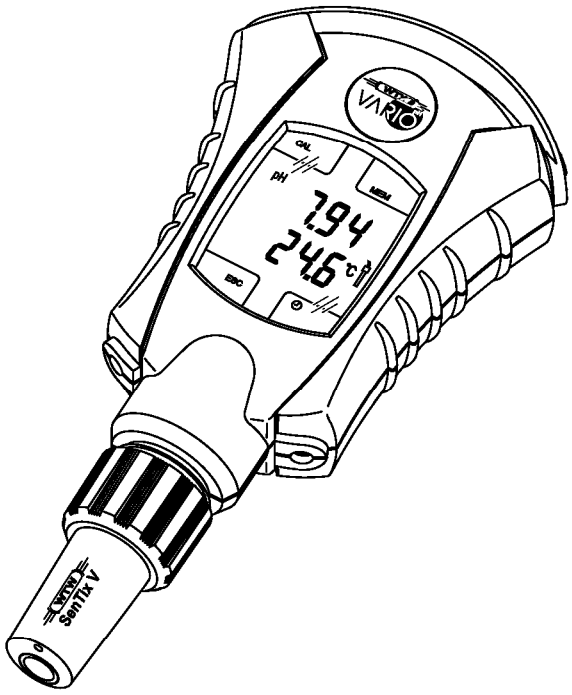
Operating manual

VARIO pH



Hand-held pH meter

ba75373e04 07/2006

Accuracy when going to press

The use of advanced technology and the high quality standard of our instruments are the result of continuous development. This may result in differences between this operating manual and your instrument. Also, we cannot guarantee that there are absolutely no errors in this manual. Therefore, we are sure you will understand that we cannot accept any legal claims resulting from the data, figures or descriptions.

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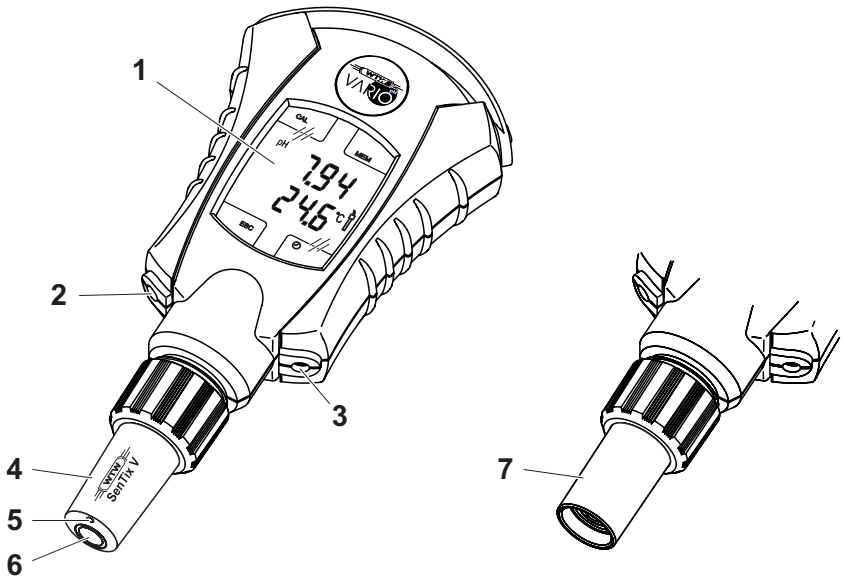
1 Overview

The hand-held VARIO pH meter enables you to measure the pH value of a solution very simply. All functions and settings are operated via the touch screen.



1	Display (touch screen)
2	Connector (red) for a temperature sensor when using an electrode with an integrated temperature sensor on the adapter
3	Connector (blue) for a temperature sensor when using an electrode with an external temperature sensor on the adapter
4	Short pH electrode
5	Junction
6	Membrane
7	Adapter for electrodes with DIN or S7 connector

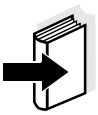
Sensor types

Short pH electrodes and electrodes with DIN or S7 connector can be connected to the meter.

Short pH electrodes are directly connected to the sensor connector of the VARIO pH. The temperature sensor and reference electrode are integrated in the short pH electrode.

Electrodes with DIN or S7 connector are connected to the VARIO pH via an adapter. The use of an external temperature probe (NTC 30) is possible.

Note
Certain sensors enhance the scope of functions of the VARIO pH.
More detailed information on the presently available sensors and their individual features can be found in chapter 7 TECHNICAL DATA.



Note
You will find additional information on electrodes and other accessories in the WTW catalog or on the Internet (http://www.wtw.com).

2 Safety

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

User qualification

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.

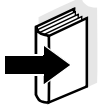
Safety instructions

The individual chapters of this operating manual use safety instructions such as the label shown below to indicate various hazards or dangers:

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

Further notes

Note
indicates notes that draw your attention to special features.



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

2.1 Authorized use

The authorized use of the meter consists exclusively of the pH and ORP measurement.
The technical specifications as given in chapter 7 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 to be **unauthorized**.

2.2 General safety instructions

This instrument is built and inspected according to the relevant guidelines and norms for electronic measuring instruments (see chapter 7 TECHNICAL DATA).
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 7 TECHNICAL DATA.

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

Safe operation

If safe operation is no longer possible, the instrument 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 instrument.

Obligations of the purchaser

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

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

3 Commissioning

3.1 Scope of delivery

VARIO pH single meter

- VARIO pH hand-held meter
- WTW Technical buffers
  - pH 4.01
  - pH 7.00
- Microfiber cleaning cloth
- Accompanying documents:
  - Manual for commissioning
  - Short instructions to be glued into the lid of the case
  - CD-ROM with a description of all instrument functions
- Transport case with insert

VARIO pH sets

Depending on the set, the following accessories are additionally contained in the scope of delivery:

Accessories	Set 1	Set 2	Set 3	Set 4	Set 5
Short pH electrode SenTix V and watering cap	x				
DIN adapter ADA/VARIO-DIN		x	x	x	x
S7 adapter ADA/VARIO-S7				x	x
SenTix 21 electrode		x			
SenTix 41 electrode			x		
SenTix 20 electrode				x	
SenTix 60 electrode					x

3.2 Initial commissioning

Perform the following activities:

- Connect the electrode to the meter (see section 3.3 and section 3.4)
- If necessary, connect the temperature sensor (see section 3.4)
- Switch on the meter (see section 4.2)
- Set the date and time (see section 4.6.1)
- Calibrate the meter together with the electrode (see section 4.4)

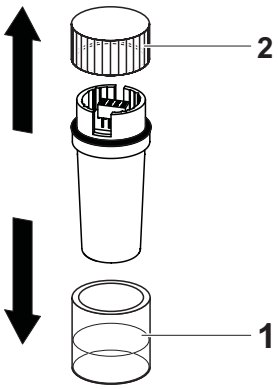
3.3 Connecting the short pH electrode

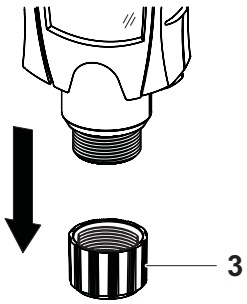
Connect a short pH electrode to the meter as follows:

1	New short pH electrode: Remove the transport cap (1) filled with liquid (potassium chloride solution) from the short pH electrode and dispose of it.

