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LENNTECH
WATER TREATMENT SOLUTIONS

Technical Information
Memosens CCS55D

Digital sensor with Memosens technology for determining free bromine



Memosens CCS55D offers high-precision measurement with long-term stability to guarantee optimum process monitoring

Application

Memosens CCS55D is a sensor for free bromine for skid manufacturers and end customers: It measures reliably in:
- seawater – to guarantee sufficient disinfection
- utilities – to detect the absence or presence of free bromine
- swimming pools – for the efficient dosing of disinfectant

Your benefits

- The right choice of sensor for every application: from trace measurements to concentrations of 200 mg/l free bromine.
- Fast response time (t_{90} < 20 s) ensures accurate process monitoring and enables a prompt response to process changes, as well as efficient process control.
- Increased process safety: precise measurement with long-term stability ensures consistent process monitoring and enables customized disinfectant dosing to suit the application.
- The low-maintenance amperometric sensor reduces the measuring point's operating costs, particularly compared with colorimetric measuring systems.
- Higher system availability thanks to rapid sensor replacement: calibrate your sensor in the lab and integrate it into the process using plug & play.
- Can be easily combined with other relevant liquid analysis parameters, such as pH and ORP, by connecting to the Liquiline multi-parameter transmitter.

Other advantages provided by Memosens technology

- Maximum process safety
- Data security thanks to digital data transmission
- Very easy to use as sensor data are saved in the sensor
- Predictive maintenance can be performed by recording sensor load data in the sensor

Endress+Hauser
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Function and system design

Measuring principle

Free bromine is determined via hypobromous acid (HOBr) according to the amperometric measuring principle.

The hypobromous acid (HOBr) contained in the medium diffuses through the sensor membrane and is reduced to bromide ions (Br^-) at the gold working electrode. At the silver counter electrode, silver is oxidized to silver bromide. Electron donation at the gold working electrode and electron acceptance at the silver counter electrode causes a current to flow which is proportional to the concentration of free bromine in the medium at constant conditions.

The concentration of hypobromous acid (HOBr) depends on the pH value. An additional pH measurement should be used to compensate for this dependency.

The transmitter uses the current signal in nA to calculate the measured variable for concentration in mg/l (ppm).

The sensor can also measure organic bromination agents. A new calibration during commissioning is recommended for this.

Mode of operation

The sensor consists of:
- Membrane cap (measuring chamber with membrane)
- Sensor shaft with counter-electrode with large surface area and a working electrode embedded in plastic

The electrodes are in an electrolyte which is separated from the medium by a membrane. The membrane prevents the electrolyte from leaking and protects against contaminant penetration.

The measuring system is calibrated by means of a colorimetric comparison measurement in accordance with the DPD method for free bromine. The calibration value determined is entered in the transmitter.

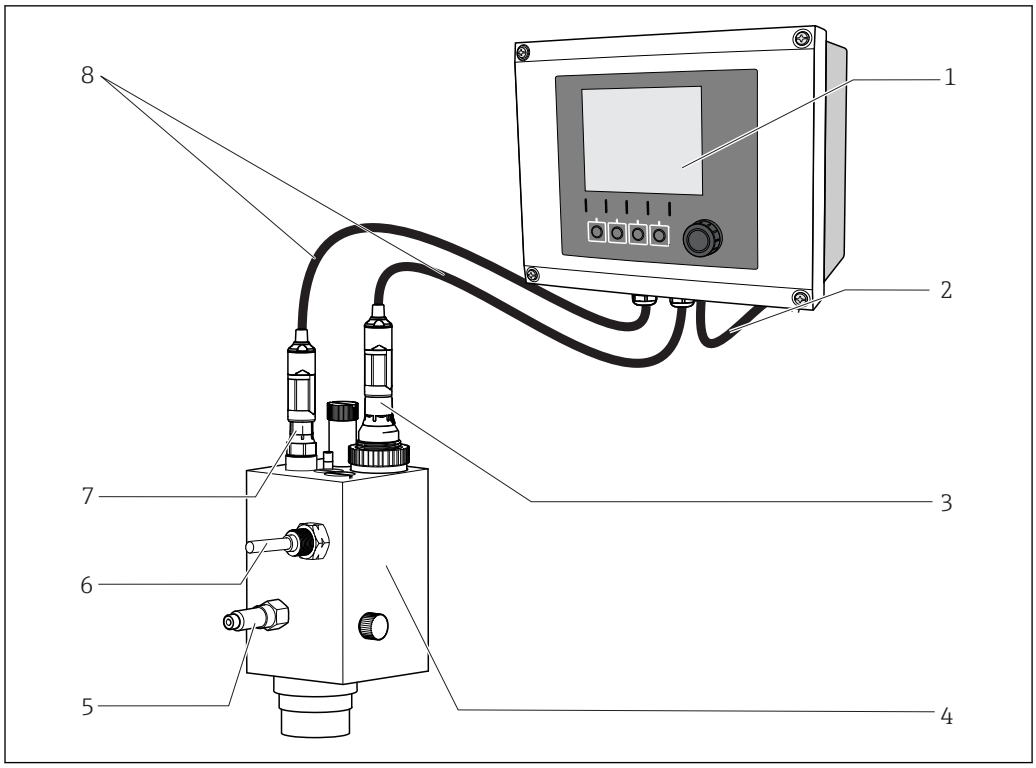
Cross-sensitivities [1)]

