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Operating Instructions
Memosens CCS53E

Digital sensor with Memosens technology for determining total chlorine

Endress+Hauser
People for Process Automation

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1 About this document

1.1 Safety information

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 used

- 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
- Minimum immersion depth
- 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 the 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.
- ▶ Measuring point faults may be repaired only 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 Intended use

Drinking water and industrial water must be disinfected through the addition of appropriate disinfectants such as chlorine gas or inorganic chlorine compounds. The dosing quantity must be adapted to continuously fluctuating operating conditions. If the concentrations in the water are too low, this could jeopardize the effectiveness of the disinfection. On the other hand, concentrations that are too high can lead to signs of corrosion and have an adverse effect on taste, as well as generating unnecessary costs.

The sensor was specifically developed for this application and is designed for continuous measurement of total chlorine in water. In conjunction with measuring and control equipment, it allows optimal control of disinfection.

In this context, the following compounds are referred to collectively as total chlorine:
- Free chlorine: hypochlorous acid (HOCl), hypochlorite ions (OCl^-)
- Inorganic combined chlorine
- Organic combined chlorine, e.g. cyanuric acid derivatives

Chloride (Cl^-) is not recorded.

The sensor is particularly suited to the following fields of application:
- Monitoring of total chlorine content in wastewater, industrial water, process water, cooling water and pool water
- Measurement, monitoring and control of total chlorine content in fresh water and seawater during the treatment of process water, swimming pool water and whirlpool bathwater

Typical application is the disinfection of wastewater, service water, process and cooling water with chlorine-based disinfectants, particularly at higher pH values up to pH 9.5. In the swimming pool, the CCS53E sensor is used in combination with the CCS51E sensor for free chlorine in order to determine the quantity of combined chlorine (chloramines).

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
- Regulations for explosion protection

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,
  take products out of service and protect them against unintentional operation.

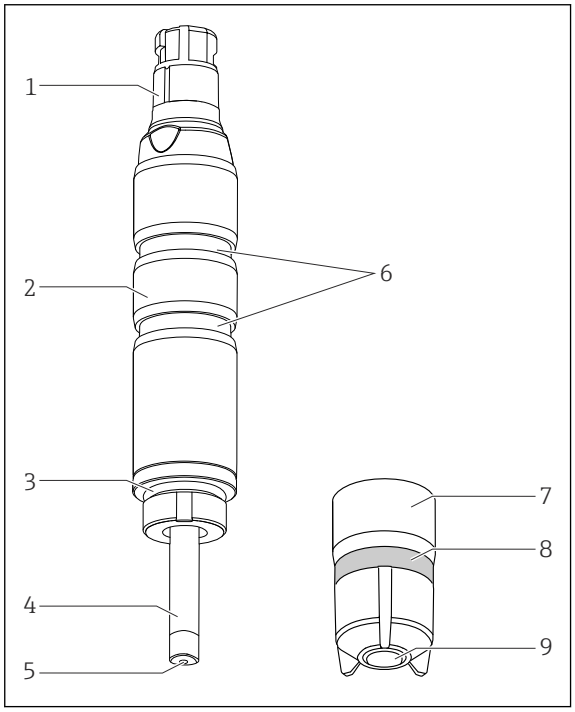
2.5 Product safety

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 Product description

3.1 Product design

The sensor consists of the following functional units:
- Membrane cap (measuring chamber with membrane)
  - Separates the inner amperometric system from the medium
  - With robust PET membrane and pressure relief valve
  - With support grid between working electrode and membrane for defined and consistent electrolyte film. This ensures a relatively constant indication while reducing the influence of fluctuating pressures and flows
- Sensor shaft with:
  - Large counter electrode
  - Working electrode embedded in plastic
  - Embedded temperature sensor



1 *Memosens plug-in head*
2 *Sensor shaft*
3 *O-ring*
4 *Large silver/silver halide counter electrode*
5 *Gold working electrode*
6 *Grooves for installation adapter*
7 *Membrane cap*
8 *Pressure relief valve (elastic)*
9 *Sensor membrane*

1 Sensor structure

3.1.1 Measuring principle

Total chlorine levels are determined in accordance with the amperometric measuring principle.

In this context, the following compounds are referred to collectively as total chlorine:
- Free chlorine: hypochlorous acid (HOCl), hypochlorite ions (OCl^-)
- Inorganic combined chlorine
- Organic combined chlorine, e.g. cyanuric acid derivatives

Chloride (Cl^-) is not recorded.

The sensor is a membrane-covered, two-electrode sensor. A gold working electrode is used as the working electrode. A counter electrode coated in silver halide is used as the counter and reference electrode.

The membrane cap, which is filled with electrolyte, constitutes the measuring chamber. The measuring electrodes are immersed in the measuring chamber. The measuring

chamber is separated from the medium by means of a microporous membrane. The chlorine compounds in the medium penetrate through the sensor membrane.

The constant polarization voltage present between the two electrodes causes the electrochemical reaction of the chlorine compounds at the working electrode. Electron donation at the working electrode and electron acceptance at the counter-electrode cause a current to flow. In the operational range of the sensor, this current flow is proportional to the chlorine concentration under constant conditions and is only slightly pH-dependent in the case of this sensor type. The transmitter uses the current signal to calculate the measured variable for concentration in mg/l (ppm).

3.1.2 Effects on the measuring signal

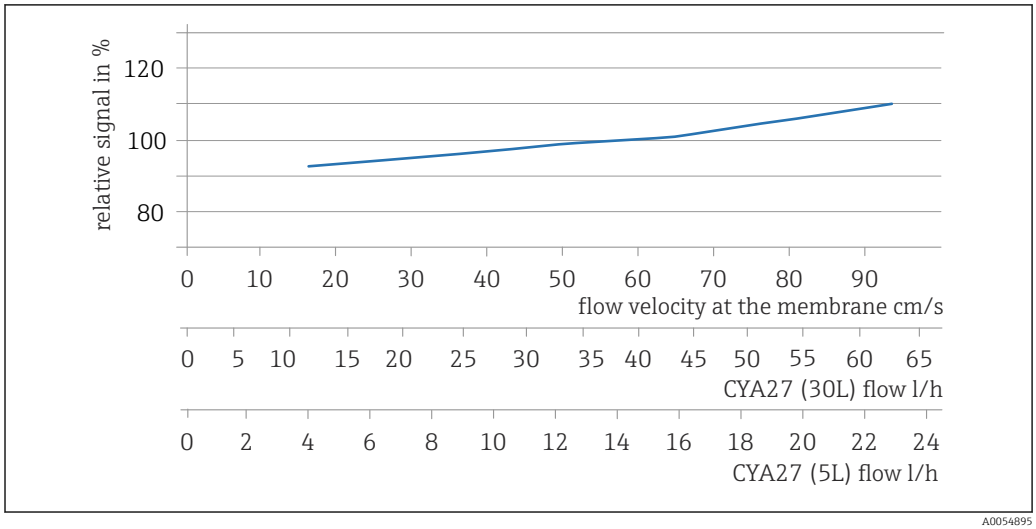
pH value

pH dependency

The sensor is specified for the pH range of pH 4 to 9. The measuring signal is practically independent within this range. However, if the pH increases from pH 7 to pH 8, the measuring signal for free chlorine is reduced by 10 %.

