VOLTCRAFT®

Operating manual

EN

KBM-110

pH Tester

BNC connection
Waterproof
Precise and fast

Table of contents

1 Legal address of the manufacturer

Conrad Electronic SE
Klaus-Conrad-Str. 1
D-92240 Hirschau
http://www.conrad.com
WEEE reg. no. DE 28001718
CE

2 About this documentation

2.1 Foreword

Read this document carefully and familiarise yourself with the operation of the product before you use it. Keep this document ready to hand and in the immediate vicinity of the product so that it is available to the personnel/user for reference at all times in case of doubt.

The product was developed according to the state of the art and fulfils the requirements of the applicable European and national Directives. All corresponding documents are available from the manufacturer.

Only technically qualified persons are permitted to carry out commissioning, operation, maintenance and decommissioning. The qualified personnel must have carefully read and understood the operating manual before beginning any work.

2.2 Purpose of the document

- This document describes the operation and maintenance of the product.
- Provides important information for working safely and efficiently with the product.
- In addition to the quick reference guide with all relevant legal and safety content in hard copy, this document is a detailed reference option for the product.

2.3 Correctness of content

The contents of this document were checked for corrected and are subject to a continuous correction and updating process. This does not rule out potential errors. In the event that errors are discovered or in case of suggestions for improvement, please inform us immediately via the indicated contact information in order to help us make this document even more user-friendly.

2.4 Layout of this document

Description

Each chapter is explained at the beginning in the description.

Prerequisite

All mandatory prerequisites are then listed for each step.

Instruction

Tasks to be carried out by the personnel / user are represented as numbered instructions. Adhere to the sequence of the specified instructions.

Representation

Shows an illustrative instruction or a configuration of the product.

Formula

Some instructions include a formula for a general understanding of a configuration, programming or a setting of the product.

Outcome of an action

Result, consequence or effect of an instruction.

Emphases

In order to simplify legibility and provide a clearer overview, various sections / information are emphasised.

- 1234 Display elements
- *Mechanical controls*
- ***Product functions***
- *Product labels*
- Cross-reference [▷ p. 5]
- *Foot notes*

2.5 Further information

Software version of the product:

- V1.2 or later

For the exact product name, refer to the type plate on the rear side of the product.

NOTE

For information about the software version, press and hold the ON button to switch on the product for longer than 5 seconds. The series is shown in the main display and the software version of the product is shown in the secondary display.

3 Safety

3.1 Explanation of safety symbols

DANGER

This symbol warns of imminent danger which can result in death, severe bodily injury, or severe property damage in case of non-observance.

DANGER

This symbol indicates danger for living tissue as well as a variety of materials, which can be damaged or destroyed when coming into contact with this chemical. Caustic effect, protective equipment required!

DANGER

This symbol indicates danger for all life forms, which can result in death or acute or chromic damage to the health after inhaling, swallowing or absorbing this chemical through the skin.

CAUTION

This symbol warns of potential dangers or harmful situations which can cause damage to the device or to the environment in case of non-observance.

NOTE

This symbol indicates processes which can have a direct influence on operation or can trigger an unforeseen reaction in case of non-observance.

NOTE

This symbol instructs the use of eye protection which protects the eyes from harmful influences when working with powerful light, UV radiation, laser, chemicals, dust, splinters or weather influences.

NOTE

This symbol instructs the use of protective gloves which offer protection from mechanical, thermal, chemical, biological or electrical hazards.

3.2 Foreseeable misuse

The fault-free function and operational safety of the product can only be guaranteed if generally applicable safety precautions and the device-specific safety instructions for this document are observed.

If these notices are disregarded, personal injury or death, as well as property damage can occur.

DANGER

Incorrect area of application!

In order to prevent erratic behaviour of the product, personal injury or property damage, the product must be used exclusively as described in the chapter Description [p. 10] in the operating manual.

– Do not use in safety / Emergency Stop devices!
– The product is not suitable for use in explosion-prone areas!
– The product must not be used for diagnostic or other medical purposes on patients!
– The product is not intended to come into direct contact with food. For measurement in foods, samples must be taken and discarded after the measurement!

3.3 Safety instructions

This product has been designed and tested according to the safety requirements for electronic measuring devices.

DANGER

Danger of breaking the electrodes!

All electrodes contain glass parts that can cause injuries when broken. There is an elevated risk of injury in connection with measurements in foods.

– Inspect the electrode before and after the measurement!
– Always measures in samples for measurements in foods. Discard these samples after the measurement!

DANGER

Potassium chloride / potassium nitrate!

The electrode contains potassium chloride or potassium nitrate. All contact with the skin, clothing and eyes should be avoided. Nevertheless, should contact occur, take the following measures

– Eyes: Flush with flowing water for at least 15 minutes, seek medical attention!
– Skin: Wash with large amounts of water for several minutes!
– Clothing: Wash immediately!
– If swallowed: Drink large amounts of water, do not induce vomiting and seek medical attention!

