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Operating Instructions
Oxymax COS61D

Sensor for measuring dissolved oxygen
with Memosens protocol

Endress+Hauser
People for Process Automation

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1 About this document

1.1 Warnings

Structure of information	Meaning
DANGER **Causes (/consequences)** If necessary, Consequences of non-compliance (if applicable) ▶ Corrective action	This symbol alerts you to a dangerous situation. Failure to avoid the dangerous situation **will** result in a fatal or serious injury.
WARNING **Causes (/consequences)** If necessary, Consequences of non-compliance (if applicable) ▶ Corrective action	This symbol alerts you to a dangerous situation. Failure to avoid the dangerous situation **can** result in a fatal or serious injury.
CAUTION **Causes (/consequences)** If necessary, Consequences of non-compliance (if applicable) ▶ Corrective action	This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in minor or more serious injuries.
NOTICE **Cause/situation** If necessary, Consequences of non-compliance (if applicable) ▶ Action/note	This symbol alerts you to situations which may result in damage to property.

1.2 Symbols

- Additional information, tips
- Permitted
- Recommended
- Forbidden or not recommended
- Reference to device documentation
- Reference to page
- Reference to graphic
- Result of a step

1.2.1 Symbols on the device

- Reference to device documentation
- Do not dispose of products bearing this marking as unsorted municipal waste. Instead, return them to the manufacturer for disposal under the applicable conditions.

2 Basic safety instructions

2.1 Requirements for personnel

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

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

2.2 Designated use

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

The main areas of application are:
- Wastewater treatment plants
  - Oxygen measurement and regulation in the activated sludge basin for a highly efficient biological cleaning process
  - Monitoring the oxygen content in the wastewater treatment plant outlet
- Water monitoring
  Oxygen measurement in rivers, lakes or seas as an indicator of the water quality
- Water treatment
  Oxygen measurement for status monitoring, e.g. of drinking water (oxygen enrichment, corrosion protection etc.)
- Fish farming
  Oxygen measurement and regulation for optimum living and growth conditions

Use of the device for any purpose other than that described, poses a threat to the safety of people and of the entire measuring system and is therefore not permitted.

The manufacturer is not liable for damage caused by improper or non-designated use.

2.3 Workplace safety

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

Electromagnetic compatibility
- The product has been tested for electromagnetic compatibility in accordance with the applicable international standards for industrial applications.
- The electromagnetic compatibility indicated applies only to a product that has been connected in accordance with these Operating Instructions.

2.4 Operational safety

Before commissioning the entire measuring point:

1. Verify that all connections are correct.
2. Ensure that electrical cables and hose connections are undamaged.

3. Do not operate damaged products, and protect them against unintentional operation.
4. Label damaged products as defective.

During operation:

- If faults cannot be rectified:
  products must be taken out of service and protected against unintentional operation.

⚠ CAUTION

Programs not switched off during maintenance activities.
Risk of injury due to medium or cleaning agent!

- Quit any programs that are active.
- Switch to the service mode.
- If testing the cleaning function while cleaning is in progress, wear protective clothing, goggles and gloves or take other suitable measures to protect yourself.

2.5 Product security

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

3 Device description, function

3.1 Optical measuring principle

Sensor structure
Oxygen-sensitive molecules (markers) are integrated into the optically active layer (fluorescence layer) .
The fluorescence layer, an optical insulating layer and a cover layer are applied on top of one another on the carrier. The cover layer is in direct contact with the medium.
The sensor optics are directed at the rear of the carrier and therefore at the fluorescence layer.

Measurement process (principle of fluorescence quenching)

If the sensor is immersed in the medium, an equilibrium is very quickly established between the oxygen partial pressure in the medium and the fluorescence layer.

1. The sensor optics send green light pulses to the fluorescence layer
2. The markers "respond" (fluoresce) with red light pulses.
   ↳ The duration and intensity of the response signals are directly dependent on the oxygen content and oxygen partial pressure.

If the medium is free from oxygen, the response signals are long and very intense.

Any oxygen molecules present mask the marker molecules. As a result, the response signals are shorter and less intense.

Measurement result

- The sensor returns a signal that depends on the concentration of oxygen in the medium.

The air pressure can be either set statically or entered via an additional sensor. The medium temperature is automatically recorded in the sensor. Both values are taken into consideration in the calculation of the oxygen concentration.

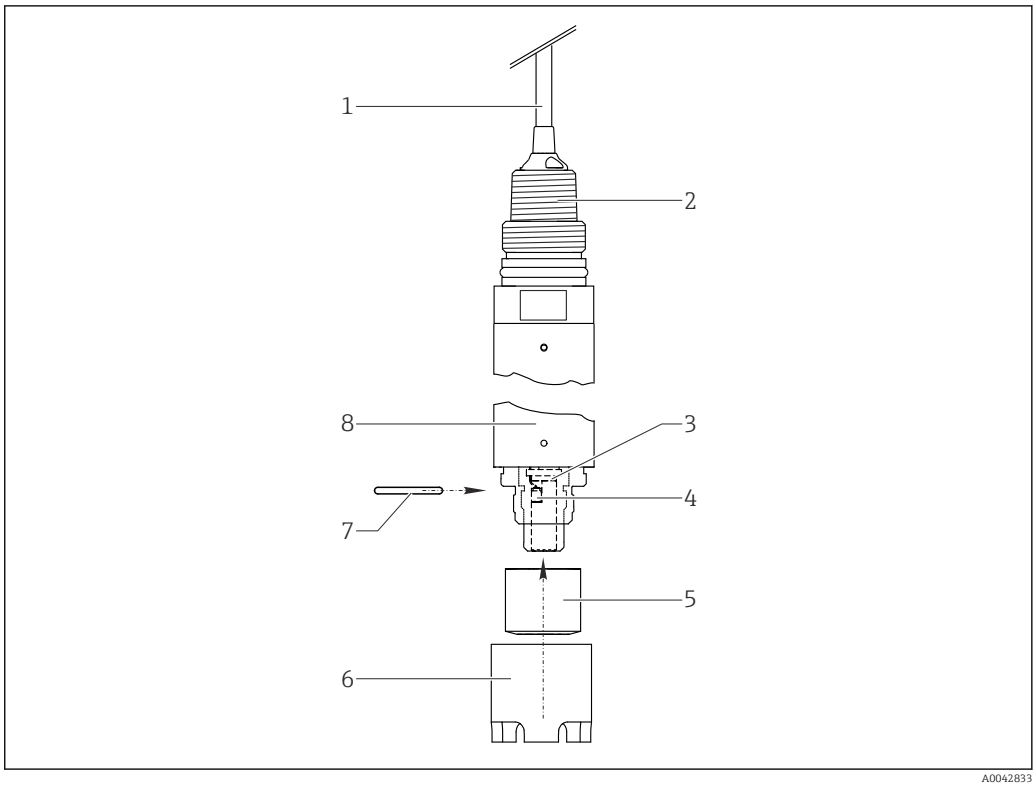
The sensor provides measured values for temperature and partial pressure as well as a raw measured value. This value corresponds to the fluorescence decay time and is approx. 20 µs in air and approx. 60 µs in oxygen-free media.

For optimum measurement results

1. During calibration, enter the current air pressure at the transmitter.
2. If the measurement is not performed at **Air 100% rh**:
   Enter the current humidity.
3. In the case of saline media:
   Enter the salinity.
4. For measurements in the units %Vol or %SAT:
   Also enter the current operating pressure in the measuring mode.

Operating Instructions for Memosens, BA01245C
For all transmitters, analyzers and samplers in the Liquiline CM44x/P/R, Liquiline System CA80XX and Liquistation CSFxx product families

3.2 Sensor design



1 Sensor structure

1 Sensor cable
2 Threaded connection
3 Detector
4 Emitter diode
5 Fluorescence cap
6 Protection guard
7 O-ring
8 Sensor shaft

The sensor consists of the following functional units:
- Sensor shaft
- Sensor head with optics (emitter and detector)
- Fluorescence cap
- Protection guard

As an alternative to the standard protection guard, other protection guard models and a cleaning unit can be used. The cleaning unit is suitable for immersion operation.

3.3 Memosens technology

Sensors with Memosens protocol have an integrated electronics unit that stores calibration data and other information. Once the sensor has been connected, the sensor data are transferred automatically to the transmitter and used to calculate the measured value.

▶ Call up the sensor data via the corresponding DIAG menu.

Digital sensors can store measuring system data in the sensor. These include the following:
- Manufacturer data
  - Serial number
  - Order code
  - Date of manufacture
- Calibration data
  - Calibration date
  - Calibration values
  - Number of calibrations
  - Serial number of the transmitter used to perform the last calibration or adjustment
- Operating data
  - Temperature application range
  - Date of initial commissioning
  - Hours of operation under extreme conditions

3.4 Membrane cap

The oxygen dissolved in the medium is diffused to the fluorescence layer of the fluorescence cap. A suitable flow is not required, as no oxygen is consumed during measurement. However, flow improves the speed at which the measuring system reacts and ensures a more representative measured value compared to a measurement in a static medium.

