

# Sterilizable Sensor for Dissolved Oxygen *OxyMax H COS 21*

**Long-term stable sensor for frequent  
sterilization and auto-cleaning**



## **Features and Benefits**

- Sensor in pharmaceutical version, 316L SS
- Short response time, ( $t_{90} < 2$  minutes)
- Wide measuring range (0.01 to 20 mg/l); 1 mg/l  $\approx$  1 ppm
- Versatile through standard process connector, Pg 13.5
- Compatible with all pH electrode holders
- Sterilizable up to 266°F (130°C)
- Integrated temperature sensor

## **Applications**

- Process control in pharmaceutical production
- Food industry
- Biotechnological production

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## Function and system design

### Measuring principle

The OxyMax H COS 21 measures the partial pressure of dissolved oxygen in liquids. The main applications are in biotechnology, pharmaceutical production, and the food industry.

The oxygen dissolved in the analysis medium is transported to the membrane by the necessary flow. The membrane is only permeable to dissolved gases. Other substances dissolved in the liquid phase (e.g. ionic substances), will not penetrate the membrane. Therefore, medium conductivity does not impact the measuring signal.

When the sensor is connected to the measuring transmitter, a fixed external voltage is applied between the cathode and anode. The resulting polarization current is indicated on a display on the measuring transmitter. The current starts high but then drops over time. At the end of polarization, the measuring current in an oxygen-free medium is 0 nA.

The oxygen molecules diffused through the membrane are reduced to hydroxide ions (OH<sup>-</sup>) at the platinum cathode. Silver is oxidized to silver ions (Ag<sup>+</sup>) at the anode. The resulting current flow from the anode to the cathode is proportional to the oxygen content in the measuring medium when the medium is in equilibrium. This current flow is converted in the measuring transmitter and indicated on the display as an oxygen concentration in mg/l (ppm) or a saturation index in % SAT.

### Measuring system

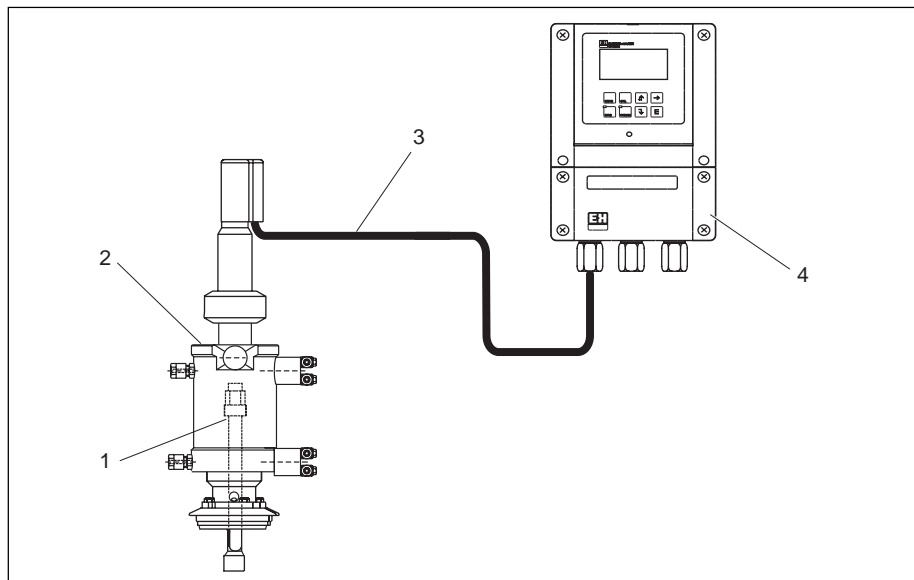
The complete measuring system consists of:

- Oxyen sensor, COS 21
- Measuring cable, COK 21
- Measuring transmitter: Liquisys M CPM 223 F (panel mount) or Liquisys M CPM 253 F (field mount enclosure).

Additional accessories available depending on application:

- Retractable electrode holder, Cleanfit CPA 475

The diagram below is an example of a complete measuring system.



