

Operating Manual for Digital pH/mV(Redox)/Thermo-Meter

GPRT 1400 AN



Specification:

Measuring range:	position 1 (pH): 0,00 to 14,00pH position 2 (°C): -20,0 to +110,0°C position 3 (mV): -1999 to +1999mV
Resolution:	0,01 pH; 0,1°C respectively 1 mV
Accuracy (only device):	(pH) $\pm 0,02$ pH ± 1 digit (°C) $\pm 0,5^\circ\text{C}$ ± 1 digit (mV) $\pm 0,2\%$ v.MW ± 1 digit
pH electrode:	pH electrode GE100 (standard electrode, in scope of supply), plug in via front-side electrode socket (cinch). GE100: combined measuring and reference electrode with refillable 3 mol/l-KCl-electrolyte Measuring range: 0 to 14 pH, temperature: 0 to 80°C, > 200 $\mu\text{S}/\text{cm}$ For permanent measurements in a highly alkaline environment, insertion measurements, measurements in waters with a low ion-content, for photography, etc. special electrodes have to be used (please refer to accessories) Please note: pH-electrodes cannot be used for redox measurements!
Redox electrode:	redox electrode GE105 has to be ordered separately, if required.
Temperature probe:	Silicon temperature probe (KTY81-210, GTF 1400 B included in scope of supply), connection via front-side socket (3.5 mm stereo plug). GTF 1400 B: Sensor electrically insulated and mounted in stainless steel (1.4571) tube, dia 6 mm, approx. 130 mm long, approx. 1 m of silicone cable with 3.5 mm stereo jack. The device is calibrated to the delivered probe. If the probe will be exchanged a re-calibration of the device is necessary.
Temp. compensation:	Automatic temperature compensation (ATC) of pH measurement if temperature probe is plugged in. (Insert both temperature probe and pH-electrode in measuring or buffer solution.) If temperature probe is not plugged in the medium temperature (0-90°C) has to be set by means of the central turning knob. (Switch position 2 [°C]: display of temperature set)
Input resistance:	approx. 10^{12} Ohm
Analog output:	1mV/digit, front side connection via 2-pin socket, dia 3.5 mm (minus = thread part, plus = insulated centre connection) examples: for pH-measuring: pH 0 = 0mV; pH 7 = 700mV, pH 14 = 1400mV for temperature-measuring: 1°C = 10mV, 50°C = 500mV for redox-measuring : 1mV = 1mV (± 1999 mV)
Display:	approx. 13 mm high, 3 1/2-digit LCD-display
Operating temperature:	0 to 45°C (ambient temperature for the device)
Nominal temperature:	25°C (accuracy specified at this ambient temperature)
Relative humidity:	0 to 80 %RH (non condensing)
Power supply:	9 V-battery type IEC 6F22 (included in scope of supply) or 10 V-DC mains supply via lateral 2.5 mm socket (automatic battery disconnection as soon as mains supply device is plugged in), suitable mains supply device: GNG10
Power consumption:	approx. 4mA
Low battery warning:	"BAT" will be displayed if the battery is exhausted
Dimension:	approx. 150 x 86 x 30 mm (h x w x d); impact resistant ABS plastic housing with integrated pop-up clip for table-top or suspended operation, electrode can be clipped on laterally.
Weight:	approx. 330g (incl. battery, electrode GE100 and temperature probe)
EMC:	the GPRT 1400 AN 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 (89/336/EWG). Additional fault: <1%



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Calibrating of the mV-range (Redox-Meter):

The device will be set up prior to leaving our works so that calibration of the mV-meter is not required. To carry out measurements set switch of hand-held measuring device to mV (a digit without decimal point will be displayed on the LCD).

Please make sure to use a redox electrode GE 105 only (special accessories) for measuring. pH-electrodes cannot be used for redox measurements.

Calibrating of the pH-range:

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 (e.g. battery water) each. (100 ml will cover the entire cylindrical area, ie approx. 55 mm as of bottle base).
- open pH7 capsule (green) carefully (turn one half of the capsule while pulling and make sure not to spill any solution), put content (including both capsule parts) into one of the bottles.
- put content of the second capsule for pH 4 (orange) (resp.. pH 10 o. pH 12) including both capsule parts in the second bottle.

The capsule shell will colour the liquid in the relevant colour:

orange = pH 4,0 ; green = pH 7,0 ; blue = pH 10,0; colourless (white capsule) = pH 12,0

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

Calibration of pH-meter:

In order to ensure optimum measuring accuracy, the calibration range should cover the measuring range.

Example for usage of calibration solutions:

measuring around pH 5: pH 4.0 and pH 7.0

measuring around pH 9: pH 7.0 and pH 10.0

Plug in temperature probe into corresponding 3.5 mm dia device socket (make sure not to confuse socket and analog output) and immerse probe into buffer solution. (Temperature compensation is carried out automatically).

