



# GREISINGER electronic GmbH

Operating Manual pH / ORP measuring device  
waterproof, with data logger

as of version V1.3

## GMH 5550



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 plugs) 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 16

*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!

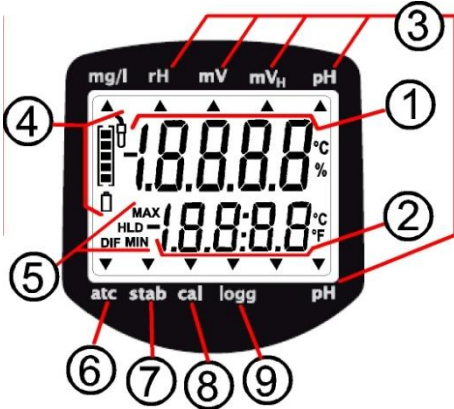
We recommend operation with interface cable USB 5100. Then device is supplied by the USB interface of the connected PC or USB power supply adapter.

- 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)

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

---

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

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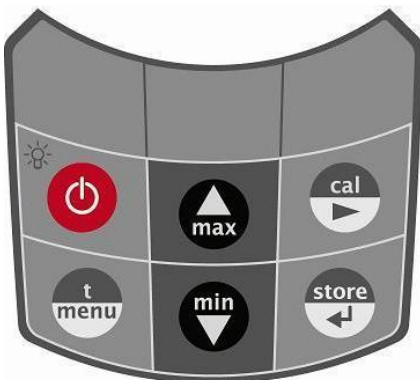
- 9 **logg arrow:** logger is ready  
arrow flashing: automatic recording (Logg CYCL) is active

## 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



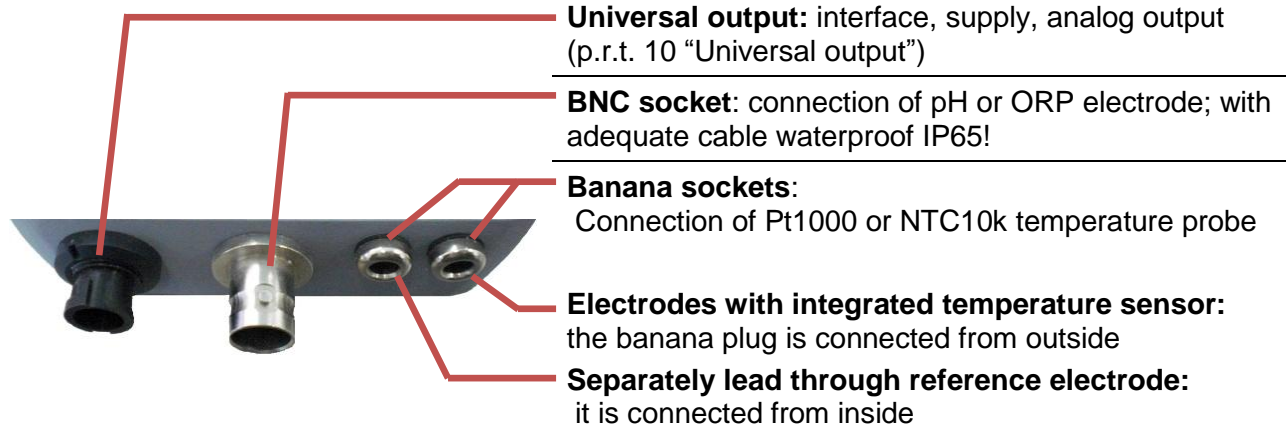
### store / enter:

Logger off: hold and save current measuring value  
( 'HLD' is displayed)


(Logger on: Operation of data logger - chapter 8)

(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 9 Configuration and 11 Fehler! Verweisquelle konnte nicht gefunden werden. 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 (if logger is deactivated)


**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 5550.

Then set device to pH measuring mode and calibrate electrode if necessary (p.r.t. chapter 7.5 Calibration of pH measurement and chapter 9 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 to 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!



