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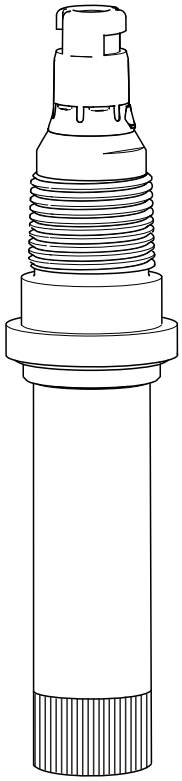
Operating Instructions
Chloromax CCS142D

Digital sensor with Memosens technology for determining free chlorine



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1 Document information

1.1 Warnings

Structure of information	Meaning
⚠ DANGER **Causes (/consequences)** 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)** 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)** 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** Consequences of non-compliance (if applicable) ▶ Action/note	This symbol alerts you to situations which may result in damage to property.

1.2 Symbols

Symbol	Meaning
	Additional information, tips
	Permitted or recommended
	Not permitted or not recommended
	Reference to device documentation
	Reference to page
	Reference to graphic
	Result of a step

2 Basic safety instructions

2.1 Requirements for personnel

Installation, commissioning, operation and maintenance of the measuring system may be carried out only by specially trained technical personnel.

- ▶ The technical personnel must be authorized by the plant operator to carry out the specified activities.
- ▶ The electrical connection may be performed only by an electrical technician.
- ▶ The technical personnel must have read and understood these Operating Instructions and must follow the instructions contained therein.
- ▶ 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 Designated use

2.2.1 General

Drinking water, process water and bathing water must be disinfected through the addition of appropriate disinfectants such as chlorine gas or inorganic chlorine compounds. The dosing quantity involved 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 process. On the other hand, concentrations which 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 free chlorine in water. In conjunction with measuring and control equipment, it allows optimum control of the disinfection process.

2.2.2 Hazardous environment in accordance with cETLus NI Cl. I, Div. 2 [1)]

- ▶ Please note the control drawing and the specified application conditions in the appendix of these Operating Instructions and follow the instructions.

2.2.3 Non-designated use

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 Occupational safety

As the user, you are responsible for complying with the following safety conditions:

- Installation guidelines
- Local standards and regulations

1) Only if connected to CM444R-EA* or CM448R-EA*

Electromagnetic compatibility

- The product has been tested for electromagnetic compatibility in accordance with the applicable European 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

1. Before commissioning the entire measuring point, verify that all connections are correct. Ensure that electrical cables and hose connections are undamaged.
2. Do not operate damaged products, and safeguard them to ensure that they are not operated inadvertently. Label the damaged product as defective.
3. If faults cannot be rectified:

   Take the products out of operation and safeguard them to ensure that they are not operated inadvertently.

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 European standards have been observed.

3 Device description, function

3.1 Measuring principle

Free chlorine is determined as hypochlorous acid 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^-) at the gold cathode. At the silver anode, silver is oxidized to silver chloride. Electron donation at the gold cathode and electron acceptance at the silver anode causes a current to flow which is in proportion to the concentration of free chlorine in the medium at constant conditions.

The concentration of hypochlorous acid depends on the pH value. This dependency can be compensated for by measuring the pH value in the flow assembly.

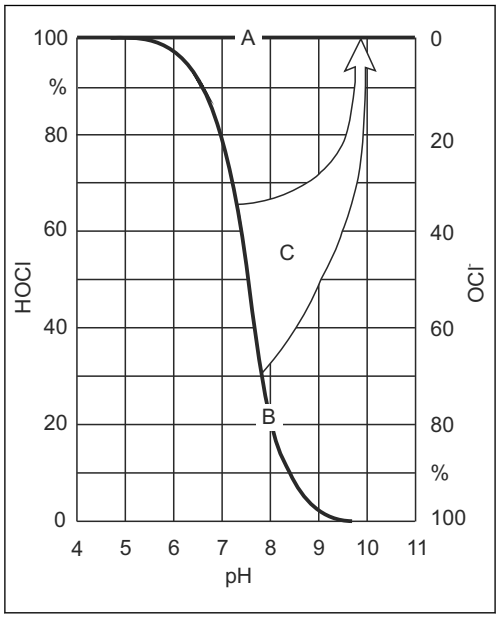
The transmitter uses the current signal to calculate the measured variable for concentration in mg/l.

3.2 Effects on the measuring signal

3.2.1 pH value

pH-dependency

Molecular chlorine (Cl_2) is present at pH values < 4. Consequently, hypochlorous acid (HOCl) and hypochlorite (OCl– remain within the range of pH 4 to 11 as components of free chlorine. As hypochlorous acid splits up (dissociates) with an increasing pH value to form hypochlorite ions (OCl^-) and hydrogen ions (H^+), the amounts of the individual components of free effective chlorine change with the pH value. For example, if the amount of hypochlorous acid is 97% at pH 6, it drops to approx. 3% at pH 9.



1 Principle of pH compensation

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

For amperometric measurement using the CCS142D chlorine sensor, only the amount of hypochlorous acid is selectively measured. This works as a powerful disinfectant in a watery solution. In contrast to this, hypochlorite is an extremely weak disinfectant. Therefore, when used as a disinfectant at higher pH values, the effectiveness of chlorine is limited. As hypochlorite ions cannot permeate the sensor membrane, the sensors do not record this value.

pH compensation of chlorine sensor signal

To calibrate and verify the chlorine measuring system, a colorimetric reference measurement must be carried out using the DPD method. Free chlorine reacts with diethyl-p-phenylendiamine to form a red dye. The intensity of the red color increases proportionally to the chlorine content. With the DPD method, the sample is buffered to a pH value of approx 6.3. Therefore, the pH value of the sample is not included in the DPD measurement. Due to the buffer function in the DPD method, all components of free effective chlorine are recorded and thus the total free chlorine is measured.