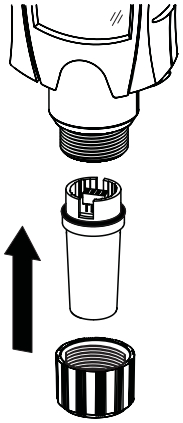
Caution

Never reuse the transport cap.The membrane of the short pH electrode could be damaged when putting on the transport cap again.

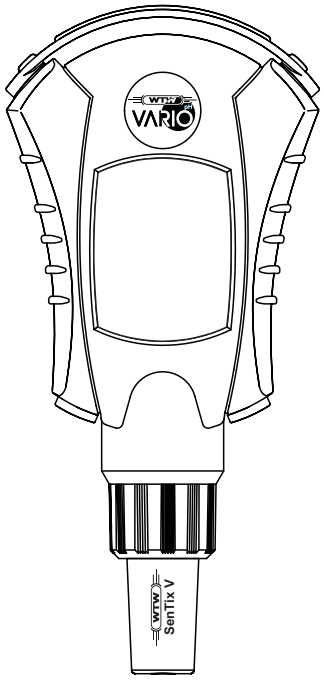




2	Pull off the protective cap (2) from the short pH electrode.
3	Unscrew the coupling ring (3) from the meter.



4	Place the short pH electrode in a straight position to the meter (turn the wide cut-out to the front) and plug it in carefully with slight force.
5	Screw the short pH electrode tight using the coupling ring. The meter is ready for operation.



If you do not wish to measure immediately, put the watering cap on the short pH electrode (see section 5.4).

3.4 Connecting an electrode

The adapters make the meter compatible with commercial electrodes. You can turn the display by 180 degrees if necessary (see section 4.8).

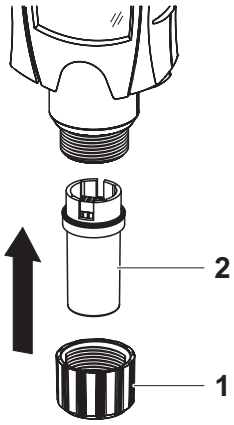
You can connect electrodes with an integrated temperature sensor (see section 3.4.1) and electrodes without a temperature sensor (see section 3.4.2).

With an electrode without integrated temperature sensor, you can additionally connect an external NTC 30 temperature probe.

3.4.1 Electrode with integrated temperature sensor

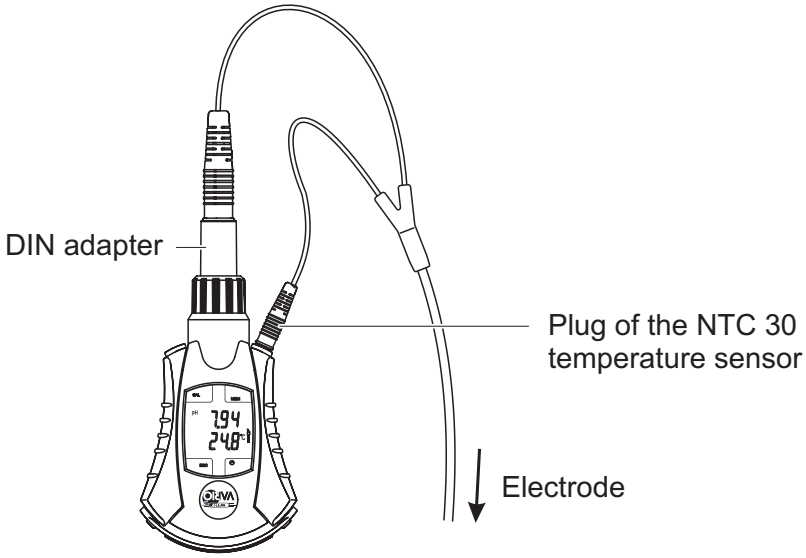
Connect an electrode with integrated temperature sensor to the VARIO pH as follows:

1	Unscrew the coupling ring (1) from the meter.
2	Place the adapter (2) in a straight position to the meter (turn the wide cut-out to the front) and plug it in carefully with slight force.



3	Using the coupling ring, tighten the adapter.
4	Connect the DIN plug of the electrode to the adapter.
5	Connect the banana plug of the electrode (temperature sensor) to the red lateral socket on the VARIO pH.

VARIO pH with connected electrode

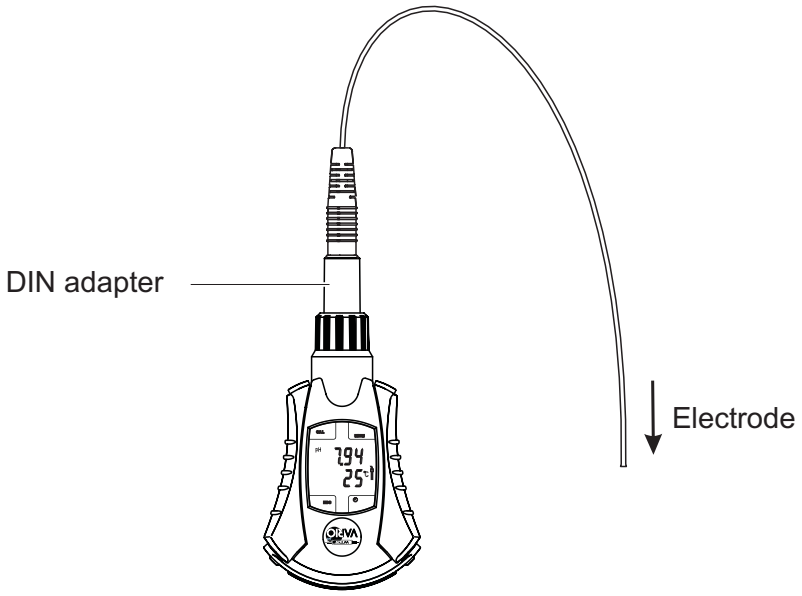


3.4.2 Electrode without temperature sensor

Connect an electrode without an integrated temperature sensor to the VARIO pH as follows:

1	Connect the adapter to the meter (see section 3.4.1).
2	Connect the plug of the electrode to the adapter.
3	If necessary, connect the two banana plugs of the external temperature probe to the lateral sockets on the VARIO pH. The polarity is arbitrary.

VARIO pH with connected electrode



Note
When using an electrode without temperature sensor it is possible to connect an external temperature probe (see section 3.4.4).

