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

Technical Information

# Ceraliquid CPS41 and CPS41D

## pH electrodes, analogue and digital with Memosens technology
## With ceramic diaphragm and liquid KCl electrolyte, optional built-in temperature sensor

### Application

Media with very low conductivities or a high percentage of organic solvents or alcohols:
- Food industry
- Biotechnology
- Laboratory measurements
- Power plants

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

### Your benefits

- Liquid KCl electrolyte enabling use at very low conductivities (≥ 0.1 µS/cm)
- Ceramic diaphragm with defined KCl flow
- Application under pressures of up to 10 bar / 145 psi with counter pressure
- Resistant to poisoning thanks to separate reference lead
- Suitable for CIP / SIP cleaning
- pH membrane glass suitable for steam sterilisation
- Four lengths available: 120, 225, 360 and 425 mm
- Available with built-in Pt 100, Pt 1000 or NTC temperature sensor

### 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

TI079C/07/en/03.05
50059346

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

- **Application at low conductivity**
  Thanks to its liquid KCl electrolyte filling, the electrode can be applied at very low conductivities (≥ 5 µS/cm with one diaphram, ≥ 0.1 µS/cm with three diaphragms).
- **Sterilisable**
  The electrode can be used in applications with steam sterilisation (max. 135 °C / 275 °F).
- **Durability**
  The electrode can be applied under pressures of up to 10 bar / 145 psi with counter pressure.

## Important properties of CPS41D

**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" 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 digitalises 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 at very low or very high pH values. When the sensor is mounted, the calibration data are automatically transferred to the transmitter and used to calculate the current pH value. Storing the calibration data in the sensor allows for calibration and adjustment away from the measuring point. The result:

- pH 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 the CPS41D to a digital transmitter with Memosens technology. Data transmission to an analogue transmitter is not possible.

**Data storage of CPS41D**

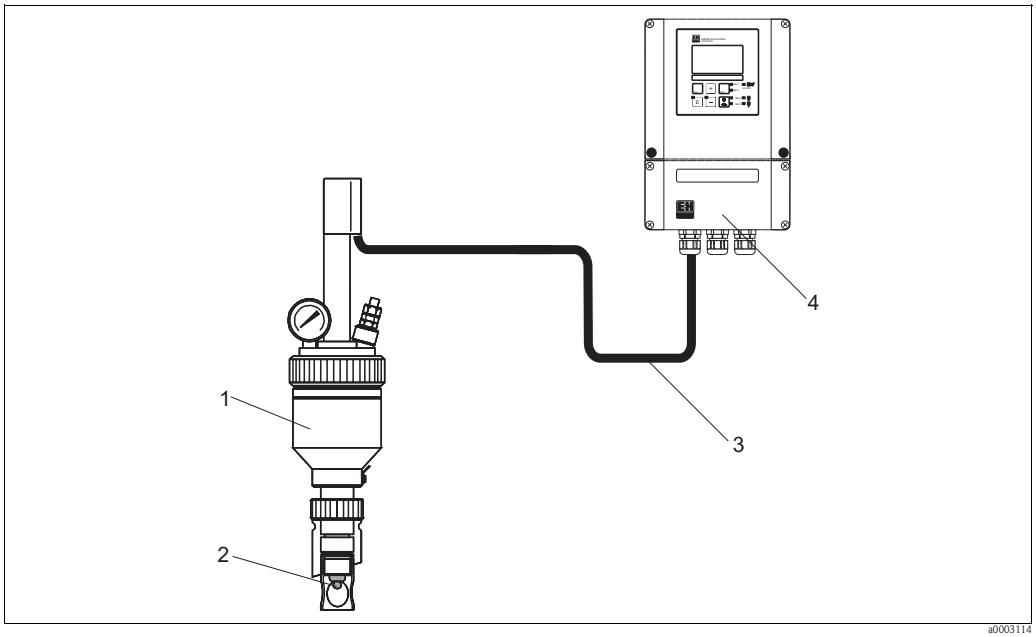
Digital sensors are able to store the following system data in the sensor.

- 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 sterilisations
  - Glass membrane impedance

These system data can be displayed with the Mycom S transmitter

**Measuring system**

A complete measuring system comprises:
- CPS41 or CPS41D pH electrode
- Transmitter, e.g. Liquisys M CPM223/253 (for CPS41D with Memosens technology)
- Special measuring cable, e.g. CPK9 or Memosens data cable for CPS41D
- Immersion, flow or retractable assembly, e.g. Unifit H CPA441




*Measuring system for redox measurement*

*1 Unifit H CPA441*
*2 CPS41 / CPS41D pH electrode*
*3 CPK9 special measuring cable (for electrodes with TOP68 plug-in head) / CYK10 for digital sensors*
*4 Liquisys M CPM253 transmitter*

