Technical Information
Ceragel CPS71 and CPS71D

pH single-rod electrode system, analog and digital with Memosens technology

For process technology and hygienic application with poison-resistant reference with ion trap

Application

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

With ATEX, FM and CSA approval for use in hazardous areas.

Your benefits

Electrode
- Certified biocompatibility, no cytotoxicity
- Acrylamide-free bridging electrolyte
- Version with pressurized reference, specially designed for fermentation processes
- Version for upside-down installation, solidified gel in the internal reference lead
- Integrated temperature sensor for effective temperature compensation

Versions BB, BC, BP and BU
- Double-junction reference system with extremely long diffusion path for poisoning substances
- Suitable for CIP/SIP cleaning and autoclavable up to 135 °C (275 °F)

Version TB, TC and TP
- Poison-resistant reference with ion trap, resulting in a very long service life, bridging electrolyte free of silver ions
- Suitable for CIP/SIP cleaning and autoclavable, depending on version up to 140 °C (284 °F)

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Function and system design

Measuring principle

pH measurement
The pH value is a measure of the acid or base character of a medium. Depending on the pH value of the medium, the electrode's membrane glass provides an electrochemical potential. This is the result of H^+ions selectively penetrating the outer layer of the membrane. As a result, an electrochemical boundary layer forms here with an electric potential. An integrated Ag/AgCl reference system forms the required reference electrode.
The transmitter converts the measured voltage into the corresponding pH value according to the NERNST equation.

General characteristics

- **Short response times**
  The ceramic junction allows sufficiently fast diffusion of the medium, thereby enabling short response times.
- **Sterilizable**
  The electrode can be sterilized and is autoclavable (max. 140 °C (284 °F)).
- **High long-term stability**
  The electrodes, which have been specially designed for fermentation processes and have an application range of "BP" and "TP", have a pressurized reference which guarantees very high long-term stability.
- **Upside-down installation**
  The "BU" electrodes are suitable for upside-down installation and can be installed at any installation angle.

Versions BB, BC, BP and BU
- **Temperature- and pressure-resistant**
  The integrated bridging electrolytes ensure that the electrode is immune to pressure and temperature fluctuations.

Versions TB, TC and TP
- **Long service life**
  Use of an ion trap as standard ensures that the reference is protected against poisoning, results in a significantly longer service life and guarantees immunity to temperature and pressure fluctuations. The ion trap also effectively prevents the diffusion of silver ions into the bridging electrolytes.

Communication and data processing
CPS71D

Measuring system data which digital sensors can save in the sensor include:

- Manufacturer data
  - Serial number
  - Order code
  - Date of manufacture
- Calibration data
  - Date of calibration
  - 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 to perform the last calibration
- Operating data
  - Temperature application range
  - pH application range
  - Date of initial commissioning
  - Maximum temperature value
  - Operating hours at temperatures above 80 °C / 100 °C (176 °F / 212 °F)
  - Operating hours at very low and very high pH values (Nernst voltage under -300 mV, over +300 mV)
  - Number of sterilizations
  - Resistance of glass membrane

The data listed above can be displayed using the Mycom S CPM153, Liquiline M CM42 and Liquiline CM44x transmitters.

Reliability
CPS71D

Maximum process safety
With its inductive transmission of the measured value via a non-contact plug-in connection, Memosens guarantees maximum process safety and offers the following advantages:
- All problems caused by moisture are eliminated:
  - The plug-in connection is free from corrosion
  - Moisture cannot corrupt the measured value
  - Plug-in system can even be connected under water
- The transmitter is galvanically decoupled from the medium.
  This means there is no need to choose between "symmetrical high-impedance" or "unsymmetrical" solutions and impedance converters when it comes to pH/ORP measurement.
- EMC safety is guaranteed by screening measures in the digital measured value transmission.
- Can easily be used in hazardous areas thanks to intrinsically safe electronics.

