



Level



Pressure



Flow



Temperature



Liquid  
Analysis



Registration



Systems  
Components



Services



Solutions

## Technical Information

# Orbisint CPS11 and CPS11D

pH electrodes, analog or with digital Memosens technology

For standard applications in process and environment technology, with dirt-repellent PTFE diaphragm, optional built-in temperature sensor



### Application

- Long-term monitoring and limit monitoring of processes with stable process conditions
  - Pulp and paper industry
  - Plastics chemistry
  - Chemical processes
  - Power plants (e.g. flue gas washers)
  - Incineration plants
  - Food industry
  - Breweries
- Water treatment
  - Drinking water
  - Cooling water
  - Well water

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

### Your benefits

- Robust electrode requiring low maintenance thanks to large PTFE ring diaphragm
- Application under pressures of up to 16 bar (232 psi)
- Process glass for highly alkaline applications available
- Built-in Pt 100 or Pt 1000 temperature sensor for effective temperature compensation (optional)
- Certified biocompatibility
- Sterilizable
- Long service life thanks to double junction system of metal lead and thus long electrode poison diffusion path
- Poison-resistant reference with ion trap (optional, CPS11D only)

### Further benefits offered by Memosens technology

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

## 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<sup>+</sup> 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

#### ■ Low maintenance

The sterilizable dirt-repellent PTFE ring diaphragm of the electrode prevents blocking and assures long-time stability and accuracy.

#### ■ Long service life

The double junction system of the metal lead offers better protection from electrode poisons and guarantees a considerably longer service life.

#### ■ Durability

Depending on the ordered version, the electrode is pressure proof up to 16 bar (232 psi) and can be applied at temperatures of up to 135 °C (275 °F.)

### Important properties of CPS11D

#### 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.
- Application in explosion-hazardous areas is unproblematic; the integrated electronics are intrinsically safe.

#### Data safety through digital data transfer

The Memosens technology digitalizes the measured values in the sensor and transfers them to the transmitter contactlessly and free from interference potential. 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.

#### 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 away from the measuring point. The result:

- Sensors can be calibrated under 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 to a transmitter with Memosens technology. Data transmission to a transmitter for analog sensors is not possible.

**Data storage of CPS11D**

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

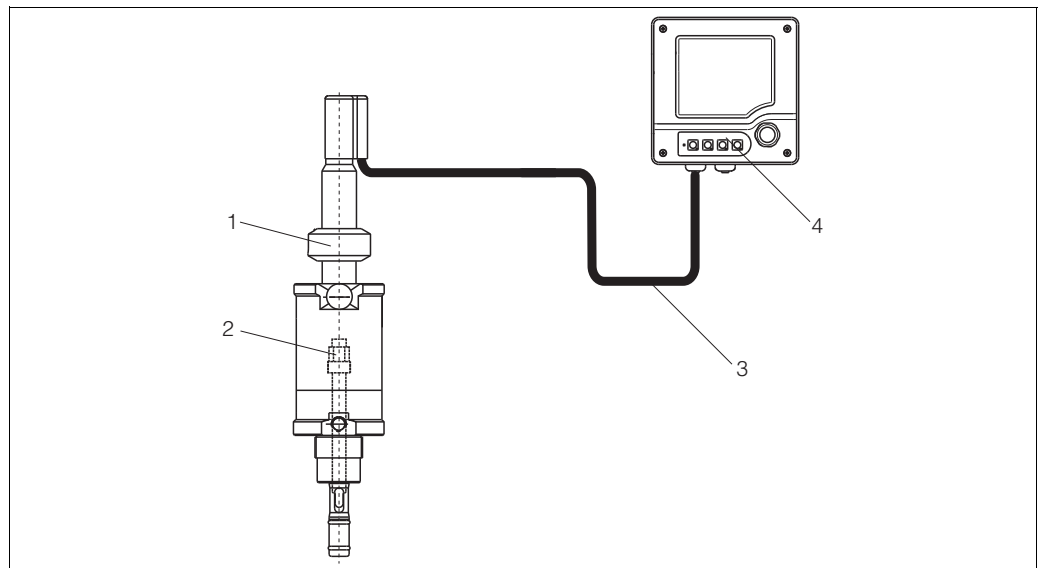
- Manufacturing data
  - Serial number
  - Order code
  - Date of manufacture
- Calibration data
  - Calibration date
  - Calibrated slope at 25 °C (77 °F)
  - Calibrated zero point at 25 °C (77 °F)
  - Temperature offset
  - Number of calibrations
  - Serial number of the transmitter used for the last 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:

