TI01620C/07/EN/03.25-00
71723744
2025-09-30

Technical Information
Memosens COS51E

Amperometric oxygen sensor for water, wastewater and utilities



Digital with Memosens 2.0 technology

Application

Typical applications include:
- Wastewater treatment plants:
  - Oxygen control in activated sludge basins
  - Treatment and monitoring of process water
- Water treatment plants:
  - Status monitoring of drinking water
  - Monitoring of water quality in rivers, lakes or oceans
- All industrial utilities:
  - Oxygen control in biological treatment phase
  - Treatment and monitoring of process water

With ATEX, IECEx, CSA C/US, NEPSI, Korea Ex, Japan Ex and INMETRO certificates for use in hazardous areas Zone 0, Zone 1 and Zone 2. With CSA C/US approval also in hazardous areas Class I Division 1 in explosive gas atmospheres. Also suitable for Class I Division 2.

Your benefits

- Maximum measurement reliability with long maintenance intervals
- Intelligent, self-monitoring sensor
  - Sensor data stored in the sensor
  - Integrated electrolyte counter
- Minimal calibration effort thanks to straightforward air calibration

Endress+Hauser
People for Process Automation

Function and system design

Measuring principle

During amperometric oxygen measurement, oxygen molecules diffuse through the membrane and are reduced to hydroxide ions (OH-) at the working electrode. At the counter-electrode, silver is oxidized to silver ions (Ag+) (this forms a silver halide layer). The associated release of electrons at the working electrode and absorption of electrons at the counter-electrode causes a current to flow. Under constant conditions, this current flow is proportional to the oxygen content of the medium. The current is converted in the transmitter and indicated on the display as an oxygen concentration in mg/l, µg/l, ppm, ppb or Vol%, ppmVol, raw value nA, as a saturation index in % SAT or as an oxygen partial pressure in hPa.

Potentiostatic three-electrode system

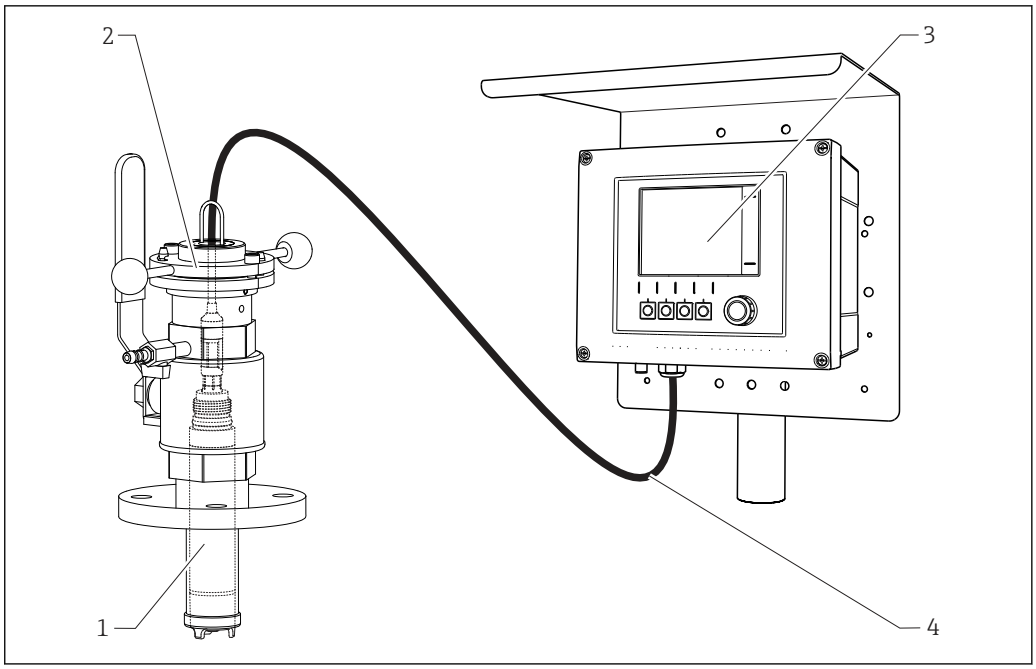
The high-impedance, current-free reference electrode plays an important role. The formation of the silver bromide or silver chloride layer at the anode causes the electrolyte's bromide or chloride ions to be depleted. With conventional membrane-covered sensors with a two-electrode system, this results in increased signal drift.

