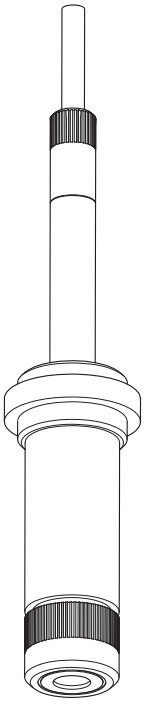
Level Pressure Flow Temperature Liquid Analysis Registration Systems Components Services Solutions

Operating Instructions

CCS140/141

Sensors for free chlorine



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Brief overview

This explains how to use these Operating Instructions to commission your sensor quickly and safely:

	Safety instructions
→ 📄 4 → 📄 5	General safety instructions Explanation of warning symbols
	▼
	Installation
→ 📄 7 → 📄 8	Installation conditions such as the sensor dimensions are illustrated here. Here, you can find an example of a complete measuring system.
	▼
	Wiring
→ 📄 9	Refer to these pages for sensor wiring.
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	Function
→ 📄 13	This chapter describes the sensor design and the operating principle.
	▼
	Commissioning
→ 📄 17 → 📄 17	Refer to these pages for sensor commissioning. This section explains how to calibrate the sensor.
	▼
	Maintenance
→ 📄 19 → 📄 24	It is absolutely essential to carry out maintenance tasks such as sensor cleaning on a regular basis to extend the sensor's operating time. Available accessories are listed here.
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	Troubleshooting
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→ 📄 29	You can find important terms on the individual sections here.

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1 Safety instructions

1.1 Designated use

Oxidizing agents such as chlorine or anorganic chlorine compounds are used for disinfection of water. Their dosing must be carefully controlled to suit the application. Too low a concentration makes the degree of disinfection questionable. Too high a concentration increases the costs and can result in corrosion effects, impairment of taste or skin irritation.
The sensor has been specially designed for this purpose. It is used for continuous measurement of free chlorine in water.
When used in connection with a measurement and control system, it permits the optimum disinfection status to be maintained.

Any other use than the one described here compromises the safety of persons and the entire measuring system and is, therefore, not permitted.
The manufacturer is not liable for damage caused by improper or non-designated use.

1.2 Installation, commissioning and operation

Please note the following items:
- Installation, commissioning, operation and maintenance of the measuring system must only be carried out by trained technical personnel.
  The technical personnel must be authorized for the specified activities by the system operator.
- Electrical connection must only be carried out by a certified electrician.
- Technical personnel must have read and understood these Operating Instructions and must adhere to them.
- Before commissioning the entire measuring point, check all the connections for correctness. Ensure that electrical cables and hose connections are not damaged.
- Do not operate damaged products and secure them against unintentional commissioning. Mark the damaged product as being defective.
- Measuring point faults may only be rectified by authorized and specially trained personnel.
- If faults can not be rectified, the products must be taken out of service and secured against unintentional commissioning.
- Repairs not described in these Operating Instructions may only be carried out at the manufacturer's or by the service organization.

1.3 Operational safety

The sensor has been designed and tested according to the state of the art and left the factory in perfect functioning order.
Relevant regulations and European standards have been met.

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

1.4 Return

If the sensor has to be repaired, please return it *cleaned* to the sales center responsible.
Please use the original packaging, if possible.

Please enclose the completed "Declaration of Hazardous Material and De-Contamination" (copy the second last page of these Operating Instructions) with the packaging and the transportation documents.
No repair without completed declaration!

1.5 Notes on safety icons and symbols

1.5.1 Safety icons

Warning!
This symbol alerts you to hazards. They can cause serious damage to the instrument or to persons if ignored.

Caution!
This symbol alerts you to possible faults which could arise from incorrect operation. They could cause damage to the instrument if ignored.

Note!
This symbol indicates important items of information.

1.5.2 Document symbols

→ 1 This symbol indicates a cross reference to a defined page (e.g. p. 1).

→ 2 This symbol indicates a cross reference to a defined figure (e.g. fig. 2).

2 Identification

2.1 Product structure

2.1.1 CCS140

Chlorine sensor, measuring range 0.05 to 20 mg Cl_2/l

	Version	
	A	without temperature sensor
	N	with NTC temperature sensor
CCS140-		complete order code

2.1.2 CCS141

Chlorine trace sensor, measuring range 0.01 to 5 mg Cl_2/l

	Version	
	N	with NTC temperature sensor
CCS141-		complete order code

2.2 Scope of delivery

The scope of delivery comprises:
- 1 chlorine sensor
- 1 bottle filled with electrolyte (50 ml)
- 1 cap for protection and storage
- 1 replacement cartridge with pretensioned membrane
- Operating Instructions, English

3 Installation

3.1 Incoming acceptance, transport, storage

- Make sure the packaging is undamaged!
  Inform the supplier about damage to the packaging. Keep the damaged packaging until the matter has been settled.
- Make sure the contents are undamaged!
  Inform the supplier about damage to the delivery contents. Keep the damaged products until the matter has been settled.
- Check that the scope of delivery is complete and agrees with your order and the shipping documents.
- The packaging material used to store or to transport the product must provide shock protection and humidity protection. The original packaging offers the best protection. Also, keep to the approved ambient conditions (see "Technical data").
- If you have any questions, please contact your supplier or your sales center responsible.

