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GREISINGER

EN

User's Guide
Digital-pH-Meter

GPH 114

CE

☞ Please carefully read these instructions before use!

☞ Please consider the safety instructions!

☞ Please keep for future reference!

Made in Germany

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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 easy reach near the device for consulting in case of doubt.

Mounting, start-up, operating, maintenance and removing from operation must be done by qualified, specially trained staff that have carefully read and understood this manual before starting any work.

The manufacturer will assume no liability or warranty in case of usage for other purpose than the intended one, ignoring this manual, operating by unqualified staff as well as unauthorized modifications to the device. The manufacturer is not liable for any costs or damages incurred at the user or third parties because of the usage or application of this device, in particular in case of improper use of the device, misuse or malfunction of the connection or of the device.

The manufacturer is not liable for misprints.

2 Safety

2.1 Intended Use

The device is designed for measuring pH using external suitable electrodes (measuring cells). The electrodes are connected via bnc connection.

Please consider: Depending on the measuring range different electrode types may be needed – choose an appropriate one.

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, etc.)
Protect the device from dirt.

2.2 Safety signs and symbols

Warnings are labeled in this document with the followings signs:

Caution! This symbol warns of imminent danger, death, serious injuries and significant damage to property at non-observance.

Attention! This symbol warns of possible dangers or dangerous situations which can provoke damage to the device or environment at non-observance.

Note! This symbol point out processes which can indirectly influence operation or provoke unforeseen reactions at non-observance.

2.3 Safety guidelines

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. 

   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. 

   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. 

   This device must not be used at potentially explosive areas! The usage of this device at potentially explosive areas increases danger of deflagration, explosion or fire due to sparking.

5. 

   The electrodes contain 3 molar KCL (GE103 1mol/l KNO_3) , which is acidly.
   First-Aid-provisions

After contact with skin:	clean with sufficient water
After contact with eyes:	rinse opened eye with sufficient water, contact oculist,
After swallowing:	drink much water. If feeling sick, contact doctor.

3 Product Specification

3.1 Scope of supply

- GPH 114 with 9V battery
- GE 114 pH- electrode with storage bottle
- Operating manual

3.2 Operation and maintenance advice

1. Battery operation:
   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.

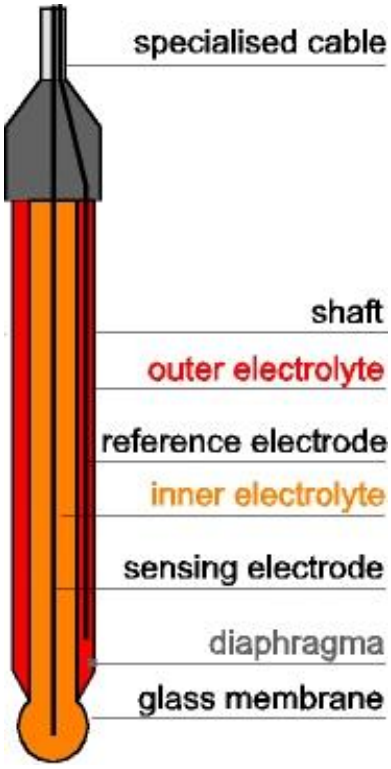
The battery has to be taken out, when storing device above 50°C. We recommend taking out battery if device is not used for a longer period of time.

2. Treat device and sensor carefully. Use only in accordance with above specification. (do not throw, hit against etc.). Protect plug and socket from soiling.
3. The electrode must be stored in 3 mol/l KCL (ours type: KCl3M), in order to avoid drying out (excluded GE103)
4. The electrode has to be stored in dry rooms at temperatures between 10°C to 30°C.
   Below 0°C the electrode might be damaged because of freezing of the electrolyte.
5. Our pH-electrodes can be used in a degree range from 90° to ± 45° compared to horizontal

4 pH-electrode

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).

4.2 Further Information

pH-electrodes are wear parts which need to be replaced, depending on the chemical or mechanical stress they are subjected to, if the values required can no longer be kept even after thorough cleaning and recovery. Please take into account that there are several materials which attack glass when they are in water solutions; other chemicals may react with the KCl-solution in the electrode thus causing blockings 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.

