



Level



Pressure



Flow



Temperature



Liquid  
Analysis



Registration



Systems  
Components



Services

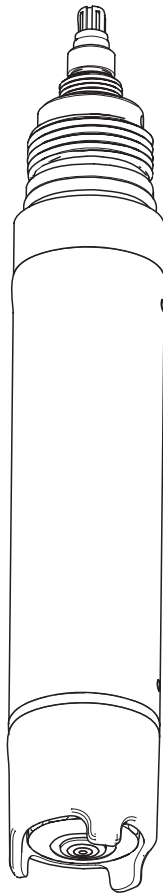


Solutions

## Operating Instructions

# Oxymax W COS31

Dissolved oxygen sensor



## Brief overview

Here is how to use these Operating Instructions to commission your sensor quickly and safely:

	<b>Safety instructions</b>
Page 4 ff. Page 5	General safety instructions Explanation of the warning symbols You can find special instructions at the appropriate position in the chapter in question. The positions are indicated with the icons Warning ⚠, Caution ⚡ and Note 📌.
	▼
	<b>Installation</b>
Page 7 ff. Page 9 ff.	Here you can find installation conditions such as sensor dimensions and the angle of installation. Installation examples can be found here.
	▼
	<b>Wiring</b>
Page 13 ff.	Refer to these pages for sensor wiring.
	▼
	<b>Sensor design and measuring principle</b>
Page 15 Page 16 ff. Page 16 ff.	Here you can read about the sensor design. The measuring principle is explained on this page. Here you can find the possible calibration methods.
	▼
	<b>Commissioning</b>
Page 19 ff.	The sensor must be polarised before calibration. Please, read on the given page how to do it.
	▼
	<b>Maintenance</b>
Page 20 ff. Page 21 ff. Page 26	It is absolutely essential to carry out maintenance tasks on a regular basis. Individual parts are subject to normal wear and tear. Here you can find out how to replace such parts. Here you can find an overview of the spare parts which can be delivered as well as an overview of the system.
	▼
	<b>Trouble-shooting</b>
Page 24 ff.	If faults occur during operation, use the checklist to locate the cause.
	▼
	▼
	<b>Index</b>
Page 29 ff.	You can find important terms and keywords on the individual sections here. Use the keyword index to find the information you need quickly and efficiently.

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# 1 Safety instructions

## 1.1 Designated use

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

Typical applications are:

- Measuring oxygen content in activated sludge basins.  
The measuring signal is used for monitoring and as a control parameter.
- Checking oxygen content in the outlet of a sewage treatment plant.
- Measuring and controlling the oxygen content in fish farming water.
- 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, therefore, 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, electrical connection, commissioning, operation and maintenance of the measuring system must only be carried out by trained technical personnel.  
The technical personnel must be authorised for the specified activities by the system operator.
- 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 for correctness. 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 authorised 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 organisation.

## 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 device requires repair, please send it *cleaned* to the sales centre responsible. Please use the original packaging, if possible.

Please enclose the completed "Declaration of contamination" (copy the second last page of these Operating Instructions) with the packaging and the transportation documents.

No repair without completed "Declaration of contamination"!

## 1.5 Notes on safety icons and symbols



Warning!

This symbol alerts you to hazards. They can cause serious damage to the instrument or to persons if ignored.



Caution!

This symbol alerts you to possible faults which could arise from incorrect operation. They could cause damage to the instrument if ignored.



Note!

This symbol indicates important items of information.

## 2 Identification

### 2.1 Product structure

Certificate	
A	Ex free version
Cable length	
0	Cable length: 1.5 m (4.92 ft)
2	Cable length: 7 m (22.97 ft)
4	Cable length: 15 m (49.22 ft)
8	Without Cable (TOP 68 version only)
9	Special design to customer specifications
Cable connection	
F	Fixed cable connection
S	Cable connection using TOP 68 plug
Membrane cap	
1	COY31-WP membrane cap, minimum flow rate 5 mm/s, for normal response time
2	COY31-S-WP membrane cap, minimum flow rate 25 mm/s, for fast response time
COS31-	Complete order code

### 2.2 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 english

If you have any questions, please contact your supplier or your sales centre responsible .

## 3 Installation

### 3.1 Incoming acceptance, transport, storage

- Make sure the packaging is undamaged!  
Inform the supplier about 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 delivery contents.  
Keep the damaged products until the matter has been settled.
- Check that the scope of delivery is complete and agrees with your order and the 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 sales centre responsible.

