# Technical Information
# Oxymax COS22D/COS22

Digital or analog sensor for the measurement of oxygen

## Sensor with long-term stability for frequent sterilizations and autoclavability

### Application

- Pharmaceutics and biotechnology
  - Process control in enzyme production
  - Control of culture processing
- Beverage industry
- Chemical industry
- Water treatment
  - Boiler feedwater
  - WFI (water for injection)
- Inertization
- Residual oxygen measurement in processes

### Your benefits

- Sensor version suitable for pharmaceutical industry:
  - Stainless steel 1.4435 (AISI 316L)
  - Sterilizable and autoclavable
- Application-specific versions:
  - Sensor for standard applications, e.g. for fermenter control
  - Trace sensor, e.g. for use in the power station sector and for the beverage industry (CO2-compatible sensor)
- Very versatile:
  - Standard process connection Pg 13.5
  - Installation possible in standard pH assemblies
- Short response time: $t_{98}$ < 60 s
- Integrated temperature sensor

### 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

Endress+Hauser
People for Process Automation

# Function and system design

**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.

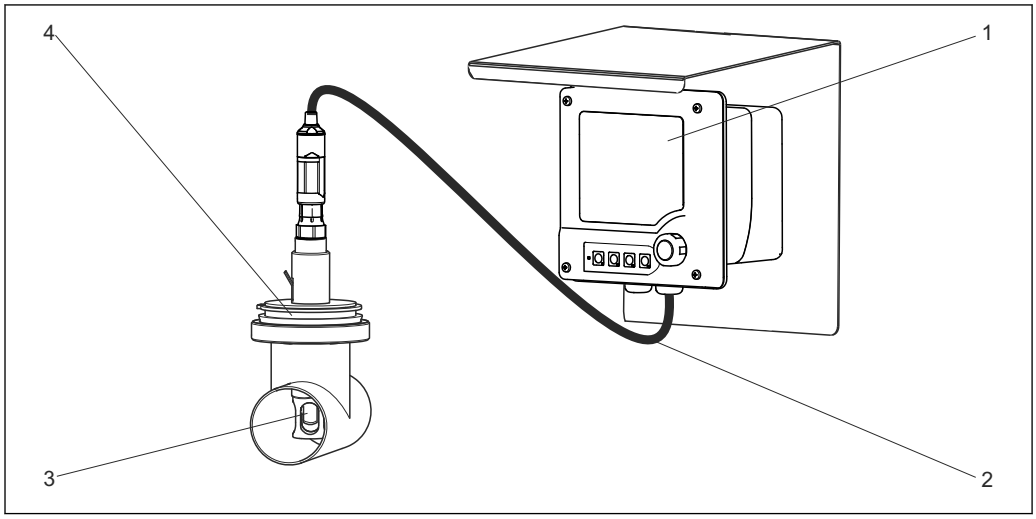
**Application in gaseous media**

The trace sensor version can be used in gaseous media, such as for inertizations and quality control in the trace range. Process monitoring in gaseous media can be performed with the standard sensor. The measured value is displayed in Vol% or as oxygen partial pressure in hPa. Sensors that are used in dry media consume more electrolyte and must therefore be maintained more frequently.

