

Operating Instructions

Liquisys M CCM223/253

Transmitter for free chlorine, chlorine dioxide and total chlorine

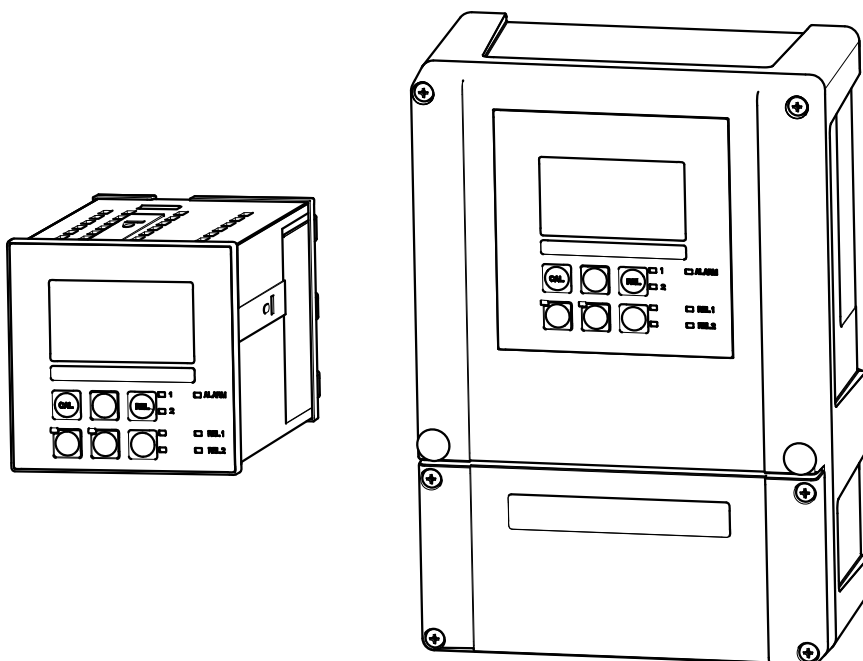


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1 Document information


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 used

-  Additional information, tips
-  Permitted or recommended
-  Forbidden or not recommended

1.3 Symbols on the device

Symbol	Meaning
	Reference to device documentation


1.4 Electrical symbols

Symbol	Meaning
 A0027423	Direct current A terminal at which DC is present or through which DC flows.
 A0027424	Alternating current A terminal to which alternating voltage (sine-wave) is applied or through which alternating current flows.
 A0027425	Direct current or alternating current A terminal at which direct voltage or alternating voltage is present or through which direct current or alternating current flows.
 A0027426	Ground connection A terminal which, from the user's point of view, is already grounded via a grounding system.
 A0027427	Protective ground connection A terminal which must be connected to ground prior to establishing any other connections.
 A0019929	Class II equipment Reinforced or double insulation
 A0027420	Alarm relay
 A0027428	Input
 A0027429	Output
 A0027430	DC voltage source
 A0027431	Temperature sensor

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 may only be carried out directly by the manufacturer or by the service organization.

2.2 Designated use

Liquisys M CCM223/253 is a transmitter for determining the amount of free chlorine, chlorine dioxide or total chlorine dissolved in water.

The transmitter is particularly suited for use in the following areas:

- Drinking water
- Water treatment
- Cooling water
- Gas scrubbers
- Reverse osmosis
- Food processing
- Swimming pool and bathing pool water

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

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

2.5.1 State of the art

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.

2.5.2 IT security

We only provide a warranty if the device is installed and used as described in the Operating Instructions. The device is equipped with security mechanisms to protect it against any inadvertent changes to the device settings.

IT security measures in line with operators' security standards and designed to provide additional protection for the device and device data transfer must be implemented by the operators themselves.

3 Incoming acceptance and product identification

3.1 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.

3.2 Scope of delivery

The delivery of the field device comprises:

- 1 transmitter
- 1 plug-in screw terminal, 3-pin
- 1 cable gland Pg 7
- 1 cable gland Pg 16 reduced
- 2 cable glands Pg 13.5
- 1 set of Operating Instructions
- For versions with HART communication:
 - 1 set of Operating Instructions: Field communication with HART
- For versions with PROFIBUS interface:
 - 1 set of Operating Instructions: Field communication with PROFIBUS PA/DP

The delivery of the panel-mounted device comprises:

- 1 transmitter
- 1 set of plug-in screw terminals
- 2 tensioning screws
- Also for EP version: 1 BNC connector (solder-free)
- 1 set of Operating Instructions
- For versions with HART communication:
 - 1 set of Operating Instructions: Field communication with HART
- For versions with PROFIBUS interface:
 - 1 set of Operating Instructions: Field communication with PROFIBUS PA/DP

3.3 Product identification

3.3.1 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
- Input and output values
- Safety information and warnings



Compare the data on the nameplate with your order.

3.3.2 Product identification

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.

3.4 Certificates and approvals

3.4.1 CE mark

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.

3.4.2 CSA General Purpose

The following device versions meet the requirements of CSA and ANSI/UL for Canada and the US:

- CCM253-**2/3/7***
- CCM223-**2/3/7***

4 Installation

4.1 Installation at a glance

Proceed as follows to completely install the measuring point:

- Install the transmitter (see the "Installation instructions" section).
- If the sensor is not yet installed in the measuring point, install it (see Technical Information of the sensor).
- Connect the sensor to the transmitter as illustrated in the "Electrical connection" section.
- Connect the transmitter as illustrated in the "Electrical connection" section.
- Commission the transmitter as explained in the "Commissioning" section.

4.1.1 Measuring system

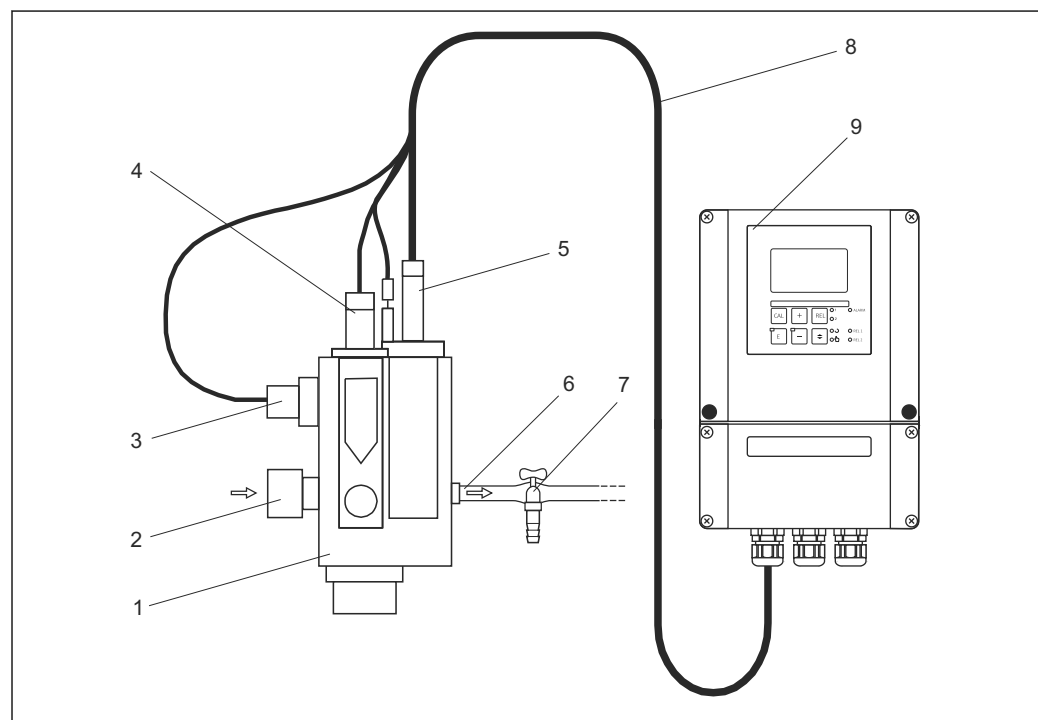
Version 1: free chlorine and chlorine dioxide

A complete measuring system comprises:

- Transmitter Liquisys M CCM223 or CCM253
- A membrane covered sensor CCS140/141 for Cl_2 or CCS240/241 for ClO_2 an open sensor 963 for Cl_2
- Flow assembly CCA250 (not required for sensor 963)

Optionally:

- pH or ORP electrode
- Proximity switch INS for flow monitoring (not with sensor 963)
- Extension cable CMK for chlorine measurement
- Extension cable CYK71 for pH/ORP measurement
- An extension cable MK for proximity switch INS
- Junction box VBC



1 Measuring system for the measurement of free chlorine or chlorine dioxide in flow operation (example)

- 1 Flow assembly CCA250
- 2 Medium inflow
- 3 Proximity switch INS
- 4 Mounting location for pH/ORP sensors
- 5 Chlorine sensor
- 6 Medium outlet
- 7 Sampling tap
- 8 Measuring cable
- 9 Transmitter CCM253

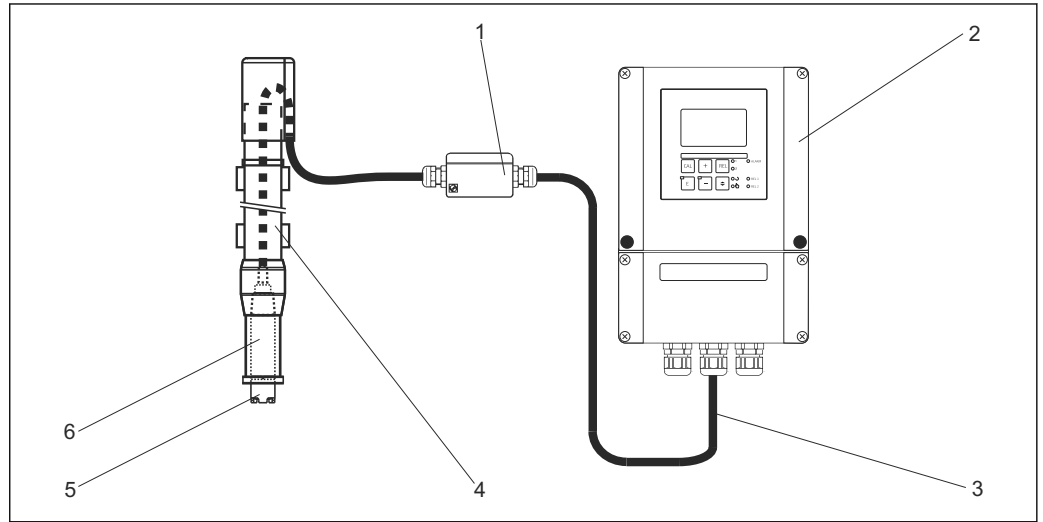
Version 2: total chlorine

A complete measuring system comprises:

- Transmitter Liquisys M CCM223 or CCM253
- Total chlorine sensor CCS120
- Flow assembly CCA250 or immersion assembly CYA611
- Measuring cable CPK9 with internal PML

Optionally:

- pH or ORP electrode
- Proximity switch INS for flow monitoring (only with flow assembly)
- Extension cable CPK9 with internal PML for chlorine measurement
- Extension cable CYK71 for pH/ORP measurement
- An extension cable MK for proximity switch INS
- Junction box VBC
- Weather protection cover CYY101 for field housing



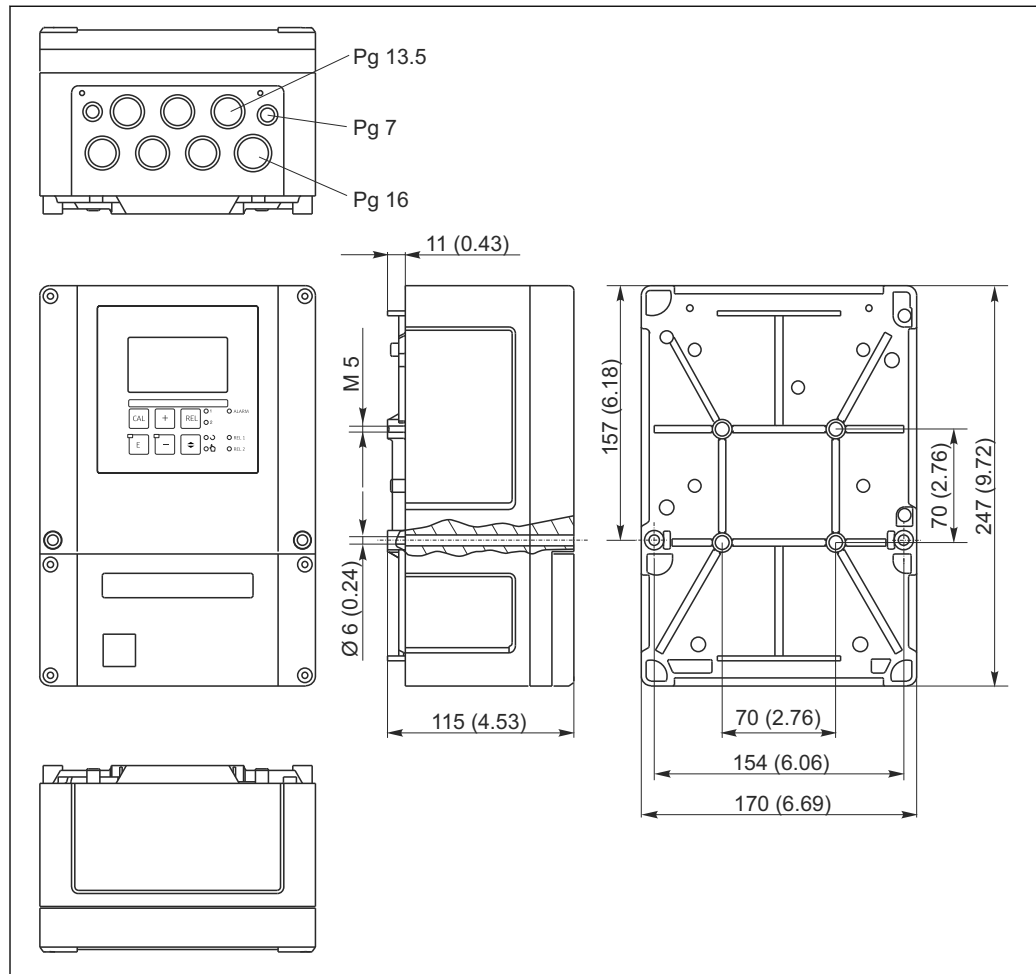
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■ 2 Measuring system for the measurement of total chlorine in immersion operation (example)

- 1 Junction box
- 2 Transmitter CCM253
- 3 Measuring cable
- 4 Immersion assembly CYA611
- 5 Chlorine sensor CCS120
- 6 Assembly adapter G1

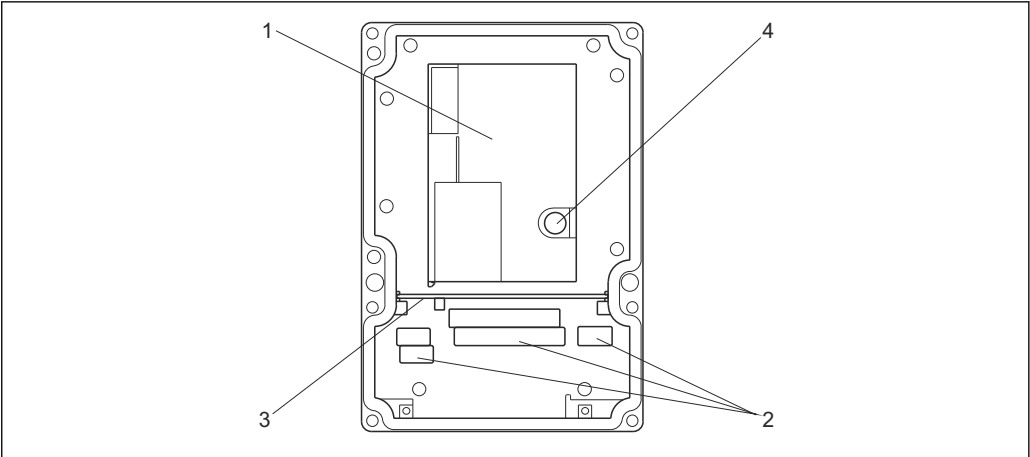
4.2 Installation conditions

4.2.1 Field device



3 Field device, dimensions in mm (inch)

i There is a hole in the perforation for the cable entry (connection of supply voltage). It serves as a pressure balance during air shipment. Make sure no moisture penetrates the inside of the housing before the cable installation. The housing is completely air-tight after cable installation.

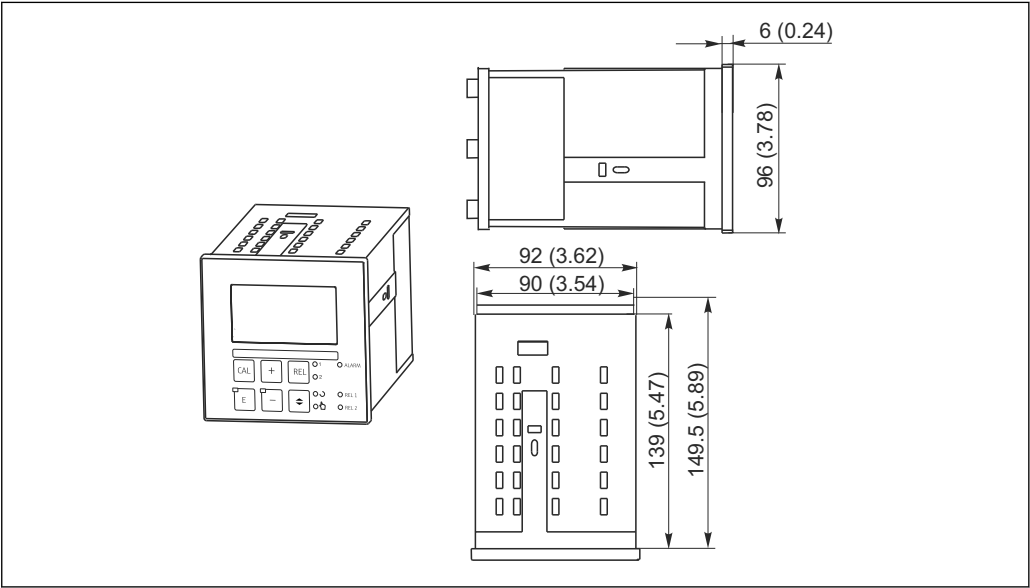


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4 View into the field housing

- 1 Removable electronics box
- 2 Terminals
- 3 Partition plate
- 4 Fuse

4.2.2 Panel-mounted device



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5 Panel-mounted device, dimensions in mm (inch)

4.3 Installation instructions

4.3.1 Field device

There are several ways of securing the field housing:

- Wall mounting with fixing screws
- Post mounting to cylindrical pipes
- Post mounting to a square securing mast

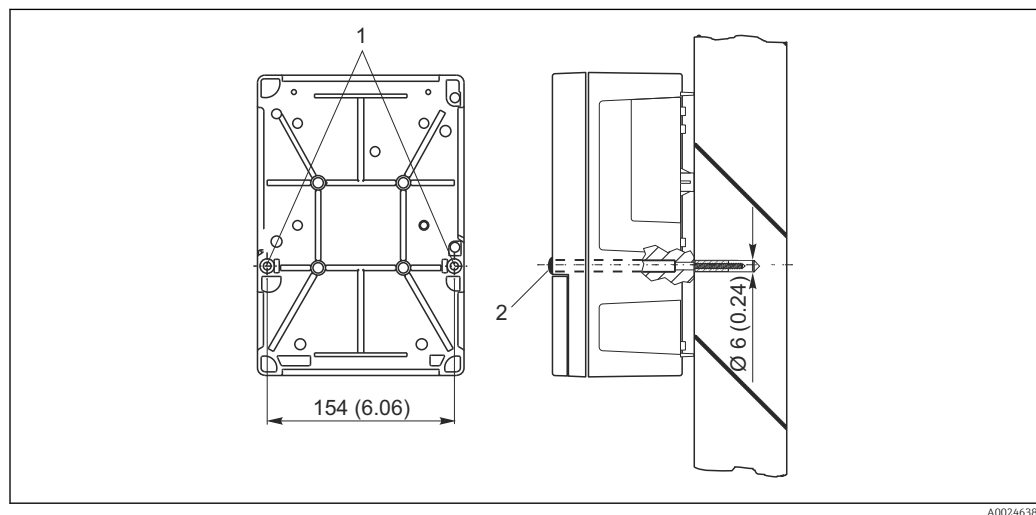
NOTICE

Effect of climatic conditions (rain, snow, direct sunlight etc.)

Impaired operation to complete transmitter failure

- When installing outside, always use the weather protection cover (accessory).

Transmitter wall mounting



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6 Field device wall mounting

1 Fixing bore holes

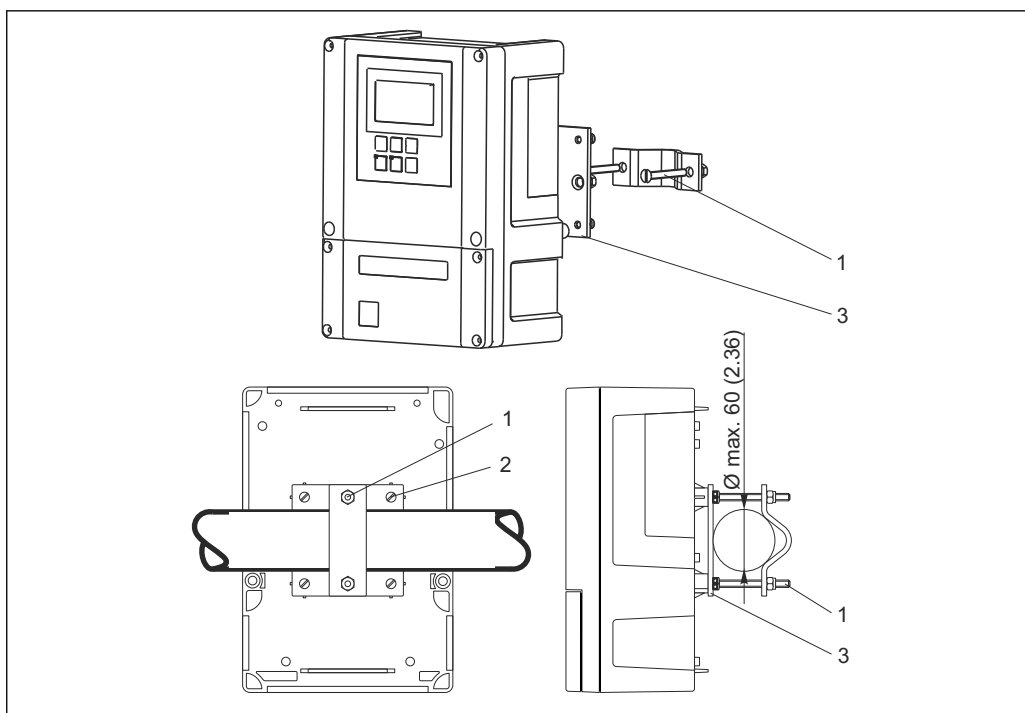
2 Plastic caps

Proceed as follows to mount the transmitter on the wall:

- Create the bore holes as shown in → 6.
- Drive two fixing screws through the fixing bore holes (1) from the front.
- Mount the transmitter on the wall as shown.
- Cover the bores with plastic caps (2).

Transmitter post mounting

i You require a post mounting kit to secure the field device to horizontal and vertical posts or pipes (max. Ø 60 mm (2.36")). This can be acquired as an accessory (see the "Accessories" section).



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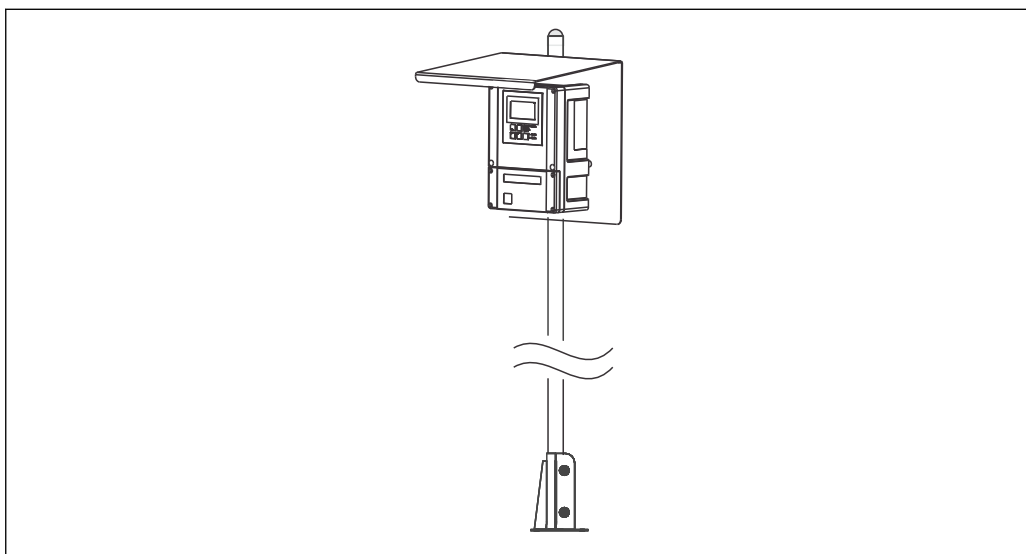
7 Field device on horizontal or vertical pipes

- 1 Securing screws
- 2 Fixing screws
- 3 Securing plate

Proceed as follows to mount the transmitter on a post:

1. Guide the two securing screws (1) of the mounting kit through the openings on the securing plate (3).
2. Screw the securing plate onto the transmitter using the four fixing screws (2).
3. Secure the bracket with the field device on the post or pipe using the clip.


You can also secure the field device to the Flexdip CYH112 bracket in conjunction with the weather protection cover. These can be acquired as accessories, see the "Accessories" section.



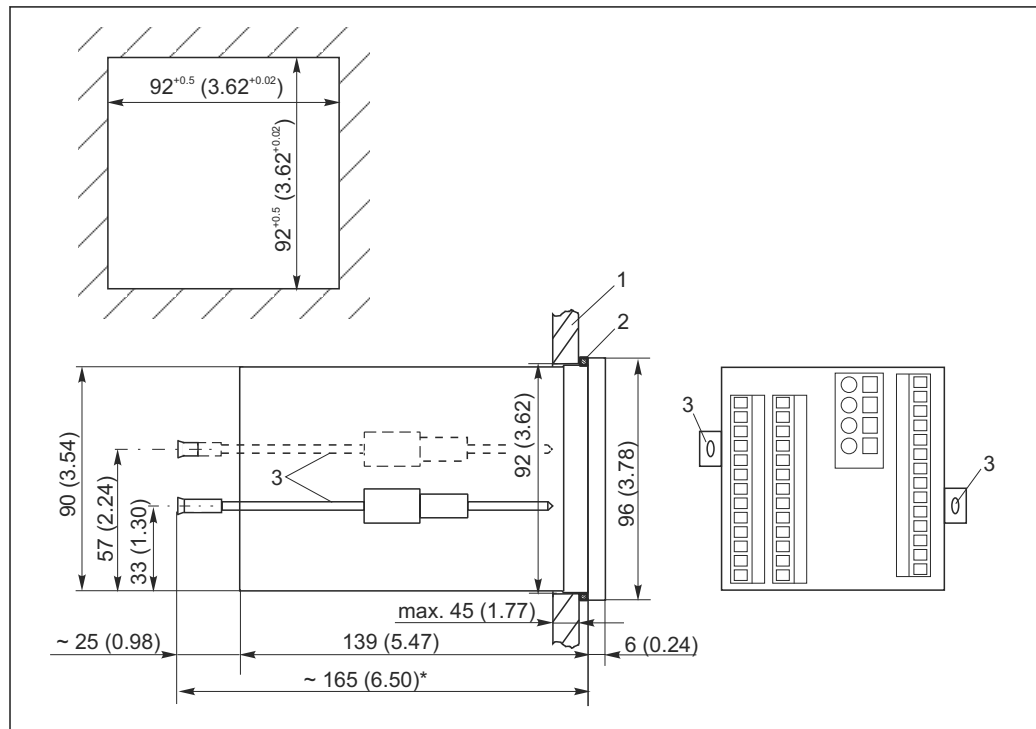
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8 Field device on Flexdip CYH112 bracket with weather protection cover

4.3.2 Panel-mounted device

The panel-mounted device is secured with the tensioning screws supplied →  9

The necessary installation depth is approx. 165 mm (6.50").



 9 Dimensions in mm (inch)

1 Mounting plate

2 Seal

3 Tensioning screws

* Necessary installation depth

4.4 Post-installation check

- After installation, check the transmitter for damage.
- Check whether the transmitter is protected against moisture and direct sunlight (e.g. by the weather protection cover).

5 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.

5.1 Wiring

WARNING

Risk of electric shock!

- ▶ At the supply point, the power supply must be isolated from dangerous live cables by double or reinforced insulation in the case of devices with a 24 V power supply.

NOTICE

The device does not have a power switch

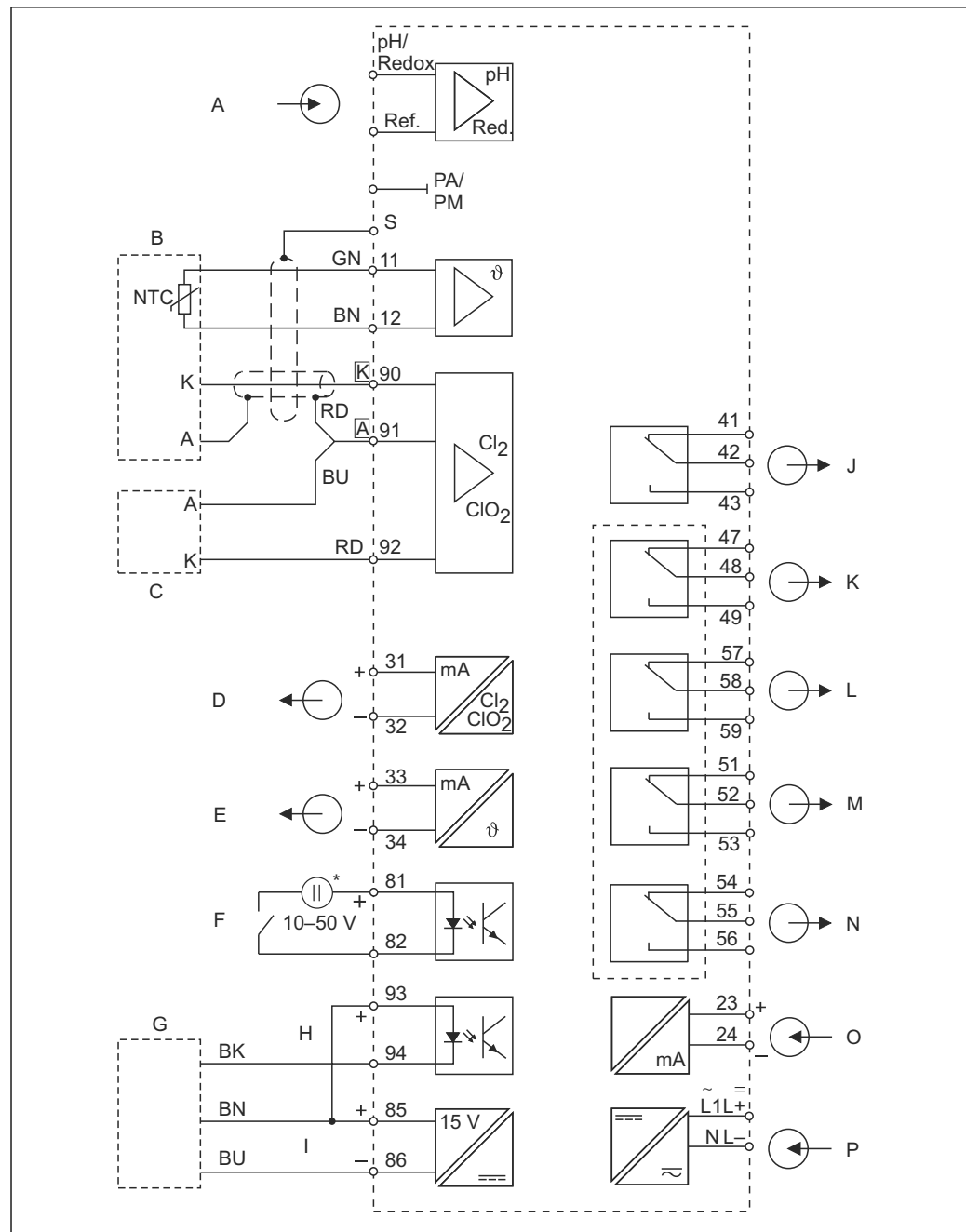
- ▶ The customer must provide a protected circuit breaker in the vicinity of the device.
- ▶ The circuit breaker must be a switch or power switch, and you must label it as the circuit breaker for the device.

The electrical connection of the transmitter depends on the sensor:

- If you are using the membrane-covered sensor CCS140 / 141 / 240 / 241 or the open sensor 963, follow the instructions and illustrations in the "Electrical connection, version 1" section.
- If you are using the total chlorine sensor CCS120, follow the instructions and illustrations in the "Electrical connection, version 2" section.

5.2 Electrical connection, version 1

The wiring diagram shows the connections of a device equipped with all the options. The connection of the sensors to the various measuring cables is explained in more detail in the "Measuring cables and sensor connection" section.