CAUTION

Erratic behaviour!

On suspicion that the product can no longer be operated without danger, it must be decommissioned and prevented from recommissioning with appropriate labelling. The safety of the user can be impaired by the device if, for example, if it shows visible damage, it no longer works as specified or if it was stored for an extended period of time under unsuitable conditions.

– Visual inspection!
– In case of doubt, send the product to the manufacturer for repair or maintenance!

NOTE

If the product is stored at a temperature above 50 °C, or is not used for an extended period of time, the batteries must be removed. Leaks from the batteries are avoided as a result.

NOTE

This product does not belong in children's hands!

For this purpose, also refer to

Technical data [31]

3.4 Intended use

The product is designed for measuring the pH value and Redox by means of suitable electrodes in water an aqueous media. Temperature compensation takes place automatically with a connected temperature sensor.

Application examples for this are, for example, drinking water, waste water, surface water, swimming pools, fish breeding and process chemistry.

See Technical data [p. 31].

3.5 Qualified personnel

For commissioning, operation and maintenance, the relevant personnel must have adequate knowledge of the measuring process and use of the measurements, for which purpose this document makes a valuable contribution. The instructions in this document must be understood, observed and followed.

In order to ensure that no risks arise from the interpretation of the measurements in the concrete application, the user must have additional technical knowledge, because the user is liable in case of damage/danger due to misinterpretation as a result of inadequate technical knowledge.

4 Description

4.1 Scope of delivery

Please check to ensure the completeness of the product after opening the package. You should find the following components:

- Quick reference guide
- Handheld measuring device, ready for operation, including batteries
- Electrode GE 114 WD

4.2 Job description

The product offers precision, speed and reliability in a compact, ergonomic housing. Additional impressive features include the dust-proof and waterproof design in accordance with IP 65/67 and the 3-line illuminated display, which offers overhead display at the push of a button. The product can be switched on, switched off and configured and the measurements and parameters can be adjusted and held with the operating elements. The product is equipped with a BNC socket for connection of different electrodes, as well as with two 4 mm banana sockets for connection of temperature sensors or a reference electrode.

5 The product at a glance

5.1 The KBM-110

LCD Display

KBM-110

BNC connection and 2x4 mm banana

KBM-110

5.2 Display elements

Display

Battery indicator	Evaluation of the battery status
Unit display	Display of units, if applicable, with unstable symbol or type of mode, min/max/hold
Main display	Measurement of the current pH value or value for min/max/hold
Auxiliary display	Corresponding temperature for the displayed pH value with unit. Measured temperatures are displayed with a decimal place, adjusted without.
Bar graph	Progress for calibration and visualisation of the electrode evaluation

NOTE

The unit display shows a rotating circle segment in the first position as long as the measurement is unstable, if the position is unoccupied by the unit display.

5.3 Operating elements

On / Off button

Press briefly	Switch on the product Activate / deactivate lighting
Long press	Switch off the product Reject changes in a menu

Up / Down button

Press briefly	Display of the min/max value
	Change value of the selected parameter
Long press	Reset the min/max value of the current measurement
Both simultaneously	Rotate display, overhead display

Function key

Press briefly	Freeze measurement
	Return to measurement display
	Call up next parameter
Long press, 2s	Start menu configuration, CONF appears in the display
Long press, 4s	Start automatic calibration, CAL appears in the display

5.4 Connections

BNC connection	Connection for electrode
	Un/locking with rotating ring on the cable plug
2x 4mm banana	Connection for temperature sensor or reference electrode

CAUTION

Waterproofness!

Waterproofness is only guaranteed for plug connections in the plugged-in state in combination with waterproof cable plugs.

– Protect contacts from soiling and moisture!

NOTE

The temperature measurement can be influenced by conductive liquids on the banana sockets. We recommend always keeping the connections dry.

6 Bases for measurement

6.1 pH measurement

6.1.1 Explanation

The pH value describes the acidic or alkaline behaviour of an aqueous solution. A pH value below 7 is acidic, a value above 7 is alkaline. A pH value of 7 is neutral.

The pH measurement is very precise, but also sensitive. The measured signals are very weak and high-ohmic. This is the case, in particularly in low-ion media.

NOTE

In order to detect the pH value of a solution, it should always be recorded together with the measurement temperature, because most liquids change their pH value with the temperature.

The following must be observed:

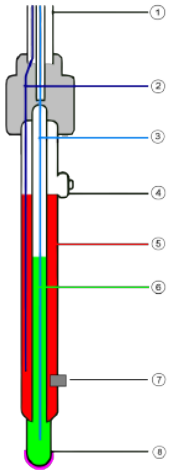
- avoid interference, electrostatic charges, etc.
- keep plug contacts clean and dry
- prevent electrodes which do not have any special waterproof versions from extended immersion above the shaft
- calibrate electrodes sufficiently often. The can range from every hour to several weeks, depending on the electrode and the application
- Use a suitable electrode

6.1.2 pH electrode

NOTE

Normally, so-called pH single-rod measuring chains are used. They include all necessary components that are integrated in an electrode.