**Measuring system**

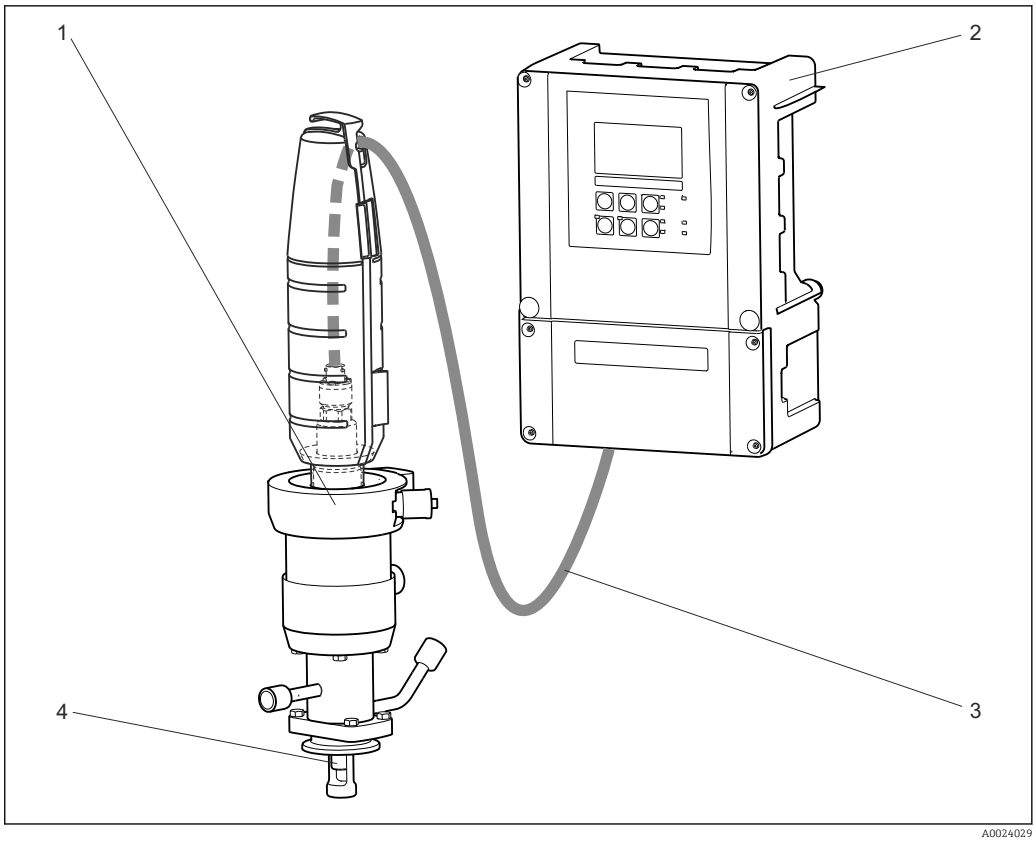
A complete measuring system comprises:
- An Oxymax COS22 or Oxymax COS22D oxygen sensor
- A transmitter, see table
- An appropriate measuring cable, see table
- Optional: an assembly, e.g. permanent installation assembly CPA442, flow assembly CPA240, or retractable assembly CPA875

| Transmitter | COS22D- standard, trace | COS22- standard | COS22- trace |
|---|---|---|---|
| Liquiline CM44x | ☑, cable: CYK10 | - | - |
| Liquiline CM42 | ☑, cable: CYK10 | - | - |
| Liquisys COM2x3 | - | ☑, cable: COK21 | - |
| Third-party provider | Memosens partner | Possible, cable: COK21 | Possible, cable: COK21 |




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

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




2 *Example of a measuring system with COS22-*1*

1 *Retractable assembly CPA875*
2 *Transmitter Liquisys COM253*
3 *Measuring cable COK21*
4 *Oxygen sensor COS22*

# 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
  - Measured value not affected by moisture. Correct transmission of even the smallest values, e.g. from amperometric sensors.
- 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 an integrated electronics unit that stores calibration data and other information (e.g. total operating hours and 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 .
- Maintenance intervals can be defined based on all stored sensor load and calibration data and predictive maintenance is possible.
- The sensor history can be documented on external data carriers and 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 using 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

# Input

**Measured values**

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

Temperature [°C, °F]

**Measuring ranges**

Measuring ranges apply for 20 ° (68 °F) and 1013 hPa (15 psi)

| | Measuring range | Optimum operational range [1] |
|---|---|---|
| COS22/22D-*1 | 0.01 to 60 mg/l<br>0 to 600 % SAT<br>0 to 1200 hPa (0 to 6 psi)<br>0 to 100 Vol% | 0.01 to 20 mg/l<br>0 to 200 % SAT<br>0 to 400 hPa (0 to 6 psi)<br>0 to 40 Vol% |
| COS22/22D-*3<br>COS22D-*4 | 0.001 to 10 mg/l<br>0 to 120 % SAT<br>0 to 250 hPa (0 to 6 psi)<br>0 to 25 Vol% | 0.001 to 2 mg/l<br>0 to 20 % SAT<br>0 to 40 hPa (0 to 6 psi)<br>0 to 4 Vol% |

