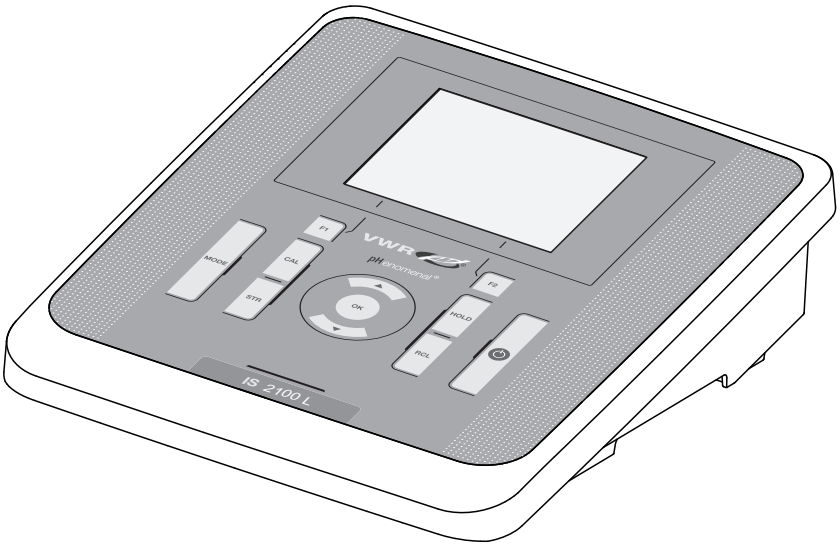
Operating manual

VWR® IS 2100 L - pH/ION Meter

EU cat. no	NA cat. no
662-1658	76460-502



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IS 2100 L - Contents

1 Safety

1.1 Safety information

1.1.1 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.

1.1.2 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.

1.1.3 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.)

1.2 Safe operation

1.2.1 Authorized use

This meter is authorized exclusively for pH, ISE and ORP measurements in a laboratory environment.

Only the operation and running of the meter according to the instructions and technical specifications given in this operating manual is authorized (see section 3 TECHNICAL DATA, page 10).

Any other use is considered unauthorized.

1.2.2 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).

1.2.3 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 3 TECHNICAL DATA, page 10).

2 Overview

2.1 IS 2100 L meter

The IS 2100 L meter enables you to perform measurements (pH, U, ISE) quickly and reliably.

The IS 2100 L provides the maximum degree of operating comfort, reliability and measuring certainty for all applications.

2.2 Sensors

A measuring system ready to measure consists of the IS 2100 L meter and a suitable sensor.

Suitable sensors are pH electrodes, ion selective electrodes and ORP electrodes.

3 Technical data

3.1 Measuring ranges, resolution, accuracy

3.1.1 pH/ORP

Measuring ranges, resolution

Variable	Measuring range	Resolution
pH	-2.0 ... +20.0	0.1
	-2.00 ... +20.00	0.01
	- 2.000 ... + 19.999	0.001
U [mV]	-2500 ... +2500	1
	-1200.0 ... +1200.	0.1
T [°C]	-5.0 ... +105.0	0.1
T [°F]	23.0 ... +221.0	0.1

Manual temperature input

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

Accuracy (± 1 digit)

Variable	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		
-2500 ... +2500	± 1	+15 °C ... +35 °C
-1200.0 ... +1200.	± 0.3	+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.

3.1.2 ISE

Measuring ranges, resolution

Variable	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

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

3.2 General data

Dimensions	ca. 240 x 190 x 80 mm	
Weight	Approx. 1.0 kg	
Mechanical structure	Type of protection	IP 43
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 1000 h without / 150 h with illumination
	Power pack (charging device)	Input: 100 ... 240 V ~ / 50 ... 60 Hz / 0.5 A Output: 9 V = / 1,1 A Connection max. overvoltage category II Primary plugs contained in the scope of delivery: Euro, US, UK and Australian.
pH sensor 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
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

4 Commissioning

4.1 Scope of delivery

- MeterIS 2100 L
- 4 batteries 1.5 V Mignon type AA
- Power pack
- Stand
- Stand holder
- Short instructions
- CD-ROM with
  - USB drivers
  - detailed operating manual
  - Software MultiLab Importer

4.2 Power supply

The IS 2100 L is supplied with power in the following ways:

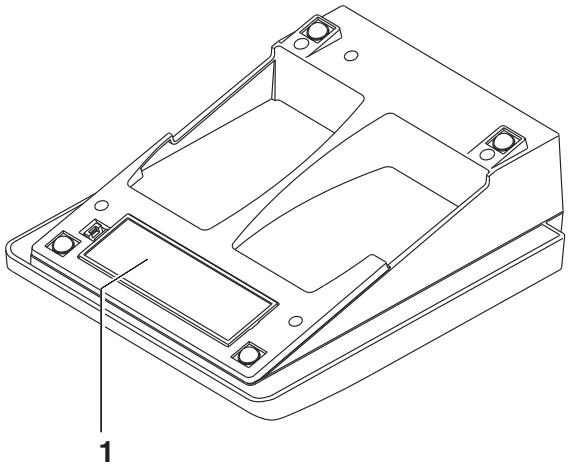
- Mains operation with the supplied power pack
- Battery operation (4 x alkaline manganese batteries, type AA)
- USB operation via a connected USB-B cable

4.3 Initial commissioning

Perform the following activities:

- Insert the supplied batteries
- For mains operation: Connect the power pack
- If necessary, mount the stand
- Switch on the meter
  (see section 5.2 SWITCHING ON THE METER, page 18)
- Set the date and time
  (see section 5.4.6 EXAMPLE 2 ON NAVIGATION: SETTING THE DATE AND TIME, page 23)

4.3.1 Inserting the batteries



1 Battery compartment

1. Open the battery compartment (1) 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.

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.

2. Place four batteries (type Mignon AA) in the battery compartment.
3. Close the battery compartment.
4. Set the date and time
(see section 5.4.6 EXAMPLE 2 ON NAVIGATION: SETTING THE DATE AND TIME, page 23).

4.3.2 Connect the power pack

CAUTION
The line voltage at the operating site must lie within the input voltage range of the original power pack (see section 3 TECHNICAL DATA, **page 10).**

CAUTION
Use original power packs only.

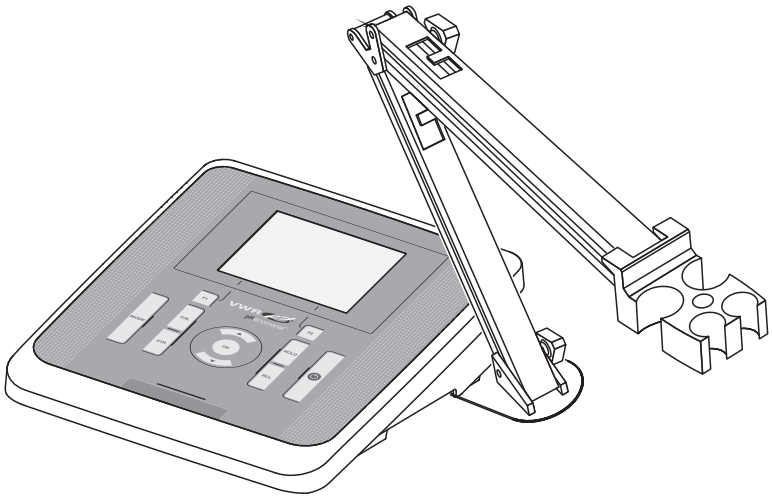
1. Connect the plug of the power pack to the socket for the power pack on the IS 2100 L.
2. Connect the original power pack to an easily accessible power outlet.

4.3.3 Stand

The stand base can be mounted at the right side of the meter.

1. Screw the stand base to the underside of the meter.
2. Insert the stand rod in the stand base.

An arrangement of the meter with the stand may look as follows:



5 Operation

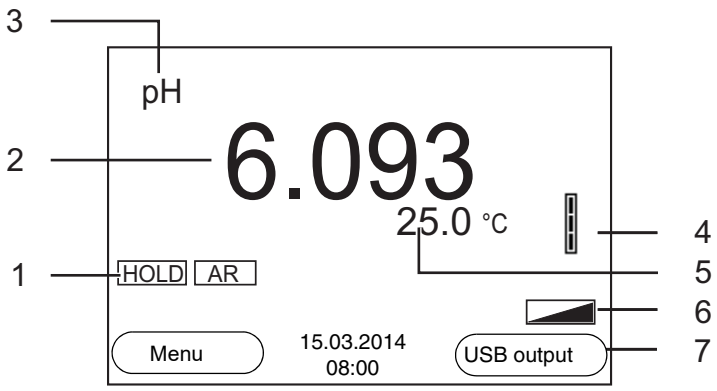
5.1 General operating principles

5.1.1 Keypad

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

<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
<MODE>:	Selects the measured parameter / Quits the settings
<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
<▲><▼>: **<▲__><▼_ _>**:	Menu control, navigation Increments, decrements values Increments, decrements values continuously
<OK>: **<OK__ >**:	Opens the menu for measurement settings / confirms entries Opens the menu for system settings
<HOLD>	Freezes the measured value (HOLD function)

5.1.2 Display

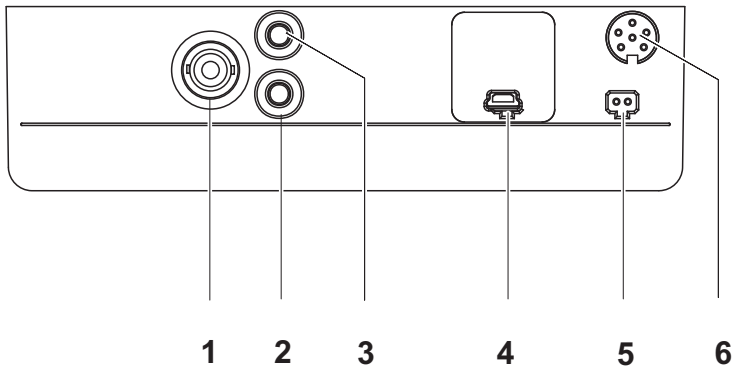


1 Status information (sensor)
2 Measured value (with unit)
3 Measured parameter
4 Sensor symbol (calibration evaluation, calibration interval)
5 Measured temperature (with unit)
6 Status information (meter)
7 Softkeys and date + time

5.1.3 Status information (meter)

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

5.1.4 Connectors

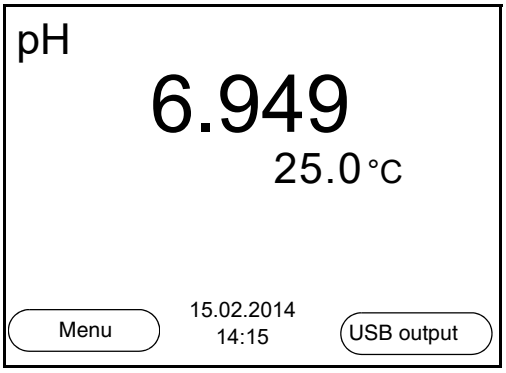


1 pH/ISE electrode
2 Reference electrode / temperature sensor
3 Reference electrode / temperature sensor
4 Mini USB-B interface
5 Power pack
6 Service interface

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.

