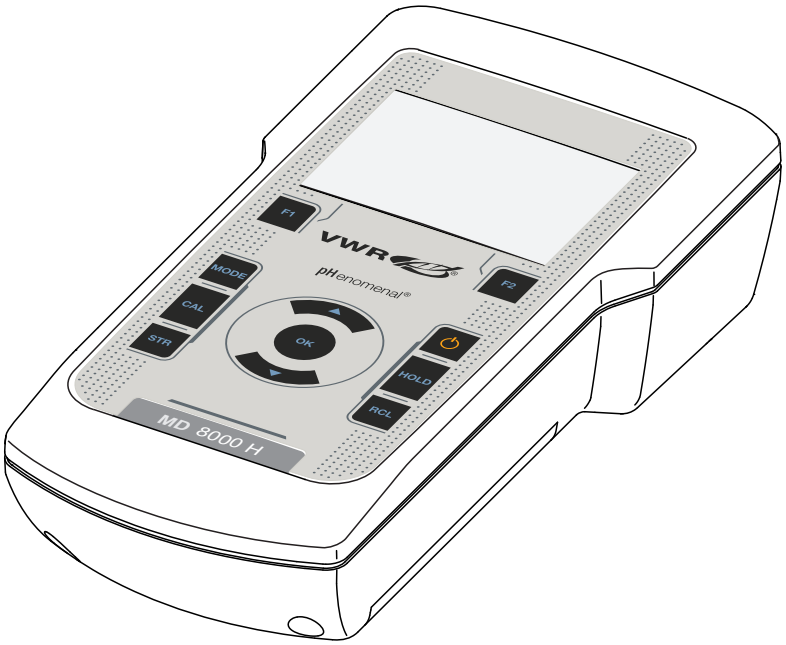
Operating manual

VWR® MD 8000 H - Multi Meter

	EU cat. no	NA cat. no
PH SET	665-0494	76460-510
PH BIO SET		76460-512



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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

The authorized use of the meter consists exclusively of the measurement of the pH, ORP, conductivity and dissolved oxygen 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 11).

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 11).

2 Overview

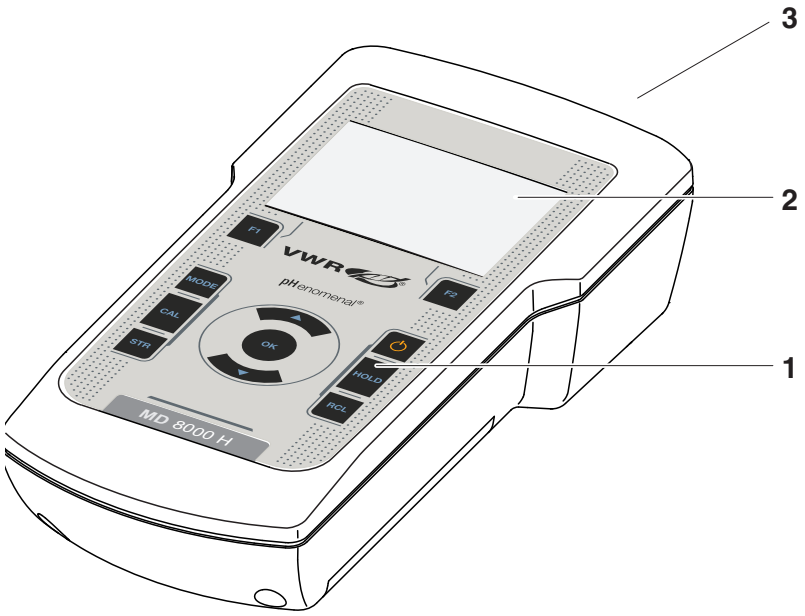
2.1 MD 8000 H meter

The MD 8000 H meter enables you to perform measurements (pH, U, conductivity, dissolved oxygen)) quickly and reliably.

The MD 8000 H provides the maximum degree of operating comfort, reliability and measuring certainty for all applications.

The MD 8000 H supports you in your work with the following functions:

- Automatic sensor recognition
- Data transmission via the USB interface (USB-B).



1 Keypad
2 Display
3 Connectors

2.2 Sensors

A measuring system ready to measure consists of the MD 8000 H meter and a suitable sensor.

Suitable sensors are IDP pH sensors, IDP ORP sensors, IDP conductivity sensors and IDP D.O. sensors.

2.2.1 IDP sensors

IDP sensors

- support the automatic sensor recognition
- show only the settings relevant to the specific sensor in the setting menu

- process signals in the sensor digitally so that precise and interference-free measurements are enabled even with long cables
- facilitate to assign a sensor to a measured parameter with differently colored couplings
- have quick-lock couplings with which to fix the sensors to the meter.

Sensor data from IDP sensors

IDP sensors transmit the following sensor data to the meter:

- SENSOR ID
  - Sensor name
  - Sensor series number
- Calibration data
- Measurement settings

The calibration data are updated in the IDP sensor after each calibration procedure. A message is displayed while the data are being updated in the sensor.

In the measured value display, you can display the sensor name and series number of the selected sensor with the [**i**] softkey. You can then display further sensor data stored in the sensor with the [More] softkey (see section 5.1.5 SENSOR INFO, page 17).

2.2.2 Automatic sensor recognition

The automatic sensor recognition for IDP sensors allows

- to operate an IDP sensor with different meters without recalibrating
- to assign measurement data to an IDP sensor
  - Measurement datasets are always stored and output with the sensor name and sensor series number.
- to assign calibration data to an IDS sensor
  - Calibration data and calibration history are always stored and output with the sensor name and sensor series number.
- to hide menus automatically that do not concern this sensor

To be able to use the automatic sensor recognition, a meter that supports the automatic sensor recognition (e.g. MD 8000 H) and a digital IDP sensor are required.

In digital IDP sensors, sensor data are stored that clearly identify the sensor. The sensor data are automatically taken over by the meter.

3 Technical data

3.1 Measuring ranges, resolution, accuracy

Measuring ranges, accuracy

Variable	Measuring range	Accuracy
Air pressure (absolute)*	300 ... 1100 mbar	± 4 mbar

* Available only if a D.O. sensor is connected

Further data are given in the documentation of your sensor.

3.2 General data

Dimensions	Approx. 180 x 80 x 55 mm (7.09 x 3.15 x 2.17 inches)	
Weight	Approx. 0.4 kg (0.88 pounds)	
Mechanical structure	Type of protection	IP 67
Electrical safety	Protective class	III
Test certificates	CE	

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

Power supply	Batteries	4 x 1.5 V alkali-manganese batteries, type AA
	Operational life	Approx. 150 h*

* The operational life is shorter is the display illumination is switched on permanently

USB interface (device)

Type	USB 1.1 USB-B (Device), PC
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 (9.843 feet)

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

- Meter MD 8000 H
- USB cable (A plug on mini B plug)
- Short instructions
- CD-ROM with
  - USB drivers
  - Comprehensive operating manual (6 languages)
  - Software MultiLab Importer

4.2 Power supply

The MD 8000 H is supplied with power in the following ways:

- Battery operation (4 batteries, 1.5 V Mignon type AA)
- USB operation via a connected USB-B cable

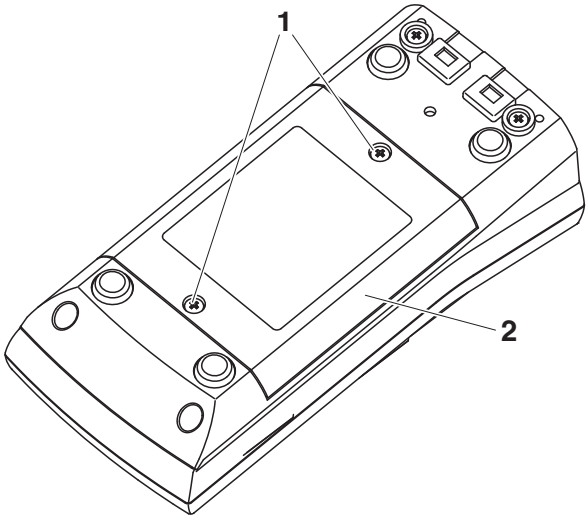
4.3 Initial commissioning

Perform the following activities:

- Insert the supplied batteries
- Switch on the meter (see section 5.2 SWITCHING ON THE METER, page 18)
- Set the date and time (see section 5.4.5 EXAMPLE 2 ON NAVIGATION: SETTING THE DATE AND TIME, page 23)

4.3.1 Inserting the batteries

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



1 Screws
2 Battery compartment

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

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

3. Place four batteries (type Mignon AA) in the battery compartment.
4. Close the battery compartment.
5. Set the date and time
(see section 5.4.5 EXAMPLE 2 ON NAVIGATION: SETTING THE DATE AND TIME, page 23).

5 Operation

5.1 General operating principles

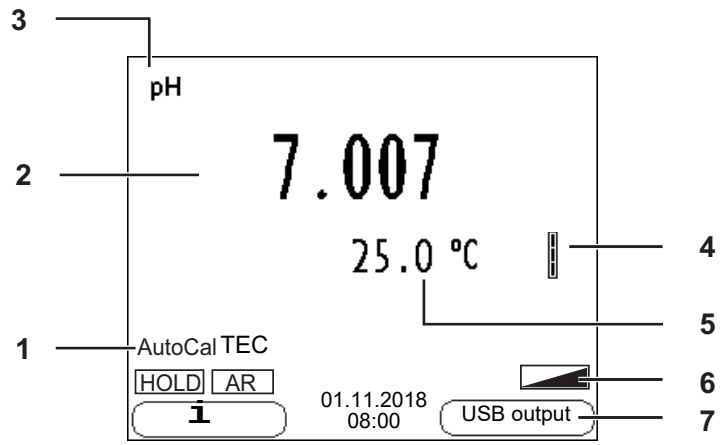
5.1.1 Keypad

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

<F1>: **<F1__>**: **<F2>**: **<F2__>**:	Softkeys providing situation dependent functions, e.g.: **<F1>**/[**i**]: View information on a sensor
<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) Switches the AutoRead measurement on or off

5.1.2 Display

Example (pH):

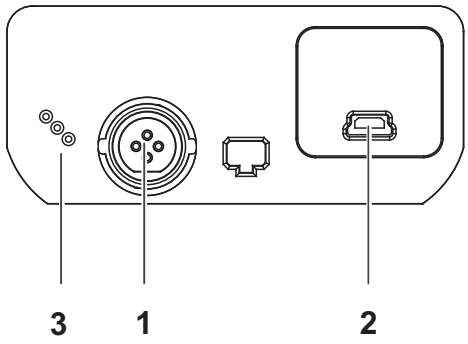


1 Status information (sensor)
2 Measured value
3 Measured parameter
4 Sensor symbol (calibration evaluation, calibration interval)
5 Measured temperature (with unit)
6 Status information (meter)
7 Softkeys and date + time

5.1.3 Status information (meter)

AR	Stability control (AutoRead) is active
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 Socket field

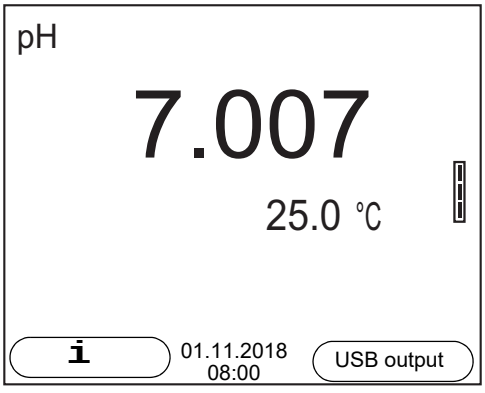


1 IDP sensors: (pH, ORP, conductivity, D.O.)
2 USB B (device) interface
3 Service interface

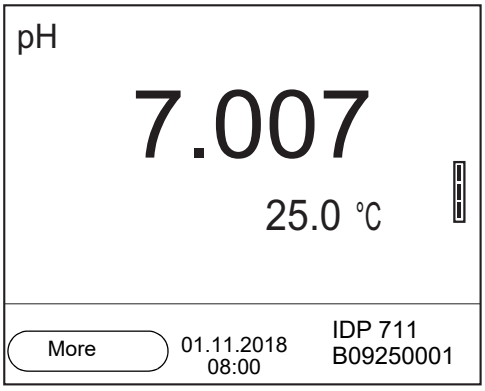
CAUTION
Only connect sensors to the meter that cannot return any voltages or currents that are not allowed (> SELV and > current circuit with current limiting).
VWR-IDP sensors meet these requirements.