### 3.2 Installation conditions

#### 3.2.1 Dimensions

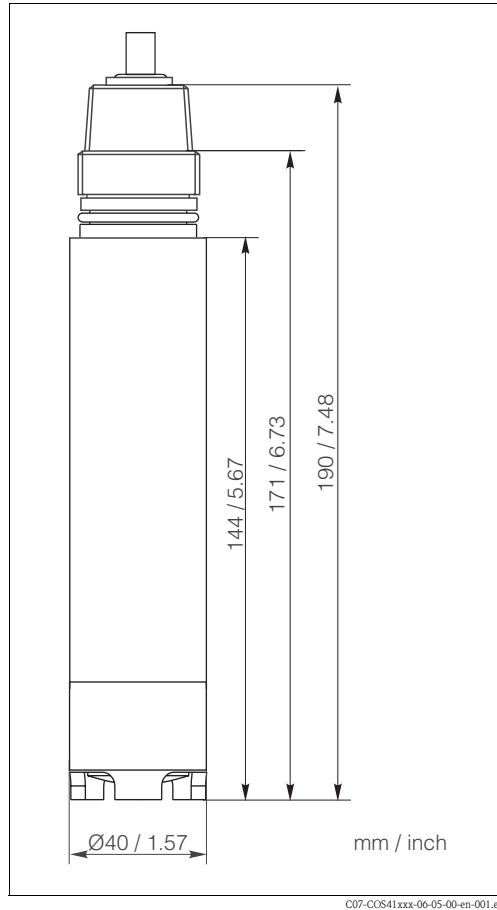


Fig. 1: Fixed cable version

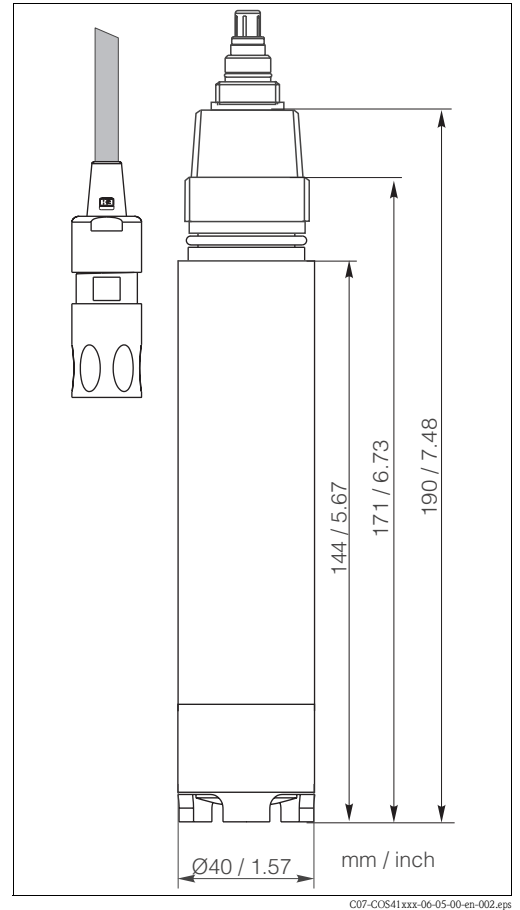


Fig. 2: TOP 68 plug-in head version

#### 3.2.2 Angle of installation

The sensor can be installed up to the horizontal in an assembly, support or a suitable process connection (Fig. 3). Other angles are not permissible. Do **not** install the sensor overhead.

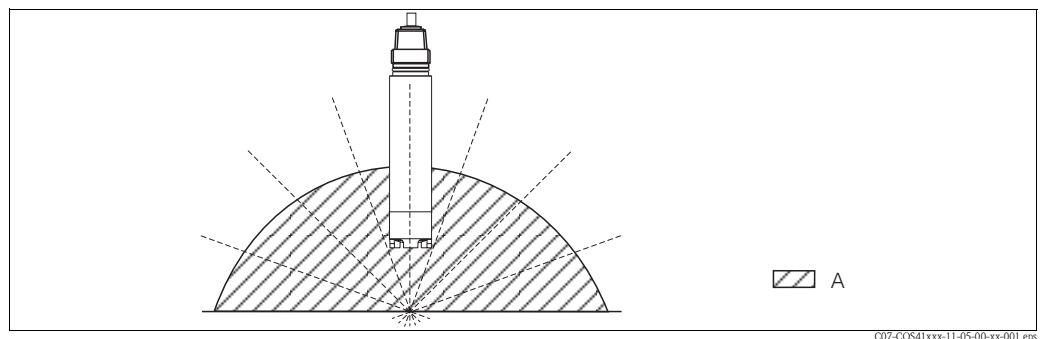


Fig. 3: Angle of installation

A Permissible installation positions: 0 ... 180°, overhead installation is not permitted



Note!

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

### 3.2.3 Installation place

- 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.
- For immersed operation in an activated sludge basin, 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:

- Oxygen sensor
- Transmitter, e.g. Liquisys M COM223/253-WX/WS
- Special measuring cable
- Assembly, e.g. flow assembly COA250, immersion assembly COA110 or retractable assembly COA451

Optional:

- Universal suspension assembly support CYH 101 for immersed operation
- Junction box VS (with cable extension)
- Automatic spray cleaning system Chemoclean

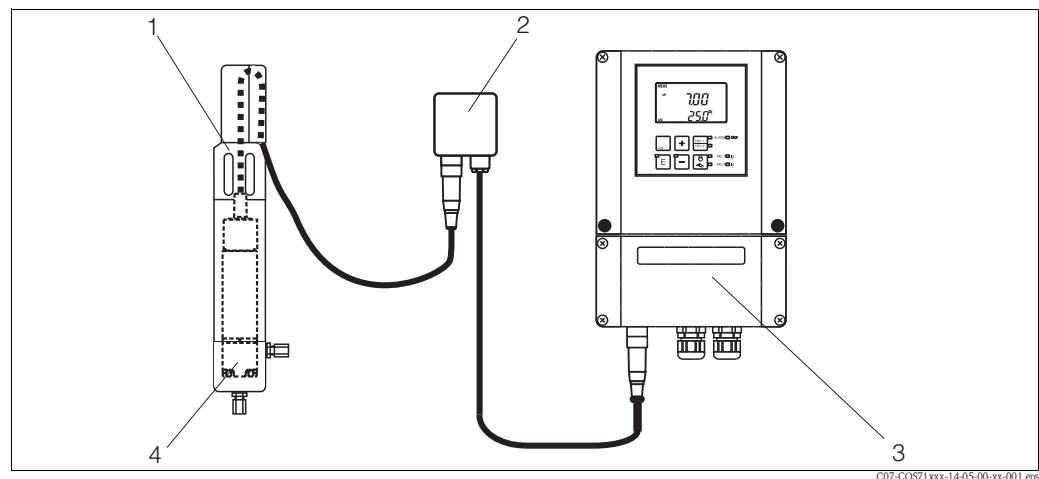


Fig. 4: Measuring system (example)

- 1 Flow assembly
- 2 Junction box VS (optional)
- 3 Transmitter Liquisys M COM253
- 4 Oxygen sensor

### 3.3.2 Installing a measuring point



Note!

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.





**Caution!**

- For immersed operation, the sensor must be installed in an immersion assembly (e.g. CYA 611).  
**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).
- Select the installation location so that there is easy access for later calibration.



**Warning!**

When using metallic assemblies and installation equipment, comply with national grounding regulations.

### 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 (Fig. 5, Fig. 6). The free swinging of the immersed assembly practically rules out vibrations from the upright post. A good self-cleaning of the membrane surface is reached due to the swinging of the assembly. According to this effect, the sensor life time can be extended.