The cap is permeable for dissolved gases only. Other substances dissolved in the liquid phase, such as ionic substances, will not penetrate through the membrane. Therefore, medium conductivity has no impact on the measuring signal.

4 Incoming acceptance and product identification

4.1 Incoming acceptance

1. Verify that the packaging is undamaged.
   ↳ Notify the supplier of any damage to the packaging.
   Keep the damaged packaging until the issue has been resolved.
2. Verify that the contents are undamaged.
   ↳ Notify the supplier of any damage to the delivery contents.
   Keep the damaged goods until the issue has been resolved.
3. Check that the delivery is complete and nothing is missing.
   ↳ Compare the shipping documents with your order.
4. Pack the product for storage and transportation in such a way that it is protected against impact and moisture.
   ↳ The original packaging offers the best protection.
   Make sure to comply with the permitted ambient conditions.

If you have any questions, please contact your supplier or your local Sales Center.

4.2 Product identification

4.2.1 Nameplate

The nameplate provides you with the following information on your device:
- Manufacturer identification
- Order code
- Extended order code
- Serial number
- Safety information and warnings

▶ Compare the information on the nameplate with the order.

4.2.2 Identifying the product

Product page

www.endress.com/cos61d

Interpreting the order code

The order code and serial number of your product can be found in the following locations:
- On the nameplate
- In the delivery papers

Obtaining information on the product

1. Go to www.endress.com.
2. Page search (magnifying glass symbol): Enter valid serial number.
3. Search (magnifying glass).
   ↳ The product structure is displayed in a popup window.
4. Click the product overview.
   ↳ A new window opens. Here you fill information pertaining to your device, including the product documentation.

Manufacturer address

Endress+Hauser Conducta GmbH+Co. KG
Dieselstraße 24
70839 Gerlingen
Germany

4.3 Scope of delivery

Scope of delivery of sensor
- Oxygen sensor with protection cap or mounted cleaning system (optional)
- Brief Operating Instructions

4.4 Certificates and approvals

A list of all the approvals is provided below. The approvals that are valid for this product depend on the device version ordered.

4.4.1 CE mark

Declaration of Conformity

The product meets the requirements of the harmonized European standards. As such, it complies with the legal specifications of the EU directives. The manufacturer confirms successful testing of the product by affixing to it the CE mark.

4.4.2 EAC (COS61D-GR)

The product has been certified according to guidelines TP TC 004/2011 and TP TC 020/2011 which apply in the European Economic Area (EEA). The EAC conformity mark is affixed to the product.

4.4.3 CSA GP (COS61D-CA)

This device has a CSA GP approval and meets the following requirements:
- Power supply via a Class 2 or limited energy source as per CSA 61010-1-12.
- Overvoltage category I.
- Ambient conditions: max. height 2 000 m (6 560 ft)

4.4.4 CSA US NI Cl 1, Div 2 (COS61D-CJ)

Hazardous areas as per CSA US CL 1, DIV 2 [1)]

Observe the Control Drawing and the operating conditions indicated in the Appendix to the Operating Instructions as well as the notes and instructions in the Appendix.

Ex approvals

Class 1, Division 2, Groups A, B, C and D T6; IP67/IP68 [1)]

This product meets the requirements of the following standards:
- ANSI/UL 61010-1, 3rd Ed.
- ANSI/UL 121201-2017
- ANSI/IEC 60529, Edition 2.2. 2013-08 Degrees of protection provided by enclosures (IP code)

Installation and operation in hazardous areas CL 1, DIV 2

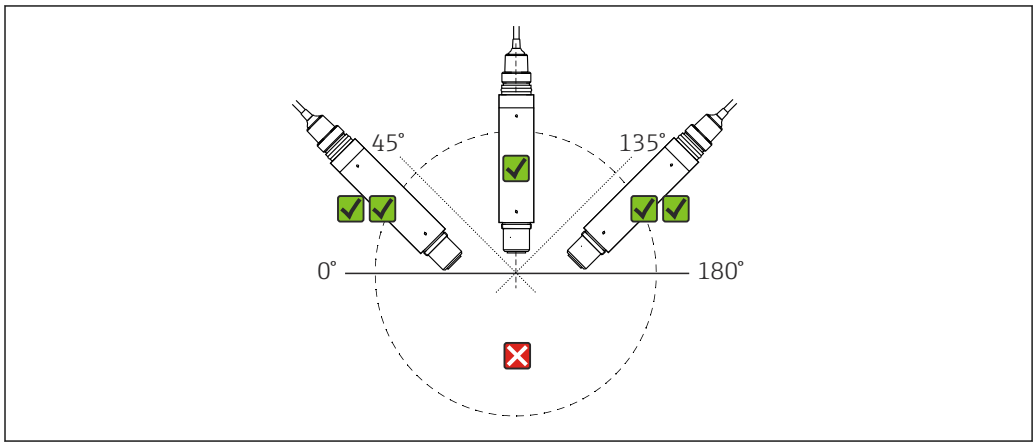
1) Only when connected to CM44x(R)-CD*

This non-sparking device has the following specified explosion protection data:
- CSA US CL 1, DIV 2
- Groups A, B, C and D
- Temperature class T6, −20 °C (−4 °F) ≤ Ta ≤ 60 °C (140 °F)
- Degree of protection: IP67/IP68
- Control Drawing: 211050778 → 📄 39

5 Mounting

5.1 Mounting requirements

5.1.1 Installation position



2 *Installation angle*

Install the sensor at an angle of inclination of 10° to 170° of 0° to 180° in an assembly, holder or suitable process connection.

- Recommended angle: 0° to 45° or 135° to 180° to prevent the attachment of air bubbles.
- At angles of inclination of 45° to 135°, air bubbles at the oxygen-sensitive membrane may result in higher readings than expected.

Other angles and upside-down installation are not recommended. Reason: Possible sediment formation and resulting falsification of the measured value.

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

5.1.2 Installation location

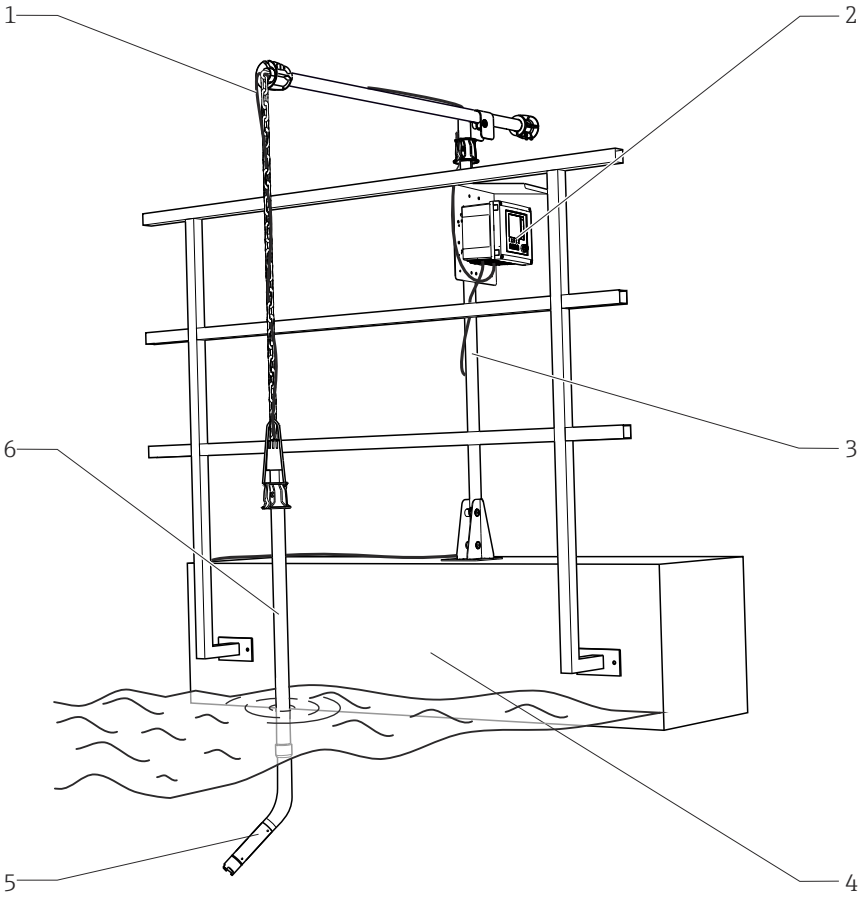
1. Choose a mounting location that is easy to access.
2. Ensure that upright posts and assemblies are fully secured and vibration-free.
3. Choose a mounting location with an oxygen concentration that is typical for the application.

