

Operating Manual

pH-/Redox-/Temperature - Measuring Device

GMH 3530

Version V2.3



Ihr kompetenter Ansprechpartner / Your competent contact partner :

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Operation And Maintenance Advice:

a.) When to replace battery:

If Δ and 'bAt' are shown in the lower display the battery has been used up and needs to be replaced. The device will, however, 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.

Please note: We recommend to take 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.

c) When connecting the temperature probe the connector may not lock to the jack correctly. In such a case hold the connector not at the case but at the buckling protection of the cable during the plug in.

Don't connect electrode canted! If plug is entered correctly, it will slide in smoothly.

To disconnect temperature probe do not pull at the cable but at the plug

If plug is entered incorrectly the connecting pins of the plug can be damaged. => Plug can no longer be used and connecting cable needs to be replaced.

d) Mains operation:

When using a power supply device please note that operating voltage has to be 10.5 to 12 V DC.

Do not apply overvoltage!! Cheap 12V-power supply devices often have excessive no-load voltage. We, therefore, recommend using regulated voltage power supply devices. Trouble-free operation is guaranteed by our power supply GNG10/3000.

Prior to connecting the plug power supply device with the mains supply make sure that the operating voltage stated at the power supply device is identical to the mains voltage.

e) Display values for damaged electrode cable or if no pH or redox-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!



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".
2. 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.
3. If device is to be connected to other devices (e.g. via serial interface) the circuitry has to be designed most carefully. Internal connection in third party devices (e.g. connection GND and earth) may result in not-permissible voltages impairing or destroying the device or another device connected.

Warning: If device is operated with a defective mains power supply (short circuit from mains voltage to output voltage) this may result in hazardous voltages at the device (e.g. sensor socket, serial interface).

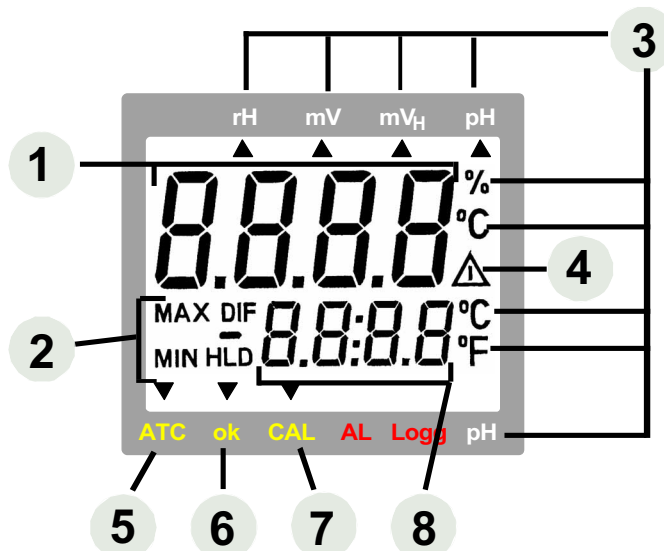
4. If there is a risk whatsoever involved in running it, the device has to be switched off immediately and to be marked accordingly to avoid re-starting.

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.

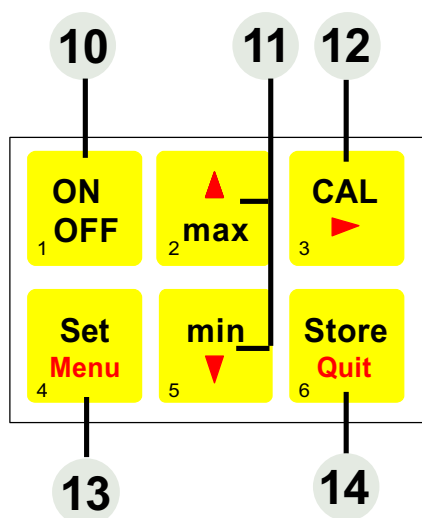
In case of doubt, please return device to manufacturer for repair or maintenance.

