

# Technical Information

## Ceragel CPS71

Analog pH sensor for chemical process applications

With poison-resistant reference thanks to ion trap



### Application

Process technology and monitoring of processes with:

- Rapidly changing pH values
- High proportion of electrode poisons such as H<sub>2</sub>S

### Your benefits

- Poison-resistant reference with ion trap ensures very long service life
- Bridging electrolyte free of silver ions
- TP version with pressurized reference, for chemical processes with high concentrations of reference poisons
- TU version for upside-down installation, solidified gel in the internal lead
- Optional, integrated temperature sensor for effective temperature compensation
- Acrylamide-free reference and bridging electrolyte
- Choice of 1 or 3 ceramic junctions (TB and TC reference system)

## Function and system design

### Measuring principle

#### pH measurement

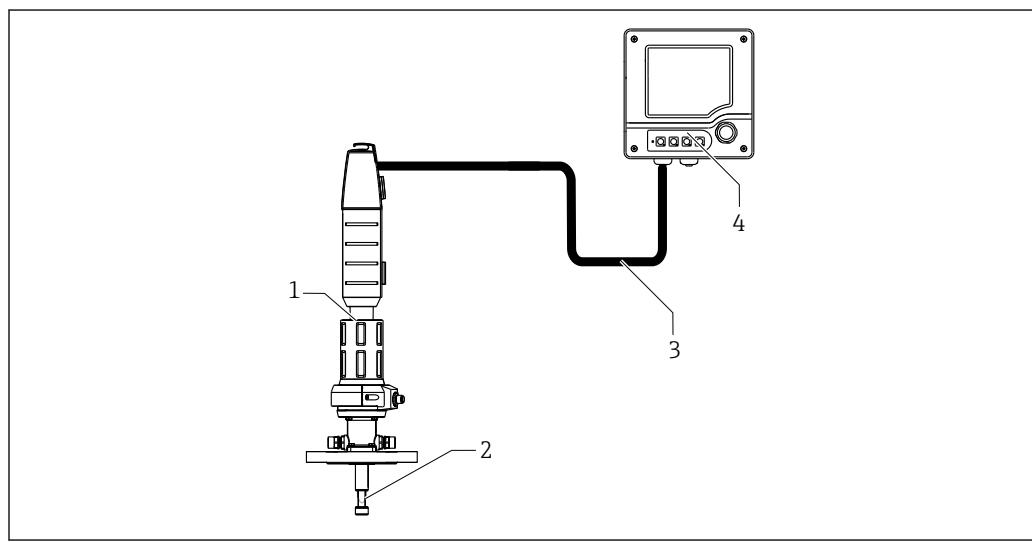
The pH value is used as a unit of measurement for the acidity or alkalinity of a medium. The membrane glass of the sensor supplies an electrochemical potential depending on the pH value of the medium. This potential is generated by the selective accumulation of  $H^+$  ions on the outer layer of the membrane. As a result, an electrochemical boundary layer with an electrical potential difference forms at this point. An integrated Ag/AgCl reference system serves as the required reference electrode.

The measured voltage is converted to the corresponding pH value using the Nernst equation.

### Measuring system

A complete measuring system consists of the following components at least:

- CPS71 pH sensor
- Transmitter, e.g., Liquiline CM42, CM42B, CM44x/R, Mycom S CPM153, Liquisys M CPM2x3
- Measuring cable CPK9 or CPK1 for analog sensors
- Assembly
  - Immersion assembly, e.g. Dipfit CPA111
  - Flow assembly, e.g. Flowfit CPA25
  - Retractable assembly, e.g. Cleanfit CPA871



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1 Example of a measuring system for pH measurement

- 1 Cleanfit CPA871 retractable assembly
- 2 pH sensor
- 3 Measuring cable CPK9
- 4 Liquiline M CM42 two-wire transmitter for hazardous areas

