GREISINGER

Member of GHM GROUP

Compact manual

EN

G 1500 series

pH / Redox measuring device

GE 114

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Table of contents

1 About this documentation

1.1 Foreword

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

The user must have carefully read and understood the operating manual before beginning any work.

1.2 Legal notices

The liability and warranty of the manufacturer for damages and consequential damages are voided with misuse, disregarding this document, disregarding safety notices, assignment of inadequately qualified technical personnel and arbitrary modifications of the device.

This document is entrusted to the recipient for personal use only. Any impermissible transfer, duplication, translation into other languages or excerpts from this operating manual are prohibited.

The manufacturer assumes no liability for print errors.

1.3 Further information

Software version of the device:

– V1.2 or later

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

NOTE

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

2 Safety

2.1 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!

⚠ 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.

2.2 Foreseeable misuse

The fault-free function and operational safety of the device can only be guaranteed if 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 device, personal injury and property damage, the device must be used exclusively as described in the chapter Description in the operating manual.

- Do not use in safety / Emergency Stop devices!
- The device is not suitable for use in explosion-prone areas!
- The device must not be used for diagnostic or other medical purposes on patients!

– The device is not intended to come into direct contact with food. For measurement in foods, samples must be taken and discarded after the measurement!
– Not suitable for use with requirements on functional safety, e.g. SIL!

2.3 Safety instructions

⚠ 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!

⚠ CAUTION

Empty batteries and batteries of inferior quality can leak more easily, which can destroy the device. Please also observe the instructions in the chapter “Operation and maintenance”.

NOTE

This device does not belong in children's hands!

2.4 Intended use

G 1500 The device is designed for measuring the pH value in water and aqueous media by means of suitable electrodes.

G 1501 The device 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.

2.5 Qualified personnel

For commissioning, operation and maintenance, the relevant personnel must have adequate knowledge of the measuring process and the significance of the measurements. The instructions in this document must be understood, observed and followed.

In order to avoid any risks arising from interpretation of the measurements in the concrete application, the user must have additional expertise. The user is solely liable for damages/danger resulting from misinterpretation due to inadequate expertise.

3 The device at a glance

LCD Display

Front view

Top view G 1500

Top view G 1501

3.1 Display elements

Display

Battery indicator	Evaluation of the battery status
Unit display	Display of units 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

3.2 Connections

BNC connection	Connection for pH electrode *(Un/locking with rotating ring on the cable plug)*
2x 4mm banana	Connection for temperature sensor or reference electrode (only available at G 1501)

⚠ CAUTION

Ensuring water tightness!

The device guarantees protection from spray water, rain or accidental immersion in water. This protection for the plug connector is only guaranteed when plugged in. Moisture or contaminants on the contacts can result in incorrect measurement results.

- Protect contacts from soiling and moisture!
- Dry off damp plug connectors as quickly as possible!

NOTE

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

3.3 Operating elements

On / Off button

Press briefly	Switch on the device
	Activate / deactivate lighting
Long press	Switch off the device
	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 button

Press briefly	▶ Freeze measurement (Hold)
	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

Operating status ▶ *device is in measured value display*

device is in a menu

4 Operation

4.1 Opening the configuration menu

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

Parameter	Values	Meaning
		
SEtt	**Setting the temperature**	
G 1500 :	-5 .. 105	Medium temperature in °C (at °F: 23 .. 221 °F)
G 1501 *:	-5 .. 105	Medium temperature in °C (at °F: 23 .. 221 °F) * *Parameter is only available without a temperature sensor connected*
PH.oF	**Setting the zero point**	
	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*
PH.SL	**Setting the gradient**	
	Current measurement	Setting of the gradient for calibration of the pH measurement. *If a calibration cannot be carried out, continue with the function key*
InP	**Measuring unit** (only at G 1501)	
	PH	pH measurement
	orP mV	Redox in mV, relative to silver / silver chloride - electrode
	orP mVH	Redox in mV_H, relative to hydrogen electrode

