Level | Pressure | Flow | Temperature | Liquid Analysis | Registration | Systems Components | Services | Solutions

Technical Information

Ceragel CPS71 and CPS71D

pH electrodes, analog and digital with Memosens technology For process technology, hygienic and sterile applications, with double junction reference system and integrated bridge electrolyte, optional built-in temperature sensor

Application

- Hygienic and sterile applications (sterilisable, autoclavable)
  - Fermenters
  - Biotechnology
  - Pharmaceutical industry
  - Food industry
- Process technology and monitoring of processes with:
  - quickly changing pH values
  - high proportion of electrode poisons such as H_2S

With ATEX, FM and CSA approval for application in hazardous areas

Your benefits

- Suitable for CIP / SIP cleaning and autoclavable maintaining high accuracy
- Certified biocompatibility
- Free of acrylamide
- Long-term stable electrode with double junction reference system
  - protected reference lead
  - extremely long diffusion path for electrode poisons
  - short response time due to ceramic diaphragm
- Integrated bridge electrolyte
  - effective and stable contact between diaphragm and reference lead
  - insensitive to temperature and pressure changes
- Version with pressurized reference system specially designed for fermentation processes
- Version for upside-down installation
- Optionally, with built-in Pt 100 or Pt 1000 temperature sensor for effective temperature compensation

Further benefits offered by Memosens technology

- Maximum process safety through contactless inductive signal transmission
- Data safety through digital data transmission
- Easy handling due to storage of sensor-specific data
- Predictive maintenance possible thanks to registration of sensor load data

TI245C/07/en/10.05
51505837

Endress+Hauser

People for Process Automation

Function and system design

Measuring principle

pH measurement
The pH value is used as a unit of measurement for the acidity or alkalinity of a liquid medium. The membrane glass of the electrode supplies an electrochemical potential which is dependent upon the pH value of the medium. This potential is generated by the selective penetration of H^+ ions through the outer layer of the membrane. An electrochemical boundary layer with an electric potential forms at this point. An integrated Ag/AgCl reference system serves as reference electrode.
The transmitter converts the measured voltage into the corresponding pH value using the Nernst equation.

General properties

- **Short response time**
  The ceramic diaphragm allows sufficiently fast diffusion of the medium thus enabling short response times.
- **Insensitive to temperature and pressure changes**
  Thanks to the composition of its integrated bridge electrolyte, the CPS71 is insensitive to temperature and pressure variation.
- **Sterilizable**
  The electrode is sterilizable and autoclavable (max. 135 °C (275 °F)).
- **High long-term stability**
  Electrodes with the application range "BP" have been specially designed for fermentation processes. They have a pressurized reference system that guarantees very high long-term stability.
- **Upside-down installation**
  Electrodes with the application range "BU" are suitable for upside-down installation. They can be installed at any inclination angle.

Important properties of CPS71D

Maximum process safety
The inductive and non-contacting measured value transmission of Memosens guarantees maximum process safety and offers the following benefits:

- All problems caused by moisture are eliminated.
  – The plug-in connection is free from corrosion.
  – Measured value distortion from moisture is not possible.
  – The plug-in system can even be connected under water.
- The transmitter is galvanically decoupled from the medium. The result: No more need to ask about "symmetrically high-impedance" or "unsymmetrical" (for pH/ORP measurement) or an impedance converter.
- EMC safety is guaranteed by screening measures for the digital measured value transmission.

Data safety through digital data transfer
The Memosens technology digitalizes the measured value in the sensor and transfers it to the transmitter via a contactless connection. The result:

- An automatic error message is generated if the sensor fails or the connection between sensor and transmitter is interrupted.
- The availability of the measuring point is dramatically increased by immediate error detection.
- The digital signals are suitable for application in hazardous areas; the integrated electronics are intrinsically safe.

Easy handling
Sensors with Memosens technology have integrated electronics that allow for saving calibration data and further information such as total hours of operation and operating hours under extreme measuring conditions. When the sensor is mounted, the calibration data are automatically transferred to the transmitter and used to calculate the current measured value. Storing the calibration data in the sensor allows for calibration and adjustment away from the measuring point. The result:

- Sensors can be calibrated unter optimum external conditions in the measuring lab. Wind and weather do neither affect the calibration quality nor the operator.
- The measuring point availability is dramatically increased by the quick and easy replacement of precalibrated sensors.
- The transmitter does not need to be installed close to the measuring point but can be placed in the control room.
- Maintenance intervals can be defined based on all stored sensor load and calibration data and predictive maintenance is possible.
- The sensor history can be documented on external data carriers and evaluation programs at any time. Thus, the current application of the sensors can be made to depend on their previous history.

Communication with the transmitter
Always connect digital sensors with Memosens technology to a transmitter with Memosens technology. Data transmission to a transmitter for analog sensors is not possible.