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10 Electrical connection of the transmitter (version 1)

A pH/ORP input (optional)

B Sensor CCS140/141/240/241

C Sensor 963 (alternative)

D Signal output 1, chlorine / chlorine dioxide

E Signal output 2, temperature, pH or ORP

F Binary input 1 (hold/cleaning)

G Proximity switch INS

H Binary input 2

* Auxiliary voltage of terminal 85/86 can be used

I Auxiliary voltage output

J Alarm (current-free contact position)

K Relay 1 (current-free contact position)

L Relay 2 (current-free contact position)

M Relay 3 (current-free contact position)

N Relay 4 (current-free contact position)

O Current input 4 to 20 mA

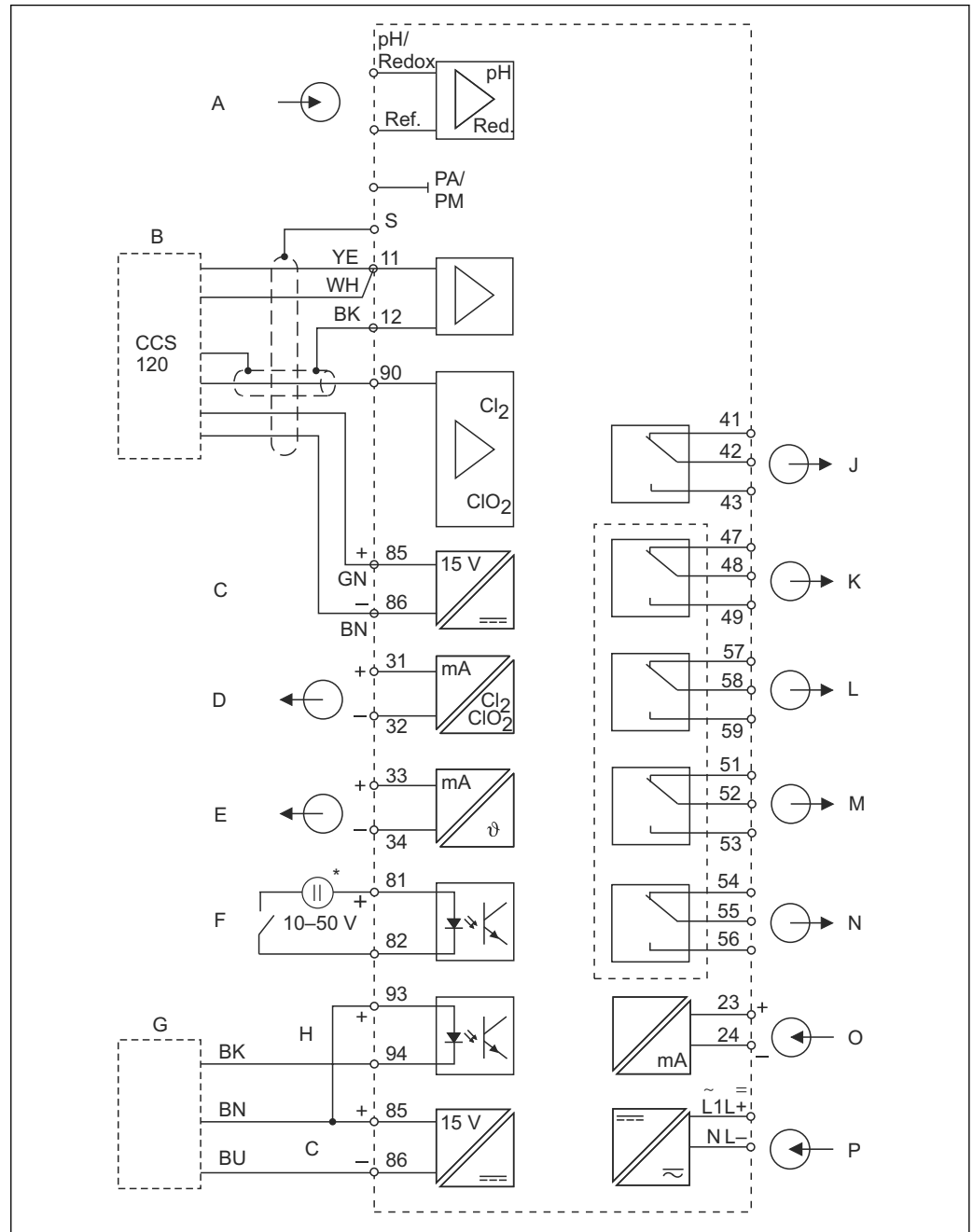
P Power connection



The device is approved for protection class II and is generally operated without a protective ground connection. Circuits "E" and "T" are not galvanically isolated from each other.

5.3 Electrical connection, version 2

The wiring diagram shows the connections of a device equipped with all the options. The connection of the sensors to the various measuring cables is explained in more detail in the "Measuring cables and sensor connection" section.



11 Electrical connection of the transmitter (version 2)

- A pH/ORP input (optional)
- B Sensor CCS120
- C Auxiliary voltage output
- D Signal output 1, total chlorine
- E Signal output 2, temperature, pH or ORP
- F Binary input 1 (hold/cleaning)

- * Auxiliary voltage of terminal 85/86 can be used
- J Alarm (current-free contact position)
- K Relay 1 (current-free contact position)
- L Relay 2 (current-free contact position)
- M Relay 3 (current-free contact position)
- N Relay 4 (current-free contact position)

- G

Proximity switch INS
- H

Binary input 2
- O

Current input 4 to 20 mA
- P

Power connection

i The device is approved for protection class II and is generally operated without a protective ground connection. Circuits "E" and "C" are not galvanically isolated from each other.

5.4 Device connection

Field device connection

Proceed as follows to connect the field device:

1.

Open the housing cover to access the terminal block in the connection compartment.
2.

Break through the perforation for a cable gland, mount a Pg gland and guide the cable through this Pg gland.
3.

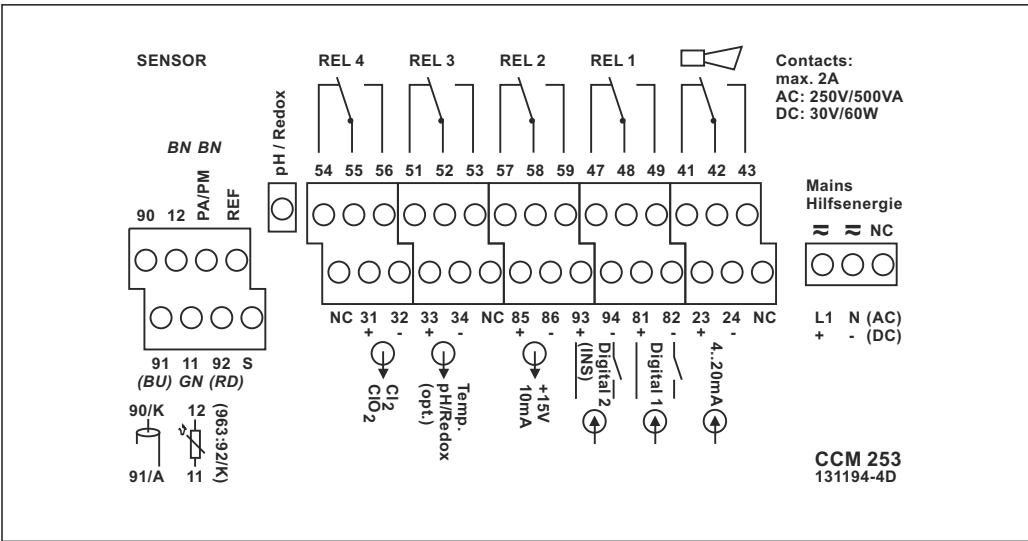
Connect the cable in accordance with the terminal assignment.
4.

Tighten the Pg gland again.

NOTICE

Non-observance could cause incorrect measurement.

- Make absolutely sure to protect the cable ends and terminals from moisture.
- Terminals marked NC may not be connected.
- Unmarked terminals may not be connected.

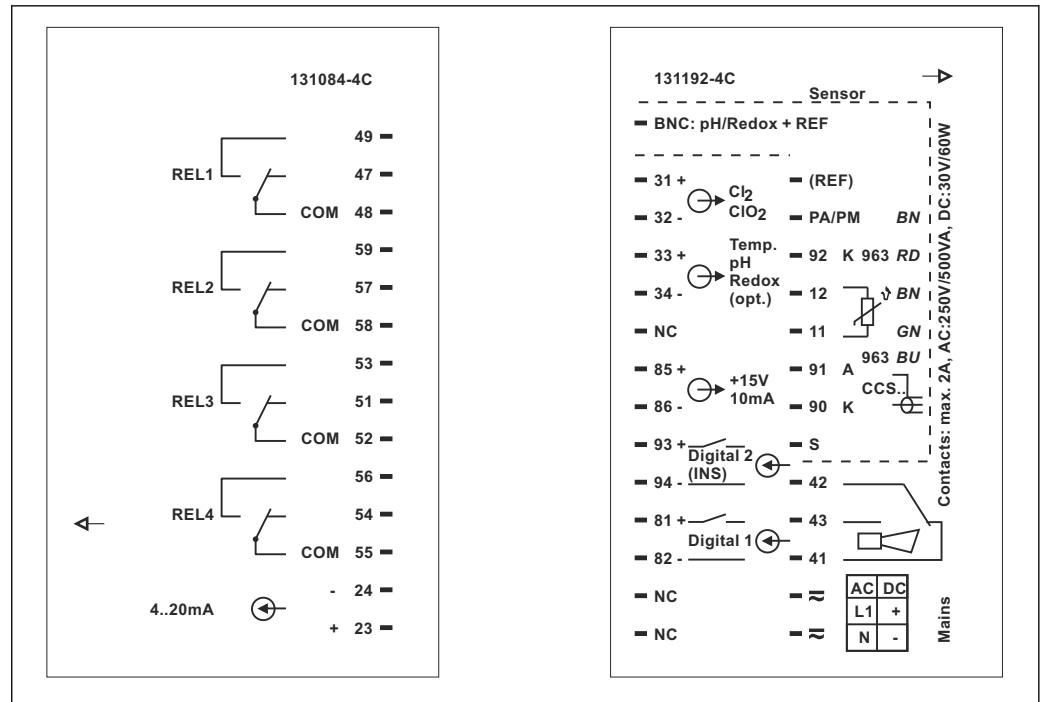


12 Field device connection compartment sticker

i Please label the sensor terminal block with the sticker provided.

Panel-mounted device connection

To connect the panel-mounted device, connect the cables in accordance with the terminal assignment to the terminals on the rear of the device.




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13 Panel-mounted device connection sticker

NOTICE

Non-observance could cause incorrect measurement.

- Make absolutely sure to protect the cable ends and terminals from moisture.
- Terminals marked NC may not be connected.
- Unmarked terminals may not be connected.

 Please label the sensor terminal block with the sticker provided.

5.5 Measuring cables and sensor connection

Sensor type	Cable	Extension
Chlorine/chlorine dioxide sensors CCS140 / 141 / 240 / 241	3 m (9.8 ft) CMK, permanently connected	VBC box + CMK
Chlorine sensor 963	-	VBC box + MK
Temperature sensor for chlorine sensor 963	CPK1	
Total chlorine sensor CCS120	CPK9-N*A1B	VBC box + CYK71
pH or ORP sensor without temperature sensor	CPK1 for sensors with GSA plug-in head CPK9 for sensors with ESA plug-in head	VBC box + CYK71

Connecting the chlorine sensors CCS140 / 141 / 240 / 241

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

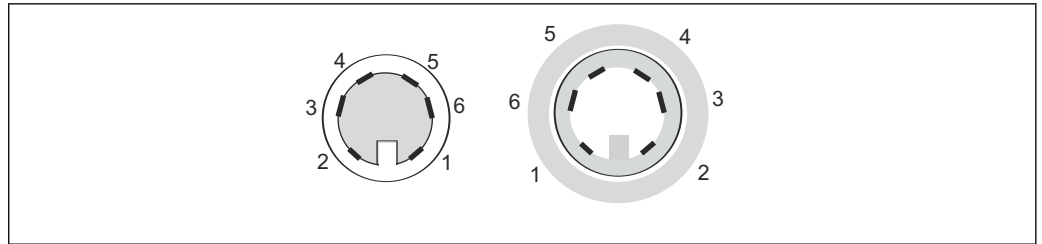
Sensor with 3 m fixed cable		Transmitter
Assignment	Core	Terminal
Outer shield		S
Anode	[A] red	91
Cathode	[K]	90
NTC temperature sensor	green	11
NTC temperature sensor	brown	12

Connecting the total chlorine sensor CCS120

Connect the sensor with the measuring cable CPK9-N*A1B (with internal PML) according to the following connection diagram:

Cable with TOP68 connection			Transmitter
Pin	Assignment	Core	Terminal
1	TC signal	Coax, inside (white)	90
2	AGND	Coax, outside (black)	12
3			
4	+UB (15 V)	green	85
5	NTC1	yellow*	11
	NTC1	white*	11
6	NTC2/AGND	brown	86
S	Shielding	S	S

* The white and yellow wires are interconnected in the TOP68 connector.



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14 TOP68 connection; pin arrangement of connector and coupling (shown from contact side)

Connecting the chlorine sensor 963

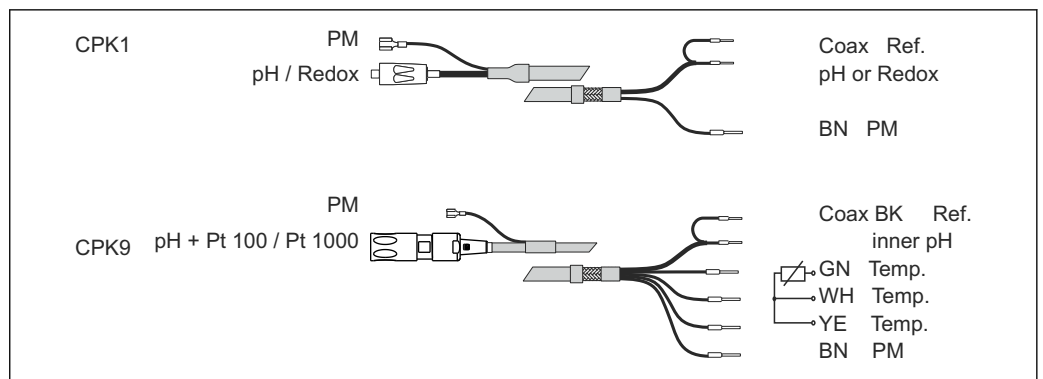
The chlorine sensor 963 is supplied without a temperature sensor ex factory. Connect the chlorine sensor to the transmitter as follows:

- Without temperature measurement:
Connect the 10 kΩ equivalent resistor supplied to terminals 11 and 12. The measured value display will then constantly show 25 °C (77 °F).
- With temperature measurement:
Mount an NTC temperature sensor 10 kΩ / 25 °C (77 °F) (120 mm installation version TSP 3692) in the chlorine sensor 963. Use the CPK1 connecting cable to connect the temperature sensor to terminals 11 and 12.
- Chlorine sensor:
Connect the red cable to terminal 92 (cathode) and the blue cable to terminal 91 (anode).

Connection of pH or ORP sensors

Connect the pH or ORP sensor always symmetrically to prevent a mutual interference of several sensors mounted in the CCA250 assembly.

Symmetrical connection requires a potential matching pin. The pin is integrated as standard in the CCA250 flow assembly and is connected by a PML to the PA/PM terminal.

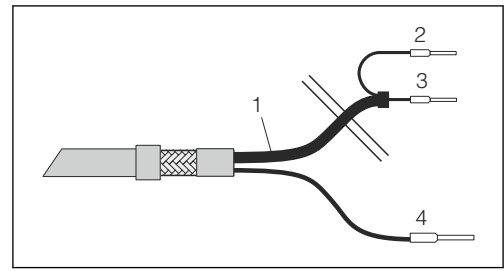


A0002330-EN

15 Connection of the pH or ORP sensor to the field instrument with the cables CPK1 or CPK9

If you are using glass electrodes with the panel-mounted device, you have to terminate the measuring cable with a BNC connector. A solder-free BNC connector is supplied with the device. To do this, proceed as follows:

1. Cut off end ferrules 2 and 3 of the coaxial cable.



A0005744

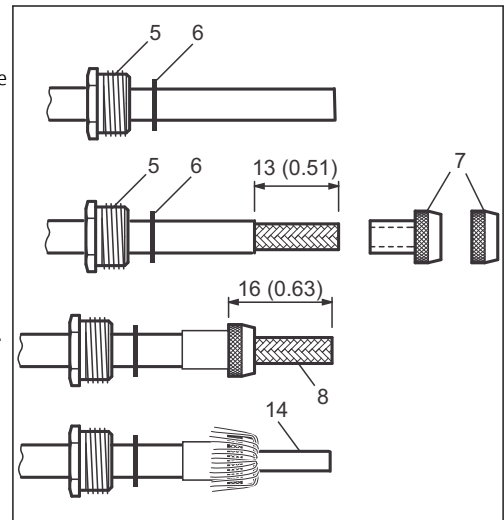
16 Cable CPK1: device connection

- 1 Coax cable
- 2 Inner shield BK (ref)
- 3 Inner coax (pH / mV)
- 4 Strand BN (PA)

2. Push the cable gland 5 and the washer 6 onto the coaxial cable.
3. Remove the insulation (13 mm (0.51")) and screw the clamping ring 7 onto the insulation.

i Parts 5 to 7 are supplied with the BNC connector for cable diameters 3.2 mm and 5 mm.

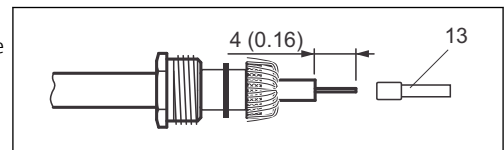
4. Fold the braided shield 8 of the shield over the clamping ring and cut off the excess material.
5. There is a semiconductor layer 14 (conductive membrane) between the inner insulation and the braided shield 8. Strip this semiconductor layer as far as the braided shield.



A0005745

17 Terminating the pH connecting cable for mounting the BNC elbow plug. Dimensions in mm (inch)

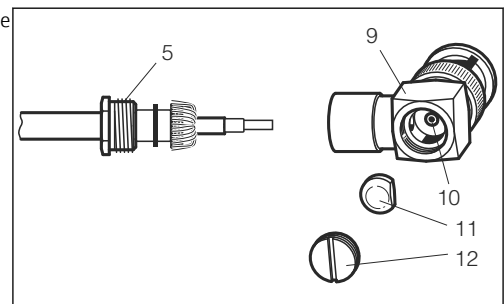
6. Remove the inner insulation (4 mm (0.16")), fit end ferrule 13 on the stripped inner conductor and secure the end ferrule with a crimping pliers.



A0005746

18 Terminating the pH connecting cable for mounting the BNC elbow plug. Dimensions in mm (inch)

7. Push the BNC connector housing 9 over the cable. The inner conductor must be located on the clamping surface 10 of the connector.
8. Tighten the cable gland 5.
9. Insert the clamp element 11 and screw in the connector cover 12. This creates a safe connection between the inner conductor and the connector pin.

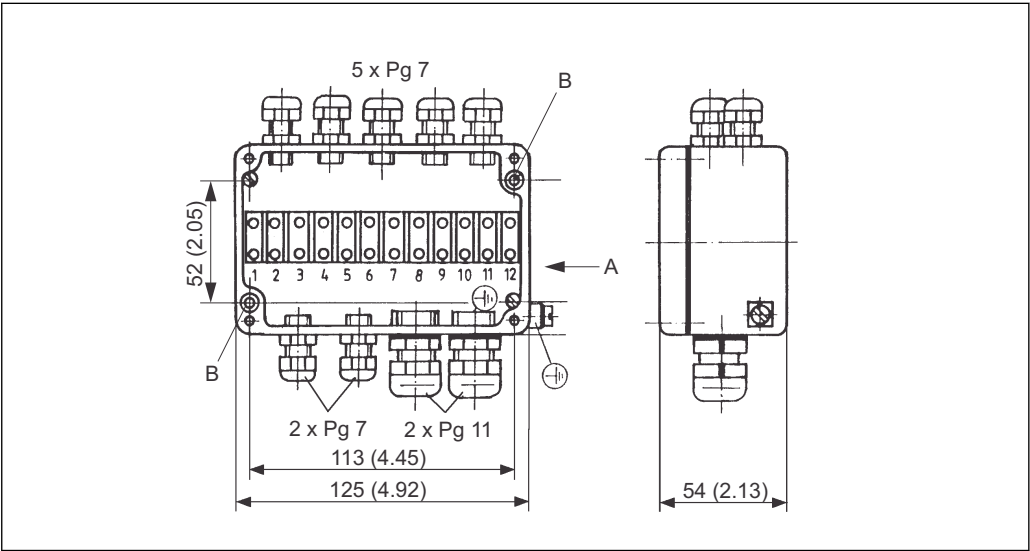


A0005747

19 Mounting the pH connecting cable in the BNC elbow plug

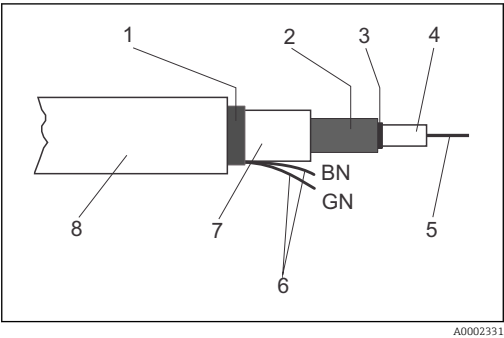
Sensor	Maximum cable length
Chlorine/chlorine dioxide sensors CCS140/141/240/ 241	Max. 30 m (98.4 ft) with cable CMK
Chlorine sensor 963	Max. 30 m (98.4 ft) with cable MK
Total chlorine sensor CCS120	Max. 15 m (49.2 ft) with cable CYK71
pH/ORP measurement	Max. 50 m (164 ft) with cable CYK71

Use the junction box VBC and the appropriate extension cable to extend the measuring cable.



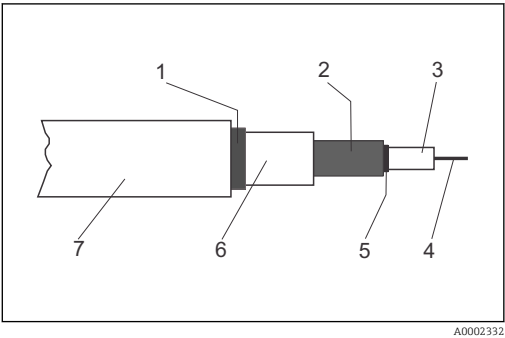
20 Junction box VBC with grounding point

- A View in arrow direction
- B 2 fixing bore holes Ø 4.5 mm (0.18")



21 Structure of cable CMK

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



22 Structure of cable CYK71

- 1 Outer shield
- 2 Inner shield, reference signal
- 3 Inner insulation
- 4 Inner conductor, measuring signal
- 5 Semi-conductor layer
- 6 2nd insulation
- 7 Outer insulation

NOTICE

Incorrect measurement due to short-circuit

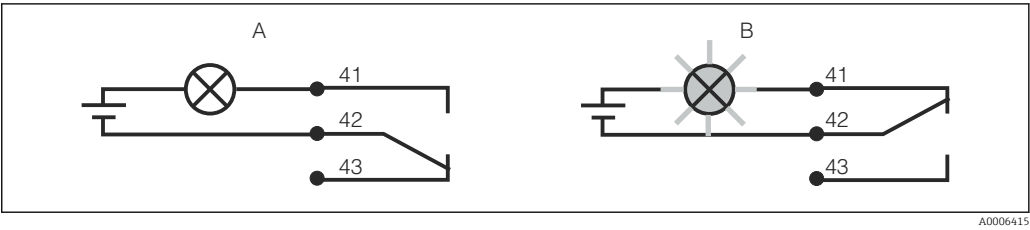
- Make sure to remove the black semiconductor layer as far as the inner shield when connecting cable CMK and CYK71.

5.6 Three-point step controller for Cl₂ / ClO₂ / total chlorine

Connect the continuously variable motor valves as follows:

1. Connect the NO contact of the motor valve to relay 3.
2. Connect the NC contact of the motor valve to relay 4.

5.7 Alarm contact



23 Recommended fail-safe switching for the alarm contact

A Normal operating status
B Alarm condition

Normal operating status

- Device in operation and no error message present (alarm LED off):
- Relay energized
 - Contact 42/43 closed

Alarm condition

- Error message present (alarm LED red) or device defective or de-energized (alarm LED off):
- Relay de-energized
 - Contact 41/42 closed

5.8 Post-connection check

Carry out the following checks once you have made the electrical connection:

Device state and specifications	Notes
Are the devices and cables free from damage on the outside?	Visual inspection

Electrical connection	Notes
Are the mounted cables strain relieved?	
Are the connected cables provided with strain relief?	
Is the cable run correct, without loops and cross-overs?	
Are the power cable and signal cables connected correctly and in accordance with the wiring diagram?	
Are all the screw terminals tightened?	
Are all the cable entries fitted, tightened and leak-proof?	

6 Operation options

6.1 Quick operation guide

You have the following ways of operating the transmitter:

- On site via the key field
- Via the HART interface (optional, with corresponding order version) with:
 - HART handheld terminal
 - PC with HART modem and the Fieldcare software package
- Via PROFIBUS PA/DP (optional, with corresponding order version) by PC with a corresponding interface and the Fieldcare software package or via a programmable logic controller (PLC).

 For operation via HART or PROFIBUS PA/DP, please read the relevant sections in the additional Operating Instructions:








- PROFIBUS PA/DP, field communication for Liquisys M CXM223/253, BA00209C/07/EN
- HART, field communication for Liquisys M CXM223/253, BA00208C/07/EN

The following section only explains operation via the keys.

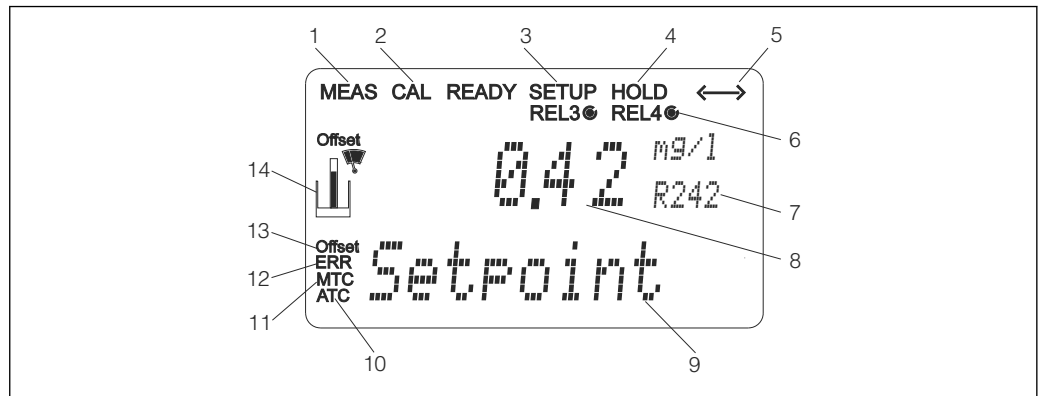
6.2 Display and operating elements

6.2.1 Display

LED displays

<div><div></div><div></div><div>A0027220</div></div>	Indicates the current operating mode, "Auto" (green LED) or "Manual" (yellow LED)
<div><div></div><div></div><div>A0027222</div></div>	Indicates the activated relay in the "Manual" mode (red LED) The status of relays 3 and 4 is indicated on the LC display.
<div><div></div><div></div><div>A0027221</div></div>	Indicates the working status of relay 1 and 2 LED green: measured value within the permitted limit, relay inactive LED red: measured value outside the permitted limit, relay active
<div><div></div><div>A0027218</div></div>	Alarm display, e.g. in event of continuous limit value overshoot, temperature sensor failure or system error (see error list)

LC display



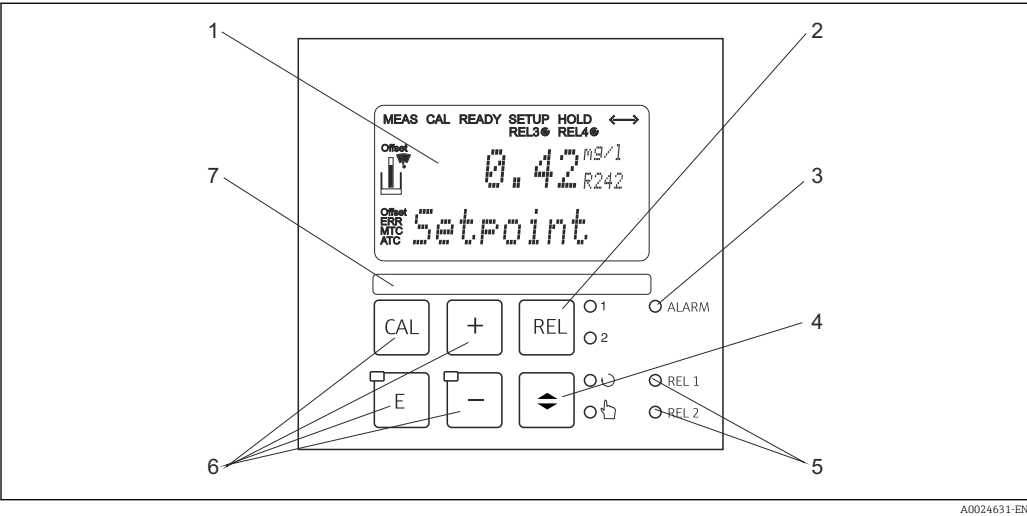
A0001924-EN

24 Transmitter LC display

- 1 Indicator for measuring mode (normal operation)
- 2 Indicator for calibration mode
- 3 Indicator for setup mode (configuration)
- 4 Indicator for "Hold" mode (current outputs remain at last current state)
- 5 Indicator for receipt of a message on devices with communication
- 6 Indicator of working status of relays 3/4: ○ inactive, ● active
- 7 Function code
- 8 In measuring mode: measured variable - in setup mode: configured variable
- 9 In measuring mode: secondary measured value - in setup/calibr. mode: e.g. set value
- 10 Indicator for autom. Temperature compensation
- 11 Indicator for man. Temperature compensation
- 12 "Error": error display
- 13 Temperature offset
- 14 Sensor symbol (see the "Calibration" section)



6.2.2 Operating elements

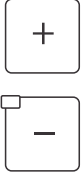

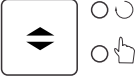
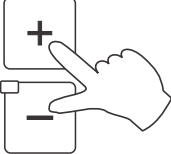
The display shows the current measured value and the temperature simultaneously, which means you have an overview of the most important process data at once. Help text in the configuration menu helps users configure the device parameters.

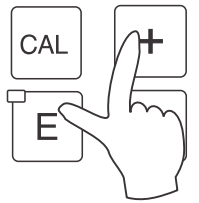
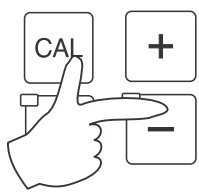


- 25 Operating elements
- 1 LC display for displaying the measured values and configuration data
 - 2 Key to switch relays in manual mode and to display the active contact
 - 3 LED for alarm function
 - 4 Changeover switch for automatic/manual mode
 - 5 LEDs for limit contactor relay (switch status)
 - 6 Main operating keys for calibration and device configuration
 - 7 Field for user-defined information

6.2.3 Key functions

<div></div> <div>A0027235</div>	<p>CAL key</p> <p>When you press the CAL key, the device first prompts you for the calibration access code:</p> <ul style="list-style-type: none">■ Code 22 for calibration■ Code 0 or any other code for reading the last calibration data <p>Use the CAL key to accept the calibration data or to switch from field to field within the calibration menu.</p>
<div></div> <div>A0027236</div>	<p>ENTER key</p> <p>When you press the ENTER key, the device first prompts you for the setup mode access code:</p> <ul style="list-style-type: none">■ Code 22 for setup and configuration■ Code 0 or any other code for reading all the configuration data. <p>The ENTER key has several functions:</p> <ul style="list-style-type: none">■ Calls up the Setup menu from the measuring mode■ Saves (confirms) data entered in the setup mode■ Moves on within function groups

 <p>A0027240</p>	<p>PLUS key and MINUS key</p> <p>In the Setup mode, the PLUS and MINUS keys have the following functions:</p> <ul style="list-style-type: none"> ■ Selection of function groups. Press the MINUS key to select the function groups in the order given in the "System configuration" section. ■ Configuration of parameters and numerical values ■ Operation of the relays in manual mode <p>In the measuring mode, the following sequence of functions is accessed by repeatedly pressing the PLUS key:</p> <ul style="list-style-type: none"> ■ Temperature displayed in °F ■ Temperature is hidden ■ pH measured value or ORP (only for EP version) ■ pH sensor signal in mV (only for EP version) ■ Sensor current of chlorine/chlorine dioxide sensor in nA ■ Zero current of sensor CCS120 ■ Current input signal in % ■ Current input signal in mA ■ Return to basic settings <p>In the measuring mode, the following sequence of information is displayed by repeatedly pressing the MINUS key:</p> <ul style="list-style-type: none"> ■ The current errors are displayed consecutively (max. 10). ■ Once all the errors have been displayed, the standard measurement display appears. In the function group F, an alarm can be defined separately for each error code.
 <p>A0027241</p>	<p>REL key</p> <p>In the manual mode, you can use the REL key to switch between the relay and the manual start of cleaning.</p> <p>In automatic mode, you can use the REL key to read out the switch-on points (for limit contactor) or set points (for PID controller) assigned to the relay in question.</p> <p>Press the PLUS key to jump to the settings of the next relay. Use the REL key to get back to the display mode (automatic return after 30 s).</p>
 <p>A0027234</p>	<p>AUTO key</p> <p>Use the AUTO key to switch between automatic mode and manual mode.</p>
 <p>A0027237</p>	<p>Escape function</p> <p>If you press the PLUS and MINUS key simultaneously, you return to the main menu, or are taken to the end of calibration if calibrating.</p> <p>If you press the PLUS and MINUS key again, you return to the measuring mode.</p>

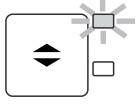
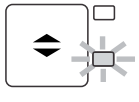
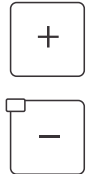

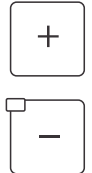
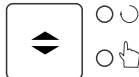
 <small>A0027238</small>	<p>Locking the keyboard</p> <p>Press the PLUS and ENTER key simultaneously for at least 3 s to lock the keyboard against any unauthorized data entry. All the settings can continue to be read.</p> <p>The code prompt displays the code 9999.</p>
 <small>A0027239</small>	<p>Unlocking the keyboard</p> <p>Press the CAL and MINUS key simultaneously for at least 3 s to unlock the keyboard.</p> <p>The code prompt displays the code 0.</p>

6.3 Local operation

6.3.1 Automatic/manual mode

The transmitter normally operates in automatic mode. Here, the relays are triggered by the transmitter. In the manual mode, you can trigger the relays manually using the REL key or start the cleaning function.