5.1.5 Sensor info

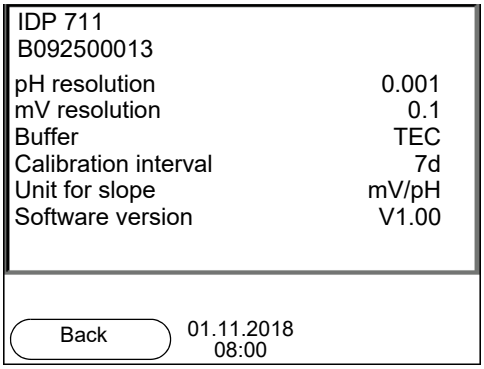
You can display the current sensor data and sensor settings of a connected sensor at any time. The sensor data are available in the measured value display with the **<F1>**/[**i**] softkey.



1. In the measured value display:
   Display the sensor data (sensor name, series number) with [**<F1>i**].

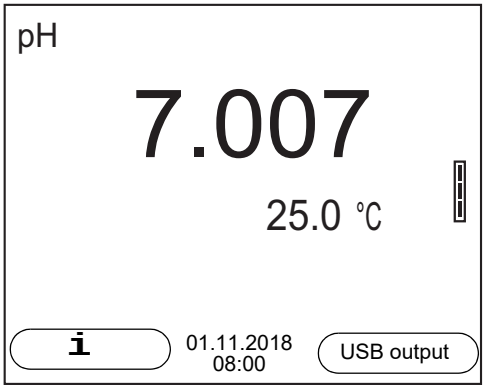


2. Display further sensor data (settings) with **<F1>**/[*More*].



5.2 Switching on the meter

1. Switch the meter on with **<On/Off>**.
   The meter performs a self-test.
2. Connect the sensor.
   The meter is ready to measure.



5.3 Switching off the meter

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

5.4 Navigation

5.4.1 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

5.4.2 Measured value display

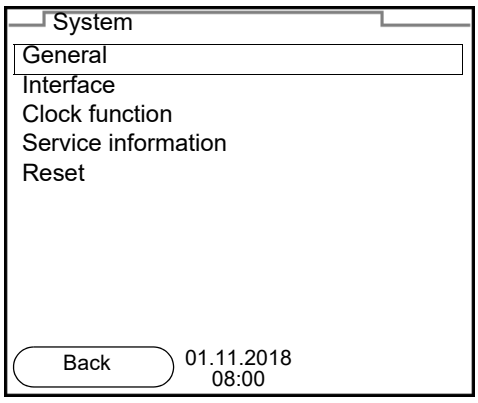
In the measured value display, you can

- open the menu for calibration and measurement settings with **<OK>** (short keystroke)
- open the system menu with the sensor-independent settings by pressing **<OK>***Storage & config* for a **<OK_ >**long keystroke, approx. 2 s).
- change the display in the selected measuring screen (e. g. pH >< mV) by pressing **<MODE>**.

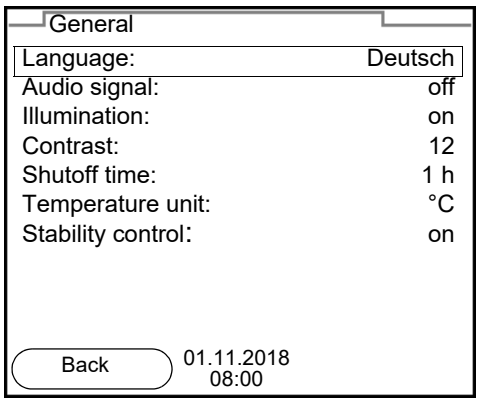
5.4.3 Menus and dialogs

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

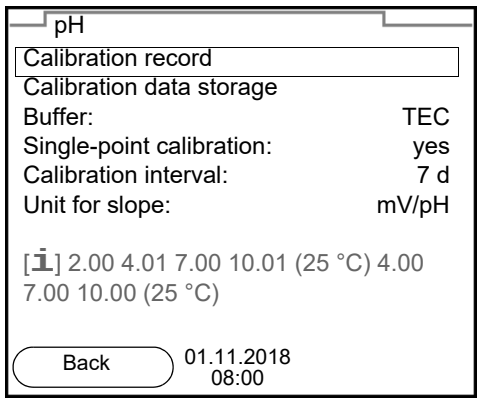
- Submenus
  The name of the submenu is displayed at the upper edge of the frame. Submenus are opened by confirming with **<OK>**. Example:



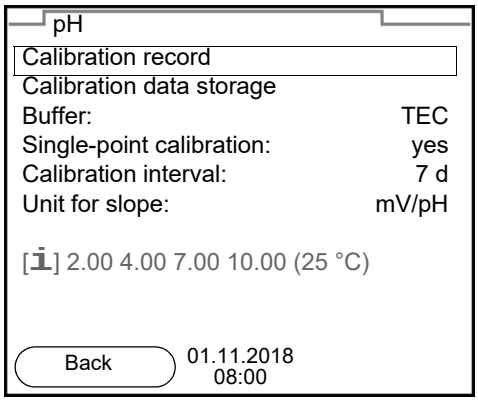
- Settings
  Settings are indicated by a colon. The current setting is displayed on the right-hand side. The setting mode is opened with **<OK>**. Subsequently, the setting can be changed with **<▲><▼>** and **<OK>**. Example:



- 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.

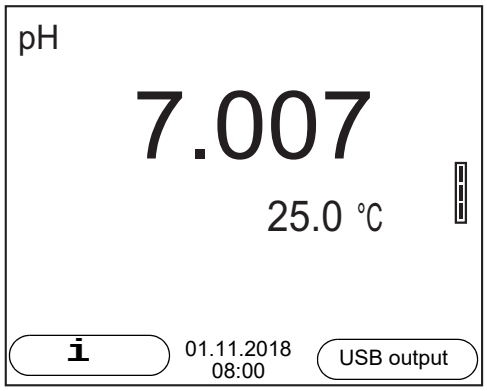


- Messages
  Information is marked by the [i] symbol. It cannot be selected. Example:

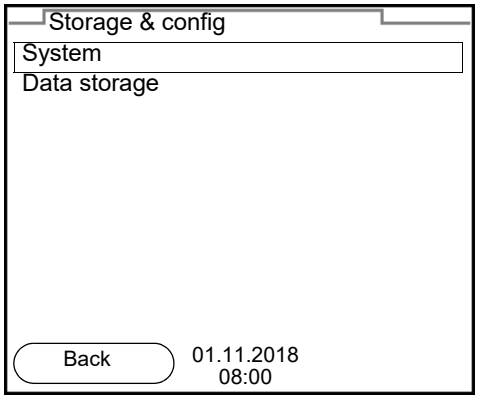


5.4.4 Navigation example 1:Setting the language

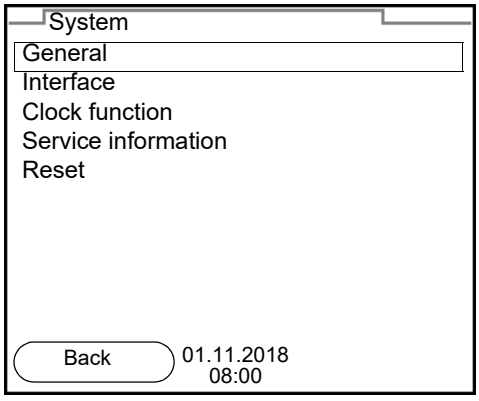
1. Press the **<On/Off>** key.
   The measured value display appears.
   The instrument is in the measuring mode.



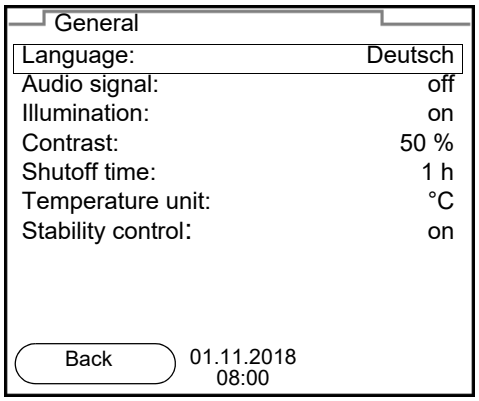
2. Using **<OK_ >**, open the *Storage & config* menu.
   The instrument is in the setting mode.



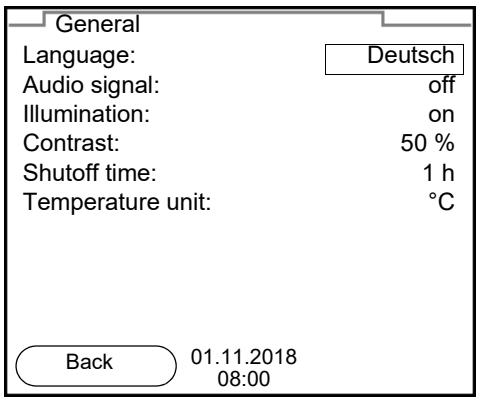
3. Select the *System* submenu with **<▲><▼>**.
   The current selection is displayed with a frame.
4. Open the *System* submenu with **<OK>**.



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.

5.4.5 Example 2 on navigation: Setting the date and time

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

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

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

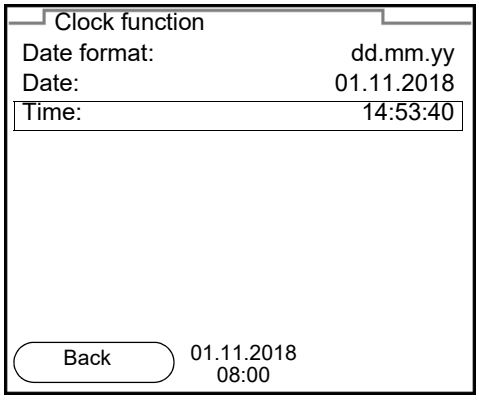
Therefore, check the time at regular intervals.

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

Setting the date, time and date format

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

1. In the measured value display:
   Using **<OK_ >**, open the *Storage & config* menu.
   The instrument is in the setting mode.
2. Select and confirm the *System* / *Clock function* 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 **<F1>**.
   or
   Switch to the measured value display with **<MODE>**.
   The instrument is in the measuring mode.

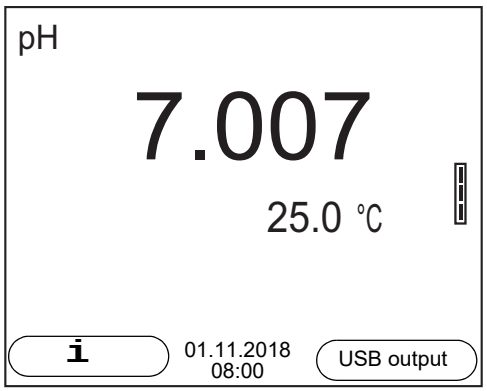
6 pH value

6.1 Measuring

6.1.1 Measuring the pH value

NOTE
When connecting a 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 IDP pH sensor to the meter.
   The pH measuring window is displayed.
2. If necessary, select the measured parameter with **<MODE>**.
3. Adjust the temperature of the solutions and measure the current temperature if the measurement is made without a temperature sensor.
4. If necessary, calibrate or check the IDP pH sensor.
5. Immerse the IDP pH sensor in the test sample.



