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Operating Instructions
Oxymax COS22D

Sensor for the measurement of dissolved oxygen with Memosens technology

Endress+Hauser
People for Process Automation

Table of contents

1 Document information

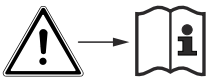
1.1 Warnings

Structure of information	Meaning
DANGER **Causes (/consequences)** If necessary, Consequences of non-compliance (if applicable) ▶ Corrective action	This symbol alerts you to a dangerous situation. Failure to avoid the dangerous situation **will** result in a fatal or serious injury.
WARNING **Causes (/consequences)** If necessary, Consequences of non-compliance (if applicable) ▶ Corrective action	This symbol alerts you to a dangerous situation. Failure to avoid the dangerous situation **can** result in a fatal or serious injury.
CAUTION **Causes (/consequences)** If necessary, Consequences of non-compliance (if applicable) ▶ Corrective action	This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in minor or more serious injuries.
NOTICE **Cause/situation** If necessary, Consequences of non-compliance (if applicable) ▶ Action/note	This symbol alerts you to situations which may result in damage to property.

1.2 Symbols

Symbol	Meaning
	Additional information, tips
	Permitted or recommended
	Not permitted or not recommended
	Reference to device documentation
	Reference to page
	Reference to graphic
	Result of a step

1.2.1 Symbols on the device

Symbol	Meaning
	Reference to device documentation
	Do not dispose of products bearing this marking as unsorted municipal waste. Instead, return them to the manufacturer for disposal under the applicable conditions.

2 Basic safety instructions

2.1 Requirements for the personnel

- Installation, commissioning, operation and maintenance of the measuring system may be carried out only by specially trained technical personnel.
- The technical personnel must be authorized by the plant operator to carry out the specified activities.
- The electrical connection may be performed only by an electrical technician.
- The technical personnel must have read and understood these Operating Instructions and must follow the instructions contained therein.
- Faults at the measuring point may only be rectified by authorized and specially trained personnel.

Repairs not described in the Operating Instructions provided must be carried out only directly at the manufacturer's site or by the service organization.

2.2 Intended use

The sensor is designed for the continuous measurement of dissolved oxygen in water.

The specific suitability depends on the sensor version:
- COS22D-**1***** (standard, measuring range 0.01 to 60 mg/l)
  - Measuring, monitoring and regulating the oxygen content in fermenters
  - Monitoring the oxygen content in biotechnology facilities
- COS22D-**3/4***** (trace measurement, measuring range 0.001 to 10 mg/l, preferred operational range 0.001 to 2 mg/l) , also suitable for high CO_2 partial pressure
  - Monitoring inertization equipment in the food industry
  - Monitoring the residual oxygen content in carbonated fluids of the beverage industry
  - Trace measurement in industrial applications such as inertizations
  - Monitoring the residual oxygen content in boiler feedwater
  - Monitoring, measuring and regulating the oxygen content in chemical processes

NOTICE

Molecular hydrogen

Hydrogen causes sensitivity in other substances and leads to false low readings or, at the worst, total failure of the sensor.
- ▶ Only use the sensor COS22D-**1/3***** in media free of hydrogen.
- ▶ Use the sensor COS22D-**4***** in media containing hydrogen.

For non-contact digital data transmission, the sensor COS22D must be connected to the digital input of the Liquiline transmitter using the CYK10 measuring cable.

Use of the device for any purpose other than that described, poses a threat to the safety of people and of the entire measuring system and is therefore not permitted.

The manufacturer is not liable for damage caused by improper or non-designated use.

2.3 Workplace safety

As the user, you are responsible for complying with the following safety conditions:
- Installation guidelines
- Local standards and regulations
- Regulations for explosion protection

Electromagnetic compatibility
- The product has been tested for electromagnetic compatibility in accordance with the applicable international standards for industrial applications.
- The electromagnetic compatibility indicated applies only to a product that has been connected in accordance with these Operating Instructions.

2.4 Operational safety

Before commissioning the entire measuring point:

1. Verify that all connections are correct.
2. Ensure that electrical cables and hose connections are undamaged.
3. Do not operate damaged products, and protect them against unintentional operation.
4. Label damaged products as defective.

During operation:

- If faults cannot be rectified:
  products must be taken out of service and protected against unintentional operation.

2.5 Product safety

2.5.1 State-of-the-art technology

The product is designed to meet state-of-the-art safety requirements, has been tested, and left the factory in a condition in which it is safe to operate. The relevant regulations and international standards have been observed.

2.5.2 Electrical equipment in hazardous areas

For all approvals
- To avoid incendive sparking, you must install the titanium hazardous area versions COS22D-BA***D*3, COS22D-GC***D*3, COS22D-8A***D*3, COS22D-TA***D*3 and COS22D-NA***D*3 in such a way that they are protected against impact and friction.
- When transporting, installing and performing maintenance in the hazardous area, you must also avoid sparks resulting from impact and friction on the sensor shaft or membrane body.
- The use of these versions in liquid media with solid particles must be avoided.
- A maximum ambient temperature of 90 °C (194 °F) must not be exceeded at the sensor head.

ATEX II 1G / IECEx Ex ia IIC T3/T4/T6 Ga

The Memosens inductive sensor cable connection system, consisting of:
- oxygen sensor Oxymax COS22D-BA
- measuring cable CYK10 or measuring cable CYK20

is suitable for use in hazardous areas according to type examination certificate BVS 04 ATEX E 121 X and IECEx BVS 11.0052X. The corresponding EU Declaration of Conformity is part of this document.

- The certified Oxymax COS22D-BA*****3 oxygen sensor, in conjunction with the CYK10-G*** measuring cable, may be connected only to certified, intrinsically safe, digital sensor circuits of the Liquiline M CM42-OE/F/I********* transmitter. The electrical connection must be made according to the wiring diagram.
- Oxygen sensors for use in the Ex area have a special conductive O-ring. The electrical connection of the metallic sensor shaft to the conductive mounting location (such as a metallic assembly) is via the O-ring.
- You must connect the assembly or the mounting location to ground using suitable measures according to the Ex standards.
- The sensors must not be operated under electrostatically critical process conditions. Avoid strong steam or dust currents that act directly on the connection system.
- Hazardous area versions of digital sensors with Memosens technology are indicated by a red-orange ring in the plug-in head.
- The maximum permitted cable length between the sensor and transmitter is 100 m (330 ft).

NEPSI Ex ia IIC T3/T4/T6 Ga

The Memosens inductive sensor cable connection system, consisting of:

- oxygen sensor Oxymax COS22D-NA and
- measuring cable CYK10 or measuring cable CYK20

is approved for use in explosive atmospheres in accordance with the **N**ational supervision and inspection center for **E**xplosion protection and **S**afety of **I**nstrumentation (NEPSI) in China.

The certified oxygen sensor Oxymax COS22D-NA*****3 may only be connected to the following certified, intrinsically safe, digital sensor circuits in conjunction with the measuring cable CYK10-G***, or a Memosens cable with an identical structure both in terms of hardware and function:

- Liquiline CM42-OJ*********
- Alternatively to an approved, intrinsically safe Memosens sensor output that supplies the following values at the very maximum:

Parameter set 1	Parameter set 2
U_0 = 5.1 V I_0 = 130 mA P_0 = 166 mW (linear output characteristic) C_i = 15 µF L_i = 95 µH	U_0 = 5.04 V I_0 = 80 mA P_0 = 112 mW (trapezoidal output characteristic) C_i = 14.1 µF L_i = 237.2 µH

- The electrical connection must be made according to the wiring diagram.
- Oxygen sensors for use in the Ex area have a special conductive O-ring. The electrical connection of the metallic sensor shaft to the conductive mounting location (such as a metallic assembly) is via the O-ring.
- You must connect the assembly or the installation location to ground according to the Ex guidelines.
- If the CYK10-G*** cable is installed with its terminal head in Ex zone 0, the cable must be protected against electrostatic charge.
- The user may not change the configuration. Only in this way will the explosion protection of the unit remain intact. Every change puts safety at risk.
- The sensors must not be operated under electrostatically critical process conditions. Avoid strong steam or dust currents that act directly on the connection system. The metal sensor shaft must be installed at the mounting location in such a way that it is electrostatically conductive (< 1 MΩ).

- To mount, use and maintain the product, you must follow the information in the Operating Instructions and the following standards:
  - GB50257 -2014 "Code for construction and acceptance of electric device for explosion atmospheres and fire hazard electrical equipment installation engineering"
  - GB 3836.13-2013 "Explosive atmospheres - Part 13: equipment repair, overhaul and reclamation"
  - GB/ T 3836.15-2017 "Explosive atmospheres - Part 15: Electrical installations design, selection and erection"
  - GB/T 3836.16-2017 "Explosive atmospheres - Part 16: Electrical installations inspection and maintenance"
  - GB/ T 3836.18-2017 "Explosive atmospheres - Part 18: Intrinsically safe electrical systems"
- Hazardous area versions of digital sensors with Memosens technology are indicated by a red-orange ring in the plug-in head.
- The maximum permitted cable length between the sensor and transmitter is 100 m (330 ft).

CSA C/ US: Ex ia IIC T6...T4 Ga Class I, Zone 0 AEx ia IIC T6...T4 Ga IS Class I, Division 1, Groups A, B, C and D T6...T4

Pay attention to the XA and control drawing for the transmitter used. The relevant XA with the control drawing is available in the Download Area of the product page under www.endress.com.