Not so with the three-electrode system:
The change in the bromide or chloride concentration is recorded by the reference electrode and an internal regulator circuit keeps the working electrode at a constant potential. The advantages are a much higher signal accuracy and significantly extended calibration intervals.

Measuring system

A complete measuring system comprises:
- a Memosens COS51E oxygen sensor
- a transmitter, see Table
- a measuring cable e.g. CYK10
- Optional: an assembly, e.g. CYA112 immersion assembly or COA451 retractable assembly
- Optional: a CYH112 assembly holder
- Optional: a cleaning unit with compressed air system
- Optional: other protection cages (71096199)

Transmitter	Memosens COS22E- standard, trace
Liquiline CM44x	Cable: CYK10
Liquiline CM42	Cable: CYK10
Liquiline Compact CM72	Cable: CYK10
Liquiline Compact CM82	Cable: CYK10
Liquiline Mobile CML18	Cable: CYK20
Third-party provider	Memosens partner



1 Example of a measuring system with Memosens COS51E digital oxygen sensor

1 Memosens COS51E oxygen sensor
2 COA451 retractable assembly
3 Liquiline CM44
4 CYK10 measuring cable

Dependability

Reliability

Memosens technology digitizes the measured values in the sensor and transmits the data to the transmitter via a . The result:
- If the sensor fails or there is an interruption in the connection between the sensor and transmitter, this is reliably detected and reported.
- The availability of the measuring point is reliably detected and reported.

Maintainability

Easy handling
Sensors with Memosens technology have integrated electronics that store calibration data and other information (e.g. total operating hours or operating hours under extreme measuring conditions). Once the sensor has been connected, the sensor data are transferred automatically to the transmitter and used to calculate the current measured value. As the calibration data are stored in the sensor, the sensor can be calibrated and adjusted independently of the measuring point. The result:
- Easy calibration in the measuring lab under optimum external conditions increases the quality of the calibration.
- Pre-calibrated sensors can be replaced quickly and easily, resulting in a dramatic increase in the availability of the measuring point.
- The availability of sensor data means that maintenance intervals can be accurately defined and predictive maintenance is possible.
- The sensor history can be documented with external storage media and evaluation programs.
- The application range of the sensor can be determined based on its previous history.

Integrity

With inductive transmission of the measured value using a non-contact connection, Memosens guarantees maximum process safety and offers the following benefits:
- All problems caused by moisture are eliminated.
  - Plug-in connection remains free from corrosion
  - Measured value distortion from moisture is not possible.
  - The plug-in system can even be connected under water.
- The transmitter is galvanically decoupled from the medium.
- EMC safety is guaranteed by screening measures for the digital transmission of measured values.

Input

Measured variables

Dissolved oxygen [mg/l, µg/l, ppm, ppb, %SAT, %Vol, ppmVol]

Temperature [°C, °F]

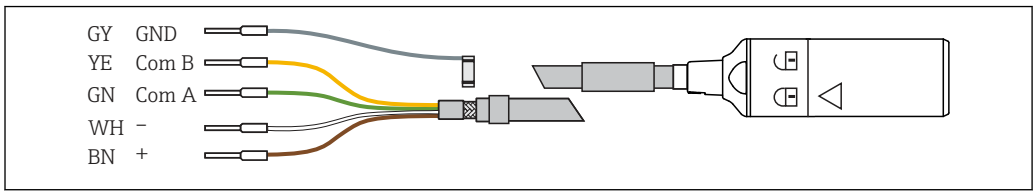
Measuring ranges

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

Power supply

Electrical connection

The electrical connection of the sensor to the transmitter is established using measuring cable CYK10.



2 *Measuring cable CYK10*

Performance characteristics

Response time [1]

At 20 °C (68 °F):
- COS51E-****TN (black membrane cap for standard response time):
  - t_{90} : 3 minutes
  - t_{98} : 8 minutes
- COS51E-****TF (white membrane cap for rapid response time):
  - t_{90} : 30 seconds
  - t_{98} : 90 seconds

Reference operating conditions

Reference temperature:	20 °C (68 °F)
Reference pressure:	1013 hPa (15 psi)
Reference application:	Air-saturated water

Signal current in air

COS51E-****TN (black membrane cap)	approx. 300 nA
COS51E-****TF (white membrane cap)	approx. 1100 nA

Zero current

< 0.1 % of the signal current in air

Measurement error [2]

COS51E-****TN (black membrane cap):	≤ ±1 % of the measured value
COS51E-****TF (white membrane cap):	≤ ±1 % of the measured value

Limit of detection (LOD) [3]

COS51E-****TN (black membrane cap):	10 ppb
COS51E-****TF (white membrane cap):	5 ppb

1) Average of all sensors that have undergone a final inspection
2) In accordance with IEC 60746-1 under rated operating conditions
3) According to DIN EN ISO 15839. The measurement error contains all the uncertainties of the sensor and transmitter (measuring chain). It does not contain all the uncertainties caused by the reference material and adjustments that may have been performed.

