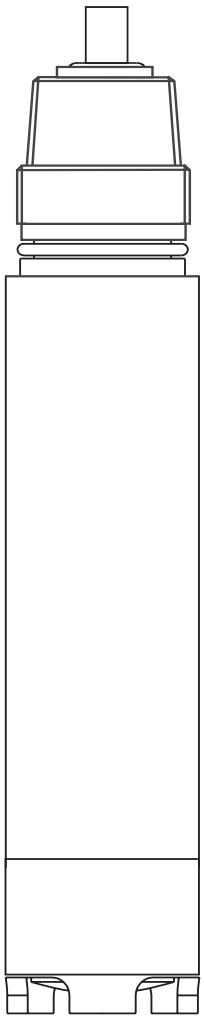
BA 284E00/09.01
No. 51508767

# *OOS 41*
# Sensor for Measuring Dissolved Oxygen

## Operating Instructions



# Contents

# 1 Safety instructions

## 1.1 Notes on safety conventions and icons

Warning!
This symbol alerts you to hazards which could cause serious injuries as well as damage to the instrument 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.

## 1.2 Designated use

The oxygen sensor OOS 41 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 discharge of a sewage treatment plant.
- Monitoring public waters.
  Measuring and controlling the oxygen content in fish farming water.
- Oxygen enrichment in drinking water.

Warning!
- If the device is used for any application other than those described in this manual, it may lead to unsafe and improper functioning of the measuring system and is therefore not permitted.
- Make sure you strictly adhere to the warnings and notes in these Operating Instructions.

## 1.3 Installation, comissioning and operation

Warning!
- Only trained technical personnel may carry out installation, electrical connection, commissioning, operation and maintenance of the measuring system. The technical personnel must be authorised to do this by the system operator.
- Technical personnel must be familiar with the instructions in this manual and must adhere to them.
- Before switching on the system, check all the connections again for correctness.
- Do not operate damaged sensors. Indicate them as being defective.
- Measuring point faults may only be remedied by authorised and trained personnel.
- If faults cannot be repaired, the sensor must be taken out of service and secured against unintentional commissioning.
- Repairs may only be carried out by the manufacturer.

## 1.4 Operational safety

The OOS 41 sensor is operationally reliable and is made to the state of the art. The appropriate regulations and EC directives (see "Technical data") have been met.

As the user, you are responsible for complying with the following safety conditions:

- Explosion protection regulations
- Installation instructions
- Operating instructions for the assembly and its materials
- Local prevailing standards and regulations

## 1.5 Return

If the device requires repair, please send the sensor **clean** (see page 18) to your supplier. Please use the original packaging where possible.
Please add the filled in »Declaration of contamination« (copy the last but one page of this manual) to the packing of the sensor and add it also to the shipping documents.

## 1.6 Disposal

Defective, non-repairable sensors must be disposed of.
Please keep to the local disposal regulations!

# 2 Identification

## 2.1 Product structure

**OOS 41**

| | | |
|---|---|---|
| | **Cable length** | |
| | 2 | Cable length 7 m |
| | 4 | Cable length 15 m |
| | 8 | without cable (only for TOP 68 version) |

| | | | |
|---|---|---|---|
| | | **Cable connection** | |
| | | F | Fixed cable connection |
| | | S | Cable connection using TOP 68 plug |

| | | | |
|---|---|---|---|
| OOS 41- | | | Complete order code |

## 2.2 Scope of delivery

Note!
- Make sure the packaging is undamaged!
  Inform the post office or the courier of any damage to the packing.
  Keep the damaged packaging until the matter has been clarified.
- Make sure the contents are undamaged!
  Inform the post office or the courier of any damage to the delivered contents.
  Keep the damaged products until the matter has been clarified.
- Use the delivery papers to check that the scope of delivery is complete.

The following items are included in the delivery:

- 1 oxygen sensor OOS 41 with transport protection cap for membrane protection
- 1 Accessories Set OOY 31-Z with the following contents:
  – 1 spare replacement cartridge OOY 31-WP
  – 10 plastic ampoules containing electrolyte filling OOY 3-F
  – 1 sealing kit OOY 31-OR with 3 O-rings
  – 6 abrasive sheets
- Operating Instructions BA 284E00

If you have questions, please contact your supplier.

# 3 Installation

## 3.1 Measuring device

A complete measuring system comprises:

- Oxygen sensor OOS 41
- Oxygen transmitter, e.g. OOM 223-DX/DS

**Optional:**

- Universal suspension assembly support OYH 101 for immersed operation
- Immersion assembly OYA 611 or flow assembly OOA 250 or OOA 461
- Junction box VBM
- Automatic spray cleaning system

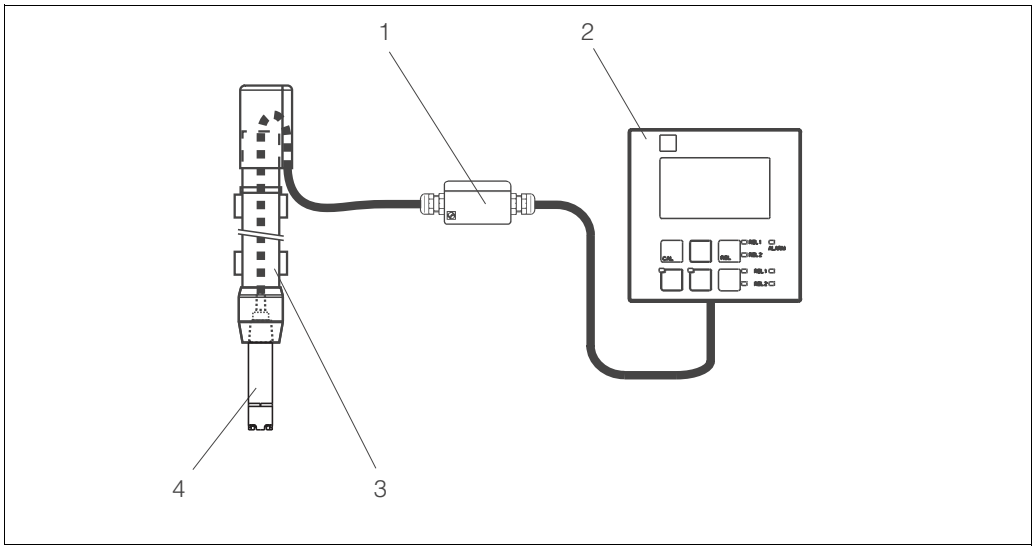



*Fig. 3.1: Complete measuring device for OOS 41 with OOM 223-DX/DS*

*1 VBM junction box (only if cable extension required)*
*2 Transmitter OOM 223-DX/DS*
*3 Immersion assembly OYA 611*
*4 Oxygen sensor OOS 41*