*pH measuring system*

- 1 COS 21 Oxygen sensor
- 2 Cleanfit CPA 475 Electrode holder
- 3 COK 21 Measuring cable
- 4 Liquisys S COM 253 F Measuring transmitter

### Measured variable

Dissolved oxygen (temperature compensation)

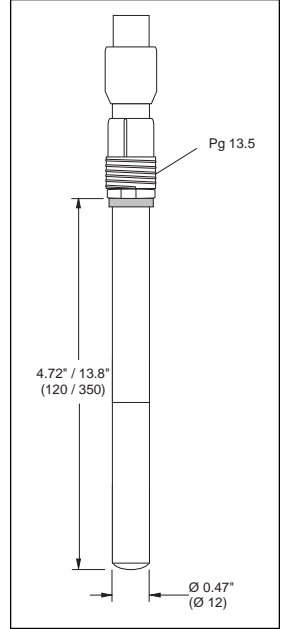
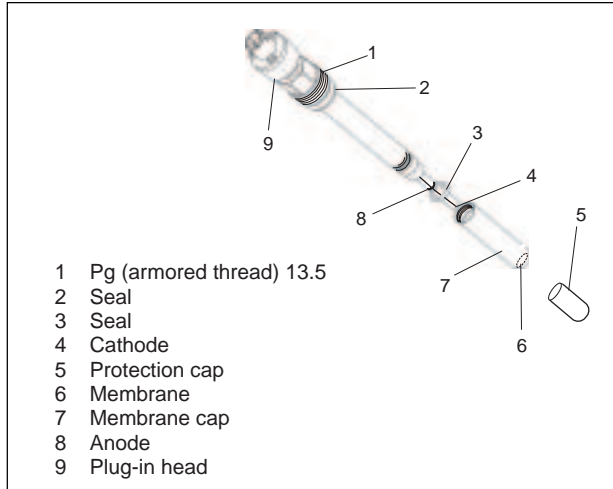
### Measuring range

0.01 to 20 mg/l (1 mg/l  $\cong$  1 ppm) and 0 to 200% saturation

## Mechanical construction

### Dimensions and mounting details

Shaft diameter: 12 mm  
 Installation length: 120 mm or 350 mm



### Weight

3.5 oz. (0.1 kg)

### Materials

Electrode shaft: 316L SS  
 Electrode combination: Ag/ Pt  
 Sealing ring: Viton®  
 Membrane: Optiflow®

### Temperature sensor

NTC 22 KΩ

### Process connection

Pg 13.5

### Electrolyte

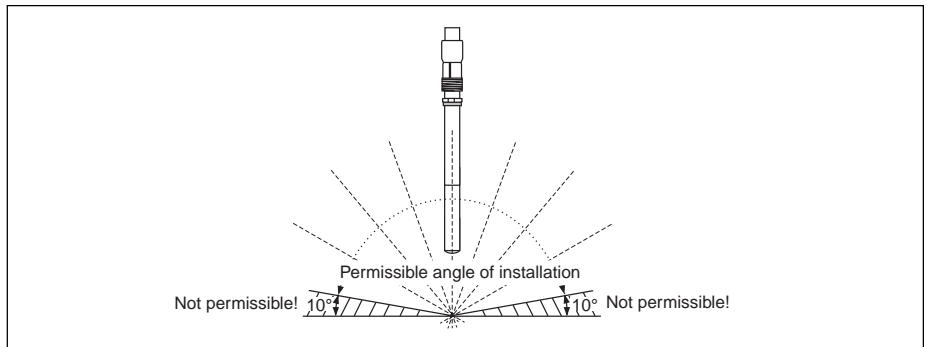
Alkaline saline solution

## Operating conditions (installation)

### Installation guidelines

Do NOT install the electrode overhead. The installation angle must be at least 10° from the horizontal.

Before installing the electrode into a holder, remove the protective cap. The sensor will not function with cap installed. Retain cap for calibration and/or sensor removal.



*Electrode installation*

**NOTE:** Refer to the operation instructions for the electrode holder used for proper installation.

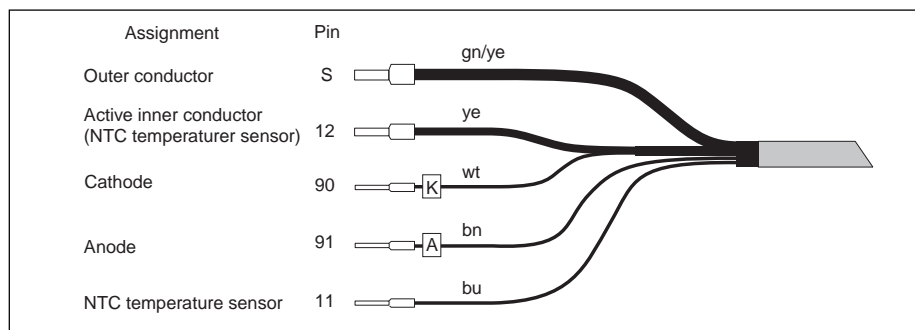
Avoid any ingress of humidity in the sensor electrical head, only use the sensor within specified limits.

