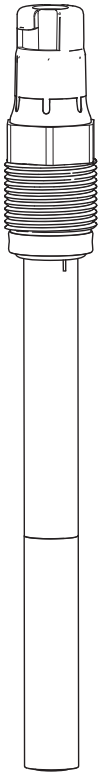
Level Pressure Flow Temperature Liquid Analysis Registration Systems Components Services Solutions

Operating Instructions

Oxymax COS22

Dissolved oxygen sensor



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People for Process Automation

Notes for using this manual

Warning instructions and their meaning

The structure, signal words and safety colors of the signs comply with the specifications of ANSI Z535.6 ("Product safety information in product manuals, instructions and other collateral materials").

Safety message structure	Meaning
⚠ DANGER **Cause (/consequences)** Consequences if safety message is not heeded ► Corrective action	This symbol alerts you to a dangerous situation. Failure to avoid the situation **will** result in a fatal or serious injury.
⚠ WARNING **Cause (/consequences)** Consequences if safety message is not heeded ► Corrective action	This symbol alerts you to a dangerous situation. Failure to avoid the situation **can** result in a fatal or serious injury.
⚠ CAUTION **Cause (/consequences)** Consequences if safety message is not heeded ► Corrective action	This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in minor or medium injury.
NOTICE **Cause/situation** Consequences if safety message is not heeded ► Action/note	This symbol alerts you to situations that can result in damage to property and equipment.

Cross reference symbols

→ 1 This symbol indicates a cross reference to a defined page (e.g. p. 1).

→ 2 This symbol indicates a cross reference to a defined figure (e.g. fig. 2).

Table of contents

1 Safety instructions

1.1 Designated use

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

The specific suitability depends on the sensor design:
- COS22-1 (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
- COS22-3 (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.

► Do not use the sensor in media containing hydrogen.

Any other use than the one described here compromises the safety of persons and the entire measuring system and is not permitted.
The manufacturer is not liable for damage caused by improper or non-designated use.

1.2 Installation, commissioning and operation

Please note the following items:
- Installation, commissioning, operation and maintenance of the measuring system must only be carried out by trained technical personnel.
  Trained personnel must be authorized for the specified activities by the system operator.
- Electrical connection must only be carried out by a certified electrician.
- Technical personnel must have read and understood these Operating Instructions and must adhere to them.
- Before commissioning the entire measuring point, check all the connections. Ensure that electrical cables and hose connections are not damaged.
- Do not operate damaged products and secure them against unintentional commissioning. Mark the damaged product as being defective.
- Measuring point faults may only be rectified by authorized and specially trained personnel.
- If faults can not be rectified, the products must be taken out of service and secured against unintentional commissioning.
- Repairs not described in these Operating Instructions may only be carried out at the manufacturer's or by the service organization.

1.3 Operational safety

The sensor has been designed and tested according to the state of the art and left the factory in perfect functioning order.
Relevant regulations and European standards have been met.

As the user, you are responsible for complying with the following safety conditions:
- Installation instructions
- Local prevailing standards and regulations.

1.4 Return

If the sensor has to be repaired, please return it *cleaned* to the sales center responsible.
Please use the original packaging, if possible.

Before returning the device, please clarify all formalities – such as obtaining an identification number – with your sales center.
Please enclose the completed "Declaration of Hazardous Material and De-Contamination" (copy the second last page of these Operating Instructions) with the packaging and the transportation documents.
No repair without completed declaration!

2 Identification

2.1 Order code

To find out the version of your device, enter the order code indicated on the nameplate in the search screen at the following address: www.products.endress.com/order-ident

2.2 Scope of delivery

The following items are included in the delivery:
- Oxygen sensor with tap water filled cap for membrane protection
- Electrolyte, 1 bottle, 10 ml (0.34 fl.oz.)
- Brief Operating Instructions
- Operating Instructions on CD

If you have any questions, please contact your supplier or your local sales center.

2.3 Certificates and approvals

The manufacturer declares the FDA compliance of the materials used.
Ask your local sales center for the certificates.

Product	**FDA certificate for**
COS22-****22	Membrane, O-rings, process sealing
COS22Z-*2*2	Membrane, O-rings, process sealing
COS22-****23	Membrane, O-rings
COS22Z-*2*3	Membrane, O-rings

3 Installation

3.1 Incoming acceptance, transport, storage

- Make sure the packaging is undamaged!
  Inform the supplier about any damage to the packaging.
  Keep the damaged packaging until the matter has been settled.
- Make sure the contents are undamaged!
  Inform the supplier about damage to the contents. Keep the damaged products until the matter has been settled.
- Check that the order is complete and agrees with your shipping documents.
- The packaging material used to store or to transport the product must provide shock protection and humidity protection. The original packaging offers the best protection. Also, keep to the approved ambient conditions (see "Technical data").
- If you have any questions, please contact your supplier or your local sales center.