If pH compensation is switched on in the transmitter, the sum of hypochlorous acid (HOCl) and hypochlorite corresponding to the DPD measurement is calculated from the chlorine sensor's measuring signal that corresponds to hypochlorous acid (HOCl) and by taking into account the pH value in the range of pH 4 to 9. For this calculation, the curve is stored in the transmitter.

When free chlorine is measured with pH compensation switched on, always perform calibration in pH-compensated mode.

When you use pH compensation, the measured chlorine value that is displayed and applied to the device output corresponds to the DPD measured value even if the pH values fluctuate. If you do not use pH compensation, the measured chlorine value corresponds to the DPD measurement only 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 is derived from the sum of several individual deviations (chlorine, pH, temperature, DPD measurement etc.).

High levels of hypochlorous acid (HOCl) during chlorine calibration have a positive effect on accuracy, whereas low levels of hypochlorous acid have a negative effect. The inaccuracy of the pH-compensated measured chlorine value increases the greater the pH difference between measuring mode and chlorine calibration or the more inaccurate the underlying individual measured values are.

Calibration taking into account the pH value

The reference measurement (DPD method, photometer) determines the total free chlorine by buffering to pH 6.3. In contrast to this, amperometric measurement determines only the HOCl component.

During operation, pH compensation is effective up to a pH value of 9. However, there is hardly any HOCl left at this pH value, and the measured current is very low. At this point, pH compensation has the effect of increasing the measured HOCl value to the actual value of the free chlorine. 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
CCS142D-G	8.2	15 %	12 nA	80 nA
CCS142D-A	8.0	20 %	4 nA	20 nA

Above these pH values, the total error of the measuring system is unacceptably high.

3.2.2 Flow

The minimum flow velocity of the membrane-covered sensor is 15 cm/s (0.5 ft/s). 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. However, if the flow rate falls below the specified value, the measuring signal depends on the flow. If an INS proximity switch is installed in the assembly, this unpermitted operating status can be reliably detected. This triggers an alarm or, if necessary, results in the dosing process being switched off.

3.2.3 Temperature

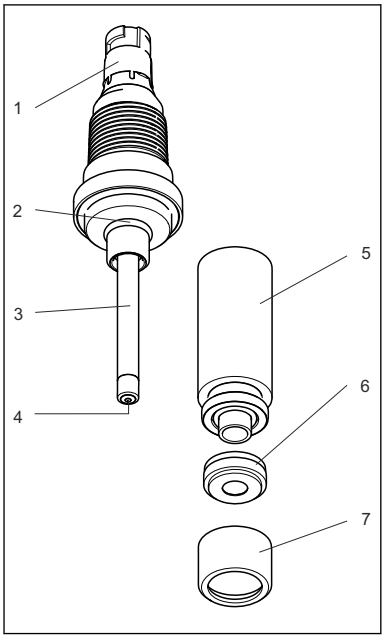
Changes in the medium temperature also influence the measuring signal. An increase in temperature causes the measured value to increase (approx. 4 % per K), while a reduction in temperature causes the measured value to decrease. Therefore, the temperature should remain constant after calibration. If the temperature has changed, a recalibration must be performed.

The Chloromax CCS142D, when used with the Liquiline, enables automatic temperature compensation (ATC). In this case, the temperature does not need to remain constant, and a recalibration in the event of temperature changes is not required.

3.3 Sensor design

The sensor consists of the following function units:

- Measuring chamber
  - to protect the anode and cathode from the medium
  - with large volume of electrolyte for a long service life in combination with the large anode and the small cathode
- Sensor shaft with
  - large anode
  - cathode embedded in plastic
  - 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



2 Sensor structure

1 Memosens plug-in head
2 O-ring
3 Large anode, silver/silver chloride
4 Gold cathode
5 Measuring chamber
6 Membrane cap with dirt-repellent membrane
7 Screw cap for securing the membrane cap

4 Incoming acceptance and product identification

4.1 Incoming acceptance

1. Verify that the packaging is undamaged.
   ↳ Notify your supplier of any damage to the packaging.
   Keep the damaged packaging until the matter has been settled.
2. Verify that the contents are undamaged.
   ↳ Notify your supplier of any damage to the delivery contents.
   Keep the damaged products until the matter has been settled.
3. Check the delivery for completeness.
   ↳ Check it against the delivery papers and 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.
   The permitted ambient conditions must be observed (see "Technical data").

If you have any questions, please contact your supplier or your local sales center.

4.2 Product identification

4.2.1 Nameplate

The nameplate provides you with the following information on your device:
- Manufacturer identification
- Order code
- Extended order code
- Serial number
- Ambient and process conditions
- Safety information and warnings
- Ex labeling on hazardous area versions

Compare the data on the nameplate with your order.

4.2.2 Product identification

Product page

www.endress.com/ccs142d

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 the product page for your product on the Internet.

2. In the navigation area on the right-hand side, select "Check your device features" under "Device support".
   ↳ An additional window opens.
3. Enter the order code from the nameplate into the search field.
   ↳ You will receive information on each feature (selected option) of the order code.

