



Installation and operating manual

pH-measuring transducer

GPHU 014 MP



WEEE-Reg.-Nr. DE 93889386



Senseca Germany GmbH

Hans-Sachs-Str. 26 | 93128 Regenstauf | GERMANY

Tel.: +49 9402 9383-0 | info@senseca.com | www.senseca.com

Contents

1	SAFETY	2
1.1	GENERAL NOTE	2
1.2	INTENDED USE	2
1.3	QUALIFIED STAFF	2
1.4	SAFETY SIGNS AND SYMBOLS	3
1.5	REASONABLE FORESEEABLE MISUSE	3
1.6	SAFETY INSTRUCTIONS	3
2	PRODUCT DESCRIPTION	4
2.1	SCOPE OF SUPPLY	4
2.2	TYPE PLATE	4
3	INSTALLATION AND COMMISSIONING	5
3.1	GENERAL INSTALLATION INSTRUCTIONS	5
4	ASSIGNMENT OF ELBOW-TYPE PLUG	5
5	PRINCIPLES OF THE MEASUREMENTS	6
5.1	PH MEASUREMENT	6
5.2	PH ELECTRODE	6
6	CALIBRATION OF THE PH-TRANSDUCER	7
6.1	IDENTIFICATION COLOUR	7
6.2	HOW TO PREPARE A CALIBRATION BUFFER SOLUTION:	7
6.3	CARRYING OUT THE CALIBRATION	7
6.4	CALIBRATION OF THE FIRST POINT	8
6.5	CALIBRATION OF THE SECOND POINT	8
7	TEMPERATURE COMPENSATION	9
7.1	AUTOMATIC TEMPERATURE COMPENSATION	9
7.2	MANUAL TEMPERATURE COMPENSATION	9
8	ERROR AND SYSTEM MESSAGES	10
9	DECOMMISSIONING, RESHIPMENT AND DISPOSAL	11
9.1	DECOMMISSIONING	11
9.2	RESHIPMENT AND DISPOSAL	11
10	SPECIFICATION	12

1 Safety

1.1 General note

Any task should exclusively be performed by subject-specific qualified personnel.

The skilled personnel should carefully read and understand the manual before using the device.

Keep this document in reach for reference in case of any doubt.

The liability and warranty of the manufacturer for damages and consequential damages expires with unintended use, failure to observe these operating instructions, non-observance of safety instructions, insufficiently skilled qualified personnel or unauthorized modifications to the device.

1.2 Intended use

The Ph-transducer converts a ph-value to 4-20 mA or 0- 10V signal (depending on the model). A big advantage for converting with a ph-transducer directly at the measuring point is the measuring value can lossless transferred for large distances.

The wire at a ph electrode is limited with 10 m up to a maximum. The GPHU is used in control- measuring- and monitoring tasks e.g. environmental- and medical technology. Every standard pH electrode can be used for the GPHU, which have optional a BNC- or a cinch- connector. Also the GPHU have two banana connectors, for using a Pt1000 probe for the temperature compensation. The temperature compensation can set manually via keys.

1.3 Qualified staff

For operating, running, maintaining and commissioning the device, the staffs needs to have an adequate level of knowledge of both, the measuring and the meaning of measured values. This manual can be a valuable contribution. All instructions have to be well-understood and complied with. To be sure that there is no risk arising due to misinterpretation of measured values, the operator must have further knowledge in case of doubt - the user is liable for any harm/damage resulting from misinterpretation due to insufficient knowledge.

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.

1.4 Safety signs and symbols

Warning notices are marked in this manual as shown below:



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.

1.5 Reasonable foreseeable misuse

1.  This device must not be used at potentially explosive areas!
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.
2.  This device must not be used at a patient for diagnostic or other medical purpose.
3.  The device is not suitable for direct connection to the 230V AC mains.

1.6 Safety instructions

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.

1.6.1 During configuration



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 10 Specification. When transporting the device from a colder to a warmer ambience condensation may cause a malfunction. In that case, before operating, it is needed to wait until the device temperature has aligned to the ambience.



General instructions and safety regulations for electric, light and heavy current plants, including domestic safety regulations (e.g. VDE), have to be observed.