There are cross-sensitivities for: total bromine, free available chlorine, total chlorine, chlorine dioxide, ozone, hydrogen peroxide and peracetic acid.

Measuring system

A complete measuring system comprises:
- Disinfection sensor CCS55D (membrane-covered, Ø25 mm) with corresponding installation adapter
- Flowfit CCA250 flow assembly
- Measuring cable CYK10, CYK20
- Transmitter, e. g. Liquiline CM44x with firmware version 01.06.08 or higher or CM44xR with firmware version 01.06.08 or higher
- Optional: pH sensor CPS31D
- Optional: extension cable CYK11
- Optional: proximity switch
- Optional: Flowfit CCA151 flow assembly (if the pH value is provided in another way)
- Optional: Flexdip CYA112 immersion assembly (if the pH value is provided in another way)

1) The listed substances have been tested individually and with different concentrations. A reaction to mixtures was not investigated.



1 *Example of a measuring system*

1 *Liquiline CM44x transmitter*
2 *Power cable for transmitter*
3 *Disinfection sensor CCS55D (membrane-covered, Ø25 mm)*
4 *Flowfit CCA250 flow assembly*
5 *Inlet to Flowfit CCA250 flow assembly*
6 *Proximity switch (optional)*
7 *CPS31D pH sensor*
8 *Measuring cable CYK10*

Dependability

Reliability

Memosens MEMOSENS

Memosens makes your measuring point safer and more reliable:
- Non-contact, digital signal transmission enables optimum galvanic isolation
- Dust- and waterproof (IP 68)
- Sensor can be calibrated in a lab, thus increasing the availability of the measuring point in the process
- Predictive maintenance thanks to recording of sensor data, e.g.:
  - Total hours of operation
  - Hours of operation with very high or very low measured values
  - Hours of operation at high temperatures
  - Calibration history

Maintainability

Easy handling

Sensors with Memosens technology have integrated electronics that store calibration data and other information (e.g. total hours of operation 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.
- Thanks to the availability of the sensor data, maintenance intervals can be accurately defined and predictive maintenance is possible.
- The sensor history can be documented on external data carriers and in evaluation programs.
- Thus, the current application of the sensors can be made to depend on their previous history.

Safety

Data security thanks to digital data transmission
Memosens technology digitizes the measured values in the sensor and transmits the data to the transmitter via a non-contact connection that is free from potential interference. The result:
- Automatic error message if sensor fails or connection between sensor and transmitter is interrupted
- Immediate error detection increases measuring point availability

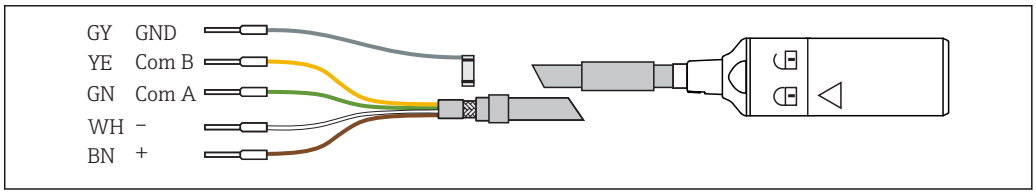
Input

Measured values	Free bromine (HOBr)	Hypobromous acid (HOBr) [mg/l, µg/l, ppm, ppb]
	Temperature	[°C, °F]
Measuring ranges	CCS55D-**31AD	0 to 5 mg/l (ppm) HOBr
	CCS55D-**31BF	0 to 20 mg/l (ppm) HOBr
	CCS55D-**31CJ	0 to 200 mg/l (ppm) HOBr
Signal current	CCS55D-**31AD	56 to 104 nA per 1 mg/l (ppm) HOBr
	CCS55D-**31BF	14 to 26 nA per 1 mg/l (ppm) HOBr
	CCS55D-**31CJ	14 to 26 nA per 1 mg/l (ppm) HOBr

