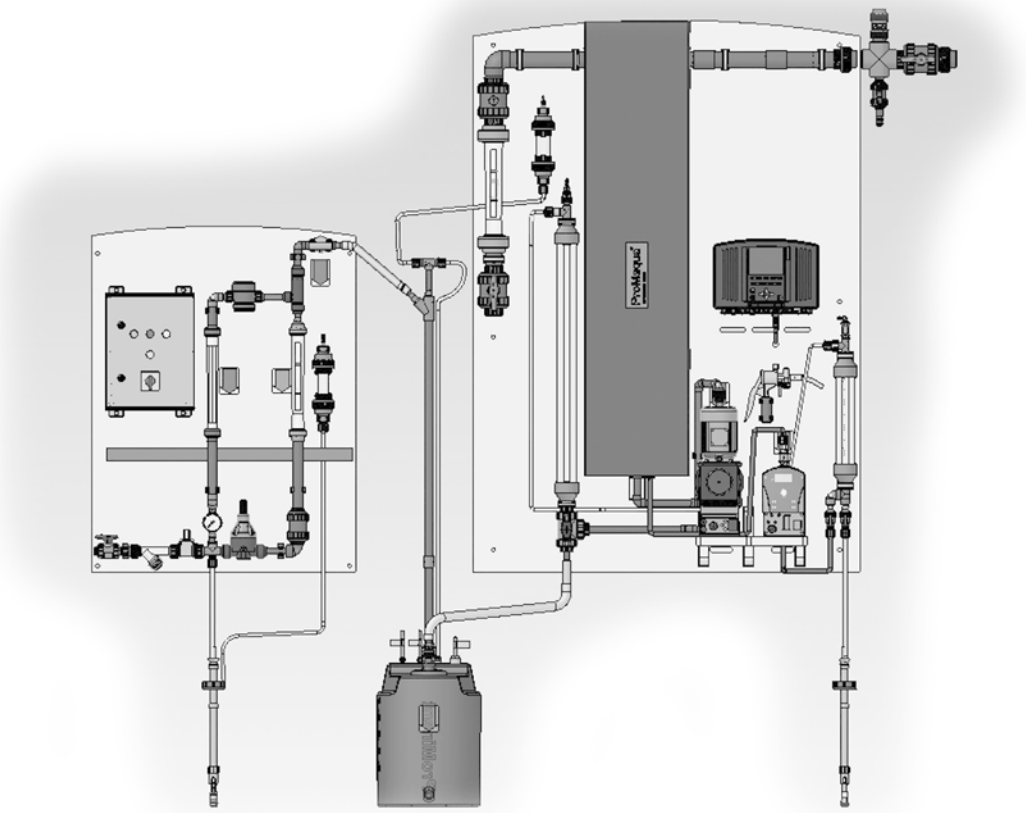
Operating instructions

Chlorine Dioxide Systems

Bello Zon® Product Range CDKc with Pre-dilution Module



The assembly and installation instructions as well as the operating instructions are necessary to ensure safe and correct operation of the Bello Zon® system. Both sets of operating instructions are only valid when read together.

Please carefully read these operating instructions before use! · Do not discard!
The operator shall be liable for any damage caused by installation or operating errors!
Technical changes reserved.

Supplementary information

Fig. 1: Please read!

Read the following supplementary information in its entirety! Should you already know this information, you have an even greater need of the Operating Instructions.

The following are highlighted separately in the document:

- Enumerated lists

- refer to references

→ Instructions

⇨ Results

'User interface text'

[Keys]

Information

This provides important information relating to the correct operation of the system or is intended to make your work easier.

Safety information

Safety information is identified by pictograms - see Safety Chapter.

Notes for the System Operator

This document includes notes and quotes from German guidelines relating to the system operator's scope of responsibility. This information does not discharge operators from their responsibility as an operator and is intended only to remind them or make them aware of specific problem areas. This information does not lay claim to being complete, nor applicable to every country and every type of application, nor to being unconditionally up-to-date.

Version number of the hardware and software

The version number of the hardware and software can be found here: In the display press *'Equipment OFF' [F2 SETTING]* , change to the menu *'CAN overview'* and press the *[ENTER]* key. In case of complaints, or if expanding the scope of use of the device, specify the version number in addition to the identity code.

Table of contents

1 Identitycode

CDK product range, version c								
CDKc	**Type**	**Capacity**						
20	CDKc 150	150 g/h						
21	CDKc 400	400 g/h						
22	CDKc 900	900 g/h						
23	CDKc 2000	2000 g/h						
24	CDKc 2800	2800 g/h						
25	CDKc 7300	7300 g/h						
26	CDKc 12000	12000 g/h						
	Design							
	P	ProMaqua						
	N	Neutral						
		Operating voltage:						
		D	230 V + 10 %, 50/60 Hz (for versions with "bypass" 04)					
		B	100-115 V + 10 %, 50/60 Hz (not available for versions with "bypass" 04 or 06)					
			Bypass version, bypass monitoring					
			02	Bypass PVC-U with float flow meter and pump				
			04	Bypass PVC-U with float flow meter and pump (VA) only with "Operating voltage" - "A" (only CDKc 150 ... 900)				
				Calibration device				
				1	with a calibration device			
					Suction lance, suction fitting for chemicals			
					0	None		
					2	Suction lance for 200 l drum (only CDKc 150 ... 2800)		
					3	Flexible suction assembly 5 m (only CDKc 150 ... 2800)		
						Mechanical design		
						0	Standard	
							Preset language	
							DE	German
							EN	English
							FR	French
							IT	Italian
							ES	Spanish
							JP	Japanese
							CZ	Czech
							PL	Polish

CDK product range, version c																
							SV	Swedish								
							NL	Dutch								
							HU	Hungarian								
							FI	Finnish								
								Control								
								0	Basic version with 4 contact inputs for leakage, external errors, high dosage and pause; 3 contact outputs for operation, warning and alarm; either 1 digital or frequency input for flow							
								1	With measurement and control features (only in conjunction with "extended inputs and outputs" = 1 or 3)							
								2	With measurement and control features with data logger and screen writer (only in conjunction with "extended inputs and outputs" = 1 or 3)							
									Extended inputs and outputs							
									0	none						
									1	2 analog inputs for control variables and flow freely configurable						
									2	1 analog output, freely configurable						
									3	2 analog inputs, 1 analog output, freely configurable						
										Communication interfaces						
										0	None					
											Certifications					
											01	CE mark				
												Temperature monitoring				
												0	No temperature monitoring			
													Hardware			
													0	Standard		
														Software		
														0	Standard	

2 About this system

The Bello Zon® chlorine dioxide generation and dosing system uses the chlorite/acid process. In these systems ClO_2 solution is generated by the chemical reaction of sodium chlorite solution with hydrochloric acid.

Decades of experience with the Bello Zon® chlorine dioxide systems has shown that using the selected process parameters, an excellent yield of 90-95 % (relative to the stoichiometric ratio) can be achieved. When correctly adjusted, no chlorite is metered as a side-product.

Bello Zon® CDK systems work with concentrated chemicals, which are diluted in the system using water to ready-to-use concentrations.

ProMinent benefits from its experience from globally executed chlorine dioxide installations in many different application fields and will willingly provide assistance during system design.

Applications:

- Public drinking water supply
- Cooling water treatment
- Paper industry within slime control and process water treatment
- Waste water treatment

3 Safety chapter

Labelling of safety information

The following signal words are used in these operating instructions to denote different levels of danger:

Identification of safety notes

The following signal words are used in these operating instructions to denote different severities of danger:

Signal word	Meaning
DANGER	Denotes a possibly hazardous situation. If this is disregarded, it will result in serious injuries.
WARNING	Denotes a possibly dangerous situation. If this is disregarded, you are in a life-threatening situation and this can result in serious injuries.
CAUTION	Denotes a possibly dangerous situation. If this is disregarded, it could result in slight or minor injuries or material damage.

Warning signs denoting different types of danger

The following warning signs are used in these operating instructions to denote different types of danger:

Warning signs	Type of danger
	Warning – corrosive substances.
	Warning – high-voltage.
	Warning – explosive substances.
	Warning – toxic substances.
	Warning – danger zone.

The three basic rules

1. - **The two components acid (HCl) and chlorite (dilute $NaClO_2$) must never be brought into contact except in the reactor! Otherwise poisonous ClO_2 gas forms abruptly and can then decompose explosively!**
2. - **Never fill the 5% HCl receiver tank with chemicals directly, only ever via the pre-dilution module! Otherwise toxic ClO_2 gas can form caused by another fault on the Bello® system.**
3. - **Never allow the bypass to become empty when the system is connected to the mains voltage and never allow the bypass water to become under vacuum pressure! Otherwise the ClO_2 solution in the reactor is placed under vacuum pressure, the ClO_2 outgasses, builds up and can decompose explosively!**

Intended use

- The Bello Zon® CDK system is intended solely for producing a ClO_2 containing disinfectant solution from hydrochloric acid, sodium chlorite solution and thinning water, used in conjunction with the pre-dilution facility, and then for dosing it into a bypass line together with water.
- Any other uses or modifications to the system are prohibited!
- The Bello Zon® system is not designed for treating liquids (other than water) nor gaseous media and solids with ClO_2!
- The Bello Zon® CDK system must not be operated with concentrated hydrochloric acid without a pre-dilution facility.
- Do not operate the system under conditions other than those described in the technical data!
- Do not allow untrained personnel to operate the Bello Zon® system! Only trained and authorised personnel should perform all other work – refer to the following table!
- You have a duty to observe the information contained in the operating instructions at the different phases of the system's service life!
- Please observe the relevant national regulations and guidelines at every phase of the device's service life!

Qualification of personnel

WARNING!
According to accident statistics, holiday replacements present a safety risk.

– Holiday replacements should also be qualified, as outlined below, and have been instructed accordingly.

Task	Qualification
Assembly, installation of hydraulic system	Trained qualified personnel
Electrical installation	Electrical technician
Initial commissioning	Service - authorised by ProMinent
Start up	Technical experts
Operation, canister replacement	Instructed person
Maintenance, repair	Service - authorised by ProMinent
Decommissioning, disposal	Technical experts
Troubleshooting	Service - authorised by ProMinent, technical experts, instructed personnel (depending on the fault)

Explanation of the terms:

Technical expert

A technical expert is deemed to be a person who is able to assess the tasks assigned to him and recognise possible dangers based on his/her technical training and experience, as well as knowledge of applicable regulations.

Note:

A technical qualification is typically proved by the required completion of a technical training course, e.g. as an engineer or craftsman. The assessment of a person's technical training can also be based on several years of work in the relevant field.

Qualified employee

A qualified employee is deemed to be a person who is able to assess the tasks assigned to him and recognise possible dangers based on his/her technical training, knowledge and experience, as well as knowledge of pertinent regulations.

Note:

A qualification of equal validity to a technical qualification can also be gained by several years of employment in the relevant field of work.

Instructed person

An instructed person is deemed to be a person who has been instructed and, if required, trained in the tasks assigned to him/her and possible dangers that could result from improper behaviour, as well as having been instructed in the required protective equipment and protective measures.

Service

The Service department refers to service technicians, who have received proven training and have been authorised by ProMinent to work on the system.

Safety equipment

The safety equipment available and instructions for testing are contained in the "Start up" chapter.

Instructions for entering a room in which chlorine dioxide systems are installed

- Access only for trained personnel.
- If there is a smell of chlorine dioxide (pungent, chlorine-like smell) access is only permitted to personnel wearing the specified protective equipment.
- Should you notice a smell of chlorine dioxide, immediately switch off the system from a safe position, e.g. emergency stop switch, installed at a distance from the system.

Safety information

WARNING!

Danger from incorrect operation

Incorrect operation can result in dangerous conditions for the system and its surroundings.

– All operating personnel should be instructed by a ProMinent service technician! (Undertaken during initial commissioning.)
– The operating instructions should be kept to hand adjacent to the system.

WARNING!

Danger due to hazardous ClO_2 gas

Under rare fault conditions toxic ClO_2 solution and gas can escape via a leak.

– A gas detector should be installed if no other measure is provided to ensure personnel safety in the event of ClO_2 escaping.
– The gas detector should reliably switch off the system if ClO_2 gas escapes and trigger an alarm that is readily apparent from a distance.

WARNING!

Danger from hazardous substances!

Possible consequence: Fatal or very serious injuries.

Please ensure when handling hazardous substances that you have read the latest safety data sheets provided by the manufacture of the hazardous substance. The actions required are described in the safety data sheet. Check the safety data sheet regularly and replace, if necessary, as the hazard potential of a substance can be re-evaluated at any time based on new findings.

The system operator is responsible for ensuring that these safety data sheets are available and that they are kept up to date, as well as for producing an associated hazard assessment for the workstations affected.

WARNING!

Danger due to hazardous substances

By operating this system the operator generates hazardous substances.

The operator is responsible for adapting the operating instructions to their system in the event that more recent knowledge about the dangers associated with a hazardous substance and its avoidance become available or national regulations prescribe something else to that stated in the supplied operating instructions.

Warning against illegal operation

Observe the regulations that apply where the device is installed.

Note for the system operator

Keywords when searching for the necessary regulations:

- Chlorine dioxide systems
- Chlorine dioxide (possibly chlorination as well)
- Potable water
- Hydrochloric acid
- Sodium chlorite
- Storage
- Hazardous substances
- Personal protective equipment

Personal protective equipment

- Face mask
- Rubber or plastic boots
- Protective gloves (ClO_2-resistant design!)
- Protective apron
- Full-face protective mask
- 1 replacement filter per protective mask

The required type and configuration of personal protective equipment may vary from country to country and change over time.

Information in the event of an emergency

- You have come into contact with acid: Refer to the "EC material safety data sheet for acid" provided by the supplier!
- You have already come into contact with chlorite: See the "EC material safety data sheet for chlorite" provided by the supplier!
- You have come into contact with ClO_2 solution or ClO_2 gas: Refer to the "Chlorine dioxide hazardous substance" data sheet: Properties of chlorine dioxide and instructions for handling aqueous solutions" in the operating instructions, part 2, appendix!
- An orange-yellow ClO_2 gas has escaped: Clear the room immediately and disconnect the power supply, for example using the emergency stop switch! Wear complete personal protective equipment and ensure the gas is precipitated out of the atmosphere using a water spray! Refer also to the "Chlorine dioxide hazardous substance data sheet: Properties of chlorine dioxide and instructions for handling aqueous solutions" in the operating instructions, part 2, appendix!
- An orange-yellow ClO_2 solution has escaped: Clear the room immediately and disconnect the power supply, for example using the emergency stop switch! Wear complete personal protective equipment and pour sodium thiosulphate solution over the ClO_2 solution, then dilute with plenty of water and wash away down the drain. Refer also to the "Chlorine dioxide hazardous substance data sheet: Properties of chlorine dioxide and instructions for handling aqueous solutions" in the appendix to the operating instructions!
- The Bello Zon® system was started after incorrect dilution or using concentrated HCl in the 5% HCl receiver tank and the metering pumps have already pumped concentrated chemicals as far as the reactor: Clear the room immediately and disconnect the power supply, for example using the emergency stop switch! Inform the fire service, explaining about the risk of explosion due to concentrated ClO_2 gas! ClO_2 gas can still explode after several hours in the event of a further fault! Refer also to the "Chlorine dioxide hazardous substance data sheet: Properties of chlorine dioxide and instructions for handling aqueous solutions" in the appendix to the operating instructions!
- The Bello Zon® system was started after incorrect dilution or using concentrated HCl in the 5% HCl receiver tank and the metering pumps have not yet started to pump: immediately switch the Bello Zon® system to *'Metering OFF'* (*[Start/Stop]*)! Only start the system when you are sure that the pre-dilution module is operating correctly.

The information required in the event of an emergency may vary from country to country and change over time.

Sound pressure level

Sound pressure level LpA < 70 dB according to EN ISO 20361

at maximum stroke length, maximum stroke rate, maximum back pressure (water)

4 System overview

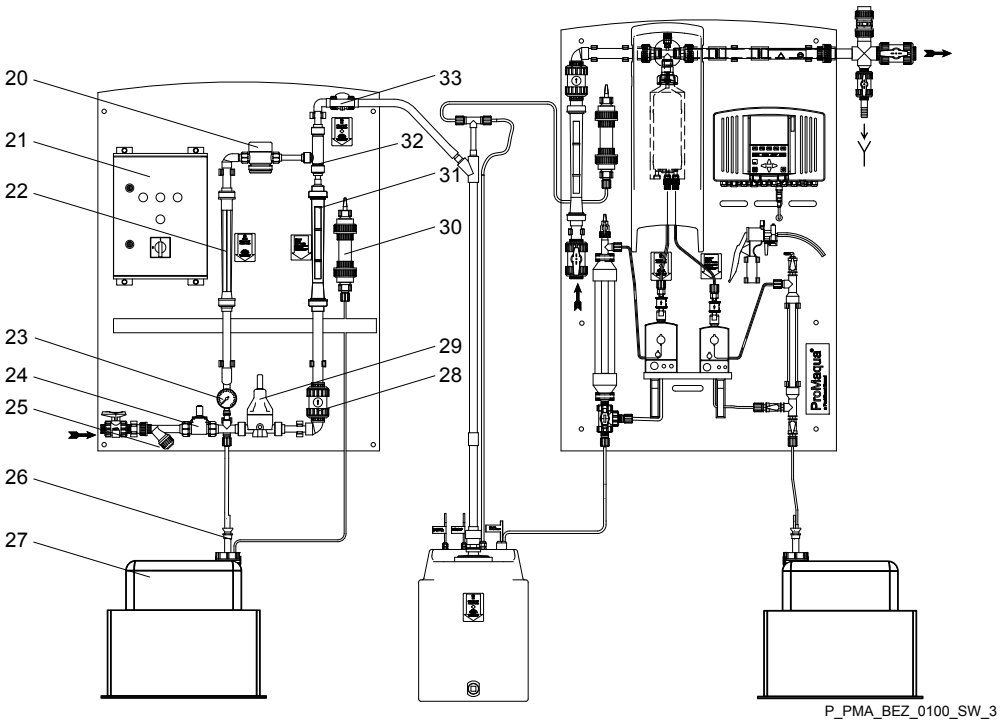


Fig. 2: Pre-dilution module components

20 Suction regulator
21 Pre-dilution module control
22 Hydrochloric acid flow meter
23 Manometer
24 Solenoid valve
25 Dirt filter
26 Hydrochloric acid suction lance
27 Storage tank for concentrated hydrochloric acid
28 Non-return valve
29 Pressure reducer
30 Acid vapour separator
31 Water flow meter
32 Injector
33 Metering ball valve

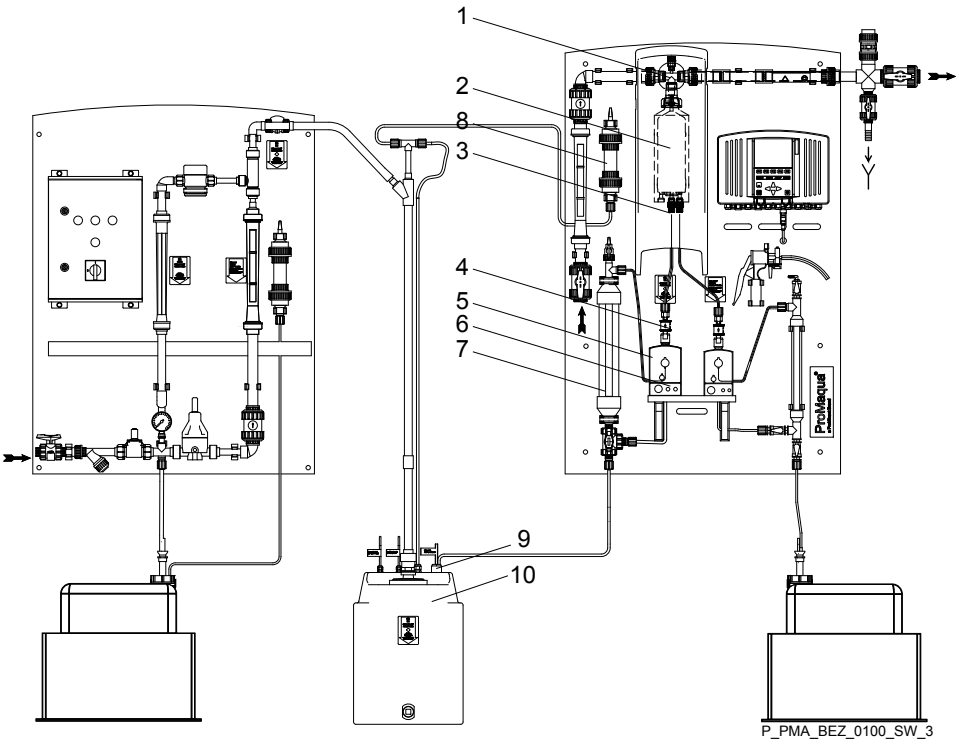


Fig. 3: Device parts for the acid metering line of the ClO_2 production system

1 Reactor outlet valve
2 Reactor
3 Acid reactor input valve
4 Dosing control acid
5 Acid bleed valve
6 Acid metering pump
7 Acid calibration device
8 Acid vapour separator
9 Acid suction lance with foot valve and level switch
10 Dilute acid in HCl receiver tank

For the sake of clarity, only parts of the acid metering line have been shown.

The corresponding device parts for the chlorite metering line are always located in a mirror image fashion to the outside right of the corresponding device component for acid. Exception: Chlorite component tank

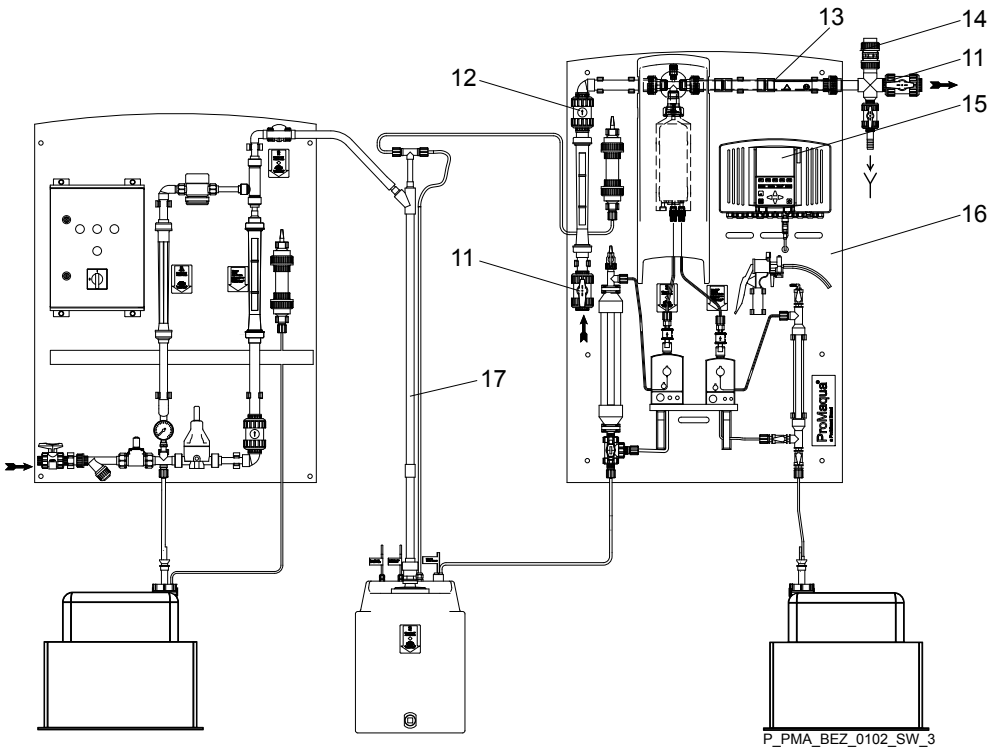


Fig. 4: Device parts of the CDKc without the device parts of the preceding figure

11	Stopcock in the bypass line	16	Bracket
12	Non-return valve	17	Ventilated feed
13	Mixer	not shown	Danger signs
14	Flushing assembly with vacuum relief valve	not shown	CDV fitting kit
15	Bello Zon® control		

5 Functional description

5.1 Chemical principle behind the systems

Chlorine dioxide systems Bello Zon® work on the hydrochloric acid-chlorite process:

Hydrochloric acid + sodium chlorite = chlorine dioxide + sodium chloride + water

($4HCl + 5NaClO_2 = 4ClO_2 + 5NaCl + 2H_2O$)

The Bello Zon® CDK systems produce a 2% chlorine dioxide solution (20 g/l ClO_2) at temperatures of at least 10 °C (15 °C with CDKc 2800 and 7300, 18 °C for CDKc 12000) through the combination of dilute hydrochloric acid and concentrated sodium chlorite solution.

This solution is immediately diluted after its creation in the bypass line and added to the water to be treated.

5.2 Operating principle of the systems

General description

Firstly the pre-dilution module dilutes the concentrated hydrochloric acid (25 - 36 %) via an injector to 5%. To achieve this, concentrated acid and water flow with coordinated flow values into the HCl storage tank. The system then draws the diluted acid from the tank.

Two metering pumps dose the dilute acid and concentrated chlorite into the reactor. There the components react to produce ClO_2 solution. The metering pumps are simultaneously used to transport this solution through the reactor outlet valve into the bypass. A mixer is connected downstream of the reactor outlet valve, which mixes the ClO_2 solution homogeneously with the bypass water. The diluted ClO_2 solution reaches the main water flow at the point of injection and dilutes itself further to the final effective concentration in the process.

The control calculates the stroke rates for the metering pumps from the transported ClO_2 capacity and, where necessary, from an actual stroke rate. Moreover, it interprets the sensor signals for the specified operating conditions (e.g. bypass flow) and switches the metering off as necessary.

Control types

The Bello Zon® system (the ClO_2 output) can be controlled in four different ways:

- Manually (using the control alone)
- Flow-proportionally (using a water meter)
- Proportional to the measured value (using a ClO_2 sensor)
- Dependent on control variables (using external control variable, e.g. from the control room)

Definitions

- *"System" is used to describe the entirety of the control of the Bello Zon® system and everything located on its bracket.*
- *The "control" refers to the control in the housing on the bracket of the Bello Zon® system.*

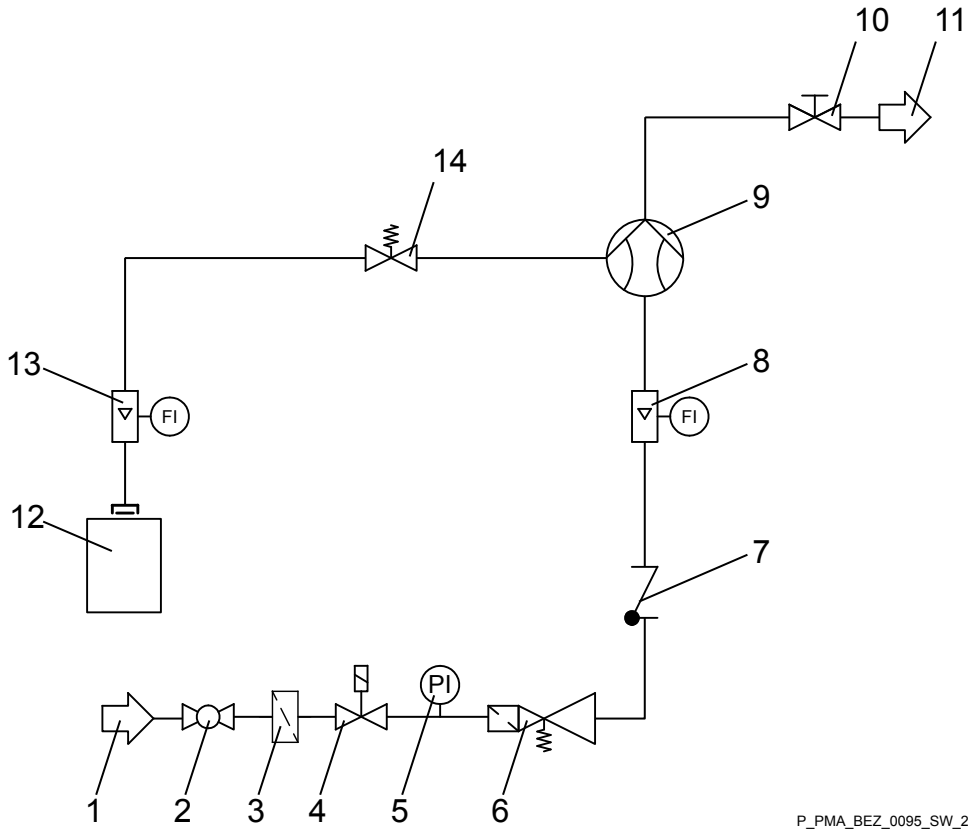


Fig. 5: Hydraulic circuit diagram for pre-dilution module

1 Water
2 Shut-off valve
3 Dirt filter
4 Solenoid valve
5 Manometer
6 Pressure reducer
7 Non-return valve
8 Water flow meter
9 Injector
10 Metering ball valve
11 Diluted acid - to the main panel
12 Concentrated acid
13 Acid flow meter
14 Suction regulator

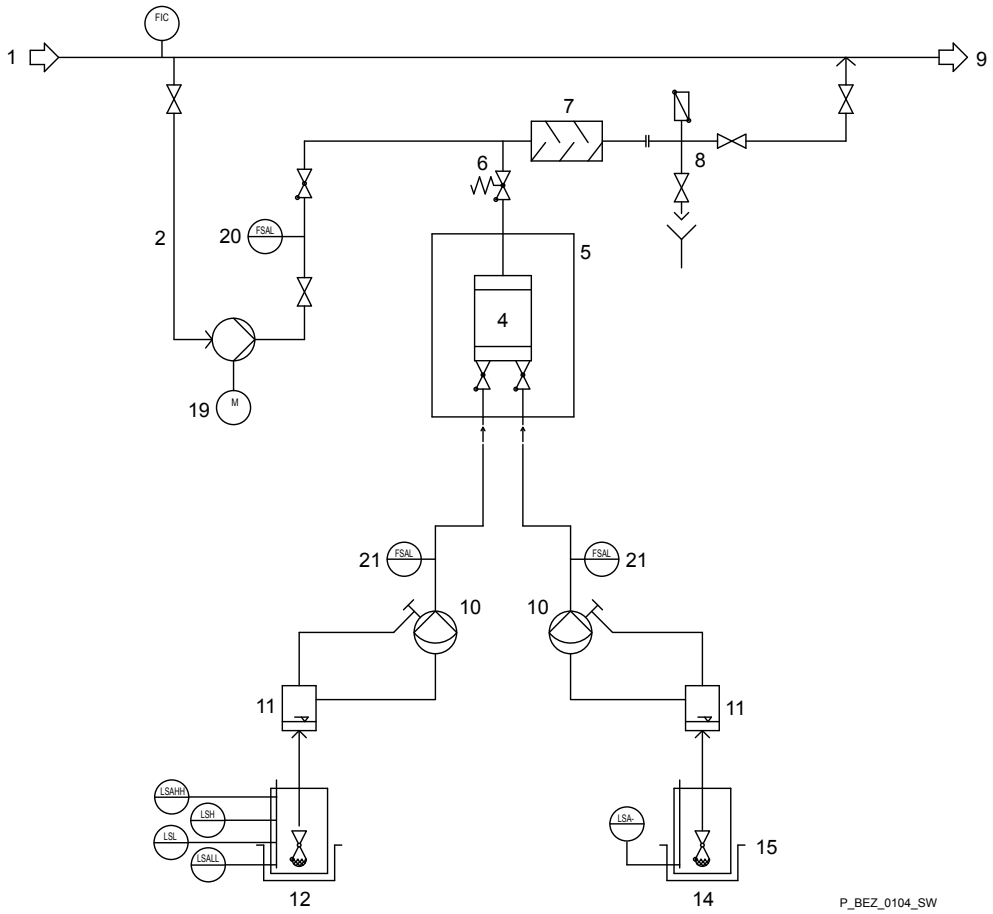


Fig. 6: Hydraulic circuit diagram for CDKc in bypass mode

1 Water to be treated
2 Bypass
4 Reactor
5 Reactor housing (optional)
6 Reactor outlet valve
7 Mixer
8 Flushing assembly with vacuum relief valve
9 Water to be treated
10 Metering pumps
11 Calibration equipment
12 Dilute acid
14 Concentrated chlorite
15 Safety collecting tray, recommended (optional)
16 Potable water, 1 ... 6 bar
19 Bypass pump (optional)
20 Bypass monitoring
21 Dosing monitor for metering pumps

5.3 Safety equipment

The description of the safety equipment can be found at the end of the "Start up" chapter.