## Input

<b>Measured variables</b>	pH value Temperature
<b>Measuring range</b>	<p><b>TB and TC versions</b></p> <ul style="list-style-type: none"> <li>▪ pH: 0 to 14</li> <li>▪ Temperature: 0 to 140 °C (32 to 284 °F)</li> <li>▪ Temperature for sensors with Ex approval and analog sensors: 0 to 135 °C (32 to 275 °F)</li> </ul> <p><b>TP version (pressurized reference)</b></p> <ul style="list-style-type: none"> <li>▪ pH: 0 to 12</li> <li>▪ Temperature: 0 to 140 °C (32 to 284 °F), 140 °C (284 °F) only for sterilization</li> <li>▪ Temperature for sensors with Ex approval and analog sensors: 0 to 135 °C (32 to 275 °F), 135 °C (275 °F) only for sterilization</li> <li>▪ Maximum 100 °C (212 °F) in continuous operation due to increasing pressure loss at T &gt; 100 °C (212 °F)</li> </ul> <p><b>TU version</b></p> <ul style="list-style-type: none"> <li>▪ pH: 0 to 14</li> <li>▪ Temperature: 0 to 140 °C (32 to 284 °F), 140 °C (284 °F) only for sterilization</li> <li>▪ Temperature for sensors with Ex approval and analog sensors: 0 to 135 °C (32 to 275 °F), 135 °C (275 °F) only for sterilization</li> <li>▪ Maximum 100 °C (212 °F) in continuous operation due to increasing pressure loss at T &gt; 100 °C (212 °F)</li> </ul>



Pay attention to the operating conditions in the process.

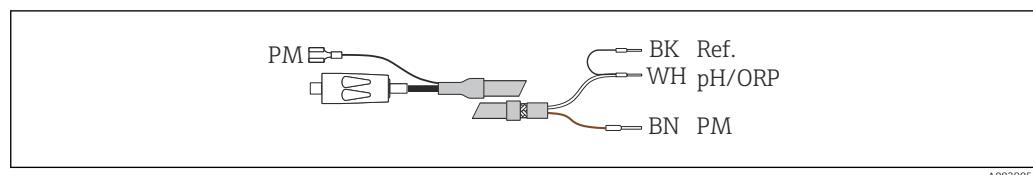
## Power supply

<b>Electrical connection</b>	Sensors with TOP68 plug-in head

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□ 2 Measuring cable CPK9

### Sensors with GSA plug-in head



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□ 3 Measuring cable CPK1

- Please follow the connection instructions contained in the Operating Instructions for the transmitter.

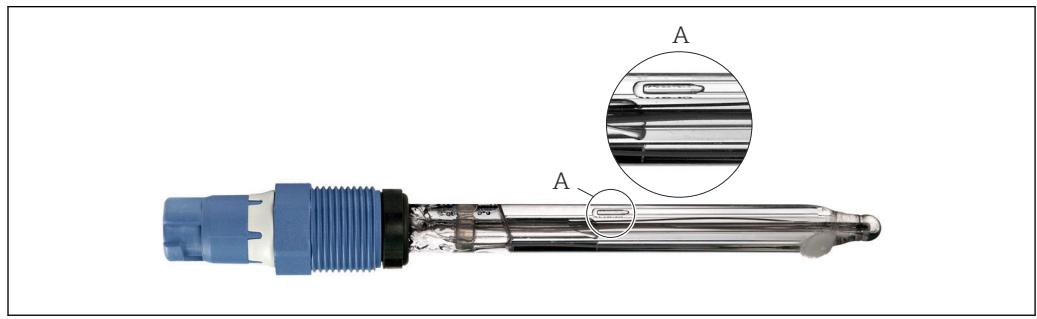
### Plug-in head

- ESA: Threaded plug-in head Pg 13.5, TOP68, 17 bar (246 psi)(abs.), Ex
- GSA: Threaded plug-in head Pg 13.5, non-Ex

## Performance characteristics

### Reference system

TB and TC reference system:	Ag/AgCl lead with ion trap, reference and bridging electrolyte 3 M KCl, acrylamide-free, flowable gel electrolyte
TP reference system:	Ag/AgCl lead with ion trap, reference and bridging electrolyte 3 M KCl, acrylamide-free, flowable gel electrolyte, pressurized 7 bar (102 psi) (absolute); display via pressure indicator
TU reference system:	Ag/AgCl lead with ion trap, reference and bridging electrolyte 3 M KCl, acrylamide-free, solidified gel electrolyte



A Pressure indicator of TP version

## Installation

### Orientation

#### TB, TC and TP reference system

- Do not install the sensors upside-down.
- The angle of inclination from the horizontal must be at least 15°.