Data storage of CPS71D

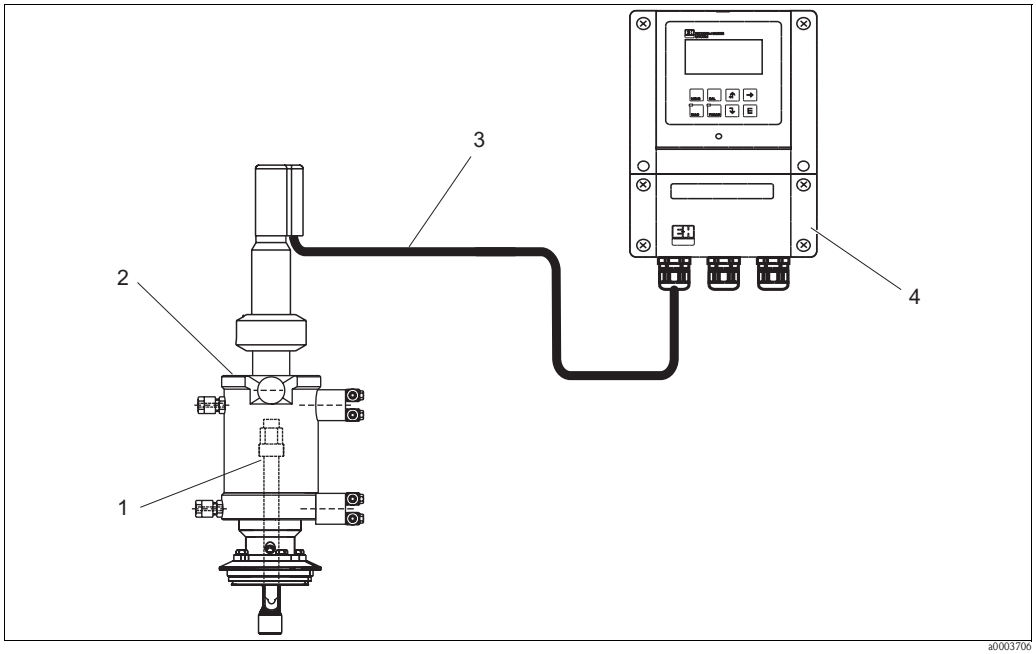
Digital sensors are able to store the following system data in the sensor.

- Manufacturing data
  - Serial number
  - Order code
  - Date of manufacture
- Calibration data
  - Calibration date
  - Calibrated slope at 25 °C (77 °F)
  - Calibrated zero point at 25 °C (77 °F)
  - Temperature offset
  - Number of calibrations
  - Serial number of the transmitter used for the last calibration
- Application data
  - Temperature application range
  - pH application range
  - Date of first commissioning
  - Maximum temperature value
  - Operating hours at temperatures above 80 °C (176 °F) and 100 °C (212 °F)
  - Operating hours at very low and very high pH values (Nernst voltage below -300 mV, above +300 mV)
  - Number of sterilizations
  - Glass membrane impedance

These system data can be displayed with Mycom S and Liquiline M transmitters.

Measuring system

A complete measuring system comprises:
- CPS71 pH electrode or CPS71D digital sensor
- Transmitter, e.g. Liquisys M CPM223/253 (with Memosens technology for CPS71D)
- CPK9 special measuring cable or CYK10 Memosens data cable for CPS71D
- Immersion, flow or retractable assembly, e.g. Cleanfit H CPA475



Measuring system for pH measurement

1 CPS71 pH electrode
2 Cleanfit H CPA475 assembly
3 Special measuring cable
4 Liquisys M CPM253 transmitter

Input

Measured variables

pH value
Temperature

Measuring range

Electrode versions BB, BC, BU:

pH:	0 to 14 pH
Temperature:	0 to 135 °C (32 to 275 °F)

Electrode version BP:

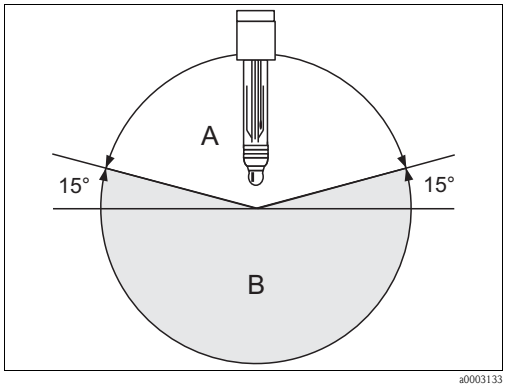
pH:	0 to 12 pH
Temperature:	0 to 135 °C (32 to 275 °F)

Caution!
Please note the process operating conditions.