Displays



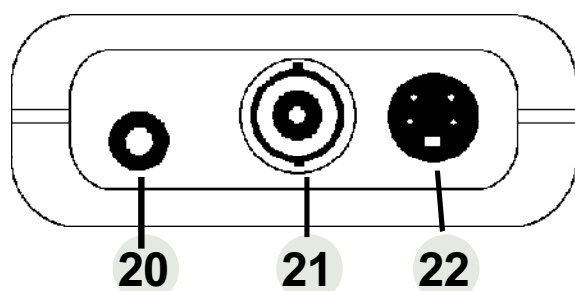
- 1 **Main display:** pH-value, redox-value (mV, mV_H), rH-value or user prompt
- 2 Display elements to show minimum/maximum/memorized measuring value
- 3 Display of **measuring units**
- 4 **Warningsignal** (low battery or recalibration prompt)
- 5 **ATC-arrow:** indicates if temperature sensor has been connected, i.e. if **automatic temperature compensation** is active, when operating in the pH, mV_H or rH mode
- 6 **ok-arrow:** indicates that measuring value has been stable for a longer period of time
- 7 **CAL-arrow:** indicates that device is being calibrated at the moment, when operating in the **pH** mode.
- 8 **Secondary display:** measuring value, temperature or user prompt

Pushbuttons



- 10 On/offkey
- 11 **min/max when taking measurements:**
 press shortly: min. or max. meas. value so far will be displayed
 press for 2 sec.: the min. or max. value will be deleted
Configuration: to enter values, or change settings
- 12 **CAL:** for 'pH' mode only:
 press shortly: display state of electrode condition and calibration data
 press for 2 sec: startpH-calibration
- 13 **Set/Menu:**
 press (Set) shortly: for 'pH' and 'mV_H': manual temperature input if no temperature probe is connected
 additionally for 'rH': manual input of pH value
 press (Menu) for 2 sec: configuration will be activated
- 14 **Store/Quit:**
 measuring: holds and memorizes current meas. value ('HLD' in display)
 Configuration: enter setting, return to measuring.


Connections






- 20 **Interface:** connection for electr. isolated interface adapter (accessory: GRS3100 or GRS3105)
- 21 **BNC-socket:** connection for pH- or redox-electrode
- 22 **Mini-DIN-socket:** connection for Pt100-temperature probe (4-wire connection; 2-wire also possible, but may result in additional meas. faults due to cable)

The mains socket is located at the left side of the instrument.

Configuration

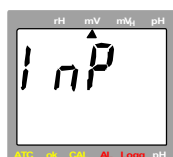
For configuration of the device press -key for 2 seconds.

Choose between the individual values that can be set by pressing the -key again. The individual values are changed by pressing the keys  or .

Use  to leave configuration and to store settings.

'Input': Selection of Measuring Function pH / Redox mV / Redox mV_H / rH / thEr

The measuring function is identified by an arrow at the top of the display:



pH: pH-measurements with pH-electrode

mV: redox measurements with redox-electrode

mV_H: redox measurement with redox-electrode. The value shown is corrected to the standard hydrogen system (DIN 38404) (temperature dependent). Temperature probe (ATC) or manual temperature input required.

rH: rH-measurement: the rH value is calculated from the measurements taken for pH, redox and temperature. You may also enter pH and temperature values manually.

thEr: Pt100 thermometer: the current temperature is displayed in the main display, the secondary display either shows the min. or max. value.