Flow

The minimum flow velocity at the membrane-covered measuring cell is 15 cm/s (0.5 ft/s). The reference range for the flow velocity is between 40 to 60 cm/s (1.3 to 2.0 ft/s). The corresponding volume flows in the Flowfit CYA27 flow assembly can be taken from the diagram, depending on the version (5 L/30 L).



If a proximity switch is installed in the assembly, this invalid operating status is recognized and an alarm is triggered or, if necessary, the dosing process is switched off.

Below the minimum flow rate, the sensor current is more sensitive to flow fluctuations. For abrasive media, it is recommended not to exceed the minimum flow. If suspended solids are present, which may form deposits, the maximum flow rate is recommended.

Temperature

Changes in the temperature of the medium affect the measured value:
- Increases in temperature result in a higher measured value (approx. 4.7 % per K) (approx. 2.5 % per K)
- Decreases in temperature result in a lower measured value (approx. - 4.7 % per K) (approx. - 2.5 % per K)

The sensor enables automatic temperature compensation (ATC) when used in conjunction with for example Liquiline CM44x. Recalibration in the case of temperature changes is not necessary.

In the event of normal and slow changes in temperature (0.3 K / minute), the internal temperature sensor is sufficient. In the event of very rapid temperature fluctuations with high amplitude (2 K/minute), an external temperature sensor is necessary to ensure maximum measurement accuracy.

For detailed information on the use of external temperature sensors, see the Operating Instructions for the transmitter

Configuring manual temperature compensation on the transmitter and entering a fixed temperature value is only recommended if the process temperature can be kept constant. The effects of temperature changes on zero point and slope are not automatically recorded in this setting and lead to false high/low readings.

Cross-sensitivity

- Oxidants, such as bromine, iodine, ozone, chlorine dioxide, permanganate, peracetic acid and hydrogen peroxide result in higher than expected readings.
- Reducing agents, such as sulfides, sulfites, thiosulfates and hydrazine, result in lower than expected readings.

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
- Extended order code
- Serial number
- Safety information and warnings
- Certificate information

▶ Compare the information on the nameplate with the order.

4.2.2 Product page

www.endress.com/ccs53e

4.2.3 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.

4.2.4 Manufacturer address

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

4.2.5 Scope of delivery

The scope of delivery comprises:
- Disinfection sensor (membrane-covered, Ø25 mm) with protective cap (ready for use)
- Tube with electrolyte (50 ml (1.69 fl oz))
- Replacement membrane cap in protective cap
- Operating Instructions
- Manufacturer's certificate

5 Installation

5.1 Installation requirements

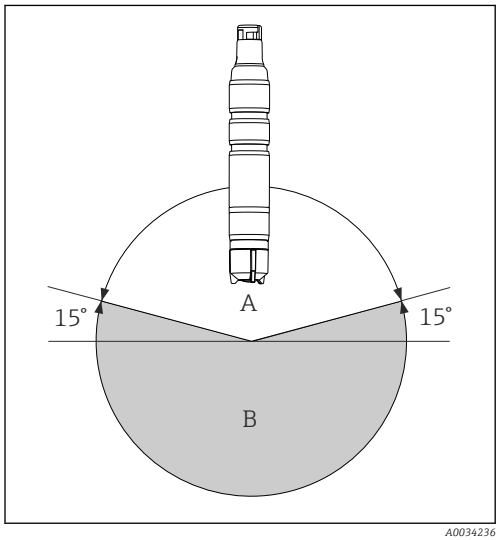
5.1.1 Orientation

NOTICE

Do not install upside down!

There is no secured electrolyte film on the work electrode and therefore no sensor function.

- 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.



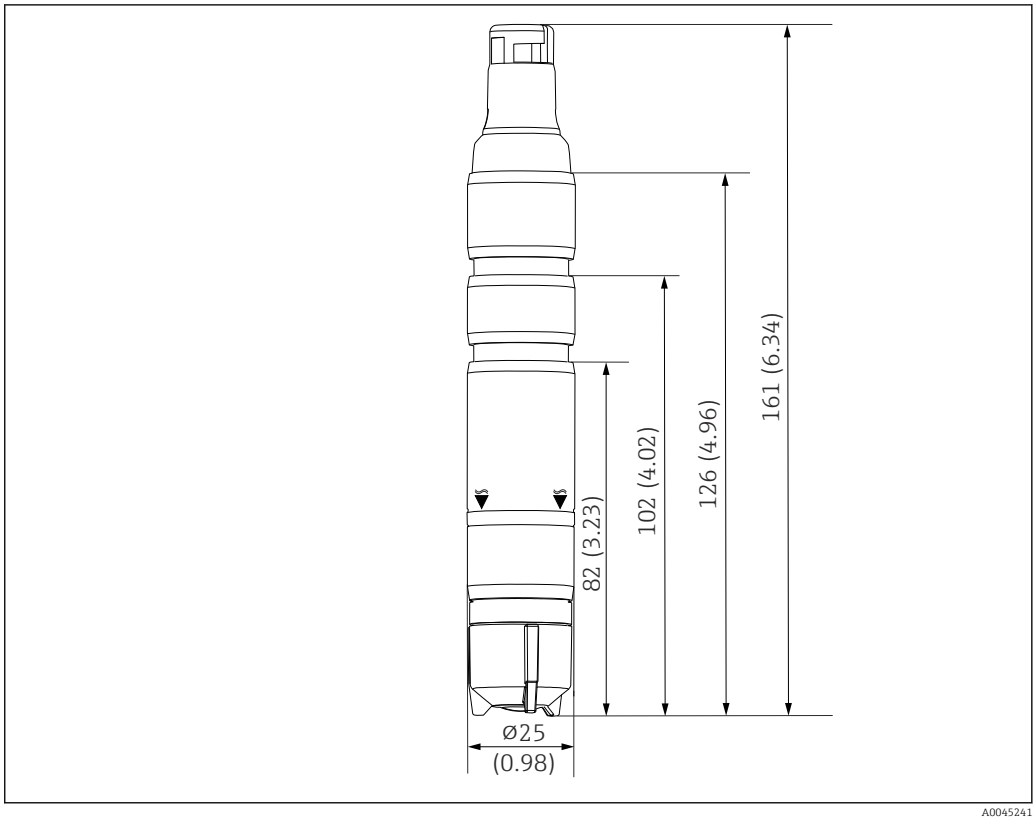
A *Permitted orientation*
B *Incorrect orientation*

5.1.2 Immersion depth

At least 50 mm (1.97 in).

This corresponds to the mark (▼) on the sensor.