How to change the operating mode:

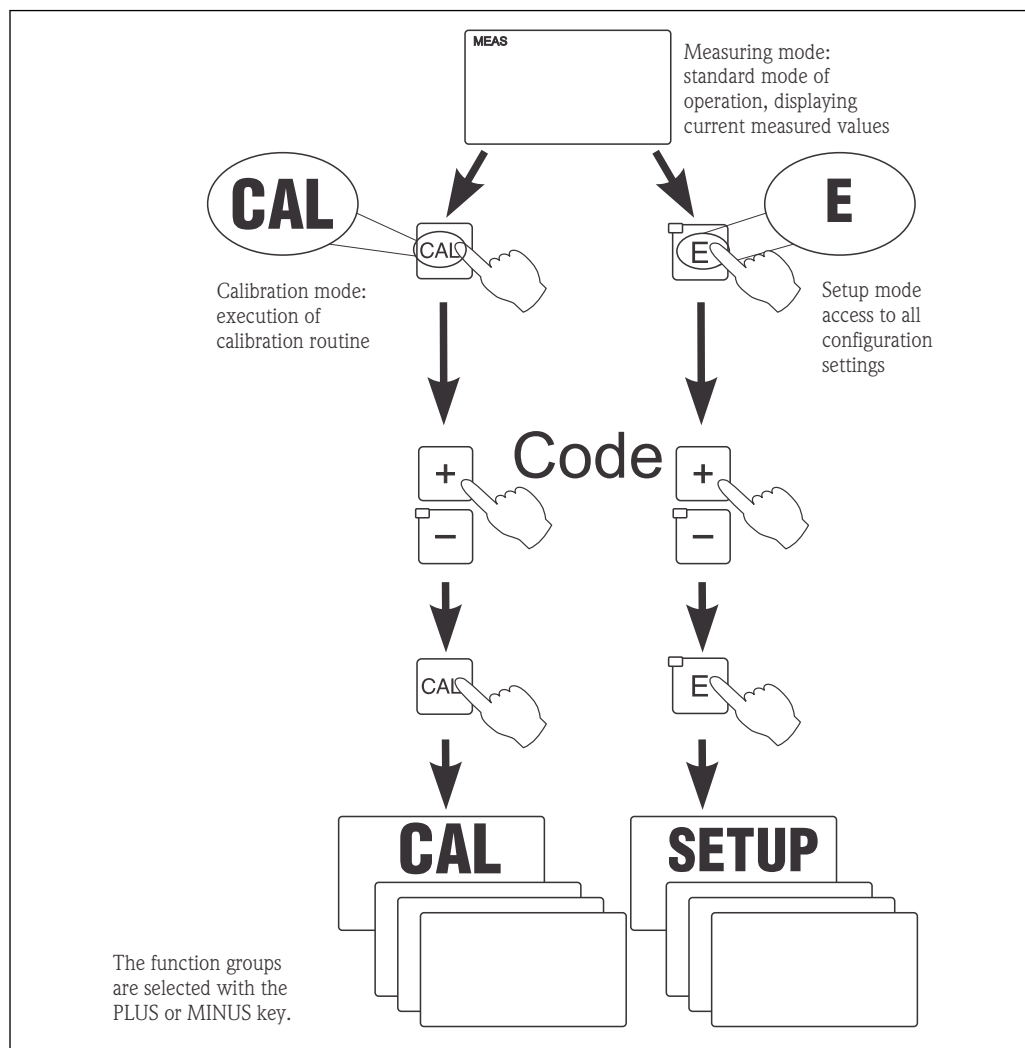
 A0027242	1. The transmitter is in automatic mode. The top LED (green) next to the AUTO key is lit.
 A0027243	2. Press the AUTOMATIC key.
 A0027240	3. To enable the manual mode, enter the code 22 via the PLUS and MINUS keys and press ENTER to confirm. The lower LED (manual mode) is lit.
 A0027241	4. Select the relay or the function. You can use the REL key to switch between the relays. The relay selected and the switch status (ON/OFF) is displayed on the second line of the display. In the manual mode, the measured value is displayed continuously (e.g. for measured value monitoring for dosing functions).
 A0027240	5. Switch the relay. The relay is switched on with PLUS and switched off with MINUS. The relay remains in this switched state until it is switched again.
 A0027234	6. Press the AUTOMATIC key to return to the measuring mode, i.e. to the automatic mode. All the relays are triggered again by the transmitter.



- The operating mode remains in effect even after a power failure. The relays assume the quiescent state, however.
- The manual mode has priority over all other automatic functions.
- Hardware locking is not possible in the manual mode.
- The manual settings are kept until they are actively reset.
- Error code E102 is signaled during manual operation.

6.3.2 Operating concept

Operating modes



A0027244-EN

26 Description of the possible operating modes

i If no key is pressed in the setup mode for approx. 15 min, the device automatically returns to the measuring mode. Any active hold (hold during setup) is canceled.

Access codes

All device access codes are fixed and cannot be altered. When the device requests the access code, it distinguishes between different codes.

- **CAL key + code 22**: access to Calibration and Offset menu
- **ENTER key + code 22**: access to the menus for the parameters which make configuration and user-specific settings possible
- **PLUS + ENTER keys** simultaneously (min. 3 s): lock the keyboard
- **CAL + MINUS keys** simultaneously (min. 3 s): unlock the keyboard
- **CAL or ENTER key + any code**: access to read mode, i.e. all the settings can be read but not modified.

The device continues measuring in the read mode. It does not shift to the "Hold" status. The current output and the controllers remain active.

Menu structure

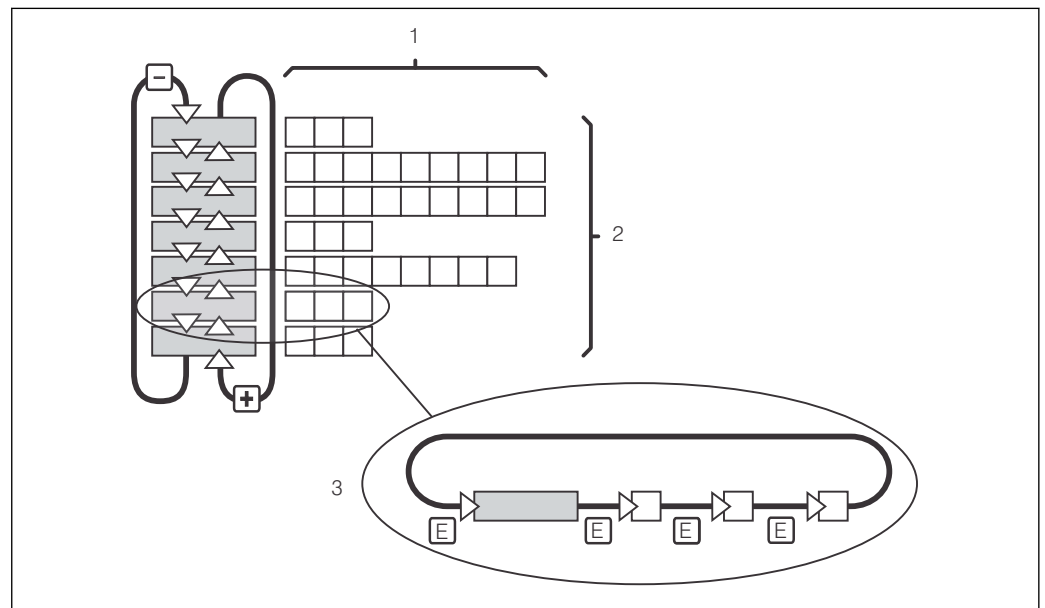
The configuration and calibration functions are arranged in function groups.

- In the setup mode, select a function group with the PLUS and MINUS keys.
- In the function group itself, switch from function to function with the ENTER key.
- Within the function, select the desired option with the PLUS and MINUS keys or edit the settings with these keys. Then confirm with the ENTER key and continue.
- Press the PLUS and MINUS keys simultaneously (Escape function) to exit programming (return to the main menu).
- Press the PLUS and MINUS keys simultaneously again to switch to the measuring mode.



If a modified setting is not confirmed by pressing ENTER, the old setting is retained.

An overview of the menu structure is provided in the Appendix to these Operating Instructions.



A0027245

27 Menu structure

- 1 Functions (selection of parameters, entry of numbers)
- 2 Function groups, scroll backwards and forwards with the PLUS and MINUS keys
- 3 Switch from function to function with the ENTER key

Hold function: "freeze" the outputs

In both the setup mode and during calibration, the current output can be "frozen" (factory setting), i.e. it constantly retains its current status. "HOLD" appears on the display. If the controller actuating variable (steady control 4 to 20 mA) is output via current output 2, it is set to 0/4 mA during a hold.

- Hold settings can be found in the "Service" function group.
- During a hold, all contacts assume a quiescent state.
- An active hold has priority over all other automatic functions.
- With every hold, the I-component of the controller is set to "0".
- Any alarm delay is reset to "0".
- This function can also be activated externally via the hold input (see Wiring diagram; binary input 1).
- A manual hold (field S3) remains active even after a power failure.

7 Commissioning

7.1 Function check

⚠ WARNING

Incorrect connection, incorrect supply voltage

Safety risks for staff and device malfunctions

- ▶ Check that all connections have been established correctly in accordance with the wiring diagram.
- ▶ Ensure that the supply voltage matches the voltage indicated on the nameplate.

7.2 Switching on

Familiarize yourself with the operation of the transmitter before it is first switched on. In particular please read the "Basic safety instructions" and "Operation options" sections. After power-up, the device performs a self-test and then goes to the measuring mode.

Now calibrate the sensor in accordance with the instructions in the "Calibration" section.

i During initial commissioning, the sensor must be calibrated so that the measuring system can return precise measurement data.

Then perform the first configuration in accordance with the instructions in the "Quick setup" section. The values set by the user are kept even in the event of a power failure.

The following function groups are available in the transmitter (the groups that are only available in the Plus Package are marked accordingly in the functional description):

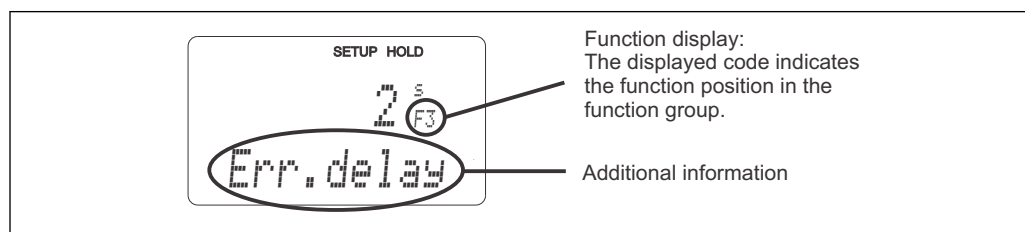
Setup mode

- SETUP 1 (A)
- SETUP 2 (B)
- CURRENT INPUT (Z)
- CURRENT OUTPUT (O)
- ALARM (F)
- CHECK (P)
- RELAY (R)
- SERVICE (S)
- E+H SERVICE (E)
- INTERFACE (I)

Calibration and offset mode

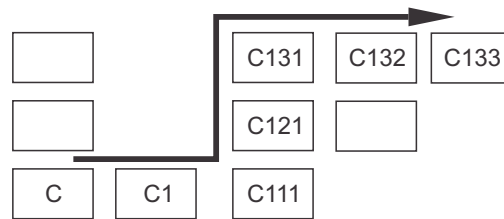
CALIBRATION (C)

i A detailed explanation of the function groups available in the transmitter can be found in the "Device configuration" section.



A0025560-EN

28 Information for the user on the display



To make it easier for you to select and find function groups and functions, a code for the corresponding field is displayed for each function → 28. The structure of this code is illustrated in → 29. The function groups are indicated as letters in the first column (see the names of the function groups). The functions of the individual groups are displayed incrementally by row and by column.

A0027502

29 Function code

Factory settings

The first time the device is switched on, the factory setting is set for all the functions. The table below provides an overview of the most important settings.

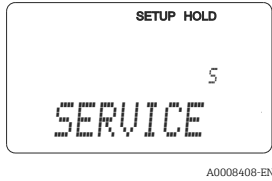
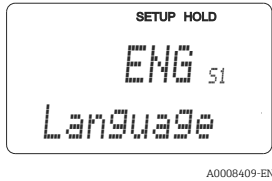
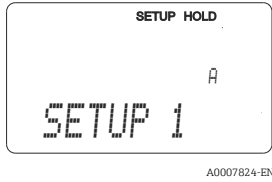
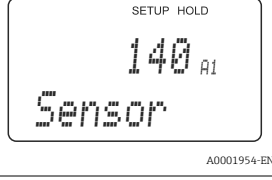
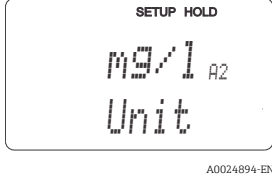
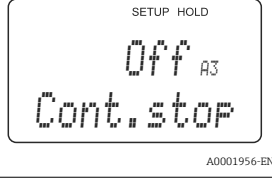
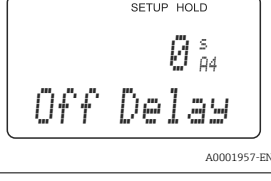
All other factory settings can be found in the description of the individual function groups in the "System configuration" section (the factory setting is highlighted in **bold**).

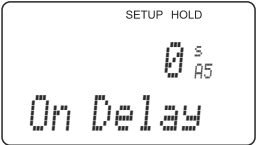
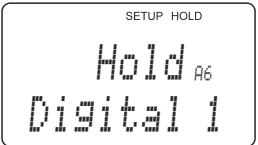
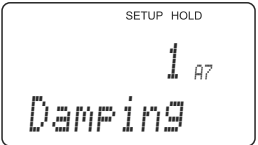
Function	Factory setting
Type of measurement	Concentration of free chlorine/total chlorine in mg/l Temperature measurement in °C pH value (EP version)
Sensor setting	CCS140 for free chlorine
Alarm contact	Steady contact
Alarm delay	Setting in minutes
Error current for alarm	22 mA
Check functions*	Off. Can be switched on if required
Limit value 1 and 2 for chlorine/chlorine dioxide	0.5 mg/l
Limit value 1 and 2 for pH*	pH 7.2
Limit value 1 and 2 for ORP*	750 mV
Limit value 1 and 2 for temperature	50 °C
Current outputs 1 and 2	4 to 20 mA
Current output 1: measured value for 4 mA signal current	0.00 mg/l
Current output 1: measured value for 20 mA signal current	2.00 mg/l
Current output 2: temperature value for 4 mA signal current*	0 °C
Current output 2: temperature value for 20 mA signal current*	50 °C

* with appropriate version

7.3 Quick Setup

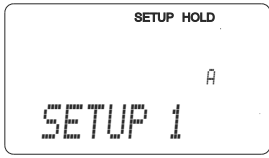
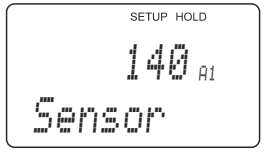
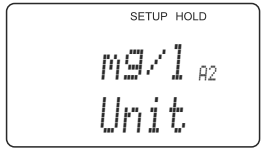
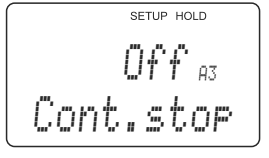
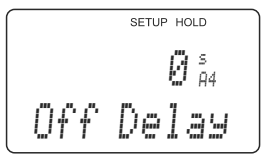
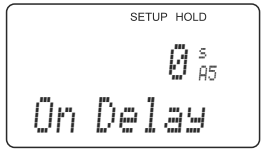
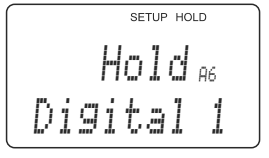
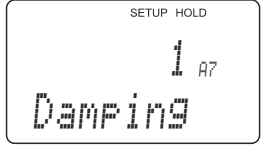
After power-up, you must make some settings to configure the most important functions of the transmitter which are required for correct measurement. The following section gives an example of this.

User entry		Range of adjustment (factory settings in bold)	Display
1.	Press the ENTER key		
2.	Enter the code 22 to open access to the menus. Press the ENTER key.		
3.	Press the MINUS key until you get to the "Service" function group.		
4.	Press ENTER to be able to make your settings.		
5.	Select your language in S1, e.g. "ENG" for English. Press ENTER to confirm your entry.	ENG = English GER = German FRA = French ITA = Italian NEL = Dutch ESP = Spanish	
6.	Press the PLUS and MINUS key simultaneously to exit the "Service" function group.		
7.	Press the MINUS key until you get to the "Setup 1" function group.		
8.	Press ENTER to be able to make your settings for "Setup 1".		
9.	In A1, select the desired sensor type. Press ENTER to confirm your entry.	120 = CCS120 140 = CCS140 141 = CCS141 240 = CCS240 241 = CCS241 963	
10.	In A2, select the desired engineering unit. Press ENTER to confirm your entry.	mg/l ppm ppb	
11.	If you have connected the INS proximity switch, you can switch on flow monitoring of the sample stream through the CCA250 assembly in A3. Press ENTER to confirm your entry.	Off INS	
12.	If flow briefly falls below the threshold value, you can suppress controller switch-off by entering a delay time in A4. Press ENTER to confirm your entry.	0 s 0 to 2000 s	

User entry		Range of adjustment (factory settings in bold)	Display
13.	In A5, enter the delay time for controller switch-on. In the case of chlorine/chlorine dioxide control, a delay until the reception of a representative measured value is recommended after a long period without flow. Press ENTER to confirm your entry.	0 s 0 to 2000 s	 <p>On Delay</p> <p>0 s A5</p> <p>SETUP HOLD</p> <p>A0001958-EN</p>
14.	In A6, select the binary input. Press ENTER to confirm your entry.	Hold = external hold Clean = cleaning trigger	 <p>Hold Digital 1</p> <p>A6</p> <p>SETUP HOLD</p> <p>A0001959-EN</p>
15.	In A7, enter the measured value damping. Measured value damping causes the measured value to be averaged over the specified number of individual measured values (if A7 = 1, no damping takes place). Press ENTER to confirm your entry. The display returns to the initial display of the "Setup 1" function group.	1 1 to 60	 <p>Damping</p> <p>1 A7</p> <p>SETUP HOLD</p> <p>A0001960-EN</p>
16.	Press PLUS and MINUS simultaneously to switch to the measurement mode.		

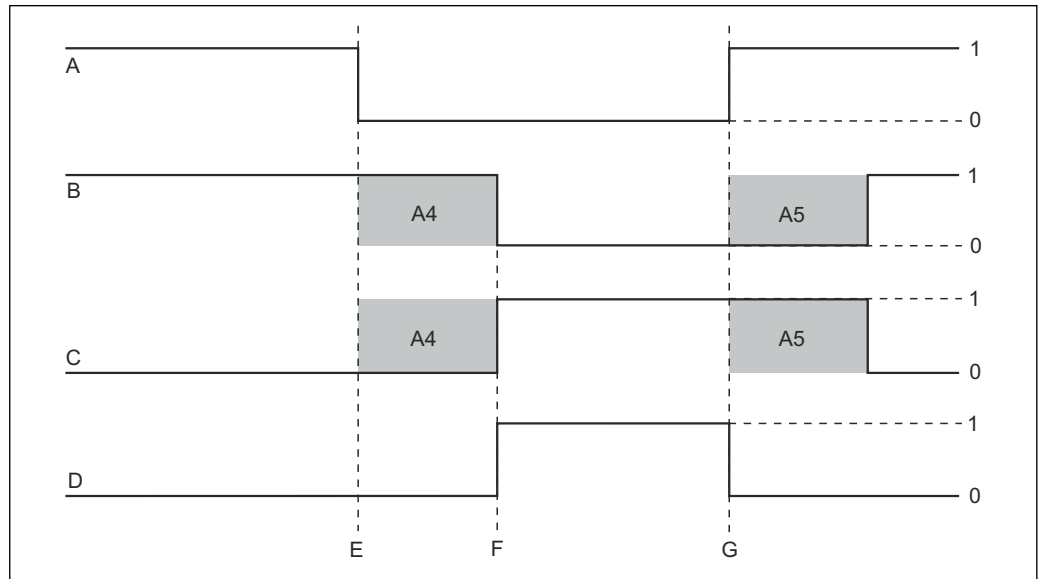
7.4 Device configuration

7.4.1 Setup 1 (chlorine/chlorine dioxide)

Coding	Field	Range of adjustment (factory settings in bold)	Display	Info
A	SETUP 1 function group		 A0007824-EN	Configuration of basic functions
A1	Select the connected sensor type	120 = CCS120 140 = CCS140 240 = CCS240 241 = CCS241 963	 A0001954-EN	If the device is reset in field S9, the configured sensor type is not modified.
A2	Select the display unit	mg/l ppm ppb	 A0001955-EN	
A3	Select flow monitoring of the sample flow through the CCA250 assembly (with controller switch-off)	Off INS	 A0001956-EN	May only be switched on when the INS proximity switch is connected.
A4	Enter the delay for controller switch-off by the sample flow	0 s 0 to 2000 s	 A0001957-EN	Brief flow shortfalls can be suppressed by this delay and do not result in controller switch-off.
A5	Enter the delay for controller switch-on by the sample flow	0 s 0 to 2000 s	 A0001958-EN	In the case of chlorine/chlorine dioxide control, a delay until the reception of a representative measured value is recommended after a long period without flow.
A6	Select binary input 1	Hold = external hold Clean = cleaning trigger	 A0001959-EN	
A7	Enter the value for measured value damping	1 1 to 60	 A0001960-EN	

Flow monitoring in the sample stream

If the flow falls below 30 l/h or if sample flow through the CCA250 assembly fails completely, this causes an alarm to be signaled when an INS proximity switch is connected. This alarm becomes active when the switch-off delay time elapses (A4 field). The alarm is canceled immediately as soon as the necessary rate of flow is restored. The device automatically stops the dosing of chemicals and the Chemoclean cleaning function for the duration of the alarm. All the relays assigned to the PID controller or to a cleaning function go to the quiescent state. The NO contact closes in the case of the three-point step controller. Dosing and cleaning actions are only resumed once the switch-on delay time has elapsed (A5 field).



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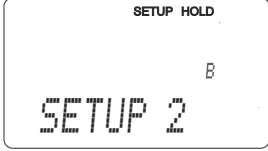
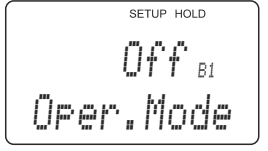
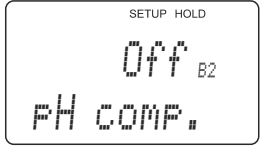

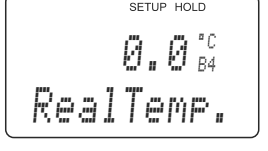
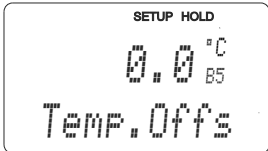
30 Alarm signaling and dosing switch-off by the sample stream

- A Flow in sample stream
- B Relay contacts of PID controller
- C NO contact on three-point step controller
- D Alarm relay
- E Flow < 30 l/h or flow failure
- F Flow alarm
- G Flow restored
- 0 Off
- 1 On
- A4 Field A4 (controller switch-off delay)
- A5 Field A5 (controller switch-on delay)

7.4.2 Setup 2 (temperature or pH/ORP)

Use this function group to change the settings for temperature measurement and pH/ORP measurement.

You already made all the settings for this function group during initial commissioning. However, you can change the values chosen at any time.

Coding	Field	Range of adjustment (factory settings in bold)	Display	Info
B	SETUP 2 function group		 A0007830-EN	Initial display screen in the SETUP 2 function group
B1	Select operating mode	Off pH ORPmV	 A0001963-EN	Field only available for EP version. ORPmV = ORP (oxidation-reduction potential) in mV. When the operating mode is changed, all user settings are automatically reset to the basic settings. If the device is reset in field S9, the configured operating mode is not modified.
B2	Select pH compensation	Off Manu Auto	 A0001964-EN	Field only available for ES and EP versions. (operation with CCS140/141)
B3	Enter the value for manual pH compensation	Last compensation value pH 4.00 to 9.00	 A0001965-EN	The field is only displayed if »manual« (Manu) was selected in the B2 field. The measured pH value is displayed as the secondary parameter.
B4	Enter the process temperature	Current measured value 0 to 50 °C	 A0001966-EN	You can edit the displayed value. The value can be changed by a maximum of ±5 °C. As the measurements are very accurate, the value generally does not need to be adjusted.
B5	Enter the temperature differential (offset)	Current offset -5.0 to 5.0 °C	 A0007835-EN	The offset is the difference between the actual value entered and the measured temperature.

Types of chlorine

A distinction is made between free chlorine and combined chlorine.

Free chlorine

Free chlorine is understood as the sum of elementary chlorine (Cl_2), hypochlorous acid (HOCl) and hypochlorite ions (OCl^-). These forms of chlorine are able to kill bacteria, inactivate viruses and oxidize organic substances within a short period of time.

Combined chlorine

Combined chlorine refers to the forms of chlorine in water and consists of chemical compounds made up of chlorine and ammonia (NH_3) or ammonium (NH_4^+) entstehen. Combined chlorine still has a disinfectant property, but far less than that of free chlorine.

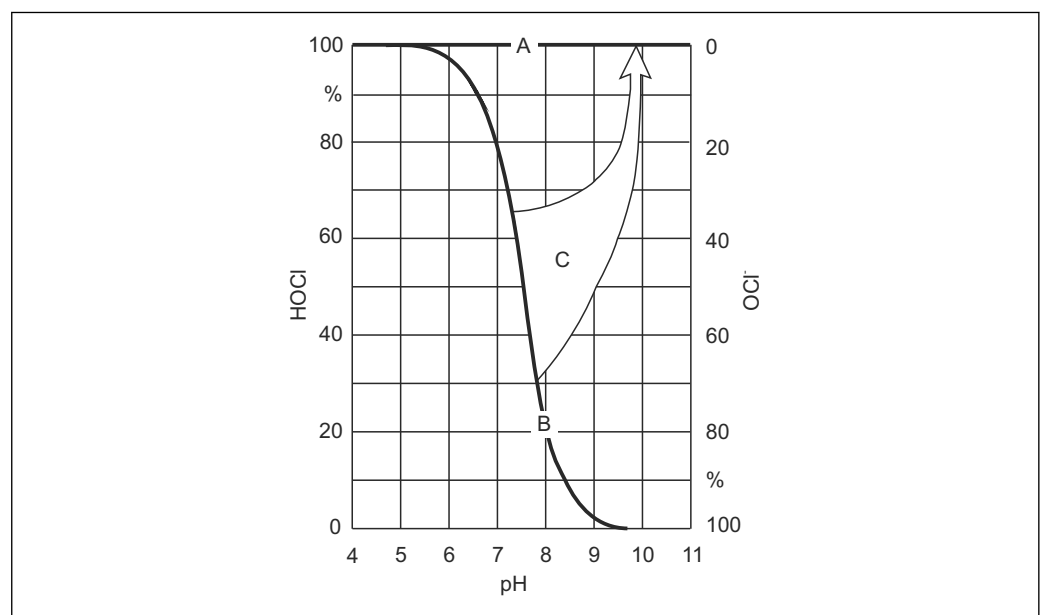
Total chlorine

Total chlorine is the sum of free chlorine and combined chlorine.

Measuring free chlorine with the CCS140 and CCS141 sensors

Molecular chlorine (Cl_2) is present at pH values < 4 . Consequently, hypochlorous acid (HOCl) and hypochlorite (OCl^-) remain as components of free chlorine within the range of pH 4 to 11.

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.



31 Basic representation of pH compensation

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

The CCS140 or CCS141 chlorine sensors selectively measure the amount of hypochlorous acid in amperometric measurement.. 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.

Measuring total chlorine with the CCS120 sensor

If, in addition to free available chlorine, ammonium is also present in the medium - preferably water - chloramines (Cl_nNH_m) form quickly. This compound is formed in various

degrees of dimerization. It is known as "combined chlorine". Combined chlorine has a lower disinfecting effect but it forms larger depots compared to free chlorine. This means:

- Significantly slower elimination of existing germs.
- Disinfectant effect over considerably longer periods.
- Disinfectant effect over considerably longer transport distances.

The CCS120 amperometric sensor measures the total chlorine content, i.e. free chlorine as well as chloramine components.


This type of measurement is only slightly pH dependent.

pH compensation of the chlorine sensor signal during free chlorine measurement

(only for ES and EP versions, for CCS140/141 sensors)

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 water under measurement is constantly buffered to a pH value of approx. 6.3. Therefore, the pH value of the water under measurement is not included in the DPD measurement here. 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 you select pH compensation in fields B2 or B3, 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 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.

pH compensation can be performed both automatically using the connected pH electrode (EP version) and manually (ES version) by entering the pH value in the B3 field.

Chlorine dioxide and total chlorine measurement is largely or entirely independent of the pH value and therefore no pH compensation is required.

Accuracy of pH compensation when measuring free chlorine

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 of free chlorine taking the pH value into consideration

The reference measurement (DPD method, photometer) determines the total free chlorine by buffering to pH 6.2. 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
CCS141	8.2	15 %	12 nA	80 nA
CCS140	8	20 %	4 nA	20 nA

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

7.4.3 Current input

For the "Current input" function group, you require a relay card with a current input which is not available in the basic device version. With this function group, you can monitor process parameters and use them for feedforward control. For this purpose, you must connect the current output of an external measured variable (e.g. flowmeter) to the 4 to 20mA input of the transmitter. The following assignment applies:

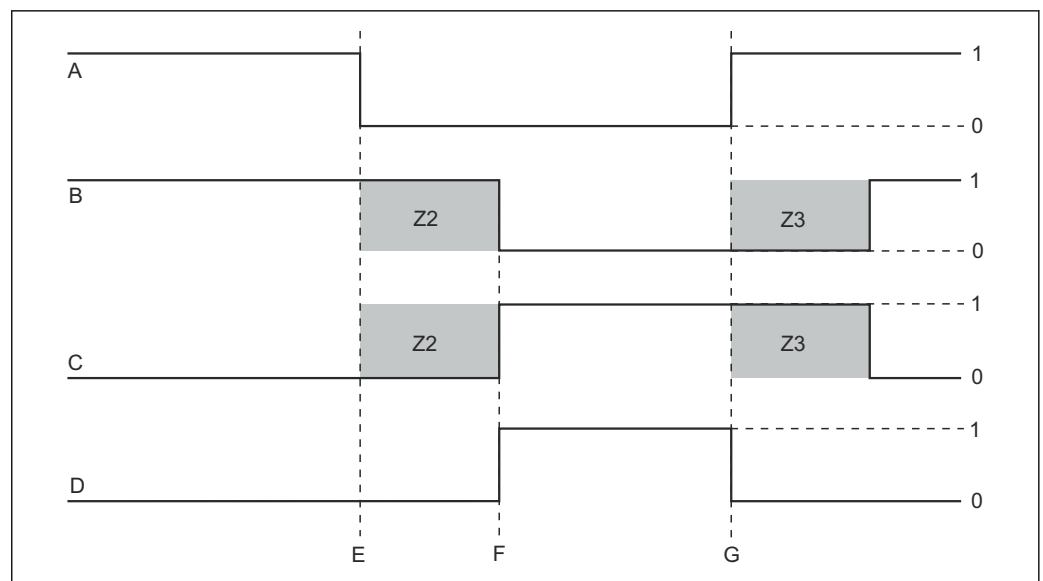
Flow in main stream	Current signal in mA	Current input signal in %
Flowmeter start of measuring range	4	0
Flowmeter end of measuring range	20	100

Flow monitoring in the main stream

This arrangement is particularly practical if the sample flow through the CCA250 assembly is completely independent of the flow in the main stream.

This permits signaling of an alarm condition in the main stream (flow too low or has completely stopped) and triggers dosing switch-off even if the medium flow is maintained due to the method of installation.

This monitoring method corresponds to monitoring the flow rate in the sample stream (see SETUP 1).



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32 Alarm signaling and dosing switch-off by the main stream

A Flow in main stream

B Relay contacts of PID controller

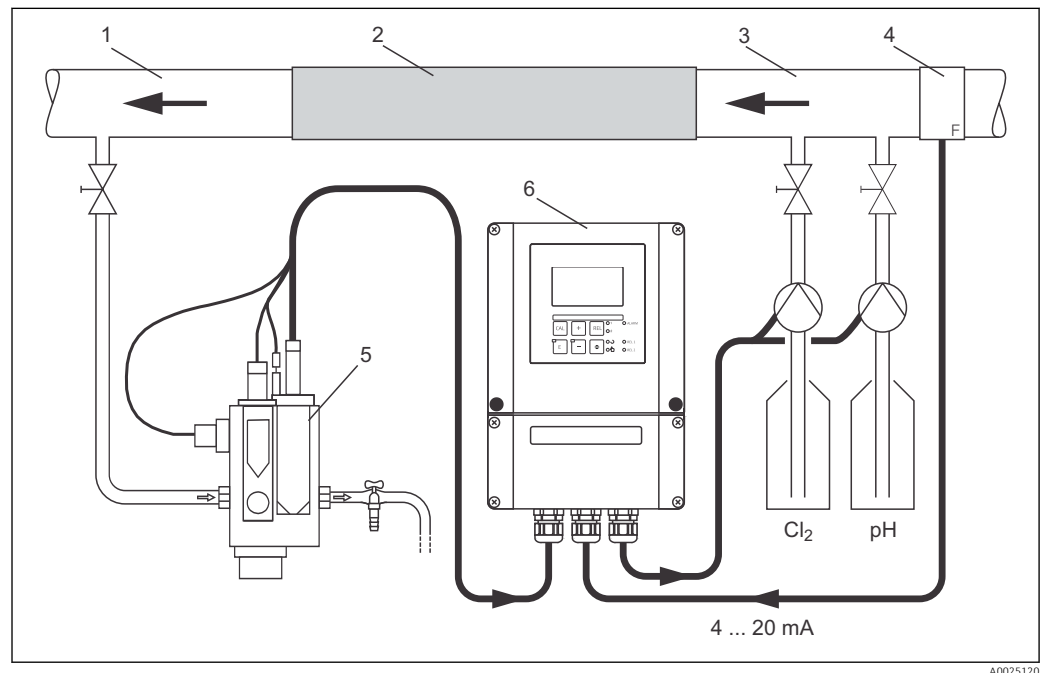
F Flow alarm

G Flow restoration

<i>C</i>	<i>NO contact on three-point step controller</i>	<i>Z2</i>	<i>Delay for controller switch-off, see field Z2</i>
<i>D</i>	<i>Alarm relay</i>	<i>Z3</i>	<i>Delay for controller switch-on, see field Z3</i>
<i>E</i>	<i>Flow below switch-off limit Z 4 or flow failure</i>	<i>0</i>	<i>Off</i>
		<i>1</i>	<i>On</i>

Feedforward control to PID controller

You can optimize control on control systems with very short response times by measuring the medium flow rate in addition to the oxygen content. Then apply this flow rate value (4 to 20 mA) as feedforward control to the PID controller.