# Input

**Measured variables**

pH value
Temperature

**Measuring range**

Electrode versions AB and AC (for water / wastewater):
pH: 1 ... 12
Temperature: -15 ... 80 °C / 5 ... 176 °F
Electrode versions BB and BC (for process applications, sterilisable)
pH: 0 ... 14
Temperature: 0 ... 135 °C / 32 ... 275 °F

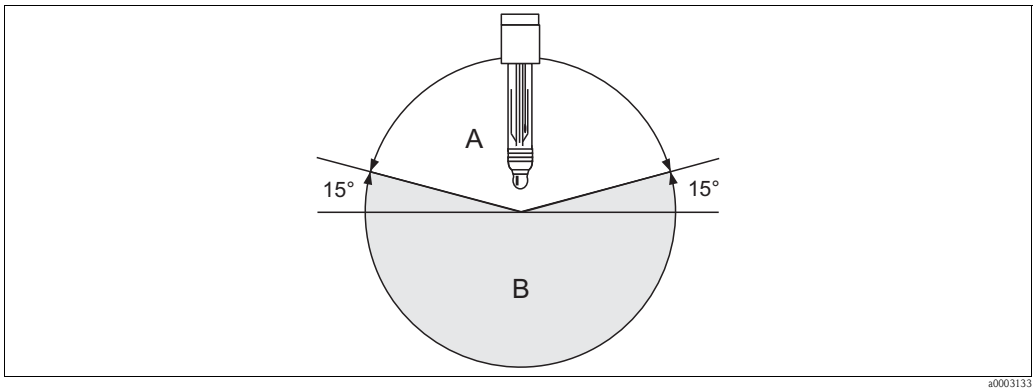
Caution!
Please note the process operating conditions.

# 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 °C / 5 °F.

**Storage temperature**

0 ... 50 °C / 32 ... 122 °F

**Ingress protection**

| | |
|---|---|
| IP 67: | GSA and SSA plug-in heads (with closed plug-in connection) |
| IP 68: | TOP68 plug-in head (1 m / 3.28 ft water column, 50 °C / 122 °F, 168 h) |
| IP 68: | Memosens plug-in head (10 m/ 32.81 ft water column, 25 °C / 77 °F, 45 days, 1M KCl) |

# Process

**Process temperature**

| | |
|---|---|
| Versions AB, AC: | -15 ... 80 °C / 5 ... 176 °F |
| Versions BB, BC: | 0 ... 135 °C / 32 ... 275 °F |

**Process pressure**

0 ... 10 bar / 0 ... 145 psi with counter pressure via a separate KCl vessel

**Mininum conductivity**

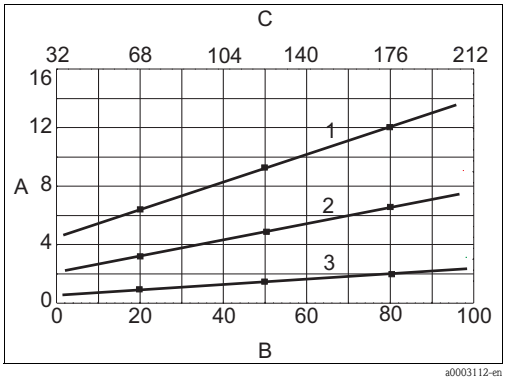
| | |
|---|---|
| Electrodes with 1 diaphragm: | min. 5 µS/cm |
| Electrodes with 3 diaphragms: | min. 0.1 µS/cm |

**pH range**

| | |
|---|---|
| Versions AB, AC: | 1 ... 12 pH |
| Versions BB, BC: | 0 ... 14 pH |

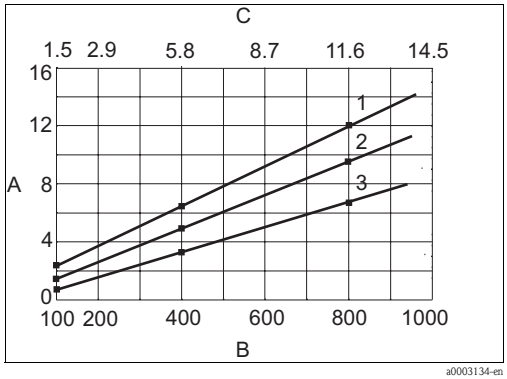
Caution!
Danger of electrode damage
Do not operate the electrodes in applications outside the given specifications!