4.3 Scope of delivery

The scope of delivery comprises:
- Chlorine sensor
- Bottle containing electrolyte (50 ml)
- Replacement cartridge with pretensioned membrane
- Operating Instructions

4.4 Certificates and approvals

4.4.1 CE mark

Declaration of Conformity

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

4.4.2 Ex approvals [2)]

cETLus NI Cl. I, Div. 2
- Conforms with UL STD 61010-1, ANSI/ISA STD 12.12.01, FM STD 3600 and FM STD 3611
- Certified according to CSA STD C22.2 NO. 61010-1 and CSA STD C22.2 NO. 213
- ETL control number: 5000765
- Control drawing: 403936

2) Only if connected to CM444R-EA* or CM448R-EA*

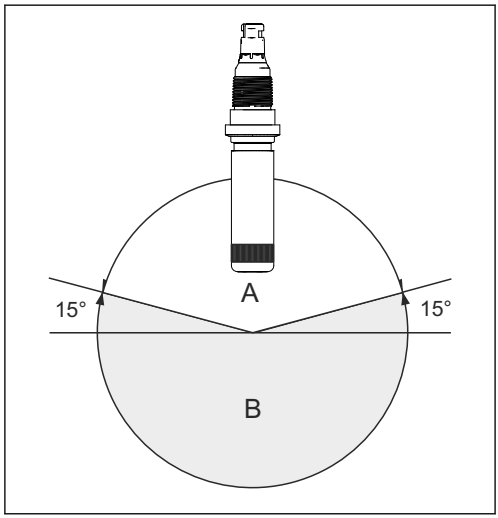
5 Installation

5.1 Installation conditions

5.1.1 Orientation

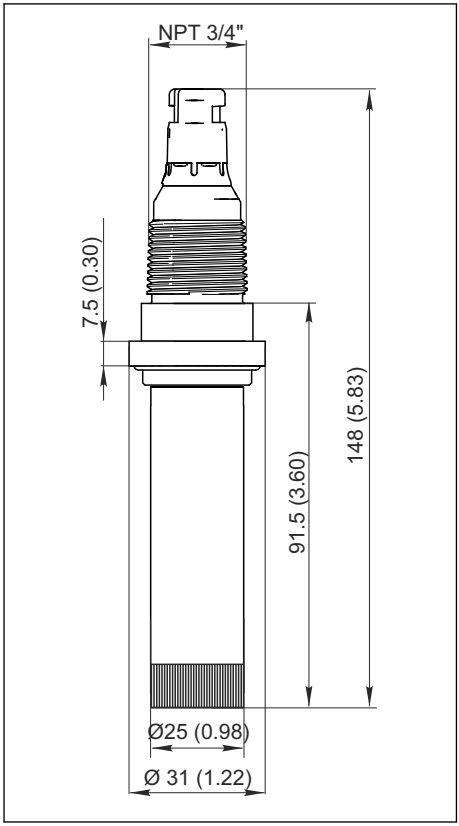
Do not install overhead!

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



A *Permitted orientation*
B *Forbidden orientation*

5.1.2 Dimensions

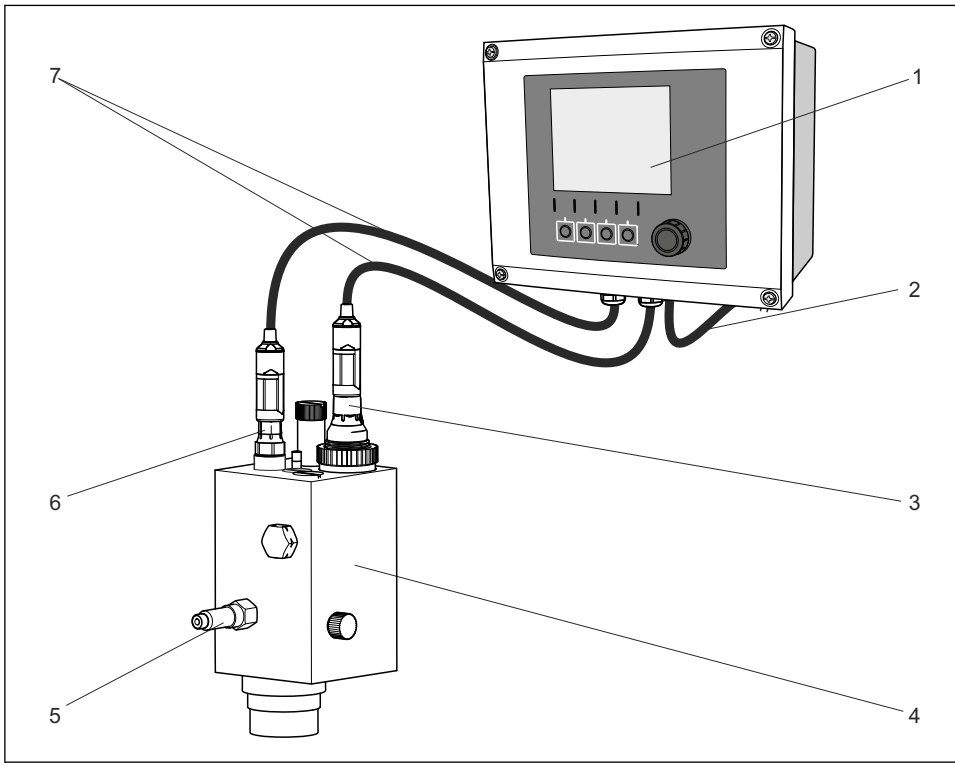


3 Dimensions in mm (inch)

5.2 Mounting the sensor

5.2.1 Measuring system

A complete measuring system comprises:
- Chloromax CCS142D chlorine sensor
- Assembly, e.g. Flowfit CCA250
- Measuring cable CYK10
- Transmitter, e.g. Liquiline CM44x or CM44xR
- Optional:
  - Extension cable CYK11
  - When using assembly CCA250: additional sensor(s), e.g. pH sensor CPS31D



4 Example of a measuring system

1 Liquiline CM44x transmitter
2 Power cable for transmitter
3 Chlorine sensor CCS142D
4 Flowfit assembly CCA250
5 Inlet to assembly (outlet on rear, not shown in graphic)
6 pH sensor CPS71D
7 Measuring cable CYK10

5.2.2 Installation in CCA250 flow assembly

The Flowfit CCA250 flow assembly is designed for installing the sensor It allows a pH and ORP sensor to be installed, in addition to the chlorine or chlorine dioxide sensor. A needle valve regulates the flow in the range of 30 to 120 l/h (7.9 to 30 gal/h).