5.2 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.



5.3 Switching off

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

Automatic shut-off function

The instrument has an automatic shut-off function in order to save the batteries (see section 9.2.1 SYSTEM, page 64). The automatic shut-off function switches off the meter if no key is pressed for an adjustable period.

The automatic shut-off function is not active

- if the communication cable is connected
- if the power pack 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 9.2.1 SYSTEM, page 64).

5.4 Navigation

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

5.4.1 Operating modes

The instrument has the following operating modes:

Operating mode	Explanation
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 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.

5.4.2 Measured value display

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

- Use **<OK>** (short pressure) to open the menu for calibration and measurement settings for the displayed measured parameter.
- Use **<OK >** (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 5.1.1 KEYPAD, page 16). These functions are not available in other operating situations.

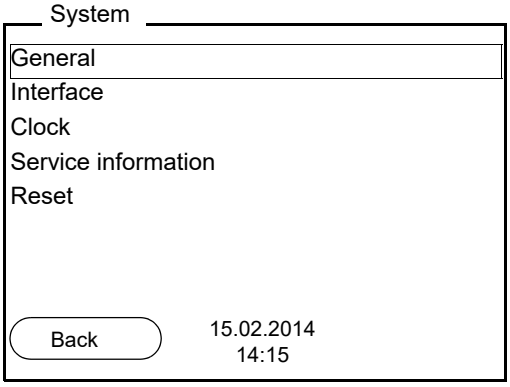
5.4.3 Menus and dialogs

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

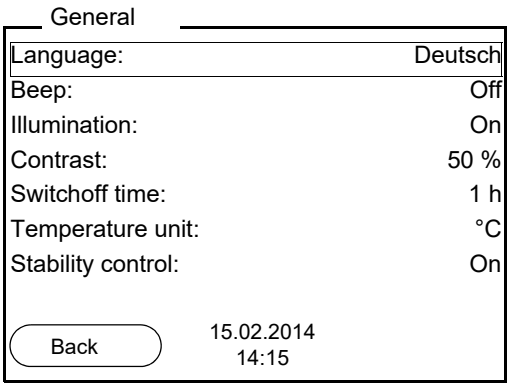
- To select a subelement, use the **<▲><▼>** keys. The current selection is displayed with a frame.
- To make further settings, switch to the next higher menu level with **<F1>**[Back].
- Use **<MODE>** to return to the measured value display.

5.4.4 Elements in menus and dialogs

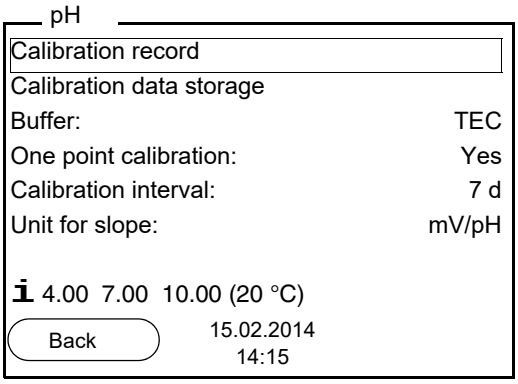
- Submenus
  The name of the submenu is displayed at the upper edge of the frame. Submenus are opened by confirming with **<OK>**. Example:



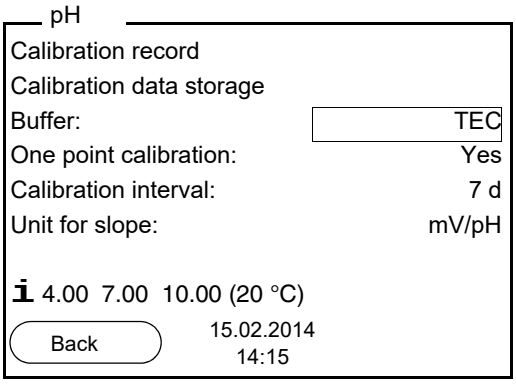
- Settings
  Settings are indicated by a colon. The current setting is displayed on the right-hand side. The setting mode is opened with **<OK>**. Subsequently, the setting can be changed with **<▲><▼>** and **<OK>**. Example:



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

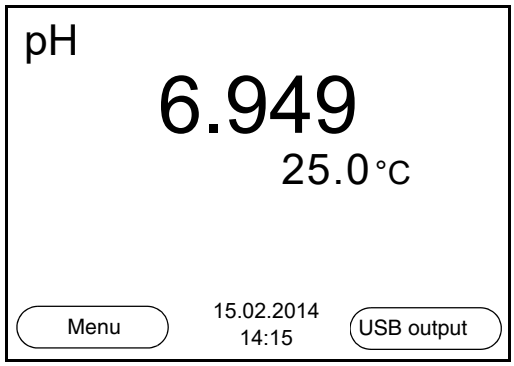


- Messages
  Information is marked by the **i** symbol. It cannot be selected. Example:

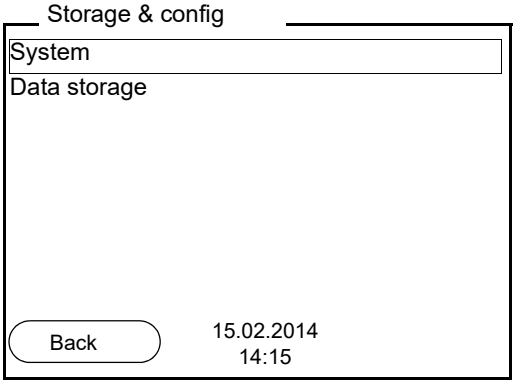


5.4.5 Navigation example 1:Setting the language

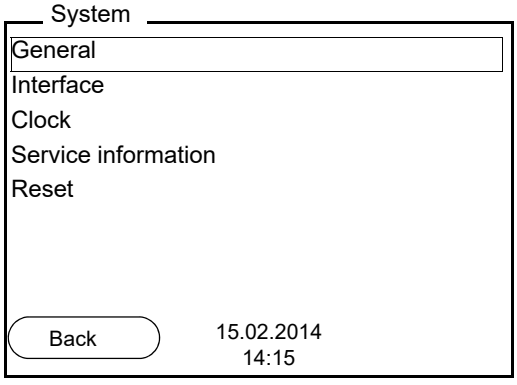
1. Press the **<On/Off>** key.
   The measured value display appears.
   The instrument is in the measuring mode.



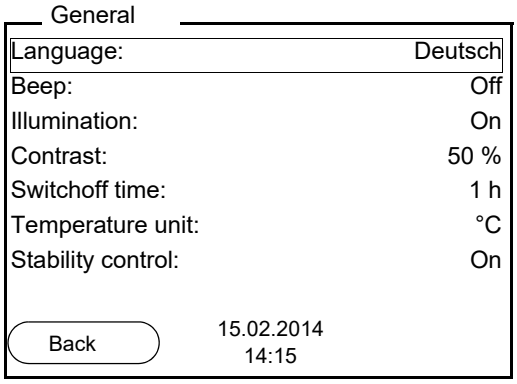
2. Open the *Storage & config* menu with **<OK__ >** (or **<F1__>**/*[Menu]*).
   The instrument is in the setting mode.



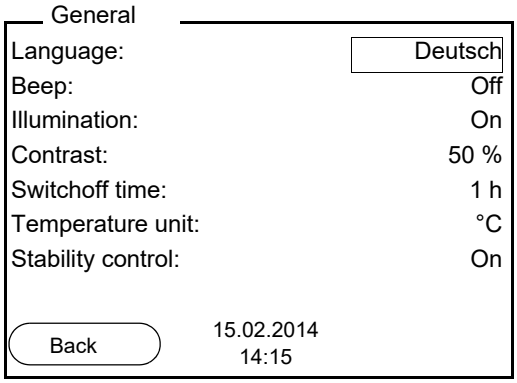
3. Select the *System* submenu with **<▲><▼>**.
   The current selection is displayed with a frame.
4. Open the *System* submenu with **<OK>**.



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



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



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

5.4.6 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:

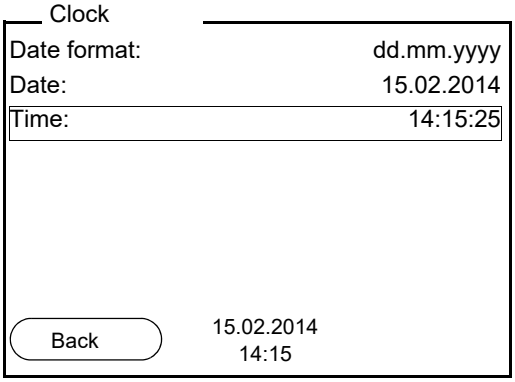
- Current date and time
- Calibration date
- Identification of stored measured values.

Therefore, check the time at regular intervals.

After a fall of the supply voltage (empty batteries), the date and time are reset.

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:
   Open the *Storage & config* menu with **<OK__ >** (or **<F1__>**/*[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.



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.

6 pH value

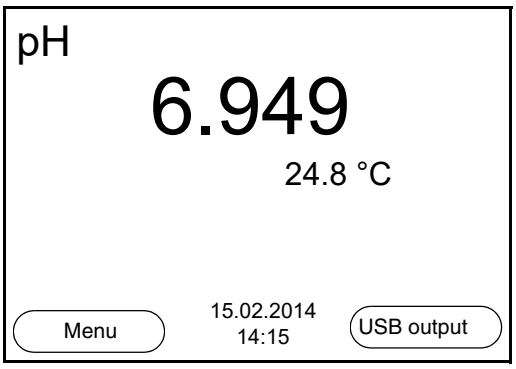
6.1 Measuring

6.1.1 Measuring the pH value

NOTE
When connecting an grounded PC/printer, measurements cannot be performed in grounded 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 6.2 CALIBRATION, page 27).

1. Connect the pH electrode to the meter.
2. If necessary, select the measured parameter with **<MODE>**.
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)

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 (see section 9.2.3 AUTOMATIC STABILITY CONTROL, page 65).

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
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.

Freezes 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.

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

6.1.2 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:

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 (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 **<OK>**/pH/*Man. temperature* menu, set the temperature value with **<▲><▼>**.

6.2 Calibration

6.2.1 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.