**KCl consumption**




*KCl consumption dependent on temperature*[1]

*A Consumption (ml/day)*
*B Temperature (°C)*
*C Temperature (°F)*
*1 800 mbar / 11.6 psi overpressure*
*2 400 mbar / 5.8 psi overpressure*
*3 100 mbar / 1.5 psi overpressure*



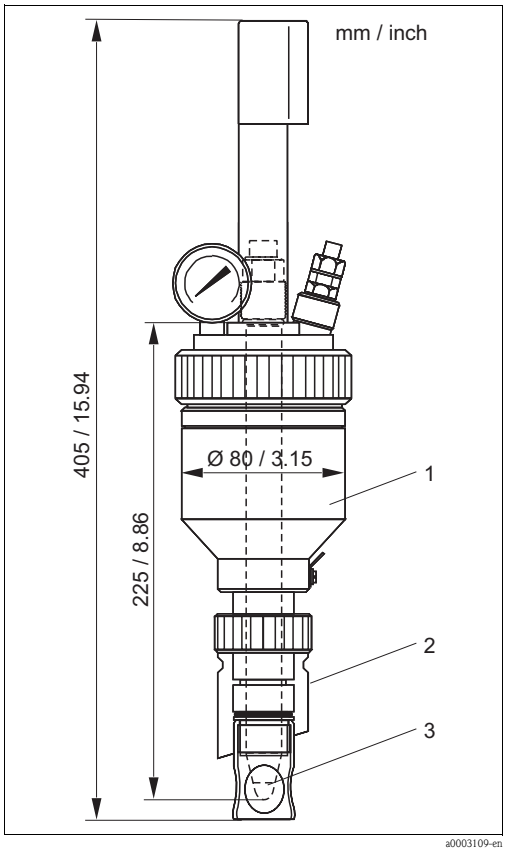

*KCl consumption dependent on process pressure*[1]

*A Consumption (ml/day)*
*B Overpressure to process (mbar)*
*C Overpressure to process (psi)*
*1 80 °C / 176 °F medium temperature*
*2 50 °C / 122 °F medium temperature*
*3 20 °C / 68 °F medium temperature*

1) KCl consumption refers to electrodes with one diaphragm. The consumption of electrodes with three diaphragms is correspondingly higher.