Installation

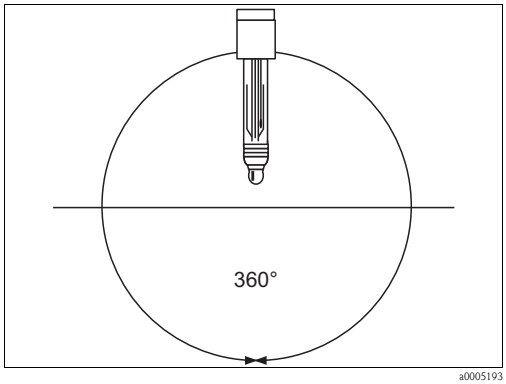
General installation instructions

- Electrode versions BB, BC, BP
  Do not install the electrode upside down. The inclination angle must be at least 15° from the horizontal. A smaller inclination angle is not permitted as such an inclination results in air cushion forming in the glass sphere. This might impair full wetting of the pH membrane with inner electrolyte.
- Electrode version BU
  This electrode is suitable for upside-down installation. You can install it at any inclination angle.



Installation of electrode versions BB, BC, BP; installation angle min. 15° from the horizontal

A permitted angle of installation
B non-permitted angle of installation



Installation of electrode version BU; any angle of installation permitted

Caution!
- Make sure that the assembly's threaded connection for the electrode is clean and well running before installing the electrode.
- Hand tighten the electrode (3 Nm)! (Given value only applies to installation in Endress+Hauser assemblies.)
- Make sure to follow the installation instructions in the operating instructions of the used assembly.

Installation instructions electrode version BP

To achieve accurate pH measurement, the silicone seal must be removed from the diaphragm before commissioning the electrode.

To do so, proceed as follows:

1. Completely remove the silicone seal from the diaphragm using the supplied knife.
2. To achieve optimum accuracy, immerse the electrode, like all pH electrodes, in buffer solution for 15 to 20 minutes before calibration.
3. Commission the electrode.

Environment

Ambient temperature

Caution!
Danger of frost damage
Do not use the electrode at temperatures below -15 °C / 5 °F.

Storage temperature

0 to 50 °C / 32 to 122 °F

Ingress protection

IP 67 with GSA plug-in head (with closed plug-in connection)
IP 68 with TOP68 plug-in head (1 m / 3.3 ft water column, 50 °C / 122 °F, 168 h)
IP 68 with Memosens plug-in head (10 m / 33 ft water column, 25 °C / 77 °F, 45 days, 1 M KCl)

Process

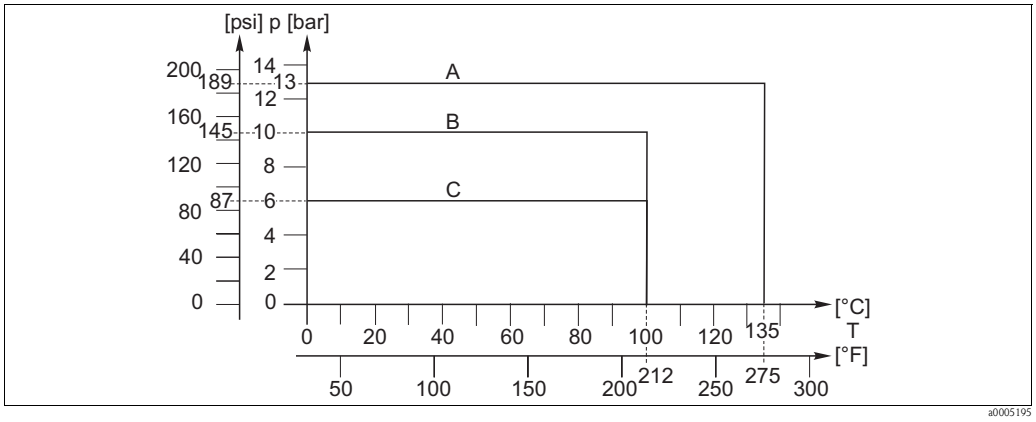
Process temperature

Electrode versions BB, BC:	0 to 135 °C (32 to 275 °F)
Electrode versions BP, BU:	0 to 100 °C (32 to 212 °F)

Process pressure

Electrode versions BB, BC:	0 to 13 bar (0 to 189 psi)
Electrode version BU:	0 to 10 bar (0 to 145 psi)
Electrode version BP:	0 to 6 bar (0 to 87 psi)