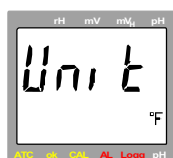
'CAL': Selection of Number of Calibration Points (for pH measurements only)



2-Pt: the pH-electrode will be calibrated at 2 points (one calibration point in the neutral range and one calibration point in the acid or basic range)

3-Pt: the pH-electrode will be calibrated at 3 points (one calibration point in the neutral, acid and basic range)

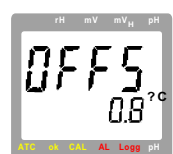
'Unit': Selection of Temperature Unit °C / °F



°C: All temperature values in degrees Celsius

°F: All temperature values in degrees Fahrenheit

'Offset': Zero Displacement of Temperature

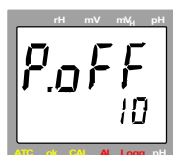


-10.0°C...10.0°C The zero point of the temperature measurement will be displaced by this value to compensate for deviations in the sensor and measuring device:

-18.0°F...18.0°F: **temperature displayed = temperature measured - Offset**

off: Zero displacement has been deactivated (=0.0°)

Power.off': Selection of Power-off Delay



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, e.g. in case of mains operation)

'Address': Selection of Base Address



01, 11, 21, ..., 91: Base address for interface communication.


Channel 1 will be addressed by the base address set, channels 2 and 3 will have the following addresses.

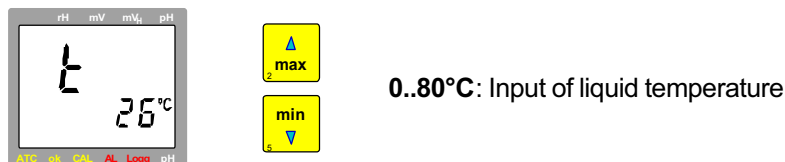
(Example: base address 21 - channel 1 = 21, channel 2 = 22, channel 3 = 23)

Using the interface converter GRS3105 it is possible to connect several devices to a single interface. As a precondition the base addresses of all devices must not be identical. In case several devices will be connected via one interface make sure to configure the base addresses accordingly.

Manual Setting of Temperature When Operating Device Without Temperature Probe


When operating in either the pH, mV_H or rH mode, the device requires the temperature value of the liquid to be measured. We, therefore, recommend to use with a temperature probe which will be automatically detected; the temperature measured will then be used to calculate the measuring values (ATC: automatic temperature compensation).

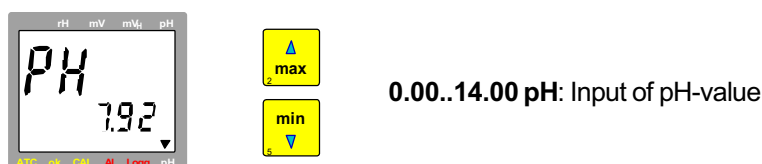
If no temperature probe is connected, temperature may be entered manually. To do so press the -key shortly..



Use the -key to acknowledge input; device returns to measuring.

Manual Stting of pH-value For Measuring Function rH

To run the GMH 3530 in the rH-measuring mode it requires both temperature inputs and the pH-values. Press  shortly to switch over to entering the pH-value:



Use -key to acknowledge setting and to return to measurement.

Calibration of 'pH'-Measurement

The electrode data of pH-electrodes are subject to a lot of fluctuation due to ageing and manufacturing tolerances. Therefore, prior to taking measurements make it a rule to always check the current calibration with buffer solutions. If deviations are too large, a recalibration will be necessary.

Buffer solutions are liquids with an accurate pH-value. The following buffers can be used for calibration

- Standard-series (4.01pH, 7.00pH and 10.01pH)
- DIN-series (1.68pH(A), 4.01pH(C), 6.87pH(D), 9.18pH(F) and 12.45pH(G))
- any buffer (neutrale buffer ranging from 6,5 ... 7,5pH)



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, therefore, recommend to use new buffer solution for calibration, as far as possible, and to rinse with non-ionising or distilled water.

How to prepare a calibration solution of the standard series

- 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 solution); put content (including both capsule parts) into one of the bottles.
- Put content of pH 4 capsule (orange) (or pH 10), including both capsule parts, in the second bottle.