Temperature classes ATEX, IECEx, CSA C/ US and NEPSI

ATEX, IECEx and NEPSI:

	Temperature class		
	T3	**T4**	**T6**
Ambient temperature T_a	−5 °C to +135 °C	−5 °C to +120 °C	−5 °C to +70 °C
Reference temperature T_{ref}	+25 °C		

CSA C/ US:

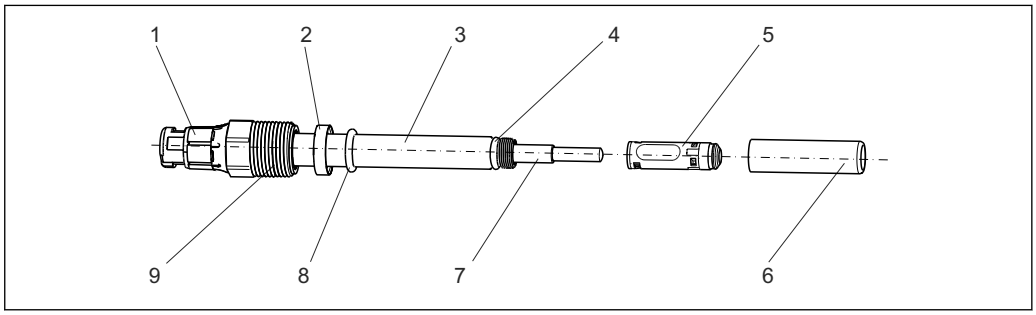
	Temperature class	
	T4	**T6**
Ambient temperature T_a	−5 °C to +115 °C	−5 °C to +65 °C
Reference temperature T_{ref}	+25 °C	

3 Device description, function

3.1 Amperometric measuring principle

The oxygen molecules that diffuse through the membrane are reduced at the cathode to hydroxide ions (OH-). At the anode, silver is oxidized to silver ions (Ag+) (this forms a silver halide layer). A current flows due to the electron donation at the cathode and the electron acceptance at the anode. Under constant conditions, this flow is proportional to the oxygen content of the medium. This current is converted in the transmitter and indicated on the display as an oxygen concentration in mg/l, µg/l, ppm, ppb or Vol%, as a saturation index in % SAT or as an oxygen partial pressure in hPa.

3.2 Sensor design



1 COS22D

1	*Plug-in head*	*4*	*O-ring 8.5 x 1.5 mm*	*7*	*Glass part with anode and cathode*
2	*Thrust collar*	*5*	*Membrane body*	*8*	*Process seal 10.77 x 2.62 mm*
3	*Sensor shaft*	*6*	*Shaft sleeve*	*9*	*Process connection Pg 13.5*

3.3 Membrane body

The oxygen dissolved in the medium is transported to the membrane by the necessary flow. The membrane is permeable for dissolved gases only. Other substances dissolved in the liquid phase, e.g. ionic substances, will not penetrate through the membrane. Therefore, medium conductivity has no impact on the measuring signal.

The sensor is shipped with a standard membrane body, which can be used for all common applications. The membrane is pretensioned at the factory and can be installed immediately.

Electrolytes are version-specific and **cannot** be mixed in a single application!

3.4 Memosens technology

Sensors with Memosens protocol have an integrated electronics unit that stores calibration data and other information. Once the sensor has been connected, the sensor data are transferred automatically to the transmitter and used to calculate the measured value.

▶ Call up the sensor data via the corresponding DIAG menu.

Digital sensors can store measuring system data in the sensor. These include the following:
- Manufacturer data
  - Serial number
  - Order code
  - Date of manufacture
- Calibration data
  - Calibration date
  - Calibration values
  - Number of calibrations
  - Serial number of the transmitter used to perform the last calibration or adjustment
- Operating data
  - Temperature application range
  - Date of initial commissioning
  - Hours of operation under extreme conditions
  - Number of sterilizations

3.5 Polarization

When the sensor is connected to the transmitter, a fixed voltage is applied between the cathode and anode. The polarization current this creates can be identified on the transmitter with a reading that is initially high, but decreases with time. The sensor cannot be calibrated until the reading is stable.

Reference value for nearly complete polarization of a sensor that was previously stored for a long time:
- COS22D-*1: 2 hours
- COS22D-*3/4: 12 hours

After this time, even measurements close to the limit of quantification are useful. The necessary polarization time is reduced for sensors that were in use shortly beforehand.

4 Incoming acceptance and product identification

4.1 Incoming acceptance

1. Verify that the packaging is undamaged.
   ↳ Notify the supplier of any damage to the packaging.
   Keep the damaged packaging until the issue has been resolved.
2. Verify that the contents are undamaged.
   ↳ Notify the supplier of any damage to the delivery contents.
   Keep the damaged goods until the issue has been resolved.
3. Check that the delivery is complete and nothing is missing.
   ↳ Compare the shipping documents with your order.
4. Pack the product for storage and transportation in such a way that it is protected against impact and moisture.
   ↳ The original packaging offers the best protection.
   Make sure to comply with the permitted ambient conditions.

If you have any questions, please contact your supplier or your local Sales Center.

4.2 Product identification

4.2.1 Nameplate

The nameplate provides you with the following information on your device:
- Manufacturer identification
- Order code
- Extended order code
- Serial number
- Safety information and warnings

▶ Compare the information on the nameplate with the order.

4.2.2 Product identification

Product page

www.endress.com/cos22d

Interpreting the order code

The order code and serial number of your product can be found in the following locations:
- On the nameplate
- In the delivery papers

Obtaining information on the product

1. Go to www.endress.com.
2. Call up the site search (magnifying glass).
3. Enter a valid serial number.
4. Search.
   ↳ The product structure is displayed in a popup window.

5. Click on the product image in the popup window.
   ↳ A new window (**Device Viewer**) opens. All of the information relating to your device is displayed in this window as well as the product documentation.

Manufacturer's address

Endress+Hauser Conducta GmbH+Co. KG
Dieselstraße 24
D-70839 Gerlingen

4.3 Scope of delivery

The scope of delivery comprises:

- Oxygen sensor with watering cap (filled with tap water) for protecting the membrane
- Electrolyte, 1 bottle, 10 ml (0.34 fl.oz.)
- Tool to push out the membrane body
- Brief Operating Instructions

4.4 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.

4.4.1 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.

4.4.2 Ex approvals

Version COS22D-BA
ATEX II 1G / IECEx Ex ia IIC T3/T4/T6 Ga

Version COS22D-8A
FM/CSA IS/NI Cl.1 Div.1 GP: A-D

Version COS22D-NA
NEPSI Ex ia IIC T3/T4/T6 Ga

Version COS22D-GC
The product has been certified in accordance with Directive TR CU 012/2011 which applies in the European Economic Area (EEA). The EAC conformity mark has been affixed to the product.
- EAC 0Ex ia IIC T6/T4/T3 Ga X
- Zone 0
- Certificate number: TC RU C-DE.AA87.B.00088

4.4.3 Certification body

DEKRA EXAM GmbH
Bochum

4.4.4 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
COS22D-****22	Membrane, O-rings, process seal
COS22Z-*2*2	Membrane, O-rings, process seal
COS22D-****23	Membrane, O-rings
COS22Z-*2*3	Membrane, O-rings

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.

4.4.5 EHEDG

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.

4.4.6 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.

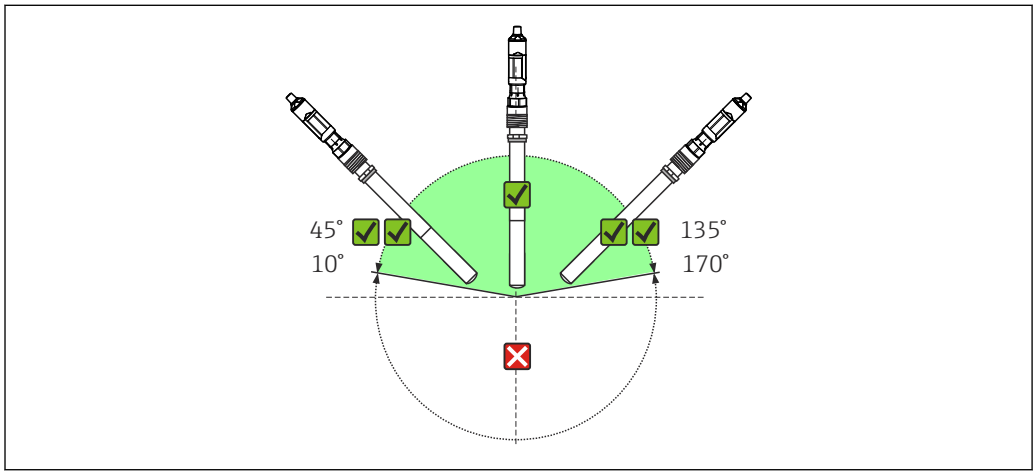
4.4.7 CRN approval

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.

5 Mounting

5.1 Mounting requirements

5.1.1 Orientation



2 *Permitted orientations*

The sensor must be installed at an angle of inclination of 10 to 170 ° in an assembly, holder or appropriate process connection. Recommended angle: 45° to prevent the attachment of air bubbles.