Stability control (AutoRead) & HOLD function

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

The measured parameter flashes on the display

- as soon as the measured value is outside the stability range
- when the automatic *Stability control* is switched off.

You can start the *Stability control* manually at any time, irrespective of the setting for automatic *Stability control* (see section 11.6.3 AUTOMATIC STABILITY CONTROL, page 69) in the *System* menu.

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

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

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

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

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

Criteria for a stable measured value

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

Measured 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.

6.1.2 Measuring the temperature

For reproducible pH measurements, it is essential to measure the temperature of the test sample.

IDP sensors measure the temperature with a temperature sensor integrated in the IDP sensor.

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

6.2 pH 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?

- Routinely within the framework of the company quality assurance
- When the calibration interval has expired

6.2.3 Carrying out automatic calibration (AutoCal)

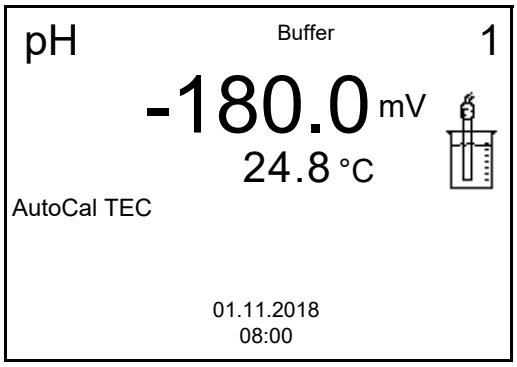
Make sure that in the sensor menu, *Buffer* menu, the buffer set is correctly selected (see section 11.1.1 SETTINGS FOR PH MEASUREMENTS, page 61).

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

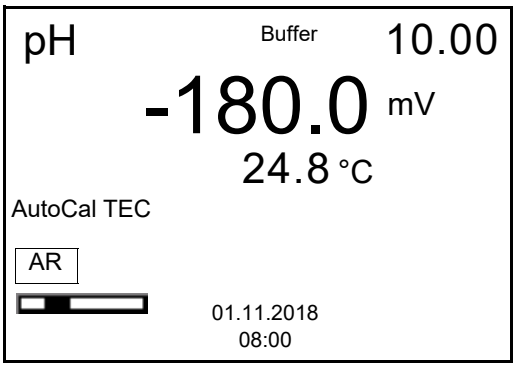
Below, calibration with Technical buffers (TEC) is described. When other buffer sets are used, other nominal buffer values are displayed. Apart from that, the procedure is identical.

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 sensor to the meter.
   The pH measuring window is displayed.
2. Keep the buffer solutions ready.
   When measuring without temperature sensor:
   Temper the buffer solutions or measure the current temperature.
3. Start the calibration with **<CAL>**.
   The calibration display for the first buffer appears (voltage display).



4. Thoroughly rinse the sensor with deionized water.
5. Immerse the sensor in the first buffer solution.
6. Start the measurement with **<OK>**.
   The measured value is checked for stability (stability control).
   The [AR] status indicator is displayed. The measured parameter flashes.



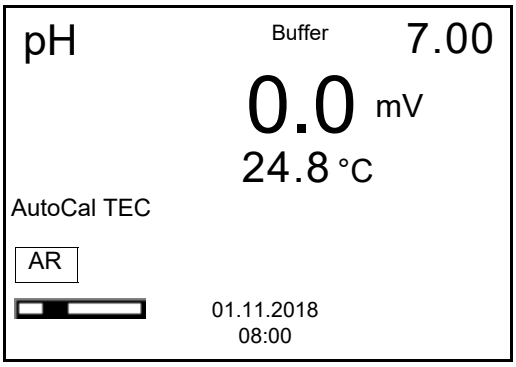
7. Wait for the end of the measurement with stability control or accept the calibration value with **<OK>**.
   The calibration display for the next buffer appears (voltage display).
8. If necessary, finish the calibration procedure as a single-point calibration with **<MODE>**.
   The calibration record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

Continuing with two-point calibration

9. Thoroughly rinse the sensor with deionized water.

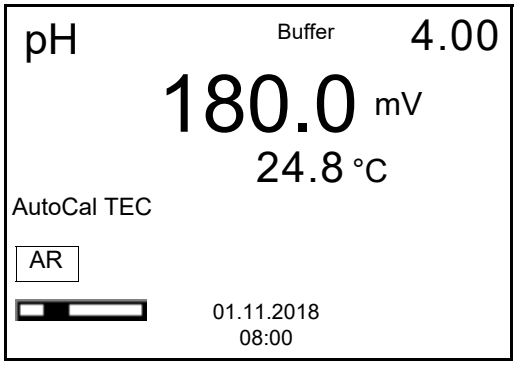
10. Immerse the pH sensor in buffer solution 2.
11. When measuring without temperature sensor:
    Enter the temperature of the buffer with **<▲><▼>**.
12. Start the measurement with **<OK>**.
    The measured value is checked for stability (stability control).
    The [AR] status indicator is displayed. The measured parameter flashes.



13. 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).
14. 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

15. Thoroughly rinse the sensor with deionized water.
16. Immerse the sensor in the next buffer solution.
17. When measuring without temperature sensor:
    Enter the temperature of the buffer with **<▲><▼>**.
18. Start the measurement with **<OK>**.
    The measured value is checked for stability (stability control).
    The [AR] status indicator is displayed. The measured parameter flashes.



19. 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).

20. If necessary, use **<MODE>** to finish the calibration.
The calibration record is displayed.
or
Switch to calibration with 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 Carrying out a manual calibration (AnyCal)

Make sure that in the sensor menu, *Buffer* menu, the AnyCal buffer set is correctly selected (see section 11.1.1 SETTINGS FOR PH MEASUREMENTS, page 61).

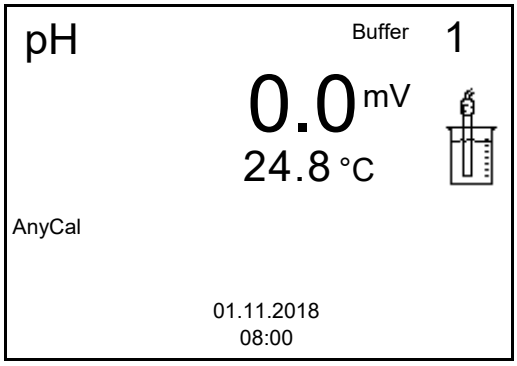
Use one to five buffer solutions in any order.
The pH values of the buffer solutions have to differ by at least one pH unit.

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.

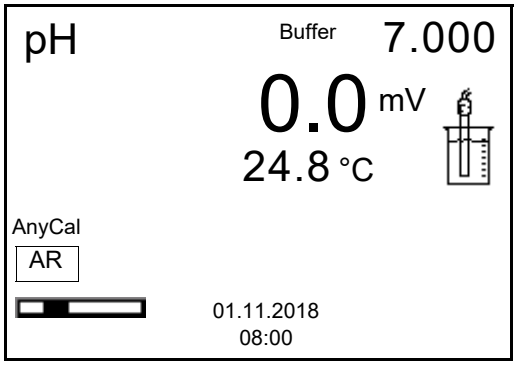
1. Connect the pH sensor to the meter.
The pH measuring window is displayed.

2. Keep the buffer solutions ready.
When measuring without temperature sensor:
Temper the buffer solutions or measure the current temperature.

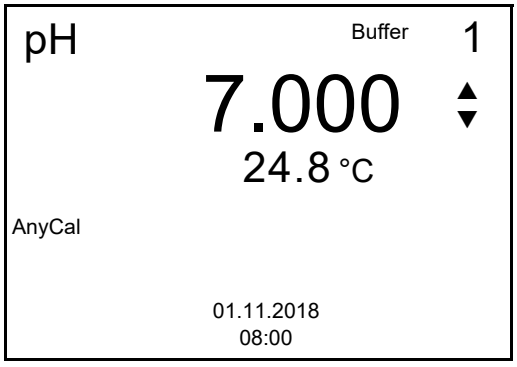
3. Start the calibration with **<CAL>**.
The calibration display for the first buffer appears (voltage display).



4. Thoroughly rinse the sensor with deionized water.
5. Immerse the pH sensor in buffer solution 1.
6. Start the measurement with **<OK>**.
   The measured value is checked for stability (stability control).
   The [AR] status indicator is displayed. The measured parameter flashes.



7. Wait for the measurement with stability control to be completed or terminate the stability control and take over the calibration value with **<OK>**.
   The pH value of the buffer solution is displayed.

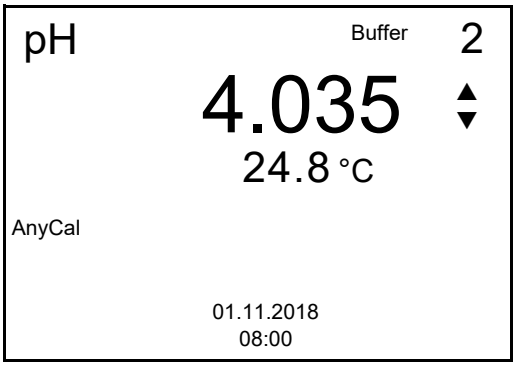


8. Set the nominal buffer value for the measured temperature with **<▲><▼>**.
9. Accept the calibration value with **<OK>**.
   The calibration display for the next buffer appears (voltage display).
10. If necessary, finish the calibration procedure as a single-point calibration with **<MODE>**.
    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 IDP pH sensor.

Continuing with two-point calibration

11. Thoroughly rinse the sensor with deionized water.
12. Immerse the pH sensor in buffer solution 2.
13. When measuring without temperature sensor:
    Enter the temperature of the buffer with **<▲><▼>**.
14. Start the measurement with **<OK>**.
    The measured value is checked for stability (stability control).
    The [AR] status indicator is displayed. 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 pH value of the buffer solution is displayed.

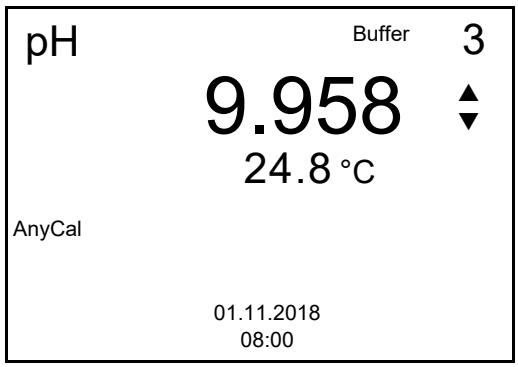


16. Set the nominal buffer value for the measured temperature with **<▲><▼>**.
17. Accept the calibration value with **<OK>**.
    The calibration display for the next buffer appears (voltage display).

18. 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

19. Thoroughly rinse the sensor with deionized water.
20. Immerse the sensor in the next buffer solution.
21. When measuring without temperature sensor:
Enter the temperature of the buffer with **<▲><▼>**.
22. Start the measurement with **<OK>**.
The measured value is checked for stability (stability control).
The [AR] status indicator is displayed. The measured parameter flashes.
23. Wait for the measurement with stability control to be completed or terminate the stability control and take over the calibration value with **<OK>**.
The pH value of the buffer solution is displayed.



24. Set the nominal buffer value for the measured temperature with **<▲><▼>**.
25. Accept the calibration value with **<OK>**.
The calibration display for the next buffer appears (voltage display).
26. If necessary, use **<MODE>** to finish the calibration.
The calibration record is displayed.
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:

Calibration	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 11.1.1 SETTINGS FOR PH MEASUREMENTS, page 61).

6.2.6 Calibration data

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

Displays the calibration data

The calibration protocol of the last calibration is available in the menu *Calibration* / *Calibration record*. To open it in the measured value display, press the **<CAL__>** key.

The calibration records of the last 10 calibrations are available in the menu *Calibration* / *Calibration data storage* / *Display*. To open the *Calibration* menu in the measured value display, press the **<OK>** key.

