

Sterilisable Process Electrode for pH /Redox Measurement *CeraGel P CPS 71/72*

pH /Redox Electrode with double Chamber Reference System and integrated Bridge Electrolyte



Features and benefits

- Long-term stability electrode with double chamber reference system
 - Very easy to handle as with standard gel electrodes
 - Effective and stable contact between diaphragm and reference lead through integrated bridge electrolytes
 - Protected reference lead
 - Extremely long diffusion path for electrode poisons
- Short response time due to ceramic diaphragm
- Poison resistance through integrated response zones for silver ions and electrode toxins
- Resistance to high temperatures and alternating pressure through integrated bridge electrolytes with new composition

Application

- Process systems and process monitoring with:
 - Quickly changing pH values
 - High proportion of electrode poisons such as H_2S
 - Alternating temperatures and pressures
- Food industry and pharmaceutical industry (sterilisability)
- Water treatment



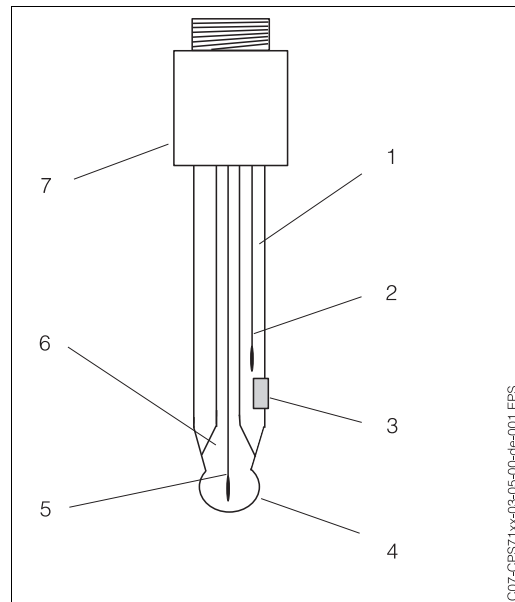
Function and system design

Measuring principle

The pH value is used as a unit of measurement for the acidity or alkalinity of a medium. The pH value plays a key role in a wide range of natural and industrial chemical and biochemical processes.

Measuring pH

In industry and in laboratories, glass electrodes are almost always used for measuring pH. The structure of a glass electrode is depicted schematically in the diagram below.

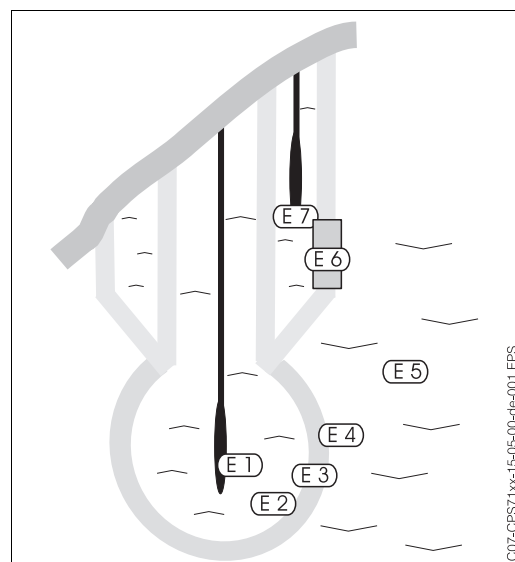


Schematic structure of a glass electrode

- 1 Reference electrolyte
- 2, 5 Ag/AgCl metal lead
- 3 Diaphragm
- 4 pH membrane
- 6 Buffered inner electrolyte
- 7 Plug-in head with Pg 13.5

The membrane glass supplies an electrochemical potential irrespective of the pH value of the medium. This is produced by the selective penetration of H^+ ions through the outer layer of the membrane. An electrochemical boundary layer forms at this point.

The potential of the overall system is made up of the total of the individual potentials (diagram below).



Individual potentials of the pH measuring chain

- E 1 Metal lead / inner electrolyte
- E 2 Inner electrolyte / membrane, inner
- E 3 Membrane, inner / membrane, outer
- E 4 Membrane, outer / medium
- E 5 Medium
- E 6 Diaphragm diffusion potential
- E 7 Reference electrolyte / reference lead

Only the potential on the "outer side of the membrane to the medium" (E 4) is variable. All other individual potentials are constant or negligibly small due to design measures (diaphragm diffusion potential). Therefore, the voltage measured along the entire chain is only dependent on the pH value of the medium.

