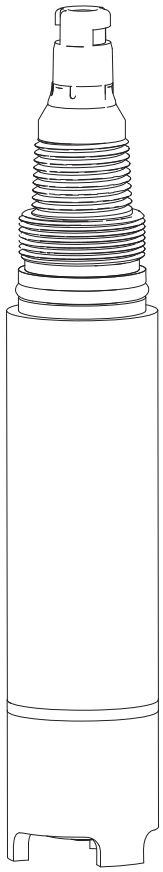
Level Pressure Flow Temperature Analytics Registration Systems Components Services Solutions

Operating Instructions

Oxymax COS51D

Digital sensor for dissolved oxygen
With Memosens technology



BA00413C/07/EN/13.12
71153927

Endress+Hauser
People for Process Automation

Documentation information

Warnings

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.

Symbols used

→ 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).

Additional information, tips

Permitted or recommended

Forbidden or not recommended

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1 Basic safety instructions

1.1 Requirements for personnel

- ► Installation, commissioning, operation and maintenance of the measuring system must only be carried out by trained technical personnel.
- ► The technical personnel must be authorized by the plant operator to carry out the specified activities.
- ► The electrical connection may only be performed by an electrical technician.
- ► The technical personnel must have read and understood these Operating Instructions and must follow the instructions they contain.
- ► Measuring point faults may only be rectified by authorized and specially trained personnel.

Repairs not described in the enclosed Operating Instructions may only be carried out directly at the manufacturer's or by the service organization.

1.2 Designated use

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

Typical applications are:
- Measuring, monitoring and regulating the oxygen content in activated sludge basins.
- Monitoring the oxygen content in the sewage treatment plant outlet.
- Monitoring, measuring and regulating the oxygen content in public waters and fish farming water.
- Monitoring of oxygen enrichment in drinking water.

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.

1.3 Occupational safety

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

Electromagnetic compatibility
With regard to electromagnetic compatibility, this device has been tested in accordance with the applicable European standards for industrial applications.
The electromagnetic compatibility indicated only applies to a device that has been connected in accordance with the instructions in these Operating Instructions.

1.4 Operational safety

- ► Before commissioning the entire measuring point, make sure all the connections are correct. Ensure that electrical cables and hose connections are not damaged.
- ► Do not operate damaged products, and safeguard them to ensure that they are not operated inadvertently. Mark the damaged product as defective.
- ► If faults cannot be rectified, the products must be taken out of service and secured against unintentional commissioning.

⚠ CAUTION

The cleaning system is not switched off during calibration or maintenance activities

Risk of injury due to medium or cleaning agent

► If a cleaning system is connected, switch it off before removing a sensor from the medium.

► If you are not switching off the cleaning system because you wish to test the cleaning function, wear protective clothing, goggles and gloves or take other appropriate measures.

1.5 Product safety

The product is designed to meet state-of-the-art safety requirements, has been tested and left the factory in a condition in which it is safe to operate. Relevant regulations and European standards have been observed.

1.6 Special safety instructions COS51D-G*8*0*

- The certified oxygen sensor Oxymax COS51D-G*8*0* may only be connected via the measuring cable CYK10-G**1 to approved intrinsically safe digital sensor circuits of the transmitter Liquiline M CM42-*G*. The electrical connection instruction must be followed.
- The measuring cable CYK10-G and its coupling must be protected from electrostatic charging, if installed through zone 0.
- The sensor may not be operated under process conditions where electrostatic charging is likely to occur. The designated use in media with a conductivity of at least 10 nS/cm can be assumed as electrostatic uncritical.
- Ex versions of digital sensors with Memosens technology are indicated by an orange-red ring on the plug-in head.
- The maximum permissible cable length is 100 m (330 ft).

2 Identification

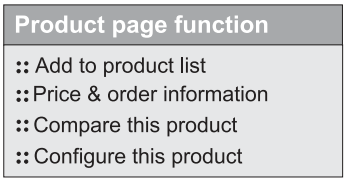
2.1 Product page and configurator

You can create a complete and valid order code by using the configurator on the internet product page.

Product page link:
www.products.endress.com/cos51d

2.2 Order code

1. You can choose from the following options on the product page located on the right:



2. Click "Configure this product".
3. The configurator opens in a separate window.
   Use the radio buttons to configure the order code from the nameplate of your device.
4. Afterwards, you can export the order code as a PDF or Excel file.
   To do so, click the appropriate button at the top of the page.

2.3 Scope of delivery

The following items are included in the delivery:
- Oxygen sensor with transport protection cap for membrane protection
- Accessories set with the following contents:
  – 2 replacement cartridges (replacement membrane caps)
  – 10 plastic ampoules containing electrolyte
  – 1 sealing kit with 3 O-rings
  – 6 abrasive sheets
- Operating Instructions (on CD only)
- Brief Operating Instructions (paper version)

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

2.4 Certificates and approvals

2.4.1 ATEX II 1G/IECEx Ex ia IIC T6 Ga

The inductive sensor-cable-plug-in system Memosens consisting of:
- oxygen sensor Oxymax W COS51D-G*8*0 and
- measuring cable CYK10-G**1

is suitable for the use in explosion-hazardous locations acc. to the type-examination certificate BVS 04 ATEX E 121 X . The corresponding EC declaration of conformity is part of this document.

2.4.2 FM/CSA

Version COS51D-O**
IS Class 1 Division 1 ABCD T4/T6
Class 1 Zone 0 AEx ia IIC T4/T6

2.4.3 Notified body

DEKRA EXAM GmbH
Bochum (Germany)

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 Dimensions

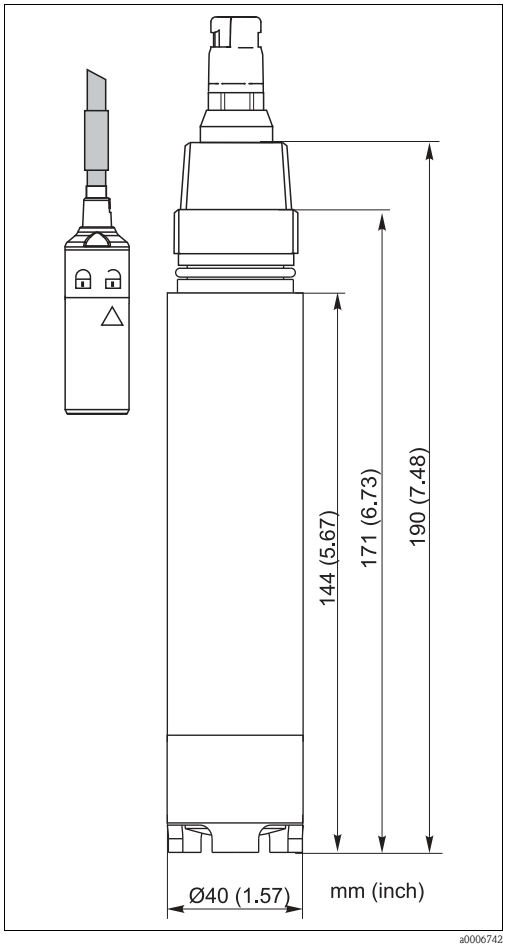


Fig. 1: Dimensions

3.2.2 Angle of installation

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

► Make sure you comply with the instructions for installing sensors. You will find them in the Operating Instructions for the assembly used.