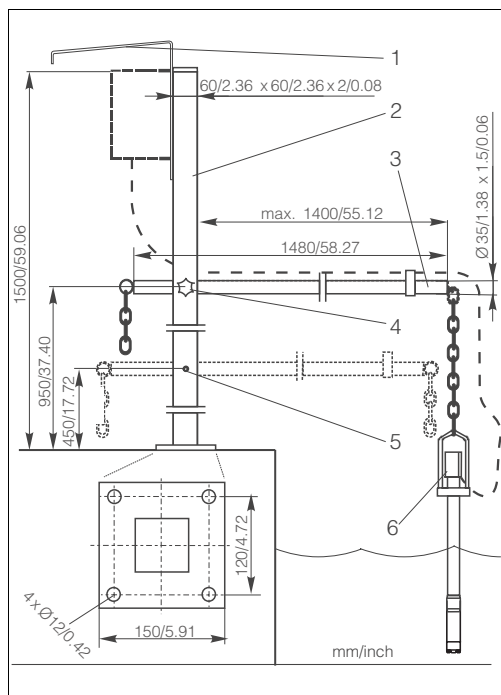


Fig. 5: Universal suspension assembly holder with immersible pendulum assembly

- 1 Weather protection cover
- 2 Upright post, square pipe SS AISI 304
- 3 Transverse pipe SS AISI 304
- 4 Star handle
- 5 Second fixing possibility for transverse pipe
- 6 Immersion assembly CYA 611

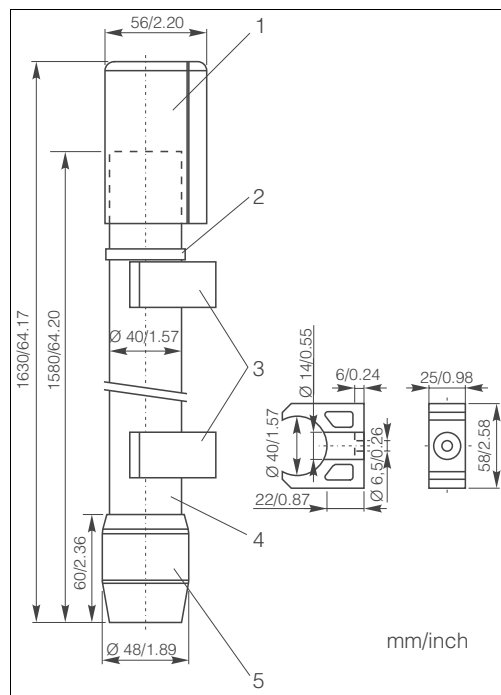


Fig. 6: Immersion assembly CYA 611

- 1 Protection cap
- 2 Worm drive hose clip
- 3 Pipe clips (detailed drawing in right half)
- 4 PVC pipe
- 5 Threaded coupling

### 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 (Fig. 7). If the flow is very strong, a second transverse pipe can be installed with its own pipe support.

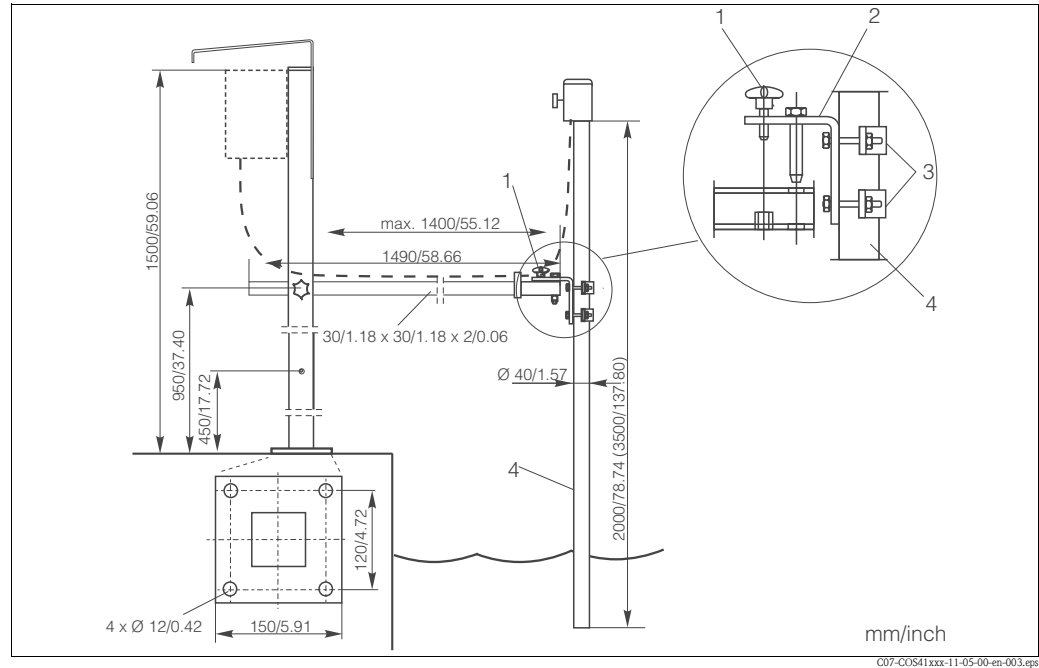


Fig. 7: Universal suspension assembly holder with immersion assembly

- 1 Star handle
- 2 Pipe holder
- 3 Fixing bracket
- 4 Immersion assembly (= immersion tube)

### Basin rim mounting

For fixing to the sides of the basin or channel, we recommend the use of a basin rim mounting of the immersion assembly (Fig. 8, Fig. 9).

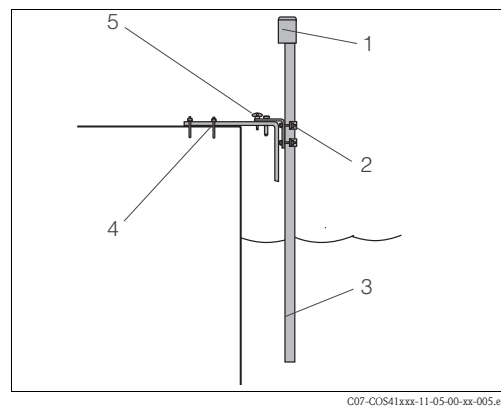


Fig. 8: Horizontal basin rim mounting

- 1 Protection cover for cable entry
- 2 Assembly holder
- 3 Immersion assembly SS 1.4301 (AISI 304)

