

# GREISINGER electronic GmbH

Operating Manual pH / ORP measuring device  
waterproof

as of version V1.3

## GMH 5530



WEEE-Reg.-Nr. DE 93889386

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## 1 General Note

Read this document carefully and get used to the operation of the device before you use it. Keep this document within reach for consulting in case of doubt.

If the device is stored at temperatures above 50°C the battery has to be removed from the device.

**NOTE:** We recommend taking out battery if device is not used for a longer period of time.



Risk of leakage!

## 2 Intended Use

The device is designed for measuring pH and ORP potentials with the help of adequate electrodes. The electrode is connected via BNC-socket.

*Please note: Different electrode types are needed for pH and ORP measurements.*

It is possible to connect a temperature probe (Pt1000 or NTC 10k, banana plug) additionally. This enables an automatic temperature compensation (ATC) for pH, rH and  $mV_H$  measurements and displaying the media's temperature.

The safety requirements (see below) have to be observed.

The device must be used only according to its intended purpose and under suitable conditions.

Use the device carefully and according to its technical data (do not throw it, strike it, ...)

Protect the device from dirt.

## 3 Safety Requirements

This device has been designed and tested in accordance with the safety regulations for electronic devices. However, its trouble-free operation and reliability cannot be guaranteed unless the standard safety measures and special safety advises given in this manual will be adhered to when using the device.

1. Trouble-free operation and reliability of the device can only be guaranteed if the device is not subjected to any other climatic conditions than those stated under "Specification".

If the device is transported from a cold to a warm environment condensation may cause in a failure of the function. In such a case make sure the device temperature has adjusted to the ambient temperature before trying a new start-up.

2. **WARNING:** If there is a risk whatsoever involved in running it, the device has to be switched off immediately and to be marked accordingly to avoid re-starting.



Operator safety may be a risk if:

- there is visible damage to the device
- the device is not working as specified
- the device has been stored under unsuitable conditions for a longer time.

In case of doubt, please return device to manufacturer for repair or maintenance.

3. **WARNING:** Do not use these products as safety or emergency stop devices or in any other application where failure of the product could result in personal injury or material damage.



Failure to comply with these instructions could result in death or serious injury and material damage.

## 4 Operation and Maintenance Advice

- a) When to replace battery:

If 'bAt' is shown in the lower display the battery has been used up and needs to be replaced. However, the device will operate correctly for a certain time. If 'bAt' is shown in the upper display the voltage is too low to operate the device; the battery has been completely used up. Change: p.r.t. chapter 14

*Please note: The battery has to be taken out, when storing device above 50°C. We recommend taking out battery if device is not used for a longer period of time.*

- b) Treat device and sensor carefully. Use only in accordance with above specification. (do not throw, hit against etc.). Protect plug and socket from soiling.

- d) USB or mains operation:

When connecting a mains cable or USB interface cable, please take care to connect only allowed components. Don't apply overvoltage!

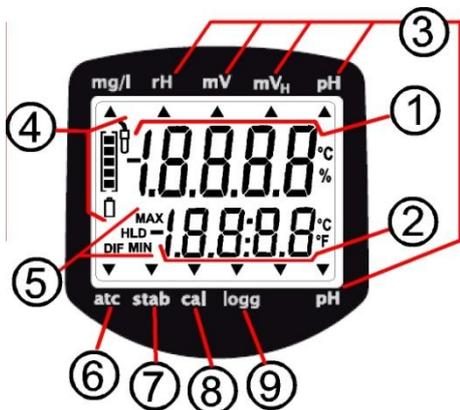
We recommend operation with interface cable USB 5100. Then device is supplied by the USB interface of the connected PC or USB power supply adapter.

- e) Display values for damaged electrode cable or if no pH or ORP electrode has been connected:

If no electrode is connected or the connection cable is damaged the display will nevertheless show mV, pH or rH values. Please note that these values can never be correct measuring results!

## 5 Handling

### 5.1 Display elements



- 1 **Main display:** pH value,  
ORP value (mV, mV<sub>H</sub>),  
rH value

---

- 2 **Secondary display:** temperature value

---

- 3 Arrows to selected **measuring unit**

---

- 4 Rating of electrode state or battery status

---

- 5 Display elements to show minimum / maximum /  
memorized measuring value

---

- 6 **atc arrow:** indicates if temperature sensor is  
connected and therefore **automatic  
temperature compensation** is active  
(only for 'pH', 'mV<sub>H</sub>' and 'rH' measuring  
mode)

---

- 7 **stab arrow:** indicates stable measuring value

---

- 8 **cal arrow:** indicates a running calibration  
(at operation mode '**pH**').