## 3.2 Installation conditions

### 3.2.1 Installation dimensions

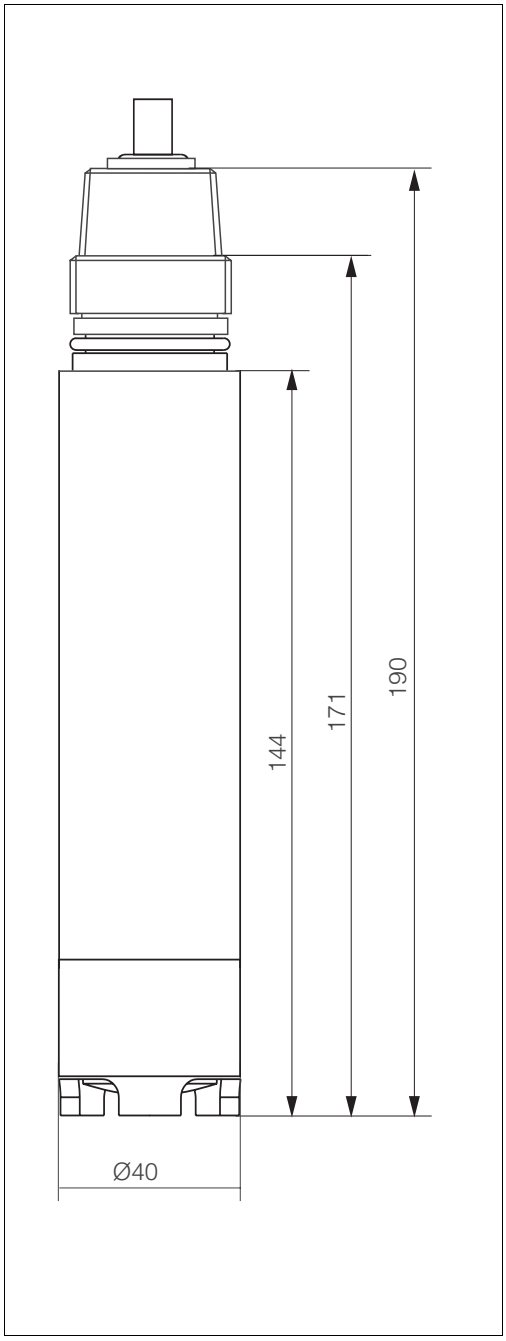



*Fig. 3.2: Dimensions OOS 41 fixed cable version*

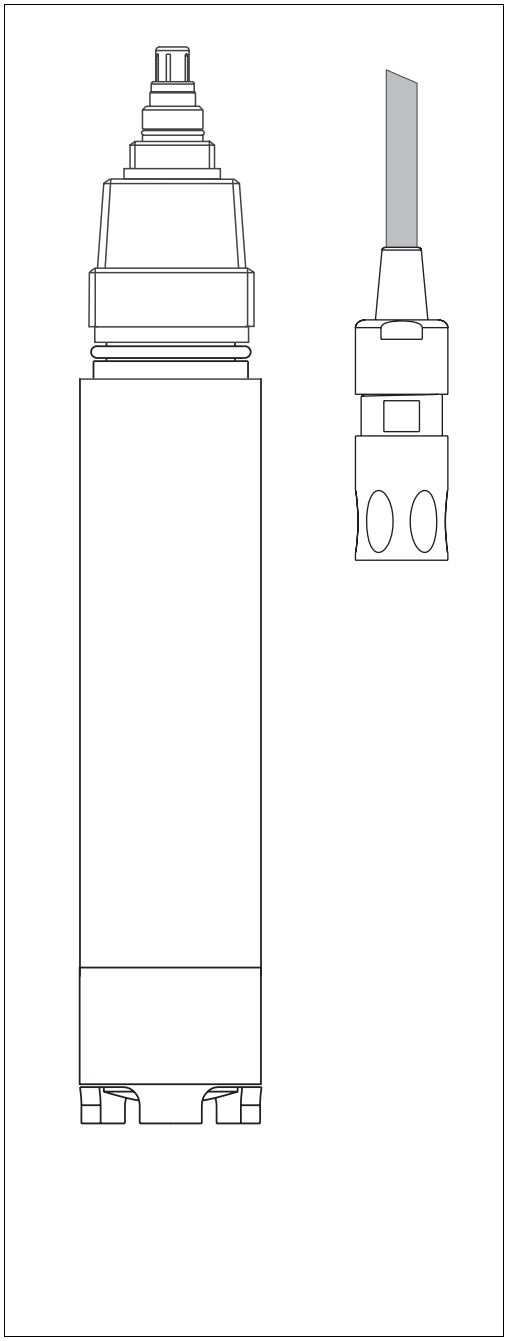


*Fig. 3.3: OOS 41 with TOP 68 plug-in head and TOP 68 plug-in cable*

## 3.3 Installation location and position

The sensor can be installed up to the horizontal in an assembly, support or a suitable process connection (Fig. 3.4). Other angles are not permissible. Do **not** install the sensor overhead.

Permissible installation

.

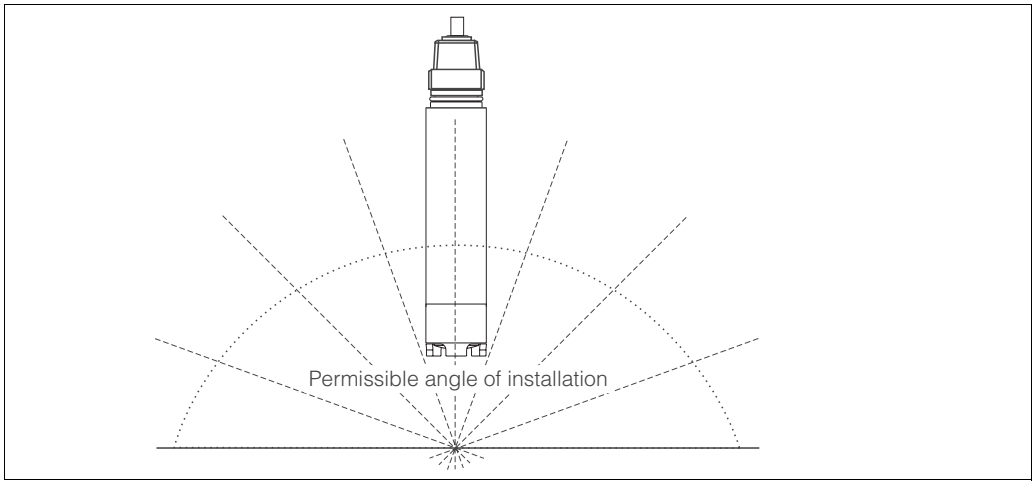



*Fig. 3.4: Permissible installation positions for the OOS 41 oxygen sensor*

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

Installing a measuring point

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

1. Installing an retractable or an flow assembly (if used) into the process.
2. Water connection to the rinse connections (if you use an assembly with cleaning function).
3. Installing and connecting the oxygen sensor.
4. Installing 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. OYA 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.