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

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

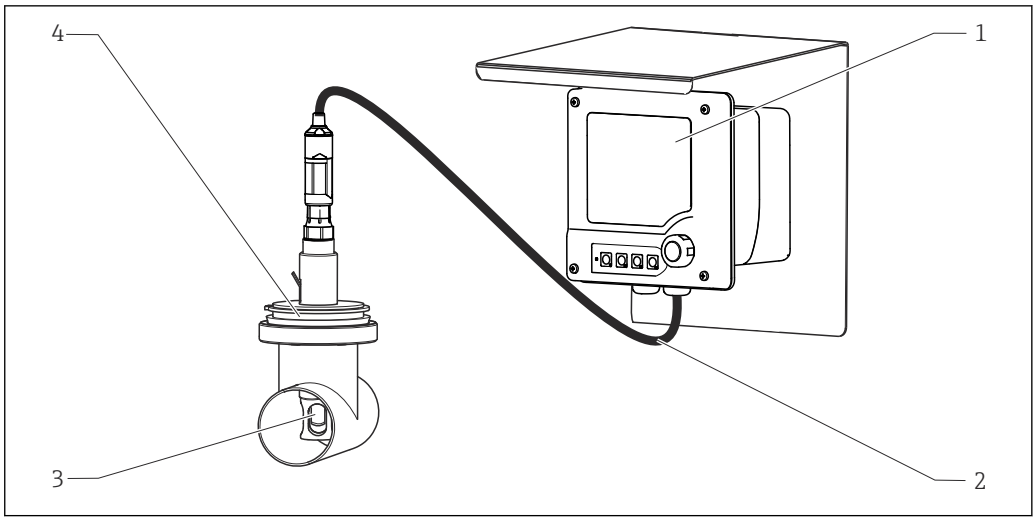
5.1.2 Mounting location

1. Choose a mounting location that is easy to access.
2. Ensure that upright posts and assemblies are fully secured and vibration-free.
3. Choose a mounting location with an oxygen concentration that is typical for the application.

5.2 Mounting the sensor

5.2.1 Measuring system

A complete measuring system comprises:
- an Oxymax COS22D oxygen sensor
- Measuring cable CYK10
- A transmitter, e.g. Liquiline CM42
- Optional: an assembly, e.g. permanent installation assembly CPA842, flow assembly CPA240 or retractable assembly CPA875



3 *Example of a measuring system with COS22D-*1*

1 *Liquiline CM42*
2 *Measuring cable CYK10*
3 *Oxymax COS22D-*1 digital oxygen sensor*
4 *Permanent installation assembly CPA442*

5.2.2 Installing at a measuring point

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

⚠ WARNING

Electrical voltage

In the event of a fault, non-grounded metallic assemblies may be live and as such are not safe to touch!

- When using metallic assemblies and installation equipment, national grounding provisions must be observed.

For complete installation of a measuring point, proceed as follows:

1. Install the retractable assembly or flow assembly (if used) into the process
2. Connect the water supply to the rinse connections (if you are using an assembly with a cleaning function)
3. Install and connect the oxygen sensor

NOTICE

Installation error

Cable breakage, loss of sensor due to cable separation, unscrewing of membrane cap!

- Do not install the sensor freely suspended from the cable!
- Screw the sensor into the assembly, ensuring that the cable is not twisted.
- Hold the sensor body steady during installation or removal. Turn **only at the hexagonal nut** of the armored coupling. Otherwise the membrane cap might be unscrewed. This will then remain in the assembly or process.
- Avoid exerting excessive tensile force on the cable (e.g. through jerky pulling movements).
- Choose a mounting location that is easy to access for later calibrations.
- Follow the instructions for installing sensors in the Operating Instructions for the assembly used.

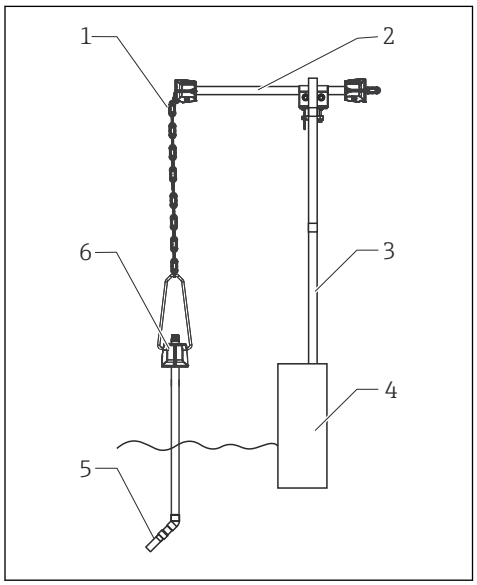
5.3 Installation examples

5.3.1 Permanent installation (CPA842)

The permanent installation assembly CPA842 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.

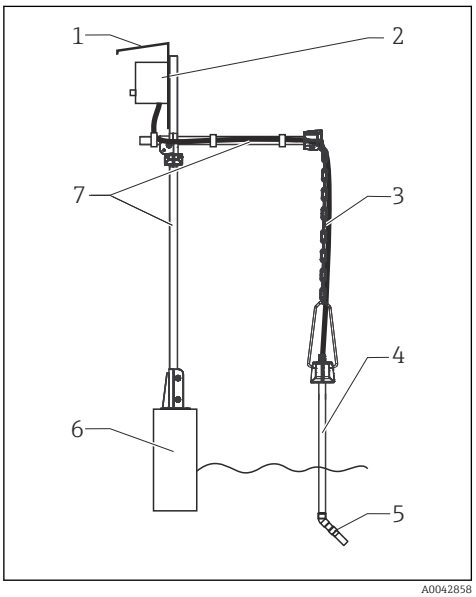
5.3.2 Immersion operation

Universal holder and chain assembly



4 *Chain holder on railing*

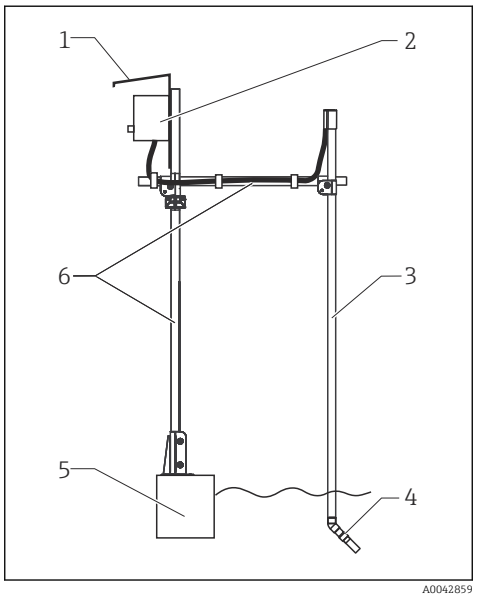
1 *Chain*
2 *Holder Flexdip CYH112*
3 *Rail*
4 *Basin rim*
5 *Oxygen sensor*
6 *Wastewater assembly Flexdip CYA112*



5 *Chain holder on upright post*

1 *Weather protection cover CYY101*
2 *Transmitter*
3 *Chain*
4 *Wastewater assembly Flexdip CYA112*
5 *Oxygen sensor*
6 *Basin rim*
7 *Holder Flexdip CYH112*

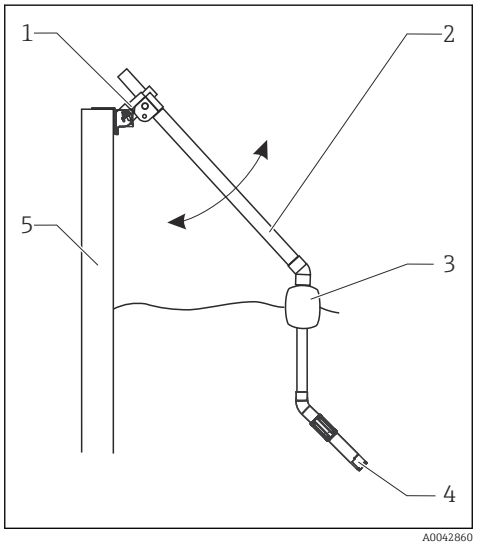
Universal holder and fixed immersion tube



6 *Assembly holder with immersion tube*

1 *Protective cover*
2 *Transmitter*
3 *Flexdip CYA112 immersion assembly*
4 *Oxygen sensor*
5 *Basin rim*
6 *Assembly holder Flexdip CYH112*

Basin rim mounting with immersion tube

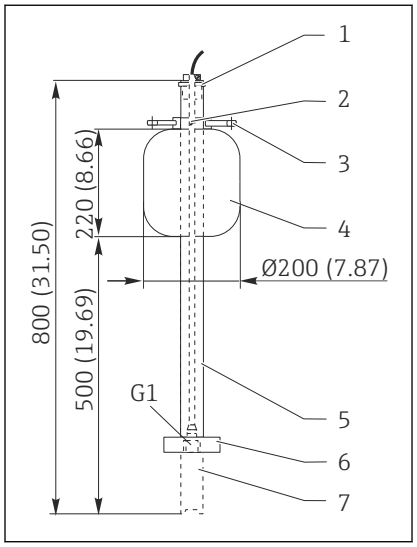


7 *Basin rim mounting*

1 *Pendulum holder CYH112*
2 *Assembly Flexdip CYA112*
3 *Assembly float*
4 *Oxygen sensor*
5 *Basin rim*

Float

The CYA112 float is for use in the case of large fluctuations in water level, for example in rivers or lakes.