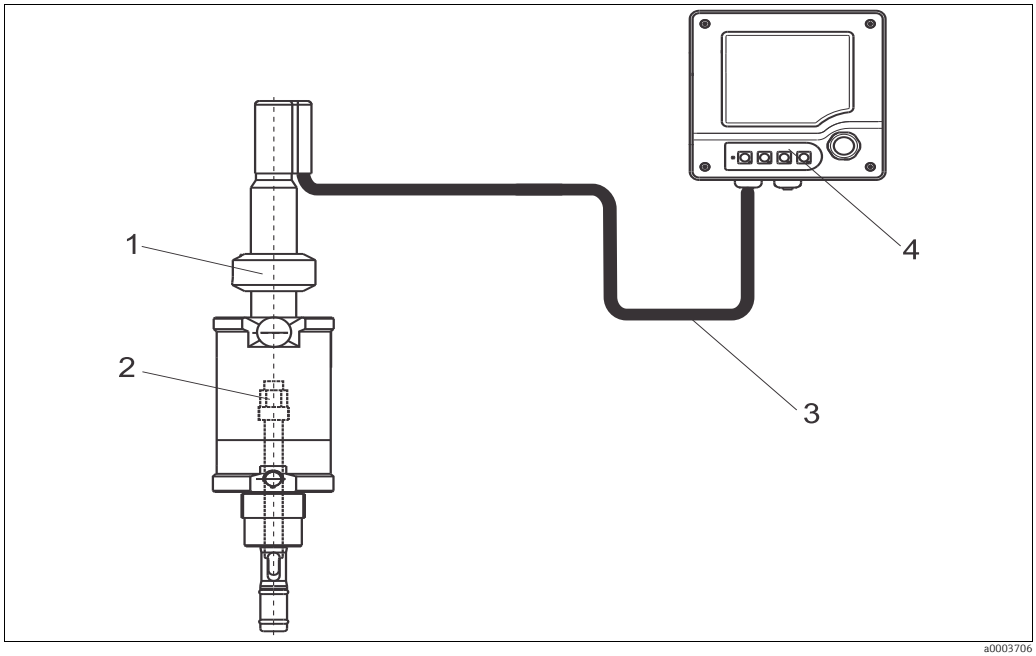
Memosens technology digitizes the measured values in the sensor and transmits them to the transmitter via a non-contact connection in a way that is free from any potential interference. The result:
- Automatic error message generation if the sensor fails or the connection between sensor and transmitter is interrupted
- Immediate error detection increases measuring point availability

Ease of use
Sensors with Memosens technology have integrated electronics that save calibration data and other information, such as total hours of operation and operating hours under extreme measuring conditions etc. When the sensor is connected, the sensor data are automatically sent to the transmitter and used to calculate the current measured value. Saving the calibration data makes it possible to calibrate the sensor irrespective of the measuring point. The result:
- Convenient calibration in the measuring lab under optimum external conditions improves the quality of the calibration.
- Measuring point availability is dramatically increased by the quick and easy replacement of precalibrated sensors.
- Installing the transmitter in the measuring container with integrated measuring devices reduces the amount of fastening material and cabling work required.
- The availability of the sensor data makes it possible to accurately determine the maintenance intervals of the measuring point and enables predictive maintenance.
- The sensor history can be documented with external storage media and evaluation programs such as Memobase Plus. The sensor's field of application can be determined based on its previous history.

Communication with the transmitter
Always connect digital sensors with Memosens technology to a transmitter with Memosens technology. It is not possible to transfer data to a transmitter for analog sensors.

Measuring system

A complete measuring system comprises:
- pH electrode CPS71 or CPS71D
- Transmitter, e.g. Liquiline CM42 (for CPS71D with Memosens technology)
- Special measuring cable CPK9 or Memosens data cable CYK10 for CPS71D
- Immersion, flow or retractable assembly, e.g. Cleanfit H CPA475



Measuring system for pH measurement

1 pH electrode CPS71
2 Process assembly Cleanfit H CPA475
3 Special measuring cable CPK9 (for electrodes with TOP68 plug-in head) / CYK10 for digital sensors
4 Liquiline CM42 transmitter

Input

Measured variables

pH value
Temperature

Measuring range

Electrode version BB, BC:
- 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)
  (135 °C (275 °F) for sterilization only, otherwise max. 100 °C (212 °F) in continuous operation due to increasing pressure loss at T > 100 °C (212 °F))

Electrode version BU:
- pH: 0 to 12 pH
- Temperature: 0 to 135 °C (32 to 275 °F)
  (135 °C (275 °F) for sterilization only, otherwise max. 100 °C (212 °F) in continuous operation due to liquefaction of gel-based inner electrolyte at T > 100 °C (212 °F))

Electrode version TB, TC:
- pH: 0 to 14 pH
- Temperature: 0 to 140 °C (32 to 284 °F)
  0 to 135 °C (32 to 275 °F) for sensors with Ex approval and analog sensors

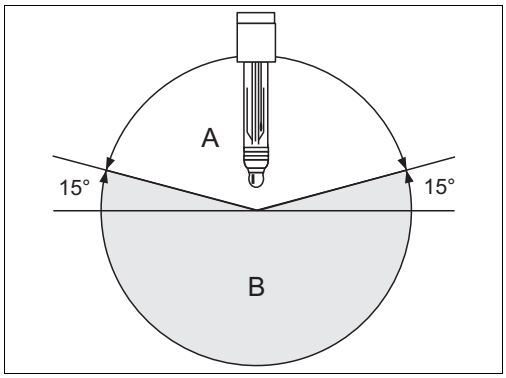
Electrode version TP (pressurized reference):
- pH: 0 to 12 pH
- Temperature: 0 to 140 °C (32 to 284 °F)
  (140 °C (284 °F) for sterilization only, otherwise max. 100 °C (212 °F) in continuous operation due to increasing pressure loss at T > 100 °C (212 °F))
  0 to 135 °C (32 to 275 °F) for sensors with Ex approval and analog sensors

Pay attention to the application conditions in the process.