**Pre-installation**
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.

**Placing**
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.

### 3.3.1 Installation examples

**Immersed operation**
For large basins, where sufficient installation distance is required from the basin edge, it is advisable to use the **upright post and chain assembly** (Figs. 3.5 and 3.6). The free swinging of the immersed assembly practically rules out vibrations from the upright post.

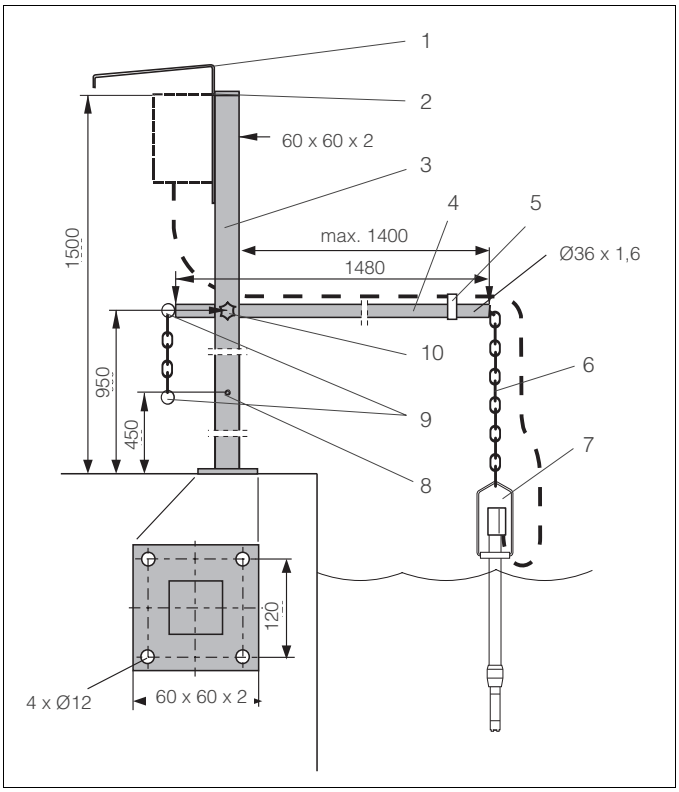



*Fig. 3.5: Universal assembly support OYH 101-A with immersible pendulum assembly OYA 611*

*1 Weather protection cover*
*2 Dummy plug*
*3 Upright post square pipe stainless steel AISI 304*
*4 Transverse pipe stainless steel AISI 304*
*5 Velco fastener*
*6 Plastic chain, length 5 m*
*7 Immersion assembly OYA 611*
*8 Second fixing possibility for transverse pipe*
*9 Plastic shackle*
*10 Star handle*

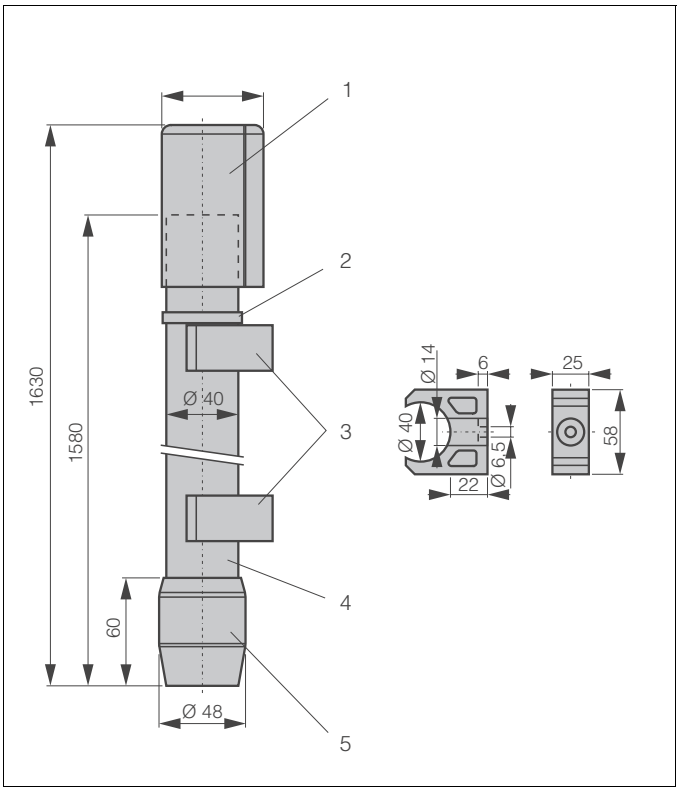



*Fig. 3.6: OYA 611: Components and dimensions*

*1 Protective cap*
*2 Worm drive hose clip*
*3 Pipe clips (detailed drawing in right half of figure)*
*4 PVC pipe*
*5 Threaded coupling*

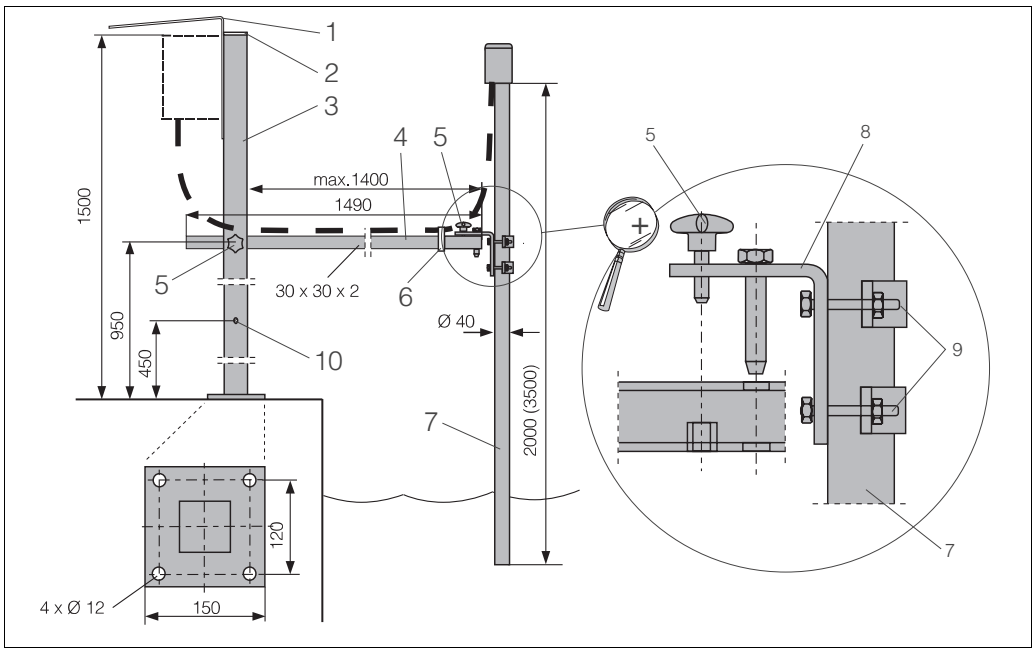



*Fig. 3.7: Universal assembly support OYH 101-D or E*

| | |
|---|---|
| *1* | *Weather protection cover* |
| *2* | *Dummy plug* |
| *3* | *Upright post square pipe stainless steel AISI 304* |
| *4* | *Transverse pipe stainless steel AISI 304* |
| *5* | *Star handle* |
| *6* | *Velco fastener* |
| *7* | *Immersion tube* |
| *8* | *Pipe holder* |
| *9* | *Fixing bracket* |
| *10* | *Second fixing possibility for transverse pipe* |

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. 3.7). If the flow is very strong, a second transverse pipe (10) can be installed with its own pipe support.