5.2 Mounting the sensor

5.2.1 Measuring system

COS61D
A complete measuring system comprises at least:
- Oxymax COS61D oxygen sensor
  with fixed cable (with ferrules or M12 plug depending on the version ordered)
- Multi-channel transmitter Liquiline CM44x
- Assembly, e.g. flow assembly COA250, immersion assembly CYA112 or retractable assembly COA451

Optional:
- Assembly holder Flexdip CYH112 for immersion operation
- Extension cable CYK11 with junction box
- Cleaning system



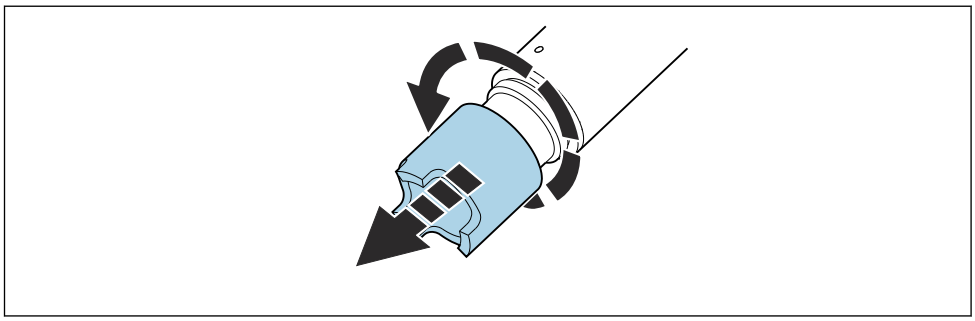
3 Example of a measuring system with COS61D

1	*Sensor cable*	*4*	*Basin rim with railing*
2	*Transmitter Liquiline CM44x*	*5*	*Oxymax COS61D oxygen sensor*
3	*Assembly Flexdip CYH112*	*6*	*Flexdip CYA112 assembly*

5.2.2 Mounting the cleaning unit or optional protection guard

If the cleaning unit is not delivered pre-assembled or if a protection guard has been used:

1.



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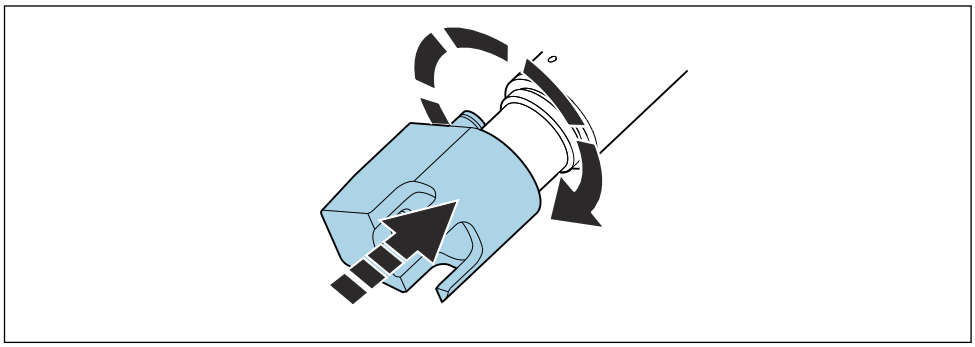
Unscrew the protection guard.

↳ Retain the protection guard for possible reuse at a later stage without the cleaning unit.

2.



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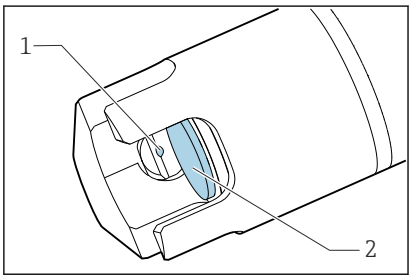
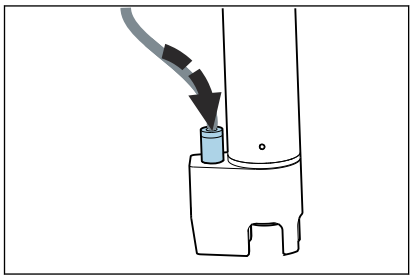
Screw on the cleaning unit or protection guard and tighten until the stop.

↳ The cleaning nozzle of the cleaning unit is now level with the spot.



1 Cleaning nozzle
2 Spot

3.



Connect the hose for the compressed air supply (to be provided on site) or compressor (→ 31) to the hose connection of the cleaning unit.

5.2.3 Installing at a measuring point

Must be installed in a suitable assembly.

⚠ WARNING

Electrical voltage

In the event of a fault, non-grounded metallic assemblies may be live and as such are not safe to touch!

- ▶ When using metallic assemblies and installation equipment, national grounding provisions must be observed.

Installation for immersion operation

- Install individual assemblies away from the basin on a solid base.
- Final assembly must be performed only at the assigned mounting location.
- Choose a mounting location that is easy to access.
- During final installation, it must be ensured that the metal sensor body is connected to ground, if necessary.

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

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

NOTICE

Installation errors

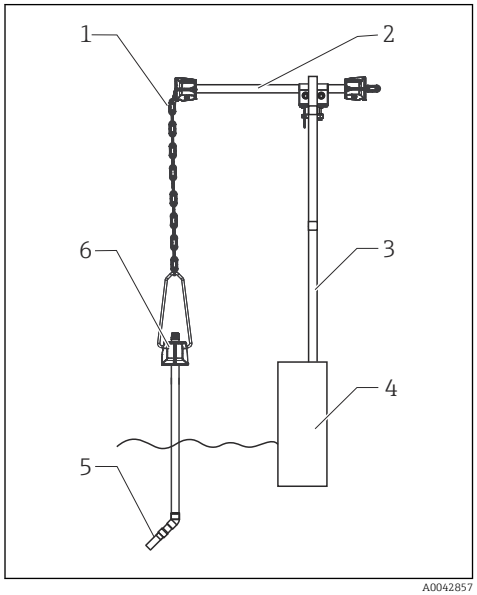
Cable breakage, loss of sensor due to cable separation, unscrewing of fluorescence cap!

- ▶ Do not install the sensor freely suspended from the cable!
- ▶ Screw the sensor into the assembly, ensuring that the cable is not twisted.
- ▶ Hold the sensor body steady during installation or removal. Otherwise the fluorescence cap or protection guard might be unscrewed. These will then remain in the process or assembly.
- ▶ During final installation, it must be ensured that the metal sensor body is connected to ground.
- ▶ Avoid exerting excessive tensile force on the cable (e.g. through jerky pulling movements).
- ▶ Choose an installation location that is easy to access for later calibrations.
- ▶ Follow the instructions for installing sensors in the Operating Instructions for the assembly used.

5.3 Installation examples

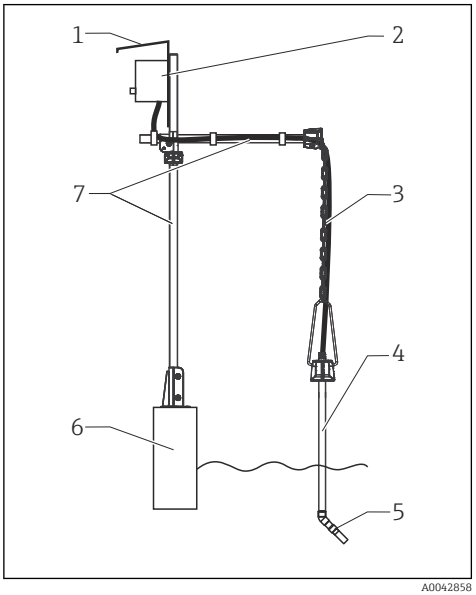
5.3.1 Immersion operation

Universal holder and chain assembly



4 *Chain holder on railing*

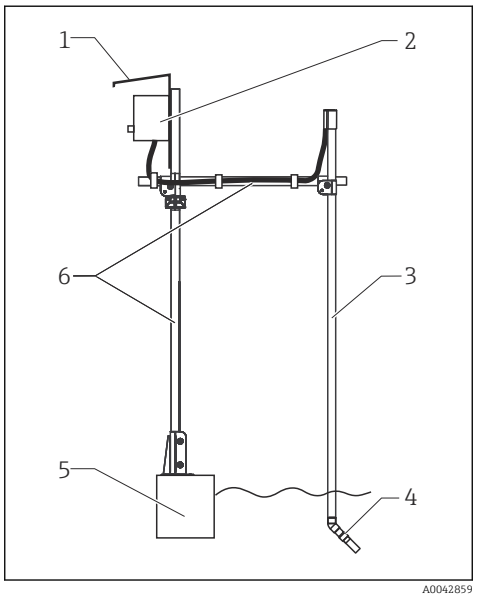
1 *Chain*
2 *Flexdip CYH112 holder*
3 *Rail*
4 *Basin rim*
5 *Oxygen sensor*
6 *Flexdip CYA112 wastewater assembly*



