

# Technical Information

## Memosens COS81D

Hygienic, optical sensor for measuring oxygen



Sensor with maximum measurement stability over multiple sterilization cycles

### Application

Typical applications include:

- Oxygen control in fermenters, e.g. in the pharmaceutical or biotechnology sectors
- Monitoring of explosive atmospheres with an oxygen concentration of up to 2%
- Quality control in the food industry

### Your benefits

- Accurate measurements with longterm stability and permanent self-monitoring
- Can be sterilized up to 140 °C (284 °F) and autoclavable
- Stainless steel 1.4435 (AISI 316L) meets the highest demands of the pharmaceutical industry
- IP68 protection
- Sensor certified in accordance with EHEDG
- Complies with the relevant sections of the ASME-BPE
- Available with a certificate of conformity for pharmaceutical requirements
- Available with inspection certificate EN 10204-3.1
- Materials compliant with FDA and/or USP class VI specifications

### Other advantages of Memosens technology

- Maximum process safety thanks to non-contact, inductive signal transmission
- Data security thanks to digital data transmission
- Very easy to use as sensor data saved in the sensor
- Recording of sensor load data in the sensor enables predictive maintenance

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## Function and system design

### Measuring principle

#### Sensor structure

Oxygen-sensitive molecules (markers) are integrated into the optically active layer (fluorescence layer).

The fluorescence layer, an optical insulating layer and a cover layer are applied on top of one another on the carrier. The cover layer is in direct contact with the medium.

The sensor optics are directed at the rear of the carrier and therefore at the fluorescence layer.

#### Measurement process (principle of quenching)

If the sensor is immersed in the medium, an equilibrium is very quickly established between the oxygen partial pressure in both the medium and the fluorescence layer.

1. The sensor optics send orange light pulses to the fluorescence layer.
2. The markers "respond" (fluoresce) with darkred light pulses.
  - ↳ The decay time and intensity of the response signals are directly dependent on the oxygen contents and oxygen partial pressure.

If the medium is free from oxygen, the decay time is long and the signal is very intense.

Any oxygen molecules present mask the marker molecules. As a result, the decay time is shorter and the signals are less intense.

#### Measurement result

- ▶ The sensor calculates the measurement result on the basis of the signal intensity and decay time using the Stern-Volmer equation.

The sensor provides measured values for temperature and partial pressure as well as a raw measured value. This value corresponds to the fluorescence decay time and is approx. 14  $\mu$ s in air and approx. 56  $\mu$ s in oxygen-free media.

#### For optimum measurement results

1. During calibration, enter the current air pressure at the transmitter.
2. If the measurement is not performed at **Air 100% rh**:  
Enter the current humidity.
3. In the case of saline media:  
Enter the salinity.
4. For measurements in the units %Vol or %SAT:  
Also enter the current operating pressure in the measuring mode.