For simple fixing to the sides of the basin or channel, we recommend the use of an immersion tube **basin edge mounting** (see Fig.).

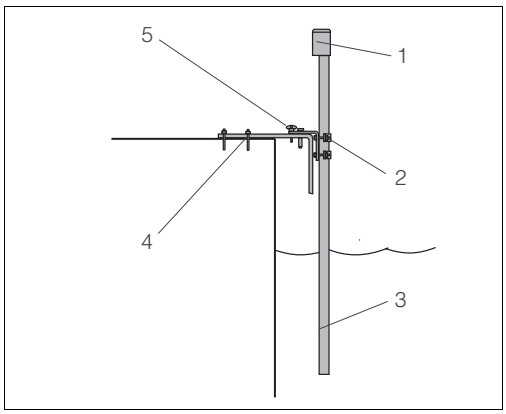



*Fig. 3.8: Horizontal basin edge mounting OYY 106-A with immersion tube OYY 105-A*

| | |
|---|---|
| *1* | *Shrouding cover for cable entry* |
| *2* | *Pipe holder* |
| *3* | *Immersion tube SS 304* |

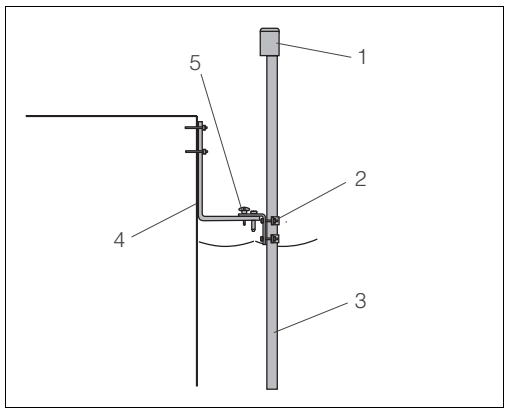



*Fig. 3.9: Vertical basin edge mounting OYY 106-A with immersion tube OYY 105-A*

| | |
|---|---|
| *4* | *Basin edge mounting* |
| *5* | *Star handle* |

If there is strong turbulence or flow, a second basin edge mounting must be used for an immersion tube.

To aid installation in strongly fluctuating water levels, e.g. in rivers or lakes, there is a **floating body OOA 110-50** available (Fig. 3.10).

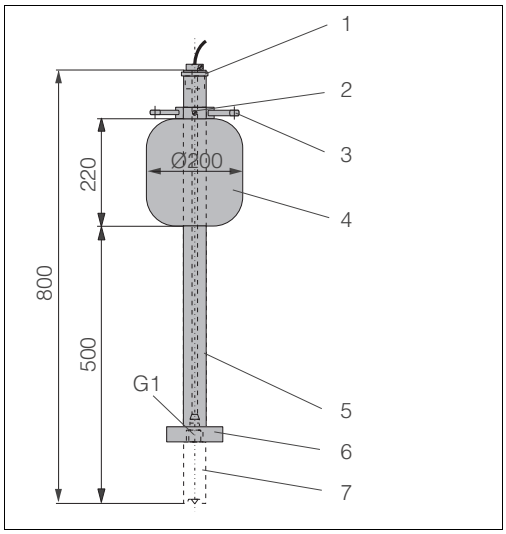



*Fig. 3.10: Float OOA 110-50*

| | |
|---|---|
| *1* | *Cable route with strain relief and rain protection* |
| *2* | *Mounting ring for ropes and chains with locking screw* |
| *3* | *Lugs Ø 15; 3x120° for anchoring* |
| *4* | *Saltwater-resistant plastic float* |
| *5* | *Pipe 40x1, rust-proof steel SS 316Ti* |
| *6* | *Shock absorber and weight* |
| *7* | *Oxygen sensor OOS 41* |

**Flow operation**

The OOA 250-A flow assembly (Fig. 3.11) 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 ¾). It can be installed in a pipe by using two 90° pipe brackets to allow inflow to the assembly (Fig. 3.12, Pos. 6).

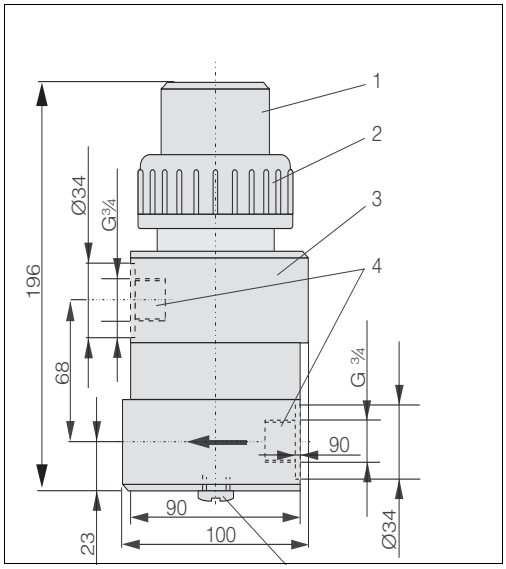



*Fig. 3.11: Flow assembly OOA 250-A*

| | |
|---|---|
| *1* | *Screw-in part for sensor* |
| *2* | *Screw ring* |
| *3* | *Meter body* |
| *4* | *Connection thread G ¾* |
| *5* | *Dummy plug on the connection thread for spray head OOR 3* |

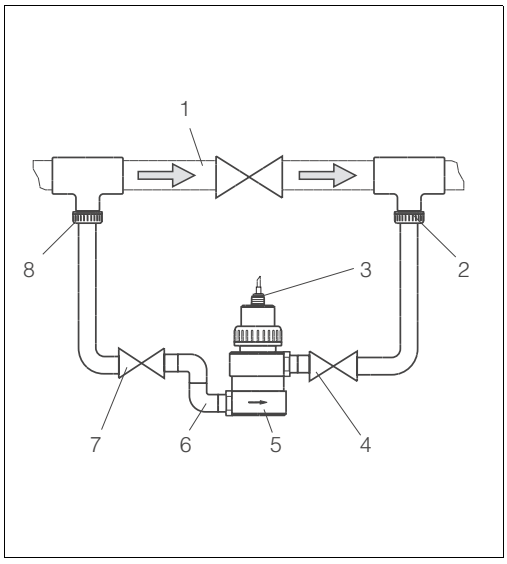



*Fig. 3.12: Bypass installation with manually actuated valves or solenoid valves*

| | |
|---|---|
| *1* | *Main line* |
| *2* | *Medium return* |
| *3* | *OOS 41* |
| *4, 7* | *Manually actuated or solenoid valves* |
| *5* | *Flow assembly OOA 250-A* |
| *6* | *90° pipe bracket* |
| *8* | *Medium removal* |

Caution!
For pressures > atmospheric pressure
- Pressurisation and work at a constant overpressure up to 10 bar poses no problems.
- Rapid pressure loss at the measuring point leads to air degassing in the electrolyte due to the sudden reductions in solubility. This could lead to a swelling of the sensor membrane.
  Avoid this problem by keeping up the pressure on the sensor. In the case of rapid pressure loss e.g. during maintenance work on the pipeline close all the valves (manual mode: manually actuated valves, automatic mode: solenoid valves, see Fig. 3.12, Pos. 4 and 7) of the assembly.

