

# Dissolved Oxygen Measurement *COS 4 / COS 4HD*

## Membrane-covered amperometric sensor



### Areas of application

The continuous measurement of the dissolved oxygen concentration in water plays an important role in many areas of water economy:

- Measurement of O<sub>2</sub> content in activated sludge basins. Here, the measuring signal is used for monitoring and as a control parameter.
- Checking the O<sub>2</sub> content in sewage treatment plant effluent
- Monitoring of public waters, e.g. rivers, lakes and sea
- Measurement and control of O<sub>2</sub> content in fish ponds and fresh or salt water fishfarming
- Water treatment, e.g. oxygen enrichment of drinking water.

Measured errors result in increased cost (e.g. of oxygenation), insufficiently clarified wastewater and fish mortality.

Depending on the application, two different versions are available:

- COS 4: standard, for applications with low to medium load regarding H<sub>2</sub>S or NH<sub>3</sub>
- COS 4HD: for applications with high load regarding H<sub>2</sub>S or NH<sub>3</sub>.

### Features and benefits

- High O<sub>2</sub> selectivity due to membrane-covered sensor
- Minimum maintenance overheads
- Superior accuracy and reliability
- High degree of long-term stability
- Easy calibration (quick calibration)
- Sensor and process monitoring in connection with the transmitter provides optimum protection against measured errors.

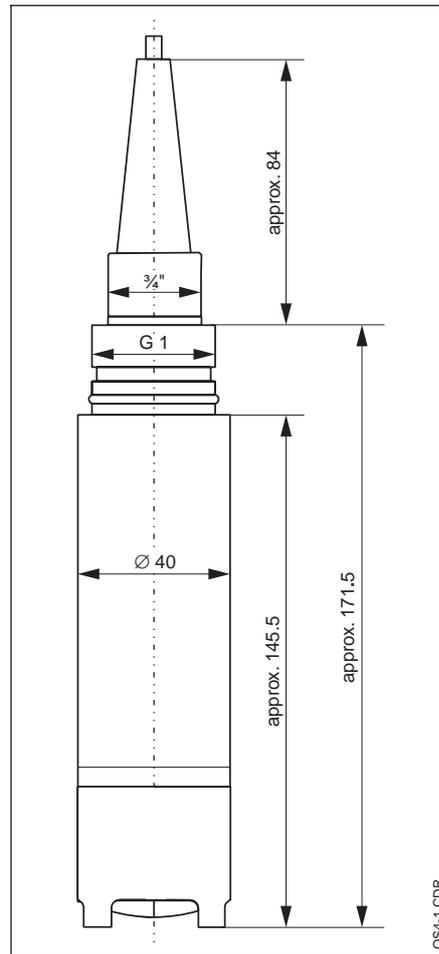
Endress + Hauser

The Power of Know How



## Dimensions and operating principle

Dimensions of  
COS 4 / 4HD



Oxygen is present in the medium as a physically dissolved gas and is transported towards the membrane by the required flow. The materials used and the manufacturing method of the membrane allow only dissolved gases to pass through but no liquid constituents. Dissolved salts and ionic substances are also held back so that with a membrane-covered sensor, in contrast to the open measuring principle, there is no influence of the medium conductivity on the measuring signal.

The oxygen molecules diffusing through the membrane are reduced to hydroxide ions ( $\text{OH}^-$ ) at the gold cathode. At the anode, silver is oxidised to silver bromide (COS 4) or silver chloride (COS 4HD). The resulting electron release at the gold cathode and electron acceptance at the anode produce a current flow that is proportional to the external oxygen concentration in the medium under constant conditions.

The current is converted in the measuring instrument and indicated on the display as the dissolved oxygen content in mg/l or oxygen saturation index value in % SAT.

## Sensor monitoring

In connection with the transmitter, a special sensor check system (SCS) automatically detects errors at the sensor and generates an error message immediately:

- Cable interruption or short-circuit
- Too high or too low measured values
- Sensor passivation, i.e. no or just very inert change of the measuring signal in spite of external oxygen content change in the medium.