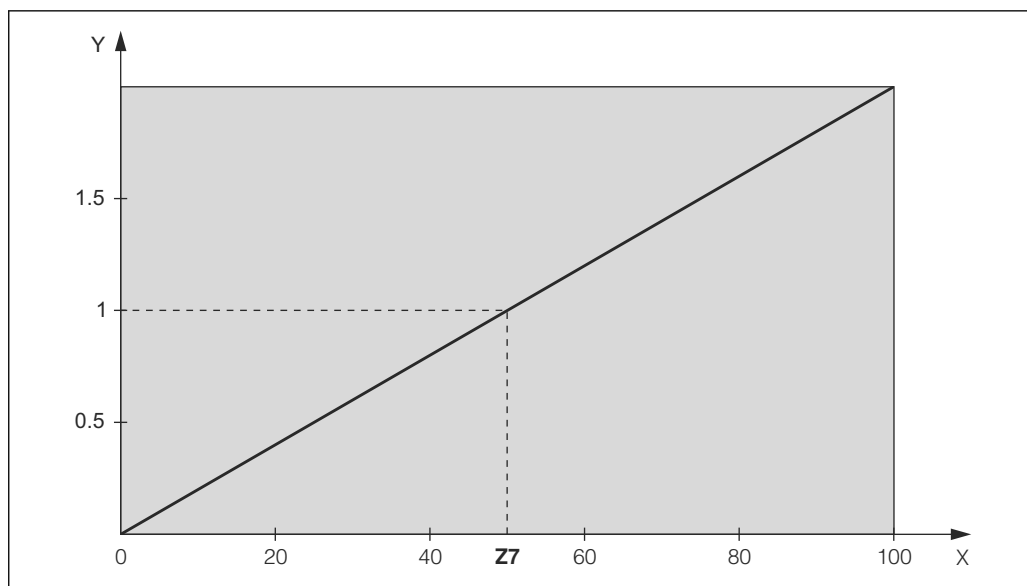


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33 Sample arrangement for feedforward control of the flow in the main stream to the PID controller

1	Medium tapping point	5	Flow assembly CCA250
2	Static mixer	6	Liquisys CCM253
3	Injection points		
4	Flowmeter		

Feedforward control is a multiplying function as illustrated in the figure below (example with factory setting):



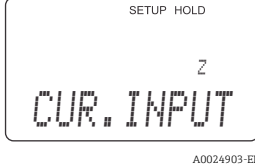

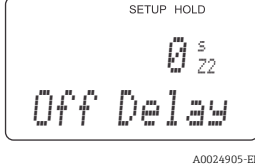
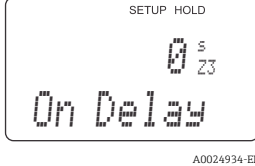
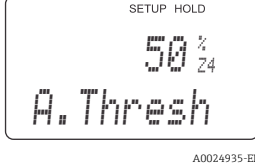
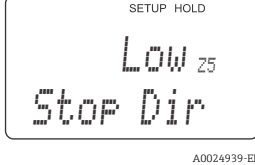
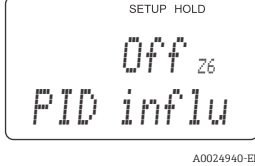
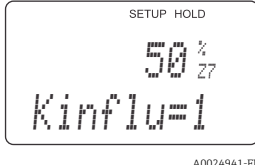
A0008942

34 Multiplying feedforward control

Y Gain K_{infl}

X Current input signal in [%]

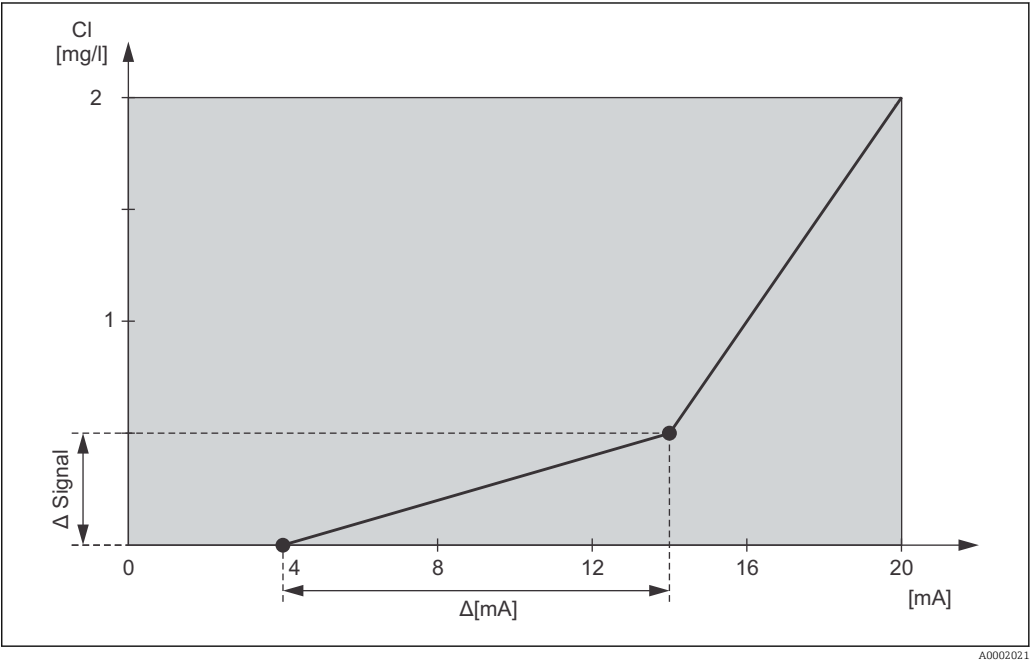
Functions marked in *italics* are not supported by the basic device version.

Coding	Field	Range of adjustment (factory settings in bold)	Display	Info
Z	CURRENT INPUT function group		 <p>SETUP HOLD Z CUR. INPUT A0024903-EN</p>	Current input settings
Z1	Select flow monitoring of main stream (with controller switch-off)	Off On	 <p>SETUP HOLD Off Z1 Cont. stop A0024904-EN</p>	Flow monitoring may only be switched on if the flowmeter is connected in the main stream. If Z1 = off, fields Z2 to Z5 are not available.
Z2	Enter the delay for controller switch-off through current input	0 s 0 to 2000 s	 <p>SETUP HOLD 0 s Z2 Off Delay A0024905-EN</p>	Brief flow shortfalls can be suppressed by this delay and do not result in controller switch-off.
Z3	Enter the delay for controller switch-on through current input	0 s 0 to 2000 s	 <p>SETUP HOLD 0 s Z3 On Delay A0024934-EN</p>	In the case of a controller, a delay until the reception of a representative measured value is recommended after a long period without flow.
Z4	Enter the switch-off limit value for the current input	50 % 0 to 100 %	 <p>SETUP HOLD 50 % Z4 A. Thresh A0024935-EN</p>	0 to 100% corresponds to 4 to 20 mA at the current input. Observe measured value assignment to the current output of the flowmeter.
Z5	Enter the switch-off direction for the current input	Low High	 <p>SETUP HOLD Low Z5 Stop Dir A0024939-EN</p>	The controller is switched off if the value entered in Z4 is undershot or overshoot.
Z6	Select feedforward control to PID controller	Off Lin = linear Basic	 <p>SETUP HOLD Off Z6 PID influ A0024940-EN</p>	If Z6 = off, the field Z7 is not available. Z6 = basic: disturbance variable only affects the basic load (alternatively dosing in proportion to quantity, if usual PID controller not possible, e.g. defective sensor).
Z7	Enter value for feedforward control at which gain = 1 applies	50 % 0 to 100 %	 <p>SETUP HOLD 50 % Z7 Kinflu=1 A0024941-EN</p>	When the value is set, the controller actuating variable is the same size when feedforward control is switched on as when feedforward control is switched off.

7.4.4 Current outputs

Use the "Current output" function group to configure the individual outputs. You can enter either a linear characteristic (O3 (1)) or a user-defined current output characteristic in conjunction with the Plus Package (O3 (3)). Exception: if you have chosen a "continuous controller" for current output 2, you cannot enter a user-defined current output characteristic for this current output.

In addition, you can also simulate a current output value (O3 (2)) to check the current outputs.



35 User-defined current output characteristic (example)

The current output characteristic must increase or decrease very monotonically.
The distance per mA between two table value pairs must be greater than:

Sensor/measurement parameter	Minimum distance per mA
CCS120	0.005 mg/l
CCS140/240	0.01 mg/l
CCS141/241 and 963	0.003 mg/l
pH	pH 0.03
ORP	5 mV
Temperature	0.25 °C

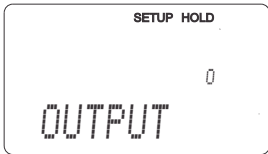
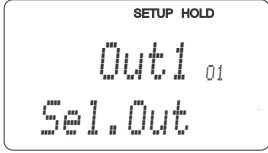
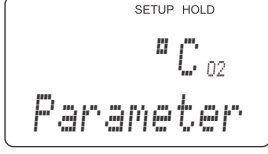
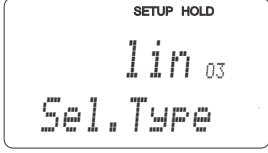
The values for the sample characteristic → 35 are entered in the following table. The distance per mA is calculated from $\Delta \text{ signal} / \Delta \text{ mA}$.

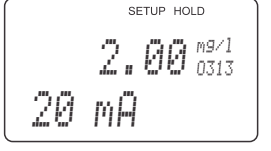
Value pair	Current output 1			Current output 2		
	Cl [mg/l]	Current [mA]	Distance per mA[]	Current [mA]	Distance per mA
1	0	4				
2	0.5	14	0.05			
3	2	20	0.25			

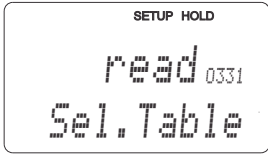
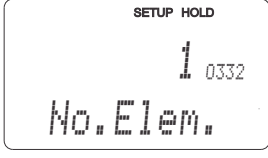
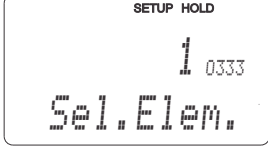
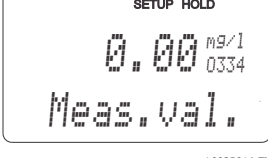
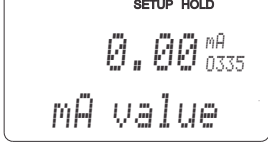
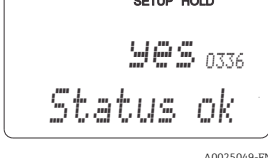
First enter the desired current output configuration into the following blank table with a pencil. Calculate the resulting signal distance per mA to observe the necessary minimum slope. Then enter the values in the device.

Value pair	Current output 1			Current output 2		
[]	Current [mA]	Distance per mA[]	Current [mA]	Distance per mA
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						

Functions marked in *italics* are not supported by the basic device version.

Coding	Field	Range of adjustment (factory settings in bold)	Display	Info
0	CURRENT OUTPUT function group		 A0025026-EN	Configuration of the current output (does not apply for PROFIBUS).
01	Select current output	Out 1 <i>Out 2</i>	 A0025027-EN	A characteristic can be selected for every output.
02	Select measured variable for 2nd current output	°C <i>Contr</i>	 A0025028-EN	pH or ORPmV only with EP version and depending on option selected in B1. R247 or R257 =curr (current output 2) can only be selected if O2=Contr (controller output) is selected.
03 (1)	Enter the characteristic type	Lin = linear (1) Sim = simulation (2) <i>Tab = table (3)</i>	 A0025029-EN	The characteristic can have a positive or negative slope for the measured value output. In the case of actuating variable output (O2 = Contr), an increasing current corresponds to an increasing actuating variable.

Coding	Field	Range of adjustment (factory settings in bold)	Display	Info
O311	Select current range	4 to 20mA 0 to 20 mA	 A0025030-EN	
O312	0/4 mA value: Enter the associated measured value	0 ppb 0 to 20000 ppb 0.00 ppm 0 to 20 ppm 0.00 mg/l 0 to 20 (5) mg/l pH 4.00 pH 4 to 9 0 mV 0 to 1500 mV 0 °C 0 to 50 °C	 A0001944-EN	<p>Here you can enter the measured value at which the min. current value (0/4 mA) is applied at the transmitter output (not for controller). For the minimum distance between the 0/4 mA and 20 mA value, see field O313</p> <p>This field is not displayed if O2 = Contr.</p>
O313	20 mA value: Enter the associated measured value	2000 ppb 0 to 20000 ppb 2.00 ppm 0 to 20 ppm 2.00 (0.50) mg/l 0 to 20 (5) mg/l pH 9.00 pH 4 to 9 1000 mV 0 to 1500 mV 50 °C 0 to 50 °C	 A0001946-EN	<p>Here you can enter the measured value at which the max. current value (20 mA) is applied at the transmitter output.</p> <p>The minimum distance between the 0/4 mA and 20 mA value must be as follows:</p> <ul style="list-style-type: none"> ■ 140/240: 0.2 mg/l ■ 141/241/963: 0.05 mg/l ■ 120: 0.1 mg/l ■ pH: pH 0.5 ■ ORP: 100 mV ■ Temperature: 5 °C <p>This field is not displayed if O2 = Contr.</p>
O3 (2)	Simulate current output	Lin = linear (1) Sim = simulation (2) Tab = table (3)	 A0025039-EN	<p>Simulation is not ended until O3(1) or O3(3) is selected. For further characteristics, see O3 (1), O3 (3).</p>
O321	Enter simulation value	Current value 0.00 to 22.00 mA	 A0025040-EN	<p>Entering a current value results in this value being directly output at the current output.</p>
O3 (3)	Enter current output table	Lin = linear (1) Sim = simulation (2) Tab = table (3)	 A0025041-EN	<p>Only for ES and EP versions. Values can also be subsequently added or modified. The values entered are automatically sorted by increasing current value. For further characteristics, see O3 (1), O3 (2).</p>

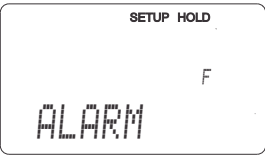

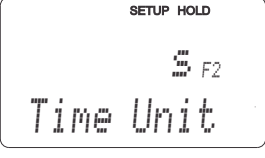
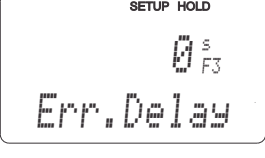
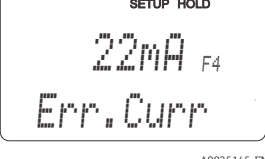

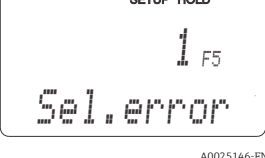
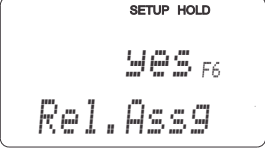
Coding	Field	Range of adjustment (factory settings in bold)	Display	Info
O331	Select table option	Read Edit	 A0025042-EN	
O332	Enter number of table value pairs	1 1 to 10	 A0025043-EN	Enter the number of pairs of x and y values (measured value and current value) here.
O333	Select table value pair	1 1 to no. elem. Assign	 A0025044-EN	The system runs through the O333 to O335 function chain as often as indicated in O332. "Assign" appears as the last step. The display goes to O336 after confirmation.
O334	Enter x value	0 ppb 0 to 20000 ppb 0.00 ppm 0 to 20 ppm 0.00 mg/l 0 to 20 (5) mg/l pH 4.00 pH 4 to 9 0 mV 0 to 1500 mV 0 °C 0 to 50 °C	 A0025046-EN	x value = measured value specified by user.
O335	Enter y value	0.00 mA 0.00 to 20.00 mA	 A0025048-EN	y value = user-defined current value pertaining to O334. Return to O333 until all values are entered.
O336	Message as to whether table status is OK	Yes No	 A0025049-EN	Back to O3. If status = no, correct the table (all settings made up until now remain intact) or go back to the measuring mode (table is deleted).

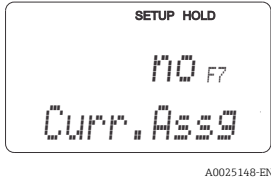
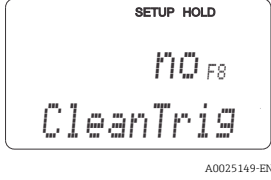
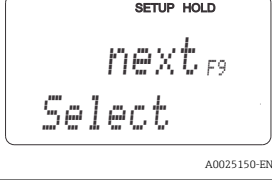
7.4.5 Alarm

You can use the "Alarm" function group to define various alarms and configure output contacts.

Each individual error can be defined to be effective or not (at the contact or as an error current).

Functions marked in *italics* are not supported by the basic device version.

Coding	Field	Range of adjustment (factory settings in bold)	Display	Info
F	ALARM function group		 A0025141-EN	Alarm function settings.
F1	Select contact type	Latch = latching Momen = momentary contact	 A0025142-EN	The option selected only applies for the fault-signaling contact, not for the error current.
F2	Select the time unit for the alarm delay	min s	 A0025143-EN	
F3	Enter alarm delay	0 min (s) 0 to 2000 s (min)	 A0025144-EN	Depending on the option selected in F2, the alarm delay can be entered in s or min.
F4	Select error current	22 mA 2.4 mA	 A0025145-EN	 If "0-20 mA" was selected in O311, "2.4 mA" may not be used.
F5	Select the error number	1 1 to 255	 A0025146-EN	Here you can select all the errors which should trigger an alarm. The errors are selected by the error numbers. Please refer to the table in the "System error messages" section for the meaning of the individual error numbers. The factory settings remain in effect for all errors that are not edited.
F6	Set alarm contact to be effective for the selected error	Yes No	 A0025147-EN	If "no" is selected, all the other alarm settings are deactivated (e.g. alarm delay). The settings themselves are maintained. This setting only applies to the error currently selected in F5.

Coding	Field	Range of adjustment (factory settings in bold)	Display	Info
F7	Set error current to be effective for the selected error	No Yes		The option selected in F4 is effective or not effective in the event of an error. This setting only applies to the error currently selected in F5.
F8	<i>Automatic cleaning function start</i>	No Yes		This field is not available for certain errors, see the "Troubleshooting and fault elimination" section.
F9	Select return to menu or next error	Next = next error number ←R		If ←R is selected, you return to F. If Next is selected, you go to F5.

7.4.6 Check

The CHECK function group is only available for devices with the Plus Package (ES and EP versions).

In the CHECK function group, you can select different monitoring functions for the measurement.

By default all monitoring functions are switched off. The Sensor Check System is adapted to the current application conditions by adding and setting the suitable functions.

Alarm threshold monitoring

When you perform chlorine or chlorine dioxide measurements without chemical dosage control, sensor errors lead to a measured value error, but have no impact on the process medium (examples: monitoring measurements in water works). Sensor errors generally cause implausibly high or low readings. This is detected and signaled by user-definable alarm thresholds.

Controller monitoring

When you perform chlorine or chlorine dioxide measurements with simultaneous chemical dosage control, sensor errors not only result in incorrect measured values but also directly impact the state of the process medium.

Particularly in the case of regulated water disinfection, due to the closed control loop there is the risk that chemical dosing will not switch on if the measured value is constantly too high. This poses a considerable danger to process stability, and could even pose a serious health hazard for humans. On the other hand, if the measured value is constantly too low this results in higher operating costs and a risk of corrosion due to the continuous dosing of chemicals.

These cases are detected and signaled using user-definable monitoring times for maximum permitted limit value overshoot and undershoot.

Sensor activity monitoring

The effect of the process medium on the sensor can also result in incorrect measured values. For example, severe deposit buildup on the sensor membrane can cause the

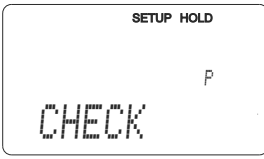
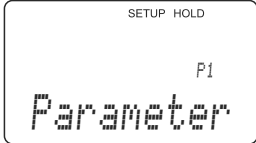
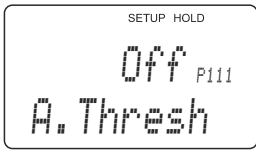
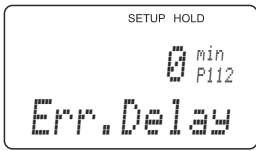
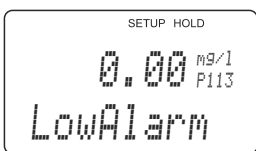
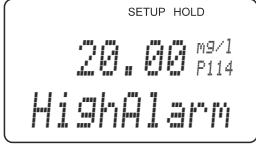
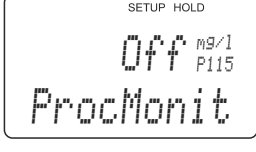
measuring signal to be very sluggish or not even change at all (constant signal). This passive behavior is detected and signaled by constantly monitoring the signal activity.

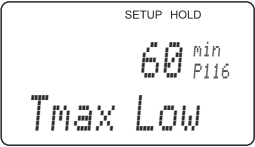
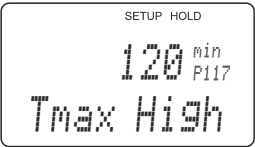
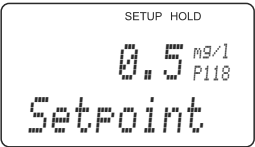

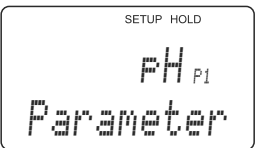
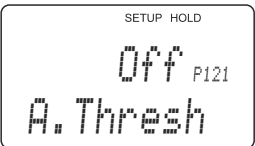
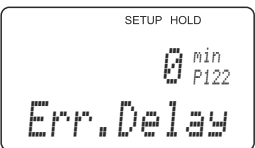
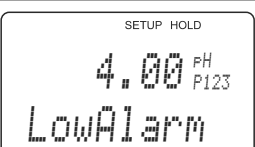
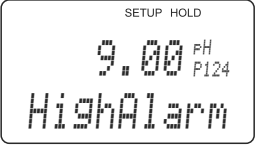
Overview of SCS monitoring functions

	Mode of operation	Possible setting	Alarm event	Use
Alarm threshold monitoring (P111 to P114) (P121 to P124)	<ul style="list-style-type: none"> User-definable lower alarm threshold (AS) User-definable upper alarm threshold (AS) 	Off	-	Applications with or without chemical dosage control
		Only lower alarm threshold	Lower alarm threshold reached or undershot	
		Only upper alarm threshold	Upper alarm threshold reached or exceeded	
		Lower and upper alarm threshold	Lower alarm threshold reached or undershot or upper alarm threshold reached or exceeded	
Controller monitoring (CC: controller check, P115 to P118 P125 to P128)	<ul style="list-style-type: none"> Switch-on duration monitoring Switch-off duration monitoring 	Off	-	Applications with chemical dosage control
		On	Set maximum duration for permanent switch-on or switch-off exceeded	
Sensor activity monitoring (AC: alternation check, P115 to P118 P125 to P128)	Signal change monitoring	Off	-	Applications with or without chemical dosage control
		On	Change within 1 hour less than <ul style="list-style-type: none"> ±0.01 mg/l (CCS140/240, sensor 963) ±0.005 mg/l (CCS141/241) pH ±0.01 ±1 mV 	

You can use the "Check" function group to monitor the measured value for permissible upper and lower limits and trigger an alarm.

Functions marked in italics are not supported by the basic device version.

Coding	Field	Range of adjustment (factory settings in bold)	Display	Info
P	CHECK function group		 A0009045-EN	Settings for sensor and process monitoring
P1(1)		Cl2 ClO2	 A0001988-EN	Cl ₂ if A1 = "120", "140", "141", "963" ClO ₂ if A1 = "240", "241"
P111	Select alarm threshold monitoring	Off Low High LoHi = low and high Lo! Hi! LoHi!	 A0001989-EN	Alarm possible with or without controller switch-off. xxxx = without controller switch-off xxxx! = with controller switch-off
P112	Enter alarm delay	0 min (s) 0 to 2000 min (s)	 A0001990-EN	Depending on the option selected in F2, the alarm delay can be entered in s or min. This delay must first elapse before undershooting/overshooting in accordance with fields P113/P114 results in an alarm.
P113	Enter lower alarm threshold	0 ppb 0 to 20000 ppb 0.00 ppm 0 to 20 ppm 0.00 mg/l 0 to 20 (5) mg/l	 A0001991-EN	Not applicable when P111 = off
P114	Enter upper alarm threshold	20000 ppb 0 to 20000 ppb 20.00 ppm 0 to 20 ppm 20.00 (5.00) mg/l 0 to 20 (5) mg/l	 A0001992-EN	Not applicable when P111 = off
P115	Select process monitoring	Off AC CC AC+CC AC! CC! AC+CC!	 A0001993-EN	AC = sensor activity monitoring CC = controller monitoring Alarm possible without or with simultaneous controller switch-off. xxxx = without controller switch-off xxxx! = with controller switch-off

Coding	Field	Range of adjustment (factory settings in bold)	Display	Info
P116	Enter maximum permissible duration for alarm threshold undershoot	60 min 0 to 2000 min	 A0002006-EN	Only if P115 = CC or AC+CC
P117	Enter maximum permissible duration for alarm threshold overshoot	120 min 0 to 2000 min	 A0002007-EN	Only if P115 = CC or AC+CC
P118	Enter limit value	500 ppb 0 to 20000 ppb 0.5 ppm 0 to 20 ppm 0.5 (0.1) mg/l 0 to 20 (5) mg/l	 A0002008-EN	Limit value for monitoring according to fields P116 and P117.  When performing external control from a process control system with an external set point, make sure that the setting matches that in field P118.
P1(2)		pH ORPmV	 A0001997-EN	Only for EP version pH or ORPmV is displayed depending on the mode of operation selected in field B1.
P121	Select alarm threshold monitoring	Off Low High LoHi = low and high Lo! Hi! LoHi!	 A0001998-EN	Alarm possible with or without controller switch-off. xxxx = without controller switch-off xxxx! = with controller switch-off
P122	Enter alarm delay	0 min (s) 0 to 2000 min (s)	 A0001999-EN	Depending on the option selected in F2, the alarm delay can be entered in s or min. This delay must first elapse before undershooting/overshooting in accordance with fields P123/P124 results in an alarm.
P123	Enter lower alarm threshold	pH 4.00 pH 4 to 8.9 0 mV 0 to 1490 mV	 A0002000-EN	Not applicable when P121 = off
P124	Enter upper alarm threshold	pH 9.00 pH 4.1 to 9 1500 mV 10 to 1500 mV	 A0002001-EN	Not applicable when P121 = off

Coding	Field	Range of adjustment (factory settings in bold)	Display	Info
P125	Select process monitoring	Off AC CC AC+CC AC! CC! AC+CC!		AC = sensor activity monitoring CC = controller monitoring Alarm possible without or with simultaneous controller switch-off. xxxx = without controller switch-off xxxx! = with controller switch-off Options CC, AC+CC, CC! and AC+CC! can only be selected if pH is selected in field P1(2).
P126	Enter maximum permissible duration for alarm threshold undershoot	60 min 0 to 2000 min		Only if P125 = CC or AC+CC
P127	Enter maximum permissible duration for alarm threshold overshoot	120 min 0 to 2000 min		Only if P125 = CC or AC+CC
P128	Enter limit value	pH 7.20 pH 4 to 9		Limit value for monitoring according to fields P126 and P127. i When performing external control from a process control system with an external set point, make sure that the setting matches that in field P128.

7.4.7 Relay configuration

For the "RELAY" function group, you require a relay card which is not available in the basic device version.

The following relay contacts can be selected and configured as desired (max. four contacts, depending on options installed):

- Limit contactor for chlorine/chlorine dioxide measured value: R2 (1)
- Limit contactor for pH/ORP measured value: R2 (2)
- Limit contactor for temperature: R2 (3)
- PID controller for chlorine/chlorine dioxide: R2 (4)
- PID controller for pH: R2 (5)
- Timer for cleaning function: R2 (6)
- Chemoclean function: R2 (7)
- Three-point step controller for chlorine/chlorine dioxide: R2 (8)

Only one function can be assigned to each relay. If a relay function is already switched on (R211 to R281), it is switched off automatically when you select another function and press ENTER to confirm (R2(1) to R2(8)).

i Pressing the REL key allows you to display the corresponding setpoint of every relay function.

Limit contactors for chlorine/chlorine dioxide/total chlorine measured value and temperature or pH or ORP measured value

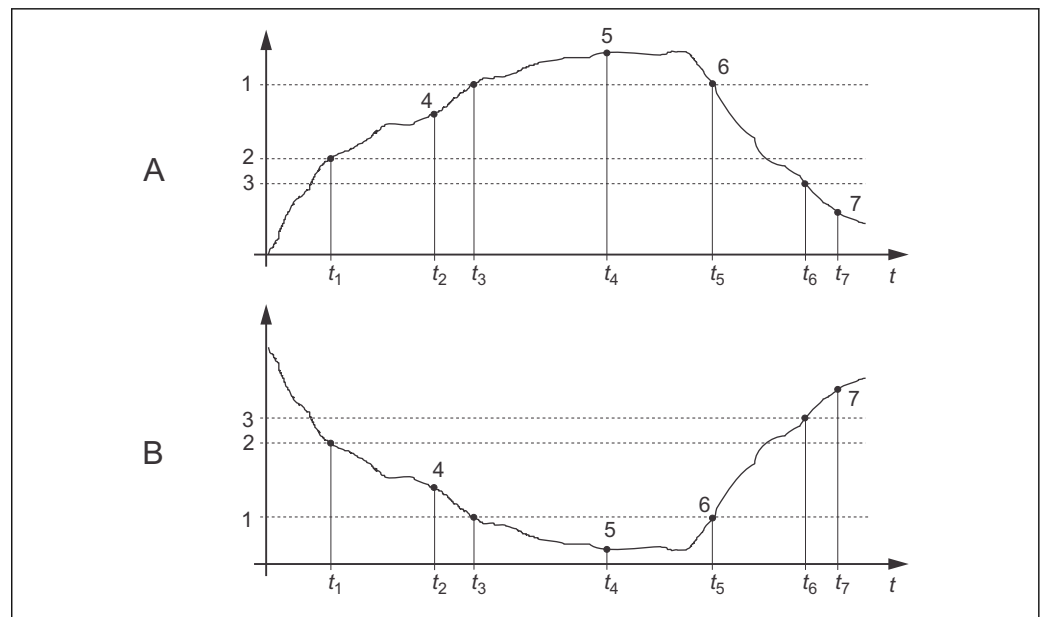
The transmitter has different ways of assigning a relay contact. Switch-on and switch-off points and pickup and dropout delays can be assigned to the limit contactor. In addition, you can configure an alarm threshold to output an error message and to start a cleaning function in conjunction with this.

These functions can be used both for the primary value and for temperature measurement.

Please refer to the switch states in →  36 for a clear illustration of the relay contact states.

- When the measured values increase (maximum function), the relay contact is closed as of t_2 after the switch-on point (t_1) has been exceeded and the pickup delay has elapsed ($t_2 - t_1$).
The alarm contact switches if the alarm threshold (t_3) is reached and the alarm delay ($t_4 - t_3$) has also elapsed (errors E067 to E070).
- When the measured values decrease, the alarm contact is reset when the value falls below the alarm threshold (t_5) again, as is the relay contact (t_7) after the dropout delay ($t_7 - t_6$).
- If the pickup and dropout delays are set to 0 s, the switch-on and switch-off points are also switch points of the contacts.

The same settings can also be made for a minimum function in the same way as for the maximum function.



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 36 Illustration of the alarm and limit value functions

- A Switch-on point > switch-off point: Max. function
 B Switch-on point < switch-off point: Min. function
 1 Alarm threshold
 2 Switch-on point
 3 Switch-off value
 4 Contact ON
 5 Alarm ON
 6 Alarm OFF
 7 Contact OFF

P(ID) controller

You can define various controller functions for the transmitter. On the basis of the PID controller, P, PI, PD and PID controllers can be implemented. For an optimum control system, use the controller that best suits your application.

■ P controller

Used for simple linear control purposes with small system deviations. Where major changes are to be controlled, overshooting may occur. In addition, a lasting control deviation must be expected.

■ PI controller

Is used for control systems where overshooting is to be avoided and no lasting control deviation should occur.

■ PD controller

Is used for processes that require quick changes and where peaks must be corrected.

■ PID controller

Is used for processes where a P, PI or PD controller does not control sufficiently.

Configuration options of the P(ID) controller

The following configuration options are available for a PID controller:

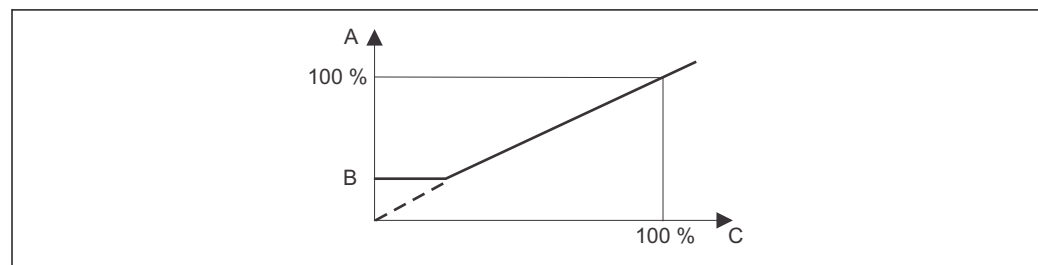
- Change control gain K_p (P influence)
- Set integral action time T_n (I influence)
- Set derivative action time T_v (D influence)

Basic load dosing (basic)

You can set a constant dosage amount (field R2411) with basic load dosing (field R241).