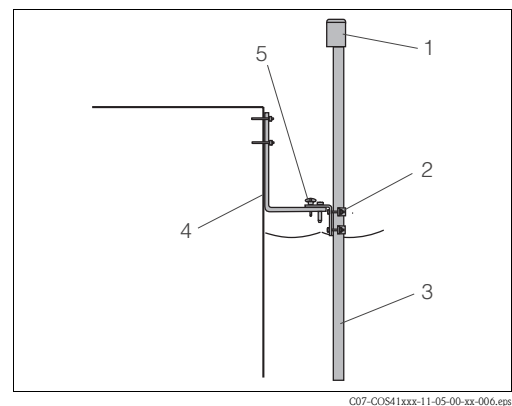


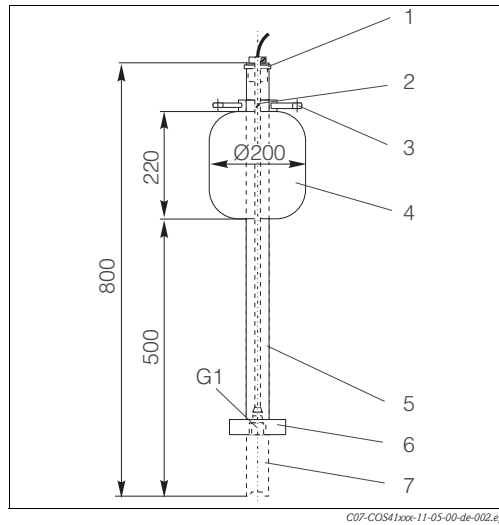
Fig. 9: Vertical basin rim mounting

- 4 Basin rim mounting
- 5 Star handle

If there is strong turbulence or flow, a second basin rim mounting must be used for the immersion assembly.

### 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 (Fig. 10).



- 1 Cable route with strain relief and rain protection
- 2 Mounting ring for ropes and chains with locking screw
- 3 Lugs  $\varnothing 15$ ;  $3 \times 120^\circ$  for anchoring
- 3 Saltwater-resistant plastic float
- 4 Pipe 40x1, rust-proof steel SS 1.4571 (AISI 316Ti)
- 5 Shock absorber and weight
- 6 Oxygen sensor
- 7

Fig. 10: Floating body

### 3.4.2 Flow operation

The COA 250-A flow assembly (Fig. 11) 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 G  $\frac{3}{4}$ ). It can be installed in a pipe by using two 90° pipe brackets to allow inflow to the assembly (Fig. 12, Pos. 6).

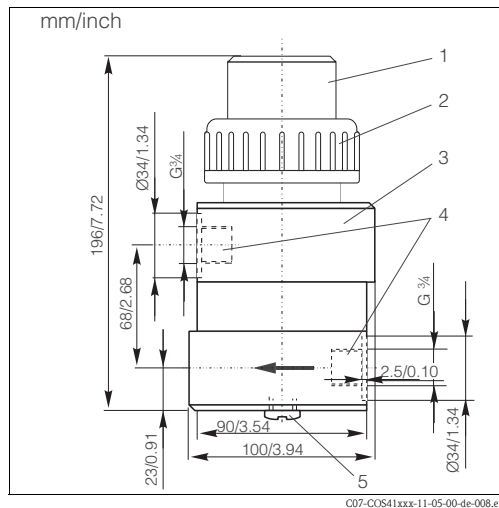


Fig. 11: Flow assembly COA 250-A

- 1 Screw-in part for sensor
- 2 Screw ring
- 3 Meter body
- 4 Connection thread G  $\frac{3}{4}$
- 5 Dummy plug (connection for spray head COR 3)

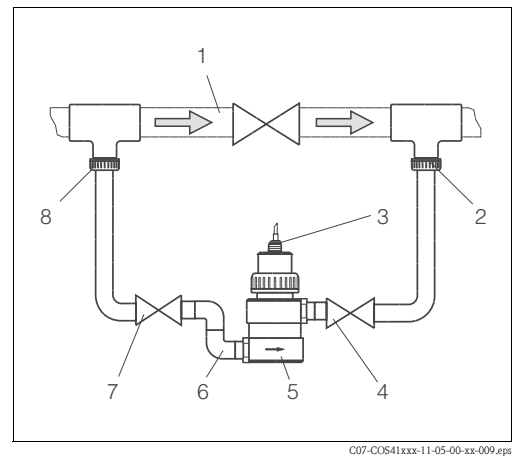


Fig. 12: Bypass installation with manually actuated valves or solenoid valves

- 1 Main line
- 2 Medium return
- 3 Oxygen sensor
- 4, 7 Manually actuated or solenoid valves
- 5 Flow assembly COA 250-A
- 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.

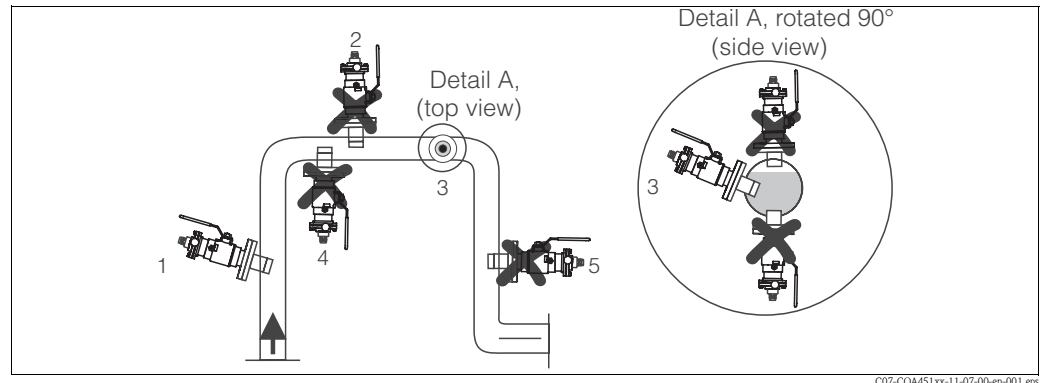


Fig. 13: Permissible and impermissible sensor installation positions

- 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



Note!

- 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 optics (→ Fig. 13).
- Measuring errors can occur, if:
  - the sensor is not immersed into the medium
  - suspended particles are settled on the sensor membrane
  - the sensor is installed overhead.