5.4 Control elements and keys

BelloZon®

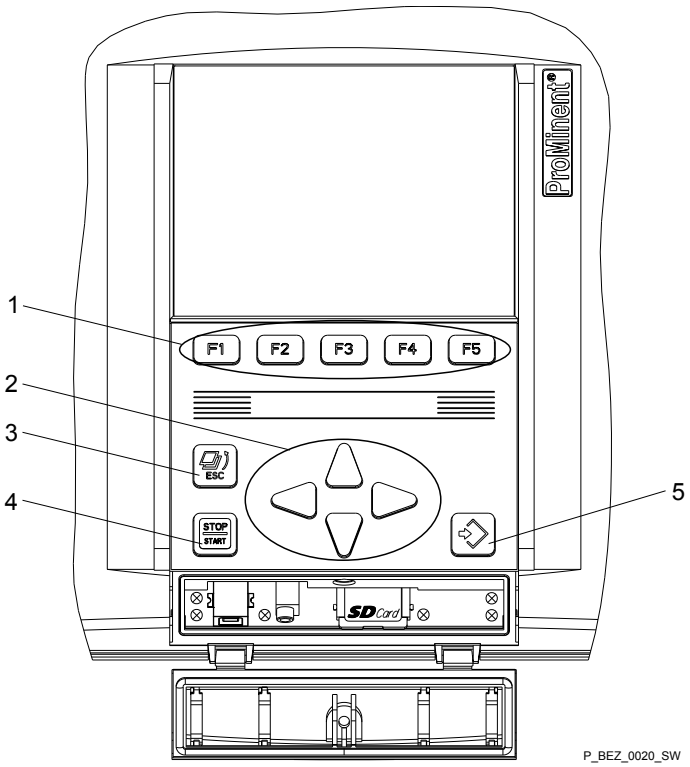


Fig. 7: The keys

1 Function keys, variably assigned
2 *[Arrow keys]*
3 *[ESC]* key
4 *[START/STOP]* key
5 *[ENTER]* key

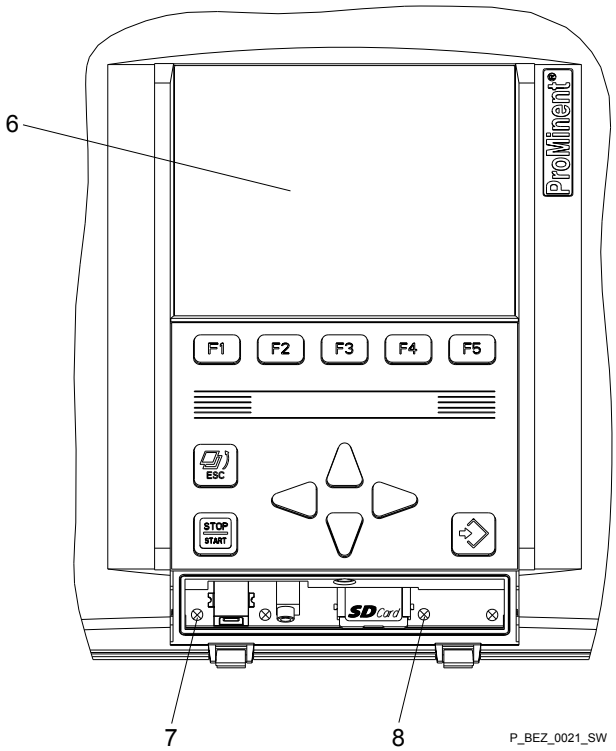


Fig. 8: The displays

6 LCD screen
7 LED devices
8 CAN 1-LED

Pre-dilution control

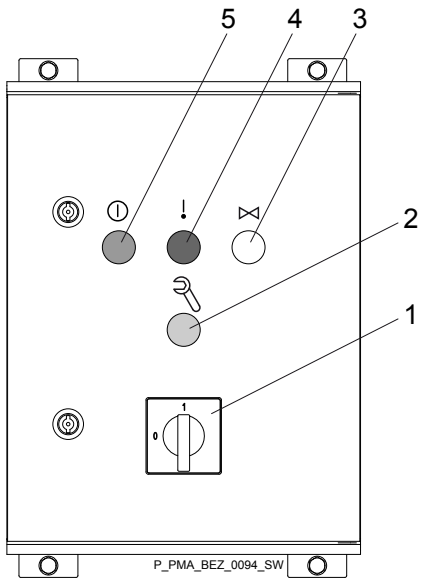


Fig. 9: Displays and switches

Item	Colour	Name	Function
1	Yellow / red	Mains switch	Switch system on and off. Switches the pre-dilution module, the Bello Zon® control and the metering pumps of the Bello Zon® system on or off.
2	yellow	"Maintenance" key	Press key briefly - acknowledge error. Press and hold key - open / close solenoid valve.
3	white	"Top-up" light	Solenoid valve is open
4	red	"Error" light	There is a fault. For more information refer to the "Troubleshooting" chapter
5	green	"Operation" light	Pre-dilution control is ready for operation or in operation. Does not light up in the event of a fault.

5.5 Functions of the keys

5.5.1 System control

START/STOP key

Use the [START/STOP] key to:

- Start the entire system. Press the *[START/STOP]* key for 3 s. *'Production off' - 'Equipment ON'*
- Stop the entire system. Press the *[START/STOP]* key: *'Production off' - 'Equipment OFF'*

5.5.2 Navigation within the operating menu

[ENTER] key

Use the [ENTER] key to:

- Navigate from menu item to menu item in the operating menu - moving to deeper levels of the operating menu.
- Select a menu item and confirm a change.

[ESC] key

Use the [ESC] key to:

- Navigate from menu item to menu item in the operating menu - moving up out of the operating menu.

– *To move from any menu item of the operating menu back to the continuous display, either press [F1] HOME or the [ESC] key as often as necessary until the continuous display appears.*
– *It is also possible to wait until the control independently jumps back to the continuous display.*

Arrow keys [UP], [DOWN], [LEFT], [RIGHT]

Use the arrow keys [UP], [DOWN], [LEFT], [RIGHT] to:

- Move between selections under a menu item.
- The *[UP]* and *[DOWN]* arrow keys can be used in a selection to change the displayed numerical value or displayed variable. The arrow keys *[LEFT]* and *[RIGHT]* can be used to select the decimal place of a numerical value which is to be changed.

Fig. 10: Changing a numerical value

Function keys [F1] to [F5]

Use the function keys *[F1]* to *[F5]*, to which various assignments can be made, to select menus or functions, which are displayed as keys in the display (e.g. *'SETTING'*, *'CALIB'*(rate) menus or the *'SAVE'* function).

CAUTION!
Warning of faulty operation
The system may not react as expected if settings are not saved due to a momentary lack of concentration.

– Only the *'SAVE'* function can be used to save the menu settings.
– Some numerical values such as *'TIME'* or *'DATE'* are stored using the *[ENTER]* button.

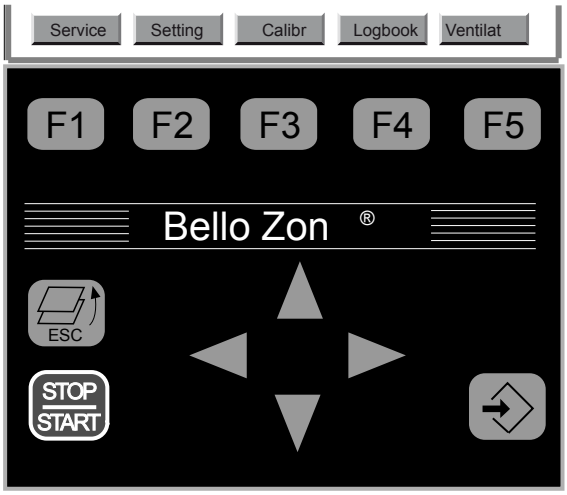


Fig. 11: Example of the assignment of the function keys

6 Setting, Diagram, Access codes and INFO-level

- *The chapters "Setting, Diagram, Access codes and INFO-level" describe the operating menu, its functions and its setting options.*
- *The following chapters then describe application in association with a concrete objective, such as "Start up", "Operate", ...*

6.1 Operating menu, schematic

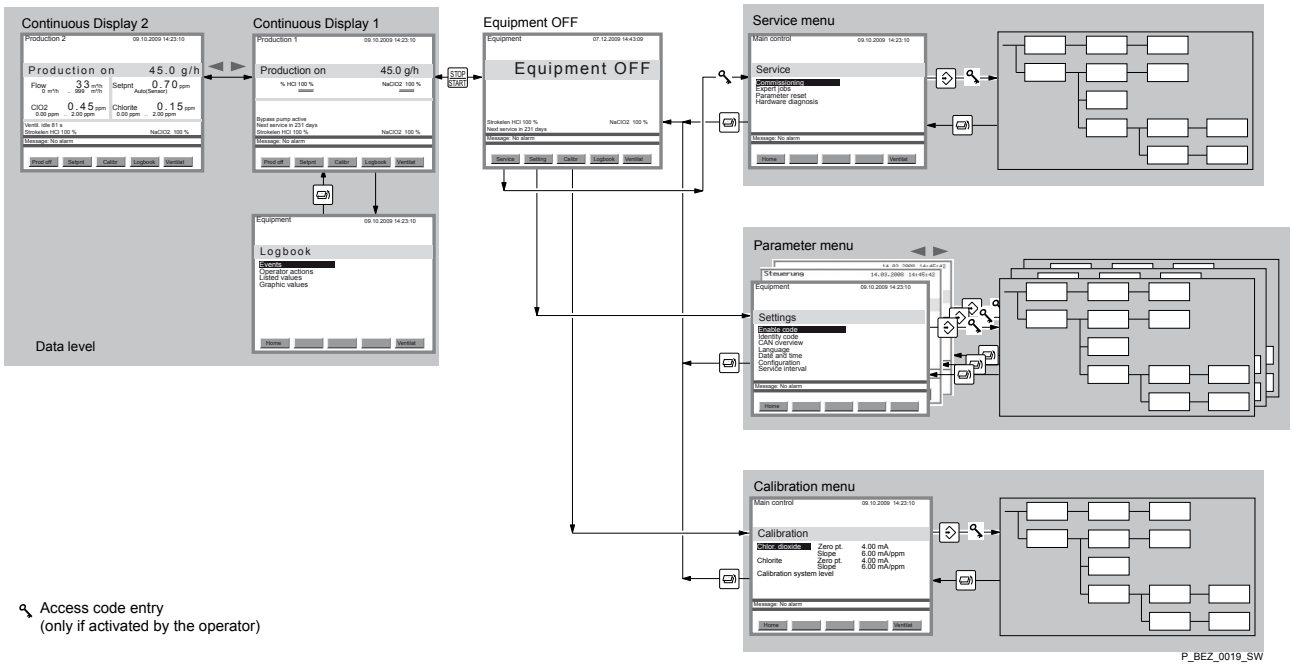


Fig. 12: Operating menu, schematic

The display 'Equipment OFF' is the linchpin of the operating menu! Numerous menus can be branched to from here. Therefore it makes sense to become familiar with its layout.

6.2 Access codes

The menus are protected using access codes with the following levels:

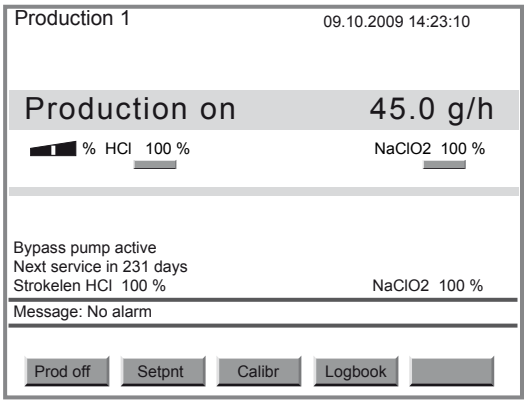
Name	Enables ...	access code
user code	Enables functions which trained personnel must use in their day-to-day work.	Factory setting: 5005, can be changed in "Settings" - "System info".
Expert code	Enables additional functions which technical experts must use in their day-to-day work.	Is only provided during technical expert training courses.
Service code	For basic settings during commissioning and maintenance.	Only known by suitably trained personnel such as customer service employees.

6.3 INFO-level

The INFO-level is reached from the "Display OFF" display by pressing the key [START/STOP]. It comprises the:

- "Continuous display 1" (*'Production 1'*)
- "Continuous display 2" (*'Production 2'*)
- Display *'Logbook'*

Continuous display 1 (Production 1)



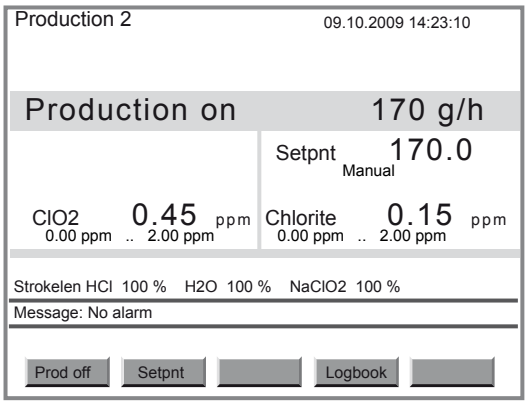
For example the "Continuous display 1" (Production 1") indicates:

- the instantaneous ClO_2 output
- The stroke length of the pumps
- The activity of the metering pumps
- The activity of the bypass pumps
- The time remaining up until maintenance
- Error messages

The following can also be carried out via the function keys:

- Switching on or off of ClO_2 production
- Change the setpoint
- Calibrate the sensors (option)
- View the log book (option)
- Acknowledge the beeper

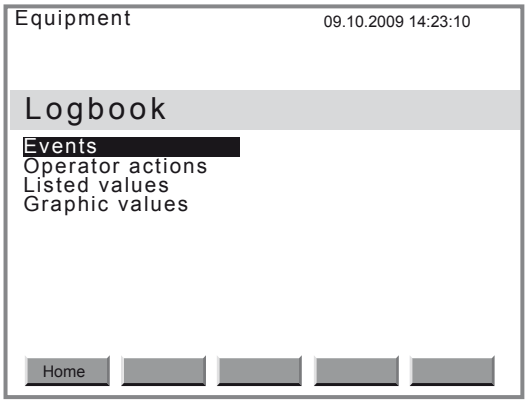
"Continuous display 2" (Production 2)



For example the "Continuous display 2" (Production 2") also indicates:

- The instantaneous flow in the bypass
- ClO_2 production setpoint
- ClO_2 concentration measured value (if function available)
- Chlorite concentration measured value (if function available) instead of the instantaneous ClO_2 output and the activity of the pumps
- ORP voltage measured value (if function available)
- Measured pH value (if function available)

"Logbook"



The "logbook" display indicates:

- The recorded events
- The operator actions at the control
- Listed values (option)
- Graphic values for the listed values (option)

Log book settings can be made under *'Settings ➔ Configuration ➔ Logbook'*.

Events

The menu *'Events'* lists the date, time and the respective event with the source. For example this may be:

- Warning set - Chlorite pump not ready
- Alarm acknowledge - Error sample water

Operator actions

The menu *'Operator actions'* lists the date, time and the respective operator action. For example this may be:

- Power on
- System on
- Production off

Listed values (option)

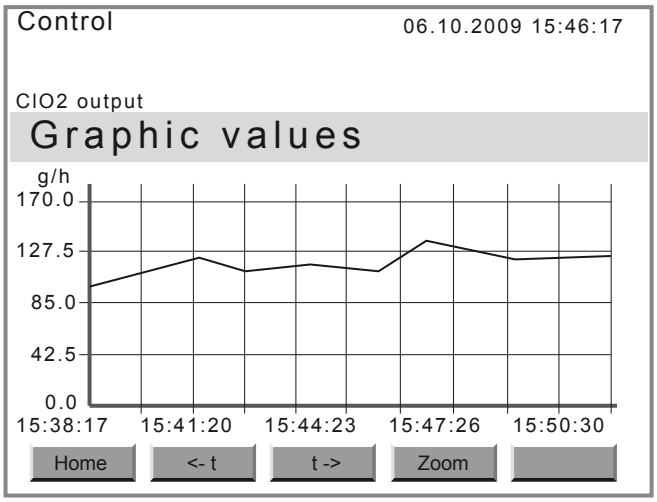
The menu *'Listed values'* lists the date, time and the measured values - independent of the system settings. For example this may be:

- ClO2 output
- ClO2 concentration
- Flow

Graphic values (option)

The menu *'Graphic values'* displays the time-dependent graphic values - independent of the system settings. For example this may be:

- ClO2 output



Key	Effect
[<- t]	Moves the measurement curve back in time.
[t ->]	Moves the measurement curve forward in time.
[Zoom]	Enlarges the section of the measurement curve.

Process the data further

To process the data further - see the "Operation" chapter.

6.4 To adjust settings

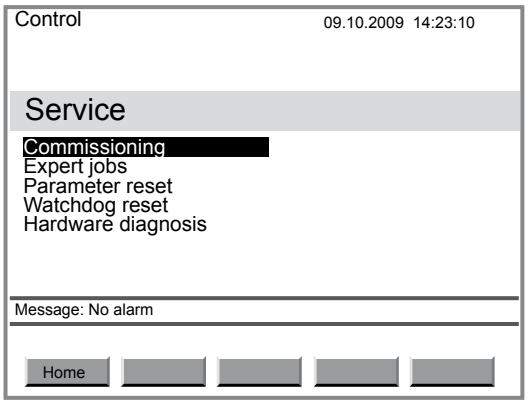
To adjust the control, the system must be "OFF" (key *[START/STOP]*) – the display *'Equipment OFF'* appears. Then the control does not actuate the pumps and ignores all input signals.

The function keys can then be used to access the corresponding menus such as:

- *'SERVICE'* menu - see chapter *Chapter 7 'Setting, Service' on page 28*
- *'SETTING'* menu - see chapter *Chapter 8 'Setting, settings' on page 34*
- *'CALIBR'*(ate)-menu - see chapter *Chapter 9 'Setting, Calibration' on page 64*

In the following chapters those menu items are omitted for which the setting options are fixed!

7 Setting, Service



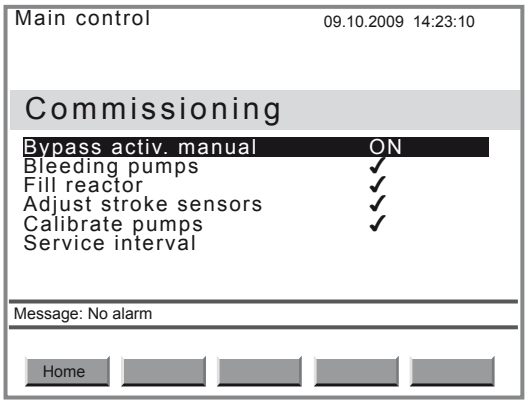
This menu contains the submenus:

1 - Commissioning: During start up, this menu must be run through - see *Chapter 7.1 'Commissioning' on page 28*

2 - Expert jobs: Contains functions for working on the pumps - see *Chapter 7.2 'Expert jobs' on page 31*

3 - Parameter reset: only for customer service - see *Chapter 7.3 'Parameter Reset' on page 33*

7.1 Commissioning

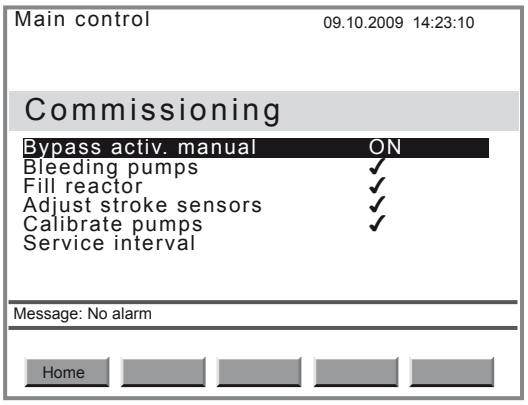


During start up, this menu must be run through.

For the detailed, binding description of system start up see the chapter "Start up".

A green tick ✓ is placed after the "Commissioning" menus in question which have been successfully run through.

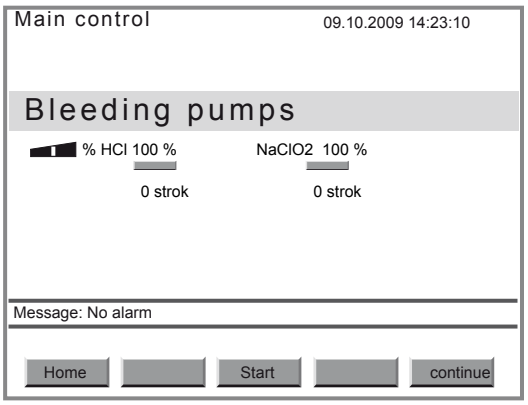
7.1.1 Bypass activ. manual



From here a possibly existing bypass pump can be manually switched off during Start up.

Outside this menu, the setting has no effect.

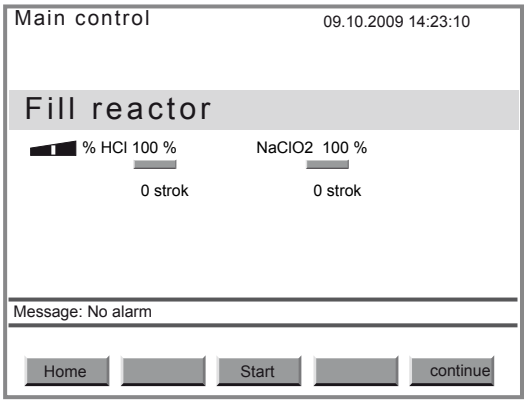
7.1.2 Bleeding pumps



This menu is used for bleeding the dosing pumps.

For more information see the "Start up" chapter.

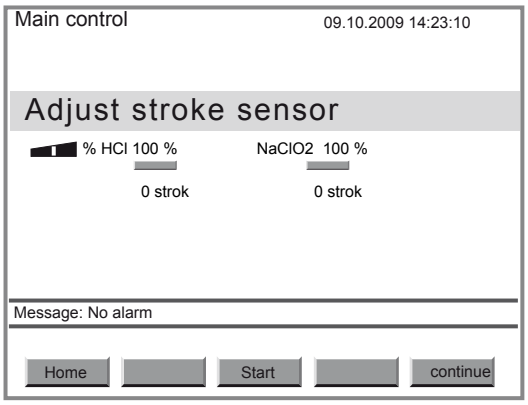
7.1.3 Fill reactor



This menu is used for filling the reactor tank.

For more information see the "Start up" chapter.

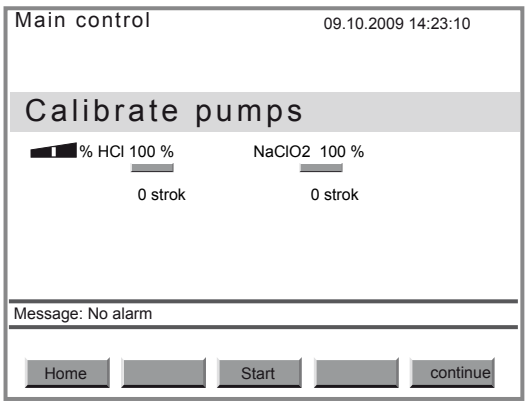
7.1.4 Stroke sensor adjust



This menu is used to adjust the stroke sensors.

For more information see the "Start up" chapter.

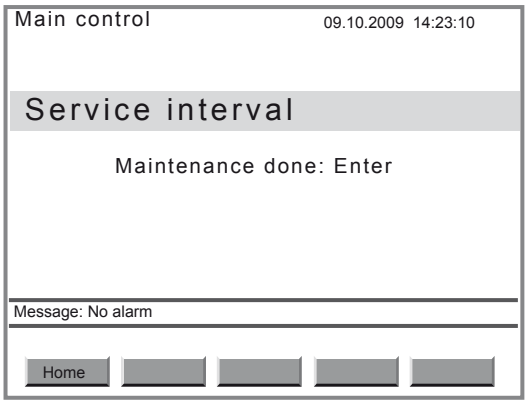
7.1.5 Calibrate pumps



The dosing pumps must be calibrated via this menu.

For more information see the "Start up" chapter.

7.1.6 Maintenance interval



In this menu, the execution of the annual maintenance must be confirmed with the *[ENTER]* key, so that the system is re-enabled and the day count-down of the annual service interval is restarted.

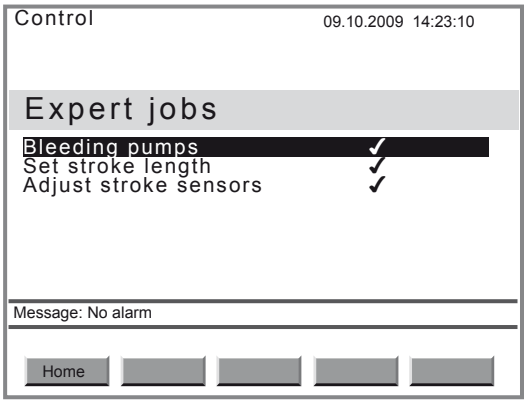
WARNING!

If the *[ENTER]* key is wrongfully pressed, the result is serious danger as a result of an exceeded service interval.

– After carrying out work other than that corresponding to the annual maintenance interval, the *[ENTER]* key must not be pressed.

For more information see the "Start up" chapter.

7.2 Expert jobs



This menu supports the following activities during operation, as they are carried out in the correct sequence:

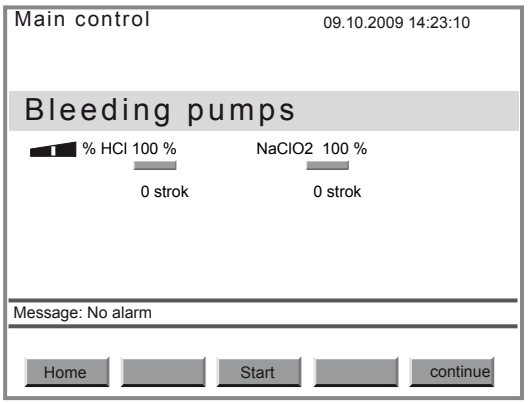
1 - Bleeding pumps - see *Chapter 7.2.1 'Bleeding pumps' on page 31*

2 - Set stroke length - see *Chapter 7.2.2 'Set stroke length' on page 32*

3 - Adjust stroke sensors - see *Chapter 7.2.3 'Adjust stroke sensors' on page 32*

For the detailed, binding description of Expert jobs, see the "Operation" chapter.