---

- 9 **No function**

### 5.2 Pushbuttons



**On / off key, backlight**

press shortly: activate backlight or switch on instrument  
press longer: switch off instrument

**t / menu:**

press shortly: at 'pH', 'rH' and 'mV<sub>H</sub>':  
manual temperature input (if no  
temperature probe is connected)  
additionally at 'rH':  
manual input of pH value

press for 2 sec. (menu): invoke configuration menu



**min / max:**

press shortly: min. or max. value is displayed  
press for 2 sec: the corresponding value is deleted



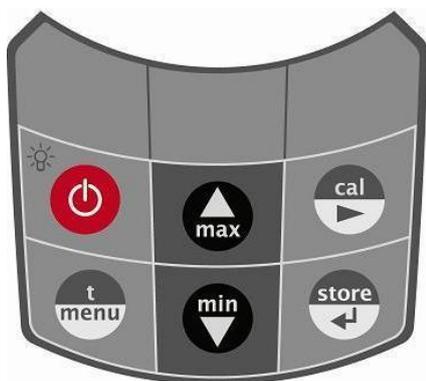
**cal:** only at mode 'pH':

press shortly: display of electrode state rating  
(electrode symbol + bar graph display)  
press for 2 sec: start pH calibration

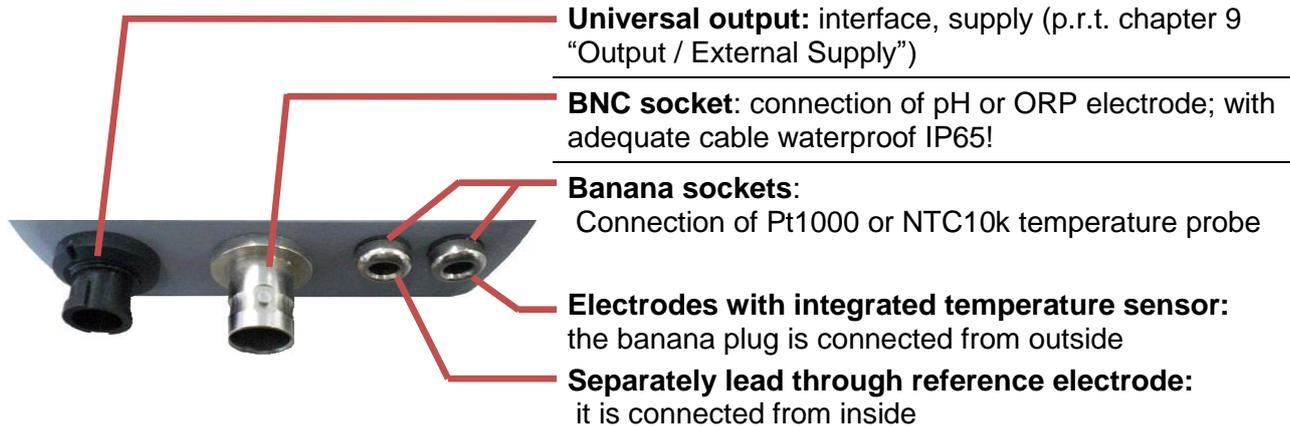


**store / enter:**

Measuring: hold and save current measuring value  
( 'HLD' is displayed)  
(Set/Menu: confirm settings, return to measuring)



## 5.3 Connections



## 6 Start Operation

Connect electrodes, turn device on via  key.



After segment test the device displays some configuration:

[arr] if zero point or slope correction is active  
(p.r.t. chapter 8 "Configuration" and 10 "Input adjustment")

Remove protective cap from electrode. (Attention: Cap should contain KCL 3 M or storage solution)

After that the device is ready for measuring.

## 7 Principles of the measurements

### 7.1 pH measurement

The pH value specifies the acid or alkaline behavior of aqueous solutions.

Solutions with a pH values below 7 are acid (the more below 7 the more acid), values higher than 7 mean alkaline and pH = 7 means neutral.

The pH value is the negative common logarithm of the hydrogen ion activity (this is often approximately equal to the concentration of dissolved hydronium ions):

$$pH \text{ value} = -\log_{10} \left( \frac{c(\text{H}^+) \cdot f(\text{H}^+)}{1 \text{ mol/l}} \right) \quad \text{with} \quad c(\text{H}^+): \text{ concentration of dissolved hydronium ions in mol/l}$$

$$f(\text{H}^+): \text{ activity coefficient (normally lower than 1)}$$

The abbreviation "pH" stands for *pondus Hydrogenii* (Latin pondus: "weight"; Hydrogenium: "hydrogen").

pH values should always be measured and saved together with the temperature of the solution:

i.e. pH 5.87; 22.8 °C.

Reason: The pH values of most liquids are depending on temperature.

The pH measurement is highly precise but also very sensitive. The measured signals are very weak (high resistance), especially if measured in low-ion media. Therefore it is very important that:

- disturbances (electrostatic charge, etc.) are prevented.
- a stable value is reached by slow stirring.
- contact plugs are kept clean and dry.
- the electrode shaft is not submersed for a longer period (exception: special water-proof types).
- the electrode is calibrated often enough (see below). The needed calibration frequency depends on the used electrode and application and varies between once every hour to once in several weeks.
- A suitable electrode is chosen. Please refer to chapter 7.4.