The electrodes usually contain 3 mol/l KCl. The storage in KCL-Solution is recommended. KCL is classified as non-hazardous, but should be handled with the necessary care (e.g. eye protection, gloves).

First aid measures

In case of contact with skin: wash off with plenty of water
In case of contact with eyes: rinse with plenty of water while holding the eyelid open and consult an eye doctor, if necessary.

If swallowed: drink plenty of water. In case of nausea, consult a doctor.

1.6.2 During normal operation



Whenever there may be 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. **With costs.**



The conceptual design, particularly when connecting with other devices has to be done thoroughly. Internal connections of other devices e.g. from ground with protective earth may lead to prohibited voltage levels that could disturb the function, damage or even destruct the device or any connected equipment.

Never run the device with a damaged or faulty power supply.

Risk of death by electrocution!



Electrodes for measuring the pH value (including those with a plastic shaft) consist partly of glass, which can cause injuries if broken.

Especially when used for measuring foods there is a danger of damage to the electrode.

Therefore, always observe the following:

- Check the electrode for damage before and after every measurement.
- When measuring foods, always use small samples for the measurement and discard afterwards.

2 Product description

2.1 Scope of supply

- | | | |
|---|---|---|
| 1 | x | ph- measuring transducer with on site display without electrode |
| 1 | x | Mounting and operating manual GPHU 014 MP |



ph- measuring transducer

2.2 Type plate

Production date code

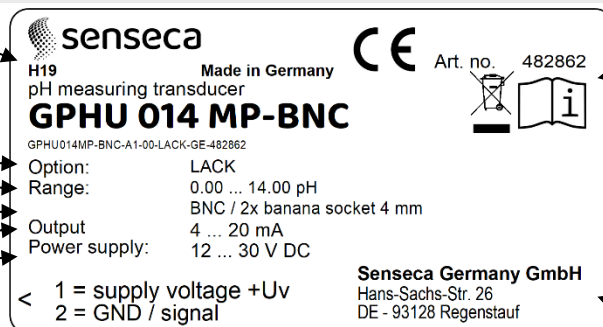
Options

Connection

Measuring range

Output signal

Power supply



Article number

CE mark: see below

Disposal: (s. Chapter 9.2)

Please refer to manual

Manufacturer address



CE mark:

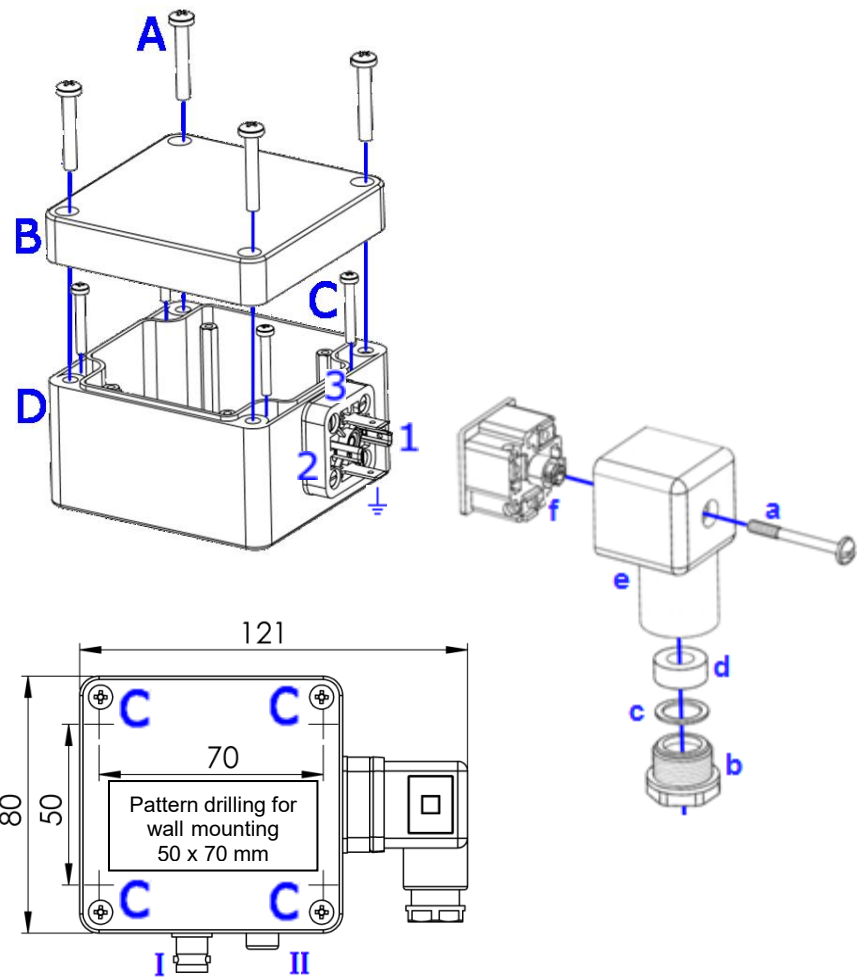
With the CE-Sign declares the manufacturer, that the Product is conform with the prevailing requirements of EU.