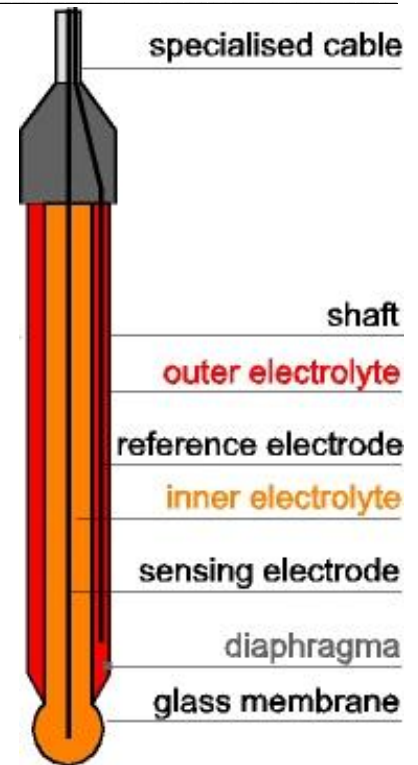
### 7.4.3 pH electrode suggestions

#### 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 12 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 9 Configuration).

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

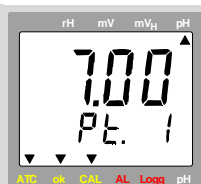
Rinse electrode with distilled water and dry it carefully.

**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'

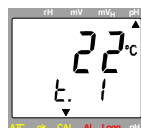


\*1)



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 used)

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.

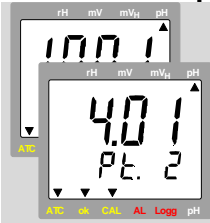
Use  to confirm the value; the next calibration step is displayed.

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



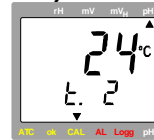
### 3. Calibration point 2: 'Pt. 2' (only for 2- or 3- point calibration)



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.

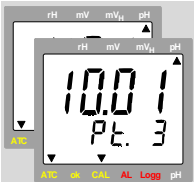
Use to confirm the value; the next calibration step is displayed.

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)

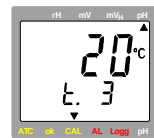
**Please note: both, an alkaline and acid calibration point are needed for a 3-point calibration.**



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:

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

Permissible electrodes' data:

Asymmetry:  $\pm 55$  mV

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

## 8 Data Logger

The device supports two different logger functions:

“**Func-Stor**”: Manual recording by keypress “store”  
Additional input of measuring point (L-Id) is needed

“**Func-CYCL**”: Automatic recording at intervals of set cycle time

The logger stores 2 measuring values per data set.

One data set consists of: measuring value pH, mV, mV<sub>H</sub> or rH  
measuring value temperature  
measuring point L-Id (only for “**Func-Stor**”)  
time and date (when data set is saved)


For the evaluation of the data the software GSOFT3050 (version V3.0 or higher) has to be used. The software also allows easy configuration and starting of the logger.

When the logger is activated (Func Stor or Func CYCL) the hold function is no more available, the key “store” is solely used for the operation of the logger functions.

### 8.1 Manual Recording (“Func-Stor”)


#### a) Save measurements manually:


Up to 1000 measurements can be saved if logger function “Func store” is selected.  
(p.r.t. “Configuration”)

 Press “store” shortly: data set is saved (“St. XX” is displayed shortly,  
where XX is the number of the data set)

**Input of measuring point “L-Id”:** Selection of measuring point via keys  or .


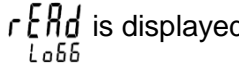
Number 0...19999 or text assigned to number 1...40 (comfortable assignment of texts can be done with gratis software GMHKonfig)


Confirm input with .


 is displayed if logger storage is full.



#### b) Read manual recordings:


Saved data sets can be viewed both with PC-software GSOFT3050 and directly on the device display.

 Press “menu” for 2 seconds:  is displayed

**Note:** “rEAd LoGG” is only displayed if data sets have been already stored. Otherwise the configuration menu is displayed: 

 Press shortly: Change between measuring values, measuring point and date+time of the data set

 or  Change between different data sets


 End display of recordings


#### c) Clear manual recordings:


If data sets have been stored, they can be deleted with the “store” key:


 Press for 2 seconds: Call menu “Clear”

Select with  or .