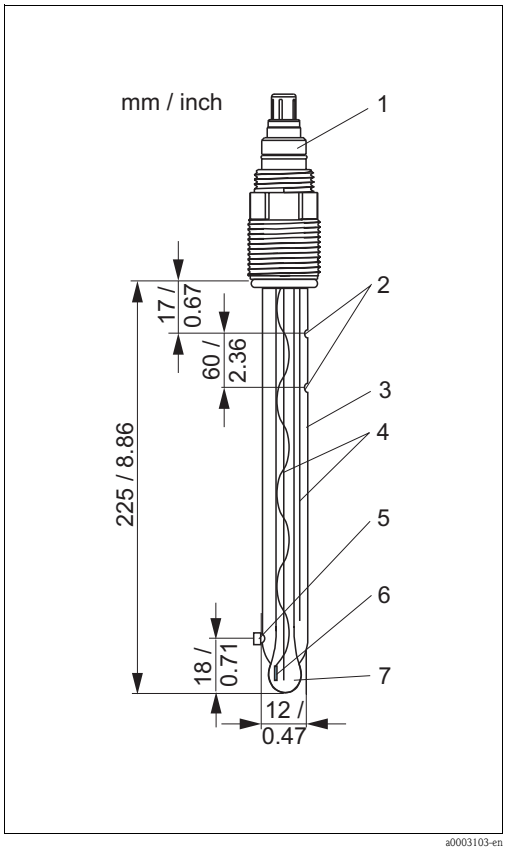
# Mechanical construction

**Design, dimensions CPS41**



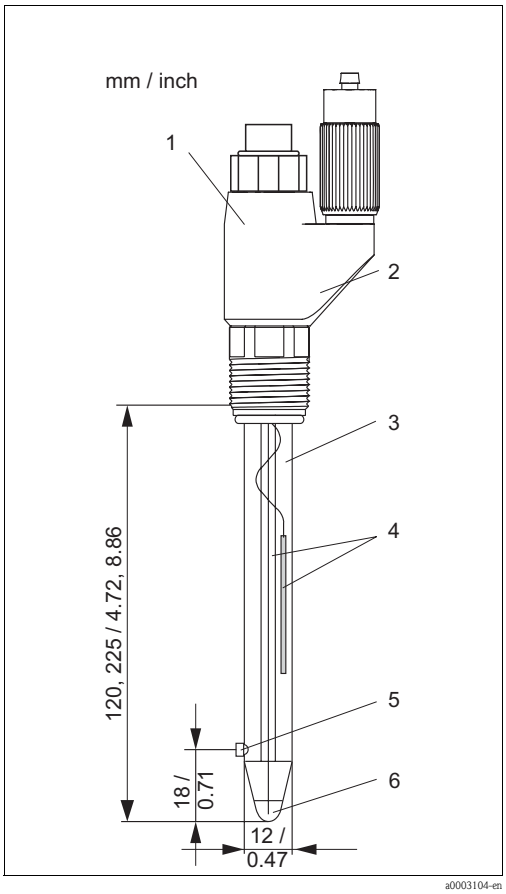

*Unifit H CPA441 with CPS41*

*1 KCl reservoir*
*2 Mounting device*
*3 CPS41 (shaft length 225 mm / 8.86")*



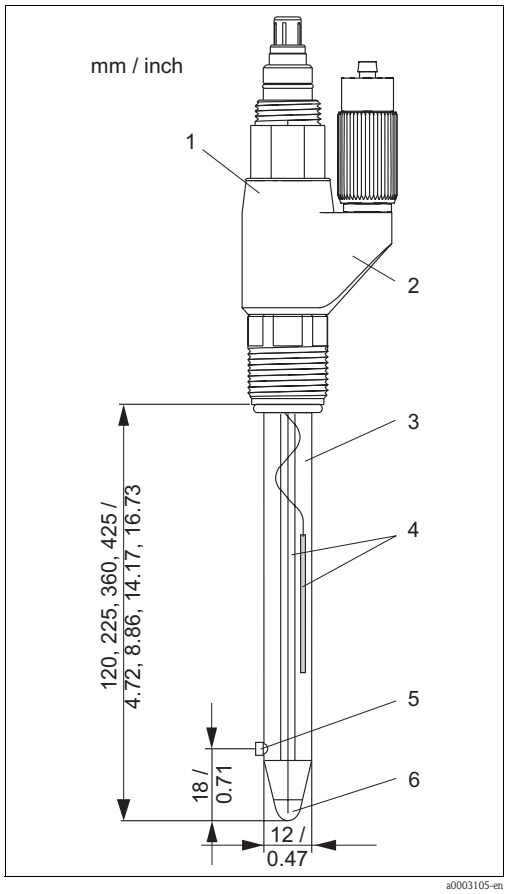

*CPS41 w. ESA plug-in head f. CPA441, temperature sensor*

*1 TOP68 plug-in head, Pg 13.5*
*2 KCl refilling*
*3 Liquid KCl electrolyte*
*4 Ag/AgCl lead*
*5 Ceramic diaphragm*
*6 Pt 100 temperature sensor*
*7 pH glass membrane*




*CPS41 with SSA plug-in head*

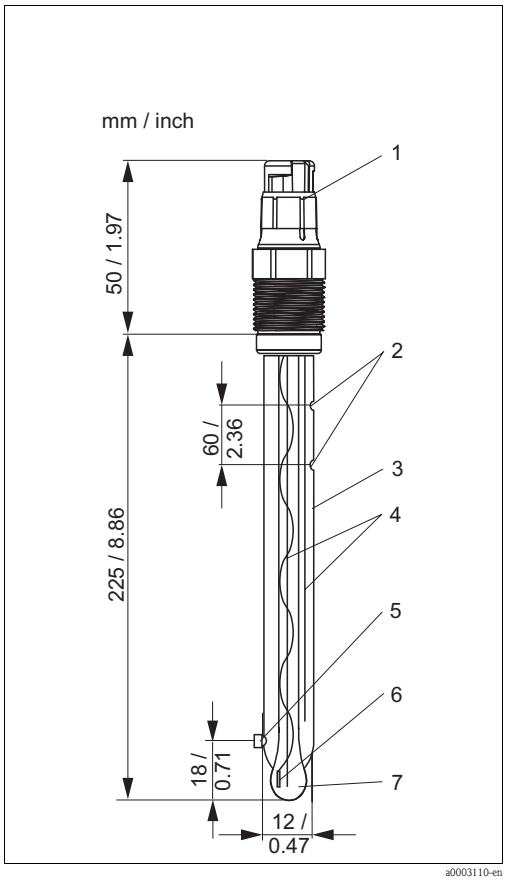
*1 SSA plug-in head, Pg 13.5*
*2 Hose connection for KCl refilling*
*3 Liquid KCl electrolyte*
*4 Ag/AgCl lead*
*5 Ceramic diaphragm*
*6 pH glass membrane*