3 Installation and Commissioning

3.1 General installation instructions

Loosen screws (A).
Remove cover (B)
Wall mounting screws (C) are not included.
The mounting-hole-diameter is 4.2 mm.
See pattern drilling above (50 x 70 mm).

Release the screw (a).
Unplug the connector.
Release the connection sealing, cable fitting (b), shim (c) and sealing-ring (d).
Pull out the connection socket (f).
Thread cable through parts (b), (c), (d) and into connector-housing (e).
To mount the connection cable 2-, 3-, or 4-wire depending on type of device see chapter 4 Assignment of elbow-type plug, the angle plug screw has to be loosened.



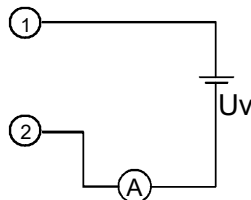
Reattach part (f) in (e).
Reattach parts (d) and (c) and tighten (b).
Plug in the connector with connection sealing and tighten (a).
Connect the ph electrode at the BNC socket (I).
Connect the temperature probe at the banana plug (II).

4 Assignment of elbow-type plug

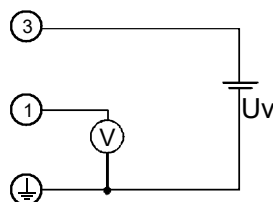


Description of the contacts.

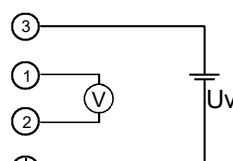
2-wire connection (4-20mA)



3- wire connection (voltage)



4- wire connection (voltage)



1= supply voltage +Uv
2= GND / signal

1 = signal +
3 = supply voltage +Uv
⊥(4) = supply voltage -Uv
signal -

1= signal +
2= signal -
3= supply voltage +Uv
⊥(4)= supply voltage -Uv

5 Principles of the measurements

5.1 pH measurement

The pH value specifies the acid or alkaline behavior of aqueous solutions.

Solutions with a pH values below 7 are acid (the more below 7 the more acid), values higher than 7 mean alkaline and pH = 7 means neutral.

The pH value is the negative common logarithm of the hydrogen ion activity (this is often approximately equal to the concentration of dissolved hydronium ions):

$$pH \text{ value} = -\log_{10} \left(\frac{c(H^+) \cdot f(H^+)}{1 \text{ mol/l}} \right) \quad \text{with} \quad \begin{array}{l} c(H^+): \text{concentration of dissolved hydronium ions in mol/l} \\ f(H^+): \text{activity coefficient (normally lower than 1)} \end{array}$$

The abbreviation "pH" stands for *pondus Hydrogenii* (Latin pondus: "weight"; Hydrogenium: "hydrogen").

pH values should always be measured and saved together with the temperature of the solution:

i.e. pH 5.87; 22.8 °C.

Reason: The pH values of most liquids are depending on temperature.