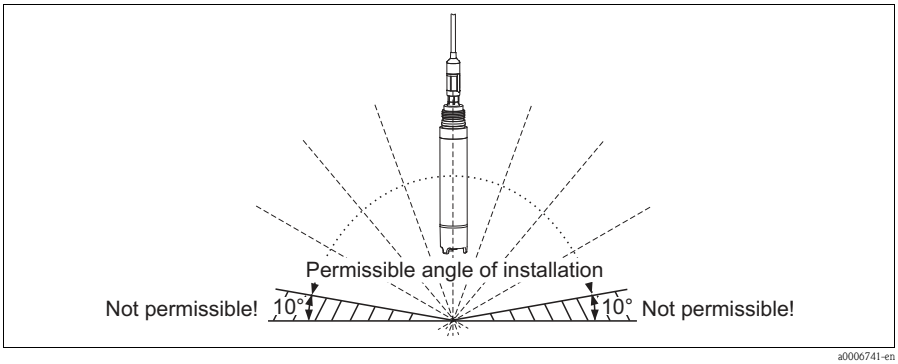


Fig. 2: Permissible angle of installation

3.2.3 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 at least:
- the digital oxygen sensor Oxymax COS51D
- a transmitter, e.g. Liquiline CM42
- a special measuring cable, CYK10
- an assembly, e.g. immersion assembly CYA112 or retractable assembly COA451

Optional (see accessories):
- Holder system CYH112 for immersion operation
- Automatic cleaning system Chemoclean with spray head

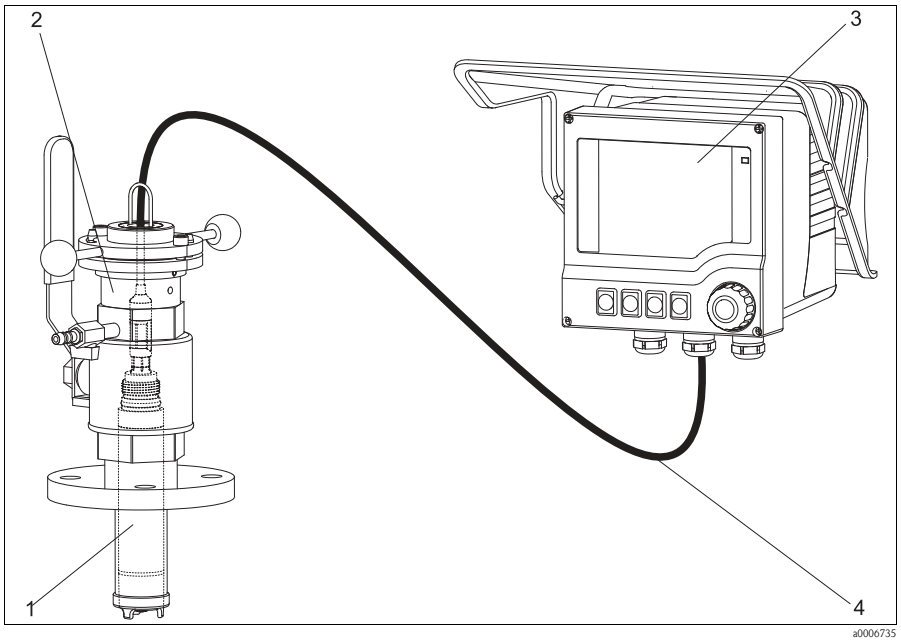


Fig. 3: Measuring system (example)

1 Digital oxygen sensor Oxymax W COS51D
2 Retractable assembly COA451
3 Liquiline M CM42
4 Measuring cable CYK10

3.3.2 Installing a measuring point

For immersed operation, install the individual modules away from the basin on a solid base. Only carry out the final installation at the intended installation location.

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.
4. Install an immersion or an suspension assembly (if used) into the process.

NOTICE

No assembly used, sensor not correctly installed, grounding regulations not observed

Risk of damaging the sensor cable, no protection to electromagnetic interferencies

- ► For immersed operation, the sensor must be installed in an immersion assembly (e.g. CYA611). **Do not install the sensor suspended from the cable.**
- ► Screw the sensor into the assembly so that the cable is not twisted.
- ► Avoid exerting excessive tensile force on the cable (e.g. from jerky pulling).
- ► When using metallic assemblies and installation equipment, comply with national grounding regulations.
- ► Observe the sensor installation instructions of the Operating Instructions of the assembly used.

3.4 Installation examples

3.4.1 Immersion operation

Upright post and chain assembly

For large basins, where sufficient installation distance is required from the basin edge (aeration basin, especially), it is advisable to use the upright post and chain assembly. The free swinging of the immersed assembly practically rules out vibrations from the upright post.
According to this effect, the sensor life time can be extended.