6.1.3 Design



1. Coaxial cable
2. Reference electrode
3. Measuring electrode
4. Refill opening
5. Electrolyte
6. Internal buffer
7. Diaphragm
8. Glass membrane / source layer

The diaphragm, which establishes a connection between the electrolyte and the liquid to be measured, can be designed in different ways. Clogging or soiling of the diaphragm is a frequent cause of a malfunctioning or sluggish electrode. Always handle the glass membrane with extreme care. The so-called source layer forms there. This is crucial for the measurement and must always be kept moist.

There are also electrodes with integrated temperature sensors.

6.1.4 Further information

A pH electrode is a wear part. If the signal is very slow or the required values are no longer observed after careful cleaning and possible regeneration, the electrode must be replaced. When using the electrodes, be aware that various substances in aqueous solutions can corrode glass and that chemicals can produce a chemical reaction with the KCl solution in the electrode, which can result in blockage of the diaphragm.

- In solutions that contain proteins, such as for measurements in medical and biological applications, KCl can cause denaturation of the protein.
- Coagulated paints
- Solutions that contain high concentrations of silver ions

Substances that accumulate on the glass membrane or the diaphragm affect the measurement and must be removed regularly. This can be achieved for example with automatic cleaning systems.

6.1.5 Choosing a pH electrode

The GE 114 WD or GE 100 can be used for most applications. However, some areas of application require special electrodes.

- GE 100 BNC is a universal electrode with two ceramic diaphragms and liquid electrolyte.
- GE 101 BNC is preferably used for small sample amounts. It comprises a glass electrode with two ceramic diaphragms and liquid electrolyte.
- GE 104 BNC is preferably used for measurements in low-ionic media, such as rainwater, aquarium water and deionised water.
- GE 114 WD is a universally applicable, durable and low-maintenance gel electrode with Pellon diaphragm. It can be used for measurements in drinking water, swimming pools, aquaria and slightly contaminated waste water.
- GE 117 BNC is a temperature-compensated gel electrode with two ceramic diaphragms and PH 13.5 cable screw coupling.
- GE 120 BNC is an insertion electrode and is preferably used for measurements in cheese, fruit and meat. For measurements in products containing proteins, the electrode must be cleaned with a special cleaner. For this purpose, we recommend the GRL 100 pepsin cleaning solution.
- GE 125 BNC is a waterproof, universally applicable, durable and low-maintenance gel electrode with ceramic diaphragm. It can be immersed above the shaft for an extended time.
- GE 151 BNC is a glass electrode and is preferably used in galvanic applications for paints and lacquers.
- GE 173 BNC is an alkaline-resistant glass electrode with ground diaphragm and gel electrolyte for chemical and waste water applications.

6.1.6 Service life

The service life of electrodes is normally at least 8 to 10 months. When cared for properly, this can usually increase to more than 2 years. The actual life will vary depending on the particular application.

6.1.7 Care and maintenance

NOTE

The GAK 1400 working and calibration set includes all necessary products for calibration, care and maintenance of the electrode. Normal cleaning takes place with the GRL 100 pepsin cleaning solution into which the electrode is immersed for 5 minutes before being rinsed off with clean water.

NOTE

Crystallisation of the 3 mol/l KCL solution is unavoidable. Crystallised potassium chloride on the protective cap and shaft can easily be removed with a fingernail or cloth and is therefore not a defect or grounds for complaint.

Dirty electrodes must be cleaned. The suitable cleaning agents for the pH glass membrane are listed in the table below.

Impurities	**Cleaners**
General residue	Mild detergent
Inorganic coatings	Commercially available liquid glass cleaners
Metal compounds	1 mol/l HCl solution or GRL 100 pepsin cleaning solution
Oil and grease	Special cleaner or solvent
Biological coatings with protein	1% pepsin enzyme in 0.1 molar GRL 100 HCl solution
Resin lignins	Acetone
Extremely resistant residues	Hydrogen peroxide or sodium hypochloride

The material of the pH probe must always be protected. Plastic shafts must not be cleaned in solvents, etc. If in doubt, contact the manufacturer to inquire about suitable cleaners for the existing electrode. This is also important in the case of aggressive substances or other substances that are not primarily water-based!

6.2 Redox measurement

6.2.1 Explanation

The Redox potential *OrP* specifies the extent to which the measured sample has an oxidising or reducing effect relative to the standard hydrogen electrode.

This potential is frequently used in swimming pools as a measured variable for the disinfecting effect of a chlorination. For aquaria, the Redox value is also an important parameter, because fish can only live within a specific Redox range. The measurement is also important in drinking water preparation, waste water monitoring and in industrial applications.