The measuring transmitter converts the measured voltage into the corresponding pH value using the Nernst equation.

The temperature and pH value of the medium influence the pH measurement and life cycle of the pH electrode. Also, substances, which may form coatings on the membrane or diaphragm thereby forming so-called electrode poisons such as H_2S , may impair the quality of measurement.

Redox potential

Besides acid/alkali equilibria, fluid media also contain equilibria between oxidising and reducing components.

The redox potential can be used to measure the state of these equilibria.

Redox potential is measured similar to the pH measurement. A platinum electrode is used instead of the pH-sensitive glass membrane.

Equipment architecture

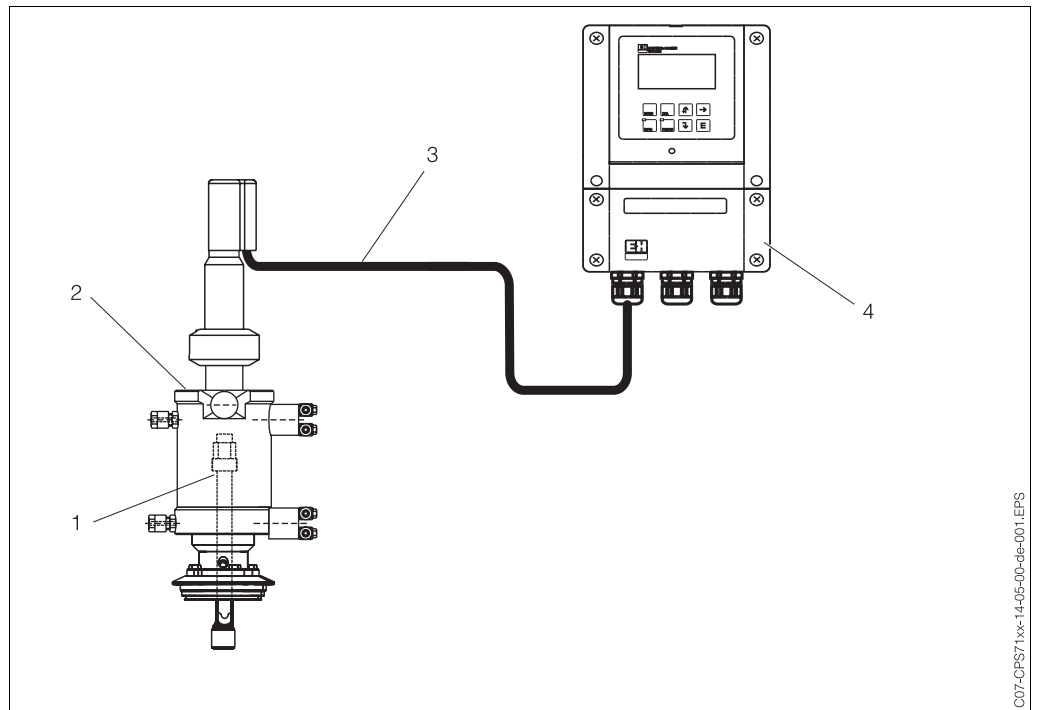
The complete measuring system comprises at least:

- pH electrode CPS 71
or redox electrode CPS 72
- Special measuring cable, e.g. CPK 9 (with TOP 68 connection)
- Measuring transmitter, e.g. Liquisys M CPM 223 (for panel mounting),
Liquisys M CPM 253 (field instrument), Mycom S CPM 153 or MyPro CPM 431.