5 *Chain holder on upright post*

1 *Weather protection cover CYY101*
2 *Transmitter*
3 *Chain*
4 *Flexdip CYA112 wastewater assembly*
5 *Oxygen sensor*
6 *Basin rim*
7 *Flexdip CYH112 holder*

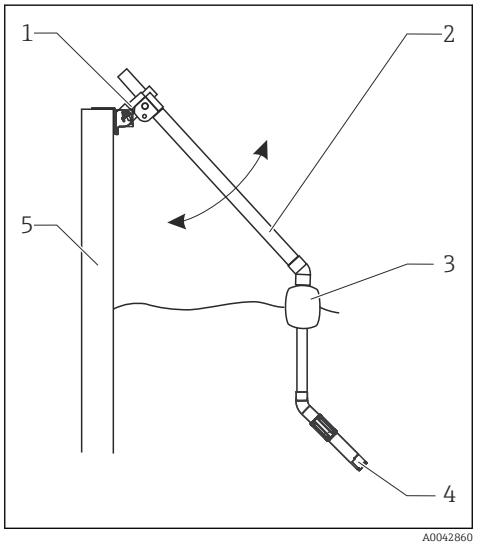
Universal holder and fixed protection pipe



6 *Assembly holder with immersion tube*

1 *Protective cover*
2 *Transmitter*
3 *Flexdip CYA112 immersion assembly*
4 *Oxygen sensor*
5 *Basin rim*
6 *Assembly holder Flexdip CYH112*

Basin rim mounting with protection pipe

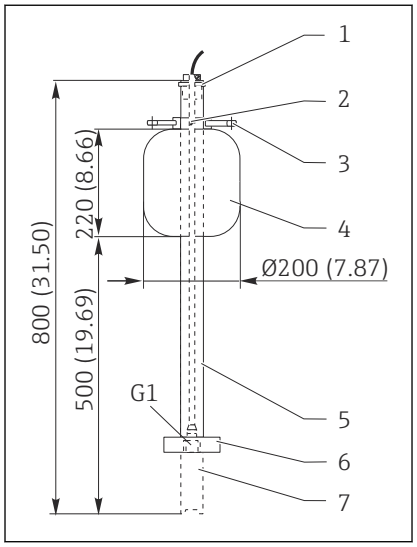


7 *Basin rim mounting*

1 *Pendulum holder CYH112*
2 *Assembly Flexdip CYA112*
3 *Assembly float*
4 *Oxygen sensor*
5 *Basin rim*

Float

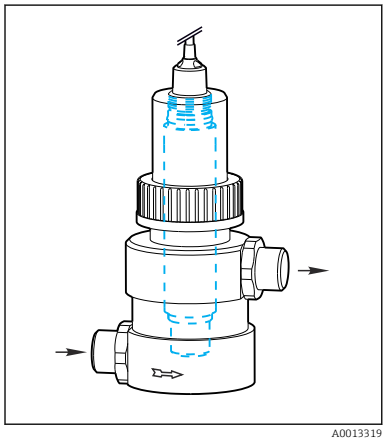
The CYA112 float is for use in the case of large fluctuations in water level, for example in rivers or lakes.



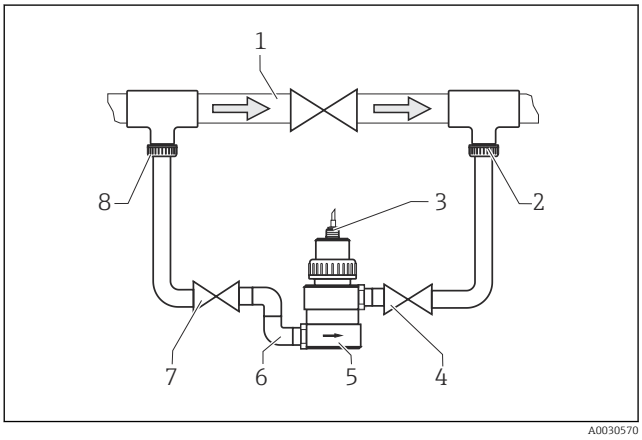
1 *Cable run with strain relief and rain shield*
2 *Fixing ring for rope and chains with terminal screw*
3 *Eyelets Ø15, 3 x 120 ° for anchoring*
4 *Plastic float, resistant to salt water*
5 *Pipe 40 x 1, stainless steel 1.4571*
6 *Bumper and ballast*
7 *Oxygen sensor*

8 *Dimensions in mm (inch)*

5.3.2 Flow assembly COA250



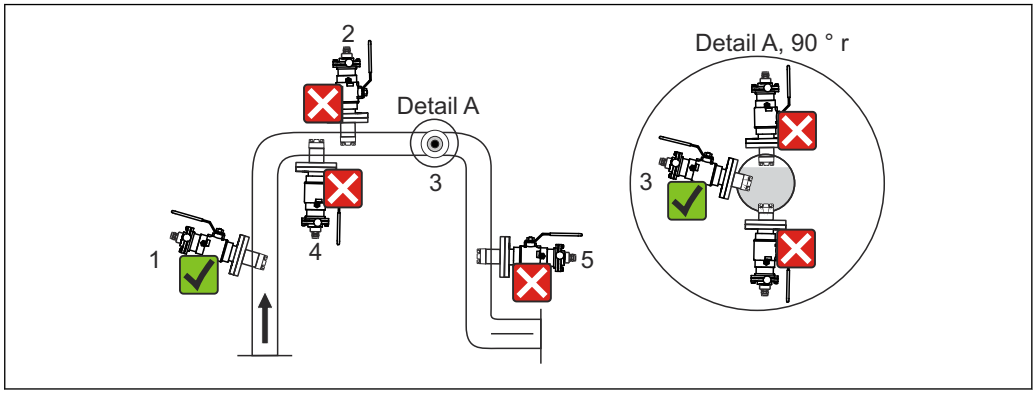
9 *COA250*



10 *Bypass installation with manually actuated valves or solenoid valves*

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

5.3.3 Retractable assembly COA451



11 *Permissible and impermissible sensor installation positions with retractable assembly COA451*

1 *Ascending pipe, best position*
2 *Horizontal pipe, sensor top down, impermissible due to air cushion or foam bubble forming*
3 *Horizontal pipe, lateral installation with permissible installation angle (acc. to sensor version)*
4 *Down pipe, impermissible*

☑ Possible installation angle

☒ Inadmissible installation angle

NOTICE

Sensor not completely in the medium. Deposits on the sensor membrane or optics. Deposits due to upside-down sensor installation.

Incorrect measurements are possible and these may affect the measuring point.

▶ Do not install the assembly at points where air pockets or bubbles form or where suspended particles may build up at the sensor membrane or sensor optics (item 2).

5.4 Post-mounting check

1. Are the sensor and cable undamaged?
2. Is the orientation correct?
3. Is the sensor installed in an assembly and is not suspended from the cable?
4. Avoid the penetration of moisture.

6 Electrical connection

⚠ WARNING

Device is live!

Incorrect connection may result in injury or death!

- ▶ The electrical connection may be performed only by an electrical technician.
- ▶ The electrical technician must have read and understood these Operating Instructions and must follow the instructions contained therein.
- ▶ **Prior** to commencing connection work, ensure that no voltage is present on any cable.

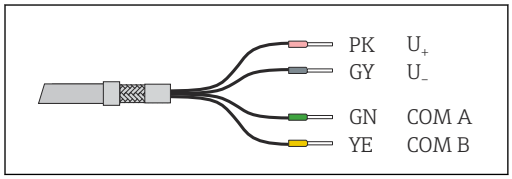
6.1 Connecting the sensor

Connection data

Sensor cable connected directly to the terminal connector of the basic module of the transmitter

Connection in hazardous areas according to CSAus CL 1, DIV 2 [2)]

- The device must be installed in a housing or (installation) cabinet which can only be accessed with a tool or key.
- Observe the Control Drawing and the operating conditions indicated in the Appendix to the Operating Instructions as well as the notes and instructions in the Appendix.



12 *Sensor fixed cable with terminated cable cores*

Optional: sensor cable plug connected to the M12 sensor socket of the transmitter

With this type of connection, the transmitter is already wired at the factory.

6.2 Ensuring the degree of protection

Only the mechanical and electrical connections which are described in these instructions and which are necessary for the required, designated use, may be carried out on the device delivered.

- ▶ Exercise care when carrying out the work.

Otherwise, the individual types of protection (Ingress Protection (IP), electrical safety, EMC interference immunity) agreed for this product can no longer be guaranteed due, for example to covers being left off or cable (ends) that are loose or insufficiently secured.