6.2.2 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

6.2.3 Automatic calibration (AutoCal)

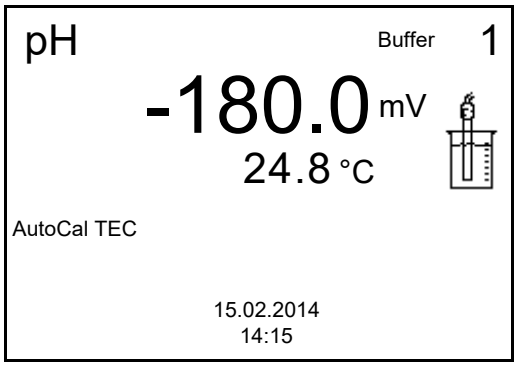
Make sure that in the sensor menu, *Buffer* menu, the buffer set is correctly selected (see 9.1.1 SETTINGS FOR PH MEASUREMENTS, PAGE 57).

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

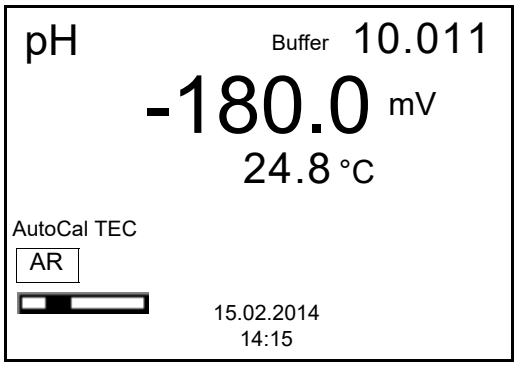
Below, calibration with Technical buffers (*TEC*) is described. When other buffer sets are used, other nominal buffer values are displayed. Apart from that, the procedure is identical.

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 **<MODE>**.
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 **<OK>**.
   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.



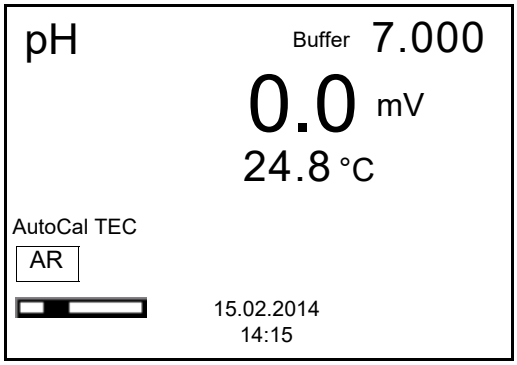
9. Wait for the end of the measurement with stability control or accept the calibration value with **<OK>**.
   The calibration display for the next buffer appears (voltage display).
10. If necessary, finish the calibration procedure as a single-point calibration with **<MODE>**.
    The calibration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

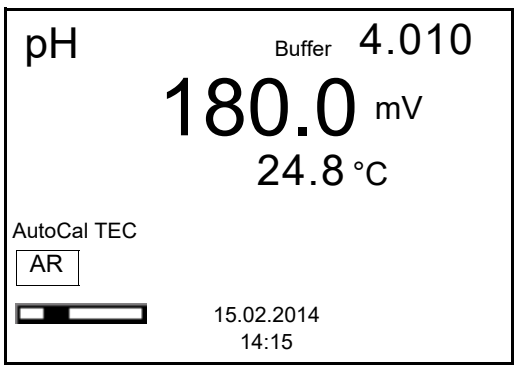
13. When measuring without temperature sensor:
    – Temper the buffer solution, or measure the current temperature.
    – Enter the temperature value with **<▲ > <▼ >**.
14. Start the measurement with **<OK>**.
    The measured value is checked for stability (stability control). The [AR] status indicator 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 **<OK>**.
    The calibration display for the next buffer appears (voltage display).
16. If necessary, finish the calibration procedure as a two-point calibration with **<MODE>**.
    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 **<OK>**.
    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 **<OK>**.
The calibration display for the next buffer appears (voltage display).

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

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.

6.2.4 Manual calibration (AnyCal)

Make sure that in the sensor menu, *Buffer* menu, the AnyCal buffer set is correctly selected (see section 9.1.1 SETTINGS FOR PH MEASUREMENTS, page 57).

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

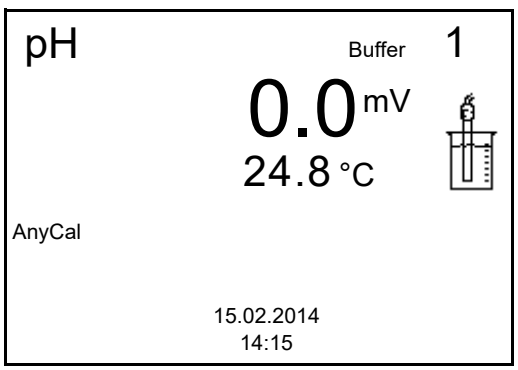
If single-point calibration was set in the menu, the calibration procedure is automatically finished with the measurement of buffer solution 1 and the calibration record is displayed.

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 **<MODE>**.

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

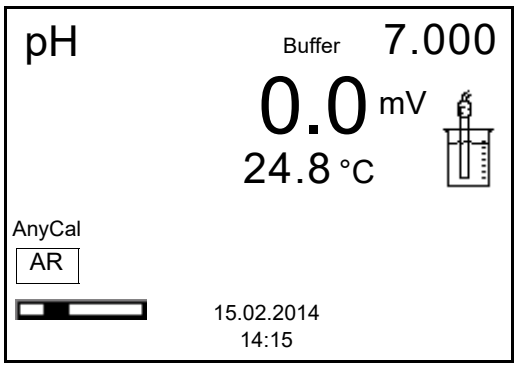


5. Thoroughly rinse the electrode with deionized water.

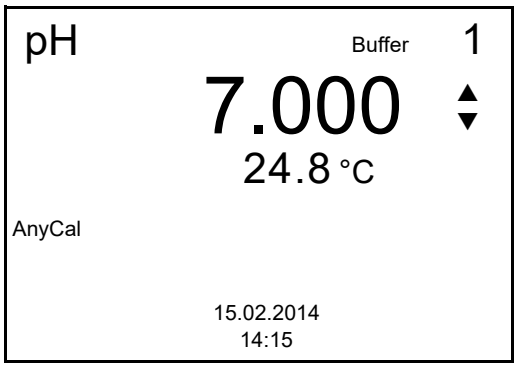
6. Immerse the electrode in the first buffer solution.

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 **<OK>**.
   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 **<OK>**.
   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 **<OK>**.
    The calibration display for the next buffer appears (voltage display).

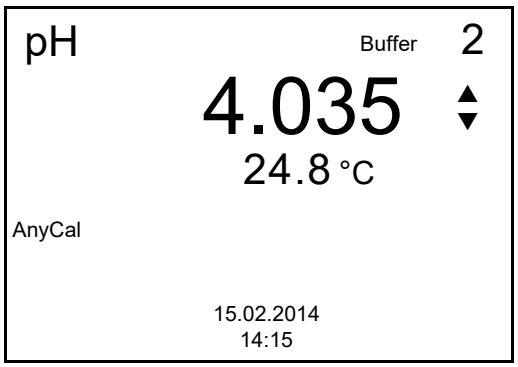
12. If necessary, finish the calibration procedure as a single-point calibration with **<MODE>**.
    The calibration record is displayed.

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.

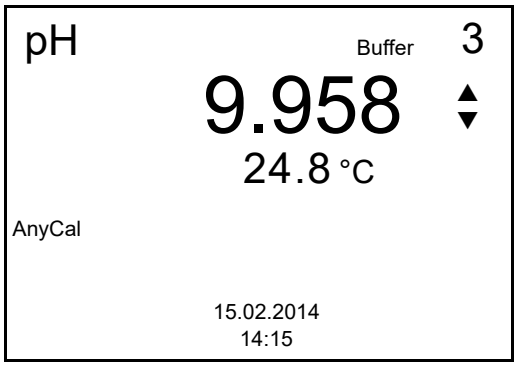
14. Immerse the electrode in the second buffer solution.
15. When measuring without temperature sensor:
    – Temper the buffer solution, or measure the current temperature.
    – Enter the temperature value with **<▲ > <▼ >**.
16. Start the measurement with **<OK>**.
    The measured value is checked 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 **<OK>**.
    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 **<OK>**.
    The calibration display for the next buffer appears (voltage display).
20. Finish the calibration procedure as a two-point calibration with **<MODE>**.
    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 **<OK>**.
    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 **<OK>**.
    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 **<OK>**.
The calibration display for the next buffer appears (voltage display).

28. Use **<MODE>** to finish calibration or
Continue calibrating using the next buffer with **<OK>**.

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.

6.2.5 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 9.1.1 SETTINGS FOR PH MEASUREMENTS, page 57).

6.2.6 Calibration data

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

Displays the calibration data

The calibration record of the last calibration is to be found under the menu item, **<OK>** / *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 memory

The calibration records of the last calibrations are to be found in the menu, **<OK>** / *Calibration* / *Calibration data storage*.

Menu item	Setting/ function	Explanation
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 **<OK>**. ● Switch directly to the measured value display with **<MODE>**.
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 oder >+30	<-62.0 oder >-50.0
Error elimination (see section 13 WHAT TO DO IF..., page 83)			

Calibration record (example)

```
IS 2100 L
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...
```

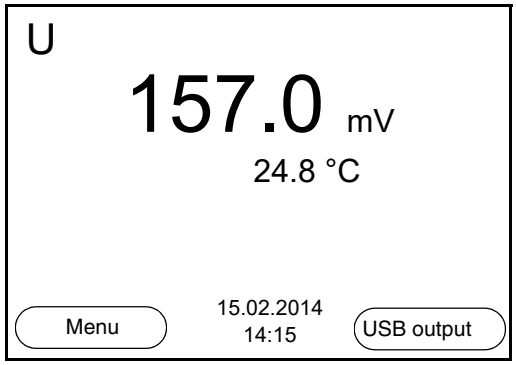
7 ORP voltage

7.1 Measuring

7.1.1 Measuring the ORP

NOTE
When connecting an grounded PC/printer, measurements cannot be performed in grounded 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 **<MODE>**.
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 (see section 9.2.3 AUTOMATIC STABILITY CONTROL, page 65).

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
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.

Freezes 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.

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

7.1.2 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 **<OK>**/U/*Man. temperature* menu, set the temperature value with **<▲><▼>**.

7.2 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.