Power supply

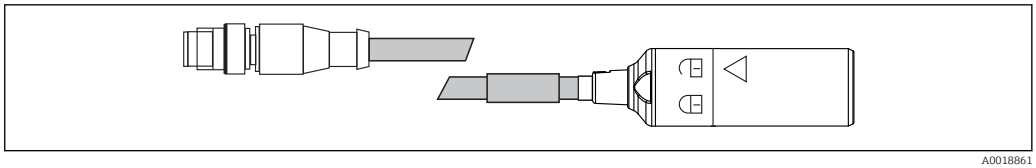
Electrical connection

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



2 *Measuring cable CYK10*

▶ To extend the cable, use measuring cable CYK11. The maximum cable length is 100 m (328 ft).



3 *Electrical connection, M12 plug*

Performance characteristics

Reference operating conditions

Temperature	20 °C (68 °F)
pH value	pH 6.5 ±0.2
Flow	40 to 60 cm/s
HOBr-free base medium	Mains water

Response time

T_{90} < 20 s (after completing polarization)

The T_{90} time can be longer under certain conditions. If the sensor is operated or stored in a bromine-free medium for a longer period, the sensor response starts immediately if bromine is present but only reaches the exact concentration value after a delay.

Measured value resolution of sensor

At most, the smallest possible measured value resolution under reference conditions is 0.05% of the measured value above the determination limit (LOQ). For example, with 1 mg/l free bromine, this corresponds to a measured value resolution of 0.0005 mg/l.

Maximum measured error

±2 % or ±5 µg/l (ppb) of value measured (depending on which value is higher)

	LOD (limit of detection) [1]	LOQ (limit of quantification) [1]
CCS55D-**31AD	0.0008 mg/l (ppm)	0.0025 mg/l (ppm)
CCS55D-**31BF	0.0026 mg/l (ppm)	0.0085 mg/l (ppm)
CCS55D-**31CJ	0.0061 mg/l (ppm)	0.0203 mg/l (ppm)

1) Based on ISO 15839. The measured error includes all the uncertainties of the sensor and transmitter (electrode system). It does not contain all the uncertainties caused by the reference material and adjustments that may have been performed.

Repeatability

CCS55D-**31AD	0.0017 mg/l (ppm)
CCS55D-**31BF	0.0087 mg/l (ppm)
CCS55D-**31CJ	0.0476 mg/l (ppm)

Nominal slope

CCS55D-**31AD	80 nA per 1 mg/l (ppm) HOBr
CCS55D-**31BF	20 nA per 1 mg/l (ppm) HOBr
CCS55D-**31CJ	20 nA per 1 mg/l (ppm) HOBr

Long-term drift

< 1 % per month (mean value, determined while operating at varying concentrations and under reference conditions)

Polarization time

Initial commissioning	60 min
Recommissioning	30 min

Operating time of the electrolyte

The operating life of the electrolyte depends greatly on the application and the medium. It becomes shorter with increasing concentrations of free bromine and increasing temperature.

at 10 % of measuring range and 20 °C	2 years
at 50 % of measuring range and 20 °C	1 year
at maximum concentration and 55 °C	60 days

Bromine intrinsic consumption

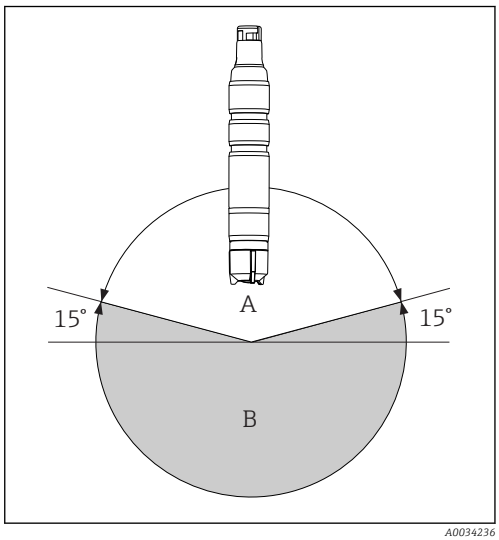
The intrinsic consumption of bromine at the sensor is negligible.

