20
pH/ION 3310
Ser. no. 08502113

ID number 2

pH1 6.012 24.8 °C, AR, S: +++
_____________________________________

15.02.2014 10:56:20
pH/ION 3310
Ser. no. 08502113

ID number 2

pH1 6.012 24.8 °C, AR, S: +++

_____________________________________
etc...
```

Quitting the display

To quit the display of stored measurement datasets, you have the following

options:

- Switch directly to the measured value display with **<M>**.
- Quit the display and move to the next higher menu level with **<F1>**/*[Back]*.

9.3.2 Erasing the measurement data storage

Erasing the measurement data storage (see section 9.3.1 EDITING THE MEASURED VALUE STORAGE, page 58).

9.3.3 Measurement dataset

A complete dataset includes:

- ID number
- Date/time
- Measured value of the connected sensor
- Measured temperature value of the connected sensor or manually set temperature
- AutoRead info: The *AR* indicator appears with the measured value if the AutoRead criterion was met while storing (stable measured value). Otherwise, there is no *AR* indicator.
- Calibration evaluation: +++, ++, +, -, or no evaluation

9.3.4 Storage locations

The pH/ION 3310 meter has two measurement data storages. The measured values recorded either manually or automatic are stored separately in individual measurement data storages.

Storage	Maximum number of datasets
Manual data storage	500
Automatic data storage	5000

10 Transmitting data (USB interface)

10.1 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 datasets of the sensors indicated on the display	Manual	● With **<F2>**/*[USB output]*. ● Simultaneously with every manual data storage process (see section 9.1 MANUAL STORAGE, page 55).
	Automatic, at intervals	● With **<F2__>**/*[USB output]*. Then you can set the transmission interval. ● Simultaneously with every automatic data storage process (see section 9.2 AUTOMATIC DATA STORAGE AT INTERVALS, page 56).
Stored measured values	Manual	● Displayed dataset with **<F2>***[USB output]* after calling up from the storage. ● All datasets with the *Output to USB* function. (see section 9.3.1 EDITING THE MEASURED VALUE STORAGE, page 58).
calibration records	Manual	● Calibration record with **<F2>**/*[USB output]* (see section 5.2.6 CALIBRATION DATA, page 30).
	automatic	● At the end of a calibration procedure.

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).

10.2 Connecting a PC

Connect the pH/ION 3310 to the PC via the USB interface.

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

Installation of the USB driver on the PC

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

- PC with Pentium processor or higher with at least one free USB connection and CD-ROM drive
- Windows XP, Windows 7.

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 pH/ION 3310 to the PC via the USB interface.
   The meter is listed as a virtual COM interface among the connections in the Windows instrument manager.

10.3 MultiLab Importer

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

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

11 Maintenance, cleaning, disposal

11.1 Maintenance

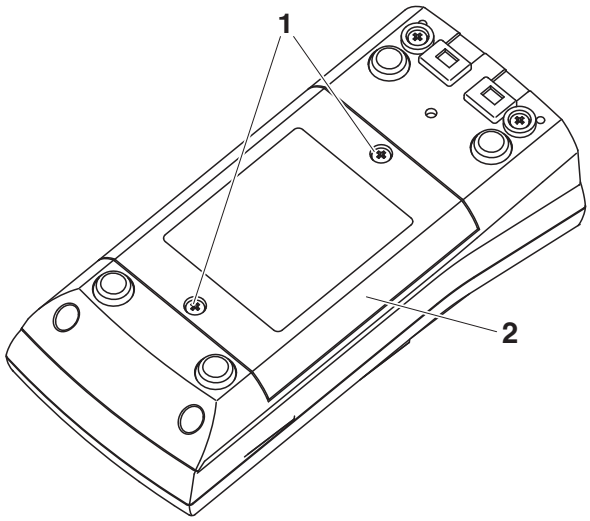
11.1.1 General maintenance activities

The only maintenance activity required is replacing the batteries.

See the relevant operating manuals of the electrodes for instructions on maintenance.

11.1.2 Replacing the batteries

You can operate the meter either with normal batteries or with rechargeable batteries (Ni-MH). In order to charge the batteries, an external charging device is required.



1 Screws
2 Battery compartment

1. Unscrew the two screws (1) on the underside of the meter.
2. Open the battery compartment (2) on the underside of the meter.
3. Remove the four batteries from the battery compartment.
4. Place four new batteries (type Mignon AA) in 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.

5. Close the battery compartment (2) and tighten the screws (1).
6. Set the date and time (see section 4.4.6 EXAMPLE 2 ON NAVIGATION: SETTING THE DATE AND TIME, page 18)

When the batteries are nearly discharged, the  status indicator is displayed.

Dispose of used batteries according to the local regulations of your country.

End users within the European Union are obligated to return used batteries
(even ecologically compatible ones) to a collection point set up for recycling
purposes.

Batteries are marked with the crossed-out waste container symbol. Therefore, they may not be disposed with the domestic waste.

11.2 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.

11.3 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.

11.4 Disposal

At the end of its operational lifetime, the meter must be returned to the disposal or return system statutory in your country. If you have any questions, please contact your supplier.

12 What to do if...

12.1 pH/ORP