8 Ion concentration

8.1 Measuring

8.1.1 Measuring the ion concentration

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

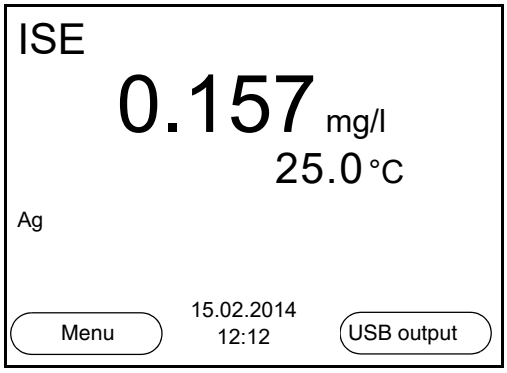
Incorrect calibration of ion sensitive electrodes will result in incorrect measured values. Calibrate regularly before measuring.

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 electrode to the meter.
   The pH/U/ISE measuring window is displayed.
2. If necessary, select the ISE display (unit, mg/l) with **<MODE>**.
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)

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 (see section 9.2.3 AUTOMATIC STABILITY CONTROL, page 65).

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.

Freezes 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.

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

8.1.2 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:

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 (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 **<▲ > <▼ >**.

8.2 Calibration

8.2.1 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 (if possible), and at regular intervals.

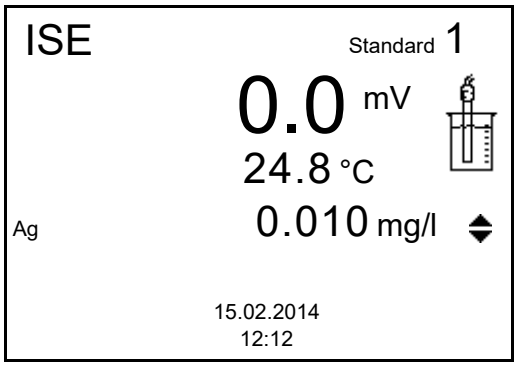
8.2.2 When to calibrate?

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

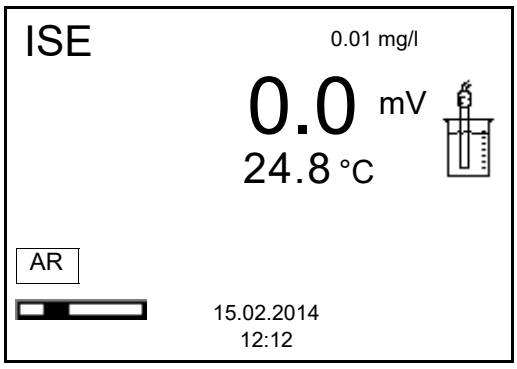
8.2.3 Calibration (ISE Cal)

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.

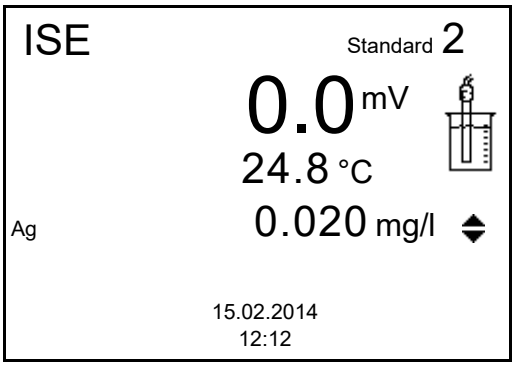
1. Connect the ISE electrode to the meter.
   The pH/U/ISE measuring window is displayed.
2. Keep the standard solutions ready.
3. When measuring without temperature sensor:
   – Temper the test sample, or measure the current temperature.
   – Enter the temperature value with **<▲ > <▼ >**.
4. In the measured value display, select the ISE measuring window with **<▲ > <▼ >** and **<MODE>**.
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 **<OK>**.
    The standard solution is measured.
    The measured value is checked for stability (AutoRead).

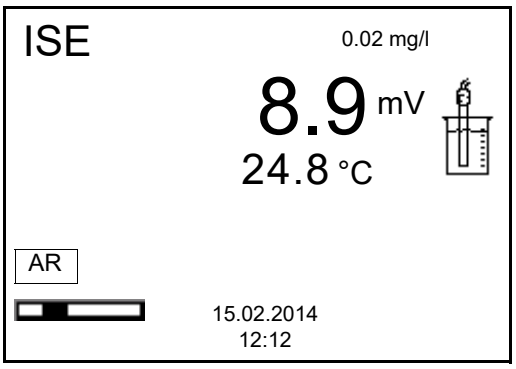


11. Wait for the end of the AutoRead measurement or accept the calibration value with **<OK>**.
    The calibration display for the next standard solution appears.

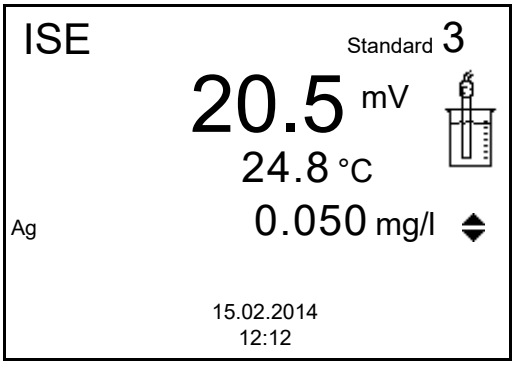


Continuing with two-point calibration

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 **<OK>**.
    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 **<OK>**.
    The calibration display for the next standard solution appears.



17. Press **<OK>** to continue with three-point calibration.
or
Finish the calibration procedure as a two-point calibration with **<MODE>**.
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.

8.2.4 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.

8.2.5 Calibration data

Displays the calibration data

The calibration record of the last calibration is to be found under the menu item, **<OK>** / *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 memory

The calibration records of the last calibrations are available in the menu, **<OK>** / *Calibration* / *Calibration data storage*.

Menu item	Setting/function	Explanation
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 **<OK>**. ● Switch directly to the measured value display with **<MODE>**.
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 83)	*Error*	< 50 or > 70 or < 25 or > 35

Calibration record (example)

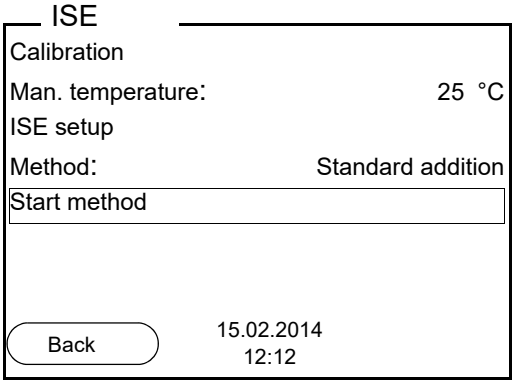
```
IS 2100 L
Ser. no. 12345678

CALIBRATIONISE
18.01.2013 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                  +++
_____________________________________
```

8.3 Selecting the measuring method

The following methods are supported:

- *Standard addition*
- *Standard subtraction*
- *Sample addition*
- *Sample subtraction*
- *Blank value addition*

1. Connect the ISE electrode to the meter.
   The pH/U/ISE measuring window is displayed.
2. If necessary, select the ISE display (unit, mg/l) with **<MODE>**.
3. If necessary, measure the temperature of the test sample with a thermometer.
4. Using **<OK>** (or **<F1>**/*[Menu]*), open the ISE menu.
5. Thoroughly rinse the electrode with distilled water.
6. Adjust the temperature of the standard solutions.
7. Select *Method* with **<▲ > <▼ >** and confirm with **<OK>**.
8. Select a method with **<▲ > <▼ >** and confirm with **<OK>**.



9. Select *Start method* with **<▲ > <▼ >** and confirm with **<OK>**.
   Measurement with the selected method begins (see section 8.3.1 STANDARD ADDITION, page 45 ... section 8.3.5 STANDARD ADDITION WITH BLANK VALUE CORRECTION (BLANK VALUE ADDITION), page 54).

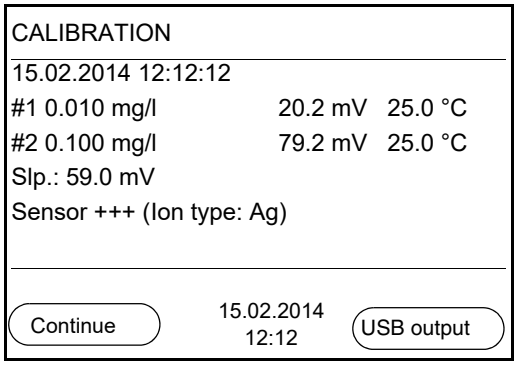
8.3.1 *Standard addition*

In the "Standard addition" procedure, a known amount of standard solution is added to the sample.

The ion concentration in the sample is calculated from the change in potential.

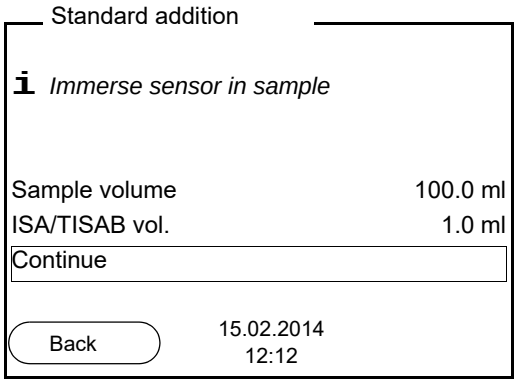
1. Select the measuring method (see section 8.3 SELECTING THE MEASURING METHOD, page 45).

2. Prepare two standard calibration solutions.
3. Perform a two-point calibration according to user guidance.
4. The calibration record is displayed as soon as a stable value is achieved for the second standard calibration solution.

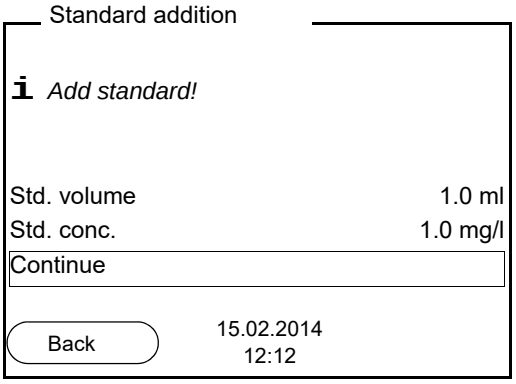


Measurement

5. Start the measurement with **<F1>**/[*Continue*].
   An entry window appears.



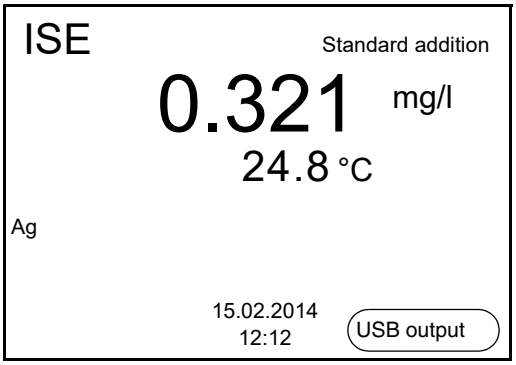
6. Prepare the sample.
7. If necessary, add the ISA/TISAB solution to the sample.
8. Thoroughly rinse the electrode with deionized water.
9. Immerse the electrode in the sample.
10. Using **<▲ > <▼ >** and **<OK>**, select the values for the volume of the sample (*Sample volume*) and the volume of the ISA/TISAB solution (*ISA/TISAB vol.*).
11. Select *Continue* with **<▲ > <▼ >** and start the measurement with **<OK>**.
    When the measurement is finished an entry window appears.