The capsule shell will colour the liquid in the relevant colour: **orange = pH4.01; green = pH7.00; blue = pH10.01**

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

Please note: Automatic temperature compensation during calibration

Both the signal of the pH-electrode and the pH-buffer are depending on temperature. If a temperature probe has been connected the temperature influence of the electrode will be compensated automatically, both during measuring and during calibration. If no sensor is connected, enter actual buffer temperature as accurate as possible (see below).


When working with the standard or DIN-buffer series the buffer temperature influences will also be compensated for. 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.


How to carry out calibration

If you have not yet done so set device to measuring mode 'pH' (see configuration). Make sure that either the 2 or 3 point calibration (whichever is required) has been activated in the configuration.


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

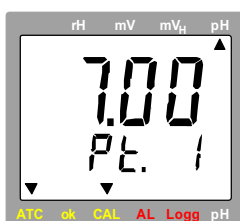
Rinse electrode with distilled water and dry.

How to start calibration: press -key for 2 sec..

The display will prompt you to measure the first calibration solution. Use -key to About calibration. In such a case the last calibration before this one remains valid.

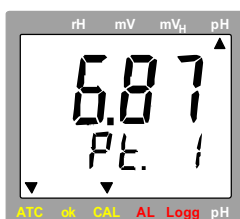
1. Selection of calibration solution

Use -key to switch over between the various series:



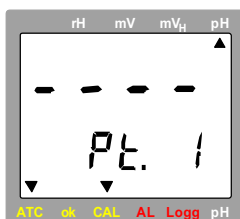
Standard-series (values at 25°C: 4.01pH, 7.00pH, 10.01pH)

neutral calibration solution 7.00pH



DIN-series (values at 25 °C: 1.68pH(A), 4.01pH(C), 6.87pH(D), 9.18pH(F), 12.45pH(G))

neutral calibration solution 6.87pH



manual buffer setting

If other buffers are to be used than those provided in the standard/or DIN series select buffer setting manually now:

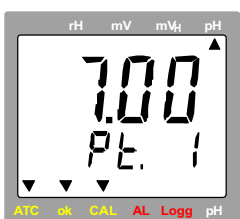


6.50 ... 7.50 pH: Setting range for neutral calibration solution



(please note, see above: 'Automatic temperature compensation during calibration')

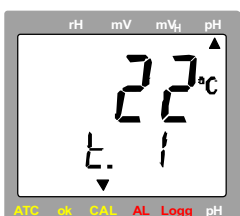
2. Calibration point 1: 'Pt. 1'




Place electrode and temperature probe (if any) in the neutral solution stirring gently. The measuring value is stable as soon as the display stops blinking and the 'ok'-arrow is


displayed in the left-hand corner of the display. Use -key to take over meas. value.

The the next calibration step will be displayed.



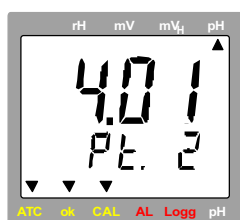
no temperature sensor: manual input of temperature of solution 1

Use -key or -key to enter the temperature of the buffer solution.




Use  to take over the value and to display the next calibration step.

3. Rinse electrode in distilled or non-ionised water

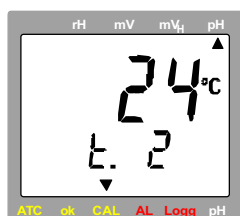
4. Calibration point 2: 'Pt. 2'





Place electrode and temperature probe (if any) in the buffer solution you want to use for the next calibration point (e.g. 4.01pH for the Standard series).


In case of manual buffer selection use  and  -keys to enter pH-value of the solution. If solutions of the Standard and DIN-series are used, their pH-value will be automatically detected. The measuring value is stable as soon as the display stops blinking and the 'ok'-arrow is displayed in the left-hand corner of the display. Use  -key to take over meas. value.