More information and instructions on cleaning and exchange of sensors are given in the documentation of your sensor.

Error message *OFL, UFL*

The measured value is outside the measuring range.

Cause	Remedy
Electrode:	
– Air bubble in front of the junction	– Remove air bubble
– Air in the junction	– Extract air or moisten junction
– Cable broken	– Replace electrode
– Gel electrolyte dried out	– Replace electrode
– The measured value is outside the measuring range of the meter	– Use suitable combination electrode

Error message, *Error*

Cause	Remedy
Electrode:	
– The values determined for zero point and slope of the combination electrode are outside the allowed limits.	– Recalibrate
– Junction contaminated	– Clean junction
– Electrode broken	– Replace electrode
Buffer solutions:	
– Incorrect buffer solutions	– Change calibration procedure
– Buffer solutions too old	– Use only once. Note the shelf life
– Buffer solutions depleted	– Change solutions

No stable measured value

Cause	Remedy
Electrode:	
– Junction contaminated	– Clean junction
– Membrane contaminated	– Clean membrane
Test sample:	
– pH value not stable	– Measure with air excluded if necessary
– Temperature not stable	– Temper if necessary
Electrode + test sample:	
– Conductivity too low	– Use suitable combination electrode
– Temperature too high	– Use suitable combination electrode
– Organic liquids	– Use suitable combination electrode

Obviously incorrect measured values

Cause	Remedy
Electrode:	
– Electrode unsuitable	– Use suitable combination electrode
– Temperature difference between buffer and test sample too great	– Adjust temperature of buffer or sample solutions
– Measurement procedure not suitable	– Follow special procedure

12.2 ISE

Error message *OFL*

Cause	Remedy
– Measuring range exceeded	– Dilute test sample

Obviously incorrect measured values

Cause	Remedy
– Electrode not connected	– Connect electrode
– Cable broken	– Replace electrode

***Error message,* Error (invalid calibration)**

Cause	Remedy
ISE electrode:	
– Moisture in the plug	– Dry plug
– Electrode obsolete	– Replace electrode
– Electrode unsuitable for the range to be measured	– Use suitable combination electrode
– Electrode not suitable for the selected ion	– Use a suitable electrode or select a suitable ion
– The gas-sensitive electrode NH 500 was calibrated with the *Ion type* setting	– Select the following settings: *Ion type* = ION, *Valency* = -1
– Socket damp	– Dry socket
Calibration procedure:	
– Calibration standards do not have the correct temperature (max. ± 2 °C temperature difference)	– Adjust the temperature of the calibration standards

Warning *[TpErr]*

Cause	Remedy
– Temperature difference between measurement and calibration greater than 2 K.	– Adjust the temperature of the test sample

Warning *[ISEErr]*

Cause	Remedy
– Electrode voltage outside calibrated range	– Recalibrate

12.3 General information

Sensor symbol flashes

Cause	Remedy
– Calibration interval expired	– Recalibrate the measuring system

Display

Cause	Remedy
– Batteries almost empty	– Replace the batteries (see section 11.1 MAINTENANCE, page 63)

Meter does not react to keystroke

Cause	Remedy
– Operating condition undefined or EMC load unallowed	– Processor reset: Press the **<ENTER>** 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, **<ENTER__>** / *Storage & config* / *System* / *Service information*. The instrument data are displayed.

13 Technical data

13.1 Measuring ranges, resolution, accuracy

13.1.1 pH/ORP

Measuring ranges, resolution

Parameter	Measuring range	Resolution
pH	-2.0 ... +20.0	0.1
	-2.00 ... +20.00	0.01
	- 2.000 ... + 19.999	0.001
U [mV]	-1200.0 ... +1200.0	0.1
	-2500 ... +2500	1
T [°C]	-5.0 ... +105.0	0.1
T [°F]	23.0 ... +221.0	0.1

Manual temperature input

Parameter	Range	Increment
T_{manual} [°C]	-25 ... +130	1
T_{manual} [°F]	-13 ... +266	1

Accuracy (± 1 digit)

Parameter	Accuracy	Temperature of the test sample
pH / range *		
-2.0 ... +20.0	± 0.1	+15 °C ... +35 °C
-2.00 ... +20.00	± 0.01	+15 °C ... +35 °C
- 2.000 ... + 19.999	± 0.005	+15 °C ... +35 °C
U [mV] / range		
-1200.0 ... +1200.0	± 0.3	+15 °C ... +35 °C
-2500 ... +2500	± 1	+15 °C ... +35 °C
T [°C] / temperature sensor		
NTC 30	± 0.1	
PT 1000	± 0.1	

** when measuring in a range of ± 2 pH around a calibration point*

The accuracy values specified here apply exclusively to the meter. The accuracy of the electrodes and buffer solutions has to be taken into account additionally.

13.1.2 ISE

Measuring ranges, resolution

Parameter	Measuring range	Resolution
ISE [mg/l]	0.000 ... 9.999 10.00 ... 99.99 100.0 ... 999.9 1000 ... 999999	0.001 0.01 0.1 1
ISE [µmol/l]	0.000 ... 9.999 10.00 ... 99.99 100.0 ... 999.9 1000 ... 999999	0.001 0.01 0.1 1
[mmol/l]	1000 ... 999999	1
ISE [mg/kg]	0.000 ... 9.999 10.00 ... 99.99 100.0 ... 999.9 1000 ... 999999	0.001 0.01 0.1 1
ISE [ppm]	0.000 ... 9.999 10.00 ... 99.99 100.0 ... 999.9 1000 ... 999999	0.001 0.01 0.1 1