### 3.5 Post-installation check

- Check the membrane for leak tightness und replace it if necessary.
- Compliance with permissible sensor installation position?
- Is the sensor installed to an assembly and is not suspended from the cable?
- Avoid moisture by rain by fitting the protective cap to the immersion assembly?

## 4 Wiring



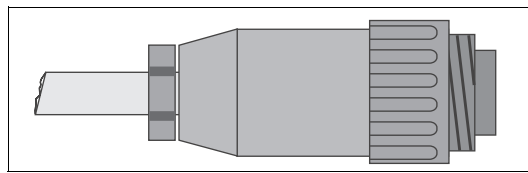
Warning!

- The electrical connection must only be carried out by authorised technical personnel.
- Technical personnel must have read and understood the instructions in this manual and must adhere to them.
- Ensure that there is no voltage at the power cable before beginning the connection work.

### 4.1 Direct connection to the transmitter

The sensor connection is different acc. to the transmitter version:

- Field device (COM253-WX/WS):  
Connect the sensor directly to the transmitter by using the special measuring cable with SXP plug.



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Fig. 14: SXP plug

- Panel mounted device (COM223-WX/WS):
  - Please, remove the SXP plug (transmitter side!) from the cable.
  - Take out the cable specification and the corresponding pins of Liquisys M COM223-WX/WS from the following table.  
Please note, that the cable specification differs acc. to the sensor version (fixed cable or TOP68 plug-in connection).

Pin of COM223	Sensor with fixed cable (OMK)		Sensor with TOP68 plug-in head (CYK71)	
	Colour	Assignment	Colour	Assignment
87	yellow	+U <sub>B</sub>	yellow	+U <sub>B</sub>
0	grey	OV	white	OV
96	pink	NTC (analogue) or comm. (digital)	green	Communication (digital)
97	blue	NTC (analogue) or comm. (digital)	brown	Communication (digital)
88	brown	-U <sub>B</sub>	Coax inner	-U <sub>B</sub>
19	green	Alarm		
18	white	Sensor signal		

## 4.2 Connection via junction box

To lengthen the sensor connection beyond the length of the fixed cable, you require a junction box VS (Fig. 15, Fig. 16).

Always connect the sensor cable with the SXP plug to the junction box.

The cable extension to the transmitter then depends from the transmitter version, i.e. field device or panel mounted device.

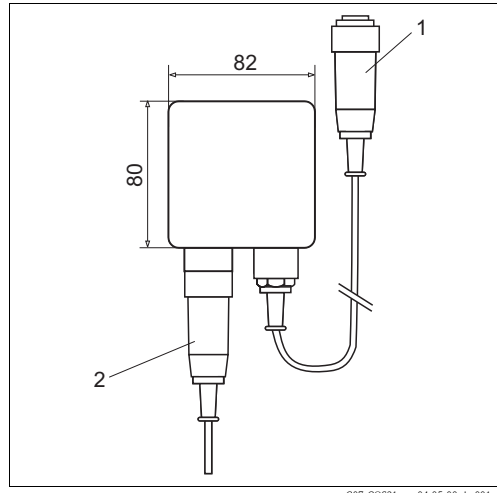


Fig. 15: Junction box VS to a field device

- 1 SXP plug to field device
- 2 SXP plug from sensor

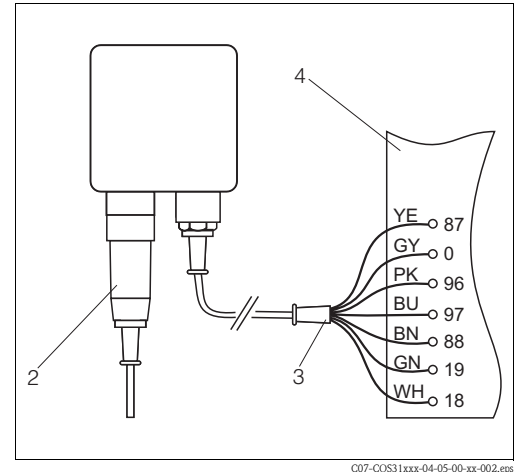


Fig. 16: Junction box VS to a panel mounted device

- 2 SXP plug from sensor
- 3 Measuring cable (OMK) to the transmitter
- 4 Connection department of the transmitter

## 4.3 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?	110/230 V AC 24 V AC/DC
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 COM 2x3.
Are all the screws terminals properly tightened ?	
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 Operation

### 5.1 Sensor design

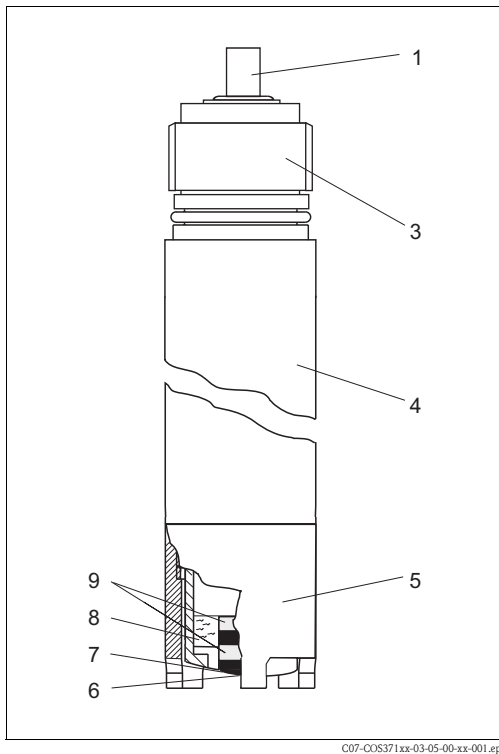


Fig. 17: Sensor design

- 1 Sensor cable
- 3 Threaded connection G1
- 4 Sensor shaft
- 5 Protection basket
- 6 Cathode
- 7 Membrane
- 8 Electrolyte
- 9 Anode