If no temperature probe is used the next calibration step will be displayed, otherwise a 2-point calibration would be completed and the state of the electrode will be displayed.



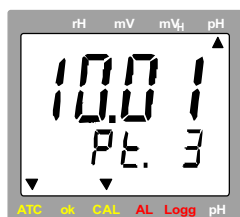
no temperature probe: manual input of temperature for solution 2

Use  or  -keys to enter the buffer solution temperature.




Use  to take over value and to display electrode condition.

5. Rinse electrode in distilled or non-ionised water, dry

6. Calibration point 3: 'Pt. 3' (for 3-point calibration only)

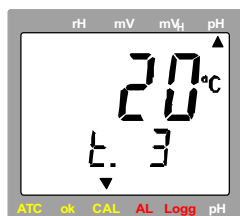


Place electrode and temperature probe (if any) in the buffer solution you want to use for the third calibration point (e.g. 10.01pH for the Standard series).



In case of manual buffer selection use  and  to enter pH-value of the solution. If solutions from the Standard and DIN-series are used their pH-value will be automatically detected. The measuring value is stable as soon as the display stops blinking and the 'ok'-arrow is displayed in the left-hand corner of the display. Use  -key to take over meas. value.


Please note: both, a basic and acid calibration point have to be selected to carry out a 3-point calibration.

If no temperature probe is used the next calibration step will be displayed, otherwise the calibration has been completed and the state of the electrode will be displayed.




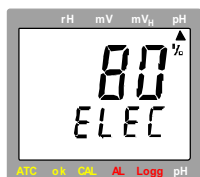
no temperature probe connected: manual input of temperature for solution 3

Use  or  -keys to enter the buffer solution temperature.

Use  to take over value and to display electrode condition.

Indication of Electrode State (for pH-measurements only)

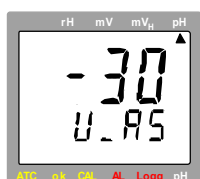
The electrode state (will be calculated during each calibration) will be displayed 3 seconds by pressing the -key or after each calibration.



- 100%** optimum electrode state
- 30...90%** satisfactory electrode state
- <30%** electrode considerably aged or soiled. Please replace electrode if there is no improvement after it has been cleaned and calibrated acc. to paragraph 'pH electrode'

For the percent evaluation both asymmetry and slope will be taken into account, the lower result will then be used to calculate the electrode state.

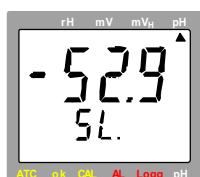
Use -key to display electrode characteristics:




Electrode asymmetry at 25°C [mV]

max. permissible range: ± 60 mV, optimum: 0 mV
Soiling of the electrode has a negative effect on the electrode asymmetry.

After pressing the -key once again shortly:



Slope of electrode at 25°C [mV/pH]

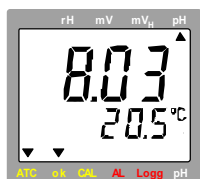
permissible range: $-62 \dots -45$ mV/pH, optimum: $-59,2$ mV/pH
In case of 2-point calibration the slope will be stated for the entire measuring range. For 3-point calibration the slope for the acid measuring range will be displayed (SL.1) first of all. By pressing the -key once again the slope for the basic range (SL.2) will be displayed

How to Perform An rH-Measurement

The rH-value of a liquid will be calculated from the measurements of the pH-value, the redox value, and the temperature of a liquid. To establish the rH-value of your solution, proceed as follows:


Please note: Make sure that pH- and redox electrodes are in a perfect condition during measuring. Make it a rule to always clean and dry them thoroughly before placing them in the solution.

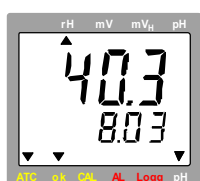
First put pH- and redox electrode and the temperature sensor in the solution, stirring it carefully.