3.2 Installation conditions

3.2.1 Dimensions

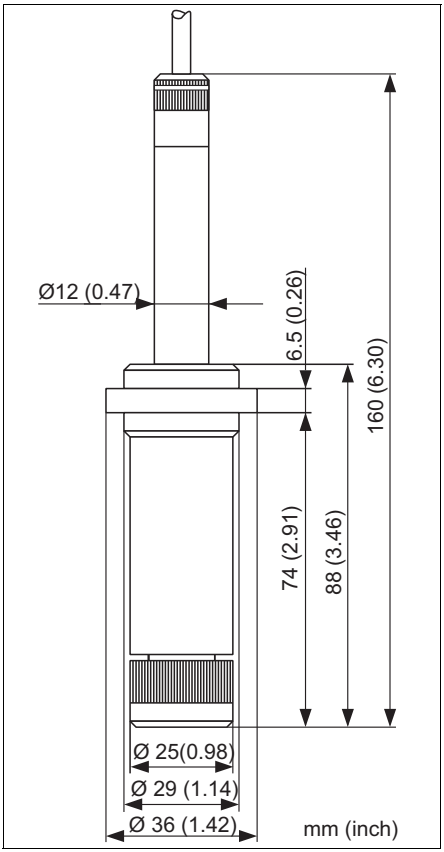

Fig. 1: Dimensions

3.3 Installation

3.3.1 Measuring system

A complete measuring system comprises at least:
- Chlorine sensor
- Liquisys M CCM223/253 transmitter
- Special measuring cable
- Flow assembly
- Reference measuring instrument for determination of free chlorine according to the DPD method

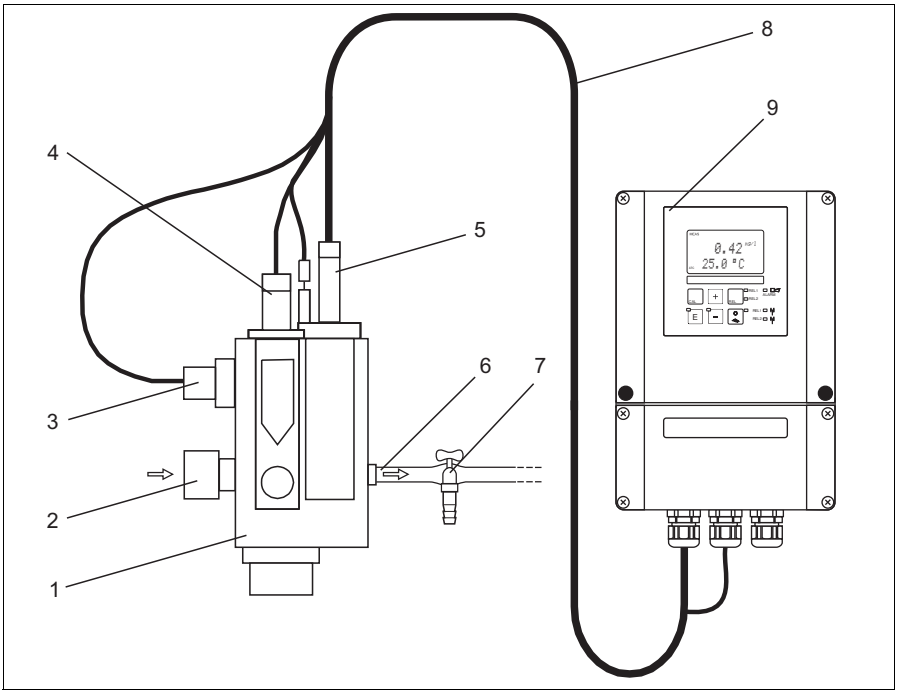

Fig. 2: Measuring system in the flow mode (example)

1	*CCA250 flow assembly*	*6*	*Medium outlet*
2	*Medium inlet*	*7*	*Sampling tap*
3	*Inductive proximity switch for flow monitoring*	*8*	*Sensor cable*
4	*Mounting places for pH/ORP sensors*	*9*	*Transmitter*
5	*Chlorine sensor*		

3.3.2 Installation in CCA250 flow assembly

The flow assembly CCA250 is designed for on-site installation of the sensor. In addition to the chlorine or chlorine dioxide sensor, a pH and an ORP sensor can be installed. A needle valve regulates the flow within the range of 30 to 120 l/h (7.9 to 31.7 US.gal/h).

When installing the sensor, note the following:
- The flow must be at least 30 l/h (7.9 US.gal/h).
  If the flow drops below this value or stops completely, this can be detected by an inductive proximity switch and an alarm signal plus locking of the dosage pumps can be triggered.
- If the medium is fed back into a surge tank, pipeline or the like, ensure that the thus generated back pressure on the sensor does not exceed 1 bar (14.5 psi) and remains constant.
- Negative pressure at the sensor, e.g. by feedback of medium to the suction side of a pump, must be avoided.

For further installation instructions, see the Operating Instructions of the flow assembly.

3.3.3 Installation in other flow assemblies

When using other flow assemblies than the CCA250 ensure the following:

- The flow velocity against the membrane is at least 15 cm/s (0.49 ft/s).
- The flow direction is upward so that carried bubbles are removed and do not collect in front of the membrane.
- The membrane is directly struck by the flow.

3.4 Post-installation check

- Check the membrane for leak tightness und replace it if necessary.
- Is the sensor installed in an assembly and is not suspended from the cable?

4 Wiring

⚠ Warning!
- The electrical connection must only be carried out by a certified electrician.
- Technical personnel must have read and understood the instructions in this manual and must adhere to them.
- Ensure that there is no voltage at the power cable before beginning the connection work.