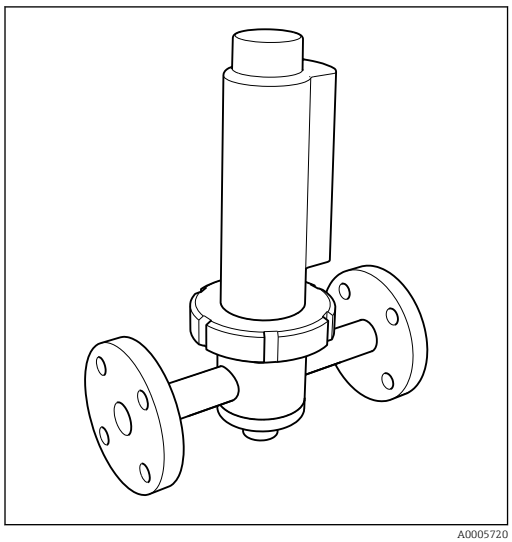
1 *Cable run with strain relief and rain shield*
2 *Fixing ring for rope and chains with terminal screw*
3 *Eyelets Ø15, 3 x 120 ° for anchoring*
4 *Plastic float, resistant to salt water*
5 *Pipe 40 x 1, stainless steel 1.4571*
6 *Bumper and ballast*
7 *Oxygen sensor*

8 Dimensions in mm (inch)

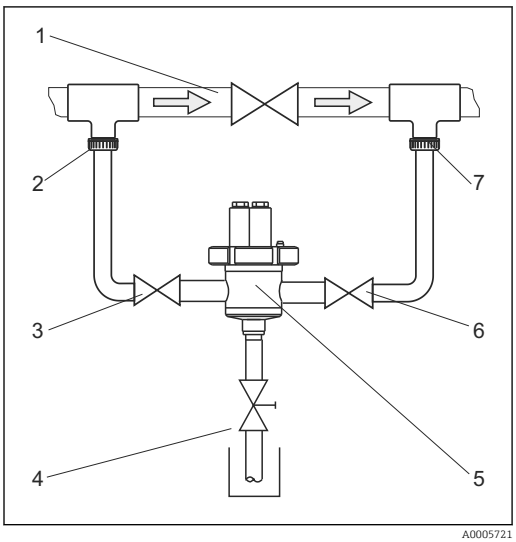
5.3.3 Flow assembly

CPA240

The flow assembly CPA240 offers up to three installation spaces for sensors with a shaft diameter of 12 mm (0.47"), a shaft length of 120 mm (4.7"), and a Pg 13.5 process connection. It very well suited for use in pipelines or hose connections. To prevent measured error with trace measurements, pay particular attention to complete ventilation of the assembly.



9 Flow assembly CPA240 with protective cover

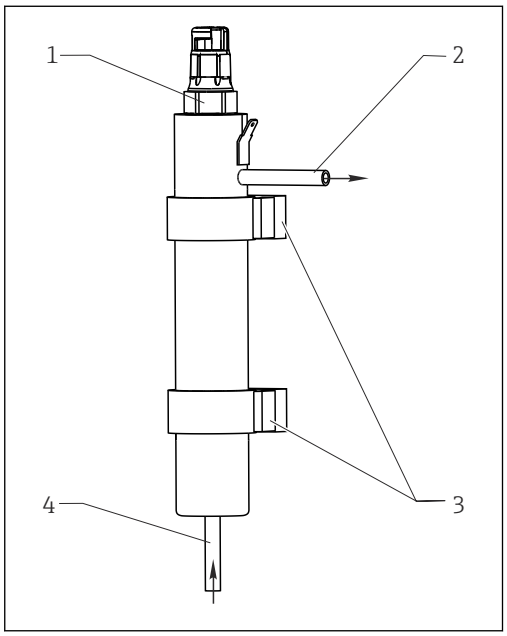


10 Bypass installation

1 *Main pipe*
2 *Medium removal*
3, 6 *Manually actuated or solenoid valves*
4 *Sampling*
5 *Flow assembly with installed sensor*
7 *Medium return*

Flow assembly CYA21 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.



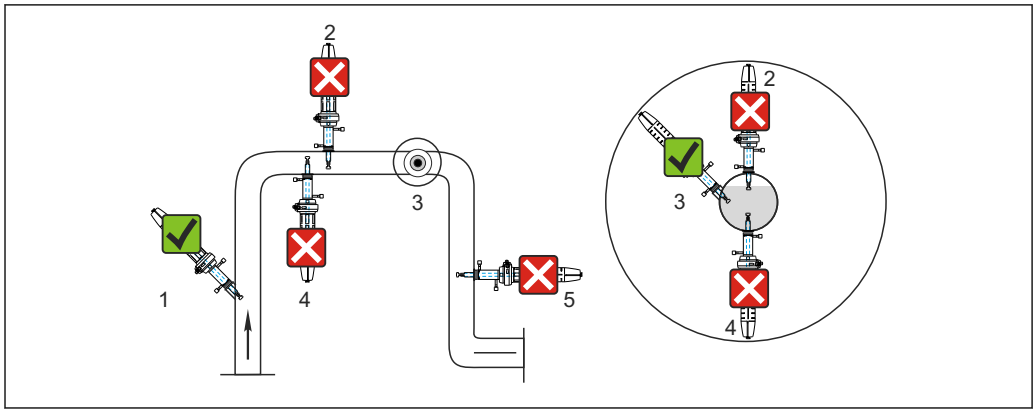
11 Flow assembly

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

5.3.4 Retractable assembly (CPA875 or CPA450)

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.



12 *Permissible and impermissible sensor installation positions with 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, unsuitable*
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.

5.4 Post-mounting check

1. Are the sensor and cable undamaged?
2. Is the orientation correct?
3. Is the sensor installed in an assembly and is not suspended from the cable?
4. Avoid the penetration of moisture by fitting the protection cap on the immersion assembly.

6 Electrical connection

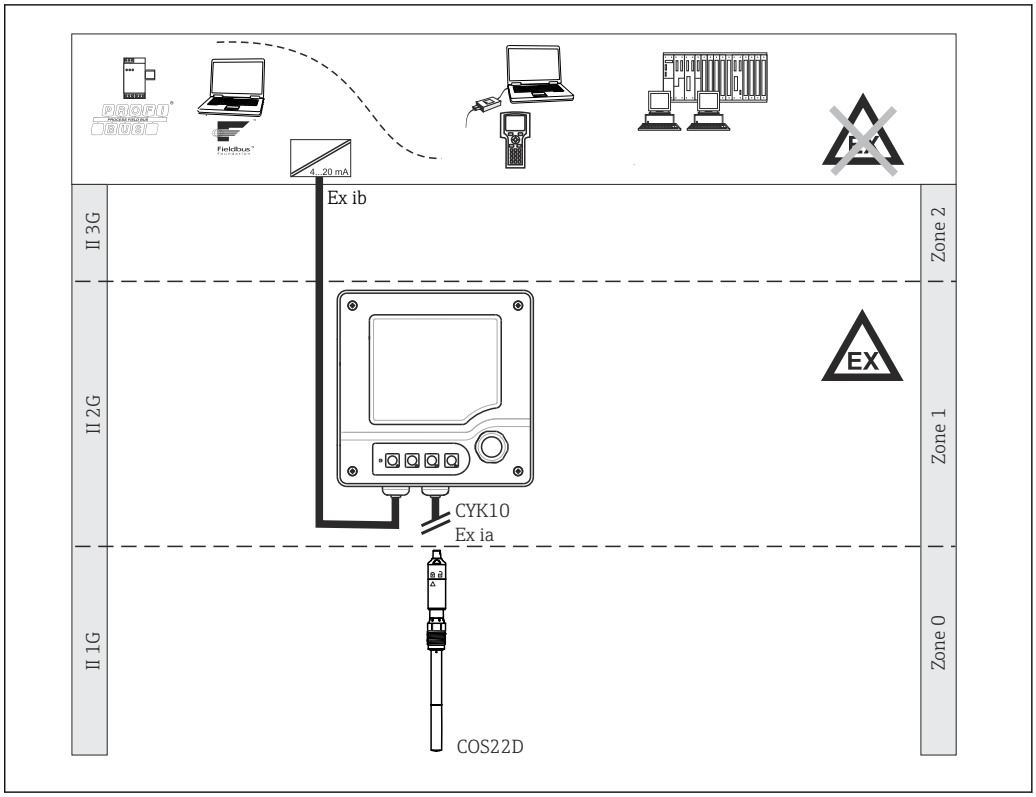
⚠ WARNING

Device is live!

Incorrect connection may result in injury or death!

- The electrical connection may be performed only by an electrical technician.
- The electrical technician must have read and understood these Operating Instructions and must follow the instructions contained therein.
- **Prior** to commencing connection work, ensure that no voltage is present on any cable.

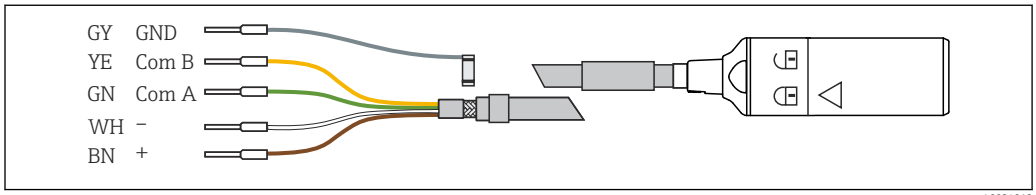
6.1 Connection guide (COS22D-BA/NA only)



13

6.2 Connecting the sensor

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



14 *Measuring cable CYK10*

6.3 Ensuring the degree of protection

Only the mechanical and electrical connections which are described in these instructions and which are necessary for the required, designated use, may be carried out on the device delivered.

▶ Exercise care when carrying out the work.

Otherwise, the individual types of protection (Ingress Protection (IP), electrical safety, EMC interference immunity) agreed for this product can no longer be guaranteed due, for example to covers being left off or cable (ends) that are loose or insufficiently secured.

6.4 Post-connection check

Device condition and specifications	**Action**
Are the sensor, assembly or cables free from damage on the outside?	▶ Perform a visual inspection.
Electrical connection	**Action**
Are the mounted cables strain-relieved and not twisted?	▶ Perform a visual inspection. ▶ Untwist the cables.
Is a sufficient length of the cable cores stripped, and are the cores positioned in the terminal correctly?	▶ Perform a visual inspection. ▶ Pull gently to check they are seated correctly.
Are all the screw terminals properly tightened?	▶ Tighten the screw terminals.
Are all cable entries mounted, tightened and leak-tight?	▶ Perform a visual inspection. In the case of lateral cable entries:
Are all cable entries installed downwards or mounted laterally?	▶ Point cable loops downward so that water can drip off.