Menu item	Setting/ function	Explanation
Calibration / *Calibration data storage* / *Display*	-	Displays the calibration records. 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>**/ [Zurück] or **<OK>**. ● Switch directly to the measured value display with **<MODE>**.
Calibration / *Calibration data storage* / *Output to RS232/USB*	-	Outputs the calibration data storage 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 IDP sensor according to the sensor operating manual			

Display	Calibration record	Zero point [mV]	Slope [mV/pH]
Error	*Error*	<-30 or >+30	<-62.0 or > -50,0
Error elimination (see section 15 WHAT TO DO IF..., page 83)			

Calibration record (USB output)

```
MD 8000 H
Ser. no. 11292113

CALIBRATIONpH
01.11.2018 15:55

Ser. no. 10501234
TEC
Buffer 1                10.00
Buffer 2                7.00
Buffer 3                4.00
Voltage 1               -177.0 mV
Voltage 2               3.0 mV
Voltage 3               184.0 mV
Temperatur 1            24.0 °C
Temperatur 2            24.0 °C
Temperatur 3            24.0 °C
Slope                   -60.2 mV/pH
Asymmetry               4.0 mV
Sensor                  +++

etc...
```

7 ORP

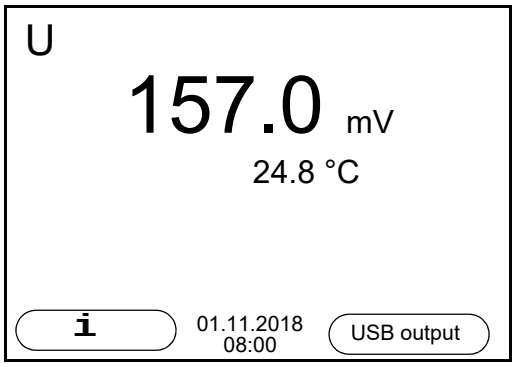
7.1 Measuring

7.1.1 Measuring the ORP

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

IDP ORP sensors are not calibrated. However, you can check IDP ORP sensors using a test solution.

1. Connect the ORP sensor to the meter.
   The ORP measuring window is displayed.
2. Adjust the temperature of the solutions and measure the current temperature if the measurement is made without a temperature sensor.
3. Temper the test solution or measure the current temperature.
4. Check the meter with the ORP sensor.
5. Immerse the ORP sensor in the test sample.



Stability control (AutoRead) & HOLD function

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

The measured parameter flashes on the display

- as soon as the measured value is outside the stability range
- when the automatic *Stability control* is switched off.

You can start the *Stability control* manually at any time, irrespective of the setting for automatic *Stability control* (see section 11.6.3 AUTOMATIC STABILITY

CONTROL, page 69) in the *System* menu.

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

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

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

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

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

Criteria for a stable measured value

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

Measured 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.

7.1.2 Measuring the temperature

For reproducible ORP measurements, it is essential to measure the temperature of the test sample.

When operating a sensor without integrated temperature sensor, you first have

to measure and enter the temperature of the sample.

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

7.2 ORP calibration

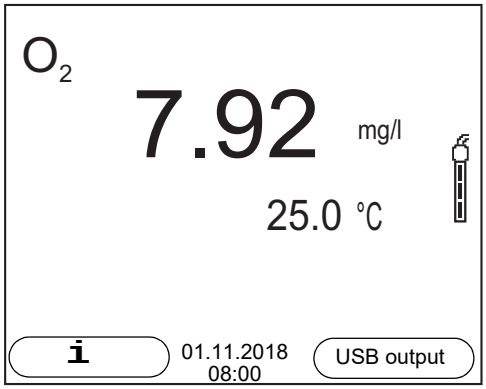
ORP electrodes are not calibrated. You can, however, check ORP electrodes by measuring the ORP of a test solution and comparing the value with the nominal value.

8 Dissolved oxygen

8.1 Measuring

8.1.1 Measuring D.O.

1. Connect the D.O. sensor to the meter.
   The D.O. measuring screen is displayed.
2. If necessary, select the measured parameter with **<MODE>**.
3. Check or calibrate the meter with the sensor.
4. Immerse the D.O. sensor in the test sample.



Selecting the displayed measured parameter

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

- D.O. concentration [mg/l]
- D.O. saturation [%]
- D.O. partial pressure [mbar].

Salinity correction

When measuring the D.O. concentration [mg/l] of solutions with a salt content of more than 1 g/l , a salinity correction is required. For this, you have to measure and input the salinity of the measured medium first.

When the salinity correction is switched on, the [Sal] indicator is displayed in the measuring screen.

You can switch the salinity correction on or off and enter the salinity in the menu for calibration and measurement settings (see section 11.3.1 SETTINGS FOR D.O. SENSORS (MENU FOR MEASUREMENT AND CALIBRATION SETTINGS), page 63).

Air pressure correction (*Saturation, local* function)

The integrated air pressure sensor of the MD 8000 H measures the current air pressure. During calibration, the air pressure correction function is automatically activated. While the parameter oxygen saturation [%] is displayed, the air pressure correction is applied if the *Saturation, local* function is active.

The air pressure correction (function *Saturation, local*) is switched on or off in the menu for calibration and measurement settings (see section 11.3.1 SETTINGS FOR D.O. SENSORS (MENU FOR MEASUREMENT AND CALIBRATION SETTINGS), page 63).

Stability control (AutoRead) & HOLD function

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

The measured parameter flashes on the display

- as soon as the measured value is outside the stability range
- when the automatic *Stability control* is switched off.

Irrespective of the setting for automatic *Stability control* (see section 11.6.3 AUTOMATIC STABILITY CONTROL, page 69) in the *System* menu, you can start a measurement with *Stability control* manually at any time.

To start the *Stability control* function manually, the HOLD function must be active.

Hold function

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

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

Stability control

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

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

You can switch off the beep (see section 11.6 SENSOR-INDEPENDENT SETTINGS, page 68).

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

Criteria for a stable measured value

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

Measured parameter	Time interval	Stability in the time interval
D.O. concentration	20 seconds	Δ : better than 0.03 mg/l
D.O. saturation	20 seconds	Δ : better than 0.4 %
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.

8.1.2 Measuring the temperature

For reproducible D.O. measurements, it is essential to measure the temperature of the test sample.

D.O. sensors measure the temperature with a temperature sensor integrated in the sensor.

8.2 Calibration

8.2.1 Why calibrate?

D.O. sensors age. Aging changes the zero point and slope of the D.O. sensor. As a result, an inexact measured value is displayed. Calibration determines and stores the current values of the zero point and slope.

8.2.2 When to calibrate?

- When the calibration interval has expired
- When your accuracy requirements are especially high
- Routinely within the framework of the company quality assurance

8.2.3 Calibration procedures

The MD 8000 H provides 2 calibration procedures:

- Calibration in water vapor-saturated air.
- Calibration via a comparison measurement (e.g. Winkler titration according to DIN EN 25813 or ISO 5813). At the same time, the relative slope is adapted to the comparison measurement by a correction factor. When the correction multiplier is active, the *[Factor]* indicator appears in the measuring window.

For both calibration procedures, an additional *Zero point calibration* is possible (see section 8.2.6 ZERO POINT CALIBRATION, page 45).

8.2.4 Calibration in water vapor-saturated air

For this calibration procedure, the *Comparison meas.* setting must be set to *off* in the *Calibration* menu.

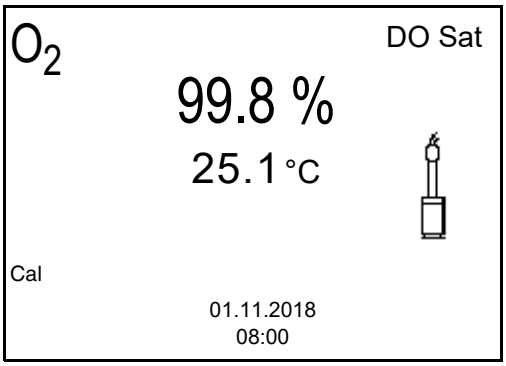
As the calibration vessel use a BOD bottle that contains a small amount of clean water (approx. 40 ml). The sensor must not be immersed in the water.

Proceed as follows to calibrate the D.O. sensor:

1. Connect the D.O. sensor to the meter.
2. Put the D.O. sensor into the calibration vessel.

Leave the sensor in the calibration vessel long enough (at least 15 minutes) until the air is saturated with water vapor and the sensor is adapted to the ambient temperature.

3. Start the calibration with **<CAL>**.



4. Start the measurement with **<OK>**.
   The measured value is checked for stability (stability control).
   The [AR] status indicator is displayed. The measured parameter flashes.
5. Wait for the measurement with stability control to be finished (beep, [HOLD][AR] status indicator).
   The calibration record is displayed and output to the interface.
6. Switch to the measured value display with **<F1>**/[continue].

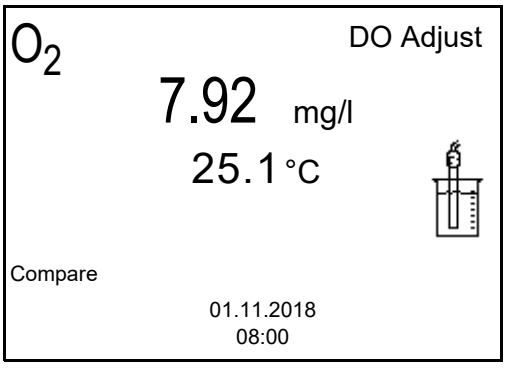
8.2.5 Calibrating with *Comparison meas.* (e.g. Winkler titration)

With the calibration procedure *Comparison meas.*, the measured value of the sensor is adjusted to the nominal value of a comparison solution with a correction factor. The current correction factor is documented in the sensor menu (**i** *Factor* = x.xxx) and in the calibration record.

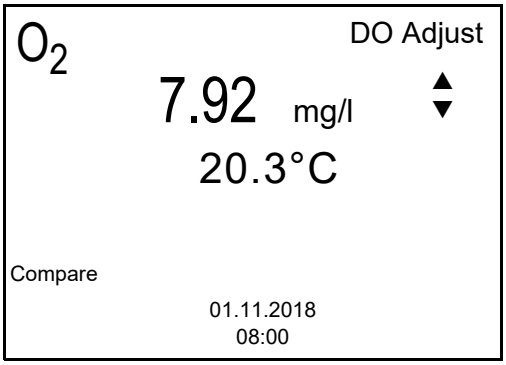
For this calibration procedure, the *Comparison meas.* setting must be set to *on* in the *Calibration* menu.

Proceed as follows to calibrate the D.O. sensor:

1. Connect the D.O. sensor to the meter.
2. Immerse the D.O. sensor in the reference solution.
3. Start the calibration with **<CAL>**.



4. Start the measurement with **<OK>**.
   The measured value is checked for stability (stability control).
   The [AR] status indicator is displayed. The measured parameter flashes.
5. Wait for the measurement with stability control to be finished (beep, [HOLD][AR] status indicator).



6. Using **<▲> <▼>**, set the correction factor to adjust the displayed measured value to the nominal value (value of the comparison measurement). Then take over the adjustment with **<OK>**.
   The meter switches to the measured value display.
   The status display *[Factor]* is active.

8.2.6 *Zero point calibration*

With a *Zero point calibration*, the zero point of the sensor is redetermined by calibrating in a zero solution.

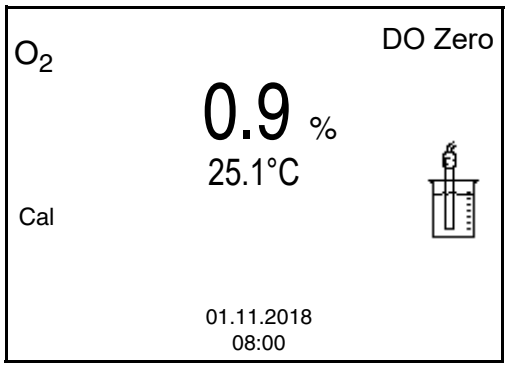
For most applications, an additional *Zero point calibration* is not required and not recommended. Only with very rare applications can the accuracy of a calibration be improved if a *Zero point calibration* was carried out before.