1. How to measure pH-value:





Connect the pH-electrode and the temperature sensor to the GMH 3530. Then set GMH3530 to pH-measuring mode and calibrate electrode, if necessary, (p.r.t. configuration and calibration during measuring mode pH).

Then take measurements of the pH-value of the solution and press the -key to memorize measurement. Do not switch off the GMH3530 before the rH-measurement has been completed as otherwise the pH-value could be deleted and will have to be entered manually.



2. How to establish rH-value:








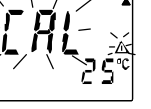
Put redox electrode and temperature sensor in the solution, stirring it carefully. Connect redox-electrode and configure the GMH3530 to rH-measuring. The main display shows the rH-value of the solution, the secondary display switches over between the pH-value measured before and the temperature.

Please note: If no temperature probe is connected the measuring values for pH and temperature can be entered manually. Press  for a short time and use  and  to enter temperature value. After pressing  shortly the pH-value can be changed. (also refer to manual temperature settings).

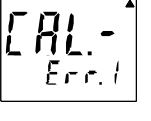

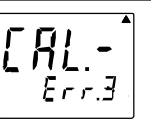

Error And System Messages

Error or system messages

General:

	Description	Remedy
	Low battery voltage, device will only continue operation for a short time	replacebattery
	Low battery voltage If mains operation: wrong voltage	replacebattery replace power supply, if fault continues to exist: device damaged
No display or confused characters	Battery voltage too low - if mains op.: power supply defective or wrong voltage/polarity - System error - device defective	replacebattery check/replace mains supply disconnect battery or power supply, wait for a short time, re-connect return to manufacturer for repair
	Values exceeding measuring range Electrode/sensor/cable defective	Check: are there any values exceeding the measuring range specified? -> meas. device not suitable -> replace
	Values below measuring range Electrode/sensor/cable defective	check: are there any values below the measuring range specified? -> meas. device not suitable -> replace
	System fault	switch on again: if fault continues to exist, device is damaged -> return to manufacturer for repair
for 'Ther.'-measurement only:		-no temperature probe connected -temperature sensor defective connect temperature sensor ->replace
pH-measurement only:		Value could not be calculated temperature out of compensating range (0...80°C), or out of measuring range (Err.1 or Err.2)
	Last calibration not valid, existing calibration data were maintained	repeat calibration process (to deactivate this warning: press Cal-key while switching device ON/OFF.

pH-calibration:

	neutral buffer not permissible: - electrode defective - wrong buffer solution - buffer solution defective	clean electrode and calibrate again if fault occurs again -> replace electrode always use neutral buffer as first solution! use new buffer solution
	Slope is too low - electrode defective - buffer solution defective	replaceelectrode use new buffer solution
	Slope is too high - electrode defective - buffer solution defective	replaceelectrode use new buffer solution
	Incorrect calibration temperature	calibration can only be carried out at 0..60°C

The pH-electrode

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 in watery solutions; other chemicals may react with the KCl-solution in the electrode thus causing blockings in the diaphragm.

Exapmles:

- with solutions containing protein, as 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.

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 (**Typ GE 103**) with suitable bridging electrolyte (type depending on application).

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.

Various applications require special electrodes

1. **Measurements in low-ion media** (rain water, aquarium water, VE-waters)
Type GE 104 (special faceted electrode as of 50 μ S/cm) or GE 106 (as of 100 μ S/cm).
2. **Sea water aquariums**
Standard pH combined electrodes with 3mol KCl (**type GE 100**).
3. **Photographic laboratories**
Use double-chamber electrodes, with bridging electrolyte (1 molar potassium-nitrate solution); potassium-nitrate solution has to be exchanged, if necessary, make sure to fill water cap for storage of electrode with potassium-nitrate solution. (**type GE 103**).
4. **Pools**
Standard pH-electrode with 3mol KCl (**type GE 100**).
5. **Soil checks**
Glass electrode with several diaphragms (**type GE 101**). Use insertion mandrell!
6. **Cheese, fruit, meat**
Insertion electrode (**type GE 101**). 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.