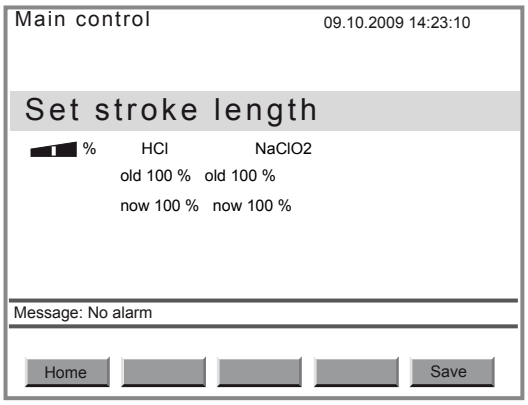
7.2.1 Bleeding pumps



This menu is used for bleeding the dosing pumps.

For more information see the "Start up" chapter.

7.2.2 Set stroke length

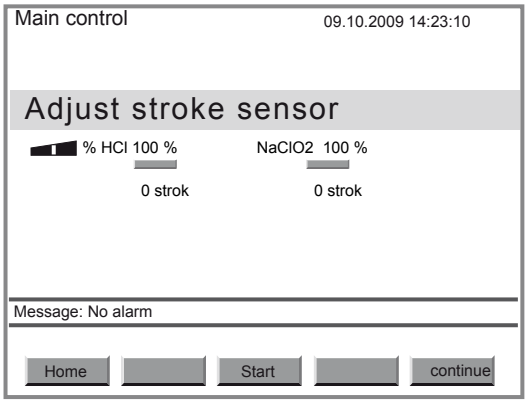


This menu must be used to adjust the stroke lengths, so that the set data are transferred to the control.

- *When using calibrated pumps and only the stroke length requires adjustment, via the menu 'Set stroke length', a recalibration is not required.*
- *The Bello Zon® control can match the number of preset strokes to the adjusted stroke length, provided the pumps inform the control via the menu 'Set stroke length' of their actual stroke lengths.*

For more information see the "Operation" chapter.

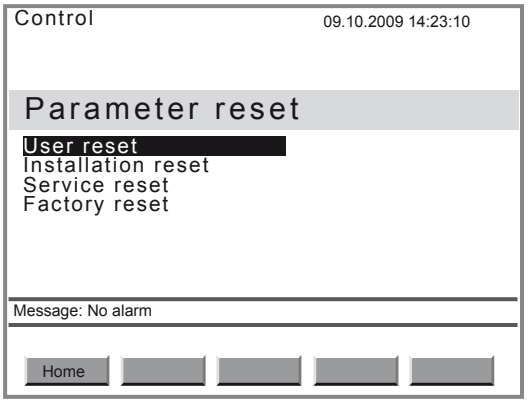
7.2.3 Adjust stroke sensors



This menu is used to adjust the stroke sensors.

For more information see the "Start up" chapter.

7.3 Parameter Reset



Type	Effects ...
User reset	All values which can be changed with a user code
Installation reset	All values which can be changed with an expert code
Service reset	All values which can be changed with a service code

This menu is used for resets which have a different effect range.

All values, which can be changed in the operating menu using the allocated access code, are reset to the factory settings upon selecting Reset in the menu.

8 Setting, settings

The "Settings" menu branches into the following parameter sets:

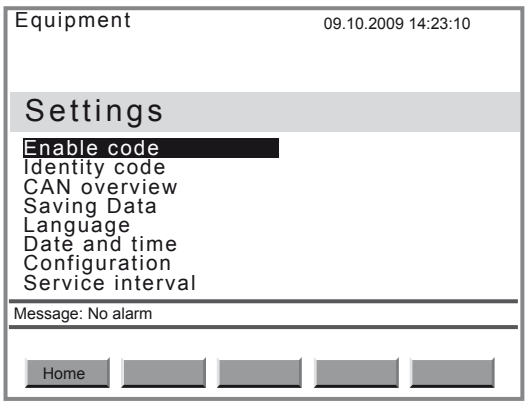
1 - *'System'* ↳ *Chapter 8.1 'System' on page 34*

2 - *'Control'* ↳ *Chapter 8.2 'Control' on page 42*

The current parameter set in which the control is currently located, is always shown by the display at the top left, e.g. see the display below.

To branch to other parameter sets from the menu *'Settings'* use the *[LEFT]* and *[RIGHT]* arrow keys.

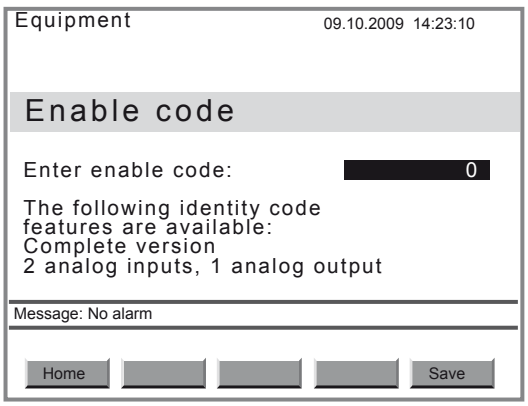
8.1 System



This menu branch of the "Settings" menu contains the "Equipment" parameter set, comprising:

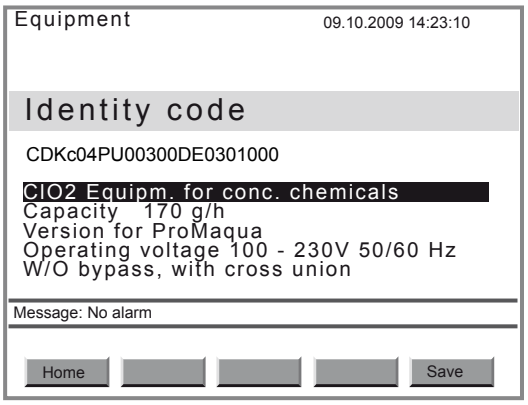
- *'Enable code'* ↳ *Chapter 8.1.1 'Enable code' on page 34*
- *'Identity code'* ↳ *Chapter 8.1.2 'Identity code' on page 35*
- *'CAN overview'* ↳ *Chapter 8.1.3 'CAN overview' on page 35*
- Data backup ↳ *Chapter 8.1.4 'Data backup' on page 38*
- *'Language'* ↳ *Chapter 8.1.5 'Language' on page 39*
- *'Date and time'* ↳ *Chapter 8.1.6 'Date and time' on page 39*
- *'Configuration'* ↳ *Chapter 8.1.7 'Configuration' on page 40*
- *'Maintenance interval'* ↳ *Chapter 8.1.8 'Maintenance interval' on page 41*

8.1.1 Enable code



From this menu, it is possible to enable an additional, chargeable identity code characteristic for the equipment using an Enable code

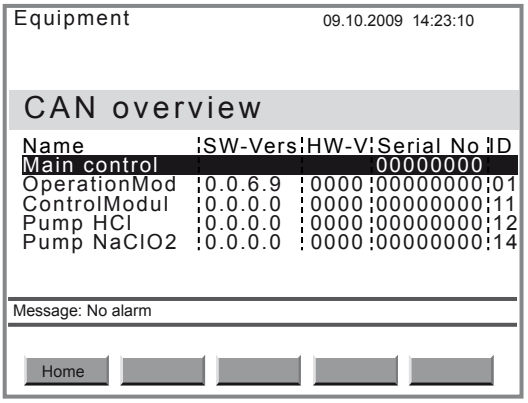
8.1.2 Identity code



This menu shows the identity code of the equipment and the explanation of the identity code options.

The identity code can also be modified here. Chargeable identity code options can only be enabled using an enable code - see the previous chapter. To do this order the required identity code from ProMinent; quote the system serial number when doing so.

8.1.3 CAN overview



This menu shows the recognized CAN modules of the system/equipment as well as their:

- Software version
- Hardware version
- Serial number
- Node ID

– *The serial number of the control is also the serial number of the system.*
– *The serial number of the Sigma b is also the serial number of its PCB.*

You can also use this menu to:

- Change the user code
- Update Bello Zon® software

8.1.3.1 Changing the user code

1. To do this press the *[P]* key in the *'CAN overview'* memory.
   ⇨ The sub-menu *'Control'* appears.

2. Change to the menu option *'User code'* (arrow keys) and press key *[P]*.
3. Enter the user code using the *[arrow keys]* and press the *[P]* key.
4. Accept the new user code by pressing *[F5 Save]*.
   ⇨ Confirm the query *'Save changes? Yes = ENTER'* by pressing the *[ENTER]* key.

8.1.3.2 BelloZon® Software Update

8.1.3.2.1 Operating Module update

Prerequisites:

- The SD card with the current file "update.bin" is at hand.
- The controller and all CAN modules - such as pumps - are connected to the supply voltage.
- The LCD screen displays *'Equipment Off'*.

1. Open the transparent interface cover below the keypad (loosen the screws).
2. Insert the SD card into the card slot replacing the one already in it.
3. Using *[F2 Setting]* switch to the menu *'Settings'* .
   ⇨ The request "Access Code" appears.
4. Enter the expert code (5050, *[Arrow Keys]*) and press *[Enter]* .
5. Select the sub-menu *'CAN Overview'* (Key *[UP]* / *[DOWN]*) and press *[Enter]* .
6. Select *'Operating Module'* (Key *[UP]* / *[DOWN]*) and press *[Enter]* .
7. Select *'Software Update'* (Key *[UP]* / *[DOWN]*) and press *[Enter]* .
8. Press *[F5 Update]* .
   ⇨ *'Programming is running'* appears followed by a window offering two software sources.
9. Using *[F2]* , start the update from the SD card.
   ⇨ A progress bar appears and then different messages. Then the controller reboots. The ProMaqua Logo appears after about 1 minute.
10. In the event that the LCD screen remains black for longer than 30 sec, keep pressing *[Enter]* until the ProMaqua Logo appears.
    ⇨ As soon as the display *'Equipment Off'* appears after about 1 minute, the update is completed.
11. Re-start the controller and all CAN modules by simultaneously switching the supply voltage off and on.
    ⇨ The controller and all CAN modules re-boot and are re-initialised.
12. Switch back to the menu *'CAN Overview'* again as above and check if the different numbers appear with all modules.
13. If something is missing, return to step 11.

14. If everything is okay, swap the SD card in the card slot with the card that was previously inserted.

WARNING!
Danger of an electric shock
The controller only provides the specified humidity protection in the event that the interface cover is also closed correctly.

– Close the interface cover and screw it tightly to ensure that it is moisture-proof.

8.1.3.2.2 Control Module update

Prerequisites:

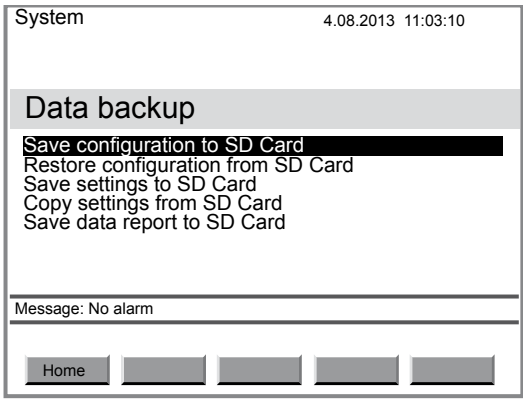
- The SD card with the current file "DXMaB_up.mhx" is to hand.
- The controller and all CAN modules - such as pumps - are connected to the supply voltage.
- The LCD screen displays *'Equipment Off'*.

1. Open the transparent interface cover below the keypad (loosen the screws).
2. Insert the SD card into the card slot replacing the one already in it.
3. Using *[F2 Setting]* switch to the menu *'Settings'*.
4. Select the sub-menu *'CAN Overview'* (Key *[UP]* / *[DOWN]*) and press *[Enter]*.
5. Select *'Control Module'* - not *'Controller'* - (Key *[UP]* / *[DOWN]*) and press *[Enter]*.
6. Select *'Software Update'* (Key *[UP]* / *[DOWN]*) and press *[Enter]*.
7. *[Press F5 Update]*.
   ⇨ First *'Programming is running'* appears, then the ProMaqua Logo and then *'Equipment Off'*.
8. Re-start the controller and all CAN modules by simultaneously switching the supply voltage off and on.
   ⇨ The controller and all CAN modules re-boot and are re-initialised.
9. Switch to the menu *'CAN Overview'* again as above and check if the different numbers appear with all modules.
10. If something is missing, return to step 8.
11. If everything is okay, swap the SD card in the card slot with the card that was previously inserted.

WARNING!
Danger of an electric shock
The controller only provides the specified humidity protection in the event that the interface cover is also closed correctly.

– Close the interface cover and screw it tightly to ensure that it is moisture-proof.

8.1.4 Data backup



You can save the following data on an SD card here:

- System configuration
- Setting data
- Data report

Requirements:

- There is an SD card with free memory space.

1. Open the transparent interface cover below the keypad (loosen the screw).
2. Insert the SD card into the card slot replacing the one already in it.
3. Using *[F2 Setting]*, switch to the menu *'Settings'*.
4. Select the sub-menu *'Saving Data'* (key *[UP]* / *[DOWN]*) and press *[Enter]*.
5. Select *'Save Configuration to SD Card'* (*[UP]* / *[DOWN]*) keys and press *[Enter]*.
6. Do the same thing with the *'Setting data'* and the *'Data report'*.
7. Remove the SD card from the slot.
8. Save the files "configuration.bin", "settings.txt" and "report.txt" on your computer.
9. Save the folder "Logbook" from the other SD card on your computer to ensure that data backup is complete.
10. If everything is working correctly, reinsert the "old" SD card into the card slot.

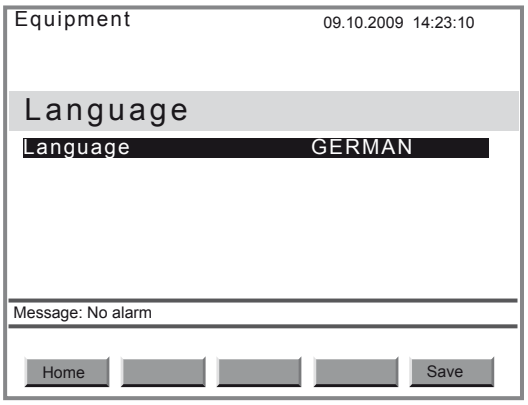
WARNING!

Danger of electric shock

The controller only provides the specified humidity protection in the event that the interface cover is also closed correctly.

– Close the interface cover and screw it tightly to ensure that it is moisture-proof.

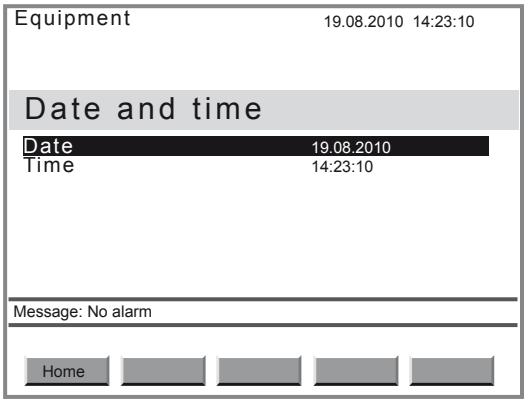
8.1.5 Language



The user interface language can be changed here.

Parameter	max.	min.	Factory setting	Code	Remarks
Language	English		Depending on identity code	none	
	German				
	French				
	Italian				
	Spanish				
	Other languages upon request and see identity code				

8.1.6 Date and time



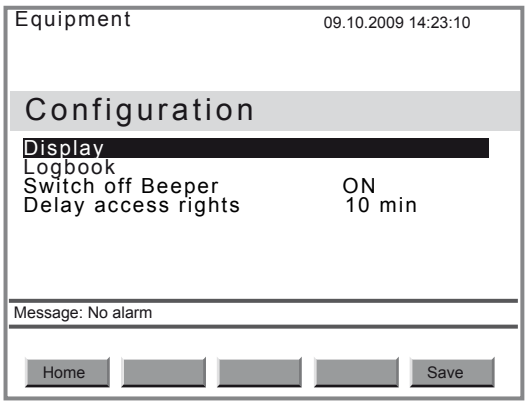
This menu is used to set the date and time for the control.

Parameter	max.	min.	Factory setting	Code	Remarks
Date*	31.12.9999	01.01.0001	-	none	
Time**	23:59:59	00:00:00	-	none	
* Format: dd.mm.yyyy, ** Format: hh:mm:ss					

Summer time

Where necessary, the time must be manually adjusted between summer time and normal time.

8.1.7 Configuration

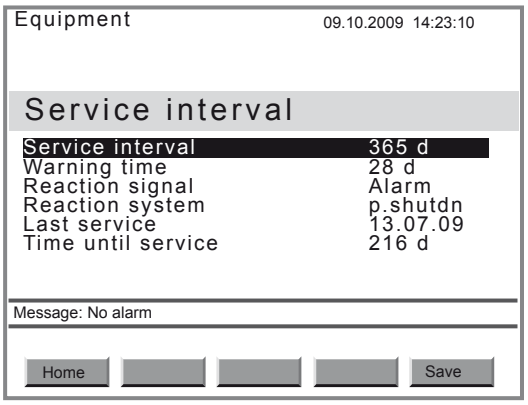


This function is used to configure:

- Display
- Log book
- Switch off beeper
- Delay access authentication

Parameter	max.	min.	Factory setting	Code	Remarks
Display					
Brightness	9999	0	7999	Factory code	
Contrast	9999	0	5000	Factory code	
Dim time	99 min	0 min	5 min	none	To extend the service life of the display
Log book					
Interval	999 s	0 s / off	60 s	User code	
Archive storing					
Archive storing	ON	OFF	ON	Factory code	
Storage time gap	7 d	1 d	1 d	User code	
Switch off beeper	ON OFF		ON	Expert code	
Delay access authentication	30 min	0 min	10 min	Expert code	

8.1.8 Maintenance interval



The following points can be adjusted here:

- Maintenance interval
- Warning time
- Reaction signal
- Reaction system

The following points are for information only:

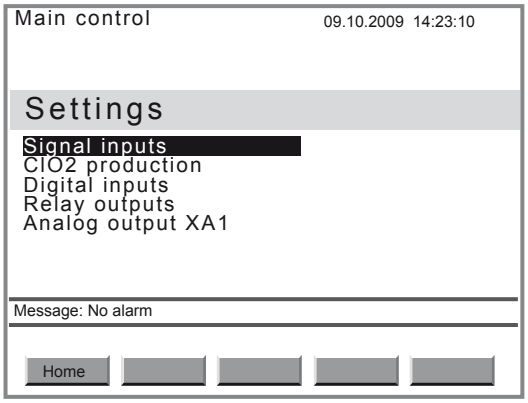
- Last service
- Time until service

Parameter	max.	min.	Factory setting	Code	Remarks
Maintenance interval					
Maintenance interval	999 d	0 d	365 d	Service code	
Warning time	999 d	0 d	28 d	Service code	Warning signal before the next maintenance interval
Reaction signal	Alarm Warning Info n.exist.		Alarm	Service code	Reaction signal
Reaction system*	p.shutdn shutdown continue		p.shutdn	Service code	Reaction system

* Explanation see "Terminology list" at the end of the operating instructions.

As soon as the *'Service interval'* has elapsed, the control reacts according to the reaction which is set under *'Reaction system'*.

8.2 Control



This menu branch of the SETTING menu contains the "Control" parameter set, comprising:

1 - *'Signal inputs'* ↳ *Chapter 8.2.1 'Signal inputs' on page 42*

2 - *'ClO2 production'* ↳ *Chapter 8.2.2 'ClO$_2$ production' on page 50*

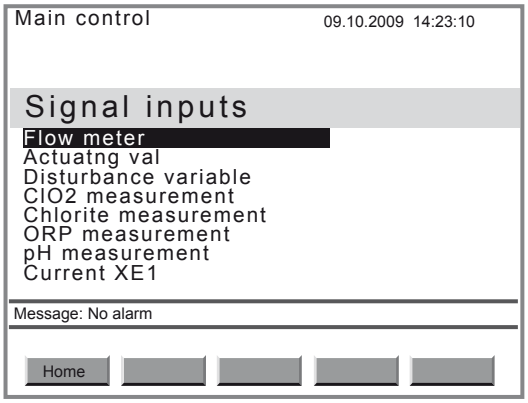
3 - *'Digital inputs'* ↳ *Chapter 8.2.3 'Digital inputs' on page 59*

4 - *'Relay outputs'* ↳ *Chapter 8.2.4 'Relay outputs' on page 61*

5 - *'Analog output XA1'* ↳ *Chapter 8.2.5 'Analog output XA1' on page 61*

From here the inputs and outputs of the control can be configured and the parameters adjusted for ClO_2 production.

8.2.1 Signal inputs



This menu is used to configure the inputs and set the corresponding limits for :

1 - *'Flow meter'* ↳ *Chapter 8.2.1.1 'Flow meter' on page 43*

2 - *'Control variable'* ↳ *Chapter 8.2.1.2 'Control variable' on page 44*

3 - *'Interference variable'* ↳ *Chapter 8.2.1.3 'Interference variable' on page 45*

4 - *'ClO2 measurement'* ↳ *Chapter 8.2.1.4 'ClO2 measurement' on page 46*

5 - *'Chlorite measurement'* ↳ *Chapter 8.2.1.5 'Chlorite measurement' on page 47*

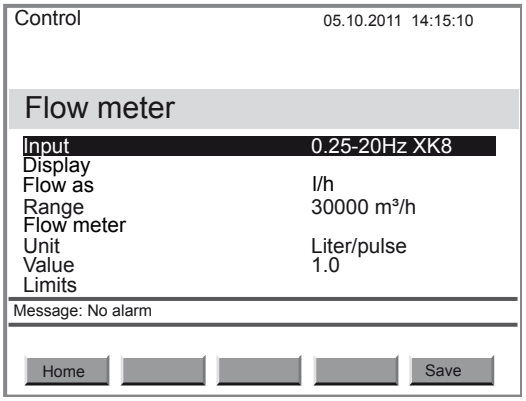
6 - *'ORP measurement'* ↳ *Chapter 8.2.1.6 'ORP measurement' on page 48*

7 - *'pH measurement'* ↳ *Chapter 8.2.1.7 'pH measurement' on page 49*

8 - *'Current XE1'* ↳ *Chapter 8.2.1.8 'Current XE1 / XE2' on page 50*

9 - *'Current XE2'*

8.2.1.1 Flow meter



This menu contains the following flow meter menu items:

- *'Input'* (input used)
- *'Display'*
- *'Flow meter'*
- *'Limit values'*

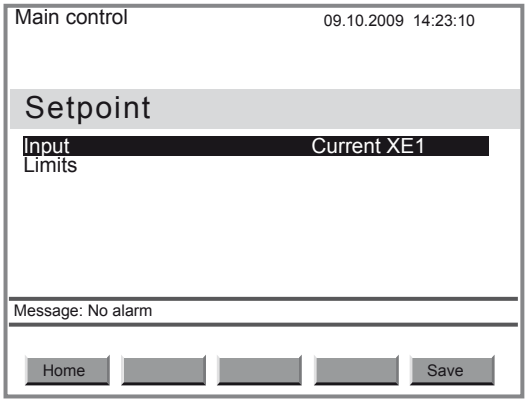
Parameter	max.	min.	Factory setting	Code	Remarks
Input	not available 0.25-20Hz XK8 10-10 000Hz XK8 Current XE1 Current XE2		not available	Service code	- 0.25-20Hz = XK8:3 & 4 10-10 000Hz = XK8:2 & 3 Current XE1 = XE1:2 & 3 Current XE1 = XE1:2 & 3
Display					
flow as	l/h	l/h	m³/h	Expert code	
Range:	30 000 ... 1 m³/h	1 m³/h	1 m³/h	Expert code	
Flow meter					
Unit	Litre/pulse Pulses/litre Litre/h m³/h		Litre/pulse	Expert code	Valid for both contact inputs
Value	9999.9	0	1.0	Expert code	Valid for both contact inputs; pulses per litre of the water meter
Limit values					
Min value(a)	30 000 m³/h	1 m³/h / off**	1 m³/h / off	Expert code	
Max value(a)	30 000 m³/h	0 m³/h	999 m³/h	Expert code	
Hysteresis(a)	30 000 m³/h	0 m³/h	10 m³/h	Expert code	
Min value(w)	30 000 m³/h	1 m³/h / off**	1 m³/h / off	Expert code	
Max value(w)	30 000 m³/h	0 m³/h	999 m³/h	Expert code	
Hysteresis(w)	30 000 m³/h	0 m³/h	30 m³/h	Expert code	

Parameter	max.	min.	Factory setting	Code	Remarks
tDelay(alarm)*	999 s	0 s	0 s	Service code	Delay period
Reaction system*	p.shutdn/shut-down/continue		shutdown	Service code	

* Explanation see "Terminology list" at the end of the operating instructions

** No error message is output.

8.2.1.2 Control variable



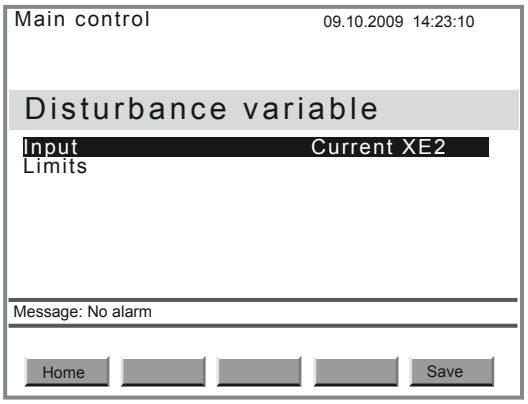
This term is explained in the "Terminology list" at the end of the operating instructions.

Parameter	max.	min.	Factory setting	Code	Remarks
Control variable:					
Input	n.exist. Current XE1 Current XE2		not available	Service code	Input used
Limits:					
Min. value (A)	100 %	1 % / off**	1 % / off	Expert code	Min. value alarm
Max. value (A)	100 %	0 %	100 %	Expert code	Max. value alarm
Hysteresis(a)	100 %	0 %	2 %	Expert code	for alarm
tDelay(alarm)*	999 s	0 s	0 s	Service code	Delay period
Reaction system*	p.shutdn/shut-down/continue		shutdown	Service code	Reaction control

* Explanation see "Terminology list" at the end of the operating instructions

** No error message is output.

8.2.1.3 Interference variable



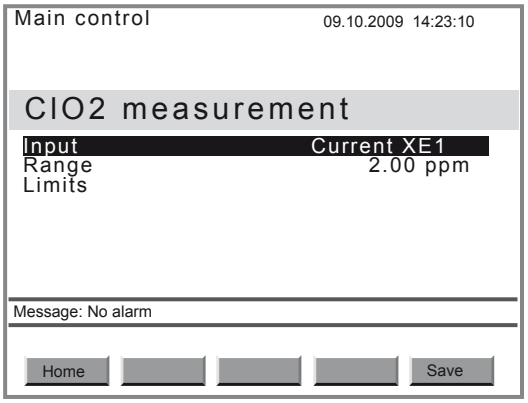
This term is explained in the "Terminology list" at the end of the operating instructions.

Parameter	max.	min.	Factory setting	Code	Remarks
Interference variable:					
Input	none Current XE1 Current XE2		none	Service code	Input used
Limits:					
Min. value (A)	100 %	1 % / off**	1 % / off	Expert code	for signal checking
Max. value (A)	100 %	0 %	100 %	Expert code	for signal checking
Hysteresis(a)	100 %	0 %	2 %	Expert code	
tDelay(alarm)*	999 s	0 s	0 s	Service code	Delay period
Reaction system*	p.shutdn/shutdown/continue		shutdown	Service code	

* Explanation see "Terminology list" at the end of the operating instructions

** No error message is output.

8.2.1.4 ClO2 measurement



An appropriately equipped Bello Zon® system can measure and also regulate ClO2.

This menu contains these menu items for ClO2 measurement:

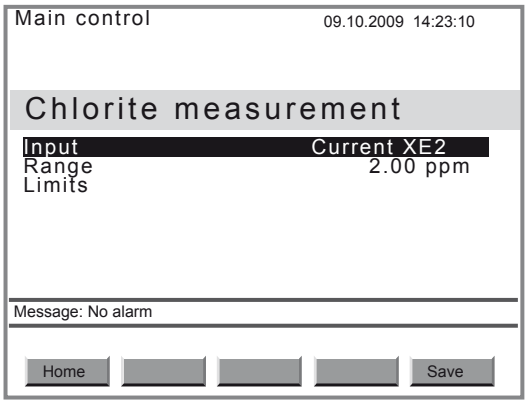
- *'Input'*
- *'Range'* (of the sensor)
- *'Limit values'*

Parameter	max.	min.	Factory setting	Code	Remarks
Input					
Input	none Current XE1 Current XE2		none	Service code	Input used
Measuring range					
	0.50 ppm 2.00 ppm 10.00 ppm 20.00 ppm		2.00 ppm	Expert code	
Limit values					
Min value(a)	Measuring range	0.00 ppm / off**	0.00 ppm / off	Expert code	
Max value(a)	Measuring range	0.00 ppm	2.00 ppm	Expert code	
Hysteresis(a)	Measuring range	0.00 ppm	0.04 ppm	Expert code	
Min value(w)	Measuring range	0.00 ppm / off**	0.00 ppm / off	Expert code	
Max value(w)	Measuring range	0.00 ppm	2.00 ppm	Expert code	
Hysteresis(w)	Measuring range	0.00 ppm	0.04 ppm	Expert code	
tDelay(alarm)*	999 s	0 s	0 s	Service code	Delay period
tDelay (warning)*	999 s	0 s	0 s	Service code	Delay period
Reaction system*	p.shutdn/shut-down/continue		shutdown	Service code	

* Explanation see "Terminology list" at the end of the operating instructions

** No error message is output.

8.2.1.5 Chlorite measurement



An appropriately equipped Bello Zon® system can measure chlorite.