## Special technical features

- Alarm messages in connection with the transmitter
- Zero calibration not required
- Exact, automatic calibration using the transmitter
- Lower measuring range limit typically 0.05 mg/l  $\text{O}_2$
- Extremely rugged "elephant skin" membrane

- Minimum flow rate only 0.005 m/s
- Easy membrane replacement due to ready-made exchangeable cap
- Electrolyte reservoir permits 5 years of operation without refilling (COS 4 / 4HD with air-saturated water in quality of drinking water)
- Max. permissible overpressure 3 bar (on membrane side)
- Long operating time due to use of high-quality materials.

## Measuring system

The operative measuring system consists of:

- Oxygen sensor COS 4 with transmitter Liquisys COM 221 / 252 or Liquisys S COM 223 / 253
- or
- oxygen sensor COS 4HD with transmitter Liquisys S COM 223 / 253
- Universal suspension assembly holder CYH 101 for immersion operation

- Immersion assembly COA 110 or CYA 611 or flow assembly COA 250 or retractable assembly COA 461
- Corresponding mounting accessories. Additionally recommended under extreme operating conditions:
- Automatic spray cleaning system Chemoclean.

# Technical data

## General specifications

Manufacturer	Endress+Hauser
Product designation	COS 4 / COS 4HD

## Mechanical data

Measuring principle	membrane-covered amperometric sensor
Materials	sensor body: PBT; membrane cap: PEEK
Operating time of one filling with COY 3-F (COS 4) or COY 3HD-F (COS 4HD)	max. 5 years (theoretical electrolytic reserve with air saturation at 20 °C)
Membrane thickness	approx. 50 µm
Threaded connections	G 1 and NPT 3/4"
Electrical connection	double-screened coaxial cable with 2 auxiliary cores, clamped connection
Cable lengths	7 m, 15 m
Max. total cable length with cable extension	50 m
Weight without packing (with cable length)	0.7 kg (7 m) or 1.1 kg (15 m)

## Measuring range

Lower measuring range limit	0.070 mg/l at 5 °C 0.035 mg/l at 20 °C 0.015 mg/l at 40 °C
Upper measuring range limit	20 mg/l
Temperature compensation	with NTC temperature sensor, 0 ... 50 °C

## Operating data

Response time	90% of upper range-value after 3 min at 20 °C 99% of upper range-value after 9 min at 20 °C
Polarisation time	< 60 min
Minimum flow velocity	typically 0.5 cm/s for 95% measured value display
Sensor monitoring	in connection with the transmitter: cable interruption or short-circuit, measured error and sensor passivation
Drift	under continuous polarisation: < 1%/month
Zero current	none