Pressure temperature load curve



Pressure temperature load curve

A Electrode versions BB, BC
B Electrode version BU
C Electrode version BP

Conductivity

min. 10 µS/cm

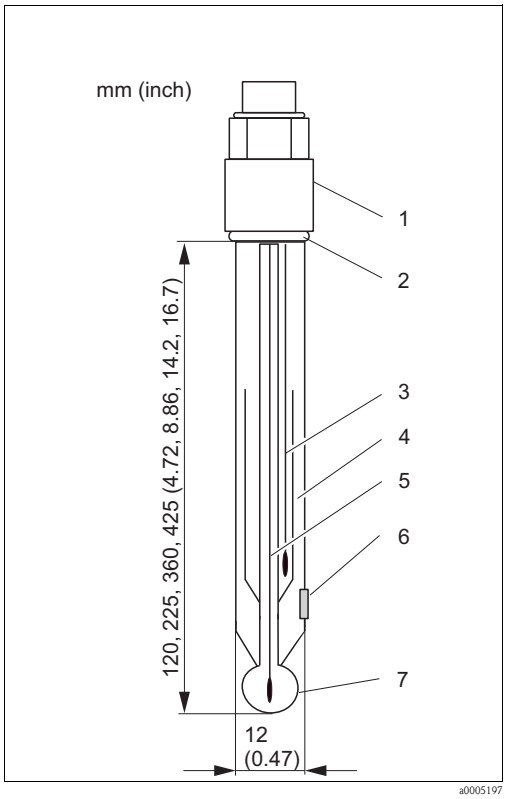
pH range

Electrode versions BB, BC, BU:	0 to 14 pH
Electrode versions BP:	0 to 12 pH

Caution!
Danger of damage to the electrode
Do not operate the electrode in applications outside the given specifications!

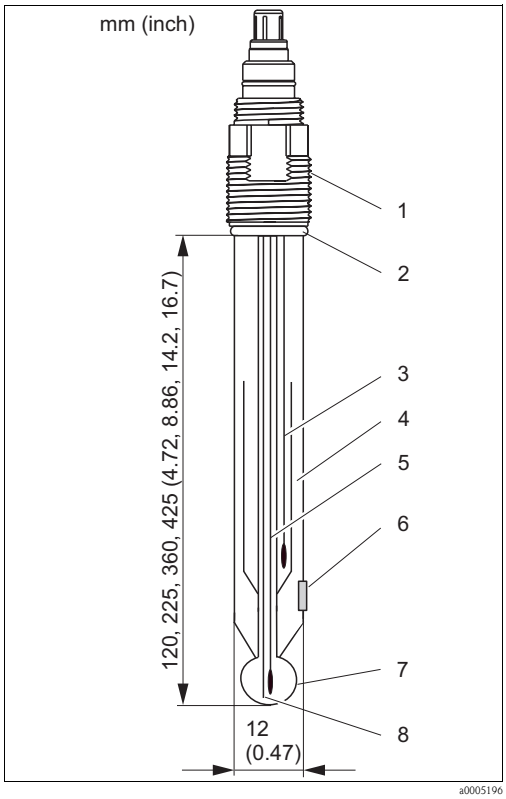
Mechanical construction

Design, dimensions CPS71



CPS71 with GSA plug-in head

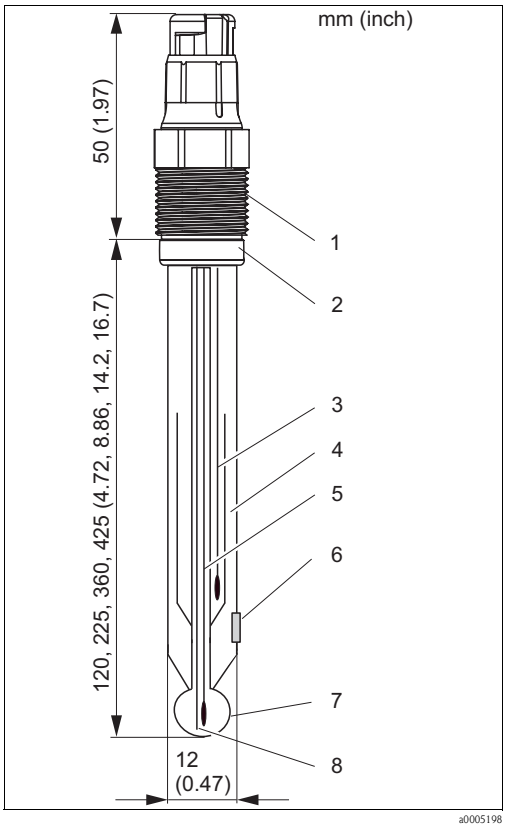
1 GSA plug-in head, Pg 13.5
2 Viton O-ring with thrust collar
3 Ag/AgCl metal lead
4 Bridge electrolyte
5 Ag/AgCl metal lead
6 Diaphragm
7 pH membrane



CPS71 with ESA plug-in head, temperature sensor

1 ESA plug-in head, Pg 13.5
2 Viton O-ring with thrust collar
3 Ag/AgCl metal lead
4 Bridge electrolyte
5 Ag/AgCl metal lead
6 Diaphragm
7 pH membrane
8 Temperature sensor

Design, dimensions CPS71D



CPS71D with Memosens plug-in head, temperature sensor

1 Memosens plug-in head, Pg 13.5
2 Viton O-ring, Viton thrust collar
3 Ag/AgCl metal lead
4 Bridge electrolyte
5 Ag/AgCl metal lead
6 Diaphragm
7 pH membrane
8 Temperature sensor

Weight

approx. 0.1 kg / 0.2 lb.