 Clear nothing (cancel menu)

 Clear all recordings

 Clear the last recording

 Confirm selection and quit menu “Clear”



## 8.2 Automatic Recording with Selectable Cycle Time (“Func CYCL”)


If logger function “Func CYCL” is selected (p.r.t. “Configuration” ) the device will automatically record measuring values at intervals of the set cycle time.

The logger’s cycle time can be set from 1s to 60min (p.r.t. “Configuration”).

Up to 10000 measurements can be saved if logger function “Func CYCL” is selected.

### a) Start recording:


 **Press “store” for 2 seconds:** Start Menu, press  again: automatic recording will be started. Each storage process is signaled by the short display of ‘St.XXXXX’, where XXXXX is the number of the saved data set.


If the logger memory is full, the recording stops automatically and the display shows 

### b) Stop recording:

 **Press “store” for 2 seconds:** If recording is running the “stop” menu is displayed

Select with  or .


 Do not stop recording  
(cancel menu)

 Stop recording


 Confirm selection and quit “stop” menu


**NOTE:** If you try to switch off the device while cyclic recording is active you will be asked whether the recording should really be stopped. The device can only be switched off if the recording is stopped. Auto-off function is deactivated as long as cyclic recording is active.


### c) Clear recordings:

 **Press “store” for 2 seconds:** If there are data sets stored and recording is already stopped the menu “Clear” is displayed

Select with  or .

 Clear nothing (cancel menu)


 Clear all recordings




 Clear the last recording



 Confirm selection and quit menu “Clear”


## 9 Configuration


**NOTE:** Some menu points depend on current device settings (e.g. some points are locked if logger memory contains data sets).

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 there are data sets stored and logger is set to “manual recording” (“Func Stor”) the first menu point displayed is “rEAd Logg” (p.r.t. chapter 8 **Fehler! Verweisquelle konnte nicht gefunden werden.** “Data Logger”)