This menu contains these menu items for chlorite measurement:

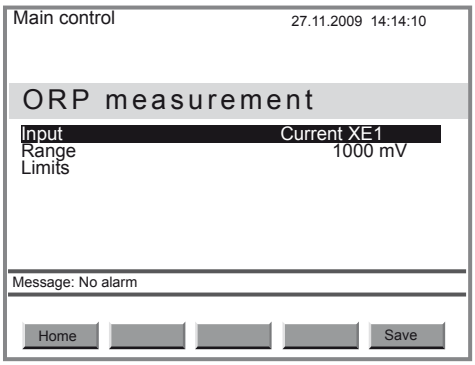
- *'Input'*
- *'Range'* (of the sensor)
- *'Limit values'*

Parameter	max.	min.	Factory setting	Code	Remarks
Input					
Input	none Current XE1 Current XE2		none	Expert code	
Measuring range	0.50 ppm 2.00 ppm		2.00 ppm	Expert code	
Limit values					
Min value(a)	Measuring range	0.00 ppm / off**	0.00 ppm / off	Expert code	
Max value(a)	Measuring range	0.00 ppm	2.00 ppm	Expert code	
Hysteresis(a)	Measuring range	0.00 ppm	0.04 ppm	Expert code	
Min value(w)	Measuring range	0.00 ppm / off**	0.00 ppm / off	Expert code	
Max value(w)	Measuring range	0.00 ppm	2.00 ppm	Expert code	
Hysteresis(w)	Measuring range	0.00 ppm	0.04 ppm	Expert code	
tDelay(alarm)*	999 s	0 s	0 s	Service code	Delay period
tDelay (warning)*	999 s	0 s	0 s	Service code	Delay period
Reaction system*	p.shutdn/shut-down/continue		shutdown	Service code	

* Explanation see "Terminology list" at the end of the operating instructions.

** No error message is output.

8.2.1.6 ORP measurement



An appropriately equipped Bello Zon® system can measure the ORP voltage.

This menu contains these menu items for ORP measurement:

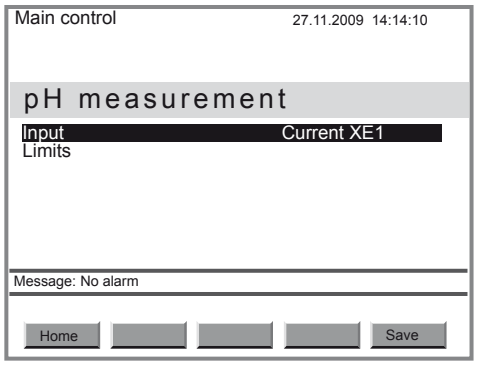
- *'ORP measurement'* (input used)
- *'Range'* (of the sensor)
- *'Limit values'*

Parameter	max.	min.	Factory setting	Code	Remarks
ORP measure-ment					
Input	none Current XE1 Current XE2		none	Service code	Input used
Measuring range	2000 mV	0 mV	1000 mV	Expert code	
Buffer solution	2000 mV	0 mV	465 mV	Expert code	
Limit values					
Min value(a)	2000 mV	0 mV / off**	0 mV / off	Expert code	
Max value(a)	2000 mV	0 mV	1000 mV	Expert code	
Hysteresis(a)	2000 mV	0 mV	10 mV	Expert code	
Min value(w)	2000 mV	0 mV / off**	0 mV / off	Expert code	
Max value(w)	2000 mV	0 mV	1000 mV	Expert code	
Hysteresis(w)	2000 mV	0 mV	10 mV	Expert code	
tDelay(alarm)*	999 s	0 s	0 s	Service code	Delay period
tDelay (warning)*	999 s	0 s	0 s	Service code	Delay period
Reaction system*	p.shutdn/shut-down/continue		shutdown	Service code	

* Explanation see "Terminology list" at the end of the operating instructions

** No error message is output.

8.2.1.7 pH measurement



An appropriately equipped Bello Zon® system can measure pH.

This menu contains these menu items for ORP measurement:

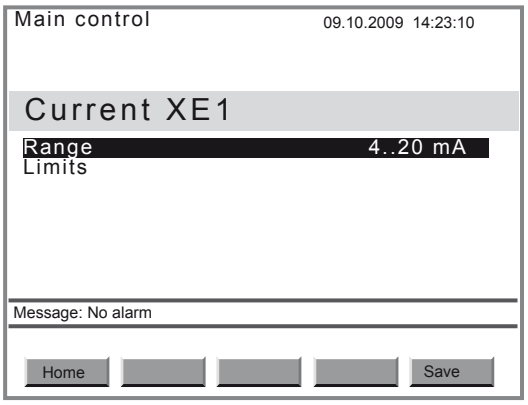
- *'Input'*
- *'Limit values'*

Parameter	max.	min.	Factory setting	Code	Remarks
Input					
Input	none Current XE1 Current XE2		not available	Service code	
Limit values					
Min value(a)	pH 16	pH -2	pH 2	Expert code	
Max value(a)	pH 16/off**	pH -2	pH 12	Expert code	
Hysteresis(a)	pH 16	pH -2	pH 0.2	Expert code	
Min value(w)	pH 16	pH -2	pH 2	Expert code	
Max value(w)	pH 16/off**	pH 0	pH 12	Expert code	
Hysteresis(w)	pH 16	pH 0	pH 0.2	Expert code	
tDelay(alarm)*	999 s	0 s	0 s	Service code	Delay period
tDelay (warning)*	999 s	0 s	0 s	Service code	Delay period
Reaction system*	p.shutdn/shut-down/continue		shutdown	Service code	

* Explanation see "Terminology list" at the end of the operating instructions

** No error message is output.

8.2.1.8 Current XE1 / XE2



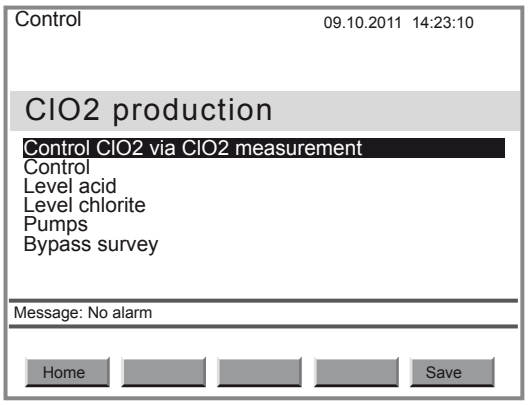
This menu is used to check the mA signal at the current input XE1 (XE2 analog).

Parameter	max.	min.	Factory setting	Code	Remarks
Current XE1					
Range	0..20 mA / 4..20 mA		4..20 mA	Expert code	
Limit values					
Min value(a)	25 mA	0 mA	3 mA	Expert code	

Parameter	max.	min.	Factory setting	Code	Remarks
Max value(a)	25 mA	0 mA	23 mA	Expert code	
Hysteresis(a)	25 mA	0 mA	0 mA	Expert code	
tDelay(alarm)*			0 s	Service code	
Reaction system*	p.shutdn/shut-down/continue		shutdown	Service code	

* Explanation see "Terminology list" at the end of the operating instructions

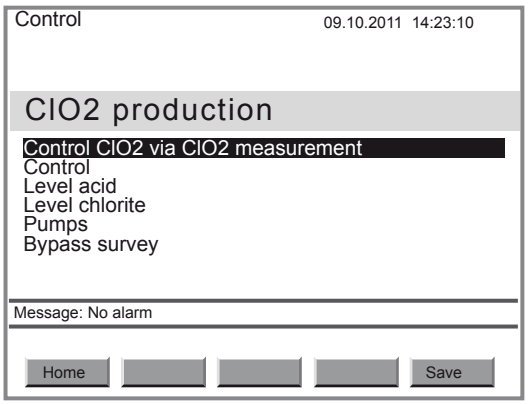
8.2.2 ClO_2 production



This menu is used to set or check the necessary parameters for ClO_2 production:

- *'Control'* ClO_2 quantity via (flow meter, ClO_2 measurement...) *Chapter 8.2.2.1 'Control ClO_2 via' on page 51*
- *'Control'* (ClO_2 production) *Chapter 8.2.2.2 'Control' on page 52*
- *'Level acid'* (suction lance switch) *Chapter 8.2.2.3 'Level acid' on page 55*
- *'Level chlorite'* (suction lance switch) *Chapter 8.2.2.4 'Level chlorite' on page 56*
- *'Pumps'* *Chapter 8.2.2.5 'Pumps' on page 57*
- *'Bypass monitor'* *Chapter 8.2.2.6 'Bypass monitor' on page 58*

8.2.2.1 Control ClO_2 via

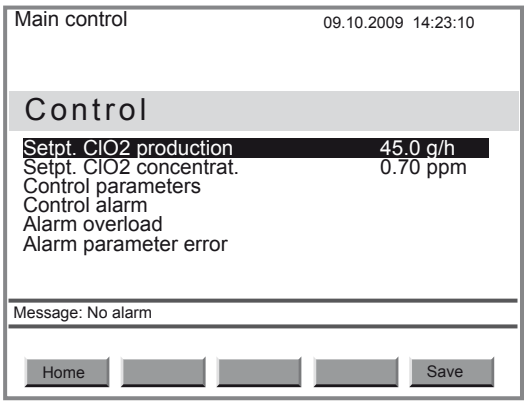


This menu is used to set which signal should be used to control the ClO_2 production quantity:

Manual	No input signal; constant quantity
Control variable	Via external control variable, e.g. from the control room; setpoint-dependent
Flow	Via water meter; flow-proportional
ClO_2 measurement	Via ClO_2 sensor; measurement-proportional
ORP measurement	Via ORP sensor

Parameter	max.	min.	Factory setting	Code	Remarks
Control ClO_2 via	Manual Control variable Flow ClO_2 measure-ment ORP measure-ment		Manual	Expert code	

8.2.2.2 Control



This menu is used to set all control parameters and the corresponding alarms.

8.2.2.2.1 Setpt. ClO2 production (manual control)

Here constant Setpt. ClO2 production can be preselected for "Control ClO2 via":

- *'Manual'*

This value can be adjusted during operation in the 'Production' continuous display using [F2] SETPOINT as soon as the control has been started using the [START/STOP] key.

8.2.2.2.2 Setpt. ClO2 concentrat. (measurement-proportional control)

Here Setpt. ClO2 production can be preselected for "Control ClO2 via":

- *'Flow'*
- *'ClO2 measurement'*

> *It is easier to adjust this value during operation via the 'Production' continuous display using [F2] SETPOINT as soon as the control has been started using the [START/STOP] key.*

8.2.2.2.3 Setpt. ClO2 high concentration

Here Setpt. ClO2 production can be preselected for "Dosing input"-"high level d.".

8.2.2.2.4 Man. CLO2 production

You can preselect Setpt. ClO2 production for "Metering input"-"Man. metering".

8.2.2.2.5 Control parameters

Here the control parameters can be set for "Control ClO2 via":

- *'ClO2 measurement'*

Parameter	max.	min.	Factory setting	Code	Remarks
Setpt. ClO_2 production	Max. production volume (config)	0 g/h	0 g/h	User code	
Setpt. ClO_2 concentrat. during ClO_2 measurement	Measuring range of the ClO_2 sensor	0.00 ppm	0.00 ppm	User code	
Setpt. ClO_2 production for manual dosing	Max. production volume (config)	0 g/h	0 g/h	User code	
Setpt. ClO_2 high concentration	Measuring range of the ClO_2 sensor	0.00 ppm	0.00 ppm	User code	
Setpt. ClO_2 concentrat. during flow measurement	2000 ppm	0.00 ppm	0.00 ppm	User code	
Setpoint ORP potential	Measuring range of the ORP sensor	0 mV	0.00 ppm	User code	
Setpoint ORP high concentration	Measuring range of the ORP sensor	0 mV	0.00 ppm	User code	
Control mode	PID control P control 2 point control		PID control	Expert code	

Parameter	max.	min.	Factory setting	Code	Remarks
Control parameters for the P control					
P factor	500 % of the measuring range	1% of the measuring range	0.20 ppm	Expert code	For ClO2
P factor	500 % of the measuring range	10 mV	100 mV	Expert code	For ORP
Basic load	100.0 %	0.0 %	0.0 %	Expert code	
Feedforward control	n.exist. additive multiplicative		n.exist.	Expert code	Feedforward control
Disturb. variable factor	100 %	0 %	100 %	Expert code	
Control parameters for the PID control					
P factor	500 % of the measuring range	1% of the measuring range	0.20 ppm	Expert code	For ClO2
P factor	500 % of the measuring range	10 mV	100 mV	Expert code	For ORP
I factor	9999 s	0 s	0 s	Expert code	
D factor	2500 s	0 s	0 s	Expert code	
Basic load	100.0 %	0.0 %	0.0 %	Expert code	
Feedforward control	n.exist. additive multiplicative		n.exist.	Expert code	Feedforward control
Disturb. variable factor	100 %	0 %	100 %	Expert code	
Control parameters for the 2 point control					
Band for 2 point control	100.00 %	0.00 %	0.00 %	Expert code	
Lower limit ctrl output	100.00 %	0.00 %	0.00 %	Factory code	
Upper limit ctrl output	100.00 %	0.00 %	100.00 %	Expert code	
On time min	999 s	0 s	0 s	Expert code	Minimum switch on time for 2 point control
Off time min	999 s	0 s	0 s	Expert code	Minimum switch on time for 2 point control

For an explanation of the parameters see "Terminology list" at the end of the operating instructions.

8.2.2.2.6 Control alarm

Parameter	max.	min.	Factory setting	Code	Remarks
tDelay(alarm)*	999 s	0 s	0 s	Service code	Delay period
Reaction signal	Alarm Warning Message None		Alarm	Expert code	
Reaction system*	p.shutdn shutdown continue		shutdown	Service code	

* Explanation see "Terminology list" at the end of the operating instructions.

Here the control parameters can be set for the reaction to a *'Control alarm'*.

8.2.2.2.7 Alarm overload

Parameter	max.	min.	Factory setting	Code	Remarks
tDelay(alarm)*	999 s	0 s	0 s	Service code	Delay period
Reaction signal	Alarm Warning Message None		None	Expert code	
Reaction system*	p.shutdn shutdown continue		continue	Service code	

* Explanation see "Terminology list" at the end of the operating instructions.

Here the control parameters can be set for the *'Alarm overload'*. This occurs as soon as the current process requires more ClO_2 solution that the system can supply.

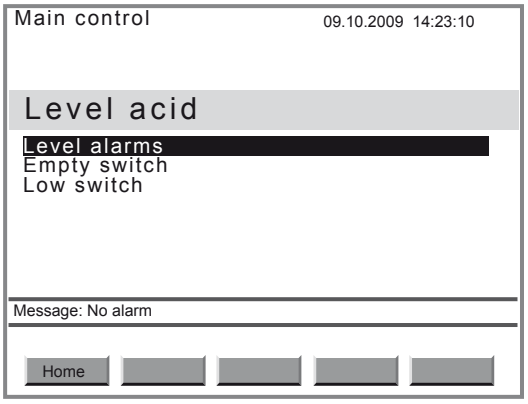
8.2.2.2.8 Alarm parameter error

Parameter	max.	min.	Factory setting	Code	Remarks
tDelay(alarm)*	999 s	0 s	0 s	Service code	Delay period
Reaction signal	Alarm Warning Message None		Warning	Expert code	
Reaction system*	p.shutdn shutdown continue		continue	Service code	

* Explanation see "Terminology list" at the end of the operating instructions.

Here the control parameters can be set for the *'Alarm parameter error'*. This occurs as soon as parameters are input into the control and confirmed which could lead to an inconsistency in a parameter set.

8.2.2.3 Level acid



Service technicians can read-off information about the following functions from this menu:

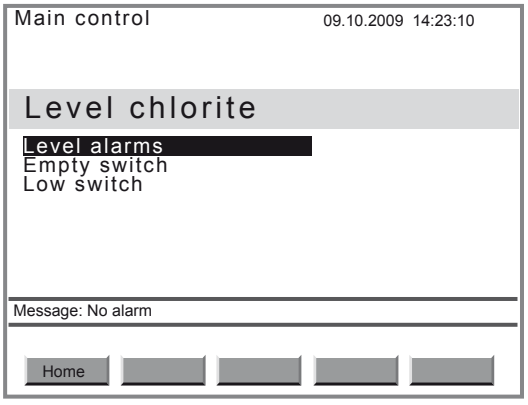
- Level alarms

These items can also be set:

- Empty switch
- Low switch

Parameter	max.	min.	Factory setting	Code	Remarks
Empty switch					
Type of contact	N/O / NC (open)		N/O	Service code	
Low switch					
Type of contact	N/O / NC (open)		N/O	Service code	

8.2.2.4 Level chlorite



Service technicians can read-off information about the following functions from this menu:

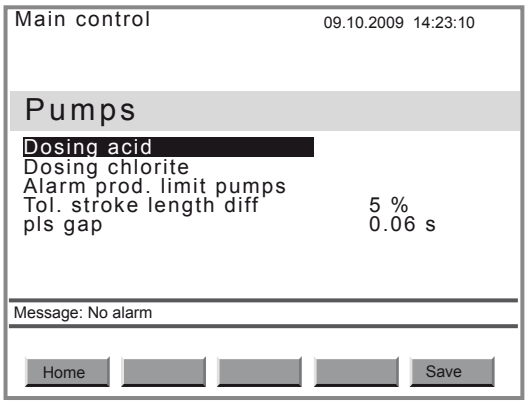
- Level alarms

These items can also be set:

- Empty switch
- Low switch

Parameter	max.	min.	Factory setting	Code	Remarks
Empty switch					
Type of contact	N/O / NC (open)		N/O	Service code	
Low switch					
Type of contact	N/O / NC (open)		N/O	Service code	

8.2.2.5 Pumps



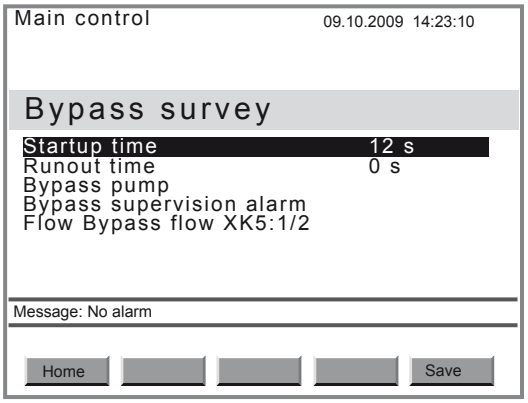
This menu is used to set or read-off the parameters for the following sub-menus:

- *'Dosing acid'*
- *'Dosing chlorite'*
- *'Alarm prod. limit Pumps'*
- *'Tol. stroke length diff'*
- *'Pls gap'*

Parameter	max.	min.	Factory setting	Code	Remarks
Dosing acid/ chlorite					
Pump:					
Calibration volume/Actual				Not adjustable here	Input upon calibration
Stroke volume/ setp.			Type dependent	Not adjustable	at medium back pressure
Stroke volume/ Actual	3000 ml	1 ml		Not adjustable here	Input upon calibration
Alarm capacity limit pumps					
Reaction signal	Alarm Warning None		None	Service code	

Parameter	max.	min.	Factory setting	Code	Remarks
Reaction system	p.shutdn shutdown continue		continue	Service code	
Pls gap	100 ms	0 ms	Type dependent	Factory code	

8.2.2.6 Bypass monitor



This function is used to set or read-off from:

- *'Startup time'*
- *'Runout time'*
- *'Bypass pump (type contact)'*
- *'Bypass supervision alarm'*
- *'Flow Bypass XK5:1/2'* (Type of contact)

Parameter	max.	min.	Factory setting	Code	Remarks
Startup time *	999 s	0 s	12 s	Expert code	
Runout time *	999 s	0 s	0 s	Expert code	
Bypass supervision alarm					
tDelay***	10 s	0 s	1 s	Service code	Delay period
Reaction signal	Alarm Warning Message None		Alarm	Service code	
Reaction system****	p.shutdn shutdown continue		p.shutdn	Service code	
Flow Bypass XK5:1/2					
Type of contact	N/O / NC (open)		N/O	Service code	

* *'Startup time'* monitoring

It is possible to select after what timespan monitoring of the bypass pump should be activated following bypass pump startup via *'Startup time'*.

** *'Runout time'* bypass pump

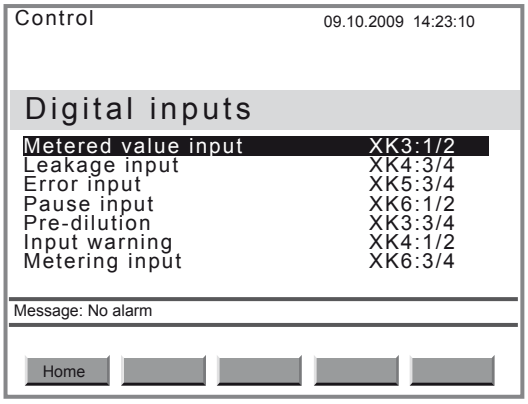
Via the *'Runout time'* it is possible to select how long the bypass pump should run on if the control switches during production to *'Off'*, *'Pause'* or *'Error'*. Should the control switch to the state *'Equipment OFF'*, the bypass pump stops immediately.

*** *'tDelay.'* Delay period

If the flow exceeds the limit during production, a warning is generated without delay and the delay period starts to elapse. However, if the flow remains below the limit throughout the delay period and beyond, the control enters the condition *'Production error'*.

**** Explanation see "Terminology list" at the end of the operating instructions.

8.2.3 Digital inputs



This menu is used to set or read-off parameters relating to:

- *'Input sample water XK3:1/2'*
- *'Input leakage XK4:3/4'* (safety collecting tray)
- *'Input error XK5:3/4'*
- *'Input pause XK6:1/2'*
- *'Pre-dilution XK3:3/4'*
- *'Input warning XK4:1/2'*
- *'Input dosing XK6:3/4'*

Parameter	max.	min.	Factory setting	Code	Remarks
Input sample water XK3:1/2					
Type of contact	N/O / NC (open)		NC	Expert code	
tDelay*	999 s	0 s	5 s	Service code	Delay period
Reaction signal	Alarm Warning Message None		Alarm	Service code	
Reaction system*	p.shutdn shutdown continue		p.shutdn	Service code	
Input leakage XK4:3/4					
Type of contact	N/O / NC (open)		NC	Service code	
tDelay*	999 s	0 s	0 s	Service code	Delay period

Parameter	max.	min.	Factory setting	Code	Remarks
Reaction signal	Alarm Warning Message None		Alarm	Service code	
Reaction system*	p.shutdn shutdown continue		p.shutdn	Service code	
Input error XK5:3/4					
Type of contact	N/O / NC (open)		NC	Service code	
tDelay*	999 s	0 s	0 s	Service code	Delay period
Reaction signal	Alarm Warning Message None		Alarm	Service code	
Reaction system*	p.shutdn shutdown continue		p.shutdn	Service code	
Input pause XK6:1/2					
Type of contact	N/O / NC (open)		NC	Service code	
Pre-dilution XK3:3/4					
Type of contact	N/O / NC (open)		NC	Service code	
Input warning XK4:1/2					
Type of contact	N/O / NC (open)		NC	Service code	
Metering input XK6:3/4**					
Type of contact	N/O / NC (open)		N/O	Service code	
Oper. mode	Non-existent Boost metering Manual metering		Non-existent	Service code	

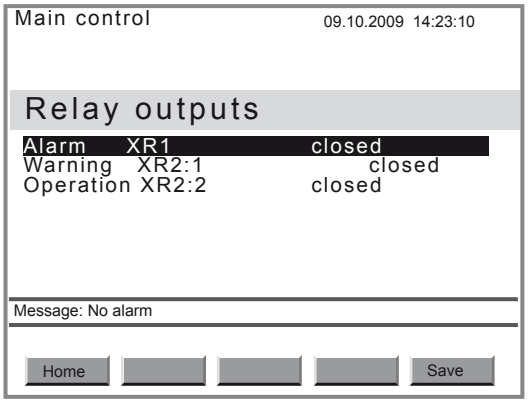
* Explanation see "Terminology list" at the end of the operating instructions.

** If, from time to time, the installation requires a high dosage of ClO_2 solution, then reconfigure *'Input dosage'* to *'Input high dosage'*. As soon as a contact between the terminals of the *'Input dosage'* is made (with *'N/O'* presetting), the control increases the ClO_2 concentration to that value, which was entered under *'Settings* ➔ *Control* ➔ *Control* ➔ *Setpoint ClO2 high concentration'*. Simultaneously, the message *'High dosage'* appears in the continuous display. Moreover, the system must also be able to supply this concentration.

** If, from time to time, the installation requires a different concentration of ClO_2 solution , then reconfigure *'Input dosage'* to *'Input manual dosing'*. As soon as a contact is made between the terminals of the *'Manual Dosing input'*, (with *'N/O'* presetting), the control increases the ClO_2 concentration to that value set under *'Settings ➔ Control ➔ Control' 'Setpoint ClO2 Man. dosing'*. Simultaneously, the message *'Manual Dosing'* appears in the continuous display. Moreover, the system must also be able to supply this concentration.

Upon opening of the contacts, the supplied concentration returns to the normal value.

8.2.4 Relay outputs

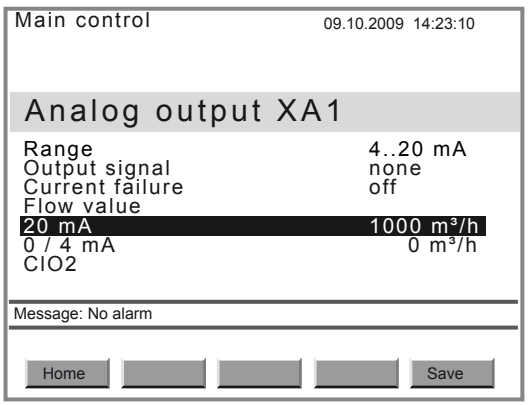


This menu is used to set or read-off parameters relating to the relay:

- *'Alarm XR1'*
- *'Warning XR2:1'*
- *'Operation XR2:2'*

Parameter	max.	min.	Factory setting	Code	Remarks
Alarm XR1					
Type of contact	N/O / NC (open)		N/O	Service code	
Warning XR2:1					
Type of contact	N/O / NC (open)		N/O	Service code	
Operation XR2:2					
Type of contact	N/O / NC (open)		N/O	Service code	

8.2.5 Analog output XA1



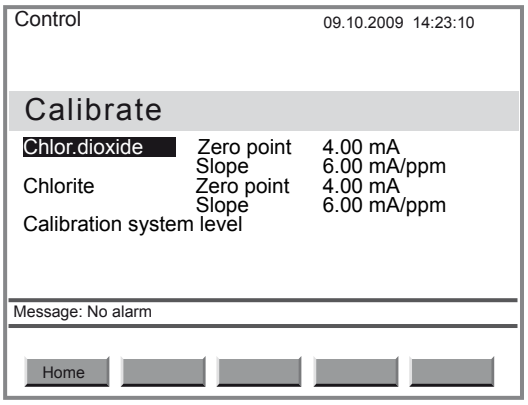
The control can output these signals via the analog output XA1, provided they are present or measured:

- *'Flow'*
- *'Control variable'*
- *'ClO2'*
- *'Chlorite'*
- *'Production volume'*
- *'ORP'*

Parameter	max.	min.	Factory setting	Code	Remarks
Range	0..20 mA 4..20 mA		4..20 mA	Expert code	
Output signal	none Flow Control variable ClO_2 Chlorite Production volume ORP pH		none	Service code	
Error current	off 0.0 mA 3.7 mA 22.0 mA 23.0 mA		off	Expert code	Signals a system fault to a PLC Programmable Logic Controller, for example (when an error exists)
Production volume:					
20 mA	Dependent on system size	0 g/h	45 g/h	Expert code	Factory setting = Measuring range-factory setting
0/4 mA	Dependent on system size	0 g/h	0 g/h	Expert code	20 mA-value ≥ 0/4 mA-value + 1 g/h
Flow value:					
20 mA	30000 m^3/h	0 m^3/h	1 m^3/h	Expert code	
0/4 mA	30000 m^3/h	0 m^3/h	0 m^3/h	Expert code	20 mA-value≥ 0/4 mA-value + 1 m^3/h
20 mA	30000 l/h	0 l/h	1 l/h	Expert code	
0/4 mA	30000 l/h	0 l/h	0 l/h	Expert code	20 mA-value≥ 0/4 mA-value + 1 l/h
ClO_2:					
20 mA	Measuring range dependent	0 ppm	2.00 ppm	Expert code	Factory setting = Measuring range-factory setting
0/4 mA	Measuring range dependent	0 ppm	0 ppm	Expert code	20 mA-value≥ 0/4 mA-value + 0.1 ppm

Parameter	max.	min.	Factory setting	Code	Remarks
Chlorite:					
20 mA	Measuring range dependent	0 ppm	2.00 ppm	Expert code	Factory setting = Measuring range-factory setting
0/4 mA	Measuring range dependent	0 ppm	0 ppm	Expert code	20 mA-value≥ 0/4 mA-value + 0.1 ppm
ORP:					
20 mA	2000 mV	0 mV	1000 mV	Expert code	Factory setting = Measuring range-factory setting
0/4 mA	2000 mV	0 mV	0 mV	Expert code	20 mA-value≥ 0/4 mA-value + 1 mV
pH:					
20 mA	pH 16.00	pH -2.00	pH 12.00	Expert code	
0/4 mA	pH 16.00	pH -2.00	pH 2.00	Expert code	20 mA-value≥ 0/4 mA-value + 0.01
Control variable:					
20 mA	100 %	0 %	100 %	Expert code	
0/4 mA	100 %	0 %	0 %	Expert code	20 mA-value≥ 0/4 mA-value + 5 %

9 Setting, Calibration



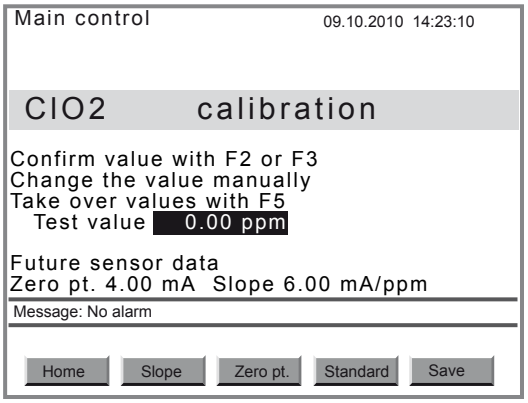
From here it is possible to calibrate:

- Chlorine dioxide (sensors) *Chapter 9.1 'ClO2' on page 64*
- Chlorite (sensors) *Chapter 9.2 'chlorite' on page 67*
- ORP (sensors) *Chapter 9.3 'Redox' on page 71*
- pH (sensors) *Chapter 9.4 'pH value' on page 73*

Only for factory settings:

- Calibration system level

9.1 ClO2



Safety notes

CAUTION!

