

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

- Pharmaceuticals 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

Function and system design

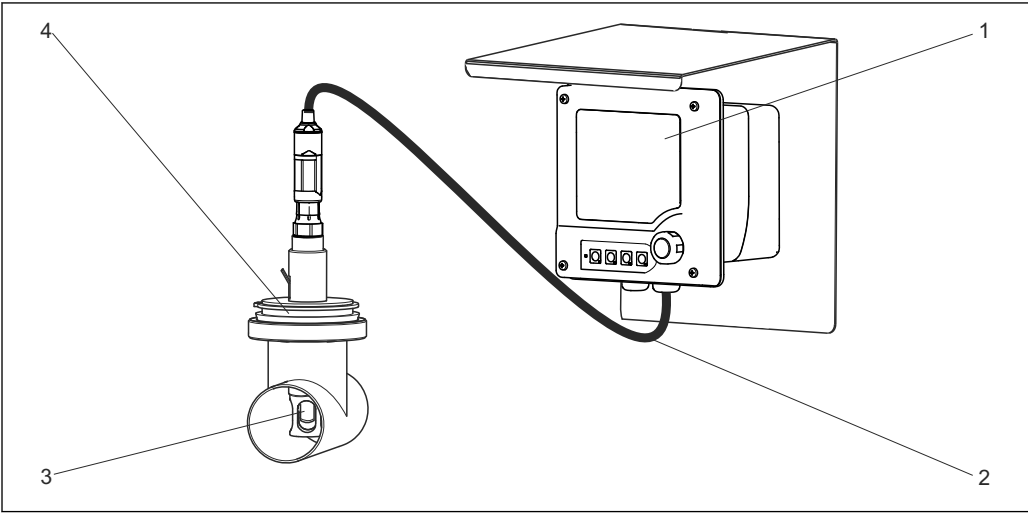
Measuring principle The oxygen molecules that diffuse through the membrane are reduced at the cathode to hydroxide ions (OH⁻). At the anode, silver is oxidized to silver ions (Ag⁺) (this forms a silver halide layer). A current flows due to the electron donation at the cathode and the electron acceptance 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:

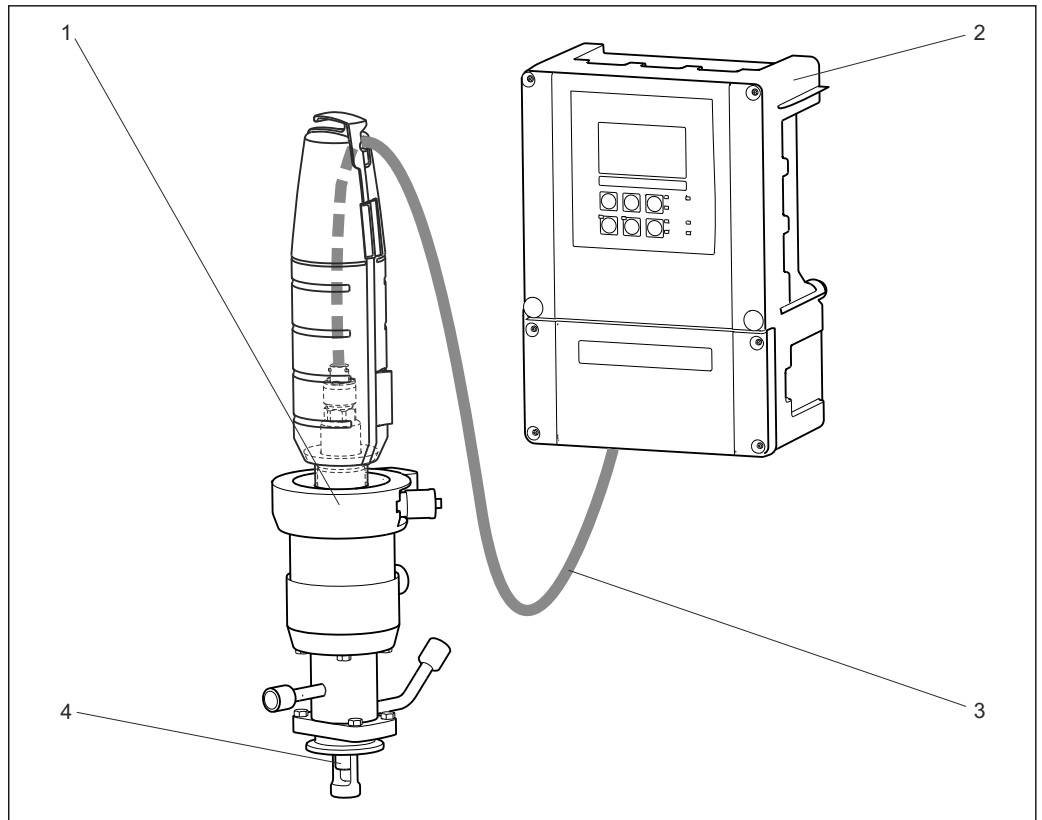
- An Oxymax COS22 or Oxymax COS22D oxygen sensor
- A transmitter, see table
- An appropriate measuring cable, see table
- Optional: an assembly, e.g. permanent installation assembly CPA442, flow assembly CPA240, or retractable assembly CPA875