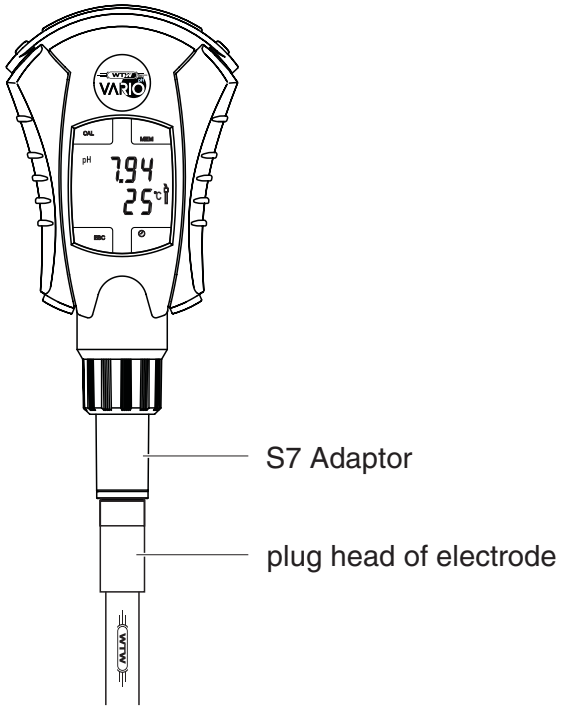
3.4.3 Electrode with S7 connector

Electrodes with a plug head connector can be connected directly to the S7 adapter or, via a cable, to the DIN adapter of the VARIO pH.

Direct connection

Connect the electrode directly as follows:

1	Connect the plug head adapter to the meter (see section 3.4.1).
2	Plug the electrode directly on the plug-in adapter.



Connection with cable

Depending on the electrode used, it is connected to the VARIO pH via a cable as described in section 3.4.1 or section 3.4.2.

Note
When using an electrode without temperature sensor it is possible to connect an external temperature probe (see section 3.4.4).

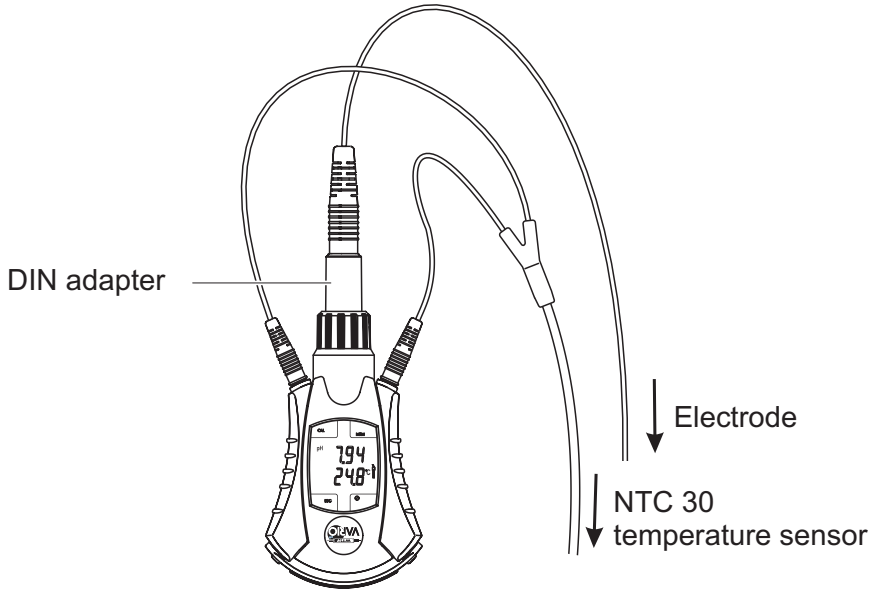
3.4.4 Connecting an external temperature probe

When using an electrode without temperature sensor it is possible to connect an external temperature probe.

Connect an external temperature probe as follows:

3	Connect the two banana plugs of the external temperature probe to the lateral sockets on the VARIO pH. The polarity is arbitrary.

VARIO pH with connected electrode and temperature probe

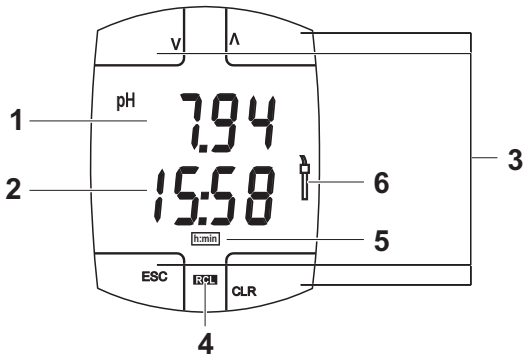


4 Operation

4.1 Operating elements

The entire operation is carried out via the touch sensitive surface of the display (touch screen). A slight pressure on the surface suffices to start a function. Any pressure on the surface is confirmed by an acoustic signal.

Display elements



1	Upper display line - example: stored pH measured value
2	Lower display line - example: storing time
3	Function keys
4	Status display indicators on the current function of the meter: Example: RCL = Read out memory
5	Additional information Example: h:min = Unit of the display in the second line
6	Sensor symbol

Touch screen

The touch screen contains 8 touch sensitive tactile areas that start different functions when being pressed, depending on the operating situation.
The function of the keys is connected to the display in this area.

Touch screen operation

In this operating manual, keys are indicated by angle brackets **<..>**.
The touch screen symbol (example <>) shows you which area you have to press. Function keys are indicated by the relevant name or symbol.
The keys can have different functions with a long and short keystroke.
In this operating manual, the key symbol (e.g. **< ESC >**) generally means a short keystroke (shorter than 1 sec). A long keystroke (approx. 1 sec) is indicated by a line after the key symbol (e.g. **< ESC ▬>**).

Operating examples:

Symbol	Meaning
<>	Press any spot on the display shortly. (Example: Switch on the meter)
<▬>	Press any key in the upper display line for a longer time (approx. 1 sec). (Example: Toggle the measured value display between pH and mV display)
< CAL >	Press "CAL" shortly.
<🕘>	Press the "Clock symbol" shortly.
< ESC ▬>	Press "ESC" for a longer time (approx. 1 sec). (Example: Switch off the meter)
<Λ> or **<V>**	Press **<Λ>** or **<V>** shortly. Increment or decrement the displayed value by 1.
<Λ▬> or **<V▬>**	Long pressure (approx. 1 sec) on **<Λ>** or **<V>**. Increment or decrement the displayed value continuously.

Note
Any keystroke is confirmed by an acoustic signal.
With a short keystroke you hear a short sound, with a long keystroke you hear a longer sound.

4.2 Switching on the meter

1	Switch on the meter with <>. After a short display test, a measured value is displayed. If no short pH electrode or adapter is connected, the error message, *Err4* appears on the display (see chapter 6 WHAT TO DO IF...).

Note
The meter has an energy saving feature to avoid unnecessary battery depletion. The energy saving feature switches the meter off if no entry is made during the specified switch-off interval (see section 4.7).

4.3 Measuring

4.3.1 General information

Depth of immersion of a short pH electrode

The flat electrode of the short pH electrode enables pH measurements on surfaces, as for example skin, paper, etc.

For measurement in a measuring solution we recommend a minimum immersion depth of approx. 2 mm for optimum and reproducible measurement results.
The maximum immersion depth of the short pH electrode in a measuring solution is up to below the coupling ring. If it is submersed deeper, liquid can penetrate the meter and damage it.

Depth of immersion of electrodes

Instructions on the depth of immersion of electrodes that are run on the VARIO pH via the adapter can be found in the documentation of your electrode.