*CPS41 with ESS plug-in head*

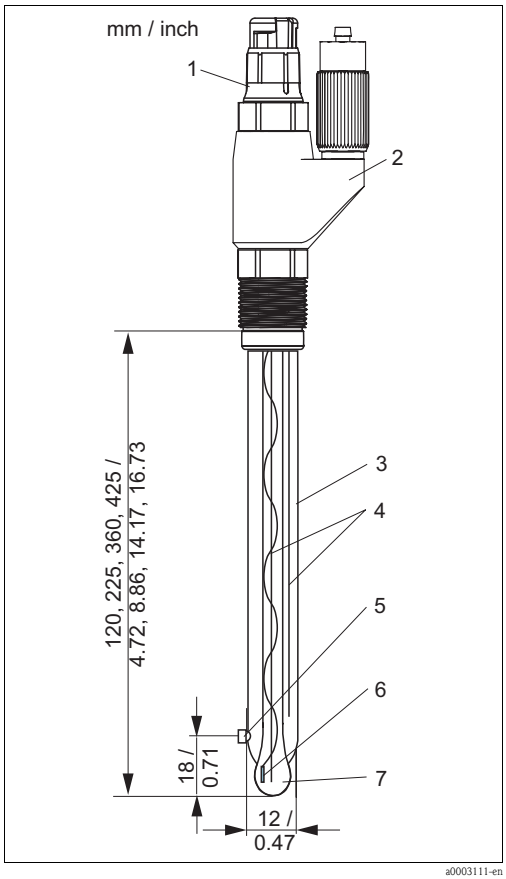
*1 ESS plug-in head, Pg 13.5*
*2 Hose connection for KCl refilling*
*3 Liquid KCl electrolyte*
*4 Ag/AgCl lead*
*5 Ceramic diaphragm*
*6 pH glass membrane*

**Design, dimensions CPS41D**




*CPS41D with Memosens plug-in head for CPA441*

*1 Memosens plug-in head*
*2 KCl refilling*
*3 Liquid KCl electrolyte*
*4 Ag/AgCl lead*
*5 Ceramic diaphragm*
*6 NTC 30K temperature sensor*
*7 pH glass membrane*




*CPS41D with Memosens plug-in head and KCl connection*

*1 Memosens plug-in head*
*2 Hose connection for KCl refilling*
*3 Liquid KCl electrolyte*
*4 Ag/AgCl lead*
*5 Ceramic diaphragm*
*6 NTC 30K temperature sensor*
*7 pH glass membrane*

**Weight**

0.1 kg / 0.2 lb.

**Materials**

| | |
|---|---|
| Electrode shaft | process glass |
| pH membrane glasses | types A, B |
| Metal lead | Ag/AgCl |
| Diaphragm | ceramic diaphragm, sterilisable |

**Process connection**

Pg 13.5

**Temperature sensor**

| | |
|---|---|
| CPS41: | Pt 100, Pt 1000 |
| CPS41D: | NTC |

**Plug-in heads**

CPS41

| | |
|---|---|
| ESA: | Threaded plug-in head Pg 13.5, TOP68 for electrodes with and without temperature sensor, 16 bar / 232 psi, Ex |
| ESS: | Plug-in head with hose connection for KCl refilling Pg 13.5, TOP68 for electrodes with and without temperature sensor, 10 bar / 145 psi, Ex |
| GSA: | Threaded plug-in head Pg 13.5 for electrodes without temperature sensor |
| SSA: | Plug-in head with hose connection for KCl refilling Pg 13.5, for electrodes without temperature sensor |
| CPS41D-****A*: | Memosens plug-in head for digital, contactless data transmission, 16 bar / 232 psi |
| CPS41D-****B*: | Memosens plug-in head with hose connection for KCl refilling, for digital contactless data transmission, 10 bar / 145 psi |

**Reference system**

Ag /AgCl metal lead with liquid KCl, 3M, AgCl free

# Certificates and approvals

**Ex approval CPS41 (ESA, ESS)**

- ATEX II 2G EEX ia IIC T3/T4/T6
- FM Class I Div. 2, in combination with the Mypro CPM431 and Mycom S CPM153 transmitters

**Ex approval CPS41D**

- ATEX II 2G EEx ia IIC T3/T4/T6

Note!
Ex versions of digital sensors with Memosens technology are indicated by an orange–red ring in the plug-in head.

**Biocompatibility**

Biocompatibility validated according to:

- ISO 10993-5:1993
- USP, current revision

**TÜV certificate TOP68 plug-in head**

Pressure resistance 16 bar, min. triple overpressure safety

**TÜV certificate Memosens plug-in head**

Pressure resistance 16 bar, min. triple overpressure safety

**Electromagnetic compatibility of CPS41D**

Interference emission and interference immunity complies with EN 61326: 1997 / A1: 1998

# Ordering information

## Product structure CPS41

| | Electrode type |
|---|---|
| 1 | without temperature sensor |
| 2 | with built-in Pt 100 (not available with GSA and SSA plug-in heads) |
| 3 | with built-in Pt 1000 (not available with GSA and SSA plug-in heads) |

| | Application range |
|---|---|
| AB | pH = 1 ... 12, T = -15 ... 80 °C / 5 ... 176 °F, 1 diaphragm |
| AC | pH = 1 ... 12, T = -15 ... 80 °C / 5 ... 176 °F, 3 diaphragms |
| BB | pH = 0 ... 14, T = 0 ... 135 °C / 32 ... 275 °F, 1 diaphragm, sterilisable |
| BC | pH = 0 ... 14, T = 0 ... 135 °C / 32 ... 275 °F, 3 diaphragms, sterilisable |