Danger from incorrect metering

Incorrect operation of the sensors can result in incorrect dosing.

- Please also observe the operating instructions for the sensor and in-line probe housing.
- The sensor must have been run-in.
- Following the replacement of a membrane cap or electrolyte, a slope calibration must be carried out.
- The slope has to be re-calibrated at regular intervals to ensure perfect operation of the sensor.
- Avoid air bubbles in the sample water, as they can adhere to the sensor membrane.
- Please note the pertinent national guidelines for calibration intervals.

CAUTION!

Warning prior to interrupting monitoring of the limits and signals

When changing to the calibration menu, the control interrupts monitoring of limit values and signals.

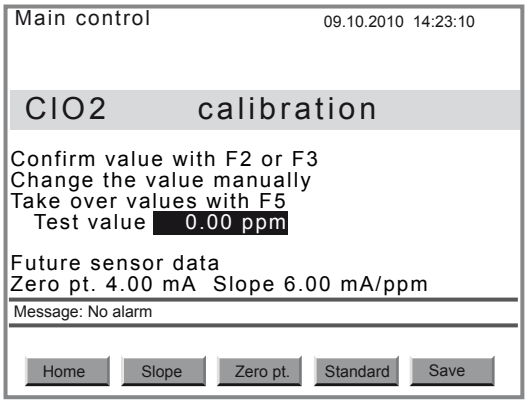
– Bear in mind when changing to the calibration menu, that the control interrupts monitoring of limit values and signals.

If you wish to reset the zero point and slope values to the factory settings, press [F4] STANDARD.

Requirements, general

- The sensor has been run-in
- Constant flow at the in-line probe housing - minimum 40 l/h
- Constant temperature of the sample water
- Identical temperature of sample water and sensor (wait approx. 15 minutes).

9.1.1 Zero point



CAUTION!

Warning of incorrect metering

If an unnecessary zero point calibration is carried out, the existing calibration can be worsened.

– Only perform a zero point calibration if you are using the sensor at the lower threshold of the measuring range.

Prerequisites:

The control is set to "Production on".

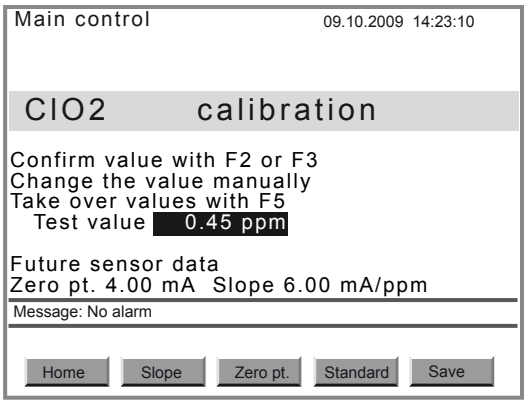
1. Remove the sensor. Sample water shut-off?
2. Dip the CDE sensor in a bucket of clean, chlorine dioxide free tap water (or in still mineral water or distilled water. Check the tap water for chlorine dioxide using a suitable sampling instrument). The chlorine dioxide free water must be at the same temperature as the bypass water.
3. Stir using the sensor until the measured value in the continuous display 2 (*'Production 2'*, Arrow keys*[LEFT]*) is stable for 5 minutes and remains close to zero.
4. Start / Stop the system using the *[START/STOP]* key.

5. Press *[F3]* CALIBR to change to the calibration menu.
6. Select the sub-menu *'Chlor. dioxide'* (*[arrow keys]*) and press *[ENTER]*.
7. Confirm the displayed measured value under *'Test value'* by pressing *[F3]* ZERO P.
8. Accept the zero point by pressing *[F5]* SAVE.
9. Replace the sensor in the in-line probe housing.

CAUTION!
Warning of incorrect metering
If a slope calibration is not also carried out following a zero point calibration, incorrect metering may occur.

– Now calibrate the slope without fail.

9.1.2 Slope



CAUTION!
Warning of incorrect metering
The measuring system cannot be calibrated, if chlorine dioxide is not present in the sample water for the entire period.

– Ensure that chlorine dioxide is present in the sample water for the entire period.

1. Press *[F3]* CALIBR to change to the calibration menu.
2. Select the sub-menu *'Chlor. dioxide'* (*[arrow keys]*) and press *[ENTER]*.
3. Immediately afterwards, take a water sample at the in-line probe housing.
4. Immediately afterwards, determine the chlorine dioxide content of the sample water with a photometer and a suitable sampling instrument (e.g. DPD 1 for chlorine dioxide (CDE sensor)).
5. Confirm the displayed measured value under *'Test value'* by pressing *[F2]* SLOPE or
6. Press *[ENTER]* to change the displayed measured value with the arrow keys and save by pressing the*[ENTER]* key, and then confirm with *[F2]* SLOPE.
7. Press *[F5]* SAVE in order to conclude the calibration process and store the values.

8. If you do not want to carry out any further calibrations, press the *[ESC]* key to jump back to the menu option *'Equipment off'*.

9. Re-open the stopcocks for the sample water, first discharge then feed.

CAUTION!
Warning of incorrect metering
It may be that the sensor infeed phase is not yet completed and consequently incorrect metering can occur.

– The calibration must be repeated without fail after a day.

Clearing faults during calibration

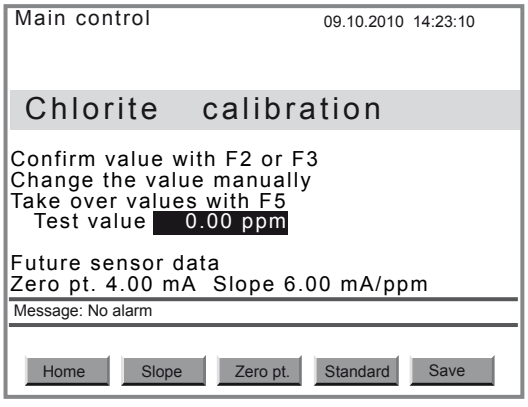
Fault description	Cause	Remedy
After the sensor run in period (for CDE approximately 2 ... 6 h), the measured value is clearly too low.	The sensor is not yet run-in.	Double the run in period or extend until the following morning.
After the run in period (for CDE approximately 2 ... 6 h) the sensor will not calibrate.	The sensor is not yet run-in.	Double the run in period or extend until the following morning.
After the extended run in period, the sensor will still not calibrate.	-	Call ProMinent customer service (phone numbers, see under *www.prominent.com* at the top under *'Contact'*).*

* Please have the following data ready:

- DPD value (chlorine dioxide)
- pH value
- Sensor type with measuring range

Fault message	Cause
'Zero point too low'	< 3 mA
'Zero point too high'	> 5 mA
'Slope too low'	Slope < 1/4 standard slope
'Slope too high'	Slope > 3 x standard slope
'Check value too low'	< 2 % of measuring range

9.2 chlorite



Safety notes

CAUTION!

Danger from incorrect measurements

Incorrect operation of the sensors can result in incorrect measurements.

- Please also observe the operating instructions for the sensor and in-line probe housing.
- The sensor must have been run-in.
- Following the replacement of a membrane cap or electrolyte, a slope calibration must be carried out.
- The slope has to be re-calibrated at regular intervals to ensure perfect operation of the sensor.
- Avoid air bubbles in the sample water, as they can adhere to the sensor membrane.
- Please note the pertinent national guidelines for calibration intervals.

CAUTION!

Warning prior to interrupting monitoring of the limits and signals

When changing to the calibration menu, the control interrupts monitoring of limit values and signals.

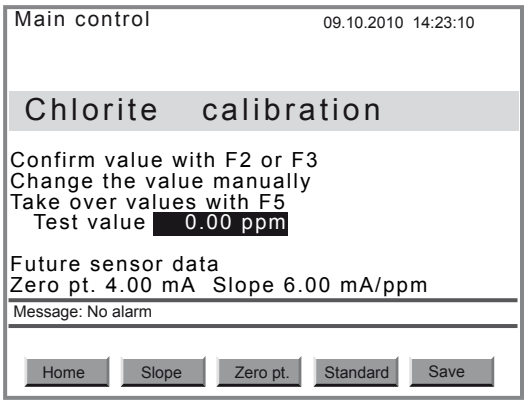
- Bear in mind when changing to the calibration menu, that the control interrupts monitoring of limit values and signals.

If you wish to reset the zero point and slope values to the factory settings, press [F4] STANDARD.

Requirements, general

- The sensor has been run-in
- Constant flow at the in-line probe housing - see "Technical data" in the sensor operating instructions
- Constant temperature of the sample water
- Identical temperature of sample water and sensor (wait approx. 15 minutes).
- There is a constant pH value in the permitted pH range of pH 6.5 .. pH 9.5

9.2.1 Zero point



CAUTION!

Warning of incorrect measurements

If an unnecessary zero point calibration is carried out, the existing calibration can be worsened.

– Only perform a zero point calibration if you are using the sensor at the lower threshold of the measuring range.

Prerequisites:

The control is set to *'Production on'*.

1. Remove the sensor. Sample water shut-off?
2. Immerse the CLT sensor in a bucket with clean tap water which is free from chlorine and reducing agents (Fe^{2+}, Mn^{2+}, nitrite, ...) (or in still mineral water or distilled water. Check the tap water for chlorite using a suitable sampling instrument). The water must be the same temperature as the bypass water.
3. Stir using the sensor until the measured value in the continuous display 2 (*'Production 2'*, Arrow keys*[LEFT]*) is stable for 5 minutes and remains close to zero.
4. Start / Stop the system using the *[START/STOP]* key.
5. Press *[F3]* CALIBR to change to the calibration menu.
6. Select the sub-menu *'Chlorite'* (*[arrow keys]*) and press *[ENTER]*.
7. Confirm the displayed measured value under *'Test value'* by pressing *[F3]* ZERO P.
8. Accept the zero point by pressing *[F5]* SAVE.
9. Replace the sensor in the in-line probe housing.

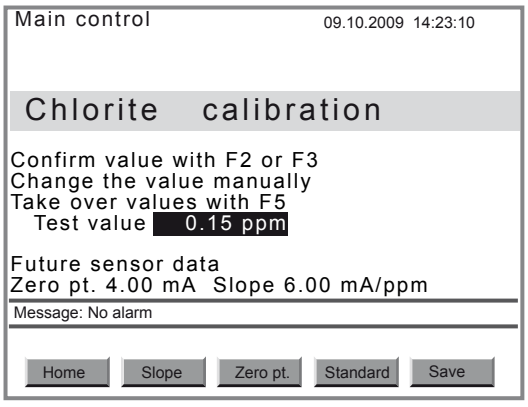
CAUTION!

Warning of incorrect measurements

If a slope calibration is not also carried out following a zero point calibration, incorrect measurements may occur.

– Now calibrate the slope without fail.

9.2.2 Slope



CAUTION!
Warning of incorrect measurements
The measuring system cannot be calibrated, if chlorite is not present in the sample water for the entire period.

– Ensure that chlorite is present in the sample water for the entire period.

1. Press *[F3]* CALIBR to change to the calibration menu.
2. Select the sub-menu *'Chlorite'* (*[arrow keys]*) and press *[ENTER]*.
3. Immediately afterwards, take a water sample at the in-line probe housing.
4. Then immediately determine the chlorite content of the sample water with a photometer and a suitable sampling instrument (e.g. DPD for chlorite (CLT sensor)).
5. Confirm the displayed measured value under *'Test value'* by pressing *[F2]* SLOPE or
6. Press *[ENTER]*, to change the displayed measured value with the arrow keys and save by pressing the*[ENTER]* key, and then confirm with *[F2]* SLOPE.
7. Press *[F5]* SAVE in order to conclude the calibration process and store the values.
8. If you do not want to carry out any further calibrations, press the *[ESC]* key to jump back to the menu option *'Equipment off'*.
9. Re-open the stopcocks for the sample water, first discharge then feed.

CAUTION!
Warning of incorrect measurements
It may be that the sensor infeed phase is not yet completed and consequently incorrect measurements can occur.

– The calibration must be repeated without fail after a day.

Clearing faults during calibration

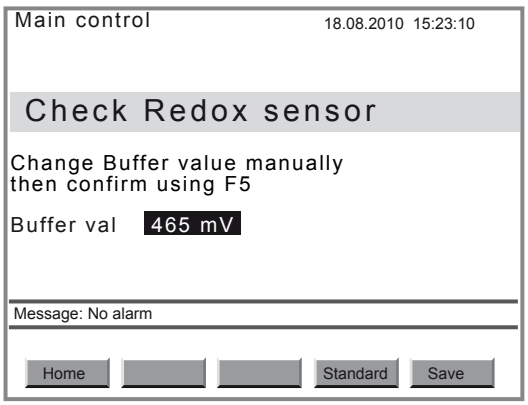
Fault description	Cause	Remedy
After the sensor run in period (for CLT approximately 2 ... 12 h), the measured value is clearly too low.	The sensor is not yet run-in.	Double the run in period or extend until the following morning.
After the run in period (for CLT approximately 2 ... 12 h) the sensor will not calibrate.	The sensor is not yet run-in.	Double the run in period or extend until the following morning.
After the extended run in period, the sensor will still not calibrate.	-	Call ProMinent customer service (phone numbers, see under www.prominent.com at the top under *'Contact'*).*

* Please have the following data ready:

- DPD value (chlorite)
- pH value
- Sensor type with measuring range

Fault message	Cause
'Zero point too low'	< 3 mA
'Zero point too high'	> 5 mA
'Slope too low'	Slope < 1/4 standard slope
'Slope too high'	Slope > 3 x standard slope
'Check value too low'	< 2 % of measuring range

9.3 Redox



Safety notes

CAUTION!

Danger from incorrect metering

Incorrect operation of the sensors can result in incorrect dosing.

- Please also observe the operating instructions for the sensor and in-line probe housing.
- For perfect operation of the sensor, the check must be repeated at regular intervals.
- Please note the pertinent national guidelines for calibration intervals.

CAUTION!

Warning prior to interrupting monitoring of the limits and signals

When changing to the calibration menu, the control interrupts monitoring of limit values and signals.

- Bear in mind when changing to the calibration menu, that the control interrupts monitoring of limit values and signals.

In the event that the displayed value deviates by more than ± 40 mV from the measured value of the buffer solution, then check and replace the buffer solution and ORP sensor as necessary.

Discard used buffer solution.

If you wish to reset the zero point and slope values to the factory settings, press [F4] STANDARD.

To exit the 'Calibration' menu without terminating the calibration, press the [ESC] key.

Requirements, general

- Constant temperature of the sample water
- Identical temperature of sample water and sensor (wait approx. 5 minutes).

Requirements:

- The sample water is shut-off - if necessary acknowledge any alarms which occur by pressing *[ENTER]*.
- The system is now in the state *'Equipment OFF'*

1. Shut-off the sample water - if necessary acknowledge any alarms which occur by pressing *[ENTER]*.
2. Unscrew the coaxial cable from the ORP sensor.
3. Remove the ORP sensor - sample water shut-off?
4. Rinse the ORP sensor with distilled water.
5. Carefully dab the ORP sensor dry with a cloth (grease-free, lint-free).
6. Press *[F3 CALIBR]* to change to the *'Calibration'* menu.
7. If necessary use the key *[DOWN]* to select *'ORP'*.
8. Use the *[ENTER]* key to change to the menu *'Check ORP'*.
9. To specify the value from the buffer bottle (e.g. 465 mV) press the *[ENTER]* key and use the *[Arrow keys]* to correct it.
10. Confirm the correction by pressing the *[ENTER]* key.
11. Immerse the ORP sensor in the buffer solution.

    If an equipotential bonding pin was used for measuring, then also dip this in the buffer solution.

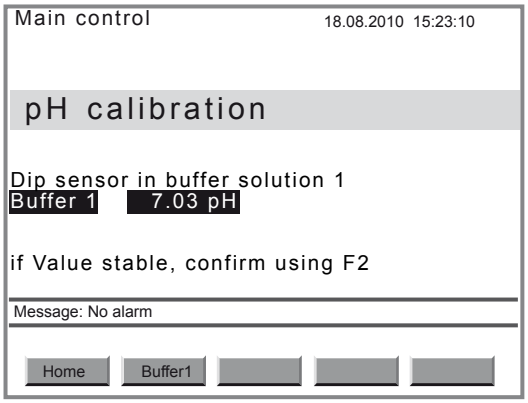
12. As soon as the displayed value is stable, press *[F2 check]* to start the test.
13. Accept the value by pressing *[F5 Save]*.

    ⇨ The control changes to the higher-level menu and simultaneously displays an error message.
14. Unscrew the coaxial cable from the ORP sensor.
15. Replace the ORP sensor in the in-line probe housing.
16. Screw the coaxial cable back onto the ORP sensor
17. Re-install the equipotential bonding pin.

18. Open the stopcocks for the sample water, first discharge then feed.
19. Press *[F1 Home]* to jump back to the central menu item *'Equipment OFF'*.
20. Restart the system using the *[START/STOP]* key.

Fault message	Cause
'Test value too low'	< -40 mV
'Test value too high'	> +40 mV

9.4 pH value



Safety notes

CAUTION!

Danger from incorrect measurements

Incorrect operation of the sensors can result in incorrect measurements.

- Please also observe the operating instructions for the sensor and in-line probe housing.
- The slope has to be re-calibrated at regular intervals to ensure perfect operation of the sensor.
- Avoid air bubbles in the sample water, as they can adhere to the sensor membrane.
- Please note the pertinent national guidelines for calibration intervals.

CAUTION!

Warning prior to interrupting monitoring of the limits and signals

When changing to the calibration menu, the control interrupts monitoring of limit values and signals.

- Bear in mind when changing to the calibration menu, that the control interrupts monitoring of limit values and signals.

Discard used buffer solution.

If you wish to reset the zero point and slope values to the factory settings, press [F4] STANDARD.

To exit the 'Calibration' menu without terminating the calibration, press the [ESC] key.

Requirements, general

- Constant temperature of the sample water
- Identical temperature of sample water and sensor (wait approx. 5 minutes).

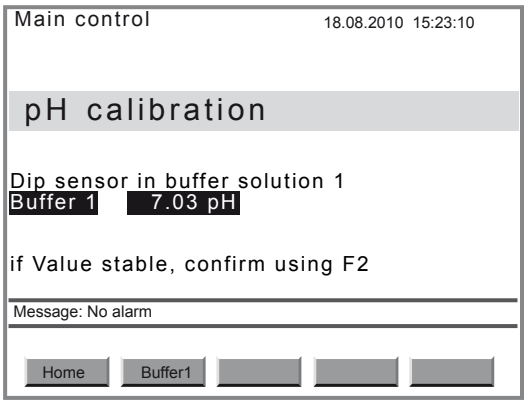
Instruction

The pH sensor calibration is a 2-point calibration.

Requirements:

- The sample water is shut-off - if necessary acknowledge any alarms which occur by pressing *[ENTER]*.
- The system is now in the state *'Equipment OFF'*

1. Unscrew the coaxial cable from the pH sensor.
2. Remove the pH sensor.
3. Rinse the pH sensor with distilled water.
4. Carefully dab the pH sensor dry with a cloth (grease-free, lint-free).
5. Screw the coaxial cable back onto the pH sensor
6. Press *[F3 CALIBR]* to change to the *'Calibration'* menu.
7. If necessary use the key *[DOWN]* to select *'pH'*.
8. Use the *[ENTER]* key to change to the menu *'pH calibration'*.

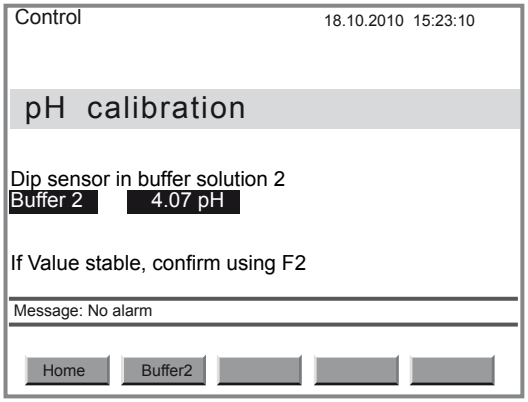


9. Immerse the pH sensor in the first quality buffer (e.g. pH 7) and stir slightly using the sensor.

If an equipotential bonding pin was used for measuring, then also dip this in the quality buffer.

10. As soon as the measured value *'Buffer 1'* is stable, confirm by pressing *[F2 Buffer 1]*.
11. To specify the value from the buffer bottle press the *[ENTER]* key and use the *[Arrow keys]*.
12. Confirm the entry by pressing the *[ENTER]* key.

13. Accept the value by pressing *[F5 Save]*.
14. Rinse the pH sensor with distilled water.
15. Carefully dab the pH sensor dry with a cloth (grease-free, lint-free).



16. Immerse the pH sensor in the second quality buffer (e.g. pH 4 or pH 10) and stir slightly using the sensor.

> *If an equipotential bonding pin was used for measuring, then also dip this in the quality buffer.*

17. As soon as the measured value *'Buffer 2'* is stable, confirm by pressing *[F2 Buffer 2]*.
18. To specify the value from the buffer bottle press the *[ENTER]* key and use the *[Arrow keys]*.
19. Confirm the entry by pressing the *[ENTER]* key.
20. Accept the value by pressing *[F5 Save]*.
    ⇨ The menu item *'Future sensor data'* and, where applicable, an error message appear.
21. If the displayed sensor data do not appear plausible, load the standard data by pressing *[F4 Standard]* and repeat the calibration.
22. If the displayed sensor data appear plausible, save this with *[F5 Save]*.
    ⇨ The query "Save changes?" appears
23. Confirm the query by pressing the *[ENTER]* key.
    ⇨ The menu item *'pH calibration'* appears from the start.
24. Unscrew the coaxial cable from the pH sensor.
25. Replace the pH sensor in the in-line probe housing - manually tighten, but ensure it is water-tight.
26. Screw the coaxial cable back onto the pH sensor
27. Re-install the equipotential bonding pin.
28. Open the stopcocks for the sample water, first discharge then feed.
29. Press *[F1 Home]* to jump back to the central menu item *'Equipment OFF'*.
30. Restart the system using the *[START/STOP]* key.

Fault message	Cause
'Zero point too low'	< -60 mV
'Zero point too high'	> +60 mV

Fault message	Cause
'Slope too low'	Slope < -65 mV/pH
'Slope too high'	Slope > -40 mV/pH
'Difference too low'	Δbuffer < pH 2.00

9.5 Calibrate pumps

The metering pumps by be calibrated by service under the *'SERVICE'* menu, see chapter ↳ *Chapter 10.3.5 'Calibrating pumps' on page 88*.

10 Start up

Safety information

WARNING!

- Carefully read through this entire chapter prior to start up.
- Only service personnel, authorised by ProMinent, should carry out initial commissioning.
- The Service personnel authorised by ProMinent should instruct the operating and maintenance personnel during start up.
- This commissioning should only be carried out by an expert.

WARNING!

Risk of explosion from the reactor and bypass

An explosive ClO_2 gas phase can form and explode if the empty reactor and the empty bypass are started up directly with chemicals.

- Only connect the chemical canisters after the reactor and bypass have been completely filled with water.

WARNING!

Risk of explosion from the reactor and bypass

An explosive ClO_2 gas phase can form in the bypass and explode if the reactor has been started up with chemicals and the bypass is empty.

- Ensure that the bypass is always filled with water, whenever the system contains chemicals.

WARNING!

Warning of the possible escape of corrosive liquid

Corrosive liquid can escape if the system leaks.

- At no operating status may the maximum permissible operating pressure for the system be exceeded.
- The entire installation should remain leak-tight when operating at maximum operating pressure.
- Carefully open all the shut-off devices in the bypass prior to start-up.
- Check the design of the hydraulic connectors.

Note for the system operator

During start up, also adhere, to the instructions laid out in the following regulations, among others:

a) - Accident prevention regulations (in Germany: GUV 8.15 and/or VGB 65): Only start up chlorination systems after they have been checked by a technical expert to ensure they are in a correct and proper state and have undergone leak testing. Ensure that chlorination systems are checked for safety by a technical expert prior to each re-commissioning. Only appoint personnel to operate and maintain chlorination systems and handle chemicals, who have been instructed in these matters and who can be expected to reliably fulfil their duties.

b) - The Ordinance on Hazardous Substances (in Germany: The German Ordinance on Hazardous Substances (GefStoffV))

c) - Requirements relating to starting chemicals - see chapter *'Safety information' on page 96*

d) - All other local regulations governing these installations outside Germany

Overview

10.1 Installation - final steps

1. First connect the water canisters instead of the chemical storage tanks.
2. Check the design of the hydraulic connectors.
3. Check the design of the electrical connections.
4. Connect the Bello Zon® system to the mains (cable with 3 x 1 mm^2).

10.2 Adjusting the system and control

1. Check that the system is off (if necessary press the *[START/STOP]* key).
2. In principle, now run sequentially through the individual tabs in the *'SETTING'* menu (*[F2] 'SETTING'*):

- *'Equipment'* tab
- *'Control'*" tab

Move from tab to tab using the [LEFT] key, [RIGHT] key; the names of the tabs appear at the top left.

"Equipment" tab

1. Use *[F2] 'SETTING'* to switch to the *'Settings'* menu, *'Equipment'* tab.
2. Check whether the identity code is suitable for the desired operating mode (flow meter, analog inputs, control properties ...) under *'identity code'* and adjust if necessary.
3. Check whether all CAN modules have been recognised by the control under *'CAN overview'*.
4. Change the language of the operating ,as necessary, under *'Language'*.
5. Change the date and time, as necessary, under *'Date and time'*.
6. Configure the inputs, display, log book and the metering modules found here under *'Configuration'*.
7. Accept the settings by pressing *[F5] 'SAVE'* and *[ENTER]*.

"Control" tab

1. Use the *[LEFT]* or *[RIGHT]* key to change to the "Control" tab.
2. Set the parameters in the menus according to the desired control mode:

1 - "Manual" control

2 - Proportional control of "Flow"

3 - Proportional control of "Setpoint"

4 - Proportional control of ClO_2 measurement

10.2.1 "Manual" control

The Bello Zon® system should operate continuously with a pre-set, constant ClO_2 output.

1. Use *[F2] 'SETTING'* to switch to the *'Setting'* menu, *'Equipment'* tab.
2. Press *[RIGHT]* to change to the *'Control'* tab.
3. If necessary configure a current input under *'Signal inputs'*. Select *'ClO2 production'* (*[UP]* or *[DOWN]* keys) and press *[Enter]*.
4. Set the *'Control ClO2 via'* to *'Manual'* (key *[ENTER]*, keys *[UP]* or *[DOWN]*, key *[ENTER]*).
5. Select *'Control'* (keys *[UP]* or *[DOWN]*) and press *[Enter]*.
6. Set the required ClO_2 output using *'Setpt. ClO2 production'* (key *[ENTER]*, *[Arrow keys]*, key *[ENTER]*).

   ⇨ From this point continuous display 1 (*'Production 1'*) and continuous display 2 (*'Production 2'*, (key *[LEFT]*)) both show the set ClO_2 output.
7. Accept the settings by pressing key *[F5] 'SAVE'* and *[ENTER]*.
8. If necessary, set limits and alarms in other menus.
9. If necessary, match the digital inputs and the analog output to the requirements (Pause, leakage sensor...).
10. Accept the settings by pressing key *[F5] 'SAVE'* and *[ENTER]*.
11. Accept all settings by pressing key *[F5] 'SAVE'* and *[ENTER]*.

10.2.2 Proportional control "Flow"

The ClO_2 output of the chlorine dioxide system should change in proportion to the volume using the flow meter signal (contact water meter, inductive flow meter ...).

1. Use *[F2]* *'SETTING'* to switch to the *'SETTING'* menu, *'System'* tab.
2. Change to the *'Control'* tab by pressing the *[RIGHT]* key.