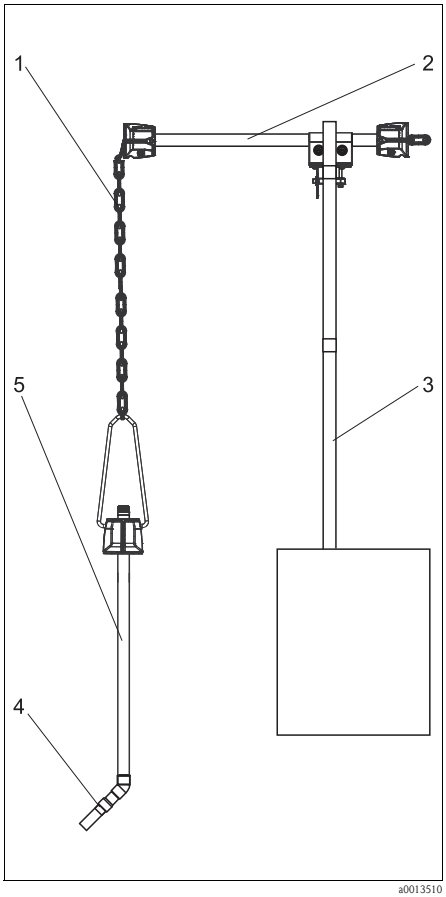


Fig. 4: Chain holder, rail mounted

1 Chain
2 Flexdip CYH112 holder
3 Rail
4 Oxymax sensor
5 Flexdip CYA112 wastewater assembly

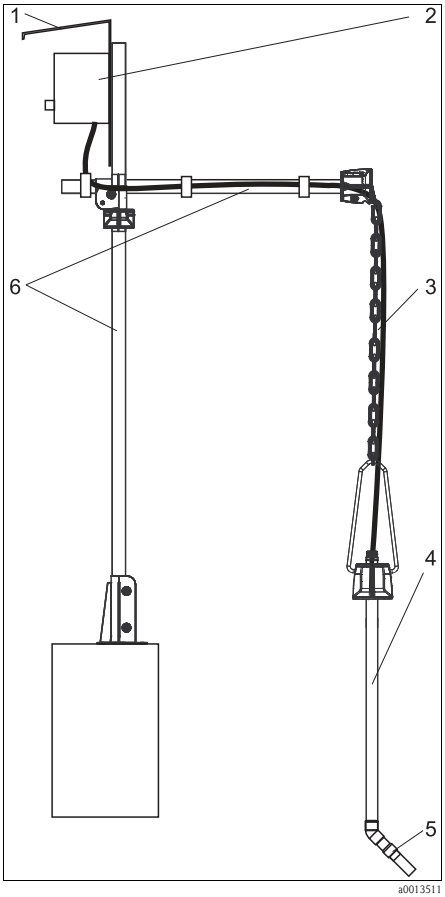


Fig. 5: Chain holder, mounted to a post

1 Weather protection cover
2 Liquiline CM44x controller
3 Chain
4 Flexdip CYA112 wastewater assembly
5 Oxymax sensor
6 Flexdip CYH112 holder

Upright post and fixed immersion assembly

The preferable type of installation for strong or turbulent flow (> 0.5 m/s) in the basin or open channels is to secure the device to an upright post and a securely mounted immersion tube. If the flow is very strong, a second transverse pipe can be installed with its own pipe support.

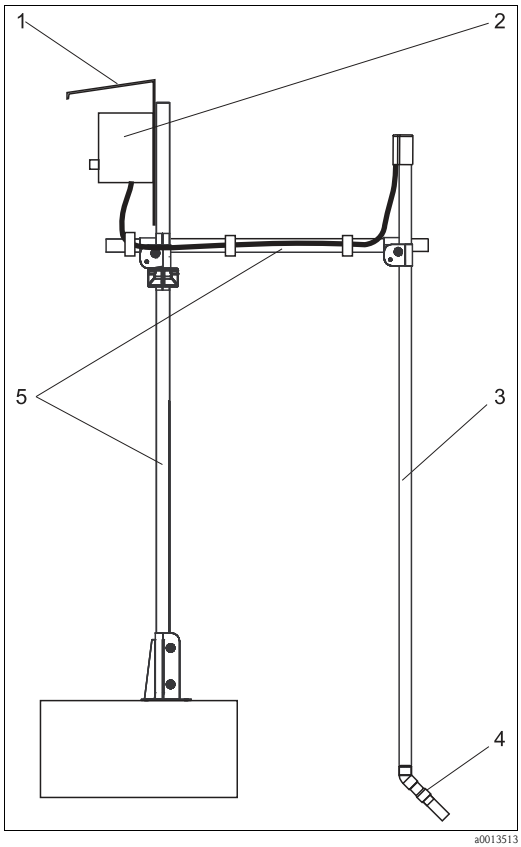


Fig. 6: Assembly holder with immersion tube

1 Weather protection cover CYY101
2 Controller Liquiline CM44x
3 Immersion assembly Flexdip CYA112
4 Oxymax sensor
5 Assembly holder Flexdip CYH112

Basin rim mounting with immersion assembly

For fixing to the sides of the basin or channel, we recommend the pendulum holder of the immersion tube. Optionally, you can also use the assembly with a float.

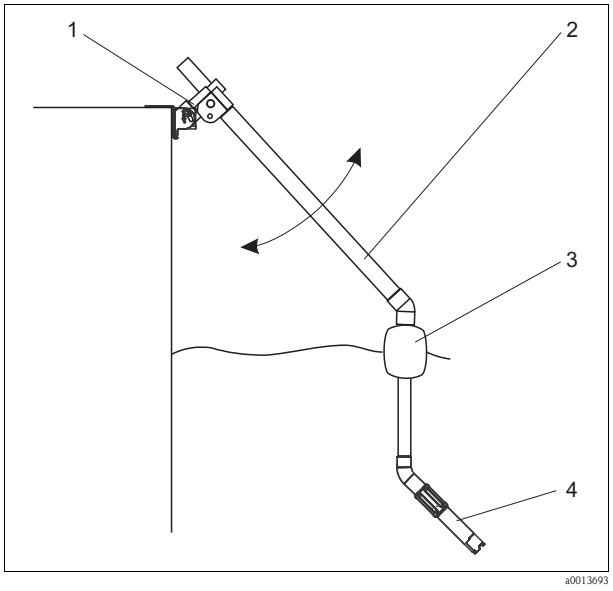
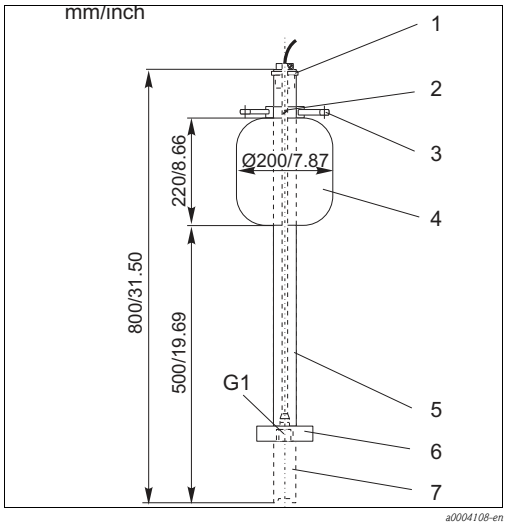


Fig. 7: Basin rim mounting

1 Pendulum holder CYH112
2 Assembly Flexdip CYA112
3 Float of assembly CYA112
4 Oxymax sensor

Floating body

To aid installation in strongly fluctuating water levels, e.g. in rivers or lakes, there is a floating body COA 110-50 available (→ 8).



1 Cable route with strain relief and rain protection
2 Mounting ring for ropes and chains with locking screw
3 Lugs Ø15, 3 x 120 ° for anchoring
4 Saltwater-resistant plastic float
5 Pipe 40x1, stainless steel 1.4571 (AISI 316Ti)
6 Shock absorber and weight
7 Oxygen sensor

Fig. 8: Floating body

3.4.2 Flow assembly

The COA250 flow assembly with automatic self-venting is suitable for use in pipelines or hose connections. The inlet is at the bottom of the assembly, the outlet at the top (connection thread G¾). It can be installed in a pipe by using two 90° pipe brackets to allow inflow to the assembly (→ 10, Pos. 6).

