TI01201C/07/EN/04.23-00
71621948
2023-06-30

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 with 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

Endress+Hauser
People for Process Automation

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Function and system design

Measuring principle

Sensor structure

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

Measurement process (principle of fluorescence quenching)

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

1. The sensor optics send orange light pulses to the luminescence layer
2. The markers "respond" (luminesce) with darkred light pulses.
   ↳ The decay time and intensity of the response signals are directly dependent on the oxygen content 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 luminescence decay time and is approx. 14 µs in air and approx. 56 µs in oxygen-free media.

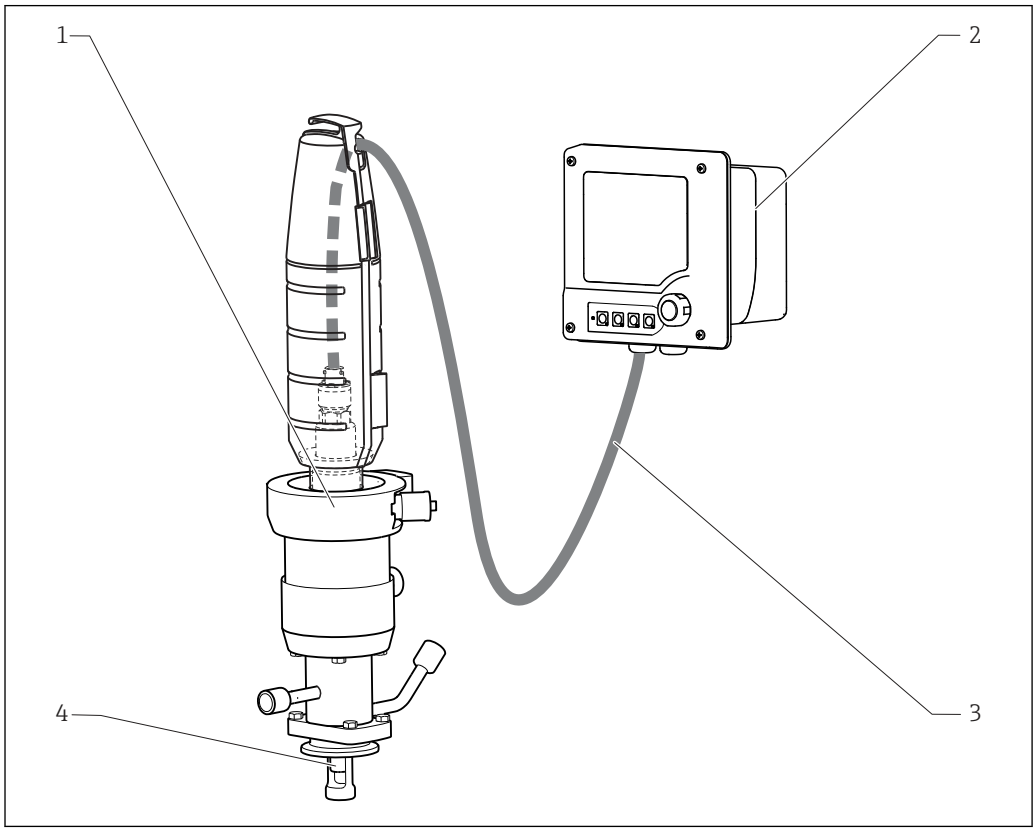
For optimum measurement results

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, Liquiline Mobile CML18
- Optional: an assembly, e.g. permanent installation assembly CPA842, flow assembly or retractable assembly CPA875



1 *Example of a measuring system with Memosens COS81D*

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

Reliability

Dependability

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

Ease of maintenance

Easy handling
Sensors with Memosens technology have integrated electronics that store calibration data and other information (e.g. total operating hours 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.
- The availability of sensor data means that maintenance intervals can be accurately defined and predictive maintenance is possible.
- The sensor history can be documented with external storage media and evaluation programs.
- The application range of the sensor can be determined based on its 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 variables

Dissolved oxygen [mg/l, µg/l, ppm, ppb, %SAT]

Oxygen (gaseous) [hPa or %Vol]

Temperature [°C, °F]

Measuring ranges

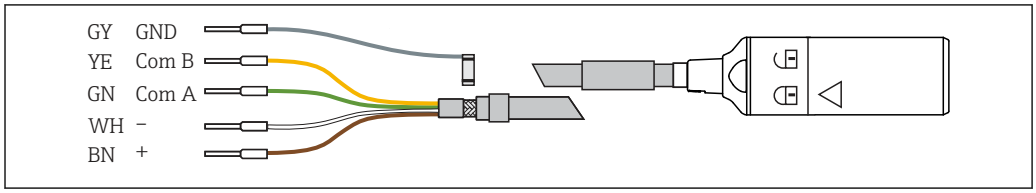
Measuring ranges apply for 25 °C (77 °F) and 1013 hPa (15 psi)

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 the measuring cable CYK10.



