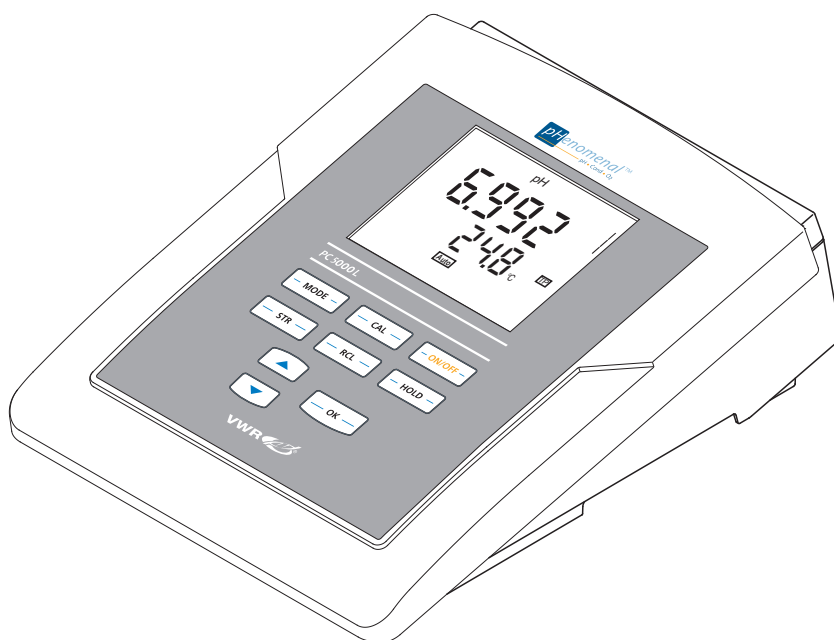




pH / conductivity meter PC 5000 L

OPERATING MANUAL



ECN: 665-0262

Version: 5
Issued: 23, 10, 2012



ba75854e05

10/2012



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Printed in Germany.

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1 Safety

This operating manual contains basic instructions that you must follow during the commissioning, operation and maintenance of the meter. Consequently, all responsible personnel must read this operating manual carefully before working with the meter. The operating manual must always be available within the vicinity of the meter.

Target group

The meter was developed for work in the laboratory. Thus, we assume that, as a result of their professional training and experience, the operators will know the necessary safety precautions to take when handling chemicals.

Safety instructions

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



Warning

indicates instructions that must be followed precisely in order to avoid possibly great dangers to personnel.



Caution

indicates instructions that must be followed precisely in order to avoid the possibility of slight injuries or damage to the meter or the environment.

Further notes



Note

indicates notes that draw your attention to special features.



Note

indicates cross-references to other documents, e.g. operating manuals.

1.1 Authorized use

The authorized use of the meter consists exclusively of the measurement of the pH value, ORP and conductivity in a laboratory environment.

The technical specifications as given in chapter 3 TECHNICAL DATA must be observed. Only the operation and running of the meter according to the instructions given in this operating manual is authorized.

Any other use is considered **unauthorized**.

1.2 General safety instructions

This meter is constructed and tested in compliance with the IEC 1010 safety regulations for electronic measuring instruments. It left the factory in a safe and secure technical condition.

Function and operational safety

The smooth functioning and operational safety of the meter can only be guaranteed if the generally applicable safety measures and the specific safety instructions in this operating manual are followed during operation.

The smooth functioning and operational safety of the meter can only be guaranteed under the environmental conditions that are specified in chapter 3 TECHNICAL DATA.

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



Safe operation

Caution

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

If safe operation is no longer possible, the meter must be taken out of service and secured against inadvertent operation!
Safe operation is no longer possible if the meter:

- has been damaged in transport
- has been stored under adverse conditions for a lengthy period of time
- is visibly damaged
- no longer operates as described in this manual.

If you are in any doubt, please contact the supplier of the meter.

Obligations of the purchaser

The purchaser of this meter must ensure that the following laws and guidelines are observed when using dangerous substances:

- EC directives for protective labor legislation
- National protective labor legislation
- Safety regulations
- Safety datasheets of the chemical manufacturers.



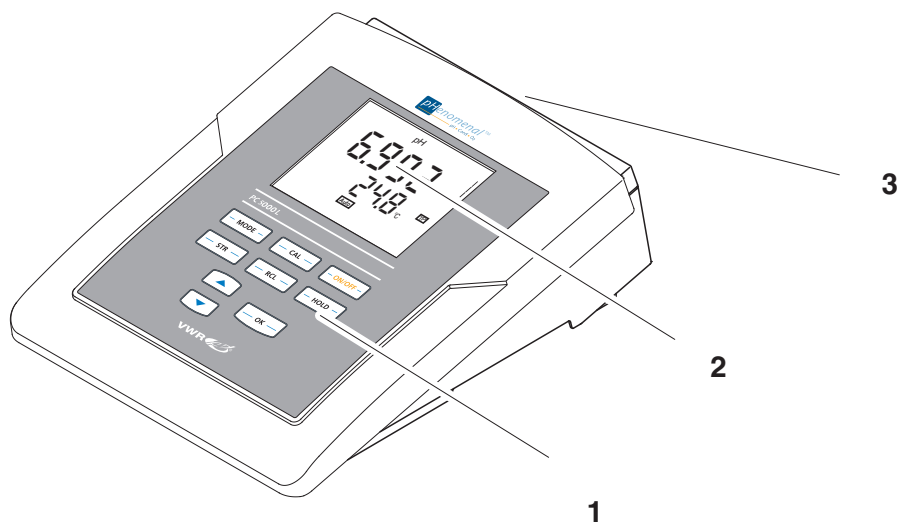
Caution

In addition to the safety instructions mentioned here, also follow the safety instructions of the sensors used. The operating manuals of the sensors are available on the supplied CD.

2 Overview

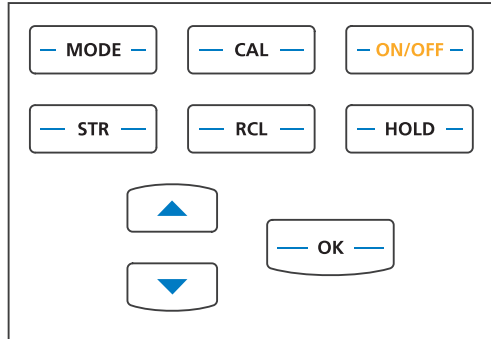
The PC 5000 L compact precision pH/conductivity meter enables you to perform measurements of the pH, ORP and conductivity quickly and reliably.

The PC 5000 L provides the maximum degree of reliability, ease of use and measuring certainty for all applications.



1	Keypad
2	Sample display
3	Socket field

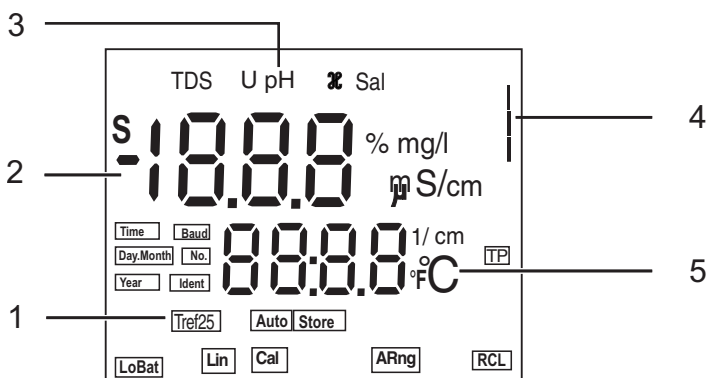
2.1 Keypad



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

	<ON/OFF>: <ON/OFF__>:	Switches the meter on or off Resets calibration data
	<MODE>: <MODE__>:	Selects the measured parameter (see also <▲__><▼__>) Opens the setting menu for calibration and measurements
	<CAL>: <CAL__>:	Calls up the calibration procedure Displays the calibration data
	<STR>:	Saves a measured value manually
	<RCL>:	Displays the manually stored measured values
 	<▲><▼> <▲__><▼__>	Increments/decrements values Selects the measured parameter
	<OK>: <OK__>:	Confirms entries Opens the setting menu for system settings
	<HOLD>:	Freezes the measured value (HOLD function)

2.2 Display

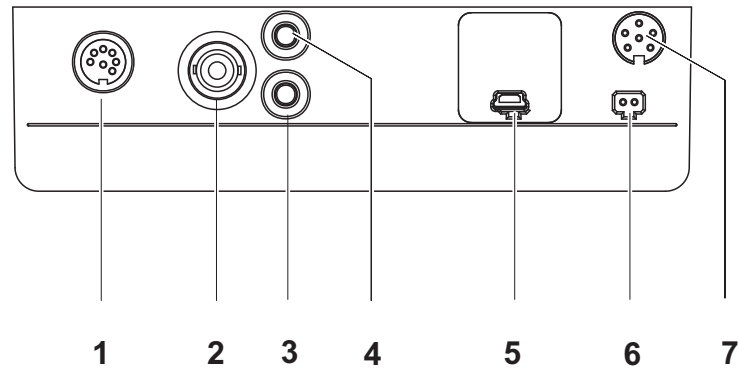


1	Status information
2	Measured value (with unit)
3	Measured parameter
4	Calibration evaluation
5	Measured temperature (with unit)

Function display indicators

E3	An error occurred during calibration
LoBat	With battery operation: batteries almost empty
TP	Temperature measurement active
Store	Saving
Auto	Automatic stability control
S	The current measured value is retained (HOLD)
RCL	The data memory is open (RCL)
TRef25	Reference temperature of 25 °C

2.3 Socket field



1	Conductivity measuring cell
2	pH electrode
3	Reference electrode
4	Temperature sensor
5	USB-B interface (device)
6	Connection for power pack
7	Service interface



Note

The inputs for the pH electrode and conductivity measuring cell are not galvanically isolated. Therefore, the pH electrode and conductivity measuring cell cannot be operated in the same test solution at the same time.