12. Add the standard solution to the sample.

13. Using **<▲ > <▼ >** and **<OK>**, enter the values for the volume of the standard solution (*Std. volume*) and concentration of the standard solution (*Std. conc.*) .

14. Select *Continue* with **<▲ > <▼ >** and start the measurement with **<OK>**.
The measurement result is displayed when the measurement is completed.



15. If necessary, start measuring further samples with **<OK>**.
Repeat steps 6 - 14 for all samples.

16. Terminate the measuring method with **<MODE>**.
A safety query appears.

17. Select *Yes* with **<▲ > <▼ >**.

18. Confirm*Yes* with **<OK>**.
Measurement with the selected method is completed.

8.3.2 *Standard subtraction*

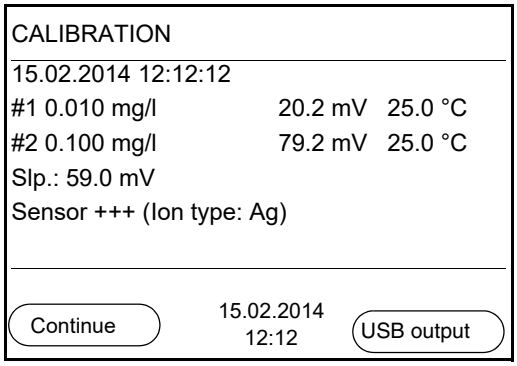
In the "Standard Subtraction" procedure, a known amount of standard solution is added to the sample (as complexing agent or precipitating agent) and, thus, the ion concentration lowered.

The ion concentration in the sample is calculated from the change in potential.

1. Select the measuring method (see section 8.3 SELECTING THE MEASURING METHOD, page 45).

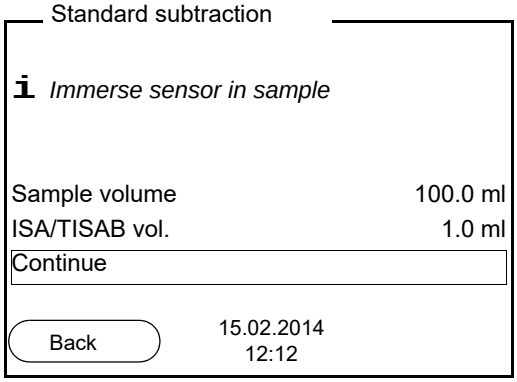
Calibration

2. Prepare two standard calibration solutions.
3. Perform a two-point calibration according to user guidance.
4. The calibration record is displayed as soon as a stable value is achieved for the second standard calibration solution.



Measurement

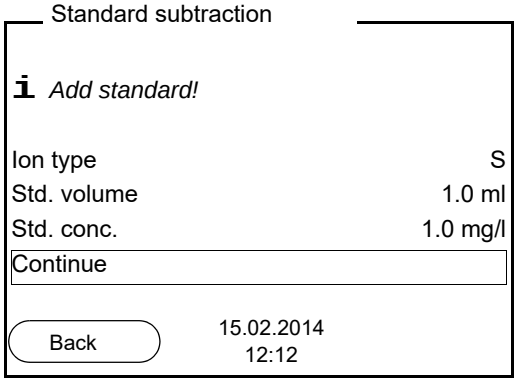
5. Start the measurement with **<F1>**/[*Continue*].
An entry window appears.



6. Prepare the sample.
7. If necessary, add the ISA/TISAB solution to the sample.
8. Thoroughly rinse the electrode with deionized water.
9. Immerse the electrode in the sample.

10. Using **<▲ > <▼ >** and **<OK>**, select the values for the volume of the sample (*Sample volume*) and the volume of the ISA/TISAB solution (*ISA/TISAB vol.*).

11. Select *Continue* with **<▲ > <▼ >** and start the measurement with **<OK>**.
When the measurement is finished an entry window appears.

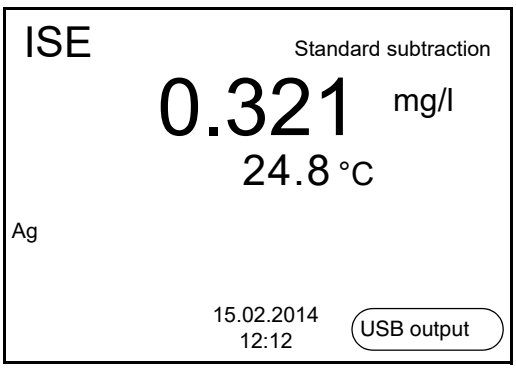


12. Add the standard (complexing agent or precipitating agent) to the sample.

13. Using **<▲ > <▼ >** and **<OK>**, enter the values for the volume of the standard solution (*Std. volume*) and concentration of the standard solution (*Std. conc.*) .

14. Using **<▲ > <▼ >** and **<OK>**, set the ion type for the ion in the standard (*Ion type*) if necessary.
On selection of the ion type that can be defined (ION):
Using **<▲ > <▼ >** and **<OK>**, set the valence (*Valency*) and molar weight (*Molar mass*) for the ion in the standard solution.

15. Select *Continue* with **<▲ > <▼ >** and start the measurement with **<OK>**.
The measurement result is displayed when the measurement is completed.



16. If necessary, start measuring further samples with **<OK>**.
Repeat steps 6 - 15 for all samples.

17. Terminate the measuring method with **<MODE>**.
A safety query appears.

18. Select *Yes* with **<▲ > <▼ >**.

19. Confirm *Yes* with **<OK>**.
Measurement with the selected method is completed.

8.3.3 *Sample addition*

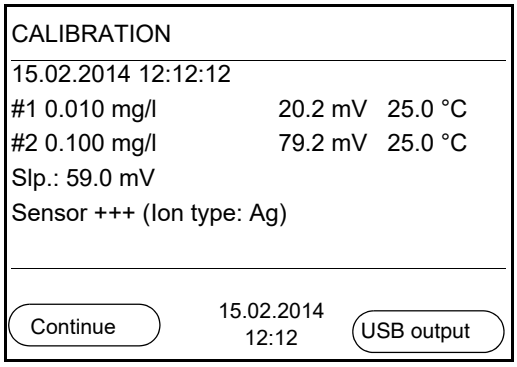
In the "Sample addition" procedure, a known amount of sample is added to the standard solution.

The ion concentration in the sample is calculated from the change in potential.

1. Select the measuring method (see section 8.3 SELECTING THE MEASURING METHOD, page 45).

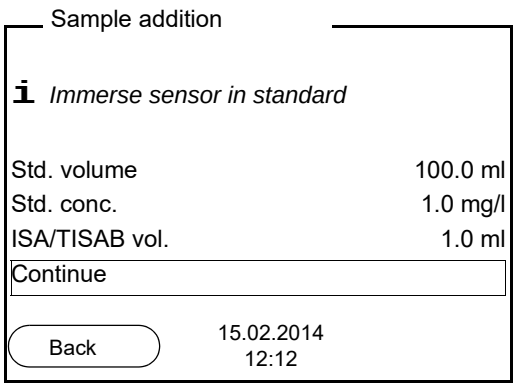
Calibration

2. Prepare two standard calibration solutions.
3. Perform a two-point calibration according to user guidance.
4. The calibration record is displayed as soon as a stable value is achieved for the second standard calibration solution.



Measurement

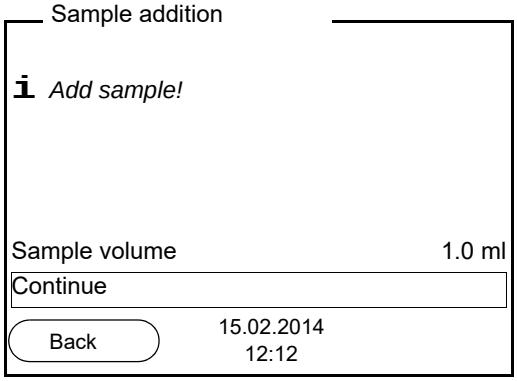
5. Start the measurement with **<F1>**/[*Continue*].
An entry window appears.



6. Prepare the standard solution.
7. If necessary, add the ISA/TISAB solution to the standard solution.
8. Thoroughly rinse the electrode with deionized water.
9. Immerse the electrode in the standard.

10. Using **<▲ > <▼ >** and **<OK>**, enter the values for the volume of the standard solution (*Std. volume*), the concentration of the standard solution (*Std. conc.*) and the volume of the ISA/TISAB solution (*ISA/TISAB vol.*).

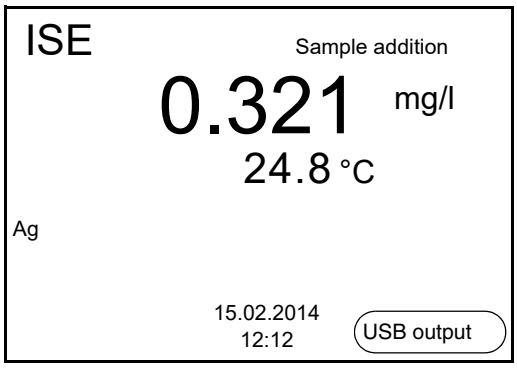
11. Select *Continue* with **<▲ > <▼ >** and start the measurement with **<OK>**.
When the measurement is finished an entry window appears.



12. Add the sample to the standard solution.

13. Using **<▲ > <▼ >** and **<OK>**, enter the value for the volume of the sample (*Sample volume*).

14. Select *Continue* with **<▲ > <▼ >** and start the measurement with **<OK>**.
The measurement result is displayed when the measurement is completed.