Electrodes have to be stored in a way that they are kept wet. An adequate solution is to store them with suitable storage bottle filled with KCl 3 M.

Problems may also occur when taking measurements in low-ion media containing solvent. Some of the problems occurring when taking measurements in such media can be counteracted by using a double-chamber electrode **(Type GE 103)** with suitable bridging electrolyte (type depending on application).

4.3 Selection of electrodes

Special electrodes for various applications:

1. **Measurements in low ion media** (rain water, water in aquariums, de-mineralized water)
   our type GE 104 (special faceted electrode for > 50µS/cm) or GE 106 (> 100µS/cm).
2. **Sea water aquariums**
   Standard combined measuring and reference electrodes **(GE 100, GE 114).**
3. **Swimming pools**
   Standard pH electrodes **(GE 100, GE 114).**
4. **Soil examinations**
   Glass electrode with several diaphragms **(GE 101)**. Use prick lance first!
5. **Cheese, fruit, meat**
   Insertion electrode **(GE 101)**. When conducting measurements in cheese, milk and other products containing proteins, a special cleaning agent has o be used for cleaning of the electrode **(pepsin solution - GRL 100)**.
6. **Photographic laboratories**

   Use double chamber electrode, with jumpering electrolyte (1 molar potassium nitrate solution); potassium nitrate solution has to be replaced as and when required. Fill watering cap with potassium nitrate solution for storage of electrode. **(GE 103)**

Normal cleaning: 0.1 molar HCl solution for at least 5 min. or protein cleaning agent.
Generally speaking, the service life of electrodes is 8 to 10 months; with proper care and maintenance their service life may even be extended to over 2 years. The actual service life is, however, dependant on the individual application If you can no longer set the pH X-value this could either be an indication that
a) the electrode is worn out and needs to be replaced, or that
b) the buffer solution is used up (prepare new solution). Even if treated very carefully during calibration (to avoid carrying over of buffer solution residuals from one solution to another if electrode is not sufficiently cleaned and dried) buffer solutions only keep for a certain period of time (approx. 1 month).
Buffer capsules can be kept for an unlimited period of time - we, therefore, recommend keeping a certain number on stock.
PH12-buffer-capsules (white) have to be stored in an exsiccator or stored together with drying agent.
We also recommend keeping a certain amount of 3 mol/l KCl on stock for re-filling.

4.4 General maintenance an measuring instructions

This pH electrode has been subjected to a series of tests demanding maximum quality standards in all stages of manufacture. **Attached electrode can be used for 0 to 14 pH respectively at temperatures between 0 and 90°C and conductivity > 200 µS/cm.**

1. Make sure to observe the following points to maintain optimum capacity and accuracy of electrode as long as possible:

1.1. Remove storage bottle from pH-electrode and rinse shaft and pH-glass diaphragm with ordinary tap water. Then dry shaft with soft tissue.

1.2. Important! Make sure to always keep pH-glass diaphragm in a slightly moist condition. If electrode is not used, the pH glass diaphragm has to be immersed into a 3 mol/l KCl solution for storage.
Drying out of the pH-glass diaphragm will affect both its capacity and sensitivity. In order to wet it throughout, put glass diaphragm in a 3 mol/l KCl solution for 24 hours.

1.3. Please avoid touching of the glass diaphragm as even the slightest damage to, or abrasion of its surface may negatively affect the capacity of the electrode.

1.4. Make it a rule to always visually check pH-electrodes for any air bubbles that might be enclosed in the pH-glass diaphragm and the external reference electrode cell. In case of air bubbles being apparent, these can be removed by shaking the electrode (downwards as for a clinical mercury thermometer)

1.5. During measurements the lateral diaphragm should also come into contact with the material to be measured. Minimum immersion depth for GE 114 is 20 mm, max. 50 mm

1.6. Electrode cable and plug should always be clean and dry as otherwise the electrical insulation may be damaged, this resulting in incorrect measurements as well as other faults.

2. Care and maintenance:

2.1. Crystallization of the 3 mol/l KCl is not avoidable!
Crystallized KCl at protection cap or closing collar can easily be removed by fingernail or cloth and is no defect or reason for reclamation.