There are additional accessories available depending on application:

- Immersed or flow or retractable assembly, e.g. CleanFit H CPA 475
- Extension cable
- Junction box VBA or VBM

The diagram below gives an example of a measuring system.



pH measuring system

- 1 pH electrode CPS 71
- 2 Assembly CleanFit H CPA 475
- 3 Special measuring cable CPK 9
- 4 Measuring transmitter Liquisys M CPM 253

Measured parameters

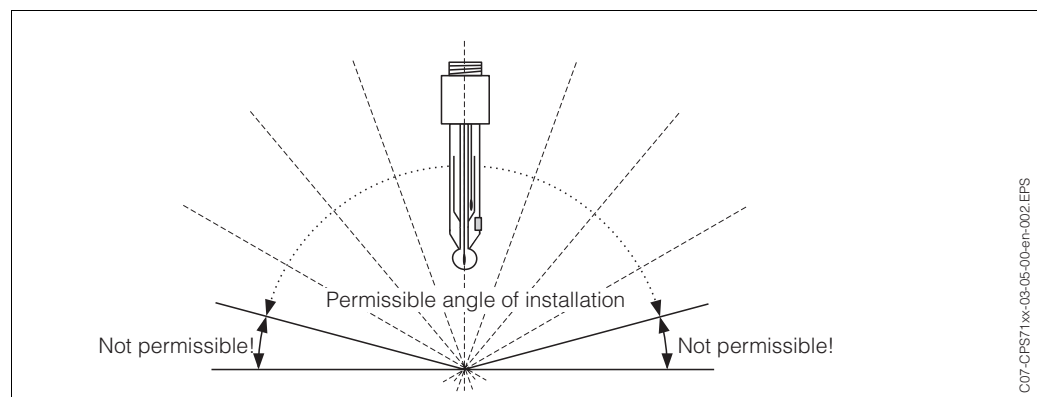
Measured variables	pH value and optional temperature (CPS 71) Redox potential (CPS 72)
Measuring range	0 ... 14 pH -1500 ... 1500 mV

Performance characteristics

Reference operating conditions	Reference temperature: 25°C Reference pressure: 1013 hPa
Maximum measured error	± 0.05 pH (CPS 71) ± 3 mV (CPS 72) (under reference conditions and precise calibration given)

Operating conditions (installation)

Installation instructions	Do not install the electrode overhead. The angle of inclination must be at least 15° from the horizontal. A smaller installation angle is not permitted as such an angle results in an air cushion forming in the glass sphere. This may impair full wetting of the pH membrane with the inner electrolyte. The diagram below shows the permissible installation conditions.
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Electrode installation; installation angle at least 15° to the horizontal



Note!
Make sure you comply with the instructions in the operating instructions for the assembly used.

Operating conditions (environment)

Ambient temperature range



The ambient temperature may not drop below -15°C .

Caution!

Danger of frost damage

Do not operate the electrode at temperatures below -15°C .

Storage temperature

0 ... 50°C

Ingress protection

IP 68 (with TOP 68 plug system)

Operating conditions (process)

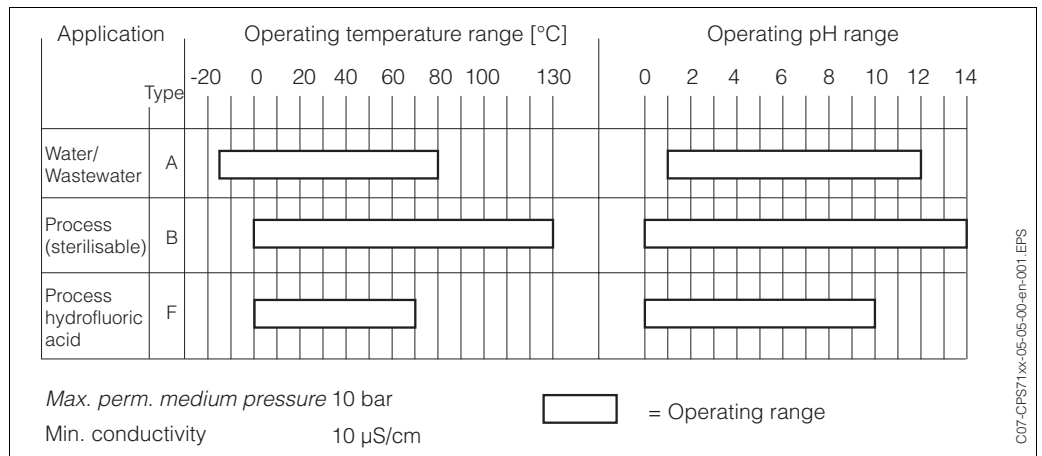
Process conditions

Process temperature range: pH: refer to diagram below Redox: $-15 \dots 130^{\circ}\text{C}$

Process pressure: 0 ... 10 bar

Minimum conductivity 10 $\mu\text{S}/\text{cm}$

The diagram below shows the applications of the various pH membrane glass specifications of the CPS 71 as a factor of electrode, process temperature and pH value.