3.2 Installation conditions

3.2.1 Angle of installation

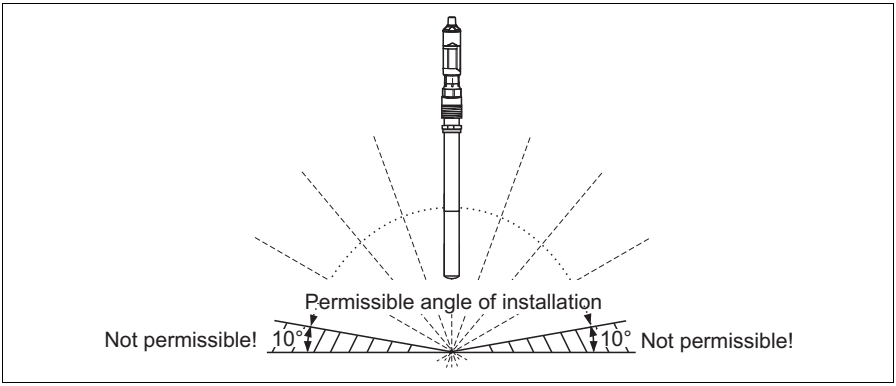

Fig. 1: Permitted angle of installation

The sensor must be installed with an inclination angle of at least 10 ° to the horizontal in an assembly, support or a corresponding process connection. Other inclination angles are not permitted. Do **not** install the sensor overhead.

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

3.2.2 Mounting location

- Select the installation location so that there is easy access for later calibration.
- Make sure that upright posts and assemblies are secured safely and vibration-free.
- Select an installation location which produces a typical oxygen concentration.

3.3 Installation instructions

3.3.1 Measuring system

A complete measuring system comprises:
- A digital oxygen sensor Oxymax COS22
- A transmitter, e.g. Liquisys COM223/253F
- An appropriate measuring cable, e.g. COK21
- Optional: an assembly, e.g. fixed installation assembly CPA442, flow assembly CPA240 or retractable assembly CPA475

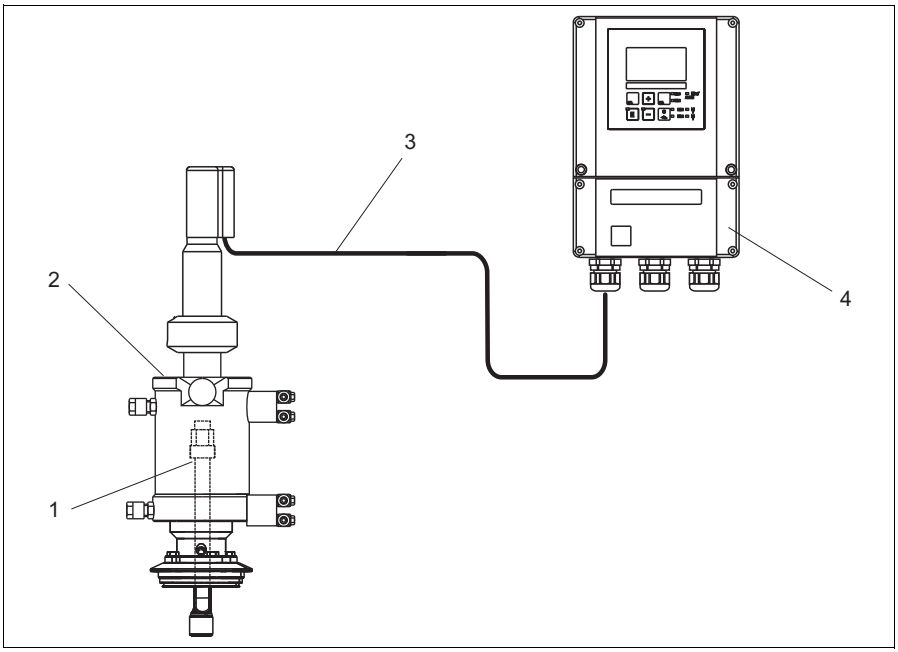

Fig. 2: Example of a measuring system with COS22

1 Oxygen sensor COS22
2 Retractable assembly CPA475
3 Measuring cable COK21
4 Transmitter Liquisys COM253F

3.3.2 Installing a measuring point

⚠ WARNING

Electrical voltage

In the event of a fault, non-grounded metallic assemblies may be under voltage and then are not touchable.

► When using metallic assemblies and installation equipment, observe the national grounding provisions.

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

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

NOTICE

Installation errors

Cable breakage, loss of the sensor, unintended unscrewing of the membrane cap

► Do not install the sensor suspended from the cable.
► Screw the sensor into the assembly so that the cable is not twisted.
► Mounting or dismounting the sensor: hold the sensor body, only turn the threaded plug-in head while screwing the sensor in or out of the assembly. Otherwise you could unscrew the sensor's membrane cap. It will remain in the assembly resp. in the process then.
► Avoid exerting excessive tensile force on the cable (e.g. from jerky pulling).
► Select the installation location so that there is easy access for later calibration.

3.4 Installation examples

3.4.1 Fixed installation (CPA442)

The CPA442 fixed installation assembly allows a sensor to be easily adapted to almost any process connections from Ingold nozzles to Varivent or Triclamp connections.
This type of installation is very suitable for tanks and larger pipes. The sensor achieves a defined immersion depth in the medium in an easy manner.

3.4.2 Flow assembly

CPA240

The CPA240 flow assembly offers up to three installation slots for sensors with a shaft diameter of 12 mm (0.47"), a shaft length of 120 mm (4.72") and a process connection Pg 13.5.
It is very suitable for use in pipes or at hose connections.
During trace measurement in particular, ensure the assembly is completely vented to avoid measuring errors.