Installation

Orientation

Do not install upside-down!

- Install the sensor in an assembly, support or appropriate process connection at an angle of at least 15 ° to the horizontal.
- Other angles of inclination are not permitted.
- Follow the instructions for installing the sensor in the Operating Instructions of the assembly used.



A *Permitted orientation*
B *Incorrect orientation*

Immersion depth

50 mm (1.97 in)

Installation instructions

Installation in Flowfit CCA151 flow assembly

The disinfection sensor (membrane-covered, Ø25 mm) is designed for installation in the Flowfit CCA151 flow assembly.

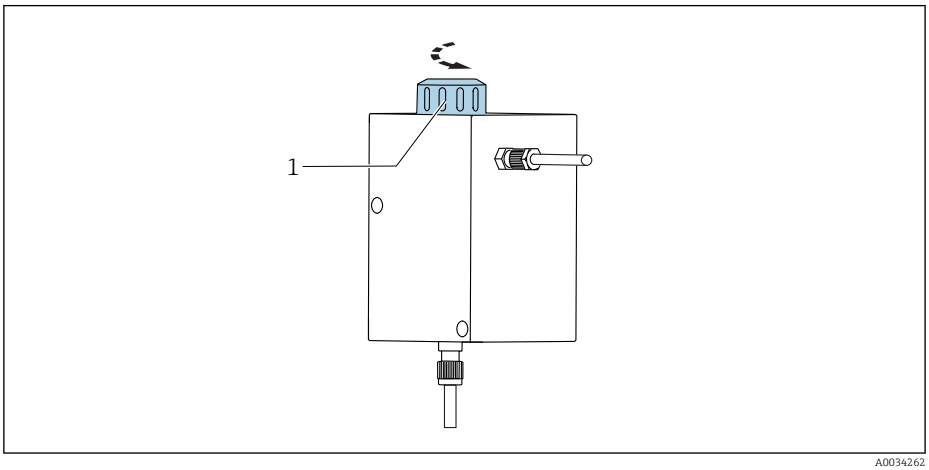
The disinfection sensor (membrane-covered, Ø25 mm) is designed for installation in the Flowfit CCA151 flow assembly if the pH value for compensation is provided in another way.

Please note the following during installation:

- The volume flow must be at least 5 l/h (1.3 gal/h).
- If the medium is fed back into an overflow basin, pipe or similar, the resulting counterpressure on the sensor may not exceed 1 bar (14.5 psi)(2 bar abs. (29 psi abs.)) and must remain constant.
- Avoid negative pressure at the sensor, e.g. due to medium being returned to the suction side of a pump.
- To avoid buildup, heavily contaminated water should also be filtered.

Preparing the assembly

1. The assembly is supplied to the customer with a union nut screwed onto the assembly: unscrew union nut from assembly.



4 *Flowfit CCA151 flow assembly*

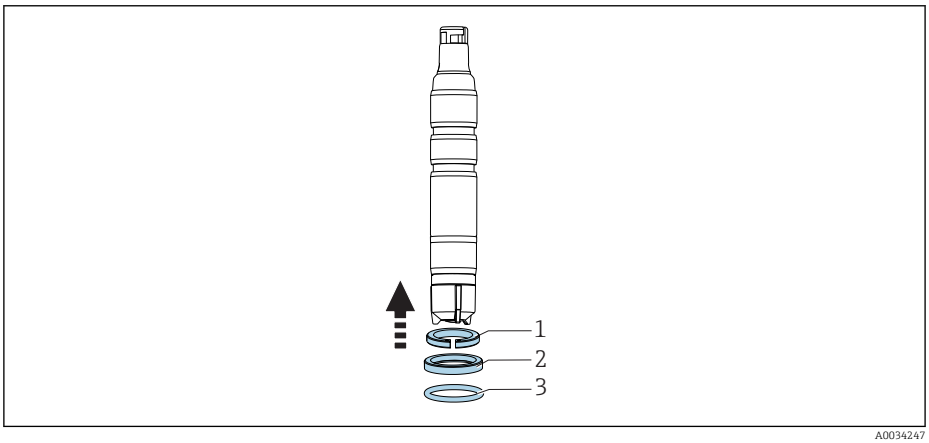
1 Union nut

2. The assembly is supplied to the customer with a dummy plug inserted in the assembly: remove dummy plug from assembly.

Equipping sensor with adapter

The required adapter (clamping ring, thrust collar and O-ring) can be ordered as a mounted sensor accessory or as a separate accessory → 14.