The pH measurement is highly precise but also very sensitive. The measured signals are very weak (high resistance), especially if measured in low-ion media. Therefore it is very important that:

- Disturbances (electrostatic charge, etc.) are prevented.
- A stable value is reached by slow stirring.
- Contact plugs are kept clean and dry.
- The electrode shaft is not submersed for a longer period (exception: special water-proof types).
- The electrode is calibrated often enough (see below). The needed calibration frequency depends on the used electrode and application and varies between once every hour to once in several weeks.
- A suitable electrode is chosen. Please refer to chapter 5.2.3 pH electrode suggestions.
-

5.2 pH electrode

5.2.1 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).

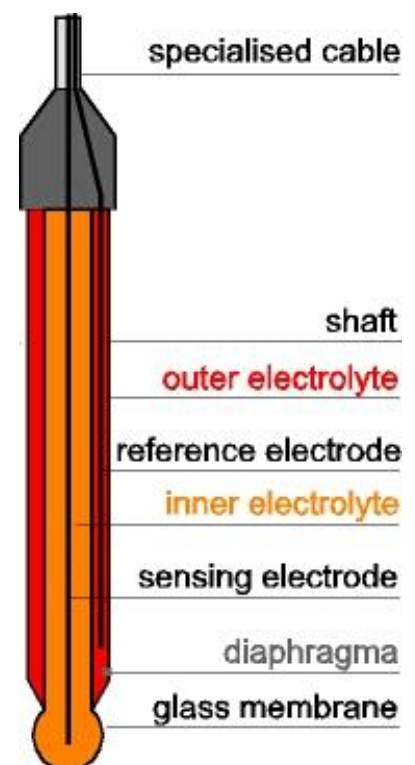
5.2.2 Further Information

pH electrodes are wear parts which need to be replaced, if the values required can no longer be kept even after thorough cleaning and recovery or the electrode signal gets to slow. The actual lifetime of an electrode depends highly on the chemical or mechanical stress it is subjected to. Please take into account that there are several materials that are in aqueous solutions aggressive to glass; other chemicals may react with the KCl-solution in the electrode thus causing blockades 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 protective cap filled with KCl 3 M. Please consider also the instructions in the electrodes manual!

5.2.3 pH electrode suggestions

Different applications require different electrodes

1. **Measurements in low-ion media** (rain water, aquarium water, VE-waters)
GE 106 BNC (as of 25 $\mu\text{S}/\text{cm}$)
2. **Sea water aquariums**
Standard pH electrodes with 3mol KCl (GE 100 BNC, GE 117)
3. **Swimming pools**
Standard pH electrodes with 3mol KCl (GE 100 BNC, GE 117)
4. **Soil checks**
Glass electrodes with several diaphragms (GE 101 BNC); use insertion mandrel!
5. **Electroplating, some paints and lacquers**
Glass electrode GE 151 BNC
6. **Cheese, fruit, meat**
Insertion electrode (GE 101 BNC or GE 120 BNC).
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 more detailed information as this is highly dependent on the individual case of application.

6 Calibration of the pH-transducer

Necessary accessories: calibration buffer solutions pH7 and pH4 or pH10, pH12. (special accessories)

6.1 Identification colour

Orange = pH 4.0
Green = pH 7.0
Blue = pH 10.0
Transparent (white capsule) = pH 12.0

6.2 How to prepare a calibration buffer solution:

- Fill two plastic bottles with 100ml distilled water each.
- Throw the pH7 capsule into one of the bottles.
- Throw the pH4 capsule or pH10, pH12) into the other one.
- The capsule shell will colour the liquid in the relevant colour:
- Make sure to prepare buffer solutions in time as they can only be used after 3 hours.



If they are needed earlier the capsules can carefully be opened. Turn one half of capsule while pulling. **Do not spill any of the contained powder!**

- Take both, powder and capsule halves, into the referring bottle.
- Shake well before usage.

6.3 Carrying out the calibration

For the optimum measuring accuracy the calibration values should be chosen according to the range to be measured.

We suggest the following.

- Measured values are below pH 7: pH 4.0 and pH 7.0
- Measured values are above pH 7: pH 7.0 and pH 10.0 or : pH 7.0 and pH 12.0

Connect the pH electrode and the temperature probe (if available) to the transmitter.