5.1.3 Dimensions

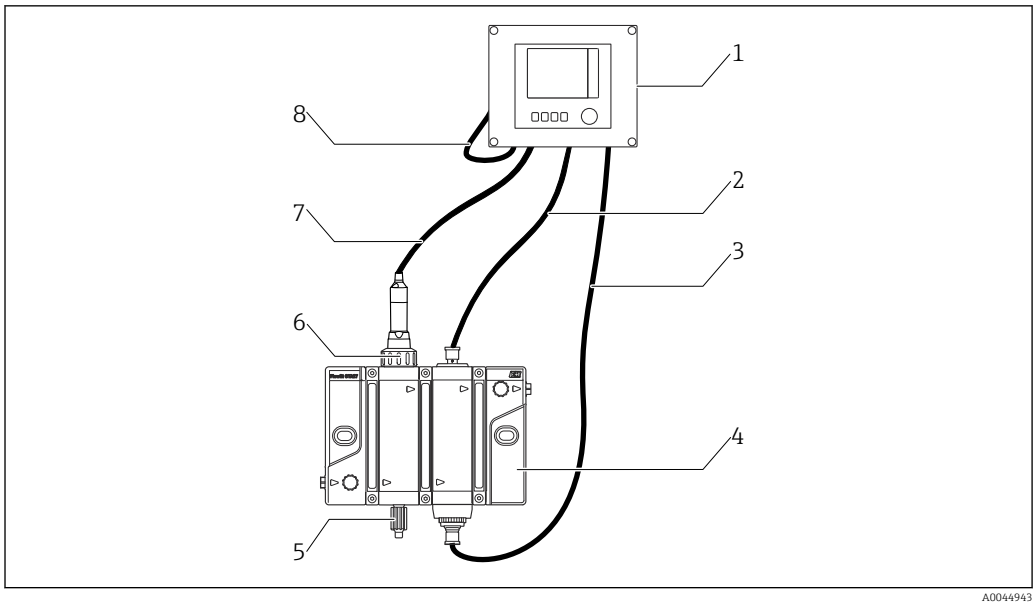


2 *Dimensions in mm (in)*

5.2 Installing the sensor

5.2.1 Measuring system

A complete measuring system comprises:
- Desinfection sensor CCS53E (membrane-covered, Ø25 mm (0.98 in)) with corresponding installation adapter
- Flowfit CYA27 flow assembly
- Measuring cable CYK10, CYK20
- Transmitter, e.g. Liquiline CM44x with firmware 01.13.00 or higher or CM44xR with firmware 01.13.00 or higher
- Optional: extension cable CYK11
- Optional: immersion assembly Flexdip CYA112



3 *Example of a measuring system*

1 *Transmitter Liquiline CM44x or CM44xR*
2 *Cable for inductive switch*
3 *Cable for status lighting on assembly*
4 *Flowfit CYA27 flow assembly*
5 *Sampling valve*
6 *Disinfection sensor Memosens CCS53E (membrane-covered, Ø25 mm (0.98 in))*
7 *Measuring cable CYK10*
8 *Power supply cable Liquiline CM44x or CM44xR*

5.2.2 Preparing the sensor

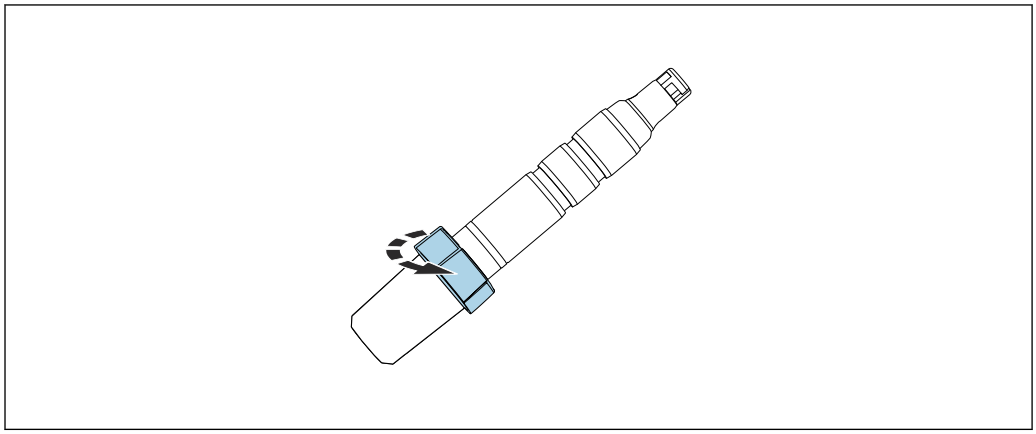
Remove protection cap from sensor

NOTICE

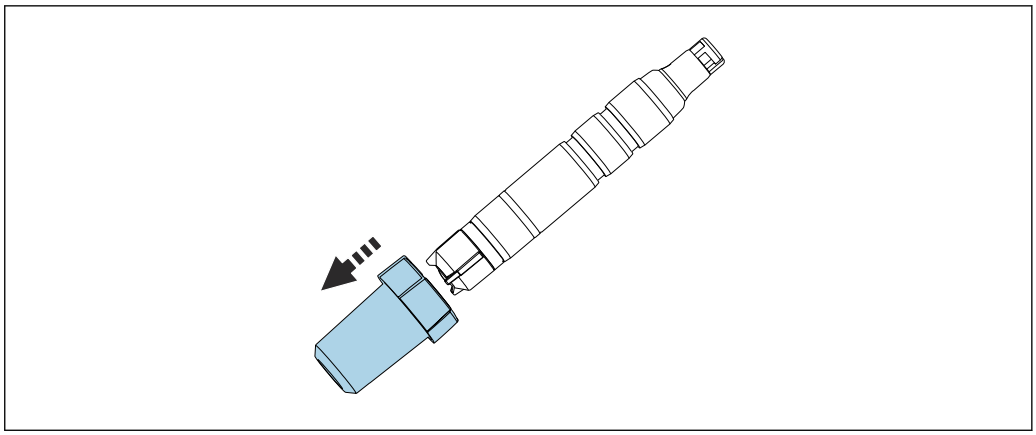
Negative pressure causes damage to the sensor's membrane cap

- When supplied to the customer and when in storage, the sensor is fitted with a protection cap.

- Release the top part of the protection cap by turning it.



- Carefully remove the protection cap from the sensor.



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5.2.3 Installing the sensor in the Flowfit CYA27 assembly

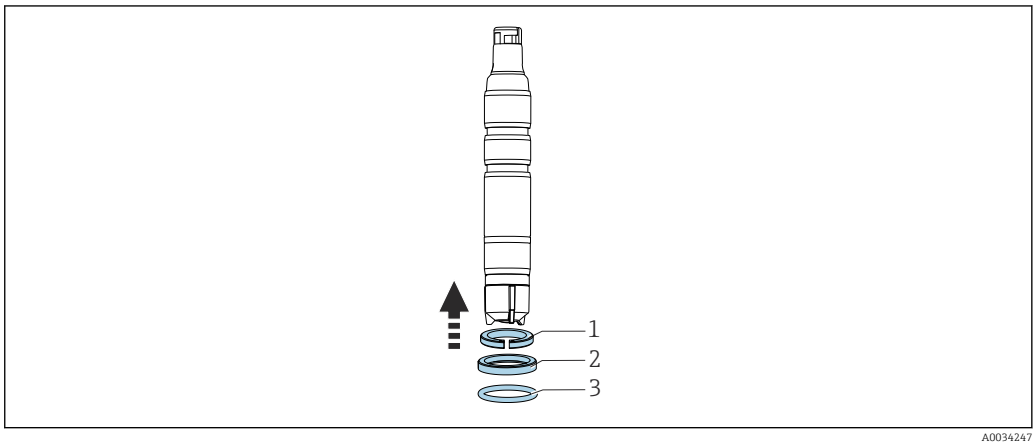
In addition to the installation of the total chlorine sensor, this assembly also enables the simultaneous operation of several other sensors and flow monitoring.