The zero point calibration is best done prior to calibrating with a calibration procedure (e.g. calibration in water vapor-saturated air or calibration via comparison measurement)..

1. Connect the D.O. sensor to the meter.
2. Place the D.O. sensor in a solution that does not contain any dissolved oxygen.

A solution not containing any dissolved oxygen can be prepared by dissolving approx. 8 to 10 g sodium sulfite (Na_2SO_3) in 500 ml tap-water. Carefully mix the solution. It may take up to 60 minutes until the solution is free of oxygen.

3. In the menu for measurement and calibration settings (**<OK>** / *Calibration* / *Zero point calibration*), start the *Zero point calibration*.
   The calibration point for the measured value 0 (DO Zero) is displayed.



4. Start the measurement with **<OK>**.
   The measured value is checked for stability (stability control).
   The [AR] status indicator is displayed. The measured parameter flashes.
5. Wait for the measurement with stability control to be finished (beep, [HOLD][AR] status indicator).
   The current value is set to zero.
   The calibration record is displayed.
6. Switch to the measured value display with **<F1>**/[continue].
   The zero point is calibrated.
   The [ZeroCal] status indicator is displayed.
7. Carry out a calibration (see section 8.2.3 CALIBRATION PROCEDURES, page 43).

8.2.7 Calibration data

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

Displaying the calibration record

The calibration protocol of the last calibration is available in the menu *Calibration* / *Calibration record*. To open it in the measured value display, press the **<CAL__>** key.

The calibration records of the last calibrations are available in the menu *Calibration* / *Calibration data storage* / *Display*. To open the *Calibration* menu in the measured value display, press the **<OK>** key.

Menu item	Setting/ function	Explanation
Calibration / *Calibration data storage* / *Display*	-	Displays the calibration records. 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>**/ [Zurück] or **<OK>**. ● Switch directly to the measured value display with **<MODE>**.
Calibration / *Calibration data storage* / *Output to RS232/USB*	-	Outputs the calibration data storage to the interface

Calibration evaluation

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

Calibration evaluationOPOX 11-3

Display	Calibration record
	+++
Error	*Error*
Error elimination (see section 15 WHAT TO DO IF..., page 83)	

Calibration record (USB output)

```
CALIBRATION Ox
01.11.2018 07:43:33

OPOX 11-3
Ser. no.  12B100016

OPOX 11 Cap                  12B100015

Sensor                       +++
```

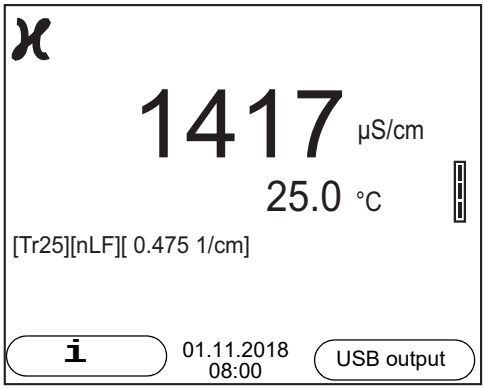
9 Conductivity

9.1 Measuring

9.1.1 Measuring the conductivity

NOTE
When connecting a 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 conductivity sensor to the meter.
   The conductivity measuring window is displayed.
   The measuring cell and cell constant for the connected IDP conductivity sensor are automatically taken over.
2. If necessary, press **<MODE>** to select the measured parameter χ.
3. Immerse the conductivity sensor in the test sample.



Selecting the displayed measured parameter

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

- Conductivity [µS/cm] / [mS/cm]
- Resistivity [Ω·cm] / [kΩ·cm] / [MΩ·cm]
- Salinity Sal [ ] (≙ psu)
- Total dissolved solids TDS [mg/l] / [g/l]

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

Stability control (AutoRead) & HOLD function

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

The measured parameter flashes on the display

- as soon as the measured value is outside the stability range
- when the automatic *Stability control* is switched off.

You can start the *Stability control* manually at any time, irrespective of the setting for automatic *Stability control* (see section 11.6.3 AUTOMATIC STABILITY CONTROL, page 69) in the *System* menu.

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

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

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

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

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

Criteria for a stable measured value

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

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

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

9.1.2 Measuring the temperature

For reproducible conductivity measurements, it is essential to measure the temperature of the test sample.

IDP sensors measure the temperature with a temperature sensor integrated in the IDP sensor.

9.2 Temperature compensation

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

You can select one of the following temperature compensation methods:

- **Nonlinear temperature compensation** (***nLF***) according to EN 27 888
- **Linear temperature compensation *(lin)*** with adjustable coefficients of 0.000 ... 3.000 %/K
- **No temperature compensation (off)**

The reference temperature and temperature compensation are set in the menu for the parameter, conductivity (see section 11.4.1 SETTINGS FOR IDP CONDUCTIVITY SENSORS, page 65).

Application tips

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

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

9.3 Calibration

9.3.1 Why calibrate?

Aging slightly changes the cell constant, e. g. due to coatings. As a result, an inexact measured value is displayed. The original characteristics of the cell can often be restored by cleaning the cell. Calibration determines the current value

of the cell constant and stores this value in the meter.
Thus, you should calibrate at regular intervals.

9.3.2 When to calibrate?

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

9.3.3 Determining the cell constant (calibration in control standard)

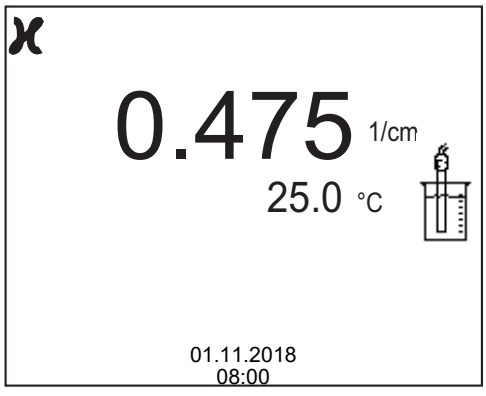
You can determine the actual cell constant of the IDP conductivity sensor by calibrating with the control standard in the following range:
0.450 cm^{-1} ... 0.500 cm^{-1} (e.g. IDP 761-C, nominal cell constant 0.475 cm^{-1})

The cell constant is determined in the control standard, 0.01 mol/l KCl.

In the default condition, the calibrated cell constant of the IDP sensor is set to 0.475 cm^{-1} (IDP conductivity sensor IDP 761-C).

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

1. Connect the conductivity sensor to the meter.
2. In the measured value display, select the conductivity parameter with **<M>**.
3. Start the calibration with **<CAL>**.
   The cell constant that was calibrated last is displayed.



4. Immerse the conductivity sensor in the control standard solution, 0.01 mol/l KCl.

5. Start the measurement with **<OK>**.
   The measured value is checked for stability (stability control).
   The [AR] status indicator is displayed. The measured parameter flashes.
6. Wait for the end of the measurement with stability control ([HOLD][AR]) status indicator or
   take over the calibrated value with **<OK>**.
   The calibration record is displayed and output to the interface.
7. Switch to the measured value display with **<OK>**.

9.3.4 Calibration data

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

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

Displaying the calibration record

The calibration protocol of the last calibration is available in the menu *Calibration* / *Calibration record*. To open it in the measured value display, press the **<CAL__>** key.

The calibration records of the last 10 calibrations are available in the menu *Calibration* / *Calibration data storage* / *Display*. To open the *Calibration* menu in the measured value display, press the **<OK>** key.

Menu item	Setting/ function	Explanation
Calibration / *Calibration data storage* / *Display*	-	Displays the calibration records. 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>**/ [Zurück] or **<OK>**. ● Switch directly to the measured value display with **<MODE>**.
Calibration / *Calibration data storage* / *Output to RS232/USB*	-	Outputs the calibration data storage to the interface

Calibration evaluation

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

Display	Calibration record	Cell constant [cm^{-1}]
	+++	Within the range 0.450 ... 0.500 cm^{-1}
Error Error elimination (see section 15 WHAT TO DO IF..., page 83)	*Error*	Outside the range 0.450 ... 0.500 cm^{-1}

Calibration record (USB output)

```
CALIBRATION Cond
01.11.2018 07:43:33

IDP 761-C
Ser. no. 09250033
Cell constant 0.476 1/cm       25.0 °C
Sensor                        +++
```

10 Turbidity measurement (VisoTurb® 900-P)

10.1 Measuring

10.1.1 Measuring the turbidity

The sensor connection and the USB-B (device) interface are galvanically insulated. This facilitates interference-free measurements also in the following cases:

- Measurement in grounded test samples
- Measurement with several sensors connected to one MD 8000 H in one test sample

Preparatory activities

Perform the following preparatory activities when you want to measure:

- Avoid gas bubbles (e.g. air bubbles) in the test sample.
- Use suitable vessels for measurement and calibration (see operating manual of the VisoTurb® 900-P sensor).
- Heed the minimum depth of immersion for the sensor

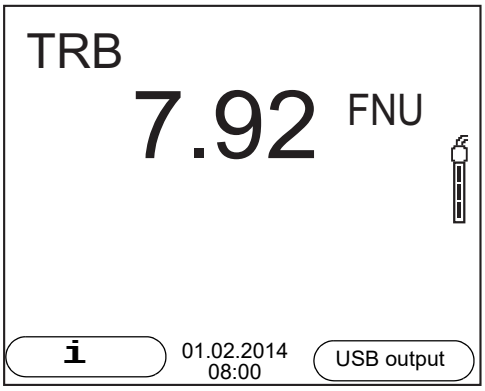
1. Connect a turbidity sensor to the measuring instrument.
   The turbidity measuring screen is displayed.
   The data for the connected IDS turbidity sensor are automatically taken over.
2. Fill the test sample into a lightproof measuring beaker up to a level of at least 6 cm.
3. When immersing the sensor in the test sample, hold the sensor at an angle.
4. For measuring, position the sensor upright.
5. Position the sensor in a way that meets the following requirements.
   - Distance to the bottom: 6 cm
   - Distance to the walls of the beaker: 2 cm
   - Minimum depth of immersion: 2 cm

To position the sensor optimally and permanently while it is measuring, fix it on a support.

Measuring

You can carry out turbidity measurements as follows:

1. Perform the preparatory activities.
2. Immerse the sensor in the test sample at an angle and then position it in the measuring container.



Selecting the displayed measured parameter

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

- Turbidity [FNU]
- Turbidity [NTU]

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.

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

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

Stability control (AutoRead)

The stability control function (*AutoRead*) continually checks the stability of the measurement signal. The stability has a considerable impact on the reproducibility of measured values. The display of the measured parameter flashes until a stable measured value is available.

You can start the *Stability control* manually at any time, irrespective of the setting for automatic *Stability control* (see section 11.6.3 AUTOMATIC STABILITY CONTROL, page 69) in the *System* menu.

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

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

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

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

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
Turbidity (FNU/NTU)	15 seconds	Δ : better than 1.0% of measured value

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

10.2 Calibration

10.2.1 Why calibrate?

The calibration line of the sensor is determined and stored through calibrating.

10.2.2 When to calibrate?

- When the calibration interval has expired
- At regular intervals

10.2.3 Calibration standards

Calibrate with 1 to 3 turbidity standard solutions. The standard solutions must

be selected in the following order.

Standard solution	Range (FNU/NTU)
1	0.0 ... 1.0
2	5.0 ... 200.0
3	200.0 ... 4000.0

The turbidity expected in the measurement dictates the number and selection of the standards. Calibration has to be carried out for the range with the highest turbidity to be expected and for all lower ranges. The standard solutions for this have to be selected in ascending order, starting with standard 1.

Example: If you expect turbidity values in the range 200 ... 4000 FNU/NTU, you have to carry out a 3-point calibration.