Configuring the water meter

Configure the *'Flow meter'* input for the water meter under *'Signal inputs'*:

1. Select *'Signal inputs'* (*[UP]* or *[DOWN]* keys) and press *[Enter]*.
2. Select *'Flow meter'* (*[UP]* or *[DOWN]* keys) and press *[Enter]*.
3. Under *'Input'* set the input for the flow meter (key *[ENTER]*, *[Arrow keys]*, key *[ENTER]*).
4. Under *'Flow as'* set the required units for the flow (key *[ENTER]*, *[Arrow keys]*, key *[ENTER]*).
5. Under *'Range'* set the required measuring range for the flow meter (key *[ENTER]*, *[Arrow keys]*, key *[ENTER]*).
6. Under *'Unit'* set the unit *'Litre/pulse'* (*[ENTER]* key, *[UP]* or *[DOWN]* keys, *[ENTER]* key).
7. Under *'Value'* set the number per litre per pulse of the flow meter (key *[ENTER]*, *[Arrow keys]*, key *[ENTER]*).
8. Set the correct values under *'Limits'*. In this respect, observe the following instructions!
9. Accept the settings with *[F5]* *'SAVE'* and *[ENTER]*.

WARNING!

Danger of explosion

ClO_2 can build up to form a concentration capable of exploding, if the Bello Zon® system is metered with insufficient dilution water.

– Always set a value greater than "0" under *'Lower l.<A>'* with analogue flow meters (0/4 - 20mA).

As small as possible a pulse interval for the water meter ensures even mixing of the ClO_2 solution in the water to be treated.

Selection of a suitable flow meter

Die Bello Zon® control should calculate the actual, instantaneous flow from the set pulse interval of a flow meter and its signals. Accordingly, the pulse interval of the water meter must be preselected to match the oscillations which are expected for the flow.

Background:

The control requires accurate values for the flow, because it must be able to calculate the appropriate current system output from them and the set ClO_2 concentration; only if this is successful, can the desired ClO_2 concentration in the water flow really be maintained at a constant level.

Consider two cases;

1. - If you expect that the flow rate will oscillate only slowly or remain constant, then use a water meter with a long pulse interval (e.g. contact water meter with reed switch or NAMUR output), which can easily "replicate" these slow oscillations for the control. It is essential that the contact water meter delivers 0.25 ... 20 pulses per second for the Bello Zon® control.
2. - If you expect that the flow rate will oscillate often and quickly, then use a water meter with a short pulse interval (e.g. IDM with frequency output (inductive flow meter)), so that it can "replicate" these fast oscillations for the control. If the pulse interval were larger in this case, the system and the system output could only react too slowly and with a very "awkward" response to changes in the actual flow. It is essential that the IDM delivers 10 ... 10,000 pulses per second for the Bello Zon® control.

The maximum, worthwhile pulse interval therefore depends on the requirements of the respective process version, as it defines the delay period with which the control reacts to oscillations in the flow.

– *For most water meters, the pulse interval can be set.*
– *The control cannot process pulse rates that are too low. This leads to irregular or too low dosing.*

Further settings

1. Select *'ClO2 production'* (*[UP]* or *[DOWN]* keys) and press *[Enter]*.
2. Set the *'Control ClO2 via'* to *'Flow'* (key *[ENTER]*, keys *[UP]* or *[DOWN]*, key *[ENTER]*).
3. Select *'Control'* (keys *[UP]* or *[DOWN]*) and press *[Enter]*.
4. Set the required ClO_2 concentration under *'Setpt. ClO2 concentration'* (key *[ENTER]*, *[Arrow keys]*, key *[ENTER]*).

   ⇨ From this point continuous display 1 (*'Production 1'*) and continuous display 2 (*'Production 2'*, (key *[LEFT]*)) both show the instantaneous ClO_2 output.
5. Accept the settings by pressing *[F5] 'SAVE'* and *[ENTER]*.
6. If necessary, set limits and alarms in other menus.
7. If necessary, match the digital inputs and the analog output to the requirements (Pause, leakage sensor...).
8. Accept the settings with *[F5] 'SAVE'* and *[ENTER]*.
9. Accept all settings with *[F5] 'SAVE'* and *[ENTER]*.

   ⇨ Continuous display 1 and continuous display 2 now show the instantaneous ClO_2 output as well as additionally the flow and the set setpoint.

   If the flow exceeds the maximum value, the ClO_2 output remains constant at its maximum value and the ClO_2 concentration falls (error message *'Warning: Prod. overload'*).

   The control stops the metering process if the flow falls below its minimum value.

10.2.3 Operating mode "Setpoint-proportional control"

The ClO_2 output of the Bello Zon® system should change with the mA signal of an external device, e.g. with the signal from a control room.

1. Using *[F2] 'PARAMETER'*, switch to the menu *'Settings'*, *'Equipment'* tab.
2. Change to the *'Control'* tab by pressing *[RIGHT]*.
3. Select *'Signal inputs'* (keys *[UP]* or *[DOWN]*) and press *[Enter]*.
4. Select *'Setpoint'* (keys *[UP]* or *[DOWN]*) and press *[Enter]*.
5. Under *'Control variable'*, set the *'Current inp. XE2'* (*[ENTER]* key, *[Arrow keys]*, *[ENTER]* key).
6. If necessary, under *'Current inp. XE2'*, adapt the current input to requirements (*[ENTER]* key, *[Arrow keys]*, *[ENTER]* key).
7. Press *[Esc]* to jump back to the *'Settings'* menu.
8. Select *'ClO2 production'* (*[UP]* or *[DOWN]* keys) and press *[ENTER]*.
9. Set the *'Control ClO2 via'* to *'Control variable'* (*[ENTER]* key, *[UP]* or *[DOWN]* keys, *[ENTER]* key).
10. Accept the settings with *[F5] 'SAVE'* and *[ENTER]*.
11. If necessary, set limits and alarms in the other menus.
12. If necessary, match the digital inputs and the analogue output to requirements (Pause, leak sensor...).
13. Accept the settings with *[F5] 'SAVE'* and *[ENTER]*.
14. Accept all settings by pressing *[F5] 'SAVE'* and *[ENTER]*.

Output adjustment range ClO_2 production for the individual system types

System type	Min. stroke length	Output adjustment range ClO_2 (g/h), For min. / max. stroke rate and ...	
		Min. stroke length, approx.	Max. stroke length, approx.
CDKc 150	70	7 ... 120	9 ... 150
CDKc 400	60	12 ... 250	20 ... 400
CDKc 900	50	23 ... 450	45 ... 900
CDKc 2000	40	42 ... 840	105 ... 2000
CDKc 2800	40	60 ... 1200	150 ... 2800
CDKc 7300	40	150 ... 2920	375 ... 7300
CDKc 12000	40	240 ... 4800	600 ... 12000

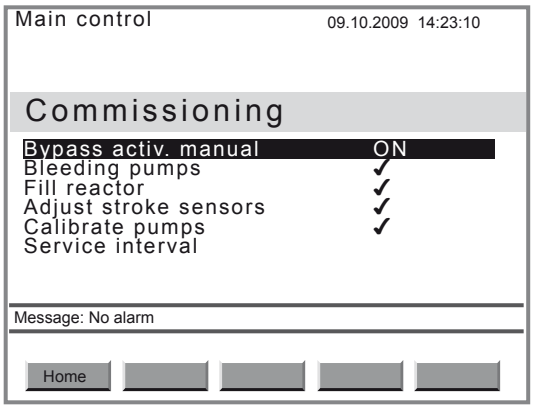
10.2.4 Proportional ClO2 measurement control

The ClO_2 output of the Bello Zon® changes according to the measured value-dependent mA signal of a ClO_2 sensor connected directly to the control.

1. Using *[F2] 'SETTING'*, switch to the menu *'Settings'*, *'Equipment'* tab.
2. Change to the *'Control'* tab by pressing *[RIGHT]*.
3. Select *'Signal inputs'* (keys *[UP]* or *[DOWN]*) and press *[Enter]*.
4. Select *'ClO2 measurement'* (keys *[UP]* or *[DOWN]*) and press *[Enter]*.
5. Under *'ClO2 measurement'*, set the *'Current inp. XE1'* (*[ENTER]* key, *[Arrow keys]*, *[ENTER]* key).
6. If necessary, under *'Measuring range'* adjust the current input to match the requirements (*[ENTER]*, *[Arrow keys]*, key *[ENTER]*).

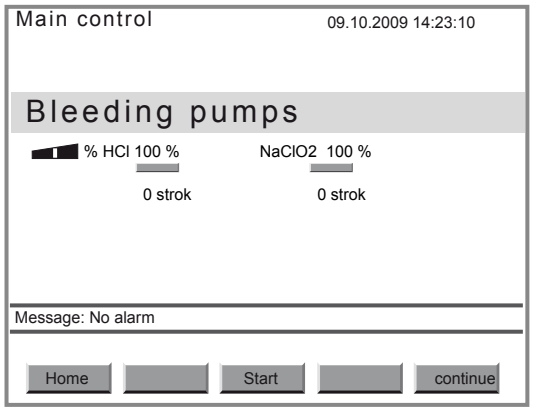
7. Select *'ClO2 production'* (*[UP]* or *[DOWN]* keys) and press *[ENTER]*.
8. Set the *'Control ClO2 via'* to *'ClO2 measurement'* (*[ENTER]*, *[Arrow keys]*, *[ENTER]*).
9. Select *'Control'* (*[UP]* or *[DOWN]* keys) and press *[Enter]*.
10. Set the required ClO_2 concentration under *'Setpt. ClO2 concentration'* (*[ENTER]* key, *[Arrow keys]*, *[ENTER]* key). The continuous display 1 (*'Production 1'*) displays the current ClO_2 output and continuous display 2 (*'Production 2'*, (*[LEFT]* key)) additionally displays the target ClO_2 concentration.
11. Select "Control" (*[UP]* or *[DOWN]* keys) and press *[Enter]*.
12. Match the control parameters to the process and press *[ENTER]*.
13. Accept the settings with *[F5] 'SAVE'* and *[ENTER]*.
14. If necessary, set limits and alarms in the other menus.
15. If necessary, match the digital inputs and the analog output to the requirements (Pause, leakage sensor...).
16. Accept the settings by pressing *[F5] 'SAVE'* and *[ENTER]*.
17. Accept all settings with *[F5] 'SAVE'* and *[ENTER]*.

10.3 Starting up the system



1. Press *[F1] 'SERVICE'* to change to the *'SERVICE'* menu.
2. Press *[ENTER]* to change to the *'Commissioning'* menu. For the following steps, see the next chapter.

10.3.1 Bleeding pumps

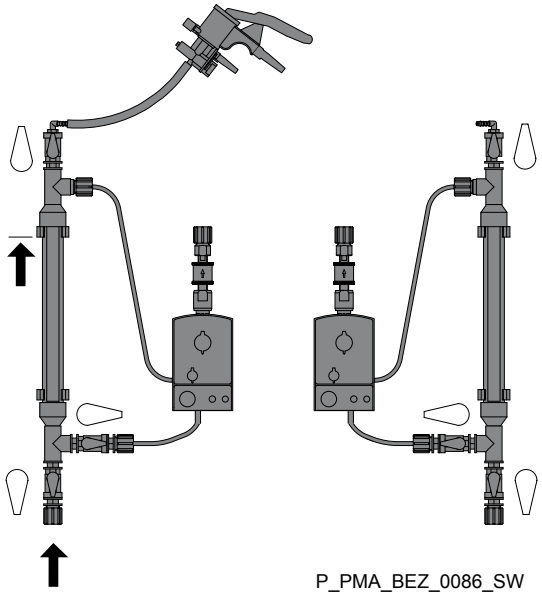


With a calibration device

Requirements:

The stroke lengths of the pumps are set to 100%.

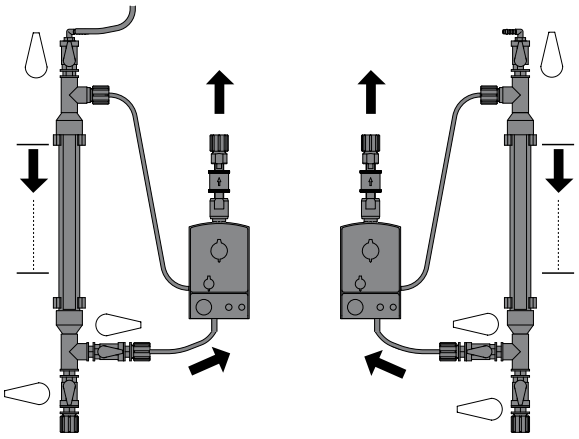
1. Remove the vacuum pump from the system bracket.



P_PMA_BEZ_0086_SW

Fig. 13: Stopcock positions during filling of the calibration devices, shown here for CDVc

2. Place the vacuum pump calibration device on the left (acid) and draw feed chemical manually up to the top to the "0" line, but no further! Is the top stopcock on the calibration device open?
3. Close the bottom stopcock to the suction lance.
4. Place the vacuum pump on the calibration device on the right (chlorite) and draw feed chemical manually up to the top to the "0" line, but no further! Is the top stopcock on the calibration device open?



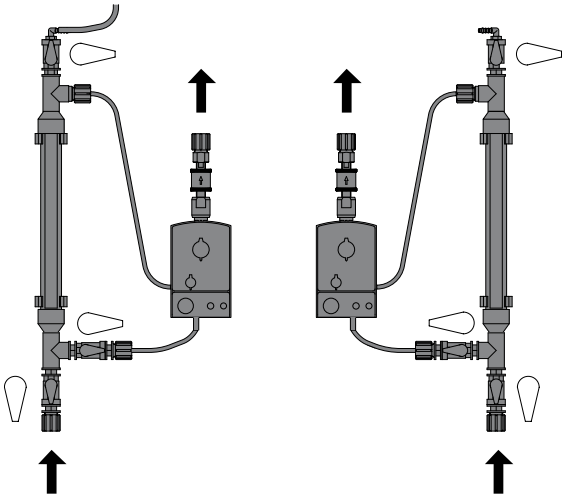
P_PMA_BEZ_0087_SW

Fig. 14: Stopcock positions during calibration, shown here for CDVc

5. Close the bottom stopcock to the suction lance.
6. Use the *[DOWN]* key to switch to *'Bleeding pumps'* and press *[ENTER]*.
7. Press *[F3]* *'START'* to start bleeding then wait until the suction lines and liquid ends are filled free from bubbles.

CAUTION!
In an emergency, the pumps can be stopped by pressing *[F3]* *'STOP'*.

8. If the suction lines and liquid ends are not yet bubble-free after the metering pumps have stopped, repeat bleeding with *[F3] 'START'*.
9. Press *[F5] 'CONTINUE'* to change to the menu *'Fill reactor tank'*.
10. Open the bottom stopcock to the acid suction lance.
11. Place the vacuum pump on the calibration device on the left and prime feed chemical manually up to the top to the "0" line, but no further!
12. Close the top stopcock on the left calibration device.
13. Open the bottom stopcock to the chlorite suction lance.
14. Place the vacuum pump on the calibration device on the right and prime feed chemical manually up to the top to the "0" line, but no further!



P_PMA_BEZ_0088_SW

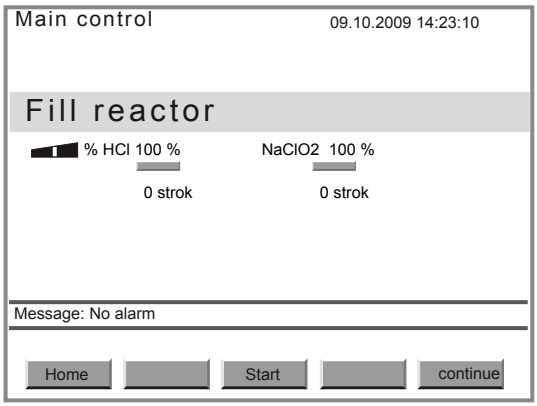
Fig. 15: Stopcock positions in operation, shown here for CDVc

15. Close the top stopcock on the right calibration device.

Clear fault arising during bleeding pumps

Fault description	Cause	Remedy
Error message, the strokes are not counted down and the overlying bar goes red.	The dosing monitor is not correctly adjusted.	■ Turn the knurled screw beneath the dosing monitor by one turn downwards. ■ Acknowledge the error message.

10.3.2 Filling the reactor



WARNING!

System components can rupture

If the flushing valve is not open when filling the reactor, the pressure of the metering pumps can cause the reactor to rupture.

– Open the flushing valve before filling the reactor.

– *When using calibrated pumps and only the stroke length requires adjustment, via the menu 'Set stroke length', a recalibration is not required.*

– *The Bello Zon® control can match the number of preset strokes to the adjusted stroke length, provided the pumps inform the control via the menu 'Set stroke length' of their actual stroke lengths.*

1. Only with initial filling: Check that pure water is connected instead of chemicals.
2. Open the flushing valve.
3. Press *[F3] 'START'* to start filling.

CAUTION!

In an emergency the pumps can be stopped with *[F3] 'STOP'*.

⇨ The control counts down the pre-set number of strokes.

4. Wait until the pre-set number of strokes is processed.
5. If the reactor is not yet full, i.e. no liquid has yet escaped from the rinse valve, start filling again by pressing *[F3] 'START'*.
6. Do not change to the next menu by pressing *[F5] 'CONTINUE'*, rather check the system for leaks - see the next chapter.

10.3.3 Checking for leaks

WARNING!

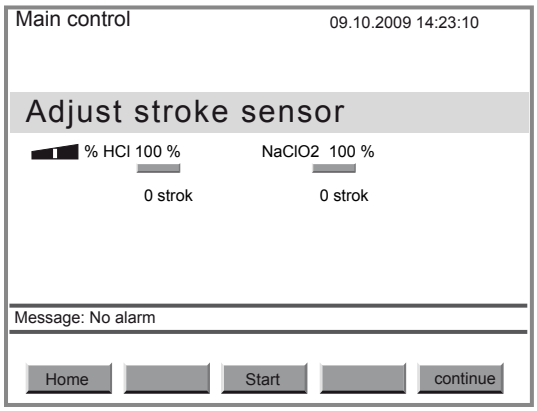
Warning of toxic ClO2 solution

Toxic ClO_2 solution can escape through leaks.

– Immediately take appropriate measures to seal any leaks.

1. If the metering pumps are not yet running, start them via the menu *'Fill reactor'* by pressing *[F3] 'START'*.
2. Check the system components for leaks when the metering pumps are running at maximum operating pressure.
3. Take appropriate action to seal any leaks.
4. If checking is still not complete, restart the metering pumps with *[F3] 'START'*.
5. If the metering pumps are still running, stop them after the test by pressing *[F3] 'STOP'*.
6. Press *[F5] 'CONTINUE'* to change to the menu *'Adjust stroke sensors'* (="Stroke sensor adjustment"), see the following chapter.

10.3.4 Adjust stroke sensors



WARNING!

Warning of a risk of explosion

If the stroke sensors are not operating, the expected ClO_2metering quantity can be incorrect, with, for example, a consequent risk of explosion.

- Never set the ring initiators too low.
- Reliably counter a fall in the back pressure.
- Observe the minimum values for the stroke lengths.

WARNING!

Warning of toxic chlorite gas

If the stroke sensors are not operating, the permissible chlorite concentration can be exceeded.

- Never set the ring initiators too low.
- Reliably counter a fall in the back pressure.
- Observe the minimum values for the stroke lengths.

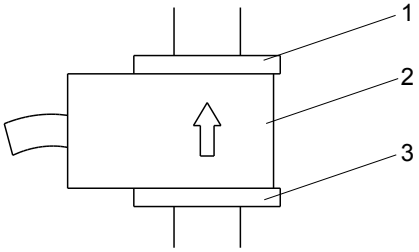


Fig. 16: Overview of dosing monitor

1 Upper adjustment washer
2 Ring initiator
3 Lower adjustment washer

Prerequisites:

The metering pumps have been bled.

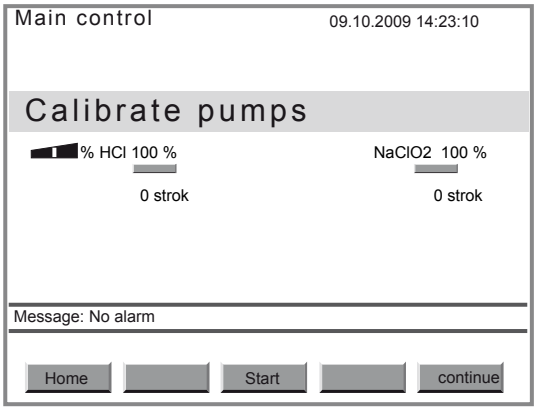
1. Turn the upper adjustment washer (1) of the dosing monitors fully upwards.
2. Reposition the ring initiators (2) and the bottom adjustment washers (3) respectively.

3. Press *[F3] 'START'* to start the metering pumps.

CAUTION!
In an emergency, the pumps can be stopped with *[F3] 'STOP'*.

4. Slowly lower each ring initiator (2), until the number beneath the corresponding green bar remains permanently on 0 to 1 strokes (e.g. for the left ring initiator (HCl): left bar).
5. Then lower the lower adjustment washer (3) by 1 turn.
6. Lower the respective upper adjustment washer (1) to the ring initiators (2).
7. Press *[F5] 'CONTINUE'* in the "Calibrate pumps" menu, see the following chapter.

10.3.5 Calibrating pumps



CAUTION!
Warning of toxic substances in the water
The chemicals will possibly not be mixed in the correct ratio within the reactor if the metering pumps are not calibrated at the operating pressure that will subsequently apply during operation.

– Only calibrate the pumps at the operating pressure that will subsequently apply during operation.

– *When using calibrated pumps and only the stroke length requires adjustment, via the menu 'Set stroke length', a recalibration is not required.*
– *The Bello Zon® control can match the number of preset strokes to the adjusted stroke length, provided the pumps inform the control via the menu 'Set stroke length' of their actual stroke lengths.*

With a calibration device

1. Remove the vacuum pump from the system bracket.

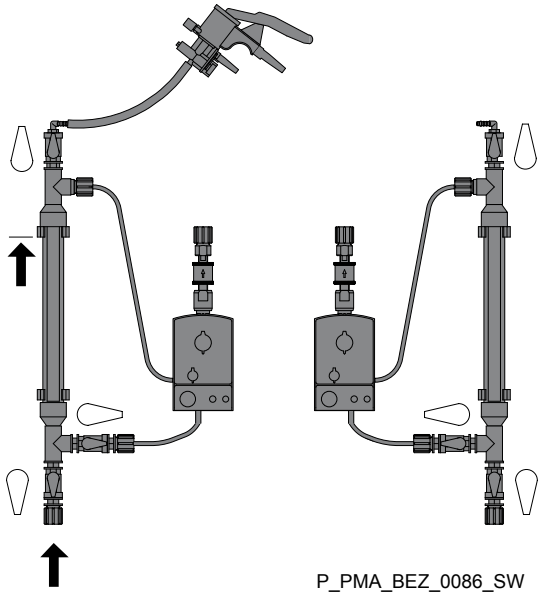


Fig. 17: Stopcock positions during filling of the calibration devices, shown here for CDVc

2. Place the vacuum pump calibration device on the left (acid) and draw feed chemical manually up to the top to the "0" line, but no further! Is the top stopcock on the calibration device open?
3. Close the bottom stopcock to the suction lance.
4. Place the vacuum pump on the calibration device on the right (chlorite) and draw feed chemical manually up to the top to the "0" line, but no further! Is the top stopcock on the calibration device open?

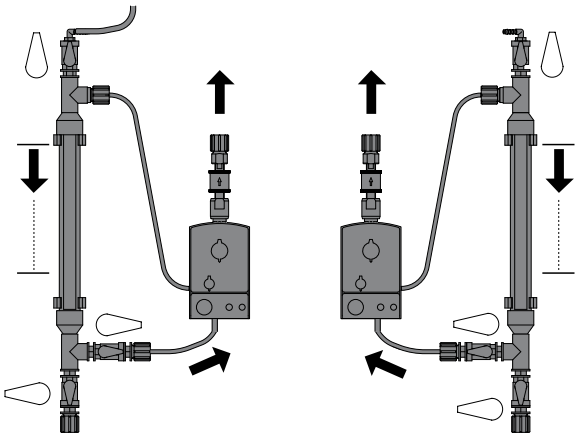


Fig. 18: Stopcock positions during calibration, shown here for CDVc

5. Close the bottom stopcock to the suction lance.

6. Press *[F3] 'START'* to start the metering pumps.

CAUTION!
In an emergency the pumps can be stopped with *[F3] 'STOP'*.

If the calibration devices become empty too soon, stop the pumps by pressing [F3] 'STOP'.

7. As soon as the displayed strokes have been processed, the pumps stop – the menu option "Set calibration" appears.
8. Press *[F2] 'ACID'*, then press *[ENTER]* and enter and record the quantity of feed chemical used from the left calibration device using the arrow keys.
9. Confirm the value by pressing *'ENTER'* and accept with *[F5] [SAVE]*.
10. Determine the difference value between the first value and the new value (in ml) for water.
11. Press *[F3] 'CHLORITE'*, then press *[ENTER]* and enter and record the quantity of feed chemical used from the right calibration device using the arrow keys.
12. Confirm the value by pressing *'ENTER'* and accept with *[F5] [SAVE]*.
13. Enter the values for acid and chlorite in the commissioning report or the system log book.
14. Press *[F5] 'CONTINUE'* to exit the menu.
15. Open the bottom stopcock to the acid suction lance.
16. Place the vacuum pump on the calibration device on the left and prime feed chemical manually up to the top to the "0" line, but no further!
17. Close the top stopcock on the left calibration device.
18. Open the bottom stopcock to the chlorite suction lance.
19. Place the vacuum pump on the calibration device on the right and prime feed chemical manually up to the top to the "0" line, but no further!

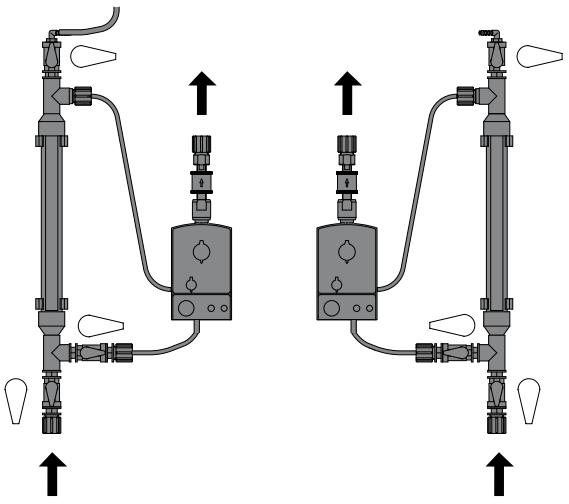


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Fig. 19: Stopcock positions in operation, shown here for CDVc

20. Close the top stopcock on the right calibration device.

A green tick is placed after each of the "Commissioning" menus which have been successfully run through.

The system now operates with the required metering volume (during initial commissioning still with water).

10.4 Testing the safety equipment

Safety collecting trays (accessory)

Remove the intact storage tank out of the dry safety collecting tray. Fill the safety collecting pan with water up to the edge and inspect for leaks.

The control should switch off metering if the safety collecting pan has leak monitoring. Press *[F1] 'QUIT'* key.

Acid and chlorite level switches

Slowly withdraw the suction lance from the filled storage tank. The control has to switch off production, the device LED flashes red, the bleeper bleeps and the alarm relay switches.

Press *[F5] 'BEEP OFF'* and then *[F1] 'QUIT'*.

Dosing monitors

Move the upper adjustment washer and the ring initiator of a dosing monitor upwards: the control should switch off metering after 6 defective strokes. Simultaneously, the LCD screen display a message, the device LED flashes red, the bleeper bleeps and the alarm relay switches.

Press *[F5] 'BEEP OFF'* then move the ring initiator and the top adjustment washer back to the initial position and press *[F1] 'QUIT'*. If the bottom adjustment washer was displaced, reset the stroke sensor.

Now check the other dosing monitors.

Reactor cover

Check that the reactor cover is correctly fitted.

It has to fulfil its role as splash protection against ClO_2.

Bypass monitor

Slowly close the stopcock upstream of the flow meter float. The control should switch off production, the LED devices flash red, the beeper beeps and the alarm relay switches.

Press *[F5] 'BEEP OFF'*, open the stopcock and then press *[F1] 'QUIT'*.

Gas detector (option)

Test the gas detector and its sensor in line with the operating instructions.

.

Only for systems that supply a ClO_2 receiver tank:

Overflow protection (site-supplied)

Ensure that the ClO_2 receiver tank is equipped with a level switch that RELIABLY disconnects the Bello Zon® system from the mains voltage.

Interruption of chemical supply (on site)

Set the chemical supply via the metering pumps so that it is reliably interrupted as soon as there is insufficient water in the bypass.

CAUTION!
With systems which are connected up in a way different to that described here, the operator should carry out a safety review of the overall system.

10.5 Pre-dilution module

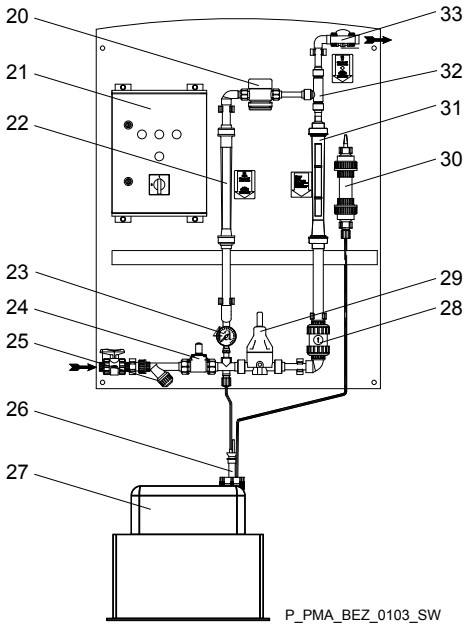


Fig. 20: Pre-dilution module components

20 Suction regulator
21 Pre-dilution module control
22 Water flow meter
23 Manometer
24 Solenoid valve
25 Dirt filter
26 Hydrochloric acid suction lance
27 Storage tank for concentrated hydrochloric acid
28 Non-return valve
29 Pressure reducer
30 Acid vapour separator
31 Hydrochloric acid flow meter
32 Injector
33 Metering ball valve

Setting values for the flows

System type CDKc	Water top-up	Top-up of HCl 25 %	Top-up of HCl 32 %	Top-up HCl 36 % *
g/h	l/h	l/h	l/h	l/h
150 - 2800	250	55	40	35
7 300 - 12000	500	110	80	70

*** pre-set**

Requirements:

- The entire system is connected ready for operation.
- After initial start-up or after maintenance or repair: Connected a storage tank with potable water instead of a storage tanks with hydrochloric acid.
- The priming pressure upstream of the pre-dilution module is between 3 ... 6 bar.