Please note the following during installation:
- Guarantee the minimum flow to the sensor 15 cm/s (0.49 ft/s)and the minimum volume flow of the assembly (5 l/h or 30 l/h).
- If the medium is fed back into an overflow basin, piping or similar, the resulting counterpressure on the sensor must not exceed 1 bar relativ (14.5 psi relativ) or 2 bar abs. (29 psi abs.) and must remain constant.
- Avoid a vacuum 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.

Fit sensor with adapter

The necessary adapter (clamping ring, thrust collar and O-ring) can be ordered as a mounted accessory for the sensor or as a separate accessory.

- First fit the clamping ring (1) from the sensor head towards the membrane cap. Then push the thrust collar (2), and then the O-ring (3) from the membrane cap towards the sensor head as far as the lower groove.



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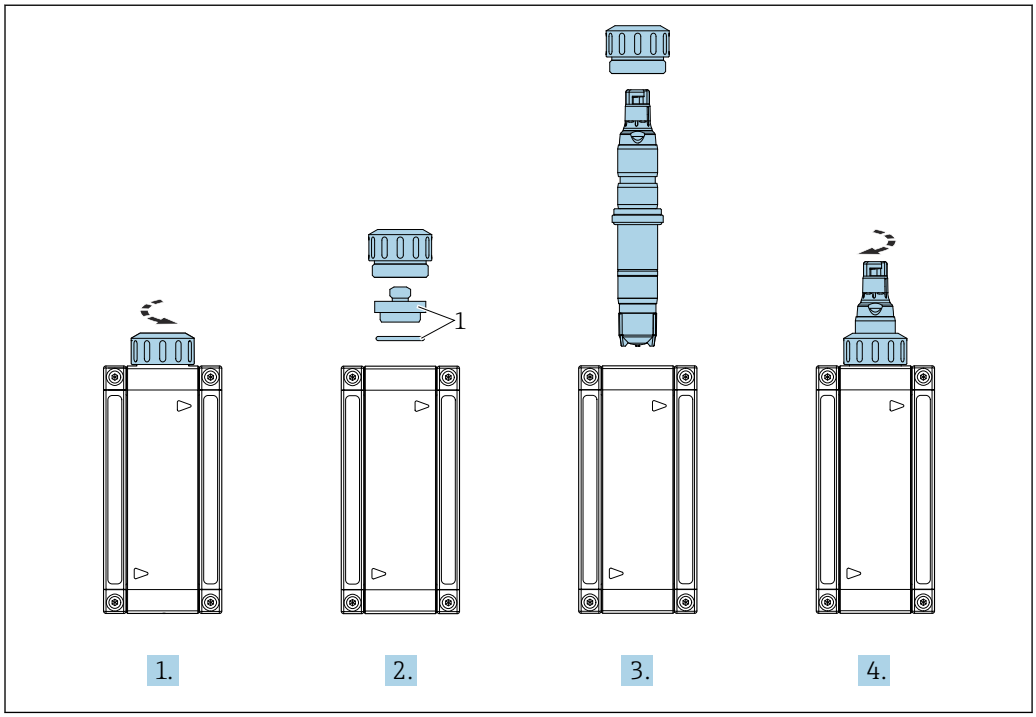
Installing sensor in assembly

1. The assembly is supplied to the customer with a union nut screwed onto the assembly: unscrew union nut from assembly.
2. The assembly is supplied to the customer with a dummy plug inserted in the assembly: remove dummy plug and O-ring (1) from the assembly.

3. Slide the sensor with adapter for Flowfit CYA27 into the opening of the assembly.
4. Screw the union nut onto the assembly.



1 Dummy plug and O-ring

5.2.4 Installing the sensor in flow assemblies

When using other flow assemblies, please ensure the following:
- A minimum flow velocity of 15 cm/s (0.49 ft/s) must 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 membrane must be exposed to direct flow.

5.2.5 Installing the sensor in the CYA112 immersion assembly

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

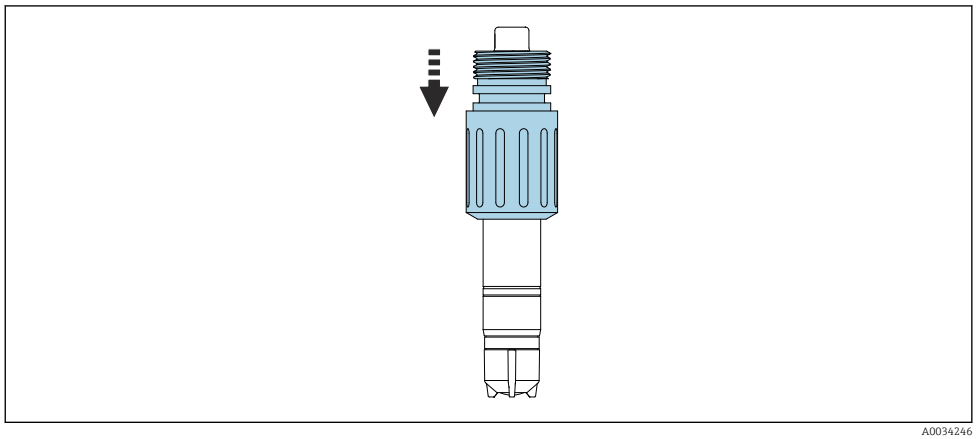
Additional installation instructions can be found in the Operating Instructions for the assembly: www.endress.com/cya112

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

Fit sensor with adapter

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

1.



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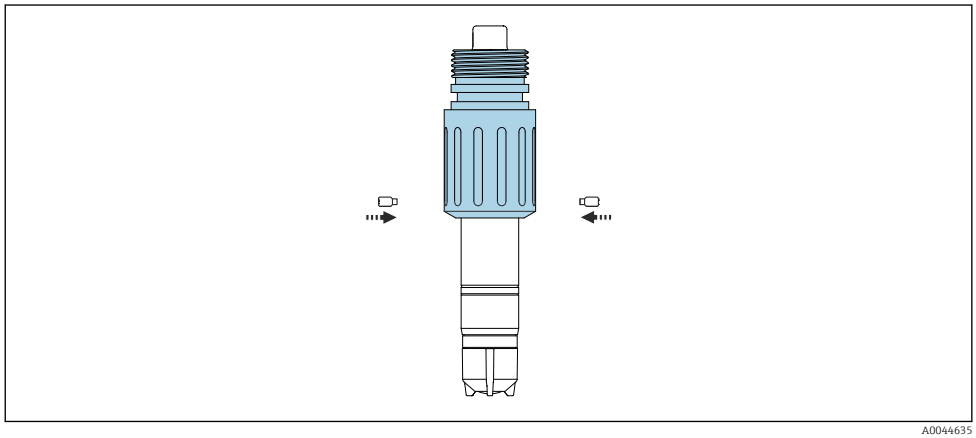
Starting from the sensor head, slide the adapter for Flexdip CYA112 onto the sensor as far as the end stop.