2.3. Dirty electrodes have to be cleaned. You will find suitable cleaning agents for the pH-glass diaphragm in the following table:

Contamination	Cleaning agent
Various deposits	Light cleaning agent
Inorganic coatings	Commercial liquids for cleaning of glass
Metal compounds	1 mol/l HCI solution
Oil, grease	Special cleaning agents or solvents
Biological coatings containing proteins	1 % pepsin enzyme in 0.1 molar HCI solution
Resin-lignines	Acetones
Highly resistant deposits	Hydrogen superoxide, sodium hypo chloride

The distinct materials of the electrode have to be considered when choosing the cleaning agent.
E.g. electrodes with plastics shaft must not be cleaned with solvents. In case of doubt please contact the manufacturer for further advice.
The same has to be considered when using aggressive or other, non water based agents!

5 Calibration of pH-Meter

Accessories required: calibrating solution for pH 7 und pH 4 (resp. special accessories pH 10, pH 12)
How to prepare a calibrating solution: chapter 10 Notes B: preparation of pH buffer solutions

5.1 Calibration of pH-Meters

In order to ensure optimum measuring accuracy, the calibration range should be larger than the measuring range. We recommend using the following calibration solutions for measurements.
less than pH 7: pH 4,0 and pH 7,0
more than pH 7: pH 7,0 and pH 12,0
Plug in Cinch plug of pH-electrode into corresponding socket and switch on device by means of the lateral slide switch (a number with decimal point will be displayed on the LCD).
Determine temperature of buffer solution and set accordingly using the central turning knob (controller for temperature compensation 0 to 90°C): 1 graduation mark = approx.10°C.
Place GPH 114 meter on a solid surface; if possible try to avoid holding the meter in your hand during calibration (please refer to "Points to be observed during measuring").

5.2 Setting of the first calibration point

Carefully remove protection cap from electrode. (Attention: cap contains 3 mol/l KCl).
Rinse electrode with distilled water, dry electrode, place it in buffer solution pH 7.0.
Wait approx. 20 to 30 seconds (for display to show stable value), then use turning knob at the far right side (pH 7) to set value to 7.00.

5.3 Setting of second calibration point

In order to check calibration repeat procedures for calibration points 1 and 2 using corresponding turning knob for re-adjustments.
In case you did not prepare pH 4.0 but another buffer solution, e.g. pH 10.0 or pH 12.0, the corresponding value (pH 10.0 or pH 12.0) can be set (calibration of second calibration point) using the left-hand turning knob (pH X).
Please note that for each and every calibration procedure the buffer solution value pH 7.0, i.e. 7.00, has to be set by means of the right-hand turning knob (ph 7).

Note: **We recommend to re-calibrate the measuring device prior to each new measuring series to ensure optimum accuracy. It has to be considered that the calibration solution and the media to be measured should had similar temperatures!**

After completion of measurements fill electrode protection cap with 3 mol/l KCl solution and slip it back onto electrode. (Gentle squeezing of the cap displaces air, thus allowing cap to be slipped on easily)

Attention: pH-electrodes are extremely delicate and sensitive measuring elements. Prior to using the pH electrode, please carefully read corresponding maintenance and measuring manual!
We shall not assume any warranty if customer fails to use proper care and skill (e.g. breaking of electrode, drying-out, blocking etc.).

6 Points to be observed during measuring

The electrode is equipped with a storage bottle.
The bottle has to be pulled off before measuring.
Then it is best to rinse the electrode with tap water.

picture with storage bottle

picture without bottle

As resistance values (resulting from both the pH electrode and from the measuring device) are generally very high when conducting pH measurements, the electrode should not be hand-held but put down during the measuring operation in order to avoid a shift in voltage parameters between the electrode and the measuring device.
In case there is no suitable place where to position the device during measuring, we recommend that the device is held as far away from the plug as possible and that there is as little movement as possible. Holding the electrode in one hand and the device in the other, could also help to minimize a shift in voltage parameters.
Make it a rule never to touch the device near the sensor plug as your hand may cause electrostatic coupling resulting in measuring inaccuracies. Sudden jumps and changes in the values given on the display when touching or shaking the plug are not normally due to a loose contact in the plug but result from electrostatic changes caused by interference from hand contact.