- CPS11 pH electrode or CPS11D digital sensor
- Transmitter, e.g. Liquiline M CM42 (with Memosens technology for CPS11D)
- Special measuring cable, e.g. CPK9 or Memosens data cable CYK10
- Immersion, flow or retractable assembly, e.g. Cleanfit P CPA472



*Measuring system for pH measurement*

- 1 *Cleanfit P CPA472 retractable assembly*
- 2 *CPS11/CPS11D pH electrode*
- 3 *Special measuring cable CPK9 for electrodes with TOP68 plug-in head / CYK10 for digital sensors*
- 4 *Liquiline M CM42 transmitter*

## Input

### Measured variables

pH value  
Temperature

### Measuring ranges

Electrode version AA, AS (for water / wastewater):

pH: 1 to 12 pH  
Temperature: -15 to 80 °C (5 to 176 °F)

Electrode version BA (for process applications, sterilizable)

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

Electrode version FA (for hydrofluoric acid):

pH: 0 to 10 pH  
Temperature: 0 to 70 °C (32 to 158 °F)

Electrode version BT with ion trap (for pulp, paper, chemical applications)

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



Caution!  
Please note the process operating conditions.

## Installation

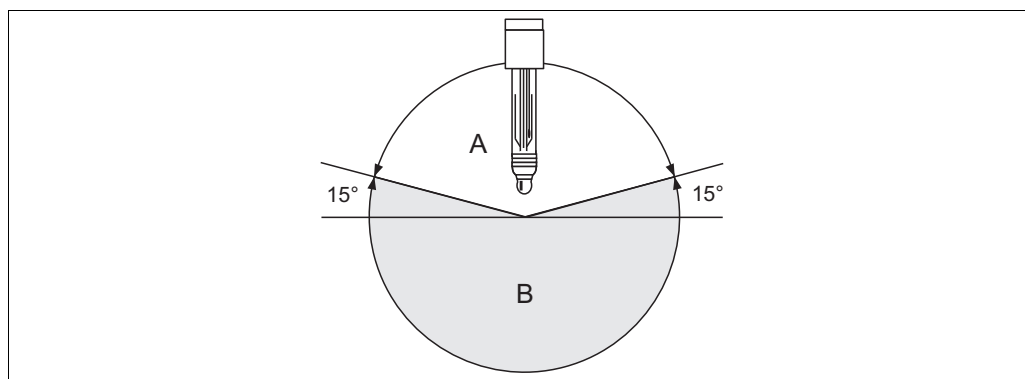
### Installation instructions

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.



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.



Electrode installation; inclination angle min. 15° from the horizontal

- A Permitted inclination angle  
B Non-permitted inclination angle

## Environment

### Ambient temperature



Caution!

*Danger of frost damage*

Do not use the electrode at temperatures below  $-15\text{ °C}$  ( $5\text{ °F}$ ).

### Storage temperature

0 to  $50\text{ °C}$  ( $32$  to  $122\text{ °F}$ )

### Ingress protection

IP 67: GSA plug-in head (with closed plug-in connection)

IP 68: TOP68 plug-in head, autoclavable up to  $135\text{ °C}$  ( $275\text{ °F}$ ), 1 m (3.28 ft) water column,  $50\text{ °C}$  ( $122\text{ °F}$ ), 168 h

IP 68: Memosens plug-in head, 10 m (32.81 ft) water column,  $25\text{ °C}$  ( $77\text{ °F}$ ), 45 days, 1M KCl

## Process

### Process temperature

Version AA, AS:  $-15$  to  $80\text{ °C}$  ( $5$  to  $176\text{ °F}$ )