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 			
rEAd LoGg	rEAd Logg: Read manual recordings, p.r.t. chapter 8.1 Manual Recording (“Func-Stor”)				
SEt 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		
	rES <sup>pH</sup>	<b>Resolution pH: Resolution of pH display</b>			
		0.1 ... 0.001	tenth pH ... thousandth pH		
	CAL	<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)		
	CALP	<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		
	C.int	<b>Calibration: Calibration reminder period (factory setting: 30)</b>			
		1 ...365	Calibration reminder period (in days)		
		oFF	No calibration reminder		
	t.inP	<b>t-Input: Select temperature input</b>		**	
		NTC	NTC 10k		
		Pt	Pt1000		
	Unit t	<b>Unit t: Select temperature unit</b>		**	
		°C:	All temperatures in degree Celsius		
		°F:	All temperatures in degree Fahrenheit		
	Auto	<b>Auto Hold: Auto measuring value identification (only for logger = oFF active)</b>			
		on	Auto measuring value identification (only for logger = oFF) Auto Hold		
		oFF	Standard hold function on key press (only for logger = oFF)		
	P.oFF	<b>Auto Power-Off: Select power-off delay</b>			
		1...120	Power-off delay in minutes. 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)		
	Li.tE	<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>				
		<b>oFF</b>	Interface and analog output off -> minimal power consumption			
		<b>SEr:</b>	Serial interface activated			
		<b>dAC:</b>	Analog output activated			
	<b>Adr.</b>	01,11..91	Base address for serial interface communication			
	<b>dAC.0</b>	z.B. -2.00..14.00 pH	Measuring value which should correspond to output 0 V e.g. 0.0 pH -> 0 V			
	<b>dAC.1</b>	z.B. -2.00..14.00 pH	Measuring value which should correspond to output 1 V e.g. 14.0 pH -> 1 V			
<b>SEt</b>	<b>Set Corr: Input adjustment</b>				**	
<b>Corr</b>		<b>Zero adjustment / offset of voltage measurement</b>				
	<b>OFFS</b>	<b>oFF</b>	No zero adjustment for voltage measurement			
		<b>-10.0 ... 10.0 mV</b>	Offset of voltage measurement in mV			
		<b>Slope adjustment of voltage measurement</b>				
	<b>SCAL</b>	<b>oFF</b>	No slope adjustment for voltage measurement			
		<b>-5.000 ... 5.000 %</b>	Slope correction of voltage measurement in %			
		<b>Zero adjustment / offset of temperature measurement</b>				
	<b>OFFS</b>	<b>oFF</b>	No zero adjustment for temperature measurement			
		<b>-5.0 ... 5.0 °C</b>	Offset of temperature measurement in °C			
		<b>Slope adjustment of temperature measurement</b>				
	<b>SCAL</b>	<b>oFF</b>	No slope adjustment for temperature measurement			
		<b>-5.00 ... 5.00%</b>	Slope correction of temperature measurement in %			
<b>SEt</b>	<b>Set Alarm: Settings for alarm function</b>					
<b>AL.</b>	<b>AL. 1</b>	<b>On / No.So</b>	Measuring channel pH/mV/rH: alarm on with buzzer / without buzzer			
		<b>OFF</b>	No alarm function for measuring channel pH/mV/rH			
	<b>A.LLo</b>	z.B. -2.00..14.00 pH	Min-alarm limit pH/mV/rH (not for AL. 1. oFF)			
	<b>A.LHi</b>	z.B. -2.00..14.00 pH	Max-alarm limit pH/mV/rH (not for AL. 1. oFF)			
	<b>AL. 2</b>	<b>On / No.So</b>	Temperature measurement: alarm on with buzzer / without buzzer			
		<b>OFF</b>	No alarm function for temperature measurement			
	<b>A2Lo</b>	-5.0 ..+150.0 °C	Min-alarm limit temperature (not for AL. 2. oFF)			
	<b>A2Hi</b>	-5.0 ..+150.0 °C	Max-alarm limit temperature (not for AL. 2. oFF)			
<b>SEt</b>	<b>Set Logger: Settings for logger function</b>				**	
<b>LoGg</b>		<b>Selection of logger function</b>				*
	<b>Func</b>	<b>CYCL</b>	<b>Cyclic:</b> cyclic logger			
		<b>Stor</b>	<b>Store:</b> manual recording			
		<b>oFF</b>	No logger activated			
	<b>CYCL</b>	0:01... 60:00	Cycle time in [minutes:seconds] (for cyclic logger)		**	
<b>SEt</b>	<b>Set Clock: Settings for real time clock</b>					
<b>CLoC</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</b>	<b>rEAd CAL: Read calibration data:</b>					
<b>CAL.</b>	p.r.t. chapter 12.2 Calibration storage (rEAd CAL)					

(\*) **If logger memory contains data sets parameters marked with (\*) cannot be called. You have to clear memory to change these parameters!**

(\*\*) **If logger is running parameters marked with (\*\*) cannot be called.**

## 10 Universal output

The output can be used either as serial interface (for USB5100 interface converter) or as analog output (0-1V). 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: +U<sub>DAC</sub>, analog output

### Attention!

Only suitable adaptor cables are permitted (accessories)!

### 10.1 Interface

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:

- **GSOFT3050:** Operating and evaluation software for the integrated logger function
- **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 / alarm / boundary values) is the unit of corresponding displayed values.

(e.g. temperature is displayed in °C -> temperature value is also transmitted in °C)

### 10.2 Analog output

A analog voltage 0-1V can be connected at the universal output socket (mode: "Out dAC").

The analog output can be easily scaled with DAC.0 and DAC.1.

Please take care not to load the analog output too heavily, otherwise the output value will be distorted and the power consumption will rise. Loads up to approx. 10 kOhm are unproblematic.

If the displayed value goes beyond DAC.1 the output voltage will be 1V.

If the displayed value falls below DAC.0 the output voltage will be 0V.

In error case (Err.1, Err.2, ----, etc.) the output voltage will be slightly higher than 1V.

The interface converter USB 5100 has a screw/plug connection; therefore no further cable is necessary if USB 5100 is used.