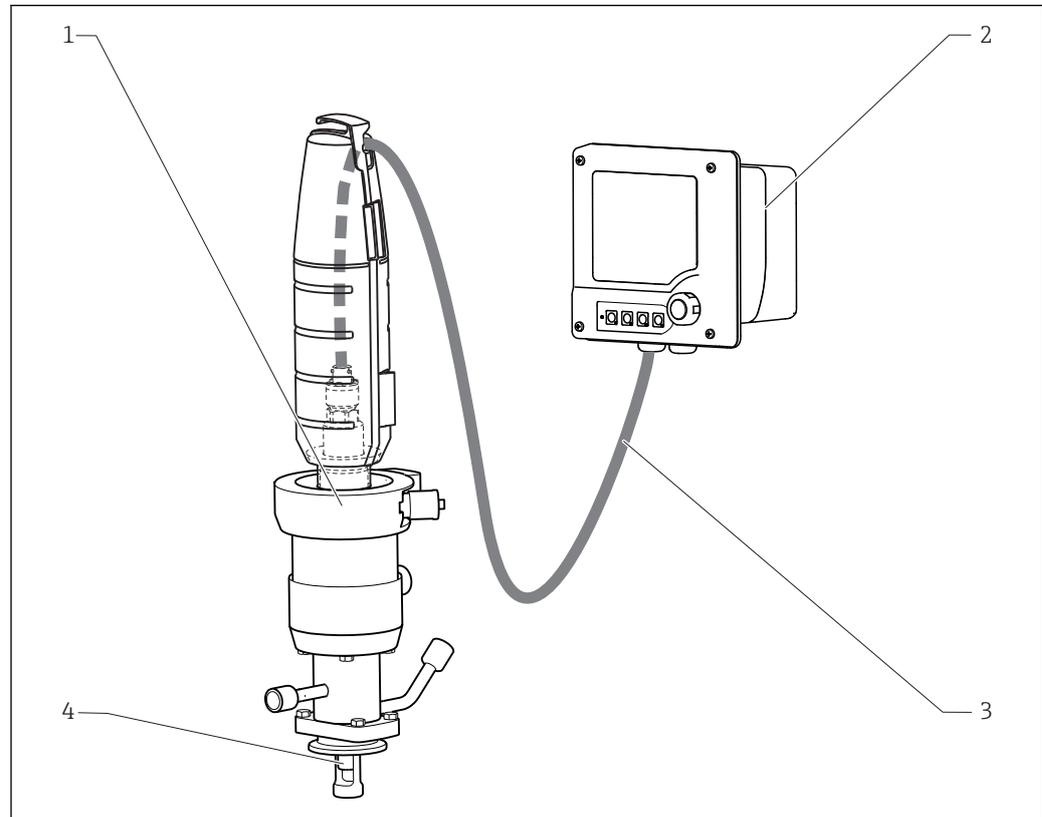


- Operating Instructions for Memosens, BA01245C  
For all transmitters, analyzers and samplers in the Liquiline CM44x/P/R, Liquiline System CA80XX and Liquistation CSFxx product families
- Operating Instructions for Liquiline CM42, BA00381C and BA00382C

## Measuring system

A complete measuring system comprises:

- a Memosens COS81D oxygen sensor
- Measuring cable CYK10
- A transmitter, e.g. Liquiline CM42, Liquiline CM44x/R, Liquiline CM44P, Liquiline Compact CM72/82
- Optional: an assembly, e.g. permanent installation assembly CPA842, flow assembly or retractable assembly CPA875



1 Example of a measuring system with COS81D

- 1 Retractable assembly CPA875
- 2 Liquiline CM42 transmitter
- 3 Measuring cable CYK10
- 4 Memosens COS81D oxygen sensor

## Dependability

### Reliability

**Memosens** 

Memosens makes your measuring point safer and more reliable:

- Non-contact, digital signal transmission enables optimum galvanic isolation
- Completely watertight
  - Can even be connected under water
  - No contact corrosion
- Sensor can be calibrated in a lab, thus increasing the availability of the measuring point in the process
- Intrinsically safe electronics mean operation in hazardous areas is not a problem.
- Predictive maintenance thanks to recording of sensor data, e.g.:
  - Total hours of operation
  - Hours of operation with very high or very low measured values
  - Hours of operation at high temperatures
  - Number of steam sterilizations
  - Sensor condition

**Maintainability**

**Easy handling**

Sensors with Memosens technology have integrated electronics that store calibration data and other information (e.g. total hours of operation or operating hours under extreme measuring conditions). Once the sensor has been connected, the sensor data are transferred automatically to the transmitter and used to calculate the current measured value. As the calibration data are stored in the sensor, the sensor can be calibrated and adjusted independently of the measuring point. The result:

- Easy calibration in the measuring lab under optimum external conditions increases the quality of the calibration.
- Pre-calibrated sensors can be replaced quickly and easily, resulting in a dramatic increase in the availability of the measuring point.
- Thanks to the availability of the sensor data, maintenance intervals can be accurately defined and predictive maintenance is possible.
- The sensor history can be documented on external data carriers and in evaluation programs.
- Thus, the current application of the sensors can be made to depend on their previous history.

**Safety**

**Data security thanks to digital data transmission**

Memosens technology digitizes the measured values in the sensor and transmits the data to the transmitter via a non-contact connection that is free from potential interference. The result:

- Automatic error message if sensor fails or connection between sensor and transmitter is interrupted
- Immediate error detection increases measuring point availability

**Sensor monitoring**

The optical signals are continuously monitored and analyzed for plausibility. If inconsistencies occur, an error message is output via the transmitter.

Aging of the sensor cap is detected. The transmitter first displays a warning for predictive maintenance and later generates an error message.

In addition, the following fault states are detected in conjunction with the transmitter's sensor check system:

- Implausibly high or low measured values
- Disturbed regulation due to incorrect measured values

## Input

**Measured values**

Dissolved oxygen [mg/l, µg/l, ppm, ppb or %SAT or hPa]  
 Oxygen (gaseous) [hPa or %Vol]  
 Temperature [°C, °F]

**Measuring ranges**

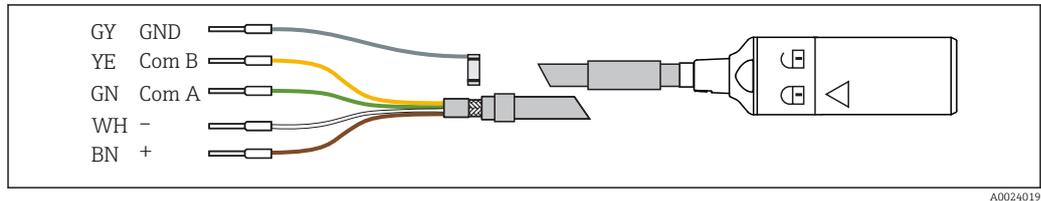
Measuring ranges apply for 25 °C (77 °F) and 1013 hPa (15 psi)

c-shaped	u-shaped
0.004 to 26 mg/l 0.05 to 285 % SAT 0.1 to 600 hPa	0.004 to 30 mg/l 0.05 to 330 % SAT 0.1 to 700 hPa

## Power supply

### Electrical connection

The electrical connection of the sensor to the transmitter is established using measuring cable CYK10.