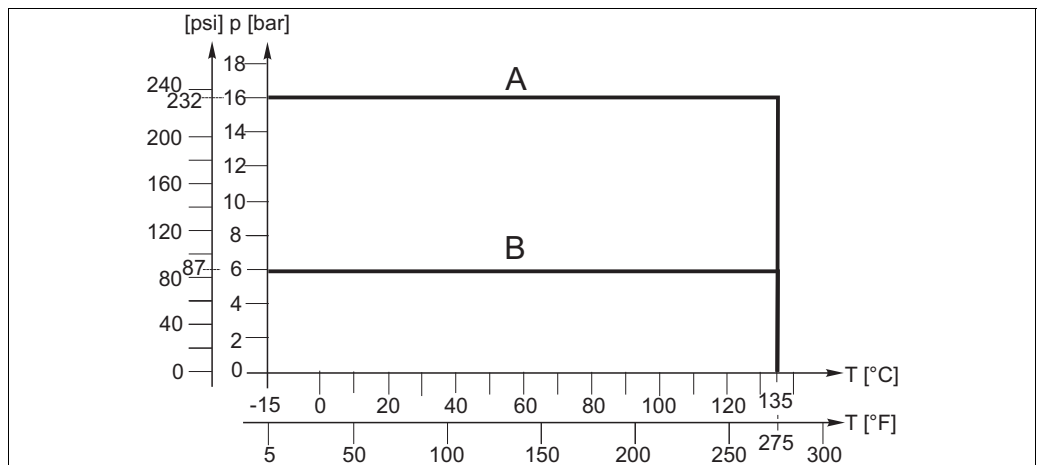
Version BA, BT:  $0$  to  $135\text{ °C}$  ( $32$  to  $275\text{ °F}$ )

Version FA:  $0$  to  $70\text{ °F}$  ( $32$  to  $158\text{ °F}$ )

### Process pressure

$0$  to  $6\text{ bar}$  ( $0$  to  $87\text{ psi}$ ) /  $16\text{ bar}$  ( $232\text{ psi}$ ) (versions CPS11-xBAxESA, CPS11D-7BAxx, CPS11D-7BTxx)

### Pressure temperature load curve



Pressure temperature load curve

A Versions CPS11-xBAxESA, CPS11D-7BAxx, CPS11D-7BTxx

B CPS11 and CPS11D (except CPS11-xBAxESA, CPS11D-7BAxx, CPS11D-7BTxx)

### Conductivity

min.  $50\text{ }\mu\text{S/cm}$

### pH range

Version AA, AS:  $1$  to  $12\text{ pH}$

Version BA, BT:  $0$  to  $14\text{ pH}$

Version FA:  $0$  to  $10\text{ pH}$



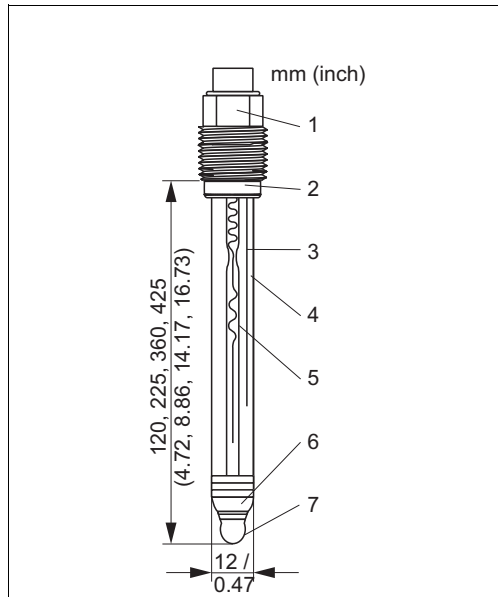
Caution!

*Danger of electrode damage*

Do not operate the electrodes in applications outside the given specifications!