**WARNING!**

To avoid injury due to chemical burns, avoid contact of alkaline electrolytes with skin, eyes, and mucous membranes. Always wear protective gloves and goggles when handling electrolyte.

## Wiring

The electrical connection between the sensor and measuring transmitter uses a multi-wire special cable COK 21. Refer to the specified transmitter wiring information for cable connection to the transmitter.



## Calibration

### Calibration preparation

The COS 21 requires calibration after:

- First start-up
- Replacement of the membrane or electrolyte
- Cleaning of the platinum cathode
- Long periods in the process without power
- Pre-determined time intervals, dependent on operating frequency

To prepare the COS 21 for calibration:

- Remove the sensor protective cap.
- Place the externally dry sensor in atmospheric air. Use a fixture to hold the sensor vertical over a pan of water. The air above the water should be saturated with water vapor. Install the sensor as close to the water surface as possible. When calibrating the sensor membrane, make sure the membrane is dry. Avoid any contact with the water surface.
- Connect the sensor to the transmitter and turn the transmitter on.
- When the sensor is connected to the Liquisys COM 223/253 F, polarization is performed automatically after power up. The voltage polarization is adjusted at the factory. If other transmitters are used, apply a polarization voltage of  $-670 \text{ mV} \pm 50 \text{ mV}$ .
- Polarization takes approximately two hours. At the beginning of polarization, the display indicates a high reading and slowly drops until the display is practically constant. Once the display has stabilized, the polarization function is complete.

### Calibration in air

You can calibrate the sensor in air-saturated water or in air saturated with water vapor. Calibration is recommended in air saturated with water vapor.

- Place the polarized externally dry sensor next to water (as described above).
- Follow the calibration procedures as outlined in the Operation Instructions for the specified analyzer transmitter.

**NOTE:** Comply with the instructions for start-up and calibration as described in the transmitter Operating Instructions.

## Maintenance

### Sensor inspection

Inspect the COS 21 sensor regularly as follows:

- Check the calibration value (polarized sensor, with air saturated with water vapor, 100% Saturated - refer to "Calibration in Air").
- Test the zero current in an O<sub>2</sub> zero calibration solution or in a nitrogen atmosphere (refer to Ordering Information). The measured variable must drop below 2% SAT within one hour. Causes for excessively high zero current include depleted electrolyte or a damaged membrane. In this case, replace the electrolyte and membrane as described below.
- If the response time is too long, or the measuring current is too low, replace the electrolyte first. If the problem is not eliminated, replace the electrolyte and membrane. Follow the instructions below for electrolyte and membrane replacement.

**NOTE:** If the problem persists, this indicates that the cathode is contaminated. In this case, clean the cathode and the face of the glass rod surrounding the cathode with a polishing cloth (contained in Service kit, Order No. 51505874). Holding the polishing cloth in one hand, press the glass rod in the cloth with the other hand, rotating it 10 or 20 times. Wash the glass rod with running water and carefully dry.

#### CAUTION!

Do not touch the anode wire! Avoid applying any pressure to the sides of the glass rod.

### Replacing electrolyte and glass membrane

Replacement of the electrolyte and membrane (Service Kit, order No. 51505874) is described as follows:

#### WARNING!

To avoid injury due to chemical burns, avoid contact of alkaline electrolytes with skin, eyes, and mucous membranes. Always wear protective gloves and goggles when handling electrolyte.

- Hold sensor with the with electrical plug-in head up vertically and unscrew the membrane cap.
- Carefully dry the glass rod with a piece of felt cloth.
- Inspect o-ring at the top of the glass. If damaged, replace o-ring.
- Use a pipette to fill the new membrane cap with 1.5 ml electrolyte (Order No. 51505873).
- Carefully screw the membrane cap onto the sensor shaft. Rinse any overflow of electrolyte with water.
- Calibrate sensor and reinstall into process.