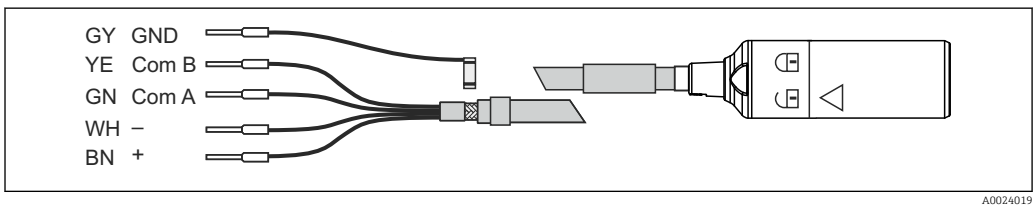
1) Applications in this range guarantee a long service life and minimum maintenance

# Power supply

**Electrical connection**

**COS22D**

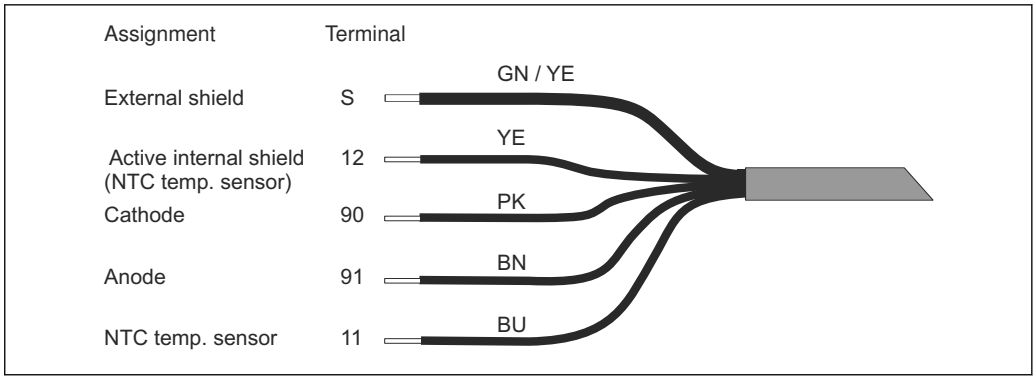
The electrical connection of the sensor to the transmitter is performed using the measuring cable CYK10.




*3 Measuring cable CYK10*

**COS22**

A multi-core COK21 measuring cable is used for the electrical connection of the sensor to the transmitter.




4 *Measuring cable COK21*

The polarization voltage must be set at the transmitter as follows:
Standard measuring range: -650mV
Trace measuring range: -550mV
The voltage is applied between the working electrode (cathode) and the reference electrode (anode).

# Performance characteristics

| | | |
|---|---|---|
| **Response time** | From air to nitrogen at reference operating conditions:<br>▪ $t_{90}$ : < 30 s<br>▪ $t_{98}$ : < 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** | COS22/22D-*1 (standard sensor): | 40 to 100 nA |
| | COS22/22D-*3, COS22D-*4 (trace sensor): | 210 to 451 nA |
| **Zero current** | COS22/22D-*1 (standard sensor): | < 0.1 % of the signal current in air |
| | COS22/22D-*3, COS22D-*4 (trace sensor): | < 0.03 % of the signal current in air |
| **Measured value resolution** | COS22/22D-*1 (standard sensor): | 10 ppb in aqueous, 0.2 hPa or 0.02 Vol% in gaseous media |
| | COS22/22D-*3, COS22D-*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** | COS22/22D-*1 (standard sensor): | ≤ ±1 % of measuring range + 10 ppb * |
| | COS22/22D-*3, COS22D-*4 (trace sensor): | ≤ ±1 % of measuring range + 1 ppb * |
| | * at reference operating conditions | |
| **Long-term drift** | < 4 % per month in reference operating conditions<br>≤ 1 % per month in operation with reduced oxygen concentration (< 4 Vol% $O_2$) | |
| **Influence of the medium pressure** | Pressure compensation not required | |