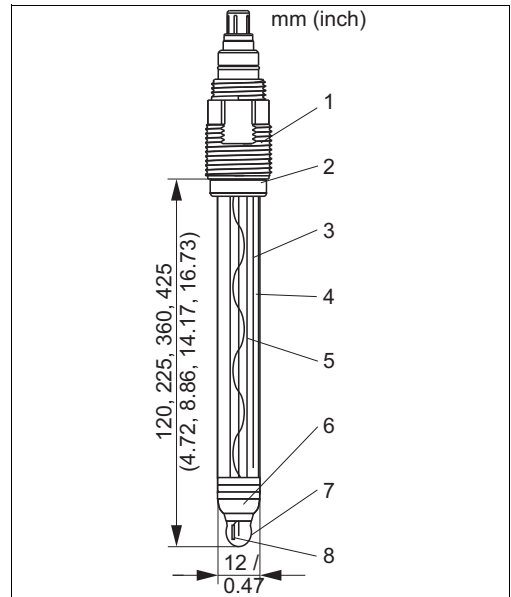
## Mechanical construction

### Design, dimensions



CPS11 with GSA plug-in head

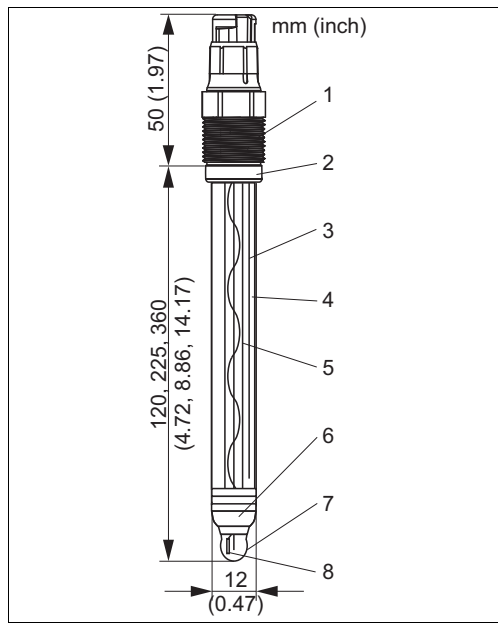
- 1 GSA plug-in head, Pg 13.5
- 2 Viton O-ring with thrust collar
- 3 Ag/AgCl metal lead - reference
- 4 "Advanced Gel" electrolyte
- 5 Ag/AgCl metal lead - pH
- 6 PTFE diaphragm
- 7 pH glass membrane



CPS11 with TOP68, built-in temperature sensor

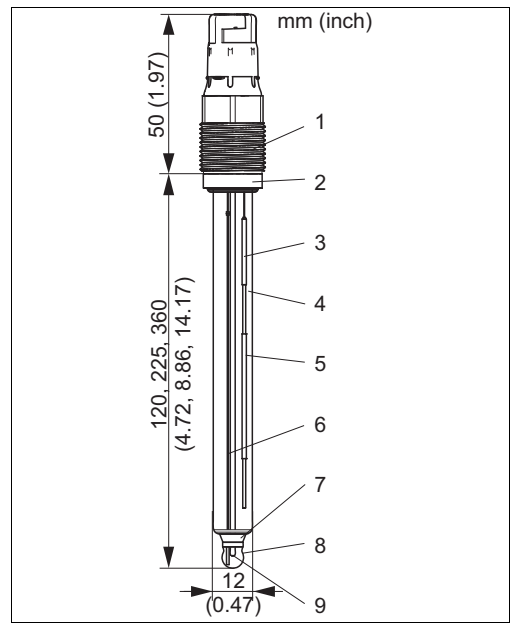
- 1 TOP68 plug-in head, Pg 13.5
- 2 Viton O-ring with thrust collar
- 3 Ag/AgCl metal lead - reference
- 4 "Advanced Gel" electrolyte
- 5 Ag/AgCl metal lead - pH
- 6 PTFE diaphragm
- 7 pH glass membrane
- 8 Pt 100 temperature sensor

### Design, dimensions CPS11D



CPS11D with Memosens, built-in temperature sensor

- 1 Memosens plug-in head, Pg 13.5
- 2 Viton O-ring with thrust collar
- 3 Ag/AgCl metal lead - reference
- 4 "Advanced Gel" electrolyte
- 5 Ag/AgCl metal lead - pH
- 6 PTFE diaphragm
- 7 pH glass membrane
- 8 Temperature sensor