3 Technical data

3.1 General data

Dimensions	Approx. 240 x 190 x 80 mm	
Weight	Approx. 1.0 kg	
Mechanical structure	Type of protection	IP 43
Electrical safety	Protective class	III
Test certificates	CE	
Ambient conditions	Storage	- 25 °C ... + 65 °C
	Operation	0 °C ... + 55 °C
	Allowable relative humidity	Annual mean: < 75 % 30 days/year: 95 % Other days: 85 %
Power supply	Batteries	4 x 1.5 V alkali-manganese batteries, type AA
	Rechargeable batteries	4 x 1.2 V NiMH rechargeable batteries, type AA (no charging function)
	Operational life	up to 1000 h (operating hours with batteries)
	Power pack	Input: 100 ... 240 V ~ / 50 ... 60 Hz / 270 mA Output: 9 V = / 1.1 A Connection max. overvoltage category II Primary plugs contained in the scope of delivery: Euro, US, UK and Australian.
Sensor input	Input resistance	> 5 * 10 ¹³ ohm
	Input current	< 1 * 10 ⁻¹² A
Service interface	This interface can be used for service purposes only.	
USB interface	Type	USB 1.1 (device) USB-B (device), data output
	Baud rate	Can be set to 1200, 2400, 4800, 9600 Baud
	Data bits	8
	Stop bits	2
	Parity	None
	Handshake	RTS/CTS
	Cable length	max. 3 m

**Guidelines
and norms used**

EMC	EC guideline 89/336/EC EN 61326 EN 61000-3-2 EN 61000-3-3 FCC Class A
Meter safety	EC guideline 73/23/EC EN 61010-1 ANSI/UL 61010-1 CAN/CSA-C22.2 No. 61010-1
IP protection class	EN 60529

FCC Class A Equipment Statement

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

3.2 Measuring ranges, resolution, accuracy

3.2.1 pH

Measuring ranges, resolution

Parameter	Measuring range	Resolution
pH	- 2.00 ... + 19.99	0.01
U [mV]	- 199.9 ... + 199.9	0.1
	- 1999 ... + 1999	1
T [°C]	0.0 ... + 100.0	0.1
T [°F]	+ 32.0 ... + 212.0	0.1

Manual temperature input

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

Accuracy (± 1 digit)

Parameter	Accuracy	Temperature of the test sample
<i>pH / Range *</i>		
- 2.00 ... + 19.99	± 0.01	+ 15 °C ... + 35 °C
<i>U [mV] / range</i>		
- 199.9 ... + 199.9	± 0.1	+ 15 °C ... + 35 °C
- 1999 ... + 1999	± 1	+ 15 °C ... + 35 °C
<i>T [°C] / temperature sensor</i>		
NTC 30	± 0.2	
PT 1000	± 0.2	

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



Note

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

3.2.2 Conductivity

Measuring ranges, resolution

Parameter	Measuring range	Resolution
κ [μS/cm]	0.0 ... 199.9	0.1
	0 ... 1999	1
κ [mS/cm]	0.00 ... 19.99	0.01
	0.0 ... 199.9	0.1
	0 ... 500	1
SAL	0.0 ... 70.0	0.1
	according to the IOT table	
TDS [mg/l]	Factor: 1.00	1
T [°C]	0.0 ... + 100.0	0.1
T [°F]	+ 32.0 ... + 212.0	0.1

Cell constants

Cell constant C	Values
Can be calibrated in the range	0.800 ... 0.880 cm ⁻¹

Reference temperature

Reference temperature	Values
Permanently set (Tref25)	25 °C

Accuracy (± 1 digit)

Parameter	Accuracy	Temp. of the test sample
κ / Temperature compensation		
None (Off)	± 0.5 %	
Linear (lin)	± 0.5 %	+ 10 °C ... + 75 °C
SAL / Range		
0.0 ... 35.0	± 0.1	+ 5 °C ... + 25 °C
	± 0.2	+ 25 °C ... + 30 °C
TDS [mg/l] / Range		
0 ... 1999	± 0.5 %	
T [°C] / Range (temperature sensor)		
0.0 ... + 100.0	± 0.2	



Note

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

4 Commissioning

4.1 Scope of delivery

- Meter PC 5000 L
- Power pack
- 4 batteries 1.5 V Mignon type AA
- Stand
- Stand base
- Short instructions
- CD-ROM with detailed operating manual

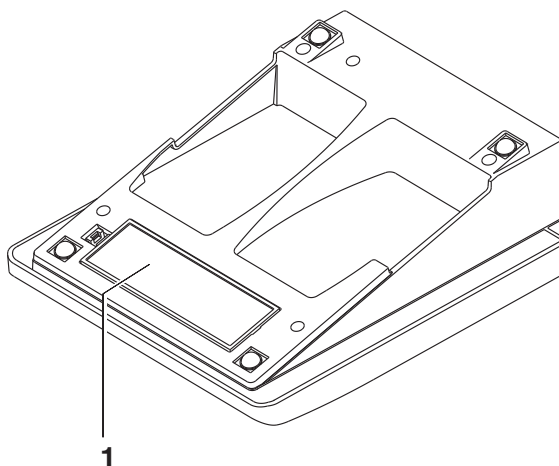
4.2 Initial commissioning

Perform the following activities:

- Insert the supplied batteries
- Connect the power pack (for line power operation only)
- Switching on the meter

4.2.1 Inserting the batteries

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



- 2 Place four batteries (type Mignon AA) in the battery compartment.

- 3 | Close the battery compartment.



Caution

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



Note

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

4.2.2 Connecting the power pack



Caution

The line voltage at the operating site must lie within the input voltage range of the original power pack (see section 3.1).



Caution

Use original power packs only (see section 3.1).

- | | |
|---|---|
| 1 | Insert the plug into the socket of the PC 5000 L. |
| 2 | Connect the original power pack to an easily accessible power outlet. |



Note

You can carry out measurements without the power pack.

4.2.3 Switching on the meter

- | | |
|---|---|
| 1 | Press the <ON/OFF> key.
A display test is briefly displayed.
Subsequently, the meter switches to the measuring mode (measured value display). |
|---|---|

Switch-off interval

The meter has an energy saving feature to avoid unnecessary battery depletion during battery operation. The energy saving feature switches off the meter if no key was pressed during the specified interval (setting the switch-off interval see section 5.9.1). When the meter is operated with the power pack the energy saving feature is not active.

Display illumination

During battery operation, the meter automatically switches off the dis-

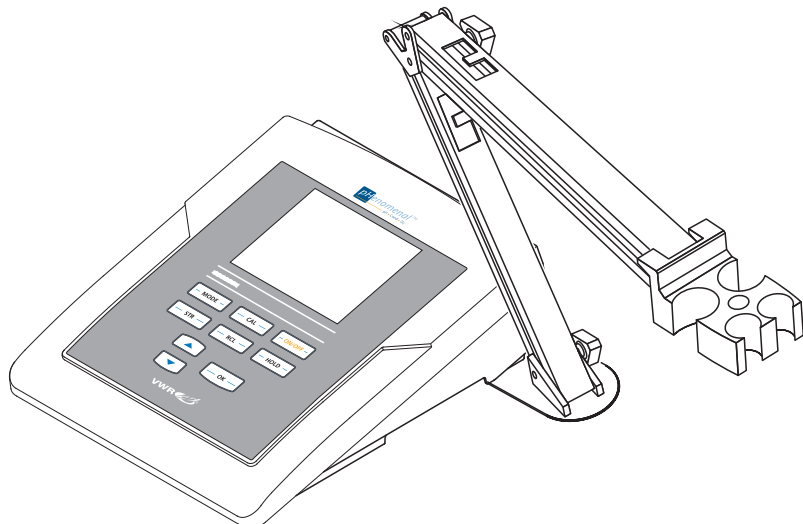
play illumination if no key has been pressed for 30 seconds (setting the display illumination see section 5.9.1). The illumination is switched on with the next keystroke again.

4.2.4 Stand

The stand base can be attached to the right side of the meter.

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

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



5 Operation

5.1 General operating principles

This section contains basic information on the operation of the PC 5000 L.