Installation

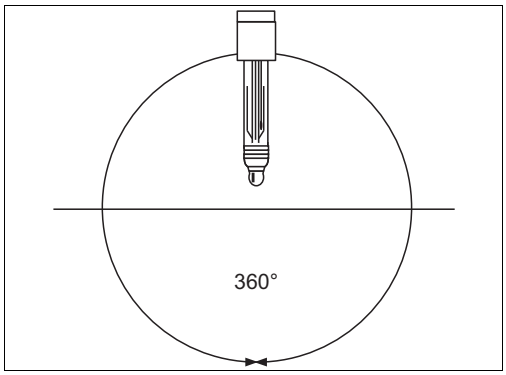
General installation instructions

- Electrode versions BB, BC, BP, TB, TC and TP
  Do not install the electrodes upside down. The inclination angle must be at least 15° from the horizontal. A smaller inclination angle is not permitted as it could cause an air bubble to form in the glass sphere and prevent the inner electrolyte from completely wetting the pH diaphragm.
- BU electrode version
  This electrode is suitable for upside-down installation. You can install it at any angle.



Installation of the electrode versions BB, BC, BP, TB, TC, TP; installation angle at least 15 ° from the horizontal

A Permitted orientation
B Non-permitted orientation



Installation of electrode version BU; any installation angle

NOTICE

Before screwing in the electrode, make sure the threaded connection of the assembly is clean and runs smoothly.

- ▸ Screw in the electrode finger-tight (3 Nm)! (Information valid only when installing with Endress+Hauser assemblies.)
- ▸ Also pay attention to the installation instructions provided in the Operating Instructions of the assembly used.

Installation instructions for electrode version BP and TP

⚠ CAUTION

Sudden rupture and flying glass splinters from the glass electrode with pressurized reference (approx. 6 bar internal pressure)

- ▸ Always wear protective goggles when working with these electrodes
- ▸ Particular caution is needed when removing the polymer seal on the reference junction. Here, a knife is used to activate the electrode for operation. .

Before commissioning the electrode, you must remove the silicone seal from the junction. The system can only measure the pH value properly when the seal has been removed.

Please proceed as follows:

1. Using the knife supplied, completely remove the silicone seal from the junction.
2. As with all pH electrodes, place the electrode in a buffer solution for 15-20 minutes prior to calibration to ensure optimum accuracy.
3. Put the electrode into operation.

Environment

Ambient temperature range

NOTICE

Risk of damage due to frost

- The sensor must not be used at temperatures below −15 °C (5 °F).

Storage temperature

0 to 50 °C (32 to 120 °F)

Degree of protection

IP 67:	GSA plug-in head (with closed connector system)
IP 68:	ESA plug-in head (1 m (3.3 ft) water column, 50 °C (120 °F), 168 h)
IP 68:	Memosens plug-in head (10 m (33 ft) water column, 25 °C (77 °F), 45 days, 1 M KCl)