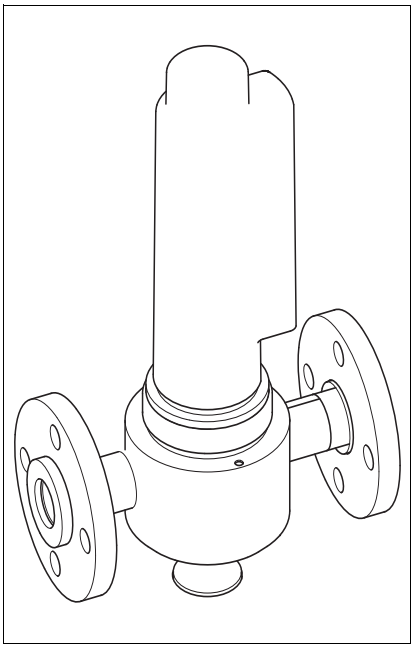

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Fig. 3: CPA240 flow assembly with protective hood

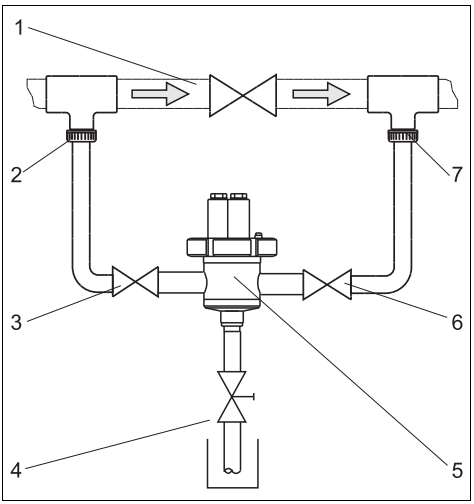

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Fig. 4: Bypass installation

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

Flow assembly for water treatment applications

The compact stainless steel assembly (see "Accessories") 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.

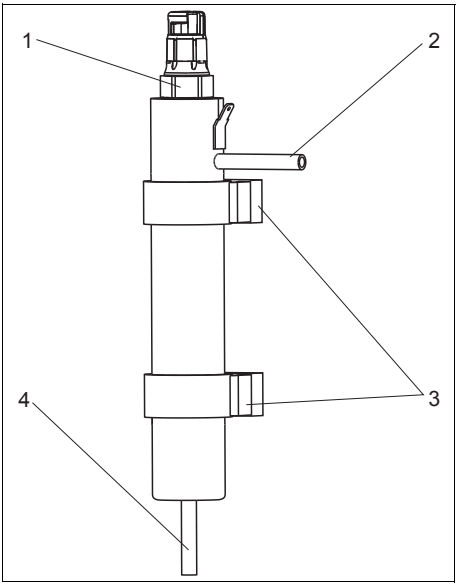

Fig. 5: Flow assembly

1 Built-in sensor
2 Drain
3 Wall mount (clamp D29)
4 Inflow

Retractable assembly (CPA475 or CPA450)

The assembly is designed for installation on tanks and pipes. Suitable nozzles must be available for this.

Install the assembly at places with constant flow. The minimum pipe diameter is DN 80 (3").

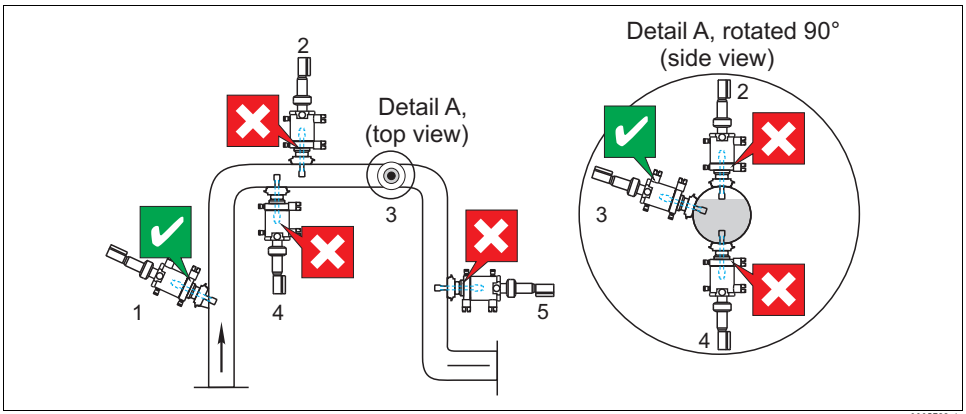

Fig. 6: Permissible and impermissible sensor installation positions with retractable assembly

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)
5 Down pipe, impermissible

NOTICE

Incorrect measurements

Sensor not in the medium all the way, buildup, overhead installation

- ► Do not install the assembly at places where air cushions or foam bubbles can be formed.
- ► Avoid deposits on the sensor membrane and/or remove them regularly.
- ► Do not install the sensor overhead.

3.5 Post-installation check

- ► Sensor and cable undamaged?
- ► Compliance with permissible sensor installation position?
- ► Is the sensor installed in an assembly and is not suspended from the cable?
- ► Avoid moisture by rain by putting the protective cap on the assembly?

4 Wiring

⚠ WARNING

Device is energized

Improper connection can cause injury or death.

- ► The electrical connection must only be carried out by a certified electrician.
- ► Technical personnel must have read and understood the instructions in this manual and must adhere to them.
- ► **Prior to beginning** any wiring work, make sure voltage is not applied to any of the cables.

4.1 Connection to the transmitter

The electrical connection between the sensor and the transmitter uses the multi-core special measuring cable COK21.