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



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- 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



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■ 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 0 to 600 % SAT 0 to 1200 hPa (0 to 6 psi) 0 to 100 Vol%	0.01 to 20 mg/l 0 to 200 % SAT 0 to 400 hPa (0 to 6 psi) 0 to 40 Vol%
COS22/22D-*3 COS22D-*4	0.001 to 10 mg/l 0 to 120 % SAT 0 to 250 hPa (0 to 6 psi) 0 to 25 Vol%	0.001 to 2 mg/l 0 to 20 % SAT 0 to 40 hPa (0 to 6 psi) 0 to 4 Vol%

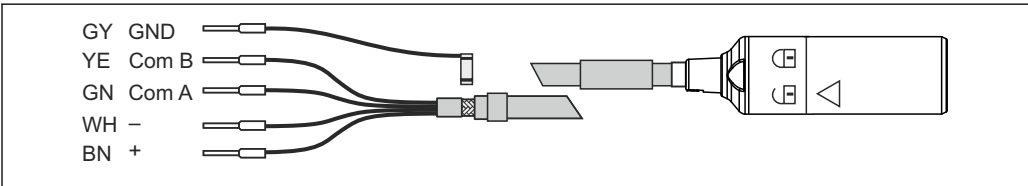
1) Applications in this range guarantee a long service life and minimum maintenance

Power supply

Electrical connection

COS22D

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

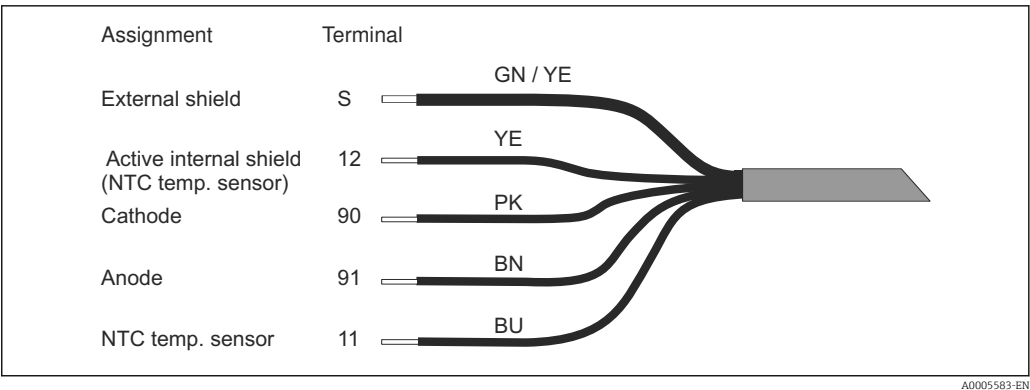


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3 Measuring cable CYK10

COS22

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



4 Measuring cable COK21

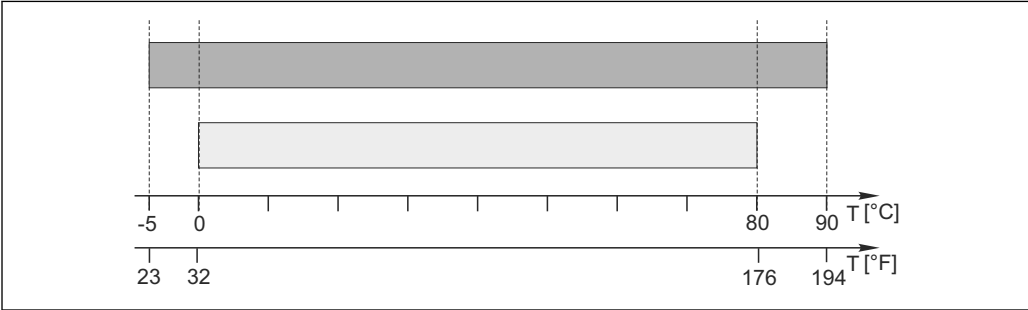
The polarization voltage must be set at the transmitter as follows:
 Standard measuring range: -650mV
 Trace measuring range: -550mV
 The voltage is applied between the working electrode (cathode) and the reference electrode (anode).

Performance characteristics

Response time	From air to nitrogen at reference operating conditions: ■ 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	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):	$\leq \pm 1$ % of measuring range + 10 ppb *
	COS22/22D-*3, COS22D-*4 (trace sensor):	$\leq \pm 1$ % of measuring range + 1 ppb *
	* at reference operating conditions	
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	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.