Limit of quantification (LOQ) [3]	COS51E-****TN (black membrane cap):	20 ppb
	COS51E-****TF (white membrane cap):	10 ppb
Repeatability	COS51E-****TN (black membrane cap):	20 ppb
	COS51E-****TF (white membrane cap):	100 ppb
Long-term drift [4]	Zero-point drift:	< 0.1 % per week
	Measuring range drift:	< 0.1 % per week
Polarization time	< 60 minutes	
Intrinsic oxygen consumption	▪ COS51E-****TN: approx. 90 ng/h in air at 25 °C (77 °F) ▪ COS51E-****TF: approx. 270 ng/h in air at 25 °C (77 °F)	
Electrolyte	Alkaline saline solution	

Installation

Installation instructions

NOTICE

Installing the unit without an assembly carries the risk of cable breakage or sensor loss!

▶ Do not install the sensor freely suspended from the cable!

Orientation

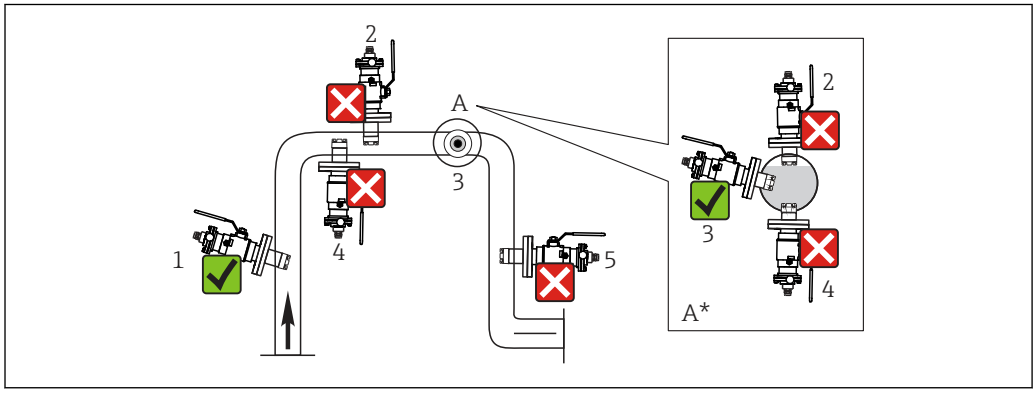
Installation examples

Retractable assembly COA451

The assembly is designed for installation on vessels and pipes. This requires the availability of suitable process connections.

4) Under constant conditions

Install the assembly in a place with uniform flow conditions. The pipe diameter must be at least DN 80.



3 Permissible and impermissible sensor installation positions with retractable assembly

1 Ascending pipe, best position
2 Horizontal pipe, sensor top down, impermissible due to air cushion or foam bubble forming
3 Horizontal pipe, lateral installation with permissible installation angle (acc. to sensor version)
4 Upside-down installation, unsuitable
5 Down pipe, impermissible
A Detail A (top view)
A Detail A, turned by 90° (side view)*

☑ *Possible installation angle*

☒ *Inadmissible installation angle*

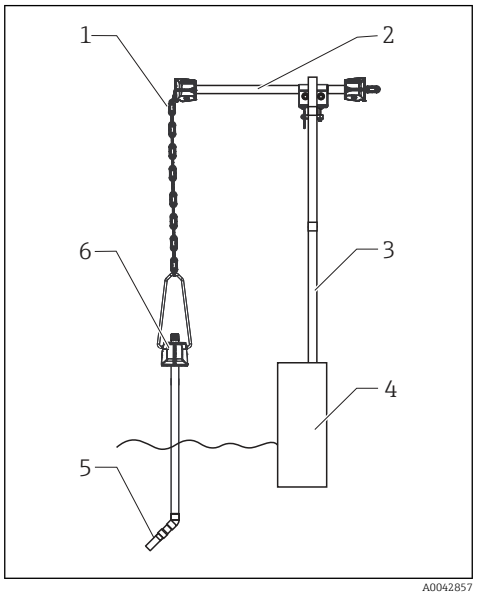
NOTICE

Sensor not fully immersed in the medium, buildup, upside-down installation
These can all cause incorrect measurements!