CPS11D-7BTxx

- 1 Memosens plug-in head, Pg 13.5
- 2 Viton O-ring with thrust collar
- 3 Ag/AgCl metal lead - reference
- 4 "Advanced Gel" electrolyte
- 5 Ion trap
- 6 Ag/AgCl metal lead - pH
- 7 PTFE diaphragm
- 8 pH glass membrane
- 9 Temperature sensor

|                           |   |  |
|---------------------------|---|--|
| <b>Weight</b>             | approx. 0.1 kg (0.22 lbs)   |  |
| <b>Material</b>           | Electrode shaft<br>pH membrane glasses<br>Metal lead<br>Diaphragm | process glass<br>types A, B, F<br>Ag/AgCl<br>ring-shaped Teflon® diaphragm, sterilizable   |
| <b>Process connection</b> | Pg 13.5   |  |
| <b>Temperature sensor</b> | CPS11:<br>CPS11D:   | Pt 100, Pt 1000<br>NTC   |
| <b>Plug-in heads</b>      | CPS11:<br>ESA<br>GSA<br>CPS11D:                                   | plug-in head Pg 13.5, TOP68 for electrodes with or without temperature sensor, 16 bar (232 psi) triple safety overpressure, Ex<br>plug-in head Pg 13.5 for electrodes without temperature sensor<br>Memosens plug-in head for digital, contactless data transmission |
| <b>Reference system</b>   | CPS11:<br>CPS11D:<br>Versions AA, AS, BA, FA<br>Version BT        | Ag/AgCl metal lead with Advanced Gel 3 M KCl, AgCl free<br>Ag/AgCl metal lead with Advanced Gel 3 M KCl, AgCl free<br>Ag/AgCl metal lead with ion trap and Advanced Gel 3 M KCl  |

## Certificates and approvals

|  |  |
|--|--|
| <b>Ex approval</b>                             | <p><b>CPS11 (TOP68)</b></p> <ul style="list-style-type: none"> <li>ATEX II 1G EEX ia IIC T3/T4/T6</li> <li>FM Class I Div. 2, in combination with the Liquiline M CM42 and Mycom S CPM153 transmitters</li> </ul> <p><b>CPS11D</b></p> <ul style="list-style-type: none"> <li>ATEX II 1G EEX ia IIC T3/T4/T6</li> <li>FM / CSA Class I Div. 2, in combination with the Liquiline M CM42 and Mycom S CPM153 transmitters</li> </ul> <p> Note!<br/>Ex versions of digital sensors with Memosens technology are indicated by an orange-red ring in the plug-in head.</p> |
| <b>Biocompatibility</b>                        | Biocompatibility validated according to: <ul style="list-style-type: none"> <li>ISO 10993-5:1993</li> <li>USP, current revision</li> </ul>   |
| <b>TÜV certificate</b>                         | <p><b>TOP68 plug-in head</b></p> <p>Pressure resistance 16 bar (232 psi), min. triple overpressure safety</p> <p><b>Memosens plug-in head</b></p> <p>Pressure resistance 16 bar (232 psi), min. triple overpressure safety</p>   |
| <b>Electromagnetic compatibility of CPS11D</b> | Interference emission and interference immunity complies with EN 61326: 1997 / A1: 1998  |

## Ordering information

### Product structure CPS11

| Electrode type    |   |
|-------------------|---|
| 1                 | without temperature sensor  |
| 2                 | with built-in Pt 100 (not available with GSA plug-in head)  |
| 3                 | with built-in Pt 1000 (not available with GSA plug-in head)   |
| Application range |   |
| AA                | pH = 1 to 12, T = -15 to 80 °C (5 to 176 °F), 6 bar (87 psi)  |
| AS                | pH = 1 to 12, T = -15 to 80°C (5 to 176 °F), 6 bar (87 psi), salt ring  |
| BA                | pH = 0 to 14, T = 0 to 135 °C (32 to 275 °F), sterilizable, 16 bar (232 psi) in combination with ESA plug-in head |
| FA                | pH = 0 to 10, T = 0 to 70 °C (32 to 158 °F), HF resistant up to 1 g/l, 6 bar (87 psi)                             |
| Shaft length      |   |
| 2                 | 120 mm (4.72")  |
| 4                 | 225 mm (8.86")  |
| 5                 | 360 mm (14.17")   |
| 6                 | 425 mm (16.73")   |
| Plug-in head      |   |
| ESA               | Plug-in head Pg 13.5, TOP68, 16 bar (232 psi) in combination with BA application range, Ex                        |
| GSA               | Plug-in head Pg 13.5, DIN coax, non-Ex  |
| CPS11-            | complete order code   |