2 *Measuring cable CYK10*

Performance characteristics

Response time

From air to nitrogen at reference operating conditions:
- t_{90} : < 10 s
- t_{98} : < 20 s

Reference conditions

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

Measurement error [1)]

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 under rated operating conditions

Installation

Installation instructions

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

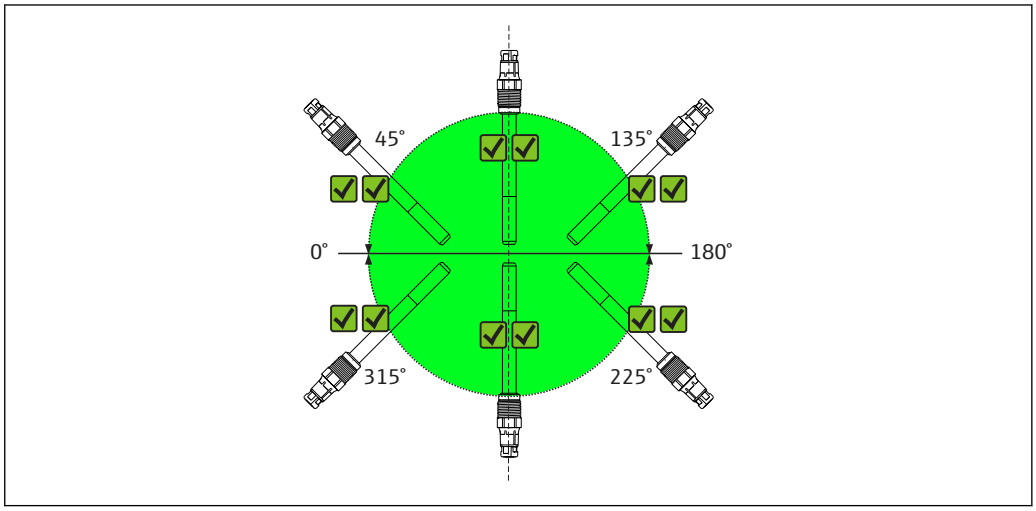
NOTICE

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)**

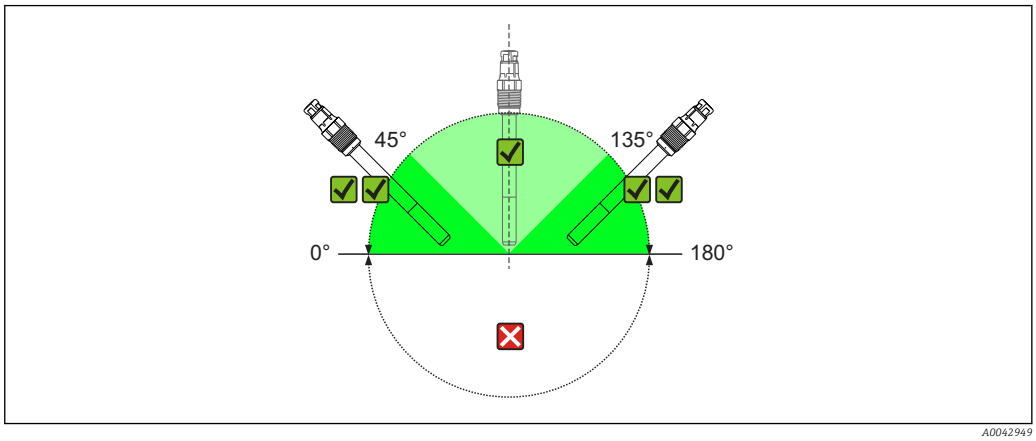


3 *Installation angle Memosens COS81D-****C*** (c-shaped spot cap)*

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

✓✓ *Recommended installation angle*

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



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

✓✓ *Recommended installation angle*

✓ *Possible installation angle*

✗ *Inadmissible installation angle*

Install the sensor at an angle of inclination of 10° to 170° of 0° to 180° in an assembly, holder or suitable 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 result in higher readings than expected.