If no temperature probe is available, switch device to temperature measuring, determine temperature of buffer solution and set temperature accordingly using the central turning knob (°C).

Put Cinch plug of pH-electrode into device socket and set switch of the hand-held measuring device to position pH (a number with decimal point and two additional digits after the point will be displayed on the LCD (e.g. 7.00)).

Setting 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 for approx. 20 to 30 seconds (for display to show stable value), then use turning knob at the right side (**pH 7**) to set value to 7.00.

Setting 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, 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, 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. For this regard that the calibration solution and the measuring solution should have the same temperature!

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 failures to use proper care and skill (e.g. breaking of electrode, drying-out, blocking etc.).

Points to be observed during measuring

As resistance values (resulting from both the pH electrode and from the measuring device itself) 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 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 minimise a shift in voltage parameters as much as possible. Make it a rule never to touch the device near the sensor plug as your hand may cause autcapacitance coupling resulting in measurement inaccuracies. Sudden jumps and changes in the displayed values when touching or shak-

ing the plug are **not** normally due to loose contacts in the plug but result from capacitance changes caused by interferences from hand contact.

Operating instructions:

- a) The device is calibrated to the probe included of the supply. If the temperature probe will be changed a re-calibration of the device is necessary!
Note: the potentiometer for the temperature adjustment are accessible via the front plate.
zero point = beside the pH-socket, slope = beside the temperature probe socket
- b) The electrode must be stored in 3 mol/l KCl (ours type: KCl3M), in order to avoid drying out (excluded GE103).
- c) The electrodes must only be used with the suitable devices. When using inappropriate devices the electrode and the device can be damaged or destructed!
- d) Device and sensor must be treated well and must be used according to the given technical specification (do not throw, bounce, etc...). Plug and sockets of the device and the electrode must be protected from contamination and humidity.
- e) Before measuring the protection-cap has to be removed.
- f) Calibrating of the measuring cell (single-rod measuring cell or measuring- and reference-electrode) have to be done according to the manufacturers instructions buffer-dilution with a value that is near the measuring cell (e.g. pH 7,0) the "asymmetry" is set. For the slope (pH X) a second buffer-dilution is used which pH-Value should be within the measuring range (e.g. pH 4,0; pH 10,0; pH12,0), but at least 2 pH-units different from the buffer-dilution used first.
- g) Our pH-electrodes can be used in a degree range from 90° to ±45° compared to horizontal



Safety regulations

This device was designed and tested considering the safety regulations for electronic measuring devices. Faultless operation and reliability in operation of the measuring device can only be assured if the General Safety Measures and the devices specific safety regulation mentioned in this users manual are considered.

1. Faultless operation and reliability in operation of the measuring device can only be assured if the device is used within the climatic conditions specified in the chapter "Specifications".
2. When transporting the device from a cold to a warm environment, condensation could affect the device's function. In this case you have to wait until the device has the same temperature as the environment before using it.
3. When connecting the device to other devices the interconnection has to be designed most thoroughly, as internal connections in third-party devices (e.g. connection of ground with protective earth) may lead to undesired voltage potentials that can affect the connected devices, could damage them or even may destruct the devices.
4. The device must be switched off and must be marked against using again, in case of obvious malfunctions of the device which are e.g.:
 - visible damage.
 - the device is not working as prescribed.
 - storing the device under inappropriate conditions for longer time.

When not sure, the device should be sent to the manufacturer for repairing or servicing.

5. **Attention:** Do NOT use this product as safety or emergency stopping device, 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.
6. The electrodes contain 3 molar KCL (GE103: 1mol/l KNO₃), 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. When feeling sick, contact doctor.

The pH-electrode:

All electrodes are delivered checked and ready for measuring. The warranty period is **6 months** for appropriate treating.

pH-electrodes are wearing parts and have to be exchanged when the demanded values are not complying with, even after thoroughly cleaning the electrode and regenerating it, depending on chemical and mechanical strain. When using please consider that different substances in aqueous solution may affect glass and that chemicals may react with the KCL-dilution in the electrode and could block the diaphragm

Examples: - protein-containing dilutions, as used in medicinal and biological measuring, the protein could be de-natured by the KCl-dilution
 - coagulated lacquers
 - dilutions containing higher concentration of silver-ions

Other problems could happen when measuring ion-depleted and solvent-containing mediums. The problems occurring measuring these mediums could partly be solved by using our double-chamber electrode with appropriate bridge-electrolyte (different, depending on use) (**type GE 103**)

Substances that deposit on the diaphragm, influence the measuring and have to be removed regularly. This can be done with the help of e.g. automatic-cleaning-facilities.