5.1.1 Operating modes

The meter has the following operating modes:

- Measurement
The display indicates the measurement data in the measured value display
- Calibration
The display guides you through a calibration procedure with calibration information
- Storage in memory
The meter stores measurement data
- Configuration
Settings and functions are displayed

5.1.2 Operation

Keys The meter is operated via keys. The keys can have different functions with long or short keystrokes.

Functions Generally, with a short keystroke a function is carried out. A long keystroke opens a setting menu.

In a setting menu, settings are selected with the <▲><▼> keys. A setting is confirmed with <OK>. With confirming, the setting is finished and the next setting is displayed.

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

5.2 pH/ORP: Measuring

Preparatory activities

Perform the following preparatory activities when you want to measure:

1	Connect the pH electrode to the meter.
2	Adjust the temperature of the buffer solutions or test solutions, or measure the current temperature, if you measure without a temperature sensor.
3	Calibrate or check the meter with the electrode.
4	Select the measured parameter with <MODE> and <▲__><▼__>.



Note

Incorrect calibration of pH electrodes leads to incorrect measured values. Calibrate regularly before measuring.



Note

The sockets for the pH electrode and conductivity measuring cell are not galvanically isolated. Therefore, the pH electrode (or temperature sensor for pH) and conductivity measuring cell cannot be operated at the same time.

Stability control

During the measuring procedure, the stability control function is automatically activated. The stability control function (drift control) checks the stability of the measured pH signal and the stability of the measured temperature signal. The stability has a considerable effect on the reproducibility of the measured value.

The status display [Auto] flashes until a stable measured value is available. As soon as the measured value is stable the status display [Auto] stops flashing.

For identical measurement conditions, the following applies:

Measured parameter	Reproducibility	Response time
pH value	< 0.02 pH units	> 15 seconds

Temperature sensor

You can measure with or without a temperature sensor. If a temperature sensor is connected, it is indicated on the display by *TP*.



Note

The PC 5000 L automatically recognizes the type of the temperature sensor used. Therefore, you can connect electrodes with an NTC30 or Pt1000.

The temperature measurement is absolutely essential for a reproduc-

ible pH measurement. If the measurement is made without a temperature sensor, proceed as follows:

- | | |
|---|--|
| 1 | Measure the current temperature using a thermometer. |
| 2 | Set the temperature value with <▲><▼>. |

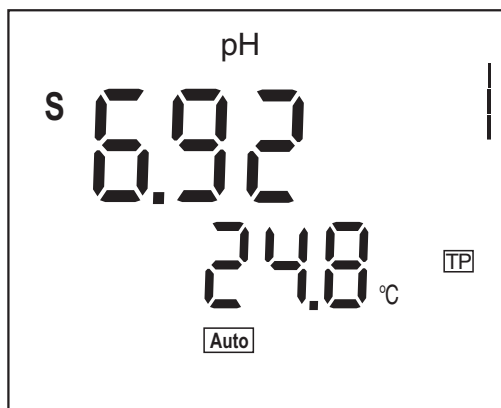


Note

When calibrating without temperature sensor, also set the current temperature of each buffer solution manually with the <▲><▼> keys.

5.2.1 Hold function

- | | |
|---|--|
| 1 | Freeze the current measured value with <HOLD> (Hold function).
An S is displayed in front of the current measured value as long as the Hold function is active. |
|---|--|

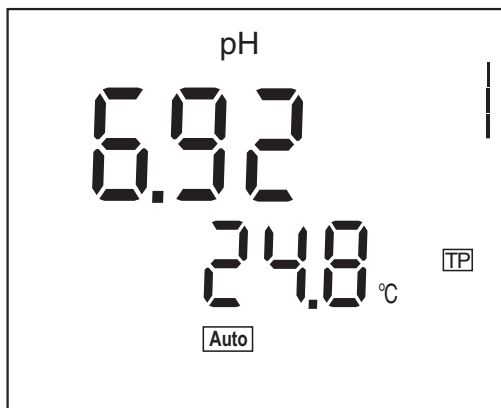


- | | |
|---|---|
| 2 | To terminate the Hold function: press the <MODE> or <HOLD> key. |
|---|---|

5.2.2 Measuring the pH value

- | | |
|---|---|
| 1 | Perform the preparatory activities according to section 5.2. |
| 2 | Immerse the pH electrode in the test sample. |
| 3 | If necessary, call up the measured parameter pH with <MODE> and <▲__><▼__>. |

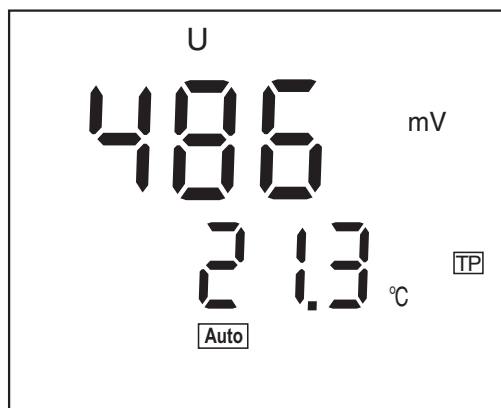
- 4 | Wait for a stable measured value.
The [Auto] display indicator flashes as long as the measured value is not yet stable.



5.2.3 Measuring the ORP

The meter can, in conjunction with an ORP electrode, measure the ORP (mV) of a solution.

- | | |
|---|--|
| 1 | Perform the preparatory activities according to section 5.2. |
| 2 | Immerse the ORP electrode in the test sample. |
| 3 | If necessary, call up the measured parameter U with <MODE> and <▲__><▼__>. |
| 4 | Wait for a stable measured value.
The [Auto] display indicator flashes as long as the measured value is not yet stable. |



Note

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

5.3 pH: Calibration

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 the current values of the zero point and slope of the electrode and stores them in the measuring instrument. Thus, you should calibrate at regular intervals.

When do you have to calibrate?

- After connecting another electrode
- If the symbol for the calibration evaluation flashes on the display:
 - e.g. after the calibration interval has expired

**CAL TEC
CAL NIST**

is adapted to the permanently programmed buffer solutions as a fully automatic single-point, two-point or three-point calibration. The buffer solutions are automatically recognized by the meter.

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 account during calibration.

Buffer set	pH values	
	at 25 °C	(at 20 °C)
Technical buffer solutions (<i>TEC1</i>) by VWR	4.00	(4.00)
	6.98	(7.00)
	9.94	(10.00)
Technical buffer solutions (<i>TEC2</i>)	2,00	
	4,00	
	7,00	
	10,011	
<i>NIST/DIN</i> buffer solutions by VWR	1.679	
	4.006	
	6.865	
	9.180	
	12.454	

Calibration points

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

	Determined values	Displayed calibration data
1-point	ASY	<ul style="list-style-type: none"> ● Zero point = ASY ● Slope = Nernst slope (-59.16 mV/pH at 25 °C)
2-point 3-point	ASY SLO	<ul style="list-style-type: none"> ● Zero point = ASY ● Slope = SLO

Stability control

The calibration procedure automatically activates the stability control function. The current measurement with stability control can be terminated at any time (accepting the current value) by pressing <OK>.

Calibration record

When finishing a calibration, the new calibration values are first displayed as an informative message and stored.

Displaying the calibration data

You can display the data of the last calibration (see section 5.4).

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 as the symbol for the calibration evaluation and in the calibration record.

Symbol for calibration evaluation	Zero point [pH]	Slope [%]
	7.34 ... 6.66	102 ... 96
	7.42 ... 6.58	103 ... 102 or 96 ... 95
	7.51 ... 6.49	105 ... 103 or 95 ... 85
Clean the electrode according to the electrode operating manual		
E3	> 7.51 or < 6.49	> 105 or < 85
Eliminate the error according to chapter 7 WHAT TO DO IF...		

Preparatory activities

1	Switch on the meter with <ON/OFF>.
2	Connect the pH electrode to the meter.
3	Keep the buffer solutions ready.
4	Adjust the temperature of the solutions and measure the current temperature if the measurement is made without temperature sensor.
5	Set the buffer set to be used for calibration as necessary.

5.3.1 Calibration interval (*Int.C*)

The calibration interval reminds you to calibrate regularly. After the specified calibration interval (*Int.C*) has expired, the symbol for the calibration evaluation flashes. It is still possible to measure.



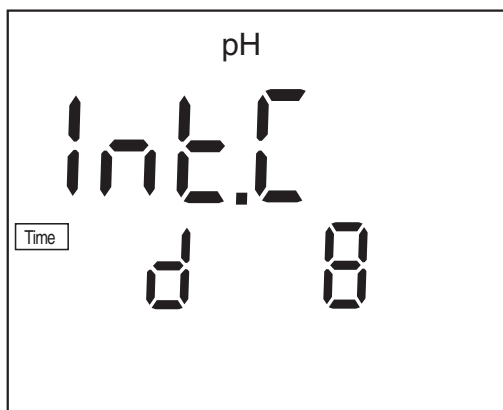
Setting the calibration interval

Note

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

The calibration interval (*Int.C*) is set to 7 days (*d7*) in the factory. You can change the interval (1 ... 999 days):

- 1 | Open the menu for measurement settings with **<MODE__>**.
- 2 | Confirm all settings with **<OK>** until *Int.C* is displayed.