4.1 Direct connection to the transmitter

The sensors are equipped with a 3 m (9.8 ft) fixed cable. Connect the sensor to the transmitter according to the following table:

Sensor with 3 m fixed cable CMK		**Transmitter**
Assignment	**Core**	**Terminal**
Outer screen		S
Anode	[A] red	91
Cathode	[K] uncolored	90
NTC temperature sensor	green	11
NTC temperature sensor	brown	12

Structure of the CMK sensor cable

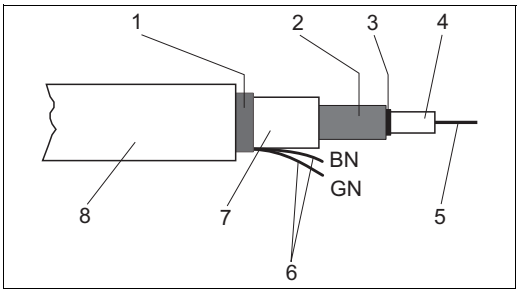

Fig. 3: Structure of CMK cable

1 Outer screen
2 Inner screen, anode
3 Semiconductor layer
4 Inner insulation
5 Inner conductor, measuring signal
6 Temperature sensor connection
7 2nd insulation
8 Outer insulation

Caution!
Make sure to remove the black semiconductor layer up to the inner screen when performing termination work.

4.2 Connection via junction box

To extend the sensor connection, use the VBC junction box.

Extend the connections as follows:
- For the chorine sensor, use a CYK71 special measuring cable.
- For the pH and ORP sensors, also use CYK71 special measuring cables.
- For the inductive proximity switch, use the MK special measuring cable.

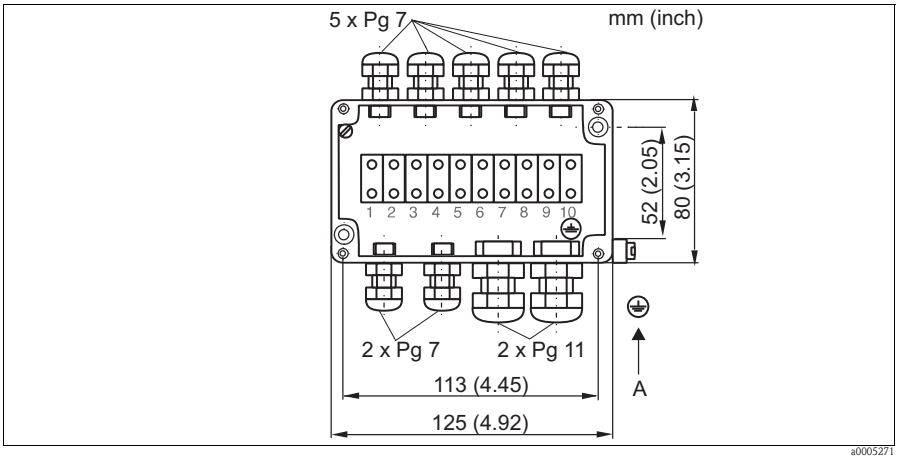

Fig. 4: VBC junction box with grounding point

Structure of the CYK71 special measuring cable

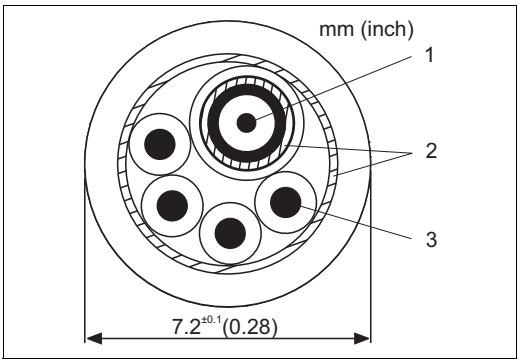

Fig. 5: Structure of CYK71 cable

1 Coax wire, e.g. pH or ORP
2 Screens
3 4 control wires YE/GN/WH/BN

4.3 Post-connection check

Instrument status and specifications	**Remarks**
Are the sensor, assembly, junction box or cable damaged?	Visual inspection
Electrical connection	**Remarks**
Does the supply voltage of the transmitter match the specifications on the nameplate?	110/230 V AC 24 V AC/DC
Are the installed cables strain-relieved and not twisted?	
Is the cable type route completely isolated?	Power cable/weak current cable
Are the power supply and signal cable correctly connected to the transmitter?	Use the connection diagram of CCM2x3.
Are all the screw terminals properly tightened?	
Are all the cable entries installed, tightened and sealed?	For lateral cable entries: cable loops downwards for water to be able to drip off.
Are all the cable entries installed downwards or lateral?	

5 Function

5.1 Sensor design

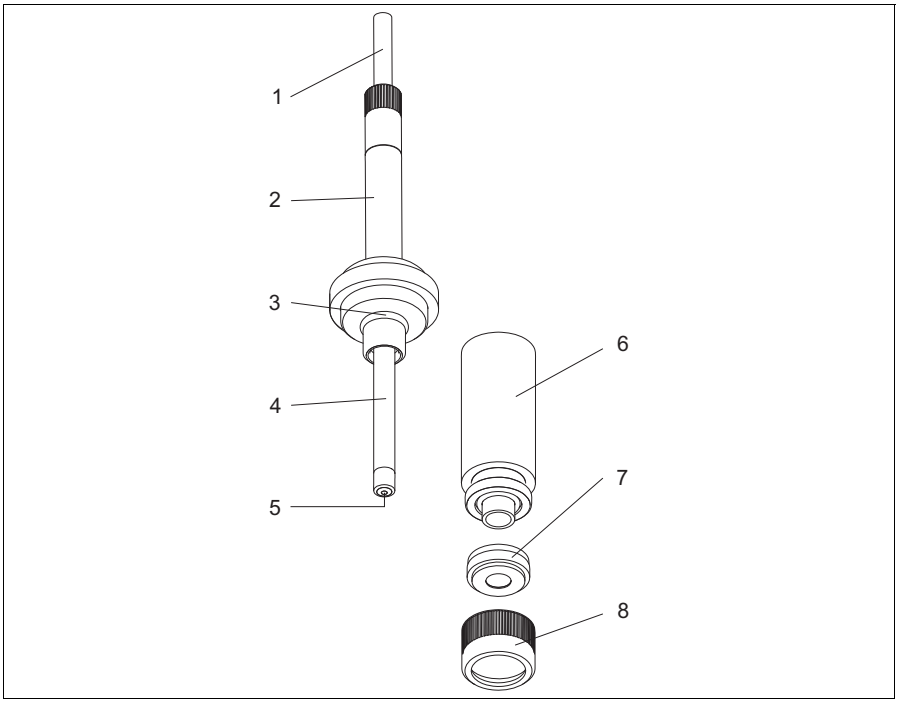

Fig. 6: Sensor design

1	*Fixed cable*	*5*	*Gold cathode*
2	*Sensor shaft*	*6*	*Measuring chamber*
3	*O-ring*	*7*	*Membrane cap with dirt-repellent membrane*
4	*Large anode, silver/silver chloride*	*8*	*Screw cap for fixing the membrane cap*