Please note the following during installation:
- The flow rate must be at least 30 l/h (7.9 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) and must remain constant.
- Negative pressure at the sensor e.g. caused by feedback of the medium to the suction side of a pump, must be avoided.

Additional installation instructions can be found in the Operating Instructions for the assembly.

5.2.3 Installation in other flow assemblies

When using other flow assemblies, please ensure the following:
- The flow velocity against the membrane is always at least 15 cm/s (0.49 ft/s).
- The flow direction is upwards so that transported air bubbles are removed and do not collect in front of the membrane.
- The membrane is struck directly by the flow.

5.2.4 Installation in CYA112 immersion assembly

Alternatively, the sensor can be installed in an immersion assembly with threaded connection NPT ¾", e.g. CYA112.

Please note the following during installation:
- Hold the sensor securely in position and screw the assembly onto the sensor so that it is handtight. This prevents the cable from twisting and rupturing.
- To improve the sealing effect, we recommend you wrap a thin PTFE tape around the thread for assemblies with an NPT ¾" thread.

Additional installation instructions can be found in the Operating Instructions for the assembly.

5.3 Post-installation check

1. Check the membrane to ensure it is sealed and undamaged.
   ↳ Replace if necessary.
2. Is the sensor installed in an assembly and not suspended from the cable?
   ↳ Install the sensor only in an assembly or directly via the process connection.

6 Electrical connection

WARNING

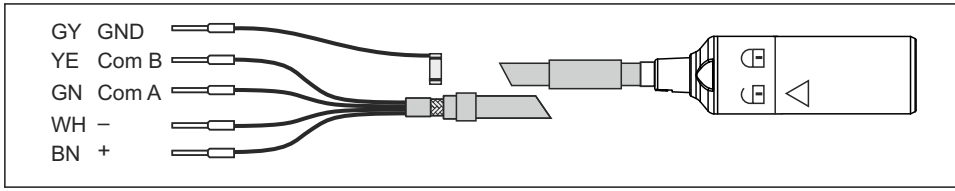
Device is live

Incorrect connection may result in injury or death.

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

6.1 Connecting the sensor

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



5 *Measuring cable CYK10*

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

6.2 Ensuring the degree of protection

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

- Exercise care when carrying out the work.

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

6.3 Post-connection check

Device condition and specifications	Notes
Are the outside of the sensor, assembly, cable undamaged?	Visual inspection
Electrical connection	**Notes**
Are the installed cables strain-relieved and not twisted?	
Is a sufficient length of the cable cores stripped, and is it positioned in the terminal correctly?	Check the fit (by pulling gently)
Are all the screws terminals properly tightened?	Tighten
Are all cable entries mounted, tightened and leak-tight?	For lateral cable entries, make sure the cables loop downwards to allow water to drip off
Are all cable entries installed downwards or mounted laterally?	

7 Commissioning

7.1 Function check

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

If using an assembly with automatic cleaning, check that the cleaning medium (e.g. water or air) is connected correctly.

⚠ WARNING

Escaping process medium

Risk of injury from high pressure, high temperatures or chemical hazards
- ▶ Before applying compressed air to an assembly with cleaning facility, make sure the connections are correctly fitted.
- ▶ Do not install the assembly in the process if you cannot make the correct connection reliably.

7.2 Sensor polarization

The voltage applied between cathode and anode by the transmitter polarizes the surface of the working electrode. Therefore, after switching on the transmitter with the senor connected, you must wait until the polarization period has elapsed before starting calibration.

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

First commissioning

CCS142D-A:	60 min.
CCS142D-G:	90 min.

Recommissioning

CCS142D-A:	30 min.
CCS142D-G:	45 min.

7.3 Sensor calibration

Reference measurement according to the DPD method

To calibrate the measuring system, carry out a colorimetric comparison measurement in accordance with the DPD method. Chlorine reacts with diethyl-p-phenylendiamine (DPD) producing a red dye, the intensity of the red color being proportional to the chlorine content. The intensity of the red color is measured by a photometer (e.g. CCM182) and displayed as chlorine content.

Prerequisites

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 period has 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 point adjustment

A zero point adjustment is not required due to the zero point stability of the membrane-covered sensor.
However, if you wish to do so, you may perform a zero point adjustment by operating the sensor in chlorine-free water for at least 15 min..

Slope calibration

1. Ensure that the pH value and temperature of the medium are constant.
2. Take a sample for 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.
4. Enter the measured value into the transmitter (see Operating Instructions for transmitter).
5. Using the DPD method, check the calibration several hours or 24 hours later.

You must carry out a slope calibration every time the electrolyte or membrane is changed!

8 Diagnostics and troubleshooting

When troubleshooting, you must take account of the entire measuring system. This comprises:
- Transmitter
- Electrical connections and lines
- Assembly
- Sensor

The possible causes of error in the following table refer primarily to the sensor. Before commencing troubleshooting, ensure that the following operating conditions have been met:
- Constant pH value after calibration, not required for measurement in "pH-compensated" mode
- Constant temperature after calibration, not required for measurement in "temperature-compensated" mode
- Medium flow rate of at least 30 l/h (7.9 gal/h)(red bar mark when using the CCA250 flow assembly)
- No use of organic chlorination agents

If the value measured by the sensor differs significantly from that of the DPD method, you should 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	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.
	Measuring chamber is not filled with electrolyte	Fill measuring chamber (→ 🖹 24)
	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 (→ 🖹 19).
	Membrane defective	Replace membrane cap.
	Shunt resistance (e.g. moisture contact) in the sensor shaft	Open measuring chamber, rub gold cathode dry. If the transmitter display does not return to zero, there is a shunt present.
	Foreign oxidants interfering with sensor	Examine medium, check chemicals.