Process

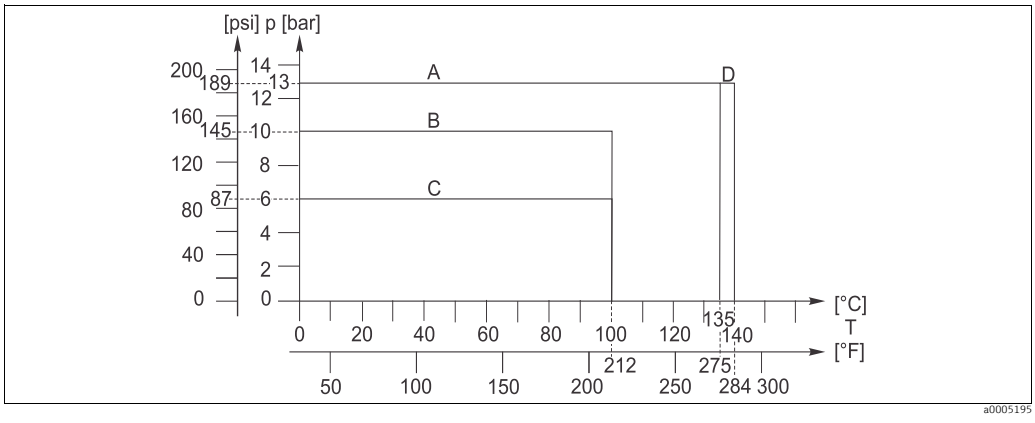
Process temperature range

Electrode version BB, BC:	0 to 135 °C (32 to 275 °F)
Electrode version BU, BP:	0 to 100 °C (32 to 212 °F) (sterilizable up to 135 °C (275 °F))
Electrode version TB, TC:	0 to 140 °C (32 to 284 °F) 0 to 135 °C (32 to 275 °F) for sensors with Ex approval and analog sensors
Electrode version TP:	0 to 100 °C (32 to 212 °F) (sterilizable up to 140 °C (284 °F))

Process pressure range

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

Pressure-temperature ratings



Pressure-temperature ratings

A Electrode version BB, BC
B BU electrode version
C Electrode version BP, TP
D Electrode version TB, TC

Minimum conductivity min. 10 µS/cm

pH range

Electrode version BB, BC, TB, TC: 0 to 14 pH

Electrode version BP, BU, TP: 0 to 12 pH

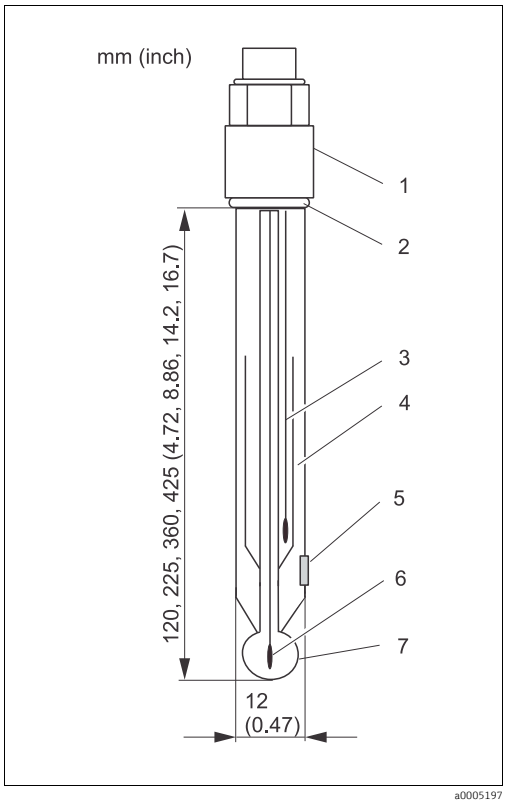
NOTICE

Risk of damage to electrode

- Never use the electrode outside of the listed specifications!