Material

Electrode shaft	process glass
pH membrane glass	type B
Metal lead	Ag/AgCl
Diaphragm	ceramic diaphragm, sterilizable and autoclavable
Gel	
Electrode versions BB, BC, BP:	completely free of acrylamide
Electrode version BU:	wetted parts free of acrylamide

Process connection

Pg 13.5

Temperature sensor

CPS71:	Pt 100, Pt 1000
CPS71D:	NTC

Plug-in heads

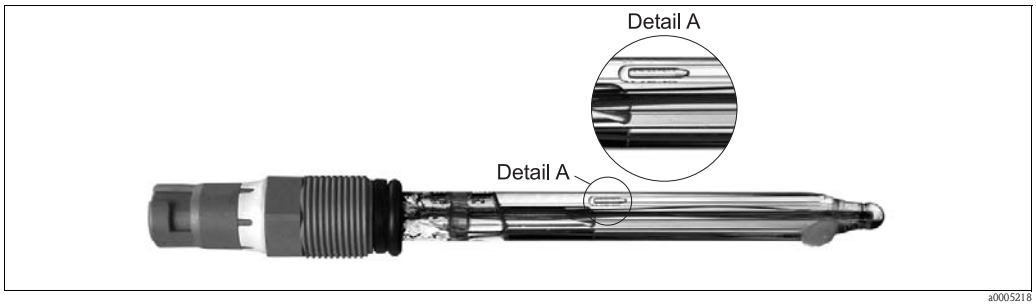
CPS71:
- ESA: threaded plug-in head Pg 13.5, TOP68 for electrodes with and without temperature sensor, 16 bar / 232 psi triple overpressure safety, Ex
- GSA: threaded plug-in head Pg 13.5 for electrodes without temperature sensor

CPS71D: Memosens for digital contactless data transmission

Reference system

Electrode versions BB, BC, BU
Ag/AgCl metal lead with Advanced Gel, 3 molar KCl, AgCl free
Bridge electrolyte

Electrode version BP
Ag/AgCl metal lead with Advanced Gel, 3 molar KCl, AgCl free
Bridge electrolyte
Pressurized reference system (6 bar (87 psi)); pressure indicator (see figure below)



Pressure indicator of electrode version BP

Certificates and approvals

Ex approval CPS71 (ESA) and CPS71D
- ATEX II 1G EEX ia IIC T3/T4/T6
- FM Class I Div. 2, in combination with the Mypro CPM431 and Mycom S CPM153 transmitters (CPS71 only)

Biocompatibility
Biocompatibility validated according to:
- ISO 10993-5:1993
- USP, current revision

TÜV certificate TOP68 and Memosens plug-in heads
Pressure resistance 16 bar, min. triple overpressure safety

EMC compatibility of CPS71D
Interference emission and interference immunity complies with EN 61326: 1997 / A1: 1998

Ordering information

Product structure CPS71

	Electrode type				
	1	without temperature sensor			
	2	with built-in Pt 100 (ESA plug-in head only)			
	3	with built-in Pt 1000 (ESA plug-in head only)			
		Application range			
		BB	pH = 0 to 14, T = 0 to 135 °C (32 to 275 °F), 13 bar (189 psi) 1 diaphragm, sterilizable		
		BC	pH = 0 to 14, T = 0 to 135 °C (32 to 275 °F), 13 bar (189 psi), 3 diaphragms, sterilizable		
		BP	pH = 0 to 12, T = 0 to 135 °C (32 to 275 °F), 6 bar (87 psi), 1 diaphragm, sterilizable, pressurized reference (with Pt 100 / Pt 1000 and ESA plug-in head only)		
		BU	pH = 0 to 14, T = 0 to 135 °C (32 to 275 °F), 10 bar (145 psi), 1 diaphragm sterilizable, upside-down installation (with Pt 100 / Pt 1000 and ESA plug-in head only)		
			Shaft length		
			2	120 mm / 4.72"	
			4	225 mm / 8.86"	
			5	360 mm / 14.2"	
			6	425 mm / 16.7"	
				Plug-in head	
				ESA	Plug-in head Pg 13.5, TOP68, 16 bar (232 psi), Ex
				GSA	Plug-in head Pg 13.5, DIN coax, non-Ex
CPS71-					complete order code