AutoRead (drift control)

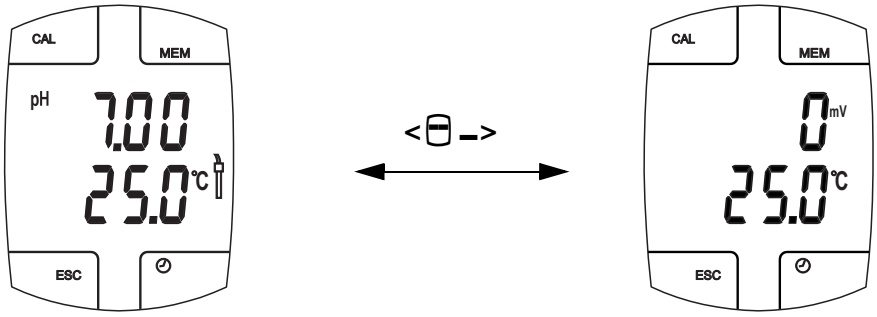
The AutoRead function (drift control) checks the stability of the measurement signal. The stability has a considerable impact on the reproducibility of measured values. The AutoRead function is automatically active. The unit of the measured value flashes on the display as long as the stability criterion is not met. A stable measured value is achieved when the unit of the measured parameter no longer flashes.

With identical measurement conditions, the following criterion is valid for the AutoRead function:

Measured parameter	Reproducibility	Response time
pH	better than 0.02	> 30 seconds

4.3.2 Measuring the pH value

1	Make sure the measuring system has a valid calibration (see section 4.4).
2	Immerse the electrode in the test sample. The display shows the main measured value (pH or mV) and temperature value. When operating an electrode without temperature sensor on the adapter, the manually entered temperature value is displayed (see section 4.3.3). The unit of the measured value display flashes (AutoRead) as long as the measured value is not stable.



3	If necessary, switch the display between pH and mV with <> [<Measured value>].
4	Wait for a stable measured value. As soon as the measured value is stable, the unit of the measured parameter (pH or mV) no longer flashes.

4.3.3 Measuring the temperature

For reproducible pH measurements, it is essential to measure the temperature of the measuring solution.
You have the following possibilities of measuring the temperature:

- Automatic measurement of the temperature by a temperature sensor integrated in the sensor module or electrode. All short pH electrodes contain a temperature sensor.
- An NTC30 external temperature probe (accessory) measures the temperature automatically (see section 3.4.2). This method is possible with electrodes without an integrated temperature sensor. When measuring with a short pH electrode no external temperature probe may be connected.
- Measuring and entering the temperature manually.

Note
The meter automatically recognizes a temperature sensor. The display accuracy of the temperature indicates whether or not a temperature sensor is connected:

Display accuracy of the temperature (°C or °F)	Temperature sensor connected?
0,1	yes
1	No

Changing the temperature unit

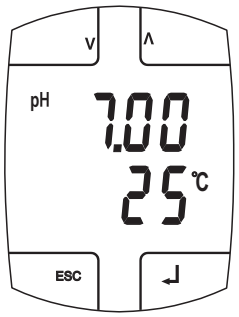
You can switch the temperature display from °C to °F:

1	Toggle the display between °C and °F with <⊖ ▬> [<Temperature>].

Manual temperature input

If you have connected an electrode without temperature sensor to the adapter:

1	Measure the temperature of the measuring solution using a thermometer.
2	Activate the temperature input with <⊖ > [<Temperature>]. The display flashes.



3	Set the temperature of the measuring solution with **<V>** and **<Λ>**.
4	Confirm the setting with **<↵>**.

Note
When calibrating without a temperature sensor set the current temperature of the respective buffer solution manually as well.

4.4 Calibration

Why calibrate?

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

Note
The calibration data are stored in the short pH electrode or DIN adapter and read out by the meter.

When to calibrate?

- During the initial commissioning of the meter or sensor
- After connecting a different electrode to the adapter
- After the calibration interval has expired (when the sensor symbol flashes)

Calibration interval

We recommend to take 14 days as a guide value for the calibration interval (the interval between two regular calibrations). The calibration interval (Int) is set to 14 days in the factory. You can select the interval in the range of 1 ... 999 days (see section 4.4.3).

Buffer sets

You can use the buffer sets quoted in the table for an automatic calibration. Use any one, two or three buffer solutions of a buffer set in a sequence of your choice. The pH values apply to the quoted temperature values. The temperature dependency of the pH values is taken into account when calibrating.

Buffer set	Name on the display	pH values at 25 °C
WTW Technical buffer solutions	*TEC*	2.00 4.01 7.00 10.01
NIST buffer solutions	*NIST*	1.68 4.01 6.87 9.18 12.45

Calibration points

Calibration can be performed with one or two or three buffer solutions (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*	● Asymmetry = *ASY* ● Slope = Nernst slope (59.2 mV/pH at 25 °C)
2-point	*ASY* *SLO*	● Asymmetry = *ASY* ● Slope = *SLO*
3-point	*ASY* *SLO*	● Asymmetry = *ASY* ● Slope = *SLO* The calibration line is calculated by linear regression.

Note
If the slope (*SLO*) is indicated on the display, you can change the unit of the slope with <⊖> [<mV/pH or %>].
The display in % refers to the Nernst slope, 59.2 mV/pH
(100 x the slope determined/Nernst slope).

AutoRead (drift control)

The *AutoRead* function is activated when the measurement of a buffer is started. The display of the unit flashes during the AutoRead measurement. The current AutoRead measurement can be terminated at any time (accepting the current value) by pressing <↵>.

Calibration data

The calibration data is stored in the short pH electrode or adapter. It contains the values for the slope and asymmetry of the current calibration. It is displayed after a valid calibration and is accessible at any time.

Calibration status

The meter has a simple display of the calibration status.

Display indication	Calibration status
	A valid calibration is available.
 flashes	A valid calibration is available. The calibration interval has expired, measurements are still possible.
No probe symbol on the display.	There is no valid calibration. Measuring with the delivery settings is possible (e.g. during the initial commissioning of a short pH electrode or after a reset).

4.4.1 Carrying out calibration

Preparatory activities

1	Switch on the meter with <>. After the display test, a measured value is displayed.
2	Keep buffer solutions from a TEC or Nist/DIN buffer set ready. For this purpose: Fill a sufficient quantity of each buffer solution in a small beaker. The quantity suffices when the minimum immersion depth for the sensor is granted (see section 4.3.1).

Manual temperature input

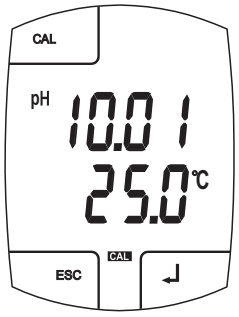
When measuring via an adapter with a sensor without temperature sensor, the temperature of the buffer solutions has to be input manually during calibration.

During calibration, the temperature can be input before measuring each buffer. *BUF* and a temperature value (without decimal place) is displayed then.

1	Activate the temperature input with <> [<Temperature>]. The selected display flashes.
2	Measure the current temperature of the buffer solution.
3	Enter the temperature of the buffer solution with <Λ> or <V>.
4	Confirm the setting with <↵>.