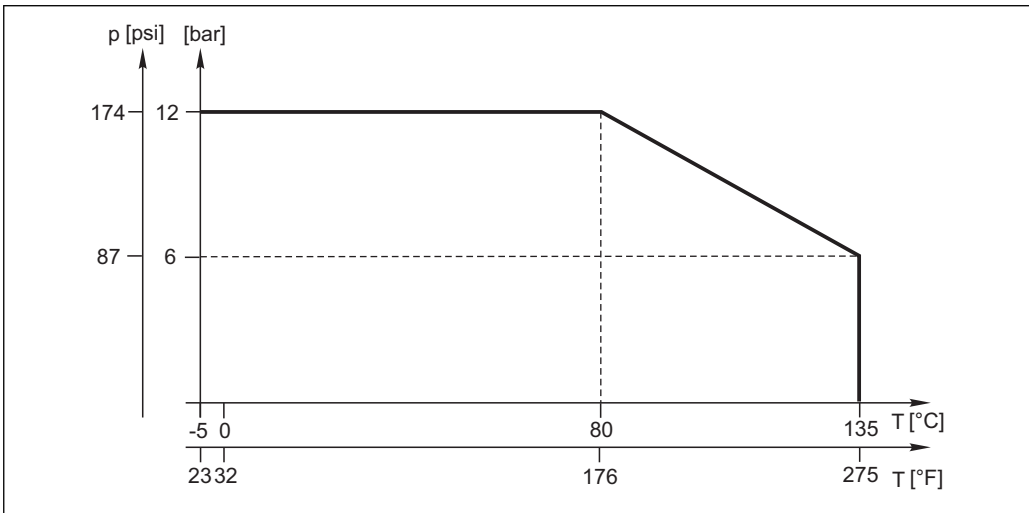
Environment

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



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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) ■ CO₂ up to 100 %, only with trace sensor COS22/22D-*3	

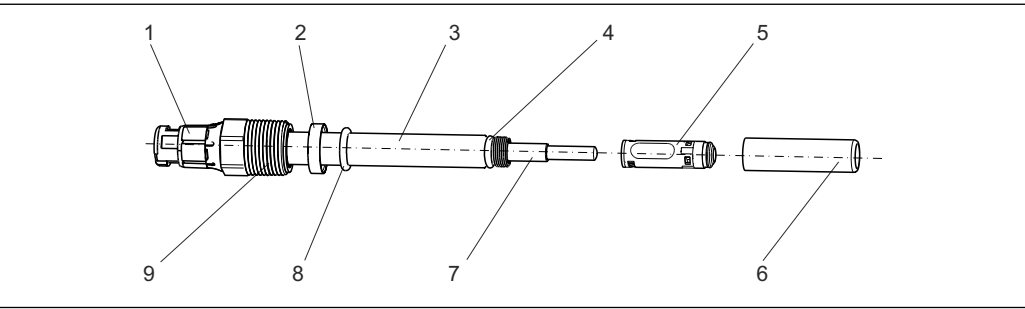
NOTICE

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.

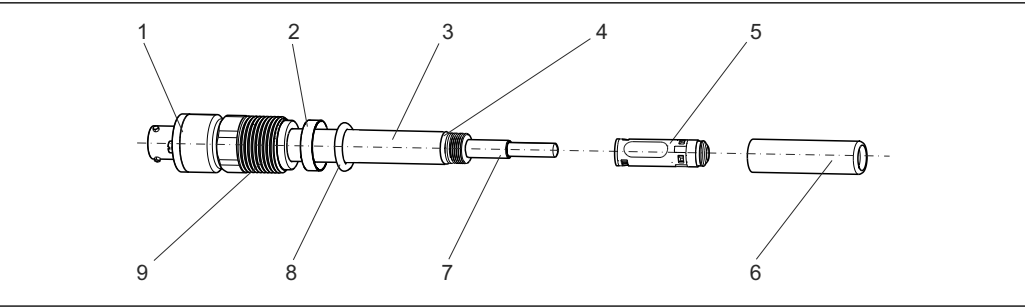
Cross-sensitivity	COS22/22D-*1/3 Molecular hydrogen causes false low readings and can, in a worst-case scenario, result in total failure of the sensor. No cross interference from hydrogen with the COS22D-*4 version.
CIP compatibility	Yes (COS22/22D-*1/3)
SIP compatibility	Yes, max. 140 °C (284 °F) (COS22/22D-*1/3)
Autoclavability	Yes, max. 140 °C (284 °F), max. 30 min. (COS22/22D-*1/3)