The sensor consists of the following function units:

- Measuring chamber
  - for protection of anode and cathode from medium
  - with large electrolyte volume guaranteeing a long service life in combination with the large anode and the small cathode
- Sensor shaft with
  - large anode
  - cathode embedded in plastic
  - optional temperature sensor

- Membrane cap with
  - robust PTFE membrane
  - special support grid between cathode and membrane for a specified and constant electrolyte film and thus a relatively constant indication even at varying pressures and flows

5.2 Operating principle

The concentration of free chlorine is determined according to the amperometric measuring principle. The hypochlorous acid (HOCl) contained in the medium diffuses through the sensor membrane and is reduced to chloride ions (Cl^-) on the gold cathode. On the silver anode, silver is oxidized to silver chloride. The electron release of the gold cathode and electron acceptance on the silver anode result in a current flow which is proportional to the free chlorine concentration in the medium under constant conditions. The concentration of hypochlorous acid in the medium depends on the pH value. This dependence can be compensated by measuring the pH value in the flow assembly.
The transmitter transforms the current signal into the measuring unit concentration in mg/l.

5.2.1 Influences on the measuring signal

pH dependence of measurement of free chlorine
Molecular chlorine (Cl_2) has pH values of < 4. Hypochlorous acid (HOCl) and hypochlorite (OCl^-) remain within the range of pH 4 to 11 as components of free chlorine. As hypochlorous acid dissociates with an increasing pH value to form hypochlorite ions (OCl^-) and hydrogen ions (H^+), the amounts of the individual components in free chlorine change with the pH value (Fig. 7). For example, if the amount of hypochlorous acid is 97% at pH 6, it drops to about 3% at pH 9.
Hypochlorous acid has a highly disinfecting effect in an aqueous solution but the disinfecting effect of hypochlorite is extremely low. Therefore, chlorine is not suitable as a disinfecting agent at high pH values.

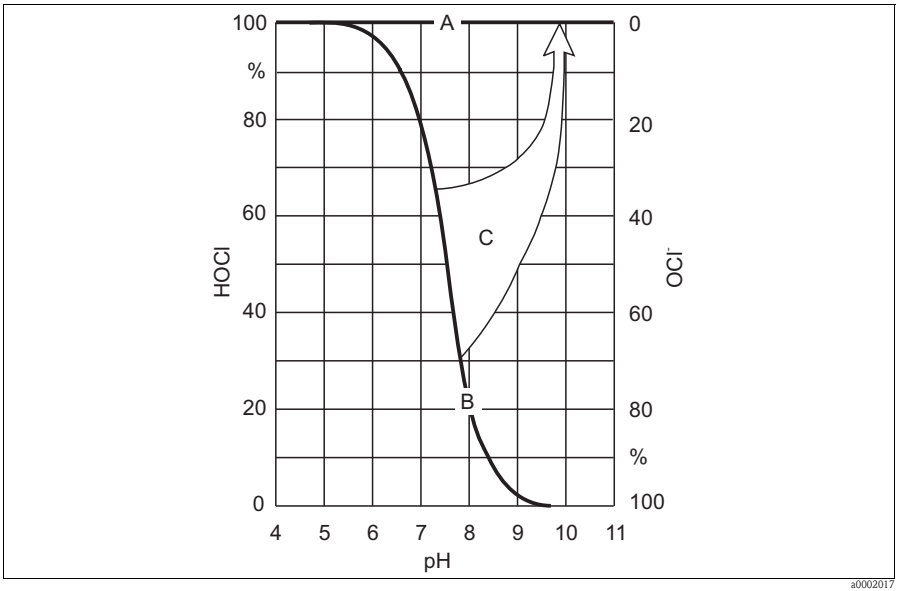

Fig. 7: Schematic diagram of pH compensation

A *Measured value* **with** *pH compensation*
B *Measured value* **without** *pH compensation*
C *pH compensation*

CCS140 or CCS141 chlorine sensors selectively measure the amount of hypochlorous acid in amperometric measurement. They do not measure the amount of hypochlorite ions because these ions do not permeate through the sensor membrane.

pH compensation of chlorine sensor signal for free chlorine

To calibrate and inspect the chlorine measuring system, a colorimetric reference measurement must be carried out using the DPD method. Free chlorine reacts with diethyl-p-phenylenediamine and forms a red dye. The intensity of the red pigmentation increases proportionally to the chlorine content. In the DPD method the measuring water is constantly buffered to a pH value of about 6.3. Therefore, the pH value of the measuring water is not included in the DPD measurement. Due to the buffer function in the DPD method, all components of free chlorine are detected and thus the total free chlorine is measured.
If you select pH compensation in the transmitter, the sum of hypochlorous acid and hypochlorite corresponding to the DPD measurement is calculated from the hypochlorous acid measured by the sensor and the pH value in the region of pH 4 to 9. For this calculation, the curve shown in Fig. 7 is stored in the transmitter.

✎ Note!
When free chlorine is measured with the pH compensation function on, always perform calibration in the pH-compensated operating mode.