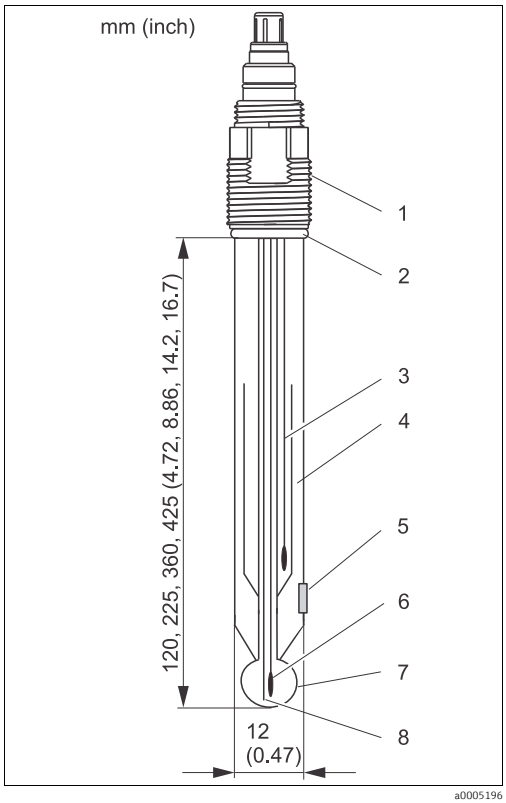
Mechanical construction

Design, dimensions CPS71



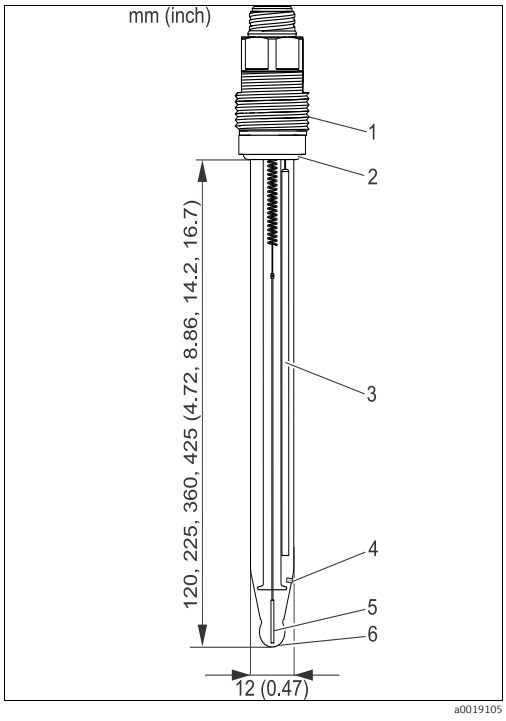
CPS71 with GSA plug-in head, BB

1 *GSA electrode plug-in head, Pg 13.5*
2 *Viton O-ring with thrust collar*
3 *Ag/AgCl external reference lead*
4 *Bridging electrolyte*
5 *Junction*
6 *Ag/AgCl internal reference lead*
7 *pH membrane*



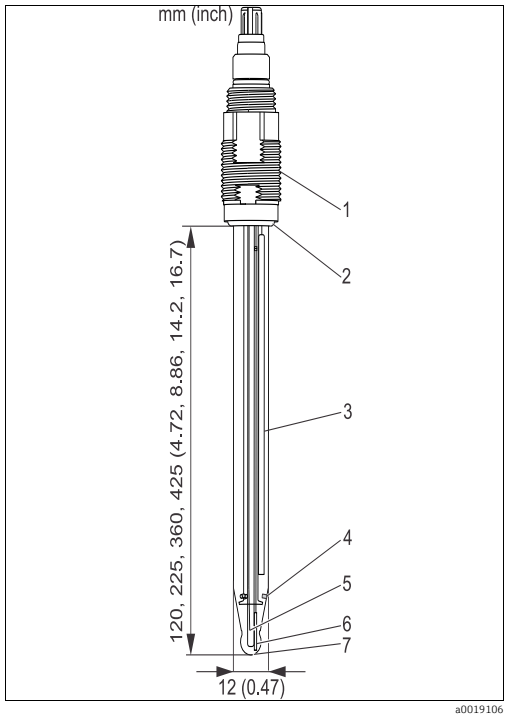
CPS71 with ESA plug-in head, temperature sensor, BB

1 *ESA electrode plug-in head, Pg 13.5*
2 *Viton O-ring with thrust collar*
3 *Ag/AgCl external reference lead*
4 *Bridging electrolyte*
5 *Junction*
6 *Ag/AgCl internal reference lead*
7 *pH membrane*
8 *Temperature sensor*



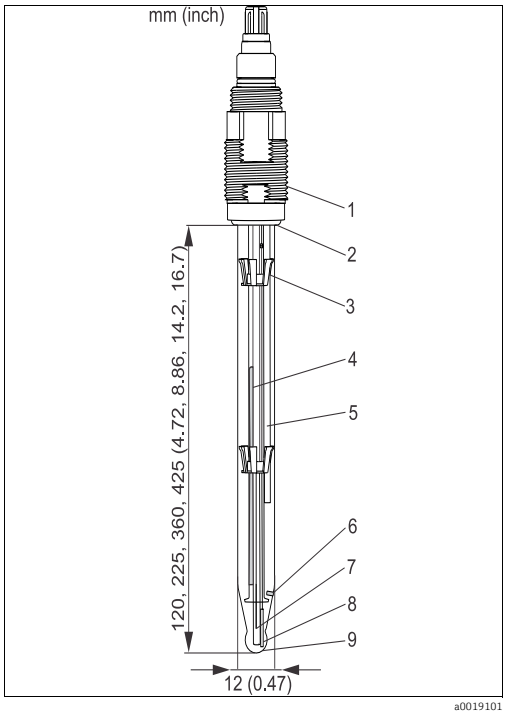
CPS71 with GSA plug-in head, TB

1 GSA electrode plug-in head, Pg 13.5
2 Viton O-ring with thrust collar
3 Ag/AgCl reference lead with ion trap
4 Junction
5 Ag/AgCl internal reference lead
6 pH membrane