Measurement takes place relative to the widespread silver/silver-chloride system with 3 mol/l KCL electrolyte. The measurements can be read directly (mV setting) or automatically with the mV_H unit setting and temperature compensation is calculated based on the standard hydrogen electrode reference system.

Calibration comparable to the pH measurement does not take place for the Redox measurement. However, the suitability of the electrodes can always be checked with Redox testing solutions, such as GRP 100.

7 Maintenance

7.1 Operating and maintenance notices

NOTE

The product and electrode must be handled with care and used in accordance with the technical data. Do not throw or strike.

NOTE

Plugs and sockets must be protected from soiling.

NOTE

If the product is stored at a temperature above 50 °C, or is not used for an extended period of time, the batteries must be removed. Leaks from the batteries are avoided as a result.

NOTE

The electrode should be stored in dry rooms at a temperature between 10 °C and 30 °C. If the storage temperature range is exceeded or undercut, the electrode can be destroyed. It should always be stored wet in 3 mol/l KCl. Extended storage in distilled or deionised water will result in depletion of the reference electrolytes.

NOTE

The pH electrode included in the scope of supply should be arranged vertically upwards with the connecting cable. A slight angle of inclination does not impair the measurement.

7.2 Battery

7.2.1 Battery indicator

If the empty frame in the battery display blinks, the batteries are depleted and must be replaced. However, the device will still operate for a certain length of time.

If the bAt display text appears in the main display, the battery voltage is no longer adequate for operation of the product. Now the battery is fully depleted.

7.2.2 Changing battery

DANGER

Danger of explosion!

Using damaged or unsuitable batteries can generate heat, which can cause the batteries to crack and possibly explode!

– Only use high-quality and suitable alkaline batteries!

CAUTION

Damage!

If the batteries have different charge levels, leaks and thus damage to the product can occur.

– Use new, high-quality batteries!
– Do not use different types of batteries!
– Remove depleted batteries and dispose of them at a suitable collection point!

NOTE

Unnecessary screwing places the water-tightness of the product, among other things, at risk and should be avoided.

NOTE

Read the following handling instructions before replacing batteries and follow them step by step. If disregarded, the product could be damaged or the protection from moisture could be diminished.

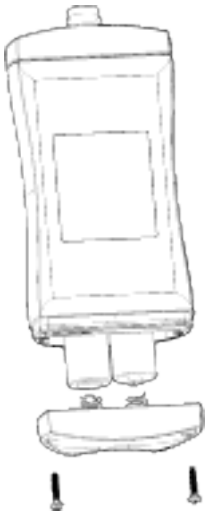
Description

Proceed as follows to replace the batteries.

Prerequisites

– The product is switched off.
– A suitable PH1 is available

Instruction



1. Unscrews the Phillips screws and remove the cover.
2. Carefully replace the two Mignon AA batteries. Ensure that the polarity is correct! It must be possible to insert the batteries in the correct position without using force.
3. The O-ring must be undamaged, clean and positioned at the intended depth. In order to facilitate assembly and avoid damage, a suitable grease can be applied.
4. Fit the cover on evenly. The O-ring must remain at the intended depth!
5. Tighten the Phillips screws.

Outcome of an action

The product is now ready for use again.

7.3 Calibration and adjustment

7.3.1 pH calibration

Description

In order to obtain reliable measurements, the device and electrode must be aligned with each other. In pH measurement, this is referred to as a calibration. In order to conduct a pH measurement, proceed as follows.

For automatic calibration, open the ***Calibration*** menu. See Automatic pH calibration [p. 19].

Prerequisite

– The pH electrode and, if applicable, a temperature sensor are inserted in the product.
– The product is switched on.

Instruction

1. Carefully remove the protective cap from the electrode.
2. Rinse off the electrode with distilled or deionised water.

Outcome of an action

Now, the product can be calibrated.

7.3.1.1 Explanation

The following steps describe how to calibrate the product.

To achieve a precise measurement, observe the following points.

NOTE

If possible, the calibration range should overlap the measuring range. To achieve this, it is recommended to use buffer solutions for measurements as follows:

– below pH 7 uses pH 7.0 and pH 4.0 buffer
– above pH 7 uses pH 7.0 and pH 10.0 buffer

NOTE

Calibrations are only possible in a temperature range from 0 °C to 60 °C! We recommend performing calibration at temperatures between 10 °C and 40 °C.

NOTE

Calibration should be conducted at the same temperature used for the measurement in the medium. To equalize the temperatures of the buffer solutions and electrode, they should be stored together for a while in a place that is protected against draught.

NOTE

If a temperature sensor is not connected, measure the temperature of the buffer solution with a thermometer. The exact value of the buffer solution is temperature dependent and can be determined based on the tables provided.

NOTE

Always use fresh buffer solutions!

7.3.1.2 Buffer solutions

Description

At least one buffer solution is required to calibrate the product. In the process, you have the option of using a ready-to-use PHL buffer solution or mixing the solution yourself with GPH buffer capsules - refer to the instructions.