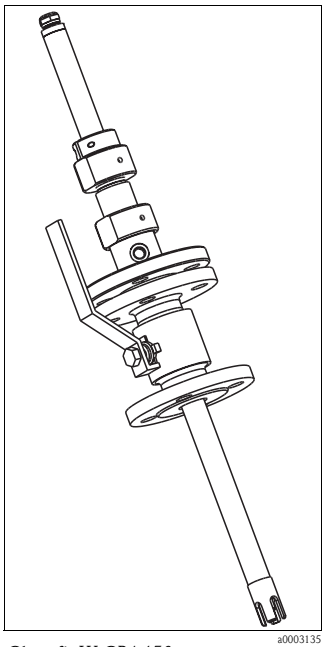
Product structure CPS71D

	Version				
	7	Basic version			
		Application range			
		BB	pH = 0 to 14, T = 0 to 135 °C (32 to 275 °F), 13 bar (189 psi), 1 diaphragm, sterilizable		
		BC	pH = 0 to 14, T = 0 to 135 °C (32 to 275 °F), 13 bar (189 psi), 3 diaphragms, sterilizable		
		BP	pH = 0 to 12, T = 0 to 135 °C (32 to 275 °F), 6 bar (87 psi), 1 diaphragm, sterilizable, pressurized reference		
		BU	pH = 0 to 14 pH, T = 0 to 135 °C (32 to 275 °F), 10 bar (145 psi), 1 diaphragm, sterilizable, upside-down installation		
			Shaft length		
			2	120 mm / 4.72"	
			4	225 mm / 8.86"	
			5	360 mm / 14.2"	
			6	425 mm / 16.7"	
				Approval	
				1	Non-hazardous area
				G	ATEX II 1G EEx ia IIC T3/T4/T6
CPS71D-					complete order code

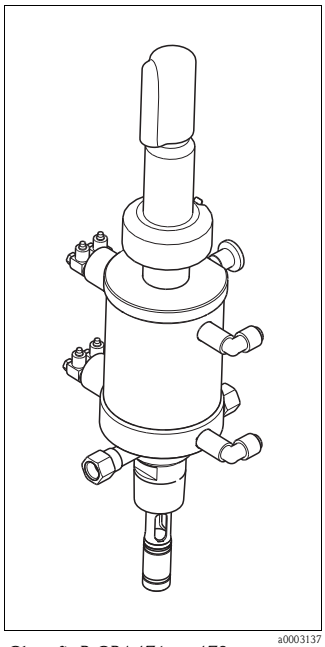
Accessories

Assemblies (selection)

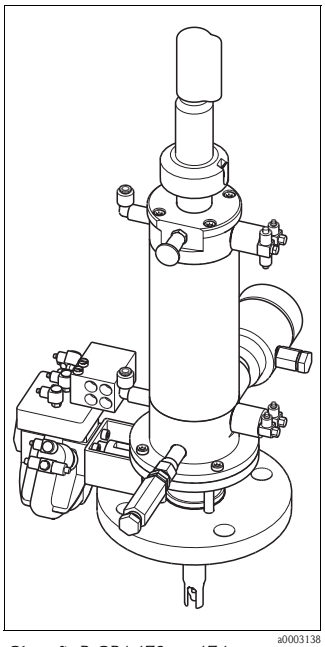
- Cleanfit W CPA450
  Manually operated, retractable assembly for installation of 120 mm (4.72") pH/ORP electrodes in tanks and pipes; Ordering acc. to product structure, see Technical Information (TI183C/07/en)
- Cleanfit P CPA471
  Compact retractable stainless steel assembly for installation in tanks and pipes, manual or pneumatic operation; Ordering acc. to product structure, see Technical Information (TI217C/07/en)
- Cleanfit P CPA472
  Compact retractable plastic assembly for installation in tanks and pipes, manual or pneumatic operation, Ordering acc. to product structure, see Technical Information (TI223C/07/en)
- Cleanfit P CPA473
  Retractable stainless steel process assembly, with ball valve for a particularly safe and reliable separation of the medium from the environment,
  Ordering acc. to product structure, see Technical Information (TI344C/07/en)
- Cleanfit P CPA474
  Retractable plastic process assembly, with ball valve for a particularly safe and reliable separation of the medium from the environment,
  Ordering acc. to product structure, see Technical Information (TI345C/07/en)