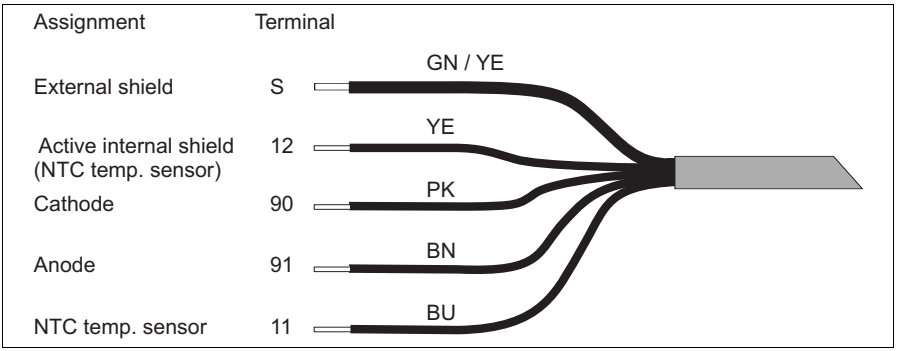

Fig. 7: Special measuring cable COK21

4.2 Post-connection check

Instrument status and specifications	**Remarks**
Are the sensor, assembly, junction box or cable damaged?	Visual inspection
Electrical connection	**Remarks**
Are the installed cables strain-relieved and not twisted ?	
Long enough length of cable core stripped and correct in terminal?	Check seating (pull slightly)
Are all the screws terminals properly tightened ?	Tighten
Are all the cable entries installed, tightened and sealed ?	For cable entries lateral: cable loops downwards for water to be able to drip off.
Are all the cable entries installed downwards or lateral ?	

5 Function

5.1 Measuring principle

5.1.1 Amperometric measuring principle

The oxygen molecules that diffuse through the membrane are reduced at the cathode into hydroxide ions (OH^-). At the anode, silver is oxidized into 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.

5.1.2 Sensor design

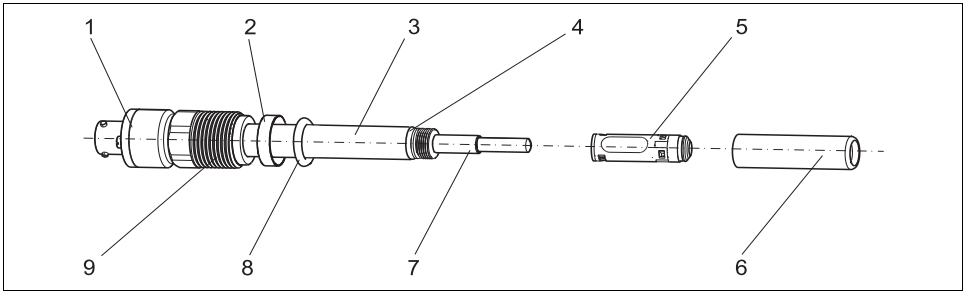

Fig. 8: Exploded view

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

5.1.3 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 display that is initially high, but decreases with time. The sensor cannot be calibrated until the display is calibrated.

Reference value for nearly complete polarization of a sensor that was previously stored for a long time:
- COS22-*1: 2 hours
- COS22-*3: 12 hours

After this time, even measurements close to the determination limit are useful.
The necessary polarization time is reduced for sensors that were in use a short time before.

5.1.4 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!

5.2 Calibration

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

Normally, sensor calibration is seldom necessary. It is necessary after:
- First commissioning
- Replacing a membrane or electrolyte
- Long breaks in operation without power supply

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

5.2.1 Types of calibration

You can carry out single-point or two-point calibration for the sensor.
In most applications, single-point calibration suffices in the presence of oxygen (=calibration of measured value at air).
The additional calibration of the zero point (two-point calibration) improves the precision of the measurement results in the trace range. Calibrate the zero point with nitrogen (minimum 99.995%) or with water free from oxygen, for example. In doing so, make sure the measured value has settled correctly (20 to 30 minutes) to avoid incorrect measurements in the trace range at a later stage.

The available types of calibration depend on the transmitter used. Refer to your transmitter's Operating Instructions to find out which types of calibration are supported.

The following section **only** describes the calibration in air (saturated with water vapor) as the easiest method of calibration and therefore the recommended method.
However, this type of calibration is only possible if the air temperature is ≥ –5 °C (23 °F).

5.2.2 Calibration in air

1. Remove the sensor from the medium.
2. Clean the outside of the sensor with a damp cloth.
3. Then wait while the sensor adjusts to the temperature of the ambient air. This takes about 20 minutes. Check that the sensor is not in direct sunlight during this time.
4. If the measured value display on the transmitter is stable, carry out the calibration in accordance with the Operating Instructions of the transmitter.
5. Place the sensor in the medium again.

Make sure you comply with the instructions for calibration in the Operating Instructions of the transmitter.