Error	Possible cause	Remedy
Display value too low	Measuring chamber not completely tightened.	Fully tighten measuring chamber or screw cap
	Membrane soiled	Clean membrane
	Air bubble in front of membrane	Release air bubble
	Air bubble between cathode and membrane	Open measuring chamber, top up electrolyte, tap
	Input flow of medium too low	Establish correct input flow (→ 🖹 7)
	Foreign oxidants interfering with DPD reference measurement	Examine medium, check chemicals (→ 🖹 6).
	Use of organic chlorination agents	Use agents according to DIN 19643 (water may need to be replaced beforehand)
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 measuring device (both AC and DC ranges). For values greater than approx. 0.5 V, find and eliminate external cause

9 Maintenance

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

NOTICE

Effects on process and process control

- When carrying out any work on the system, take into account possible repercussions for process control or 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 interval

1. Check the measurement at regular intervals; depending on the prevailing conditions, **at least once a month**.
2. Clean the sensor if the membrane is visibly soiled (→ 🖹 23).
3. Replace the electrolyte **once per season or every 12 months**. Depending on the chlorine content on site, this period can be reduced or extended.
4. Calibrate the sensor if desired or when necessary (→ 🖹 19).

9.2 Clean sensor

⚠ CAUTION

Diluted hydrochloric acid

Hydrochloric acid causes irritation if it comes into contact with the skin or eyes.

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

NOTICE

Chemicals that reduce surface tension

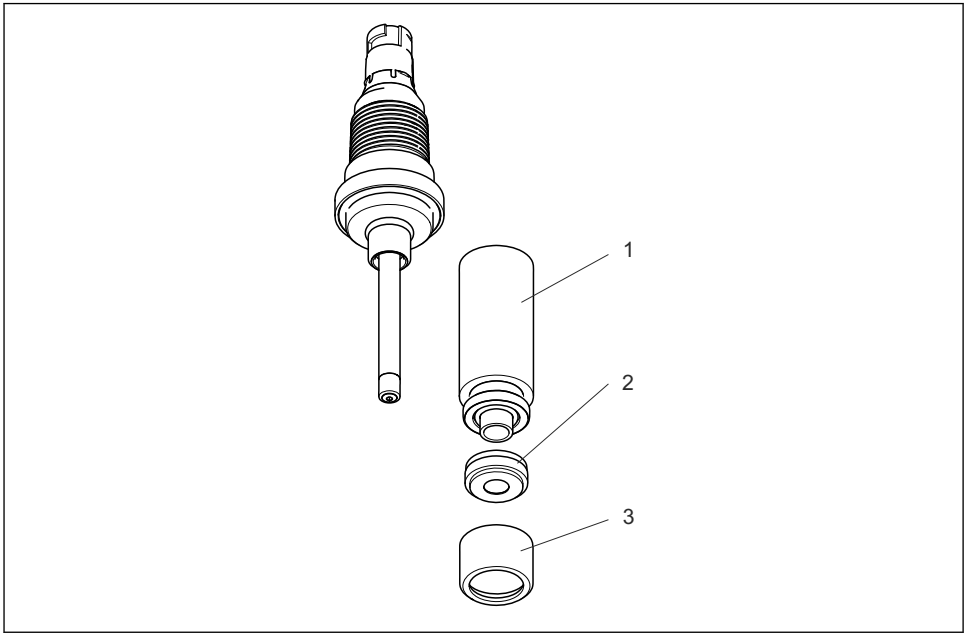
Chemicals that reduce surface tension can penetrate the sensor membrane and cause measuring errors due to blockage.

- Do not use chemicals that reduce surface tension.

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. Alternatively, place it for several minutes in 1 to 5% hydrochloric acid without any further chemical additives.

9.3 Replacing the membrane



A0026509

1. Unscrew the measuring chamber (pos. 1).
2. Unscrew the front screw cap (pos. 3).
3. Remove the membrane cap (pos. 2) and replace it with a CCY14-WP replacement cartridge.
4. Refill the measuring chamber with electrolyte CCY14-F (→ 24).

9.4 Refilling the electrolyte

NOTICE

Damage to membrane and electrodes, air bubbles

Possibility of measuring errors to complete failure of the measuring point

- Do not touch the membrane or electrodes. Avoid damaging them.
- The electrolyte is chemically neutral and is not hazardous to health. Nonetheless, do not swallow it and avoid contact with the eyes.
- Keep the electrolyte bottle closed after use. Do not transfer the electrolyte to other containers.
- Do not store the electrolyte for longer than 1 year. The electrolyte must not be yellow in color. Note the use-by date on the label.
- Avoid forming air bubbles when pouring the electrolyte into the membrane cap.

Refilling the electrolyte

1. Unscrew the measuring chamber from the sensor shaft.
2. Hold the measuring chamber at an angle and pour in approx. 7 to 8 ml (0.24 to 0.27 fl.oz) of electrolyte, up to the internal thread.
3. Tap the filled measuring chamber several times on a flat surface so that adherent air bubbles on the inside 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. While tightening, excess electrolyte is forced out at the bottom of the sensor.
6. If necessary, use a cloth to wipe the measuring chamber and screw cap dry.