7 Calibration and adjustment

Calibration is a means of adapting the transmitter to the characteristic values of the sensor.

Calibration of the sensor is essential according to:
- Initial commissioning
- Changing the membrane or electrolyte
- Long pauses in operation without power supply

Within the framework of system monitoring, for example, calibration can also be cyclically monitored (at typical time intervals, depending on operating experience) or renewed.

7.1 Types of calibration

You can carry out a slope or zero point calibration for the sensor.

In most applications, single-point calibration in the presence of oxygen is sufficient (=calibration of the sensor slope). When switching from process to calibration conditions, you have to allow a longer settling time for the sensor.

The additional calibration of the zero point improves the accuracy of the measurement results at trace concentrations. You can calibrate the zero point using nitrogen (min. 99.995%) or oxygen-free water. Make sure that the sensor is polarized and the measured value is settled at the zero point (at least 20-30 minutes) to prevent later incorrect measurements at trace concentrations.

The following describes calibration of the slope in air (saturated with water vapor) as the easiest and recommended calibration method. However, this type of calibration is possible only if the air temperature is ≥ 0 °C (32 °F).

7.2 Calibration in air

1. Activate the hold status at the transmitter.
2. Remove the sensor from the medium.
3. Clean the outside of the sensor carefully with a damp cloth.
4. Allow a temperature compensation time of approx. 20 minutes for the sensor in the ambient air. Make sure that the sensor is not exposed to any direct ambient effects (direct sunlight, drafts) during this time.
5. Is the measured value display on the transmitter stable:
   Perform the calibration in accordance with the Operating Instructions for the transmitter. Pay particular attention to the software settings for the stability criteria for calibration and for the ambient pressure.
6. Where necessary:
   Adjust the sensor by accepting the calibration data.
7. Then place the sensor back into the medium.
8. Deactivate the hold status at the transmitter.

▶ Follow the calibration instructions in the Operating Instructions for the transmitter used.

7.3 Calculation example for the calibration value

As a check, you can calculate the expected calibration value (transmitter display) as shown in the following example (salinity is 0).

1. Determine the following:

- Ambient temperature for the sensor (air temperature in the case of the **Air 100% rh** or **Air variable** calibration methods, water temperature in the case of the **H2O air-saturated** calibration method)
- The altitude above sea level
- The current air pressure (= relative air pressure based on sea level) at the time of calibration. (If indeterminable, use 1013 hPa.)

2. Determine the following:

- The saturation value S acc. to Table 1
- The altitude factor K acc. to Table 2

Table 1

T [°C (°F)]	S [mg/l=ppm]	T [°C (°F)]	S [mg/l=ppm]	T [°C (°F)]	S [mg/l=ppm]	T [°C (°F)]	S [mg/l=ppm]
0 (32)	14.64	11 (52)	10.99	21 (70)	8.90	31 (88)	7.42
1 (34)	14.23	12 (54)	10.75	22 (72)	8.73	32 (90)	7.30
2 (36)	13.83	13 (55)	10.51	23 (73)	8.57	33 (91)	7.18
3 (37)	13.45	14 (57)	10.28	24 (75)	8.41	34 (93)	7.06
4 (39)	13.09	15 (59)	10.06	25 (77)	8.25	35 (95)	6.94
5 (41)	12.75	16 (61)	9.85	26 (79)	8.11	36 (97)	6.83
6 (43)	12.42	17 (63)	9.64	27 (81)	7.96	37 (99)	6.72
7 (45)	12.11	18 (64)	9.45	28 (82)	7.82	38 (100)	6.61
8 (46)	11.81	19 (66)	9.26	29 (84)	7.69	39 (102)	6.51
9 (48)	11.53	20 (68)	9.08	30 (86)	7.55	40 (104)	6.41
10 (50)	11.25						

Table 2

Altitude [m (ft)]	K	Altitude [m (ft)]	K	Altitude [m (ft)]	K	Altitude [m (ft)]	K
0 (0)	1.000	550 (1800)	0.938	1050 (3450)	0.885	1550 (5090)	0.834
50 (160)	0.994	600 (1980)	0.932	1100 (3610)	0.879	1600 (5250)	0.830
100 (330)	0.988	650 (2130)	0.927	1150 (3770)	0.874	1650 (5410)	0.825
150 (490)	0.982	700 (2300)	0.922	1200 (3940)	0.869	1700 (5580)	0.820
200 (660)	0.977	750 (2460)	0.916	1250 (4100)	0.864	1750 (5740)	0.815
250 (820)	0.971	800 (2620)	0.911	1300 (4270)	0.859	1800 (5910)	0.810
300 (980)	0.966	850 (2790)	0.905	1350 (4430)	0.854	1850 (6070)	0.805
350 (1150)	0.960	900 (2950)	0.900	1400 (4600)	0.849	1900 (6230)	0.801
400 (1320)	0.954	950 (3120)	0.895	1450 (4760)	0.844	1950 (6400)	0.796
450 (1480)	0.949	1000 (3300)	0.890	1500 (4920)	0.839	2000 (6560)	0.792
500 (1650)	0.943						

3. Calculate factor **L**:

$$L = \frac{\text{Relative air pressure at calibration}}{\text{1013 hPa}}$$

4. Determine the **M** factor:

- **M** = 1.02 (for **Air 100% rh** calibration method)
- **M** = 1.00 (for **H2O air-saturated** calibration method)

5. Calculate calibration value **C**:

$$\mathbf{C} = \mathbf{S} \cdot \mathbf{K} \cdot \mathbf{L} \cdot \mathbf{M}$$

Example
- Air calibration at 18 °C (64 °F), altitude 500 m (1650 ft) above sea level, current air pressure 1009 hPa
- S = 9.45 mg/l, K = 0.943, L = 0.996, M=1.00
- Calibration value C = 8.88 mg/l.

Factor K in the table is not required if the measuring device returns the absolute air pressure L_{abs} (air pressure depending on altitude) as the measured value. The formula for calculation is then: $C = S \cdot L_{abs}$.

7.4 Zero point calibration

The zero point is not so important when working with relatively high concentrations of oxygen.

However, once oxygen sensors are used at low concentrations and in the trace range, they must also be calibrated at the zero point.

Zero point calibrations are demanding as the ambient medium - usually air - already has a high oxygen content. This oxygen must be excluded for zero point calibration of the sensor.

A calibration with zero-point gel COY8 can be used for this purpose:
The oxygen-depleting gel COY8 (→ 35)creates an oxygen-free medium for zero point calibration.

Prior to sensor zero point calibration, check the following:
- Is the sensor signal stable?
- Is the value displayed plausible?

1. If the sensor signal is stable:
   Calibrate the zero point.
2. If necessary:
   Adjust the sensor by accepting the calibration data.

The reference method (sample calibration in zero point) can also be used here if appropriate collecting vessels or reference measurement are available.

If the oxygen sensor is calibrated too early, this can result in an incorrect zero point.

Rule of thumb: operate the sensor for at least 30 min in the zero-point gel.

If the sensor was already operated in the trace range before the zero point calibration, the time specified above generally suffices. If the sensor was operated in air, significantly more time must be factored in to also remove residual oxygen from any dead volume inherent to the design. Here a value of 2 hours applies as a general rule.

Follow the instructions in the kit documentation enclosed with the zero-point gel.

8 Commissioning

8.1 Function check

Prior to initial commissioning, ensure that:
- The sensor is correctly installed
- The electrical connection is correct
- There is sufficient electrolyte in the membrane cap
  The transmitter is not displaying a warning about electrolyte depletion

Please note the information on the safety data sheet to ensure safe use of the electrolyte.

If using an assembly with automatic cleaning function:

▶ Check that the cleaning medium (water or air, for example) is connected correctly.

⚠ WARNING

Escaping process medium

Risk of injury from high pressure, high temperatures or chemical hazards!

▶ Before applying pressure to an assembly with cleaning system, ensure that the system has been connected correctly.
▶ If you cannot reliably establish the correct connection, do not install the assembly in the process.

Following commissioning, the sensor must be serviced at regular intervals, as only then can reliable measurement be guaranteed.

Operating Instructions for the transmitter used, such as BA01245C if using the Liquiline CM44x or CM44xR.

8.2 Sensor polarization

NOTICE

Incorrect measurements due to ambient influences!

▶ Always avoid strong direct sunlight on the sensor.
▶ Comply with the instructions for commissioning in the Operating Instructions of the transmitter used.

The sensor has been tested at the factory for proper functioning and is shipped in a condition in which it is ready to operate.

To prepare for calibration:

1. Remove the sensor protection cap.
2. Expose the sensor, which is dry on the outside, to the air atmosphere.
   ↳ The air should be saturated with water vapor. Therefore, install the sensor as close as possible to a water surface. However, the sensor membrane must remain dry during calibration. Therefore, avoid direct contact with the water surface.
3. Connect the sensor to the transmitter.
4. Switch on the transmitter.
   ↳ When the sensor is connected to the transmitter, the polarization takes place automatically after the transmitter powers up.
5. Wait for polarization time to elapse.

8.3 Calibrating the sensor

Calibrate the sensor (e.g. air calibration) immediately after the polarization time elapses.

The calibration intervals depend greatly on:
- The application
- The installation position of the sensor

The following method helps you determine the necessary calibration intervals:

1. Inspect the sensor one month after commissioning. To do so, remove the sensor from the medium and dry it off.
2. After 10 minutes, measure the oxygen saturation index in air.
   ↳ Decide using the results:
   a) Measured value not 100 ±2 %SAT? → Calibrate the sensor.
   b) Measured value = 100 ±2 %SAT? → Double the length of time to the next inspection.
3. Proceed as indicated in Step 1 after two, four and eight months.
   ↳ This allows you to determine the optimum calibration interval for your sensor.