The Redox-electrode



The device has been optimized for electrodes using silver/silver chloride as reference system and the electrolyte KCl, 3mol/l. If other types are used the measuring function mV_H will supply wrong measuring results.

How to treat electrode:

- Store electrode in dry environment at temperatures between 10°C and 30°C. If temperature falls below -5°C the electrolyte may freeze and the electrode be destroyed.
- The electrode is equipped with a protection cap and must always be kept wet. The protection cap contains a 3mol/l-KCl-solution which needs to be topped up, if necessary. If combined electrodes and reference electrodes are kept within distilled water for a longer period of time this may lead to a loss of KCl.
- Remove air bubbles in the membrane ball by shaking (like fever thermometer).
- Check reference electrolyte level at regular intervals; if necessary, top up electrolyte level with 3 mol/l KCl solution through filling hole (closed by means of a silicon ring) using a syringe or pipette.
- Rinse electrodes thoroughly with distilled water prior to measuring.
- Rinse again during the measuring process. Clean electrodes after use. We recommend a pepsin hydrochloric acid (GRL 100) to clean soiling by protein.
- The platinum cap (silvery) can be cleaned by any commercial cleaning powder (put some cleaning powder on a piece of cloth and apply to platinum in rotary movements for a short time)
- In case the measuring function of the electrode is impaired or reacting extremely slow, please proceed as follows:
 - check reference electrode for air bubbles
 - check reference electrode by comparing meas. results to those obtained by another reference electrode
 - treat sensitive glass membrane with recovery solution (1 to 2 minutes at ambient temperature)
 - replace electrode

Our scope of supply includes all solutions for calibrating, topping up, cleaning and activating.

The serial interface

All measuring and setting data of the device can be read and changed by means of the serial interface and a suitable electrically isolated interface adapter (GRS3100 or GRS3105). In order to avoid faulty transmission, we have gone to a lot of trouble to design security measures for this function.

The following **standard software packages** are available for data transfer:

- EBS9M** 9-channel software to display the measuring value (channel 1) and the temperature (channel 2)
- EASYCONTROL**: Universal multi-channel software (EASYBUS-, RS485-, or GMH3000- operation possible) for real-time recording and presentation of measuring data in the ACCESS@-data base format.

In case you want to develop your own software we offer a **GMH3000-developmentpackage** including

- a universally applicable Windows functions library ('GMH3000.DLL') with documentation that can be used by all 'serious' programming languages, suitable for:
Windows 3.1™, Windows 3.11 for Workgroups™, Windows 95™, Windows 98™, Windows NT™
- Programming examples Visual Basic 4.0, Delphi 1.0, Testpoint (Keithley Windows measuring software)

The following interface functions will be supported:

Operating mode		pH		mV		rH		Ther	DII-Code	Name / function
Channel	1	2	1	2	1	2	1			
	x	x	x	x	x	x	x	x	0	Read nominal value
		x		x		x			1	Set nominal value
	x	x	x	x	x	x	x	x	3	Read system status
	x	x	x	x	x	x	x	x	6	Read min. value
	x	x	x	x	x	x	x	x	7	Read max. value
	x		x		x		x		12	Read ID no.
	x		x		x		x		174	Delete min. value
	x		x		x		x		175	Delete max. value
	x	x	x	x	x	x	x	x	176	Read min. measuring range
	x	x	x	x	x	x	x	x	177	Read max. measuring range
	x	x	x	x	x	x	x	x	178	Read unit for measuring range
	x	x	x	x	x	x	x	x	179	Read decimal point for measuring range
	x	x	x	x	x	x	x	x	180	Read measuring type
		x		x		x	x		194	Set display unit
	x	x	x	x	x	x	x	x	199	Read meas. type in display
	x	x	x	x	x	x	x	x	200	Read min. display range
	x	x	x	x	x	x	x	x	201	Read max. display range
	x	x	x	x	x	x	x	x	202	Read unit of display
	x	x	x	x	x	x	x	x	204	Read decimal point of display
	x		x		x		x		208	Read channel count
	x								210	Read electrode state
		x		x		x	x		216	Read offset correction
		x		x		x	x		217	Set offset correction
	x		x		x		x		222	Read power-off delay
	x		x		x		x		223	Set power-off delay
	x		x		x		x		240	Reset instrument
	x		x		x		x		248	special device functions
	x		x		x		x		254	Read program version

