Operating Manual for Digital pH-Meter GPHR 1400

Specification

Measuring range:	0.00 to 14.00 pH
Resolution:	0.01 pH
pH-electrode:	pH-electrode GE014 (standard electrode, incl. in scope of supply), plug in via front-side electrode socket (Cinch).
	GE014: combined measuring and reference electrode with refillable 3 mol-KCl-electrolyte
conductivity	measuring range: 2 to 12 pH, temperature: 5 to 45°C, 200 µS/cm
	For permanent measurements in a highly alkaline environment, special electrodes have to be used. (Please refer to special accessories.)
Input resistance:	Approx. 10^{12} Ohm
Accuracy (unit only):	+/- 0.02 pH +/- 1 digit
Working temperature:	0 to 45°C (ambient temperature for unit)
Nominal temperature:	25° C
Power supply:	9 V-battery type IEC 6F22 (included in scope of supply)
Battery service life:	Approx. 200 h
Low battery warning:	Automatic; "BAT" displayed in case of low battery voltage
Display:	3 1/2 digit LCD, approx. 13 mm high
Dimensions of housing:	Approx. 106 x 67 x 30 mm (height x width x depth)
Weight:	Approx. 200 g (incl. battery and electrode GE014)
Calibrating:	3 turning knobs for 1. temperature compensation 0 to 90° C 2. pH 7-value 3. pH X-value (eg pH 1.09 or 4 or 10 or 12) depending on working environment

Points to be observed during measuring:

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 plut as posible 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 minimise a shift in voltage parameters. Make it a rule never to touch the device near the sensor plug as your hand may cause autocapacitance 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 capacitance changes caused by interference from hand contact.

Calibrating of ph-Meter:

Accessories required: calibrating solution for ph7 and ph4 (respectively ph10, ph12 (special accessories))

How to prepare a calibrating solution:

- fill 2 plastic bottles (special accessories) with 100 ml distilled water (eg battery water) each. (100 ml will cover the entire cylindrical area, ie approx. 55 mm as of bottle base)
- place capsule for ph7 (green) in one of the bottles
- place second capsule for ph4 (orange) (respectively ph10 or ph12) in second bottle

The capsule will imbue the liquid with the respective characteristic colour:
orange = ph 4,0; green = ph 7,0, blue = ph 10,0, colourless (white capsule) = ph 12.0
Make sure that buffer solutions are prepared in time as solutions are only ready for use after capsules have dissolved respectively swollen up. Shake well before use. Pieces of swollen up capsule, which may remain in the solution, have no negative effects on the buffer solution

Calibration of pH-meter:

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 pH7: pH 4.0 and pH 7.0
more than pH7: pH 7.0 and pH 10.0

Plug in Cinch plug of pH-electrode into corresponding unit 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 = 10° C
Place GPHR 1400 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).

Setting of the first calibration point:

Carefully remove protection cap from electrode. (Attention: cover contains 3 mol KCl). Rinse electrode with distilled water, dry electrode, place it in buffer solution pH 7.0. Wait for 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.

Setting of the second calibration point:

Rinse electrode with distilled water once again, dry electrode, place it in buffer solution pH 4.0. Wait for another 20 to 30 seconds (for display to show stable value), then use turning knob at the far left side (**pH X**) to set value to 4.00. 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, eg 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, ie 7.00, has to be set by means of the right-hand turning knob (**ph 7**).

We recommend to re-calibrate the measuring device prior to each new measuring series to ensure optimum accuracy.
After completion of measurements fill electrode protection cap with 3 mol 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 failes to use proper care and skill (eg breaking of electrode, drying-out, blocking etc.).

The pH electrode

Introduction:
pH electrodes are wearing parts, which - depending on the chemic and mechanic stress they are subjected to - have to be replaced as soon as the values required can no longer be maintained even after a most thorough cleaning and regeneration. Please take into account that various substances in hydrous solutions may attack glass and that certain chemic substances and the KCl solution in the electrode may cause a chemic reaction leading to the blocking up of the diaphragm.