## 7.2 ORP measurement

The ORP potential (also known as reduction potential or ORP) is a measure of the oxidizing or reducing potential of the measured media compared to the standard hydrogen electrode.

This potential is often used in swimming pools to rate the disinfectant effect of chlorination. Also for aquarium keepers the ORP value is an important parameter, because fishes need ORP values within specified boundaries to live. Drinking water purification, water monitoring and industrial applications are some further fields where the ORP value is of importance.

The measurement is done with a common silver chloride electrode (reference system with 3-molar potassium chloride solution). The measured value can be directly displayed (mode mV) or converted to "reference system: standard hydrogen electrode" and temperature compensated at mode mV<sub>H</sub>.

There is no calibration comparable with that of the pH measurement. However, the electrode's capability can be checked with ORP test solutions (for example GRP 100).

Suitable ORP electrodes: e.g. **GE 105 BNC**

## 7.3 rH measurement

The rH value is a calculated value of a pH **and** a ORP measurement. For example it is used to describe the anti oxidative effect of food. This is a measure for the ability of food to reduce harmful free radicals.

To measure the rH value of a solution, proceed as follows:

### 7.3.1 Manual input of pH value (and temperature)

You can set the value for pH and temperature (if no temperature sensor is connected) manually. Press key

 shortly and set the temperature value with keys  and . Press  shortly again and enter the pH value. Confirm with .

### 7.3.2 Automatic input of pH value from preceding pH measurement

**Note:** It is important that the pH and ORP electrodes are in sound condition and that they are cleaned and dried well before they are inserted to the solution.

First place pH and ORP electrode and temperature probe in the solution and stir carefully.

#### 1. Measuring pH value:

Connect the pH electrode and temperature probe to the GMH 5530.

Then set device to pH measuring mode and calibrate electrode if necessary (p.r.t. chapter 7.5 **Fehler! Verweisquelle konnte nicht gefunden werden.** "Calibration of pH measurement" and chapter 8 "Configuration").

Measure the pH value of the solution and store the measured value with .

Do not turn off the device until the tH measurement is finished. If the device is turned off the saved pH value is deleted and has to be set manually for the following rH measurement.

#### 2. Get the rH value:

Connect ORP electrode and set device to rH measuring mode. The main display shows the calculated rH value of the solution, the secondary display shows the prior measured pH value and the temperature alternatingly.

## 7.4 pH electrode

### 7.4.1 Design

In most cases so-called combination electrodes are used. That means that all needed elements are integrated in a single electrode (including reference electrode).

Sometimes even a temperature sensor is integrated.

The picture on the right shows an electrode without temperature sensor.

There are several design types for the diaphragm, but generally said it is the connection between electrolyte and the measured solution. A blockade or soiling of the diaphragm is often the reason for the electrodes idleness and erratic behavior.

The glass membrane has to be treated with care. The hydrated gel layer forms on the surface of the glass membrane, which is of highest importance for the measurement. The electrode has to be kept wet to preserve the hydrated gel layer (see below).

### 7.4.2 Further Information

pH-electrodes are wear parts which need to be replaced, if the values required can no longer be kept even after thorough cleaning and recovery or the electrode signal gets too slow. The actual lifetime of an electrode depends highly on the chemical or mechanical stress it is subjected to. Please take into account that there are several materials that are in aqueous solutions aggressive to glass; other chemicals may react with the KCl-solution in the electrode thus causing blockades in the diaphragm.

#### Examples:

- with solutions containing protein, like they are used on the medical and biological sector, KCl may result in the denaturation of the protein.
- coagulated varnish
- solutions with a relatively high concentration of silver ions

Any material depositing on the measuring membrane or the diaphragm will influence the measurements and have to be removed at regular intervals. This can be done by means of automatic cleaning equipment.

**ATTENTION:** Electrodes have to be stored in a way that they are kept wet. An adequate solution is to store them with suitable protective cap filled with KCl 3 M. Please consider also the instructions in the electrodes manual!