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2 Measuring cable CYK10

## Performance characteristics

### Response time

From air to nitrogen at reference operating conditions:

- $t_{90} : < 10 \text{ s}$
- $t_{98} : < 20 \text{ s}$

### Reference operating conditions

Reference temperature: 25 °C (77 °F)  
 Reference pressure: 1013 hPa (15 psi)

### Maximum measured error <sup>1)</sup>

At 25 °C (77 °F)

Measured value [mg/l]	Maximum measured error [mg/l]	Measured value [hPa]	Maximum measured error [hPa]
0.04	±0.008	1	±0.2
0.8	±0.017	20	±0.4
9.1	±0.1	210	±2
26	±0.5	600	±12

1) In accordance with IEC 60746-1 at rated operating conditions

## Installation

### Installation instructions

Must be installed in a suitable assembly (depending on the application).

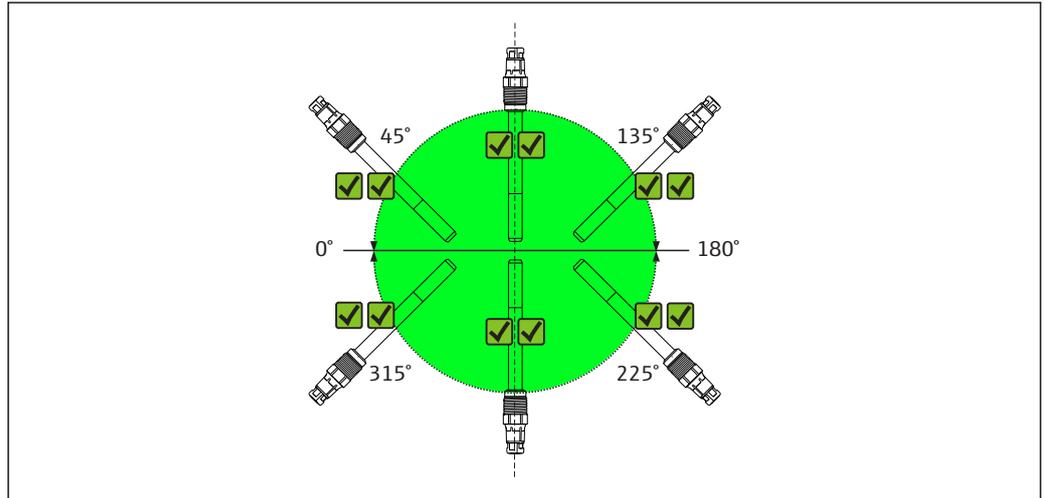
#### NOTICE

**Installing the unit without an assembly carries the risk of cable breakage or sensor loss!**

- ▶ Do not install the sensor freely suspended from the cable!

### Orientation

#### COS81D-\*\*\*C\*\*\* (c-shaped)



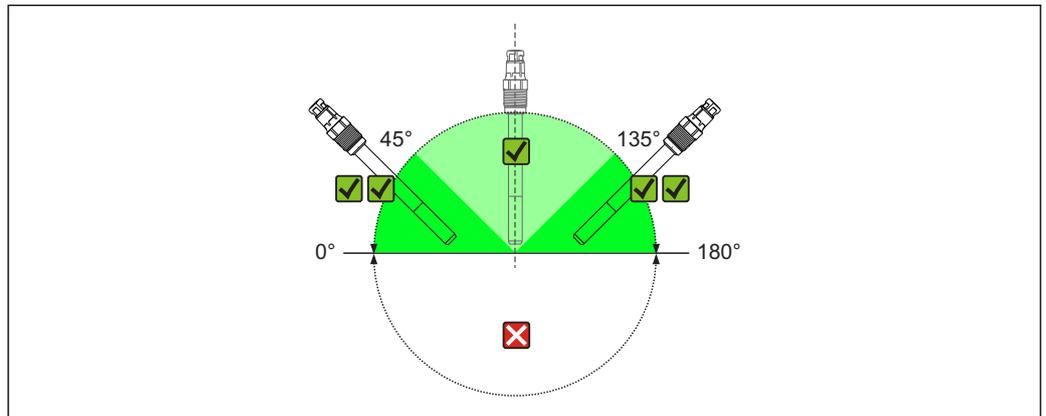
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3 Installation angle for Memosens COS81D-\*\*\*C\*\*\* (c-shaped spot cap)

The sensor can be installed at any installation angle (0 to 360 °).

✓✓ Recommended installation angle

#### COS81D-\*\*\*U\*\*\* (u-shaped)



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4 Installation angle for Memosens COS81D-\*\*\*U\*\*\* (u-shaped spot cap)

✓✓ Recommended installation angle

✓ Possible installation angle

✗ Inadmissible installation angle

The sensor must be installed at an angle of inclination of 0 to 180° in an assembly, holder or appropriate process connection. Recommended angle: 0 to 45° or 135 to 180° to prevent the attachment of air bubbles. At angles of inclination of 45 to 135°, air bubbles at the oxygen-sensitive membrane may increase the measured value.