Cleanfit W CPA450

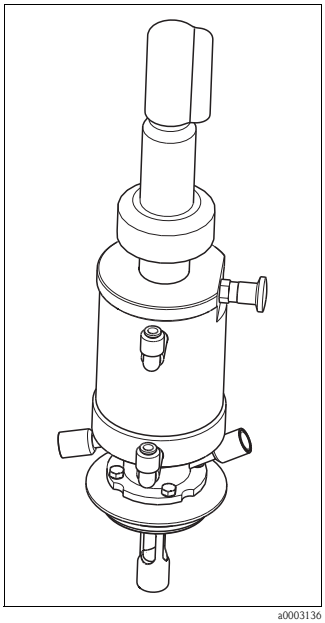


Cleanfit P CPA471 or 472

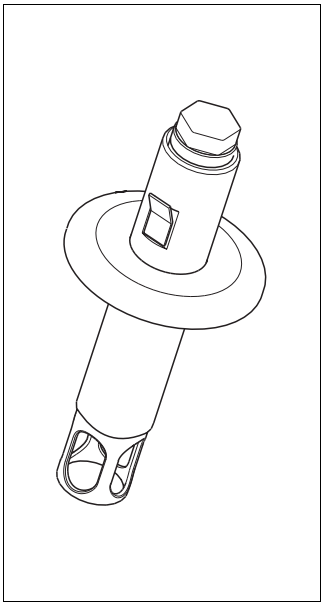


Cleanfit P CPA473 or 474

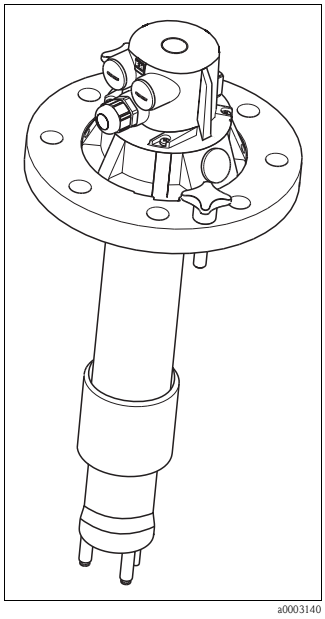
- Cleanfit H CPA475
  Retractable assembly for installation in tanks and pipes under sterile conditions,
  Ordering acc. to product structure, see Technical Information (TI240C/07/en)
- Unifit H CPA442
  Process assembly for the food industry, biotechnology and pharmaceutical industry,
  Ordering acc. to product structure, see Technical Information (TI306C/07/en)
- Dipfit W CPA111
  Plastic immersion and installation assembly for open and closed tanks,
  Ordering acc. to product structure, see Technical Information (TI112C/07/en)



Cleanfit H CPA475

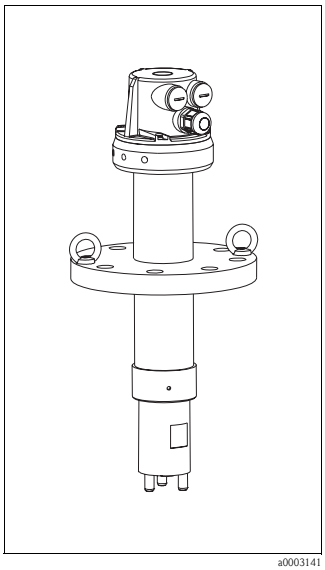


Unifit H CPA442

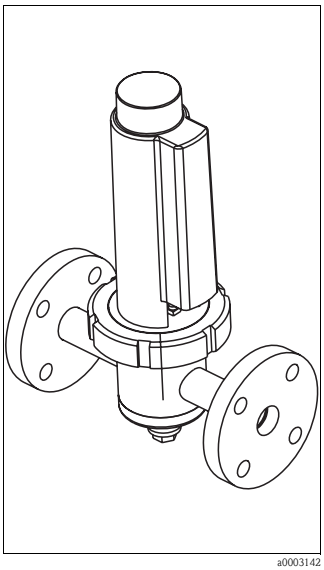


Dipfit W CPA111

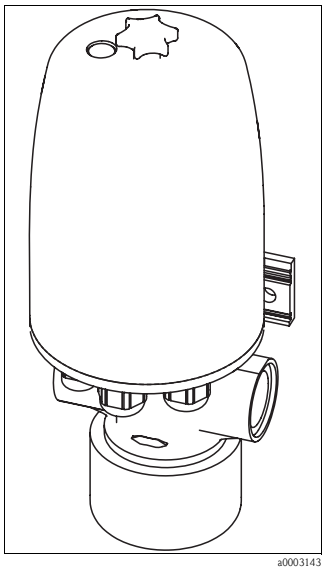
- Dipfit P CPA140
  Immersion assembly for pH/ORP electrodes for demanding processes,
  Ordering acc. to product structure, see Technical Information (TI178C/07/en)
- Flowfit P CPA240
  Flow assembly for pH/ORP electrodes, for demanding processes,
  Ordering acc. to product structure, see Technical Information (TI179C/07/en)
- Flowfit W CPA250
  Flow assembly for pH/ORP electrodes,
  Ordering acc. to product structure, see Technical Information (TI041C/07/en)