1. Only with initial start up: At the same time as performing the following steps, check the leak-tightness of all threaded connectors and connectors.
2. Check the setting of the level switches in the HCl storage tank (Max and Max-Max).
3. Now place the suction lance for hydrochloric acid (26) into a storage tank with HCl.
4. Set the limit switch on the "Water flow meter" (31) just below the specified value for "Water top-up", see *on page 91*.
5. Set the limit switch on the "Hydrochloric acid flow meter" (22) just below the specified value for "HCl top-up", see *on page 91*.
6. Turn the adjustment screw on the suction regulator (20) clockwise until it will turn no further.
7. Turn the adjustment screw on the suction regulator (20) counter-clockwise 2 turns.
8. Switch on the dilution control (21) with its main switch.
   ⇨ The solenoid valve opens.
9. Set the metering ball valve (33) to 180.
10. Attempt to set the water flow using the pressure reducer (29) upstream of the system to the correct value - see *on page 91*.
11. Attempt to set the concentrated hydrochloric acid flow using the metering ball valve (33) to the correct value - see *on page 91*.
12. As soon as the flows are set and constant for 15 s, close the solenoid valve (24) by pressing and holding the yellow key of the dilution control (21).
13. After the floats have dropped, reopen the the solenoid valve (24) by pressing and holding the yellow key of the dilution control (21) and check the flow values in the flow meters.
14. If the flow value of the water deviates significantly from the setpoint, readjust it using the pressure reducing valve (29).
15. If both flows deviate from the setpoints, readjust them again using the metering ball valve (33): Repeat points 8 to 11.
16. Close the solenoid valve (24) by pressing and holding the yellow key of the dilution control (21).
17. Empty the HCL receiver tank for dilute hydrochloric acid (under the CDK system) into a discharge gutter and rinse away with plenty of water.
18. Open the solenoid valve (24) by pressing and holding the yellow key of the dilution control (21).
19. Check the flow values and readjust as necessary.

10.6 Installation of the chemical canisters

1. Switch off production in the continuous display with *[F1] 'PROD OFF'* – "Production off" appears.
2. Position the chemical canisters beneath the system - acid on the left (HCl, red), chlorite on the right ($NaClO_2$, blue) – viewed from the front!
3. Immerse the left suction lance in the acid chemical canister. Does the foot valve float just above the base of the chemical canister?
4. Tighten the screw lid.
5. Immerse the right suction lance in the chlorite chemical canister. Does the foot valve float just above the base of the chemical canister?
6. Tighten the screw lid.
7. Only with a heating system for chemical pipelines: The temperature of the chemicals should always remain below 35 °C.

10.7 Checking ClO_2 production

1. In the continuous display, switch on production by pressing *[F1] 'PROD ON'*, *'Production on'* appears.
2. After a suitable time period, prepare a sample from the main water supply line (downstream of a reaction tank, if fitted, or at an in-line probe housing) - the ClO_2 solution should have reached this point by then.
3. Place the sample in a clean vessel and immediately mix it with the DPD 1 reagent - see the operating instructions for your colorimeter; ClO_2 tends to outgas, especially at water temperatures of > 25 °C!
4. Immediately measure the ClO_2 content of the sample using a colorimeter, e.g. using the photometer DT 1.
5. If necessary, adjust the control parameters or supply quantity in the *'SETTING'* menu, allow the system to run and repeat the measurement after a sufficiently long interval.
6. Sign the completed commissioning report.

CAUTION!

Warning against illegal operation

– Observe national and local regulations with regard to ClO_2 concentrations.

If the stroke length has to be changed, then:

– *Carry this out via the 'Adjust stroke length' menu.*
– *Note the minimum stroke lengths - refer to the chapter ""Control variable-proportional control"" operating mode"*

– *For safe operation, set the stroke length as long as possible; this prevents outgassing of the chemicals in the suction lines.*
– *To ensure efficient mixing, set the stroke length as short as possible, because this results in a higher stroke rate.*

10.8 Saving system data

It is essential that you save the following files - refer to the chapter entitled "Setting"-"Setting"-"Saving Data":

- "configuration.bin"
- "settings.txt"
- "report.txt"

A second SD card is needed for this.

- - - The Bello Zon® system is now ready for operation! - - -

11 Operation

WARNING!

Risk of explosion due to ClO_2 gas

Together the two components, hydrochloric acid (HCl) and sodium chlorite ($NaClO_2$), almost instantaneously form large quantities of toxic ClO_2 gas, which can decompose in an explosive manner.

– Never bring the two components, hydrochloric acid (HCl) and sodium chlorite ($NaClO_2$), into contact with each other except in the reactor.

WARNING!

Warning of toxic ClO_2 gas

Mix-ups often occur when pouring chemicals back into chemical canisters. Lots of toxic ClO_2 gas can be generated.

– Never pour chemicals from chemical canisters back into other canisters or pour them together.

WARNING!

Warning of toxic ClO_2 solution

If system leaks occur, toxic ClO_2 solution can escape.

– In no operating status should the system's maximum permissible operating pressure be exceeded.
– The entire installation should remain leak-tight when operated at maximum operating pressure.

11.1 Replacing chemical canisters

Safety information

WARNING!

Warning of toxic ClO_2 gas

Large quantities of toxic ClO_2 gas can be produced if the chemical canisters are not handled correctly.

– Only allow trained personnel to change the chemical canisters.
– Observe the colour code:
  Red stands for acid (HCl, on left),
  Blue for chlorite ($NaClO_2$, right).
– Never place both suction lances in the same vessel or swap them.

WARNING!

Warning of toxic ClO_2 solution

Toxic ClO_2 solution can escape if leaks occur due to corrosion on the system.

– Ensure that the hydrochloric acid conforms to DIN EN 939.
– The chlorite must conform to DIN EN 938.
– Ensure that the dilution water is of drinking water quality.

Basic purity requirements

For sodium chlorite 24 ... 25 %	Upper limit as per DIN EN 938
Sodium chlorate	12 g/l
Sodium nitrate	0.3 g/l

For hydrochloric acid 25 ... 36 %	Upper limit as per DIN EN 939
Iron	60 mg/l
Halogenated organic compounds	6 mg/l

For the dilution water
Drinking water quality

Minimum temperatures, liquids

For chemicals and water	Temperature, at least
CDKc 150 ... 2000	10 °C
CDKc 2800 ... 7300	15 °C
CDKc 12000	18 °C

Maximum temperature, liquids

For chemicals and water	Maximum temperature
for all systems	40 °C

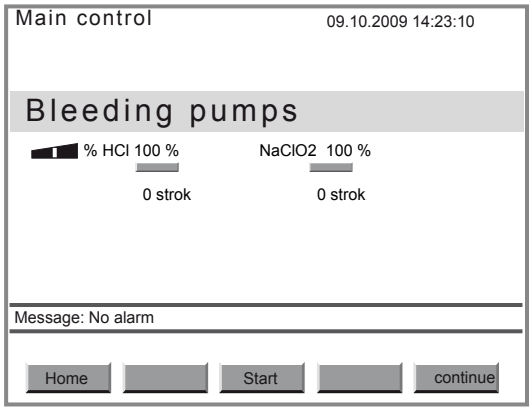
Operating guidelines

The following instructions are intended for the concentrated acid storage tank beneath the pre-dilution module! They are not intended for the HCL receiver tank for dilute acid beneath the CDK system.

1. Switch off ClO_2 production in the continuous display using the *[F1] 'PROD OFF'* key.
   ⇨ *'Production off'* appears.
2. Carefully remove each suction lance out of its chemical canister. Raise slowly, keep vertical!
3. Place each of the suction lances in its own bucket full of clean water. This prevents the suction lances from running dry and ClO_2 being created.
4. Close the empty chemical canisters and ensure they are disposed of properly.
5. Place the new chemical canisters beneath the system:
   Red stands for acid (on left), blue for chlorite (on right)!
6. Slowly raise each suction lance, hold vertical and insert into the corresponding chemical canister.
   Red stands for acid, blue for chlorite!
7. Check the suction lines for air bubbles, bleed as necessary (as described in the next chapter).
8. Switch on ClO_2 production in the continuous display using the *[F1] 'PROD ON'* key.
   ⇨ *'Production on'* appears.

If necessary: Start the manual top-up of the HCl storage tank by briefly pressing the yellow key with the "Spanner" symbol on the pre-dilution control.

11.2 Bleeding pumps



Requirements:

The stroke lengths of the pumps are set equal to each other and in line with the minimum values from the table *on page 81*.

1. Press *[F1] 'SERVICE'* to change to the *'SERVICE'* menu.
2. Using the *[DOWN]* key switch to the *'Expert jobs'* menu and press *[ENTER]*.
3. Use the *[Arrow keys]* to select the *'Bleeding pumps'* menu.
4. Press *[ENTER]* to change to the *'Bleeding pumps'* menu.
5. Place each suction lance in its own bucket full with clean water.
6. Slightly open the pumps' bleed valves (clockwise).
7. Press *[F3] 'START'* to start bleeding then wait until the suction lines and liquid ends are filled free from bubbles.

CAUTION!
In an emergency, the pumps can be stopped by pressing *[F3] 'STOP'*.

8. If the suction lines and liquid ends are not yet bubble-free after the metering pumps have stopped, repeat bleeding with *[F3] 'START'*.
9. Stop bleeding with *[F3] 'STOP'* if the suction lines and liquid ends are bubble-free earlier than expected.
10. Press *[F1] 'HOME'* to change to the *'Equipment OFF'* display.
11. Close the coarse/fine bleed valves on the pumps (anticlockwise direction).

WARNING!

Warning of toxic ClO_2 gas

When pouring chemicals together lots of toxic ClO_2 gas can be generated.

- Never pour the contents of the bleed bottles together.
- Never pour the contents of the bleed bottles back into the chemical canisters. There is too great a risk of a mix-up.
- Pour the contents of the bleed bottles individually into the drainage and flush away each of chemical contents with lots of water.

CAUTION!

Hazardous chemicals can escape

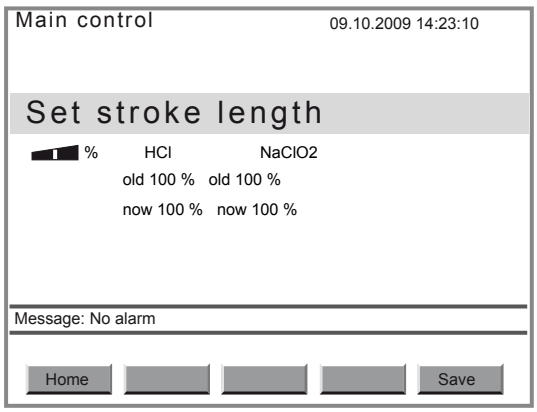
The bleed bottles may overflow after several sequential bleed processes.

- If carrying out several sequential bleed processes, monitor the liquid level of the bleed bottles.

Clear fault arising during bleeding pumps

Fault description	Cause	Remedy
Error message, the strokes are not counted down and the overlying bar goes red.	The dosing monitor is not correctly adjusted.	■ Turn the knurled screw beneath the dosing monitor by one turn downwards. ■ Acknowledge the error message.

11.3 Set stroke length



If the stroke length has to be changed, then:

- *Carry this out in the "Set stroke length" menu.*
- *Observe the minimum values from the table* *on page 81.*

- *For safe operation, set the stroke length as long as possible; this prevents outgassing of the chemicals in the suction lines.*
- *To ensure efficient mixing, set the stroke length as short as possible, because this results in a higher stroke rate.*

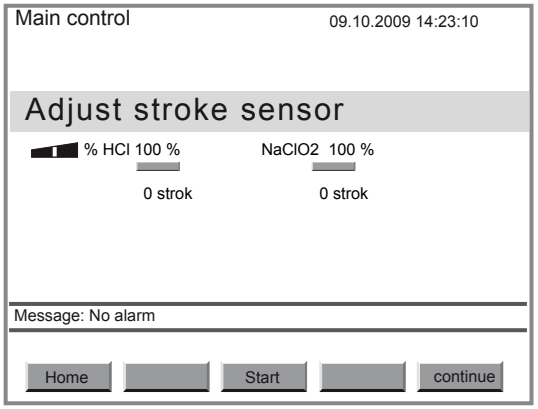
1. Press *[F1]* *'SERVICE'* to change to the *'SERVICE'* menu.
2. Press the *[ENTER]* key to change to the menu *'Expert jobs'*.
3. Use the arrow keys to select the menu *'Set stroke length'*.
4. Press the *[ENTER]* key to change to the menu *'Set stroke length'*.
5. Set the new stroke lengths at the metering pumps.
6. Accept the new values for the stroke lengths by pressing *[F5]* *'SAVE'*.

   ⇨ The *'Adjust stroke sensors'* menu appears.
7. Now adjust the stroke sensors without fail - see the following chapter.

Output adjustment range ClO_2 production for the individual system types

System type	Min. stroke length	Output adjustment range ClO_2 (g/h), For min. / max. stroke rate and ...	
		Min. stroke length, approx.	Max. stroke length, approx.
CDKc 150	70	7 ... 120	9 ... 150
CDKc 400	60	12 ... 250	20 ... 400
CDKc 900	50	23 ... 450	45 ... 900
CDKc 2000	40	42 ... 840	105 ... 2000
CDKc 2800	40	60 ... 1200	150 ... 2800
CDKc 7300	40	150 ... 2920	375 ... 7300
CDKc 12000	40	240 ... 4800	600 ... 12000

11.4 Adjust stroke sensors



WARNING!

Warning of a risk of explosion

If the stroke sensors are not operating, the expected ClO_2metering quantity can be incorrect, with, for example, a consequent risk of explosion.

- Never set the ring initiators too low.
- Reliably counter a fall in the back pressure.
- Observe the minimum values for the stroke lengths.

WARNING!

Warning of toxic chlorite gas

If the stroke sensors are not operating, the permissible chlorite concentration can be exceeded.

- Never set the ring initiators too low.
- Reliably counter a fall in the back pressure.
- Observe the minimum values for the stroke lengths.

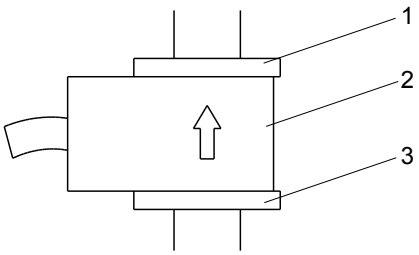


Fig. 21: Overview of dosing monitor

1 Upper adjustment washer
2 Ring initiator
3 Lower adjustment washer

Prerequisites:

The metering pumps have been bled.

1. Turn each upper adjustment washer (1) of the dosing monitors - see figure Fig. 21 - fully upwards.
2. Reposition the ring initiators (2) and the bottom adjustment washers (3) respectively.
3. Press *[F3] 'START'* to start the metering pumps.

CAUTION!

In an emergency the pumps can be stopped with *[F3] 'STOP'*.

4. Slowly lower each ring initiator (2), until the number beneath the corresponding green bar remains permanently on 0 to 1 strokes (e.g. for the left ring initiator (HCl): left bar).
5. Then lower the lower adjustment washer (3) by 1 turn.
6. Lower the respective upper adjustment washers (1) to the ring initiators (2).
7. Press *[F5] 'CONTINUE'* to exit the menu.
8. Press *[F1] 'HOME'* to change to the *'Equipment OFF'* display.

11.5 Checking sensors

Regularly check the sensors with metered value-dependent metering. The interval depends on national regulations or process conditions - see the sensors' operating instructions.

ClO_2 sensor

Check the display value of the sensor on the control using a suitable chlorine-dioxide measuring instrument (e.g. DPD) - see sensor operating instructions.

If necessary, recalibrate the sensor, see chapter "Setting, Calibration" and the sensor operating instructions.

Chlorite sensor

Check the display value of the sensor at the control using a suitable chlorine-dioxide measuring instrument (e.g. DPD) - see sensor operating instructions.

If necessary, recalibrate the sensor, see chapter "Setting, Calibration" and the sensor operating instructions.

ORP sensor

Check the display value of the sensor at the control using a suitable quality buffer solution (e.g. for 465 mV) - see sensor operating instructions.

If the stable display value deviates by more than ±40 mV from the buffer value, replace the sensor - see sensor and in-line probe housing operating instructions.

pH sensor

Check the display value of the sensor at the control using a suitable quality buffer solution (e.g. for pH 7) - see sensor operating instructions.

If necessary, recalibrate the sensor, see chapter "Setting, Calibration" and the sensor operating instructions.

11.6 Further processing of data

General

The Bello Zon® control only saves the events, operator actions and listed values on the SD card under the transparent interface cover of the control - see Fig. 8. This is the only place it saves them permanently; if the control is disconnected from the mains voltage, it no longer displays the old values. The old values can also no longer be imported from the SD card into the control. However, they can be transferred from the SD card to a PC, where they can be displayed or further processed.

The capacity of the SD card supplied is 512 MB. In general, this is sufficient capacity for 6 months to 1 year.

However, the control can also use SD cards with a capacity of up to 2 GB.

The formatting of the SD card needs to be FAT.

Inserting the SD card

1. Open the bottom transparent interface cover on the control to insert the SD card.
2. Push the SD card into the card slot until it engages. If it is not engaged, the error message *'SD card not initialised'* appears.
3. Close the interface cover and screw in place to ensure that it is moisture-proof.

WARNING!

Danger of electric shock

– Ensure that the transparent interface cover is screwed in place to ensure it is moisture-proof.

Evaluation of the SD card files

1. Remove the SD card - logically reversed as under *'Inserting the SD card' on page 101*.
2. Copy the files contained in the SD card to a PC via a card reader - they are contained in the "Logbook" directory.
3. Reinsert the SD card – as under *'Inserting the SD card' on page 101*.

Now open the TXT files using a spreadsheet program such as EXCEL.

If you have changed the Bello Zon® control's clock from or to summer time, bear this in mind during data evaluation.

12 What happens in the event of incorrect operation?

a) Chemical canisters

Incorrect operation:	Chemical canisters are interchanged.
Consequence:	Toxic ClO_2 gas is formed in the chemical lines and chemical canisters.

Incorrect operation:	Incorrect chemicals or chemicals in the incorrect concentration or purity are used and the Bello Zon® system / pumps started.
Consequence:	Uncontrolled, dangerous reactions can take place. Explosions may occur, toxic ClO_2 gas can escape.

b) Stroke sensors

Incorrect operation:	Ring initiator set too low.
Consequence:	It is possible that the stroke sensor does not identify a reduction of the flow volume of > 30 % and the dosing continues running. Excess acid or chlorite is requested. ■ The processed ClO_2 dosing quantity which the control displays, is no longer correct. ■ If too little chlorite is present, the still present excess amount of acid is reinforced and the ClO_2 solution diluted. ■ With too little acid: – The yield of ClO_2 falls and the displayed ClO_2 quantity is no longer correct. – The result is possible health hazards due to exceeding of the permissible chlorite concentration!

c) Bypass

Incorrect operation:	The limit contact of the flow meter in the bypass is set too low.
Consequence:	The ClO_2 concentration in the bypass becomes too high and environmental damage or health hazards result. If a gas phase can form, an explosion may occur.

d) Control

Incorrect operation:	Incorrect calibration values set for the dosing pumps.
Consequence:	Excess acid or chlorite is requested. ■ The processed ClO_2 dosing quantity which the control displays, is no longer correct. ■ If too little chlorite is present, the still present excess amount of acid is reinforced and the ClO_2 solution diluted. ■ With too little acid: – The yield of ClO_2 falls and the displayed ClO_2 quantity is no longer correct. – The result is possible health hazards due to exceeding of the permissible chlorite concentration!

e) Pre-dilution module

Incorrect operation:	HCl over diluted.
Consequence:	■ The yield of ClO_2 falls and the displayed ClO_2 quantity is no longer correct. ■ The result is possible health hazards due to exceeding of the permissible chlorite concentration!

Incorrect operation:	HCl too concentrated.
Consequence:	The increased acid excess makes the ClO_2 solution even more acidic. If the acid reaches the HCl receiver tank in an almost undiluted state, then a further system operating error could lead to the generation of an explosive ClO_2 solution.

Incorrect operation:	Suction regulator set incorrectly.
Consequence:	If, due to extraction, the acid reaches the HCl receiver tank in an almost undiluted state, then a further system operating error could lead to the generation of an explosive ClO_2 solution. Also undiluted acid can overflow out of the HCl receiver tank.

13 Maintenance

Safety information

WARNING!

Toxic ClO_2 can escape

If maintenance is neglected, in the worst case this would result in the escape of ClO_2 solution through a pipe leak.

– Service should maintain the Bello Zon® system at least annually.

WARNING!

Toxic chemicals can escape

Toxic chemicals in the hydraulic components of the system.

– Prior to any maintenance work (e.g. replacement of components etc.), rinse the Bello Zon® system with water until the piping and especially the reactor no longer contain any chemicals.

WARNING!

Danger of electric shock

Danger due to incorrectly replaced electrical cabling.

– Control cabling or mains leads should only be replaced by Service.
– Only use the appropriate special cabling.

NOTE for the system operator

Have chlorine dioxide systems regularly checked for safety by a technical expert, but in any event at least annually and before any recommissioning - for example also in compliance with German accident prevention regulations [GUV 8.15 or VGB 65 § 19 (2)].

We recommend an interval of 6 months for CDK systems.

Service can carry out this check as part of maintenance work. We therefore recommend concluding a service contract.

13.1 Inspection work by the operator

Interval	Maintenance work	Personnel
Daily to weekly, depending on the operating conditions	System inspection - see below.	Instructed personnel
	Metering pump inspection - see below.	Instructed personnel
	Cleaning of the housing - see below.	Instructed personnel
	Acid vapour separator inspection - see below.	Instructed personnel

System inspection

1. Check the ClO_2 concentration in the water treated; observe national regulations.
2. Check and compare the liquid levels in the chemical canisters, look out for a possible *'Low level'* warning in the display, if necessary have Bello Zon® acid and Bello Zon® chlorite ready for use.
3. Record the consumption of Bello Zon® acid and Bello Zon® chlorite (system log book).
4. Check the flow in the bypass.
5. Check the system for leak-tightness.
6. Check the flows at the pre-dilution module.

Cleaning the housing

1. Clean the housing with a cloth moistened with soapy water.

CAUTION!
Solvent can attack the surfaces.
– Never use solvents.

2. Wipe the housing dry.

Inspecting metering pumps

1. Check the dosing head screws for correct seating.
2. Check the metering lines on both the discharge and suction sides for correct fit.
3. Check the discharge valve and suction valves for correct fit.
4. Check for moisture in the leakage hole of the backplate. There has probably been a diaphragm rupture if moisture is present.

Acid vapour separator inspection

1. Check both acid vapour separators for dark discolouring of the binding agent.
2. If the packing is coloured blue-violet, replace the binding agent.

Acid vapour separator for acid canisters

To bind the HCl vapours which may arise during filing and drainage processes, an acid vapour separator is fitted to both the acid canister and the corresponding calibration device. Their padding is replaceable.

Accessories	Part no.
Acid vapour separator, 130 ml	1034692
Binding agent type 1, 150 ml	1035854

13.2 Service work by the Service team

Interval	Maintenance work	Personnel
After 6 months, at least annually	Replace all wear parts - ProMinent maintenance kit! With older systems, check the pipe walls of the bypass line for lime-scale.	Customer Service department
	Check the system for safety	Customer Service department
After 10 years	If not previously replaced, replace the reactor and all bypass piping now.	Customer Service department
	Replace the batteries of the control on a preventative basis - refer to the chapter entitled "Disposal".	Customer Service department

Concluding maintenance

1. Conclude maintenance in the *'Service'* menu under *'Commissioning'* - *'Maintenance interval'* with *[Enter]*.
   ⇨ The daily countdown of the next annual maintenance interval is restarted.
2. 
   CAUTION!
   Following maintenance and repairs on the pre-dilution module: Initially only use potable water to restart the pre-dilution module.
3. Save the following files and data - refer to the chapter entitled "Setting"-"Setting"-"Saving Data":
   - "configuration.bin"
   - "settings.txt"
   - "report.txt"
   - "Logbook" folder
4. Sign the completed maintenance report.

Maintenance sets for CDKc systems

The maintenance sets contain all wear parts which are to be exchanged within the scope of regular system maintenance.

Maintenance set, complete for	Part no.
CDKc 150	1043841
CDKc 400	1043842
CDKc 900	1043843
CDKc 2000	1043864
CDKc 2800	1043865
CDKc 7300	1043866
CDKc 12000	1043867

14 Repairs

WARNING!

The reactor can explode

If unauthorised repair work is carried out, the worst case scenario is a reactor explosion.

– Only Customer Service may repair the Bello Zon® system.

15 Troubleshooting

WARNING!

The reactor can explode

The worst case scenario is a reactor explosion if unqualified repair work is carried out.

– Only personnel with the stipulated qualifications may carry out troubleshooting.

– *If dosing is "OFF", then the control does not actuate the pumps and ignores nearly all input signals (with the exception of 'External error', 'Leakage' ...).*
– *If you wish to contact ProMinent because of a fault, then e-mail the following files and data in advance - refer also to the chapter entitled "Setting"-"Setting"-Saving Data":*
  – *"configuration.bin"*
  – *"settings.txt"*
  – *"report.txt"*
  – *"Logbook" folder*

15.1 Faults without error messages

Fault description	Cause	Remedy	Personnel
Liquid is escaping from the backplate of a metering pump.	The liquid end leaks at the diaphragm.	Re-tighten the Allen screws on the dosing head. If this is unsuccessful, inform the Service department.	Instructed personnel
The metering pump has been working for a long time, but suddenly is no longer pumping.	Air in the metering line or the chemical canister is empty.	Bleed the metering line, check the liquid level in the chemical canister, if unsuccessful:	Instructed personnel
	Pump diaphragm probably defective.	Replace diaphragm.	Customer Service department
Metering pump does not meter, a green bar is not flashing - see "Continuous display 1" Fig. 12.	CAN cable connection problem.	Check the CAN cable connection.	Instructed personnel
	Problem with pump mains voltage.	Check the applied mains voltage.	Electrician
	The pump fuse is defective.	Check the fuse and replace as necessary - see end of chapter.	Customer Service department
Chemical consumption oscillates unusually.	The metering pumps are overstrained due to too low operating pressure.	Increase the operating pressure over 1.5 bar.	Technical experts
The ClO_2 concentration in the water fluctuates unusually.	The metering pumps are overstrained due to too low operating pressure.	Increase the operating pressure over 1.5 bar.	Technical experts

15.2 Faults with error messages, pre-dilution control

Fault description	Cause	Remedy
The red "Error" light flashes quickly.	The acid component container is empty, if the BelloZon® control indicates this simultaneously.	Replace the acid component tank.
	The injection valve was incorrectly set.	Set the injection valve in line with the "Start up" chapter.
	There is a blockage in the water supply line or the line to the HCl storage tank.	Eliminate the blockage.
The red "Error" light flashes slowly.	The injection valve was incorrectly set.	Set the injection valve in line with the "Start up" chapter.
	There is a blockage in the water supply line or the line to the HCl storage tank.	Eliminate the blockage.
The red "Error" light is lit continuously.	The pre-dilution control has identified an internal error.	Call the ProMinent Service.

15.3 Faults with BelloZon® error messages

The error messages, which occur during calibration, are listed in the chapter entitled "Setting"-"Calibration".

Fault description	Cause	Remedy	Personnel
Operating time expired	System should be serviced.	Service system.	Customer Service department
Operating time nearly expired	System should be serviced.	Book customer service.	Instructed personnel
Bypass control - as an error message	No flow in the bypass.	Press *[F1] 'QUIT'*, check bypass, press *[F1] 'ON'*.	Technical experts
Bypass control - as a warning message	Operating status.	No remedy necessary.	
CANBus failure	CANBus failure.	Briefly interrupt the mains voltage to the Bello Zon® control and all CAN modules.	Instructed personnel
Chlorite CANOpen - nodes not found	No CAN bus connection to the chlorite pump fitted.	Check the cable connections to the chlorite pump.	Instructed personnel
Chlorite concentration high	Problem with the entire application.	Check system.	Technical experts
Chlorite concentration too high	Problem with the entire application.	Press *[F1] 'QUIT'*, check system, press *[F1] 'ON'*.	Technical experts
Chlorite pump not ready	see "Detailed troubleshooting", below	see "Detailed troubleshooting", below	
Chlorite conc. low	Problem with the entire application.	Book customer service.	Technical experts
Chlorite conc. too low	Problem with the entire application.	Book customer service.	Technical experts
Chlorite signal (cable break)	Cable break	Check the cable connector to the CLT sensor	Instructed personnel
Chlorite calibration faulty	Zero point or slope lie outside the tolerance range.	Improve CLT sensor calibration once more.	