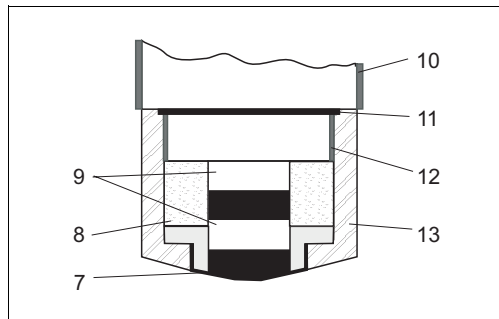


Fig. 18: Sensor head, cutaway drawing

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

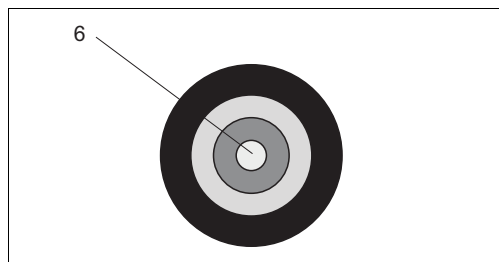


Fig. 19: Sensor head, top view

- 6 Cathode

The sensor consists of the following function units:

- Sensor shaft (Fig. 17, pos. 4)
- Sensor head with cathode and anode (Fig. 18, Fig. 19)
- Membrane cap with electrolyte filling (Fig. 18, pos. 13 and 8)
- Protection basket (Fig. 17, pos. 5)



Note!

- 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 Polarisation

When the sensor is connected to the transmitter, a fixed external voltage is applied between the cathode and anode. The resulting polarisation current is indicated on a display on 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<sup>-</sup>) at the cathode. Silver is oxidised to silver ions (Ag<sup>+</sup>) at the anode (this forms a silver bromide layer, AgBr). A current flows due to the connected electrode release at the cathode and accepted at the anode. In equilibrium, this flow is proportional to the oxygen content of the medium. This current is converted in the measuring instrument and indicated on the display as an oxygen concentration in mg/l, as a saturation index in % SAT or as an oxygen partial pressure in hPa.

## 5.3 Calibration

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

The sensor requires calibration after:

- first commissioning
- replacing a membrane or electrolyte
- cleaning the cathode
- long breaks in operation without power supply
- typical time intervals dependent on operating experience

There are three basic types of calibration:

- in air (preferably saturated water vapour, e.g. near the water surface)
- in air-saturated water
- by entering a reference measured value in the transmitter (sensor remains in the medium).



Note!

Following **only** the calibration in air is discribed because it is the easiest and that's why the recommended method of calibration.

Calibration in air is only possible if air temperature  $\geq -5$  °C.



### 5.3.1 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. If the sensor is removed from a closed pressure system with a process pressure greater than atmospheric pressure:
  - Open the membrane cap to equilibrate the pressure and clean the cap if necessary.
  - Replace the electrolyte filling and close the membrane cap again.
  - Wait for the polarisation time to end.
4. 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.
5. If the measured value display on the transmitter is stable, carry out the calibration in accordance with the Operating Instructions of the transmitter.
6. Place the sensor in the medium again.



Note!

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

### 5.3.2 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 sensor temperature (ambient air)
  - 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 for an approximate calculation.)
2. Define:
  - the saturation value **S** acc. to the first table
  - the factor **K** acc. to the second table

°C	S [mg/l]
0	14.64
1	14.23
2	13.83
3	13.45
4	13.09
5	12.75
6	12.42
7	12.11
8	11.81
9	11.53
10	11.25

°C	S [mg/l]
11	10.99
12	10.75
13	10.51
14	10.28
15	10.06
16	9.85
17	9.64
18	9.45
19	9.26
20	9.08

°C	S [mg/l]
21	8.90
22	8.73
23	8.57
24	8.41
25	8.25
26	8.11
27	7.96
28	7.82
29	7.69
30	7.55

°C	S [mg/l]
31	7.42
32	7.30
33	7.18
34	7.06
35	6.94
36	6.83
37	6.72
38	6.61
39	6.51
40	6.41

Altitude [m]	K
0	1.000
50	0.994
100	0.988
150	0.982
200	0.977
250	0.971
300	0.966
350	0.960
400	0.954
450	0.949
500	0.943

Altitude [m]	K
550	0.938
600	0.932
650	0.927
700	0.922
750	0.916
800	0.911
850	0.905
900	0.900
950	0.895
1000	0.890

Altitude [m]	K
1050	0.885
1100	0.879
1150	0.874
1200	0.869
1250	0.864
1300	0.859
1350	0.854
1400	0.849
1450	0.844
1500	0.839

Altitude [m]	K
1550	0.834
1600	0.830
1650	0.825
1700	0.820
1750	0.815
1800	0.810
1850	0.805
1900	0.801
1950	0.796
2000	0.792

3. Determine:
  - **L** = rel. air pressure at calibration (1013 hPa if unknown)
  - **M** = 1.02 for calibration in air resp. 1.00 for calibration in air-saturated water
4. Calculate the calibration value **C**:

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

#### Example

- Air calibration at 18°C, altitude 500 m above sea level, air pressure 1022 hPa
- $S = 9.45 \text{ mg/l}$ ,  $K = 0.943$ ,  $L = 1.0089$ ,  $M = 1.02$

Calibration value  $C = 9.17 \text{ mg/l}$ .

## 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 water connection at the assembly rinse connection.



**Warning!**

Danger of medium leaking off

Before applying compressed air to an assembly with cleaning facility, make sure the connections are correctly fitted. Otherwise, the assembly may not be insert into the process.

### 6.2 Polarisation

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 Liquisys M COM 223/253, polarisation is automatically performed after switching on the transmitter.
5. The polarisation time takes about 1 hour.



**Note!**

Polarisation starts high, then drops gradually. You will recognise the end of polarisation when the display stabilises and remains practically constant.



**Caution!**

- When you remove the sensor from the medium, protect the sensor from strong sunlight.
- Make sure you comply with the instructions for commissioning and calibration in the Operating Instructions of the transmitter.

### 6.3 Calibrate

Calibrate the sensor (Calibration in air, → Page 17) immediately after it's polarisation.

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  $102 \pm 2$  %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.




**Note!**

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

## 7 Maintenance

Maintenance work must be 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 following activities must be carried out:

- Cleaning the sensor  
(In particular when the membrane is soiled)
- 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 near to 102% SAT (display of O<sub>2</sub> saturation with COM 2x3 by pressing 4 times the  key).
- Replace a defective membrane or one which cannot be cleaned any more.
- Recalibration.



Note!

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

### 7.1 Cleaning the sensor

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.
- Soiling or poisoning of the electrolyte
  - ➡ causes 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.