When you use pH compensation, the measured chlorine value displayed and applied to the instrument output corresponds to the DPD measured value even if the pH values fluctuate. If you do not use pH compensation, the measured chlorine value only corresponds to the DPD measurement if the pH value remains unchanged compared with the calibration. Without pH compensation the chlorine measuring system must be recalibrated when the pH value changes.

Accuracy of pH compensation

The accuracy of the pH compensated measured chlorine value depends on the sum of several single measured deviations (chlorine, pH, temperature, DPD measurement etc.).
High amounts of hypochlorous acid (HOCl) during chlorine calibration have positive effects on the accuracy whereas low amounts of hypochlorous acid have negative effects.
Inaccuracy of the pH compensated chlorine value increases the bigger the pH difference between operation and calibration gets or the more inaccurate the single measured values are.

Calibration of free chlorine measurement taking into account the pH value

The reference measurement (DPD method, photometer) determines the complete free chlorine by buffering to pH 6.3. In contrast to this, amperometric measurement only determines the HOCl components.
The pH compensation causes the HOCl value to be increased to the actual value of free chlorine. During operation, pH compensation is active up to a pH value of 9. Since there is hardly any HOCl left at this pH value and the measured current is very low, calibration of the complete measuring system makes sense only up to a pH value of the medium of 8 or 8.2.

Sensor	pH value	HOCl content	Uncompensated value	Compensated value
CCS141	8.2	15 %	12 nA	80 nA
CCS140	8	20 %	4 nA	20 nA

Above these pH values the total measured error of the measuring system is inacceptable.

Flow

The membrane-covered sensor requires a minimum flow velocity of 15 cm/s (0.5 ft/s) in order to function properly. When using the CCA250 flow assembly, this value corresponds to a flow rate of 30 l/h (8 gal/h) (upper edge of float at level of red bar mark). At higher flow rates, the measuring signal is virtually flow independent. At lower flow rates, the measuring signal depends on the flow. If an INS proximity switch is installed in the assembly, too low flow rates can reliably be detected, allowing to signal an alarm or to block the dosage pumps if required.

Temperature

Changes in the medium temperature influence the measuring signal. A temperature increase causes the measured value to increase (approx. 4% per K), a temperature reduction causes it to decrease. Therefore the temperature should remain constant after calibration of the chlorine measuring point or a recalibration must be performed if the temperature has changed.
When using the sensor versions CCS140/141-N in combination with Liquisys M, an automatic temperature compensation is performed. In this case, the temperature does not need to remain constant and recalibrations after temperature changes are not required.

6 Commissioning

Note!
- Read also the instructions on commissioning and operation in the Operating Instructions of the used transmitter.
- The power supply of the transmitter and the sensor may not be interrupted. After longer power interruption (> 2 h), the sensor must be recommissioned (polarization time).
- After commissioning, the sensor must be kept permanently wet.
- Do not switch off the measuring system during interval operation! Dosing devices may be controlled by timer switches.
  However, if no disinfectant is dosed over a long period of time (several weeks), the sensor must be disconnected from the transmitter, opened, emptied and stored dry (see chapter "Storage").

6.1 Installation and function check

Before first commissioning, check if:
- the sensor ist correctly installed
- the electrical connection is correct.

6.2 Polarization

The voltage applied between cathode and anode by the transmitter polarizes the surface of the gold electrode. Therefore, after switching on the transmitter with connected sensor, you have to wait until the polarization period has elapsed before you can start the calibration.
To achieve a stable display value, the sensors need the following polarization periods:

First commissioning:

CCS140:	60 min.
CCS141:	90 min.

Recommissioning:

CCS140:	30 min.
CCS141:	45 min.

6.3 Calibration

Reference measurement according to the DPD method
The calibration of the measuring system requires a colorimetric reference measurement according to the DPD method. Chlorine reacts with diethyl-p-phenylenadiamine (DPD) by producing a red dye, the intensity of the red color being proportional to the chlorine concentration.
The intensity of the red dye is measured by a photometer (e.g. CCM182, see accessories) and displayed as chlorine concentration.

Requirements
The sensor reading is stable (no drifts or unsteady values for at least 5 minutes). This is normally fulfilled, when:

- The polarization period is finished.
- The flow is constant and within the correct range.
- The sample medium and the sensor are at the same temperature.
- The pH value is within the admissible range.

Zero-point adjustment
A zero-point adjustment is not required thanks to the zero stability of the membrane-covered sensor.
If you, however, wish to perform a zero-point adjustment, operate the sensor in chlorine-free water for at least 15 min.

Slope calibration

For slope calibration, perform the following steps:

1. Ensure a constant pH value and temperature of the medium.
2. Take a sample for DPD measurement. The sampling location has to be close to the installed sensor. Use the sampling tap if available.
3. Determine the free chlorine content with a photometer (e.g. CCM182, see accessories) according to the DPD method. To do so, see the instructions on measurement of free chlorine in the Operating Instructions of the photometer.
4. Enter the measured value into the transmitter (see Operating Instructions of the transmitter).
5. After initial installation of the sensor, check the calibration by DPD measurement 24 hours later.

Note!
Carry out a slope calibration every time the membrane or electrolyte is changed.

7 Maintenance

Check the measurement at regular intervals; depending on the respective conditions at least once a month.

Perform the following tasks:
- If the membrane is visibly soiled, clean the sensor (see section "Cleaning the sensor").
- Refill the sensor with electrolyte once per season or every 12 months. Depending on the chlorine content on site, this period can be reduced or extended (see section "Refilling the electrolyte").
- Calibrate the sensor when necessary (see section "Calibration").

7.1 Cleaning the sensor

Caution!
- Do not use chemicals reducing the surface tension.
- When using hydrochloric acid, observe the safety regulations.