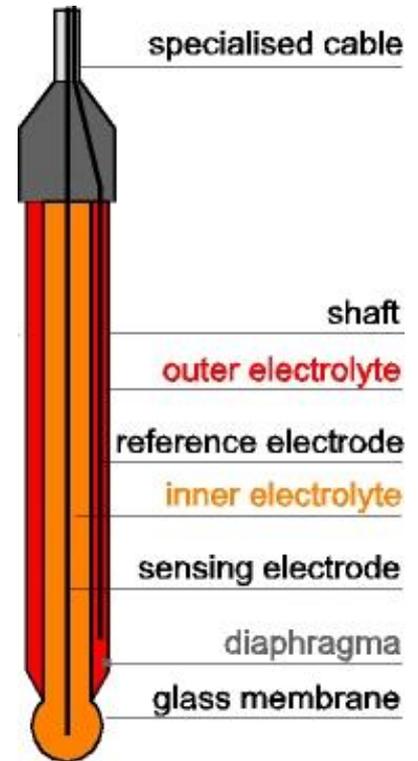
### 7.4.3 pH electrode suggestions

#### Different applications require different electrodes

1. **Measurements in low-ion media** (rain water, aquarium water, VE-waters)  
GE 106 BNC (as of 25  $\mu\text{S}/\text{cm}$ )
2. **Sea water aquariums**  
Standard pH electrodes with 3mol KCl (**GE 100 BNC, GE 117**)
3. **Swimming pools**  
Standard pH electrodes with 3mol KCl (**GE 100 BNC, GE 117**)
4. **Soil checks**  
Glass electrodes with several diaphragms (**GE 101 BNC**); use insertion mandrel!
5. **Electroplating, some paints and lacquers**  
Glass electrode **GE 151 BNC**
6. **Cheese, fruit, meat**  
Insertion electrode (**GE 101 BNC or GE 120 BNC**).  
When taking measurements in cheese, milk and other high-protein products use special cleaning agent to clean electrode. (**pepsin solution - GRL 100**).

**Standard cleaning:** apply 0.1 molar HCl-solution for at least 5 minutes or protein cleaning agent.

The average service life of an electrode is 8 to 10 months but may be increased to 2 years if electrode is well maintained and treated carefully. We regret not being able to give a more detailed information as this is highly dependent on the individual case of application.



## 7.5 Calibration of pH measurement

The electrode data of pH electrodes are subject to fluctuation due to ageing and manufacturing tolerances. Therefore it is necessary to check the calibration with buffer solutions before measurements take place. If deviations are too large, a recalibration is necessary. See also: Chapter 11 GLP

Buffer solutions are liquids with an accurate pH-value. The following buffers can be used for calibration:

- Technical buffer series **CAL PHL** (ready to use, pH 4.01, pH 7.00 und pH 10.01)
- Standard series **CAL GPH** (buffer capsules to be mixed with water pH 4.01, pH 7.00 and pH 10.01)
- DIN series **CAL dIn** (pH 1.68 (A), pH 4.01 (C), pH 6.87 (D), pH 9.18(F) und pH 12.45(G))
- Arbitrary buffer **CAL Edit** (neutral buffer ranging from 6.5 ... 7.5pH)

**NOTE:** Service life of a buffer solution is limited and will be further reduced unless the electrodes are properly rinsed and dried when changing over the solutions. This may even result in incorrect calibration! We recommend to use new buffer solution for calibration, as far as possible, and to rinse with deionized or distilled water.

### 7.5.1 How to prepare calibration buffers of standard GPH series (capsules)

- Fill 2 plastic bottles with 100 ml distilled water each.
- Open pH 7 capsule (green) carefully (turn one half of the capsule while pulling and make sure not to spill any of the powder); put content (including both capsule parts) into one of the bottles.
- Put content of pH 4 capsule (orange) (or pH 10, blue) and both capsule parts into a second bottle.

The capsule shell will color the liquid in the respective color:

**orange = pH4.01; green = pH7.00; blue = pH10.01**

Make sure to prepare buffer solutions in time as they can only be used after at least 3 hours. Shake well before use.

### 7.5.2 Automatic temperature compensation during calibration

Both the signal of the pH-electrode and the pH-buffer are depending on temperature. If a temperature probe is connected, the temperature influence of the electrode is compensated automatically during measuring as well as during calibration. Otherwise enter actual buffer temperature as accurate as possible (see below). When working with the standard or DIN-buffer series, the influences of buffer temperature are also compensated. If buffers are entered manually, make sure to enter the pH-values of the buffers at the relevant temperature to ensure optimum calibration of the device.

### 7.5.3 How to carry out calibration

**Please note: the calibration can only carried out at a temperature range of 0 - 60°C !**

If you have not yet done so set device to measuring mode 'pH'. Make sure that either the **1-, 2- or 3- point calibration** (whichever is required) and desired buffer series (**Std, dIn** or **Edit**) the has been activated (further information in chapter 8 "Configuration").

Carefully remove electrode safety cap (Attention! Contains 3 mol KCl!).

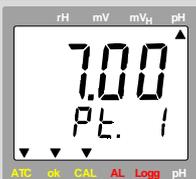
Rinse electrode with distilled water and dry it carefully.

**How to start calibration: press  key for 2 seconds.**

The display will prompt you to measure the first calibration solution.

You can abort calibration at any time by pressing  key. In such a case the last calibration before this one remains valid.

#### 1. Calibration point 1: 'Pt. 1'



**\*1)**

Place electrode and temperature probe (if any) in the neutral solution stirring gently.

(For 1-point calibration: solutions with arbitrary pH value (e.g. pH 4) can be uses)

As soon as the measured pH value got stable the next calibration step will be displayed.