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

If the measured turbidity is outside the measurement range, OFL is displayed.

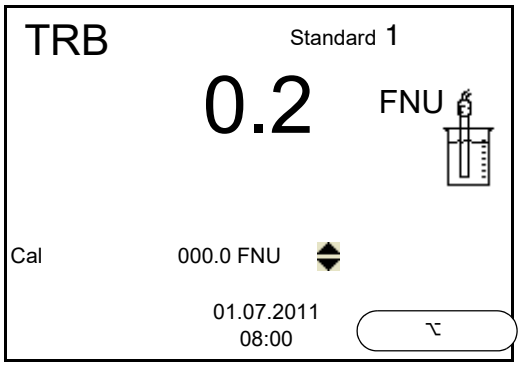
As the standard with turbidity value 0.0 FNU you can use clean tap water or filtered, deionized water in a suitable calibration vessel, depending on the required quality (see operating manual of the sensor VisoTurb® 900-P). This standard should be freshly prepared prior to every calibration.

Standards with turbidity values for the calibration ranges 2 and 3 are available as accessories (see operating manual of the sensor VisoTurb® 900-P). Calibration can be carried out in the bottles the standards are delivered in. The standards can be used several times within their shelf life.

Replace the standards solutions if you have any doubts concerning their quality or after the expiration date.

10.2.4 Carry out calibration

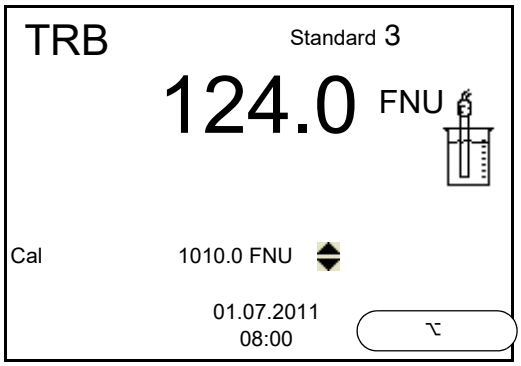
1. Perform the preparatory activities.
2. Connect the turbidity sensor to the measuring instrument.
   The turbidity measuring screen is displayed.
3. Keep the standard solutions ready in suitable calibration vessels.
4. In the measured value display, select the TRB measuring window with **<▲ > <▼ >** and **<MODE>**.
5. Start the calibration with **<CAL>**.
   The calibration display appears.



6. Thoroughly rinse the turbidity sensor with distilled water and dry it with a lint-free cloth.
7. Immerse the turbidity sensor in the test sample at an angle.
8. Position the turbidity sensor in the measuring vessel.
9. Use **<▲ > <▼ >** and **<▶>** to set the concentration of the standard solution for each digit and confirm with **<OK>**.
   The standard solution is measured.
   The measured value is checked for stability (AutoRead).
10. Wait for the end of the AutoRead measurement.
    The calibration display for the next standard solution appears.

Continuing with two-point calibration

11. Thoroughly rinse the turbidity sensor with distilled water and dry it with a lint-free cloth.
12. Immerse the turbidity sensor in the test sample at an angle.
13. Position the turbidity sensor in the measuring vessel.
14. Use **<▲ > <▼ >** and **<▶>** to set the concentration of the standard solution for each digit and confirm with **<OK>**.
    The standard solution is measured.
    The measured value is checked for stability (AutoRead).
15. Wait for the end of the AutoRead measurement.
    The calibration display for the next standard solution appears.



16. If necessary, terminate the calibration as a two-point calibration with **<MODE>**.
The new calibration values are displayed.
or
Continue with three-point calibration.

Continuing with three-point calibration

Repeat the steps 11 to 15 with the third standard solution. The new calibration values are displayed after the last calibration step was completed.

10.2.5 Calibration data

Displays the calibration data

Calibration The calibration protocol of the last calibration is available in the menu **<OK>** / *Calibration record*. To open it in the measured value display, press the **<CAL__>** key.

The calibration records of the last 10 calibrations are available in the menu *Calibration* / *Calibration data storage* / *Display*. To open the *Calibration* menu in the measured value display, press the **<OK>** key.

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 **<PRT>**. ● Output all calibration records to the interface with **<PRT_>**. ● Quit the display with **<ESC>** or **<OK>**. ● Switch directly to the measured value display with **<MODE>**.
Calibration / *Calibration data storage* / *Output to RS232/USB*	-	Outputs the calibration records to the interface.

Calibration evaluation

After calibrating, the meter automatically evaluates the calibration.

Display	Calibration record	Explanation
	+++	Optimum calibration
		Good calibration

Calibration record (USB output)

```
CALIBRATION TRB:
18.09.2014 08:09:10

VisoTurb 900-P
Ser. no. 14E999003

# 1                    0.0 FNU
# 2                    124.0 FNU
Sensor                 +++
_____________________________________
```

11 Settings

11.1 pH measurement settings

11.1.1 Settings for pH measurements

Settings

The settings 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>** key. After completing the settings, switch to the measured value display with **<MODE>**.

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 last calibration records (max. 10)
Calibration / *Calibration data storage* / *Output to RS232/USB*	-	Outputs the calibration data storage to the interface
Calibration / *Buffer*	***TEC*** *AnyCal* *NIST/DIN* *...*	Buffer sets to be used for pH calibration. More buffers and details: see section 11.1.2 BUFFER SETS FOR CALIBRATION, page 62 and section 6.2 PH CALIBRATION, page 27.
Calibration / *Single-point calibration*	*yes* ***no***	Quick calibration with 1 buffer
Calibration / *Calibration interval*	*1 ...* ***7*** *... 999 d*	*Calibration interval* for the IDPpH sensor (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).
pH resolution	***0.001*** *0.01* *0.1*	Resolution of the pH display
mV resolution	***0.1*** *1*	Resolution of the mV display
Reset	-	Resets all sensor settings to the delivery condition (see section 11.7.1 RESETTING THE MEASUREMENT SETTINGS, page 70).

11.1.2 Buffer sets for calibration

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

No.	Buffer set *	pH values	at
1	*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 section 11.1.1 SETTINGS FOR PH MEASUREMENTS, page 61).

11.1.3 Calibration interval

The calibration evaluation is displayed as a sensor symbol.

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>**.
2. In the *Calibration* / *Calibration interval* menu, set the calibration interval with **<▲><▼>**.
3. Confirm the setting with **<OK>**.
4. Quit the menu with **<MODE>**.

11.2 ORP measurement settings

11.2.1 Settings for ORP measurements

The settings are made in the menu for measuring settings of the ORP measurement. To open the settings, display the required measured parameter in the measured value display and press the **<OK>** key. After completing the settings, switch to the measured value display with **<MODE>**.
Default settings are printed in **bold**.

Menu item	Possible setting	Explanation
mV resolution	***0.1*** *1*	Resolution of the mV display
Reset	-	Resets all sensor settings to the delivery condition (see section 11.7.1 RESETTING THE MEASUREMENT SETTINGS, page 70).

11.3 D.O. measurement settings

11.3.1 Settings for D.O. sensors (menu for measurement and calibration settings)

Settings

The settings are available in the menu for measurement and calibration settings. To open the settings, display the required measured parameter in the measured value display and press the **<OK>** key. After completing the set-

tings, switch to the measured value display with **<MODE>**.

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 last calibration records.
Calibration / *Calibration data storage* / *Output to RS232/USB*	-	Outputs the calibration data storage to the interface
Calibration / *Calibration interval*	*1 ...* ***180*** *... 999 d*	*Calibration interval* for the D.O. sensor (in days). The meter reminds you to calibrate regularly by the flashing sensor symbol in the measuring screen.
Calibration / *Comparison meas.*	*on* ***off***	Enables to adjust the measured value with the aid of a comparison measurement, e.g. Winkler titration. For details, see section 8.2 CALIBRATION, page 42.
Calibration / *cap coefficients*	*K1* *...* *K5* *KC*	Enter the cap coefficients here after exchanging the sensor cap. For details, see section 11.3.2 ENTER CAP COEFFICIENTS, page 65.
Salinity/*Sal correction*	*on* ***off***	Manual salt content correction for concentration measurements.
Salinity/*Salinity*	***0.0*** *... 70.0*	Salinity or salinity equivalent for the salt content correction. This menu item is only available if the manual salinity correction is switched on.
Resolution	***0.1*** *1*	Set a high or low resolution. The setting of the resolution is separately stored for each measured parameter.

Menu item	Possible setting	Explanation
Saturation, local	*on* *off*	*Saturation, local* is a procedure that takes the local air pressure into account for each saturation measurement. For details, see section 11.3.3 SATURATION, LOCAL, page 65.
Reset	-	Resets all sensor settings to the delivery condition (see section 11.7.1 RESETTING THE MEASUREMENT SETTINGS, page 70).

11.3.2 Enter *cap coefficients*

The values of the coefficients are provided with the sensor cap.

1. Change the digit of the highlighted position with **<▲><▼>** .
2. Go to the next position with **<◀><▶>**.
3. Confirm with **<OK>** when a coefficient is completely entered.

11.3.3 *Saturation, local*

Irrespective of the height or air pressure, the calibration value is set to 100 %. The function *Saturation, local* fulfills the EU regulations for the parameter oxygen saturation [%].

When the *Saturation, local* is enabled the display shows an [L] for the parameter oxygen saturation.

D.O. mg/L readings are unaffected by the selection of the *Saturation, local* function.

11.4 Cond measurement settings

11.4.1 Settings for IDP conductivity sensors

Settings

The settings are made in the menu for the measured parameter, conductivity. To open the settings, display the required measured parameter in the measured value display and press the **<OK>** key. After completing the settings,

switch to the measured value display with **<M>**.

Default settings are printed in **bold**.

Setting menu

Menu item	Possible setting	Explanation
Calibration / *Calibration record*	-	Displays the calibration record of the last calibration.
Calibration / *Calibration data storage* / *Display*	-	Displays the last calibration records (max. 10)
Calibration / *Calibration data storage* / *Output to RS232/USB*	-	Outputs the calibration data storage to the interface
Calibration / *Calibration interval*	*1 ...* ***150*** *... 999 d*	*Calibration interval* for the IDP conductivity sensor (in days). The meter reminds you to calibrate regularly by the flashing sensor symbol in the measuring screen.
Type		Used measuring cell
	Cal	Measuring cells whose cell constant is determined by calibration in the KCL control standard solution. Calibration range: 0.450 to 0.500 cm^{-1} The currently valid cell constant is displayed in the status line.
	man	Freely (manually) adjustable cell constant in the range 0.450 ... 0.500 $cm^{-1.}$
Cell const. man	*0.450 ...* ***0.475*** *... 0.500 cm^{-1}*	Display and setting options for the manually adjustable cell constant. This menu item is only available when *Type man* is set.
Temp. comp. (TC) / *Method*	***nLF*** *Lin off*	Procedure for temperature compensation (see section 9.2 TEMPERATURE COMPENSATION, page 50). This setting is only available for the measured parameters, conductivity (χ) and resistivity (ρ).

Menu item	Possible setting	Explanation
Temp. comp. (TC) / *Linear coeff.*	*0.000 ...* ***2.000*** *... 3.000 %/K*	Coefficient of the linear temperature compensation. This menu item is only available when the linear temperature compensation is set.
Temp. comp. (TC) / *Reference temp.*	*20 °C* ***25 °C***	Reference temperature This setting is only available for the measured parameters, conductivity (𝜒) and resistivity (ρ).
Multiplier for TDS	*0.40 ...* ***1.00***	Factor for TDS value
Reset	-	Resets all sensor settings to the delivery condition (see section 11.7.1 RESETTING THE MEASUREMENT SETTINGS, page 70).

11.5 Turb measurement settings

11.5.1 Settings for turbidity sensors

The settings are made in the menu for the measured parameter, turbidity. To open the settings, display the required measured parameter in the measured value display and press the **<OK>** key. After completing the settings, switch to the measured value display with **<M>**.
The possible settings are individually displayed for each sensor. Default settings are printed in **bold**.