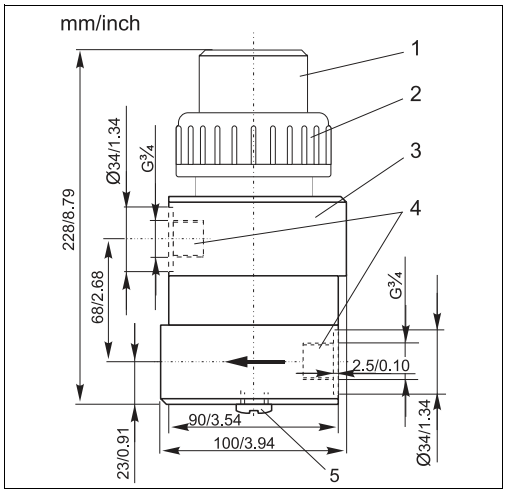


Fig. 9: Flow assembly COA250

1 Screw-in part for sensor
2 Screw ring
3 Meter body
4 Connection thread G¾
5 Dummy plug (connection for spray head CUR3)

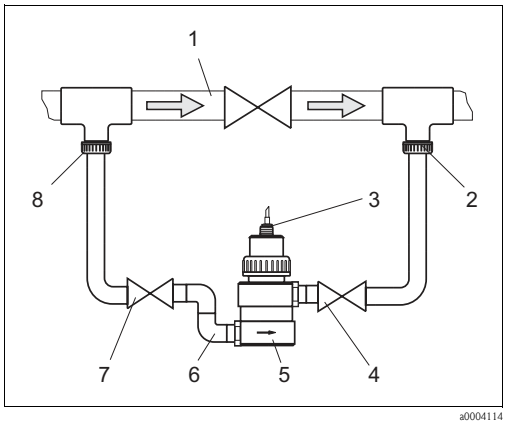


Fig. 10: Bypass installation with manually actuated valves or solenoid valves

1 Main line
2 Medium return
3 Oxygen sensor
4, 7 Manually actuated or solenoid valves
5 Flow assembly COA250
6 90 ° pipe bracket
8 Medium removal

3.4.3 Retractable assembly

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").

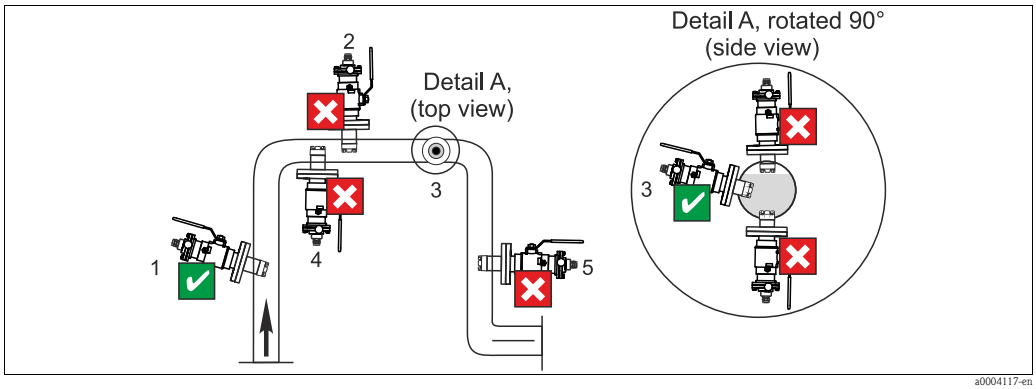


Fig. 11: Permissible and impermissible sensor installation positions

1 Ascending pipe, best position
2 Horizontal pipe, sensor top down, impermissible due to air cushion or foam bubble forming
3 Horizontal pipe, installation with permissible emitting angles (acc. to sensor version)
4 Overhead installation, impermissible due to missing electrolyte contact of the sensor electrodes
5 Down pipe, impermissible

NOTICE

Sensor not immersed into the medium, suspended particles settled on the sensor membrane or sensor optics, sensor installed overhead

Measuring errors can occur

► Do not install the assembly at places, where air cushions or foam bubbles can be formed or where suspended particles can settle on the sensor membrane or optics (→ 11).

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 Quick wiring guide

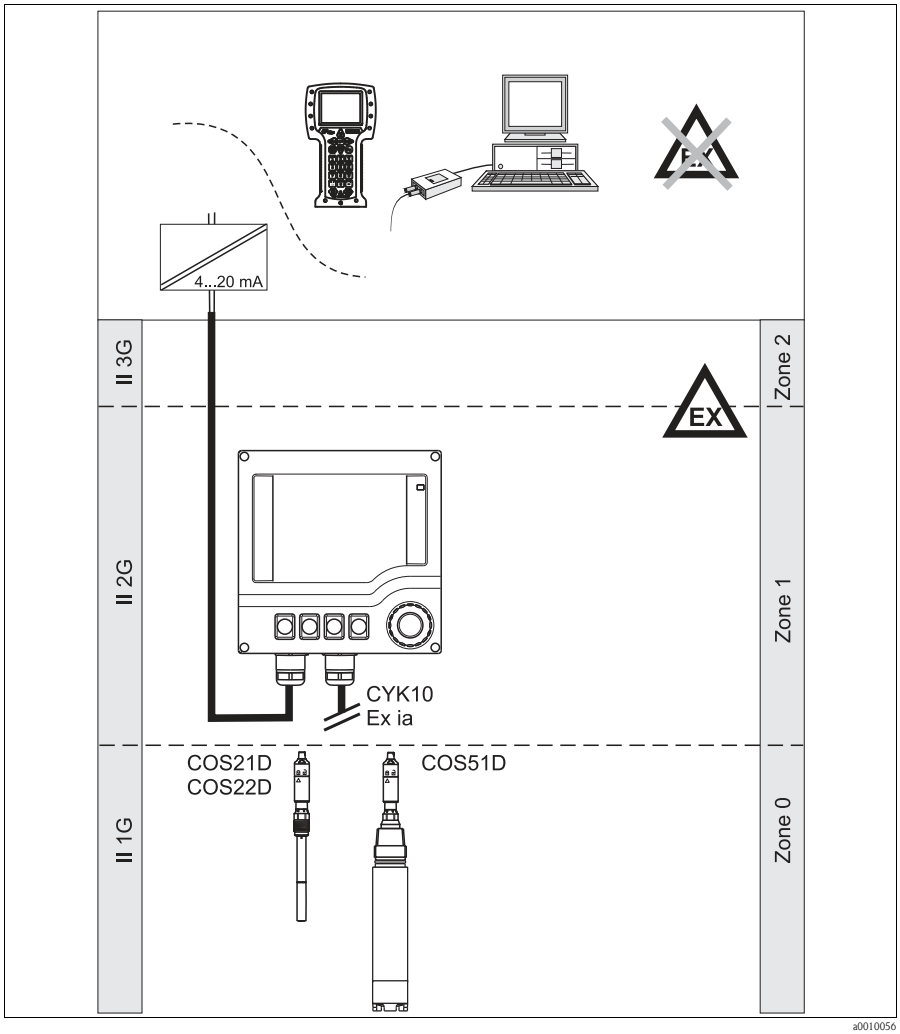


Fig. 12: Connection in hazardous locations

4.2 Temperature ranges

If the ambient temperatures indicated are observed, no temperatures which are impermissible for the temperature class in question will occur at the sensor.