2.



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Fix the adapter with the 2 stud screws supplied and an Allen screw (2 mm (0.08 in)).

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

For detailed information on installing the sensor in Flexdip CYA112 assembly, see Operating Instructions for assembly www.endress.com/cya112

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6 Electrical connection

⚠ CAUTION

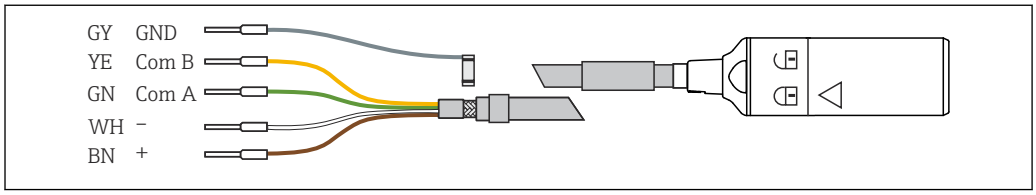
Device is live

Incorrect connection may result in injury!

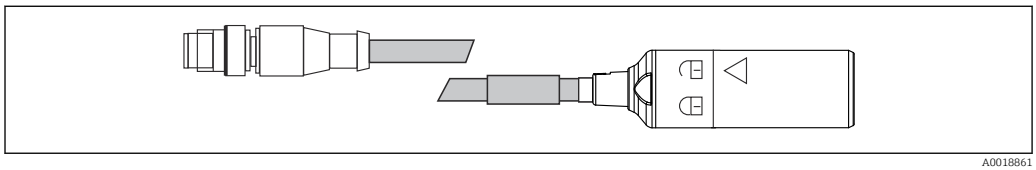
- ▶ The electrical connection may be performed only by an electrical technician.
- ▶ The electrical technician must have read and understood these Operating Instructions and must follow the instructions contained therein.
- ▶ **Prior** to commencing connection work, ensure that no voltage is present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

6.1 Connecting the sensor

is electrically connected to the transmitter is performed via the Memosens data cable CYK10.



4 *Measuring cable CYK10*



5 *CYK10 with M12 plug, electrical connection*

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 intended use, may be established 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.

6.3 Post-connection check

Device condition and specifications	Action
Are the sensor, assembly or cables free from damage on the outside?	▶ 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 all screw terminals tightened?	▶ Tighten the screw terminals.

Device condition and specifications	Action
Are all the cable entries installed, 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 Commissioning

7.1 Installation and function check

Prior to commissioning, ensure that:
- The sensor is correctly installed
- The electrical connection is correct
- There is sufficient electrolyte in the membrane cap
- The transmitter is not displaying a warning about electrolyte depletion

Please note the information on the safety data sheet to ensure safe use of the electrolyte.

Always keep the sensor moist after commissioning.

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.
- ▶ Do not install the assembly in the process if you cannot reliably establish the correct connection.

7.2 Sensor polarization

When connected to the transmitter, a voltage is applied between the working electrode and the counter electrode. The electrode is polarized. The processes taking place during polarization affect the measuring signal. It is therefore necessary to wait for the polarization time to elapse before a calibration can take place.

To achieve a stable display value, the sensor requires the following polarization times:

Initial commissioning	45 min
Recommissioning	20 min

7.3 Calibrating the sensor

Reference measurement according to the DPD method for total chlorine

To calibrate the measuring system, carry out a colorimetric comparison measurement in accordance with the DPD method for total chlorine. Chlorine reacts with diethyl-p-phenylendiamine (DPD) producing a red dye, the intensity of the red color being proportional to the chlorine content.
Measure the intensity of the red color using a photometer, (e.g. PF-3) . The photometer indicates the total chlorine content content.
Two reagents are usually needed for the measurement of total chlorine. DPD-1 contains the dye and buffer. DPD-3 contains potassium iodide, an additive that enables the measurement of combined chlorine. Comply with the manufacturer's instructions for correct use.

Requirements

The sensor reading is stable (no drifts or unsteady values for at least 5 minutes). This is normally guaranteed once the following preconditions have been met:
- The polarization time has fully elapsed.
- The flow is constant and within the correct range.
- The sensor and the medium are at the same temperature.
- The pH value is within the permitted range.

Zero adjustment
A zero adjustment is not required due to the zero point stability of the membrane-covered sensor.
However, a zero adjustment can be performed if desired.

1. To perform a zero adjustment, operate the sensor for at least 15 min. in chlorine-free water, using the assembly or protective cap as a vessel.
2. Alternatively, perform the zero adjustment using the zero point gel COY8.

Slope calibration

Always perform a slope calibration in the following cases:
- After replacing the membrane cap
- After replacing electrolyte

1. Ensure that the pH value and temperature of the medium are constant.
2. Take a representative sample for the DPD measurement. This must be done in close proximity to the sensor. Use the sampling tap if available.
3. Determine the chlorine content using the DPD method for total chlorine.
4. Enter the measured value into the transmitter (see Operating Instructions for transmitter).
5. To ensure greater accuracy, check the calibration several hours or a day later using the DPD method.

7.4 Electrolyte counter

The electrolyte counter monitors the consumption of the electrolyte in the sensor membrane cap over time. Warning message M505 of the Liquiline transmitter serves as an aid for timely sensor maintenance. The warning limit can be configured individually.

Activating the electrolyte counter and warning limit

1. Go to **Menu/Setup/Inputs/<Sensor Disinfection>/Extended setup/Diagnostics settings** and select **Electrolyte counter**.
2. Select **Function: On**.
3. Under **Warning limit**, set the value in accordance with the custom maintenance plan. The default setting is restored by resetting to the factory settings.

Reading out the electrolyte counter

1. Go to **Menu/Diagnostics/Sensor information/<Sensor Disinfection>/Sensor operation**.
2. Read out **Charge**.

8 Diagnostics and troubleshooting

When troubleshooting, the entire measuring point must be taken into account. This comprises:
- Transmitter
- Electrical connections and lines
- Assembly
- Sensor

The possible causes of errors in the following table refer primarily to the sensor. Before commencing troubleshooting, ensure that the following operating conditions have been met:
- Measurement in "temperature-compensated" mode (can be configured on the CM44x transmitter) or constant temperature following calibration
- Flow velocity of at least 15 cm/s (0.5 ft/s)
- No other disinfectants used

NOTICE

▶ If the value measured by the sensor differs significantly from that of the DPD method, first consider all possible malfunctions of the photometric DPD method (see Operating Instructions for photometer). If necessary, repeat the DPD measurement several times.