1. First slide the clamping ring, then the thrust collar, and then the O-ring from the membrane cap towards the sensor head and into the lower groove.

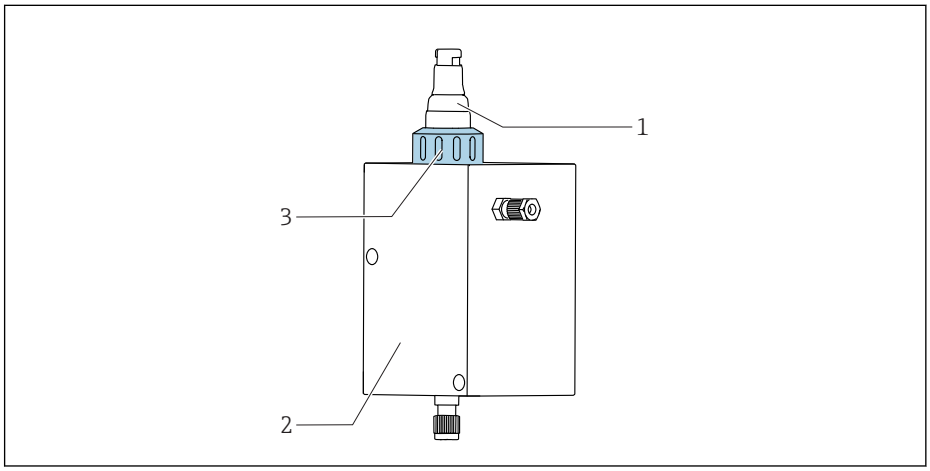


5 *Slide clamping ring (1), thrust collar (2) and O-ring (3) upwards from the membrane cap to the sensor shaft and into the lower groove.*

Installing sensor in assembly

2. Slide sensor with adapter for Flowfit CCA151 into the opening in the assembly.

3. Screw union nut onto assembly on block.



6 *Flowfit CCA151 flow assembly*

1 Disinfection sensor
2 Flowfit CCA151 flow assembly
3 Union nut for securing a disinfection sensor

Installation in Flowfit CCA250 flow assembly

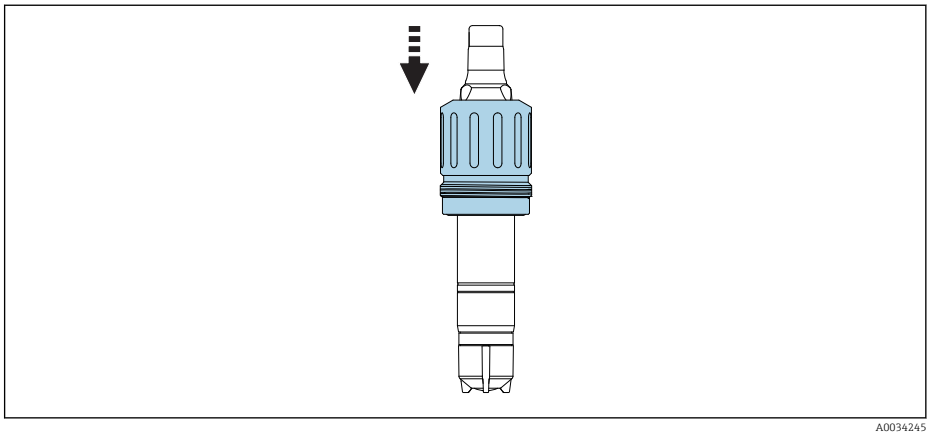
The sensor can be installed in the Flowfit CCA250 flow assembly. In addition to allowing the installation of a sensor for free bromine, this also allows the simultaneous operation of a pH and an ORP sensor for example. A needle valve controls the volume flow in the range of 30 to 120 l/h (7.9 to 31.7 gal/h).

Please note the following during installation:
- The volume flow must be at least 30 to 120 l/h (7.9 to 31.7 gal/h). If the flow drops below this value or stops completely, this can be detected by an inductive proximity switch and used to trigger an alarm with locking of the dosage pumps.
- If the medium is fed back into an overflow basin, pipe or similar, the resulting counterpressure on the sensor may not exceed 1 bar (14.5 psi)(2 bar abs. (29 psi abs.)) and must remain constant.
- Negative pressure at the sensor, e.g. due to medium being returned to the suction side of a pump, must be avoided.