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.

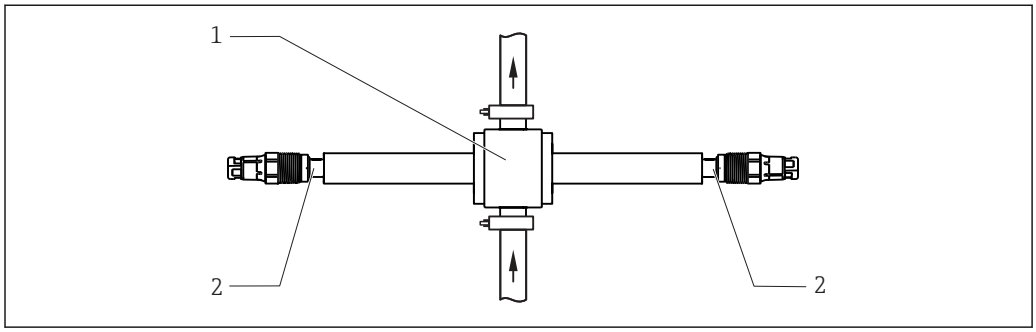
Installation examples

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. The assembly can be operated with 1 or 2 sensors.

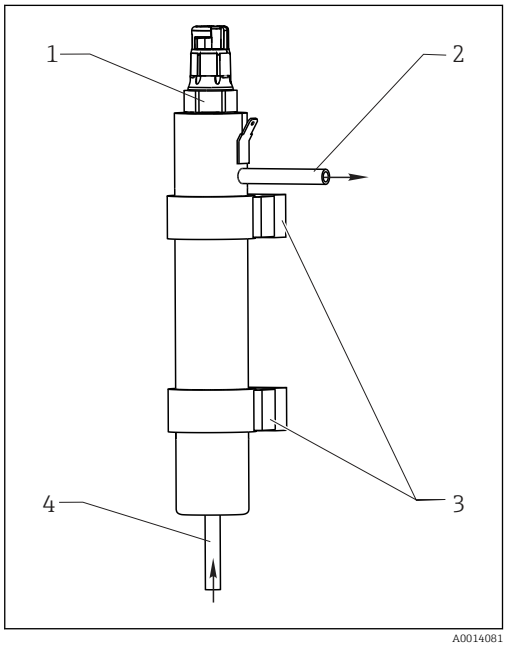


5 Flow assembly CYA680

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 CYA21

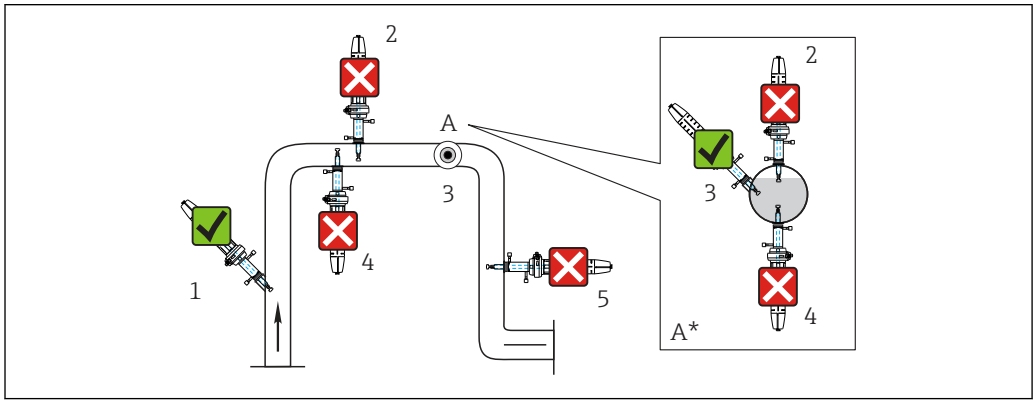
1 Installed Memosens COS81D sensor
2 Drain
3 Wall mount (clamp D29)
4 Inflow

Retractable assembly (CPA875 or CPA450) COA451

The assembly is designed for installation on vessels and pipes. This requires the availability of suitable process connections.

Install the assembly in a place with uniform flow conditions. The pipe diameter must be at least DN 80.