**No temperature sensor: manual input of temperature of buffer 1**

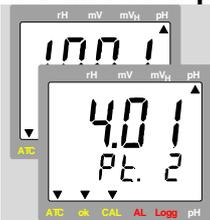
Use  or  to enter the temperature of the buffer solution.

Use  to confirm the value; the next calibration step is displayed.

If 1-point calibration is chosen the calibration is already done at this point, the bar graph display on the left shows the electrode's state rating.

#### 2. Rinse electrode in distilled or deionized water, dry electrode

### 3. Calibration point 2: 'Pt. 2' (only for 2- or 3- point calibration)



Place electrode and temperature probe (if any) in the second buffer solution (e.g. for standard series this is: pH 4.01 or pH 10.01) and stir gently.

As soon as the measured pH value got stable the next calibration step will be displayed.

\*1)



**No temperature sensor: manual input of temperature of buffer 2**

Use or to enter the temperature of the buffer solution.

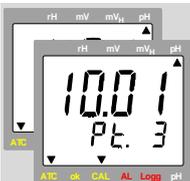
Use to confirm the value; the next calibration step is displayed.

If 2-point calibration is chosen the calibration is already done at this point, the bar graph display on the left shows the electrode's state rating.

### 4. Rinse electrode in distilled or deionized water, dry electrode

### 5. Calibration point 3: 'Pt. 2' (only for 3- point calibration)

**Please note: both, an alkaline and acid calibration point are needed for a 3-point calibration.**



Place electrode and temperature probe (if any) in the third buffer solution (e.g. for standard series this is: pH 10.01) and stir gently.

As soon as the measured pH value got stable the next calibration step will be displayed.

\*1)



**No temperature sensor: manual input of temperature of buffer 3**

Use or to enter the temperature of the buffer solution.

Use to confirm the value; the next calibration step is displayed.

Calibration has finished, the bar graph display on the left shows the electrode's state rating.

\*1) In case of manual buffer selection (CAL Edit) use or to enter pH value of the used solution. If solutions from the standard and DIN series are used their pH value will be automatically detected.

### Error messages of pH calibration:

|              |   |  |
|--------------|---|--|
| CAL<br>Err.1 | Neutral buffer not permissible<br>- Electrode defective<br>- Wrong buffer solution<br>- Buffer solution defective | Clean electrode and calibrate again, if error occurs again -> replace electrode<br>Always use neutral buffer as first solution (exception: 1 point calibration)<br>Use new buffer solution |
| CAL<br>Err.2 | Slope is too low:<br>- Electrode defective<br>- Buffer solution defective   | Replace electrode<br>Use new buffer solution   |
| CAL<br>Err.3 | Slope is too high:<br>- Electrode defective<br>- Buffer solution defective  | Replace electrode<br>Use new buffer solution   |
| CAL<br>Err.4 | Incorrect calibration temperature   | Calibration can only be done at 0...60 °C  |

Permissible electrodes' data:

Asymmetry: ±55 mV

Slope: -62 ... -45 mV/pH

## 8 Configuration

To change device settings, press “menu”  for 2 seconds. This will activate the configuration menu (main display: “Set”).

Pressing “menu”  changes between the menus points, pressing  jumps to the referring parameters, which can be selected with key .

The parameters can be changed with  or .

Pressing “menu”  again jumps back to the main configuration menu and saves the settings.

“enter”  finishes the configuration and returns to standard measuring operation.

**NOTE:** Pressing “menu” and “store” at the same time for more than 2 seconds will reset the device to factory defaults.

If no key is pressed for more than 2 minutes the configuration will be aborted. All changes will not be saved!