	Temperature class T6
Ambient temperature T_a	–5 to +50 °C

4.3 Direct connection to the transmitter

The sensor is connected to the transmitter via the measuring cable CYK10.

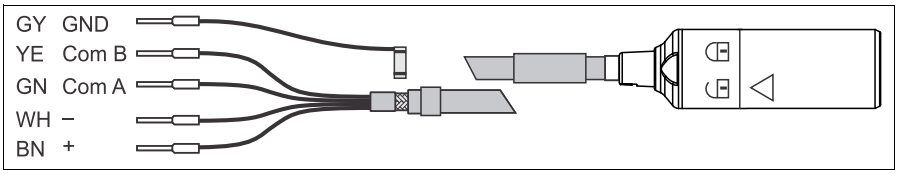


Fig. 13: Measuring cable CYK10

4.4 Post-connection check

Instrument status and specifications	**Remarks**
Are the sensor, assembly, junction box or cable damaged?	Visual inspection
Electrical connection	**Remarks**
Does the supply voltage of the transmitter match the specifications on the nameplate?	
Are the installed cables strain-relieved and not twisted ?	
Is the cable type route completely isolated ?	Power cable/weak current cable
Are the power supply and signal cable correctly connected to the transmitter ?	Use the connection diagram of the transmitter.
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 Device description

5.1 Sensor design

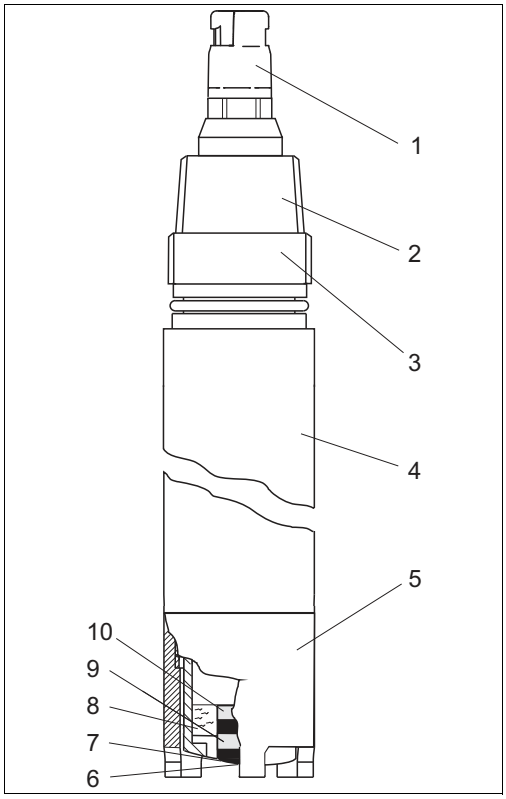


Fig. 14: Sensor design

1 Memosens Plug-in head
2 Threaded connection NPT ¾"
3 Threaded connection G1
4 Sensor shaft
5 Protection basket
6 Gold cathode
7 Membrane
8 Electrolyte
9 Anode

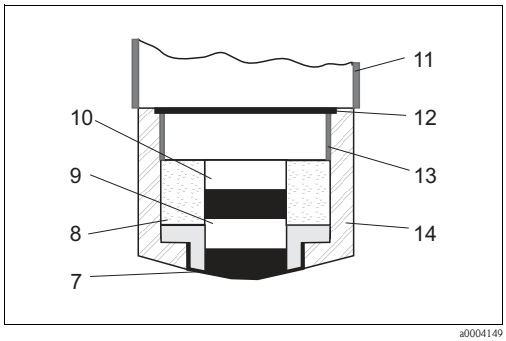


Fig. 15: Sensor head, cutaway drawing

7 Membrane
8 Electrolyte
9 Anode
10 Reference electrode
11 Threaded connection for protection basket
12 Sealing ring
13 Threaded connection for membrane cap
14 Membrane cap

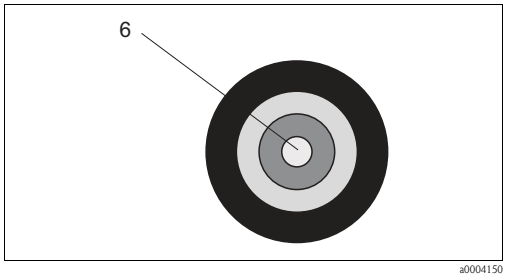


Fig. 16: Sensor head, top view

6 Cathode

The sensor consists of the following function units:
- Sensor shaft
- Protection basket

Observe the following
- Alternatively to the protection basket, you can use a spray head COR 3 (optional, see "Accessories") for use in immersed operation with cleaning function.
- The membrane cap screwed onto the sensor head is filled with electrolyte. The screw connection seals it from the medium.
- The membrane which is in contact with the medium is pretensioned in the factory.

5.2 Measuring principle

5.2.1 Polarization

When the sensor is connected to the transmitter, a fixed external voltage is applied between the cathode and anode. The resulting polarization current is indicated on the display of the transmitter. The current starts high but then drops over time. The sensor can only be calibrated when the display is stable.

5.2.2 Membrane

The oxygen dissolved in the medium is conveyed to the membrane by the incoming flow. The membrane is only permeable for dissolved gases. 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.

5.2.3 Amperometric principle

The oxygen molecules diffused through the membrane are reduced to hydroxide ions (OH-) at the cathode. Silver is oxidized to silver ions (Ag+) at the anode (this forms a silver halogenide 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.

5.2.4 Potentiostatic three-electrode-system

The high-impedance, current-free reference electrode plays an important role.
The formation of a silver bromide or silver chloride coating on the anode uses up the bromide or chloride ions dissolved in the electrolyte
In the case of conventional membrane-covered sensors working with the two-electrode system, this causes an increase in signal drift.

This is not the case with the three-electrode system:
The change in bromide or chloride concentration is registered by the reference electrode and an internal control circuit holds the working electrode potential constant. The advantages of this principle are significantly increased accuracy of the signal and considerably extended calibration intervals.