- ▶ Do not install assembly at points where air pockets or bubbles may form.
- ▶ Avoid buildup on the sensor membrane or remove it at regular intervals.
- ▶ Do not install sensor upside down.

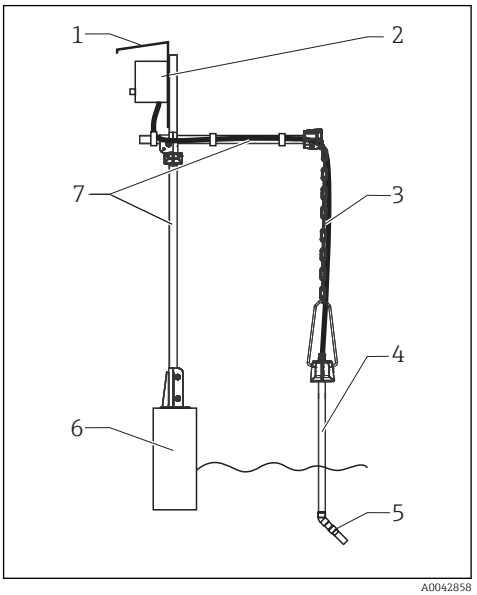
Immersion operation

Universal holder and chain assembly



4 *Chain holder on railing*

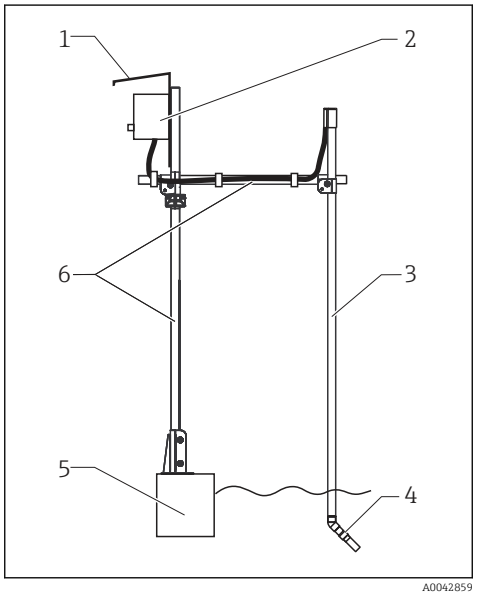
1 *Chain*
2 *Holder Flexdip CYH112*
3 *Rail*
4 *Basin rim*
5 *Oxygen sensor*
6 *Wastewater assembly Flexdip CYA112*



5 *Chain holder on upright post*

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

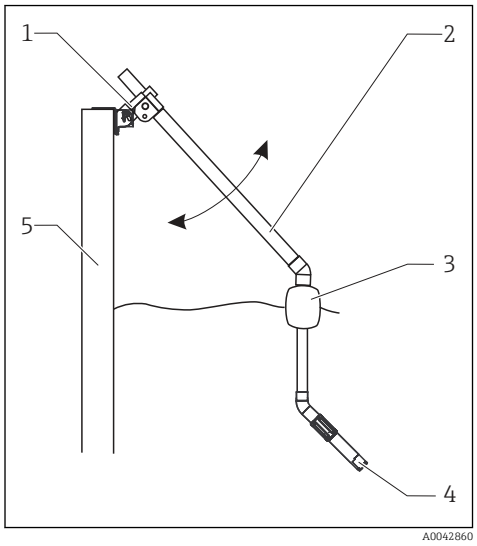
Universal holder and fixed immersion tube



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 immersion tube

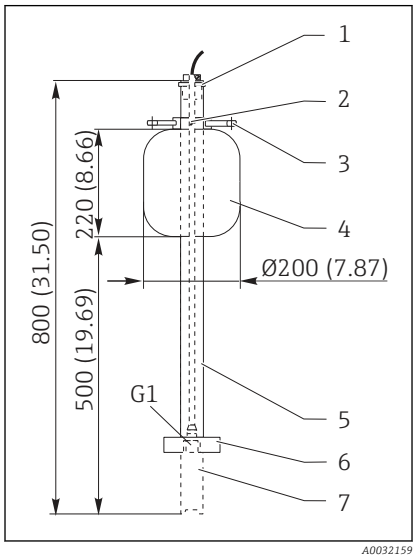


7 *Basin rim mounting*

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.