| | Shaft length |
|---|---|
| 2 | 120 mm / 4.72" (ESS and SSA plug-in heads only) |
| 4 | 225 mm / 8.86" |
| 5 | 360 mm / 14.17" (ESS plug-in head only) |
| 6 | 425 mm / 16.73" (ESS plug-in head only) |

| | Plug-in head |
|---|---|
| ESA | Plug-in head Pg 13.5, TOP68, 16 bar / 232 psi, Ex |
| ESS | Hose connection head Pg 13.5, TOP68, Ex |
| GSA | Plug-in head Pg 13.5, DIN coax, non Ex |
| SSA | Hose connection head Pg 13.5, non Ex |

| | |
|---|---|
| CPS41- | complete order code |

## Product structure CPS41D

| | Version |
|---|---|
| 7 | Basic version |

| | Application range |
|---|---|
| AB | pH = 1 ... 12, T = -15 ... 80 °C / 5 ... 176 °F, 1 diaphragm |
| AC | pH = 1 ... 12, T = -15 ... 80 °C / 5 ... 176 °F, 3 diaphragms |
| BB | pH = 0 ... 14, T = 0 ... 135 °C / 32 ... 275 °F, 1 diaphragm, sterilisable |
| BC | pH = 0 ... 14, T = 0 ... 135 °C / 32 ... 275 °F, 3 diaphragms, sterilisable |

| | Shaft length |
|---|---|
| 2 | 120 mm / 4.72" (versions with KCl hose connection only) |
| 4 | 225 mm / 8.86" |
| 5 | 360 mm / 14.17" (versions with KCl hose connection only) |
| 6 | 425 mm / 16.73" (versions with KCl hose connection only) |

| | Electrolyte supply |
|---|---|
| A | Shaft hole for KCl refilling, CPA441 |
| B | KCl hose connection, CPY7 |

| | Approval |
|---|---|
| 1 | Non-hazardous area |
| G | ATEX II 2G EEx ia IIC T3/T4/T6 |

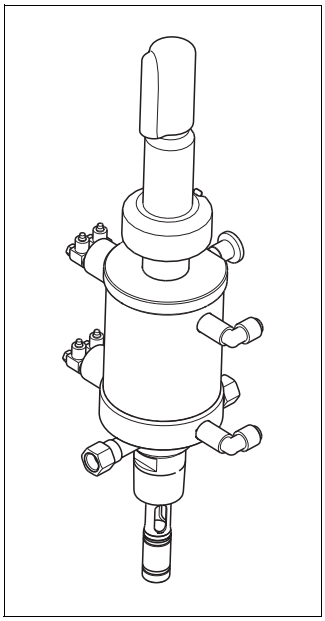
| | |
|---|---|
| CPS41D- | complete order code |

# Accessories

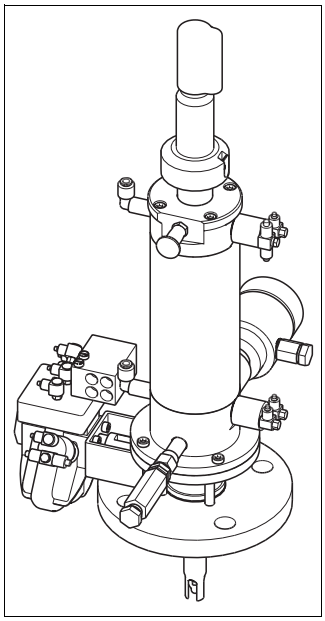
Note!
In the following sections, you find the accessories available at the time of issue of this documentation.
For information on accessories that are not listed here, please contact your responsible service.

**Assemblies (Selection)**

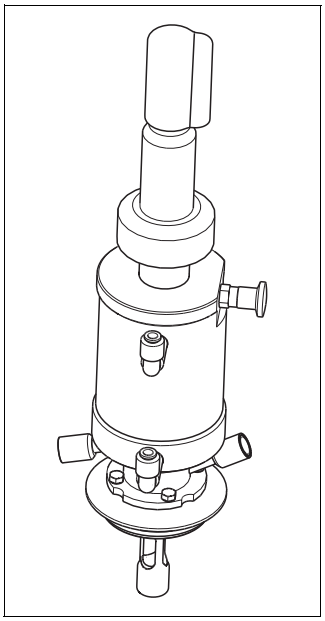
- Cleanfit P CPA471
  Compact retractable stainless steel assembly for installation in tanks and pipes, manual or pneumatic operation
  Ordering acc. to product structure, see Technical Information (TI217C/07/en)
- Cleanfit P CPA472
  Compact retractable plastic assembly for installation in tanks or 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 H CPA475
  Retractable assembly for installation in tanks and pipes under sterile conditions
  Ordering acc. to product structure, see Technical Information (TI240C/07/en)