Functions for this device only (DLL-248)

Operatingmode		pH		mV		rH		Ther	Code		Name	Function		
Channel	1	2	1	2	1	2	1		R	W				
reade/write	R	W	R	W	R	W	R	W	R	W	R	W		
	x	x			x	x			x	x	1	257	Operating mode	Choice between modes of operation
	x										20	276	Uasymmetry	pH-calibration
	x										21	277	Slope 1	pH-calibration
	x										22	278	Slope 2	pH-calibration
							x	x			30	286	pH-value	pH-value for rH-measurement

Specification:

Display ranges:

Temperature:	-100,0 ... +250,0°C or -148,0 ... +482,0°F
pH:	0,00 ... 14,00 pH
Redox (ORP):	-1999 ... +2000 mV; referring to hydrogen system: -1792 ... +2206 mV _H (acc. to DIN 38404)
rH:	rH 0,0 ... 70,0

Resolutions: 0,1°C or 0.1°F / 0,01 pH / 1 mV / 0,1 rH

Accuracy: (at nominal temperature) device ±1digit

Temperature:	±0,2°C (-20..80°C), otherwise ±0,4°C
pH:	±0,01 pH (for electrode temperature 10..50°C)
Redox:	±0,1% FS (mV and mV _H)
rH:	±0,1 rH

Sensor connections:

pH, Redox, rH:	BNC-socket
Temperature:	-pin screened Mini-DIN-plug for Pt100 4-wire (2-wire also possible)

Input resistance: (pH, Redox) 10¹² Ohm

Nominal temperature: 25°C

Working temperature: 0 to +50°C

Relative humidity: 0 to +95%r.h. (non-condensing)

Storage temperature: -20 to +70°C

Interface Serial interface (3.5mm jack), serial interface can be connected to RS232 interface of a PC via electrically isolated interface adapter GRS3100 (see accessories).

Memory: Min-, Max-value- and Hold memory

Power supply 9V-battery, type IEC 6F22 (included) as well as additional d.c. connector (dia of internal pin 1.9 mm) for external 10.5-12V direct voltage supply. (suitable power supply: GNG10/3000)

Power consumption approx. 3 mA

Low battery warning:  and. ' bAt '

Automatic-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.

Housing dimensions 142 x 71 x 26 mm (L x W x D)
impact-resistant ABS plastic housing, membrane keyboard, transparent panel. Front side IP65, integrated pop-up clip for table top or suspended use.

Weight approx. 145 g

Temp. compensation: Automatic temperature compensation (ATC) in the operating modes "pH" or "mV_H" if temperature probe is used. If no temp. probe is used, temperature can be entered manually.

pH-calibration:
- 2 point or 3 point calibration with standard buffers, DIN-buffers, manually entered buffers
- autom. buffer detection, temperature dependence of standard or DIN buffers will be automatically compensated

- permissible electrode data: asymmetry: ±55 mV
slope: -62...-45 mV/pH

- sensor evaluation according to calibration result (from 10 to 100%).

rec. redox electrodes Reference system: silver/silver chloride, electrolyte: KCl, 3 mol/l
(use only this type when changing values to hydrogen system "mV_H" as well as for rH-measurements!)

EMC:

The GMH3630 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%