## Performance characteristics

### Reference operating conditions

Reference temperature, 77°F (25°C)  
Reference pressure, 14.7 psia (1013 hPa)  
Flow, 0.09 ft/s (0.03 m/s) minimum

### Maximum measured error

± 1% of measured value, according to IEC 746-1  
Sensitivity, 40 to 80 nA, minimum 0.01 mg/l (1 mg/l ≙ 1 ppm)

### Non-repeatability

± 0.05% of measured value

### Polarization voltages

-670 ± 50 mV

### Polarization time

Maximum 2 hours

### Long-term drift

Zero point drift, < 0.1% per week at 86°F (30° C) and constant conditions  
Measuring range drift, < 0.1% per week at 86°F (30° C) and constant conditions

### Influence of medium on temperature

Approximately 3.1% per K (compensated by the transmitter)

### Influence of measuring medium pressure

Pressure compensation not required

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<b>Response time <math>t_{90}</math></b>	< 120 seconds at 77°F (25°C), from air to nitrogen
<b>Residual current</b>	<0.1% of current in air
<b>Internal oxygen consumption</b>	Approximately 20 ng/h in air at 77°F (25°C)

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### Operating conditions (environment)

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<b>Ambient temperature</b>	14° to 140°F (-10° to 60°C)
<b>Storage temperature</b>	14° to 140°F (-10° to 60°C)
<b>Measuring temperature</b>	32° to 122°F (0° to 50°C)

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CAUTION! Do not allow sensor to dry out! Store the sensor with the protection cap filled with 0.02 N NaOH.

### Operating conditions (process)

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<b>Process conditions</b>	Process temperature range, 32° to 266°F (0° to 130°C) Process pressure range, 0 to 58 psi (0 to 4 bar)
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**Sterilization** When autocleaning the COS 21, place the cap on the electrical plug-in head tightly to avoid ingress of moisture. Plug-in head protection is not required when the sensor is sterilized while still in the process.

**NOTE:** If water penetrates the plug-in head, it must be dried with warm or compressed air to prevent corrosion or contact problems.

## Ordering information

### COS 21 sensor

COS 21 -  1  2  3

- 1 Immersion depth  
 1 120 mm  
 2 225 mm  
 3 350 mm  
 5 120 mm, 3.1B certificate  
 6 225 mm, 3.1B certificate  
 7 350 mm, 3.1B certificate
- 2 Plug-in head  
 K Standard O<sub>2</sub> plug-in head
- 3 Membrane cap  
 0 Basic hygienic version

## Accessories

<b>Membrane replacement kit</b>	Service kit containing 3 membrane caps, set of o-ring seals, replacement electrolyte, and polishing cloth	Order No.: 51505874
<b>Electrolyte</b>	50 ml refill bottle	Order No.: 51505873
<b>Calibration solution</b>	O <sub>2</sub> calibration solution	Order No.: 50001041
<b>Sensor cable</b>	COK 21, 3 ft (1 m) COK 21, 10 ft (3 m) COK 21, 16 ft (5 m) COK 21, 33 ft (10 m)	Order No.: 51505871 Order No.: 51505870 Order No.: 51505869 Order No.: 51505868
<b>Autoclean accessories</b>	Protective cap for electrical plug-in head	Order No.: 51505872
<b>Electrode holders</b>	Cleanfit CPA H 475 Unifit H CPA 440 (120 mm electrodes) Proffit H CPA 465 Refer to the Technical Information listed below for sensor holder specifications.	

## Supplemental Documentation

- COM 223/253F Liquisys M Transmitter  
 CPA 475 CleanFit P Holder, TI 240C/24/ae  
 CPA 465 Proffit Sensor Holder, TI 146C/24/ae

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**United States**

Endress+Hauser, Inc.  
2350 Endress Place  
Greenwood, IN 46143  
Phone: (317) 535-7138  
888-ENDRESS  
FAX: (317) 535-8498

**Canada**

Endress+Hauser  
Canada Ltd.  
1440 Graham's Lane  
Unit 1, Burlington  
ON, L7S 1W3  
Phone: (905) 681-9292  
800-668-3199  
FAX: (905) 681-9444

**Mexico**

Endress+Hauser  
Paseo del Pedregal No. 610  
Col. Jardines del Pedregal  
01900, Mexico D.F.  
Mexico  
Phone: (525) 568-2405  
FAX: (525) 568-7459

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