If no temperature probe is available, the temperature of the buffer solution has to be measured by any other way and has to be entered manually by means of the keys. See chapter 7.2 Manual Temperature Compensation.

6.4 Calibration of the first point



Remove the electrode safety cap carefully. Contains 3 mol KCl!

- Rinse electrode with distilled water and dry.
- Place electrode to the pH 7.0 buffer solution. If available, temperature probes, too).
- Stir gently and wait at least 20 seconds until a stable measuring value is displayed and start calibration:
Press key 1 ("SET") for 2 seconds, the display will show "PH 7" and the currently measured pH value alternating.
Set the value of the pH 7 solution with the keys 2 and 3.
Acknowledge the pH 7 calibrations by pressing key 1.
The display now shows "PH -" alternating with the currently measured pH value.
- Next steps: See chapter 6.5 Calibration of the second point.
- If there are larger deviations of the measuring values, the calibration should be repeated.



Note! If the value of the solution cannot be set, the maximum permissible range for the zero offset is exceeded. In this case the electrode is defective or the calibration solution is unfit for use.

The pH 7 calibration is restricted to a nominal pH value in between 6.75 to 7.25 pH. When trying to perform a calibration outside this range the display will show "Err" on key press of key 1 "SET".

Therefore the transmitter doesn't accept this value and remains at the entering of the first calibration point.

6.5 Calibration of the second point

- Rinse electrode with distilled water and dry. Place electrode to the pH 4.0 or pH10, pH12 buffer solution. If available, temperature probes, too.
- Stir gently and wait at least 20 seconds until a stable measuring value is displayed and continue the calibration:
Set the value of the buffer solution with the keys 2 and 3.
Acknowledge the calibration by pressing key 1.
The calibration will now be saved in the device, it is now calibrated.
- To check the calibration the electrode should be tested with the referring buffer solutions. If there are larger deviations of the measuring values, the calibration should be repeated.



Note! If the device does not allow the input of the buffer value, the permissible range of the electrode's slope is exceeded. In this case the electrode is defective or the calibration solution is unfit for use.

- The calibration of the second point is restricted to values of < 5.00 pH respectively >9.00 pH. When trying to perform a calibration outside the range, the display will show "Err" on key press of key 1 "SET". Therefore the transmitter doesn't accept this value and remains at the entering of the second calibration point.
- Calibration should be done before each new measuring series to get highest accuracy. Refill the protection cap with 3 mol KCl solutions after usage of the electrode and put it back on top of the electrode. Press cap gently to displace most of the contained air – then it can be pushed to the electrode much easier.



Electrodes are very sensitive. Please read manual of the electrode carefully before usage.

7 Temperature Compensation

Temperature can be compensated automatically when temperature probe is connected. Or manually.

7.1 Automatic Temperature Compensation

- As soon as a Pt1000 temperature probe is connected and the temperature is within the temperature measuring range the transducer activates the automatic temperature compensation (ATC).
- The display now shows an arrow pointing to "ATC".
- Display of the measured temperature:
Press key 2 or 3 shortly, the display will show the temperature value in degrees Celsius for approx. 4 seconds and the arrow "Temp".



Note! To connect electrodes with integrated Pt1000 and only one banana plug (e. g. GE 117) the plug has to be connected at the upper socket! The lower jack is connected with the „Sig-“-connector (outside contact) of the electrode socket.

7.2 Manual Temperature Compensation

- If no temperature probe is connected the manually entered value will be used, the "ATC" arrow won't be shown.
- Display of entered temperature:
Press key 2 or 3 shortly, the display will show the temperature value in degrees Celsius for approx. 4 seconds and the arrow "Temp".
- Setting of temperature:
Press key 2 or 3 more often or longer lasting and enter the desired value in the range of: -30 ... 150 °C.