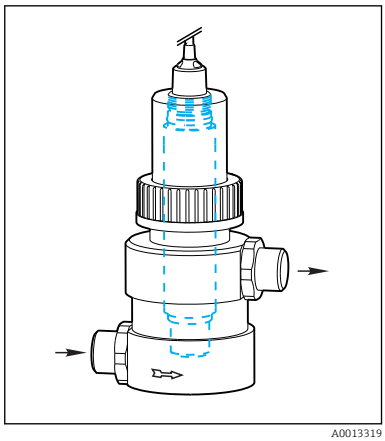


1 Cable run with strain relief and rain shield
2 Fixing ring for rope and chains with terminal screw
3 Eyelets Ø15, 3 x 120 ° for anchoring
4 Plastic float, resistant to salt water
5 Pipe 40 x 1, stainless steel 1.4571
6 Bumper and ballast
7 Oxygen sensor

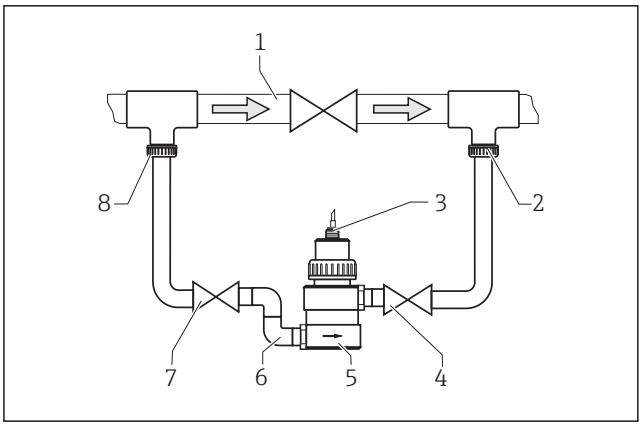
8 *Dimensions in mm (inch)*

Flow assembly COA250

The COA250 flow assembly with automatic self-venting is suitable for use in pipelines or at hose connections. The inlet is at the bottom of the assembly and the outlet is at the top (G¾ connection thread). It is installed in a pipe using two 90° pipe brackets at the inlet of assembly (item 6).