5.2.3 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 ambient temperature for the sensor (air temperature for "air" calibration method,water temperature for "air-saturated water" calibration type)
   - the altitude above sea level
   - the current air pressure (=rel. air pressure to sea level) at the time of calibration. (If undeterminable, use 1013 hPa (407 inH_2O) for an approximate calculation.)
2. Define:
   - the saturation value **S** acc. to the first table
   - the factor **K** acc. to the second table

T [°C (°F)]	S [mg/l=ppm]
0 (32)	14.64
1 (34)	14.23
2 (36)	13.83
3 (37)	13.45
4 (39)	13.09
5 (41)	12.75
6 (43)	12.42
7 (45)	12.11
8 (46)	11.81
9 (48)	11.53
10 (50)	11.25

T [°C (°F)]	S [mg/l=ppm]
11 (52)	10.99
12 (54)	10.75
13 (55)	10.51
14 (57)	10.28
15 (59)	10.06
16 (61)	9.85
17 (63)	9.64
18 (64)	9.45
19 (66)	9.26
20 (68)	9.08

T [°C (°F)]	S [mg/l=ppm]
21 (70)	8.90
22 (72)	8.73
23 (73)	8.57
24 (75)	8.41
25 (77)	8.25
26 (79)	8.11
27 (81)	7.96
28 (82)	7.82
29 (84)	7.69
30 (86)	7.55

T [°C (°F)]	S [mg/l=ppm]
31 (88)	7.42
32 (90)	7.30
33 (91)	7.18
34 (93)	7.06
35 (95)	6.94
36 (97)	6.83
37 (99)	6.72
38 (100)	6.61
39 (102)	6.51
40 (104)	6.41

Altitude [m (ft)]	K
0	1.000
50 (160)	0.994
100 (330)	0.988
150 (490)	0.982

Altitude [m / ft]	K
550 (1800)	0.938
600 (1980)	0.932
650 (2130)	0.927
700 (2300)	0.922

Altitude [m / ft]	K
1050 (3450)	0.885
1100 (3610)	0.879
1150 (3770)	0.874
1200 (3940)	0.869

Altitude [m / ft]	K
1550 (5090)	0.834
1600 (5250)	0.830
1650 (5410)	0.825
1700 (5580)	0.820

Altitude [m (ft)]	K	Altitude [m / ft]	K	Altitude [m / ft]	K	Altitude [m / ft]	K
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 the factor **L**:

$$L = \frac{\text{relative air pressure during calibration}}{1013\ \text{hPa}}$$

4. Calculate the calibration value **C**:

$$C = S \cdot K \cdot L$$

Example

- Air calibration at 18°C (64 °F), altitude 500 m (1650 ft) above sea level, air pressure 1009 hPa (405 inH_2O)
- S = 9.45 mg/l, K = 0.943, L = 0.996

Calibration value C = 8.88 mg/l.

You do not need factor K from the table if your device returns the absolute air pressure L_{abs} (location-dependent air pressure) as the measured value.
Thus, the formula for calculation is: $C = S \cdot L_{abs}$.

6 Commissioning

6.1 Function check

Before first commissioning, check if:
- the sensor is correctly installed
- the electrical connection is correct.

If using an assembly with automatic cleaning, check the correct connection of the cleaning agent (e.g. water or air).

⚠ WARNING

Escaping process medium

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

► Before applying compressed air to an assembly with cleaning facility, make sure the connections are correctly fitted.

► Do not install the assembly in the process if you cannot make the correct connection reliably.

6.2 Polarization

NOTICE

Incorrect measurements due to ambient influences

► Be absolutely certain to avoid direct sunlight on the sensor.

► Make sure you comply with the instructions for commissioning in the Operating Instructions of the transmitter.

The sensor has been tested at the factory for proper function and is shipped in ready-to-operate condition.

To prepare for the calibration, carry out the following steps:

1. Pull off the sensor protection cap.
2. Expose the sensor, which should be 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 surface of water. However, the sensor membrane must remain dry during calibration. Therefore, avoid direct contact with the surface of water.
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 power-up of the transmitter.
5. Wait for the polarization time to run out.

6.3 Calibration

Calibrate the sensor (air calibration) immediately after the polarization time has elapsed.

The calibration intervals depend heavily on:
- The application and
- The installation position of the sensor.

The following methods help you determine how long the calibration intervals should be:
1. Check the sensor one month after its being put into operation by taking it out of the fluid, drying it and then measuring the oxygen saturation index at air after 10 minutes.
   Decide using the results:
   a. If the measured value is not at 100 ± 2 %SAT, you have to calibrate the sensor.
   b. Otherwise, double the length of time to the next inspection.
2. Proceed as per Point 1 after two, four and/or eight months. In this way, you can determine the optimum calibration interval for your sensor.

Be sure to calibrate the sensor at least once a year.

7 Maintenance

7.1 Maintenance tasks

The following tasks are mandatory:
- Cleaning the sensor
- Replace wear parts or consumables:
  - Electrolyte
  - Membrane body
  - Sealing ring
- Check the measuring 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).
  4. The measured value should be at 100 ± 2 % SAT
- Recalibration (if desired or required)

7.2 Maintenance intervals

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)
- Greatly varying conditions, e.g. daily CIP cleaning = short cycles (1 month or shorter)

The following method helps you determine the necessary intervals:
1. Inspect the sensor one month after commissioning.
   Take it out of the medium and dry it.
2. After 10 minutes, measure the oxygen saturation index in air.
   Decide using the results:
   a. If the measured value is not at 100 ±2 %SAT, you have to maintain the sensor.
   b. Otherwise, double the length of time to the next inspection.
3. Proceed similarly after two, four and/or eight months. In this way, you can determine the optimum maintenance interval for your sensor.

Particularly for widely varying process conditions, damage of the membrane can occur even within a maintenance cycle. You can recognize this by implausible sensor behavior.

7.3 Cleaning the sensor

The measurement can be corrupted by sensor fouling or malfunction, e.g.:
- —> cause longer response times and a reduced slope under certain circumstances.

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

Clean the sensor:
- before every calibration
- at regular intervals during operation as necessary
- before returning it for repairs.