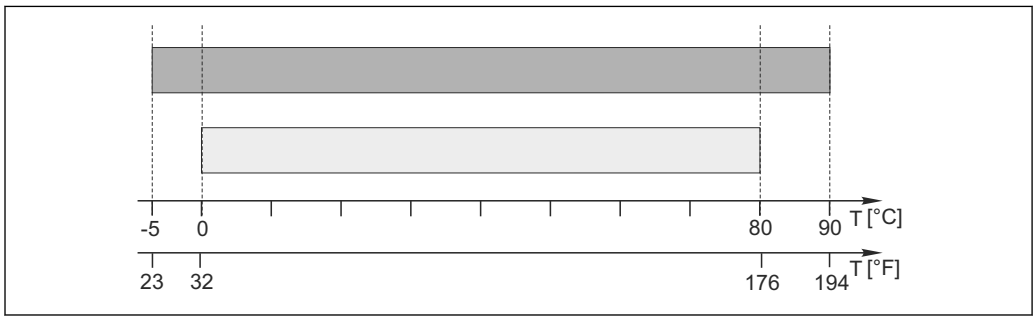
| | | |
|---|---|---|
| **Polarization time** | COS22/22D-*1 (standard sensor): | < 30 min for 98% signal value, 2 h for 100% |
| | COS22/22D-*3, COS22D-*4 (trace sensor): | < 3 h for 98% signal value, 12 h for 100% |
| **Intrinsic oxygen consumption** | COS22/22D-*1 (standard sensor): | Approx. 20 ng/h in air at 25 ˚C (77 ˚F) |
| | COS22/22D-*3, COS22D-*4 (trace sensor): | Approx. 100 ng/h in air at 25 ˚C (77 ˚F |
| **Operating time of the electrolyte** | Theoretical operating time at $p_{O2}$ = 210 mbar and T=25 ˚C (77 ˚F) | |
| | COS22/22D-*1 (standard sensor): | > 1.5 years |
| | COS22/22D-*3, COS22D-*4 (trace sensor): | > 3 months |

**Temperature compensation**

**COS22D**

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)

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**COS22**

Compensation of the membrane properties depending on the transmitter, recommended: 2.4 % per K

# Installation

**Installation instructions**

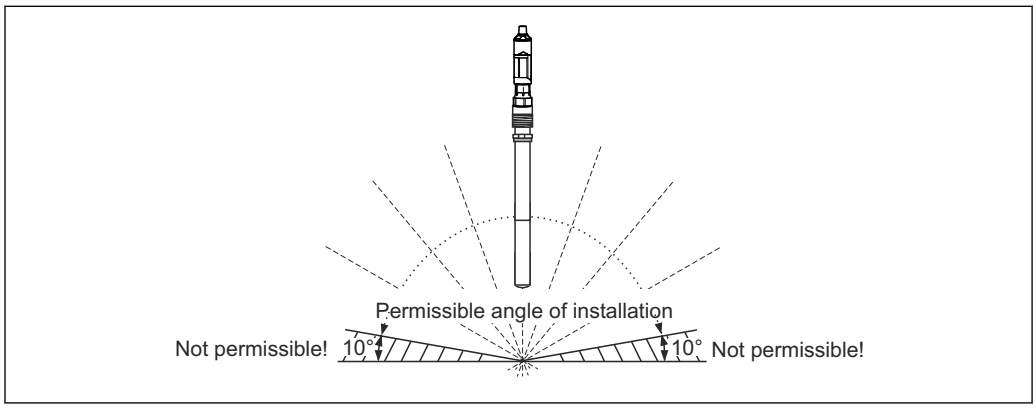
Installation in suitable assembly is required (depending on the application)

**NOTICE**

**If the unit is installed without an assembly, there is the danger of rupturing cables or losing the sensor**

► Do not install the sensor suspended from the cable!

**Installation angle**

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*5 Permitted orientations*

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

Inclination angles other than those mentioned are not permitted. Do **not** install the sensor overhead.

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

# Environment

**Ambient temperature range**

| | |
|---|---|
| COS22/22D-*1 /3: | -5 to +135 °C (23 to 275 °F), non-freezing |
| COS22D-*4: | -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%, COS22D: condensating, COS22: not condensating in area of T-82 connection