In any case, calibrate the sensor at least once a year.

9 Troubleshooting

▶ If one of the following problems is present:
Check the measuring system in the order shown.

Problem	Testing	Remedial action
Nothing displayed, no reaction from the sensor	Power supplied to the transmitter?	▶ Establish the power supply.
	Sensor cable connected correctly?	▶ Establish correct connection.
	Medium flow present?	▶ Create medium flow.
	Deposit buildup on the membrane?	▶ Clean sensor.
	No electrolyte in the measuring chamber?	▶ Refill or replace electrolyte.
Displayed value too high	Polarization ended?	▶ Wait for polarization time to elapse.
	Is sensor calibrated/adjusted?	▶ Recalibrate/readjust.
	Displayed temperature clearly too low?	▶ Check sensor, if necessary send sensor in for repair.
	Membrane visibly stretched?	▶ Replace membrane cap.
	Electrolyte contaminated?	▶ Replace electrolyte.
	Open the sensor and dry the electrodes. Is the transmitter reading now at 0?	1. Check the cable connection. 2. If the problem persists: Send sensor in for repair.
Displayed value too low	Is sensor calibrated/adjusted?	▶ Recalibrate/readjust.
	Medium flow present?	▶ Create medium flow.
	Displayed temperature clearly too high?	▶ Check sensor, if necessary send sensor in for repair.
	Deposit buildup on the membrane?	▶ Clean sensor.
	Electrolyte contaminated?	▶ Replace electrolyte.
Display value fluctuating greatly	Membrane visibly stretched?	▶ Replace membrane cap.
	Open the sensor and dry the electrodes. Is the transmitter reading now at 0?	1. Check the cable connection. 2. If the problem persists: Send sensor in for repair.

1. Pay attention to the troubleshooting information in the Operating Instructions for the transmitter.
2. Check the transmitter if necessary.

10 Maintenance

Take all the necessary precautions in time to ensure the operational safety and reliability of the entire measuring system.

NOTICE

Effects on process and process control!

- When carrying out any work on the system, bear in mind any potential impact this could have on the process control system and the process itself.
- For your own safety, only use genuine accessories. With genuine parts, the function, accuracy and reliability are also ensured after maintenance work.

10.1 Maintenance schedule

Maintenance cycles depend to a great extent on the operating conditions.

The following rule of thumb applies:
- Constant conditions, e.g. power plant = long cycles (1/2 year)
- Widely varying conditions, e.g. daily CIP or SIP cleaning, fluctuating process pressure = short cycles (1 month and shorter)

The following method helps you determine the necessary intervals:

1. Inspect the sensor one month after commissioning. To do so, remove the sensor from the medium and dry it carefully.
2. After 10 minutes, measure the oxygen saturation index in air.
   ↳ Decide using the results:
   a) Measured value not 100 ± 2 % SAT? → Service the sensor.
   b) Measured value = 100 ± 2 % SAT? → Double the length of time to the next inspection.
3. Proceed as indicated in Step 1 after two, four and eight months.
   ↳ This allows you to determine the optimum maintenance interval for your sensor.

Particularly in the case of widely fluctuating process conditions, damage may occur to the membrane even within a maintenance cycle. You can recognize this by implausible sensor behavior. (→ 28)

10.2 Maintenance tasks

The following tasks are mandatory:

1. Clean the sensor glass body with anode and cathode (particularly if the membrane is dirty). → 29
2. Replace wear parts or consumables. → 30
3. Check measurement function. → 33
4. Recalibrate (if desired or necessary).
   ↳ Follow the Operating Instructions for the transmitter.

10.3 Cleaning the of the sensor

The measurement can be corrupted by sensor fouling or malfunction due to the following, for example:
Deposit buildup on the sensor membrane
↳ This results in a longer response time and, under certain circumstances, a reduced slope.

For reliable measurement, the sensor must be cleaned at regular intervals. The frequency and intensity of the cleaning operation depend on the medium.

Clean the sensor:
- Before every calibration
- At regular intervals during operation as necessary
- Before returning it for repairs

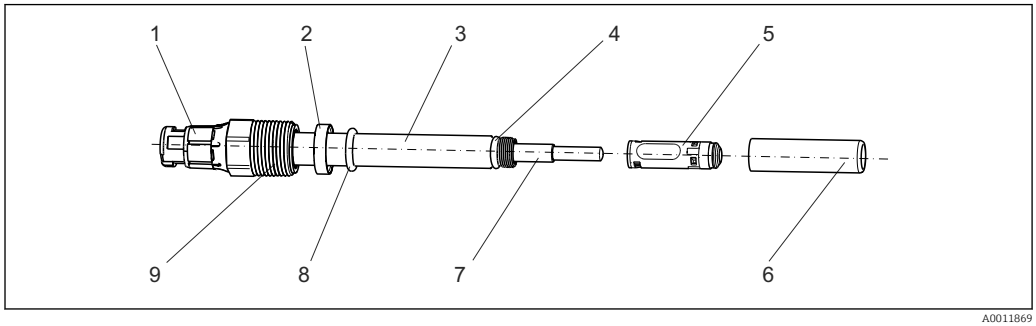
Type of contamination	Cleaning
Salt deposits	1. Immerse the sensor in drinking water or in 1-5 % hydrochloric acid (for a few minutes). 2. Then rinse it with copious amounts of water.
Dirt particles on the sensor shaft and shaft sleeve (**not membrane!**)	▶ Clean sensor shaft and sleeve with water and a suitable sponge.
Dirt particles on membrane or membrane body	▶ Clean the membrane with water and a soft cloth.

▶ After cleaning:
Rinse with copious amounts of clean water.

10.4 Wear parts and consumables

Parts of the sensor are subject to wear during operation. By taking suitable measures, you can restore the normal operating function.

Corrective action	Reason
Replace sealing rings	Visible damage to a sealing ring
Replacing electrolyte	Unstable or implausible measuring signal or fouling of the electrolyte
Replacing the membrane body	Membrane is damaged or can no longer be cleaned (hole or overstretching)



15 COS22D

1	*Plug-in head*	*4*	*O-ring 8.5 x 1.5 mm*	*7*	*Glass part with anode and cathode*
2	*Thrust collar*	*5*	*Membrane body*	*8*	*Process seal 10.77 x 2.62 mm*
3	*Sensor shaft*	*6*	*Shaft sleeve*	*9*	*Process connection Pg 13.5*

10.4.1 Replacing sealing rings

It is compulsory to replace the sealing ring if it is visibly damaged. Only use original sealing rings.

The following O-rings can be replaced:
- Sealing ring for shaft sleeve: item 4 → 30
- Sealing ring towards process (conductive for Ex): item 8

If the sealing ring on the membrane body (item 5) is damaged, the entire membrane body must be replaced.

10.4.2 Replacing the electrolyte

The electrolyte is used up gradually during operation. This is caused by electrochemical substance reactions. In de-energized state, no substance reactions take place, and the electrolyte is not used up. The operating time of the electrolyte is shortened by diffusion of dissolved gases such as H_2S, NH_3 or high concentrations of CO_2.

Theoretical operating time at p_{O2} = 210 mbar and T=25 °C (77 °F)

COS22D-*1 (standard sensor):	> 1.5 years
COS22D-*3/4 (trace sensor):	> 3 months

⚠ CAUTION

The standard electrolyte is a strong irritant

Danger of severe skin and eye irritation!
- ▶ Be absolutely certain to observe the corresponding workplace safety regulations.
- ▶ Wear protective gloves and goggles when handling the electrolyte.
- ▶ In case of eye contact: Remove contact lenses, rinse eyes with water for a few minutes and contact a doctor.
- ▶ In case of skin contact: Take off wet clothing immediately, wash the skin or take a shower.

Generally, the following applies:
- The electrolyte must be changed if the membrane body is detached.
- Sensors operated close to the zero point consume hardly any chemical electrolyte. The electrolyte does not have to be replaced for a long period.
- Sensors operated at high oxygen partial pressures (> 100 hPa) consume a significant amount of electrolyte. The electrolyte has to be replaced frequently.
- 25 ml of electrolyte is enough to fill the membrane body approx. 15 times.

Draining the electrolyte

1. Disconnect the sensor from the transmitter and remove it from the medium.
2. Clean the exterior of the sensor.
3. Hold the sensor vertically and unscrew the shaft sleeve.
   ↳ The membrane body is either in the shaft sleeve or is still on the glass part with the anode and cathode.
4. Remove the membrane body. For this purpose, use the tool provided to push out the membrane body.
5. Drain the membrane body and rinse it with potable water.

Topping up the electrolyte and installing the membrane body

1. Pour fresh electrolyte from the supply bottle into the membrane body.
2. Remove all air bubbles from the electrolyte by tapping the side of the membrane body (using a pen or pencil, for example).
3. Hold the sensor vertically and carefully fit the membrane body, filled with electrolyte, onto the glass part.

4. Carefully screw on the shaft sleeve and tighten until the stop.

Putting the sensor back into operation

1. Connect the sensor to the transmitter.
2. Polarize the sensor and recalibrate it.
3. After this:
   Re-immerse the sensor into the medium.
4. Check that the transmitter does not signal an alarm.

10.4.3 Replacing the membrane body

Removing the membrane body

1. Disconnect the sensor from the transmitter and remove it from the medium.
2. Clean the exterior of the sensor.
3. Hold the sensor vertically and unscrew the shaft sleeve.
   ↳ The membrane body is either in the shaft sleeve or is still on the glass part with the anode and cathode.
4. Remove the membrane body. For this purpose, use the tool provided to push out the membrane body.
5. Dispose of the old membrane body and the old electrolyte.
6. Take a **new** membrane body out of its packaging.