Depending on the type of soiling, proceed as follows:

Type of soiling	Cleaning
Salt deposits	Immerse the sensor in drinking water or in 1-5% hydrochloric acid for a few minutes. Afterwards, rinse it with copious amounts of water.
Dirt particles on the sensor body **(not cap!)**	Clean the sensor body mechanically with water and a suitable brush.
Dirt particles on the membrane body or the membrane	Clean with water and a soft sponge.

After cleaning, rinse the sensor with copious amounts of clean water.

7.4 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.

Measure	Reason
Replacing the sealing ring	Visible damage to the sealing ring
Changing the electrolyte	Unstable or implausible measuring signal or fouling of the electrolyte
Replacing the membrane cap	Membrane is damaged or can no longer be cleaned (hole or overstretching)

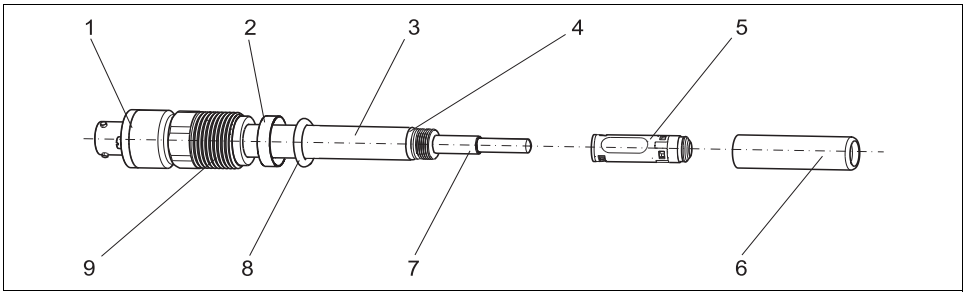

Fig. 9: Exploded view

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

7.4.1 Replacing the sealing ring

The sealing ring must be replaced if visibly damaged. For replacement, use only original sealing rings.

The following O-rings can be replaced:
- Sealing ring for shaft sleeve
- Sealing ring to process

If the sealing ring on the membrane body is damaged, you have to replace the entire membrane body.

7.4.2 Changing the electrolyte and/or the membrane body

The electrolyte is used up slowly 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.

The theoretical operating time of an electrolyte filling for use in air-saturated potable water (pO_2=210 mbar) at 25 °C (77 °F) is as follows:
- COS22-*1 (standard sensor): >1.5 years
- COS22-*3 (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 clothing, gloves and goggles when handling the electrolyte.
- ► In case of eye contact: Remove contact lenses, flush 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 membrane cap must be replaced if:
  - It is damaged.
  - It is stretched. This makes the produced sensor currents too small.
- Changing the electrolyte is mandatory 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 partial oxygen pressures (> 100 hPa) consume a significant amount of electrolyte. The electrolyte has to be replaced frequently.

Removing the old membrane body

1. Remove the sensor from the medium.
2. Clean the outside 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 portion with the anode and cathode.
4. Remove the membrane body.
   To do so, use a suitable tool or carefully press it out of the shaft sleeve from the outside.
5. Decide:
   a. Do you want to replace the membrane body and not use it again?
      ▶ Dispose of the electrolyte and the old membrane body.
   b. Do you want to replace the electrolyte only and not replace the membrane body?
      ▶ Drain the membrane body and flush with potable water.
      ▶ Continue as for the new membrane body.

Installing the new membrane body

1. Fill fresh electrolyte from the supply bottle into a new 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 push the membrane body, filled with electrolyte, on the glass portion.
4. Carefully screw on the shaft sleeve as far as it will go.

After replacing the membrane cap, the sensor must be repolarized and recalibrated. Then insert the sensor into the medium and check that no alarm is displayed on the transmitter.

7.4.3 Replacing the glass body with the cathode

NOTICE

Polishing the cathode can cause impaired function or total failure of the sensor.

► Do not clean the cathode mechanically.

If the cathode is coated, replace the glass body.

1. Hold the sensor vertically and unscrew the shaft sleeve.
2. If the membrane body remains on the glass body and not in the shaft sleeve, remove it from the glass body.
3. Flush 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. Ensure that you do not damage the electrical contact pins.
7. Fill the membrane body with electrolyte (see preceding section), then screw the shaft sleeve back on.

8 Accessories

8.1 Connection accessories

Special measuring cable COK21
- Cable length 3 m (9.8 ft)
  order no. 51505870
- Cable length 10 m (33 ft)
  order no. 51505868

8.2 Installation accessories

Flowfit CPA240
- pH/redox flow assembly for processes with a high level of requirements
- Technical Information TI179C/07/en

Cleanfit CPA475
- Retractable assembly for installation in tanks and pipework under sterile conditions
- Technical Information TI240C/07/en

Unifit CPA442
- Installation assembly for food, biotechnology and pharmaceuticals, with EHEDG and 3A certificate
- Technical Information TI306C/07/en

Cleanfit CPA450
- Manual retractable assembly for installing 120 mm sensors in tanks and pipework
- Technical Information TI183C/07/en

Flow assembly for 120 mm sensors
- compact stainless steel assembly with low sample volume
- order no.: 71042404

9 Trouble-shooting

9.1 Trouble-shooting instructions

If any of the following problems occur, test the measuring device as indicated.