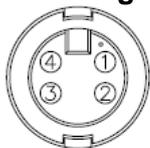
| Menu   | Parameter   | Value  | Description |
|--|---|--|-------------|
|  |  |  Or  |             |
| <b>SEt</b><br>Conf   | <b>Set Configuration: General configurations</b>                                  |  |             |
| <b>INP</b>   | <b>Input: Selection of measured variable</b>                                      |  |             |
|  | Arrow “rH”  | rH value measurement   |             |
|  | Arrow “mV”  | mV value measurement (REDOX or ORP)  |             |
|  | Arrow “mV <sub>H</sub> ”  | mV value measurement referring to standard hydrogen system   |             |
|  | Arrow “pH”  | pH value measurement   |             |
| <b>RES</b> <sup>pH</sup>   | <b>Resolution pH: Resolution of pH display</b>                                    |  |             |
|  | 0.1 ... 0.001   | tenth pH ... thousandth pH   |             |
| <b>CAL</b>   | <b>Calibration: Select number of calibration points</b>                           |  |             |
|  | 1-Pt  | 1-point (only offset calibration, slope = -59.2mV/pH)  |             |
|  | 2-Pt  | 2- point (neutral + another one)   |             |
|  | 3-Pt  | 3- point (neutral + one acid + one alkaline buffer)  |             |
| <b>CALP</b>  | <b>Calibration: Select buffer series</b>  |  |             |
|  | GPH   | Technical Buffer series: GPH-Capsules (pH7, pH4, pH 10)  |             |
|  | PHL   | Technical liquid buffer series: PHL (pH7, pH4, pH 10)  |             |
|  | dIn   | DIN 19266 buffer series pH 1.68(A), pH 4.01(C), pH 6.87(D), pH 9.18(F), pH 12.45(G)  |             |
|  | Edit  | Arbitrary buffer, manual input   |             |
| <b>Cont</b>  | <b>Calibration: Calibration reminder period (factory setting: 30)</b>             |  |             |
|  | 1 ...365  | Calibration reminder period (in days)  |             |
|  | oFF   | No calibration reminder  |             |
| <b>tINP</b>  | <b>t-Input: Select temperature input</b>  |  |             |
|  | NTC   | NTC 10k  |             |
|  | Pt  | Pt1000   |             |
| <b>Unit t</b>  | <b>Unit t: Select temperature unit</b>  |  |             |
|  | °C:   | All temperatures in degree Celsius   |             |
|  | °F:   | All temperatures in degree Fahrenheit  |             |
| <b>Auto</b> <sup>HLd</sup>   | <b>Auto Hold: Auto measuring value identification</b>                             |  |             |
|  | on  | Auto measuring value identification Auto Hold  |             |
|  | oFF   | Standard hold function on key press  |             |
| <b>P.oFF</b>   | <b>Auto Power-Off: Select power-off delay</b>                                     |  |             |
|  | 1...120   | Power-off delay in minutes.<br>Device will be automatically switched off as soon as this time has elapsed if no key is pressed/no interface communication takes place. |             |
|  | oFF   | Automatic power-off function deactivated (continuous operation)  |             |
| <b>LiTE</b>  | <b>Background illumination</b>  |  |             |
|  | oFF:  | Illumination deactivated   |             |
|  | 5 ... 120   | Turn off illumination after 5... 120s (factory settings: 5 s)  |             |
|  | on:   | Illumination always on   |             |

| Menu             | Parameter   | Value  | Description  |
|------------------|---|--|--|
|                  |   | or   |  |
|                  | <b>Out</b>  | <b>Universal Output</b>                                    |  |
|                  |   | oFF  | Interface and analog output off -> minimal power consumption |
|                  |   | SEr:   | Serial interface activated                                   |
|                  |   | dAC:   | Analog output activated                                      |
|                  | <b>Adr.</b>   | 01,11..91  | Base address for serial interface communication              |
| <b>SEt</b>       | <b>Set Corr: Input adjustment</b>   |  |  |
| <b>Corr</b>      |   | <b>Zero adjustment / offset of voltage measurement</b>     |  |
|                  |   | oFF  | No zero adjustment for voltage measurement                   |
|                  | <b>OFFS</b>   | -10.0 ... 10.0 mV  | Offset of voltage measurement in mV                          |
|                  |   | <b>Slope adjustment of voltage measurement</b>             |  |
|                  |   | oFF  | No slope adjustment for voltage measurement                  |
|                  | <b>SCAL %</b>   | -5.000 ... 5.000 %   | Slope correction of voltage measurement in %                 |
|                  |   | <b>Zero adjustment / offset of temperature measurement</b> |  |
|                  |   | oFF  | No zero adjustment for temperature measurement               |
|                  | <b>OFFS °C</b>  | -5.0 ... 5.0 °C  | Offset of temperature measurement in °C                      |
|                  |   | <b>Slope adjustment of temperature measurement</b>         |  |
|                  |   | oFF  | No slope adjustment for temperature measurement              |
|                  | <b>SCAL °C %</b>  | -5.00 ... 5.00 %   | Slope correction of temperature measurement in %             |
| <b>SEt</b>       | <b>Set Clock: Settings for real time clock</b>  |  |  |
| <b>CLOC</b>      |   | HH:MM  | <b>Clock:</b> set time      hours:minutes                    |
| <b>YEAR</b>      |   | YYYY   | <b>Year:</b> set year  |
| <b>DATE</b>      |   | TT.MM  | <b>Date:</b> set date      day.month                         |
| <b>rEAd CAL.</b> | <b>rEAd CAL: Read calibration data:</b><br>p.r.t. chapter 11.2 "Calibration storage (rEAd CAL)" |  |  |

## 9 Output / External Supply

The device has a serial output (for interface converter USB 5100). If the output is not needed, it is strongly recommended to deactivate it (Out oFF) to lower power consumption. This increases battery life time. If the device is used together with interface adapter USB 5100 the device is supplied from the interface.

**Pin assignment:**



- 4: external supply +5V, 50mA
- 3: GND
- 2: TxD/RxD (3.3V Logic)
- 1: no function

**Attention!**

Only suitable adaptor cables are permitted (accessories)!

The device can be connected to a USB interface of a PC by the electrically isolated interface converter USB 5100 (accessory). The data is transmitted binary-coded and protected against transmission errors by complex safety mechanism (CRC).