## 11 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:

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

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

## 12 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.

### 12.1 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.

### 12.2 Calibration storage (rEAd CAL)

The last 16 calibrations are 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:

	<b>Press for 2 seconds</b> The display will show:	rEAd LoBB or  (configuration level)
	<b>Press several times until this is displayed:</b>	read cal. = “read calibration data”
	<b>Press shortly:</b> switch between <ul style="list-style-type: none"> <li>- U.ASY = asymmetry voltage in mV</li> <li>- SL. 1 = slope acid in mV/pH *<sup>1)</sup></li> <li>- SL. 2 = slope alkaline in mV/pH *<sup>1)</sup></li> <li>- date+time display of data set</li> </ul> Additionally the bar graph display shows the electrode state rating of the corresponding calibration.	
	oder	Change between the different calibration data sets
	Quit calibration data sets display	

\*<sup>1)</sup> 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

## 13 Alarm (“AL.”)

There are 3 possible settings:

off (AL.oFF), on with buzzer (AL.on), on without buzzer (AL.no.So).

Alarm is given in the following cases (if alarm active, AL.on or AL.no.So):

- Lower alarm boundary (AL. Lo) under-run
- Upper alarm boundary (AL. Hi) over-rum
- Sensor error
- Low battery (bAt)
- Err.7: system error (always with buzzer!)

In case of an alarm, and when polling the interface the prio-flag is set in the returned interface message.

## 14 Real Time Clock (“CLOC”)

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

## 15 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.



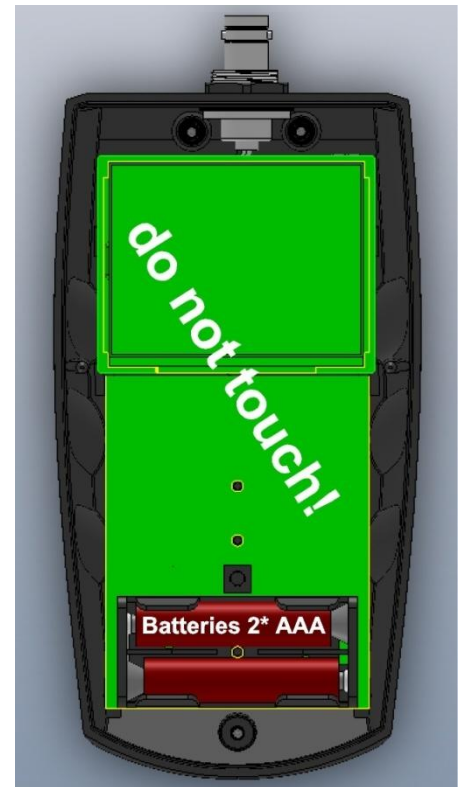
## 16 Replacing batteries

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.



## 17 Error and System Messages

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

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

$Er. 7$  = 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.

## 18 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 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 additional connection for reference electrode: 4mm banana socket
	Temperature	Pt1000 or NTC 10k via 4 mm banana socket
	Interface / ext. supply	4-pole socket for serial interface and supply, analog output 0-1V
Input resistance	pH, ORP	>10 <sup>12</sup> Ohm
Display		4 ½ digit 7-segment, additional bar graph display for battery and electrode, illuminated
pH calibration	Automatic	1 -, 2- or 3-point calibration, either DIN 19266-buffer or technical buffer GPH / PHL
	Manual	1 -, 2- or 3- point calibration
GLP		16 calibration storage adjustable calibration intervals (1 to 365 days, CAL warning after expiration)
Data logger		Real-time clock Cyclic: 10000 data sets, cycle time 1s to 60 mins Single: 1000 data sets, with measuring point input
Alarm		Buzzer / visual / interface
Additional functions		Min / max / hold
Housing		Break-proof ABS housing, incl. silicone protective cover
	Protection class	IP65, IP67
	Dimensions L*B*H [mm]	160 * 86 * 37 incl. silicone protective cover, approx. 250 g incl. battery and cover
Power supply		2*AAA batteries, (included in delivery)
Current consumption		2 mA (Out = oFF, equivalent to 500 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 communication takes place for the time of the power-off delay. The power-off delay can be set to values between 1 and 120 min.; it can be completely deactivated.
EMV		The device corresponds to the essential protection ratings established in the Regulations of the Council for the Approximation of Legislation for the member countries regarding electromagnetic compatibility (2004/108/EG). Additional fault: <1%

## 19 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.