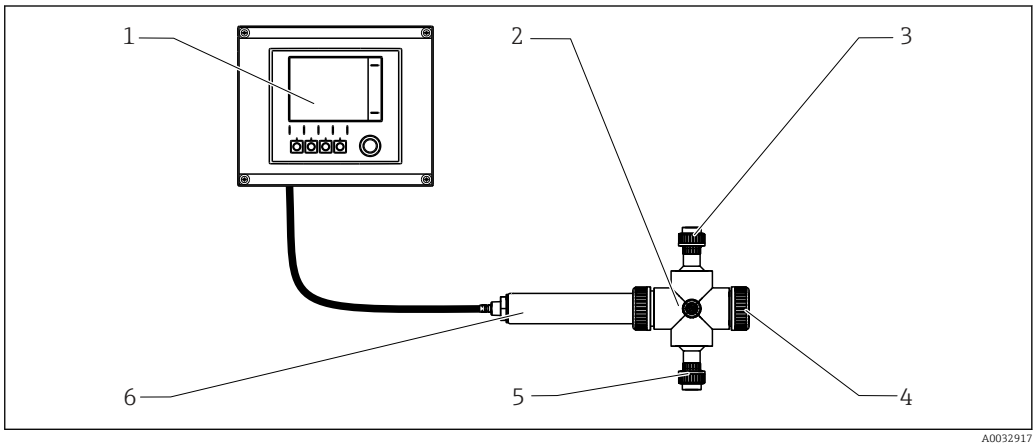
9 COA250



10 Bypass installation with manually actuated valves or solenoid valves

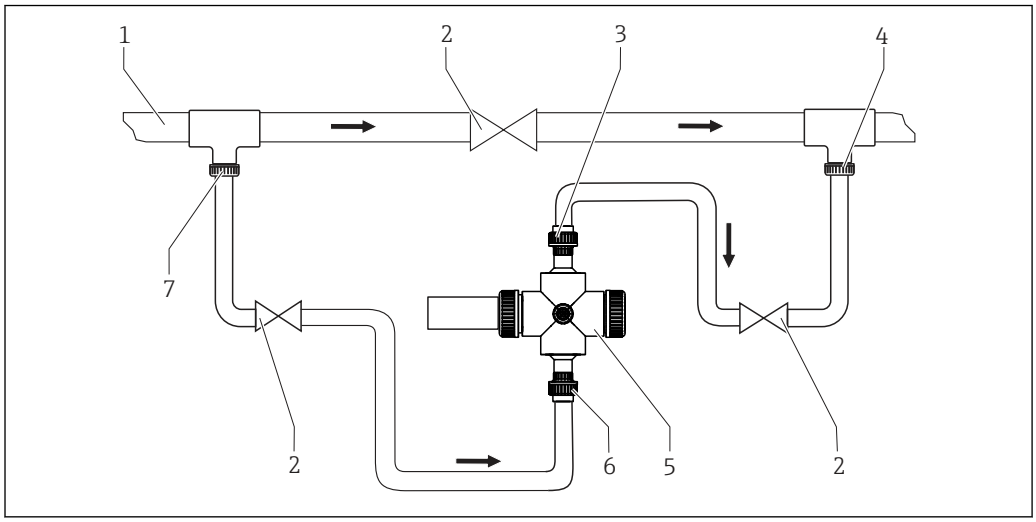
1 Main pipe
2 Medium return
3 Oxygen sensor
4, 7 Manually actuated or solenoid valves
5 Flow assembly COA250-A
6 90 ° pipe elbow
8 Medium removal

Universal flow assembly Flowfit CYA251



11 Measuring system with CYA251

1 Transmitter
2 Flow assembly
3 Medium outlet
4 Cap
5 Medium inflow
6 Memosens COS51E



12 Connection diagram

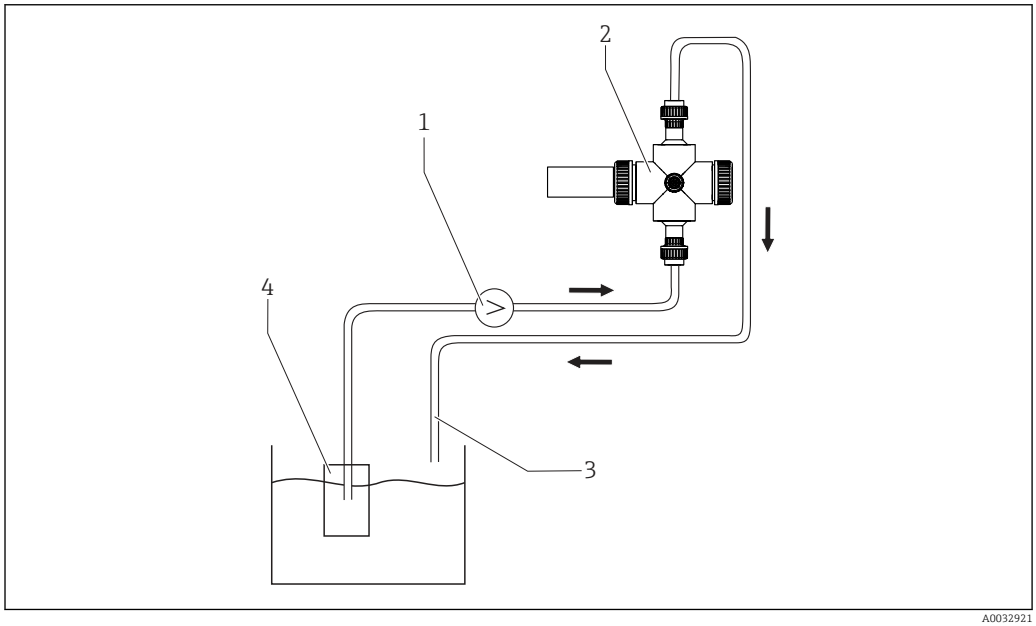
1	*Main pipe*	*5*	*Medium inflow*
2	*Manually actuated or solenoid valves*	*6*	*Flow assembly*
3	*Medium outlet*	*7*	*Medium removal*
4	*Medium return*		

Mount the sensor in the assembly in accordance with the Operating Instructions (BA00495C).

There must be a minimum flow rate of 100 ml/h (0.026 gal/h).

- Take increased response times into account.