Calibration procedure:

1	Start the calibration with <CAL>. The display indicates the adjusted buffer set, *TEC BUF* or NIST BUF. The CAL status indicator appears.
2	If necessary, change the adjusted buffer set with <> [<Buffer set>] (*TEC BUF* or NIST BUF).
3	Confirm the adjusted buffer set with <↵>. *BUF1* is displayed.
4	If necessary, enter the temperature of the first buffer solution manually.
5	Immerse the electrode in the first buffer solution.



6	Start measurement with <↵>. The unit of the measured value display flashes (AutoRead) as long as the measured value is not stable.
7	Toggle between the display of the nominal buffer value (pH) and the electrode voltage (mV) as necessary with <⊖> [<pH or mV>].
8	Wait until the measured value is stable. *BUF2* appears on the display. or Accept the measured value with <↵>. *BUF2* appears on the display.

Note
At this point, calibration can be terminated with **< ESC >**. This corresponds to a **single-point calibration**. For this, the instrument uses the Nernst slope (-59.2 mV/pH at 25 °C) and determines the asymmetry of the electrode. The asymmetry that was determined (*ASY*) appears on the display. By pressing **<↵>** you display the slope of the calibration line (*SLO*). After a successful calibration the probe symbol appears in the measured value display.

Two-point calibration

9	To continue the calibration with a further buffer, thoroughly rinse the electrode with deionized water.
10	If necessary, enter the temperature of the second buffer solution manually.
11	Immerse the electrode in the buffer solution.
12	Start measurement with <↵>. The unit of the measured value display flashes (AutoRead) as long as the measured value is not stable.
13	Toggle between the display of the nominal buffer value (pH) and the electrode voltage (mV) as necessary with <⊖> [<pH or mV>].
14	Wait until the measured value is stable. *BUF3* appears on the display. or Accept the measured value with <↵>. *BUF3* appears on the display.

Note
At this point, calibration can be terminated with **< ESC >**. This corresponds to a **two-point calibration**. The asymmetry that was determined (*ASY*) appears on the display. By pressing **<↵>** you display the slope of the calibration line (*SLO*). After a successful calibration the probe symbol appears in the measured value display.

Three-point calibration

15	To continue the calibration with a further buffer, thoroughly rinse the electrode with deionized water.
16	If necessary, enter the temperature of the third buffer solution manually.
17	Immerse the pH electrode in the buffer solution.
18	Start measurement with **<↵>**. The unit of the measured value display flashes (AutoRead) as long as the measured value is not stable.
19	Toggle between the display of the nominal buffer value (pH) and the electrode voltage (mV) as necessary with **<⊖>** [**<**pH or mV**>**].
20	Wait until the measured value is stable. The value of the asymmetry that was determined *(ASY)* appears on the display. or Accept the measured value with **<↵>**. The value of the asymmetry that was determined *(ASY)* appears on the display.
21	By pressing **<↵>** display the slope of the calibration line (*SLO*).

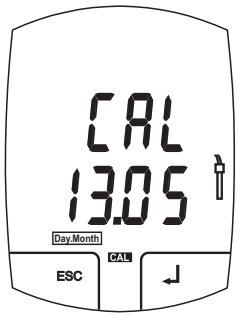
Note
You can also terminate the calibration prematurely with **< ESC >**. The values of the two-point calibration for slope and asymmetry will then remain stored. The asymmetry that was determined (*ASY*) appears on the display. By pressing **<↵>** you display the slope of the calibration line (*SLO*). After a successful calibration the probe symbol appears in the measured value display.

Note
If no valid calibration can be accomplished, the *Err3* error message appears on the display. Measuring is not possible in this condition. Possible causes and actions for error elimination can be found in chapter 6 WHAT TO DO IF....

4.4.2 Displaying the calibration data

The calibration data are displayed after calibrating (see section 4.4.1) and are accessible at any time.

1	Switch on the meter with <>. The display test is displayed.
2	During the display test: Display the date of the last calibration with **< CAL >**.



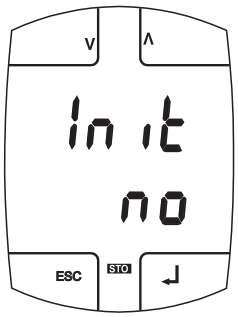
3	Press <↵> to display the asymmetry (*ASY*).
4	Press <↵> to display the slope (*SLO*).
5	Toggle between the display of the slope in mV/pH and % as necessary with <> [<mV/pH or %>]. The display in % refers to the Nernst slope, 59.2 mV/pH (100 x the slope determined/Nernst slope).
6	Switch to the measuring mode with <↵> or **< ESC >**.

4.4.3 Setting the calibration interval

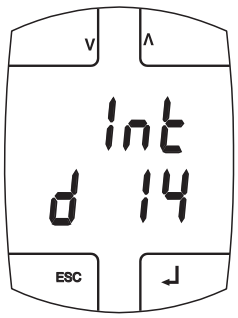
The calibration interval determines how many days after the last calibration the instrument should remind you to recalibrate.

The probe symbol on the display flashes when the calibration interval has expired.

1	Using **<CAL ▂>**, start the *INIT* initialization menu.



2	Press **<↵>** to confirm *NO* for the initialization. The setting of the calibration interval is displayed. The display flashes.



3	Set the calibration interval in days (d) with **<Λ>** and **<V>**.
4	Confirm the setting with **<↵>**. The meter switches to the measured value display.

4.5 Saving

The VARIO pH meter has a data memory. It can store up to 50 measurement datasets, depending on the short pH electrode or DIN adapter connected.

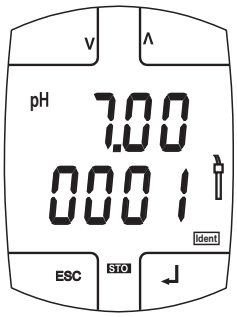
A dataset consists of:

- Main measured value (pH measured value or mV measured value)
- Measured temperature value
- Time and date
- ID number (0000 - 9999)

4.5.1 Saving measured data

You can save measured data as follows:

1	Start the saving of the current measured value with **< MEM >**. The memory number of the next free memory location is displayed under the current measured value. The **STO** status indicator appears.
2	Switch to the display of the ID number with **<↵>**. The ID number that was last entered appears on the display.
3	Edit the four-digit ID number as necessary with <⊖> and <⊕> [<ID number>].



4	Using **<Λ>** and **<V>**, enter the required ID number (0 ... 9999). The selected display flashes.
5	Confirm the ID number with **<↵>**.
6	Save the measurement data set with **<↵>**. or Cancel the storing procedure without storing by pressing **< ESC >**.

If all memory locations are occupied, the StoFull message appears. You have the following options:

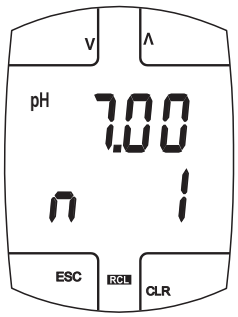
Saving the current measured value. The oldest measured value (memory location 1) will be overwritten by this	Press <↵>
Returning to the measuring mode without saving	Press < ESC >
Erasing the entire memory	see section 4.5.3.