Dipfit P CPA140

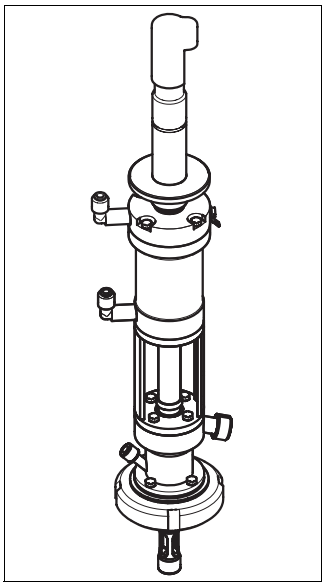


Flowfit P CPA240

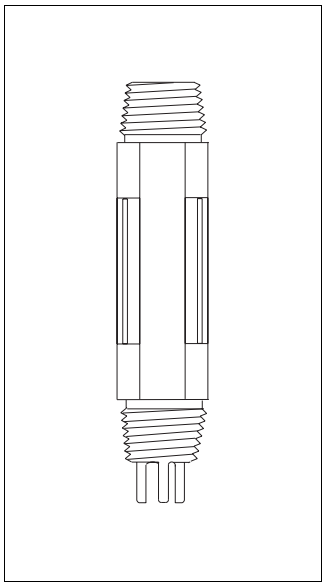


Flowfit W CPA250

- Probfit H CPA465
  Retractable assembly for installation in tanks and pipes under sterile conditions,
  Ordering acc. to product structure, see Technical Information (TI146C/07/en)
- Ecofit CPA640
  Process connection adapter and cable set for 120 mm (4.72") pH/ORP electrodes,
  Ordering acc. to product structure, see Technical Information (TI264C/07/en)



Probfit H CPA465



Ecofit CPA640

Transmitters

- Liquiline M CM42
  Modular two-wire transmitter, stainless steel or plastic, field or panel instrument,
  various Ex approvals (ATEX, FM, CSA, Nepsi, TIIS),
  HART, PROFIBUS or FOUNDATION Fieldbus available
  Ordering acc. to product structure, see Technical Information (TI381C/07/en)
- Liquisys M CPM223/253
  Transmitter for pH and ORP, field or panel-mounted housing,
  HART or PROFIBUS available
  Ordering acc. to product structure, see Technical Information (TI194C/07/en)
- Mycom S CPM153
  Transmitter for pH and ORP, one or two channel version, Ex or non-Ex,
  HART or PROFIBUS available
  Ordering acc. to product structure, see Technical Information (TI233C/07/en)

Buffer solutions

Technical buffer solutions, accuracy 0.02 pH, acc. to NIST/DIN
- pH 4.0 red, 100 ml (3.4 fl.oz.), order no. CPY2-0
- pH 4.0 red, 1000 ml (34 fl.oz.), order no. CPY2-1
- pH 7.0 green, 100 ml (3.4 fl.oz.), order no. CPY2-2
- pH 7.0 green, 1000 ml (34 fl.oz.), order no. CPY2-3

Technical buffer solutions for single use, accuracy 0.02 pH, acc. to NIST/DIN
- pH 4.0 20 x 20 ml (0.68 fl.oz.), order no. CPY2-D
- pH 7.0 20 x 20 ml (0.68 fl.oz.), order no. CPY2-E

Measuring cables

CPK9 special measuring cable
- For pH/ORP sensors with TOP68 plug-in head, for high-temperature and high-pressure applications, IP 68
- Ordering acc. to product structure, see Technical Information (TI118C/07/en)

- CPK1 special measuring cable
  For pH/ORP electrodes with GSA plug-in head
  Ordering acc. to product structure, see Technical Information (TI118C/07/en)

- CPK12 special measuring cable
  For pH/ORP glass electrodes and ISFET sensors with TOP68 plug-in head
  Ordering acc. to product structure, see Technical Information (TI118C/07/en)

- CYK10 Memosens data cable
  For digital sensors with Memosens technology
  Ordering according to product structure, see below

	Certificates			
	A			Standard, non Ex
	G			ATEX II 1G EEx ia IIC T6/T4
		Cable length		
		03		Cable length: 3 m (9.8 ft)
		05		Cable length: 5 m (16 ft)
		10		Cable length: 10 m (33 ft)
		15		Cable length: 15 m (49 ft)
		20		Cable length: 20 m (66 ft)
		25		Cable length: 25 m (82 ft)
		88		... m length
		89		... ft length
			Ready-made	
			1	Wire terminals
CYK10-				complete order code

International Head Quarters

Endress+Hauser
GmbH+Co. KG
Instruments International
Colmarer Str. 6
79576 Weil am Rhein
Deutschland

Tel. +49 76 21 9 75 02
Fax +49 76 21 9 75 34 5
www.endress.com
info@ii.endress.com

TI245C/07/en/10.05
51505837
Printed in Germany / FM+SGML 6.0 / DT

Endress+Hauser

People for Process Automation