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



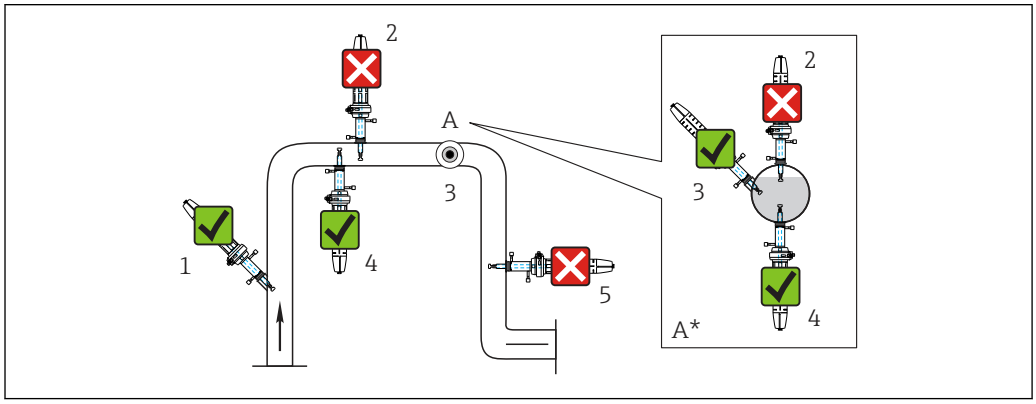
7 *Suitable and unsuitable installation positions for Memosens COS81D with u-shaped spot cap and retractable assembly*

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*

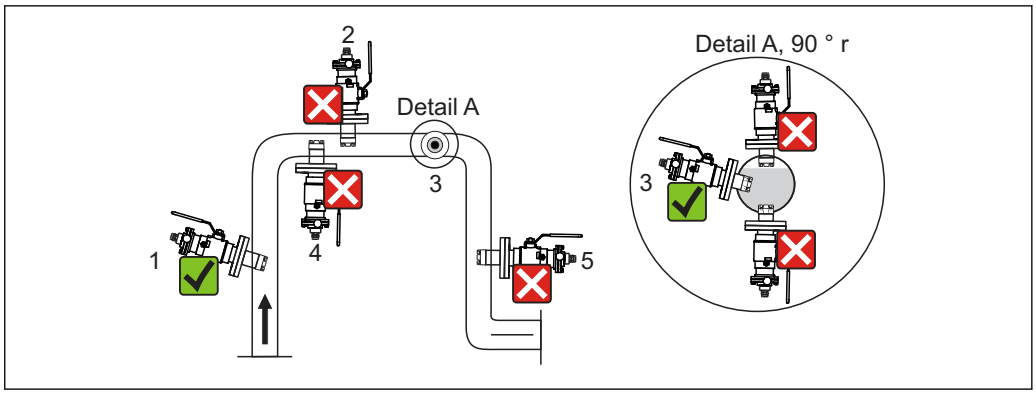
✗ *Inadmissible installation angle*

NOTICE

Sensor not fully immersed in the medium, buildup, upside-down installation

These can all cause incorrect measurements!

- ▶ Do not install assembly at points where air pockets or bubbles may form.
- ▶ Avoid buildup on the spot cap or remove it at regular intervals.
- ▶ Do not install sensor COS81D-****U (u-shaped) upside down.



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*

NOTICE

Sensor not completely in the medium. Deposits on the sensor membrane or optics. Deposits due to upside-down sensor installation.

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 (-13 to 122 °F)