# Process

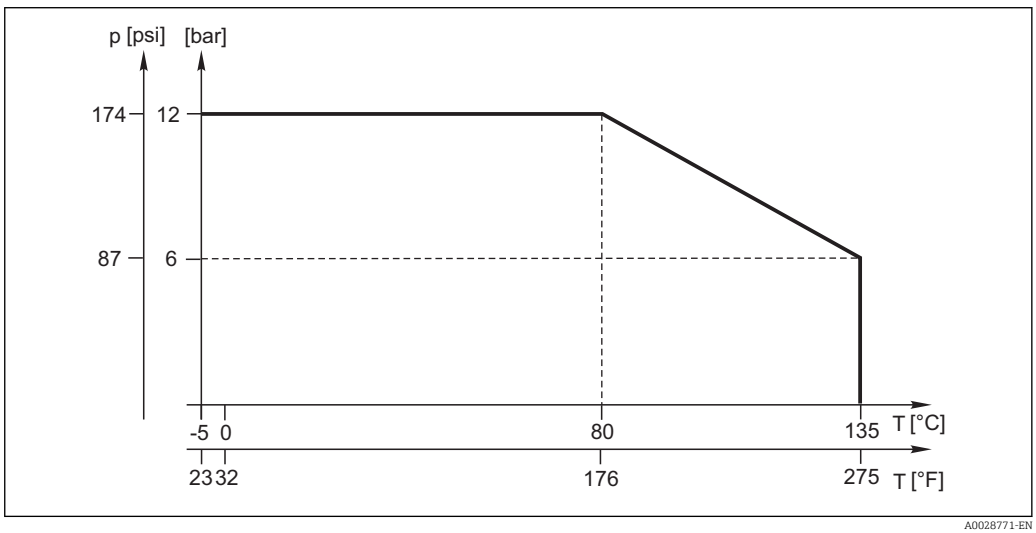
**Process temperature**

| | |
|---|---|
| COS22/22D-*1 /3: | -5 to +135 °C (23 to 275 °F), non-freezing |
| COS22D-*4: | -5 to +80 °C (23 to 180 °F), non-freezing |

**Process pressure**

Ambient pressure ... 12 bar (... 174 psi) absolute

**Temperature-pressure ratings**




**Minimum flow**

| | |
|---|---|
| COS22/22D-*1 (standard sensor): | 0.02 m/s (0.07 ft/s) |
| COS22/22D-*3, COS22D-*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 COS22/22D-*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**

COS22/22D-*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 (COS22/22D-*1/3)

**SIP compatibility**

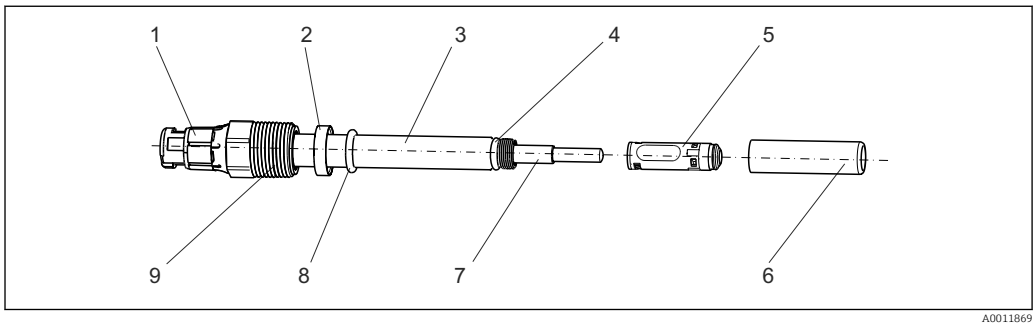
Yes, max. 140 °C (284 °F) (COS22/22D-*1/3)

**Autoclavability**

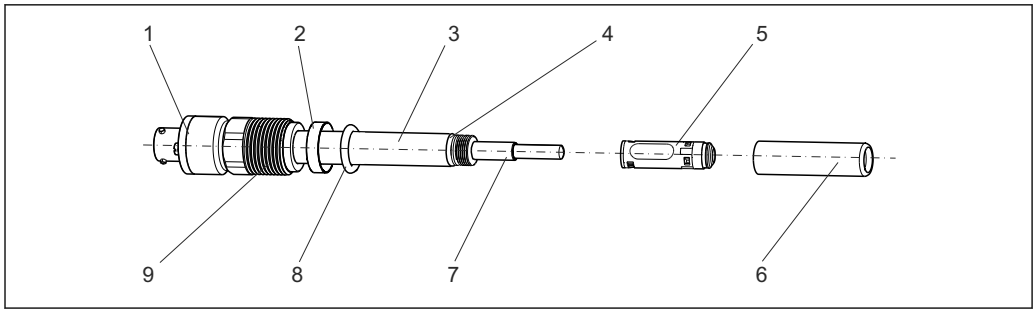
Yes, max. 140 °C (284 °F), max. 30 min. (COS22/22D-*1/3)