Temperature and pH applications of the CPS 71 electrode



Caution!

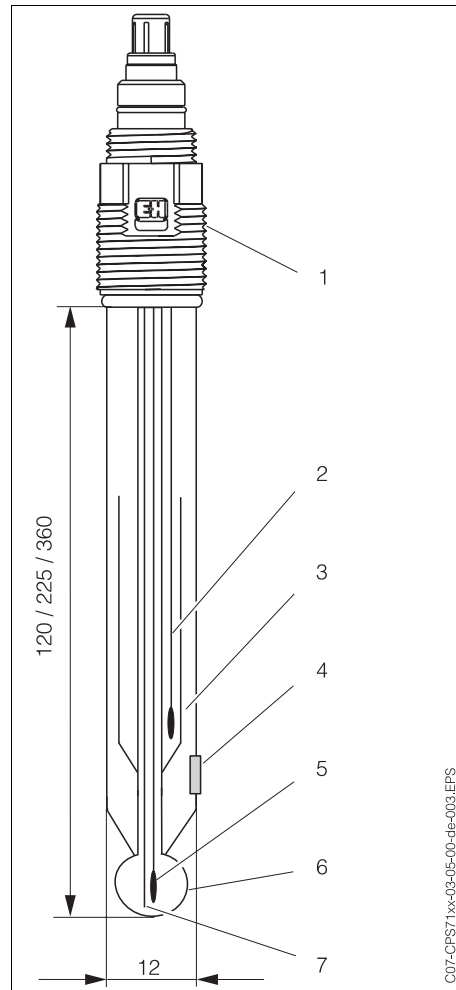
Danger of damage to the electrode

Never use the electrode for applications outside the given specifications.

Please refer to the instructions on process conditions for the assembly used as specified in the operating instructions.

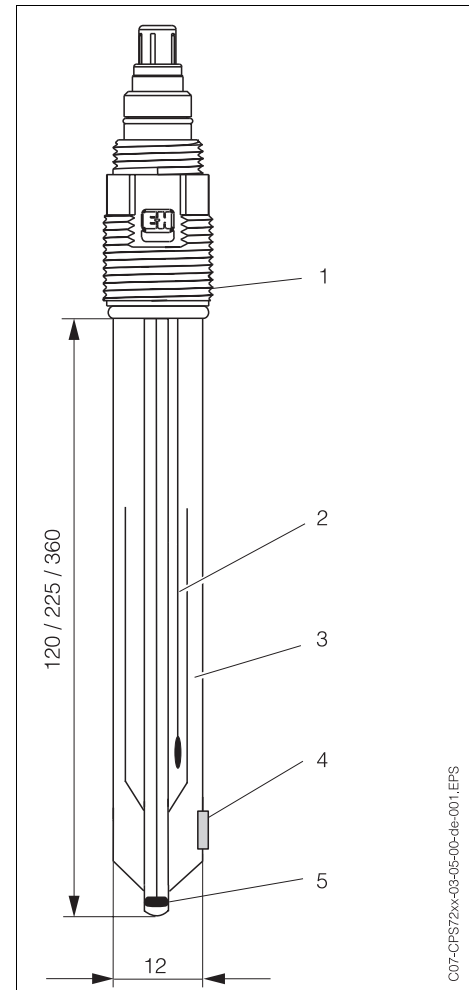
Mechanical construction

Design, dimensions



pH electrode CPS 71

- | | |
|----------------------|----------------------|
| 1 Pg 13.5 | 5 Ag/AgCl metal lead |
| 2 Ag/AgCl metal lead | 6 pH membrane |
| 3 Bridge electrolyte | 7 Temperature sensor |
| 4 Diaphragm | |