9.5 Storing the sensor

During short-term interruptions to measurement:

1. If the assembly is guaranteed not to empty out,
   you may leave the sensor in the flow assembly.
2. If there is a possibility that the assembly may empty out,
   Remove the sensor from the assembly.
3. To ensure that the membrane of the removed sensor remains moist, moisten the inner sponge in the protective cap and slide the cap onto the measuring chamber.

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

1. Remove the sensor from the assembly.
2. Empty the sensor.
3. Rinse the measuring chamber and the electrode shaft with cold water and leave to dry.
4. Screw the sensor down loosely and not to the stop, to ensure that the membrane remains unstressed.
5. When recommissioning the sensor, proceed according to the "Commissioning" (→ 19) section.

9.6 Regenerating the sensor

During measurement, the electrolyte in the sensor is gradually exhausted due to chemical reactions. The gray-brown silver chloride layer that is applied to the anode at the factory continues to grow during sensor operation. However, this has no effect on the reaction taking place at the cathode.

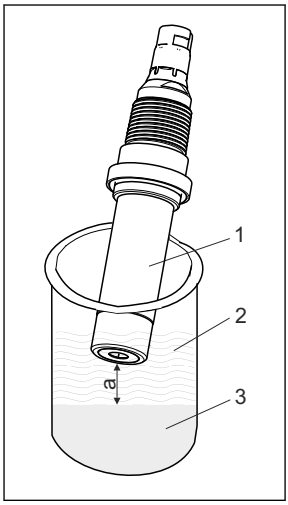
A change in the color of the silver chloride layer indicates an effect on the reaction that is taking place. Therefore, carry out a visual inspection to ensure that the gray-brown color of the anode has not changed. If the color of the anode has changed, e.g. if it is spotted, white or silvery, the sensor must be regenerated.

▶ Send it to the manufacturer for regeneration.

9.7 Reconditioning the sensor

Longterm operation of the sensor (> 3 months) in a chlorine-free medium, i.e. with very low sensor currents, may lead to 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 can be reconditioned.

The following materials are required for reconditioning:
- Deminieralized water
- Polishing sheet (see "Accessories", → 🖹 28)
- Beaker
- Approx. 100 ml (3.38 fl.oz) of chlorine bleach lye NaOCl, approx. 13 %, pharmaceutical quality (available at chemical stores or pharmacies)



A0026513

1 Sensor
2 Gaseous phase of chlorine bleach lye
3 Chlorine bleach lye
a Distance between sensor and liquid, 5 to 10 mm (0.2 to 0.4 inch)

1. Close the medium inlet and outlet and make sure that no liquid can escape from the assembly.
2. Remove the sensor from the assembly.
3. Unscrew the measuring chamber and put it aside.
4. Polish the sensor's gold cathode using the polishing sheet: Place a wetted strip of the sheet in your hand, polish the gold cathode on the strip using circular movements, and rinse the sensor with demineralized water.
5. If necessary:
   Top up the electrolyte in the measuring chamber and screw the measuring chamber back onto the sensor shaft.
6. Fill the beaker to approx. 10 mm (0.4 inch) with chlorine bleach lye and position it safely.

7. The sensor must not touch the liquid.
   Place the sensor in the gaseous phase approx. 5 to 10 mm (0.2 to 0.4 inch) above the chlorine bleach lye.
   ↳ The sensor current will now increase. The absolute value and the speed of increase depend on the temperature of the chlorine bleach lye.
8. When the sensor current has reached a value of several hundred nA:
   Leave the sensor in this position for approx. 20 min..
9. If the value of several hundred nA is not reached:
   Cover the beaker to avoid a quick air change.
10. Once the 20 min. have elapsed, re-install the sensor in the assembly.
11. Open the medium inlet and outlet again.
    ↳ The sensor current will now normalize.

After allowing sufficient settling time (no noticeable drift), calibrate the measuring chain.

10 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 office.

10.1 Connection accessories

CYK10 Memosens data cable
- 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

10.2 Installation accessories

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

Technical Information TI00062C

10.3 Accessories for maintenance and calibration

Photometer
- Photometer for determining chlorine and pH value
- Order no.: 71257946

Service kit CCS14x
- For chlorine sensors CCS140 / CCS141 / CCS142D
- 2 replacement cartridges, electrolyte 50 ml (1.69 fl.oz), polishing sheets
- Order No. 71076921

11 Repair

11.1 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 swift, safe and professional device returns, please read the return procedures and conditions at www.endress.com/support/return-material.

11.2 Disposal

The device contains electronic components and must therefore be disposed of in accordance with regulations on the disposal of electronic waste.

Observe the local regulations.

12 Technical data

12.1 Input

12.1.1 Measured variables

Free chlorine:	hypochlorous acid (HOCl)

12.1.2 Measuring ranges

CCS142D-A:	0.05 to 20 mg/l Cl_2 (at 20 °C (68 °F), pH 7.2)
CCS142D-G:	0.01 to 5 mg/l Cl_2 (at 20 °C (68 °F), pH 7.2)

12.1.3 Signal current

CCS142D-A:	Approx. 25 nA per mg/l Cl_2 (at 20 °C (68 °F), pH 7.2)
CCS142D-G:	Approx. 80 nA per mg/l Cl_2 (at 20 °C (68 °F), pH 7.2)

12.2 Performance characteristics

12.2.1 Reference operating conditions

20 °C (68 °F)

pH 7.2

12.2.2 Response time

T_{90} < 2 min

in applications involving mainly active chlorination

12.2.3 Measured value resolution

CCS142D-A:	Approx. 15 µg/l Cl_2
CCS142D-G:	Approx. 5 µg/l Cl_2

12.2.4 Measured error

1% of reading

12.2.5 Repeatability

- Sensor: ± 1%
- Reference method: depending on version

Calibration standards do not have long-term stability.