# Mechanical construction

**Design**



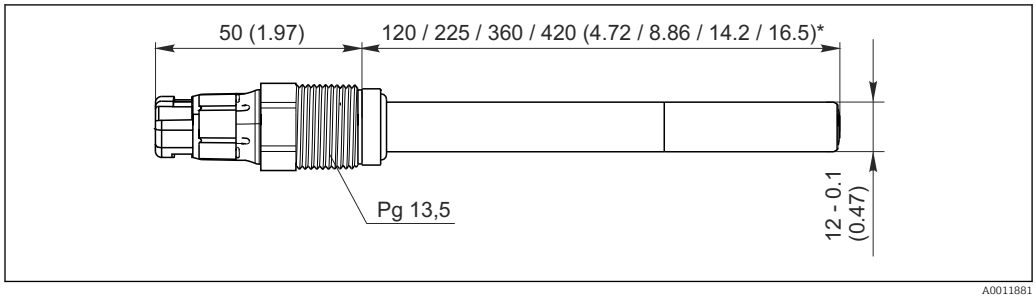

*6 COS22D*



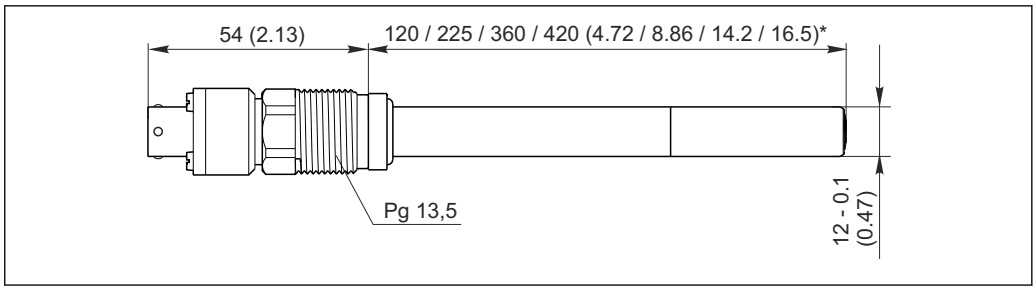

*7 COS22*

| | | | | | |
|---|---|---|---|---|---|
| *1* | *Plug-in head* | *4* | *O-ring 8.5 x 1.5 mm* | *7* | *Glass portion 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* |