*Cleanfit P CPA471 or 472*

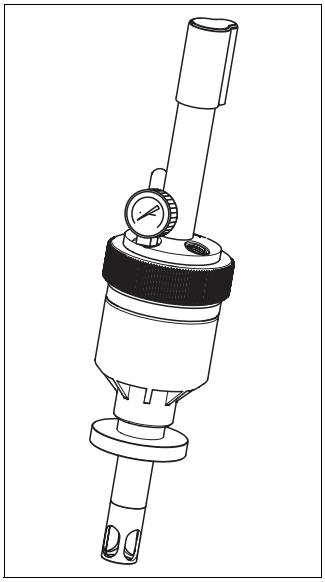



*Cleanfit P CPA473 or 474*

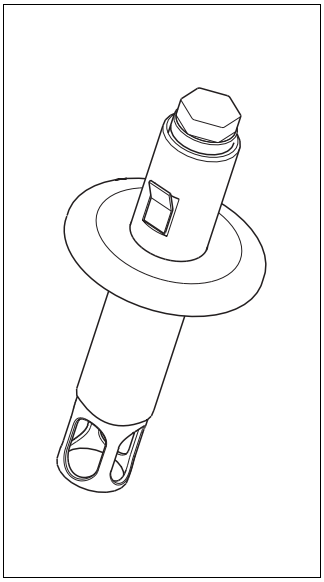



*Cleanfit H CPA475*

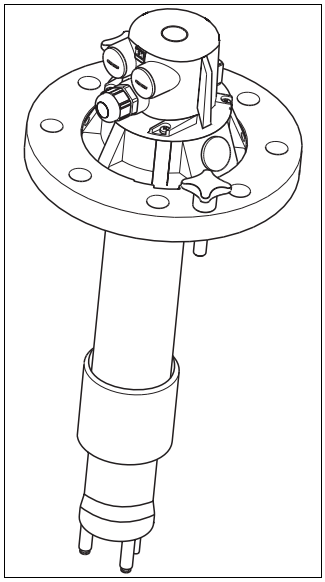
- Unifit H CPA441
  Process assembly with integrated electrolyte vessel for installation of pH/redox electrodes
  Ordering acc. to product structure, see Technical Information (TI026C/07/en)
- Unifit H CPA442
  Process assembly for the food industry, biotechnology and pharmaceutical industry, complies with EHEDG criteria and 3A standard 74-02
  Ordering acc. to product structure, see Technical Information (TI306C/07/en)
- Dipfit W CPA111
  Immersion and installation assembly for open and closed tanks
  Ordering acc. to product structure, see Technical Information (TI112C/07/en)




*Unifit H CPA441*

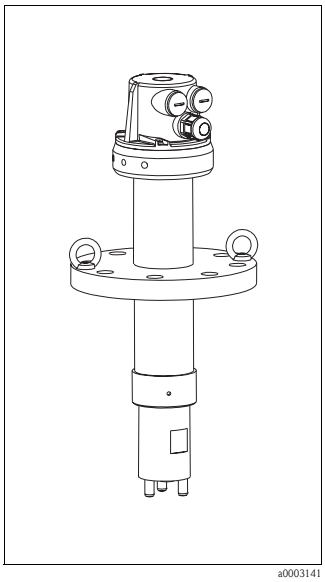



*Unifit H CPA442*

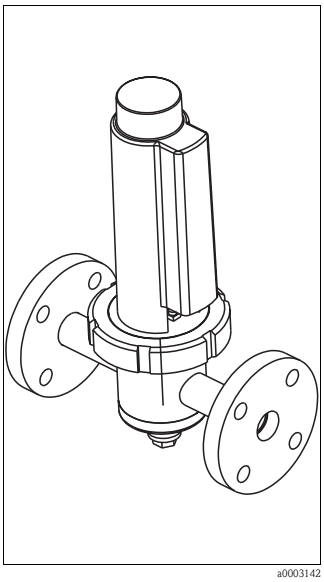



*Dipfit W CPA111*

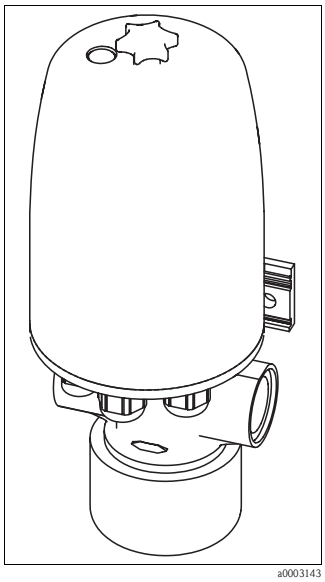
- Dipfit P CPA140
  Immersion assembly for pH/redox electrodes, for demanding processes
  Ordering acc. to product structure, see Technical Information (TI178C/07/en)
- Flowfit P CPA240
  Flow assembly for pH/redox electrodes, for demanding processes
  Ordering acc. to product structure, see Technical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