An installation angle < 15° is not permitted, as otherwise an air bubble will form. Contact between the reference and membrane glass is then no longer guaranteed.

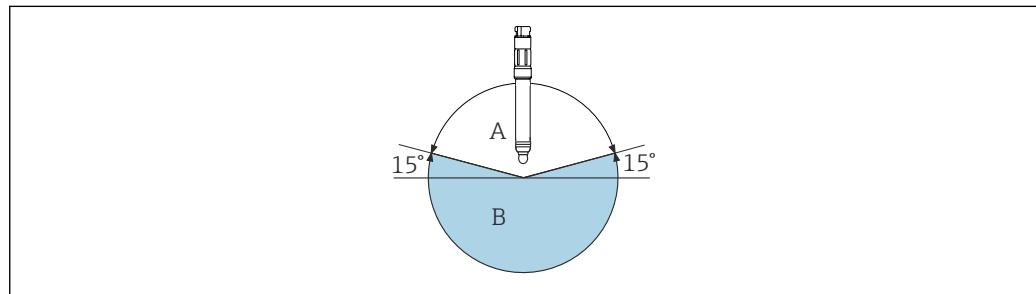


Fig. 4 Installation angle at least 15° from the horizontal

A Permitted orientation  
B Incorrect orientation

#### TU reference system

- The sensor is suitable for upside-down installation.
- Install the sensor at any angle.

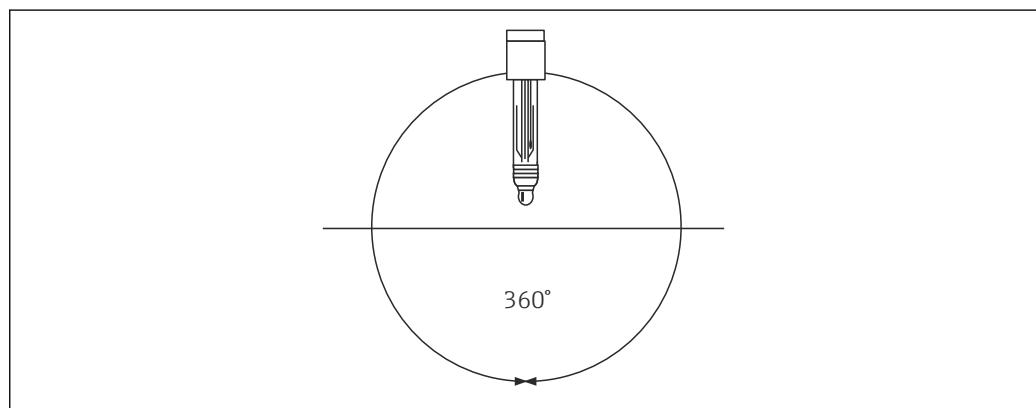


Fig. 5 Any installation angle

### Installation instructions for electrode version TP

#### ⚠ CAUTION

#### Glass sensor with pressurized reference

Possibility of sudden rupture and injury from glass splinters!

- Always wear protective goggles when working with these sensors.
- Exercise particular care when removing the silicone seal from the reference junction. Here, a knife is used to activate the sensor for measuring operation.

For correct pH measurement:

1. Before commissioning the sensor, remove the silicone seal from the junction. Use the knife supplied for this purpose.
2. For optimum accuracy, insert the sensor into a calibration buffer solution with a pH of 15 to 20 min for 4 to 9 before calibration.
3. Put the sensor into operation.

## Environment

Storage temperature	0 to 50 °C (32 to 122 °F)
Degree of protection	<ul style="list-style-type: none"> <li>▪ IP 68: ESA plug-in head (1 m (3.3 ft) water column, 50 °C (122 °F), 168 h)</li> <li>▪ IP 67: GSA plug-in head (with closed connector system)</li> </ul>