5.2.5 Memosens technology

The sensor is connected to the cable connection (CYK10) without contact. The power and data are transferred inductively
Once connected to the transmitter, the data saved in the sensor are read digitally. You can call up these data using the corresponding DIAG menu.

Data that digital sensors save include the following:
- Manufacturer data
  - Serial number
  - Order code
  - Date of manufacture
- Calibration data
  - Calibration date
  - Calibration values
  - Number of calibrations
  - Serial number of the transmitter used to perform the last calibration
- Operational data
  - Date of commissioning
  - Hours of operation under extreme conditions
  - Data for sensor monitoring.

5.3 Calibration

Calibration is a means of adapting the transmitter to the characteristic values of the sensor.
As normally no zero calibration is required for the sensor, a single-point calibration is carried out in the presence of oxygen.

Normally, sensor calibration is seldom necessary. It is necessary after:
- First commissioning
- Replacing a membrane or electrolyte
- Cleaning the cathode
- 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.

5.3.1 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.

Types of calibration:
- Slope:
  - Air (saturated with water vapor, e.g. near the water surface)
  - Air-saturated water
  - Variable air (entering the current relative humidity and the absolute air pressure)
  - Data entry
- Zero point:
  - Zero point calibration (nitrogen or water free from oxygen)
  - Data entry
- Reference:
  - Grab sample calibration
  - Offset
  - Slope

5.3.2 Calibration intervals

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

You can determine the intervals with the following method:

1. Check the sensor one month after its being put into operation:
   - Remove the sensor from the medium.
   - Clean the outside of the sensor with a damp cloth.
   - Then dry the sensor membrane e.g. by using a tissue.
   - Measure the oxygen saturation index at air after 20 minutes.
2. Decide using the results:
   a. If the measured value is not at 102 ±2 %SAT, you have to calibrate the sensor.
   b. Otherwise, lengthen the time to the next inspection.
3. 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.

5.3.3 Calibration in air

1. Remove the sensor from the medium.
2. Clean the outside of the sensor with a damp cloth.
   Then dry the sensor membrane e.g. by using a tissue.
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.

5.3.4 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 **L** (=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

°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

°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

°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

°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
200 / 660	0.977
250 / 820	0.971
300 / 980	0.966
350 / 1150	0.960
400 / 1320	0.954
450 / 1480	0.949
500 / 1650	0.943

Altitude [m / ft]	K
550 / 1800	0.938
600 / 1980	0.932
650 / 2130	0.927
700 / 2300	0.922
750 / 2460	0.916
800 / 2620	0.911
850 / 2790	0.905
900 / 2950	0.900
950 / 3120	0.895
1000 / 3300	0.890

Altitude [m / ft]	K
1050 / 3450	0.885
1100 / 3610	0.879
1150 / 3770	0.874
1200 / 3940	0.869
1250 / 4100	0.864
1300 / 4270	0.859
1350 / 4430	0.854
1400 / 4600	0.849
1450 / 4760	0.844
1500 / 4920	0.839

Altitude [m / ft]	K
1550 / 5090	0.834
1600 / 5250	0.830
1650 / 5410	0.825
1700 / 5580	0.820
1750 / 5740	0.815
1800 / 5910	0.810
1850 / 6070	0.805
1900 / 6230	0.801
1950 / 6400	0.796
2000 / 6560	0.792

3. Calculate the factor **L**:

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

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

   C = S · K · 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
Measurement errors due to environmental conditions
► Urgently protect the sensor from strong sunlight.
► Make sure you comply with the instructions for commissioning and calibration in the Operating Instructions of the transmitter.

The sensor was tested in the factory for perfect functionality and is supplied ready for operation.

To prepare for calibration, proceed as follows:

1. Remove the sensor protective cap.
2. Place the externally dry sensor in atmospheric air. The air should be saturated with water vapour. Therefore, install the sensor as close to the water surface as possible. When calibrating the sensor membrane, make sure the membrane remains dry. Therefore, avoid any direct contact with the water surface.
3. Connect the sensor to the transmitter and switch on the transmitter.
4. Switch-on the transmitter.
   If you connect the sensor to the transmitter, polarization is automatically performed after switching on the transmitter.
5. Wait for the polarization time to end.

6.3 Calibration

Calibrate the sensor (calibration type "Air") immediately after it’s polarization.

6.4 Automatic cleaning

Compressed air is most suitable for cyclic cleaning. The cleaning unit is either ready supplied or can be retrofitted, and is attached to the sensor head. It operates at a capacity of 20-60 l/min. Optimum results are achieved with 2 bar (29 psi) and 60 l/min.

The following settings are recommended for the cleaning unit:

Type of soiling	Cleaning interval	Cleaning duration
Media containing grease and oils	15 min	20 s
Biofilm	60 min	20 s

7 Maintenance

Maintenance work must carried out at regular intervals. To ensure that it is carried out, we recommend you enter the maintenance dates into an operations logbook or in an operations calendar in advance.

The maintenance cycle primarily depends on:
- the system
- the installation conditions and
- the medium in which measurement is taking place.

The following activities must be carried out:
- Cleaning the sensor
  (In particular when the membrane is soiled)
- If necessary, replacing wear and tear materials:
  – sealing ring
  – electrolyte
  – membrane cap
- Check the measuring function:
  – Remove the sensor from the medium.
  – Clean and dry the membrane.
  – After about 10 minutes, measure the oxygen saturation index in air (without recalibration).
  – The measured value should be near to 102% SAT
- Recalibration.

7.1 Cleaning

The measurement can be corrupted by sensor fouling or malfunction, e.g.:
- Coatings on the sensor membrane
  —> cause longer response times and a reduced slope under certain circumstances.
- Soiling or poisoning of the electrolyte
  —> causes longer response times and false measurement.
- Coatings on the electrodes
  —> cause longer response times and false measurement.

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.

7.1.1 External cleaning

Clean the outside of 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 cap or the membrane	Clean with water and a soft sponge.

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

For regular automatic sensor cleaning, we recommend equipping the measuring point with a fully-automatic cleaning system, e.g. Chemoclean (see accessories).

7.1.2 Cleaning the cathode

The cathode only needs to be cleaned when it is visibly soiled or there is a coating of silver on it.

To clean it, proceed as follows:

1. Unscrew the membrane cap from the membrane body.
2. Carefully clean the cathode surface in two stages with the abrasive sheet (contained in scope of supply) until the (silver) coating is fully removed. Use the green sheet first and then the yellow sheet.
3. Clean the open sensor head with drinking or distilled water.
4. Fill the membrane cap with fresh electrolyte COY3-F and screw it back onto the membrane body (up to the stop).