Unit	**Display unit temperature**	
	°C	Temperature display in °C
	°F	Temperature display in °F
AL.	**Alarm** (only at G 1501)	
	oFF	No alarm active
	on	Alarm via text insertion, acoustic signal and flashing of the background lighting
	bEEP	Alarm via text insertion and acoustic signal
	LitE	Alarm via text insertion and flashing of the background lighting
AL.Lo	**Min. alarm limit** *(only available if AL <> off)*	
pH	0.00 .. AL.Hi	a min. alert is triggered if the value falls below this value.
mV	-1500 .. AL.Hi	
mV_H	-1293 .. AL.Hi	
AL.Hi	**Max. alarm limit** *(only available if AL <> off)*	
pH	AL.Lo .. 14.00	If the value is exceeded, a max. alarm is triggered.
mV	AL.Lo .. 1500	
mV_H	AL.Lo .. 1707	
PoFF	**Shut-off time**	
	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

LitE	**Backlight**	
	oFF	Backlight deactivated
	15, 30, 60, 120, 240	Automatic shut-off of the backlight after a selected time in seconds, during which no buttons have been pressed
	on	No automatic shut off of the backlight
init	**Factory settings**	
	no	Use current configuration
	YES	Reset device to factory settings. After confirming with the *function-button*, the display shows: init donE

4.2 Adjustment of the measuring input (only available at G 1501)

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 display text t.oF or t.SL when switching on.

1. Switch the device off.
2. Hold the *down button* and press the *On/Off button* briefly to switch on the device and open the ***Adjustment*** menu.
3. The display shows the first parameter. Release the *down button*.

Parameter	Values	Meaning
		
t.oF	**Zero point correction**	
	0.00	No zero point correction
	-5.00 … 5.00	Zero point correction in °C. (at °F -9.00 .. 9.00)
t.SL	**Gradient correction of the temperature**	
	0.00	No gradient correction of the temperature
	-5.00 … 5.00	Gradient correction in %

Formula used by device:

Temperature = °C: Display = (measured value - t.oF) * (1 + t.SL / 100)

Temperature = °F: Display = (meas. value - 32 °F - t.oF) * (1 + t.SL / 100) + 32 °F

Adjustment example:

Temperature unit= °C, the adjustment is carried out in 2 separate steps at 0 °C (e.g. ice water) and at a reference temperature (e.g. clinical thermometer with water bath 37 °C).- First set the values of t.oF and t.SL in the adjustment menu to 0

Zero point: - Set the temperature probe to 0 °C and let it adjust.
- Start the adjustment menu and enter the display value at 0 °C for t.oF
- After leaving the menu, the device should now display 0.0 °C.

Slope: - Set the temperature sensor to the reference temperature and let it adjust.
- Calculate slope correction: $t.SL = \left(\frac{reference\ temperature}{display} - 1\right) * 100$
- Start adjustment menu and enter the calculated value at t.SL
- Exit menu, the device should now display the reference temperature.

5 Measurement Basics

NOTE

To start the measurement, remove the protection cap from the electrode and rinse the shaft and the membrane with distilled water.

5.1 pH measurement

5.1.1 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:

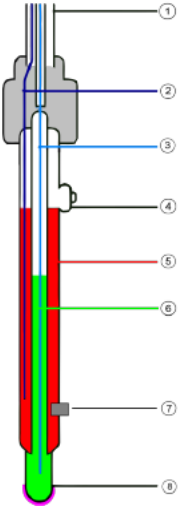
- avoid interference, electrostatic charges, etc.
- keep plug contacts clean and dry
- prevent electrodes, which do not have any special waterproof versions from extended immersion above the shaft
- calibrate electrodes sufficiently often. The can range from every hour to several weeks, depending on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

5.1.2 pH electrode

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

There are also electrodes with integrated temperature sensors.

Design of a pH electrode:



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.

5.1.3 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.

5.1.4 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.

5.1.5 Choosing a pH electrode

For most applications, the GE 114 or GE 100 or the GE 135 can be used.
However, some areas of application require special electrodes, please refer to our catalog.