### Product structure CPS11D

| Version           |   |
|-------------------|---|
| 7                 | max. 135 °C (275 °F), built-in temperature sensor                                     |
| Application range |   |
| AA                | pH = 1 to 12, T = -15 to 80 °C (5 to 176 °F), 6 bar (87 psi)                          |
| AS                | pH = 1 to 12, T = -15 to 80 °C (5 to 176 °F), 6 bar (87 psi), salt ring               |
| BA                | pH = 0 to 14, T = 0 to 135 °C (32 to 275 °F), 16 bar (232 psi), sterilizable          |
| BT                | pH = 0 to 14, T = 0 to 135 °C (32 to 275 °F), 16 bar (232 psi), ion trap              |
| FA                | pH = 0 to 10, T = 0 to 70 °C (32 to 158 °F), 6 bar (87 psi), HF resistant up to 1 g/l |
| Shaft length      |   |
| 2                 | 120 mm (4.72")  |
| 4                 | 225 mm (8.86")  |
| 5                 | 360 mm (14.17")   |
| 6                 | 425 mm (16.73")   |
| Approval          |   |
| 1                 | Non-hazardous area  |
| G                 | ATEX II 1G EEx ia IIC T3/T4/T6  |
| CPS11D-           | complete order code   |

## Accessories



### Note!

In the following sections, you find the accessories available at the time of issue of this documentation. For information on accessories that are not listed here, please contact your responsible service.

### 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)

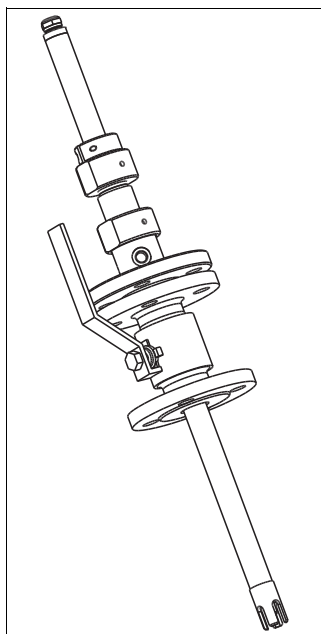
#### Mycom S CPM153

- 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)

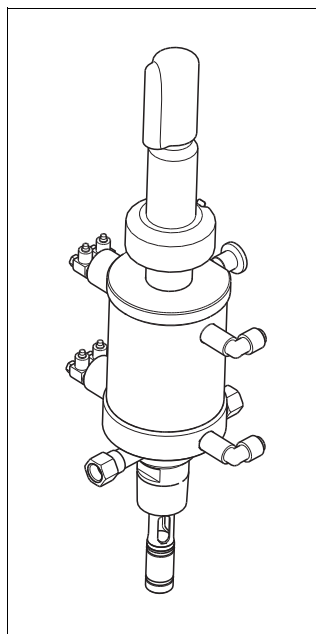


**Assemblies (Selection)**

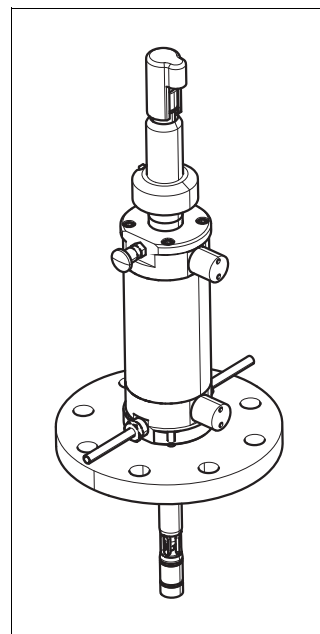
- Cleanfit W CPA450  
Manually operated, retractable assembly for installation of 120 mm (4.72") pH/ORP electrodes in tanks and pipes,  
Ordering acc. to product structure, see Technical Information (TI183C/07/en)
- Cleanfit P CPA471  
Compact retractable stainless steel assembly for installation in 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 CPA472D  
Robust retractable assembly for pH, ORP and other industry sensors, manual or pneumatic operation,  
heavy-duty version;  
Ordering acc. to product structure, see Technical Information (TI403C/07/en)