**Dimensions**

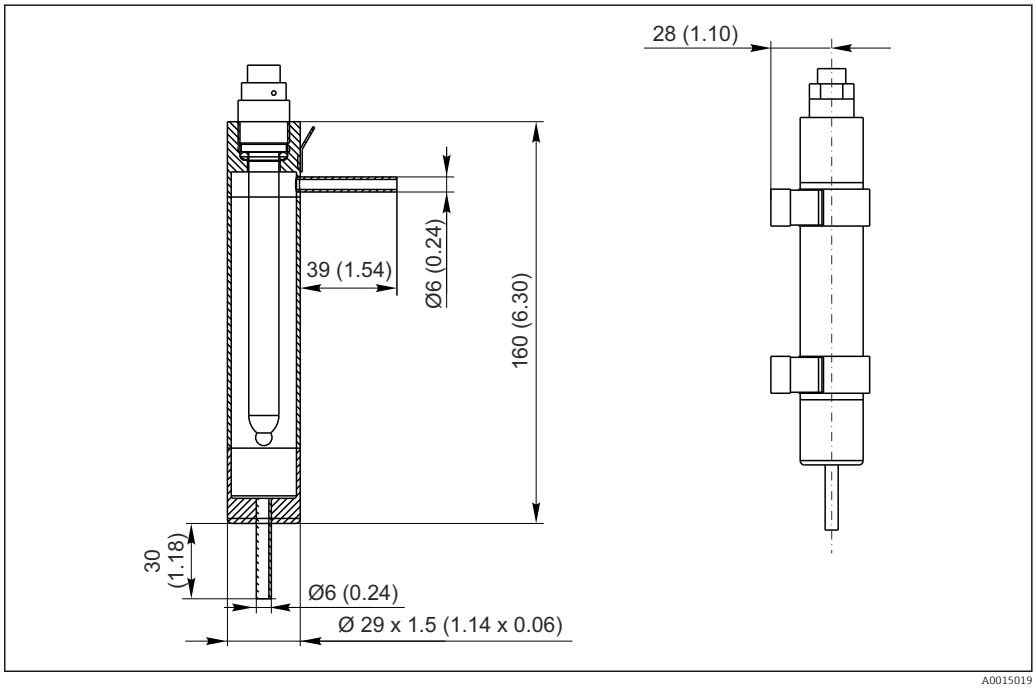



*8 Dimensions in mm (inch)*




*9 Dimensions in mm (inch)*

**Flow assembly for sensors with Ø 12 mm (accessories)**




*10 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)<br>Titanium<br>Alloy C22 |
| Electrode combination | COS22/22D-*1/3: silver / platinum<br>COS22D-*4: silver / gold |
| Process seal | VITON (FDA-compliant) |
| Process seal for ATEX/FM/CSA/NEPSI/TIIS | VITON (not FDA-compliant) |
| Seals/O-rings | VITON (FDA-compliant) |
| Membrane body, sealing ring for shaft sleeve | Perfluoroelastomer with USP88 Class VI |
| Membrane | Silicone (FDA-compliant, in compliance with USP87/88 class VI), PTFE, steel mesh |

**Process connection**

Pg 13.5

**Surface roughness**

$R_a$ < 0.38 µm

**Temperature sensor**

NTC 22 kΩ

| | | |
|---|---|---|
| **Electrolyte** | COS22/22D-*1 (standard sensor): | Slightly alkaline electrolyte |
| | COS22/22D-*3 (trace sensor): | Neutral electrolyte |
| | COS22D-*4 (trace sensor, gold): | Slightly alkaline electrolyte |

# Certificates and approvals

**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 EC directives. The manufacturer confirms successful testing of the product by affixing to it the CE mark.

**Ex approvals**

**Version COS22D-BA**
ATEX II 1G / IECEx Ex ia IIC T3/T4/T6 Ga
FM/CSA IS/NI Cl.1 Div.1 GP: A-D

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

**Version COS22D-TA**
TIIS Ex ib IIC T4

**Material certificates**

**Manufacturer declaration of FDA compatibility**

The manufacturer declares the use of FDA-listed materials.
Ask your Sales Center for the certificates.

| Product | FDA certificate for |
|---|---|
| COS22/22D-****22 | Membrane, O-rings, process seal |
| COS22Z-*2*2 | Membrane, O-rings, process seal |
| COS22/22D-****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 (e.g. CPA442). Doing so will sufficiently separate the process from the Ex connection.

**Material test certificate**

A test certificate 3.1 in accordance with EN10204 is supplied depending on the version (→ Product Configurator on the product page).

**EHEDG**

Compliance with EHEDG's criteria for hygienic design
- TÜV Rheinland, Apeldorn, Netherlands
- Certificate type: Type EL Class I

# Ordering information

**Product page**

www.endress.com/cos22

www.endress.com/cos22d

**Product Configurator**

The navigation area is located on the right of the product page.

1. Under "Device support" click "Configure your selected product".
   ↳ 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 at the top of the screen.

**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

# 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 office.

**Assemblies (selection)**

**Cleanfit CPA875**
- Retractable process assembly for sterile and hygienic applications
- For in-line measurement with standard 12 mm sensors for parameters such as pH, ORP and 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 120 mm sensors 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. Order No.: 71042404

**Measuring cable**

**Cable for COS22D**

**CYK10 Memosens data cable**
- 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

**Cable for COS22**

**COK21**
- Cable length 3 m (9.8 ft)
  Order No. 51505870
- Cable length 10 m (33 ft)
  Order No. 51505868

**Zero-point gel**

**COY8**
Zero-point gel for oxygen sensors
- Oxygen-depleting gel for test purposes
- Product Configurator on the product page: www.endress.com/coy8

Technical Information TI01244C

**Maintenance kit**

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