## Process

Process temperature range	<p><b>NOTICE</b></p> <p><b>Risk of damage from frost!</b></p> <ul style="list-style-type: none"> <li>► Do not use the sensor at temperatures below –15 °C (5 °F).</li> </ul> <p>TB and TC versions: 0 to 140 °C (32 to 284 °F)            0 to 135 °C (32 to 275 °F) for sensors with Ex approval and analog sensors</p> <p>TP and TU versions: 0 to 100 °C (32 to 212 °F)            (sterilizable up to 140 °C (284 °F)/135 °C (275 °F) for sensors with Ex approval and analog sensors)</p>
Process pressure range	<p><b>CAUTION</b></p> <p><b>Pressurization of sensor due to prolonged use under increased process pressure</b></p> <p>Possibility of sudden rupture and injury from glass splinters!</p> <ul style="list-style-type: none"> <li>► Avoid fast heating of these pressurized sensors if they are used under reduced process pressure or under atmospheric pressure.</li> <li>► When handling these sensors, always wear protective goggles and appropriate protective gloves.</li> </ul> <p>TB and TC versions: 1 to 14 bar (14.5 to 203 psi) (absolute)            TU version: 1 to 11 bar (14.5 to 159.5 psi) (absolute)            TP version: 1 to 7 bar (14.5 to 101.5 psi) (absolute)</p> <p><b>i</b> 0.8 bar (11.6 psi) (absolute) is possible as minimum. Be aware of quick KCl consumption.</p>

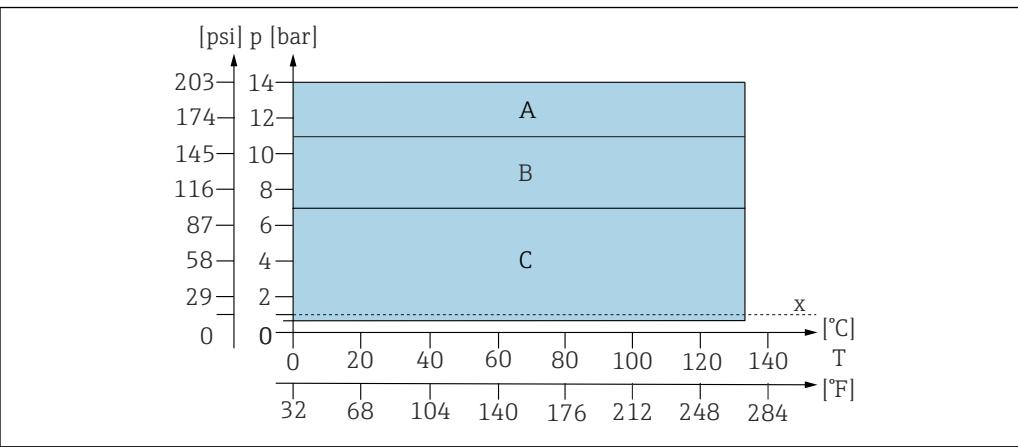
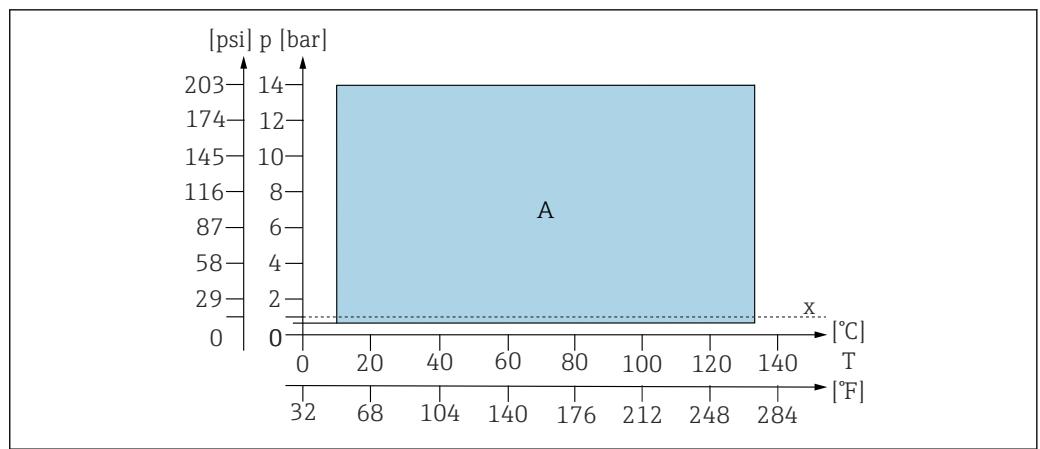
Conductivity	10 µS/cm (at atmospheric pressure, without flow)
Pressure/temperature ratings	