15. If necessary, start measuring further samples with **<OK>**.
Repeat steps 6 - 14 for all samples.

16. Terminate the measuring method with **<MODE>**.
A safety query appears.

17. Select *Yes* with **<▲ > <▼ >**.

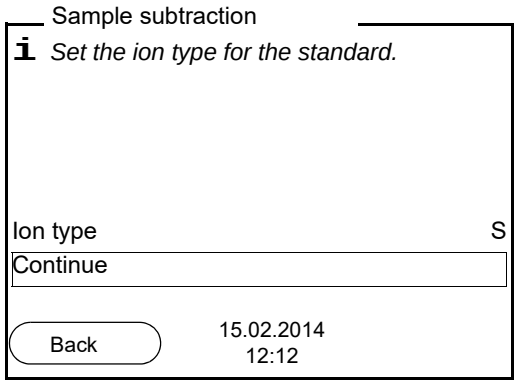
18. Confirm*Yes* with **<OK>**.
Measurement with the selected method is completed.

8.3.4 *Sample subtraction*

With the Sample subtraction procedure, a known amount of sample is added to the standard solution (complexing agent or precipitating agent).

The ion concentration in the sample is calculated from the change in potential. The sample subtraction is one method for the indirect determination of ions. It is used for the determination of ions for which no direct determination is possible.

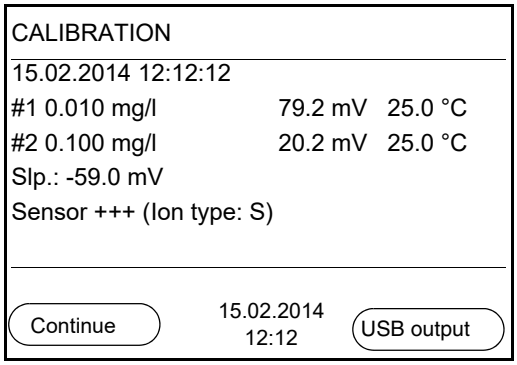
1. Select the measuring method (see section 8.3 SELECTING THE MEASURING METHOD, page 45).
   An entry window appears.



2. Using **<▲ > <▼ >** and **<OK>**, set the ion type for the ion in the standard (*Ion type (sub)*) if necessary.
   On selection of the ion type that can be defined (ION):
   Using **<▲ > <▼ >** and **<OK>**, set the valence (*Valency*) and molar weight (*Molar mass*) for the ion in the standard solution.
3. Select and confirm *Continue* with **<▲ > <▼ >** and **<OK>**.

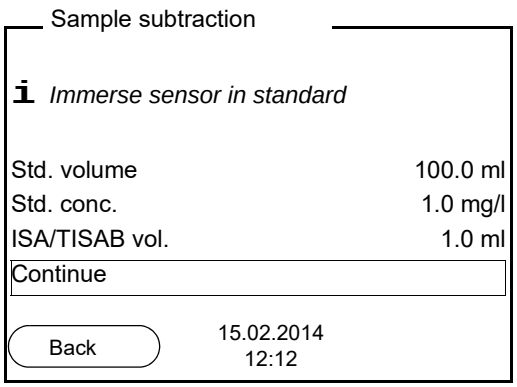
Calibration

4. Prepare two standard calibration solutions.
5. Perform a two-point calibration according to user guidance.
6. The calibration record is displayed as soon as a stable value is achieved for the second standard calibration solution.

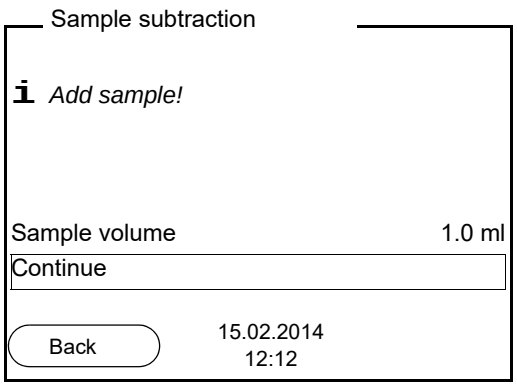


Measurement

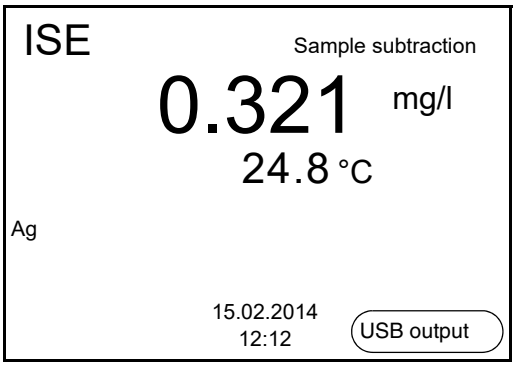
7. Start the measurement with **<F1>**/[*Continue*]
   An entry window appears.



8. Prepare the standard solution.
9. If necessary, add the ISA/TISAB solution to the standard solution.
10. Thoroughly rinse the electrode with deionized water.
11. Immerse the electrode in the standard solution (complexing agent or precipitating agent).
12. Using **<▲ > <▼ >** and **<OK>**, enter the values for the volume of the standard solution (*Std. volume*), the concentration of the standard solution (*Std. conc.*) and the volume of the ISA/TISAB solution (*ISA/TISAB vol.*).
13. Select *Continue* with **<▲ > <▼ >** and start the measurement with **<OK>**.
    When the measurement is finished an entry window appears.



14. Add the sample to the standard (complexing agent or precipitating agent).
15. Using **<▲ > <▼ >** and **<OK>**, enter the value for the volume of the sample (*Sample volume*).
16. Select *Continue* with **<▲ > <▼ >** and start the measurement with **<OK>**.
    The measurement result is displayed when the measurement is completed.



17. If necessary, start measuring further samples with **<OK>**.
Repeat steps 8 - 16 for all samples.

18. Terminate the measuring method with **<MODE>**.
A safety query appears.

19. Select *Yes* with **<▲ > <▼ >**.

20. Confirm*Yes* with **<OK>**.
Measurement with the selected method is completed.

8.3.5 Standard addition with blank value correction (*Blank value addition*)

In the "Standard addition with blank value correction" procedure, a known amount of standard solution is added to the sample in two steps.

The ion concentration in the linear range of the electrode characteristic curve is increased with the first addition.

The second addition is equivalent to the standard addition. The ion concentration in the sample is calculated from the change in potential.

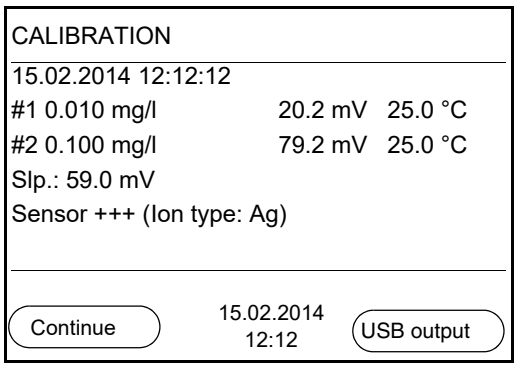
1. Select the measuring method (see section 8.3 SELECTING THE MEASURING METHOD, page 45).

Calibration

2. Prepare two standard calibration solutions.

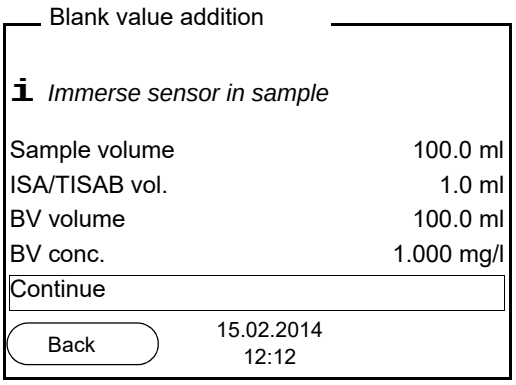
3. Perform a two-point calibration according to user guidance.

4. The calibration record is displayed as soon as a stable value is achieved for the second standard calibration solution.



Measurement

5. Start the measurement with **<F1>**/[*Continue*]
An entry window appears.



6. Prepare the sample.

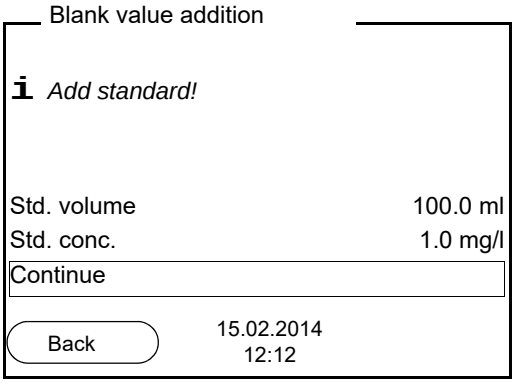
7. If necessary, add the ISA/TISAB solution to the sample.

8. Thoroughly rinse the electrode with deionized water.

9. Immerse the electrode in the sample that was supplemented with blank value solution.

10. Using **<▲ > <▼ >** and **<OK>**, enter the values for the volume of the sample (*Sample volume*), the volume of the ISA/TISAB solution (*ISA/ TISAB vol.*), the volume of the blank value solution (*BV volume*) and the concentration of the blank value solution (*BV conc.*).

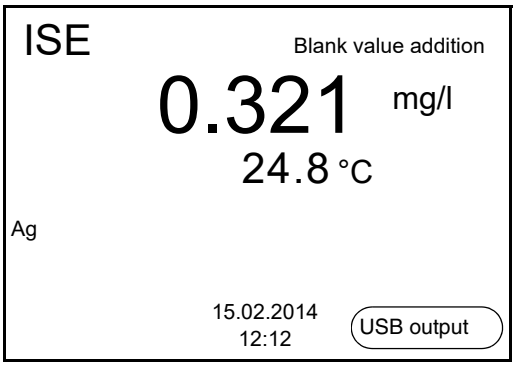
11. Select *Continue* with **<▲ > <▼ >** and start the measurement with **<OK>**.
When the measurement is finished an entry window appears.



12. Add the standard solution to the sample.

13. Using **<▲ > <▼ >** and **<OK>**, enter the values for the volume of the standard solution (*Std. volume*) and concentration of the standard solution (*Std. conc.*) .

14. Select *Continue* with **<▲ > <▼ >** and start the measurement with **<OK>**.
The measurement result is displayed when the measurement is completed.



15. If necessary, start measuring further samples with **<OK>**.
    Repeat steps 6 - 12 for all samples.
16. Terminate the measuring method with **<MODE>**.
    A safety query appears.
17. Select *Yes* with **<▲ > <▼ >**.
18. Confirm*Yes* with **<OK>**.
    Measurement with the selected method is completed.

9 Settings

9.1 Measurement settings

9.1.1 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 **<OK>** (or **<F1>**/*[Menu]*) key. After completing the settings, switch to the measured value display with **<MODE>**.

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

Default settings are printed in **bold**.