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 <b>(not on the membrane!)</b>	Clean the sensor body mechanically with water and a suitable brush.
Dirt particles on the membrane cap or the membrane	Clean the membrane with water and a soft sponge.



Caution!

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

## 7.2 Regenerating the sensor

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

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



Warning!

Before beginning regeneration, switch off the power supply at the transmitter.

### 7.2.1 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 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 electrode with drinking or distilled water.
4. Fill the membrane cap with fresh electrolyte COY 3-F and screw it back onto the membrane body (up to the stop).



Caution!

The **anode** is covered with a silver bromide layer at the factory. **Do not clean the anode under any circumstances!**

If the coating of the anode is removed as a result of operation, the sensor is unusable and must be sent in for recoating. In this case, contact your sales office.

### 7.2.2 Replacing the sealing ring

Replacing the sealing ring is only necessary when it is visibly damaged. For replacement, use only the supplied sealing rings COY 31-OR.

### 7.2.3 Replacing the electrolyte

The electrolyte COY 3-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 life of an electrolyte filling for use in air-saturated drinking water at 20°C is max. 5 years. The electrolyte life is shortened by diffused, dissolved gases such as H<sub>2</sub>S, NH<sub>3</sub> or high concentrations of CO<sub>2</sub>.

Particular loads occur with:

- anaerobic stages (e.g. denitrification)
- strongly polluted industrial wastewater, particularly at high temperatures.

**Warning!**

Risk of acid burns!

The electrolyte is strongly alkaline. You must follow the appropriate occupational safety regulations. Always wear protective gloves and goggles with handling electrolytes.

To replace the electrolyte, proceed as follows:

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.

## 7.2.4 Replacing the membrane cap

### Removing the old membrane cap

1. Remove the sensor from the medium.
2. Unscrew the protection basket.
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 basket back on.

**Note!**

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

## 8 Accessories

### 8.1 Connection accessories

- VS junction box  
with plug-in socket and 7-pole plug,  
for cable extension from sensor (COS 31, COS 3 with SXP connector) to transmitter, IP 65;  
order no. 50001054
- Measuring cable OMK  
for use as extension cable between junction box VS and transmitter, not terminated  
sold by the metre – order no. 50004124
- Measuring cable for sensors COS 31 and COS 71 with TOP 68 connector  
COK 31; length: 1.5 m (4.92 ft) – order no. 51506820  
COK 31; length: 7 m (22.97 ft) – order no. 51506821  
COK 31; length: 15 m (49.22 ft) – order no. 51506822

### 8.2 Installation accessories

- Immersion assembly COA110  
for sensor immersion in the basin, PVC pipe resp. PUR floating body with SS 1.4571 (AISI 316Ti)  
immersion tube;  
Ordering acc. to product structure (see Technical Information TI 035C/07/en, 50052566)
- Flow assembly COA250  
for sensor installation in pipe lines, PVC;  
(Technical Information TI111C/07/en, order no. 50068518)  
Order no. COA 250-A
- Retractable assembly Cleanfit COA451  
Manually driven retractable assembly, stainless steel, with ball valve, for oxygen sensors;  
ordering acc. to product structure (Technical Information TI368C/07/en, 51512831)
- Immersion assembly Dipfit W CYA611  
for sensor immersion in basins, open channels and tanks, PVC;  
Ordering acc. to product structure (Technical Information TI 166C/07/en)
- Immersion assembly CYY105  
for sensor immersion in basins, SS 1.4404 (AISI 316L) pipe, SS 1.4571 (AISI 316Ti) fitting;  
Ordering acc. to product structure (Technical Information TI 092C/07/en, 50061228)
- Basin rim holder CYY106  
for sensor immersion into the basin, SS 1.4301 (AISI 304);  
Order no. CYY106-A
- Baffle plate OP  
extra protection for extreme current conditions; order no. 50028712
- Membrane protection basket COY3-SK  
or sensor use in fish ponds; order no. 50081787

### 8.3 Measurement, controlling and sensor cleaning

- Liquisys M COM223/253  
Transmitter with integrated sensor function monitoring, measured value monitoring, free  
configuration alarm contact, field or control panel installation, HART® or PROFIBUS possible;  
Ordering acc. to product structure, see Technical Information TI 199C/07/en;  
order no. 51500281
- ChemoClean  
Injector CYR10 and programme sequencer CYR20  
Ordering by product structure, see Technical Information (TI 046C/07/en)
- Spray head COR3  
for sensor cleaning in immersion operation; order no.: COR3-0

## 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
<b>No display, no sensor reaction</b>	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.
<b>Displayed value too high</b>	With a TOP 68 connection: humidity or dirt in plug?	Cleaning of the TOP 68 plug-in connection by using cleaning alcohol.
	Polarisation complete?	Wait until polarisation 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.
<b>Displayed value too low</b>	With a TOP 68 connection: Humidity or dirt in plug ?	Cleaning of the TOP 68 plug-in connection by using cleaning alcohol.
	Sensor calibrated?	Recalibrate
	Medium flow available?	Create flow.
	Displayed 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.
<b>Strong deviations in displayed value</b>	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.
	EMC interference on the measuring system?	Remove outer screening of sensor and extension cable at terminal S. Cut measuring and signalling lines from h.v. power lines.



Problem	Check	Remedial action
<b>Membrane breakage alarm</b>	Membrane no longer sealed due to damage?	Replace membrane cap, polarise and calibrate the sensor.
	Membrane outside-to-outside not damaged?	Screw membrane cap tight. If the alarm still occurs: Separate sensor from transmitter for min. 30 seconds. Repeat once or twice, if the alarm remains. If the alarm still occurs: replace membrane cap, polarise and calibrate.
	Sealing ring of membrane cap not clean?	Take the sensor from the medium, clean and dry it. Clean the sealing ring or replace it, if it is damaged. Separate sensor from transmitter for min. 30 seconds. Repeat once or twice, if the alarm remains. If the alarm still occurs: send sensor in for repair.



Note!

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



Caution!