As an alternative to bypass operation, direct the sample flow from a filter unit with an open outlet through the assembly:



13 Flow assembly with open outlet

1 Pump
2 Assembly
3 Open outlet
3 Filter unit

Environment

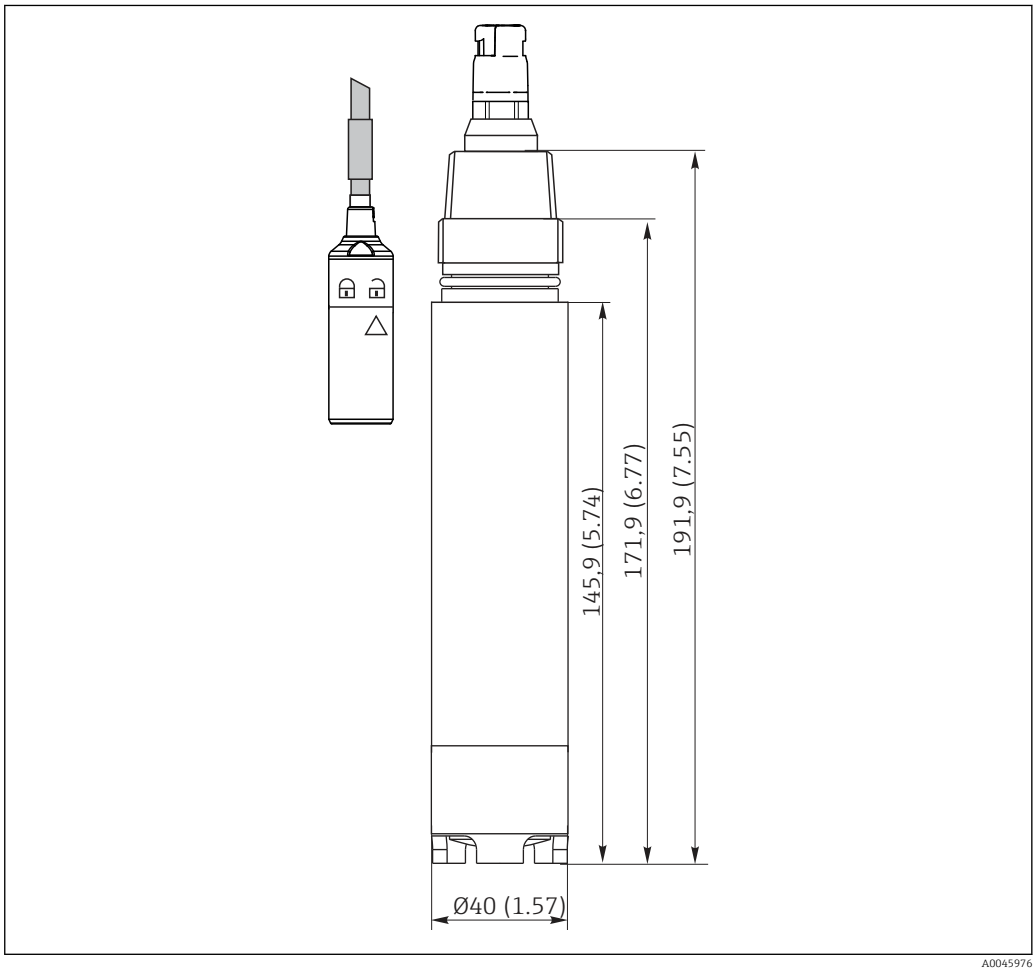
Ambient temperature range	−5 to 60 °C (23 to 140 °F)
Storage temperature range	▪ Filled with electrolyte: −5 to 60 °C (20 to 140 °F) ▪ Without electrolyte: −20 to 60 °C (0 to 140 °F)
Degree of protection	IP68 (2 m (6.5 ft) water column, 21 °C (70 °F), 24 hours)

Process

Process temperature range	−5 to 60 °C (41 to 140 °F)
Process pressure range	5 bar (72.5 psi) abs.

Mechanical construction

Dimensions



14 Dimensions in mm (inch)

Weight	0.3 kg (0.7 lbs)

Materials

Parts in contact with medium

Sensor shaft	POM
Membrane cap	POM
Working electrode	Gold
Counter-electrode and reference electrode	Silver/Silver halide
Membrane	ETFE (COS51-****TN) FEP (COS51-****TF)

Process connection

G1, NPT 3/4"

Membrane thickness

- COS51D-***0*:
  Approx. 50 µm
- COS51D-***1*:
  Approx. 25 µm

Temperature sensor

NTC 30KΩ

Certificates and approvals

Current certificates and approvals for the product are available at www.endress.com on the relevant product page:

1. Select the product using the filters and search field.
2. Open the product page.
3. Select **Downloads**.

Ex certification

ATEX
II 1G Ex ia IIC T6 Ga

CSA C/US
- IS Class I Division 1 Groups A, B, C and D T6
- Ex ia IIC T6 Ga
- IS Class I Zone 0 AEx ia IIC T6 Ga