*Dipfit P CPA140*

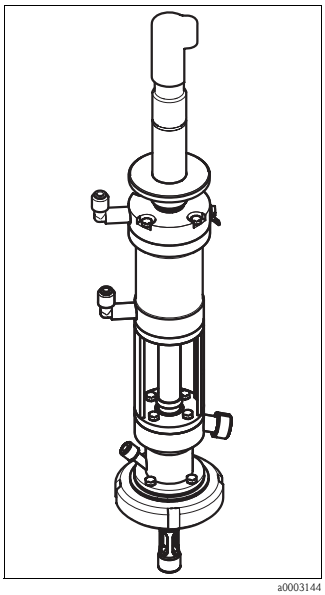



*Flowfit P CPA240*

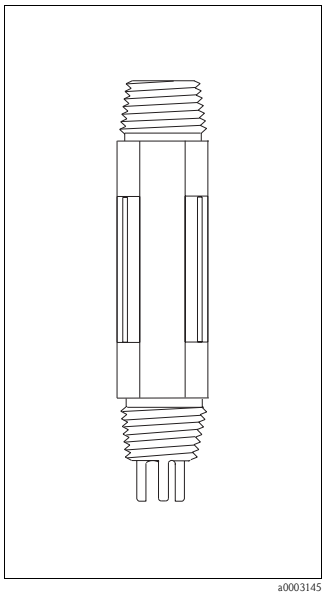



*Flowfit W CPA250*

- 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 electrodes with TOP68 plug-in head
  Ordering acc. to product structure, see Technical Information (TI264C/07/en)




*Probfit H CPA465*




*Ecofit CPA640*

**Electrolyte vessel**

- CPY7 electrolyte vessel
  Reservoir for KCl electrolyte, 150 ml / 0.04 US.gal
  Ordering acc. to product structure, see Operating Instructions (BA 128C/07/en)

**Electrolyte solutions**

KCl-electrolyte solutions for liquid filled electrodes
- 3.0 mol, T = -10 ... 100 °C (14 ... 212 °F), 100 ml (3 oz), order no. CPY4-1
- 3.0 mol, T = -10 ... 100 °C (14 ... 212 °F), 1000 ml (30 oz), order no. CPY4-2
- 1.5 mol, T = -30 ... 100 °C (-22 ... 266 °F), 100 ml (3 oz), order no. CPY4-3
- 1.5 mol, T = -30 ... 100 °C (-22 ... 266 °F), 1000 ml (30 oz), order no. CPY4-4

**Buffer solutions**

Technical buffer solutions, accuracy 0.02 pH, acc. to NIST/DIN
- pH 4.0 red, 100 ml (0.026 US gal.), order no. CPY 2-0
- pH 4.0 red, 1000 ml (0.264 US gal.), order no. CPY 2-1
- pH 7.0 green, 100 ml (0.026 US gal.), order no. CPY 2-2
- pH 7.0 green, 1000 ml (0.264 US gal.), order no. CPY 2-3

Technical buffer solutions for single use, accuracy 0.02 pH, acc. to NIST/DIN
- pH 4.0 20 x 20 ml (0.005 US gal.), order no. CPY 2-D
- pH 7.0 20 x 20 ml (0.005 US gal.), order no. CPY 2-E

**Transmitters**

- Liquisys M CPM223/253
  Transmitter for pH and redox, 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 redox, one or two channel version, Ex or Non-Ex,
  Hart® or PROFIBUS available
  Ordering acc. to product structure, see Technical Information (TI233C/07/en)
- Mypro CPM431
  Two-wire transmitter for pH and redox,
  Hart® or PROFIBUS
  Ordering acc. to product structure, see Technical Information (TI173C/07/en)

**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/redox electrodes with GSA plug-in head
  Ordering acc. to product structure, see Technical Information (TI118C/07/en)
- CPK12 special measuring cable
  For pH/redox 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 pH sensors with Memosens technology (CPSxxD)
  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 / 9.84 ft | |
| | | 05 | Cable length: 5 m / 16.41 ft | |
| | | 10 | Cable length: 10 m / 32.81 ft | |
| | | 15 | Cable length: 15 m / 49.22 ft | |
| | | 20 | Cable length: 20 m / 65.62 ft | |
| | | 25 | Cable length: 25 m / 82.03 ft | |
| | | 88 | ... m length | |
| | | 89 | ... ft length | |
| | | | **Ready-made** | |
| | | | 1 | Wire terminals |
| **CYK10-** | | | | complete order code |

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

**International Head Quarters**

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