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

Check	Measure	Setpoint
<b>Voltage inspection</b>	With the sensor connected, test the operating voltage on the Lquisys M COM 223/253-WX/WS transmitter	between terminals 87 and 0: +8 V between terminals 88 and 0: -8 V
<b>Slope inspection</b>	Place the sensor in the air, and dry with a paper towel.	After 10 minutes: approx. 102% SAT (4 times $\square$ )
<b>Zero point inspection</b>	Immerse the sensor in zero solution <sup>1</sup> .	Display near to 0 mg/l (0% Sat)
	Open the measuring chamber and dry the electrodes.	
<b>Temperature sensor check</b>	Disconnect the sensor and measure the resistance: – between TOP68 pins 3 and 4 – between SXP pins 3 and 4 (with fixed cable version)	depending on temperature: 5 °C: 74.4 k $\Omega$ 10 °C: 58.7 k $\Omega$ 15 °C: 46.7 k $\Omega$ 20 °C: 37.3 k $\Omega$ 25 °C: 30.0 k $\Omega$ 30 °C: 24.3 k $\Omega$

<sup>1</sup> 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.



**Note!**  
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.
<p style="font-size: small;">C07-COS41 xxx-09-05-06-xx-001.eps</p> <p>Fig. 20: COS31</p>	1	Sensor	see 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
	4	Membrane protection basket	on request
	without fig.	Electrolyte COY3-F – 10 plastic ampoules, transparent	50053349
		Polishing sheets COY3-PF – for cathode cleaning – 10 pieces	51506973
		Zero solution – 3 units to produce 3 x 1 litre oxygen free solution	50001041
	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

If the device requires repair, please send it *cleaned* to the sales centre responsible. Please use the original packaging, if possible.

Please enclose the completed "Declaration of contamination" (copy the second last page of these Operating Instructions) with the packaging and the transportation documents.  
No repair without completed "Declaration of contamination"!

### 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

<b>Measured value</b>	dissolved oxygen [mg/l / % SAT / hPa]
<b>Measuring range</b>	with Liquisys M COM223/253-WX/WS: 0.05 ... 60.00 mg/l 0.00 ... 600 % SAT 0 ... 1200 hPa

### 10.2 Performance characteristics

<b>Response time</b>	<ul style="list-style-type: none"> <li>■ COS31-XXX1 (membrane cap for normal response time):           <ul style="list-style-type: none"> <li>- T<sub>90</sub>: 3 minutes</li> <li>- T<sub>99</sub>: 9 minutes (each at 20 °C)</li> </ul> </li> <li>■ COS31-XXX2 (membrane cap for fast response time):           <ul style="list-style-type: none"> <li>- T<sub>90</sub>: 0.5 minutes</li> <li>- T<sub>99</sub>: 1.5 minutes (each at 20 °C)</li> </ul> </li> </ul>
<b>Slope</b>	approx. 300 nA (at 20 °C, 1013 hPa)
<b>Polarisation time</b>	< 60 minutes
<b>Minimum flow rate</b>	for 95 % of measured value display: <ul style="list-style-type: none"> <li>■ COS31-XXX1: typical 0.5 cm/s</li> <li>■ COS31-XXX2: typical 2.5 cm/s</li> </ul>
<b>Drift</b>	with permanent polarisation: < 1 % per month
<b>Zero current</b>	zero current free
<b>Sensor monitoring</b>	with Liquisys M COM 223/253: cable interruption or short-circuit incorrect measurement and sensor passivation

### 10.3 Environment

<b>Storage temperature</b>	filled with electrolyte: -5 ... 50 °C (23 ... 122 °F) without electrolyte: -20 ... 60 °C (-4 ... 140 °F)
<b>Ingress protection</b>	IP 68

### 10.4 Process

<b>Process pressure</b>	max. 10 bar (145 psi) permissible overpressure Underpressure operation is not permissible.
<b>Process temperature</b>	-5 ... 50 °C (23 ... 122 °F)

## 10.5 Mechanical construction

<b>Design, dimensions</b>	see chapter "Installation"	
<b>Weights</b>	with cable length 7 m (22.97 ft): 0.7 kg (1.5 lb.) with cable length 15 m (49.22 ft): 1.1 kg (2.4 lb.) with TOP68 plug-in connection: 0.3 kg (0.7 lb.)	
<b>Materials</b>	Sensor shaft: Membrane cap: Cathode: Anode:	stainless steel 1.4571, AISI 316Ti POM Gold Silver / Silver bromide
<b>Process connections</b>	G1	
<b>Cable entry (sensor)</b>	Fixed cable or TOP68 plug-in connection	
<b>Cable entry (transmitter)</b>	<ul style="list-style-type: none"> <li>■ SXP plug (field device)</li> <li>■ Terminal connection (panel mounted device)</li> </ul>	
<b>Cable length incl. extension cable</b>	max. 100 m / 328.1 ft (including cable extension)	
<b>Temperature compensation</b>	NTC temperature sensor 30 kΩ at 25 °C (77 °F), 0 ... 50 °C (32 ... 122 °F)	
<b>Membrane thickness</b>	<ul style="list-style-type: none"> <li>■ COS31-XXX1: approx. 50 μm</li> <li>■ COS31-XXX2: approx. 25 μm</li> </ul>	

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# Declaration of contamination

Dear customer,  
 Because of legal determinations and for the safety of our employees and operating equipment, we need this "Declaration of contamination" with your signature before your order can be handled. Please, include the completely filled in declaration with the device and the shipping documents in any case. Add also safety sheets and / or specific handling instructions if necessary.

Type of device / sensor:	_____	Serial no.:	_____
Medium / concentration:	_____	Temperature:	_____ Pressure: _____
Cleaned with:	_____	Conductivity:	_____ Viscosity: _____

## Warning hints for medium used (mark the appropriate hints)

							
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
radioactive	explosive	caustic	poisonous	harmful to health	biologically hazardous	inflammable	safe

## Reason for return

\_\_\_\_\_  
 \_\_\_\_\_

## Company data

Company:	_____	Contact person:	_____
	_____		_____
Address:	_____	Department:	_____
	_____	Phone:	_____
	_____	Fax / e-mail:	_____
		Your order no.:	_____

I hereby certify that the returned equipment has been cleaned and decontaminated acc. to good industrial practices and is in compliance with all regulations. This equipment poses no health or safety risks due to contamination.

\_\_\_\_\_  
 (Place, date)

\_\_\_\_\_  
 (Company stamp and legally binding signature)

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