EAC Ex
0Ex ia IIC T6 Ga X

INMETRO
Ex ia IIC T6 Ga

IECEx
Ex ia IIC T6 Ga

Japan Ex
Ex ia IIC T6 Ga

Korea Ex
Ex ia IIC T6 Ga

NEPSI
Ex ia IIC T6 Ga

UK Ex
Ex ia IIC T6 Ga

Additional certifications and declarations

EAC

The product has been certified according to Directive TP TC 020/2011 applicable in the Eurasian Economic Union (EAEU). The product bears the EAC mark of conformity.

Ordering information

Product page

www.endress.com/cos51e

Product Configurator

On the product page there is a **Configure** button to the right of the product image.

1. Click this button.
   ↳ The Configurator opens in a separate window.
2. Select all the options to configure the device in line with your requirements.
   ↳ In this way, you receive a valid and complete order code for the device.
3. Export the order code as a PDF or Excel file. To do so, click the appropriate button on the right above the selection window.

For many products you also have the option of downloading CAD or 2D drawings of the selected product version. Click the **CAD** tab for this and select the desired file type using picklists.

Scope of delivery

The scope of delivery comprises:
- Ordered version of the sensor with protective cap (filled with tap water) to protect the membrane
- Accessories set with the following contents:
  - 2 replacement membrane caps
  - Electrolyte, 1 bottle, 10 ml (0.34 fl.oz.)
  - Seal set with 3 O-rings
  - 6 polishing foils in 2 grit sizes
- Safety instructions for the hazardous area (for sensors with Ex approval)
- Brief Operating Instruction
- Optional: cleaning unit
- Optional: replacement caps

If you have any questions, please do not hesitate to contact the the Endress+Hauser sales team.

Accessories

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

► For accessories not listed here, please contact your Service or Sales Center.

Device-specific accessories

Assemblies (selection)

Flowfit CYA251
- Connection: See product structure
- Material: PVC-U
- Product Configurator on the product page: www.endress.com/cya251

Technical Information TI00495C

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

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 capstone, on the wall or directly onto railings.
- Plastic or stainless steel version
- Product Configurator on the product page: www.endress.com/cyh112

Technical Information TI00430C

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

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

Measuring cables

Memosens data cable CYK10
- For digital sensors with Memosens technology
- Product Configurator on the product page: www.endress.com/cyk10

Technical Information TI00118C

Memosens laboratory cable CYK20
- For digital sensors with Memosens technology
- Product Configurator on the product page: www.endress.com/cyk20

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

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

Liquiline CM42
- Modular two-wire transmitter for hazardous and non-hazardous areas
- HART®, PROFIBUS or FOUNDATION Fieldbus is possible
- Order according to product structure

Technical Information TI00381C

Liquiline Mobile CML18
- Multiparameter mobile device for laboratory and field
- Reliable transmitter with display and app connection
- Product Configurator on the product page: www.endress.com/CML18

Operating Instructions BA02002C

Liquiline Compact CM82
- Configurable 1-channel multiparameter transmitter for Memosens sensors
- Ex- and non-ex applications possible in all industries
- Product Configurator on the product page: www.endress.com/CM82

Technical Information TI01397C

Liquiline Compact CM72
- 1-channel single parameter field device for Memosens sensors
- Ex- and non-ex applications possible in all industries
- Product Configurator on the product page: www.endress.com/CM72

Technical Information TI01409C

Memosens analog converter CYM17
- Converter for Memosens sensors
- Enables the simple use of digital Memosens sensors in fermentation applications in the laboratory
- Product Configurator on the product page: www.endress.com/cym17

Operating Instructions BA01833C

Memobase Plus CYZ71D
- PC software to support laboratory calibration
- Visualization and documentation of sensor management
- Sensor calibrations stored in database
- Product Configurator on the product page: www.endress.com/cyz71d

Technical Information TI00502C

Maintenance kit

COV45 maintenance kits for COS41/COS51X
- Maintenance kit for COS51D and COS51E
- Scope of supply of maintenance kit COV45 is based on the configuration:
  - Maintenance kit, complete
  - with 10x sensor electrolyte
  - with 2x membrane cap
  - with seal set
  - with polishing foil
- Or each can be ordered individually
  Ordering information: www.endress.com/cos51e under "Accessories/Spare parts"



www.addresses.endress.com

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