Examples

- When coming into contact with solutions containing proteins, as may be the case when conducting measurements in the medical and biological field, KCl can cause denaturation of the protein.
- Coagulated lacquers
- Solutions containing a larger concentration of silver ions

Problems may also occur when conducting measurements in low ion media containing solvent. Some of the problems occurring in such media can be prevented by using a double-chamber electrode with suitable jumpering electrolyte (type depending on application). **Our type GE 103**.
As they will influence the measurements, any deposits that may accumulate on the measuring membrane or diaphragm have to be removed regularly, eg by means of an automatic cleaning unit.

Special electrodes for various applications:

1. Measurements in low ion media (rain water, water in aquariums, de-mineralised water, eg for toy fish breeding): special faceted electrode (**our type GE 104**). Conductivity > 50 µS/cm.
GE 106 for conductivity > 100 µS/cm
GE 100 or GE 014 for conductivity > 200 µS/cm.

2. **Sea water aquariums**
Standard combined measuring and reference electrodes with 3 mol *KCl* (**Our types GE 100 or GE 014**)

3. **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 (**Our type GE 103**).

4. **Swimming pools**
Standard pH electrode with 3 mol *KCl* (**Our types GE 100 or GE 014**)

5. **Soil examinations**
Glass electrode with several diaphragms (**Our type GE 101**) Use prick lance first !

6. **Cheese, fruit, meat**
Insertion electrode (**Our type GE 101**)
When conducting measurements in cheese, milk and other products containing proteins, a special cleaning agent has to be used for cleaning of the electrode (pepsin solution - can be ordered from us).

Normal cleaning: 0.1 molar HCI 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 pHX-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. 3 to 4 months).
Buffer capsules can be kept for an unlimited period of time - we, therefore, recommend to keep a certain number on stock. We also recommend to keep a certain amount of 3 mol *KCl* on stock for re-filling.

General maintenance and measuring instructions for pH combi-electrodes (our standard type GE 014)

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 2 to 12 pH respectively at temperatures between 5 and 45° 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-protection cap from pH-glass diaphragm and rinse glass body and pH-glass diaphragm with ordinary tap water. Then dry glass body and pH-diaphragm 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 KC*l* 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 In order to avoid a pressure build-up or vacuum in the reference electrode cell, thus ensuring trouble-free penetration, shift rubber closing collar covering the electrolyte filling hole. For storage, the closing collar has to be properly and carefully replaced as otherwise the electrolyte will leak.
During measurements the lateral diaphragm should also come into contact with the material to be measured. Minimum immersion depth for GE 100 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 Check liquid level of reference electrolyte at regular intervals; if necessary top up with 3 mol/l KCl solution through filling hole using a syringe or pipette.

2.2 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 hypochloride

Special accessories:

GE 014	low Cost standard pH-electrode for standard applications (2 to 12 pH; 5 to 45° C); conductivity > 200µS/cm
GE 100	standard electrode for normal applications, 3 mol KCl (0 to 14 pH, 0 to 80° C); conductivity > 200µS/cm
GE 101	standard electrode for soft media (use prick lance first when conducting measurements in soil, meat etc.)
GE 103	Double-chamber electrode eg for photographic purposes (development solution etc.) 1mol KNO_3-electrolyte
GE 104	special faceted electrode for low ion water, eg distilled water, rain water etc. and conductivity > 50 µS/cm
GE 106	low cost pH electrode for conductivity > 100µS/cm.
GE 105	redox electrode (with platinum pin) cpl. with test solution
KCL 3M	100 ml injection bottle with 3 mol KCl electrolyte for topping up and/or storage (fill in protection cap) of electrodes with 3 mol KCl electrolyte.
KCL 3MG	200 ml injection bottle with 3 mol KCl electrolyte
KNO3 1M	100 ml injection bottle with 1 mol KNO_3-electrolyte (eg for GE 103)
GPF 100	plastic bottle 100 ml, for preparation of buffer solutions
GPF 200	plastic bottle 200 ml with injection cap
GPH 4.0	buffer capsule orange (pH 4.0) for preparation of 100 ml buffer solution
GPH 7.0	buffer capsule green (pH 7.0) for preparation of 100 ml buffer solution
GPH 10.0	buffer capsule blue (pH 10.0) for preparation of 100 ml buffer solution
GPH 12.0	buffer capsule white (pH 12.0) for preparation of 100 ml buffer solution
SET 014	buffer solution set (one buffer capsule pH4 and pH7 each as well as 2 plastic bottles 100ml each)
GRL 100	pepsin cleaning solution 100 ml