	Colour	10 °C	20 °C	25 °C	30 °C	40 °C
PHL 4.0	Red	4.02	4.00	4.01	4.01	4.01
PHL 7.0	Green	7.06	7.02	7.00	6.99	6.97
PHL 10.0	Blue	10.18	10.07	10.01	9.97	9.89

Ready-to-use buffer solutions in 250 ml dosing bottles with a dosing volume of 20 to 25 ml.

Prerequisite

– Plastic bottle
– approx. 100 ml of distilled water
– Buffer capsule

Instruction

	Colour	10 °C	20 °C	25 °C	30 °C	40 °C
GPH 4.0	Orange	3.99	3.99	4.01	4.01	4.03
GPH 7.0	Green	7.06	7.01	7.00	6.99	6.98
GPH 10.0	Blue	10.18	10.06	10.01	9.97	9.89
GPH 12.0	White	12.35	12.14	12.00	11.89	11.71

Buffer capsules for 100 ml buffer solution

1. Fill a plastic bottle with approx. 100 ml of distilled water.
2. Open the buffer capsule carefully by twisting the capsule halves and pulling. It should be ensured that nothing is spilled. They can also be used without opening them; opening the capsules only reduces to time for dissolving.
3. Place the buffer capsule and its contents in the plastic bottle.
4. Wait at least 3 hours.
5. Shake well before using for the first time.

Outcome of an action

Then you can begin with calibration of the product.

7.3.1.3 Automatic pH calibration

Description

The following steps describe how to calibrate the product automatically.

Prerequisite

– The product is switched on.
– The pH electrode and, if applicable, a temperature sensor are inserted in the product.
– Ready-to-use GPH 7.0 buffer solution.
– Ready-to-use GPH 4.0 or GPH 10.0 buffer solution.

NOTE

Automatic calibration can also be carried out with the pre-mixed PHL buffer solutions. Since the temperature compensation relates to the GPH capsules, an error of a few hundredths pH should be taken into account, depending on the temperature. Refer also to the differences in the tables of the buffer solutions in Buffer solutions [p. 18] and --- FEHLENDER LINK ---.

Instruction

1. Press the *Function key* for 4 seconds to open the ***Calibration*** menu. CAL appears in the display.
2. Release the *Function key*.
3. PH 7 appears in the display.
4. Place the electrode in the GPH 7.0 buffer solution.
5. The product determines the correct value automatically. If the value is determined, the display flashes and an acoustic signal is issued to indicate a change to the next calibration point.
6. If the temperature sensor is not inserted, enter the temperature of the buffer solution by pressing the *Up key* and *Down key* and confirm the entry by pressing the *Function key* again.
7. PH 4 and PH 10 alternate in the display.
8. Then, rinse the electrode with distilled or deionised water.

9. Place the electrode in the second buffer solution. The product recognises whether it is a PH 4 or PH 10 buffer solution automatically.
10. If the temperature sensor is not inserted, enter the temperature of the buffer solution by pressing the *Up key* and *Down key* and confirm the entry by pressing the *Function key* again.
11. Then, rinse the electrode again with distilled or deionised water.

Outcome of an action

After successful completion of the calibration the assessment of the electrode condition is displayed briefly in percent. Then, the current measurement is shown in the display again. A low value can be the result of the age of the electrode, contaminated or old buffer solutions or impurities on the BNC connector.

If the calibration is not completed successfully an error message is displayed. CAL Err. appears in the display. See Error and system messages [▶ p. 28]. Confirm the error message pressing the *Function key*. The product restarts and the standard value for the zero point and gradient are restored.

For this purpose, also refer to

Buffer solutions [▶ 18]

7.3.1.4 Manual 1-point pH calibration

Description

The following steps describe how to perform a 1-point pH calibration.

NOTE

A 1-point calibration is only advantageous if measurement takes place in a narrow range around the calibration point. A reliable electrode evaluation is not possible in this case. We recommend conducting a 2-point calibration, because a 1-point calibration only entails a shift of the zero point.

Prerequisite

– An arbitrary buffer solution is available.

Instruction

1. Press the *Function key* for 2 seconds to open the ***Configuration*** menu.
2. ConF appears in the display. Release the Function key.
3. The parameter SEt.t appears if the temperature sensor is not plugged in. If the temperature sensor is plugged in, you jump to the next point.
4. Enter the temperature of the buffer solution by pressing the *Up key* and *Down key* and confirm the entry by pressing the *Function key* again.
5. The PH.oF parameter appears in the display.
6. Place the electrode in the buffer solution.
7. Wait until the display value is stable.
8. Adjust the value corresponding to the buffer solution with the *Up key* and *Down key* and confirm the entry by pressing the *Function key* again for 2 seconds.
9. Then, rinse the electrode again with distilled or deionised water.

Outcome of an action

After successful completion of the calibration the assessment of the electrode condition is displayed briefly in percent. Then, the current measurement is shown in the display again. A low value can be the result of the age of the electrode, contaminated or old buffer solutions or impurities on the BNC connector.