Setting menu of the VisoTurb® 900-P

Menu item	Possible setting	Explanation
Calibration / *Calibration record*	-	Displays the calibration record of the last calibration.
Calibration / *Calibration data storage* / *Display*	-	Displays the last calibration records (max. 10)
Calibration / *Calibration data storage* / *Copy to USB flash drive*	-	Outputs the stored calibration data to a connected USB memory device/ USB printer)
Calibration / *Calibration data storage* / *Output to RS232/USB*	-	Outputs the calibration data storage to the interface

Menu item	Possible setting	Explanation
Calibration / *Calibration interval*	*1 ... **30** ... 999 d*	*Calibration interval* for the turbidity sensor (in days). The meter reminds you to calibrate regularly by the flashing sensor symbol in the measuring screen.
Resolution	*0.1* *1*	Resolution of the FNU/NTU display
Reset	-	Resets all sensor settings to the delivery condition (see section 11.7.1 RESETTING THE MEASUREMENT SETTINGS, page 70).

11.6 Sensor-independent settings

11.6.1 *System*

To open the *Storage & config* menu, press the **<OK_ >** 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* / *Audio signal*	***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* / *Shutoff time*	*10 min ... **1h** ... 24 h*	Adjusts the switch-off time
System / *General* / *Temperature unit*	***°C*** *°F*	Temperature unit, degrees Celsius or degrees Fahrenheit. All temperature values are displayed with the selected unit.
System / *General* / *Stability control*	***on*** *off*	Switches on or off the automatic stability control during measurement (see section 11.6.3 AUTOMATIC STABILITY CONTROL, page 69)

Menu item	Possible setting	Explanation
System / *Interface* / *Baud rate*	*1200, 2400,* ***4800****, 9600, 19200*	Baud rate of the USB Device interface
System / *Interface* / *Output format*	***ASCII*** *CSV*	Output format for data transmission For details, see section 13 TRANSMITTING DATA (USB INTERFACE), page 79
Only for: *Output format CSV*: ● *System* / *Interface* / *Decimal separator* ● *System* / *Interface* / *Output header*	***Dot (xx.x)*** *Comma (xx,x)*	Decimal separator Output of a header for *Output format*: *CSV*
System / *Clock function*	*Date format* *Datum* *Time*	Settings of time and date. For details, see section 5.4.5 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 default values. For details, see section 11.7.2 RESETTING THE SYSTEM SETTINGS, page 72

11.6.2 *Data storage*

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

Detailed information on the memory functions of the MD 8000 H are given in section 12 DATA STORAGE, page 73.

11.6.3 Automatic *Stability control*

The automatic *Stability control* 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 11.6 SENSOR-INDEPENDENT SETTINGS, page 68).

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.

11.6.4 Automatic switch-off function

The instrument has an automatic switch-off function in order to save the batteries (see section 11.6.1 SYSTEM, page 68). The automatic switchoff function switches off the meter if no key is pressed for an adjustable period.

The automatic switchoff function is not active

- if a USB-B cable is connected
- if the *Automatic data storage* function is active, or with *automatic data transmission*

11.6.5 Display illumination

The meter automatically switches off the display illumination if no key is pressed for 20 seconds.

The illumination is switched on with the next keystroke again.

You can also generally switch on the display illumination (see section 11.6.1 SYSTEM, page 68).

11.7 Reset

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

11.7.1 Resetting the measurement settings

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

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

Setting	Default settings
Buffer	TEC
Calibration interval	7 d
Unit for slope	mV/pH
Measured parameter	pH
Unit for slope	0.001
mV resolution	0.1
Asymmetry	0 mV
Slope	-59.2 mV

Setting	Default settings
Man. temperature	25 °C
Single-point calibration	off

The sensor settings are reset under the *Reset* menu item in the menu for calibration and measurement settings. To open the settings, display the required measured parameter in the measured value display and press the **<OK>** key.

ORP

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

Setting	Default settings
mV resolution	0.1
Man. temperature	25 °C

The sensor settings are reset under the *Reset* menu item in the menu for calibration and measurement settings. To open the settings, display the required measured parameter in the measured value display and press the **<OK>** key.

Dissolved oxygen

The following settings for D.O. measurements are reset to the default settings with the *Reset* function:

Setting	Default settings
Calibration interval	180 d
Check interval	60 d
Measured parameter	D.O. concentration (mg/l)
Relative slope (S_{Rel})	1.00
Salinity (value)	0.0
Salinity (function)	off
Number of calibration points	1
Resolution	0.1
Saturation, local	off

The sensor settings are reset under the *Reset* menu item in the menu for calibration and measurement settings. To open the settings, display the required measured parameter in the measured value display and press the **<OK>** key.

Conductivity

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

Setting	Default settings
Calibration interval	150 d
Measured parameter	χ

Setting	Default settings
Cell constant (c)	Depending on the connected measuring cell: 0.475 cm^{-1} (calibrated) 0.475 cm^{-1} (set)
Temperature compensation	nLF
Reference temperature	25 °C
Temperature coefficient (TC) of the linear temperature compensation	2.000 %/K
TDS multiplier	1.00

The sensor settings are reset under the *Reset* menu item in the menu for calibration and measurement settings. To open the settings, display the required measured parameter in the measured value display and press the **<OK>** key.

11.7.2 Resetting the system settings

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

Setting	Default settings
Language	English
Audio signal	on
Baud rate	4800 Baud
Output format	ASCII
Decimal separator	.
Contrast	50
Illumination	Auto
Shutoff time	1 h
Temperature unit	°C
Stability control	on

The resetting of the system settings is done in the menu *Storage & config* / *System* / *Reset*. To open the menu *Storage & config* in the measured value display, press the **<OK_ >** key.

12 Data storage

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

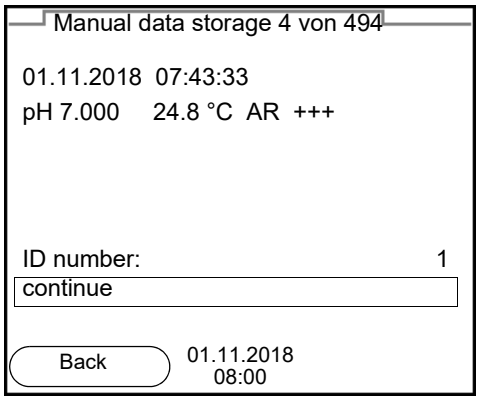
- Manual data storage (see section 12.1 MANUAL DATA STORAGE, page 73)
- Automatic data storage at intervals (see section 12.2 AUTOMATIC DATA STORAGE AT INTERVALS, page 74)

Each data storage process transmits the current dataset to the USB interface.

12.1 Manual data storage

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

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

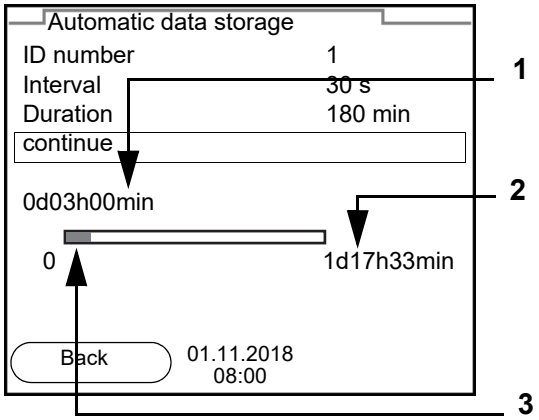
When all storage locations are occupied, it is not possible to continue storing. Then you can e.g. transmit the stored data to a PC (see section 12.3.1 EDITING THE MEASURED VALUE DATA STORAGE, page 76) and subsequently erase the data storage (see section 12.3.2 ERASING THE MEASUREMENT DATA STORAGE, page 77).

12.2 Automatic data storage at intervals

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

Configuring the automatic memory function

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



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

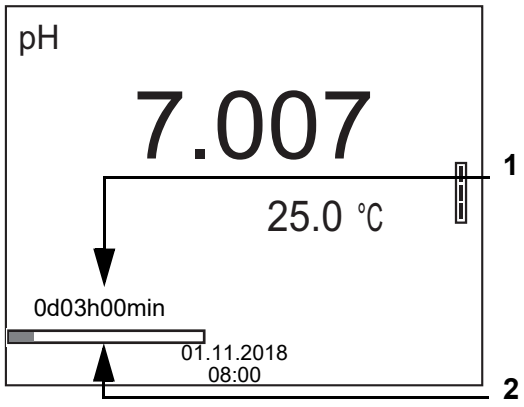
Settings

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

Menu item	Possible setting	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*	Storage interval. The lower limit of the storage interval can be restricted by the number of free storage locations. The upper limit is restricted by the storage duration.
Duration	*1 min ... x min*	Storage duration. Specifies after which time the automatic data storage should be terminated. The lower limit of the storage duration is restricted by the storage interval. The upper limit is restricted by the number of free storage locations.

Starting the automatic storing function

To start the automatic data storage 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 storage duration

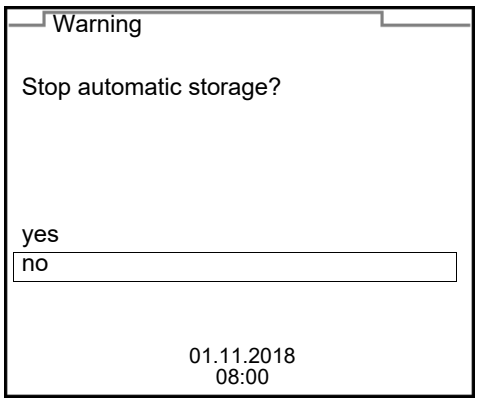
The active automatic data storage function can be recognized by the progress bar in the status line. The progress bar indicates the remaining storage duration.

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

Terminating the automatic memory function prematurely

Proceed as follows to switch off the automatic data storage function before the adjusted storage 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 storage function is terminated.

12.3 Measurement data storage

12.3.1 Editing the measured value data storage

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

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

Editing the data memory

The data storage is edited in the menu, *Storage & config* / *Data storage*. To open the *Storage & config* menu, press the **<OK_ >** key in the measured value display.

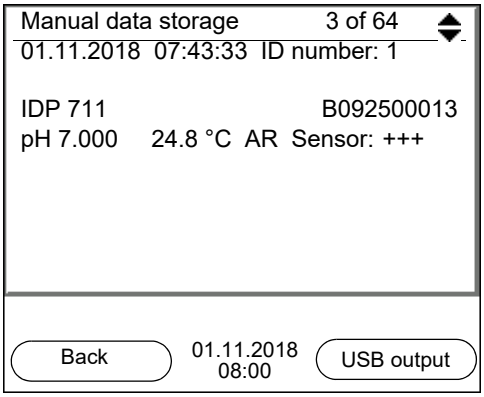
Open the manual or automatic data storage directly with the **<RCL>** or **<RCL__>** key.

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

Settings

Menu item	Setting/ function	Explanation
Data storage / *Manual data storage* / *Display*	-	Displays all measurement data-sets 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>**/ [Zurück].
Data storage / *Manual data storage* / *Output to RS232/ USB*	-	Outputs all stored measurement data to the interface.
Data storage / *Manual data storage* / *Erase*	-	Erases the entire manual measurement data storage. Note: All calibration data remain stored when this action is performed.

Display presentation of a dataset



Representation of a dataset (USB output)

```
01.11.2018 07:43:33
MD 8000 H
Ser. no. 09250023

ID number 2

IDP 711
Ser. no. B092500013
pH  6.012 24.8 °C, AR, S: +++
_____________________________________

01.11.2018 07:43:53
MD 8000 H
Ser. no. 09250013

ID number 2

IDP 711
Ser. no. B092500013
pH  6.012 24.8 °C, AR, S: +++
_____________________________________
```

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>**/[Zurück].