Mechanical construction

Design



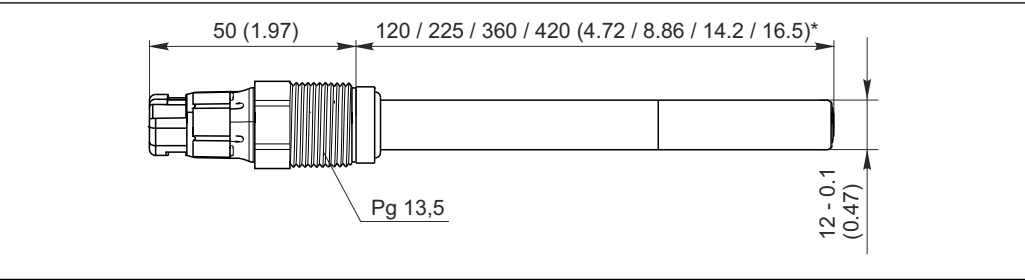
6 COS22D



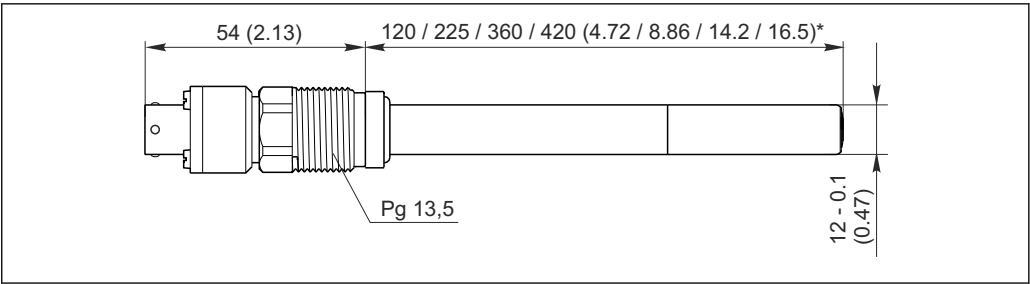
7 COS22

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|-----------------|-----------------------|--|
| 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



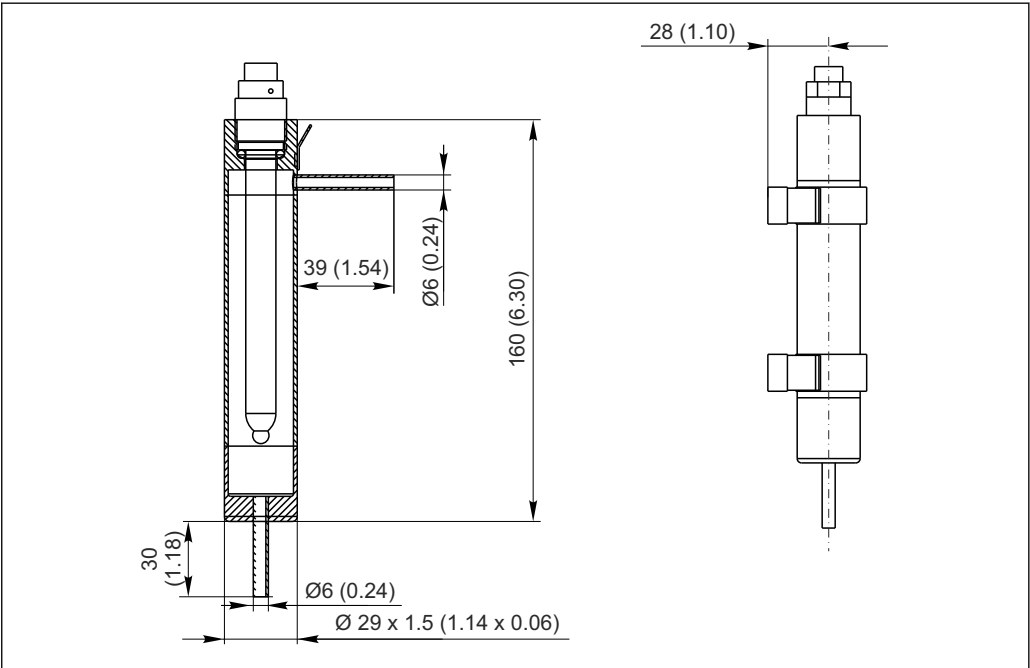
8 Dimensions in mm (inch)



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9 Dimensions in mm (inch)

Flow assembly for sensors with Ø 12 mm (accessories)



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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) Titanium Alloy C22	
	Electrode combination	COS22/22D-*1/3: silver / platinum COS22D-*4: silver / gold	
	Process seal	VITON (FDA-compliant)	
	Process seal for ATEX/FM/CSA/NEPSI/IIIS	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.
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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
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Material certificates	Manufacturer declaration of FDA compatibility The manufacturer declares the use of FDA-listed materials. Ask your Sales Center for the certificates.
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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
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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 pharmaceuticals
- 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.: 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"

www.addresses.endress.com