If the membrane is visibly soiled, proceed as follows:

1. Remove the sensor from the flow assembly.
2. Clean the membrane mechanically with a gentle water jet or put it for some minutes in 1 to 5 % hydrochloric acid without chemical additives.

7.2 Replacing the membrane

1. Unscrew the measuring chamber (pos. 1) from the shaft.
2. Unscrew the front screw cap (pos. 3).
3. Remove the membrane cap (pos. 2) and replace it by a CCY14-WP replacement cartridge.
4. Refill the measuring chamber with CCY14-F electrolyte (see section "Refilling the electrolyte").

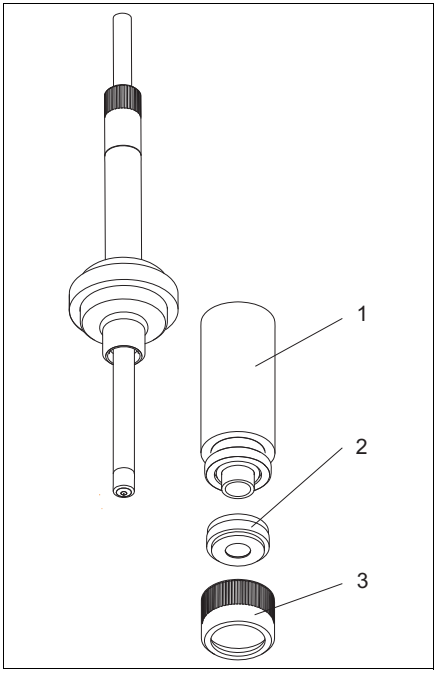

Fig. 8: Membrane replacement

1 Measuring chamber
2 Membrane cap
3 Screw cap

7.3 Refilling the electrolyte

⚠ Warning!
Do not swallow the electrolyte! Avoid contact of the electrolyte with skin or eyes. Otherwise wash with a lot of cold water! In case of eye inflamation, contact a doctor!
Wear gloves when refilling the electrolyte.

☝ Caution!
- Do not touch or damage the electrodes!
- The electrolyte is sensitive to oxidation: Always keep the electrolyte bottle closed after use. Do not transfer the electrolyte into other containers!
- The electrolyte should not be stored for more than 1 year and not yellow (use by date, see label).
- Avoid forming air bubbles when pouring the electrolyte into the measuring chamber!

Proceed as follows to fill in the electrolyte:

1. Unscrew the measuring chamber from the sensor shaft.
2. Hold the measuring chamber at an angle and fill in about 7 to 8 ml (0.24 to 0.27 fl.oz) electrolyte, up to the internal thread of the measuring chamber.
3. Tap the filled measuring chamber several times on a flat surface so that adherent air bubbles can detach and rise.
4. Insert the sensor shaft vertically from above into the measuring chamber.
5. Slowly tighten the measuring chamber to the stop. Excess electrolyte is pressed out at the sensor bottom during the tightening.

7.4 Storing the sensor

During short-term interruptions in measurement:
- If it is ensured that the assembly will not drain off, you can leave the sensor in the assembly.
- If the assembly might drain off, remove the sensor from the assembly. To keep the membrane of the uninstalled sensor wet, moisten the inner sponge of the protection cap and slide the cap onto the measuring chamber.

During long-term interruptions in measurement, particularly if dehydration is possible:
- Empty the sensor.
- Rinse the measuring chamber and electrode shaft with cold water and let them dry.
- Screw the sensor down loosely and not to the stop so that the membrane remains unstressed.
- Proceed according to chapter "Commissioning" when recommissioning the sensor.

7.5 Regenerating the sensor

During measurement, the electrolyte in the sensor is gradually exhausted by chemical reactions. The silver chloride layer, applied to the anode at the factory, continues to grow epitaxially during sensor operation. This has no effect on the reaction taking place at the cathode.

A change in color of the silver chloride layer, however, indicates effects on the reaction at the cathode. Therefore, ensure by visual inspection that the grey-brown color of the anode has not changed. If the anode color has changed, e.g. if it is spotted, white or silvery, the sensor must be regenerated.
Send it to the manufacturer for this purpose.

7.6 Reconditioning the sensor

Long-term operation (> 1 week) in chlorine-free media, i.e. with very low sensor currents, leads to a deactivation of the sensor.
This deactivation is a continuous process that results in a lower slope and longer response times. After long-term operation in a chlorine-free medium, the sensor must be reconditioned.

You need the following materials for reconditioning:
- Demineralized water
- Polishing sheet (see "Accessories")
- Beaker
- Approx. 100 ml (3.381 fl.oz) of chlorine bleach liquor NaOCl approx. 13 %, pharmaceutical quality (available at chemical stores or pharmacies)

Proceed as follows:

1. Close the medium inlet and outlet and make sure that no medium can squirt out of the assembly.
2. Remove the sensor from the assembly.
3. Unscrew the measuring chamber and put it aside.
4. Polish the gold cathode of the sensor using the polishing sheet:
   – Place a wetted strip of the sheet in your hand.
   – Polish the gold cathode by moving it circularly on the strip.
   – Rinse the sensor with demineralized water.
5. Top up the electrolyte if required (see chapter "Refilling the electrolyte") and screw the measuring chamber back into place.
6. Fill the beaker with chlorine bleach liquor to about 10 mm (0.39") and position it safely.
7. ☝ Caution!
   The sensor must not touch the liquid.

   Place the sensor in the gaseous phase about 5 to 10 mm (0.2" to 0.39") above the chlorine bleach liquor.