Menu item	Possible setting	Explanation
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 **<OK>**. ● Switch directly to the measured value display with **<MODE>**.
Calibration / *Calibration data storage* / *Output to USB*	-	Outputs the calibration records to the interface.
Calibration / *Buffer*	***TEC*** AnyCal *NIST/DIN* TEC 2 ...	Buffer sets to be used for pH calibration (see section 6.2 CALIBRATION, page 27).
Calibration / *One point calibration*	*Yes* ***No***	Quick calibration with 1 buffer

Menu item	Possible setting	Explanation
Calibration / *Serial number (sensor)*	-	Entry of the serial number of the connected sensor. The serial number is output in the calibration record. ● Change the contents of the highlighted position with **<▲ ><▼ >**. ● Go to the next position with **<F2>**/[▶]. ● When the serial number has been completely entered, confirm with **<OK>**.
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.
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).
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 9.3.1 RESETTING THE MEASUREMENT SETTINGS, page 65).

9.1.2 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 calibration.

No.	Buffer set *	pH values	at
1	TEC EU Technical buffers EU	2.00 4.00 7.00 10.00	20 °C
2	TEC US Technical buffers US		
3	AnyCal	Any	Any
4	NIST/DIN DIN buffers according to DIN 19266 and NIST Traceable Buffers	1.679 4.006 6.865 9.180 12.454	25 °C
5	TEC 2 Technical buffers	4.010 7.000 10.011	25 °C
6	Merck 1*	4.000 7.000 9.000	20°C
7	Merck 2 *	1.000 6.000 8.000 13.000	20°C
8	Merck 3 *	4.660 6.880 9.220	20°C
9	Merck 4 *	2.000 4.000 7.000 10.000	20°C
10	Merck 5 *	4.010 7.000 10.000	25 °C

* Brand names or trade names are trademarks of their respective owners protected by law.

The buffers are selected in the menu, pH / **<OK>** / *Calibration* / *Buffer* (see 9.1.1 SETTINGS FOR PH MEASUREMENTS, PAGE 57).

9.1.3 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. Open the menu for measurement settings with **<OK>** (or **<F1>**/*[Menu]*).
2. In the *Calibration* / *Calibration interval* menu, set the calibration interval with **<▲><▼>**.
3. Confirm the setting with **<OK>**.
4. Quit the menu with **<MODE>**.

9.1.4 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 **<OK>** (or **<F1>**/*[Menu]*) key. After completing the settings, switch to the measured value display with **<MODE>**.

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

Default settings are printed in **bold**.

Menu item	Possible setting	Explanation
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 9.3.1 RESETTING THE MEASUREMENT SETTINGS, page 65).

9.1.5 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 **<OK>** (or **<F1>**/*[Menu]*) key. After completing the settings, switch to the measured value display with **<MODE>**.

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

Menu item	Possible setting	Explanation
Calibration / *Calibration record*	-	Displays the calibration record of the last calibration.
Calibration / *Calibration data storage* / *Output to USB*	-	Outputs the calibration records to the interface.
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 **<OK>**. ● Switch directly to the measured value display with **<MODE>**.

Menu item	Possible setting	Explanation
Calibration / *Serial number (sensor)*	-	Entry of the serial number of the connected sensor. The serial number is output in the calibration record. ● Change the contents of the highlighted position with **<▲ ><▼ >**. ● Go to the next position with **<F2>**/[▶]. ● When the serial number has been completely entered, confirm with **<OK>**.
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 8.1.1 MEASURING THE ION CONCENTRATION, page 38).
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.
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, %)
Method	*Standard addition* *Standard subtraction* *Sample addition* *Sample subtraction* *Blank value addition*	Selection of the available measuring methods.
Start method		Start measurement with the selected method.

9.2 Sensor-independent settings

9.2.1 *System*

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

Default settings are printed in **bold**.

Menu item	Possible 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 ...* ***50*** *... 100 %*	Changes the display contrast
System / *General* / *Switchoff time*	*10 min ...* ***1h*** *... 24 h*	Adjusts the shut-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 11 TRANSMITTING DATA (USB INTERFACE), page 73)
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	Explanation
System / *Clock*	*Date format* *Datum* *Time*	Time and date settings (see section 5.4.6 EXAMPLE 2 ON NAVIGATION: SETTING THE DATE AND TIME, page 23)
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 9.3.2 RESETTING THE SYSTEM SETTINGS, page 66).

9.2.2 *Data storage*

This menu contains all functions to display, edit and erase stored measured values and calibration records (see section 10 DATA MEMORY, page 67).

9.2.3 Automatic *Stability control*

The automatic *Stability control* (AutoRead) function continuously 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 9.2.1 SYSTEM, page 64).

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.

9.3 Reset

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

9.3.1 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
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 **<OK>** (or **<F1>**/*[Menu]*) key.

9.3.2 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
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 **<OK__ >** (or **<F1__>**/*[Menu]*) key.

10 Data memory

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

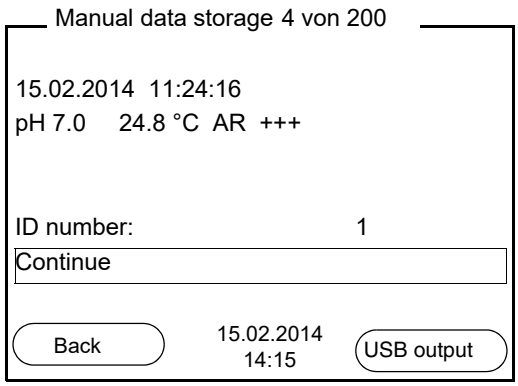
- Manual data memory (see section 10.1 MANUAL STORAGE, page 67)
- Automatic storage at intervals (see section 10.2 AUTOMATIC DATA STORAGE AT INTERVALS, page 68)

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

10.1 Manual storage

You can transmit a measurement dataset to the data memory as follows. With each data storage process, the current datasets of the sensors indicated on the display are transmitted to the interface at the same time.

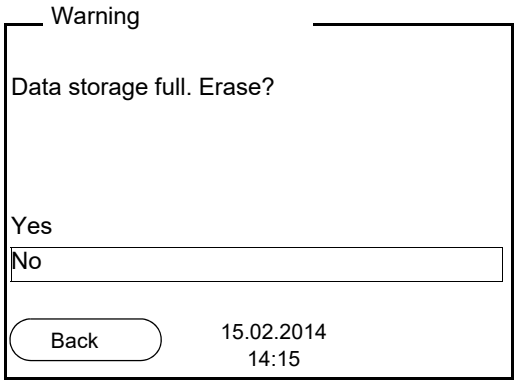
1. Press the **<STR>** key shortly.
   The menu for manual data storage appears.



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:



You have the following options:

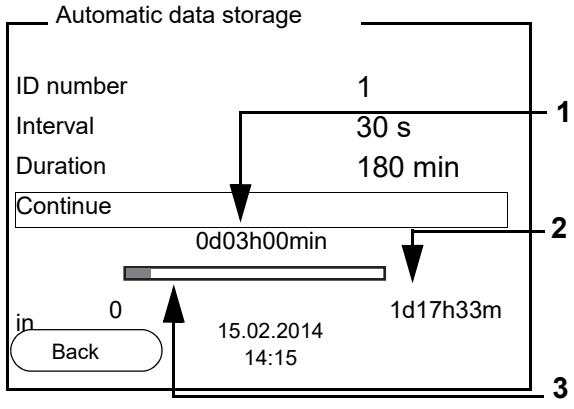
- To erase the entire memory, confirm *Yes*.
- To cancel the storing process and switch to the measured value display, confirm *No*. Then you can e.g. store the recorded data to a PC (see section 10.3.1 EDITING THE MEASUREMENT DATA MEMORY, page 70) and subsequently erase the data memory (see section 10.3.2 ERASING THE MEASUREMENT DATA MEMORY, page 72).

10.2 Automatic data storage at intervals

The storing interval (*Interval*) determines the time interval between automatic data storing 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 memory function

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



1 Specified entire storing duration
2 Max. available storing duration
3 Graphical display of the memory usage

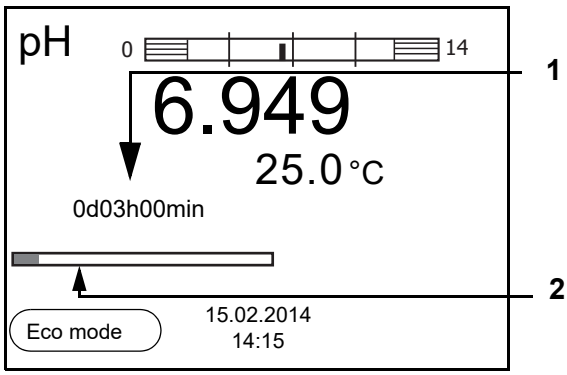
Settings

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

Menu item	Possible setting	Explanation
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*	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.



1 Remaining storing duration

2 Graphical display of the storing 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, **<MODE>**, **<STR__ >** and **<On/Off>**. The other keys and the automatic shut-off function are deactivated.

Energy saving mode ([Eco mode])

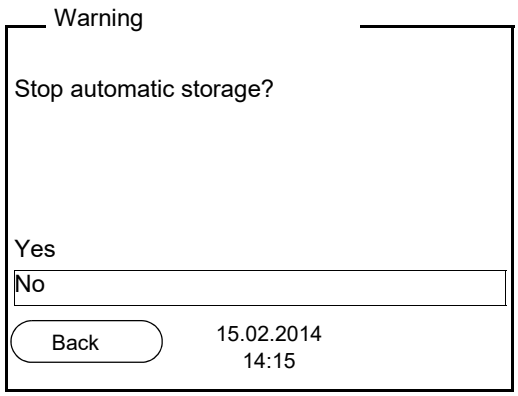
If the automatic storing function is active, the meter provides an energy saving mode ([Eco mode]) to avoid unnecessary energy consumption. The energy

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 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.



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

10.3 Measurement data memory

10.3.1 Editing the measurement data memory

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

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

Editing the data memory

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

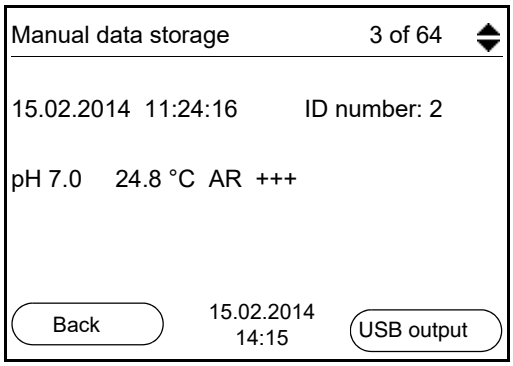
Open the manual or automatic storage directly with the **<RCL>** or **<RCL__>** key.

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/ function	Explanation
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 memory. 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
IS 2100 L
Ser. no. 08502113

ID number 2

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

15.02.2014 10:56:20
IS 2100 L
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 **<MODE>**.
- Quit the display and move to the next higher menu level with **<F1>**/*[Back]*.