2) Only if connecting to CM44x(R)-CD*

6.3 Post-connection check

Device health and specifications	Action
Is the outside of the sensor, assembly or cable free from damage?	▶ Perform a visual inspection.
Electrical connection	**Action**
Are the mounted cables strain-relieved and not twisted?	▶ Perform a visual inspection. ▶ Untwist the cables.
Is a sufficient length of the cable cores stripped, and are the cores positioned in the terminal correctly?	▶ Perform a visual inspection. ▶ Pull gently to check they are seated correctly.
Are the power supply and signal lines connected correctly?	▶ Use the transmitter wiring diagram.
Are all screw terminals tightened?	▶ Tighten the screw terminals.
Are all cable entries mounted, firmly tightened and leak-tight?	▶ Perform a visual inspection. In the case of lateral cable entries:
Are all cable entries mounted on the side or pointing downwards?	▶ Point cable loops downward so that water can drip off.

7 Calibration and adjustment

During calibration, the measured value is compared to the value expected under specified conditions (depending on the calibration method, e.g. in air with 100% rH at sea level).

No further calibration is usually necessary, except in the following cases:
Membrane cap replacement

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

Fully polarize the sensor prior to calibration.

Ideally, use the calibration vessel for calibration. To do so, unscrew the protection guard from the sensor and insert the sensor into the calibration container as far as it will go (angle of departure).

7.1 Types of calibration

The following types of calibration are possible:
- Zero point
  - Single-point calibration in nitrogen or zero-point gel COY8
  - Data entry
- Slope
  - **Air 100% rh** (air, water vapor-saturated)
  - **H2O air-saturated** (air-saturated water)
  - Air, variable
  - Data entry
  - Sample calibration
- Temperature adjustment

7.2 Calibration intervals

Specifying the intervals

If you want to calibrate the sensor intermittently for a special application and/or on account of a special type of installation, you can calculate the intervals using the following method:

1. Remove the sensor from the medium.
2. Clean the outside of the sensor with a damp cloth.
3. Then dry the sensor diaphragm carefully with a soft paper towel for example.
4. NOTICE
   Incorrect measurements caused by atmospheric influences!
   ▶ Protect the sensor against external influences such as sunlight and wind.

   After 10 minutes, measure the oxygen saturation index in air.
5. Decide using the results:

a) Measured value is **not** 100 ± 2 %SAT → Calibrate sensor.

b) If the values are within the specified interval, the sensor does not need to be calibrated. The time period between inspections can be extended.

6. Repeat the steps specified after two, four or eight months to determine the optimum calibration interval for your sensor.

▶ In any case, calibrate the sensor at least once a year.

7.3 Calibration in air With 100% rH

1. Remove the sensor from the medium.
2. Clean the outside of the sensor carefully with a damp cloth.
3. Suspend the sensor just above the surface of the water.
   Do not immerse the sensor.
4. Allow a temperature compensation time of approx. 20 minutes for the sensor in the ambient air. Make sure that the sensor is not exposed to any direct ambient effects (direct sunlight, drafts) during this time.
5. Is the measured value display on the transmitter stable:
   Perform the calibration in accordance with the Operating Instructions for the transmitter. Pay particular attention to the software settings for the stability criteria for calibration and for the ambient pressure.
6. Where necessary:
   Adjust the sensor by accepting the calibration data.
7. Then place the sensor back into the medium.
8. Deactivate the hold status at the transmitter.

► Follow the calibration instructions in the Operating Instructions for the transmitter used.

7.4 Calculation example for the calibration value

As a check, you can calculate the expected calibration value (transmitter display) as shown in the following example (salinity is 0).

1. Determine the following:

- Ambient temperature for the sensor (air temperature for **Air 100% rh** or **Air variable** calibration types, water temperature for **H2O air-saturated** calibration type)
- The altitude above sea level
- The current air pressure (= relative air pressure based on sea level) at the time of calibration. (If indeterminable, use 1013 hPa.)

2. Determine the following:

- The saturation value S acc. to Table 1
- The altitude factor K acc. to Table 2

Table 1

T [°C (°F)]	S [mg/l=ppm]	T [°C (°F)]	S [mg/l=ppm]	T [°C (°F)]	S [mg/l=ppm]	T [°C (°F)]	S [mg/l=ppm]
0 (32)	14.64	11 (52)	10.99	21 (70)	8.90	31 (88)	7.42
1 (34)	14.23	12 (54)	10.75	22 (72)	8.73	32 (90)	7.30
2 (36)	13.83	13 (55)	10.51	23 (73)	8.57	33 (91)	7.18
3 (37)	13.45	14 (57)	10.28	24 (75)	8.41	34 (93)	7.06
4 (39)	13.09	15 (59)	10.06	25 (77)	8.25	35 (95)	6.94
5 (41)	12.75	16 (61)	9.85	26 (79)	8.11	36 (97)	6.83
6 (43)	12.42	17 (63)	9.64	27 (81)	7.96	37 (99)	6.72
7 (45)	12.11	18 (64)	9.45	28 (82)	7.82	38 (100)	6.61
8 (46)	11.81	19 (66)	9.26	29 (84)	7.69	39 (102)	6.51

T [°C (°F)]	S [mg/l=ppm]	T [°C (°F)]	S [mg/l=ppm]	T [°C (°F)]	S [mg/l=ppm]	T [°C (°F)]	S [mg/l=ppm]
9 (48)	11.53	20 (68)	9.08	30 (86)	7.55	40 (104)	6.41
10 (50)	11.25						

Table 2

Height [m (ft)]	K	Height [m (ft)]	K	Height [m (ft)]	K	Height [m (ft)]	K
0 (0)	1.000	550 (1800)	0.938	1050 (3450)	0.885	1550 (5090)	0.834
50 (160)	0.994	600 (1980)	0.932	1100 (3610)	0.879	1600 (5250)	0.830
100 (330)	0.988	650 (2130)	0.927	1150 (3770)	0.874	1650 (5410)	0.825
150 (490)	0.982	700 (2300)	0.922	1200 (3940)	0.869	1700 (5580)	0.820
200 (660)	0.977	750 (2460)	0.916	1250 (4100)	0.864	1750 (5740)	0.815
250 (820)	0.971	800 (2620)	0.911	1300 (4270)	0.859	1800 (5910)	0.810
300 (980)	0.966	850 (2790)	0.905	1350 (4430)	0.854	1850 (6070)	0.805
350 (1150)	0.960	900 (2950)	0.900	1400 (4600)	0.849	1900 (6230)	0.801
400 (1320)	0.954	950 (3120)	0.895	1450 (4760)	0.844	1950 (6400)	0.796
450 (1480)	0.949	1000 (3300)	0.890	1500 (4920)	0.839	2000 (6560)	0.792
500 (1650)	0.943						

3. Calculate factor **L**:

$$L = \frac{\text{Relative air pressure at calibration}}{\text{1013 hPa}}$$

4. Determine the **M** factor:

- **M** = 1.02 (for **Air 100% rh** calibration type)
- **M** = 1.00 (for **H2O air-saturated** calibration type)

5. Calculate calibration value **C**:

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

Example

- Air calibration at 18 °C (64 °F), altitude 500 m (1650 ft) above sea level, current air pressure 1009 hPa
- S = 9.45 mg/l, K = 0.943, L = 0.996, M=1.02
- Calibration value C = 9.05 mg/l.

Factor K in the table is not required if the measuring device returns the absolute air pressure L_{abs} (air pressure depending on altitude) as the measured value. The formula for calculation is then: $C = S \cdot L_{abs}$.

8 Commissioning

8.1 Function check

Prior to initial commissioning, ensure that:
- The sensor is correctly installed
- The electrical connection is correct

If using an assembly with automatic cleaning function:

▶ Check that the cleaning medium (water or air, for example) is connected correctly.

⚠ WARNING

Escaping process medium

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

▶ Before applying pressure to an assembly with cleaning system, ensure that the system has been connected correctly.

▶ If you cannot reliably establish the correct connection, do not install the assembly in the process.

▶ Following commissioning, service the sensor at regular intervals.

A reliable measurement is guaranteed.

Operating Instructions for the transmitter used, such as BA01245C if using the Liquiline CM44x or CM44xR.

8.2 Calibrating the sensor

The sensor is calibrated at the factory. A new calibration of the slope is only required after replacing the sensor cap and in special situations.

A new calibration of the zero point is only required in special situations.

8.3 Cleaning the sensor automatically

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

Recommended 115 V compressed air cleaning unit:
Order No.: 71194623

The following settings are recommended for the cleaning unit:

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

9 Troubleshooting

9.1 Troubleshooting instructions

▶ If one of the following problems is present:
Check the measuring system in the order shown.