Error	Possible cause	Remedial action
No display, no sensor current	No supply voltage at the transmitter	▶ Establish mains connection
	Connection cable between sensor and transmitter interrupted	▶ Establish cable connection
	There is no electrolyte in the membrane cap	▶ Fill membrane cap
	No input flow of medium	▶ Establish flow, clean filter
Display value too high	Polarization of the sensor not yet completed	▶ Wait for polarization to be completed
	Membrane defective	▶ Replace membrane cap
	Shunt (e.g. moisture contact) in the sensor shaft	▶ Remove membrane cap ▶ Rub the working electrode to dry ▶ If the transmitter display does not return to zero, there is a shunt present: replace sensor
	Foreign oxidants interfering with sensor	▶ Examine medium, check chemicals

Error	Possible cause	Remedial action
Display value too low	Membrane cap not screwed on fully	▶ Fill membrane cap with fresh electrolyte ▶ Screw membrane cap on fully
	Membrane soiled	▶ Clean membrane
	Air bubble in front of membrane	▶ Release air bubble
	Air bubble between working electrode and membrane	▶ Remove membrane cap, top up electrolyte ▶ Remove air bubble by tapping on the outside of the membrane cap ▶ Screw on membrane cap
	Input flow of medium too low	▶ Establish correct flow
	Foreign oxidants interfering with DPD reference measurement	▶ Examine medium, check chemicals
	Use of organic disinfectants	▶ Use suitable agent (e.g. as per DIN 19643) (water may need to be replaced first) ▶ Use suitable reference system
Display fluctuates considerably	Hole in membrane	▶ Replace membrane cap

9 Maintenance

Please note the information on the safety data sheet to ensure safe use of the electrolyte.

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.

9.1 Maintenance schedule

Interval	Maintenance work
If deposits are visible on the membrane (biofilm, limescale)	▶ Clean sensor membrane → 25
If dirt is visible on the surface of the electrode body	▶ Clean electrode body of sensor → 25

▪ Slope depending on application:
  ▪ Every 6 months (at maximum) if conditions remain constant in the permitted range of 0 to 55 °C (32 to 131 °F)
  ▪ In the case of severe temperature fluctuations, e.g. from 10 °C (50 °F) to 25°C (77 °F) and back
▪ Zero adjustment:
  ▪ If operated in concentration range below 0.5 mg/l (ppm)
  ▪ If negative measured value is displayed with factory calibration
	▶ Calibrate the sensor

▪ If electrolyte counter warning is active ▪ Every 3-6 months, depending on the application, when measuring combined chlorine ▪ If cap is replaced ▪ For determining the zero point ▪ If the slope is too low or too high relative to the nominal slope and the membrane cap is not visibly damaged or dirty	▶ Fill the membrane cap with fresh electrolyte → 24
▪ If there are grease/oil deposits (dark or transparent spots on the membrane) ▪ If slope is too high or too low or sensor current is very noisy ▪ If it is obvious that the sensor current is significantly dependent on the temperature (temperature compensation not working).	▶ Replace the membrane cap → 26
If changes are visible on the working electrode or counter electrode (gray/yellow coating no longer present)	▶ Regenerate the sensor

9.2 Maintenance tasks

9.2.1 Cleaning the sensor

CAUTION

Diluted acids

Acids such as hydrochloric acid, acetic acid, or citric acid (max. concentration 3%, room temperature) cause irritation upon contact with skin or eyes.

- ▶ When using diluted acids, wear protective clothing such as gloves and goggles.
- ▶ Avoid splashes.

NOTICE

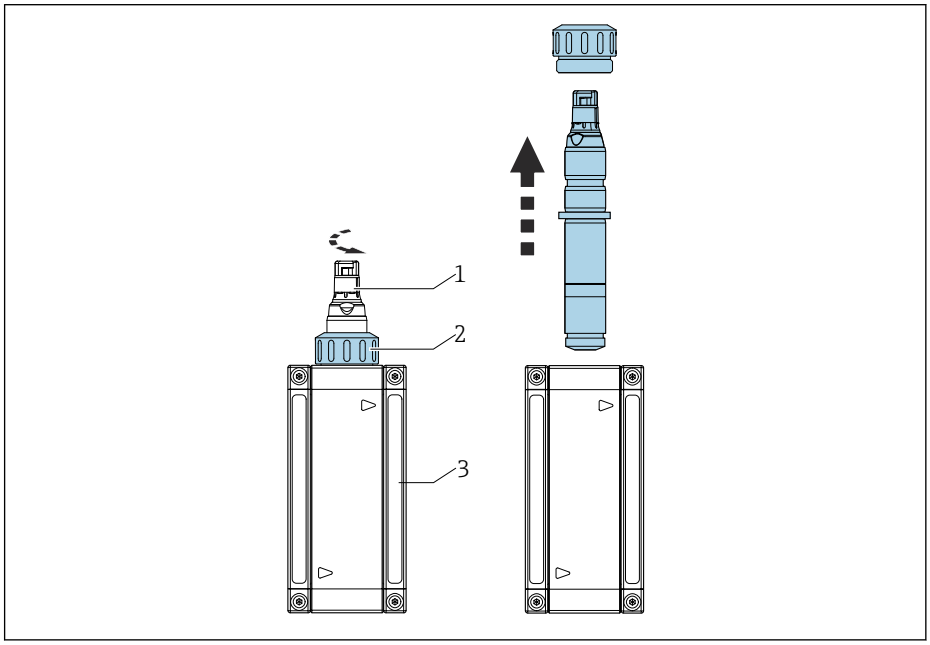
Chemicals that reduce surface tension (e.g. surfactants in cleaning agents or organic solvents that can be mixed with water, such as alcohol)

Chemicals that reduce the surface tension cause the sensor membrane to lose its special property and protective function, which results in measurement errors.

- ▶ Do not use any chemicals that reduce surface tension.

Removing the sensor from the Flowfit CYA27 assembly

1. Remove the cable.
2. Unscrew the union nut from the assembly.
3. Pull sensor out through opening in assembly.



1 *Disinfection sensor*
2 *Union nut for securing a disinfection sensor*
3 *Flowfit CYA27 flow assembly*

For detailed information on "Removing the sensor from the Flowfit CYA27 assembly, see the Operating Instructions for the assembly www.endress.com/cya27.

Operating Instructions BA02059C

Cleaning the sensor membrane

If the membrane is visibly dirty, e.g. biofilm, proceed as follows:

1. Remove the sensor from the flow assembly .
2. Remove the membrane cap → 26.
3. Clean the membrane cap mechanically with a gentle jet of water.
4. Alternatively: soak the membrane cap for a few minutes in diluted acid or in a recommended cleaning agent without chemical additives.
5. Then rinse thoroughly with water.
6. Screw the membrane cap back onto the sensor → 26.

Clean the electrode body

1. Remove sensor from flow assembly.
2. Remove membrane cap → 26.

3. Wipe gold electrode carefully using a soft sponge.
4. Rinse electrode body with demineralized water, alcohol or acid.
5. Fill the membrane cap with fresh electrolyte.
6. Screw the membrane cap back onto the sensor → 26.

9.2.2 Filling the membrane cap with fresh electrolyte

Please note the information on the safety data sheet to ensure safe use of the electrolyte.

NOTICE

Damage to membrane and electrodes, air bubbles

Possibility of measurement errors to complete failure of the measuring point

- Avoid damage to membrane and electrodes.
- Keep the electrolyte tube closed after use. Do not transfer electrolyte to other vessels.
- Do not store electrolyte for longer than 2 years. The electrolyte must not be yellow in color. Observe the use-by date on the label.
- Avoid air bubbles when pouring electrolyte into membrane cap.