Problem	Check	Remedial action
No display, no sensor reaction	Mains voltage to the transmitter?	Connect mains voltage.
	Sensor connected correctly?	Set up correct connection.
	Medium flow available?	Create flow.
	Coating on the membrane?	Clean the sensor.
	Electrolyte in the measuring chamber?	Fill with electrolyte or replace electrolyte.
Displayed value too high	Polarization complete?	Wait until polarization time ends.
	Sensor calibrated?	Recalibrate
	Temperature display clearly too low?	Check sensor, if necessary send sensor in for repair.
	Membrane visibly stretched?	Replace membrane cap.
	Electrolyte soiled?	Replace electrolyte.
	Open sensor. Dry electrodes. Transmitter display now at 0?	Check electrical connection. If the problem still occurs, send the sensor in.
Displayed value too low	Sensor calibrated?	Recalibrate
	Medium flow available?	Create flow.
	Displayesd temperature clearly too high?	Check sensor, if necessary send sensor in for repair.
	Coating on the membrane?	Clean membrane or replace membrane cap.
	Electrolyte soiled?	Replace electrolyte.
Strong deviations in displayed value	Membrane visibly stretched?	Replace membrane cap.
	Open sensor. Dry electrodes transmitter display now at 0?	Check electrical connection. If the problem still occurs, send the sensor in.

Make sure you comply with the instructions for troubleshooting in the Operating Instructions of the transmitter. If necessary, carry out a test of the transmitter.

9.2 Spare parts and consumable material

	Number of membranes				
	A	3 pieces			
	B	10 pieces			
		Material of O-rings			
		2	Fluoroelastomer FDA		
		5	Perfluoroelastomer USP Cl. VI		
			Material of membrane ring		
			B	Stainless steel	
			D	Titanium	
			E	Alloy C22	
				Material of process sealing	
				2	Fluoro elastomer FDA
				3	Fluoro elastomer Ex
COS22Z-					Order code
	Electrolyte (optional)				
E1	Standard, 25 ml				
E2	Traces, 25 ml				
	Inner glass body (optional)				
F1	Standard				
F2	Traces				
	Material of the shaft sleeve (optional)				
G1	Stainless steel				
G2	Titanium				
G3	Alloy C22				
	Test, Certificate (optional, multiple selection possible)				
HA	3.1				
	Additional approval (optional, multiple selection possible)				
IA	Pharma Certificate of compliance				

To complete your order code, simply add the optional features to the end of the order code. If you have any questions, please contact your local sales office.

9.3 Return

If the sensor has to be repaired, please return it *cleaned* to the sales center responsible.
Please use the original packaging, if possible.

Before returning the device, please clarify all formalities - such as obtaining an identification number - with your sales center.
Please enclose the completed "Declaration of Hazardous Material and De-Contamination" (copy the second last page of these Operating Instructions) with the packaging and the transportation documents.
No repair without completed declaration!

9.4 Disposal

The device contains electronic components and must therefore be disposed of in accordance with regulations on the disposal of electronic waste.
Please observe local regulations.

10 Technical data

10.1 Input

10.1.1 Measured variable

Dissolved oxygen [mg/l, µg/l, ppm, ppb, % SAT or hPa]
Temperature [° C, °F)

10.1.2 Measuring range

	Measuring range	Optimum operational range
COS22-*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%
COS22-*3	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%

All ranges refer to 20 °C (68 °F) and 1013 hPa (15 psi).

10.2 Performance characteristics

10.2.1 Response time

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

10.2.2 Reference operating conditions

Reference temperature: 25 °C (77 °F)
Reference pressure: 1013 hPa (15 psi)

10.2.3 Signal current in air

COS22-*1 (standard sensor): 40 to 100 nA
COS22-*3 (trace sensor): 210 to 451 nA

10.2.4 Zero current

COS22-*1 (standard sensor): < 0.1 % of the current at air
COS22-*3 (trace sensor): < 0.03 % of the current at air

10.2.5 Measured value resolution

COS22-*1 (standard sensor): 10 ppb in liquids, 0.2 hPa or 0.02 Vol% in gaseous media
COS22-*3 (trace sensor): 1 ppb in liquids, 0.02 hPa or 0.002 Vol% in gaseous media
equals the recommended resolution at the transmitter

10.2.6 Maximum measured error

±1.25 % of measuring range[1)]

10.2.7 Repeatability

±1 % of the measuring range end

10.2.8 Long-term drift

< 4 % per month under reference operating conditions
≤ 1 % per month when operating under reduced oxygen conditions (<4 Vol% O_2)

10.2.9 Influence of medium pressure

Pressure compensation not necessary

10.2.10Polarization time

COS22-*1 (standard sensor): < 30 min for 98% of the signal value, 2 h for 100%
COS22-*3 (trace sensor): < 3 h for 98% of the signal value, 12 h for 100%

10.2.11Oxygen depletion (intrinsic consumption)

COS22-*1 (standard sensor): approx. 20 ng/h at air at 25 °C (77 °F)
COS22-*3 (trace sensor): approx. 100 ng/h at air at 25 °C (77 °F)

10.2.12 Operating time of the electrolyte

Theoretical durability at pO_2 = 210 mbar and T=25 °C (77 °F)
COS22-*1 (standard sensor): > 1.5 years
COS22-*3 (trace ensor): > 3 months

10.2.13 Temperature compensation

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

10.3 Environment

10.3.1 Storage temperature

–5 to +50 °C (20 to 120 °F) at 95% relative air humidity, not condensing

1) In accordance with IEC 61298-2 at nominal operating conditions

NOTICE

Danger of drying out

► Only store the sensor with the protection cap (filled with tap water).