Topping up the electrolyte and installing the membrane body

1. Pour fresh electrolyte from the supply bottle into the membrane body.
2. Remove all air bubbles from the electrolyte by tapping the side of the membrane body (using a pen or pencil, for example).
3. Hold the sensor vertically and carefully fit the membrane body, filled with electrolyte, onto the glass part.
4. Carefully screw on the shaft sleeve and tighten until the stop.

Putting the sensor back into operation

1. Connect the sensor to the transmitter.
2. Polarize the sensor and recalibrate it.
3. After this:
   Re-immerse the sensor into the medium.
4. Check that the transmitter does not signal an alarm.

10.4.4 Replacing glass body with cathode

NOTICE

Polishing the cathode can cause the impaired functioning or total failure of the sensor!

▶ Do not clean the cathode mechanically.

If the cathode is coated with buildup replace the glass body:

1. Hold the sensor vertically and unscrew the shaft sleeve: item 6 → 30.
2. If the membrane body (item 5) remains on the glass body (item 7) and not in the shaft sleeve:
   Remove it from the glass body.
3. Rinse the glass body, along with the anode and cathode, using distilled water.

4. Pull the used glass body out of the holder.
5. Dry the inside of the electrode holder.
6. Plug a new glass body (from the membrane kit) into the holder so that it fits. When doing so, ensure that you do not damage the electrical contact pins.
7. Fill the membrane body with electrolyte and screw the shaft sleeve back on.

10.5 Testing the measurement function

1. Remove the sensor from the medium.
2. Clean and dry the membrane.
3. After about 10 minutes, measure the oxygen saturation index in air (without recalibration).
   ↳ The measured value should be at 100 ± 2 % SAT.

11 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.

11.1 Assemblies (selection)

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

Flowfit CPA240
- pH/redox flow assembly for processes with stringent requirements
- Product Configurator on the product page: www.endress.com/cpa240

Technical Information TI00179C

Unifit CPA442
- Installation assembly for food, biotechnology and pharmaceutics
- With EHEDG and 3A certificate
- Product Configurator on the product page: www.endress.com/cpa442

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

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

11.2 Measuring cable

11.2.1 Cable for COS22D

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

11.3 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

Technical Information TI01244C

11.4 Maintenance kit

COS22Z

- Service Kit, COS22 and COS22D
- Ordering information: www.endress.com/cos22d under "Accessories/spare parts"

12 Repair

12.1 Spare parts and consumables

COS22Z
- Service Kit, COS22 and COS22D
- Ordering information: www.endress.com/cos22d under "Accessories/spare parts"

12.2 Return

The product must be returned if repairs or a factory calibration are required, or if the wrong product was ordered or delivered. As an ISO-certified company and also due to legal regulations, Endress+Hauser is obliged to follow certain procedures when handling any returned products that have been in contact with medium.

To ensure the swift, safe and professional return of the device:

▶ Refer to the website www.endress.com/support/return-material for information on the procedure and conditions for returning devices.

12.3 Disposal

If required by the Directive 2012/19/EU on waste electrical and electronic equipment (WEEE), the product is marked with the depicted symbol in order to minimize the disposal of WEEE as unsorted municipal waste. Do not dispose of products bearing this marking as unsorted municipal waste. Instead, return them to Endress+Hauser for disposal under the applicable conditions.

13 Technical data

13.1 Input

Measured variables

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

Temperature [˚C, ˚F]

Measuring ranges

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

	Measuring range	Optimum operational range [1]
COS22D-*1	0.01 to 60 mg/l 0 to 600 % SAT 0 to 1200 hPa 0 to 100 Vol%	0.01 to 20 mg/l 0 to 200 % SAT 0 to 400 hPa 0 to 40 Vol%
COS22D-*3/4	0.001 to 10 mg/l 0 to 120 % SAT 0 to 250 hPa 0 to 25 Vol%	0.001 to 2 mg/l 0 to 20 % SAT 0 to 40 hPa 0 to 4 Vol%

1) Applications in this range guarantee a long service life and minimum maintenance

13.2 Performance characteristics

Response time

From air to nitrogen at reference operating conditions:
- t_{90} : < 30 s
- t_{98} : < 60 s

Reference operating conditions

Reference temperature:	25 ˚C (77 ˚F)
Reference pressure:	1013 hPa (15 psi)
Reference application:	Air-saturated water

Signal current in air

COS22D-*1 (standard sensor):	40 to 100 nA
COS22D-*3/4 (trace sensor):	210 to 451 nA

Zero current

COS22D-*1 (standard sensor):	< 0.1 % of the signal current in air
COS22D-*3/4 (trace sensor):	< 0.03 % of the signal current in air

Measured value resolution

COS22D-*1 (standard sensor):	10 ppb in aqueous, 0.2 hPa or 0.02 Vol% in gaseous media
COS22D-*3/4 (trace sensor):	1 ppb in aqueous, 0.02 hPa or 0.002 Vol% in gaseous media

Corresponds to the recommended measured value resolution at the transmitter

Maximum measured error [1]	COS22D-*1 (standard sensor): COS22D-*3/4 (trace sensor): * at reference operating conditions	≤ ±1 % of measuring range + 10 ppb * ≤ ±1 % of measuring range + 1 ppb *
Long-term drift	< 4 % per month in reference operating conditions ≤ 1 % per month in operation with reduced oxygen concentration (< 4 Vol% O_2)	
Influence of the medium pressure	Pressure compensation not required	
Polarization time	COS22D-*1 (standard sensor): COS22D-*3/4 (trace sensor):	< 30 min for 98% signal value, 2 h for 100% < 3 h for 98% signal value, 12 h for 100%
Intrinsic oxygen consumption	COS22D-*1 (standard sensor): COS22D-*3/4 (trace sensor):	Approx. 20 ng/h in air at 25 °C (77 °F) Approx. 100 ng/h in air at 25 °C (77 °F

Operating time of the electrolyte

The electrolyte is used up gradually during operation. This is caused by electrochemical substance reactions. In de-energized state, no substance reactions take place, and the electrolyte is not used up. The operating time of the electrolyte is shortened by diffusion of dissolved gases such as H_2S, NH_3 or high concentrations of CO_2.

Theoretical operating time at p_{O2} = 210 mbar and T=25 °C (77 °F)

COS22D-*1 (standard sensor):	> 1.5 years
COS22D-*3/4 (trace sensor):	> 3 months

⚠ CAUTION

The standard electrolyte is a strong irritant

Danger of severe skin and eye irritation!

- ▶ Be absolutely certain to observe the corresponding workplace safety regulations.
- ▶ Wear protective gloves and goggles when handling the electrolyte.
- ▶ In case of eye contact: Remove contact lenses, rinse eyes with water for a few minutes and contact a doctor.
- ▶ In case of skin contact: Take off wet clothing immediately, wash the skin or take a shower.

Generally, the following applies:

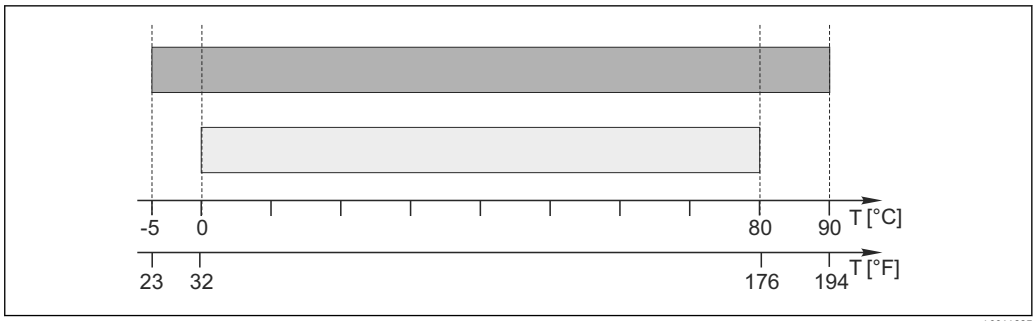
- The electrolyte must be changed if the membrane body is detached.
- Sensors operated close to the zero point consume hardly any chemical electrolyte. The electrolyte does not have to be replaced for a long period.
- Sensors operated at high oxygen partial pressures (> 100 hPa) consume a significant amount of electrolyte. The electrolyte has to be replaced frequently.
- 25 ml of electrolyte is enough to fill the membrane body approx. 15 times.