4.5.2 Displaying measured data from the memory

Stored measurement datasets always have the main measured value in the upper display line and a variable display of further elements of the measurement dataset in the lower line.

Display stored datasets as follows:

1	Display the memory with < MEM >. The RCL status indicator appears on the display. The measurement dataset that was saved last is displayed.
2	Scroll through the stored datasets with <Λ> and <V>.
3	If necessary, display further elements of the dataset (ID number, date, time, temperature) with <⊟ > [Element of the measurement dataset]. When scrolling further, this element is displayed in the second line together with the measured value.



4	Scroll through the stored datasets with <Λ> <V>.
5	If necessary, display further elements of the dataset (ID number, date, time, temperature) with <⊟ > [Element of the measurement dataset].
6	Switch to the measuring mode with < ESC >.

4.5.3 Erasing measured data from the memory

To erase all datasets proceed as follows:

1	Display the memory with **< MEM ▁>**. The **RCL** status indicator appears on the display. The measured value that was saved last is displayed.
2	Erase the entire memory with **< CLR >**. A security prompt appears.
3	Confirm the deletion with **<↵>**. After the deletion, *NO DATA* appears on the display.
4	Switch to the measuring mode with **< ESC >**.

4.6 Clock

The meter has a clock.
When storing measured values and calibrating, the current date and time are automatically stored as well.

The clock has the following additional functions:

- Alarm function (see section 4.6.2).
- Stopwatch (see section 4.6.3) and
- Timer (see section 4.6.4).

Note
The automatic switch-off function (section 4.7) is not activated as long as the clock is indicated on the display.

4.6.1 Displaying and adjusting the date and time

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

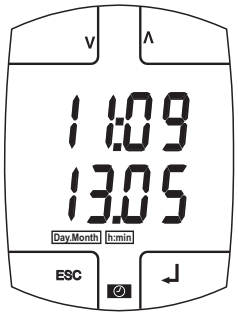
- Current date and time
- Calibration date
- Alarm function
- Identification of stored measured values.

Therefore, check the time regularly.

Note
The date and time are reset to 01.01.2003, 00:00 hours with a battery change. Set the clock after each battery change.

Setting the date and time

1	Switch on the meter with <⏻>. After a short display test, a measured value is displayed.
2	Press <⏲> to indicate the time and date on the display. The ⏲ status indicator appears.
3	Select the hours or minutes with <◀> or <▶> [<Hours> or <Minutes>]. The h:min symbol flashes.



4	Set the time with <**V**> and <**Λ**>.
5	Using <◀> or <▶>, select the [<Day> or <Month>]. The Day.Month symbol flashes.
6	Set the date with <**V**> and <**Λ**>.
7	Confirm the setting with <↵>. The year is displayed.
8	Set the year with <**V**> and <**Λ**>.
9	Confirm the setting with <↵>. The time and date are displayed again.
10	Switch to the measured value display with <**ESC**>. or Set the alarm time (see section 4.6.2).

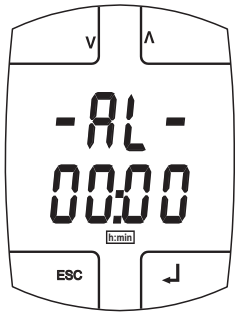
4.6.2 Alarm function

With the alarm function you set a point of time (alarm time) at which an alarm signal should sound. Prerequisite is the correct setting of the time (see section 4.6.1).

The alarm signal also sounds when the meter is switched off.

Setting the alarm time

1	Switch on the meter with <>. After a short display test, a measured value is displayed.
2	Press <> to indicate the time and date on the display. The status indicator appears.
3	Indicate the alarm time with <>. The alarm time appears on the display.
4	Select the hours or minutes with <> or <> [<Hours> or <Minutes>]. The selected display flashes.



5	Set the alarm time with <V> and <Λ>.
6	Confirm with <>. The alarm time is set.

Switching on the alarm function

7	Switch to the date and time display with <>. The alarm function is switched on. The status indicator flashes. or Switch to the date and time display with <ESC>. The alarm time is stored. The alarm function is switched off.
8	When the alarm time is due and the alarm function is switched on, an alarm signal can be heard for one minute and the measured value display flashes. Switch off the alarm signal with <>.
9	Switch to the date and time display with <>. The alarm function is switched off.

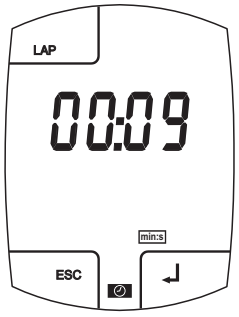
Switching off the alarm function

1	Display the alarm time (see above).
2	Switch off the alarm function with **< ESC >**. The display shows the date and time. The alarm function is switched off.

4.6.3 Stopwatch

With the stopwatch, you measure time periods of up to 59:59 (minutes:seconds). In the case of longer periods the stopwatch starts counting at 00:00 again.

1	Display the stopwatch with **<⏲▬>**. The ⏲ status indicator appears. The stopwatch is on 00:00.
2	Start the stopwatch with **<↵>**. The stopwatch starts counting the seconds.

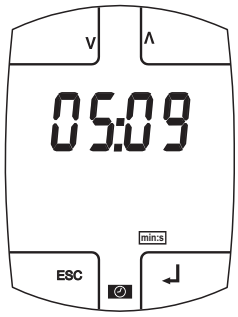


3	Display the current time as an intermediate time with **< LAP >**. The intermediate time is displayed under the running stopwatch.
4	Stop the stopwatch with **<↵>**.
5	Let it continue with **<↵>**. or Reset the stopwatch to 00:00 with **< RESET >**. or Terminate the stopwatch and switch to the measured value display with **< ESC >**.

4.6.4 Timer

The timer function can count down the seconds of a specified time interval (timer interval) of maximum 59:59 (minutes:seconds). When the specified timer interval has expired, an alarm signal sounds for one minute and the display flashes.

1	Display the stopwatch with <⏱_>. The ⏱ status indicator appears. The stopwatch is on 00:00.
2	Select the minutes or seconds with <-> or <-> [<Minutes> or <Seconds>]. The selected display flashes.



3	Set the timer interval (minutes:seconds) with <V> and <Λ>. The stopwatch has been converted to a timer.
4	Confirm the setting with <↵>.
5	Start the timer with <↵>.
6	If necessary, display the remaining time as an intermediate time with <LAP>.
7	If necessary, stop the timer before the time has expired with <↵> and make it continue with <↵>.
8	As soon as the time has expired the alarm signal sounds. Switch off the alarm signal with <▤>. The timer goes on counting with a negative sign.
9	Stop the timer with <↵>.

Note
If the timer has been stopped you can

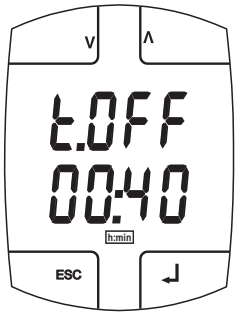
- Reset the timer to the adjusted timer interval with **< RESET >**.
- Terminate the timer and switch to the measured value display with **< ESC >**.

4.7 Switch-off interval

The automatic switch-off switches off the meter automatically if no entry is made for a specified time (switch-off interval). This saves the battery of the meter.