## 3.4 Sensor design and functional description

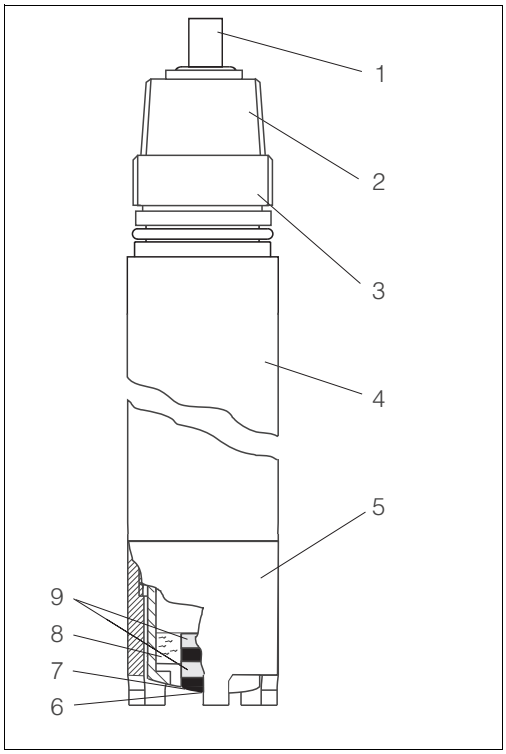



*Fig. 3.13: Sensor design OOS 41*

| | |
|---|---|
| *1* | *Sensor cable* |
| *2* | *Threaded connection NPT ¾"* |
| *3* | *Threaded connection G 1* |
| *4* | *Sensor body* |
| *5* | *Protection basket* |
| *6* | *Gold cathode* |
| *7* | *Membrane* |
| *8* | *Electrolyte* |
| *9* | *Anode* |

### 3.4.1 Design

The sensor consists of the following function units:

- Sensor body
- sensor head with gold cathode and anode
- Membrane cap with electrolyte filling
- Protection basket

The electrical connection is either done by a fixed cable (1) or by a TOP 68 plug-in connection.
The threaded connections NPT ¾" (2) and G 1 (3) are designed for installing the sensor in an immersion or flow assembly.
The protection basket (5) is screwed on. Alternatively to the protection basket, you can use a spray head OOR 3 (optional, see "Accessories", page 22) 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 seated tightly in the membrane cap (pretensioned in the factory).
The gold cathode (6), anode (Ag/AgBr, 9) and an internal temperature sensor are located inside the sensor head.

The figure on the next page shows an enlarged side view (Fig. 3.14) and top view (Fig. 3.15) of the sensor head.

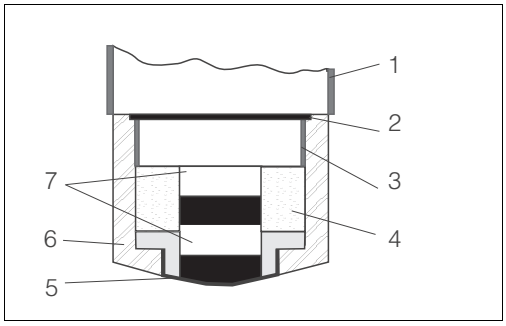



*Fig. 3.14: Sensor head with membrane cap (Side view with cut-away view of membrane cap)*

| | |
|---|---|
| *1* | *Screw thread for protection basket* |
| *2* | *Sealing ring* |
| *3* | *Screw thread for membrane cap* |
| *4* | *Electrolyte* |

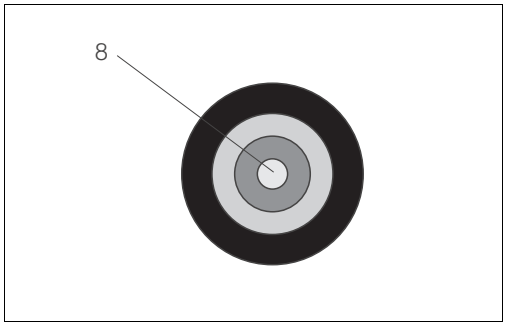



*Fig. 3.15: Sensor head (top view with membrane cap removed)*

| | |
|---|---|
| *5* | *Membrane* |
| *6* | *Membrane cap* |
| *7* | *Anode* |
| *8* | *Gold cathode* |

### 3.4.2 Functional description

**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.

**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.

**Amperometric measuring principle**
The oxygen molecules diffused through the membrane are reduced to hydroxide ions ($OH^-$) at the gold cathode. Silver is oxidised to silver ions ($Ag^+$) at the anode (this forms a silver bromide layer, AgBr).
A current flows due to the connected electrode release at the gold 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.

## 3.5 Post-installation check

After installing the sensor, carry out the following checks:

| Checks | Remarks |
|---|---|
| Membrane OK (visual inspection)? | Replace membrane if there is a leak. |
| Compliance with permissible sensor installation position? | see Chapter 3.3 |
| Sensor installed in immersion assembly? | Do not install the sensor suspended from the cable. |
| Protective cap fitted to immersion assembly? | Avoid moisture by rain in the assembly. |

# 4 Wiring

## 4.1 Direct connection to the transmitter

The sensor OOS 41 is connected using a special measuring cable. The wiring diagram is contained in the Operating Instructions of the transmitter OOM 223-DX/DS

## 4.2 Connection via the junction box VBM

To lengthen the sensor connection beyond the length of the fixed cable, you require a junction box VBM. The connection is lengthened to the transmitter using the special measuring cable OYK 71.