If the calibration is not completed successfully an error message is displayed. CAL Err. appears in the display. See Error and system messages [▶ p. 28].

7.3.1.5 Manual 2-point pH calibration

Description

The following steps describe how to perform a 2-point pH calibration.

Prerequisite

– A buffer solution with a value between pH 6.75 and pH 7.25 is available.
– A second buffer solution with a value below pH 6 and above pH 8 is available.

Instruction

1. Press the *Function key* for 2 seconds to open the ***Configuration*** menu.
2. CONF appears in the display. Release the Function key.
3. The parameter SET.E appears if the temperature sensor is not plugged in. If the temperature sensor is plugged in, you jump to the next point.
4. Enter the temperature of the buffer solution by pressing the *Up key* and *Down key* and confirm the entry by pressing the *Function key* again.
5. The PH.OF parameter appears in the display.
6. Place the electrode in the buffer solution with a value between pH 6.75 and pH 7.25.
7. Wait until the display value is stable.
8. Adjust the value corresponding to the buffer solution with the *Up key* and *Down key* and confirm the entry by pressing the *Function key*.
9. The PH.SL parameter appears in the display.
10. Place the electrode in the second buffer solution with a value below pH 6 or above pH 8.

NOTE

A gradient compensation with buffer solutions between pH 6 and pH 8 is not possible. With entry of the compensation value, the resulting gradient value is calculated immediately and CAL Err.2 or CAL Err.3 appears in the display instead of the measurement of the values are invalid.

11. Wait until the display value is stable.
12. Adjust the value corresponding to the buffer solution with the *Up key* and *Down key* and confirm the entry by pressing the *Function key*.
13. Then, rinse the electrode again with distilled or deionised water.

Outcome of an action

After successful completion of the calibration the assessment of the electrode condition is displayed briefly in percent. Then, the current measurement is shown in the display again. A low value can be the result of the age of the electrode, contaminated or old buffer solutions or impurities on the BNC connector.

If the calibration is not completed successfully an error message is displayed. CAL Err. appears in the display. See Error and system messages [▸ p. 28]. Confirm the error message pressing the *Function key*. The product restarts and the standard value for the zero point and gradient are restored.

8 Operation

8.1 Commissioning

8.1.1 Explanation

Description

The product is switched on with the *On/Off button*. It may be necessary to configure the product after switching on. See Configuration [▶ p. 22].

Prerequisite

– Sufficiently full batteries are inserted in the product.
– A suitable pH electrode is plugged in.

Instruction

– Press *On/Off button*.

Outcome of an action

Information about the configuration of the product appears in the display.

PoFF	Automatic shut-off	Automatic shut-off activated. The product is switched off if no buttons have been pressed after the adjusted time
t.oF	Zero point correction	If a zero point correction of the temperature sensor was made
t.SL	Gradient correction	If a gradient correction of the temperature sensor was made
CAL	Calibration	Blinks if no valid calibration is available

The product is now ready for measurement.

NOTE

The product must be calibrated to the electrode prior to starting the measurement. If the electrode is chosen, re-calibration is necessary. See Calibration and adjustment service.

8.2 Configuration

8.2.1 Explanation

The following steps describe how to adapt the product for your purposes.

NOTE

There are various configuration parameters available depending on the product version and configuration. They can differ depending on the product version and configuration.

8.2.2 Opening the configuration menu

Description

In order to configure the product, you must first open the ***Configuration*** menu. The menu is opened as shown in the illustration.

Prerequisite

– The product is switched on.

Instruction

1. Press the *Function key* for 2 seconds to open the ***Configuration*** menu.
2. ConF appears in the display. Release the function key.

3. By briefly pressing the *Function key*, you can scroll through the parameters. Select the parameter you would like to configure.
4. When you have selected the desired parameter, change the parameter to the desired value with the *Up button* and the *Down button*.
5. The changes are saved after running through the entire ***Configuration*** menu. Stor appears in the display. The ***Configuration*** menu can be exited from any arbitrary parameter by pressing and holding the *Function key* for 2 seconds. The changes made up that point are saved.

Representation

Call up menu	Next parameter	Change value	Save changes	Discard changes
2s		Press: Single step Hold: Rapid change	2s	2s

Outcome of an action

The ***Configuration*** menu is closed after the last parameter.

NOTE

If the product is switched off without saving the configuration, the last save value is reproduced on the next start-up of the product.

8.2.3 Configuring parameters of the configuration menu

Description

The following representation shows the available parameters and various configuration options.

Prerequisite

– The ***Configuration*** menu is open. See Opening the configuration menu [▷ p. 22].

Instruction

1. Select the desired parameter you would like to configure.
2. Adjust the desired configuration in the selected parameter with the *Up button* and *Down button*.
3. The available configuration options are listed for each parameter in the following representation.