- 3 | Set the calibration interval with **<▲><▼>**.
- 4 | Confirm the setting with **<OK>**.

5.3.2 Automatic calibration (CAL TEC, CAL NIST)

For the TEC and NIST procedures, use one to three buffer solutions of the relevant buffer set (Technical buffers or NIST buffers) in any order.

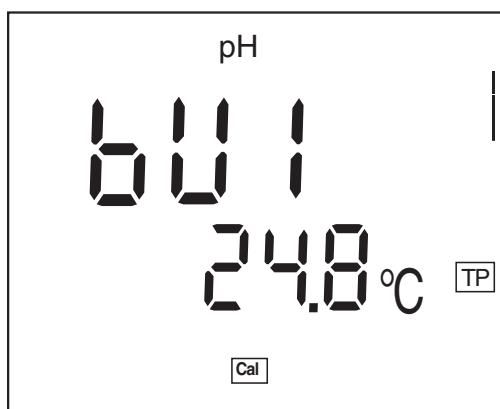
Select the buffer set (see section 5.9.2).



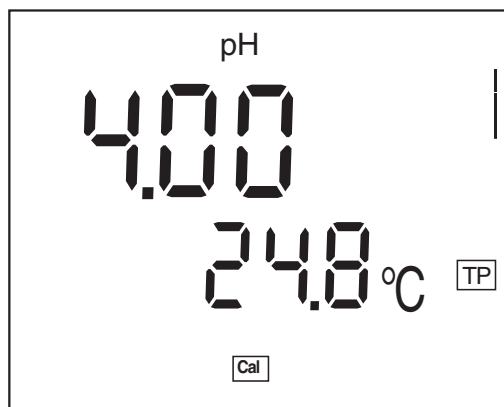
Note

The steps 4, 9 and 14 are not necessary if you use a temperature sensor.

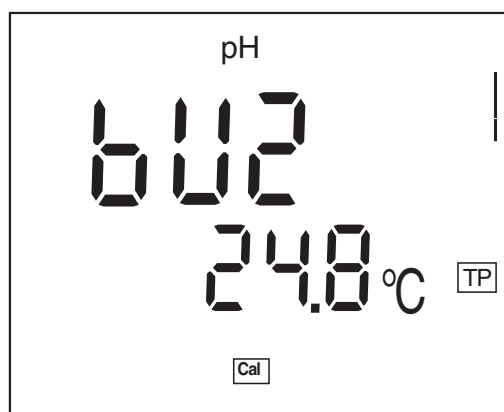
1	If necessary, call up the measured parameter pH with <MODE> and <▲__><▼__> .
2	Start the calibration with <CAL> . <i>CAL</i> and the selected buffer set (<i>TEC1</i> , <i>TEC2</i> or <i>NIST</i>) are displayed.
3	Start the calibration with <OK> . <i>BU1</i> and the temperature are displayed.



4	If necessary, set the temperature of the buffer solution with <▲><▼> .
5	Immerse the pH electrode in the first buffer solution.
6	Start the measurement with <OK> . The [Auto] display indicator flashes. The electrode voltage (mV) or the nominal value of the buffer (setting: see section 5.9.2) is displayed.



7 As soon as a stable value is recognized, *BU2* appears.

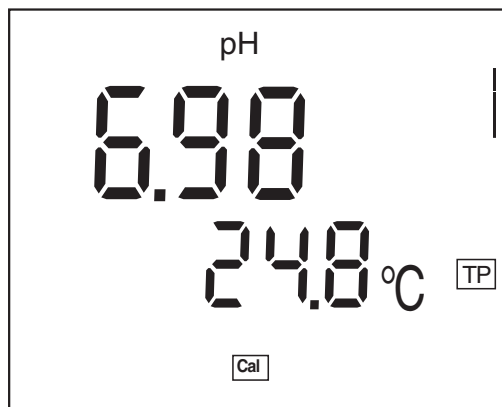


Note

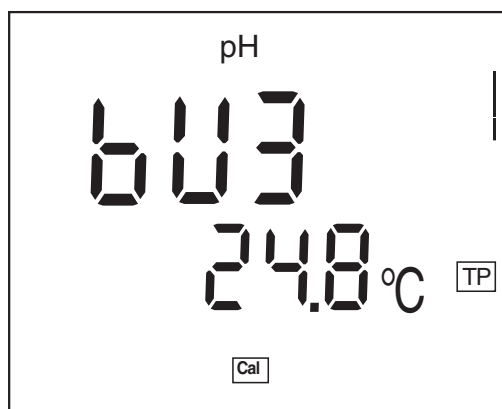
Here you can cancel the calibration procedure with **<MODE>**. This corresponds to a **single-point calibration**. The value of the zero point (ASY) is displayed. Pressing **<OK>** displays the value of the slope (SLO).

Continuing with two-point calibration

8	Thoroughly rinse the electrode with distilled water.
9	If necessary, set the temperature of the second buffer solution with <▲><▼> .
10	Immerse the electrode in the second buffer solution.
11	Press the <OK> key. The [Auto] display indicator flashes. The electrode voltage (mV) or the nominal value of the buffer (setting: see section 5.9.2) is displayed.



12 | As soon as a stable value is recognized, *BU3* appears.

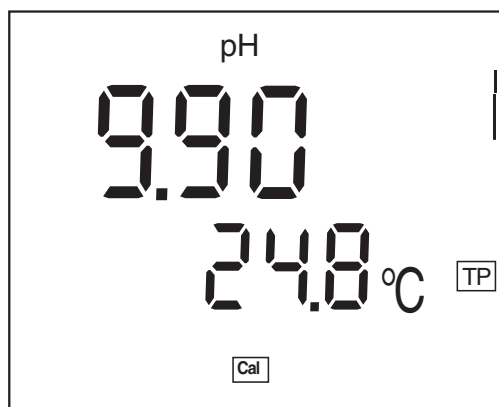


Note

Here you can cancel the calibration procedure with **<MODE>**. This corresponds to a **two-point calibration**. The value of the zero point (ASY) is displayed. Pressing **<OK>** displays the value of the slope (SLO).

Continuing with three-point calibration

13	Thoroughly rinse the electrode with distilled water.
14	If necessary, set the temperature of the third buffer solution with <▲><▼> .
15	Immerse the electrode in the third buffer solution.
16	Press the <OK> key. The [Auto] display indicator flashes. The electrode voltage (mV) or the nominal value of the buffer (setting: see section 5.9.2) is displayed.

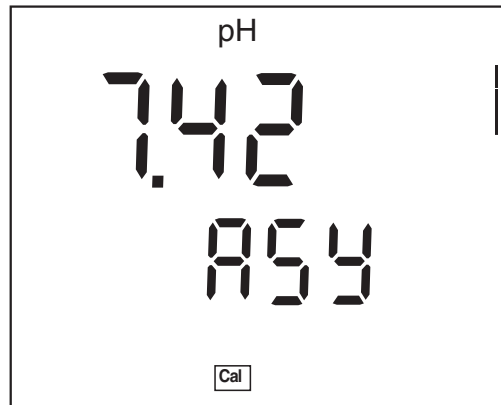


- | | |
|----|---|
| 17 | The asymmetry is displayed as soon as a stable value is recognized. |
| 18 | Press the <OK> key.
The value of the slope appears on the display. |
| 19 | To return to the measuring mode: Press the <OK> key. |

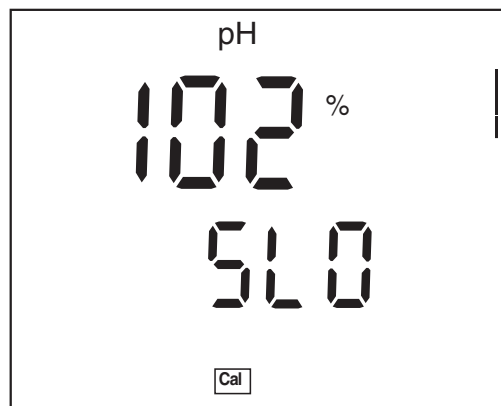
5.4 pH: Downloading calibration data

You can download calibration data to the display as follows:

- 1 If necessary, call up the measured parameter pH with **<MODE>** and **<▲__><▼__>**.
- 2 Pressing **<CAL__>** displays the calibration data (asymmetry).



- 3 Press **<OK>** to display the slope.



5.5 Conductivity/Salinity: Measuring

Preparatory activities

Perform the following preparatory activities when you want to measure:

1	Connect a measuring cell to the meter.
2	Calibrate or check the meter with the measuring cell.
3	Select the measured parameter with <MODE> and <▲__><▼__>.



Note

The sockets for the pH electrode and conductivity measuring cell are not galvanically isolated. Therefore, the pH electrode (or temperature sensor for pH) and conductivity measuring cell cannot be operated at the same time.

Stability control [Auto]

During the measuring procedure, the stability control function is automatically activated. The stability control function [Auto] checks the stability of the measured conductivity signal and the stability of the measured temperature signal. The stability has a considerable effect on the reproducibility of the measured value.