CPS71 with ESA plug-in head, TC

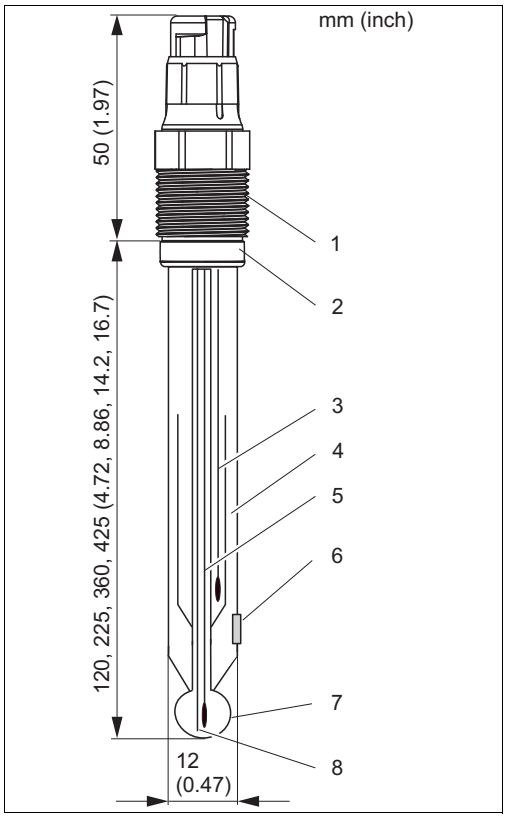
1 ESA electrode plug-in head, Pg 13.5
2 Viton O-ring with thrust collar
3 Ag/AgCl reference lead with ion trap
4 Junction
5 Temperature sensor
6 Ag/AgCl internal reference lead
7 pH membrane



CPS71 with ESA plug-in head, TP

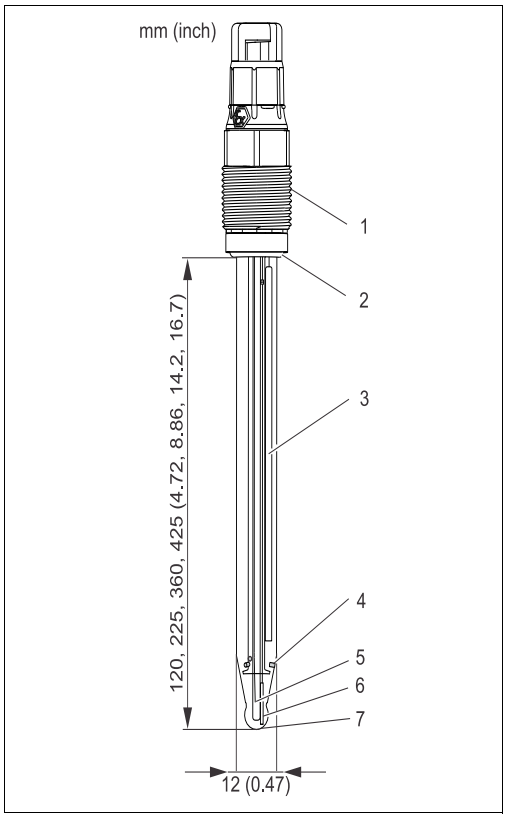
1 ESA electrode plug-in head, Pg 13.5
2 Viton O-ring with thrust collar
3 Spacer
4 Pressure indicator with air bubble
5 Ag/AgCl reference lead with ion trap
6 Junction
7 Temperature sensor
8 Ag/AgCl internal reference lead
9 pH membrane

Design, dimensions CPS71D



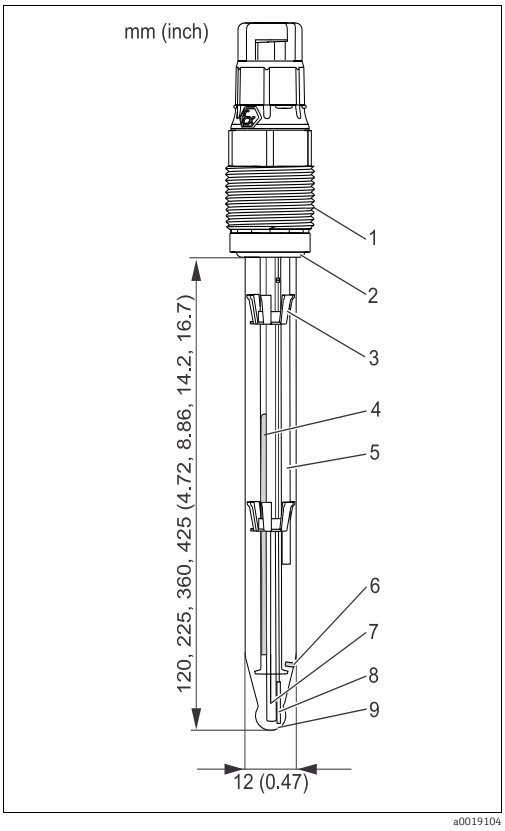
CPS71D with Memosens plug-in head, temperature sensor, BB