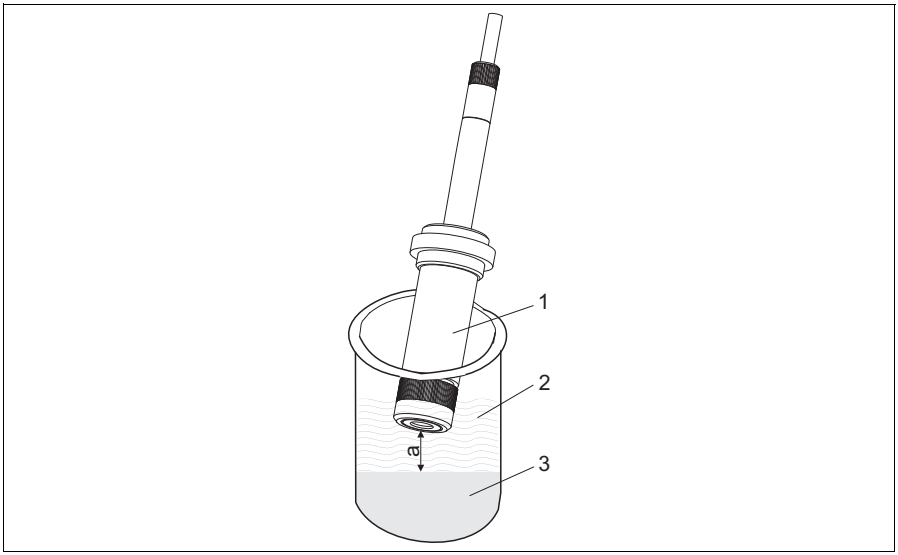

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Fig. 9: Reconditioning of the sensor above chlorine bleach liquor

1	*Sensor*	*3*	*Chlorine bleach liquor*
2	*Gaseous phase of chlorine bleach liquor*	*a*	*Distance between sensor and liquid, 5 to 10 mm*

8. The sensor current will now increase. The absolute value and the speed of increase depend on the temperature of the chlorine bleach liquor.
   – When the sensor current has reached a value of several hundred nA, leave the sensor under these conditions over a period of 20 min.
   – If the recommended current value cannot be reached, cover the beaker to avoid quick air change.
9. After the 20 min. have elapsed, re-install the sensor in the assembly.
10. Re-establish the medium flow. The sensor current will normalize.
11. After sufficient settling time (no noticeable drift), calibrate the measuring chain.

8 Accessories

8.1 Connection accessories

Junction box VBC
- Metallic junction box for cable extension,
- Dimensions (W x D x H): 125 x 80 x 54 mm / 4.92 x 3.15 x 2.13 inches
- Order no. 50005181

MK extension cable
- Two-wire signal cable with additional screen and PVC insulation. Particularly for the transmission of output signals of transmitters or input signals of controllers and for temperature measurement.
- Order no. 50000662

CYK71 measuring cable
- Non-terminated cable for the connection of sensors or the extension of sensor cables
- Sold by the meter, order numbers:
  - non-Ex version, black: 50085333
  - Ex version, blue: 51506616

8.2 Installation accessories

Flowfit CCA250
- Flow assembly for chlorine, chlorine dioxide, pH and ORP sensors
- Ordering acc. to product structure, see Technical Information TI062C/07/en

Immersion assembly Dipfit W CYA611
- For sensor immersion in basins, open channels and tanks, PVC
- Ordering acc. to product structure, see Technical Information TI166C/07/en

Compact measuring station CCE1/CCE3
- Panel mounted ready for connection for holding one or three transmitters, with flow assembly CCA250-A1
- Order numbers:
  - CCE1: 50041731
  - CCE3: 50041733
- Technical Information TI014C/07/en

8.3 Transmitter

Liquisys M CCM223/253
- Transmitter for chlorine, field or panel-mounted housing,
- Hart® or PROFIBUS available,
- Ordering acc. to product structure, see Technical Information (TI214C/07/en)

8.4 Maintenance / calibration

CCM182
- Microprocessor-controlled photometer for determining chlorine and pH value
- Measuring range for chlorine: 0.05 - 6 mg/l
- Measuring range for pH value: 6.5 - 8.4
- Order no.: CCM182-0

CCY14-WP
- 2 replacement cartridges ready-made for CCS140/141/142D chlorine and CCS240/241 chlorine dioxide sensors
- Order no. 50005255

CCY14-F
- Electrolyte for CCS140 / CCS141 / CCS142D chlorine sensors; 50 ml
- Order no. 50005256

Polishing sheets COY31-PF
- 10 pieces for cleaning of the gold cathode
- For oxygen and chlorine sensors
- Order no. 51506973

9 Troubleshooting

9.1 Troubleshooting instructions

Troubleshooting must take account of the whole measuring system. The measuring system comprises:

- Transmitter
- Electrical connections and lines
- Assembly
- Sensor

The possible causes of failures listed in the following table primarily refer to the sensor. Make sure that the following operating conditions are met before commencing troubleshooting:

- Constant pH value after chlorine calibration, not required for measurement in the "pH compensated" mode of operation
- Constant temperature after calibration, not required for measurement in the "temperature compensated" mode of operation
- Minimum flow rate of 30 l/h (7.9 gal/h) (red bar mark when using the CCA250 assembly)
- No use of organic chlorination agents

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 of the photometer). If necessary, repeat the DPD measurement several times.