The status display [Auto] flashes until a stable measured value is available. As soon as the measured value is stable the status display [Auto] stops flashing.

For identical measurement conditions, the following applies:

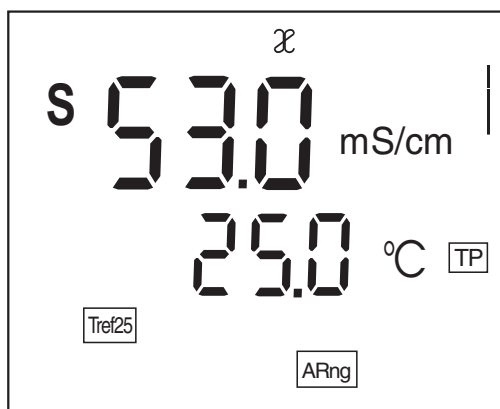
Measured parameter	Reproducibility	Response time
Conductivity	better than 0.5% of measured value	> 10 seconds

Temperature sensor

The temperature measurement is absolutely essential for a reproducible conductivity measurement. If a temperature sensor is integrated in the sensor, it is indicated on the display by [TP].

5.5.1 Hold function

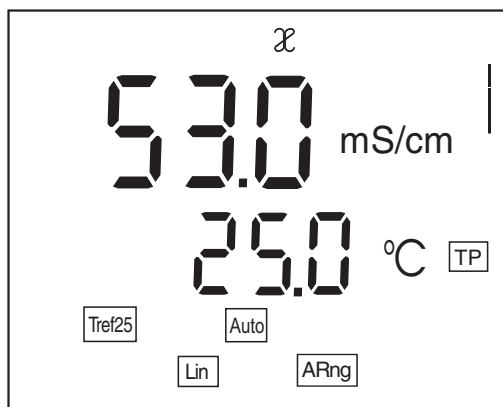
- 1 Freeze the current measured value with **<HOLD>** (Hold function).
An S is displayed in front of the current measured value as long as the Hold function is active.



- 2 To terminate the Hold function: press the **<MODE>** or **<HOLD>** key. The S in front of the measured value is no longer displayed.

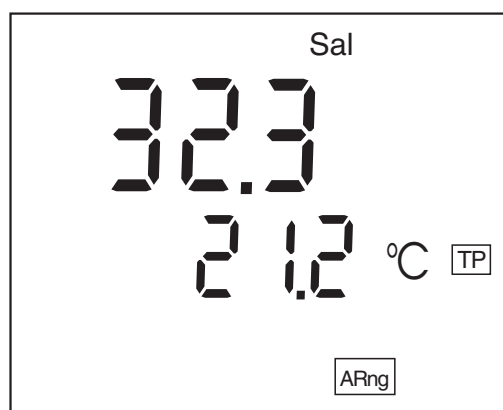
5.5.2 Measuring the conductivity

- 1 Perform the preparatory activities according to section 5.5.
- 2 Immerse the conductivity measuring cell in the test sample.
- 3 If necessary, call up the measured parameter ∞ with **<MODE>** and **<▲__><▼__>**.
- 4 Wait for a stable measured value.
The [Auto] display indicator flashes as long as the measured value is not yet stable.



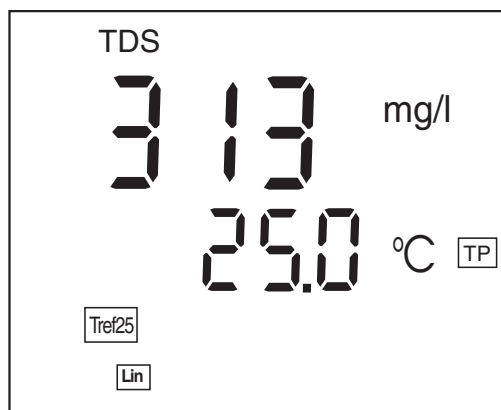
5.5.3 Measuring the salinity

- | | |
|---|--|
| 1 | Perform the preparatory activities according to section 5.5. |
| 2 | Immerse the conductivity measuring cell in the test sample. |
| 3 | If necessary, call up the measured parameter Sal with <MODE> and <▲><▼>. |
| 4 | Wait for a stable measured value.
The [Auto] display indicator flashes as long as the measured value is not yet stable. |



5.5.4 Measuring the total dissolved solids (TDS)

1	Perform the preparatory activities according to section 5.5.
2	Immerse the conductivity measuring cell in the test sample.
3	If necessary, call up the measured parameter TDS with <MODE> and <▲_><▼_>.
4	Wait for a stable measured value.

**Note**

The TDS factor is 1.00.

A linear temperature coefficient is used for measurement.

5.6 Conductivity: Determining the cell constant [C]

Why determine the cell constant?

Due to aging, the cell constant slightly changes. As a result, an inexact measured value is displayed. Calibration determines the current value of the cell constant and stores this value in the meter. Thus, you should calibrate at regular intervals.

In the range $0.800 \dots 0.880 \text{ cm}^{-1}$ you can determine the cell constant of the conductivity measuring cell by calibrating in the control standard 0.01 mol/l KCl .

Calibration interval (Int.C)

After the specified calibration interval has expired, the symbol for the calibration evaluation flashes, reminding you to calibrate the measuring cell. It is still possible to measure.

The calibration interval (Int.C) is set to 180 days (d180) in the factory. You can change the interval (see section 5.9.2).



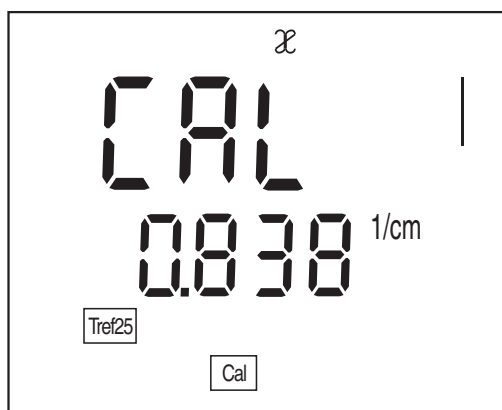
Note

To maintain the high measurement accuracy of the measuring system, clean the measuring cell and recalibrate after the calibration interval has expired.

5.6.1 Determining the cell constant (calibration)

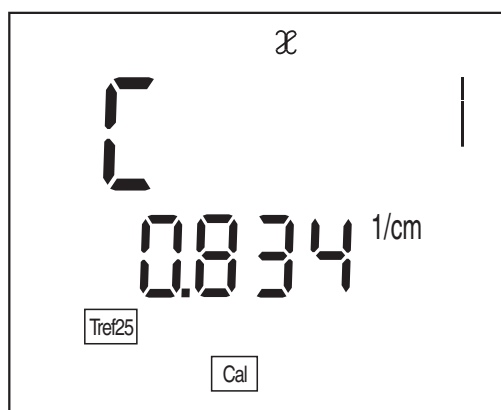
Determining the cell constant (calibration in control standard)

- 1 Press <CAL> to display the last calibrated cell constant.



- 2 Immerse the measuring cell in the control standard solution, 0.01 mol/l KCl .

- 3 Start the calibration with **<OK>**.
 The determination of the cell constant with stability control starts. The [Auto] display flashes until a stable signal is available.
 The cell constant determined is displayed. The meter automatically stores the cell constant.



- 4 Switch to the measuring mode with **<OK>**.
 The determined cell constant is used.



Stability control

Note

If the error message *E3* appears, refer to chapter 7 WHAT TO DO IF...

During calibration, the stability control is automatically activated.




Note

This method of automatically determining the cell constant by calibration in the 0.01 mol/l KCL control standard solution can only be used for measuring cells with cell constants in the range 0.800 ... 0.880 cm⁻¹.

Calibration evaluation

After calibration, the meter automatically evaluates the current status. The evaluation appears on the display.

Display	Cell constant [cm^{-1}]
 You are working with a correctly calibrated measuring cell.	in the range $0.800 \dots 0.880 \text{ cm}^{-1}$
$E3$ Eliminate the error according to chapter 7 WHAT TO DO IF...	Outside the range $0.800 \dots 0.880 \text{ cm}^{-1}$

Displaying calibration data

You can display the calibration data.

- 1 Press **<CAL__>** to display the calibration data. The calibrated cell constant is displayed.

5.7 Storage in memory

The meter has an internal data memory. It can store up to 500 datasets.