PID control plus basic load dosing

If you have selected this function (PID + Basic) in field R241, the PID-controlled dosage amount does not drop below the basic load value entered in field R2411.



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 37 Control characteristic of PID controller with basic load dosing

A PID plus basic load

B Basic load

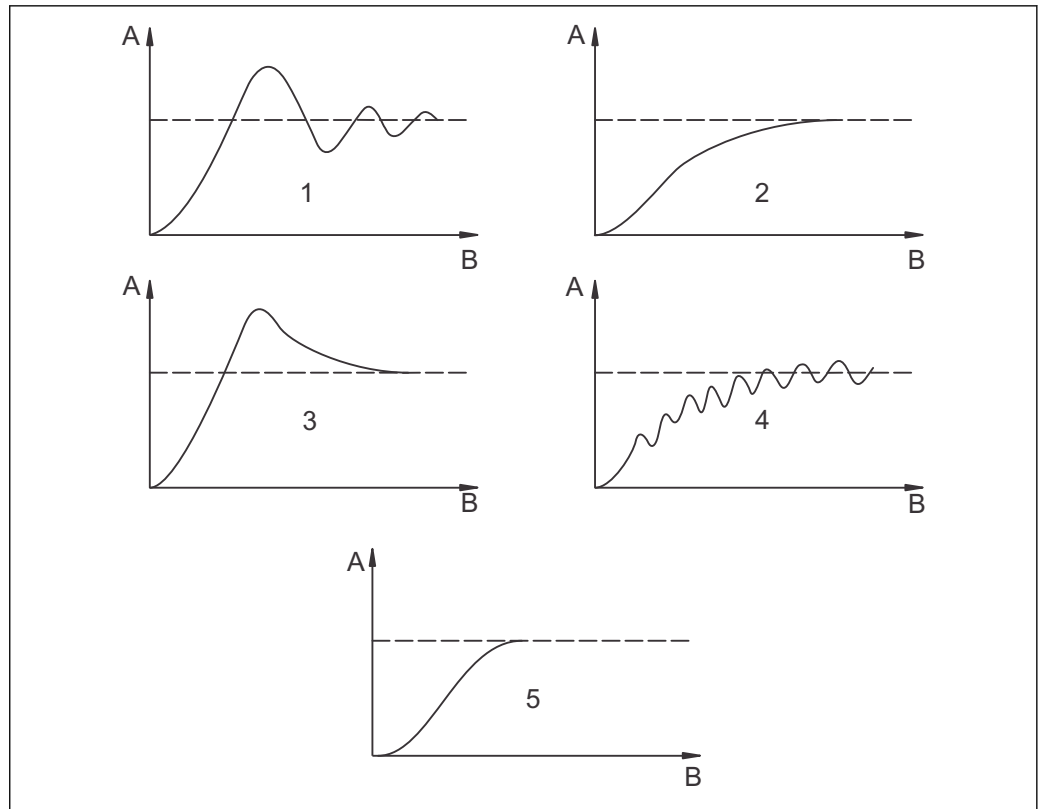
C PID

Commissioning

If you do not yet have any experience for setting the control parameters, set the values that yield the greatest possible stability in the control circuit. Proceed as follows to optimize the control circuit further:

- Increase the control gain K_p until the controlled variable just starts to overshoot.
- Reduce K_p slightly again and then reduce the integral action time T_n so that the shortest possible correction time without overshooting is achieved.
- To reduce the response time of the controller, also set the derivative action time T_v .

Control and fine optimization of the set parameters with a recorder



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38 Optimization of settings T_n and K_p

A Actual value

B Time

1 T_n too small

2 T_n too large

3 K_p too large

4 K_p too small

5 Optimum setting

Actuating signal outputs via contacts (R247 to R2410 and R257 to R2510)

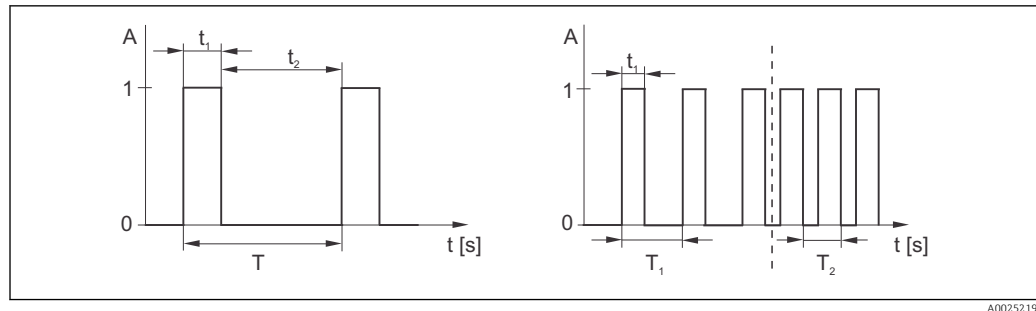
Each control contact outputs a cyclical signal whose intensity corresponds to the controller's actuating value. A distinction is made according to the type of signal cycle:

■ Pulse length modulation

The bigger the calculated manipulated variable is, the longer the contact affected remains picked up. The period T can be adjusted between 0.5 and 99 s (field R248 or R258). Outputs with pulse length modulation are used to activate solenoid valves.

■ Pulse frequency modulation

The bigger the calculated manipulated variable is, the higher the switching frequency of the contact affected. The maximum switching frequency $1/T$ can be set between 60 and 180 min^{-1} (field R249 or R259). The on-time t_{on} is constant. It depends on the set maximum frequency and is approx. 0.5 s for 60 min^{-1} and approx. 170 ms for 180 min^{-1} . 170 ms. Outputs with pulse frequency modulation are used to activate directly controlled solenoid dosing pumps.



39 Signal of a pulse-length modulated controller contact (left) and of a pulse frequency-modulated controller contact (right)

Contact: 1 = on, 0 = off T Period
 Time (s): t₁ = t_{on} t₂ = t_{off} T₁ T₂ Impulse period length (1/T₁ and 1/T₂)

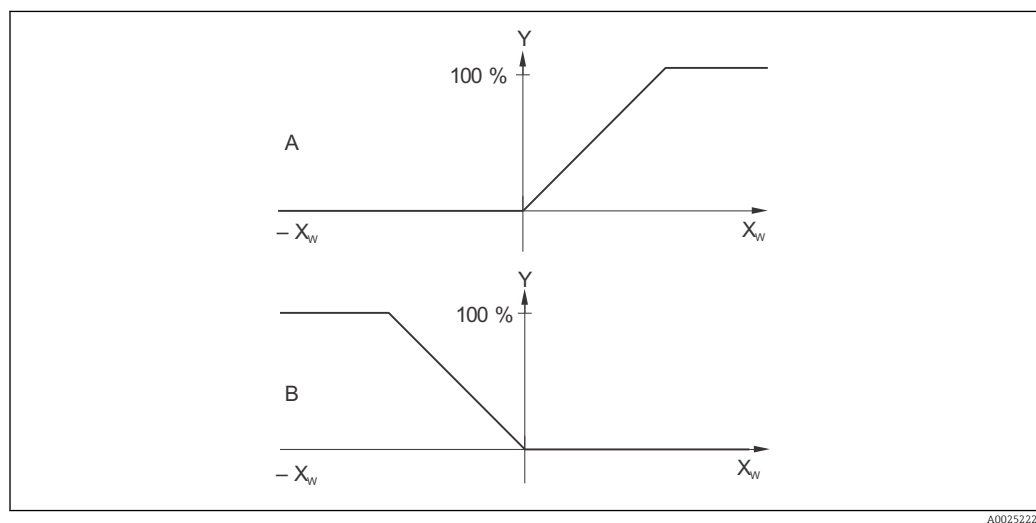
Constant controller

The controller can also control the second analog current output (if provided). You can configure the constant controller in the fields R247 or R257 and O2.

Control characteristic for direct and inverse control action

You can choose between two control characteristics in the R246 and R256 field:

- Direct control action = maximum function
- Inverse control action = minimum function



40 Control characteristic of a proportional controller with direct and inverse control action

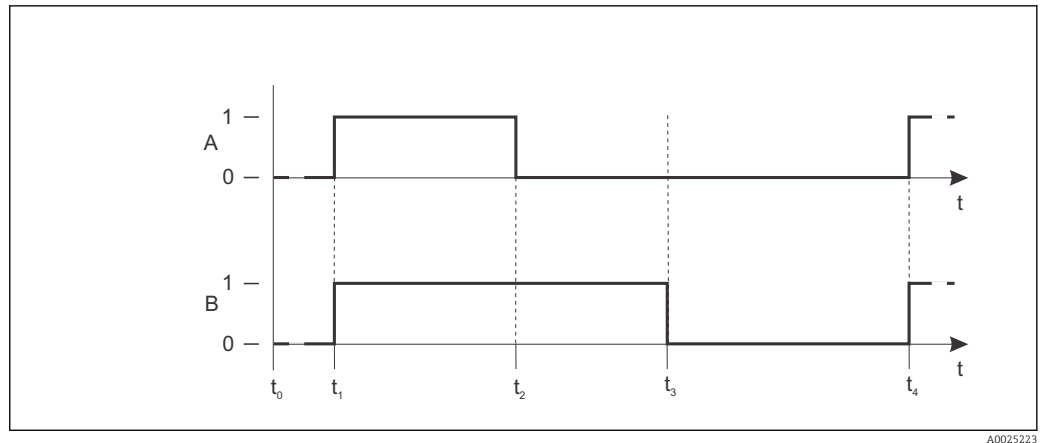
A Direct = maximum function
 B Inverse = minimum function
 X_W Control deviation
 Y Current output signal = controller actuating variable

Timer for cleaning function

This function includes a simple cleaning option. You can set the time interval after which cleaning should start. Therefore you can only select a constant interval sequence.

Other cleaning functions are available for selection in conjunction with the Chemoclean function (device version with four contacts required, see the "Chemoclean function" section).

i The timer and Chemoclean do not work independently of one another. While one of the two functions is active, the other cannot be started.



41 Connection between cleaning time, pause time and hold dwell period

A Wiper and/or spray cleaning system

B Hold function

0 Inactive

1 active

t0 Normal operation

t1 cleaning start

t2-t1 Cleaning time

t3-t2 Clean hold dwell period (0 to 999 s)

t4-t3 Pause time between two cleaning intervals (1 to 7200 min)

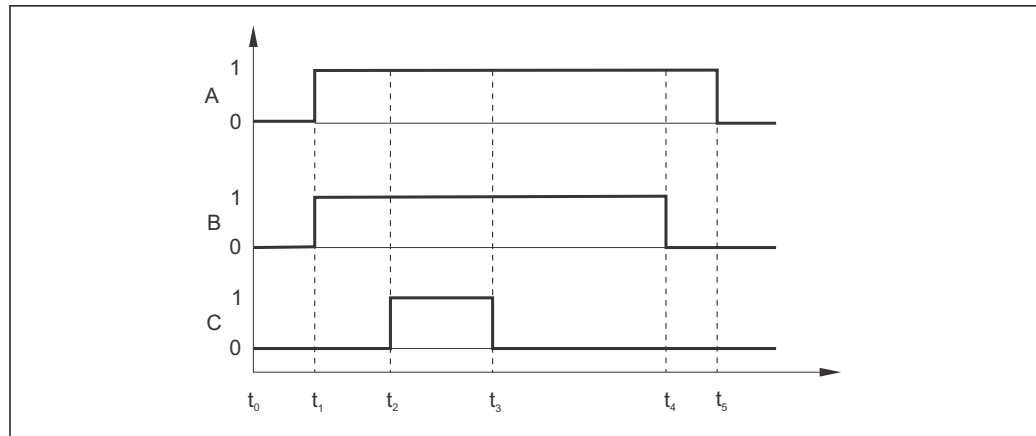
Chemoclean function

Just like the timer function, Chemoclean can also be used to start a cleaning cycle. However, Chemoclean also gives you the added option of defining various cleaning and rinsing intervals and of dosing cleaning agent.

Therefore, it is possible to clean irregularly with different repeat cycles and to separately set the cleaning times with post rinse times.

Please note the following:

- To use the Chemoclean function the transmitter has to be equipped with a designated relay board (see product structure or chapter "accessories").
- The timer and Chemoclean are mutually dependent. While one of the two functions is active, the other cannot be started.
- For the Chemoclean function, the relays 3 (water) and 4 (cleaner) are used.
- If the cleaning is prematurely aborted, a post rinse time always follows.
- If the setting is "Economy", cleaning only takes place with water.



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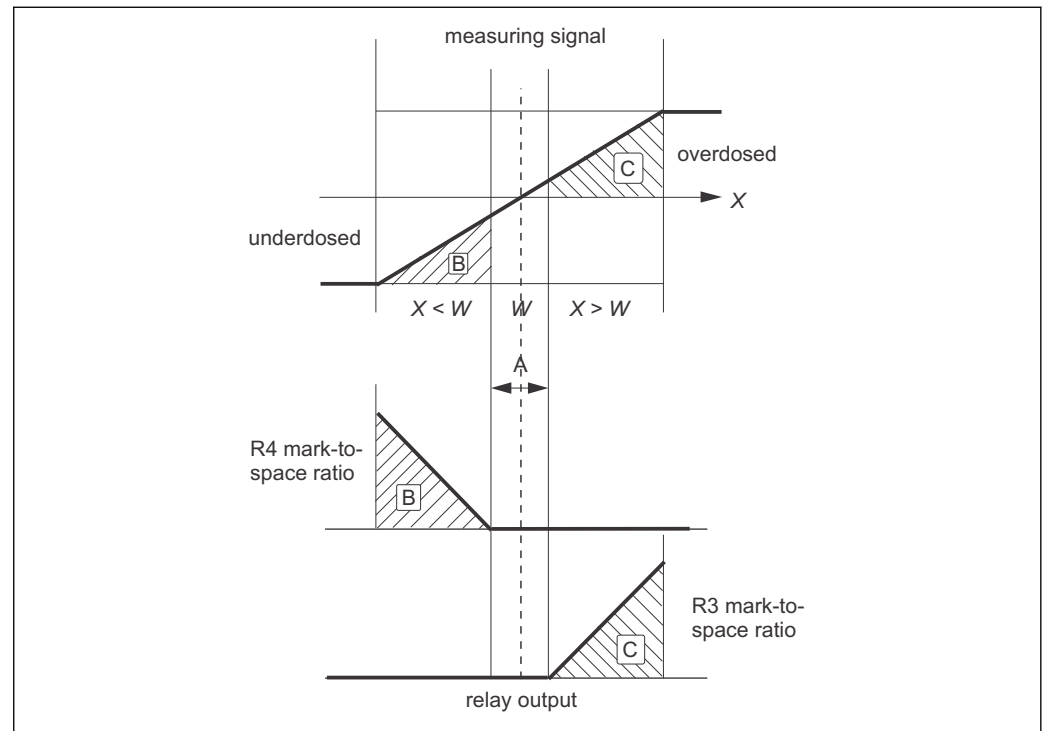
42 Sequence of a cleaning cycle

- A Hold function
- B Water valve is triggered
- C Cleaning valve is triggered
- 0 Contact off
- 1 Contact on
- t_0 Normal operation
- t_1 cleaning start
- t_2-t_1 Pre-rinse time
- t_3-t_2 Cleaning time
- t_4-t_3 Post rinse time
- t_5-t_4 Hold dwell period

Three-point step controller

With this type of controller, you can control motorized valves for metering chlorine gas.

- If the controller activates relay 3, the motorized valve closes.
- If the controller activates relay 4, the motorized valve opens.



43 Function of the three-point step controller

- A Measured value is in set point window
 B Measured value is smaller than the set point
 C Measured value is larger than the set point
 W Set point
 X Measured value

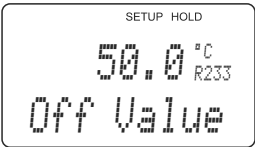
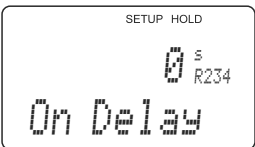
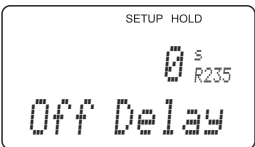
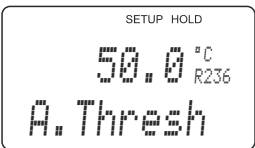
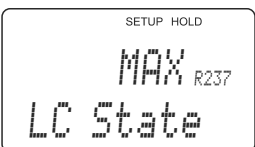
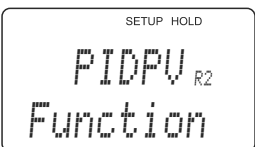
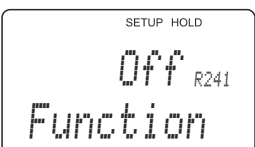
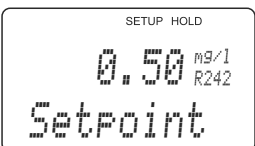
- Measured value is in set point window (A)
Relays 3 and 4 are **not** activated. The motorized valve does not change.
- Measured value is smaller than the set point (B)
Not enough chlorine gas is metered. Relay 4 is activated (pulse control). The motorized valve is opened further and the dosage metered is increased.
- Measured value is larger than the set point (C)
Too much chlorine gas is metered. Relay 3 is activated (pulse control). The motorized valve is closed further and the dosage metered is reduced.

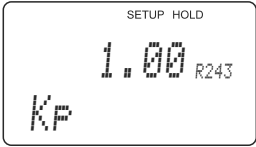
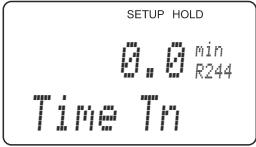
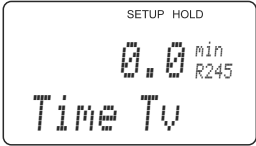
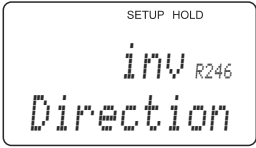
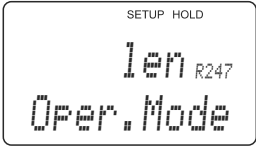
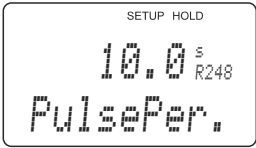
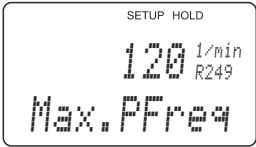
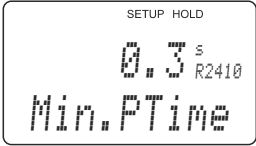
Functions marked in *italics* are not supported by the basic device version.

Coding	Field	Range of adjustment (factory settings in bold)	Display	Info
R	RELAY			Relay contact settings
R1	Select the contact to be configured	Rel1 Rel2 Rel3 Rel4		Rel3 (water) and Rel4 (cleaner) are only available with the relevant version of the transmitter. If Chemoclean is used as the cleaning method, Rel4 is not available.
R2 (1)	Configure limit contactor for Cl ₂ /ClO ₂	LC PV= limit contactor Cl₂/ClO₂ (1) LC °C = limit contactor pH (2) LC °C = limit contactor T (3) PID controller Cl ₂ /ClO ₂ (4) PID controller pH (5) Timer (6) <i>Clean= Chemoclean (7)</i> <i>Three-point step controller</i>		PV = process value If Rel4 is selected in the R1 field, Clean = Chemoclean cannot be selected. By confirming with ENTER, another relay function already switched on is switched off and its settings are reset to the factory settings.
R211	Switch function of R2 (1) off or on	Off On		All the settings are retained.
R212	Enter the switch-on point of the contact	20000 ppb 0 to 20000 ppb 20 ppm 0 to 20 ppm 20 (5) mg/l 0 to 20 (5) mg/l		Never set the switch-on point and the switch-off point to the same value! (Only the operating mode selected in A1 is displayed.)
R213	Enter the switch-off point of the contact	20000 ppb 0 to 20000 ppb 20 ppm 0 to 20 ppm 20 (5) mg/l 0 to 20 (5) mg/l		Entering a switch-off point selects either a Max contact (switch-off point < switch-on point) or a Min contact (switch-off point > switch-on point), thereby implementing a hysteresis that is constantly required (see "Illustration of the alarm and limit functions" figure).

Coding	Field	Range of adjustment (factory settings in bold)	Display	Info
R214	Enter pickup delay	0 s 0 to 2000 s	<p>SETUP HOLD 0^s R214 On Delay</p> <p>A0009070-EN</p>	
R215	Enter dropout delay	0 s 0 to 2000 s	<p>SETUP HOLD 0^s R215 Off Delay</p> <p>A0009071-EN</p>	
R216	Enter alarm threshold (as absolute value)	20000 ppb 0 to 20000 ppb 20 ppm 0 to 20 ppm 20 (5) mg/l 0 to 20 (5) mg/l	<p>SETUP HOLD 20^{mg/l} R216 A. Thresh</p> <p>A0002038-EN</p>	<p>If the alarm threshold is undershot/overshot, this triggers an alarm with the error message (E067 to E070) and an error current at the transmitter (note alarm delay in field F3).</p> <p>If defined as a Min contact, the alarm threshold must be < switch-off point.</p>
R217	Display status for limit contactor	MAX MIN	<p>SETUP HOLD MAX R217 LC State</p> <p>A0009073-EN</p>	Display only
R2 (2)	Configure limit contactor for pH or ORP mV	LC pH= limit contactor pH LVORP = limit contactor ORP mV	<p>SETUP HOLD LC pH R2 Function</p> <p>A0002025-EN</p>	<p>Only for EP version. Measurement is configured for pH or ORP depending on the mode of operation selected in field B1.</p> <p>By confirming with ENTER, another relay function already switched on is switched off and its settings are reset to the factory settings.</p>
R221	Switch function of R2 (2) off or on	Off On	<p>SETUP HOLD off R221 Function</p> <p>A0009074-EN</p>	Any settings made for the limit contactor are not deleted if the function is switched off.
R222	Enter the switch-on point of the contact	pH 9 pH 4 to 9 1500 mV 0 to 1500 mV	<p>SETUP HOLD 9.00^{pH} R222 On Value</p> <p>A0002041-EN</p>	Never set the switch-on point and the switch-off point to the same value!

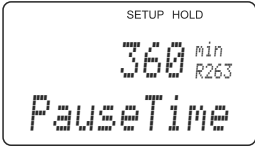
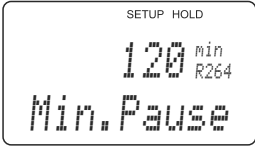
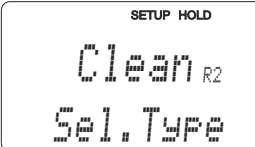
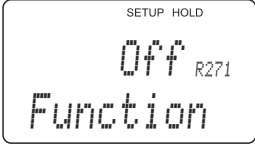
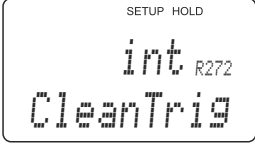
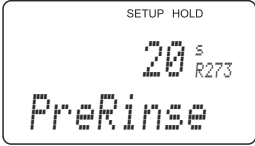
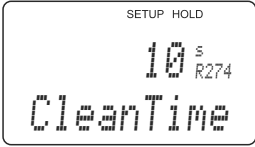
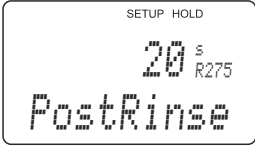
Coding	Field	Range of adjustment (factory settings in bold)	Display	Info
R223	Enter the switch-off point of the contact	pH 9 pH 4 to 9 1500 mV 0 to 1500 mV		Entering a switch-off point selects either a Max contact (switch-off point < switch-on point) or a Min contact (switch-off point > switch-on point), thereby implementing a hysteresis that is constantly required (see "Illustration of the alarm and limit functions" figure).
R224	Enter pickup delay	0 s 0 to 2000 s		
R225	Enter dropout delay	0 s 0 to 2000 s		
R226	Enter alarm threshold (as absolute value)	pH 9 pH 0 to 9 1500 mV 0 to 1500 mV		If the alarm threshold is undershot/overshot, this triggers an alarm with the error message (E067 to E070) and an error current at the transmitter (note alarm delay in field F3). If defined as a Min contact, the alarm threshold must be < switch-off point.
R227	Display status for limit contactor	MAX MIN		Display only
R2 (3)	Configure limit contactor for temperature	LC °C = limit contactor T		By confirming with ENTER, another relay function already switched on is switched off and its settings are reset to the factory settings.
R231	Switch function of R2 (3) off or on	Off On		Any settings made for the limit contactor are not deleted if the function is switched off.
R232	Enter switch-on temperature	50 °C 0 to 50 °C		Never set the switch-on point and the switch-off point to the same value!

Coding	Field	Range of adjustment (factory settings in bold)	Display	Info
R233	Enter switch-off temperature	50 °C 0 to 50 °C	 A0002049-EN	Entering a switch-off point selects either a Max contact (switch-off point < switch-on point) or a Min contact (switch-off point > switch-on point), thereby implementing a hysteresis that is constantly required (see "Illustration of the alarm and limit functions" figure).
R234	Enter pickup delay	0 s 0 to 2000 s	 A0002050-EN	
R235	Enter dropout delay	0 s 0 to 2000 s	 A0002051-EN	
R236	Enter alarm threshold (as absolute value)	50 °C 0 to 50 °C	 A0002052-EN	If the alarm threshold is undershot/overshot, this triggers an alarm with the error message (E067 to E070) and an error current at the transmitter (note alarm delay in field F3). If defined as a Min contact, the alarm threshold must be < switch-off point.
R237	Display status for limit contactor	MAX MIN	 A0002053-EN	Display only
R2 (4)	Configure P(ID) controller for Cl ₂ /ClO ₂	PIDPV	 A0002027-EN	PV = process value of main measuring parameter By confirming with ENTER, another relay function already switched on is switched off and its settings are reset to the factory settings.
R241	Switch function of R2 (4) off or on	Off On Basic PID+B	 A0002054-EN	On = PID controller Basic = basic load dosing PID+B = PID controller + basic load dosing
R242	Enter set point	500 ppb 0 to 20000 ppb 0.5 ppm 0 to 20 ppm 0.5 (0.1) mg/l 0 to 20 (5) mg/l	 A0002057-EN	The set point is the value to be maintained by the control system. Using this control process, this value is restored when an upwards or downwards deviation occurs.

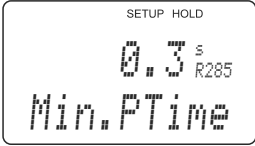
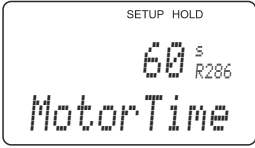
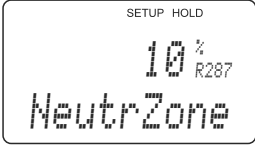
Coding	Field	Range of adjustment (factory settings in bold)	Display	Info
R243	Enter control gain K_P	1.00 0.01 to 20.00	 A0002058-EN	See the "P(ID) controller" section.
R244	Enter integral action time T_n (0.0 = no I-component)	0.0 min 0.0 to 999.9 min	 A0002059-EN	See the "P(ID) controller" section. With every hold, the I-component is set to zero. Although the hold can be deactivated in field S2, this does not apply for Chemoclean and timer!
R245	Enter derivative action time T_v (0.0 = no D-component)	0.0 min 0.0 to 999.9 min	 A0002060-EN	See the "P(ID) controller" section.
R246	Select controller characteristic	Inv = inverse (initial setting for sodium hypochlorite Dir = direct	 A0002061-EN	See the "P(ID) controller" section. This setting is required depending on the desired dosing direction (dosing above or below the set point).
R247	Select pulse length or pulse frequency	Len = pulse length Freq = pulse frequency Curr = current output 2	 A0002062-EN	Pulse length e.g. for solenoid valve, pulse frequency e.g. for solenoid dosing pump, see the "Actuating signal outputs" section. Curr = current output 2 can only be selected if O2 = Contr.
R248	Enter pulse interval	10.0 s 0.5 to 999.9 s	 A0002063-EN	This field only appears if pulse length is selected in R247. If pulse frequency is selected, R248 is skipped and entries continue with R249.
R249	Enter maximum pulse frequency of the adjuster	120 min⁻¹ 60 to 180 min ⁻¹	 A0002064-EN	This field only appears if pulse frequency is selected in R247. If pulse length is selected, R249 is skipped and entries continue with R2410.
R2410	Enter minimum switch-on time t_{ON}	0.3 s 0.1 to 5.0 s	 A0002055-EN	This field only appears if pulse length is selected in R247.

Coding	Field	Range of adjustment (factory settings in bold)	Display	Info
R2411	Enter basic load	0 % 0 to 40 %		<p>When you select the basic load, you enter the desired dosing quantity.</p> <p>100% basic load would correspond to:</p> <ul style="list-style-type: none"> ■ Constantly on if R247 = len ■ Fmax if R247 = freq (field R249) ■ 20 mA if R247 = curr
R2 (5)	Configure P(ID) controller for pH	PIDpH		By confirming with ENTER, another relay function already switched on is switched off and its settings are reset to the factory settings.
R251	Switch function of R2 (5) off or on	Off On Basic PID+B		<p>On = PID controller</p> <p>Basic = basic load dosing</p> <p>PID+B = PID controller + basic load dosing</p>
R252	Enter set point	pH 7.20 pH 4 to 9		The set point is the value to be maintained by the control system. Using this control process, this value is restored when an upwards or downwards deviation occurs.
R253	Enter control gain K_p	1.00 0.01 to 100.00		See the "P(ID) controller" section
R254	Enter integral action time T_n (0.0 = no I-component)	0.0 min 0.0 to 999.9 min		See the "P(ID) controller" section With every hold, the I-component is set to zero. Although the hold can be deactivated in field S2, this does not apply for Chemoclean and timer!
R255	Enter derivative action time T_v (0.0 = no D-component)	0.0 min 0.0 to 999.9 min		See the "P(ID) controller" section
R256	Select controller characteristic	Inv = inverse Dir = direct (Initial setting for acid)		See the "P(ID) controller" section This setting is required depending on the desired dosing direction (dosing above or below the set point).

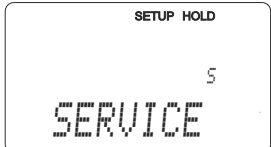
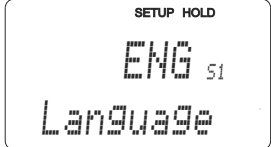
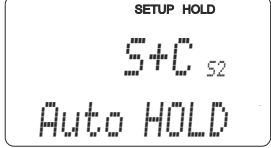
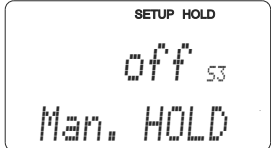
Coding	Field	Range of adjustment (factory settings in bold)	Display	Info
R257	Select pulse length or pulse frequency	Len = pulse length Freq = pulse frequency Curr = current output 2	<p>A0002092-EN</p>	Pulse length e.g. for solenoid valve Pulse frequency e.g. for solenoid dosing pump Curr = current output 2 can only be selected if O2 = Contr.
R258	Enter pulse interval	10.0 s 0.5 to 999.9 s	<p>A0002093-EN</p>	This field only appears if pulse length is selected in R257. If pulse frequency is selected, R258 is skipped and entries continue with R259.
R259	Enter maximum pulse frequency of the adjuster	120 min⁻¹ 60 to 180 min ⁻¹	<p>A0002094-EN</p>	This field only appears if pulse length is selected in R257. If pulse length is selected, R259 is skipped and entries continue with R2510.
R2510	Enter minimum switch-on time t_{ON}	0.3 s 0.1 to 5.0 s	<p>A0002085-EN</p>	This field only appears if pulse length is selected in R257.
R2511	Enter basic load	0 % 0 to 40 %	<p>A0002086-EN</p>	This field only appears for the EP version. When you select the basic load, you enter the desired dosing quantity. 100% basic load would correspond to: <ul style="list-style-type: none"> Constantly on if R257 = len F_{max} if R257 = freq (field R259) 20mA if R257 = curr
R2 (6)	Configure cleaning function (timer)	Timer (6)	<p>A0009063-EN</p>	Only one cleaning agent (generally water) is used for the cleaning. By confirming with ENTER, another relay function already switched on is switched off and its settings are reset to the factory settings.
R261	Switch function of R2 (6) off or on	Off On	<p>A0002095-EN</p>	
R262	Enter rinsing/cleaning time	30 s 0 to 999 s	<p>A0002096-EN</p>	Settings for hold and relay are active for this time.

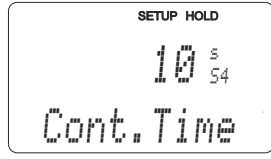
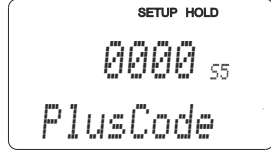
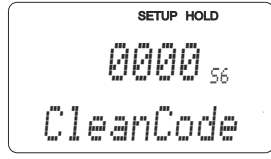
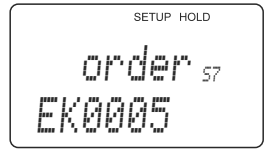
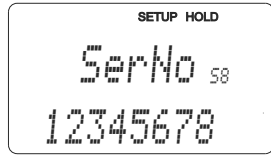
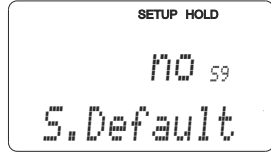
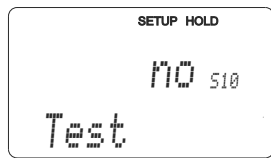
Coding	Field	Range of adjustment (factory settings in bold)	Display	Info
R263	Enter pause time	360 min 1 to 7200 min	 A0002097-EN	The pause time is the time between two cleaning cycles (see the "Timer for cleaning function" section).
R264	Enter minimum pause time	120 min 1 to 3600 min	 A0002098-EN	The minimum pause time prevents constant cleaning if a cleaning trigger is pending.
R2 (7)	Configure cleaning with Chemoclean (for version with four contacts, Chemoclean option and contacts 3 and 4 assigned)	Clean= Chemoclean (7)	 A0009064-EN	See the "Chemoclean function" section. By confirming with ENTER, another relay function already switched on is switched off and its settings are reset to the factory settings.
R271	Switch function of R2 (7) off or on	Off On	 A0002099-EN	
R272	Select type of start pulse	Int = internal (time-controlled) Ext = external (digital input 2) I+ext = internal + external I+stp = internal, suppressed by external	 A0002100-EN	No real time clock is available. External suppression is required for irregular time intervals (e.g. weekends).
R273	Enter pre-rinse time	20 s 0 to 999 s	 A0002101-EN	Rinsing is performed with water.
R274	Enter cleaning time	10 s 0 to 999 s	 A0002102-EN	Cleaning is performed with cleaning agent and water.
R275	Enter post rinse time	20 s 0 to 999 s	 A0002103-EN	Rinsing is performed with water.