Inclination angles other than those mentioned are not permitted. In order to avoid buildup and condensation on the spot, do **not** install the COS81D-\*\*\*U\*\*\* sensor upside down.

Follow the instructions for installing sensors in the Operating Instructions for the assembly used.

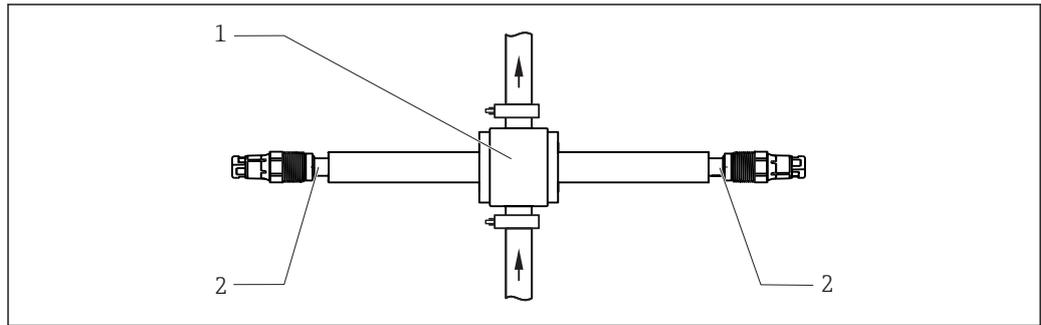
## Installation examples

### Permanent installation (CPA442)

The permanent installation assembly CPA442 enables easy adaptation of a sensor to nearly any process connections from Ingold nozzles to Varivent or Tri-Clamp connections. This kind of installation is very well suited for tanks and larger pipes. You will achieve a defined immersion depth of the sensor into the medium in the simplest way.

### Flow assembly CYA680

The flow assembly is available in various nominal diameters and materials. It can be installed both in horizontal and vertical pipes.

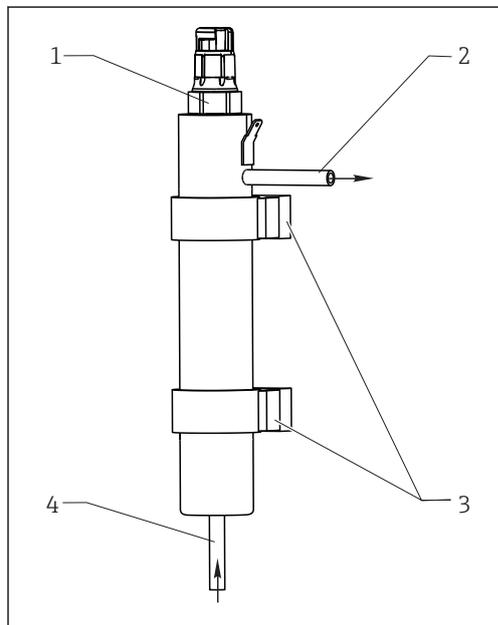


5 Flow assembly CYA680

- 1 Flow chamber of assembly
- 2 Installed sensor Memosens COS81D

### Flow assembly for water treatment and processes

The compact stainless steel assembly offers space for a 12-mm sensor with a length of 120 mm. The assembly has a low sampling volume and, with the 6-mm connections, it is best suited for residual oxygen measurement in water treatments and boiler feedwater. The flow comes from below.



6 Flow assembly

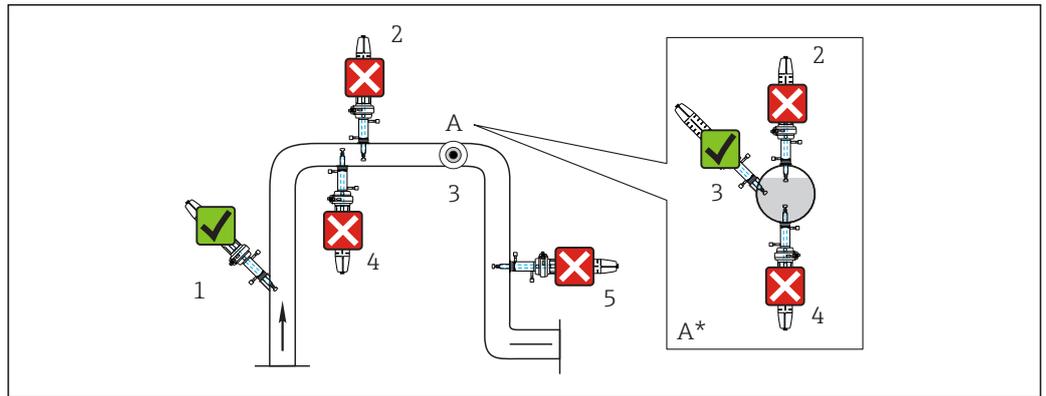
- 1 Installed sensor Memosens COS81D
- 2 Drain
- 3 Wall mount (clamp D29)
- 4 Inflow

### Retractable assembly (CPA875 or CPA450) COA451

The assembly is designed for installation on tanks and pipes. Suitable nozzles must be available for this.