1 *Memosens plug-in head*
2 *Viton O-ring with thrust collar*
3 *Ag/AgCl external reference lead*
4 *Bridging electrolyte*
5 *Ag/AgCl internal reference lead*
6 *Junction*
7 *pH membrane*
8 *Temperature sensor*



CPS71D with Memosens plug-in head, TB

1 *Memosens plug-in head*
2 *Viton O-ring with thrust collar*
3 *Ag/AgCl reference lead with ion trap*
4 *Junction*
5 *Temperature sensor*
6 *Ag/AgCl internal reference lead*
7 *pH membrane*



CPS71D with Memosens plug-in head, TP

1 Memosens plug-in head
2 Viton O-ring with thrust collar
3 Spacer
4 Pressure indicator with air bubble
5 Ag/AgCl reference lead with ion trap
6 Junction
7 Temperature sensor
8 Ag/AgCl internal reference lead
9 pH membrane

Weight

0.1 kg (0.22 lbs) for length of 120 mm (4.72 inch)

Materials

Electrode shaft	Glass to suit process
pH membrane glass	Type B
Metal lead	Ag/AgCl
Junction	Ceramic, sterilizable and autoclavable
Gel	Bridging electrolyte acrylamide-free, no cytotoxicity
Electrode version BB, BC, BP:	Completely acrylamide-free
Electrode version BU:	In contact with medium polyacrylamide-free

Process connection

Pg 13.5

Temperature sensor

CPS71:	Pt 100, Pt 1000
CPS71D:	NTC 30K

Plug-in heads

CPS71:

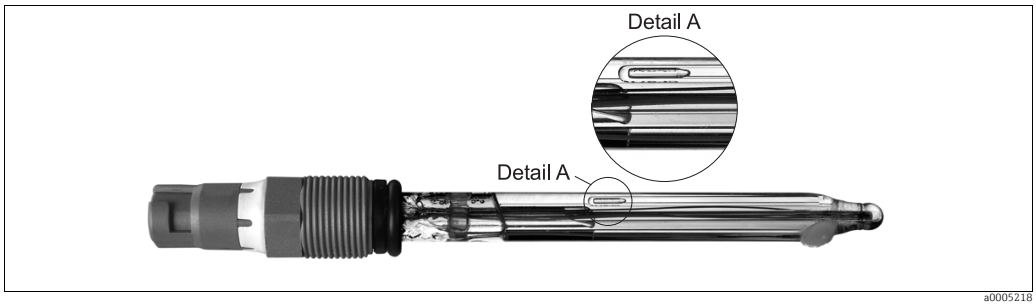
ESA:	Threaded plug-in head Pg 13.5, TOP68, 16 bar (232 psi), Ex
GSA:	Threaded plug-in head Pg 13.5, non-Ex

CPS71D: Memosens plug-in head for digital, non-contact data transmission, 16 bar (232 psi), Ex or non-Ex

Reference system

Electrode versions BB, BC, BU:
Ag/AgCl reference lead with Advanced Gel 3 M KCl, AgCl-free
Bridging electrolyte

Electrode version BP:
Ag/AgCl reference lead with Advanced Gel 3 M KCl, AgCl-free
Bridging electrolyte
Pressurized (6 bar); display via pressure indicator (see diagram below).



Pressure indicator for electrode version BP and TP

Electrode version TB, TC:
Ag/AgCl reference lead with gel, acrylamide-free, non-cytotoxic, 3 M KCl, AgCl-free, ion trap

Electrode version TP:
Ag/AgCl reference lead with gel, acrylamide-free, non-cytotoxic, 3 M KCl, AgCl-free, ion trap
Pressurized 6 bar; display via pressure indicator (see diagram above).

Certificates and approvals

Ex approval CPS71 (ESA) and CPS71D

ATEX/NEPSI
- II 1G Ex ia IIC T3/T4/T6 Ga

FM/CSA
- IS/NI CL. I. Div 1, Group A-D

Biocompatibility

Biocompatibility certified in accordance with:

- ISO 10993-5:1993
- USP <87>, agar diffusion test and decoloration test

TÜV certificate ESA and Memosens plug-in head

Pressure resistance 16 bar (232 psi), minimum three times the safety pressure

Electromagnetic compatibility of CPS71D

Interference emission and interference immunity as per EN 61326: 2006

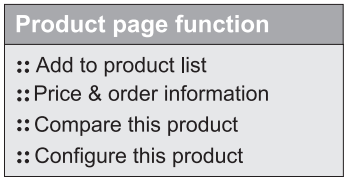
Ordering information

Product structure

You can create a valid and complete order code on the Internet with the Configurator tool.