Representation

Parameter	Values	Meaning
Setting the temperature		
SEt.t		Only without temperature sensor plugged in
	-5 .. 105	Adjustable temperature value in °C, or in °F 23 .. 221
Setting the zero point		
PH.oF		
	Current measurement	Setting of the zero point for calibration of the pH measurement. If a calibration cannot be carried out, continue with the *function key*

Setting the gradient		
PH.SL		
	Current measurement	Setting of the gradient for calibration of the pH measurement. If a calibration cannot be carried out, continue with the *function key*
Input		
InP		
	PH	
	OrP mV	Redox in mV, relative to silver / silver chloride - electrode
	OrP mVH	Redox in mV_H, relative to hydrogen electrode
Temperature unit		
Unit		
	°C	Temperature display in °C
	°F	Temperature display in °F
Alarms		
AL.		
	oFF	No active alarm
	on	Alarm alerting via text display, acoustic signal and flashing of the backlighting
	bEEP	Alarm alerting via text display and acoustic signal
	LitE	Alarm alerting via text display and flashing of the backlighting
AL.Lo		Depending on the setting of the parameter value InP
	PH	0.00 .. AL.Hi
	mV	-1500 .. AL.Hi
	mV_H	-1293 .. AL.Hi
AL.Hi		Depending on the setting of the parameter value InP
	PH	AL.Lo .. 14.00
	mV	AL.Lo .. 1500
	mV_H	AL.Lo .. 1707
Shut-off time		
PoFF		
	oFF	No automatic shut-off
	15 30 60 120 240	Automatic shut-off after a selected time in minutes, during which no buttons have been pressed

Backlighting

Li tE

oFF	Backlighting deactivated
15 30 60 120 240	Automatic shut-off of the backlighting after a selected time in seconds, during which no buttons have been pressed
on	No automatic shut-off of the backlighting

Factory settings

In it

no	Use current configuration
YES	Reset product to factory settings. In it donE appears in the display

Outcome of an action

The changed value is saved and the ***Configuration*** menu is closed. Stor appears in the display. If necessary, the product is restarted automatically in order to adopt the changed values.

NOTE

The configuration is closed if no button is pressed for 2 minutes. Any changes made up to that point are not saved. c.End appears in the display.

There is no active timeout with the parameters PH.oF and PH.SL.

8.2.4 Adjustment of the measuring input

Description

The temperature input can be adjusted with the zero point correction and the gradient correction. If an adjustment is made, you change the pre-adjusted factory settings. This is signalled with the t.oF or t.SL when the product is switched on. The standard settings of the zero point value and the gradient value is 0.00. It signals that no correction is made.

In order to adjust the product, you must first open the ***Adjustment*** menu. The menu is opened as shown in the illustration.

Prerequisites

- Sufficiently full batteries are inserted in the product.
- The product is switched off.
- Ice water, regulated precision water baths or a water bath with a reference measurement are available as a reference.

Instruction

1. Press and hold the *Down button*.
2. Press the *On/Off button* to switch on the product and open the ***Configuration*** menu. Release the *Down button*. The display shows the first parameter.
3. By briefly pressing the *Function key*, you can scroll through the parameters. Select the parameter you would like to configure.
4. When you have selected the desired parameter, change the parameter to the desired value with the *Up button* and the *Down button*.
5. In order to save the new parameter value, press and hold the *Function key* for longer than 1 second.

Representation

Call up menu

Hold — Release

Outcome of an action

The ***Configuration*** menu is closed after the last parameter.

NOTE

If the product is switched off without saving the configuration, the last save value is reproduced on the next start-up of the product.

8.2.5 Configuring parameters of the adjustment menu

Description

The following representation shows the available parameters and various configuration options.

Prerequisites

The ***Adjustment*** menu is open. See Adjustment of the measuring input [▷ p. 25].

Instruction

1. Select the desired parameter you would like to configure.
2. Adjust the desired configuration in the selected parameter with the *Up button* and *Down button*.
3. The available configuration options are listed for each parameter in the following representation.

Representation

Parameter	Values	Meaning
Zero point correction		
t.oF		
	0.00	No zero point correction
	-5.00 .. 5.00	Zero point correction in °C. and/or at °F -9.00 .. 9.00
Gradient correction of the temperature		
t.SL		
	0.00	No gradient correction
	-5.00 .. 5.00	Gradient correction in %

Formula

Gradient correction °C:

Display = (measured value – t.oF) * (1 + t.SL / 100)

Gradient correction °F:

Display = (measured value – 32 °F – t.oF) * (1 + t.SL / 100) + 32 °F

Example calculation

– Zero point correction t.oF to 0.00
– Gradient correction t.SL to 0.00
– Display unit Unit to °C
– Display in ice water -0.2 °C
– Display in ice water setpoint t.oF = 0.0 °C
– Display in water bath 36.6 °C
– Display in water bath setpoint t.SL = 37.0 °C
– t.oF = display zero point correction – setpoint zero point
– t.oF = -0.2 °C – 0.0 °C = -0.2 °C
– t.SL = (setpoint gradient correction / (display gradient correction – t.oF) – 1) *100
– t.SL = (37.0 °C / (36.6 °C – (-0.2)) -1) *100 = 0.54

Outcome of an action

The changed value is saved and the ***Configuration*** menu is closed.