Install the assembly in places with uniform flow conditions. The minimum pipe diameter is DN 80.

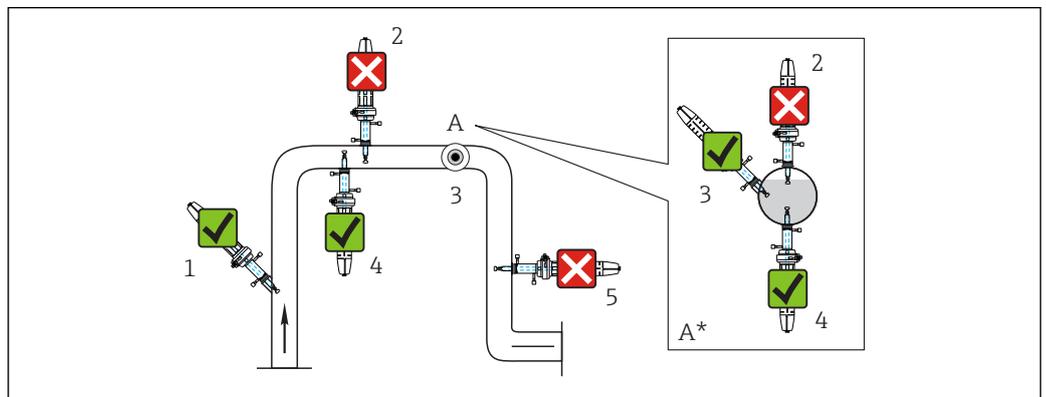
**Installation position for COS81D-\*\*\*\*U\*\*\* (with u-shaped spot cap)**



7 Suitable and unsuitable installation positions for Memosens COS81D with u-shaped spot cap and retractable assembly

- 1 Ascending pipe, best position
- 2 Horizontal pipe, sensor top down, impermissible due to air cushion or foam bubble forming
- 3 Horizontal pipe, lateral installation, with suitable installation angle
- 4 Upside-down installation, unsuitable
- 5 Down pipe, impermissible
- A Detail A (top view)
- A\* Detail A, turned by 90° (side view)
- ✓ Possible installation angle
- ✗ Inadmissible installation angle

**Installation position for COS81D-\*\*\*\*C\*\*\* (with c-shaped spot cap)**



8 Suitable and unsuitable installation positions for Memosens COS81D with c-shaped spot cap and retractable assembly

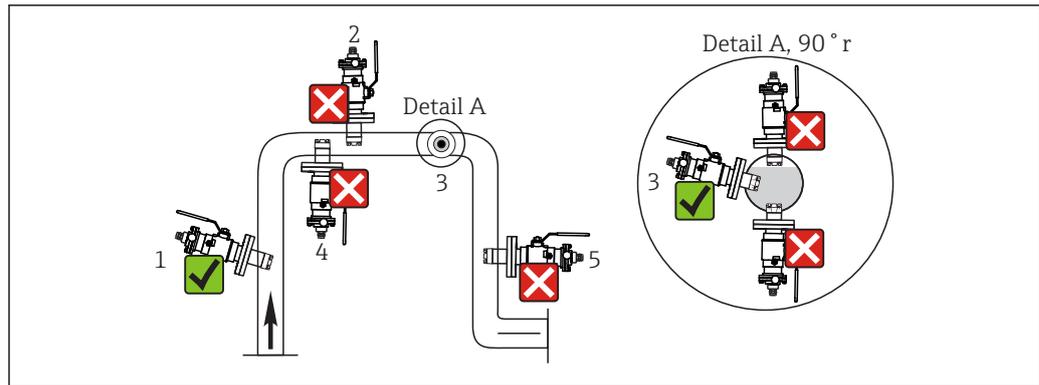
- 1 Ascending pipe, best position
- 2 Horizontal pipe, sensor top down, impermissible due to air cushion or foam bubble forming
- 3 Horizontal pipe, lateral installation with permissible installation angle (acc. to sensor version)
- 4 Upside-down installation, only in conjunction with c-shaped spot cap
- 5 Down pipe, impermissible
- ✓ Possible installation angle
- ✗ Inadmissible installation angle

**NOTICE**

**Sensor not in the medium all the way, buildup, upside-down installation**

These can all cause incorrect measurements!

- ▶ Do not install assembly at points where air pockets or bubbles may form.
- ▶ Avoid or regularly remove deposits on the sensor membrane fluorescence cap spot cap.
- ▶ Do not install sensor COS81D-\*\*\*\*U (u-shaped) upside down.



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9 Permissible and impermissible sensor installation positions with retractable assembly COA451

- 1 Ascending pipe, best position
- 2 Horizontal pipe, sensor top down, impermissible due to air cushion or foam bubble forming
- 3 Horizontal pipe, lateral installation with permissible installation angle (acc. to sensor version)
- 4 Down pipe, impermissible

- ✓ Possible installation angle
- ✗ Inadmissible installation angle

**NOTICE**

**Sensor not fully immersed in the medium, buildup on sensor membrane or sensor optics, buildup due to sensor being installed upside down**

Incorrect measurements are possible and these may affect the measuring point.