Enter the following addresses in the browser to access the relevant product page:
www.products.endress.com/cps71
www.products.endress.com/cps71d

1. You can find the following options on the right-hand side of the product page:



2. Click "Configure this product".
3. The Configurator opens in a separate window. You can now configure your device and receive the complete and valid order code.
4. Now export the order code as a PDF or Excel file. To do so, click the corresponding button at the top of the page.

Accessories

Assemblies (selection)

Cleanfit W CPA450
- Manual retractable assembly for pH/ORP electrodes for installation of 120 mm electrodes in tanks and pipes
- Order according to product structure (-> Online Configurator, www.products.endress.com/cpa450)
- Technical Information TI183C/07/EN

Cleanfit P CPA471
- Compact stainless steel retractable assembly for installation in tanks and pipes, for manual or pneumatically remote -controlled operation
- Order according to product structure (-> Online Configurator, www.products.endress.com/cpa471)
- Technical Information TI217C/07/EN

Cleanfit P CPA472
- Compact plastic retractable assembly for installation in tanks and pipes, for manual or pneumatically remote-controlled operation
- Order according to product structure (-> Online Configurator, www.products.endress.com/cpa472)
- Technical Information TI223C/07/EN

Cleanfit P CPA472D
- Robust retractable assembly for pH, ORP and other industrial sensors, for manual or pneumatically remote-controlled operation, heavy-duty version made from very durable materials
- Order according to product structure (-> Online Configurator, www.products.endress.com/cpa472d)
- Technical Information TI403C/07/EN

Cleanfit P CPA473
- Stainless steel process retractable assembly with ball valve shutoff for particularly reliable separation of the medium from the environment
- Order according to product structure (-> Online Configurator, www.products.endress.com/cpa473)
- Technical Information TI344C/07/EN

Cleanfit P CPA474
- Plastic process retractable assembly with ball valve shutoff for particularly reliable separation of the medium from the environment
- Order according to product structure (-> Online Configurator, www.products.endress.com/cpa474)
- Technical Information TI345C/07/EN

Cleanfit H CPA475
- Retractable assembly for pH/ORP measurement in tanks and pipes under sterile measuring conditions
- Order according to product structure (-> Online Configurator, www.products.endress.com/cpa475)
- Technical Information TI240C/07/EN

Unifit H CPA442
- Process assembly for food, biotechnology and chemicals; for 120 mm electrodes
- Order according to product structure (-> Online Configurator, www.products.endress.com/cpa442)
- Technical Information TI306C/07/EN

Dipfit W CPA111
- Immersion and installation assembly made of plastic for open and closed containers
- Order according to product structure (-> Online Configurator, www.products.endress.com/cpa111)
- Technical Information TI112C/07/EN

Dipfit P CPA140
- pH/ORP immersion assembly with flange connection for very demanding processes
- Order according to product structure (-> Online Configurator, www.products.endress.com/cpa140)
- Technical Information TI178C/07/EN

Flowfit P CPA240
- pH/ORP flow assembly for very demanding processes
- Order according to product structure (-> Online Configurator, www.products.endress.com/cpa240)
- Technical Information TI179C/07/EN

Flowfit W CPA250
- Flow assembly for pH/ORP measurement
- Order according to product structure (-> Online Configurator, www.products.endress.com/cpa250)
- Technical Information TI041C/07/EN

Ecofit CPA640
- Set comprising adapter for 120 mm pH sensors and sensor cable with TOP68 coupling
- Order according to product structure (-> Online Configurator, www.products.endress.com/cpa640)
- Technical Information TI264C/07/EN

Buffer solutions

Quality buffers from Endress+Hauser - CPY20
- Solutions which are traced by a DAkkS-accredited Endress+Hauser buffer laboratory (DkkS = German Accreditation Body) to a primary reference material of the PTB and to standard reference material of the National Institute of Standards and Technology (NIST) in accordance with DIN 19266 are used as secondary reference buffer solutions.
- Order according to product structure (-> Online Configurator, www.products.endress.com/cpy20)

Measuring cable

Measuring cable
- For sensors with TOP68 plug-in head, for high-temperature and high-pressure applications, IP 68
- Order according to product structure, see Technical Information (TI118C/07/EN)

Special measuring cable CPK1
- For pH/ORP electrodes with GSA plug-in head
- Order according to product structure, see Technical Information (TI118C/07/en)

Memosens data cable CYK10
- For digital sensors with Memosens technology
- Order according to product structure (--> Online Configurator, www.products.endress.com/cyk10)

www.addresses.endress.com

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