Coding	Field	Range of adjustment (factory settings in bold)	Display	Info
R276	Enter number of repeat cycles	0 0 to 5		R273 to R275 is repeated.
R277	Enter pause time	360 min 1 to 7200 min		The pause time is the time between two cleaning cycles (see the "Chemoclean function" section).
R278	Enter minimum pause time	120 min 1 to R277		The minimum pause time prevents constant cleaning if an external cleaning start is pending.
R279	Enter number of cleaning cycles without cleaning agent (economy function)	0 0 to 9		After cleaning with cleaner, up to 9 cleaning sessions can be carried out with water only until the next cleaning session with cleaner takes place.
R2 (8)	Configure three-point step controller for Cl_2/ClO_2	3 PSt (8)		Only with relays 3 and 4.. By confirming with ENTER, another relay function already switched on is switched off and its settings are reset to the factory settings.
R281	Switch function of R2 (8) off or on	Off On		
R282	Enter set point	500 ppb 0 to 20000 ppb 0.5 ppm 0 to 20 ppm 0.5 (0.1) mg/l 0 to 20 (5) mg/l		The set point is the value to be maintained by the control system. Using this control process, this value is restored when an upwards or downwards deviation occurs.
R283	Enter control gain K_P	1.00 0.10 to 100.00		See the "P(ID) controller" section
R284	Enter integral action time T_n	0.0 min 0.0 to 999.9 min		See the "P(ID) controller" section

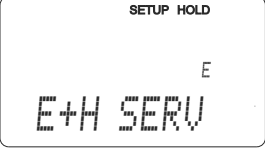

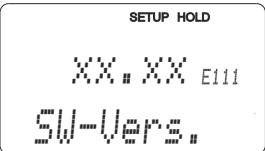
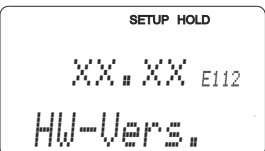
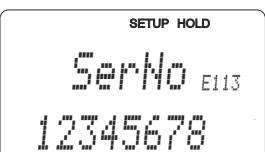
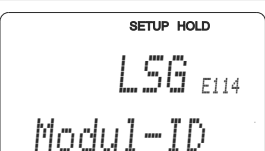
Coding	Field	Range of adjustment (factory settings in bold)	Display	Info
R285	Enter minimum switch-on time t_{ON}	0.3 s 0.1 to 5.0 s	 A0002112-EN	
R286	Enter motor run time	60 s 10 to 999 s	 A0002113-EN	Motor run time from "fully closed" state to "fully open" state.
R287	Enter neutral zone	10 % 0 to 40 %	 A0002114-EN	

7.4.8 Service

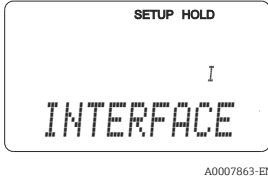
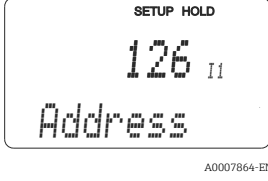
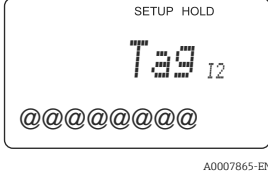
Coding	Field	Range of adjustment (factory settings in bold)	Display	Info
S	SERVICE function group		 A0008408-EN	Service function settings.
S1	Select language	ENG = English GER = German FRA = French ITA = Italian NL = Dutch ESP = Spanish	 A0008409-EN	The option selected only applies for the fault-signaling contact, not for the error current.
S2	Configure a hold	S+C = hold during configuration and calibration Cal = hold during calibration Setup = hold during configuration None = no hold	 A0008413-EN	S = setup C = calibration
S3	Manual hold	Off On	 A0008414-EN	The setting is retained even in the event of a power failure.

Coding	Field	Range of adjustment (factory settings in bold)	Display	Info
S4	Enter hold dwell period	10 s 0 to 999 s	 A0008415-EN	
S5	Enter SW upgrade release code (Plus Package)	0000 0000 to 9999	 A0008416-EN	The code can be found on the nameplate. If an incorrect code is entered, you are taken back to the measurement menu. The number is edited with the PLUS or MINUS key and confirmed with the ENTER key. "1" is displayed if the code is active.
S6	Enter SW upgrade release code for Chemoclean	0000 0000 to 9999	 A0008417-EN	The code can be found on the nameplate. If an incorrect code is entered, you are taken back to the measurement menu. The number is edited with the PLUS or MINUS key and confirmed with the ENTER key. "1" is displayed if the code is active.
S7	Order number is displayed		 A0006005	If the device is upgraded, the order code is changed automatically.
S8	Serial number is displayed		 A0008420-EN	
S9	Reset the device to the basic settings	No Sens = sensor data Facy = factory settings	 A0008421-EN	Sens = last calibration is deleted and is reset to factory setting. Facy = all data (apart from A1 and S1) are deleted and reset to the factory setting!
S10	Perform device test	No Displ = display test	 A0008410-EN	

7.4.9 E+H Service

Coding	Field	Range of adjustment (factory settings in bold)	Display	Info
E	E+H SERVICE function group		 A0007857-EN	Information on the device version
E1	Select module	Contr = controller (central module) (1) Trans = transmitter (2) Main = power unit (3) Rel = relay module (4) Sens = sensor (5)	 A0007858-EN	
E111 E121 E131 E141 E151	Software version is displayed		 A0007859-EN	If E1 = contr: device software If E1 = trans, main, rel: module firmware If E1 = sens: sensor software
E112 E122 E132 E142 E152	Hardware version is displayed		 A0007861-EN	Info display
E113 E123 E133 E143 E153	Serial number is displayed		 A0007860-EN	Info display
E114 E124 E134 E144 E154	Module ID is displayed		 A0007862-EN	Info display

7.4.10 Interfaces

Coding	Field	Range of adjustment (factory settings in bold)	Display	Info
I	INTERFACE function group			Communication settings (only for HART or PROFIBUS device version).
I1	Enter bus address	Address HART: 0 to 15 or PROFIBUS: 0 to 126		Each address may only be assigned once in a network. If a device address ≠ 0 is selected for a HART device, the current output is automatically set to 4 mA and the device prepares for multi-drop operation.
I2	The tag name is displayed			


7.4.11 Communication

For devices with a communication interface, please also refer to the separate Operating Instructions BA00208C/07/EN (HART®) or BA00209C/07/DE (PROFIBUS®).

7.5 Calibration

Use the CAL key to access the calibration function group.

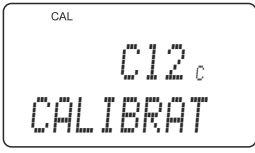
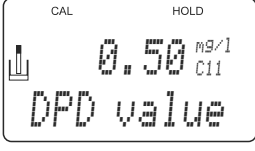
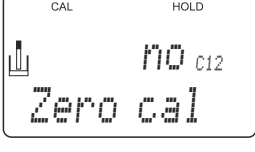
Use this function group to calibrate the transmitter.

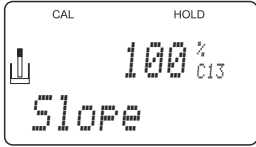
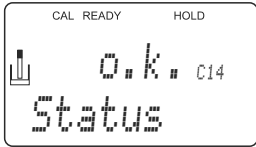
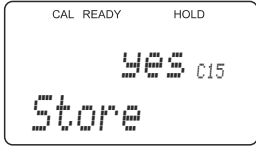

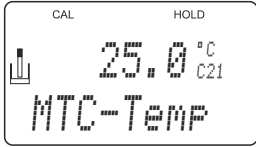
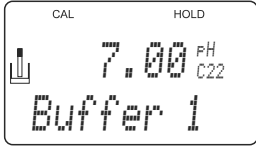
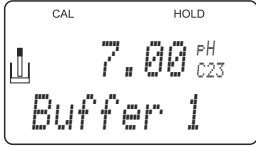
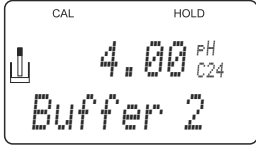
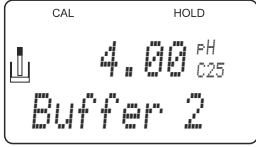
 When calibrating the "Free chlorine" measurement mode, make sure to pay attention to the pH value and the temperature of the medium. The limit values are provided in the following table:

Sensor	pH _{min}	pH _{max}	T _{min}	T _{max}
CCS140	4	8	10 °C (50 °F)	45 °C (113 °F)
CCS141	4	8.2	2 °C (36 °F)	45 °C (113 °F)
CCS240	-	-	2 °C (36 °F)	45 °C (113 °F)
CCS241	-	-	2 °C (36 °F)	45 °C (113 °F)
CCS120	5.5	9.5	5 °C (41 °F)	45 °C (113 °F)

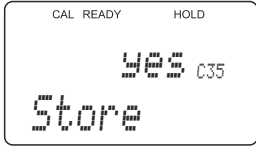


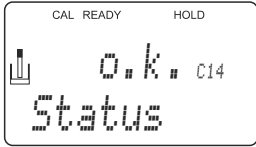
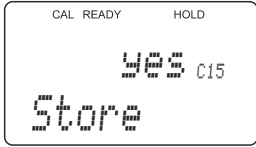
Please note the following:

- You require a photometer, e.g. PF-3 (see "Accessories") to calibrate chlorine and chlorine dioxide. A photometer with a higher accuracy rating and lower detection limit is required for calibration in the trace range (<0.1 mg/l).
- If the calibration is aborted by simultaneously pressing the PLUS and MINUS keys (return to C15, C29 or C35), or if the calibration is incorrect, the original calibration data are used again. A calibration error is indicated by "ERR" and the sensor symbol flashes on the display.
Repeat calibration!
- For each calibration, the device automatically switches to hold (factory setting).
- On completion of the calibration, the device returns to the measurement mode. The "hold" symbol appears on the display during the hold dwell period (field S4).

Coding	Field	Range of adjustment (factory settings in bold)	Display	Info
C(1)	CALIBRATION function group: Calibration Cl ₂ / ClO ₂	Cl2 ClO2	 A0006351-EN	Cl2 if A1 = 120/140/141/963 ClO2 if A1 = 240/241
C11	Enter DPD calibration value	Value of last calibration	 A0002420-EN	Minimum values for the calibration: <ul style="list-style-type: none"> ■ For CCS120/140/240 and sensor 963: 0.05 mg/l ■ For CCS141/241: 0.01 mg/l
C12	Zero point calibration?	No Yes	 A0002421-EN	Only if A1 = 963 Zero point calibration: <ol style="list-style-type: none"> 1. Pass unchlorinated water through the assembly. 2. Wait for 10 minutes. 3. Accept by selecting YES and pressing ENTER

Coding	Field	Range of adjustment (factory settings in bold)	Display	Info
C13	Slope is displayed	100 % Minimum 25% (3%) Maximum 500%	 A0002422-EN	Minimum permitted slope: <ul style="list-style-type: none"> For CCS140/141 with pH compensation and for CCS240/241: 25% For CCS120/140/141 without pH compensation and for sensor 963: 3%
C14	Calibration status is displayed	o. k. E xxx	 A0002423-EN	
C15	Store calibration result	Yes No New	 A0002424-EN	If C14 = E xxx, then only No or New. If New, then return to C. If Yes/No, then return to "Measurement".
C(2)	CALIBRATION function group: pH calibration	pH	 A0002418-EN	
C21	Calibration status is displayed	25 °C 0 to 50 °C	 A0002425-EN	This field is only for recording the calibration temperature. An entry must not be made.
C22	Enter pH value of the first buffer solution	Buffer value of the last calibration pH 3.50 to 9.50	 A0002427-EN	Press the ENTER key to display the current measured value. Press the ENTER key again as soon as the measured value has adjusted to the buffer value.
C23	Calibration is performed		 A0002428-EN	Stability check: The value is accepted if the stability level is $\leq \text{pH} \pm 0.05$ for more than 10 seconds.
C24	Enter pH value of the second buffer solution	Buffer value of the last calibration pH 3.50 to 9.50	 A0002429-EN	Buffer 2 must have a different value to buffer 1. A plausibility check is performed. Press the ENTER key and proceed as in field C22.
C25	Calibration is performed		 A0002430-EN	Stability check: The value is accepted if the stability level is $\leq \text{pH} \pm 0.05$ for more than 10 seconds.

Coding	Field	Range of adjustment (factory settings in bold)	Display	Info
C26	Slope is displayed	59.16 mV/pH 38.00 to 65.00 mV/pH	 A0002431-EN	
C27	Zero point is displayed	pH 7.00 pH 5.00 to 9.00	 A0002432-EN	
C28	Calibration status is displayed	o. k. E xxx	 A0002452-EN	
C29	Store calibration result?	Yes No New	 A0002434-EN	If C28 = E xxx, then only No or New. If New, then return to C. If Yes/No, then return to "Measurement".
C(3)	CALIBRATION function group: ORP mV calibration	ORPmV	 A0002419-EN	
C31	Enter the value of the ORP buffer	Buffer value of the last calibration 0 to 1500 mV	 A0002435-EN	Press the ENTER key to display the current measured value. Press the ENTER key again as soon as the measured value has adjusted to the buffer value.
C32	Calibration is performed		 A0002436-EN	Stability check: The value is accepted if the stability level is $\leq \text{pH} \pm 1 \text{ mV}$ for more than 10 seconds.
C33	Zero point is displayed	-100 to +100 mV	 A0002437-EN	
C34	Calibration status is displayed	o. k. E xxx	 A0002438-EN	

Coding	Field	Range of adjustment (factory settings in bold)	Display	Info
C35	Store calibration result?	Yes No New	 A0002439-EN	If C34 = E xxx, then only No or New. If New, then return to C. If Yes/No, then return to "Measurement".
C(4)	CALIBRATION function group: Zero point CCS120	Zero point	 A0006376-EN	Zero point calibration for CCS120
C12	Zero point calibration?	No Yes	 A0002421-EN	Only if A1 = 120 Zero point calibration: 1. Pass unchlorinated water through the assembly. 2. Wait for 10 minutes. 3. Accept by selecting YES and pressing ENTER
C14	Calibration status is displayed	o. k. E xxx	 A0002423-EN	
C15	Store calibration result?	Yes No New	 A0002424-EN	If C14 = E xxx, then only No or New. If New, then return to C. If Yes/No, then return to "Measurement".

8 Diagnostics and troubleshooting

8.1 Trouble shooting instructions

The transmitter continuously monitors its functions itself. If an error occurs which the device recognizes, this is indicated on the display. The error number is shown below the display of the main measured value. If more than one error occurs, you can call these up with the MINUS key.

Refer to the "System error messages" table for the possible error numbers and remedial measures.

Should a malfunction occur without any transmitter error message, please refer to the "Process-specific errors" or the "Device-specific errors" tables to localize and rectify the error. These tables provide you with additional information on any spare parts required.

8.2 System error messages

You can display and select the error messages with the MINUS key.

Error No.	Display	Tests/remedial action	Alarm contact	Error current	Autom. cleaning start	PROFIBUS Status
			Facty	Facty	Facty	PV ¹⁾
			User	User	User	Temp
E001	EEPROM memory error	<ul style="list-style-type: none"> Switch off device and switch it on again. Load software compatible with hardware Load measurement-parameter specific device software. If the error persists, send in the device for repair to your local sales center or replace the device. 	Yes	No	X	OC
					X	OC
E002	Device not calibrated, calibration data invalid, no user data or user data invalid (EEPROM error), device software not suitable for hardware (controller)		Yes	No	X	OC
					X	OC
E003	Download error	Invalid configuration. Repeat download.	Yes	No	X	OC
					X	OC
E004	Device software version not compatible with module hardware version	Load software compatible with hardware Load measurement-parameter specific device software.	Yes	No	X	OC
					X	OC
E007	Transmitter malfunction, device software not compatible with transmitter version		Yes	No	X	OC
					X	OC
E010	Temperature sensor defective, not connected or short-circuited (measurement continues with 25 °C)	Check temperature sensor and connections; check the measuring device and measuring cable with a temperature simulator if necessary.	Yes	No	No	80
						OC
E032	Upper or lower pH slope range exceeded	Repeat calibration and replace buffer solution; if necessary, replace sensor and check the device and	No	No	X	80
					X	80
E033	pH value zero point too low or too high		No	No	X	80

Error No.	Display	Tests/remedial action	Alarm contact	Error current	Autom. cleaning start	PROFIBUS Status	
			Facty	Facty	Facty	PV ¹⁾	
			User	User	User	Temp	
		measuring cable with a simulator.			X	80	
E034	ORP offset range exceeded or below range		No	No	X	80	
					X	80	
E035	Sensor 963 zero point signal outside permitted range	<ul style="list-style-type: none">▪ Service the sensor (in accordance with sensor manual).▪ Check connections.▪ Check activated carbon filter.	No	No	X	80	
					X	80	
E038	Cl sensor signal outside permitted range during slope calibration	<ul style="list-style-type: none">▪ Service the sensor (in accordance with sensor manual).▪ Check connections.▪ Check DPD measuring device.▪ Do not use organic chlorination agent.	No	No	X	80	
					X	80	
E041	Calculation of calibration parameters aborted	Repeat calibration and replace buffer solution; replace sensor if necessary, check device and measuring cable.	No	No	X	80	
					X	80	
E042	Distance between buffer value and zero point (pH7) too small (single-point calibration)	For slope calibration, use a buffer solution which has at least a distance of ΔpH = 2 to the electrode zero point.	No	No	X	80	
					X	80	
E043	Distance between buffer 1 and buffer 2 calibration values too small (two-point calibration)	Use buffer solutions which differ by at least Δ pH = 2.	No	No	X	80	
					X	80	
E044	Stability requirement not met during calibration	Repeat calibration and replace buffer solution; if necessary, replace sensor and check the device and measuring cable with a simulator.	No	No	X	80	
					X	80	
E045	Calibration aborted		No	No	X	80	
					X	80	
E055	Lower Cl/ClO ₂ measuring range exceeded	Check measurement and connections; if necessary, check device and measuring cable with a simulator.	Yes	No	No	44	
						80	
E056	Lower pH/mV measuring range exceeded		Yes	No	No	44	
						80	
E057	Upper Cl/ClO ₂ measuring range exceeded		Yes	No	No	44	
						80	
E058	Upper pH/mV measuring range exceeded		Yes	No	No	44	
						80	
E059	Below temperature measuring range		Yes	No	No	80	
						44	

Error No.	Display	Tests/remedial action	Alarm contact	Error current	Autom. cleaning start	PROFIBUS Status
			Facty	Facty	Facty	PV ¹⁾
			User	User	User	Temp
E061	Temperature measuring range exceeded		Yes	No	No	80
						44
E063	Below current output range 1	Check measured value and current assignment	Yes	No	No	80
						80
E064	Current output range 1 exceeded		Yes	No	No	80
						80
E065	Below current output range 2		Yes	No	No	80
						80
E066	Current output range 2 exceeded		Yes	No	No	80
						80
E067	Set point exceeded limit contactor 1	Check configuration	Yes	No	No	80
						80
E068	Set point exceeded limit contactor 2		Yes	No	No	80
						80
E069	Set point exceeded limit contactor 3		Yes	No	No	80
						80
E070	Set point exceeded limit contactor 4		Yes	No	No	80
						80
E080	Current output 1 range too small	Increase range in "Current outputs" menu.	Yes	No	X	80
					X	80
E081	Current output 2 range too small		Yes	No	X	80
					X	80
E085	Incorrect setting for error current	If the current range "0 to 20 mA" was selected in field O311, the error current may not be set to "2.4 mA".	Yes	No	No	80
						80
E100	Current simulation active		Yes	No	X	80
					X	80
E101	Service function active	Switch off service function or switch device off and then on again.	No	No	X	80
					X	80
E102	Manual mode active		No	No	X	80
					X	80
E106	Download active	Wait for download to finish.	No	No	X	80
					X	80
E116	Download error	Repeat download.	Yes	No	X	0C
					X	0C
E152	Measuring signal of Cl/ClO ₂ parameter delayed or frozen	■ Check and service the sensor and connection, and replace if necessary.	No	No	No	44
						44

Error No.	Display	Tests/remedial action	Alarm contact	Error current	Autom. cleaning start	PROFIBUS Status
			Facty	Facty	Facty	PV ¹⁾
			User	User	User	Temp
E153	Measuring signal of pH/mV parameter delayed or frozen	<ul style="list-style-type: none"> Check whether medium has really changed or not. 	No	No	No	44
						44
E154	Cl/ClO ₂ below lower alarm threshold for period exceeding alarm delay	<ul style="list-style-type: none"> Perform manual comparison measurement if necessary. 	Yes	No	No	X
						X
E155	Cl/ClO ₂ above upper alarm threshold for period exceeding alarm delay	<ul style="list-style-type: none"> Service the sensor (in accordance with sensor manual). Recalibrate the measuring system. 	Yes	No	No	X
						X
E156	Actual Cl/ClO ₂ value undershoots alarm threshold for longer than the set permissible maximum period	<ul style="list-style-type: none"> Check the flow. Check the chemical supply. Check dosing devices. 	Yes	No	No	X
						X
E157	Actual Cl/ClO ₂ value exceeds alarm threshold for longer than the set permissible maximum period		Yes	No	No	X
						X
E158	pH/mV below lower alarm threshold for period exceeding alarm delay		Yes	No	No	X
						X
E159	pH/mV above upper alarm threshold for period exceeding alarm delay		Yes	No	No	X
						X
E160	Actual pH/mV value undershoots alarm threshold (CC setpoint) for longer than the set permissible maximum period		Yes	No	No	X
						X
E161	Actual pH/mV value exceeds alarm threshold (CC setpoint) for longer than the set permissible maximum period		Yes	No	No	X
						X
E162	Dosage stop	Check settings in the CURRENT INPUT and CHECK function groups.	Yes	No	No	X
						X
E163	Uncompensated chlorine value too imprecise since pH value > 9	Check pH value and adjust according to system requirements. If pH values > 9, the disinfection effect is questionable since the chlorine now exists as the less effective OCl ⁻ .	Yes	No	No	X
						X

Error No.	Display	Tests/remedial action	Alarm contact	Error current	Autom. cleaning start	PROFIBUS Status	
			Facty	Facty	Facty	PV ¹⁾	
			User	User	User	Temp	
E170	Flow through assembly too low or zero	Restore flow. Check medium pipe.	Yes	No	No	X	
						X	
E171	Flow in main stream too low or zero	Restore flow.	Yes	No	No	X	
						X	
E172	Switch-off limit for current input exceeded	Check process variables at sending measuring device. Change range assignment if necessary.	Yes	No	No	X	
						X	
E173	Current input < 4 mA		Yes	No	No	X	
						X	
E174	Current input > 20 mA		Yes	No	No	X	
						X	

1) PV = process variable, primary value

8.3 Process-specific errors

Use the following table to localize and rectify any errors occurring.

Error	Possible cause	Tests/remedial action	Tools, spare parts
No device function	Device fuse defective	Replace fuse	Fine-wire fuse, M 250 V / 3.15 A
	No power supply	Establish power supply	Check with voltmeter
Display flashes	Automatic controller switch-off due to alarm	Determine cause according to error code Exxx and eliminate.	
	Current output simulation	End the simulation	
Chlorine measurement: Slope too low	Sensor was in chlorine-free water or in air.	Short conditioning over (not in!) chlorine bleach, wait for conditioning time in water before calibration.	Chlorine bleach / chlorine parent solution
No match with DPD control measurement	Measurement takes place without pH compensation, while DPD measurement is always buffered to pH 6.3.	Measure chlorine value pH-compensated	Select CCM223/253 with ES option (manual compensation) or EP (automatic compensation).
DPD measured value much too high	Organic chlorination agent used (may also be used only at times or for shock chlorination). In this case, no correlation between actual free chlorine, DPD measurement and amperometric measurement. DPD value too high by a factor of up to 5.	Use free (gaseous) chlorine or chlorine from inorganic chlorine compounds.	If organic chlorination agent was used previously, the entire system must be evacuated and carefully cleaned!
Chlorine value too high	Membrane defective	Replace membrane cap.	Replacement cartridges CCY 14-WP
	Polarization not complete	Wait for polarization time to finish	Be patient
	Foreign oxidizing agent	Analyze medium	Detailed knowledge of the process

Error	Possible cause	Tests/remedial action	Tools, spare parts
	Shunt in chlorine sensor	Replace sensor	Replacement sensor
Chlorine value too low	Measuring chamber not closed	Refill and screw closed carefully	Electrolyte
	Air cushion outside in front of membrane	Remove air bubble, possibly select better installation position	
	Air cushion inside membrane	Refill and screw closed so that it is bubble-free	Electrolyte
Chlorine value wrong/cannot be calibrated; zero current too large	Wrong polarization voltage	Measure polarization voltage, replace MKC1 module if necessary.	DVM (+) at S or 90, DVM (-) at 91 CCS140/141: -20 mV CCS240/241: +120 mV
	Wrong sensor type selected	Check sensor selection	
pH/mV measurement: Measuring chain zero-point cannot be adjusted	Contaminated reference system	Test with new sensor	pH/mV sensor
	Membrane clogged	Clean or grind membranes (not with TEFLON® membranes)	HCl 3%, needle file (only file in one direction); new sensor
	Measuring line open	Short-circuit pH input and connect to PM -> reading pH 7	
	Asymmetric sensor voltage too high	Clean junction or test with another sensor	HCl 3%, needle file (only file in one direction); new sensor
	Potential matching of Liquisys -> medium incorrect	Always connect CCM223/253 symmetrically with PM.	Wiring diagrams
No or slow change of readings	Sensor fouled	Clean sensor	Cleaning agent
	Sensor old	Replace sensor	New sensor
	Sensor defective (reference lead)	Replace sensor	New sensor
Measuring chain slope not adjustable/ slope too low	Connection not at high impedance (moisture, dirt)	Check cable, plug connector and junction boxes	pH simulator, insulation tester
	Device input defective	pH measurement directly at device	pH simulator
	Sensor old	Replace sensor	pH sensor
Measuring chain slope not adjustable/ No slope	Hair-line crack in the glass membrane	Replace sensor	pH sensor
	Connection not at high impedance	Check cable, plug connector and junction boxes	pH simulator, insulation tester
Constant, incorrect measured value	Sensor does not immerse properly or protection cap not removed	Check installation position, remove protection cap	
	Air pockets in assembly	Check assembly and installation position	
	Grounding short at or in device	Perform test measurement in insulated vessel, perform with buffer solution if required.	Plastic vessel, buffer solutions
	Hair-line crack in the glass membrane	Replace sensor	pH sensor

Error	Possible cause	Tests/remedial action	Tools, spare parts
	Device in impermissible operating condition (does not respond when key pressed)	Disconnect line voltage for approx. 10 seconds	Possibly EMC problem: if problem persists, check grounding and wire routing.
Incorrect temperature value	Incorrect sensor connection	Check connections using wiring diagram. Three-wire connection always required	Wiring diagram in "Electrical connection" section
	Sensor or measuring cable defective	Check sensor and cable	Ohmmeter
Incorrect pH measured value in the process	Flow too high	Reduce flow or measure in a bypass.	
	Potential in medium	Possibly ground with or/at PM pin (connect PA/PM with PE).	Problem mainly occurs in plastic lines.
	Sensor fouling or buildup on sensor	Clean sensor	For heavily contaminated media: use spray cleaning
Fluctuations in measured value	Interference on measuring cable	Connect cable shield as per wiring diagram	See the "Electrical connection" section
	Interference on signal output cable	Check cable routing, possibly route cable separately	Route signal output and measuring input lines separately
	Interference potential in medium	Eliminate source of interference or ground medium as close as possible to sensor.	
	No potential matching on symmetrical input	Connect PM pin in assembly to device terminal PA/PM.	
Controller or timer cannot be activated	No relay module available	Install LSR1-2 or LSR1-4 module	
Controller/limit contact does not work	Controller switched off	Activate controller	See fields R2xx
	Controller in operating mode "Manual off"	Select "Auto" or "Manual on" mode	Keyboard, REL key
	Pickup delay setting too long	Switch off or shorten pickup delay time	See fields R2xx
	"Hold" function active	"Auto hold" for calibration, "Hold" input activated; "Hold" active via keyboard	See fields S2 to S4
Controller/limit contact works continuously	Controller in operating mode "Manual on"	Select "Auto" or "Manual off" mode	Keyboard, REL and AUTO keys
	Dropout delay setting too long	Shorten dropout delay time	See fields R2xx
	Control loop interruption	Check measured value, current output value, actuators, chemical supply	
No current output signal	Cable disconnected or short-circuited	Disconnect cable and measure directly at device	mA meter 0–20 mA
	Output defective	See the "Device-specific errors" section	
Fixed current output signal	Current simulation active	Switch off simulation.	See field O3
	Impermissible operating state of processor system	Disconnect line voltage for approx. 10 seconds	Possibly EMC problem: if problem persists, check grounding and wire routing.
Incorrect current output signal	Incorrect current assignment	Check current assignment: 0–20 mA or 4–20 mA?	Field O311

Error	Possible cause	Tests/remedial action	Tools, spare parts
	Total load in the current loop too high ($> 500 \Omega$)	Disconnect output and measure directly at device	mA meter for 0–20 mA DC
	EMC (interference coupling)	Disconnect both output cables and measure directly at device	Use shielded cables, ground shields at both ends, where necessary route cable in another cable duct
Current output table is not accepted	Value interval too small	Select practical intervals	
No output signal for temperature or pH/mV	Device does not have a second current output	Check version using nameplate, if necessary replace the LSCH-x1 module	LSCH-x2 module, see the "Spare parts" section
	Device with PROFIBUS-PA	PA device has no current output!	
Chemoclean function not available	No relay module (LSR1-x) installed or only LSR1-2 available	Install LSR1-4 module. Chemoclean is enabled using the release code supplied by the manufacturer in the Chemoclean retrofit kit.	LSR1-4 module, see the "Spare parts" section
Plus Package functions not available	Plus Package not enabled (enable by entering a code which depends on the serial number and which is supplied by E+H when a Plus Package is ordered)	<ul style="list-style-type: none"> For Plus Package retrofit: code is supplied by E+H → enter this code. After replacing a defective LSCH/LSCP module: first enter device serial number manually (see nameplate), then enter the existing code number. 	For a detailed description, see the "Replacement of central module" section.
No HART communication	No HART central module	Verify using nameplate: HART = -xxx5xx and -xxx6xx	Upgrade to LSCH-H1 / -H2
	No or incorrect DD (device description)	For further information, see BA00208C/07/EN, "HART field communication with Liquisys CxM223/253"	
	HART interface missing		
	Load too small (must be $> 230 \Omega$)		
	HART receiver (e.g. FXA 191) not connected via load but via power supply		
	Incorrect device address (addr. = 0 for single operation, addr. > 0 for multidrop operation)		
	Line capacitance too high		
	Interference on line		
	Several devices set to same address	Assign addresses correctly	No communication possible if several devices set to the same address
No PROFIBUS communication	No PA/DP central module	Verify using the nameplate: PA = -xxx3xx / DP = xxx4xx	Upgrade to LSCP module, see the "Spare parts" section
	Incorrect device software version (without PROFIBUS)	For further information, see BA00209C/07/EN "PROFIBUS PA/DP - Field communication for Liquisys CxM223/253".	Information about PROFIBUS configuration is provided in Technical Information TI00260F, while detailed information about instrumentation and accessories is provided in Operating Instructions BA00198F
	With Commuwin (CW) II: CW II version and device software version incompatible		
	No or incorrect DD/DLL		

Error	Possible cause	Tests/remedial action	Tools, spare parts
	Incorrect baud rate setting for segment coupler in DPV-1 server		
	Bus user (master) has wrong address or address assigned twice		
	Bus user (slave) has wrong address		
	Bus line not terminated		
	Line problems (too long, cross-section too small, not shielded, shield not grounded, wires not twisted)		
	Bus voltage too low (Bus voltage typ. 24 V DC for non-Ex)	The voltage at the device's PA/DP connector must be at least 9 V	

8.4 Device-specific errors

The following table helps you during the diagnosis and points to any spare parts required.

Depending on the degree of difficulty and the measuring equipment present, diagnosis is carried out by:

- Trained operator personnel
- The user's trained electrical technicians
- Company responsible for system installation/operation
- Endress+Hauser Service

Information on the exact spare part designations and on how to install these parts can be found in the "Spare parts" section.