10.3.2 Erasing the measurement data memory

Erasing the measurement data memory (see section 10.3.1 EDITING THE MEASUREMENT DATA MEMORY, page 70).

10.3.3 Measurement dataset

A complete dataset consists of:

- 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

10.3.4 Memory locations

The IS 2100 L 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

11 Transmitting data (USB interface)

11.1 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 10.1 MANUAL STORAGE, page 67).
	Automatic, at intervals	● With **<F2__>**/*[USB output]*. Then you can set the transmission interval. ● Simultaneously with every automatic data storing process (see section 10.2 AUTOMATIC DATA STORAGE AT INTERVALS, page 68).
Stored measured values	Manual	● Displayed dataset with **<F2>***[USB output]* after calling up from the memory. ● All datasets with the *Output to USB* function. (see section 10.3.1 EDITING THE MEASUREMENT DATA MEMORY, page 70).
Calibration records	Manual	● Calibration record with **<F2>**/*[USB output]* (see section 6.2.6 CALIBRATION DATA, page 34).
	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).

11.2 Connecting a PC

Connect the IS 2100 L to the PC via the USB interface.

NOTE
When connecting an grounded PC/printer, measurements cannot be performed in grounded 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 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 IS 2100 L to the PC via the USB interface.
   The meter is listed as a virtual COM interface among the connections in the Windows instrument manager.

11.3 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.

12 Maintenance, cleaning, disposal, accessories

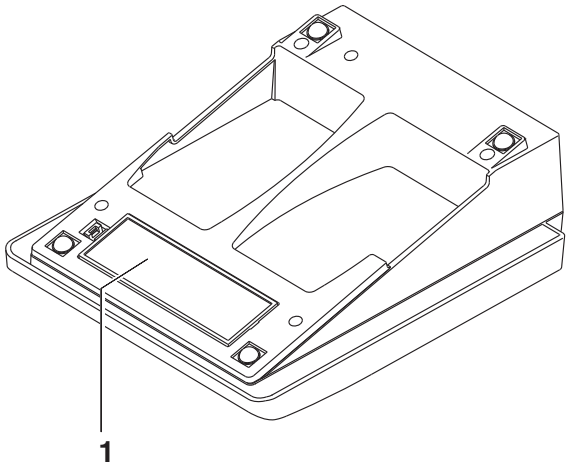
12.1 Maintenance

12.1.1 General maintenance activities

The only maintenance activity required is replacing the batteries.

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

12.1.2 Replacing the batteries



1 Battery compartment

1. Open the battery compartment (1) on the underside of the meter.
2. 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.

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.

3. Place four batteries (type Mignon AA) in the battery compartment.
4. Close the battery compartment.
5. Set the date and time
(see section 5.4.6 EXAMPLE 2 ON NAVIGATION: SETTING THE DATE AND TIME, page 23).

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.

12.2 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.

12.3 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.

12.4 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

12.5 Accessories

12.5.1 General information

	Order no. (Catalogue No.)	
Accessories	**EU**	**NA**
Storage tube	662-1167	89236-592
COMMUNICATION KIT (CD-ROM, USB cable, Manual)	662-1225	76470-840
Articulated stand for 4 electrodes and temperature sensor	662-1169	-
Storage vessel	662-1248	-

12.5.2 pH / ORP

	Order no. (Catalogue No.)	
Electrodes (pH)	**EU**	**NA**
pHenomenal 110 PH ELECTRODE PHENOMENAL GEL EPOXY BNC	662-1156	76460-452
pHenomenal 111 PH ELECTRODE PHENOMENAL 3IN1 GEL 1M BNC	662-1157	76460-454
pHenomenal 111-3 PH ELECTRODE PHENOMENAL 3IN1 GEL 3M BNC	662-1158	-
pHenomenal 220 PH ELECTRODE PHENOMENAL NACHF. GLAS BNC	662-1159	76460-456
pHenomenal 221 PH ELECTRODE PHENOMENAL 3IN1 GLAS 1M	662-1161	76460-458
pHenomenal 221-3 PH ELECTRODE PHENOMENAL 3IN1 GLAS 3M	662-1162	-
pHenomenal MIC 220 PH ELECTRODE PHENOMENAL MICRO NACHF.BNC	662-1163	-
pHenomenal SPEAR 220 PH ELECTRODE PHENOMENAL KOMB. SPEER TYP	662-1164	-
pHenomenal LS 221 PH ELEKTRODE PHENOMENAL 3IN1 GLAS 1M	662-1247	76460-462
GENERAL PH EKTRODE GEL EPOXY BNC SJ113	662-1382	76460-468
GENERAL PH ELEKTRODE GEL EPOXY BNC DJ113	662-1385	76460-470
SURFACE PH ELEKTRODE GEL EPOXY BNC SF113	662-1388	76460-472
SEMI MICRO PH ELEKTRODE GEL GLASS SM123	662-1391	76460-474
GENERAL PH ELEKTRODE KCL GLASS BNC SJ223	662-1395	76460-476
SURFACE PH ELEKTRODE KCL GLASS BNC SF223	662-1398	76460-478

Electrodes (pH)	Order no. (Catalogue No.) EU	NA
SEMI MICRO PH ELEKTRODE KCL GLASS SM223	662-1402	76460-480
SPEAR PH ELEKTRODE KCL GLASS BNC SP223	662-1405	76460-482

Electrodes (ORP)	Order no. (Catalogue No.) EU	NA
pHenomenal ORP 220 REDOX ELECTRODE PHENOMENAL KOMB. 1M BNC	662-1165	76460-460
REDOX ELEKTRODE GEL EPOXY BNC RD113	662-1408	76460-484
REDOX ELEKTRODE GEL GLASS BNC RD223	662-1409	76460-486

Solutions	EU	NA
Buffer pH 4 AVS TITRINORM, 100 ml	32095.184	-
Buffer pH 7 AVS TITRINORM, 100 ml	32096.187	-
Buffer pH 10 AVS TITRINORM, 100 ml	32040.185	-
Buffer NIST pH 4.01, 30 x 30 ml	1.99001.0001	-
Buffer NIST pH 7, 30 x 30 ml	1.99002.0001	-
Buffer NIST pH 10, 30 x 30 ml	1.99004.0001	-
Buffer pH 1.68, 500 mL	-	BDH5006-500ML
Buffer pH 4, 500 mL	-	BDH5024-500ML
Buffer pH 7, 500 mL	-	BDH5052-500ML
Buffer pH 10, 500 mL	-	BDH5078-500ML
Buffer pH 12.45, 500 mL	-	BDH5096-500ML
Buffer NIST pH 4.006, 500 mL	-	BDH5018-500ML
Buffer NIST pH 6.865, 500 mL	-	BDH5040-500ML
Buffer NIST pH 9.18, 500 mL	-	BDH5066-500ML
Buffer NIST pH 10.012, 500 mL	-	BDH5072-500ML
Storage Solution (3 moles/l KCl), 100 ml	83605.180	BDH7296-0
Cleaning Solution Pepsine/Hydrochloric acid, 100 ml	83603.180	89207-612

12.5.3 ISE

	Order no. (Catalogue No.)	
Electrodes	**EU**	**NA**
Ag/S 800 with BNC-plug, combined electrode for silver and sulfide	662-7058	
Br 800 with BNC-plug, combined electrode for bromide	662-7130	
Ca 800 with BNC-plug, combined electrode for calcium	662-7368	
Cd 800 with BNC-plug, combined electrode for cadmium	662-7370	
Cl 800 with BNC-plug, combined electrode for chloride	662-7372	
CN 800 with BNC-plug, combined electrode for cyanide	662-7374	
Cu 800 with BNC-plug, combined electrode for copper	662-7376	
F 800 with BNC-plug, combined electrode for fluoride	662-7378	
I 800 with BNC-plug, combined electrode for iodide	662-7380	
K 800 with BNC-plug, combined electrode for potassium	662-7382	
NO 800 with BNC-plug, combined electrode for nitrate	662-7385	
EXCHANGE HEAD K 800/AT	662-7384	
EXCHANGE HEAD NO 800/AT	662-7387	

Accessories	**EU**	**NA**
Universal bridge electrolyte ELY/BR/503 for R503 reference electrode 250 ml	662-0492	
Internal electrolyt ELY/IN/502 for R 502 reference electrode 250 ml	662-0354	
Bridge electrolyt ELY/BR/502 for R 502 reference electrode 250 ml	662-0355	
Bridge electrolyte ELY/BR/503/N for R503 reference electrode for nitrate 250 ml	662-0493	
Bridge electrolyte ELY/BR/503/K for R503 reference electrode for potassium 250 ml	662-0494	

MAINTENANCE KIT OXYGEN	664-0049	76460-466

13 What to do if...

13.1 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 the electrode
– Gel electrolyte dried out	– Replace the electrode
– The measured value is outside the measuring range of the meter	– Use a suitable electrode

Error message,
Error

Cause	Remedy
Electrode:	
– The values determined for zero point and slope of the electrode are outside the allowed limits.	– Recalibrate
– Junction contaminated	– Clean the junction
– Electrode broken	– Replace the 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 the 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 a suitable electrode
– Temperature too high	– Use a suitable electrode
– Organic liquids	– Use a suitable electrode

Obviously incorrect measured values

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

13.2 ISE

Error message *OFL*

Cause	Remedy
– Measuring range exceeded	– Dilute test sample

Obviously incorrect measured values

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

Error message *Error* (invalid calibration)

Cause	Remedy
ISE electrode:	
– Moisture in the plug	– Dry plug
– Electrode obsolete	– Replace the electrode
– Electrode unsuitable for the range to be measured	– Use a suitable 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 NH4* 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

13.3 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 12.1 MAINTENANCE, page 75)

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, **<OK__ >** / *Storage & config* / *System* / *Service information*. The instrument data are displayed.

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 IS 2100 L 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 IS 2100 L).

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 IS 2100 L to a USB interface (virtual COM port) of the PC.
4. Switch on the IS 2100 L.
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 IS 2100 L from the PC.
   The IS 2100 L 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 86).

15 Glossary

pH/ORP/ISE

Asymmetry see zero point

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

ORP 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).

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.

Slope The slope of a linear calibration function.

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

General topics

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).

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.
Reset	Restoring the original condition of all settings of a measuring system.
Resolution	Smallest difference between two measured values that can be displayed by a meter.
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.
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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Z

17 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 accessories and related products
- Additional product information and special offers

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

18 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 misapplication, 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.

19 Compliance with local laws and regulations

The customer is responsible for applying for and obtaining the necessary 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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