at 95% relative humidity, non-condensing

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

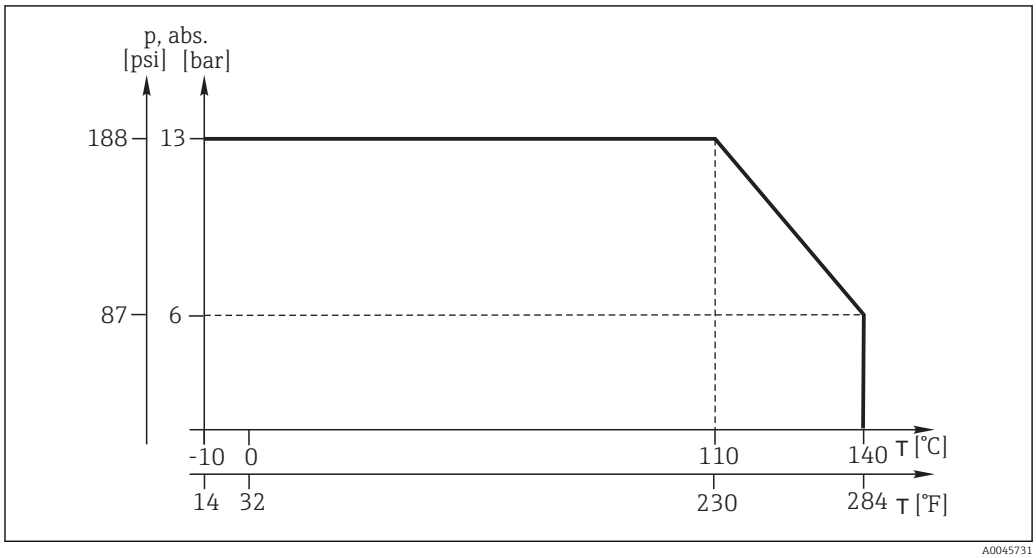
Process temperature

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)

Pressure

0.02 to 13 bar (0 to 190 psi) abs.

Temperature/pressure ratings



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)

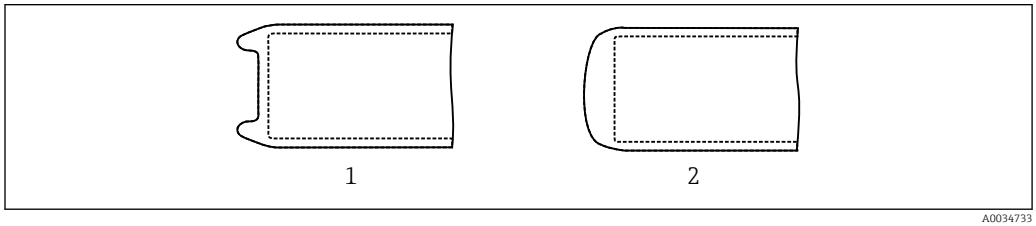
Autoclavability

Yes, max. 140 °C (284 °F)

Mechanical construction

Device type

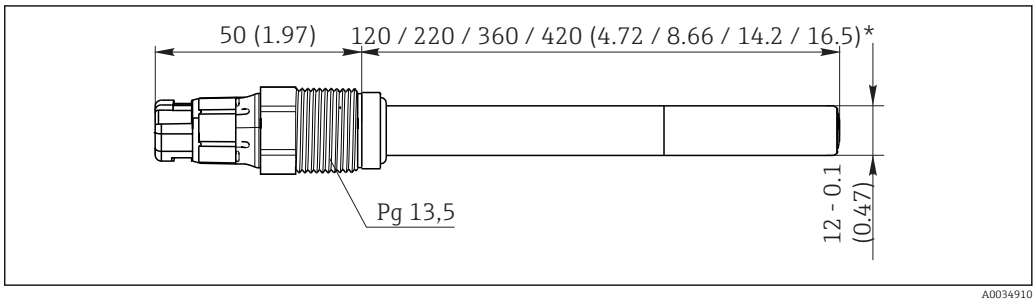
The sensor's spot cap can have either a c-shaped or u-shaped design.



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

Materials

Parts in contact with medium	
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 µm

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-Weihenstephan
- 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

Product Configurator

1. **Configure**: Click this button on the product page.
2. Select **Extended selection**.
   ↳ The Configurator opens in a separate window.
3. Configure the device according to your requirements by selecting the desired option for each feature.
   ↳ In this way, you receive a valid and complete order code for the device.
4. **Apply**: Add the configured product to the shopping cart.

For many products, you also have the option of downloading CAD or 2D drawings of the selected product version.

5. **Show details**: Open this tab for the product in the shopping cart.
   ↳ The link to the CAD drawing is displayed. If selected, the 3D display format is displayed along with the option to download various formats.

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.

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 (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

Technical Information TI01168C

Unifit CPA842
- Installation assembly for food, biotechnology and pharmaceutics
- With EHEDG and 3A certificate
- Product Configurator on the product page: www.endress.com/cpa842

Technical Information TI00306C

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

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

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

Technical Information TI01295C

Measuring cable

Memosens data cable CYK10
- For digital sensors with Memosens technology
- Product Configurator on the product page: 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

Technical Information TI00118C

Memosens laboratory cable CYK20
- For digital sensors with Memosens technology
- Product Configurator on the product page: www.endress.com/cyk20

Zero-point gel

COY8

Zero-point gel for oxygen and disinfection sensors
- Disinfectant-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

Technical Information TI01244C



www.addresses.endress.com

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