Temperature compensation

Compensation of the membrane properties takes place in the transmitter between -5 and 90 °C (23 to 194 °F); above 90 °C (194 °F), extrapolation takes place

- Measured variable as partial pressure [hPa] or in Vol%: -5 to 90 °C (23 to 194 °F)
- Measured variable as concentration [mg/l]: 0 to 80 °C (32 to 176 °F)
- Measured variable as saturation [%SAT]: -5 to 90 °C (23 to 194 °F)

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



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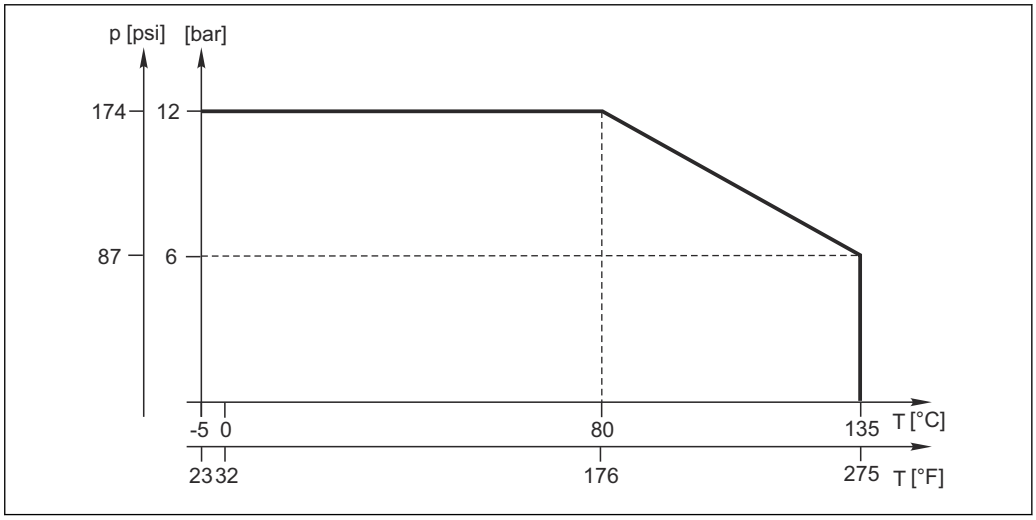
13.3 Environment

Ambient temperature	COS22D-*1 /3: COS22D-*4:	-5 to +135 °C (23 to 275 °F), non-freezing -5 to +50 °C (23 to 120 °F), non-freezing
Storage temperature	−5 to +50 °C (20 to 120 °F) at 95% relative humidity, non-condensing **NOTICE** **Danger of sensor drying out!** ▶ Store the sensor with the watering cap only (filled with tap water).	
Degree of protection	IP 68 (10 m (33 ft) head of water at 25 °C (77 °F) over 45 days, 1 mol/l KCl)	
Humidity	0 to 100%, condensating	

13.4 Process

Process temperature	COS22D-*1 /3 (standard/trace sensor): COS22D-*4 (trace sensor, gold):	-5 to +135 °C (23 to 275 °F), non-freezing -5 to +80 °C (23 to 180 °F), non-freezing
Process pressure	Ambient pressure … 12 bar (… 174 psi) absolute	
Temperature/pressure ratings		

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Minimum flow	COS22D-*1 (standard sensor):	0.02 m/s (0.07 ft/s)
	COS22D-*3/4 (trace sensor):	0.1 m/s (0.33 ft/s)

Chemical resistance

Parts in contact with the medium are chemically resistant to:
- Diluted acids and alkalis
- Hot water and superheated steam up to max. 135 °C (275 °F)
- CO_2 up to 100 %, only with trace sensor COS22D-*3

NOTICE

Hydrogen sulfide and ammonia shorten the operating life of the sensor!
- ▶ Do not use the sensor in applications where it is exposed to hydrogen sulfide or ammonia vapors.

Cross-sensitivity

COS22D-*1/3

Molecular hydrogen causes false low readings and can, in a worst-case scenario, result in total failure of the sensor.
No cross interference from hydrogen with the COS22D-*4 version.

CIP compatibility

Yes (COS22D-*1/3)

SIP compatibility

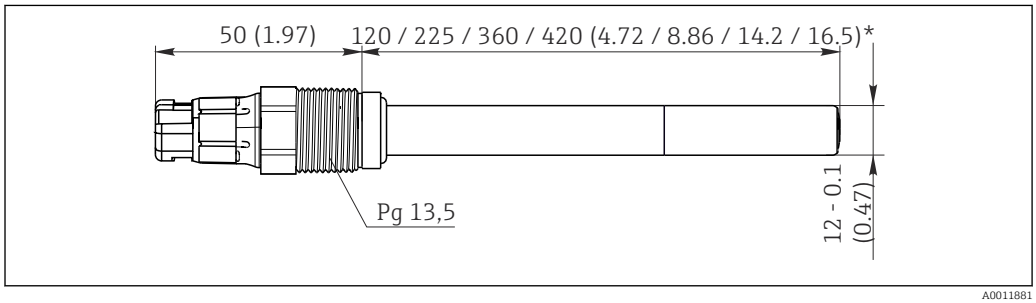
Yes, max. 140 °C (284 °F) (COS22D-*1/3)

Autoclavability

Yes, max. 140 °C (284 °F), max. 30 min. (COS22D-*1/3)

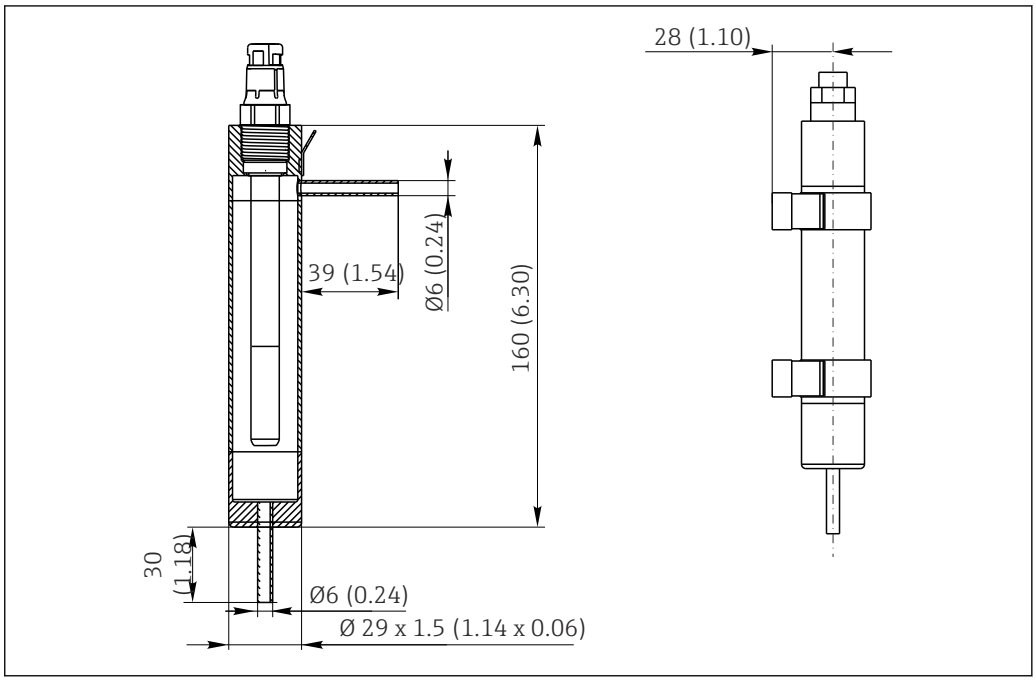
13.5 Mechanical construction

Dimensions



16 Dimensions in mm (inch)

Flow assembly for sensors with Ø 12 mm (accessory)



17 *Dimensions in mm (inch)*

Weight	Depending on the design (length) 0.2 kg (0.44 lbs) to 0.7 kg (1.54 lbs)	
Materials	**Parts in contact with medium**	
	Sensor shaft (depending on the version)	Stainless steel 1.4435 (AISI 316L) Titanium Alloy C22
	Electrode combination	COS22D-*1/3: silver / platinum COS22D-*4: silver / gold
	Process seal	VITON (FDA-compliant)
	Process seal for Ex versions	VITON (not FDA-compliant)
	Seals/O-rings	VITON (FDA-compliant)
	Membrane body, sealing ring for shaft sleeve	Perfluoroelastomer with USP<88> Class VI
	Membrane	Silicone (FDA-compliant, in compliance with USP87/88 class VI), PTFE, steel mesh
Process connection	Pg 13.5 Torque max. 3 Nm	
Surface roughness	R_a < 0.38 µm	
Temperature sensor	NTC 22 kΩ	
Electrolyte	COS22D-*1 (standard sensor):	Slightly alkaline electrolyte
	COS22D-*3 (trace sensor):	Neutral electrolyte
	COS22D-*4 (trace sensor, gold):	Slightly alkaline electrolyte

14 Appendices

EG/EU-Konformitätserklärung
EC/EU-Declaration of Conformity
Déclaration CE/UE de Conformité

Endress+Hauser
People for Process Automation

CE

Company Endress+Hauser Conducta GmbH+Co. KG
Dieselstraße 24, 70839 Gerlingen, Germany
erklärt als Hersteller in alleiniger Verantwortung, dass das Produkt
declares as manufacturer under sole responsibility, that the product
déclare sous sa seule responsabilité en qualité de fabricant que le produit

Product Memosens Sensoren / Memosens sensors / Memosens capteurs
COS21D-*12*1
COS22D-BA**3**
COS51D-G*8*0

zusammen mit Messkabel / together with measuring cable / ensemble avec cable de mesure

CYK10-ab**	**a = G, E;**	**b = 1, 2**
CYK20-BAab	**a = B1, B2;**	**b = C1, C2**

Regulations den folgenden Europäischen Richtlinien entspricht:
conforms to following European Directives:
est conforme aux prescription des Directives Européennes suivantes :

EMC	2014/30/EU
ATEX	2014/34/EU

Standards angewandte harmonisierte Normen oder normative Dokumente:
applied harmonized standards or normative documents:
normes harmonisées ou documents normatifs appliqués :

EN 61326-1	(2013)	EN 60079-0	(2012)	+ A11 (2013)
EN 61326-2-3	(2013)	EN 60079-11	(2012)	
		EN 60079-26	(2007)	+ Corrigendum 1

Certification

EG-Baumusterprüfbescheinigungs-Nr. EC-Type Examination Certificate No. Numéro de l'attestation d'examen CE de type	BVS 04 ATEX E 121 X
Ausgestellt von/issued by/délivré par	DEKRA EXAM GmbH (0158)
Qualitätssicherung/Quality assurance/Système d'assurance qualité	DEKRA EXAM GmbH (0158)

Gerlingen, 20.04.2016
Endress+Hauser Conducta GmbH+Co. KG

i. V. Jörg-Martin Müller
Technology

i. V. Sven-Matthias Scheibe
Technology Certifications and Approvals

EC_00357_01.16

Index

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