Problem	Check	Remedy
Blank display, no sensor reaction	Power supplied to the transmitter?	▶ Establish the power supply.
	Sensor cable connected correctly?	▶ Establish correct connection.
	Deposit buildup on the fluorescence layer of the sensor cap?	▶ Clean the sensor cap or fluorescence layer carefully with a damp cloth.
Displayed value too high	Is sensor calibrated/adjusted? Measured value in air not 100 ± 2 %SAT?	▶ Recalibrate/readjust. ↳ When calibrating, enter the current air pressure at the transmitter.
	Displayed temperature clearly too low?	▶ Check sensor, if necessary send sensor in for repair.
	For TOP68 plug-in connection: moisture or dirt in the plug?	▶ Clean and dry the plug-in connection.
	Has salinity been taken into account?	▶ Enter salinity value on transmitter.
Displayed value too low	Is sensor calibrated/adjusted? Measured value in air not 100 ± 2 %SAT?	▶ Recalibrate/readjust. ↳ When calibrating, enter the current air pressure at the transmitter.
	Displayed temperature clearly too high?	▶ Check sensor, if necessary send sensor in for repair.
	Medium flow present?	▶ Create medium flow.
	Is the fluorescence cap worn?	▶ Replace the fluorescence cap.
	Buildup on the fluorescence layer?	▶ Clean the sensor carefully with a soft cloth.
Display in Vol% or %SAT not plausible	Medium pressure not taken into account	▶ Enter medium pressure on transmitter.

1. Pay attention to the troubleshooting information in the Operating Instructions for the transmitter.
2. Check the transmitter if necessary.

9.2 Checking the sensor

Check	Measure	Target value
Slope check	▶ Place the sensor in air. ▶ Dry the sensor with a paper towel.	Measured value display after 1 min: Approx. 100 %SAT
Zero-point check	▶ Immerse the sensor in COY8 zero-point gel (→ 🖹 31).	Display after 30 min: Close to 0 mg/l (0 %SAT)

1. In the case of deviations from the target values:
Perform troubleshooting as indicated in the troubleshooting instructions.
2. Contact the Sales Center if necessary.

10 Maintenance

Take all the necessary precautions in time to ensure the operational safety and reliability of the entire measuring system.

NOTICE

Effects on process and process control!

- ▶ When carrying out any work on the system, bear in mind any potential impact this could have on the process control system and the process itself.
- ▶ For your own safety, only use genuine accessories. With genuine parts, the function, accuracy and reliability are also ensured after maintenance work.

10.1 Maintenance schedule

Maintenance cycles depend to a great extent on the operating conditions.

The following rule of thumb applies:

- Constant conditions, e.g. aeration basin = long cycles (1/2 year)
- Widely varying conditions, e.g. fluctuating process pressure = short cycles (1 month and shorter)

The following method helps determine the necessary intervals:

1. Inspect the sensor one month after commissioning. To do so, remove the sensor from the medium and dry it carefully.
2. After 10 minutes, measure the oxygen saturation index in air.
   ↳ Decide using the results:
   a) Measured value not 100 ± 2 %SAT? → Service the sensor.
   b) Measured value = 100 ± 2 %SAT? → Double the length of time to the next inspection.
3. Proceed as indicated in Step 1 after two, four and eight months.
   ↳ This allows you to determine the optimum maintenance interval for your sensor.

NOTICE

Implausible sensor behavior

Damage to the fluorescence layer even within a maintenance cycle.

- ▶ Check the cable connection.
- ▶ Send sensor in for repair.

10.2 Maintenance work

The following tasks must be performed:

1. Clean the sensor fluorescence cap . → 27
2. Replace wear parts or consumables. → 28
3. Check measurement function. → 29
4. Recalibrate (if desired or necessary).
   ↳ Follow the Operating Instructions for the transmitter.

10.3 Cleaning the exterior of the sensor

The measurement can be corrupted by sensor fouling or malfunction due to the following, for example:
Deposit buildup on the fluorescence cap
↳ This results in a longer response time and, under certain circumstances, a reduced slope.

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

Clean the sensor:
- Before every calibration
- At regular intervals during operation as necessary
- Before returning it for repairs

Type of contamination	Cleaning
Salt deposits	1. Immerse the sensor in drinking water or in 1-5 % hydrochloric acid (for a few minutes). 2. Then rinse it with copious amounts of water.
Dirt particles on the sensor shaft and shaft sleeve (**not fluorescence cap!**)	▶ Clean sensor shaft and sleeve with water and a suitable sponge.
Dirt particles on fluoresence cap	▶ Clean the fluorescence cap with water and a soft cloth.

▶ After cleaning:
Rinse with copious amounts of clean water.

10.4 Cleaning the sensor optics

The optics need to be cleaned only if medium has penetrated a defective membrane cap.

1. Unscrew the protection guard and membrane cap from the sensor head.
2. Carefully clean the optical surface with a soft cloth until the buildup is fully removed.
3. Wipe the optical surface with a soft cloth that is wetted with drinking water or distilled water.
4. Dry the optical surface and screw on a functional membrane cap.

NOTICE
Damage, scratches on optical surface
Distorted measured values
▶ Make sure that the optical surface is not scratched or damaged in any other way.

10.5 Wear parts and consumables

Parts of the sensor are subject to wear during operation. By taking suitable measures, you can restore the normal operating function.

Action required	Reason
Replace process seals	Visible damage to a process seal
Replace fluorescence cap	Fluorescence layer is damaged or can no longer be cleaned. (Damage to black protective layer is such that the pink fluorescent layer is visible.)

10.5.1 Replacing sealing rings

It is compulsory to replace the sealing ring if it is visibly damaged. Only use original sealing rings (COV61 maintenance kit).

10.5.2 Replacing the membrane cap

The typical operating life of a fluorescence cap is more than 2 years. The sensor checks whether the cap is aging and issues a warning via the transmitter if the rate of aging

reaches a specific value. The sensor is still able to measure at this stage. However, it is advisable to change the cap as quickly as possible.

Removing the old fluorescence cap

1. Activate the hold function at the transmitter.
2. Remove the sensor from the medium.
3. Unscrew the protection guard or cleaning unit.
4. Clean the exterior of the sensor.
5. Unscrew the fluorescence cap.
6. Clean and dry the emitter diode.

Installing the new fluorescence cap

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

1. Carefully screw the new fluorescence cap onto the sensor head and tighten until the stop.
   ↳ After replacing the fluorescence cap, recalibrate and adjust the sensor.
2. Screw the protection guard or cleaning unit back on.
3. Then place the sensor back into the medium and check that no alarm is displayed on the transmitter.
4. Deactivate the hold function at the transmitter.

10.6 Checking the measurement function

1. Remove the sensor from the medium.
2. Clean and dry the fluorescence cap.
3. Adjust the process pressure at the transmitter if it differs from the atmospheric pressure; otherwise, a comparison will not be possible.
4. After about 10 minutes, measure the oxygen saturation index in air (without recalibration).
   ↳ The measured value should be at 100 ± 2 %SAT.

11 Accessories

The following are the most important accessories available at the time this documentation was issued.

Listed accessories are technically compatible with the product in the instructions.

1. Application-specific restrictions of the product combination are possible.
   Ensure conformity of the measuring point to the application. This is the responsibility of the operator of the measuring point.
2. Pay attention to the information in the instructions for all products, particularly the technical data.
3. For accessories not listed here, please contact your Service or Sales Center.

11.1 Assemblies (selection)

Flexdip CYA112
- Immersion assembly for water and wastewater
- Modular assembly system for sensors in open basins, channels and tanks
- Material: PVC or stainless steel
- Product Configurator on the product page: www.endress.com/cya112

Technical Information TI00432C

Flowfit COA250
- Flow assembly for oxygen measurement
- Product Configurator on the product page: www.endress.com/coa250

Technical Information TI00111C

Cleanfit COA451
- Manual retractable assembly made of stainless steel with ball valve shutoff
- For oxygen sensors
- Product Configurator on the product page: www.endress.com/coa451

Technical Information TI00368C

11.2 Assembly holder

Flexdip CYH112
- Modular holder system for sensors and assemblies in open basins, channels and tanks
- For Flexdip CYA112 water and wastewater assemblies
- Can be affixed anywhere: on the ground, on the coping stone, on the wall or directly onto railings.
- Stainless steel version
- Product Configurator on the product page: www.endress.com/cyh112

Technical Information TI00430C

11.3 Measuring cable

Memosens data cable CYK11
- Extension cable for digital sensors with Memosens protocol
- Product Configurator on the product page: www.endress.com/cyk11

Technical Information TI00118C

11.4 Zero-point gel

COY8
Zero-point gel for oxygen and disinfection sensors
- Disinfectant-free gel for the verification, zero point calibration and adjustment of oxygen and disinfection measuring points
- Product Configurator on the product page: www.endress.com/coy8

Technical Information TI01244C

11.5 Junction box RM COS61D

RM
- Junction box for cable extension of COS61D sensor with Memosens plug-in connector
- With 2x PG 13.5 cable gland
- Degree of protection: IP 65
- Order number: 51500832