Filling the membrane cap with electrolyte

1. Remove the membrane cap → 26.
2. Pour approx. 7 ml (0.24 fl oz) of electrolyte into the membrane cap until it is level with the start of the internal thread.
3. Slowly screw on the membrane cap as far as the end stop → 25. This will cause excess electrolyte to be displaced at the valve and thread.
4. If necessary, pat the sensor and membrane cap dry using a cloth.
5. Reset operating hours counter for electrolyte on transmitter under **Menu/ Calibration/<Sensor disinfection>/Disinfection/Change electrolyte or Change sensor cap and electrolyte/Save**

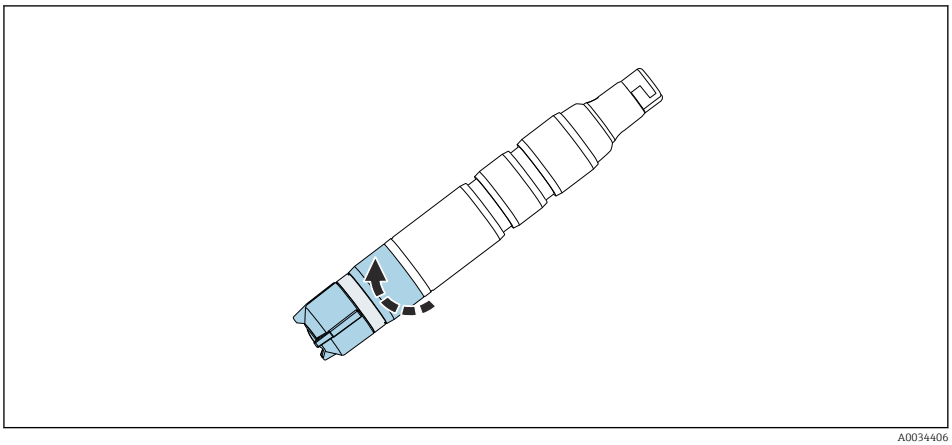
9.2.3 Replacing the membrane cap

1. Remove the sensor from the flow assembly .
2. Remove the membrane cap → 26.
3. Pour fresh electrolyte into the new membrane cap until it is level with the start of the internal thread.
4. Check if the sealing ring is mounted in the membrane cap.
5. Screw the new membrane cap onto the sensor shaft → 26.
6. Screw on the membrane cap until the membrane at the working electrode is slightly overstretched (1 mm (0.04 in)).
7. Reset the operating hours counter for the membrane cap on the transmitter. For detailed information, see the Operating Instructions for the transmitter.

Removing the membrane cap

▶ Carefully rotate the membrane cap.

↳



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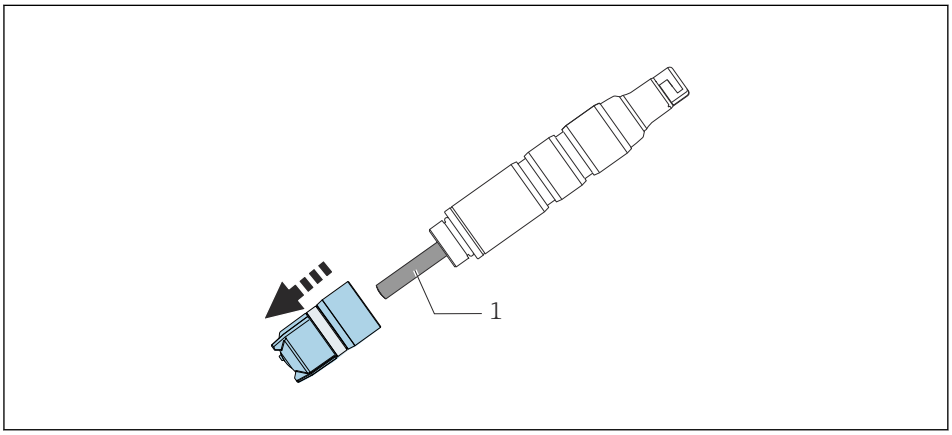
▶ Carefully remove the membrane cap.

↳



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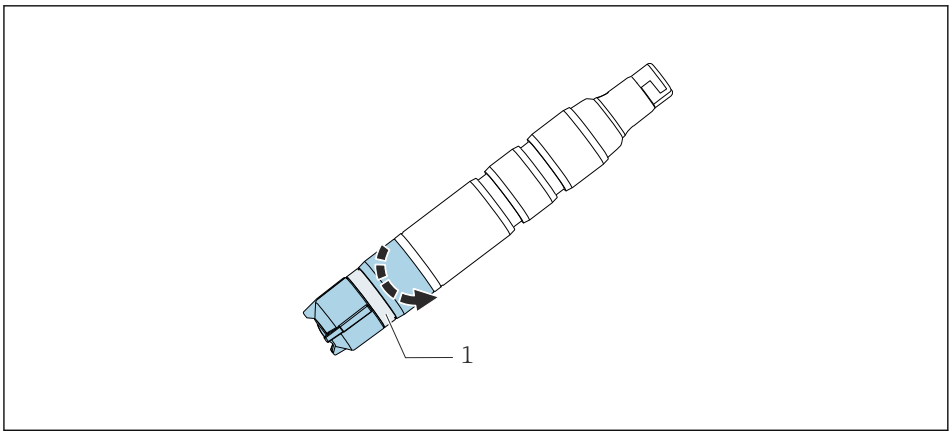
1 Electrode body

Screwing the membrane cap onto the sensor

▶ Screw the membrane cap onto the sensor shaft: hold sensor by the shaft.

↳



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6 Screw on the membrane cap: keep pressure relief valve clear.

1 Pressure relief valve

9.2.4 Storing the sensor

If measurement is suspended for a short period of time and it can be guaranteed that the sensor will be kept moist while in storage:

1. The assembly is guaranteed not to empty out,
   you may leave the sensor in the flow assembly.
2. There is a possibility that the assembly may empty out,
   remove the cable and remove the sensor from the assembly.
3. To keep the membrane moist after the sensor has been removed, refill the protection cap with electrolyte or clean water.
4. Fit the protection cap on the sensor → 28.

During longterm interruptions to measurement, particularly if dehydration is possible:

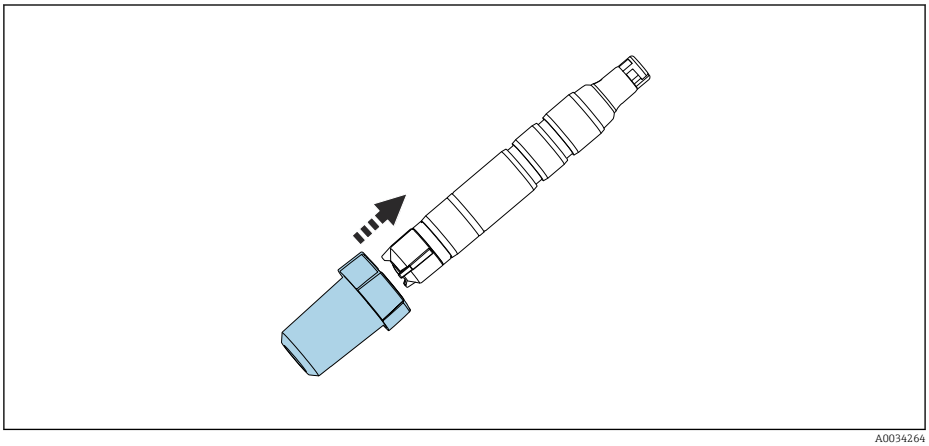
1. Remove the cable.
2. Remove the sensor from the assembly .
3. Clean sensor shaft and membrane cap with cold water and leave to dry.
4. Loosely screw on the membrane cap as far as the end stop. This ensures that the membrane remains slack.
5. Put on the dry protective cap for mechanical protection → 26.
6. When recommissioning the device, fill electrolyte into the membrane cap → 26 and then follow the steps for commissioning → 20.