Fig. 6 Pressure/temperature diagram

- A TB, TC, BC versions
- C TU, BU versions
- D TP, BP versions
- x Atmospheric pressure



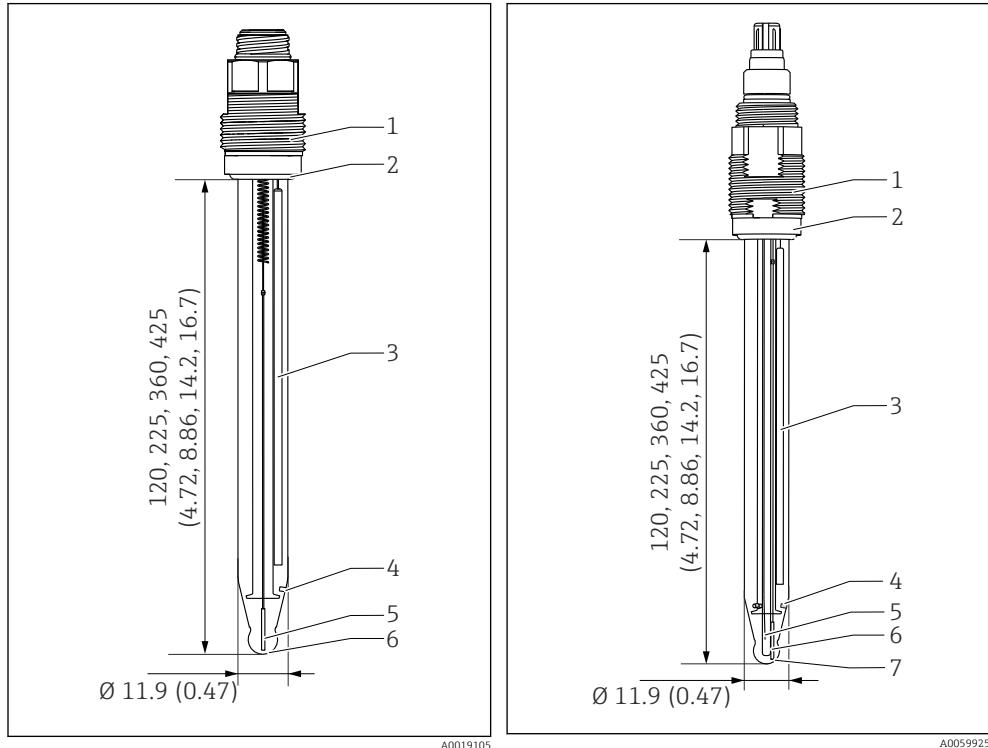
7 Pressure/temperature diagram

A BB version

x Atmospheric pressure

## Mechanical construction

### Design, dimensions

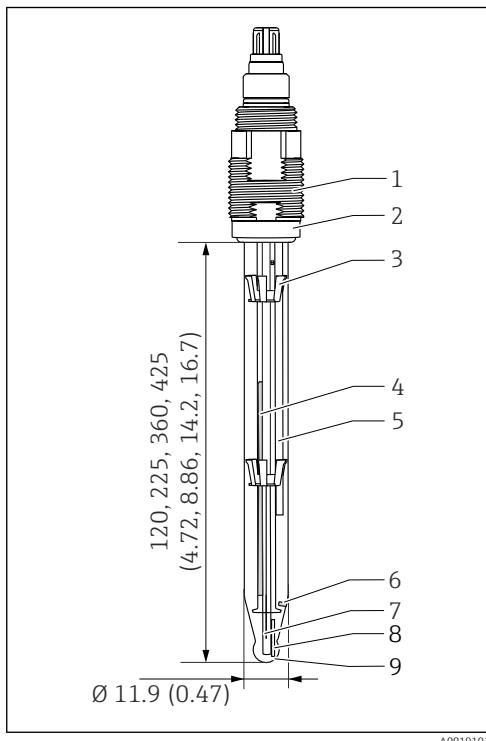


8 CPS71 with GSA plug-in head, TB

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

9 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 lead with ion trap
- 4 Junction
- 5 Temperature sensor
- 6 Ag/AgCl internal lead - pH
- 7 pH glass membrane



10 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 lead with ion trap
- 6 Junction
- 7 Temperature sensor
- 8 Ag/AgCl internal lead - pH
- 9 pH glass membrane

**Weight** 0.1 kg (0.2 lb) at a length of 120 mm (4.7 in)

<b>Materials</b>	Sensor shaft:	Glass to suit process
	Open aperture:	Ceramic, sterilizable and autoclavable

**i** Yellowish milky discoloration in the electrolyte of the sensor does not affect the measurement performance and quality of the sensor.