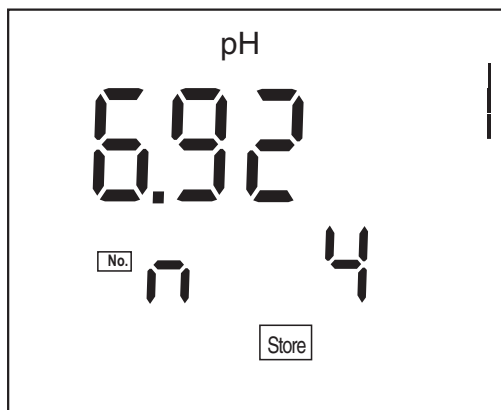
A complete dataset consists of:

- Date/time
- Memory location
- ID number
- Measured value
- Temperature
- Temperature measuring procedure (manual or automatic)

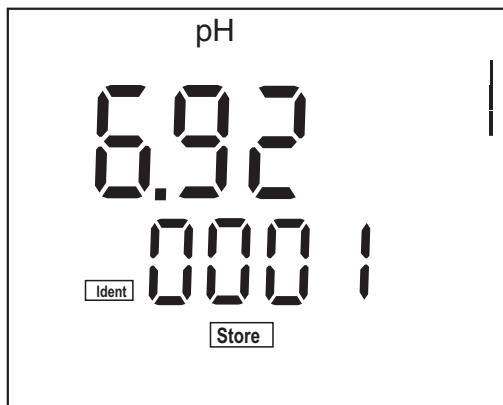
5.7.1 Storing measurement data

You can transmit a measured value to the data memory as follows:

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



- 2 Confirm with **<OK>**.
The display switches to the entry of the ID number.



- 3 Using **<▲>****<▼>**, enter the required ID number (1 ... 9999).
- 4 Confirm with **<OK>**.
The dataset is stored.
The meter switches to the measuring mode.

Message *StoFull*

This message appears when all of the 500 memory locations are occupied.

When the memory is full, you can:

- press **<OK>** to store the current measured value.
The oldest measured value (memory location 1) will be overwritten by this
- press **<MODE>** to switch to the measured value display without storing
- download the data memory (see section 5.7.2)
- clear the memory (see section 5.7.3).

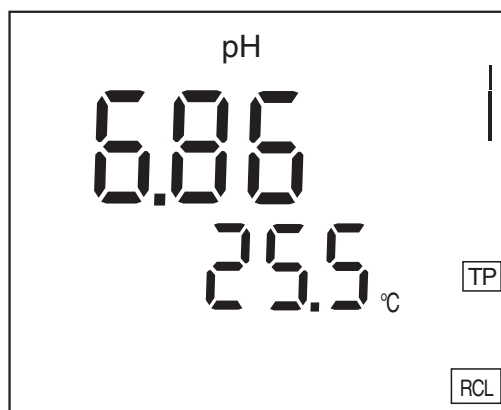
5.7.2 Downloading the data memory

You can download stored measurement datasets:

- to the display
- to the interface (see section 5.8.1)

Download to the display

1	Open the storage menu with <RCL>.
2	If necessary, scroll with <RCL> until <i>Sto disp</i> (measurement datasets) is displayed.
3	Press <OK> to display the dataset that was last stored. The memory location of the dataset is displayed for approx. 2 s, then the respective temperature appears.



While the memory is displayed you can:

- press <MODE__> to toggle between pH/U and Σ /Sal/TDS
- press <OK> to display further data of the dataset (ID number, date (day, month), time, temperature, memory location)
- press <▲> to display the next dataset
- press <▼> to display the previous dataset



Note

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

1	Use <OK> to scroll on until the required data, e. g. the date, is displayed.
2	Use <▲> or <▼> to scroll until the required date is displayed.

5.7.3 Erasing the data memory

You can erase all stored measurement datasets.

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

5.7.4 Downloading calibration data

You can download calibration data:

- to the display
 - via the memory menu
 - via the calibration menu
- to the interface (see section 5.8.1)

Download to display via memory menu

1	Open the storage menu with <RCL> .
2	If necessary, scroll with <RCL> until <i>CAL diSP</i> is displayed.
3	Press <OK> to display the calibration data.

While the calibration data is displayed you can:

- press **<OK>** to display further calibration data (zero point (ASY), slope (SLO))
- press **<CAL__>** to download the calibration record to the interface

5.8 Transmitting data

The meter has a USB-B interface (device).

Via this interface you can transmit data to a PC and update the meter software.



Note

The respective interface cable has to be connected if you want to download data to the USB interface.

In addition, the driver for the USB interface must be installed on the PC from the enclosed CD-ROM (see section 5.8.4).

Terminal program

In general, a terminal program is used to establish a connection from a data interface to a device and to communicate with the device via a display console. Normally a terminal program provides the option to store in a test file or print the contents of the console.

Terminal programs are available from different manufacturers for different operating system. Windows (versions 95 to XP) includes the terminal program, "HyperTerminal". It is in the program menu under Accessories.

More detailed information is given in the user information of the terminal program.



Caution

The interface is not galvanically isolated.

When a grounded PC is connected, measurements cannot be performed in grounded media as incorrect values would result.

5.8.1 Options for data transmission

Via the USB interface you can transmit data to a PC.

The following table shows which data are transmitted to the interface in which way:

Data	Control	Operation / description
Current measured values	Manual	<ul style="list-style-type: none"> ● With <OK>. ● Simultaneously with every manual storage process (see section 5.7.1).
Stored measured values	Manual	<ul style="list-style-type: none"> ● All datasets (see section 5.8.2)
Calibration records	Manual	<ul style="list-style-type: none"> ● Without display indication (see section 5.8.3). ● During the display indication with <CAL__> (see section 5.7.4).
	Automatic	<ul style="list-style-type: none"> ● At the end of a calibration procedure.

5.8.2 Downloading stored measurement datasets

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

5.8.3 Downloading calibration data

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

5.8.4 USB interface (device)

Connect the interface to the PC via a USB cable.



Warning

The USB interface is not galvanically isolated.

When a grounded PC is connected, measurements cannot be performed in grounded media as incorrect values would result.

Installation of the USB driver on the PC

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

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

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 PC 5000 L to the PC via the USB interface. The meter is listed as a virtual COM interface among the connections in the Windows instrument manager.

5.9 Settings

You can adapt the meter to your individual requirements. The settings are done in the following menus:

- System settings (<OK__>)
 - Display illumination (*LEd*)
 - Baud rate (*Baud*)
 - Switch-off interval (*t.Of*)
 - Date (*Day.Month*)
 - Date (Year)
 - Time (*Time*)
- Measurement settings (<MODE__>)
 - Buffer set for pH calibration (*CAL TEC1, TEC2 / CAL NIST*)
 - Display of the buffer during calibration
(nominal pH value [*pH*] or measured voltage value in mV [*U*])
 - Temperature compensation (*tc lin / tc no*)
 - Temperature unit (*°C / °F*)
 - pH calibration interval (*Int.C [0 ... 999]*)
 - Conductivity calibration interval (*Int.C [0 ... 999]*)



Note

You can exit the setting menu at any time by pressing <MODE>. Settings already modified and confirmed with <OK> are stored.

5.9.1 System settings

The default setting is printed in bold.

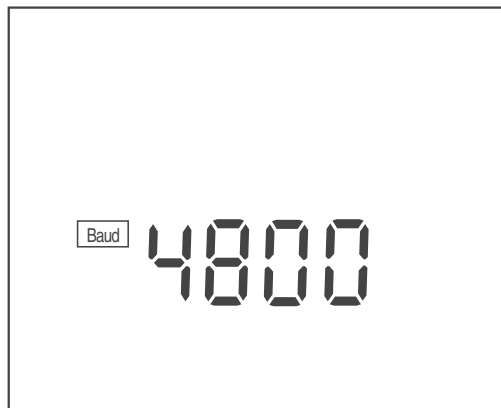
Display illumination (<i>LEd</i>)	Auto , On, Off
Baud rate (<i>Baud</i>)	1200, 2400, 4800 , 9600
Switch-off interval (<i>t.Off</i>)	10, 20, 30, 40, 50 min, 1 , 2, 3, 4, 5, 10, 15, 20, 24 h
Date (<i>Day.Month</i>)	Any
Date (Year)	Any
Time (<i>Time</i>)	Any

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

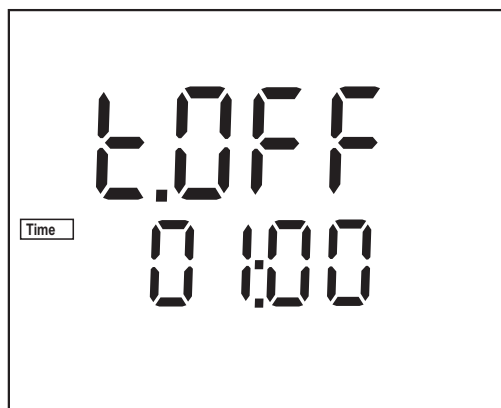
Display illumination (*LEd*)



- 2 Set the display illumination with <▲><▼> .
- 3 Confirm with <OK>. *Baud*, the setting of the baud rate is displayed.