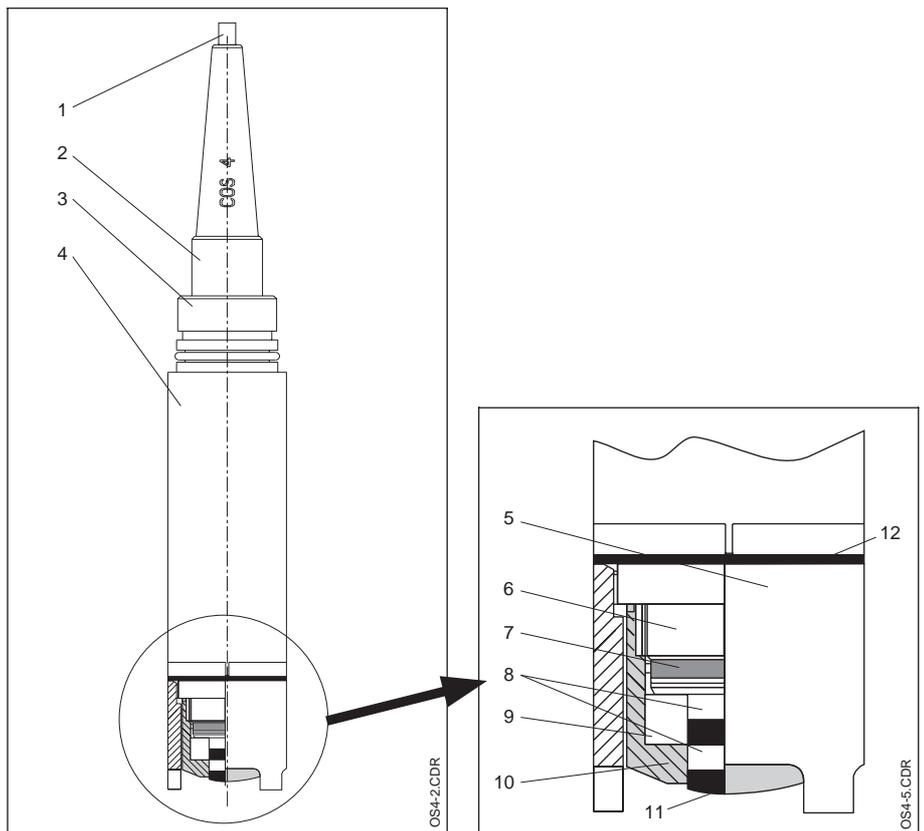
## Temperature and pressure

Max. permissible overpressure (membrane side)	3 bar
Max. permissible overpressure (cable side)	1 bar
Ingress protection	IP 68
Nominal operating temperature	-5 ... 50 °C
Storage temperature	filled: -5 ... 50 °C, unfilled: -20 ... 60 °C
Temperature compensation	with NTC temperature sensor, 0 ... 50 °C

Subject to modifications.

## Design

- COS 4 / 4HD:
- 1 Sensor cable
  - 2 NPT 3/4" thread
  - 3 G 1 thread
  - 4 Sensor body
  - 5 Protection guard
  - 6 Thrust collar
  - 7 Trapezoid sealing ring
  - 8 Anode made of silver/silver bromide (COS 4) or silver/silver chloride (COS 4HD)
  - 9 Electrolyte
  - 10 Membrane cap
  - 11 Gold cathode
  - 12 Red colour ring (COS 4HD only)



## Product structure

Oxygen sensor COS 4 / COS 4HD	
<b>Cable length</b>	
2	7 m
4	15 m
↓	
<b>COS 4-</b>	<input type="text"/> <b>complete order code</b>
or	
<b>COS 4HD-</b>	<input type="text"/> <b>complete order code</b>

## Accessories

- COY 3-WP**  
2 ready-made exchangeable cartridges with pre-tensioned membrane for COS 4  
Order No.: 50053348
- COY 3-F**  
Filling electrolyte for COS 4,  
10 plastic ampoules, transparent  
Order No.: 50053349
- COY 3HD-F**  
Filling electrolyte for COS 4HD,  
10 plastic ampoules, red  
Order No.: 51503267
- COY 3-TR**  
Trapezoid seal, 3 pcs., greased,  
for COS 4 / 4HD  
Order No.: 50080252
- COY 3-SK**  
Membrane protection guard for use  
in fish culture basins for COS 4  
Order No.: 50081787
- CMK**  
Special cable for extension between  
sensor and transmitter  
Order No.: 50005374

## Supplementary documentation

- Universal suspension assembly holder CYH 101  
Technical Information No. 50061228
- Immersion assembly COA 110  
Technical Information No. 50057221
- Immersion assembly CYA 611  
Technical Information No. 50085800
- Flow assembly for COA 250  
Technical Information No. 50068520
- Retractable assembly Proffit COA 461  
Technical Information No. 50082361
- Transmitter Liquisys S COM 223 / 253  
Technical Information No. 51500281
- Automatic cleaning system Chemoclean CYR 10 / CYR 20  
Technical Information No. 50014223

Endress+Hauser  
GmbH+Co.  
Instruments International  
P.O. Box 2222  
D-79574 Weil am Rhein  
Germany

Tel. (07621) 975-02  
Fax (07621) 975-345  
<http://www.endress.com>  
[info@ii.endress.com](mailto:info@ii.endress.com)

**Endress + Hauser**  
The Power of Know How