**Process connection** Pg 13.5

**Temperature sensor** Pt100, Pt1000

## Certificates and approvals

Current certificates and approvals for the product are available at [www.endress.com](http://www.endress.com) on the relevant product page:

1. Select the product using the filters and search field.
2. Open the product page.
3. Select **Downloads**.

<b>Ex certification</b>	<b>TOP68</b> <ul style="list-style-type: none"><li>■ ATEX II 1G Ex ia IIC T4/T6 Ga</li><li>■ UKCA Ex II 1G Ex ia IIC T3/T4/T6 Ga</li><li>■ FM Class I Div. 2, in conjunction with the Liquiline M CM42, CM42B and Mycom S CPM153 transmitters</li><li>■ CSA Class I Div. 1, in conjunction with the Liquiline M CM42, CM42B and Mycom S CPM153 transmitters</li></ul>
<b>Additional certification</b>	<b>EAC</b> <p>The product has been certified in accordance the TP TC 012/2011 directive applicable in the Eurasian Economic Union (EAEU). The EAC conformity mark has been affixed to the product.</p>

## Ordering information

Product page	<a href="http://www.endress.com/cps71d">www.endress.com/cps71d</a> <a href="http://www.endress.com/cps71">www.endress.com/cps71</a>
Product Configurator	<ol style="list-style-type: none"> <li>1. <b>Configure:</b> Click this button on the product page.</li> <li>2. Select <b>Extended selection</b>.           <ul style="list-style-type: none"> <li>↳ The Configurator opens in a separate window.</li> </ul> </li> <li>3. Configure the device according to your requirements by selecting the desired option for each feature.           <ul style="list-style-type: none"> <li>↳ In this way, you receive a valid and complete order code for the device.</li> </ul> </li> <li>4. <b>Accept:</b> Add the configured product to the shopping cart.</li> </ol> <p> For many products, you also have the option of downloading CAD or 2D drawings of the selected product version.</p> <ol style="list-style-type: none"> <li>5. <b>CAD:</b> Open this tab.           <ul style="list-style-type: none"> <li>↳ The drawing window is displayed. You have a choice between different views. You can download these in selectable formats.</li> </ul> </li> </ol>

Scope of delivery	<p>The scope of delivery comprises:</p> <ul style="list-style-type: none"> <li>▪ Ordered version of the sensor</li> <li>▪ Operating Instructions</li> <li>▪ Supplementary sheet for optionally ordered certificates</li> </ul>
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## Accessories

The following are the most important accessories available at the time this documentation was issued.

Listed accessories are technically compatible with the product in the instructions.

1. Application-specific restrictions of the product combination are possible.  
Ensure conformity of the measuring point to the application. This is the responsibility of the operator of the measuring point.
2. Pay attention to the information in the instructions for all products, particularly the technical data.
3. For accessories not listed here, please contact your Service or Sales Center.

Assemblies	<p><b>Cleanfit CPA472D</b></p> <ul style="list-style-type: none"> <li>▪ Robust retractable assembly for pH, ORP and other industrial sensors</li> <li>▪ Heavy-duty version made of durable materials</li> <li>▪ For manual or pneumatic, remote-controlled operation</li> <li>▪ Product Configurator on the product page: <a href="http://www.endress.com/cpa472d">www.endress.com/cpa472d</a></li> </ul> <p> Technical Information TI00403C</p> <p><b>Cleanfit CPA871</b></p> <ul style="list-style-type: none"> <li>▪ Flexible process retractable assembly for water, wastewater and the chemical industry</li> <li>▪ For applications with standard sensors with 12 mm diameter</li> <li>▪ Product Configurator on the product page: <a href="http://www.endress.com/cpa871">www.endress.com/cpa871</a></li> </ul> <p> Technical Information TI01191C</p> <p><b>Cleanfit CPA875</b></p> <ul style="list-style-type: none"> <li>▪ Retractable process assembly for sterile and hygienic applications</li> <li>▪ For in-line measurement with standard sensors with 12 mm diameter, e.g. for pH, ORP, oxygen</li> <li>▪ Product Configurator on the product page: <a href="http://www.endress.com/cpa875">www.endress.com/cpa875</a></li> </ul> <p> Technical Information TI01168C</p>
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**Cleanfit CPA450**