NOTE

If the product is switched off without saving the configuration, the last save value is reproduced on the next start-up of the product.

9 Error and system messages

Display	Meaning	Possible causes	Remedy
>CAL<	Error during the last calibration	Faulty calibration	Conduct a new calibration
No display, unclear characters or no response when buttons are pressed	Battery depleted System error Product is defective	Battery depleted Error in the product Product is defective	Replace battery Send in for repair
bAt	Battery depleted	Battery depleted	Replace battery
bAt Lo	Battery depleted	Battery depleted	Replace battery
CAL Err.1	Neutral buffer not allowed	Incorrect buffer solution used Buffer solution is contaminated Electrode contaminated or defective	Use fresh buffer solution Clean electrode, re-calibrate Replace electrode
CAL Err.2	Slope is too low	Incorrect buffer solution used Buffer solution is contaminated Electrode contaminated or defective	Use fresh buffer solution Clean electrode, re-calibrate Replace electrode
CAL Err.3	Slope is too high	Incorrect buffer solution used Buffer solution is contaminated Electrode contaminated or defective	Use fresh buffer solution Clean electrode, re-calibrate Replace electrode
CAL Err.4	Incorrect calibration temperature	Temperature too low or too high	Range of 0..60 °C
CAL Err.5	Time exceeded during automatic calibration	Unstable electrode signal Buffer solution is contaminated	Stirring of the buffer solution Clean the electrode Use fresh buffer solution Restart calibration
Err.1	Measuring range exceeded	Measurement too high Incorrect electrode connected Electrode or product defect	The measurement is above the permissible range Check electrode Send in for repair
Err.2	Measuring range is undercut	Measurement too low Incorrect electrode connected Electrode or product defect	The measurement is below the permissible range Check electrode Send in for repair
SYS Err	System error	Error in the product	Switch product on/off

Replace batteries
Send in for repair

10 Disposal

NOTE

The device must not be disposed of with household waste. If the product is disposed of, please take it to a municipal collection point, where it will be transported to a disposal company in accordance with requirements of hazardous goods laws. Otherwise, return it to us, freight prepaid. We will then arrange for the proper and environmentally-friendly disposal. Please dispose of empty batteries at the collection points intended for this purpose.

11 Technical data

Measuring range		pH	Redox	Temperature
		0.00 .. 14.00 pH	-1500 .. +1500 mV 1293 .. +1707 mV_H	-5 .. 105 °C 23 .. 221 °F
Accuracy (at nominal temperature)		± 0.02 pH ± 1 digit	± 0.1% FS ± 1 Digit	± 0.3 °C
Temperature compensation		-5 .. 105 °C (or 23 .. 221 °F)		Not compensated
Input resistance		ca. 10^{12} Ohm		
Nominal temperature		25°C		
Measuring cycle		approx. 2 measurements per second		
Connections	pH, Redox	BNC connection for electrode		
	Temperature	Banana 4mm, Pt1000 2-wire		
Display		3-line segment LCD, additional symbols, illuminated (adjustable white, permanent illumination)		
Additional functions		Min/Max/Hold		
pH calibration		Manual 1- or 2-point or automatic 2-point calibration		
Housing		Break-proof ABS housing		
	Protection rating	IP65 / IP67 (only with electrodes identified as waterproof in the connected state for devices with BNC connection)		
	Dimensions L*W*H [mm] and weight	108 * 54 * 28 mm without BNC plug 130 g, incl. battery, without electrode 190 g, incl. battery and electrode		
Operating conditions		-20 to 50 °C; 0 to 95 % r.h. (temporarily 100 % r.h.)		
Storage temperature		-20 to 70 °C		
Current supply		2*AA battery (included in the scope of delivery)		
	Current requirement/ battery life	approx. 0.7 mA, approx. 2.5 mA with lighting Service life > 3000 hours with alkaline batteries (without backlighting)		
	Battery indicator	4-stage battery status indicator, Replacement indicator for depleted batteries: "BAT"		
Auto-power-OFF function		The device switches off automatically if this is activated		
Directives and standards		The devices conform to the following Directives of the Council for the harmonisation of legal regulations of the Member States: 2014/30/EU EMC Directive 2011/65/EU RoHS Applied harmonised standards: EN 61326-1:2013 Emission limits: Class B Immunity according to Table 2 Additional errors: < 0.5 % FS EN 50581:2012 The device is intended for mobile use and/or stationary operation in the scope of the specified operating conditions without further limitations.		

12 Service

12.1 Manufacturer

If you have any questions, please do not hesitate to contact us:

Contact

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