Equipping sensor with adapter

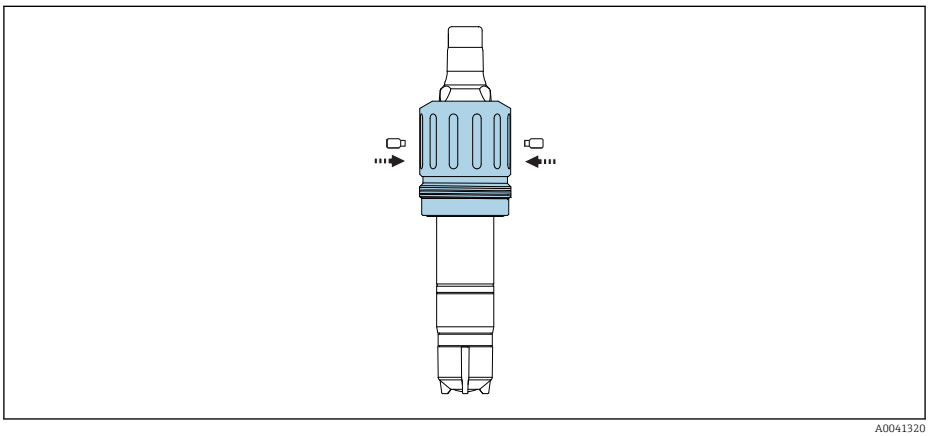
The required adapter can be ordered as a mounted sensor accessory or as a separate accessory.→ 14

1. Slide adapter for Flowfit CCA250 from the sensor head up to the stop on the sensor.



7 *Slide on adapter for Flowfit CCA250.*

2. Fix the adapter with the 2 stud screws supplied and an Allen screw (2 mm).



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3. Screw the sensor into the assembly.

For detailed information on "Installing sensor in Flowfit CCA250 assembly", see Operating Instructions for assembly

Installation in other flow assemblies

When using other flow assemblies, please ensure the following:
- A flow velocity of at least 16 cm/s (0.52 ft/s) must always be ensured at the membrane.
- The flow direction is upwards. Transported air bubbles must be removed so that they do not collect in front of the membrane.
- The flow must be directed to the membrane.

Pay attention to the additional installation instructions in the Operating Instructions for the assembly.

Installation in Flexdip CYA112 immersion assembly

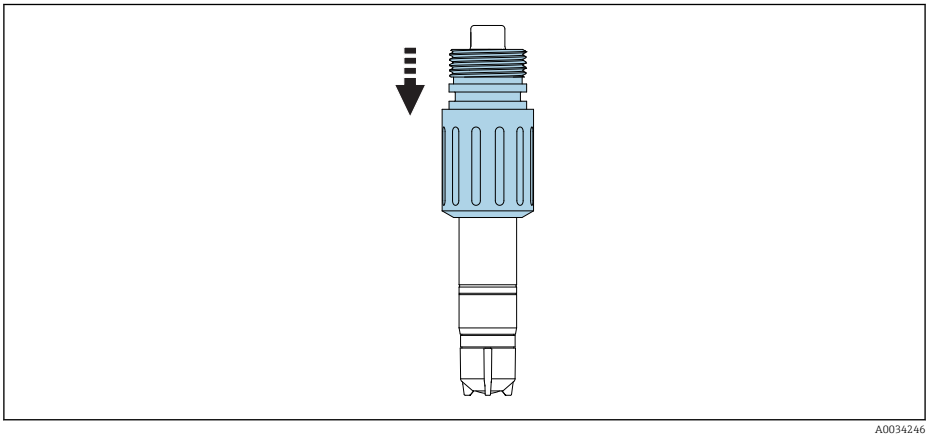
Alternatively, the sensor can be installed in an immersion assembly with a G1 threaded connection.

Ensure sufficient flow towards the sensor when using the immersion assembly .