12.2.6 Nominal slope

CCS142D-A:	-25 nA per mg/l
CCS142D-G:	-80 nA per mg/l

12.2.7 Long-term drift

< 1.5 % per month

12.2.8 Polarization time

CCS142D-A:	Commissioning: 60 min, Reoperation: 30 min
CCS142D-G:	Commissioning: 90 min, Reoperation: 45 min

12.2.9 Operating time of the electrolyte

At average medium concentrations of 1 mg/l Cl_2

CCS142D-A:	> 5 years
CCS142D-G:	> 3 years

12.2.10 Chlorine intrinsic consumption

At average medium concentrations of 1 mg/l Cl_2 and under reference operating conditions

CCS142D-A:	25 ng Cl_2 per hour
CCS142D-G:	100 ng Cl_2 per hour

12.3 Environment

12.3.1 Ambient temperature range

–5 to 55 °C (20 to 130 °F), non-freezing

12.3.2 Storage temperature

With electrolyte:	5 to 50 °C (40 to 120 °F)
Without electrolyte:	-20 to 60 °C (-4 to 140 °F)

12.3.3 Degree of protection

IP 68 (up to mounting collar Ø 36 mm (1.42"))

12.4 Process

12.4.1 Process temperature

0 to 45 °C (32 to 110 °F), non-freezing

12.4.2 Process pressure

max. 2 bar (29 psi) absolute, if installed in assembly CCA250

12.4.3 pH range

At average medium concentrations of 1 mg/l Cl_2 and under reference operating conditions

Calibration	
CCS142D-A:	pH 4 to 8
CCS142D-G:	pH 4 to 8.2
Measurement	pH 4 to 9

Chlorine measurement possible up to pH 9 with limited accuracy

12.4.4 Flow

min. 30 l/h (8 gal/h), in assembly CCA250

12.4.5 Minimum flow

min. 15 cm/s (0.5 ft/s)

12.5 Mechanical construction

12.5.1 Dimensions

→ 14

12.5.2 Weight

0.1 kg (0.2 lbs)

12.5.3 Materials

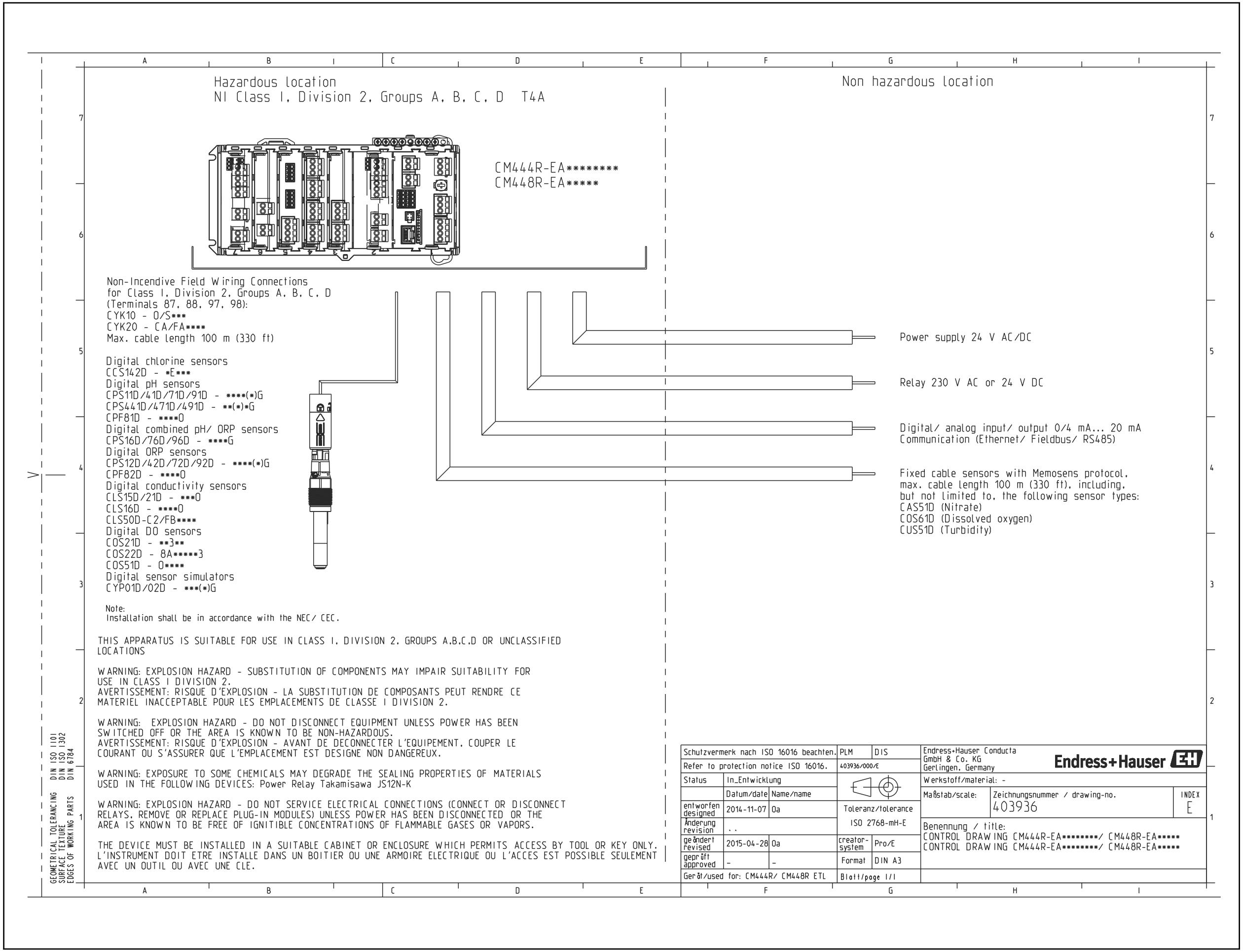
Sensor shaft:	PVC
Membrane:	PTFE
Membrane cap:	PBT (GF 30), PVDF
Cathode:	Gold
Anode:	Silver/silver chloride