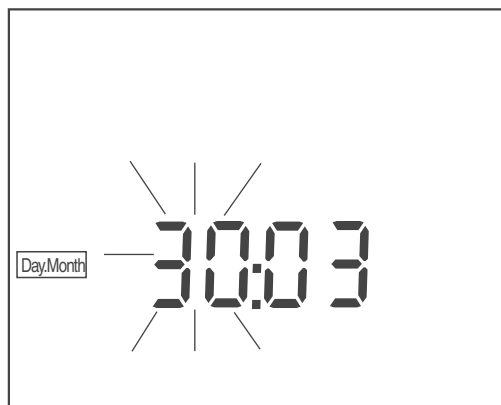
Baud rate (*Baud*)

- | | |
|---|---|
| 4 | Set the required baud rate with <▲><▼> . |
| 5 | Confirm with <OK>.
<i>t.OFF</i> , the setting of the switch-off interval is displayed. |

Switch-off interval (*t.Off*)

- | | |
|---|--|
| 6 | Set the switch-off interval with <▲><▼>. |
| 7 | Confirm with <OK>.
<i>Day.Month</i> , the setting of the date is displayed.
The day display flashes. |

Date and time



8	Set the date of the current day with $\langle \blacktriangle \rangle \langle \blacktriangledown \rangle$.
9	Confirm with $\langle \mathbf{OK} \rangle$. The month display flashes.
10	Set the current month with $\langle \blacktriangle \rangle \langle \blacktriangledown \rangle$.
11	Confirm with $\langle \mathbf{OK} \rangle$. Year, the setting of the year is displayed.
12	Set the year with $\langle \blacktriangle \rangle \langle \blacktriangledown \rangle$.
13	Confirm with $\langle \mathbf{OK} \rangle$. The setting of the time is displayed. The hour display flashes.
14	Set the current hour with $\langle \blacktriangle \rangle \langle \blacktriangledown \rangle$.
15	Confirm with $\langle \mathbf{OK} \rangle$. The minute display flashes.
16	Set the current minute with $\langle \blacktriangle \rangle \langle \blacktriangledown \rangle$.
17	Confirm with $\langle \mathbf{OK} \rangle$. The system settings are completed. The meter switches to the measuring mode.

5.9.2 Measurement settings

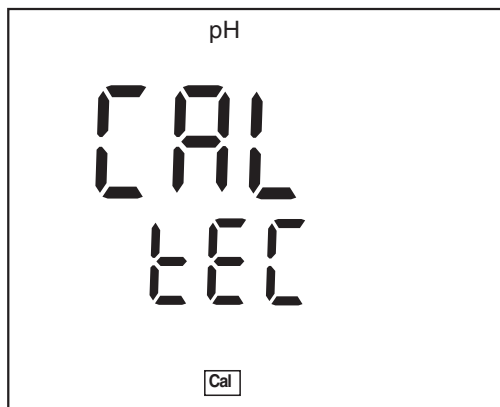
These settings apply to calibration and measurement (the default setting is printed in bold).

pH: Buffer set for pH calibration (<i>pH CAL</i>)	<i>CAL TEC1</i> (Technical buffers VWR) <i>CAL TEC2</i> (Technical buffers) <i>CAL NIST</i> (NIST buffers)
pH: Display during pH calibration (<i>pH BUF</i>)	<i>pH</i> (nominal buffer value), <i>U</i> (electrode voltage)
Conductivity Temperature compensation (<i>TC</i>)	Lin* , no
Conductivity Temperature unit (<i>Uni</i>)	° C , °F
pH: Calibration interval (<i>Int.C</i>)	0 ... 7 ... 999 <i>d</i>
Conductivity Calibration interval (<i>Int.C</i>)	0 ... 180 ... 999 <i>d</i>

- * The calculation of the linear temperature compensation is based on the permanently set reference temperature, Tref25. The coefficient of the linear temperature compensation is 2.11 %/K.

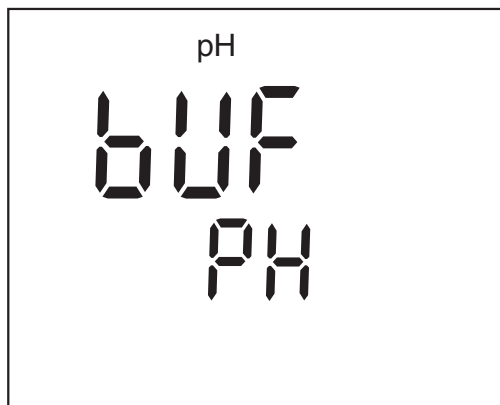
- 1 Using **<MODE__>**, open the menu for measurement and calibration settings.
The first setting is displayed.

**Calibration buffer set for
pH calibration
(CAL)**



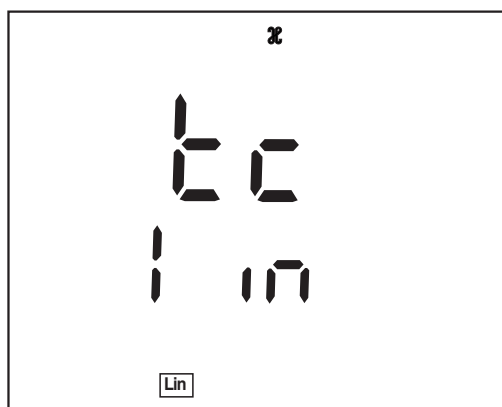
- 2 Select the buffer set for pH calibration (*CAL TEC1, TEC2/ CAL NIST*) with **<▲><▼>**.
- 3 Confirm with **<OK>**.
BUF, the setting of the display during pH calibration is displayed.

**Display during
calibration
(BUF)**



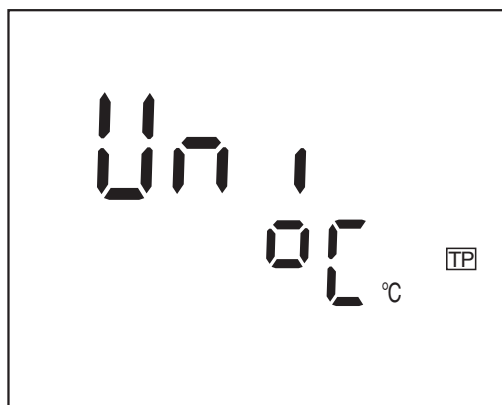
- 4 Using **<▲><▼>**, select the *pH* or *U* display during calibration.
- 5 Confirm with **<OK>**.
tc, the setting of the temperature compensation is displayed.

Temperature compensation



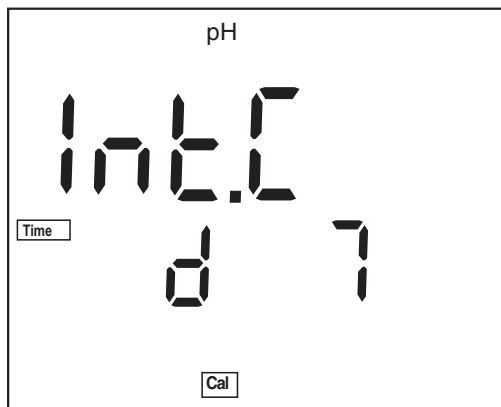
- | | |
|---|--|
| 6 | Using <▲><▼>, select the temperature compensation <i>Lin</i> or <i>no</i> . |
| 7 | Confirm with <OK>. <i>Uni</i> , the setting of the unit of the temperature value is displayed. |

Temperature unit (*Uni*)



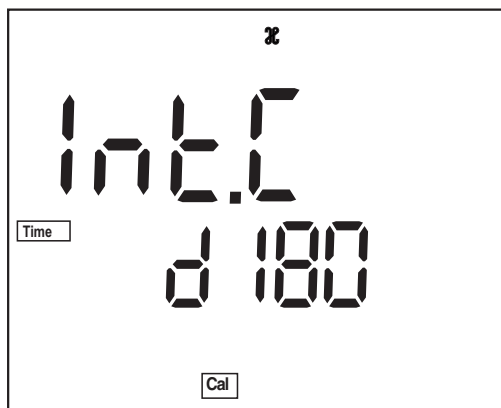
- | | |
|---|---|
| 8 | Using <▲><▼>, toggle between °C and °F. |
| 9 | Confirm with <OK>. <i>Int.C</i> , the setting of the calibration interval for pH measurements is displayed. |

pH calibration interval (Int.C)



- 10 Set the interval with <▲><▼>.
- 11 Confirm with <OK>. *Int.C*, the setting of the calibration interval for conductivity measurements is displayed.

Conductivity calibration interval (Int.C)



- 12 Set the interval with <▲><▼>.
- 13 Confirm with <OK>. The measurement settings are completed. The meter switches to the measuring mode.

5.10 Reset

5.10.1 Resetting calibration values

This function resets the calibration values to the default condition. All other meter settings are retained.

Calibration values in the default condition

Zero point	pH 7.000
Slope	100 %
Cell constant	0.840 cm ⁻¹

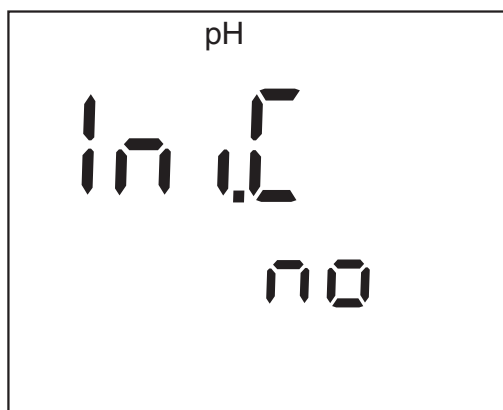


Note

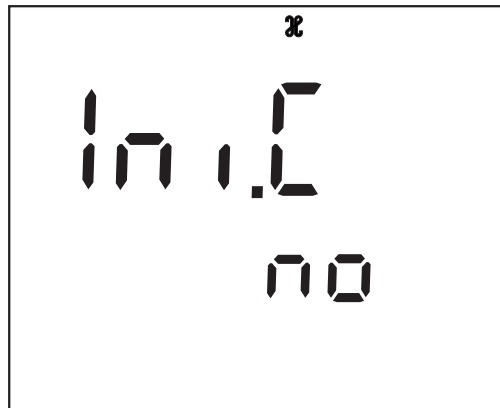
The measuring system is not calibrated after a reset. Before measuring, recalibrate the meter.