- Manual retractable assembly for installing sensors with a diameter of 12 mm and a length of 120 mm in tanks and pipes
- Product Configurator on the product page: [www.endress.com/cpa450](http://www.endress.com/cpa450)

 Technical Information TI00183C

**Cleanfit CPA473**

- Stainless steel process retractable assembly with ball valve shutoff for particularly reliable separation of the medium from the environment
- Product Configurator on the product page: [www.endress.com/cpa473](http://www.endress.com/cpa473)

 Technical Information TI00344C

**Cleanfit CPA474**

- Plastic process retractable assembly with ball valve shutoff for particularly reliable separation of the medium from the environment
- Product Configurator on the product page: [www.endress.com/cpa474](http://www.endress.com/cpa474)

 Technical Information TI00345C

**Unifit CPA842**

- Hygienic installation assembly for food, biotechnology and pharmaceuticals
- For in-line measurement with standard sensors with 12 mm diameter, e.g. for pH, ORP, oxygen
- Product Configurator on the product page: [www.endress.com/cpa842](http://www.endress.com/cpa842)

 Technical Information TI00306C

**Dipfit CPA111**

- Immersion and installation assembly made of plastic for open and closed vessels
- Product Configurator on the product page: [www.endress.com/cpa111](http://www.endress.com/cpa111)

 Technical Information TI00112C

**Dipfit CPA140**

- pH/ORP immersion assembly with flange connection for very demanding processes
- Product Configurator on the product page: [www.endress.com/cpa140](http://www.endress.com/cpa140)

 Technical Information TI00178C

**Flowfit CPA240**

- pH/ORP flow assembly for processes with stringent requirements
- Product Configurator on the product page: [www.endress.com/cpa240](http://www.endress.com/cpa240)

 Technical Information TI00179C

**Flowfit CPA25**

- Flow assembly for pH/ORP measurement
- Product Configurator on the product page: [www.endress.com/cpa25](http://www.endress.com/cpa25)

 Technical Information TI01710C

**Ecofit CPA640**

- Set comprising adapter for 120 mm pH/ORP sensors and sensor cable with TOP68 coupling
- Product Configurator on the product page: [www.endress.com/cpa640](http://www.endress.com/cpa640)

 Technical Information TI00246C

**Flexdip CYA112**

- Immersion assembly for water and wastewater
- Modular assembly system for sensors in open basins, channels and tanks
- Material: PVC or stainless steel
- Product Configurator on the product page: [www.endress.com/cya112](http://www.endress.com/cya112)

 Technical Information TI00432C

<b>Buffer solutions</b>	<b>High-quality buffer solutions from Endress+Hauser - CPY20</b> High-quality CPY20 pH buffers ensure maximum precision in pH calibrations. Available in pH 2.0, pH 4.0, pH 7.0, pH 9.0, pH 9.2, pH 10.0 and pH 12.0. Further details and Product Configurator on the product page: <a href="http://www.endress.com/cpy20">www.endress.com/cpy20</a>
<b>Measuring cable</b>	<b>Measuring cable CPK9</b> <ul style="list-style-type: none"><li>▪ Terminated measuring cable for connecting analog sensors with TOP68 plug-in head</li><li>▪ Selection in accordance with product structure</li><li>▪ Product Configurator on the product page: <a href="http://www.endress.com/ckp9">www.endress.com/ckp9</a></li></ul>  Technical Information TI00118C <b>CPK1</b> <ul style="list-style-type: none"><li>▪ For pH/ORP sensors with GSA plug-in head</li><li>▪ Product Configurator on the product page: <a href="http://www.endress.com/ckp1">www.endress.com/ckp1</a></li></ul>  For ordering information, contact your sales office or see <a href="http://www.endress.com">www.endress.com</a> .







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