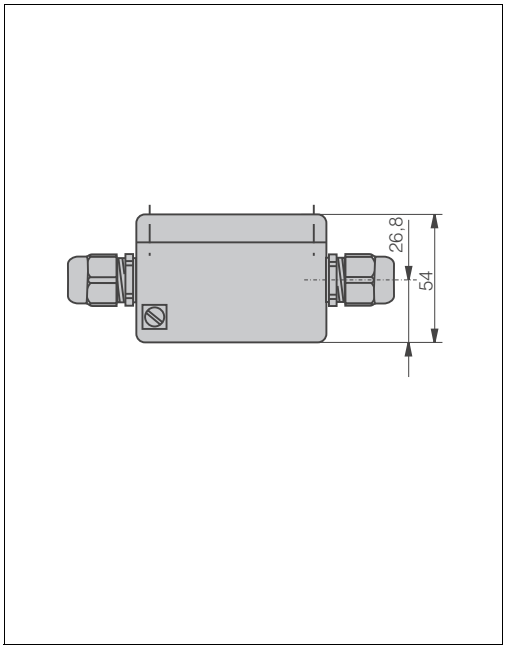



*Fig. 4.1: Junction box VBM, side view*

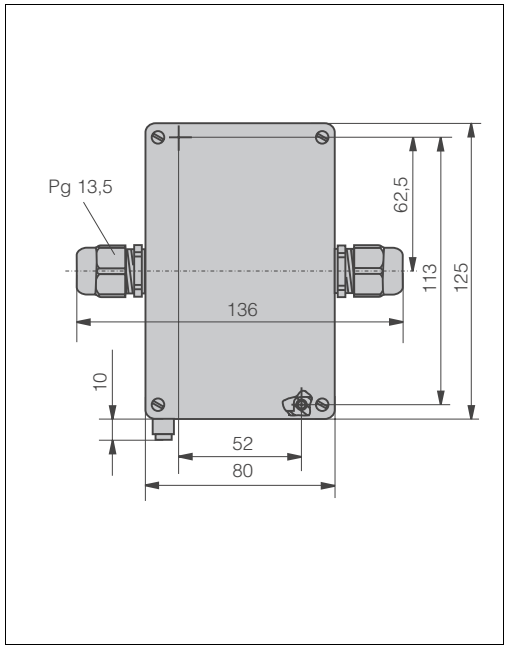



*Fig. 4.2: Junction box VBM, plan view*

Figs. 4.1 and 4.2 show the junction box VBM with its dimensions. The special measuring cable OYK 71 is depicted in Fig. 4.3. Please refer to it for information on the terminals and their assignment for connection to the transmitter. The interior white and yellow pilot wires have no function.

Special measuring cable OYK 71

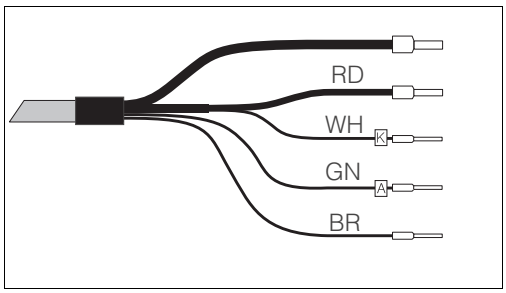



*Fig. 4.3: Special measuring cable OYK 71*

| Terminal | Assignment |
|---|---|
| S | Outer screening |
| 12 | Active inner screening (NTC temperature sensor) |
| 90 | Cathode |
| 91 | Anode |
| 11 | NTC temperature sensor |

Fig. 4.4 on page 14 is a schematic diagram of the sensor connection to the junction box VBM.

Connection diagram with junction box

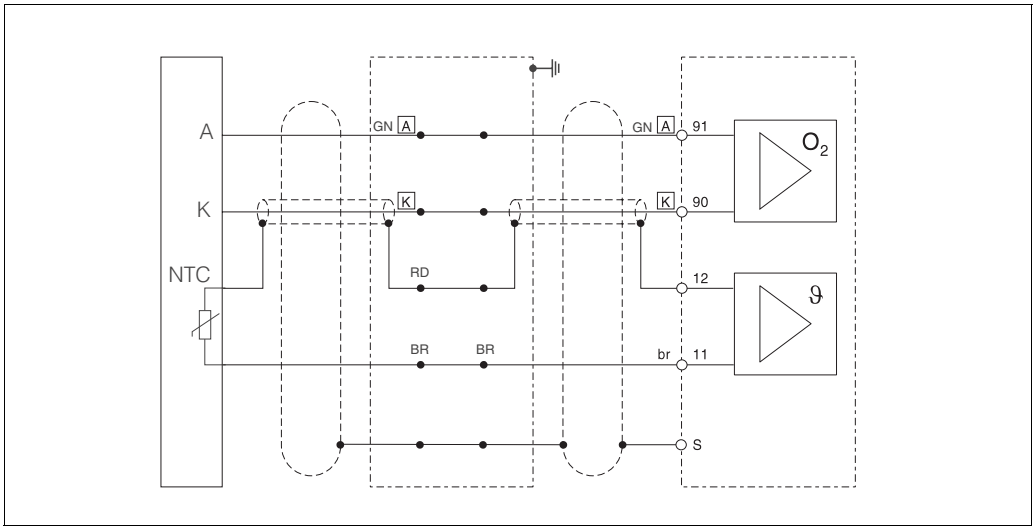



*Fig. 4.4: Connection diagram with junction box VBM*

## 4.3 Post-connection check

After wiring up the electrical connection, carry out the following checks:

| **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 ? | 100 V ... 230 V AC long-range<br>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 ? | |
| Are all the screws terminals properly tightened ? | Use the connection diagram of OOM 223-DX/DS. |
| Are all the cable entries installed, tightened and sealed ? | |
| Are all the cable entries installed downwards or lateral ? | |
| For cable entries lateral: cable loops downwards for water to be able to drip off. | |

# 5 Commissioning

## 5.1 Function check

Before the first commissioning, make sure of the following points:

- That the sensor was correctly installed (Post-installation check, see Chapter 3.5)
- That the electrical connection is correct (Post-connection check, see Chapter 4.3)

If using an assembly with automatic cleaning, check the correct water connection at the assembly rinse connection.

Warning!
Danger of medium escaping.
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.

## 5.2 Polarisation

The sensor was tested in the factory for perfect functionality and is supplied ready for operation.
To prepare for calibration, proceed as follows:

- Remove the sensor protective cap.
- 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.
- Connect the sensor to the transmitter and switch on the transmitter.
- If you connect the sensor to the transmitter OOM 223-DX/DS, polarisation is automatically performed after switching on the transmitter.
- The polarisation time takes about 1 hour.

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.

## 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 OOS 41, a single-point calibration is carried out in the presence of oxygen.
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).

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 ≥ – 5 °C.