- 1 Press <ON/OFF__> to open the menu for the reset of the calibration data.
pH Ini.C no is displayed.

Resetting calibration values (pH)



- 2 Press <▲><▼> to display *no* or *YES*.
YES: Reset the calibration values.
no: Retain the calibration values.
- 3 Confirm with <OK>.
⌘ Ini.C no is displayed.

**Resetting calibration
values (conductivity)**

- | | |
|---|---|
| 4 | Press <▲><▼> to display <i>no</i> or <i>YES</i> .
<i>YES</i> : Reset the meter settings.
<i>no</i> : Retain the meter settings. |
| 5 | Confirm with <OK>.
The menu is finished.
The meter switches to the measuring mode. |

**Note**

The measuring system is not calibrated after a reset. Before measuring, recalibrate the meter.

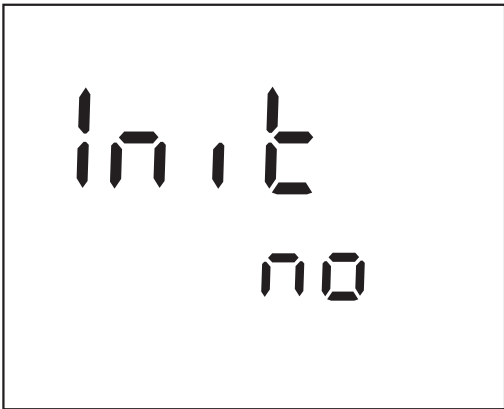
5.10.2 Resetting all meter settings

This function resets to the default condition all meter settings (system settings and calibration values).

The values and the default condition are given in the following sections:

System settings	section 5.9.1
Measurement settings	section 5.9.2

Resetting the meter settings

1	Switch on the meter with <ON/OFF> . The display test appears briefly on the display.
2	During the display test, press <MODE> to open the menu for the reset of the meter settings. <i>Init no</i> is displayed.
	
3	Press <▲><▼> to display <i>no</i> or <i>YES</i> . <i>YES</i> : Reset the meter settings. <i>no</i> : Retain the meter settings.
4	Confirm with <OK> . The menu is finished. The meter switches to the measuring mode.

6 Maintenance, cleaning, disposal, accessories

6.1 Maintenance

The only maintenance activity required is replacing the batteries.

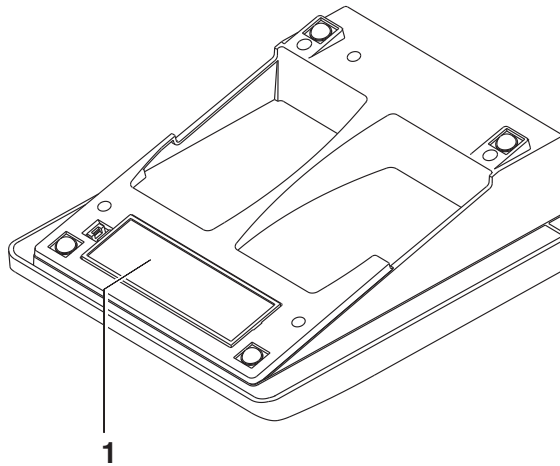


Note

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

6.1.1 Replacing the batteries

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



- | | |
|---|--|
| 2 | Remove the four batteries from the battery compartment. |
| 3 | Place four new batteries (type Mignon AA) in the battery compartment. |
| 4 | Close the battery compartment (1).
The date (day) flashes on the display. |
| 5 | Set the date and time according to section 5.9.1. |



Caution

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

Only use leakproof alkaline manganese batteries.

**Note**

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

6.2 Cleaning

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

**Caution**

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

6.3 Packing

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

6.4 Disposal

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

Instead it is 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 is also your responsibility to decontaminate the equipment in case of biological, chemical and/or radiological contamination, so as to protect from health hazards the persons involved in the disposal and recycling of the equipment.

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

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

Thank you.

6.5 Accessories

6.5.1 General information

Accessories	Order no.
SURVIVAL KIT PHENOMENAL	662-1166
Storage tube	662-1167
COMMUNICATION KIT (CD-ROM, USB cable, Manual)	662-1225
Articulated stand for 4 electrodes and temperature sensor	662-1169
Storage vessel	662-1248

6.5.2 pH / ORP

Electrodes (pH)	Order no.
pHenomenal 110 PH ELECTRODE PHENOMENAL GEL EPOXY BNC	662-1156
pHenomenal 111 PH ELECTRODE PHENOMENAL 3IN1 GEL 1M BNC	662-1157
pHenomenal 111-3 PH ELECTRODE PHENOMENAL 3IN1 GEL 3M BNC	662-1158
pHenomenal 220 PH ELECTRODE PHENOMENAL NACHF. GLAS BNC	662-1159
pHenomenal 221 PH ELECTRODE PHENOMENAL 3IN1 GLAS 1M	662-1161
pHenomenal 221-3 PH ELECTRODE PHENOMENAL 3IN1 GLAS 3M	662-1162
pHenomenal MIC 220 PH ELECTRODE PHENOMENAL MICRO NACHF.BNC	662-1163
pHenomenal SPEAR 220 PH ELECTRODE PHENOMENAL KOMB. SPEER TYP	662-1164

Electrodes (ORP)	Order no.
pHenomenal ORP 220 REDOX ELECTRODE PHENOMENAL KOMB. 1M BNC	662-1165
Solutions	
Buffer pH 4 AVS TITRINORM, 100 ml	32095.184
Buffer pH 7 AVS TITRINORM, 100 ml	32096.187
Buffer pH 10 AVS TITRINORM, 100 ml	32040.185
Buffer NIST pH 4.01, 30 x 30 ml	1.99001.0001
Buffer NIST pH 7, 30 x 30 ml	1.99002.0001
Buffer NIST pH 10, 30 x 30 ml	1.99004.0001
Storing solution (3 Mol/l KCl), 100 ml	83605.180
Cleaning solution Pepsine/Hydrochloric acid, 100 ml	83603.180

6.5.3 Conductivity

Measuring cells	Order no.
pHenomenal CO 11 CONDUCTIVITY SENSOR PHENOMENAL 1,5M 8PIN	663-0147
Solutions	
KCl 0.01 mol/L: 1.413 mS/cm, 100 mL	83607.180
KCl 0.01 mol/L: 1.413 mS/cm, 500 mL	83607.290
KCl 0.1 mol/L: 12.8 mS/cm, 500 mL	83608.260

7 What to do if...

7.1 General information

Symbol for calibration evaluation flashes	Cause – Calibration interval expired	Remedy – Recalibrate the measuring system
Display, LoBat	Cause – Batteries almost empty	Remedy – Replace the batteries (see section 6.1 MAINTENANCE)
Meter does not react to keystroke	Cause – Operating condition undefined or EMC load unallowed	Remedy – Processor reset: Press the <OK> and <ON/OFF> key simultaneously.
You want to know which software version is in the meter	Cause – E. g., a question by the service department	Remedy – Switch on the meter. During the display test, display the software version with <OK>.

7.2 pH

Error message OFL, UFL

Cause	Remedy
pH electrode:	
– Measured value outside the measuring range	– Use suitable electrode
– Air bubble in front of the diaphragm	– Remove air bubble
– Air in the diaphragm	– Extract air or moisten diaphragm
– Cable broken	– Replace electrode
– Gel electrolyte dried out	– Replace electrode

Error message, E3

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

No stable measured value

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

Obviously incorrect measured values

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

7.3 Conductivity

Error message *OFL, UFL*

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

Error message, *E3*

Cause	Remedy
– The cell constant is outside of the allowed limits	– Recalibrate – Replace measuring cell
– Measuring cell broken	– Replace measuring cell
– Calibration standard unsuitable	– Use suitable, clean calibration standard (0.01 mol/l KCl)

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9 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.

10 Warranty

VWR International warrants that this product will be free from defects in material and workmanship for a period of two (2) years from date of purchase. If a defect is present, VWR will, at its option, repair, replace, or refund the purchase price of this product at no charge to you, 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.

For your protection, items being returned must be insured against possible damage or loss. This warranty shall be limited to the replacement of defective products. IT IS EXPRESSLY AGREED THAT THIS WARRANTY WILL BE IN LIEU OF ALL WARRANTIES OF FITNESS AND IN LIEU OF THE WARRANTY OF MERCHANTABILITY.



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