You can specify the switch-off interval yourself. The switch-off interval is from 10 minutes minimum to 24 hours maximum.

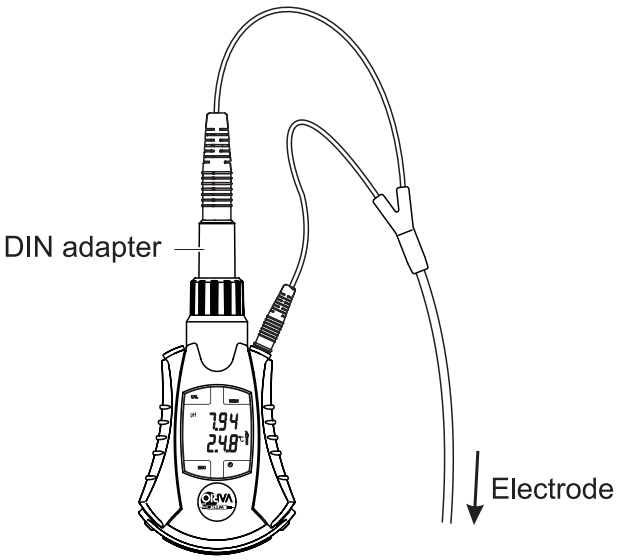
1	Switch on the meter with <>. The display test is displayed.
2	During the display test (approx. 2 sec.): Display the switch-off interval with **< MEM >**.



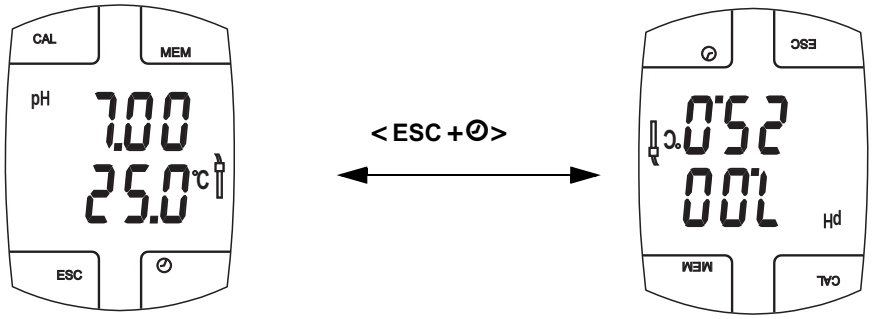
3	Select a switch-off interval with **<V>** and **<Λ>**.
4	Confirm the setting with **<↵>**. The display switches to the measured value display. The automatic switch-off switches off the meter if no entry is made during the switch-off interval.

4.8 Turning the display

When operating the meter with the adapter, the display indication can be turned by 180 degrees. Thus the cables of a connected electrode can be led backwards.



1	Switch on the meter with <>. After the display test, a measured value is displayed.
2	Keep < **ESC** > pressed and press <>. The display indication is turned.



4.9 Reset

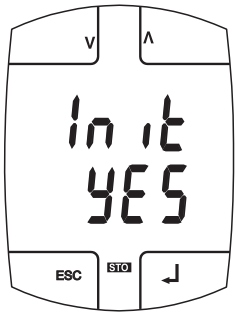
The following measurement parameters are reset to the delivery status:

Parameter	Default settings
Measuring mode	pH
Asymmetry	0 mV
Slope	-59.2 mV/pH
Calibration procedures	TEC
Temperature, manual	25 °C

Note
The calibration data gets lost when the measurement parameters are reset. Recalibrate after performing a reset. Stored data are retained.

Resetting the measurement parameters

1	Using **<CAL ▬>**, start the *INIT* initialization menu.
2	Using **<Λ>** or **<V>** or <⊖>, select *YES* for initialization.



3	Confirm with **<↵>**. The reset is performed. The meter switches to the setting of the calibration interval. The display flashes. You can change the calibration interval (see section 4.4.3) or switch to the measured value display with **<ESC>**.

5 Maintenance, cleaning, disposal

5.1 Maintenance

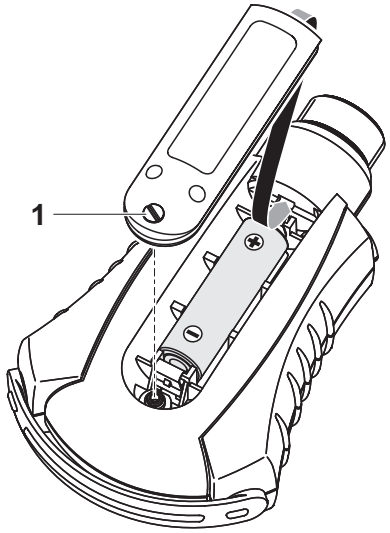
The meter is almost maintenance-free.
The only maintenance activity is exchanging the battery when it is depleted (*LoBat* display indicator).

5.2 Battery exchange

The *LoBat* display indicator indicates that the battery should be changed. The battery is then largely depleted.

Caution
Only use leakproof alkaline manganese batteries.

Replacing the battery



1	Unscrew the screw (1) on the back of the meter and remove the lid of the battery compartment by pulling at the screw.
2	Remove the depleted battery from the battery compartment.
3	Place the new battery (type Mignon AA) in the battery compartment. Make sure that the poles of the battery are the right way round. The ± signs on the battery must correspond to the ± signs in the battery compartment.
4	Close the battery compartment.

5.3 Cleaning

Occasionally wipe the outside of the meter with a damp, soft cloth.

Caution
The housing components are made out of synthetic materials (polyurethane, ABS and PMMA). Thus, avoid contact with acetone and similar detergents that contain solvents. Remove any splashes immediately.

Cleaning the touch screen

Activate the cleaning mode so the instrument will not interpret the contact with the touch screen as entries.

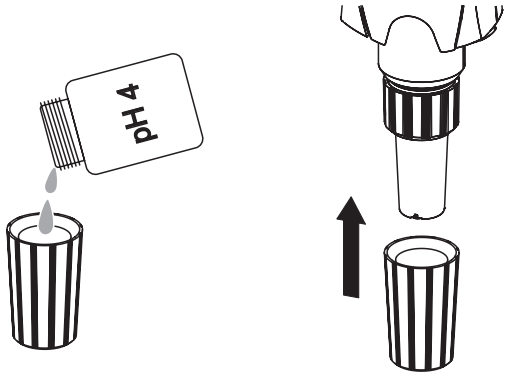
1	Switch the meter off with **< ESC _>**.
2	Switch the meter on with **<** ▭ **_>**. *CLR PAD* is displayed. The cleaning mode is active. Short contacts do not start any functions.
3	Clean the touch screen.
4	Switch to the measuring mode with **<** ▭ **_>**.