10.3.2 Ambient temperature range

–5 to +135 °C (23 to 175 °F)

10.3.3 Ingress protection

IP 68 (10 m (33 ft) water column at 25 °C (77 °F) during 45 days, 1 mol/l KCl)

10.4 Process

10.4.1 Process temperature

–5 to +135 °C (23 to 175 °F)

10.4.2 Process pressure

ambient pressure to 12 bar (174 psi)

10.4.3 Temperature-pressure chart

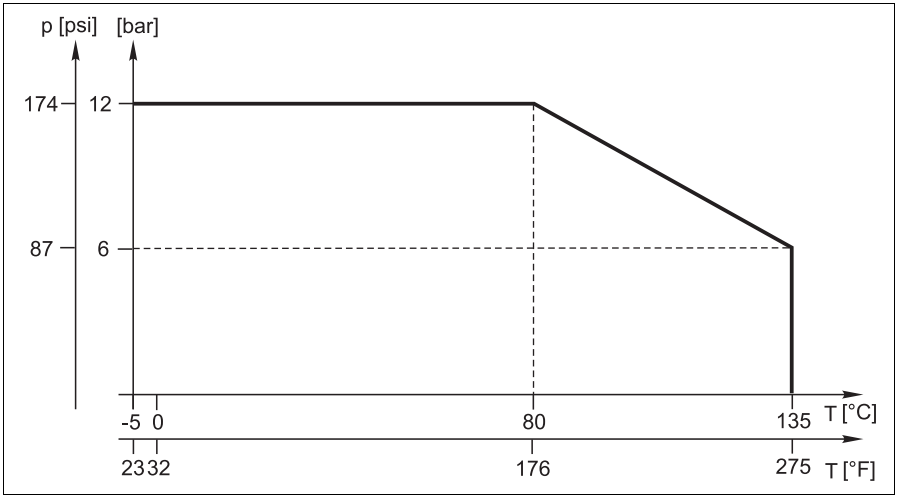

Fig. 10: Temperature-pressure diagram

10.4.4 Minimum flow

COS22-*1 (standard sensor): 0.02 m/s (0.07 ft/s)
COS22-*3 (trace ensor): 0.1 m/s (0.33 ft/s)

10.4.5 Chemical resistance

Parts in contact with medium are chemically resistent against:
- Dissolved acids and bases
- Hot water and steam
  max. 135 °C (275 °F)
- CO_2
  up to 100 %, with trace sensor COS22-*3 only

NOTICE

Hydrogen sulfide and ammonia reduce the durability of the sensor

► Do not use the sensor in applications, where the sensor is exposed to hydrogen sulfide and ammonia vapors.

10.4.6 Cross-sensitivity

Molecular hydrogen causes at least lesser findings and can cause total sensor failure.

10.4.7 CIP compatibility

Versions COS22-****2

10.5 Mechanical construction

10.5.1 Weight

Depending on version (length)
0.2 kg (0.44 lbs) to 0.7 kg (1.54 lbs)

10.5.2 Materials

In contact with medium	
Sensor shaft (depending on version)	Stainless steel 1.4435 (AISI 316L) Titane Alloy C22
Electrode combination	Silver / platinum
Sealings/O-rings Process seal	Viton® (FDA compliant) Perfluoro elastomer with USP88 Class VI
Membrane	Silicone (FDA compliant), PTFE, steel mesh

10.5.3 Process connection

Thread Pg 13.5

10.5.4 Surface roughness

$R_a < 0.38$ µm

10.5.5 Temperature sensor

NTC 22 kΩ

10.5.6 Electrolyte

COS22-*1 (standard sensor): alkalescent electrolyte
COS22-*3 (trace sensor): neutral electrolyte

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Endress+Hauser

People for Process Automation

Declaration of Hazardous Material and De-Contamination

RA No. ☐☐☐☐☐☐☐

Please reference the Return Authorization Number (RA#), obtained from Endress+Hauser, on all paperwork and mark the RA# clearly on the outside of the box. If this procedure is not followed, it may result in the refusal of the package at our facility.

Because of legal regulations and for the safety of our employees and operating equipment, we need the "Declaration of Hazardous Material and De-Contamination", with your signature, before your order can be handled. Please make absolutely sure to attach it to the outside of the packaging.

Type of instrument / sensor _____ **Serial number** _____

☐ **Used as SIL device in a Safety Instrumented System**

Process data

Temperature _____ [°F] _____ [°C] Pressure _____ [psi] _____ [Pa]

Conductivity _____ [µS/cm] Viscosity _____ [cp] _____ [mm^2/s]

Medium and warnings

	Medium /concentration	Identification CAS No.	 flammable	 toxic	 corrosive	 harmful/ irritant	 other *	 harmless
Process medium								
Medium for process cleaning								
Returned part cleaned with								

* explosive; oxidising; dangerous for the environment; biological risk; radioactive

Please tick should one of the above be applicable, include safety data sheet and, if necessary, special handling instructions.

Description of failure _____

_____

_____

Company data

Company _____ Phone number of contact person _____

Address _____ Fax / E-Mail _____

_____

_____ Your order No. _____

"We hereby certify that this declaration is filled out truthfully and completely to the best of our knowledge.We further certify that the returned parts have been carefully cleaned. To the best of our knowledge they are free of any residues in dangerous quantities."

_____ _____ _____

(place, date) Name, dept. (please print) Signature

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