Short info's on electrodes supplied in sets:

- GE 100 is a universally applicable, durable electrode with two ceramic diaphragms and liquid electrolyte.
  It can be used for measurements in drinking water, swimming pools, aquaria and slightly contaminated waste water.
- GE 114 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 135 is a waterproof, universally applicable, durable and low-maintenance gel electrode with ceramic diaphragm and integrated Pt1000 temperature sensor.
  It can be immersed above the shaft for an extended time.

5.1.6 Care and maintenance

NOTE

The glass tip of the electrode with the sensitive hydrated layer must be kept moist, e.g. with 3 mol/l KCl solution in the storage cap. Accidental drying-out of the electrode can be reversed under certain circumstances after storage for several hours in 3 mol/l KCl, but this cannot be guaranteed.

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**
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 electrode 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!

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5.2 Redox measurement (ORP) (only available at G 1501)

5.2.1 Explanation

The Redox potential 0RP 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 mVH measuring 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.

5.2.2 redox electrode

NOTE

Special redox electrodes (e.g. GR 105) are used for the redox measurement.

The pH electrodes cannot be used for redox measurement!

6 Operation and maintenance

6.1 Operating and maintenance notices

NOTE

The device 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 device 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.

6.2 Calibration of the pH measurement

6.2.1 General Explanation

The following steps describe how to calibrate the device.

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 Puffer pH 7,0 and pH 4,0

– above pH 7 uses Puffer pH 7,0 and pH 10,0.

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!

6.2.2 Buffer solutions

At least one buffer solution is required to calibrate the device.

With the help of the GPH buffer capsules, appropriate solutions can be prepared as follows:

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.

Temperature dependence of the buffer solution:

	color	**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

Alternatively, you can also use ready-to-use PHL buffer solution.
(The temperature dependency is printed there in each case).

6.3 Automatic pH calibration

With the "automatic calibration" function, the device can be recalibrated with the help of 2 buffer solutions. The temperature dependence of the GPH buffer solution is automatically compensated.

NOTE

The ready-mixed PHL buffer solutions have a slightly different temperature dependence. When using the PHL buffer solutions, an adjustment error of a few hundredths of pH is to be expected, depending on the temperature of the solutions.

NOTE

Rinse off the electrode with distilled or deionised water before and after placing the electrode in the buffer solution.

Procedure for the calibration:

1. Press the *Function key* for 4 seconds to open the ***Calibration*** menu. The display shows CAL.
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 device 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 device 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.

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. An aged or contaminated electrode, incorrect adjustment of the pressure, contamination of the platinum electrode or a damaged membrane can be the cause for a lower evaluation.

If the calibration is not completed successfully, an error message is displayed. CAL Err. appears in the display See Error and system messages [▶ 25]. Confirm the error message pressing the *Function key*. The device restarts and the standard value for the gradient is restored.

6.4 Manual calibration

In the configuration menu, it is possible to manually adjust the device by entering the corresponding parameters (SEt.t, PH.oF and PH.SL), similar to a device with rotary knobs.

You can carry out a 1-point or 2-point calibration.

1-point calibration: Here, only a zero point shift of the measurement takes place. 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

Required material: any buffer solution

2- point calibration: First the zero point and then the slope are calibrated.

Required material:
- A buffer solution with a value between pH 6.75 and 7.25
- A second buffer solution with a value below pH 6 or above pH 8

We recommend conducting a 2-point calibration or the automatic calibration, because a 1-point calibration only entails a shift of the zero point.

NOTE

Rinse off the electrode with distilled or deionised water before and after placing the electrode in the buffer solution.

Procedure for the calibration:

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 any buffer solution (for 1-point calibration) or the buffer solution with a value of pH 6.75 ... 7.25 (for 2-point).
7. Wait until the display value is stable.
8. Adjust the value corresponding to the buffer solution (note temperature dependence!) with the *Up key* and *Down key*
9. 1-point: Press the *Function key* for 2 seconds to confirm the entry and to end the calibration.
   2-point: Press the *Function key* briefly to confirm the entry and proceed with the with the 2nd calibration point.