NOTICE
Removed silver bromide layer (normally brownish coating)
Sensor is unusable (anode and/or reference electrode is/are silver) and must be sent in for recoating
► Do not clean anode and/or reference electrode under any circumstances!
► If the coating is removed as a result of operation: Contact your sales office.

7.2 Replacing wear and tear materials

Parts of the sensor will suffer wear and tear during operation.
Suitable action can restore normal operating functionality. This action includes:

Action	Cause
Replacing the sealing ring	visual damage to a sealing ring
Replacing the electrolyte	unstable or implausible measuring signal or electrolyte soiling
Replacing the membrane cap	uncleanable membrane, damaged membrane (hole or overstretch)

7.2.1 Replacing the sealing ring

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

7.2.2 Replacing the electrolyte

The electrolyte COY3-F is slowly used up during measuring operations. The cause of this is electrochemical substance reactions. No substance reactions occur in de-energised state and the electrolyte is not used up.

The theoretical service life of an electrolyte filling for use in air-saturated drinking water at 20 °C (68 °F) is as follows:
- COS51-****0: 5 years
- COS51-****1: 1 year

The electrolyte life is shortened by diffused, dissolved gases such as H_2S, NH_3 or high concentrations of CO_2.

Particular loads occur with:
- anaerobic stages (e.g. denitrification)
- strongly polluted industrial wastewater, particularly at high temperatures.

⚠ CAUTION
The electrolyte is strongly alkaline
Risk of acid burns
► You must follow the appropriate occupational safety regulations.
► Always wear protective gloves and goggles with handling electrolytes.

Replacing the electrolyte:

1. Remove the membrane cap.
2. Replace the electrolyte and, if necessary, the membrane cap.
3. Place the membrane cap back on the membrane body and screw the cap to the stop.

7.2.3 Replacing the membrane cap

Only use the right membrane cap (COY31-WP [black for normal response time], COY31S-WP [white for fast response time])!

Removing the old membrane cap

1. Remove the sensor from the medium.
2. Unscrew the protection guard.
3. Clean the outside of the sensor.
4. Unscrew the membrane cap.
5. If necessary, clean the cathode or replace the sealing ring if it is damaged.
6. Rinse the electrode holder with drinking water.

Installing the new membrane cap

7. Make sure that there are no dirt particles on the sealing surface.
8. Fill the complete contents of a plastic ampoule (containing electrolyte COY3-F) into the membrane cap.
9. Remove all the air bubbles in the electrolyte by tapping the side of the membrane cap (e.g. with a pencil).
10. Hold the sensor body **at an angle** and carefully screw the membrane cap onto it **down to the stop.**
11. Screw the protection guard back on.
12. Reset the calibration counter (Liquiline calibration menu, "Cap replacement").

After replacing the membrane cap, polarize and recalibrate the sensor. Then insert the sensor into the medium and check that no alarm is displayed on the transmitter.

8 Accessories

In the following sections, you find the accessories available at the time of issue of this documentation.
For information on accessories that are not listed here, please contact your local service or sales center.

8.1 Connection accessories

CYK10 Memosens data cable
- For digital sensors with Memosens technology
  pH, redox, oxygen (amperometric), chlorine, conductivity (conductive)
- Ordering as per product structure (-> online Configurator, www.products.endress.com/cyk10)

CYK11 Memosens data cable
- Extension cable for digital sensors with Memosens protocol
- Ordering as per product structure (–> Online configurator, www.products.endress.com/cyk11)

8.2 Installation accessories

Flow assembly COA250
- For sensor installation in pipe lines, PVC
- Ordering acc. to product structure (–> Online configurator: www.products.endress.com/coa250)
- Technical Information TI00111C/07/EN

Retractable assembly Cleanfit COA451
- Manually driven retractable assembly, stainless steel, with ball valve, for oxygen sensors;
- Ordering acc. to product structure (–> Online configurator: www.products.endress.com/coa451)
- Technical Information TI00368C/07/EN

Holder system Flexdip CYH112 for water
- Modular holder system for sensors and assemblies in open basins, channels and tanks
- The holder system CYH112 works for nearly any type of fixing – fixing on the floor, wall or directly on a rail.
- Material: stainless steel
- Ordering acc. to product structure (–> Online configurator: www.products.endress.com/cyh112)
- Technical Information TI00430C/07/EN

Wastewater assembly Flexdip CYA112
- Modular assembly system for sensors in open basins, channels and tanks
- Versions in stainless steel or PVC
- Ordering per product structure (–> Online configurator: www.products.endress.com/cya112)
- Technical Information TI00432C/07/EN

Baffle plate OP
- extra protection for extreme flow conditions
- order no. 50028712

Membrane protection guard COY3-SK
- for sensor use in fish ponds
- order no. 50081787

8.3 Cleaning

Pressurized air cleaning system for COSXX
- Connection: 6/8 mm or 6.35 mm (¼")
- Materials: POM/V4A
- Order numbers
  – 6/8 mm: 71110801
  – 6.35 mm (¼"): 71110802

Compressor
- For cleaning system
- 230 V AC order number: 71072583
- 115 V AC order number: 71096199

Chemoclean
- Injector CYR10
- Ordering acc. to product structure
- Technical Information TI00046C/07/EN

Chemoclean COR3
- Spray head for sensor cleaning in immersion operation
- Material: PVC
- order no.: COR3-0

9 Trouble-shooting

9.1 Trouble-shooting instructions

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	Humidity or dirt in plug?(Fixed cable version only)	Cleaning by using cleaning alcohol.
	Polarization complete?	Wait until polarization time ends.
	Last calibration with different sensor?	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.
	Anode coating dissolved, is the anode silver instead of brown?	Send in the sensor for recoating.
	Cathode silver-plated?	Clean the cathode.
Displayed value too low	Humidity or dirt in plug?(Fixed cable version only)	Cleaning by using cleaning alcohol.
	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 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 Sensor checks

Only authorised and trained personnel may test the sensor!
You will also require a multimeter (voltage, resistance).

Check	Measure	Setpoint
Slope inspection	Place the sensor in the air, and dry with a paper towel.	After 10 minutes: approx. 102% SAT
Zero point inspection	Immerse the sensor in zero solution[1].	Display near to 0 mg/l (0% Sat)
	Open the measuring chamber and dry the electrodes.	

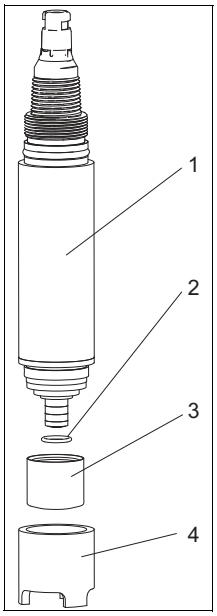
[1] How to use the zero solution:

1. Fill a large beaker (1.5 - 2 l) with approx. 1 l of water.
2. Pour a cap-full of the zero solution into the water.
3. Immerse the sensor into the water and wait a sufficient period of time (15 min. for oxygen depletion).
   The display drops to around 0 mg/l (0 %SAT).