11.6 Protection guard

Membrane protection guard
- For using the sensor in fish farming tanks
- Order No.: 50081787

11.7 Cleaning unit

Compressed air cleaning for COSXX
- Connection: OD 6/8 mm (incl. reduction hose coupling) or OD 6.35 mm (¼")
- Materials: POM/V4A
- Order No.
  - AD 6/8 mm: 71110801
  - AD 6.35 mm (¼"): 71110802

Compressor
- For compressed air cleaning
- Order No.
  - 230 V AC order no. 71072583
  - 115 V AC order no. 71194623

Spray cleaning for CYA112 assembly
Order No.
- Assembly length 600 mm (23.62 in): 71158245
- Assembly length 1 200 mm (47.42 in): 71158246

Chemoclean CYR10B
- Cleaning injector for spray cleaning and retractable assemblies
- Product Configurator on the product page: www.endress.com/CYR10B

Technical Information TI01531C

11.8 Transmitter

Liquiline CM44

- Modular multi-channel transmitter for hazardous and non-hazardous areas
- HART®, PROFIBUS, Modbus or EtherNet/IP is possible
- Order according to product structure

Technical Information TI00444C

12 Repair

12.1 Spare parts and consumables

Memosens COV61
- Maintenance kit for COS61D
- Ordering information: www.endress.com/cos61d under “Accessories/spare parts”

12.2 Return

The product must be returned if repairs or a factory calibration are required, or if the wrong product was ordered or delivered. As an ISO-certified company and also due to legal regulations, Endress+Hauser is obliged to follow certain procedures when handling any returned products that have been in contact with medium.

To ensure the swift, safe and professional return of the device:

▶ Refer to the website www.endress.com/support/return-material for information on the procedure and conditions for returning devices.

12.3 Disposal

If required by the Directive 2012/19/EU on waste electrical and electronic equipment (WEEE), the product is marked with the depicted symbol in order to minimize the disposal of WEEE as unsorted municipal waste. Do not dispose of products bearing this marking as unsorted municipal waste. Instead, return them to the manufacturer for disposal under the applicable conditions.

13 Technical data

13.1 Input

Measured variables	Dissolved oxygen [mg/l, µg/l, ppm, ppb, %SAT µs] Oxygen (gaseous) [hPa or %Vol] Temperature [°C, °F]
Measuring ranges	Measuring ranges apply for 20 °C (68 °F) and 1013 hPa (15 psi) With Liquiline CM44x, CM44xR, CM44P: ▪ 0 to 20 mg/l ▪ 0 to 400 hPa ▪ 0 to 200 %SAT

13.2 Performance characteristics

Response time	From air to nitrogen at reference operating conditions: t_{90} : 60 s	
Reference conditions	Reference temperature: Reference pressure: Reference application:	25 °C (77 °F) 1013 hPa (15 psi) Air-saturated water
Measurement error [3]	**Measuring range** < 12 mg/l 12 mg/l to 20 mg/l	**Maximum measured error** 0.01 mg/l or ±1 % of reading ±2% of reading
Repeatability	±0.5 % of end of measuring range	
Operating life of membrane cap	>2 years (under reference operating conditions, protect against direct sunlight)	

13.3 Environment

Ambient temperature range	−20 to 60 °C (−4 to 140 °F)
Storage temperature range	−20 to 60 °C (−4 to 140 °F)
Degree of protection	IP 68 (test conditions: 10 m (33 ft) water column, at 25 °C (77 °F) over 30 days)

3) In accordance with IEC 60746-1 under rated operating conditions

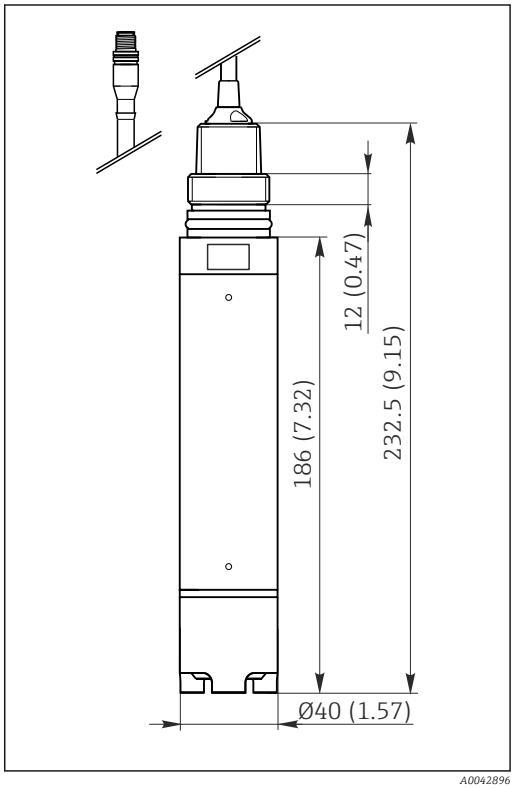
Electromagnetic compatibility	Interference emission and interference immunity as per EN 61326: 2005, Namur NE 21:2007

13.4 Process

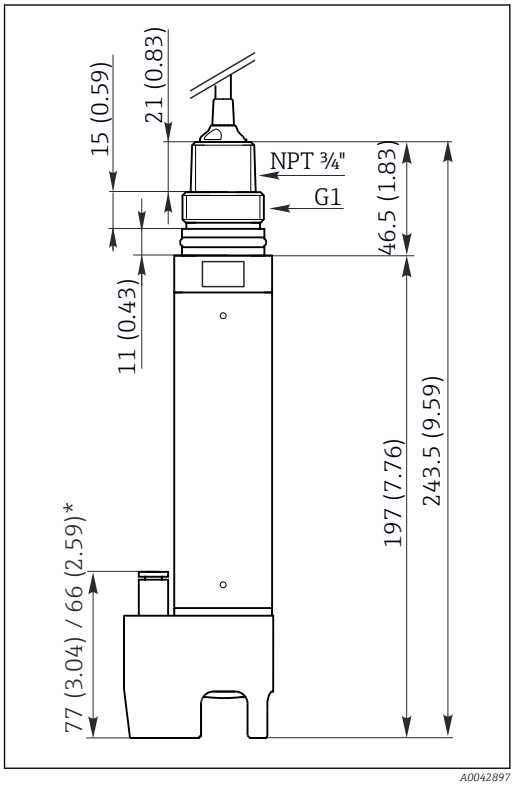
Process temperature	−5 to +60 °C (23 to 140 °F)
Process pressure	Ambient pressure 1 to 10 bar (14.5 to 145 psi) abs.

13.5 Mechanical construction

Dimensions



13 *With optional M12 connector*

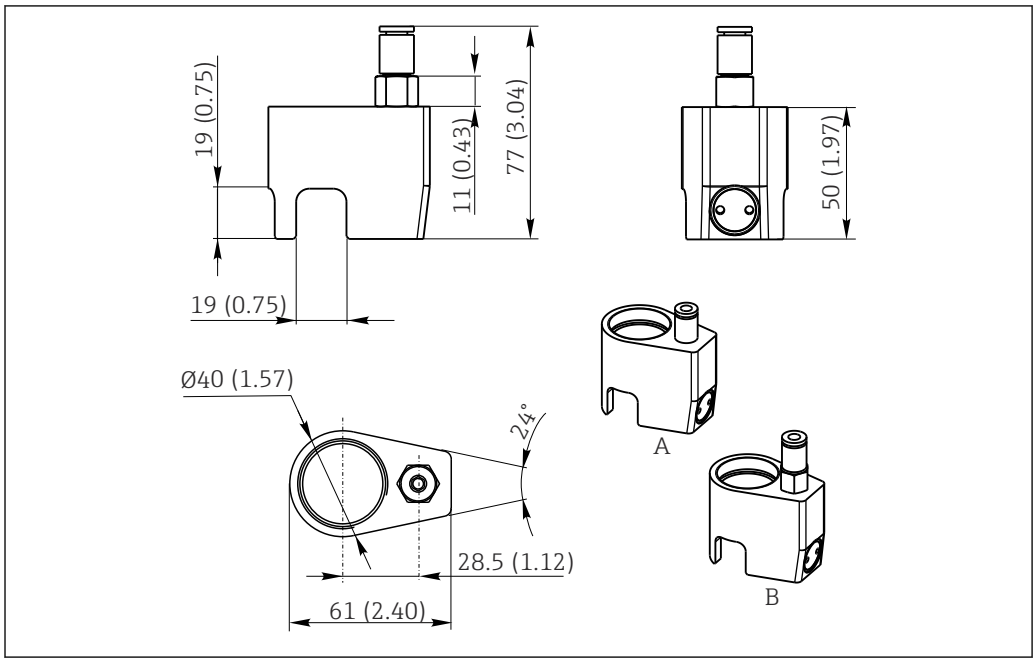


14 *With optional cleaning unit*

* *depending on version of cleaning unit*

Dimensions in mm (inch)