7 Reshipment and Disposal

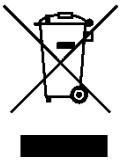
7.1 Reshipment

DANGER

All devices returned to the manufacturer have to be free of any residual of measuring media and/or other hazardous substances. Measuring residuals at housing or sensor may be a risk for persons or environment

Use an adequate transport package for reshipment, especially for fully functional devices. Please make sure that the device is protected in the package by enough packing materials.

7.2 Disposal instructions



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.

8 Specification

Measuring ranges	0,00 ... 14,00 pH
Resolution	0,01 pH
Accuracy (only device)	± 0,02 pH ± 1 Digit (at nominal temperature = 25°C
Working conditions	0 to 45 °C; 0 to 80 % r.F. (non condensing)
Storage temperature	-20 to 70 °C
Connection	BNC bayonet
pH-electrode	GE 114 (standard electrode, incl. In scope of supply), combined measuring and reference electrode with gel-electrolyte. Measuring range: 0 to14 pH, temperature 0 to 90°C conductivity >200µS/cm
Input resistant	approx.10^{12} Ohm
Display	3 ½ digit, approx. 13 mm high LCD
Calibration	3 turning knobs for: 1. temperature compensation 0 to 90°C, 2. pH 7-value and 3. pH X-value (e.g. pH 1,09, pH 4, pH 10 or pH 12, depending on working environment)
Dimensions H*W*D	119 x 69 x 33 mm
Weight	Approx. 210g (incl. battery und electrode GE 114)
Power supply	9V-battery, type IEC 6F22 (incl. in scope off supply) Battery service life: approx. 200 hours
Change battery indicator	Automatic: 'bAt 'displayed in case of low battery voltage
EMV	The device corresponds tot he essential protection ratings established in the Regulations oft he Council fort he Approximation of Legislation fort he member countries regarding electromagnetic compatibility (2004/108/EG). Additional error < 1%

9 Notes A: Temperature influence on pH buffer solutions

GPH buffer capsules for 100 ml buffer solution

Capsules for do-it-yourself mixing – unopened capsules can be stored a long time (approx. 3 years)

T [°C]	10	20	25	30	40
GPH 4,0	3,99	3,99	4,01	4,01	4,03
GPH 7,0	7,06	7,01	7,00	6,99	6,98
GPH 10,0	10,18	10,06	10,01	9,97	9,89
GPH 12,0	12,35	12, 14	12,00	11,89	11,71

10 Notes B: preparation of pH buffer solutions

General information on pH buffer solutions

The actual characteristic curve of pH electrodes deviates from the ideal characteristic. Thus the electrodes have to be calibrated before initial operation and thereafter at regular intervals to get accurate measuring values.
At least a 2-point calibration is required to get the parameters 'offset' and 'slope'. Two different buffer solutions are necessary for this.
A 1-point calibration only affects the 'offset' whereas 'slope' is assumed to be the ideal value of -59.2 mV/pH. A device calibrated only at 1 point assures only accurate measuring values at a range close to the buffer value.

Buffer capacity β

The pH value of a buffer solution changes only very little when small amounts of acids or bases are added. The buffer capacity β and the dilution influence dpH are values to measure this capability. The buffer capacity β is the amount of a strong acid or base that has to be added to 1 liter of the buffer solution in order to change its pH value by 1. The dilution influence dpH is the change of the pH value of the buffer solution when it is diluted with pure water at a ratio of 1 to 1.
Typical values for buffer capacity and dilution influence are: β = 0.03; dpH = 0.05

Please consider when choosing buffers solutions: date of expiry

Unopened and well stored buffer capsules (GPH) can be stored for a very long time in contrast to ready to use or self prepared buffer solutions. Caution with alkaline buffers: they age comparatively fast if opened (i.e. at air). The buffer gets more acid, because carbon dioxide from air is dissolved.

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

1. Fill 2 plastic bottles with 100 ml distilled water each.
2. 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.
3. 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.