Equipping sensor with adapter

The required adapter can be ordered as a mounted sensor accessory or as a separate accessory.→ 14

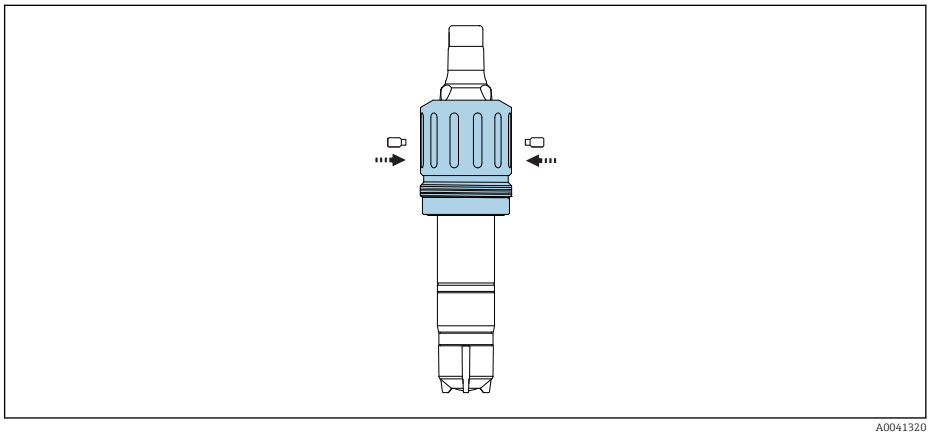
1. Slide adapter for Flexdip CYA112 from the sensor head up to the stop on the sensor.



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8 Slide on adapter for Flexdip CYA112.

2. Fix the adapter with the 2 stud screws supplied and an Allen screw (2 mm).



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3. Screw the sensor into the assembly. The use of a quick release fastener is recommended.

For detailed information on "Installing sensor in Flexdip CYA112 assembly", see Operating Instructions for assembly

Environment

Ambient temperature range

-20 to 60 °C (-4 to 140 °F)

Storage temperature

	Long-term storage up to 2 years (maximum)	Storage up to 48 h (maximum)
With electrolyte	0 to 35 °C (32 to 95 °F) (non-freezing)	35 to 50 °C (95 to 122 °F)
Without electrolyte	−20 to 60 °C (−4 to 140 °F)	

Degree of protection

IP68 (1.8 m (5.91 ft)) water column over 7 days at 20 °C (68 °F)

Process

Process temperature

0 to 55 °C (32 to 130 °F), non-freezing

Process pressure

The inlet pressure depends on the specific fitting and installation.

The measurement can take place with a free outlet.

The medium pressure directly upstream from the sensor membrane may not exceed 1 bar (14.5 psi) (2 bar abs. (29 psi abs.)).

- In terms of sensor condition and performance, it is essential that the flow velocity limits specified in the following table be observed.

	Flow velocity [cm/s]	Volume flow [l/h]		
		Flowfit CCA250	Flowfit CCA151	Flexdip CYA112
Minimum	16	30	5	The sensor is suspended freely in the medium; pay attention to the minimum flow velocity of 16 cm/s during installation.
Maximum	80	120	20	

pH range	Range of effectiveness of free bromine	pH 5 to 10 [1]
	Calibration	pH 5 to 9
	Measurement	pH 5 to 10

1) Up to pH 5 and in the presence of chloride ions (Cl^-) free chlorine and free bromine is produced and included in the measurement