- ▶ Do not install the assembly at points where air pockets or bubbles form or where suspended particles may build up at the sensor membrane or sensor optics (item 2).

## Environment

**Ambient temperature** -5 to +100 °C (23 to 212 °F)

**Storage temperature** -25 to 50 °C (77 to 120 °F)  
at 95% relative air humidity, not condensating

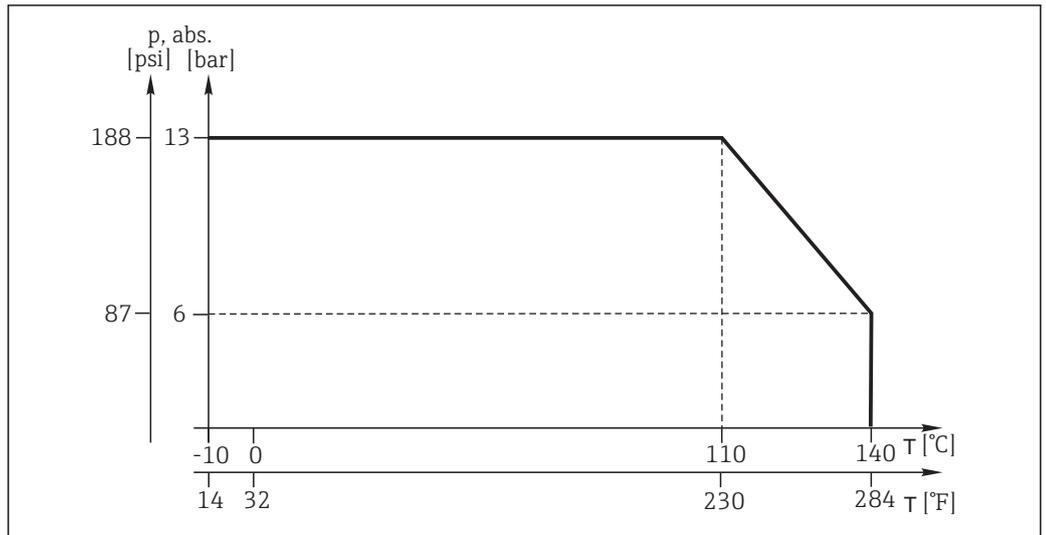
**Degree of protection** IP68 (10 m (33 ft) water column at 25 °C (77 °F) over 28 days)  
IP69K (test in accordance with DIN 40050-9)

## Process

Process temperature	Sensor	General	Oxygen measurement
	COS81D-****1* (EPDM)	-10 to +140 °C (15 to 280 °F)	
	COS81D-****3* (FFKM)	0 to +140 °C (32 to 280 °F)	
	COS81D-**C*** (c-shaped)		0 to 60 °C (32 to 140 °F)
	COS81D-**U*** (u-shaped)		0 to 80 °C (32 to 175 °F)

**Process pressure** 0.02 to 13 bar (0 to 190 psi) abs.

**Temperature-pressure ratings**



A0032287-EN

**Chemical resistance**

**NOTICE**

**Halogen-containing solvents, ketones and toluene**

Halogen-containing solvents (dichloromethane, chloroform), ketones (e.g. acetone, pentanone) and toluene have a cross-sensitive effect and result in decreased measured values or, at worst, in the complete failure of the sensor!

- Use the sensor only in media that are free from halogens, ketones and toluene.

**CIP compatibility**

Yes

**SIP compatibility**

Yes, max. 140 °C (284 °F)

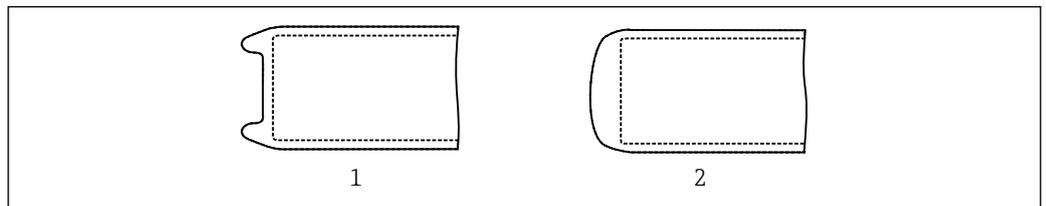
**Autoclavability**

Yes, max. 140 °C (284 °F)

## Mechanical construction

**Design**

The sensor's spot cap can have either a c-shaped or u-shaped design.