Error	Possible cause	Tests/remedial action	Execution, tools, spare parts
Device cannot be operated, display value 9999	Operation locked	Press CAL and MINUS keys simultaneously.	See the "Key functions" section
Display dark, no light-emitting diode active	No line voltage	Check whether line voltage is present	Electrical technician / e.g. multimeter
	Supply voltage wrong/too low	Compare actual line voltage and nameplate data	User (data for energy supply company or multimeter)
	Connection faulty	<ul style="list-style-type: none"> ■ Terminal not tightened ■ Insulation jammed ■ Wrong terminals used 	Electrical technician
	Device fuse defective	Compare line voltage and the nameplate data and replace fuse	Electrical technician/suitable fuse; see exploded drawing in the the "Spare parts" section
	Power unit defective	Replace power unit, note version	Onsite diagnosis by Endress +Hauser Service, test module necessary
	Central module defective	Replace central module, note version	Onsite diagnosis by Endress +Hauser Service, test module necessary
	Field device: ribbon cable loose or defective	Check ribbon cable, replace if necessary	See the "Spare parts" section

Error	Possible cause	Tests/remedial action	Execution, tools, spare parts
Display dark, light-emitting diode active	Central module defective (module: LSCH/LSCP)	Replace central module, note version	Onsite diagnosis by Endress+Hauser Service, test module necessary
Values appear on display but: <ul style="list-style-type: none"> Display does not change and / or Device cannot be operated 	Device or module in device not correctly mounted	Panel-mounted device: reinstall insert. Field device: remount display module	Perform with the aid of the installation drawings in the the "Spare parts" section
	Impermissible operating system condition	Disconnect line voltage for approx. 10 seconds	Possibly Possible EMC problem: if this persists, check the installation or have checked by Endress+Hauser Service
Device gets hot	Voltage wrong/too high	Compare line voltage and nameplate data	User, electrical technician
	Power unit defective	Replace power unit	Diagnosis only by Endress+Hauser Service
Cl/CIO ₂ measured value and/or temperature measured value incorrect	Transmitter module defective (module: MKIC), please first carry out tests and take measures as per the "Process-specific errors" section	Measuring input test: <ul style="list-style-type: none"> Chlorine input open = display 0.00 mg/l 10 kΩ resistance at terminals 11 + 12 = display 25 °C 	If test negative: replace module (note version) Perform with the aid of the exploded drawings in the "Spare parts" section.
Current output, incorrect current value	Incorrect adjustment	Check with integrated current simulation, connect mA meter directly to current output.	If simulation value incorrect: adjustment in factory or new LSCH module required. If simulation value correct: check current loop for load and shunts.
	Load too large		
	Shunt / short to ground in current loop		
	Incorrect mode of operation	Check whether 0–20 mA or 4–20 mA is selected.	
No current output signal	Current output stage defective (only for LSCH module; LSCP has no current output)	Check with integrated current simulation, connect mA meter directly to current output	If test negative: Replace central module (note version)
Additional relays not working	Field device: ribbon cable loose or defective	Check ribbon cable seating, replace cable if required.	See the "Spare parts" section
Only 2 additional relays can be triggered	LSR1-2 relay module with 2 relays is installed	Upgrade to LSR1-4 with 4 relays.	User or Endress+Hauser Service
Additional functions (Plus Package) missing	No or incorrect release code used	If retrofitting: check whether the correct serial number was quoted when ordering the Plus Package.	Handled by Endress+Hauser Sales
	Incorrect device serial number saved in LSCH/LSCP module	Check whether serial number on the nameplate matches SNR in LSCH/ LSCP (field S 8).	The serial number of the device is definitive for the Plus Package.
Additional functions (Plus Package and/or Chemoclean) missing after LSCH/LSCP module replacement	Replacement modules LSCH or LSCP have the device serial number 0000 when they leave the factory. The Plus Package or Chemoclean are not enabled on leaving the factory.	In the case of LSCH/LSCP with SNR 0000, a device serial number can be entered once in fields E115 to E117. Then enter the release codes for the Plus Package and/or Chemoclean if necessary.	For a detailed description, see the "Replacement of central module" section.

Error	Possible cause	Tests/remedial action	Execution, tools, spare parts
No HART or PROFIBUS PA/DP interface function	Incorrect central module	HART: LSCH-H1 or H2 module, PROFIBUS-PA: LSCP-PA module, PROFIBUS-DP: LSCP-DP module, see field E112.	Replace central module; User or Endress+Hauser Service.
	Wrong software	SW version, see field E111.	
	Bus problem	Remove some devices and repeat the test.	Contact Endress+Hauser Service.

9 Maintenance

WARNING

Process pressure and temperature, contamination, electrical voltage

Risk of serious or fatal injury

- ▶ If the sensor has to be removed during maintenance work, avoid hazards posed by pressure, temperature and contamination.
- ▶ Make sure the device is de-energized before you open it.
- ▶ Power can be supplied to switching contacts from separate circuits. De-energize these circuits before working on the terminals.

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

The maintenance of the measuring point comprises:

- Calibration
- Cleaning the controller, assembly and sensor
- Checking the cables and connections

When performing any work on the device, bear in mind any potential impact this may have on the process control system or on the process itself.

NOTICE

Electrostatic discharge (ESD)

Risk of damaging the electronic components

- ▶ Take personal protective measures to avoid ESD, such as discharging beforehand at PE or permanent grounding with a wrist strap.
- ▶ For your own safety, only use genuine spare parts. With genuine parts, the function, accuracy and reliability are also ensured after maintenance work.

9.1 Maintenance of the entire measuring point

9.1.1 Cleaning the transmitter

Clean the front of the housing using commercially available cleaning agents only.

The front of the housing is resistant to the following in accordance with DIN 42 115:

- Ethanol (for a short time)
- Diluted acids (max. 2% HCl)
- Diluted alkaline solutions (max. 3% NaOH)
- Soap-based household cleaning agents

When performing any work on the device, bear in mind any potential impact this may have on the process control system or on the process itself.

NOTICE**Prohibited cleaning agents**

Damage to the housing surface or housing seal

- ▶ Never use concentrated mineral acids or alkaline solutions for cleaning.
- ▶ Never use organic cleaners such as benzyl alcohol, methanol, methylene chloride, xylene or concentrated glycerol cleaner.
- ▶ Never use high-pressure steam for cleaning purposes.

9.1.2 Cleaning the pH/mV sensors (EP version)**⚠ CAUTION****Cleaning not switched off during calibration or maintenance activities**

Risk of injury due to medium or cleaning agent

- ▶ If a cleaning system is connected, switch it off before removing a sensor from the medium.
- ▶ If you wish to check the cleaning function and have therefore not switched off the cleaning system, please wear protective clothing, goggles and gloves or take other appropriate measures.

⚠ CAUTION**Risk of injury from cleaning agents**

- ▶ When using the following cleaning agents, make sure to protect your hands, eyes and clothing.

Please clean **contamination on the glass electrodes** as follows:

- Oily and greasy films:
Clean with hot water or temperature-controller detergent (grease remover, e.g. alcohol, acetone, possibly dishwashing detergent).
- Lime and metal hydroxide buildup:
Dissolve buildup with diluted hydrochloric acid (3 %) and then rinse thoroughly with plenty of clear water.
- Sulfidic buildup (from flue gas desulfurization or sewage treatment plants):
Use a mixture of hydrochloric acid (3 %) and thiocarbamide (commercially available) and then rinse thoroughly with plenty of clear water.
- Buildup containing proteins (e.g. food industry):
Use a mixture of hydrochloric acid (0.5 %) and pepsin (commercially available) and then rinse thoroughly with plenty of clear water.
- Fibers, suspended substances:
Pressurized water, surface-active agents if necessary
- Light biological buildup:
Pressurized water

ORP electrodes:

Carefully clean the metal pins or surfaces mechanically.



After mechanical cleaning, the ORP sensor can require several hours conditioning time. For this reason, check the calibration after one day.

ISFET sensors

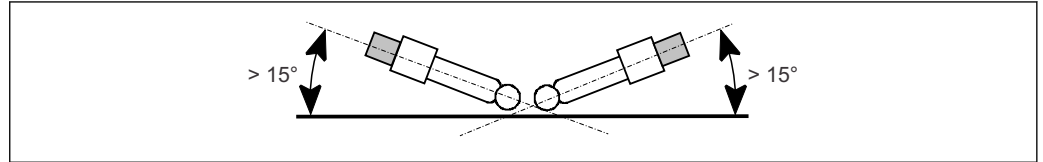
- Never use acetone to clean ISFET sensors as this could damage the material.
- After being cleaned with compressed air, ISFET sensors require approx. 5 to 8 minutes until the closed-control loop is re-established and the measured value has adjusted to the real value.

Clogged membranes can be cleaned mechanically under certain circumstances (does not apply to ISFET sensors, Teflon membranes and open ring junction electrodes):

- Use a small warding file.
- Only file in one direction.

Air bubbles in the electrode:

- Air bubbles can indicate incorrect mounting. For this reason check the orientation.
- The range 15° to 165° to the horizontal is allowed (ISFET sensors are the exception).
- Not permitted: horizontal installation or installation with the plug-in head pointing downwards.



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■ 44 Permitted angle of installation for glass electrodes

Check for reference system reduction

The inner reference lead of the reference system (Ag/AgCl) of a combination electrode or a separate reference electrode is usually brownish and matt. A silver-colored reference system is reduced and therefore defective. This is caused by a current flowing through the reference element.

Possible causes for the current flow:

- Incorrect measuring device operating mode selected (PML pin connected, but operating mode asymmetrical ("without PML"). See also the function description for "Selecting the connection type".
- Shunt in measuring cable (e.g. due to moisture) between reference line and grounded shield or PM line.
- Measuring device defective (shunt in reference input or entire input amplifier downstream of PE).

9.1.3 Maintenance of chlorine sensors

Please refer to the Operating Instructions for your sensor for sensor maintenance and troubleshooting:

CCS120	BA00388C/07/EN
CCS140/141	BA00058C/07/EN
CCS240/241	BA00114C/07/EN
963	BA00039C/07/EN

The Operating Instructions contain detailed information including:

- Sensor design and function
- Mounting and installation
- Electrical connection
- Commissioning and calibration
- Calculation examples and tables for verification of measured values
- Maintenance, regeneration, cleaning
- Troubleshooting table
- Accessories and spare parts
- Technical data and ordering information

9.1.4 Assembly

Refer to the assembly operating manual for information on servicing and troubleshooting the assembly. The assembly operating manual describes the procedure for mounting and disassembling the assembly, replacing the sensors and seals, and contains information on the material resistance properties, as well as on spare parts and accessories.

9.1.5 Maintenance of pH connecting cables and junction boxes (EP version)

Check the cables and connections for moisture. Moisture is indicated by a sensor slope that is too small. If nothing more can be displayed or if the display is fixed at pH 7, please check the following components:

- Sensor head
- Sensor plug
- Junction box, if fitted
- Extension cable

NOTICE


Incorrect measurements caused by moisture in the measuring cable

- If there is moisture in the measuring cable, the cable must be replaced!

A shunt in the cable of $> 20 \text{ M}\Omega$ cannot be measured with normal multimeters but is damaging for the pH measurement. Connect a pH simulator instead of the sensor. The value that is displayed on the transmitter must match the value set at the simulator. The value can differ at the second decimal place at the very maximum.

If you do not have a pH simulator, you can test the cable with a commercially available megohmmeter. Please note the following when performing the test:

- Make sure to disconnect the pH measuring cable from the sensor and device!
- If you are using a junction box, you should check the infeed and outfeed measuring cable separately.
- Check the cable with 1000 V DC (at least with 500 V DC) testing voltage.
- If the cable is intact, the insulation resistance is $> 100 \text{ G}\Omega$.
- If the cable is defective (moist), there is flashover.
The cable must be replaced.

 You can clean (desalinate) the sensor head and junction box with de-ionized water and dry them with a hot air dryer.

9.2 Test and simulation

9.2.1 Chlorine sensors

Chlorine sensors work according to the amperometric principle and supply very small direct currents as the measuring signal.

A chlorine sensor can be simulated by a DC source. Due to the small currents, however, the simulation is highly sensitive. Use shielded cables and ground the simulator. Typical slope values are provided in the table below:

Sensor	Typical slope value
CCS120	Approx. 115 nA per mg Cl/l
CCS140	Approx. 25 nA per mg Cl/l
CCS141	Approx. 80 nA per mg Cl/l
CCS240	Approx. 100 nA per mg ClO ₂ /l
CCS241	Approx. 350 nA per mg ClO ₂ /l
963	Approx. 20 µA per mg Cl/l

9.2.2 Temperature measurement

The transmitter uses the NTC sensor of the chlorine sensor to measure the temperature.

Due to the relatively high sensor resistance, a two-wire connection is sufficient.

Simulation can be performed with a normal decade resistor. The table below contains some simulation values:

Temperature	NTC simulation value
0 °C (32 °F)	29.490 kΩ
10 °C (50 °F)	18.787 kΩ
20 °C (68 °F)	12.268 kΩ
25 °C (77 °F)	10.000 kΩ
30 °C (86 °F)	8.197 kΩ
40 °C (104 °F)	5.594 kΩ

9.2.3 pH/ORP measurement

Simulation is performed with a pH/mV simulator or an mV voltage source.



In the case of the CCM223/253, the pH or mV must always be measured symmetrically. For this reason, each simulation requires potential matching with the simulator. Connect the reference signal of the simulator (normal shield of the pH coaxial measuring line) to the PA/PM terminal of the transmitter.

Zero point rapid test

- In the case of the panel-mounted device, connect the BNC inner conductor to the BNC receptacle and the PM terminal.
- In the case of the field device, connect the pH terminal, the Ref terminal and the PM terminal.
- For pH the reading must be approx. 7, and for ORP approx. 0 mV.

Test with DC supply point

pH value	Simulation
2	295 mV
4	177 mV
7	0 mV
9	-118 mV
12	-295 mV

9.2.4 Flow monitoring

Flow is monitored by an inductive proximity switch (INS) in the CCA250 assembly. This switch is powered by 15 V from the auxiliary voltage output of the transmitter.

Function of the INS

Flow	INS	INS output
Yes	damped	low impedance
No	not damped	high-impedance

Test or emergency mode

If you connect terminal 93 to terminal 85 and terminal 94 to terminal 86, this simulates an active proximity switch and thus a correct flow.



Do not run the measuring system continuously in this state. Reestablish flow monitoring as soon as possible!

10 Repair

10.1 Spare parts

Please order spare parts from your local Sales Office. For this purpose, use the order numbers listed in the "Spare part kits" section.

For safety, you should always provide the following additional data when ordering spare parts:

- Device order code
- Serial number
- Software version, if possible

You can take the order code and serial number from the nameplate.

The software version is provided in the device software provided that the device processor system is still working.

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

www.endress.com/spareparts_consumables

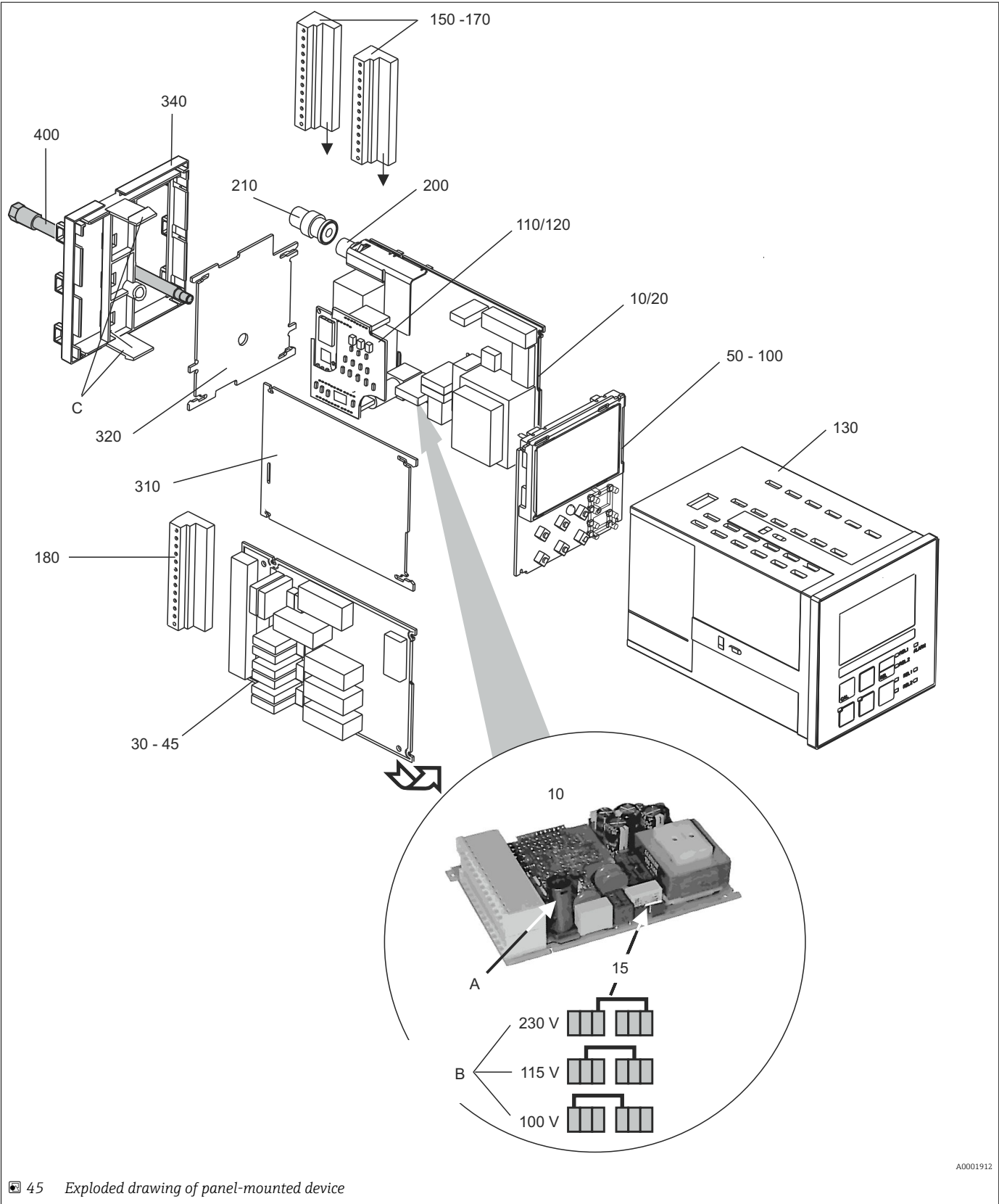
10.2 Disassembling the panel-mounted device

 Please note the effects on the process if the device is taken out of service!

See the exploded drawing for the item numbers.

1. Disconnect the terminal block (item 150 to 180) from the rear of the device to de-energize the device.
2. Press in the latches of the end frame (item 340) and remove the frame from the rear.
3. Release the special screw (item 400) by turning it counter-clockwise.
4. Remove the entire electronics block from the housing. The modules are only mechanically connected and can be easily separated:
5. Simply remove the processor/display module towards the front.
6. Pull out the brackets of the rear plate (item 320) slightly.
7. Now you can remove the side modules.
8. Remove the Cl transmitter (item 110/120) as follows:
9. Using a fine wire cutter, nip off the heads of the synthetic distance holders.
10. Then remove the module from above.


Assembly is the reverse of the disassembly sequence. Tighten the special screw finger-tight without using a tool.



The exploded drawing contains the components and spare parts of the panel-mounted device. You can take the spare parts and the corresponding order number from the following section using the item numbers.

Item	Kit description	Name	Function/contents	Order no.
10	Power unit (main module)	LSGA	100/115/230 V AC	51500317
15	Jumper		Part of power unit, item 10	
20	Power unit (main module)	LSGD	24 V AC + DC	51500318
30	Relay module	LSR1-2	2 relays	51500320
35	Relay module	LSR2-2i	2 relays + 4-20 mA current input	51504304
35	Kit for Cxm2x3 relay module PROFIBUS DP	LSR2-DP	Relay module + 2 relays Curr. input + DP terminals Hardware version 2.10 and higher	71134732
40	Relay module	LSR1-4	4 relays	51500321
45	Relay module	LSR2-4i	4 relays + 4-20 mA current input	51504305
50	Central module	LSCH-S1	1 current output	51502467
50	Kit for CCM2x3 central module PROFIBUS DP	LSCP	PROFIBUS DP central module Relay module + 2 relays Curr. input + DP terminals Hardware version 2.10 and higher	71134731
60	Central module	LSCH-S2	2 current outputs	51502468
70	Central module	LSCH-H1	1 current output + HART	51502497
80	Central module	LSCH-H2	2 current outputs + HART	51502496
90	Central module	LSCP-PA	PROFIBUS PA/no current output	51502495
100	Central module	LSCP-DP	PROFIBUS DP/no current output	51502498
110	Cl transmitter	MKC1	Input Cl and temperature	51502466
120	Cl/pH transmitter	MKC1	Input Cl, pH/mV, temperature	51502465
130, 400	Housing module		Housing with front membrane, sensory tappets, seal, special screw, tensioning dogs, connection plates and nameplates	51501075
150	Complete terminal strip set Standard + HART		Terminal strip set, inputs/outputs, power supply, alarm relay	51502463
160	Complete terminal strip set PROFIBUS-PA		Terminal strip set, inputs/outputs, power supply, alarm relay	51502464
170	Complete terminal strip set PROFIBUS-DP		Terminal strip set, inputs/outputs, power supply, alarm relay	51502490
180	Terminal strip		Terminal strip for relay modules	51501078
200	pH input socket		Socket with screen plate	51501070
210	BNC connector		BNC easy solder-free, angled	50074961
310, 320, 340, 400	Housing mechanical parts		Rear plate, side panel, end frame, special screw	51501076
340	End frame PROFIBUS-DP		Rear frame for PROFIBUS DP, with D-submin plug connector	51502513
A	Fuse		Part of power unit, item 10	
B	Choice of line voltage		Position of jumper on power unit, item 10 depending on line voltage	
C	End frame latches		Part of the end frame	

10.3 Disassembling the field device

 Please note the effects on the process if the device is taken out of service!

See the exploded drawing for the item numbers.


You require the following tools to disassemble the field device:

- Standard set of screwdrivers
- Torx screwdriver, size TX 20

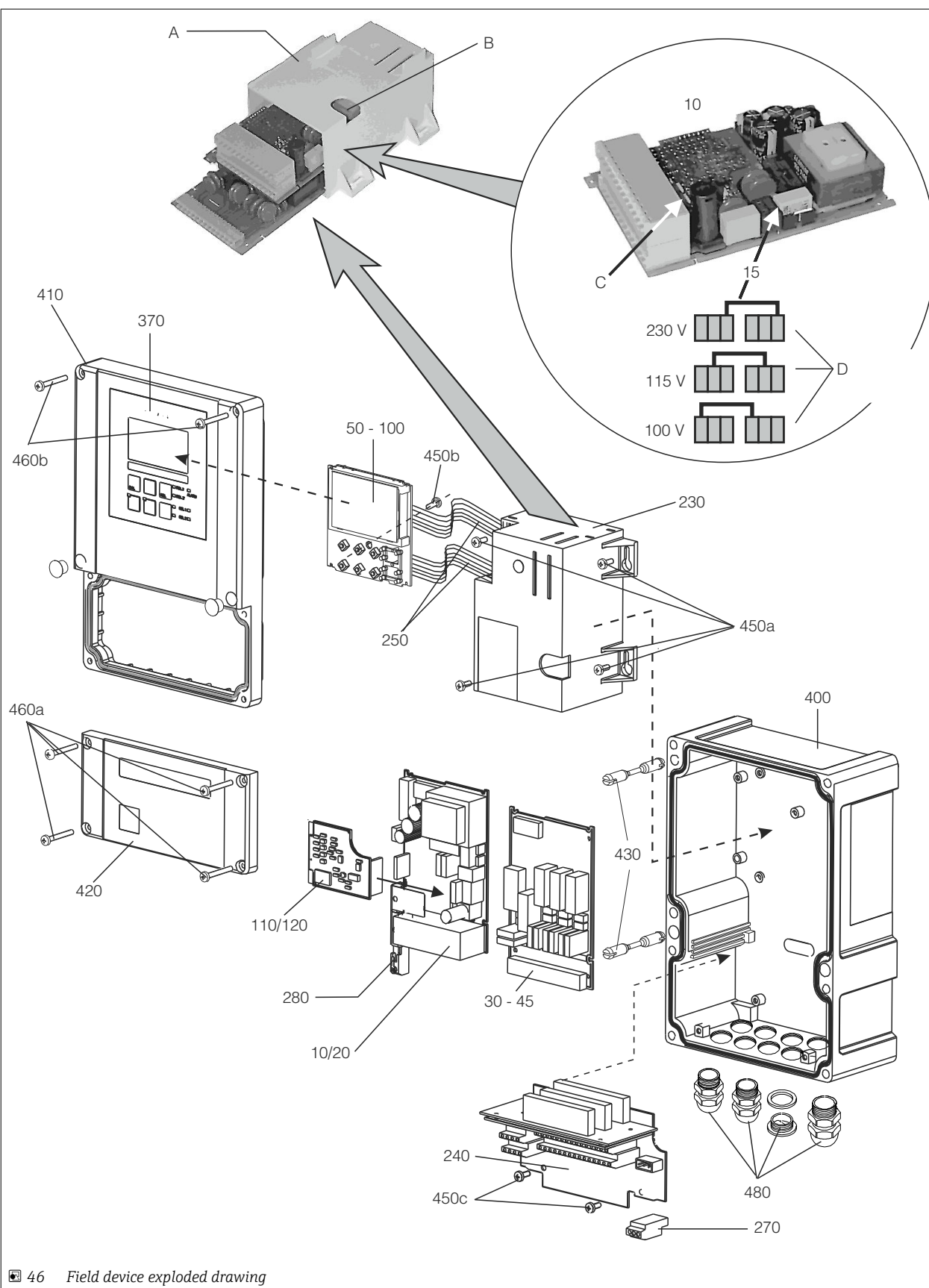
Proceed as follows to disassemble the field device:

1. Open and remove the cover of the connection compartment (item 420).
2. Disconnect the supply terminal (item 270)) to de-energize the device.
3. Open the display cover (item 410) and release the ribbon cables (item 250) on the central module side (item 50 to 100) .
4. To remove the central module (item 50) release the screw in the display cover (item 450 b).
5. Proceed as follows to remove the electronics box (item 230) :
6. Turn the screws in the housing base (item 450 a) by two revolutions to release them.
7. Then push the entire box backwards and remove it from above while making sure that the module locks do not open.
8. Release the ribbon cables (item 250) .
9. Bend the module locks out and remove the modules.
10. To remove the docking module (item 240) remove the screws in the housing base (item 450 c) and remove the entire assembly from above.
11. To remove the CI transmitter (item 110/120) on devices with a pH/mV input, bend the shielding plate up.
12. Disconnect the connected strand (pH input, strand comes from the BNC connection jack) and nip off the heads of the synthetic distance sleeves using a fine wire cutter.
13. Then remove the module from above.

To assemble, carefully push the modules into the guide rails of the electronics box and let them engage in the side box noses.

 It is not possible to mount the modules incorrectly. Modules inserted in the electronics box incorrectly are not operable since the ribbon cables cannot be connected.

Make sure the cover seals are intact to guarantee IP 65 ingress protection.



The exploded drawing contains the components and spare parts of the field device. You can take the spare parts and the corresponding order number from the following section using the item numbers.

Item	Kit description	Name	Function/contents	Order no.
10	Power unit (main module)	LSGA	100/115/230 V AC	51500317
15	Jumper		Part of power unit, item 10	
20	Power unit (main module)	LSGD	24 V AC + DC	51500318
30	Relay module	LSR1-2	2 relays	51500320
35	Relay module	LSR2-2i	2 relays + 4-20 mA current input	51504304
35	Kit for Cxm2x3 relay module PROFIBUS DP	LSR2-DP	Relay module + 2 relays Curr. input + DP terminals Hardware version 2.10 and higher	71134732
40	Relay module	LSR1-4	4 relays	51500321
45	Relay module	LSR2-4i	4 relays + 4-20 mA current input	51504305
50	Central module	LSCH-S1	1 current output	51502467
50	Kit for CCM2x3 central module PROFIBUS DP	LSCP	PROFIBUS DP central module Relay module + 2 relays Curr. input + DP terminals Hardware version 2.10 and higher	71134731
60	Central module	LSCH-S2	2 current outputs	51502468
70	Central module	LSCH-H1	1 current output + HART	51502497
80	Central module	LSCH-H2	2 current outputs + HART	51502496
90	Central module	LSCP-PA	PROFIBUS PA/no current output	51502495
100	Central module	LSCP-DP	PROFIBUS DP/no current output	51502498
110	Cl transmitter	MKC1	Input Cl and temperature	51502466
120	Cl/pH transmitter	MKC1	Input Cl, pH/mV, temperature	51502465
230, 240	Inner housing fittings		Docking module, empty electronics box, small parts	51501073
250	Ribbon cable lines		2 ribbon cable lines	51501074
270	Terminal strip		Terminal strip for connection to power supply	51501079
280	pH terminal		pH terminal with shielding plate	51501071
370, 410, 420, 430, 460	Housing cover		Display cover, connection compartment cover, front membrane, hinges, cover screws, small parts	51501068
400, 480	Housing base		Base, threaded joints	51501072
310, 320, 340, 400	Housing mechanical parts		Rear plate, side panel, end frame, special screw	51501076
A	Electronics box with relay module LSR1-x (bottom) and power unit LSGA/LSGD (top)			
B	Fuse also accessible if electronics box installed			
C	Fuse		Part of power unit, item 10	
D	Choice of line voltage		Position of jumper on power unit, item 10 depending on line voltage	

10.4 Replacing the central module


 Generally, when a central module has been replaced, all data which can be changed are set to the factory setting.

If possible, note the customized settings of the device, such as:

- Calibration data
- Current assignment, main parameter and temperature
- Relay function selections
- Limit value/controller settings
- Cleaning settings
- Monitoring functions
- Interface parameters

Proceed as described below if a central module is replaced:

1. Disassemble the device as explained in the "Dismantling the panel-mounted instrument" or "Dismantling the field instrument" section.
2. Use the part number on the central module to check whether the new module has the same part number as the previous module.
3. Reassemble the device with the new module.
4. Put the device back into operation and check the basic functions (e.g. measured value and temperature display, operation via keyboard).
5. Read the serial number ("ser-no.") off the nameplate of the device (e.g. 6A345605G00) and enter this number in fields E115 (1st digit = year, one-digit (6 in the example)), E116 (2nd digit: month, one-digit (A in the example)), E117 (digits 3-6 cons. number, four-digit (3456 in the example)).
 - ↳ In the field E118, the complete number is displayed again so you can check it is correct.

 You can only enter the serial number for new modules with the serial number 0000. This can only be done once! For this reason, make sure the number entered is correct before you press ENTER to confirm!

If an incorrect code is entered, the additional functions are not enabled. An incorrect serial number can only be corrected at the factory!

1. Press ENTER to confirm the serial number or cancel the entry to enter the number again.
2. If available, enter the release codes for the Plus Package and/or Chemoclean in the "Service" menu.
3. Check the Plus Package release (e.g. by opening the function group CHECK / Code P) or the Chemoclean function.
4. Make the customized device settings again.

10.5 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.

10.6 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.

11 Accessories

11.1 Sensors

CCS120

- Amperometric sensor for total chlorine
- Measuring range 0.1 to 10 mg/l
- Product Configurator on the product page: www.endress.com/ccs120



Technical Information TI00388C

CCS140

- Membrane-covered amperometric sensor for free chlorine
- Measuring range 0.05 to 20 mg/l
- Product Configurator on the product page: www.endress.com/ccs140



Technical Information TI00058C

CCS141

- Membrane-covered amperometric trace sensor for free chlorine
- Measuring range 0.01 to 5 mg/l
- Product Configurator on the product page: www.endress.com/ccs141



Technical Information TI00058C

CCS240

- Membrane-covered amperometric sensor for chlorine dioxide
- Measuring range 0.05 to 20 mg/l
- Product Configurator on the product page: www.endress.com/ccs240



Technical Information TI00114C

CCS241

- Membrane-covered amperometric trace sensor for chlorine dioxide
- Measuring range 0.01 to 5 mg/l
- Product Configurator on the product page: www.endress.com/ccs241



Technical Information TI00114C

11.2 Connection accessories

Measuring cable CYK71

- Underminated cable for connecting analog sensors and for extending sensor cables
- Sold by the meter, order numbers:
 - Non-Ex version, black: 50085333
 - Ex-version, blue: 50085673

CPK1

For pH/ORP electrodes with GSA plug-in head



Ordering information is available from your sales office or at www.endress.com.

CPK9

- Terminated measuring cable for connecting analog sensors with TOP68 plug-in head
- Selection in accordance with product structure



For more information and to order, please contact your sales office.