10. The PH.SL parameter appears in the display
11. Place the electrode in the second buffer solution with a value below pH 6 or above pH 8.
12. Wait until the display value is stable.
13. Adjust the value corresponding to the buffer solution (note temperature dependence!) with the *Up key* and *Down key.*
14. Press the *Function key* for 2 seconds to confirm the entry and to end the calibration.
15. Then, rinse the electrode again with distilled or deionised water.

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”.
Confirm the error message pressing the *Function key*. The device restarts and the standard value for the zero point and gradient are restored

6.5 Display the electrode assessment of active calibration

Display the electrode assessment of active calibration:

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 SEtt appears if the temperature sensor is not plugged in. Press the *Function key* briefly again to switch to the next parameter.
4. The PH.oF parameter appears in the display.
5. Press the *Function key* for 2 seconds without changing the values with the *Up key* or *Down key* to exit the menu.

The electrode assessment in percent is displayed (“----” if no valid data is available).

6.6 Battery

6.6.1 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 device. The battery is fully depleted.

6.6.2 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 device can occur.

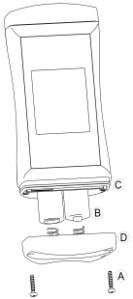
– Only use high-quality and suitable alkaline batteries!
– Do not use different types of batteries!
– Remove depleted batteries immediately and dispose of them at a suitable collection point.

NOTE

Unnecessary unscrewing endangers the protection against moisture and should therefore be avoided.

NOTE

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



1. Unscrews the Phillips screws (A)and remove the cover.
2. Carefully replace the two Mignon AA batteries (B). 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 (C) must be undamaged, clean and positioned at the intended depth.
4. Fit the cover (D) on evenly. The O-ring must remain at the intended depth!
5. Tighten the Phillips screws (A).

7 Error and system messages

Display	Meaning	Possible causes	Remedy
----	Sensor cable defect Sensor or probe defect Measurement far outside of the measuring range	Cable breakage Incorrect measuring probe Measuring probe or device defect	Connect a suitable measuring probe Stay within allowable measurement range Send in for repair
No display, unclear characters or no response when buttons are pressed	Battery depleted System error Device is defective	Battery depleted Error in the device	Replace battery Send in for repair
bAt	Battery depleted	Battery depleted	Replace battery
>CAL<	Error during the last calibration	Faulty calibration	Conduct a new calibration
Err.1	Measuring range exceeded	Measurement too high Incorrect electrode / probe connected Electrode, probe or device defect	Stay within allowable measurement range Check electrode / probe Send in for repair
Err.2	Measuring range is undercut	Measurement too low Incorrect electrode / probe connected Electrode, probe or device defect	Stay within allowable measurement range Check electrode / probe Send in for repair
SYS Err	System error	Error in the device	Switch device on/off Replace batteries Send in for repair

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

8 Technical data

Measuring range	G 1500	G 1501
pH	0.00 .. 14.00 pH	0.00 .. 14.00 pH
Redox	--	-1500 .. +1500 mV -1293 .. +1707 mV_H
Temperature	--	-5.0 .. 105.0 °C (23.0 .. 221.0 °F)
Accuracy *(at nom. temperature)*		
pH	± 0.02 pH ± 1 digit	± 0.02 pH ± 1 digit
Redox	--	± 0.1% FS ± 1 digit
Temperature	--	± 0.3 °C
Connection		
pH, (redox)	BNC connection for electrode	BNC connection for electrode
Temperature	--	Banana 4 mm, Pt1000 (2-wire)

Temperature compensation for pH	-5 .. 105 °C (or 23 .. 221 °F)
Input resistance pH	approx. 10^{12} Ohm
Measuring cycle	approx. 2 measurements per second
Display	3-line segment LCD, additional symbols, illuminated (white, luminous duration adjustable)
Standard functions	Min/max/hold
pH calibration	Manual 1- or 2-point or automatic 2-point calibration
Temperature adjustment	Offset and gradient correction
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	108 * 54 * 28 mm, without BNC socket or kink protection
Weight (G 1500 / G 1501)	~ 130 / 135 g incl. batteries, without electrode ~ 180 / 185 g incl. batteries and electrode GE 114