*Cleanfit W CPA450*

a0003135

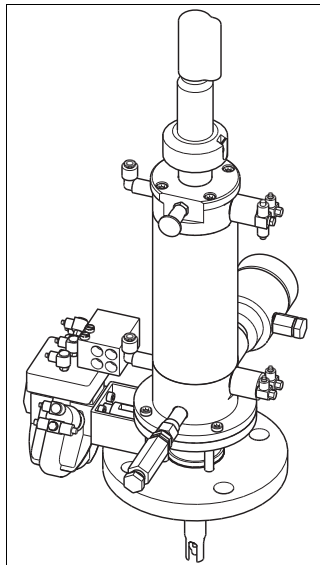
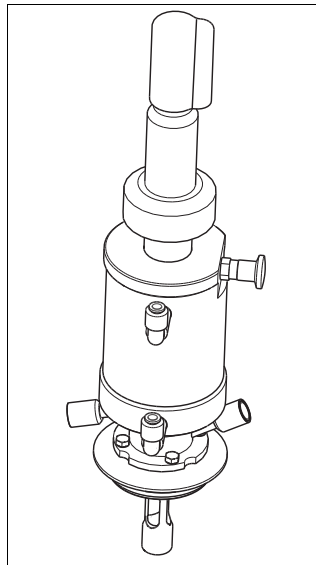
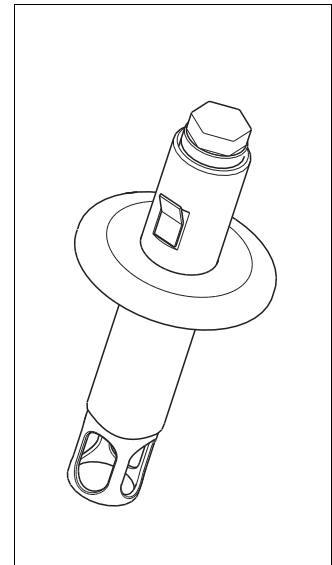
*Cleanfit P CPA471 or 472*

a0003137

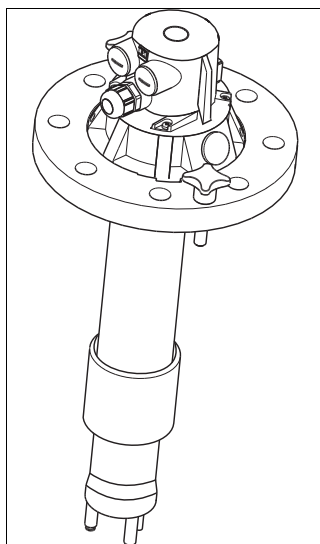
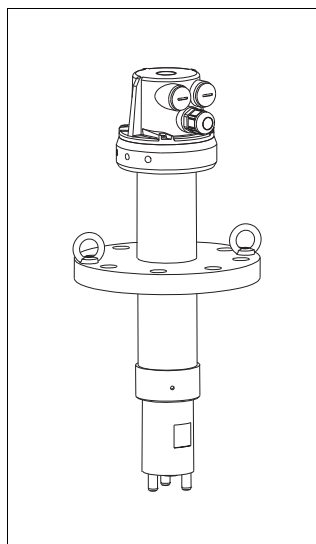
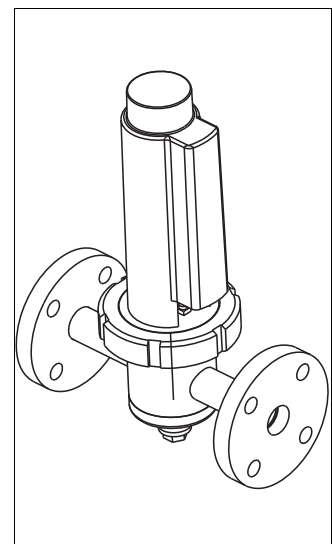
*Cleanfit P CPA472D*

a0009269

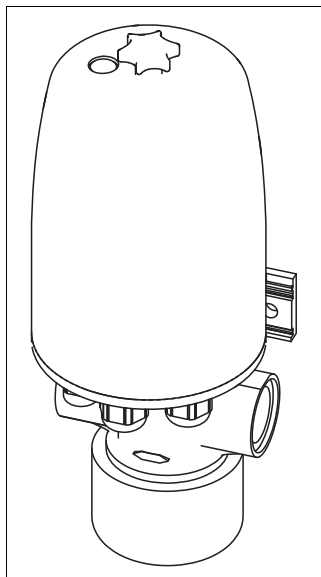
- **Cleanfit P CPA473**  
Retractable stainless steel process assembly, with ball valve for a particularly safe and reliable separation of the medium from the environment,  
Ordering acc. to product structure, see Technical Information (TI344C/07/en)
- **Cleanfit P CPA474**  
Retractable plastic process 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 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)