Flow

At least 5 l/h (1.3 gal/h), in the Flowfit CCA151 flow assembly

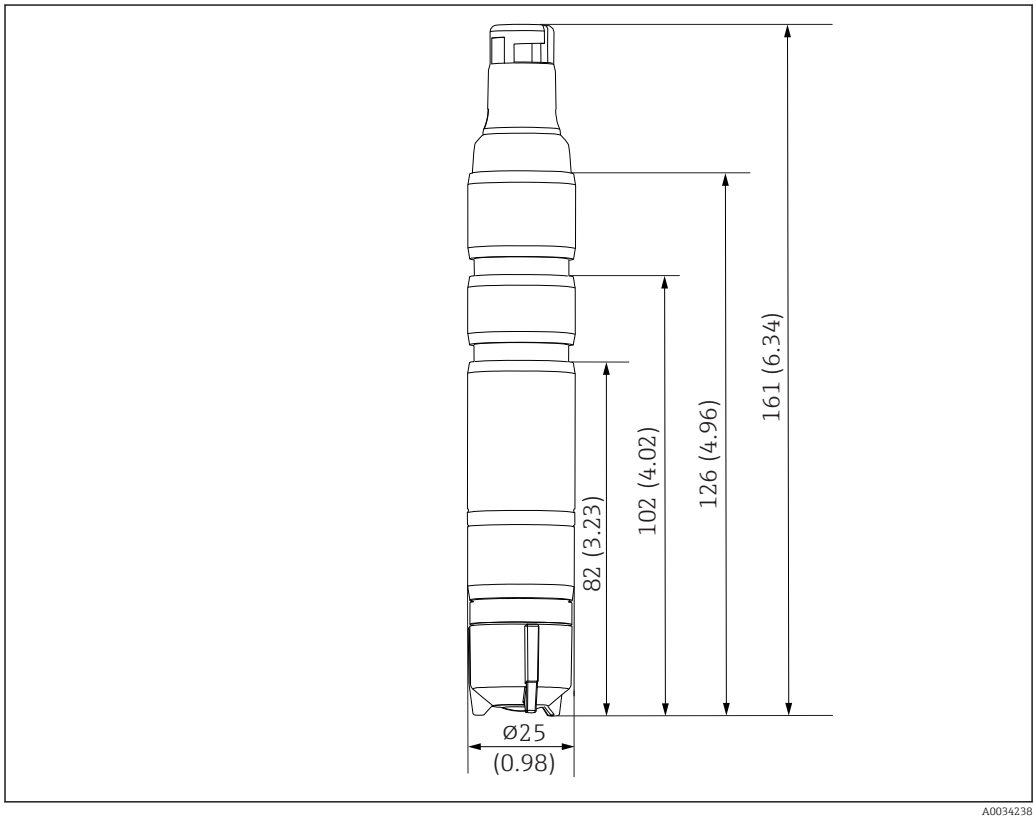
At least 30 l/h (7.9 gal/h), in the Flowfit CCA250 flow assembly

Minimum flow

At least 16 cm/s (0.5 ft/s), e.g. with Flexdip CYA112 immersion assembly

Mechanical construction

Dimensions



9 Dimensions in mm (in)

Weight

Sensor with membrane cap and electrolyte (without protection cap and without adapter)
Approx. 95 g (3.35 oz)

Materials

Sensor shaft	PVC
Membrane	PET
Membrane cap	PVDF
Protection cap	▪ Vessel: PC Makrolon (polycarbonate) ▪ Seal: Kraiburg TPE TM5MED ▪ Cover: PC Makrolon (polycarbonate)
Sealing ring	FKM
Sensor shaft coupling	PPS

Cable specification

max. 100 m (330 ft), incl. Cable extension

Certificates and approvals

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.

Ex approvals [2)]

cCSAus NI Cl. I, Div. 2
This product complies with the requirements defined in:
- UL 61010-1
- ANSI/ISA 12.12.01
- FM 3600
- FM 3611
- CSA C22.2 NO. 61010-1-12
- CSA C22.2 NO. 213-16
- Control drawing: 401204

Ordering information

Product page

www.endress.com/ccs55d

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 delivery comprises:
- Disinfection sensor (membrane-covered, Ø25 mm) with protection cap (ready for use)
- Bottle with electrolyte (50 ml (1.69 fl.oz))
- Replacement membrane cap in protection cap
- Operating Instructions
- Manufacturer inspection certificate

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

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.

Maintenance kit CCV05

Order according to product structure

- 2 x membrane caps and 1 x electrolyte 50 ml (1.69 fl.oz)
- 1 x electrolyte50 ml (1.69 fl.oz)
- 2 x sealing set

Device-specific accessories

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

Technical Information TI00118C

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

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

Flowfit CCA151
- Flow assembly for disinfection sensors
- Product Configurator on the product page: www.endress.com/cca151

Technical Information TI01357C

Flowfit CCA250
- Flow assembly for disinfection and pH/ORP sensors
- Product Configurator on the product page: www.endress.com/cca250

Technical Information TI00062C

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

Photometer PF-3
- Compact hand-held photometer for determining the reference measured value
- Color-coded reagent bottles with clear dosing instructions
- Order No.: 71257946

Kit adapter CCS5xD for CCA151
- Clamping ring
- Thrust collar
- O-ring
- Order No. 71372027

Adapter kit CCS5x(D) for CCA250
- Adapter incl. O-rings
- 2 studs for locking in place
- Order No. 71372025

Adapter kit CCS5x(D) for CYA112
- Adapter incl. O-rings
- 2 studs for locking in place
- Order No. 71372026

COY8

Zero-point gel for oxygen and disinfection sensors

- Oxygen-free and chlorine-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

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