Nominal temperature	25 °C
Operating conditions	-20 to 50 °C; 0 to 95 %RH (temporarily condensing)
Storage temperature	-20 to 70 °C
Current supply	2 * AA batteries (mignon)
Current requirement	approx. 0,7 mA, approx. 2,5 mA with backlight
battery life	Service life > 3000 hours with alkaline batteries *(without backlight)*
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 1 Additional errors: < 1 % FS EN IEC 63000:2018 The device is intended for mobile use and/or stationary operation in the scope of the specified operating conditions without further limitations.

pH-electrode	**GE 114 WD**	**GE 100 BNC**	**GE 135 BNC**
Operating range:	pH 0-14, 0..60 °C, >200 µS/cm	pH 0-14, 0..80 °C, >100 µS/cm	pH 0-14, 0..80 °C, >150 µS/cm
Reference electrolyte:	3 mol/l KCl (gel)	3 mol/l KCl (refillable)	3 mol/l KCl (gel)
Diaphragm type:	1x pellon	2x ceramic	1x ceramic
Membrane shape:	sphere	cylinder	cone
Tube:	PC, approx. Ø12 x 120 mm	Tyril, approx. Ø12 x 120 mm	PC, approx. Ø12 x 130 mm
Connection:	BNC	BNC	BNC, 4 mm banana
Temp. sensor:	None	None	Pt1000

9 Disposal

Separation by material and recycling of device components and packaging must take place at the time of disposal. The valid regional statutory regulations and directives applicable at the time must be observed.

NOTE

The device must not be disposed of with household waste. Return it to us, freight prepaid. We will then arrange for the proper and environmentally-friendly disposal.

Private end users in Germany have the possibility of dropping off the device at the municipal collection centre. Batteries must be removed beforehand!

Please dispose of empty batteries at the collection points intended for this purpose

10 Service

10.1 Manufacturer

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

Contact:

GHM Messtechnik GmbH

GHM GROUP - Greisinger

Hans-Sachs-Str. 26

93128 Regenstauf | GERMANY

Email: info@greisinger.de | www.greisinger.de

WEEE reg. no. DE 93889386

11 Accessories

Spare parts:

GB-AA-2	art. no. 479249	Spare batteries AA (2 pcs.)

Electrodes / sensors:

GE 100 - BNC	art. no. 600704	Universal pH electrode, refillable KCL electrolyte
GE 114 - BNC	art. no. 610460	Universal pH electrode
GE 135 - BNC	art. no. 483292	Universal pH electrode with integrated Pt1000 temperature sensor
GR 105 - BNC	art. no. 607798	Universal redox electrode
GF 1T-T3-B-BS	art. no. 611088	Pt 1000 probe with silicone handle

Accessories:

GAK 1400	art. no. 603523	Working and calibration set for pH
GPF 100	art. no. 601417	Plastic bottle with wide neck, 100 ml
GPH 4,0 / 5	art. no. 602614	Buffer capsules pH 4,0 (5 pieces)
GPH 7,0 / 5	art. no. 602616	Buffer capsules pH 7,0 (5 pieces)
GPH 10,0 / 5	art. no. 602618	Buffer capsules pH 10,0 (5 pieces)
GPH 12,0 / 5	art. no. 602620	Buffer capsules pH 12,0 (5 pieces)
GRL 100	art. no. 601422	Pepsin cleaning solution, 100 ml
KCL 3 M	art. no. 602477	3 mol KCL electrolyte, 100 ml
ST-G1000	art. no. 611373	Protective bag with belt clip
GCLIP 1000	art. no. 475820	Metal belt clip, self-adhesive
G1000_BASE	art. no. 481885	Table stand, wall holder
GKK 1000	art. no. 611603	Case (235 x 185 x 48 mm), with punched lining for 1 device of the G1xxx-series
GKK 252	art. no. 601056	Case (235 x 185 x 48 mm), with foam lining for universal use
GKK 1001	art. no. 611604	Case (395 x 295 x 106 mm), universal for water analysis G1xxx series