5.4 Storage

To maintain the operability of the meter and short pH electrode for a long time, please observe the following instructions:

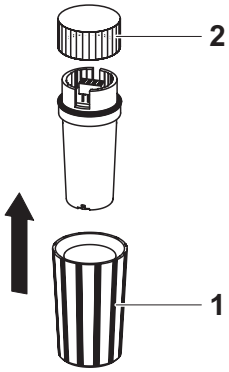
- Do not store the short pH electrode for a longer period of time without the watering cap put on. The short pH electrode might be damaged by this.
- If possible, leave the short pH electrode or adapter connected to the meter and avoid to plug it on or off when it is not necessary. Thus, the watertight plug-in connector will be well protected.
- To store electrodes for a longer period of time, please follow the instructions in the operating manual of the electrode.
- For a longer storage period, moisten the sponge in the watering cap with a few drops of pH 4 buffer solution and put the watering cap on the short pH electrode.
  During a longer storage period, occasionally check the sponge in the watering cap for sufficient moisture.

Moistening the watering cap



Storing the short pH electrode

In order to store an already used short pH electrode separately from the meter, protect the electrode with the watering cap (1) and the socket of the short pH electrode with the original protective cap (2).



5.5 Transport

Activate the cleaning mode. Thus, the instrument will not interpret any contact with the touch screen as an entry while being transported, e. g. in a pocket (see chapter 5.3).

5.6 Disposal

Dispose of the meter without the battery as electronic waste at an appropriate collection point.

6 What to do if...

Error message	Cause	Remedy
OFL, UFL	– Air bubble in front of the junction	– Remove air bubble
	– Electrode defective	– Replace electrode

Error message	Cause	Remedy
Err3	Erroneous calibration The data of the electrode are outside the specified characteristics.	– Recalibrate – Reset to default setting (see section 4.9)
	Electrode:	
	– Junction contaminated	– Clean junction
	– Membrane contaminated	– Clean membrane
	– Moisture in the plug	– Dry plug
	– Electrode obsolete	– Replace electrode
	– Electrode broken	– Replace electrode
	Meter:	
	– Incorrect buffer set	– Select correct buffer set
	– Incorrect solution temperature (without temperature sensor)	– Set the correct temperature
	– Socket damp	– Dry socket
	Buffer solutions:	
	– Incorrect buffer set	– Use a suitable buffer set
	– Buffer solutions too old	– Use only once. Note the shelf life

Error message	Cause	Remedy
Err4	No short pH electrode or adapter	– Connect short pH electrode or adapter – Check the plug connection – Switch the meter off and then on again. – Perform processor reset – Replace short pH electrode or adapter

Error message	Cause	Remedy
Err5	Short pH electrode or adapter defective	– Check the plug connection – Switch the meter off and then on again. – Processor reset: Press <> and <> at the same time and release them again. Stored data and calibration values are retained. – Replace short pH electrode or adapter

No stable measured value	Cause	Remedy
	Electrode:	
	– Junction contaminated	– Clean junction
	– Membrane contaminated	– Clean membrane
	Measuring solution:	
	– pH value not stable	– Measure with air excluded if necessary
	– Temperature not stable	– Adjust temperature if necessary

Adapter with electrode + measuring solution:	
– Conductivity too low	– Use suitable electrode
– Temperature too high	– Use suitable electrode
– Organic liquids	– Use suitable electrode

Display of LoBat

Cause	Remedy
– Battery almost empty	– Exchange the battery (see section 5.2)

Instrument does not react to keystroke

Cause	Remedy
– Operating condition undefined or EMC load unallowed	– Processor reset: Press <> and <> at the same time and release them again. Stored data and calibration values are retained.

Sensor symbol flashes

Cause	Remedy
– Calibration interval expired	– Recalibrate the measuring system

Message StoFul

Cause	Remedy
– All memory locations are full	– Clear the memory (see section 4.5.2).

7 Technical data

Depending on the connected sensor (short pH electrode or external electrode), the VARIO pH instrument has different functions or measuring features.

7.1 General data

Dimensions approx. 140 x 80 x 33 mm (without short pH electrode, without adapter)

Weight approx. 115 g (without short pH electrode, without adapter, without battery)

Mechanical structure

Type of protection	IP 65 (hose-proof)

Electrical safety

Protective class	III

Test certificates CE

Ambient conditions

Storage	- 25 °C ... + 65 °C
Operation	-10 °C ... + 55 °C
Climatic class	2

Power supply

Battery	1 x 1.5 V, type Mignon/AA
Battery life time	Maximum approx. 1500 operating hours

Guidelines and norms used

EMC	EC guideline 89/336/EEC EN 61326-1:1998
Instrument safety	EC guideline 73/23/EEC EN 61010-1 A2:1995
Climatic class	VDI/VDE 3540
IP protection	EN 60529:1991

7.2 Measuring ranges, resolution, accuracy

7.2.1 Short pH electrode SenTix V

Measured parameter	Measuring range	Resolution	Accuracy (± 1 digit)
pH	- 0.00 ... + 14.00	0,01	± 0.01 *
U [mV]	- 1000 ... + 1000	1	± 1
T [°C]	0.0 ... + 80.0	0,1	± 0.3
T [°F]	32.0 ... + 176.0	0,1	± 0.18

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

7.2.2 Adapter with electrode (DIN and S7 connection)

Measured parameter	Maximum usable measuring range	Resolution	Accuracy (± 1 digit)
pH	- 2.00 ... + 16.00	0,01	± 0.01 *
U [mV]	- 1000 ... + 1000	1	± 1
T [°C]	- 5.0 ... + 100.0	0,1	± 0.3
T [°F]	+ 23.0 ... + 212.0	0,1	± 0.54

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

8 Lists

This chapter provides additional information and orientation aids.

Abbreviations The list of abbreviations explains the indicators and the abbreviations that appear on the display and in the manual.

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

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

Abbreviations

ASY	Asymmetry
NIST	pH calibration with buffer solutions produced according to DIN 19 266
TEC	pH calibration with WTW technical buffer solutions according to DIN 19267
°C	Temperature unit, degrees Celsius
Cal	Calibration
Init	Initialization Resets individual basic functions to the status they had on delivery
LoBat	Batteries almost empty (Low Battery)
mV	Voltage unit
mV/pH	Unit of the electrode slope (internat. mV)
OFL	Display range exceeded (Overflow)
pH	pH value
SLO	Slope setting on calibration
UFL	Value is below the display range (Underflow)

Glossary

Adjusting To manipulate a measuring system so that the relevant value (e. g. the displayed value) differs as little as possible from the correct value or a value that is regarded as correct, or that the difference remains within the tolerance.

Asymmetry Designation for the offset potential of a pH electrode. The measurable potential of a symmetrical electrode, the membrane of which is immersed in a solution with the pH of the nominal electrode zero point. For WTW electrodes, the pH of the nominal electrode zero point is pH 7.

AutoRead WTW name for a function to check the stability of the measured value.

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).

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

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

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

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).

Measuring system The measuring system comprises all the devices used for measuring, e. g. meter and probe. In addition, there is the cable and possibly an amplifier, terminal strip and armature.

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

Offset potential The measurable potential of a symmetrical electrode, the membrane of which is immersed in a solution with the pH of the nominal electrode zero point. The asymmetry is part of the offset potential.

pH value The pH 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.

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.

Slope The slope of a linear calibration function.

Standard solution The standard solution is a solution where the measured value is known by definition. It is used to calibrate a measuring system.

Test sample Designation of the 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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