ISE [%]	0.000 ... 9.999 10.00 ... 99.99 100.0 ... 999.9 1000 ... 999999	0.001 0.01 0.1 1

Manual temperature input

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

13.2 General data

Dimensions	pH/ION 3310:	Approx. 180 x 80 x 55 mm
Weight	pH/ION 3310:	Approx. 0.4 kg
Mechanical structure	Type of protection	IP 67
Electrical safety	Protective class	III
Test certificates	CE, cETLus	

Ambient conditions	Storage	-25 °C ... +65 °C
	Operation	+5 °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 1000 h without / 150 h with illumination

pH sesnor input	Input resistance	> 5 * 10^{12} ohm
	Input current	< 1 * 10^{-12} A

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

Applicable directives and standards	EMC	EC directive 2004/108/EC EN 61326-1 EN 61000-3-2 EN 61000-3-3 FCC Class A
	Meter safety	EC directive 2006/95/EC EN 61010-1 UL 61010-1 CAN/CSA-C22.2#61010-1
	IP protection class	EN 60529

14 Firmware update

Available firmware updates are provided on the Internet.
With the firmware update program and a PC you can update the firmware of the pH/ION 3310 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 pH/ION 3310).

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.
2. In the windows start menu, open the update folder and start the firmware update program.
3. Using the USB interface cable, connect the pH/ION 3310 to a USB interface (virtual COM port) of the PC.
4. Switch on the pH/ION 3310.
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 terminatory message is displayed after a successful programming process. The firmware update is completed.
7. Disconnect the pH/ION 3310 from the PC.
   The pH/ION 3310 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 (see YOU WANT TO KNOW WHICH SOFTWARE VERSION IS IN THE METER, PAGE 68).

15 Glossary

pH/ORP/ISE

Asymmetry see zero point

Junction The junction is a porous body in the housing wall of reference electrodes or electrolyte bridges. It arranges the electrical contact between two solutions and makes the electrolyte exchange more difficult. The expression, junction, is also used for ground or junction-less transitions.

Electromotive force of a combination electrode The electromotive force U of the combination electrode is the measurable electromotive force of an electrode in a solution. It equals the sum of all the galvanic voltages of the combination electrode. Its dependency on the pH results in the electrode function, which is characterized by the parameters, slope and zero point.

Zero point The zero point of a pH combination electrode is the pH value at which the electromotive force of the pH combination electrode at a specified temperature is zero. Normally, this is at 25 °C.

pH value The pH value is a measure of the acidic or basic effect of an aqueous solution. It corresponds to the negative decadic logarithm of the molal hydrogen ions activity divided by the unit of the molality. The practical pH value is the value of a pH measurement.

Potentiometry Name of a measuring technique. The signal (depending on the measured parameter) of the electrode is the electrical potential. The electrical current remains constant.

ORP voltage The ORP is caused by oxidizing or reducing substances dissolved in water if these substances become effective on an electrode surface (e.g. a gold or platinum surface).

Slope The slope of a linear calibration function.

General information

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

AutoRange Name of the automatic selection of the measuring range.

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.

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).

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

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.
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.
Reset	Restoring the original condition of all settings of a measuring system.
Stability control (AutoRead)	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 function	Name of a mathematical function expressing the temperature behavior of a test sample, a sensor or part of a sensor.

16 Index

Xylem |ˈzīləm|

1) The tissue in plants that brings water upward from the roots;
2) a leading global water technology company.

We're 12,500 people unified in a common purpose: creating innovative solutions to meet our world's water needs. Developing new technologies that will improve the way water is used, conserved, and re-used in the future is central to our work. We move, treat, analyze, and return water to the environment, and we help people use water efficiently, in their homes, buildings, factories and farms. In more than 150 countries, we have strong, long-standing relationships with customers who know us for our powerful combination of leading product brands and applications expertise, backed by a legacy of innovation.

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