Optional cleaning unit



15 Dimensions in mm (inch)

A Compressed air cleaning COS61/61D OD 6/8 mm (additional information → 31
B Compressed air cleaning COS61/61D OD 6.35 mm (¼") (additional information → 31

Weight	with cable length 7 m (23 ft):	0.7 kg (1.5 lbs)
	with cable length 15 m (49 ft):	1.1 kg (2.4 lbs)

Materials	**Parts in contact with medium**	
	Fluorescence cap	PVC / POM
	Spot layer	Silicone
	Orifice plate	PET
	O-rings	EPDM
	Cap holder	1.4404
	Shaft tube	1.4571
	Housing connection	POM
	Protection guard	POM
	Housing air purge unit	POM

Process connection	G1, NPT 3/4"
Sensor cable	Shielded 4-core fixed cable
Cable connection at transmitter	▪ Terminal connection, end ferrules ▪ Optional: M12 connector
Maximum cable length	max. 100 m (330 ft), incl. Cable extension
Temperature compensation	Internal

Interface	Memosens protocol

14 Appendices

EU-Konformitätserklärung
EU-Declaration of Conformity
Déclaration UE de Conformité

Endress+Hauser
People for Process Automation

CE

Company **Endress+Hauser Conducta GmbH+Co. KG**
Dieselstraße 24, 70839 Gerlingen, Germany
erklärt als Hersteller in alleiniger Verantwortung, dass das Produkt
declares as manufacturer under sole responsibility, that the product
déclare sous sa seule responsabilité en qualité de fabricant que le produit

Product **Oximax COS61D**

Regulations den folgenden Europäischen Richtlinien entspricht:
conforms to following European Directives:
est conforme aux prescription des Directives Européennes suivantes :

EMC 2014/30/EU (L96/79)
RoHS 2011/65/EU (L174/88)

Standards angewandte harmonisierte Normen oder normative Dokumente:
applied harmonized standards or normative documents:
normes harmonisées ou documents normatifs appliqués :

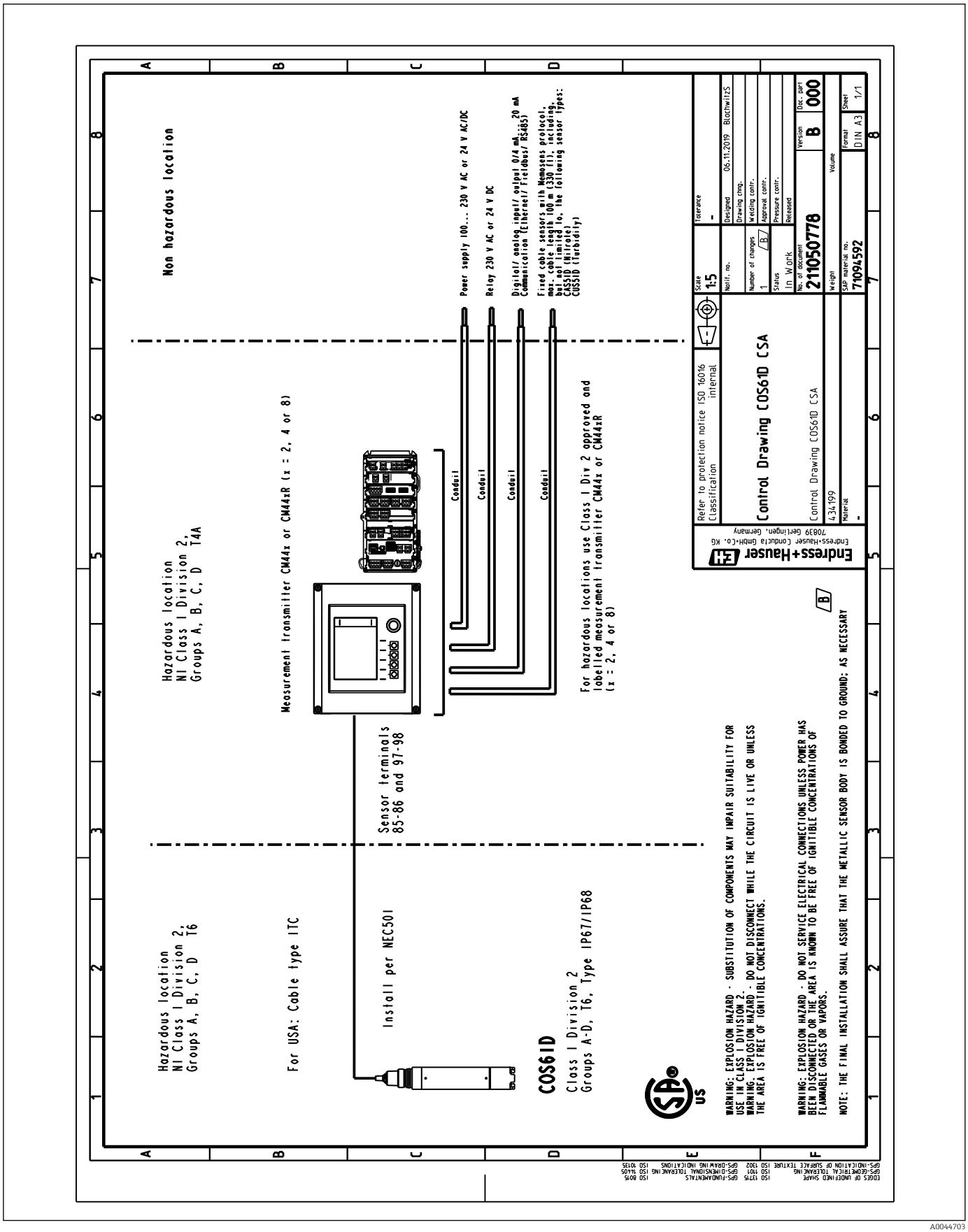
EN 61326-1 (2013)
EN 61326-2-3 (2013)
EN 50581 (2012)

Gerlingen, 31.05.2017
Endress+Hauser Conducta GmbH+Co. KG

i.V. Jörg-Martin Müller
Technology

i.V. Robert Binder
Technology Certifications and Approvals

EC_00156_02.16


Non hazardous location
Hazardous location
NI Class I Division 2,
Groups A, B, C, D T4A
Measurement transmitter CM44x or CM44xR (x = 2, 4 or 8)
Power supply 100... 230 V AC or 24 V AC/DC
Relay 230 V AC or 24 V DC
Digital/ analog input/ output 0/4 mA ... 20 mA
Communication (Ethernet/ Fieldbus/ RS485)
Fixed cable sensors with Memosens protocol,
max. cable length 100 m (330 ft), including,
but not limited to, the following sensor types:
CASSIO (Nitrate)
CUSSIO (Turbidity)
Conduit
Conduit
Conduit
Conduit
For hazardous locations use Class I Div 2 approved and
labelled measurement transmitter CM44x or CM44xR
(x = 2, 4 or 8)
Hazardous location
NI Class I Division 2,
Groups A, B, C, D T6
For USA: Cable type ITC
Install per NEC501
Sensor terminals
85-86 and 97-98
COS61D
Class I Division 2
Groups A-D, T6, Type IP67/IP68
WARNING: EXPLOSION HAZARD - SUBSTITUTION OF COMPONENTS MAY IMPAIR SUITABILITY FOR USE IN CLASS I DIVISION 2.
WARNING: EXPLOSION HAZARD - DO NOT DISCONNECT WHILE THE CIRCUIT IS LIVE OR UNLESS THE AREA IS FREE OF IGNITIBLE CONCENTRATIONS.
WARNING: EXPLOSION HAZARD - DO NOT SERVICE ELECTRICAL CONNECTIONS UNLESS POWER HAS BEEN DISCONNECTED OR THE AREA IS KNOWN TO BE FREE OF IGNITIBLE CONCENTRATIONS OF FLAMMABLE GASES OR VAPORS.
NOTE: THE FINAL INSTALLATION SHALL ASSURE THAT THE METALLIC SENSOR BODY IS BONDED TO GROUND; AS NECESSARY
B
Endress+Hauser
Endress+Hauser Conducta GmbH+Co. KG
70839 Gerlingen, Germany
Refer to protection notice ISO 16016
Classification internal
Control Drawing COS61D CSA
Control Drawing COS61D CSA
Scale 1:5
Tolerance -
Notif. no.
Number of changes 1 B
Status In Work
No. of document 2110507778
Version B
Doc. part 000
Designed 06.11.2019 Blochwitz
Drawing chng.
Welding contr.
Approval contr.
Pressure contr.
Released
Weight
Volume
SAP material no. 71094592
Format DIN A3
Sheet 1/1
Material -
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