8 Error and System Messages

Display	Description	Possible fault cause	Remedy
FE 1	Measuring values exceeding measuring range	PH value is out of the transducers measuring range.	Transducer is unsuitable for application.
		Calibration is wrong.	Recalibrate the transducer.
		Temperature of temperature compensation is different to the real temperature.	Manual temp.comp: enter the right value.
			ATC: check if temperature probe is connected correctly and is placed in the measuring medium, wait until the temperature value is adjusted, if necessary.
FE 2	Measuring values below measuring range	Temperature of temperature compensation is different to the real temperature.	Manual temp.comp: enter the right value.
			ATC: check if temperature probe is connected correctly and is placed in the measuring medium, wait until the temperature value is adjusted, if necessary.
		PH electrode defective.	Replace electrode.
		Transducer defective.	Return to manufacturer for repair.
FE 7	System fault	Error in transducer.	Disconnect transducer from supply and reconnect. If error remains: => Return to manufacturer for repair.
8.8.8.8	Segment test	The transducer performs a display test for 2 seconds after switch on. After that it will change the display of the measuring.	
	Input signal is not valid	PH electrode not connected.	Check the connection and cable.
		Permissible input range is exceeded.	Check if not a wrong electrode (redox or others) is connected. Replace electrode.

9 Decommissioning, Reshipment and disposal

9.1 Decommissioning

Always disconnect the device before from its supply before decommission e.g. at fuse. Valid general safety requirements shall be observed.

Please also make sure that connected Loads are disconnected also and are in a safe state.

9.2 Reshipment and disposal



All devices returned to the manufacturer have to be free of any residual of measuring media and 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. Add the completed reshipment form of the Senseca website.



The device must not be disposed in the unsorted municipal waste! Send the device directly to us (sufficiently stamped), considering the above if it should be disposed. We will dispose the device appropriate and environmentally sound.

10 Specification

Measuring range		0.00 ... 14.00 pH or see 2.2 Type plate	
Output signal		See 2.2 Type plate	
Accuracy: device at nominal temperature	Display	±0.02 pH ±1 digit	
	Output signal	±0.2 % FS	
Connection		4 - 20 mA ->2-wire see chapter 4 Assignment of elbow-type plug Voltage ->3- resp. 4-wire see chapter 4 Assignment of elbow-type plug	
Electric isolation		input electrically isolated	
Auxiliary energy: supply voltage		U _v = 12 - 30 V DC (4-20mA) U _v = 18 - 30 V DC (0-10V) or refer to type plate	
Reverse voltage protection		50V permanent	
Perm. impedance at 4-20mA		R _L (Ohm) > 3000 Ohm Example: for U _v = 18V: R _A < (18V - 12V) / 0.02A => R _A < 300 Ohm	
Permissible load at 0-...V		R _L (Ohm) > 3000 Ohm	
Electrode		Any pH electrode of our program is suitable. - refer to suitable socket! Electrode is not included in scope of supply!	
Input resistance		10 ¹² Ohm	
Electrode socket		BNC-socket	
Temperature compensation		-30 ... 150 °C	
Temperature probe input		Manually by means of 2 Automatically when Pt1000 temperature probe is connected	
Temperature sensor socket		2 x banana plug Ø4mm	
Calibration	Acceptable electrode data	via 3 keys and integrated LCD	
		asymmetry	approx. ±50 mV
		slope	approx. 45 ... 62 mV/pH
Display		approx. 10 mm high, 3½-digit LCD-display	
Nominal temperature		25 °C	
Operating temperature		0 ... 50 °C	
Relative humidity		0 ... 95 % RH non-condensing	
Storage temperature		-20 ... 70 °C	
Housing		ABS. IP65 - with the exception of electrode and temperature probe connection sockets	
Dimensions		82 x 80 x 55 mm. Without elbow-type plug and sensor sockets	
Mounting		With fixing holes for wall mounting. In housing - accessible after cover has been removed	
Mounting distance		50 x 70 mm, max. shaft diameter of mounting screws is 4 mm	
Electric connection		elbow-type plug conforming to DIN 43650 (IP65) Maximum wire cross section: 1.5 mm ² Wire/cable diameter from 4.5 to 7 mm	
Directives / standards		The device confirm to following European directives: 2014/30/EU EMC directive 2011/65/EU RoHS Applied harmonized standards EN 61326-1 : 2013 Emission level: Class B EMI immunity according to table 2 Additional fault: <1%	