Cleanfit P CPA473 or 474 #0003138Cleanfit H CPA475 #0003136Unifit H CPA442 #0003139

- **Dipfit W CPA111**  
Plastic immersion and installation assembly for open and closed tanks,  
Ordering acc. to product structure, see Technical Information (TI112C/07/en)
- **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)

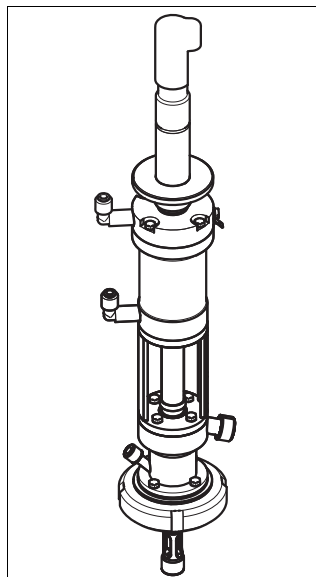
Dipfit W CPA111 #0003140Dipfit P CPA140 #0003141Flowfit P CPA240 #0003142

- Flowfit W CPA250  
Flow assembly for pH/ORP electrodes,  
Ordering acc. to product structure, see Technical Information (TI041C/07/en)
- Proffit 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)



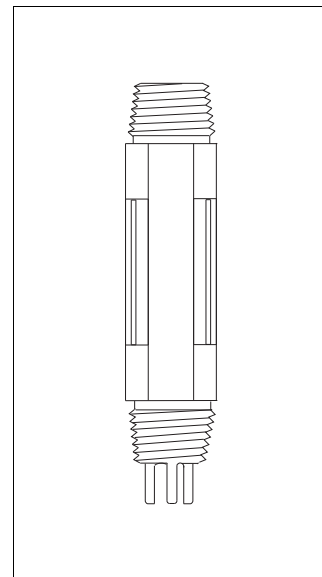
Flowfit W CPA250

a0003143



Proffit H CPA465

a0003144



Ecofit CPA640

a0003145

**Buffer solutions**

**High-quality buffer solutions of Endress+Hauser**

The secondary buffer solutions have been referenced to primary reference material of the PTB (German Federal Physico-technical Institute) and to standard reference material of NIST (National Institute of Standards and Technology) according to DIN 19266 by a DKD (German Calibration Service) accredited laboratory.

| pH value     |  |
|--------------|--|
| A            | pH 2.00 (accuracy ± 0.02 pH)                                   |
| C            | pH 4.00 (accuracy ± 0.02 pH)                                   |
| E            | pH 7.00 (accuracy ± 0.02 pH)                                   |
| G            | pH 9.00 (accuracy ± 0.02 pH)                                   |
| I            | pH 9.20 (accuracy ± 0.02 pH)                                   |
| K            | pH 10.00 (accuracy ± 0.05 pH)                                  |
| M            | pH 12.00 (accuracy ± 0.05 pH)                                  |
| Quantity     |  |
| 01           | 20 x 18 ml (0.68 fl.oz) only buffer solutions pH 4.00 and 7.00 |
| 02           | 250 ml (8.45 fl.oz)  |
| 10           | 1000 ml (0.26 US gal)  |
| 50           | 5000 ml (1.32 US gal) canister for Topcal S                    |
| Certificates |  |
| A            | Buffer analysis certificate                                    |
| Version      |  |
| 1            | Standard   |
| CPY20-       | complete order code  |

## Measuring cables

CPK9 special measuring cable

- For 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              |
| <b>CYK10-</b> | complete order code         |



Note!

Ex versions of CYK10 are indicated by an orange-red coupling end.

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