Ensure that no biofouling occurs during longer interruptions to measurement:

- Remove continuous organic deposits, such as films of bacteria.

Fit the protection cap on the sensor

1. To keep the membrane moist after the sensor has been removed, refill the protection cap with electrolyte or clean water.
2. Top part of protection cap is in the open position.
   Carefully slide protection cap onto the membrane cap.



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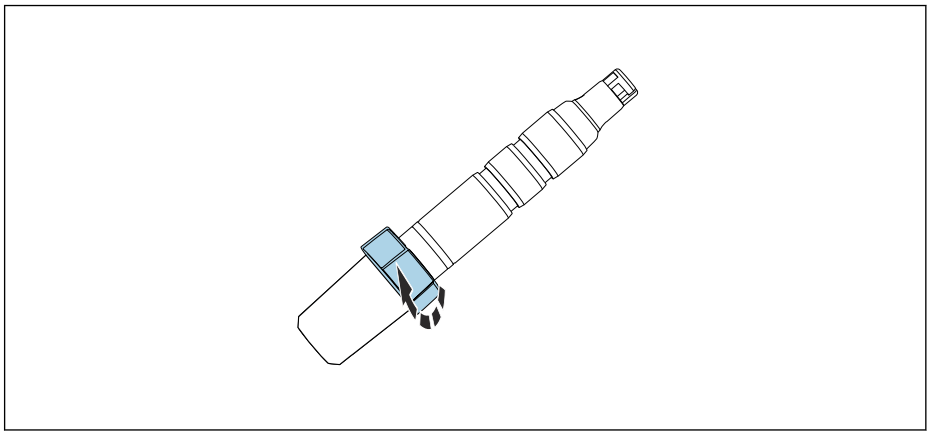
3. Secure protection cap by rotating the top part of the protection cap.



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9.2.5 Regenerating the sensor

During measurement, the electrolyte in the sensor is gradually exhausted due to chemical reactions and by exchange with the medium. The gray-yellow silver iodide layer that is applied to the counter electrode at the factory continues to grow during sensor operation and can take on a light yellow color. This has no effect on the reaction taking place at the working electrode.

Heavy scratches on the sensor surface indicate impaired functionality.

- Send the sensor to the manufacturer for regeneration.

10 Repair

10.1 Spare parts

For more detailed information on spare parts kits, please refer to the "Spare Part Finding Tool" on the Internet:

www.endress.com/spareparts_consumables

10.2 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.

10.3 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.

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 Maintenance kit CCV05

Order according to product structure

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

11.2 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 CYA27
- Modular flow assembly for multiparameter measurements
- Product Configurator on the product page: www.endress.com/cya27

Technical Information TI01559C

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

Adapter kit CCS5x(D/E) for CYA27
- Clamping ring
- Thrust collar
- O-ring
- Order No. 71372027

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

Complete quick fastener kit for CYA112
- Adapter, inner and outer parts incl. O-rings
- Tool for mounting and disassembly
- Order No. 71093377 or mounted accessory of CYA112

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

12 Technical data

12.1 Input

Measured variables	Total chlorine	[mg/l, µg/l, ppm, ppb] ▪ Free available chlorine: ▪ Hypochlorous acid (HOCl) ▪ Hypochlorite ions (OCl^-) ▪ Combined chlorine (chloramines) ▪ Organically combined chlorine (e.g. cyanuric acid derivatives)
	Temperature	[°C, °F]
Measuring range	CCS53E-**11AD**	0 to 5 mg/l(ppm) total chlorine
	CCS53E-**11BF**	0 to 20 mg/l(ppm) total chlorine
Signal current	CCS53E-**11AD**	8 to 20 nA per 1 mg/l (ppm) HOCl
	CCS53E-**11BF**	8 to 20 nA per 1 mg/l (ppm) HOCl

12.2 Performance characteristics

Reference operating conditions	Temperature	20 °C (68 °F)
	pH value	pH 7.5 ±0.2
	Flow	40 to 60 cm/s
	HOCl-free base medium	Mains water
Response time	T_{90} < 180 s (after completing polarization)	
Polarization time	Initial commissioning	45 min
	Recommissioning	20 min
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 limit of quantification (LOQ).	
Measurement error	±2 % and ±5 µg/l (ppb) of value measured (depending on which value is higher)	

	LOD (limit of detection) [1]	LOQ (limit of quantification)
CCS53E-**11AD**	0.008 mg/l (ppm) HOCl	0.028 mg/l (ppm) HOCl
CCS53E-**11BF**	0.008 mg/l (ppm) HOCl	0.028 mg/l (ppm) HOCl

1) Based on ISO 15839. The measurement error includes 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.

Repeatability	CCS53E-**11AD**	0.004 mg/l (ppm)
	CCS53E-**11BF**	0.007 mg/l (ppm)

Nominal slope	CCS53E-**11AD**	11 nA per 1 mg/l (ppm) HOCl
	CCS53E-**11BF**	11 nA per 1 mg/l (ppm) HOCl

Long-term drift

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

Operating time of the electrolyte

3 to 6 months (depending on the water quality)

Intrinsic consumption

The intrinsic consumption of chlorine at the sensor is negligible.

12.3 Environment

Ambient temperature

−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 55 °C (95 to 131 °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)

12.4 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 sensor can be operated at process pressures up to 1 bar relativ (14.5 psi relativ) (2 bar abs. (29 psi abs.)).

pH range	Range of effectiveness of total chlorine	pH 4 to 9 [1]
	Calibration	pH 4 to 9
	Measurement	pH 4 to 9

1) Up to pH 4 and in the presence of chloride ions (Cl^-), Cl_2 is produced which is also measured

Conductivity

The sensor can also be used in media with a very low conductivity, such as demineralized water.

Flow

At least 5 l/h (1.3 gal/h), in the Flowfit CYA27 flow assembly (5 l version)

At least 30 l/h (7.9 gal/h), in the Flowfit CYA27 flow assembly (30 l version)

Flow

At least 15 cm/s (0.5 ft/s) , e.g. with Flexdip CYA112 immersion assembly

- 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 CYA27 (5 l version)	Flowfit CYA27 (30 l version)	Flexdip CYA112
Minimum	15	5	30	The sensor is suspended freely in the medium; pay attention to the minimum flow velocity of 15 cm/s during installation.
Maximum	80	30	60	

12.5 Mechanical construction

Dimensions	→ 13	
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/PVDF
	Membrane cap	PVDF
	Protective cap	▪ Vessel: PC ▪ Seal: TPE ▪ Cover: PC
	Sealing ring	FKM
	Sensor shaft coupling	PPS
Cable specification	max. 100 m (330 ft), incl. Cable extension	

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