The following standard software packages are available:

- **EBS20M / -60M:** 20-/60-channel software for measuring value display
- **EASYControl net:** Universal multi-channel software for real-time recording and displaying of measuring data; with real database

In case you want to develop your own software we offer a **GMH3000-development package** including:

- a universally applicable Windows functions library ('GMH3x32e.DLL') with documentation, can be used by all 'established' programming languages, suitable for:  
Windows 2000™, Windows XP™, Windows Vista™, Windows 7™
- Programming examples Visual Basic 4.0™, Delphi 1.0™, Testpoint™ etc.

**The device has 2 channels:**

- channel 1: actual-value-channel pH, mV or rH and base address
- channel 2: temperature value

**NOTE:** The unit of all transmitter values (including measuring values) is the unit of corresponding displayed values.  
(e.g. temperature is displayed in °C -> temperature value is also transmitted in °C)

## 10 Input adjustment

The zero point and slope of each measuring inputs can be adjusted with the parameters offset (“OFFS”) and scale (“SCAL”).

A reasonable adjustment presumes reliable references (e.g. ice water, controlled precision water bath, etc.). If the inputs are adjusted (i.e. offset and scale are different from default settings) the device will shortly display “Corr” after turned on.

Default setting for offset and scale are ‘off’ = 0.0, i.e. inputs are not changed.

Zero point correction:

$$\text{Displayed value} = \text{measured value} - \text{OFFS}$$

Zero point and slope correction:

$$\text{Displayed value} = (\text{measured value} - \text{OFFS}) * (1 + \text{SCAL} / 100)$$

$$(\text{Displayed value } ^\circ\text{F} = (\text{measured value } ^\circ\text{F} - 32^\circ\text{F} - \text{OFFS}) * (1 + \text{SCAL} / 100) )$$

## 11 GLP

GLP (Good Laboratory Practice) includes regular check of devices and accessories. For pH measurements it is highly important to ensure correct pH calibration. The device provides the following functions to help with this.

The usage of the GLP functions is only reasonable if the electrode is not changed. Although all data is stored in the device, it refers to the particular electrode.

### 11.1 Calibration interval (C.Int)

You can input the interval after which the device reminds you to recalibrate.

The interval times should be chosen according to the application and the stability of the electrode.

“CAL” flashes on the display as soon as the interval has expired.

### 11.2 Calibration storage (rEAd CAL)

The last calibration is stored with results and date and can be read out.

**Display calibration data:**

Save calibration data can be comfortably read out via PC software GMHKonfig or displayed directly at the device:



**Press for 2 seconds**

The display will show:

rEAd Lo55 or SEt Conf (configuration level)



**Press several times until this is displayed:**

rEAd CAL.

read cal. = “read calibration data”

**Press shortly:** switch between

- U.ASY = asymmetry voltage in mV
- SL. 1 = slope acid in mV/pH <sup>\*1)</sup>
- SL. 2 = slope alkaline in mV/pH <sup>\*1)</sup>
- date+time display of data set



Additionally the bar graph display shows the electrode state rating of the corresponding calibration.



Quit calibration data sets display

\*1) 1-point calibration: slope acid = slope alkaline = 59.16mV/pH is assumed

2-point calibration: slope acid = slope alkaline = determined slope

3-point calibration: slope acid and slope alkaline are determined separately

## 12 Real Time Clock (“CLOC”)

The real time clock is used for chronological assignment of the calibration points. Please check the settings when necessary.

## 13 Accuracy Check / Adjustment Service

You can send the device to the manufacturer for adjustment and inspection.

Calibration certificate - DKD certificate - official certifications:

If the measuring instrument is supposed to receive a calibration certificate, it has to be sent to the manufacturer (declare test levels, e.g. -20; 0°C; 70°C).

If the device is certificated together with a suitable sensor very high overall accuracies are possible.

Basic settings can only be checked and – if necessary – corrected by the manufacturer.

A calibration protocol is enclosed to the device ex works. This documents the precision reached by the production process.

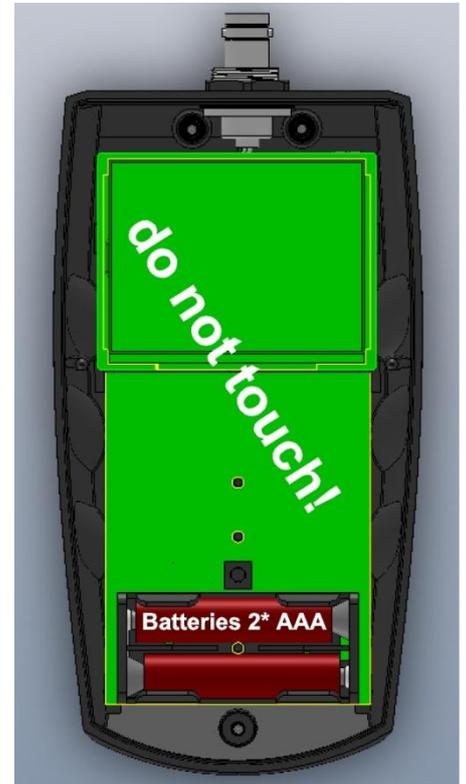
## 14 Replacing batteries

Before changing batteries, please read the following instruction and follow it step by step.