12.3.2 Erasing the measurement data storage

Erasing the measurement data storage (see section 12.3.1 EDITING THE MEASURED VALUE DATA STORAGE, page 76).

12.3.3 Measurement dataset

A complete dataset consists of:

- Date/time
- Meter name, series number
- Sensor name, series number

- ID number
- Measured value of the connected sensor
- Measured temperature value of the connected sensor
- AutoRead info: *AR* appears with the measured value if the AutoRead criterion was met while storing (stable measured value). Otherwise, the *AR* display is missing.
- Calibration evaluation:
  - 4 levels (+++, ++, +, -, or no evaluation)

12.3.4 Storage locations

The MD 8000 H meter has two measurement data storages. The measured values recorded either manually or automatic are stored separately in individual measurement data storages.

Data memory	Maximum number of datasets
Manual data storage	494
Automatic data storage	4500

13 Transmitting data (USB interface)

13.1 Outputting current measurement data

1. Output the current measurement data to the USB-B interface with **<F2>***[USB output]*.

13.2 Transmitting data (to a PC)

The meter has a USB-B interface (*USB Device*) e.g. to connect a PC.

Via the USB-B interface (*USB Device*) you can transmit data to a PC or printer and update the meter software.

13.3 Connecting the PC / USB-B interface (*USB Device*)

Connect the MD 8000 H to the PC via the USB-B interface.

Installation of the USB driver on the PC

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

- PC with at least one free USB connection and CD-ROM drive
- Windows 2000, Windows XP, Windows Vista or Windows 7.

1. Insert the supplied installation CD in the CD drive of your PC.
2. Install the driver from the CD.
   Follow the Windows installation instructions as necessary.
3. Connect the MD 8000 H to the PC via the USB-B interface.
   The meter is listed as a virtual COM interface among the connections in the Windows instrument manager.
4. Set the same transmission data at the connected instrument (PC):
   - Baud rate: to be selected in the range 1200 ... 19200
   - Handshake: RTS/CTS
   - Set at the PC only:
     – Parity: none
     – Data bits: 8
     – Stop bits: 2

13.4 Options for data transmission to a PC

Via the USB-B 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 measured values of all connected sensors	Manual	● With **<F2>**/*[USB output]*. ● Simultaneously with every manual data storage process (see section 12.1 MANUAL DATA STORAGE, page 73).
	automatic, at intervals	● With **<F2__>**/*[USB output]* . Then you can set the transmission interval. ● Simultaneously with every automatic data storage process (see section 12.2 AUTOMATIC DATA STORAGE AT INTERVALS, page 74).
Stored measured values	Manual	● Displayed dataset with **<F2>***[USB output]* after calling up from the data storage. ● All datasets with the *Output to RS232/USB* function. (see section 12.3.1 EDITING THE MEASURED VALUE DATA STORAGE, page 76).
Calibration records	Manual	● Calibration record with **<F2>**/*[USB output]* (see section 6.2.6 CALIBRATION DATA, page 34; section 8.2.7 CALIBRATION DATA, page 46; section 9.3.4 CALIBRATION DATA, page 52).
	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, measuring datasets, calibration records).

13.5 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.

14 Maintenance, cleaning, disposal

14.1 Maintenance

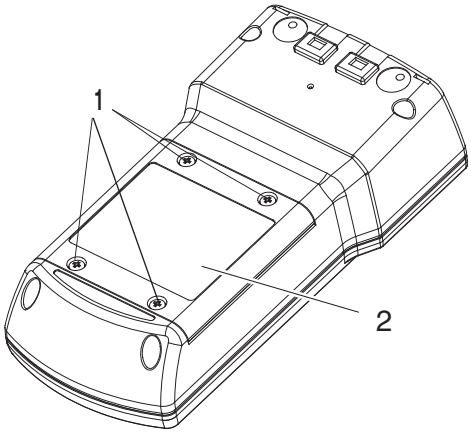
14.1.1 General maintenance activities

The only maintenance activity required is replacing the batteries.

See the relevant operating manuals of the IDP sensors for instructions on maintenance.

14.1.2 Replacing the batteries

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



1 Screws
2 Battery compartment

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

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

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

5. Set the date and time (see section 5.4.5 EXAMPLE 2 ON NAVIGATION: SETTING THE DATE AND TIME, page 23).

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.

14.2 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.

14.3 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.

14.4 Disposal

This equipment is marked with the crossed out wheeled bin symbol.
It means that this equipment must not be disposed of with unsorted waste. Instead it's your responsibility to correctly dispose of your equipment at the end of its lifecycle by handing 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!

15 What to do if...

15.1 pH

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
IDP pH sensor:	
– The measured value is outside the measuring range of the meter	– Use a suitable IDP pH sensor
– Air bubble in front of the junction	– Remove air bubble (e.g. sway or stir the solution)
– Air in the junction	– Extract air or moisten junction
– Cable broken	– Replace the sensor
– Gel electrolyte dried out	– Replace the sensor

Error message, *Error*

Cause	Remedy
IDP pH sensor:	
– The values determined for zero point and slope of the IDP pH sensor are outside the allowed limits.	– Recalibrate
– Junction contaminated	– Clean junction
– Sensor soiled	– Clean the sensor
– Sensor broken	– Replace the sensor
Buffer solutions:	
– The used buffer solutions do not agree with the set buffer set	– Set different buffer set or – Use different buffer solutions
– Buffer solutions too old	– Use only once. Note the shelf life
– Buffer solutions depleted	– Change solutions

No stable measured value

Cause	Remedy
IDP pH sensor:	
– Junction contaminated	– Clean junction
– Membrane contaminated	– Clean membrane
– pH sensor soiled	– Clean the pH sensor
Test sample:	
– pH value not stable	– Measure with air excluded if necessary
– Temperature not stable	– Adjust temperature if necessary
IDP pH sensor + test sample:	
– Conductivity too low	– Use a suitable IDP pH sensor
– Temperature too high	– Use a suitable IDP pH sensor
– Organic liquids	– Use a suitable IDP pH sensor

Obviously incorrect measured values

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

15.2 Dissolved oxygen

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
– Measured value outside the measuring range	– Use a suitable IDP D.O. sensor

Error message, *Error*

Cause	Remedy
– Sensor contaminated	– Clean the sensor
– Measured temperature value outside the operating conditions (display of OFL/UFL instead of a temperature value)	– Keep to the temperature range for the test sample
– Defective sensor	– Calibration – Exchange the sensor cap – Replace the sensor

15.3 Conductivity

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
– Measured value outside the measuring range	– Use a suitable IDP conductivity sensor

Error message, *Error*

Cause	Remedy
– Sensor contaminated	– Clean the sensor and replace it if necessary
– Calibration solution not suitable	– Check the calibration solutions

15.4 General topics

Sensor symbol flashes

Cause	Remedy
– Calibration interval expired	– Recalibrate the measuring system

Display	Cause	Remedy
	– Batteries almost empty	– Replace the batteries (see section 14.1 MAINTENANCE, page 81)

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 or IDP sensor	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. or – Connect the sensor. Press softkey [**<F1>i<F1>**] / [*More*] The sensor data are displayed (see section 5.1.5 SENSOR INFO, page 17)

16 Firmware update

16.1 Firmware update for the meter MD 8000 H

With the "Firmware Update " program and a PC you can update the firmware of the MD 8000 H to the newest version.

For firmware updates for the meter, go to **www.vwr.com**, or contact your VWR sales center.

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

For the update via the USB-B 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 MD 8000 H).

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 are displayed there.
2. In the windows start menu, open the update folder and start the firmware update program for the meter
3. Using the USB interface cable, connect the MD 8000 H to a USB interface (virtual COM port) of the PC.
4. Switch on the MD 8000 H.
5. In the firmware update program, start the update process with OK.
6. Follow the instructions of the firmware update program.
   During the programming process, a corresponding message and a progress bar (in %) are displayed.
   The programming process takes up to 15 minutes. A terminatory message is displayed after a successful programming process. The firmware update is completed.
7. Disconnect the MD 8000 H from the PC.
   The MD 8000 H is ready for operation again.

After switching the meter off and on you can check whether the meter has taken over the new software version (see YOU WANT TO KNOW WHICH SOFTWARE VERSION IS IN THE METER OR IDP SENSOR, PAGE 86).

16.2 Firmware update for IDP sensors

With the "Firmware Update " program and a PC you can update the firmware of the IDP sensor to the newest version.

For firmware updates for the IDP sensors, go to **www.vwr.com**, or contact your VWR sales center.

For the update connect the IDP sensor with the MD 8000 H, and the MD 8000 H with a PC.

For the update via the USB-B 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 MD 8000 H).

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 sensor (or sensor type), the new data are displayed there.
2. In the windows start menu, open the update folder and start the firmware update program for the IDP sensor.
3. Connect the IDP sensor with the MD 8000 H meter.
4. Using the USB interface cable, connect the MD 8000 H to a USB interface (virtual COM port) of the PC.
5. Switch on the MD 8000 H.
6. In the firmware update program, start the update process with OK.
7. 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 up to 5 minutes. A terminatory message is displayed after a successful programming process. The firmware update is completed.
8. Disconnect the MD 8000 H from the PC.
   Meter and sensor are ready for operation again.

After switching the meter off and on you can check whether the sensor has taken over the new software version (see YOU WANT TO KNOW WHICH SOFTWARE VERSION IS IN THE METER OR IDP SENSOR, PAGE 86).

17 Glossary

pH/ORP

Asymmetry see zero point

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

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 (U) 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 combination electrode is the pH value at which the electromotive force of the pH combination electrode at a specified temperature is zero. Normally, this is at 25 °C.

Conductivity

Cell constant (c) Characteristic quantity of a conductivity measuring cell, depending on the geometry.

Conductivity (χ) Short form of the expression, specific electrical conductivity.
It corresponds to the reciprocal value of the resistivity.
It is a measured value of the ability of a substance to conduct an electric current. In water analysis, the electrical conductivity is a dimension for the ionized substances in a solution.

Reference temperature Fixed temperature value to compare temperature-dependent measured values. For conductivity measurements, the measured value is converted to a conductivity value at a reference temperature of 20 °C or 25 °C.

Resistivity (ρ) Short name for the specific electrolytic resistance. It corresponds to the reciprocal value of the electrical conductivity.

Salinity

The absolute salinity S_A of seawater corresponds to the relationship of the mass of dissolved salts to the mass of the solution (in g/Kg). In practice, this dimension cannot be measured directly. Therefore, the practical salinity according to IOT is used for oceanographic monitoring. It is determined by measuring the electrical conductivity.

Salt content

General designation for the quantity of salt dissolved in water.

Temperature coefficient

Value of the slope α of a linear temperature function.

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

Temperature compensation

Name of a function that considers the temperature influence on the measurement and converts it accordingly. Depending on the measured parameter to be determined, the temperature compensation functions in different ways. For conductimetric measurements, the measured value is converted to a defined reference temperature. For potentiometric measurements, the slope value is adjusted to the temperature of the test sample but the measured value is not converted.

Dissolved oxygen

D.O. partial pressure

Pressure caused by the oxygen in a gas mixture or liquid.

D.O. saturation

Short name for the relative D.O. saturation.

The ratio of the D.O. partial pressure in the test sample to the D. O. partial pressure of air at the currently present air pressure.
Example: 100% means that the D. O. partial pressure in the test sample is the same as that in the ambient air – air and test sample are at equilibrium.

Salinity

The absolute salinity S_A of seawater corresponds to the relationship of the mass of dissolved salts to the mass of the solution (in g/Kg). In practice, this dimension cannot be measured directly. Therefore, the practical salinity according to IOT is used for oceanographic monitoring. It is determined by measuring the electrical conductivity.

Salt content

General designation for the quantity of salt dissolved in water.

Slope (relative)

Relation of the slope value to the value of a theoretical reference sensor of the same construction type.

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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19 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.

20 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.

21 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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