The sensor requires calibration after:
- first commissioning
- replacing a membrane or electrolyte
- cleaning the gold cathode
- long breaks in operation without power supply
- typical time intervals dependent on operating experience

### 5.3.1 Calibration in air

To calibrate the sensor in air, proceed as follows:

- 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.
- 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.
  – Change the electrolyte filling and close the membrane cap again.
  – Wait for the polarisation time to end.
- 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.
- If the measured value display on the transmitter is stable, carry out the calibration in accordance with the Operating Instructions of the transmitter.
- 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 Table 1 on page 17
- The factor **K** acc. to Table 2 on page 17

3. Determine:
- **L =** [rel. air pressure at calibration] : [1013 hPa]
- **M =** 1.02 for calibration in air
  **M =** 1.00 for calibration in air-saturated water

4. Calculate the calibration value:

**Calibration value = S • K • L • M**

Example:

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

Calibration value = 9.17 mg/l

*Table 1:*
*Saturation value S as a factor of temperature*
*(taken at an air pressure of 1013 hPa)*

| °C | S [mg/l] | °C | S [mg/l] | °C | S [mg/l] | °C | S [mg/l] |
|---|---|---|---|---|---|---|---|
| 0 | 14.64 | 11 | 10.99 | 21 | 8.90 | 31 | 7.42 |
| 1 | 14.23 | 12 | 10.75 | 22 | 8.73 | 32 | 7.30 |
| 2 | 13.83 | 13 | 10.51 | 23 | 8.57 | 33 | 7.18 |
| 3 | 13.45 | 14 | 10.28 | 24 | 8.41 | 34 | 7.06 |
| 4 | 13.09 | 15 | 10.06 | 25 | 8.25 | 35 | 6.94 |
| 5 | 12.75 | 16 | 9.85 | 26 | 8.11 | 36 | 6.83 |
| 6 | 12.42 | 17 | 9.64 | 27 | 7.96 | 37 | 6.72 |
| 7 | 12.11 | 18 | 9.45 | 28 | 7.82 | 38 | 6.61 |
| 8 | 11.81 | 19 | 9.26 | 29 | 7.69 | 39 | 6.51 |
| 9 | 11.53 | 20 | 9.08 | 30 | 7.55 | 40 | 6.41 |
| 10 | 11.25 | | | | | | |

*Table 2:*
*Correction factor K as a factor of mean altitude*
*(above sea level)*

| Altitude [m] | K | Altitude [m] | K | Altitude [m] | K | Altitude [m] | K |
|---|---|---|---|---|---|---|---|
| 0 | 1.000 | 550 | 0.938 | 1050 | 0.885 | 1550 | 0.834 |
| 50 | 0.994 | 600 | 0.932 | 1100 | 0.879 | 1600 | 0.830 |
| 100 | 0.988 | 650 | 0.927 | 1150 | 0.874 | 1650 | 0.825 |
| 150 | 0.982 | 700 | 0.922 | 1200 | 0.869 | 1700 | 0.820 |
| 200 | 0.977 | 750 | 0.916 | 1250 | 0.864 | 1750 | 0.815 |
| 250 | 0.971 | 800 | 0.911 | 1300 | 0.859 | 1800 | 0.810 |
| 300 | 0.966 | 850 | 0.905 | 1350 | 0.854 | 1850 | 0.805 |
| 350 | 0.960 | 900 | 0.900 | 1400 | 0.849 | 1900 | 0.801 |
| 400 | 0.954 | 950 | 0.895 | 1450 | 0.844 | 1950 | 0.796 |
| 450 | 0.949 | 1000 | 0.890 | 1500 | 0.839 | 2000 | 0.792 |
| 500 | | | | | | | |

# 6 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 following activities must be carried out:

- Cleaning the sensor
  In particular when the membrane is soiled (see Chapter 6.1).
- Check the measuring function
  A simple inspection of the measuring function is to 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 (display of $O_2$ saturation with OOM 223-DX/DS by pressing 4 times »+« - key).
- Replace a defective membrane or one which cannot be cleaned any more.
- Recalibration (see Chapter 5.3.1)

Note!
For regular automatic sensor cleaning, we recommend equipping the measuring point with a fully-automatic cleaning system.

## 6.1 Cleaning the outside of 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 to Endress+Hauser for repairs.

Depending on the type of soiling, proceed as follows:

| Type of soiling | Cleaning measure |
|---|---|
| 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 the membrane)** | 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.

## 6.2 Regeneration

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 gold cathode (Chap. 6.2.1) | Soiled or silver-plated gold cathode |
| Replacing the sealing ring (Chap. 6.2.2) | Visual damage to the sealing ring |
| Replacing the electrolyte (Chap. 6.2.3) | unstable or implausible measuring signal or electrolyte soiling |
| Replacing the membrane cap (Chap. 6.2.4) | Uncleanable membrane<br>Damaged membrane (hole or overstretch) |

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

### 6.2.1 Cleaning the gold cathode

The gold 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:

- Unscrew the membrane cap from the membrane body.
- Carefully clean the gold 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.
- Clean the electrode with drinking or distilled water.
- Fill the membrane cap with fresh electrolyte OOY 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 supplier.

### 6.2.2 Replacing the sealing ring

Replacing the sealing ring (see Fig. 3.14 on page 12, Pos. 2) is only necessary when it is visibly damaged. For replacement, use only the supplied sealing rings OOY 31-OR.

### 6.2.3 Replacing the electrolyte

The electrolyte OOY 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 $H_2S$, $NH_3$ or high concentrations of $CO_2$.

Particular loads occur with:

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

To replace the electrolyte, proceed as follows:

1. Remove the membrane cap (see Chap. 6.2.4).
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.

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.

### 6.2.4 Replacing the membrane cap

#### Remove the old membrane cap

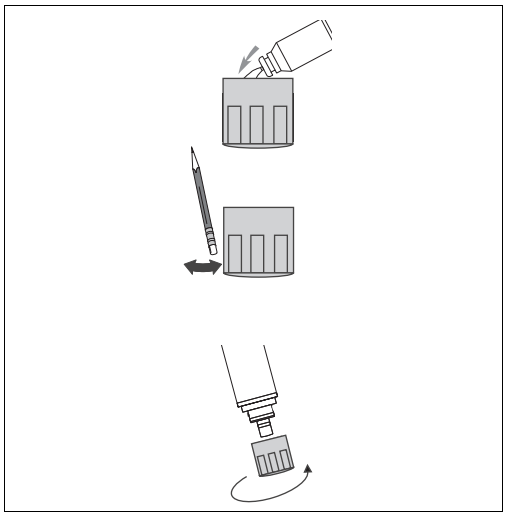
1. Remove the sensor from the medium.
2. Unscrew the protection basket.
3. Clean the outside of the sensor (see page 18).
4. Unscrew the membrane cap.
5. If necessary, clean the gold cathode (page 19) or replace the sealing ring if it is damaged (page 20).
6. Rinse the electrode holder with drinking water.

#### Install the new membrane cap

Caution!
Only use the membrane cap OOY 31-WP for the OOS 41 sensor (colour: black).

7. Make sure that there are no dirt particles on the sealing surface.

8. Replace the membrane cap as follows:



Pour the complete contents of a plastic ampoule (containing electrolyte OOY3-F) into the membrane cap.

Remove all the air bubbles in the electrolyte by tapping the side of the membrane cap (e.g. with a pencil).

Hold the sensor body **at an angle** and carefully screw the membrane cap onto it **down to the stop**.

9. Screw the protection basket back on.

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 (if an alarm occurs, see Chap. 8.1).