Not following the instruction may cause harm to the instrument or the protection against ingress of water and dust may be lost!

Avoid unnecessary opening of the instrument!

1. Open the 3 Phillips screws at the backside of the instrument.
2. Lay down the still closed instrument, so that the display side points upwards.  
The lower half of the housing incl. The electronics should be kept lying down during battery change.  
This avoids loss of the sealing rings of the screw holes.
3. Lift upper half of housing. Keep an eye on the six function keys, to be sure not to damage them.
4. Change carefully the two batteries (Type: AAA).
5. Close the housing, taking care that it is positioned correctly, otherwise the sealing may be damaged. Afterwards press the two halves together, lay the instrument with display pointing downwards and screw it together again, beginning with the single lower screw.



## 15 Error and System Messages

$Er. \neq$  Value exceeding measuring range, value too high

$Er. \leq$  = Value exceeding measuring range, value too low

$Er. \uparrow$  = System error – the device has detected a system error (device defective or not within working temperature)

>CAL< CAL flashing in main display: either preset calibration interval has expired or last calibration is not valid. Device has to be calibrated!

If **“bAt”** is flashing the battery will be exhausted soon. Further measurements are possible for short time. If **“bAt”** is displayed continuously the battery is ultimately exhausted and has to be replaced. Further measurements aren't possible any more.

## 16 Specification

|                          |                            |  |
|--------------------------|----------------------------|--|
| Measuring ranges         | pH                         | -2.000 ... 16.000 pH   |
|                          | ORP / mV                   | -1999.9 ... 1999.9 mV  |
|                          |                            | Relating to hydrogen system: -1792 ... +2207 mV <sub>H</sub> (at 25°C, DIN 38404)  |
|                          | rH                         | 0.0 ... 70.0 rH  |
|                          | Temperature                | -5.0 ... +150.0 °C, Pt1000 or NTC 10k<br>23.0 ... 302.0 °F   |
| Accuracy                 | pH                         | ±0.005 pH  |
|                          | ORP / mV                   | ±0.05% FS  |
|                          | Temperature                | ±0.2 K   |
| Working conditions       |                            | -25 to 50 °C; 0 to 95 % RH (non condensing)  |
| Storage temperature      |                            | -25 to 70 °C   |
| Connections              | pH, ORP                    | BNC-socket, suitable for standard BNC and water-proof BNC cables<br>additional connection for reference electrode: 4mm banana socket   |
|                          | Temperature                | Pt1000 or NTC 10k via 4 mm banana socket   |
|                          | Interface /<br>ext. supply | 4-pole socket for serial interface and supply  |
| Input resistance         | pH, ORP                    | >10 <sup>12</sup> Ohm  |
| Display                  |                            | 4 ½ digit 7-segment, additional bar graph display for battery and electrode,<br>illuminated  |
| pH calibration           | Automatic                  | 1 -, 2- or 3-point calibration,<br>either DIN 19266-buffer or technical buffer GPH / PHL   |
|                          | Manual                     | 1 -, 2- or 3- point calibration  |
| GLP                      |                            | adjustable calibration intervals (1 to 365 days, CAL warning after expiration)   |
| Additional functions     |                            | Min / max / hold   |
| Housing                  |                            | Break-proof ABS housing, incl. silicone protective cover   |
|                          | Protection class           | IP65, IP67   |
|                          | Dimensions<br>L*B*H [mm]   | 160 * 86 * 37 incl. silicone protective cover,<br>approx. 250 g incl. battery and cover  |
| Power supply             |                            | 2*AAA batteries, (included in delivery)  |
| Current consumption      |                            | 0.8 mA (Out = oFF, equivalent to 1250 h), illumination ~10mA (auto-off)  |
| Change battery indicator |                            | Automatically if battery exhausted "bAt", warning "bAt" flashing   |
| Auto-off-function:       |                            | Device will be automatically switched off if no key is pressed/no interface<br>communication takes place for the time of the power-off delay. The power-off<br>delay can be set to values between 1 and 120 min.; it can be completely<br>deactivated.       |
| EMV                      |                            | The device corresponds to the essential protection ratings established in the<br>Regulations of the Council for the Approximation of Legislation for the member<br>countries regarding electromagnetic compatibility (2004/108/EG). Additional<br>fault: <1% |

## 17 Disposal instruction



Batteries must not be disposed in the regular domestic waste but at the designated collecting points. The device must not be disposed in the unsorted municipal waste! Send the device directly to us (sufficiently stamped), if it should be disposed. We will dispose the device appropriate and environmentally sound.