12.5.4 Cable specification

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

13 Installation and operation in hazardous environment Class I Div. 2

Non-sparking device for use in specified hazardous environment in accordance with:
- cETLus Class I Div. 2
- Gas group A, B, C, D
- Temperature class T6, -5 °C (23 °F) < Ta < 55 °C (131 °F)
- Control drawing: 403936


Hazardous location
NI Class I, Division 2, Groups A, B, C, D T4A
Non hazardous location
CM444R-EA********
CM448R-EA*****
Non-Incendive Field Wiring Connections
for Class I, Division 2, Groups A, B, C, D
(Terminals 87, 88, 97, 98):
CYK10 - O/S***
CYK20 - CA/FA****
Max. cable length 100 m (330 ft)
Digital chlorine sensors
CCS142D - *E***
Digital pH sensors
CPS11D/41D/71D/91D - ****(*)G
CPS441D/471D/491D - **(*)*G
CPF81D - ****0
Digital combined pH/ ORP sensors
CPS16D/76D/96D - ****G
Digital ORP sensors
CPS12D/42D/72D/92D - ****(*)G
CPF82D - ****0
Digital conductivity sensors
CLS15D/21D - ***0
CLS16D - ****0
CLS50D-C2/FB****
Digital DO sensors
COS21D - **3**
COS22D - 8A*****3
COS51D - 0****
Digital sensor simulators
CYP01D/02D - ***(*)G
Note:
Installation shall be in accordance with the NEC/ CEC.
Power supply 24 V AC/DC
Relay 230 V AC or 24 V DC
Digital/ analog input/ output 0/4 mA... 20 mA
Communication (Ethernet/ Fieldbus/ RS485)
Fixed cable sensors with Memosens protocol,
max. cable length 100 m (330 ft), including,
but not limited to, the following sensor types:
CAS51D (Nitrate)
COS61D (Dissolved oxygen)
CUS51D (Turbidity)
THIS APPARATUS IS SUITABLE FOR USE IN CLASS I, DIVISION 2, GROUPS A,B,C,D OR UNCLASSIFIED LOCATIONS
WARNING: EXPLOSION HAZARD - SUBSTITUTION OF COMPONENTS MAY IMPAIR SUITABILITY FOR USE IN CLASS I DIVISION 2.
AVERTISSEMENT: RISQUE D'EXPLOSION - LA SUBSTITUTION DE COMPOSANTS PEUT RENDRE CE MATERIEL INACCEPTABLE POUR LES EMPLACEMENTS DE CLASSE I DIVISION 2.
WARNING: EXPLOSION HAZARD - DO NOT DISCONNECT EQUIPMENT UNLESS POWER HAS BEEN SWITCHED OFF OR THE AREA IS KNOWN TO BE NON-HAZARDOUS.
AVERTISSEMENT: RISQUE D'EXPLOSION - AVANT DE DECONNECTER L'EQUIPEMENT, COUPER LE COURANT OU S'ASSURER QUE L'EMPLACEMENT EST DESIGNE NON DANGEREUX.
WARNING: EXPOSURE TO SOME CHEMICALS MAY DEGRADE THE SEALING PROPERTIES OF MATERIALS USED IN THE FOLLOWING DEVICES: Power Relay Takamisawa JS12N-K
WARNING: EXPLOSION HAZARD - DO NOT SERVICE ELECTRICAL CONNECTIONS (CONNECT OR DISCONNECT RELAYS, REMOVE OR REPLACE PLUG-IN MODULES) UNLESS POWER HAS BEEN DISCONNECTED OR THE AREA IS KNOWN TO BE FREE OF IGNITIBLE CONCENTRATIONS OF FLAMMABLE GASES OR VAPORS.
THE DEVICE MUST BE INSTALLED IN A SUITABLE CABINET OR ENCLOSURE WHICH PERMITS ACCESS BY TOOL OR KEY ONLY.
L'INSTRUMENT DOIT ETRE INSTALLE DANS UN BOITIER OU UNE ARMOIRE ELECTRIQUE OU L'ACCES EST POSSIBLE SEULEMENT AVEC UN OUTIL OU AVEC UNE CLE.
GEOMETRICAL TOLERANCING DIN ISO 1101
SURFACE TEXTURE DIN ISO 1302
EDGES OF WORKING PARTS DIN 6784
Schutzvermerk nach ISO 16016 beachten.
Refer to protection notice ISO 16016.
PLM DIS
403936/000/E
Status In_Entwicklung
Datum/date Name/name
entworfen designed 2014-11-07 Oa
Änderung revision . .
geändert revised 2015-04-28 Oa
geprüft approved - -
Gerät/used for: CM444R/ CM448R ETL
Toleranz/tolerance ISO 2768-mH-E
creator-system Pro/E
Format DIN A3
Blatt/page 1/1
Endress+Hauser Conducta GmbH & Co. KG Gerlingen, Germany
Endress+Hauser
Werkstoff/material: -
Maßstab/scale:
Zeichnungsnummer / drawing-no. 403936
INDEX E
Benennung / title:
CONTROL DRAWING CM444R-EA********/ CM448R-EA*****
CONTROL DRAWING CM444R-EA********/ CM448R-EA*****

Index

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