Different fields of application

1. **Measuring ion-depleted mediums** (rainwater, aquarium-water, VE-water)
Our Type GE 104 (special-grinding-electrode from 20 μ S/cm) or GE 106 (from 25 μ S/cm)
2. **Seawater-aquarium**
 Normal pH-single-rod measuring cells with 3 mol/l KCl (**type GE 100**)
3. **Photo-laboratories**
 Double-chamber-electrode (**type GE 103**) with bridge-electrolyte. (front chamber 1 mol/l KNO_3 , rear chamber: 3 mol/l KCl). Watering-cap for storing the electrode has to be filled with 1 mol/l KNO_3 .
4. **Swimming-pool**
 Standard pH-electrode with 3 mole/l KCl (**type GE 100 or GE104**)
5. **Ground survey**
 Glass-electrode with different diaphragms (**type GE 101**). Use our pre-injection-spike! (our type VD120)
6. **Cheese, fruits, meat**
 Injection-electrode (**type GE 101**). When measuring cheese, milk and other products containing protein, the electrode has to be cleaned with a special cleaning-fluid (pepsin-cleaning agent – e.g. contained in working and calibration set)

Normal cleaning: Put the electrode for 10 min. in the pepsin-cleaning agent GRL100 (0,1 mole HCl with pepsin)

The lifetime of electrodes is normally at least 8-10 months, when treating and cleaning the electrodes thoroughly it can be risen up to over 2 years. Exact statements can not be given, because it depends on the relative case of operation.

When the pH X-Value can not be set, this is a sign that

- a) the electrode is exhausted and has to be exchanged or
- b) the buffer-dilution has exhausted (prepare new dilution). Prepared buffer-dilutions have a limited life time (about 1 month) when using/calibrating it thoroughly (no procrastination of buffer-dilution-residua from one dilution to an other through cleaning and drying the electrode not enough)

Buffer-capsules have no lifetime limitations, therefore we recommend keeping a sufficient number of them in stock. PH12-buffer-capsules (white) have to be stored in an exsiccator or stored together with drying agent.

The electrolyte (3mol/l KCl) should always be available for refilling, its also recommended to keep enough in stock.

General maintenance and measuring instructions for pH-combination-electrodes

This pH-electrode has been tested and has been subordinated strict quality controls in all manufacturing-steps

1. To keep the optimum efficiency and accuracy for a long time take care of the following points:

- 1.1. Remove the storing protection-cap from the pH-glass-diaphragm and clean the glass-rod and the diaphragm with distilled water. After that dry the diaphragm and the glass rod with a soft paper towel.
- 1.2. **Important!** The pH-glass-diaphragm has to be kept wet. When not in use the electrode must be stored in 3 mole/l KCl-dilution. (except GE 103 – here 1 mol/l KNO_3). Should the pH-glass-diaphragm be dried out, the efficiency and the responsiveness are affected. To continuously moistening the electrode store it in 3 mol/l KCl-dilution for 24 hours. (except GE 103)
A longer storage of a single-rod-electrode or a reference-electrode in destinated water will deplete them of KCl. Please refill KCl-electrolyte (saturated or 3 mole) in time (except GE 103)
- 1.3 Do not touch the glass-diaphragm! Damages on the surface and attrition affect the efficiency negatively.
- 1.4 Before using perform a visual check of the pH-electrode. Should there be air-bubbles in the pH-glass-diaphragm or the outer reference-electrode you can get them out by shaking the electrode downward (like handling a quicksilver-fibre-thermometer)
- 1.5 Take care that the side diaphragm contacts the media you want to measure.
Minimum depth for GE 100 e.g. 20 mm, maximum 50 mm
- 1.6 Keep cable and plug of the electrode always clean and dry. When not, the electric insulation will be lost, through this measuring errors may occur.
- 1.7 The electrode has to be stored in dry rooms at temperatures between 10°C to 30°C. Below –5°C the electrode may be damaged because the electrolyte may freeze.

2. care and maintenance

- 2.1 check the liquid level of the reference-electrode regularly and refill it with 3 mole KCl with the help of an injection or a pipette. (except GE 107, GE 108 and GE 109)
- 2.2 Crystallisation of the 3 mole/l KCl (3 mole KCl) is inevitable! Crystallised KCl on the protection-cap and the breech-collar can be removed with fingernails or a paper towel. This is no defect or a reason for reclamation.
- 2.3 Contaminated electrodes have to be cleaned. The suitable cleaning agents for the pH-glass-diaphragm are given in the table below:

<u>contamination</u>	<u>cleaning-agent</u>
general deposits	mild washing-agent
inorganic coatings	common fluids for glass cleaning
metallic compounds	1 mole/l HCl-dilution
oil, fat	special cleaning agents or solvent
biological coatings with protein	pepsin-enzyme in 0,1 molar HCl-dilution (GRL100)
resin-lignin	acetone
extreme resistant deposits	hydrogen peroxide, sodium hypochloride

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!

Disposal instructions

Exhausted pH-electrodes must be disposed via special refuse. When delivering exhausted electrodes from our product range, free for us (sufficient post paid), we will dispose them for free.