MK extension cable

- Twin-core signal cable with additional shielding and PVC insulation
- Particularly for the transmission of output signals of transmitters or input signals of controllers and for temperature measurement.
- Order number: 50000662

VBC junction box

- For cable extension (for chlorine measuring systems)
- Dimensions (B x D x H): 125 x 80 x 54 mm (4.92 x 3.15 x 2.13 ")
- 10 terminal strips
- Cable entries: 7 x Pg 7, 2 x Pg 11
- Material: aluminum
- Degree of protection: IP 65 (i NEMA 4x)
- Order No. 50005181

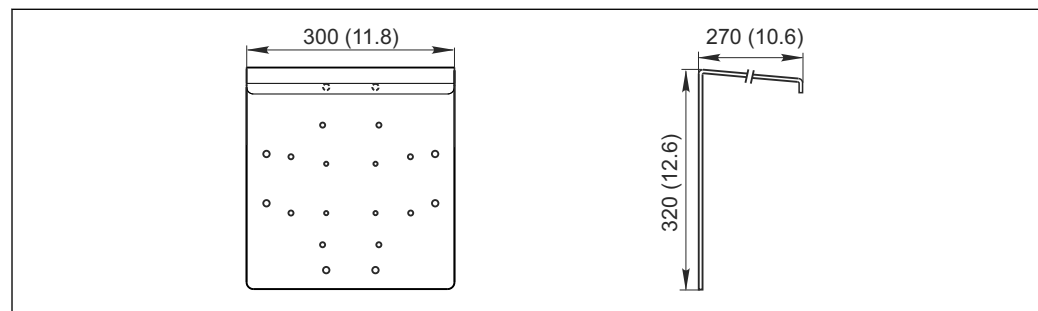
VBM

- Junction box for cable extension
- 10 terminal strips
- Cable entries: 2 x Pg 13.5 or 2 x NPT ½"
- Material: aluminum
- Degree of protection: IP 65
- Order numbers
 - Cable entries Pg 13.5 : 50003987
 - Cable entries NPT ½": 51500177

11.3 Installation accessories

CYY101

- Weather protection cover for field devices
- Absolutely essential for field installation
- Material: stainless steel 1.4301 (AISI 304)
- Order No. CYY101-A



A0024627

47 Dimensions in mm (inch)

Flexdip CYH112

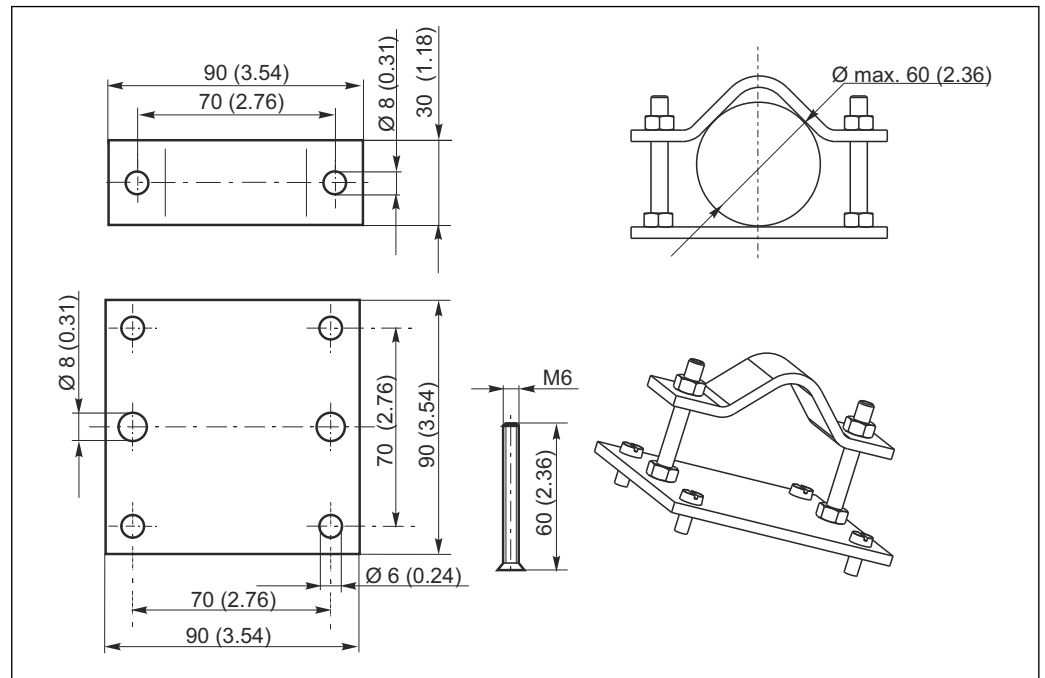
- Modular holder system for sensors and assemblies in open basins, channels and tanks
- For Flexdip CYA112 water and wastewater assemblies
- Can be affixed anywhere: on the ground, on the capstone, on the wall or directly onto railings.
- Stainless steel version
- Product Configurator on the product page: www.endress.com/cyh112



Technical Information TI00430C

Post mounting kit

- For securing the field housing to horizontal and vertical posts and pipes
- Material: stainless steel 1.4301 (AISI 304)
- Order No. 50086842



48 Dimensions in mm (inch)

11.4 Software and hardware add-ons

The add-ons can only be ordered by quoting the serial number of the device in question.

- Plus Package
Order No. 51502242
- Chemoclean function (requires four-relay card)
Order No. 51502871
- Two-relay card
Order No. 51500320
- Four-relay card
Order No. 51500321
- Two-relay card with current input
Order No. 51504304
- Four-relay card with current input
Order No. 51504305
- pH package for EK version
Order No. 51502460
- pH package for ES version
Order No. 51503526

11.5 Metering system

Compact measuring station CCE10/CCE11

- Fully assembled and wired panel for one or three transmitters, with CCA250-A1 flow assembly
- Product Configurator on the product page: www.endress.com/cce10 or www.endress.com/cce11



Technical Information TI00440C

11.6 Calibration accessories

Photometer PF-3

- Compact hand-held photometer for determining free available chlorine
- Color-coded reagent bottles with clear dosing instructions
- Order No.: 71257946

12 Technical data

12.1 Input

Measured variables	Total chlorine Free available chlorine Chlorine dioxide Temperature pH value or ORP (optional)	
Cl ₂ /ClO ₂ signal input	CCS120/140/141/240/241: Sensor 963:	0 to 5000 nA -100 to 500 µA
Temperature measurement	Temperature sensor for CCS120/140/141/240/241: Display range:	NTC, 10 kΩ at 25 °C (77 °F) 0 to 50 °C (32 to 122 °F)
pH and ORP measurement	pH measuring range: ORP measuring range: Zero point adjustment: Slope adjustment	pH 3.5 to 9.5 0 to 1500 mV ±100 mV 38 to 65 mV/pH
Binary inputs	Voltage Current consumption	10 to 50 V Max. 10 mA
Current input	4 to 20 mA, galvanically isolated Load: 260 Ω for 20 mA (voltage drop 5.2 V)	

12.2 Output

Output signal	HART	
	Signal encoding	Frequency Shift Keying (FSK) + 0.5 mA via current output signal
	Data transmission rate	1200 baud
	Galvanic isolation	Yes
	PROFIBUS PA	
	Signal encoding	Manchester Bus Powered (MBP)
	Data transmission rate	31.25 kBit/s, voltage mode
	Galvanic isolation	Yes (IO modules)

PROFIBUS DP	
Signal encoding	RS485
Data transmission rate	9.6 kBd, 19.2 kBd, 93.75 kBd, 187.5 kBd, 500 kBd, 1.5 MBd
Galvanic isolation	Yes (IO modules)

Signal on alarm	2.4 or 22 mA in the event of an error	
Load	Max. 500 Ω	
Transmission range	Cl ₂ /ClO ₂	
	CCS120	0 to 10 mg/l
	CCS140/240	0 to 20 mg/l
	CCS141/241 and 963	0 to 5 mg/l
	Temperature	0 to 50 °C (32 to 120 °F)
	pH	4 to 9
	ORP	0 to 1500 mV
Signal resolution	Max. 700 digits/mA	
Separation voltage	Max. 350 V _{RMS} / 500 V DC	
Auxiliary voltage output	Output voltage	15 V \pm 0.6 V
	Output current	Max. 10 mA
Contact outputs	Switching current with ohmic load ($\cos \varphi = 1$)	Max. 2 A
	Switching current with inductive load ($\cos \varphi =$ Max. 0.4)	Max. 2 A
	Switching voltage	Max. 250 V AC, 30 V DC
	Switching power with ohmic load ($\cos \varphi = 1$)	Max. 500 VA AC, 60 W DC
	Switching power with inductive load ($\cos \varphi =$ 0.4)	Max. 500 VA AC, 60 W DC
Limit contactors	Pickup/dropout delay	0 to 2000 s
Controller	Function (configurable)	Pulse length/pulse frequency controller, continuous controller
		Three-point step controller for Cl ₂ /ClO ₂
	Controller behavior	P, PI, PD, PID, basic load dosing
	Control gain K _p	0.01 to 20.00
	Integral action time T _n	0.0 to 999.9 min
	Derivative action time T _v	0.0 to 999.9 min
	Period length for pulse length controller	0.5 to 999.9 s
	Frequency for pulse frequency controller	60 to 180 min ⁻¹
	Basic load	0 to 40 % of max. actuating variable
	Motor run time for three-point step controller	10 to 999 s
	Neutral zone for three-point step controller	0 to 40 %

Alarm	Function (switchable)	Latching/momentary contact
	Alarm threshold adjustment range	Cl ₂ /ClO ₂ /pH/ORP/temperature: entire range
	Alarm delay	0 to 2000 s
	Monitoring time for lower limit violation	0 to 2000 min
	Monitoring time for upper limit violation	0 to 2000 min

Protocol-specific data

HART	
Manufacturer ID	11 _h
Device type	0094 _h
Transmitter-specific revision	0001 _h
HART version	5.0
Device description files (DD)	www.endress.com/hart
HART load (communication resistor)	250 Ω
Device variables	None (only dynamic variables PV and SV)
Supported features	-

PROFIBUS PA	
Manufacturer ID	11 _h
Device type	1518 _h
Device revision	0001 _h
Profile version	2.0
GSD files	www.endress.com/profibus
GSD version	
Output values	Primary value, temperature
Input variables	PCS display value
Supported features	Device lock: The device can be locked using the hardware or software.

PROFIBUS DP	
Manufacturer ID	11 _h
Device type	151E _h
Profile version	2.0
GSD files	www.endress.com/profibus
GSD version	
Output values	Primary value, temperature
Input variables	PCS display value
Supported features	Device lock: The device can be locked using the hardware or software.

12.3 Power supply

Supply voltage	Depending on order version: <ul style="list-style-type: none"> ■ 100/115/230 V AC +10/-15 %, 48 to 62 Hz ■ 24 V AC/DC +20/-15 %
----------------	--

Power supply via fieldbus	HART	
	Supply voltage	Not applicable, active current outputs
	Reverse polarity protection	Not applicable, active current outputs

PROFIBUS PA	
Supply voltage	9 V to 32 V, max. 35 V
Sensitivity to reverse polarity	No
FISCO/FNICO compliant according to IEC 60079-27	No

PROFIBUS DP	
Supply voltage	9 V to 32 V, max. 35 V
Sensitivity to reverse polarity	Not applicable
FISCO/FNICO compliant according to IEC 60079-27	No

Power consumption	Max. 7.5 VA
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Mains fuse	Fine-wire fuse, semi-delay 250 V/3.15 A
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Circuit breaker	NOTICE The device does not have a power switch <ul style="list-style-type: none"> ▶ The customer must provide a protected circuit breaker in the vicinity of the device. ▶ The circuit breaker must be a switch or power switch, and you must label it as the circuit breaker for the device. ▶ At the supply point, the power supply for the 24 V versions must be isolated from dangerous live cables by double or reinforced insulation.
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Cable specification	Cable length (CCS140/141/240/241)	Max. 30 m (98 ft) with CMK cable
	Cable length (chlorine sensor 963)	Max. 30 m (98 ft) with CMK cable
	Cable length (CCS120)	Max. 15 m (49 ft) with CPK9 cable
	Cable length (pH/ORP)	Max. 50 m (160 ft) with cable CYK71

Overvoltage protection	According to EN 61000-4-5
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12.4 Performance characteristics

Reference operating conditions	Reference temperature:	25 °C (77 °F)
Measured value resolution	CCS120/140/240 and 963 CCS141/241 pH value ORP Temperature	0.01 mg/l 0.001 mg/l 0.01 pH 1 mV 0.1 °C
Maximum measured error	Display(pH, T = const.) CCS140/141/240/241 CCS120 and 963 Temperature Signal output CCS140/141/240/241/ CCS120/963 pH ORP Temperature	Max. 0.5 % of measured value ± 4 digits Max. 1 % of measured value ± 4 digits 0.03 pH 3 mV ±0.3 K Max. 0.75 % of measuring range Max. 1.25 % of current output range Max. 1.25 % of current output range Max. 1.25 % of measuring range
 Measured errors in accordance with DIN IEC 746 Part 1, at rated operating conditions		
Repeatability	Max. 0.2 % of measuring range	

12.5 Environment

Ambient temperature range	-10 to +55 °C (+10 to +130 °F)	
Storage temperature	-25 to +65 °C (-10 to +150 °F)	
Electromagnetic compatibility	Interference emission and interference immunity as per EN 61326-1:2006, EN 61326-2-3:2006	
Degree of protection	Field device Panel-mounted device	IP 65 / integrity according to NEMA 4X IP 54 (front), IP 30 (housing)
Electrical safety	As per EN/IEC 61010-1:2010, overvoltage category II for installations up to 2000 m (6500 ft) above MSL	
CSA	Device versions with CSA General Purpose approval are certified for indoor use.	

Relative humidity	10 to 95%, not condensing
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Degree of contamination	The product is suitable for pollution degree 2.
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12.6 Mechanical construction

Dimensions	Panel-mounted device	L x B x D: 96 x 96 x 145 mm (3.78" x 3.78" x 5.71") Installation depth: approx. 165 mm (6.50 ")
	Field device	L x B x D: 247 x 170 x 115 mm (9.72" x 6.69" x 4.53")
Weight	Panel-mounted device	Max. 0.7 kg (1.54 lbs.)
	Field device	Max. 2.3 kg (5.07 lbs.)
Materials	Panel-mounted device housing	Polycarbonate
	Field housing	ABS PC FR
	Front membrane	Polyester, UV-resistant
Terminals	Cable cross-section	Max. 2.5 mm ² (14 AWG)

13 Appendix



Enter meas.
value damping
1 (no damping)
1 ... 60

A7

Feedforward control
gain = 1 at

50% 0 ... 100%

Z7

Enter x value (meas. val.)

0.00; 0 ... 20 (5) mg/l
0 °C; 0 ... 50 °C

O334

Enter y value (current)

4.00 mA 0 ... 20.00 mA

O335

Table status o.k.

yes; no

O336

Enable error current
for error just entered

no; yes

F7

Automatic start
of cleaning function

no; yes

F8

Select "next error"
or return to menu
next = next error
<---R

F9

CHECK	P	Chlorine / ClO2	P1(1)	Select alarm threshold monitoring Off; Low; High LoHi; LoI; HiI; LoHiI	P111	Alarm delay 0 min (s) 0 ... 2000 min (s) (dep. on F2)	P112	Set lower alarm threshold 0.00 mg/l 0 ... 19.9 (4.9) mg/l	P113	Set upper alarm threshold 20.00 (5.00) mg/l 0.1 ... 20 (5) mg/l	P114	Select process monitoring Off; AC; CC; AC CC ACI; CC!; ACCC!	P115
		3-point step controller Cl2 / ClO2 (only with Rel3 and Rel4)	R2(8)	Switch function R2(8) on or off Off; On	R281	Enter setpoint 0.5 (0.1) mg/l 0 ... 20 (5) mg/l	R282	Enter control gain Kp 1.00 0.01 ... 100.00	R283	Enter integral action time Tn (0.0 = no I comp.) 0.0 min 0.0 ... 999.9 min	R284		
		Clean = Chemoclean (only with Rel3 and Rel4)	R2(7)	Switch function R2(7) on or off Off; On	R271	Select start pulse int = internal i+ext = internal + external ext = external i+stp = int. w. suppression by ext.		R272	Enter pre-rinse time 20 s 0 ... 999 s	R273			
		Timer	R2(6)	Switch function R2(6) on or off Off; On	R261	Define rinse time 30 s 0 ... 999 s	R262	Define pause time 360 min 1 ... 7200 min	R263	Define minimum pause time 120 min 1 ... 3600 min	R264		
		PID controller Cl2 / ClO2	R2(4)	Switch function R2(4) on or off Off; On; Basic; PID+B	R241	Enter setpoint 0.5 (0.1) mg/l 0 ... 20 (5) mg/l	R242	Enter control gain Kp 1.00 0.01 ... 100.00	R243	Enter integral action time Tn (0.0 = no I comp.) 0.0 min 0.0 ... 999.9 min	R244		
		LC °C = Limit contactor T	R2(3)	Switch function R2(3) on or off Off; On; Basic; PID+B	R231	Enter switch-on temperature 50 °C 0 ... 50 °C	R232	Enter switch-off temperature 50 °C 0 ... 50 °C	R233	Set pick-up delay 0 s 0 ... 2000 s	R234		
		LC PV = limit contactor Cl2 / ClO2	R2(1)	Switch contact R2(1) on or off Off; On	R211	Select switch-on point of contact 20 (5) mg/l 0 ... 20 (5) mg/l	R212	Select switch-off point of contact 20 (5) mg/l 0 ... 20 (5) mg/l	R213	Set pick-up delay 0 s 0 ... 2000 s	R214		
		Select contact to be configured Rel1; Rel2; Rel3; Rel4	R1	Configure Hold S+C = for param. + cal. CAL = with Cal. Setup = for param. no = no Hold	S2	Manual Hold Off; On	S3	Enter Hold dwell time 10 s 0 ... 999 s	S4	Enter SW upgrade release code (Plus pack.) 0 0 ... 9999	S5		
		ENG; GER; FRA; ITA; NEL; ESP	S1	Module software SW Version	E141	Hardware version HW Version	E142	Serial number is displayed	E143	Module identification is displayed	E144		
		Main (= mainboard)	E1(3)	Module software SW Version	E131	Hardware version HW Version	E132	Serial number is displayed	E133	Module identification is displayed	E134		
Trans (= transmitter)	E1(2)	Module software SW Version	E121	Hardware version HW Version	E122	Serial number is displayed	E123	Module identification is displayed	E124				
E+H SERVICE	E	Contr (= controller)	E1(1)	Instrument software SW Version	E111	Hardware version HW Version	E112	Serial number is displayed	E113	Module identification is displayed	E114		
		Enter address HART: 0 ... 15 or PROFIBUS: 1 ... 126	I1	Tag description @@@@@@@@	I2								

Set max. perm. period of lower limit exceeding 60 min 0 ... 2000 min	Set max. perm. period of upper limit exceeding 120 min 0 ... 2000 min	Set limit value 0.5 (0.1) mg/l 0 ... 20 (5) mg/l
P116	P117	P118

Enter min. switch-on time t_{ON} 0.3 s 0.1 ... 5.0 s	Motor run time 60 s 10 ... 999 s	Neutral zone 10% 0 ... 40%	3-p. step contr.: assigns 2 contacts, only permitted for contacts 3+4
R285	R286	R287	

Enter cleaning time 10 s 0 ... 999 s	Enter post-rinse time 20 s 0 ... 999 s	Define repeat times 0 0 ... 5	Define period between two cleaning cycles (pause time) 360 min 1 ... 7200 min	Define min. pause time 120 min 1 ... R277 min	Number of cleaning cycles without cleaning agent 0 0 ... 9
R274	R275	R276	R277	R278	R279
Chemoclean: assigns 2 contacts, only permitted for contacts 3+4					

Enter deriv. action time T_V (0.0 = no D comp.) 0.0 min 0.0 ... 999.9 min	Select control characteristic inv; dir	Select len = pulse length freq = pulse frequency curr = current output 2	Enter pulse period 10.0 s 0.5 ... 999.9 s	Enter max. pulse frequency 120 1/min 60 ... 180 1/min	Enter min switch-on time t_{ON} 0.3 s 0.1 ... 5.0 s	Enter basic load 0% 0 ... 40%
R245	R246	R247	R248	R249	R2410	R2411

Set drop-out delay 0 s 0 ... 2000 s	Set alarm threshold (as abs. value) 50 °C 0 ... 50 °C	Display LC status MAX; MIN
R235	R236	R237

Set dropout delay 0 s 0 ... 2000 s	Set alarm threshold (as abs. value) 20 (5) mg/l 0 ... 20 (5) mg/l	Display LC status MAX; MIN
R215	R216	R217

Enter SW upgrade release code Chemocl. 0 0 ... 9999	Order number is displayed	Serial number is displayed	Reset instrument no; sens; factory	Start instrument test no; display
S6	S7	S8	S9	S10

Operating matrix version EP						
CALIBRATION zero (CCS120) CALIBRATION ORP mV (dep. on B1) CALIBRATION pH (dep. on B1) CALIBRATION Cl₂ / ClO₂	Zero calibration (only if A1 = 120) no; yes	Calibration status is displayed o.k. Exxx	Store calibration result yes; no; new			
	C15	C14	C15			
	Enter value of ORP buffer Buffer value of last cal. 0 ... 1500 mV	Calibrating Adopt if stable ±1 mV (> 10 s)	Zero point is displayed -100 ... +100 mV	Calibration status is displayed o.k. Exxx	Enter calibration results yes; no; new	
	C31	C32	C33	C34	C35	
	Enter calibration temperature 25.0 °C -10 ... +60 °C	Enter pH value of first buffer solution Buffer value of last cal. pH 3.50 ... 9.50	Calibrating Adopt if stable pH ±0.05 (> 10 s)	Enter pH value of second buffer solution Buffer value of last cal. pH 3.50 ... 9.50	Calibrating Adopt if stable pH ±0.05 (> 10 s)	Slope is displayed 59.16 mV/pH 38.00 ... 65.00 mV/pH
	C21	C22	C23	C24	C25	C26
	Enter DPD calibration value Value of last cal.	Zero calibration (only if A1 = 963) no; yes	Slope is displayed 100% min. 25% (3%) max. 500%	Calibration status is displayed o.k. Exxx	Store calibration result yes; no; new	
	C11	C12	C13	C14	C15	
<div style="display: flex; justify-content: space-between;"> <div> Edit: Code 22 Read: any code CAL </div> <div> Edit: Code 22 Read: any code E </div> </div>						
MEAS. VALUE DISPLAY with TEMPERATURE DISPLAY in °C	+	Meas. value display Temperature display in °F	Meas. value display No temp. display	Meas. value display pH; ORP (dep. on B1)	Meas. value display pH signal in mV	Meas. value display Sensor current in nA
	-	1st error is displayed (if present)	Other errors are displayed (up to max. 10 errors)			
SETUP 1	Select sensor 140; 141; 240; 241; 963; 120	Display unit mg/l; ppm; ppb	Controller switch-off by sample stream Off; INS	Delay for contr. sw.-off by sample stream 0 s 0 ... 2000 s	Delay for contr. sw.-on by sample stream 0 s 0 ... 2000 s	Select digital input 1 ext.Hold Clean Trig.
	A1	A2	A3	A4	A5	A6
SETUP 2	Select operating mode Off; pH; ORP mV	pH compensation Off; Manu; Auto	Manual pH compensation last comp. value pH 4.00 ... 9.00	Enter correct process temperature current meas. value 0 ... 50 °C	Enter temperature difference (offset) current offset -5.0 ... +5.0 °C	
	B1	B2*	B3	B4	B5	
* field B2 not available for CCS240/241						
CURRENT INPUT	Controller switch-off by current input Off; Input	Delay for controller sw.-off current input 0 s 0 ... 2000 s	Delay for controller sw.-on current input 0 s 0 ... 2000 s	Switch-off limit for current input 50% 0 ... 100%	Switch-off direction for current input Low; High	Feedforward control to PID controller Off; lin = linear
	Z1	Z2	Z3	Z4	Z5	Z6
CURRENT OUTPUT	Select current output Output1; Output2	Select meas. parameter for 2nd current output °C; pH; ORPmV; Contr	lin = linear	Select current range 4-20 mA; 0-20 mA	Enter 0/4-mA value 0.00 mg/l; 0 ... 20 (5) mg/l 0.00 ppm; 0 ... 20 ppm 0 ppb; 0 ... 20000 ppb pH 4.00; pH 4 ... 9 0 mV; 0 ... 1500 mV 0 °C; 0 ... 50 °C	Enter 20-mA value 2.0 (0.5); 0 ... 20 (5) mg/l 2.0 ppm; 0 ... 20 ppm 2000 ppb; 0 ... 20000 ppb pH 9.00; pH 4 ... 9 1000 mV; 0 ... 1500 mV 50 °C; 0 ... 50 °C
	O1	O2	O3(1)	O311	O312	O313
			Tab = Table O3(3)	Select table options read edit O331	Enter number of table pairs 1 1 ... 10 O332	Select table pairs 1 1 ... No. of table pairs assign O333
			sim = simulation O3(2)	Enter simulation value current value 0 ... 22.0 mA O321		

Zero point is displayed pH 7.00 pH 5.00 ... 9.00	Calibration status is displayed o.k. Exxx	Store calibration results yes ; no; new
C27	C28	C29

Meas. value display Current input in mA	Meas. value display Current input in %	Only LCD switchover!
--	---	----------------------

Enter meas. value damping 1 (no damping) 1 ... 60
A7

Feedforward control gain = 1 at 50% 0 ... 100%
Z7

Enter x value (meas. val.) 0.00 ; 0 ... 20 (5) mg/l pH 4.00 ; pH 4 ... 9 0 mV ; 0 ... 1500 mV 0 °C ; 0 ... 50 °C	Enter y value (current) 4.00 mA 0 ... 20.00 mA	Table status o.k. yes ; no
O334	O335	O336

ALARM	Select contact type Latch = latching c. Momen = momentary c.	Select unit for alarm delay min; s	Alarm delay 0 min (s) 0 ... 2000 min (s) (depending on F2)	Define error current 22 mA; 2.4 mA	Select error number 1 1 ... 255	Enable alarm contact yes; no
	F	F1	F2	F3	F4	F5
CHECK	ORP mV (dep. on B1)	Select alarm threshold monitoring Off; Low; High; Lo Hi Low!; High!; LoHi!	Alarm delay 0 min (s) 0 ... 2000 min (s) (depending on F2)	Set lower alarm threshold 0 mV 0 ... 1490 mV	Set upper alarm threshold 1500 mV 10 ... 1500 mV	Select process monitoring Off; AC; AC!
	P1(2)	P121	P122	P123	P124	P125
CHECK	pH (dep. on B1)	Select alarm threshold monitoring Off; Low; High; Lo Hi Low!; High!; LoHi!	Alarm delay 0 min (s) 0 ... 2000 min (s) (depending on F2)	Set lower alarm threshold pH 4.00 pH 4 ... 8.9	Set upper alarm threshold pH 9.00 pH 4.1 ... 9	Select process monitoring Off; AC; CC; AC CC AC!; CC!; ACCC!
	P1(2)	P121	P122	P123	P124	P125
CHECK	Chlorine / ClO2	Select alarm threshold monitoring Off; Low; High Lo Hi; Low!; High!; LoHi!	Alarm delay 0 min (s) 0 ... 2000 min (s) (depending on F2)	Set lower alarm threshold 0.00 mg/l; 0 ... 20 mg/l 0.5 ppm; 0 ... 20 ppm 0 ppb; 0 ... 20000 ppb	Set upper alarm threshold 20.00 mg/l; 0 ... 20 mg/l 20.00 ppm; 0 ... 20 ppm 20000 ppb; 0 ... 20000 ppb	Select process monitoring Off; AC; CC; AC CC AC!; CC!; ACCC!
	P1(1)	P111	P112	P113	P114	P115
	3-point step controller Cl2 / ClO2 (only with Rel3 and Rel4)	Switch function R2(8) on or off Off; On	Enter setpoint 0.5 (0.1) mg/l; 0 ... 20 (5) mg/l 0.5 ppm; 0 ... 20 ppm 500 ppb; 0 ... 20000 ppb	Enter control gain Kp 1.00 0.01 ... 100.00	Enter integral action time Tn (0.0 = no I comp.) 0.0 min 0.0 ... 999.9 min	
	R2(8)	R281	R282	R283	R284	
	Clean = Chemoclean (only with Rel3 and Rel4)	Switch function R2(7) on or off Off; On	Select start pulse int = internal i+ext = internal + external ext = external i+stp = int. w. suppression of ext.	Enter pre-rinse time 20 s 0 ... 999 s		
	R2(7)	R271	R272	R273		
	Timer	Switch function R2(6) on or off Off; On	Define rinse time 30 s 0 ... 999 s	Define pause time 360 min 1 ... 7200 min	Define min. pause time 120 min 1 ... 3600 min	
	R2(6)	R261	R262	R263	R264	
	PID controller pH	Switch function R2(5) on or off Off; On; Basic; PID+B	Enter setpoint pH 7.20 pH 4 ... 9	Enter control gain Kp 1.00 0.01 ... 100.00	Enter integral action time Tn (0.0 = no I comp.) 0.0 min 0.0 ... 999.9 min	
	R2(5)	R251	R252	R253	R254	
	PID controller Cl2 / ClO2	Switch function R2(4) on or off Off; On; Basic; PID+B	Enter setpoint 0.5 (0.1) mg/l; 0 ... 20 (5) mg/l 0.5 ppm; 0 ... 20 ppm 500 ppb; 0 ... 20000 ppb	Enter control gain Kp 1.00 0.01 ... 100.00	Enter integral action time Tn (0.0 = no I comp.) 0.0 min 0.0 ... 999.9 min	
	R2(4)	R241	R242	R243	R244	
	LC °C = Limit contactor T	Switch function R2(3) on or off Off; On	Set switch-on temperature 50 °C 0 ... 50 °C	Set switch-off temperature 50 °C 0 ... 50 °C	Set pick-up delay 0 s 0 ... 2000 s	
	R2(3)	R231	R232	R233	R234	
LCORP = Limit contactor ORP (dep. on B1)	Switch function R2(2) on or off Off; On	Select contact switch-on point 1500 mV 0 ... 1500 mV	Select contact switch-off point 1500 mV 0 ... 1500 mV	Set pick-up delay 0 s 0 ... 2000 s		
R2(2)	R221	R222	R223	R224		
LC pH = Limit contactor pH (dep. on B1)	Switch function R2(2) on or off Off; On	Select contact switch-on point pH 9 pH 4 ... 9	Select contact switch-off point pH 9 pH 4 ... 9	Set pick-up delay 0 s 0 ... 2000 s		
R2(2)	R221	R222	R223	R224		
RELAY	Select contact to be configured Rel1; Rel2; Rel3; Rel4	LC PV = Limit contactor Cl2 / ClO2	Switch function R2(1) on or off Off; On	Select contact switch-on point 20 (0.5) mg/l; 0 ... 20 (5) mg/l 20 ppm; 0 ... 20 ppm 20000 ppb; 0 ... 20000 ppb	Select contact switch-off point 20 (0.5) mg/l; 0 ... 20 (5) mg/l 20 ppm; 0 ... 20 ppm 20000 ppb; 0 ... 20000 ppb	Set pick-up delay 0 s 0 ... 2000 s
R	R1	R2(1)	R211	R212	R213	R214

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Enable error current for error just selected no; yes	Automatic start of clean function no; yes	Select "next error" or return to menu next = next error ←---R
F7	F8	F9

Set max. perm. period for lower alarm threshold 60 min 0 ... 2000 min	Set max. perm. period for upper alarm threshold 120 min 0 ... 2000 min	Set limit value pH 7.20 pH 4 ... 9
P126	P127	P128
Set max. perm. period for lower limit exceeding 60 min 0 ... 2000 min	Set max. perm. period for lower limit exceeding 120 min 0 ... 2000 min	Set limit value 0.5 (0.1) mg/l ; 0 ... 20 (5) mg/l 0.5 ppm ; 0 ... 20 ppm 500 ppb ; 0 ... 20000 ppb
P116	P117	P118

Enter min. switch-on time t_{ON} 0.3 s 0.1 ... 5.0 s	Motor run time 60 s 10 ... 999 s	Neutral zone 10% 0 ... 40%
R285	R286	R287

3-p. step controller: assigns 2 contacts, only permitted for contacts 3+4

Enter cleaning time 10 s 0 ... 999 s	Enter post-rinse time 20 s 0 ... 999 s	Define repeat cycles 0 0 ... 5	Define period between two cleaning cycles (pause time) 360 min 1 ... 7200 min	Define minimum pause time 120 min 1 ... R277 min	Number of cleaning cycles without cleaning agent 0 0 ... 9
R274	R275	R276	R277	R278	R279

Chemoclean: assigns 2 contacts, only permitted for contacts 3 (+4)

Enter deriv. action time T_V (0.0 = no D comp.) 0.0 min 0.0 ... 999.9 min	Select control characteristic dir; inv	Select len = pulse length freq = pulse frequency curr = current output 2	Enter pulse period 10.0 s 0.5 ... 999.9 s	Enter max. pulse frequency 120 1/min 60 ... 180 1/min	Enter min. switch-on time t_{ON} 0.3 s 0.1 ... 5.0 s	Enter basic load 0% 0 ... 40%
R255	R256	R257	R258	R259	R2510	R2511
Enter deriv. action time T_V (0.0 = no D comp.) 0.0 min 0.0 ... 999.9 min	Select control characteristic inv; dir	Select len = pulse length freq = pulse frequency curr = current output 2	Enter pulse period 10.0 s 0.5 ... 999.9 s	Enter max. pulse frequency 120 1/min 60 ... 180 1/min	Enter min. switch-on time t_{ON} 0.3 s 0.1 ... 5.0 s	Enter basic load 0% 0 ... 40%
R245	R246	R247	R248	R249	R2410	R2411
Set drop-out delay 0 s 0 ... 2000 s	Set alarm threshold 50 °C 0 ... 50 °C	Display of LC status MAX; MIN				
R235	R236	R237				
Set drop-out delay 0 s 0 ... 2000 s	Set alarm threshold 1500 mV 0 ... 1500 mV	Display of LC status MAX; MIN				
R225	R226	R227				
Set drop-out delay 0 s 0 ... 2000 s	Set alarm threshold pH 9.00 pH 0 ... 9	Display of LC status MAX; MIN				
R225	R226	R227				
Set drop-out delay 0 s 0 ... 2000 s	Set alarm threshold 20 (5) mg/l ; 0 ... 20 (5) mg/l 20 ppm ; 0 ... 20 ppm 20000 ppb ; 0 ... 20000 ppb	Display of LC status MAX; MIN				
R215	R216	R217				

SERVICE	Select language ENG; GER; FRA; ITA; NEL; ESP		Configure Hold S+C = for param. + cal. CAL = for Cal. Setup = for param. no = no Hold		Manual Hold Off; On	Enter Hold dwell time 10 s 0 ... 999 s	Enter SW upgrade release code (Plus pack.) 0 0 ... 9999
	S		S2		S3	S4	S5
	Rel (= relay)		Module software SW Version	Hardware version HW Version	Serial number is displayed	Module identification is displayed	
	E1(4)		E141	E142	E143	E144	
	Main (= mainboard)		Module software SW Version	Hardware version HW Version	Serial number is displayed	Module identification is displayed	
E+H SERVICE	E1(3)		E131	E132	E133	E134	
	Trans (= transmitter)		Module software SW Version	Hardware version HW Version	Serial number is displayed	Module identification is displayed	
	E1(2)		E121	E122	E123	E124	
	Contr (= controller)		Instrument software SW Version	Hardware version HW Version	Serial number is displayed	Module identification is displayed	
	E1(1)		E111	E112	E113	E114	
INTERFACE	Enter address HART: 0 ... 15 or PROFIBUS: 1 ... 126		Tag description @@@@@@@@				
	I		I2				

Control SW upgrade release code Chemocl. 0 0 ... 9999	Order number is displayed	Serial number is displayed	Reset instrument no; sens; factory	Start instrument test no; display
S6	S7	S8	S9	S10

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