Depending on the conditions (contact surface water/air), the zero solution is stable for up to 12 hours.

If there are deviations from the reference values, follow the troubleshooting instructions or contact your sales office.

9.3 Spare parts

	Position	Spare parts kit	order no.
 *Fig. 17: Spare parts*	1	Sensor	acc. to product structure
	2	Sealing ring COY31-OR – Material: Viton – 3 pieces	51506985
	3	Membrane cap – Replacement cartridge COY31-WP for normal response time – 2 preterminated replacement cartridges with pretensioned membrane	51506976
		Membrane cap – Replacement cartridge COY31S-WP for fast response time – 2 preterminated replacement cartridges with pretensioned membrane	51506977
	without fig.	Zero solution – 3 units to produce 3 x 1 litre oxygen free solution	50001041
		Electrolyte COY3-F – 10 plastic ampoules, transparent	50053349
		Polishing sheets COY3-PF – for cathode cleaning – 10 pieces	51506973
	2-4	Accessories kit COY31-Z, one of each: – Electrolyte COY3F – Replacement cartridge COY31-WP for normal response time – Sealing ring COY31-OR – Polishing sheet COY3-PF	51506784
		Accessories kit COY31-S-Z, one of each: – Electrolyte COY3F – Replacement cartridge COY31S-WP for fast response time – Sealing ring COY31-OR – Polishing sheet COY3-PF	51506785

9.4 Return

The device must be returned if repairs or a factory calibration are required, or if the wrong device has been ordered or delivered. According to legal regulations, Endress+Hauser, as an ISO-certified company, is required to follow certain procedures when handling returned products that are in contact with medium.

To ensure swift, safe and professional device returns, please read the return procedures and conditions on the internet site:
www.services.endress.com/return-material

9.5 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

Measured variable

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

Measuring range

0.01 to 100 mg/l
0.00 to 1000 % SAT
0 to 2000 hPa

10.2 Performance characteristics

Response time

- COS51D-***0* (black membrane cap for normal response time):
  - t_{90}: 3 minutes
  - t_{98}: 8minutes (each at 20 °C / 68 °F)
- COS51D-***1* (white membrane cap for fast response time):
  - t_{90}: 0.5 minutes
  - t_{98}: 1.5 minutes (each at 20 °C / 68 °F)

Reference operating conditions

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

Signal current in air[1)]

- COS51D-***0* (black membrane cap):
  approx. 300 nA
- COS51D-***1* (white membrane cap):
  approx. 1100 nA

Polarization time

< 60 minutes

Longtime drift

Zero-point drift: < 0.1 % per week at 30 °C (86 °F)
Measuring range drift: < 0.1 % per week at 30 °C (86 °F) [1)]

1) under constant conditions each

Zero current

< 0.1 % of the current in air

Measured value resolution

0.01 mg/l (0.01 ppm)

Maximum measured error

±1 % of measured value[2)]

Repeatability

±1 % of measured value

Oxygen intrinsic consumption

- COS51D-***0*:
  Approx. 90 ng/h in air at 25 °C (77 °F)
- COS51D-***1*:
  Approx. 270 ng/h in air at 25 °C (77 °F)

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

10.3 Environment

Ambient temperature range	–5 to 50 °C (20 to 120 °F)
Storage temperature	filled with electrolyte: –5 to 50 °C (20 to 120 °F) without electrolyte: –20 to 60 °C (0 to 140 °F)
Ingress protection	IP 68 (test conditions: 10 m (33 ft) water column at 25 °C (77 °F) in 30 days)

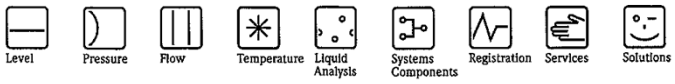
10.4 Process

Process temperature	–5 to 50 °C (20 to 120 °F)
Process pressure	max. 10 bar (145 psi) Underpressure operation is not permissible.

10.5 Mechanical construction

Weight	0.3 kg (0.7 lbs)
Materials	Sensor shaft: POM Membrane cap: POM Cathode: Gold Anode/Reference electrode: Silver / silver bromide
Process connection	G1 and NPT ¾"
Temperature compensation	internal
Membrane thickness	■ COS51D-***0*: approx. 50 µm ■ COS51D-***1*: approx. 25 µm
Electrolyte solution	Alkaline electrolyte

11 EC Declaration of Conformity



EG 156C/07/a3

EG-Konformitätserklärung
EC Declaration of Conformity
CE Déclaration de Conformité

Endress+Hauser Conducta Gesellschaft für Mess- und Regeltechnik mbH+Co. KG
Dieselstrasse 24, 70839 Gerlingen, Germany

erklärt in alleiniger Verantwortung, dass die Produkte
declares in sole responsibility that the products
déclare sous sa seule responsabilité que les produits

Memosens Sensoren / sensors / capteurs

Oxymax COS21D-*12*1
Oyxmax COS22D-BA**3**
Oxymax COS51D-G*8*0
mit Kabel / with cable / avec câble **CYK10-G**1**

EG-Baumusterprüfbescheinigung:
EC type examination certificate: **BVS 04 ATEX E 121 X**
Certificat de l'examen CE de type :
ausgestellt von / issued by / exposé par : **DEKRA EXAM GmbH**

mit den Vorschriften folgender Europäischen Richtlinien übereinstimmen:
are in conformity with the regulations of the following European Directives:
sont conformes aux prescriptions et directives Européennes suivantes:

94/9/EG (Geräte zur Verwendung in explosionsgefährdeten Bereichen)
(Equipment for use in potentially explosive atmospheres)
(Appareils et systèmes de protection en atmosphère explosive)

2004/108/EG (Elektromagnetische Verträglichkeit)
(Electromagnetic Compatibility)
(Compatibilité électrotechnique)

Angewandte harmonisierte Normen oder normative Dokumente:
Applied harmonized standards or normative documents:
Normes harmonisées ou documents normatives appliquées:
EN 60079-0:2009, EN 60079-11:2007, EN 60079-26:2007
EN 61326-1:2006, EN 61326-2-3:2006

Benannte Stelle für QS-Überwachung:
Notified body for QA control:
Organisme notifié pour l'assurance qualité :
DEKRA EXAM GmbH
Kennnummer / Identification number /
numéro d'identification (0158)

Gerlingen, 2010-01-25

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Director Development

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People for Process Automation

a0014925

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