# 7 Accessories

## 7.1 Connection accessories

- Junction box VBM
  for extension with special measuring cable OYK 71.
  2 screw unions Pg 13.5 for cable entry and 10 high-impedance, isolated screw terminals for single wire connection.
  Dimensions: 125 x 80 x 54 mm (L x W x H)
  Material: painted aluminium. Ingress protection IP 65; Order No. 50003987
- Special measuring cable OYK 71
  Special extension cable between junction box VBM and transmitter
- Special measuring cable with TOP 68 plug-in connection
  cable OOK 41, cable length 7m
  cable OOK 41, cable length 15m

## 7.2 Installation accessories

- Immersion assembly OYA 611
- Flow assembly OOA 250-A
- Installation on basin rim OYY 106-A
- Spray head OOR 3 for immersed operation
- Baffle plate OP
  extra protection for extreme current conditions
- Membrane protection basket OOY 3-SK
  for sensor use in fish ponds

## 7.3 Spare parts

- Electrolyte filling OOY 3-F
  10 plastic ampoules, transparent
- Zero calibration solution
  3 screw-top bottles to produce 3 x 1 litre oxygen-free solution
- Replacement cartridge OOY 31-WP for normal response time
  2 preterminated spare replacement cartridges with pretensioned membrane
- Sealing ring OOY 31-OR
- Mebrane protective basket
  for immersion of dissolved oxygen in fish ponds

## 7.4 Measurement, controlling and cleaning the sensor

- Transmitter OOM 223-DX/DS
  Integrated electrode function monitoring,
  measured value monitoring, free configuration of alarm contact
  Technical Information TI 199E00 (Order No. 51505694)

# 8 Trouble-shooting

## 8.1 Trouble-shooting instructions

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

| Problem | Test | 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 sensor |
| | Electrolyte in the measuring chamber ? | Fill with electrolyte or replace electrolyte |
| **Display value too high** | 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 |
| | Gold cathode silver-plated ? | Clean the gold cathode |
| **Value indicated too low** | 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 ? | Produce flow |
| | Temperature display on transmitter clearly too high ? | Check sensor, if necessary send sensor in for repair |
| | Coating on the membrane ? | Clean membrane or replace membrane cap |
| | Electrolyte soiled? | Replace electrolyte |
| **Strong deviations in displayed value** | Membrane visibly stretched ? | Replace membrane cap |
| | Open sensor. Dry electrodes transmitter display now at 0 ? | Check electrical connection. If the problem still occurs, send in the sensor. |
| | 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. |

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.

## 8.2 Sensor test

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

Then carry out the following to test the sensor:

| Test | Measure | Setpoint |
|---|---|---|
| **Voltage inspection** | With the sensor connected, test the polarisation voltage on the OOM 223-DX/DS transmitter | between terminals 90 and 91:<br><br>– 650 mV |
| **Slope inspection** | Place the sensor in the air, and dry with a paper towel | After 10 minutes, the measured value display should display approx. 102% SAT (display by 4 times »+« -key). |
| **Zero point inspection** | Immerse the sensor in zero solution (see "Accessories" page 22).<br>Wait for 15 minutes (consumption of the residue of oxygen in the sensor).<br><br>Open the measuring chamber and dry the electrodes | Display near to 0 mg/l (0% Sat)<br><br><br><br>Display near to 0 mg/l (0% Sat) |
| **Temperature sensor check** | Disconnect the sensor and measure the resistance between red and brown flexible wires | depending on temperature:<br><br>5°C 74.4 kΩ<br>10°C 58.7 kΩ<br>15°C 46.7 kΩ<br>20°C 37.3 kΩ<br>25°C 30.0 kΩ<br>30°C 24.3 kΩ |
| **Cable check** | Disconnect, open and dry the sensor.<br><br>Measure the resistance between Gold cathode and white braided wire.<br><br>Measure the resistance between anode and green braided wire. | <br><br>< 1 Ω<br><br><br>< 1 Ω |

Note!
If there are deviations from the reference values, follow the troubleshooting instructions or contact your supplier.

## 8.3 Spare parts

- Replacement cartridge OOY 31-WP for replacing membrane cap
  2 preterminated spare replacement cartridges with pretensioned membrane
- Sealing ring OOY 31-OR

# 9 Technical data

| General specifications | |
|---|---|
| Product name | OOS 41 |
| **Environment** | |
| Storage temperature | filled with electrolyte: – 5 ... 50°C<br>without electrolyte: –20 ... 60°C |
| **Process conditions** | |
| Process temperature range | –5 ... 50°C |
| Process pressure range | 10 bar max. permissible overpressure<br>Underpressure operation is not permissible |
| **Measuring system** | |
| Measuring principle | Membrane covered amperometric sensor |
| Parameter | Oxygen partial pressure-proportional current signal |
| Measuring range (with transmitter OOM 223-DX/DS) | 0.05 ... 20.00 mg/l<br>0.00 ... 200% SAT<br>0 ... 400 hPa |
| Slope | approx. 300 nA at 20°C and 1013 hPa |
| Temperature compensation | NTC temperature sensor 30 kΩ, 0- 50°C |
| Response time | $T_{90}$: 3 minutes<br>$T_{99}$: 9 minutes (both at 20°C) |
| Polarisation time | < 60 minutes |
| Minimum flow speed | typ. 0.5 cm/s for 95% measured value display |
| Drift | with continuous polarisation: < 1% / month |
| Zero current | zero-current-free |
| Sensor monitoring | Connected to transmitter OOM 223-DX/DS:<br>cable interruption or short-circuit,<br>incorrect measurement and sensor passivation |
| **Mechanical construction** | |
| Materials | Sensor body: POM<br>Membrane cap: POM<br>Cathode: Gold<br>Anode: Silver/silver bromide |
| Threaded connection | G 1 and NPT ¾" |
| Electrical connection | Double-screened coaxial cable with 2 pilot wires, terminal connection |
| Membrane thickness | approx. 50 µm |
| max. total cable length for cable extension | 50 m |
| Weight (at cable length) | 0.7 kg (7 m) or 1.1 kg (15 m) |
| Ingress protection | IP 68 |
| Cable connection (sensor side) | Fixed cable or TOP 68 connection |

# Index

# Declaration of contamination

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

type of instrument / sensor: _____ serial number: _____

medium / concentration: _____ temperature: _____ pressure: _____

cleaned with: _____ conductivity: _____ viscosity: _____

**Warning hints for medium used:**


☐ radioactive ☐ explosive ☐ caustic ☐ poisonous ☐ harmful of health ☐ biological hazardous ☐ inflammable ☐ safe

Please mark the appropriate warning hints.

**Reason for return:**

_____

_____

**Company data:**

company: _____ contact person: _____

_____ _____

_____ department: _____

address: _____ phone number: _____

_____ 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.

_____ _____

(Date) (company stamp and legally binding signature)

**Your supplier:**

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