Redox electrode CPS 72

- | | |
|----------------------|---------------------------|
| 1 Pg 13.5 | 5 Platinum ring electrode |
| 2 Ag/AgCl metal lead | |
| 3 Bridge electrolyte | |
| 4 Diaphragm | |

Weight 0.1 kg

Materials

Electrode shaft:	Process-specific glass, lead-free
pH membrane glasses:	Types A, B, F
Metal lead	Ag/AgCl
Diaphragm:	Ceramic, sterilisable
Redox measuring element:	Platinum

Temperature sensor Pt 100, Pt 1000 or NTC 3 K Ω (Class A acc. to DIN IEC 751)

Process connection Pg 13.5

Plug-in heads

ESA: Threaded plug-in head Pg 13.5, TOP 68 for electrodes with temperature sensor
HDA: Threaded plug-in head Pg 13.5, TOP 68 for electrodes with temperature sensor, 16 bar (triple safety overpressure in accordance with TÜV certificate)
GSA: Threaded plug-in head Pg 13.5, for electrodes without temperature sensor
SME: Threaded plug-in head Pg 13.5, SMEK

Electrolyte Polytex 3 mol/l KCl, AgCl-free
Bridge electrolyte

Ordering information

Product structure of CPS 71

Electrode type			
1		pH combination electrode $E_0 = 7.0$	
2		pH combination electrode $E_0 = 7.0$ with Pt100 temperature sensor	
3		pH combination electrode $E_0 = 7.0$ with Pt1000 temperature sensor	
7		pH combination electrode $E_0 = 7.0$ with temperature sensor NTC 3 K Ω	
Application			
	AB	pH 1-12, -15 to 80°C, 1 diaphragm	
	AC	pH 1-12, -15 to 80°C, 3 diaphragms	
	BB	pH 0-14, 0 to 130°C, sterilisable, 1 diaphragm	
	BC	pH 0-14, 0 to 130°C, sterilisable, 3 diaphragms	
	FB	pH 0-14, 0 to 70°C, max. 1 g/l HF, 1 diaphragm	
Shaft length			
	2	120 mm	
	4	225 mm	
	5	360 mm	
Plug-in head			
	ESA	Threaded plug-in head Pg 13.5, TOP 68	
	HDA	Threaded plug-in head Pg 13.5, TOP 68, 16 bar	
	GSA	Threaded plug-in head Pg 13.5, DIN coax (not for electrodes with temperature sensor)	
	SME	Threaded plug-in head Pg 13.5, SMEK	
CPS 71-			Complete order code

Product structure of CPS 72

Electrode type			
	0	Standard version	
Measuring element			
	PB	Platinum ring	
Shaft length			
	2	120 mm	
	4	225 mm	
	5	360 mm	
Plug-in head			
	ESA	Threaded plug-in head Pg 13.5, TOP 68	
	HDA	Threaded plug-in head Pg 13.5, TOP 68, 16 bar	
	GSA	Threaded plug-in head Pg 13.5, DIN coax (not for electrodes with temperature sensor)	
	SME	Threaded plug-in head Pg 13.5, SMEK	
CPS 72-			Complete order code

Accessories

pH buffer solutions

pH 4.0 red, contents: 100 ml; Order No.: CPY 2-0
pH 4.0 red, contents: 1000 ml; Order No.: CPY 2-1
pH 7.0 green, contents: 100 ml; Order No.: CPY 2-2
pH 7.0 green, contents: 1000 ml; Order No.: CPY 2-3

Redox buffer solutions

+225 mV pH 7.0, contents: 100 ml; Order No.: CPY 3-0
+468 mV pH 0.0, contents: 100 ml; Order No.: CPY 3-1

pH measuring cable

For electrodes with either ESA or HDA plug-in heads:
pH measuring cable CPK 9 (also for high temperature applications, IP 68 / NEMA 6X, also for explosion-hazardous areas)

For electrode with GSA plug-in head:
pH measuring cable CPK 1

Order No. for measuring cables according to specification,
see Technical Information TI 118C/07/en; Order No. 50068526

Endress+Hauser
GmbH+Co.
Instruments International
P.O. Box 2222
D-79574 Weil am Rhein
Germany

Tel. (07621) 975-02
Fax (07621) 975-345
<http://www.endress.com>
info@ii.endress.com

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