Error	Possible cause	Remedy
No display, no sensor current	No supply voltage at the transmitter	Establish mains connection.
	Connection cable between sensor and transmitter interrupted	Establish cable connection.
	No electrolyte filled into the measuring chamber	Fill measuring chamber (see chapter "Refilling the electrolyte").
	No input flow of medium	Establish flow, clean filter.
Display value too high	Polarization of the sensor not yet completed	Wait for complete polarization (see chapter "Polarization").
	Membrane defective	Replace membrane cap.
	Shunt resistance (e.g. moisture contact) in the sensor, at the connections or in the connection cable	Open measuring chamber, rub gold cathode dry. If the display of the transmitter does not return to zero, there is a shunt.
	Interference of foreign oxidants on the sensor	Examine medium, check chemicals.
Display too low	Measuring chamber not completely tightened	Tighten measuring chamber or screw cap tight.
	Membrane soiled	Clean membrane.
	Air bubble in front of membrane	Release air bubble.
	Air bubble between cathode and membrane	Open measuring chamber, fill in some electrolyte, tap.
	Input flow of medium too low	Establish correct input flow (see chapter "Influences on measuring signal").
	Interference of foreign oxidants on the DPD reference measurement	Examine medium, check chemicals (see chapter "Operating principle").
	Use of organic chlorination agents	Use agents acc. to DIN 19643 (water replacement may be required).
Display fluctuates considerably	Hole in membrane	Replace membrane cap.
	External voltage in medium	Measure voltage between the PMC pin and the protective ground of the transmitter (both AC and DC ranges). For values exceeding approx. 0.5 V, find and eliminate external cause.
Temperature display too low	Supply line to NTC temperature sensor broken	Test the wires (green/brown) and measure the NTC resistance, replace the sensor if necessary.
Temperature display too high	Supply line to NTC temperature sensor short-circuited	Test the wires (green/brown) and measure the NTC resistance, replace the sensor if necessary.

9.2 Return

If the sensor has to be repaired, please return it *cleaned* to the sales center responsible. Please use the original packaging, if possible.

Please enclose the completed "Declaration of Hazardous Material and De-Contamination" (copy the second last page of these Operating Instructions) with the packaging and the transportation documents.
No repair without completed declaration!

9.3 Disposal

Please dispose of the device in accordance with the local regulations.

10 Technical data

10.1 Input

Measured variable	Free chlorine:	hypochlorous acid (HOCl)
Measuring range	CCS140 (for industrial water, pool water): CCS141 (for drinking water applications):	0.05 to 20 mg Cl_2/l (25 °C (77 °F), pH 7.2) 0.01 to 5 mg Cl_2/l (25 °C (77 °F), pH 7.2)
Signal current	CCS140: CCS141:	approx. 25 nA per mg Cl_2/l (25° C (77 °F), pH 7.2) approx. 80 nA per mg Cl_2/l (25 °C (77 °F), pH 7.2)

10.2 Performance characteristics

Response times	T_{90} < 2 min in applications involving mainly active chlorination	
Polarization time	CCS140: First polarization: Repolarization: CCS141: First polarization: Repolarization:	 60 min 30 min 90 min 45 min
Drift	< 1.5 % per month	
Recommended maintenance interval for electrolyte	typically 12 months	

10.3 Environment

Storage temperature	Filled with electrolyte:	5 to 50 °C (41 to 122 °F)
	Without electrolyte:	-20 to 60 °C (-4 to 140 °F)
Ingress protection	IP 68 (up to the mounting collar Ø 36 mm (Ø 1.42"))	

10.4 Process

Temperature range	CCS140: CCS141:	10 to 45 °C (50 to 113 °F) 2 to 45 °C (36 to 113 °F)
pH range	CCS140: CCS141:	4 to 8 pH 4 to 8.2 pH ✎ Note! Chlorine measurement possible up to pH 9 with limited accuracy.
Pressure	Medium in the CCA250 assembly: max. 1 bar (14.5 psi)	
Flow volume	in the CCA250 assembly: min. 30 l/h (8 US.gal./h)	
Flow velocity	min. 15 cm/s (0.5 ft/s)	

10.5 Mechanical construction

Design, dimensions	see chapter "Installation conditions"	
Weight	approx. 0.5 kg (1.1 lb.)	
Materials	Sensor shaft: Membrane: Membrane cap: Cathode: Anode:	PVC PTFE PBT (GF 30), PVDF Gold Silver / silver chloride
Cable connection	Fixed cable (3 m (9.84 ft)), four cores, double-screened, low noise	
Cable length	max. 30 m (98 ft) (cable extension included)	
Temperature compensation	NTC, 10 kΩ at 25 °C (77 °F)	

Index

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Endress+Hauser

People for Process Automation

Declaration of Hazardous Material and De-Contamination

RA No. ☐☐☐☐☐☐☐

Please reference the Return Authorization Number (RA#), obtained from Endress+Hauser, on all paperwork and mark the RA# clearly on the outside of the box. If this procedure is not followed, it may result in the refusal of the package at our facility.

Because of legal regulations and for the safety of our employees and operating equipment, we need the "Declaration of Hazardous Material and De-Contamination", with your signature, before your order can be handled. Please make absolutely sure to attach it to the outside of the packaging.

Type of instrument / sensor _____ **Serial number** _____

☐ **Used as SIL device in a Safety Instrumented System**

Process data

Temperature _____ [°F] _____ [°C] Pressure _____ [psi] _____ [Pa]

Conductivity _____ [µS/cm] Viscosity _____ [cp] _____ [mm^2/s]

Medium and warnings

	Medium /concentration	Identification CAS No.	 flammable	 toxic	 corrosive	 harmful/ irritant	 other *	 harmless
Process medium								
Medium for process cleaning								
Returned part cleaned with								

* explosive; oxidising; dangerous for the environment; biological risk; radioactive

Please tick should one of the above be applicable, include safety data sheet and, if necessary, special handling instructions.

Description of failure _____

_____

_____

Company data

Company _____

_____

Address

_____

_____

Phone number of contact person

_____

Fax / E-Mail _____

Your order No. _____

"We hereby certify that this declaration is filled out truthfully and completely to the best of our knowledge.We further certify that the returned parts have been carefully cleaned. To the best of our knowledge they are free of any residues in dangerous quantities."

_____ (place, date)

_____ Name, dept. (please print)

_____ Signature

PSF/Konta XIV

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