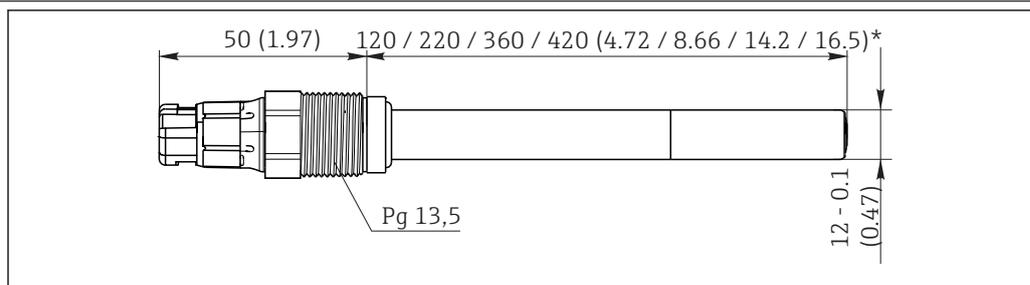


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10 Design of spot cap

- 1 u-shaped
- 2 c-shaped

**Dimensions**



11 Dimensions in mm (inch)

**Weight** Depending on the design (length)  
 Example: 0.1 kg (0.20 lbs) for version with 120 mm length

<b>Materials</b>	<b>Parts in contact with medium</b>	
	Sensor shaft	Stainless steel 1.4435 (AISI 316L)
	Process seal	FKM (USP<87>, <88> Class VI and FDA)
	Process seal for Ex versions	FKM (not FDA-compliant)
	Seals/O-rings	EPDM, FFKM (USP<87>, <88> Class VI and FDA)
	Spot layer	Silicone (USP<87>, <88> Class VI and FDA)

**Process connection** Pg 13.5  
 Torque max. 3 Nm

**Surface roughness**  $R_a < 0.38 \mu\text{m}$

**Temperature sensor** Pt1000 (Class A according to DIN IEC 60751)

## Certificates and approvals

A list of all the approvals is provided below. The approvals that are valid for this product depend on the device version ordered.

**CE mark** **Declaration of Conformity**  
 The product meets the requirements of the harmonized European standards. As such, it complies with the legal specifications of the EU directives. The manufacturer confirms successful testing of the product by affixing to it the **CE** mark.

**EAC** The product has been certified according to guidelines TP TC 004/2011 and TP TC 020/2011 which apply in the European Economic Area (EEA). The EAC conformity mark is affixed to the product.

**Ex approvals**

- Version COS81D-BA**  
ATEX II 1G Ex ia IIC T3/T4/T6 Ga
- Version COS81D-IA**  
IECEX Ex ia IIC T3/T4/T6 Ga
- Version COS81D-C3**  
CSA C/ US Class I, Zone 0 AEx ia IIC T6...T4 Ga and IS Class I, Division 1, Groups A, B, C and D T6...T4
- Version COS81D-NA**  
NEPSI Ex ia IIC T3/T4/T6 Ga

**Material certificates**

**Manufacturer declaration of FDA compatibility**

All parts (seals) in contact with the medium comply with the relevant regulations of the U.S. Food and Drug Administration (FDA).  
 Certified in the FDA Declaration of Conformity and Pharma CoC (→ Product Configurator on the product page)

Product	FDA certificate for
COS81D-*****1	O-rings, process seal, spot layer in contact with medium

 **Hazardous area versions**

For operation in FDA processes, another FDA-approved seal must be installed before the process seal (for example CPA442). Doing so will sufficiently separate the process from the Ex connection.

**Material test certificate**

A test certificate 3.1 in accordance with EN 10204 is supplied depending on the version (→ Product Configurator on the product page).

This certificate certifies the traceability of the materials used including the pipe material.

**EHEDG**

**COS81D-\*\*\*\*\*1\* only**

Compliance with EHEDG's criteria for hygienic design

- Technical University of Munich, Research Center for Brewing and Food Quality, Freising-Weißenstephan
- Certificate type: Type EL Class I

The use of an EHEDG-certified assembly is a prerequisite for the easy-to-clean installation of a 12-mm sensor in accordance with EHEDG requirements. Furthermore, the instructions regarding the hygienic installation and operation of the assembly in the relevant Operating Instructions must be adhered to.

**ASME BPE**

**Only COS81D-\*\*\*\*C\*1\***

Designed in accordance with the criteria of ASME (American Society of Mechanical Engineers) BPE (Bioprocessing Equipment)

Ensure a suitable assembly is used.

**Regulation (EC) No. 1935/2004**

Meets the requirements of Regulation (EC) No. 1935/2004

The sensor therefore meets the requirements for materials that come into contact with food.

**Biological reactivity test**

Certificate of Compliance for biological reactivity tests as per USP (United States Pharmacopeia) part<87> and part <88> class VI with batch traceability of materials in contact with product (O-rings, spot layer in contact with medium).

**Marine approvals**

A selection of sensors have type approval for marine applications, issued by the following classification societies: ABS (American Bureau of Shipping), BV (Bureau Veritas), DNV-GL (Det Norske Veritas-Germanische Lloyd) and LR (Lloyd's Register). Details of the order codes of the approved sensors, and the installation and ambient conditions, are provided in the relevant certificates for marine applications on the product page on the Internet.

**CRN approval**

As the assembly can be operated at a nominal pressure greater than 15 psi (approx. 1 bar), it has been registered according to CSA B51 ("Boiler, pressure vessel, and pressure piping code"; category F) with a CRN (Canadian Registration Number) in all Canadian provinces.

**Ordering information**

**Product page**

[www.endress.com/cos81d](http://www.endress.com/cos81d)

**Product Configurator**

On the product page there is a **Configure** button to the right of the product image.

1. Click this button.
  - ↳ The Configurator opens in a separate window.
2. Select all the options to configure the device in line with your requirements.
  - ↳ In this way, you receive a valid and complete order code for the device.
3. Export the order code as a PDF or Excel file. To do so, click the appropriate button on the right above the selection window.

 For many products you also have the option of downloading CAD or 2D drawings of the selected product version. Click the **CAD** tab for this and select the desired file type using picklists.

**Scope of delivery****Scope of delivery of sensor**

- Oxygen sensor with protection cap
- Brief Operating Instructions
- Certificate

**Scope of delivery of the Memosens COV81 maintenance kit is based on the configuration**

- Spot cap
- O-ring mounting tool
- Cleaning cloth for optics
- O-rings
- Certificate

## Accessories

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

- ▶ For accessories not listed here, please contact your Service or Sales Center.

**Assemblies (selection)**

 COS81D with 220 mm length is suitable for all assemblies requiring an installation length of 225 mm.

**Cleanfit CPA875**

- Retractable process assembly for sterile and hygienic applications
- 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/cpa875](http://www.endress.com/cpa875)

 Technical Information TI01168C

**Unifit CPA842**

- Installation assembly for food, biotechnology and pharmaceuticals
- With EHEDG and 3A certificate
- Product Configurator on the product page: [www.endress.com/cpa842](http://www.endress.com/cpa842)

 Technical Information TI00306C

**Cleanfit CPA450**

- Manual retractable assembly for installing sensors with a diameter 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

**Flow assembly**

- For sensors with Ø 12 mm and length 120 mm
- Compact stainless steel assembly with low sampling volume
- Order No.: 71042404

**Flowfit CYA21**

- Universal assembly for analysis systems in industrial utilities
- Product Configurator on the product page: [www.endress.com/CYA21](http://www.endress.com/CYA21)

 Technical Information TI01441C

**CYA680**

- Flow assembly for hygienic sensors
- For sensor installation in pipes
- Suitable for cleaning in place (CIP) and sterilization in place (SIP)
- Certified biocompatibility as per USP Class VI, FDA-listed seals and hygienic, electropolished surfaces Ra=0.38 µm (15 µinch)
- Product Configurator on the product page: [www.endress.com/cya680](http://www.endress.com/cya680)

 Technical Information TI01295C

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**Measuring cable**

**Memosens data cable CYK10**

- For digital sensors with Memosens technology
- Product Configurator on the product page: [www.endress.com/cyk10](http://www.endress.com/cyk10)

 Technical Information TI00118C

**Memosens data cable CYK11**

- Extension cable for digital sensors with Memosens protocol
- Product Configurator on the product page: [www.endress.com/cyk11](http://www.endress.com/cyk11)

 Technical Information TI00118C

**Memosens laboratory cable CYK20**

- For digital sensors with Memosens technology
  - Product Configurator on the product page: [www.endress.com/cyk20](http://www.endress.com/cyk20)
- 

**Zero-point gel**

**COY8**

Zero-point gel for oxygen and disinfection sensors

- Oxygen-free and chlorine-free gel for the verification, zero point calibration and adjustment of oxygen and disinfection measuring points
- Product Configurator on the product page: [www.endress.com/coy8](http://www.endress.com/coy8)

 Technical Information TI01244C

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**Junction box RM**

**Transmitter**

**Liquiline CM44**

- Modular multi-channel transmitter for hazardous and non-hazardous areas
- Hart®, PROFIBUS, Modbus or EtherNet/IP possible
- Order according to product structure

 Technical Information TI00444C

**Liquiline CM42**

- Modular two-wire transmitter for hazardous and non-hazardous areas
- Hart®, PROFIBUS or FOUNDATION Fieldbus possible
- Order according to product structure

 Technical Information TI00381C

**Liquiline Mobile CML18**

- Multiparameter mobile device for laboratory and field
- Reliable transmitter with display and app connection
- Product Configurator on the product page: [www.endress.com/CML18](http://www.endress.com/CML18)

 Operating Instructions BA02002C

**Liquiline Compact CM82**

- Configurable 1-channel multiparameter transmitter for Memosens sensors
- Ex- and non-ex applications possible in all industries
- Product Configurator on the product page: [www.endress.com/CM82](http://www.endress.com/CM82)

 Technical Information TI01397C

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**Liquiline Compact CM72**

- 1-channel single parameter field device for Memosens sensors
- Ex- and non-ex applications possible in all industries
- Product Configurator on the product page: [www.endress.com/CM72](http://www.endress.com/CM72)



Technical Information TI01409C

**Liquiline To Go CYM290**

- Portable device for the measurement of pH/ORP, conductivity, oxygen and temperature in all industries
- Product Configurator on the product page: [www.endress.com/CYM290](http://www.endress.com/CYM290)



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[www.addresses.endress.com](http://www.addresses.endress.com)

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