Fault description	Cause	Remedy	Personnel
ClO2 concentration high	Problem with ClO_2 dosing	Press *[F1] 'QUIT'*, check ClO_2 metering, press *[F1]* ON.	Technical experts
ClO2 concentration low	Problem with ClO_2 metering.	Check ClO_2 dosing.	Technical experts
ClO2 concentration too high	Problem with ClO_2 metering.	Check ClO_2 dosing.	Technical experts
ClO2 concentration too low	Problem with ClO_2 metering.	Press *[F1] 'QUIT'*, check ClO_2 metering, press *[F1] 'ON'*.	Technical experts
ClO2 signal (cable break)	Cable break	Check the cable connector to the CDE or CDP sensor	Instructed personnel
Bad ClO2 calibration	Zero point or slope lie outside the tolerance range.	Improve CDE or CDP sensor calibration again.	
Dosing error chlorite	see "Detailed troubleshooting", below	Press *[F1]* QUIT, next - see "Detailed troubleshooting", below	Instructed personnel
Dosing error acid	- see "Detailed troubleshooting", below	Press *[F1]* QUIT, next - see "Detailed troubleshooting", below	Instructed personnel
Flow Bypass	- see "Detailed troubleshooting", below	- see "Detailed troubleshooting", below	Instructed personnel
Flow signal (cable break)	Cable rupture of the mA wire for the main water line flow meter.	Check cable connector.	Instructed personnel
Flow high	The flow in the main water line is very high.	Check system.	Technical experts
Flow low	The flow in the main water line is very low.	Check system.	Technical experts
Flow too high	The flow in the main water line is too high.	Press *[F1] 'QUIT'*, check system, press *[F1] 'ON'*.	Technical experts
Flow too low	The flow in the main water line is too low.	Press *[F1] 'QUIT'*, check system, press *[F1] 'ON'*.	Technical experts
Flow signal too high	The flow signal from the main water line is too high.	Check the signal generator.	Instructed personnel
Leakage input	Leakage in the safety collecting trays.	Check chemical canisters for leaks. Rectify the cause of the leaks or replace both chemical canisters. Clean the safety collecting tray. Refer to the safety data sheets for the chemicals.	Instructed personnel
Error input	External fault, such as gas detector	Press *[F1] 'QUIT'*, check system, press *[F1] 'ON'*.	Technical experts
Incorrect control parameters	The control parameters are not accepted by the controller.	Enter the correct control parameters.	Instructed personnel
Stroke length error Chlorite	Incorrect stroke length on the chlorite metering pump.	Press *[F1] 'QUIT'*, check stroke length or set the same value for all pumps, press *[F1] 'ON'*.	Instructed personnel
Stroke length error Acid	Incorrect stroke length on the acid metering pump.	Press *[F1]* QUIT, check stroke length or set the same value for all pumps, press *[F1]* ON.	Instructed personnel
IO CANopen - node not found	Fault at the cable connector in the control	Check the cable connector in the control.	Customer Service department
No alarm	Normal condition	No remedy necessary	

Fault description	Cause	Remedy	Personnel
Sample water fault	Sample water fault	Press *[F1] 'QUIT'*, check system, press *[F1] 'ON'*.	Instructed personnel
pH high	Problem with the entire application.	Check system.	Technical experts
pH low	Problem with the entire application.	Check system.	Technical experts
pH too high	Problem with the entire application.	Check system.	Technical experts
pH too low	Problem with the entire application.	Check system.	Technical experts
pH signal (cable break)	Cable break	Check the cable connector to the pH sensor	Instructed personnel
Bad pH calibration	Zero point or slope lie outside the tolerance range.	Repeat calibration, if necessary replace the pH sensor.	
ORP high	Problem with the entire application.	Check system.	Technical experts
ORP low	Problem with the entire application.	Check system.	Technical experts
ORP too high	Problem with the entire application.	Check system.	Technical experts
ORP too low	Problem with the entire application.	Check system.	Technical experts
ORP signal (cable break)	Cable break	Check the cable connector to the ORP sensor	Instructed personnel
Bad ORP test	The test value lies outside the tolerance range.	Repeat the test, if necessary replace the ORP sensor.	
Acid CANopen - node not found	No CAN bus connection to the acid pump fitted.	Check the cable connections to the acid pump.	Instructed personnel
Acid pump not ready	- see "Detailed troubleshooting", below	- see "Detailed troubleshooting", below	
SD card not initialised	The small slider on the SD card is set to "LOCK.	Slide the small slider towards the contacts of the SD card.	
	No SD card inserted.	Insert an SD card.	
	The SD card is not formatted or is incorrectly formatted.	Format the SD card (FAT16)	
	The SD card is full.	Replace the SD card with an empty card.	
Control variable signal (cable rupture)	mA cable connector to the signal generator interrupted.	Check the mA cable connector to the signal generator.	Instructed personnel
Control variable high	Error at the setpoint signal generator.	Check the signal generator.	Instructed personnel
Control variable low	Error at the setpoint signal generator.	Check the signal generator.	Instructed personnel
Control variable signal too high	Error at the setpoint signal generator.	Press *[F1] 'QUIT'*, check the signal generator, press *[F1] 'ON'*.	Instructed personnel
Control variable too low	Error at the setpoint signal generator.	Press *[F1] 'QUIT'*, check the signal generator, press *[F1] 'ON'*.	Instructed personnel
Control variable signal too high	Error at the setpoint signal generator.	Check the signal generator.	Instructed personnel
Interference variable signal (cable rupture)	mA cable connector to the signal generator interrupted.	Check the mA cable connector to the signal generator.	Instructed personnel

Fault description	Cause	Remedy	Personnel
Dist. variable high	Error at the interference variable signal generator.	Check the signal generator.	Instructed personnel
Dist. variable low	Error at the interference variable signal generator.	Check the signal generator.	Instructed personnel
Dist. variable too high	Error at the interference variable signal generator.	Press *[F1] 'QUIT'*, check the signal generator, press *[F1] 'ON'*.	Instructed personnel
Dist. variable too low	Error at the interference variable signal generator.	Press *[F1] 'QUIT'*, check the signal generator, press *[F1] 'ON'*.	Instructed personnel
Dist. variable too high	Error at the control variable signal generator.	Check the signal generator.	Instructed personnel
Supply Chlorite empty	The chlorite storage tank is empty.	Press *[F1] 'QUIT'*, next - see "Detailed troubleshooting", below.	
Supply Chlorite low	The liquid level in the chlorite storage tank is low.	Change both chemical canisters - see chapter ↳ *Chapter 11.1 'Replacing chemical canisters' on page 95*. WARNING!	
Supply Acid empty	The chlorite storage tank is empty.	Press *[F1] 'QUIT'*, next - see "Detailed troubleshooting", below.	
Supply Acid low	The liquid level in the acid storage tank is low.	Change both chemical canisters - see chapter ↳ *Chapter 11.1 'Replacing chemical canisters' on page 95*. WARNING!	
Pre-dilution	Fault at the pre-dilution control.	Call the ProMinent Service.	

Detailed troubleshooting

Fault description	Cause	Remedy	Personnel
'Dosing error acid' or *'Dosing error chlorite'*	A dosing monitor is incorrectly adjusted.	Adjust the dosing monitor - see chapter ↳ *Chapter 11.4 'Adjust stroke sensors' on page 99*. Press *[F1] 'ON'*.	
	The back pressure has risen.	If there is a high rise in pressure, rectify the cause, if there is a low rise in pressure, readjust the dosing monitor - see Chapter ↳ *Chapter 11.4 'Adjust stroke sensors' on page 99*. Press *[F1] 'ON'*.	
	There is air in the line from the vessel to the dosing monitor sensor, the vessel is empty.	See chapter ↳ *Chapter 11.1 'Replacing chemical canisters' on page 95*. Press *[F1] 'ON'*.	
	Leak in the line from the vessel to the dosing monitor.	Rectify the leak.	Customer Service department
'Acid pump not ready' or *'Chlorite pump not ready'*	The metering pump has not yet been bled or calibrated during commissioning.	- see chapter ↳ *Chapter 11.2 'Bleeding pumps' on page 97*.	Technical experts
	The stroke length is set at too small a value.	Increase the stroke length with the adjustment knob - see chapter ↳ *Chapter 11.3 'Set stroke length' on page 98*.	Technical experts
'Supply Acid empty' or *'Supply Chlorite empty'*	Chemical canister empty.	Change both chemical canisters - see chapter ↳ *Chapter 11.1 'Replacing chemical canisters' on page 95*.	Technical experts

Fault description	Cause	Remedy	Personnel
		Bleed metering pumps - see chapter *Chapter 11.2 'Bleeding pumps' on page 97*. Press *[F1] 'ON'*.	
'Flow Bypass'	The ball valve in the bypass is not open.	Open the ball valve in the bypass.	Instructed personnel
	The cable connector from the bypass monitor to the control is faulty.	Rectify this cable connection.	Instructed personnel
	If fitted: The bypass pump is not pumping.	Check the bypass pump.	Instructed personnel
	The float in the flow meter is blocked.	Clear the blockage and clean the flow meter.	Instructed personnel
	The limit contact is defective.	Check the limit contact and replace if necessary.	Instructed personnel

Change the control's mains fuse

WARNING!
Danger of electric shock
Individual components can carry mains voltage within the control.

– Disconnect the control from the mains power supply and secure to prevent switching on again.

WARNING!
Danger of electric shock
Even when the mains power supply is disconnected, there can still be mains voltage at the terminal blocks XR1 and XR2.

– Switch the corresponding power supply to a de-energised state and secure to prevent switching on again.

WARNING!
Warning of the risk of fire and malfunction
Fire risks and malfunctions can result from the use of incorrect fuses.

– Only use approved ProMinent original fuses, see *Chapter 15.3 'Faults with BelloZon® error messages' on page 110*. Only in rare cases will any other fuse, with the values given below, have exactly the same properties.

Personnel: ■ Electrician

1. Loosen the four countersunk screws.
2. Remove the front part. For further information - see the Assembly and Installation Instructions, chapter "Installation, electrical".
3. Open the bayonet coupling of the corresponding fuse holder. Fuse layout, see *Chapter 15.3 'Faults with BelloZon® error messages' on page 110*.
4. Replace the defective fuse with a new one.
5. Ensure the bayonet coupling engages.
6. Tightly re-close the housing.

Permitted fuses for the Bello Zon® control (230 V AC or 115 V AC)

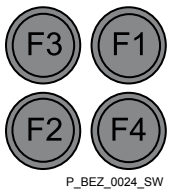


Fig. 22: Fuse layout in the control

Description	Type	Supplied ...	Terminals	Part no.
F1	0.4 ATT	Control	XP	712060
F2	10 AT	Bypass pump	X12:1, 5, 9	712073
F3	1.0 AT	Solenoid valves	X12:2, 6, 10; X12:3, 7, 11	732409
F4	10 AT	Metering pumps	X11:1 ... 12	712073
Micro fuse 5 x 20 mm:				

The fuses are each contained in a fuse holder with a bayonet coupling. They are located in the terminal box of the control, on the right above the mains voltage terminals. For the layout, see figure.

16 Decommissioning

WARNING!

Risk of explosion due to ClO_2 gas

Together the two components, hydrochloric acid (HCl) and sodium chlorite ($NaClO_2$) almost instantaneously form large quantities of toxic ClO_2 gas, which can also decompose in an explosive manner.

- Never pour the contents of the chemical canisters together.
- Never pour the contents of the bleed bottles back into the chemical canisters.
- Never place both suction lances together or one after the other in the same bucket.

WARNING!

Warning of the possible escape of corrosive liquid

The liquid ends of the dosing pumps contain corrosive liquids.

- Do not open the bleed valves on the liquid ends of the metering pumps.

16.1 For a short period

Only remove the Bello Zon® system from service for a few hours up to 1 day.

→ Press the *[START/STOP]* key.

⇨ *'Dosing STOP'* appears.

The power supply to the control of the Bello Zon® system must not be interrupted during this period.

CAUTION!

Warning of incorrect metering

Nevertheless, if the power supply to a possibly fitted chlorine dioxide or chlorite sensor is interrupted, for a period longer than 2 hours, it may subsequently deliver incorrect measurements.

- Do not interrupt the power supply to a chlorine dioxide or chlorite sensor for longer than 2 hours.
  In the event that this occurs, run the sensor in according to its operating instructions.

CAUTION!

Warning of incorrect metering

The ClO_2 in the reactor decomposes within a few hours (due to its high concentration). Hence after switching back on, the system temporarily meters less ClO_2 than the control indicates.

– Bear these circumstances in mind when switching back on.
– As far as possible operate the system without switching off.

16.2 Over longer periods

Taking the Bello Zon® system out of service for longer periods:

Chlorine dioxide in an unstable compound, which decomposes over time. If the Bello Zon® system is to be taken out of service for more than 1 day, then the reactor should be rinsed through with water. The flushing equipment in the bypass line is used for this purpose - see assembly - and the Installation Instructions, "Hydraulic Installation" Chapter.

Safety notes

WARNING!

Warning of explosive ClO_2 gas

It takes just a short period for ClO_2 solution to form an explosive ClO_2 gaseous phase.

– Rinse and detoxify the reactor content.

WARNING!

Warning of toxic ClO_2 gas, ClO_2 solution and sodium chlorite

The inside of the system contains toxic substances.

– Take appropriate protective measures, wear safety glasses, rubber gloves, gas mask, rubber apron, see safety data sheets.
– If contact occurs with these chemicals, immediately rinse with plenty of cold water, then proceed further in accordance with the safety data sheets.

WARNING!

Warning of corrosive hydrochloric acid and sodium chlorite

The inside of the system contains corrosive substances.

– Take appropriate protective measures, wear safety glasses, rubber gloves, gas mask, rubber apron, see safety data sheets.
– If contact occurs with these chemicals, immediately rinse with plenty of cold water, then proceed further in accordance with the safety data sheets.

WARNING!

Warning against illegal operation

Observe national and local regulations.

Personnel:	■ Technical experts
Protective equipment:	■ Safety glasses ■ Chemically resistant safety gloves ■ Chemically resistant protective apron ■ Protective respirator, ambient air dependent
Special tool:	■ Approx: 3 m of hose with textile, d 19/27 mm, soft PVC #37041 ■ pH measurement instrument Provisionally pH indicator paper, however it is bleached by ClO_2! ■ Neutralising container - see table, "Dilution volume": It must exceed this volume. ■ Drinking water - see table for quantities ■ Sodium hydroxide solution NaOH 50 % (C, caustic) - see table for quantities ■ Hydrogen peroxide H_2O_2 30 % (Xi, irritating) - see table for quantities ■ Sodium perborate $NaBO_3$ * 4 H_2O - see table for quantities

1. Start / Stop the system using the *[Start/Stop]* key.
   ⇨ The message "Equipment OFF" appears.
2. Close the bypass shut-off valves upstream and downstream of the system.
3. Carefully place each of the suction lances upright its own container full with drinking water.
4. Make a tank available that contains the appropriate "dilution volume" for the reactor, taken from the table below.
5. Fill the tank with the amount of water corresponding to the "To be provided water quantity".
6. In it, dissolve the specified quantities of sodium hydroxide solution NaOH and hydrogen peroxide H_2O_2

   or sodium perborate $NaBO_3$ * 4 H_2O.
7. Connect the PVC hose to the rinse valve and lead in into the tank below the fluid level.
8. Open the rinse valve.
9. Follow the path *'Service ➔ Commissioning'*.
10. Set *'Bypass active manual'* to *'OFF'*.
    ⇨ The dosing pumps can also operate, via the *'Commissioning'* menu, without bypass monitoring.
11. Next change to the menu *'Commissioning'* under *'Fill reactor'* - see chapter *'Settings, Service'* - *'Commissioning.'*
    ⇨ The dosing pumps begin to pump.
12. If the PVC hose still contains yellow solution, then as soon as the dosing pumps have stopped, press *[F3]* so that rinsing can be continued.
13. As soon as rinsing is finished, open the shut-off valves in the bypass line.

14. Close the rinse valve and secure against unauthorised opening (padlock or cable ties ...).

Neutralising quantities

Type	Reactor volume	ClO_2 quantity	Dilution volume	Water quantity to be provided	NaOH 50 %	H_2O_2 30 %	$NaBO_3 * 4 H_2O$	
	l	s	l	l	ml	ml	s	ml
CDKc 150	1.4	28	5	3	98	21	182	105
CDKc 400	3.5	70	2	7	245	53	455	263
CDKc 900	7.5	150	25	16	525	113	975	546
CDKc 2000	17.5	350	58	37	1225	263	2275	1315
CDKc 2800	17.5	350	58	37	1225	263	2275	1315
CDKc 7300	43.8	876	145	92	3066	659	5694	3291
CDKc 12000	43.8	876	145	92	3066	659	5694	3291

1 table spoon of sodium perborate = 10 ... 15 ml = 15 ... 25 g

17 Disposal and transport

WARNING!

Only return the device for repair in a cleaned state and with hydraulic components - refer to the chapter "Decommissioning"!

Only send the unit complete with a filled in Decontamination Declaration form. The Decontamination Declaration constitutes an integral part of an inspection / repair order. A unit can only be inspected or repaired when a Decontamination Declaration Form is submitted that has been completed correctly and in full by an authorised and qualified person on behalf of the operator.

The "Decontamination Declaration Form" can be found in the Appendix or under *www.prominent.com*.

WARNING!

Danger due to toxic and corrosive chemicals

The Bello Zon® system could still contain hydrochloric acid (HCl), sodium chlorite ($NaClO_2$) and chlorine dioxide (ClO_2).

– The entire Bello Zon® system must be thoroughly rinsed through with water - see chapter 12 "Decommissioning". If necessary, also rinse the empty chemical canisters.

WARNING!

Danger from residual toxic chlorine dioxide

ClO_2 is drawn into PVDF parts, such as the reactor. It discolours this so it goes yellow.

– Place yellow discoloured PVDF parts in bright light (sunlight, halogen lamp) until the yellow colouring is removed.
  Rinse through the parts once more.
  Only then can they be transported.

WARNING!

Danger to persons and the environment

Pay special attention to chemicals, control unit electronic waste and the lithium batteries upon disposal.

– Observe the conditions which apply to your site.

WARNING!

Danger due to lithium battery.

If the lithium battery is mistreated or handled violently (heating, short-circuiting, crushing), it may be give off substances harmful to health and can heat up or explode!

– The battery must be removed from the control. It is clamped in a holder on the rear side of the housing upper section - see below.
– It must be disposed of separately from the device.

Removing the battery

1. Unscrew the four securing screws at the front on the housing upper section and take the housing upper section off from the housing lower section.
2. To remove the battery from the bracket, press on the flap of the holder - see figure.

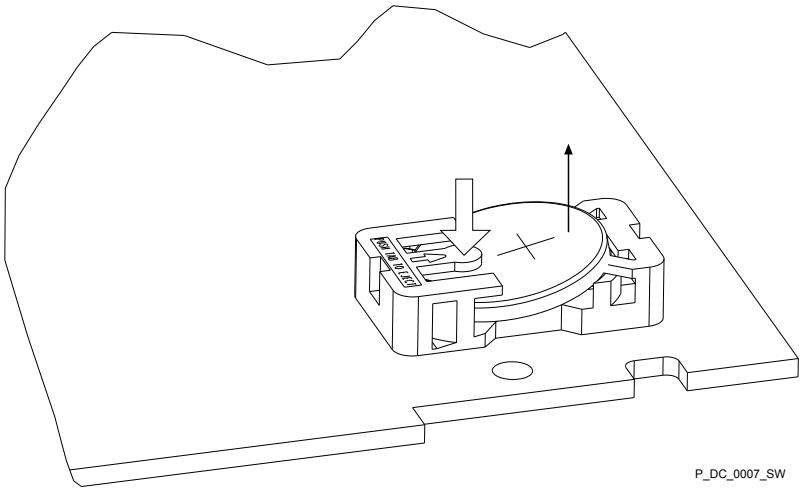


Fig. 23: Removing the battery

18 Glossary of technical terms

pH value

pH-value is a measure of the concentration (activity) of hydrogen ions or, put simply, is a measure of the acidity or alkalinity of water.

The pH value influences the corrosiveness: The corrosiveness of the water increases as the pH value decreases. Metallic materials can be attacked.

Calibration (sensor comparison)

All sensors differ from the theoretical values. Therefore a calibration must be carried out on the measuring transducer.

The slope of the sensor can change as a result of ageing and soiling.

Zero point

This refers to, for example, the current or voltage that a sensor emits in very pure water. The zero point of the sensor can change as a result of ageing and soiling.

Slope / sensitivity

This value is, for example, given in mA/ppm or mV/pH at 25 °C.

Control variable (measured value, actual value)

The control variable is the variable which is to be measured or recorded (e.g. ClO_2 concentration).

Setpoint

Set point refers to a value which is to be maintained at a constant level in the process by the controller (e.g. concentration ClO_2 = 0.30 ppm).

Disturbance variable

The control can, for example, process the signal of a flow measurement as a disturbance variable.

This disturbance value influences the production volume calculated by the controller dependent on this external signal.

Depending on the nature of the effect on the production volume, it is referred to either as a

- multiplicative disturbance variable (flow-proportional effect) or an
- additive disturbance variable (disturbance variable-related effect)

The disturbance variable signal exists as a 0/4 ... 20 mA signal.

When "commissioning", the zero point signal of the flow gauge has to be checked without flow (must be ≥ 0).

Multiplicative disturbance variable

CAUTION!

The multiplicative disturbance variable is not intended to permanently switch off the production volume.

– In this case you should realise deactivation via the pause function.

This type of disturbance variable processing is used, for example, with flow neutralisation.

The "Calculated Production volume" initially determined by the controller is influenced by the ratio "Actual Disturbance variable" to "Disturb. variable factor". The "Final Production volume" can at most equal 100 %:

Final production volume [g/h] = Calculated Production volume [g/h] * Actual Disturbance variable [%] / Disturb. variable factor [%]

Examples

Description	Unit	1.	2.	3.	4.
Calculated Production volume	g/h	0	50	50	50
Actual disturbance variable (transmitted via mA signal)	%	5	10	20	0
Disturb. variable factor (set in menu *'ClO2 production'*)	%	100	50	100	50
Final Production volume	g/h	0	10	10	0

Legend:

The "Calculated Production volume" is the Production volume which is issued by the controller without a disturbance variable.

If the ratio "Actual Disturbance variable" to "Disturb. variable factor" > 1, then the final Production volume can even be greater than the "Calculated Production volume"!

Additive Disturbance variable

The additive disturbance variable switch is suitable for metering tasks, in which the production volume is dependent in the first place on the disturbance variable (e.g. flow) and requires only minimal re-correction. This type of disturbance variable processing is used, for example, in the chlorination of water with approximately constant ClO_2 uptake.

A disturbance variable related base load metering value will be added to the first "calculated Production volume" determined by the controller. The Final Production volume can at most equal 100 %:

Production volume [g/h] = Calculated Production volume [g/h] + Max. Production volume [g/h] * Actual Disturbance variable [%] / Disturb. variable factor [%]

- *If there is no current interference variable (flow = 0), but a calculated Production volume of the PID control, then the final Production volume corresponds to the "calculated Production volume" of the PID control.*
- *If there is a current disturbance variable (flow > 0) and the "calculated Production volume" of the PID control equals "0", then the final Production volume corresponds to the 2nd term from the above formula.*

Examples

Description	Unit	1.	2.	3.	4.	5.	6.
Calculated Production volume	g/h	40	90	50	50	50	0
Actual disturbance variable (transmitted via mA signal)	%	5	5	2	10	20	5
Disturb. variable factor (set in menu *'ClO2 production'*)	%	100	50	100	50	100	10
Max. Production volume	g/h	120	120	120	120	120	120
Final Production volume	g/h	46	102	52.4	74	74	60

Legend:

The "Calculated Production volume" is the Production volume which is issued by the controller without a disturbance variable.

If the ratio "Actual Disturbance variable" to "Disturb. variable factor" > 1, then the Disturbance variable fraction of the Production volume can be greater than the "Max. Production volume"!

If there is no actual disturbance variable (flow = 0), but a calculated Production volume of the PID control, then the final Production volume corresponds to the calculated Production volume of the PID control.

If there is an actual disturbance variable (flow > 0) and the calculated Production volume of the PID control equals "0", then the final Production volume corresponds to the 2nd term from the above formula:

Max. production volume [g/h] * Actual Disturbance variable [%] / Disturb. variable factor [%]

Control variable

The variable (e.g. mA signal), which originates from an external system, is designated as the control variable so that the system output can be set using it.

Delay period tDelay(alarm, general)

In the event that a limit value is violated, the control will trigger an error message only after the delay set here. This means that brief limit value violations will not trigger an error message.

Delay period tDelay (Bypass survey)

If the flow exceeds the limit during production, a warning is generated without delay and the delay period starts to elapse. However, if the flow remains below the limit throughout the delay period and beyond, the control enters the condition "Production error".

Control

The control can be used as a P-, PI-, PD-, PID or 2 point control. This depends on the settings of the control parameters.

The control function (output of control variable) can be switched off by means of the "Pause control input".

Control variable calculation is resumed as soon as Pause is ceased.

There are the following types of controller:

P controller:

The setpoint is directly proportional to the deviation of the actual value from the set point.

PI controller:

In systems with continuous attrition a pure controller will never lead to the set point being achieved, as shortly before this point the setpoint is only just sufficient to compensate for the attrition, but to reach the set point. The I-part of the PI controller ensures that the setpoint is increased above that calculated by the P controller, should the set point not be reached within the reset time Tn.

The I-function is inactive with Tn=0.

PD controller:

The PD controller compensates the inertia that occurs in reaction to rapidly varying ratios. To do this, the controller determines the current speed of variation of the reading, and from this calculates the value that would result upon expiry of the derivative time Tv. The PD controller immediately sets the setpoint that the P controller would calculate from this future value.

The D-function is inactive with Tv=0.

PID controller:

The PID controller combines all three functions.

2 point control:

If the setpoint is exceeded by the "Switch diff.", the controller issues a control variable of 100 % for a reset process. As soon as the setpoint is exceed by the "Switch diff.", the controller sets the control variable back to 0 %.

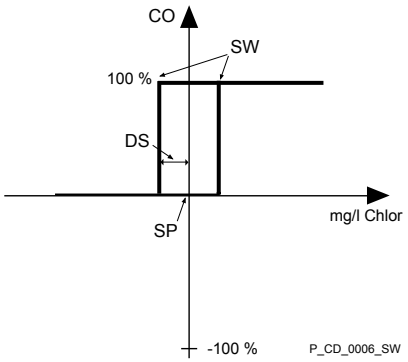


Fig. 24: 2 point control

CO Control variable
SW Switching points
DS Switch diff. =
SP Setpoint

Additive basic load

A basic load is added to the current actuating variable. The additive basic load means that, for example, constant attrition can be compensated for.

YGes = Yp + 15 %

Legend: additive basic load = 15 %

Limit values

"Lower lim" means that the limit criterion has been transgressed by dropping below the lower limit

"Upper lim" means that the limit criterion has been transgressed by exceeding the upper limit

Reaction system

If an alarm occurs, the system can react in different ways:

continue - The system does not switch off, but continues to work normally.

shutdown - The system switches off (error), if the condition clears, the system then continues working as it was working prior to the error.

p.shutdn - The system switches off permanently, i.e. it remains in the state "error", until the alarm is acknowledged. These alarms remain displayed until they are acknowledged.

Pause

When the Pause contact is closed, the control sets the control outputs to "0" provided the pause contact is closed. While the Pause contact is closed, the control determines the P factor; the I and the D factor are inactive.

Boost metering

If, from time-to-time, the installation requires a high dosing of ClO_2 solution, then reconfigure "Input dosing" to "High. dosing" in "Settings"-"Digital inputs". If a contact between the terminals of the "Input dosing" is closed (with "N/O" presetting), the control increases the ClO_2 concentration to that value, which was entered under "Settings"-"Control"-"ClO2 production"-"Controller". Simultaneously, the message "High dosage" appears in the continuous display. Moreover, the system must also be able to supply this concentration.

Upon opening of the contacts, the supplied concentration returns to the normal value.

Manual metering

If, from time-to-time, the installation requires a certain constant dosing of ClO_2 solution, then reconfigure "Input dosing" to "Man. dosing" in "Settings"-"Digital inputs". If a contact between the terminals of the "Input dosing" is closed (with "N/O" presetting), the control sets the ClO_2 concentration to that value, which was entered under "Settings"-"Control"-"ClO2 production"-"Manual". Simultaneously, the message "man. Dosing" appears in the continuous display. Moreover, the system must also be able to supply this concentration.

Upon opening of the contacts, the supplied concentration returns to the current value.

19 Chlorine dioxide hazardous substance data sheet

(The text is based on the hazardous substances data sheet issued by the Bundesvereinigung der Firmen im Gas- und Wasserfach e.V. FIGWA, 50968 Cologne, dated 16.4.1998.)

Properties of chlorine dioxide and instructions for handling aqueous solutions

The chlorine dioxide solutions used for water treatment have a concentration of ≤ 2 g/L ClO_2. At a temperature of up to 25 degrees C, this results in a chlorine dioxide concentration in the gas chamber of less than 100 g/m^3. Consequently, if preparation is carried out correctly, this will rule out explosive decomposition in both the gas chamber and in the stock solution.

19.1 Physical and chemical properties

19.1.1 Chemical characterisation

Aqueous solution of chlorine dioxide (ClO_2) ≤ 2 g ClO_2/L of physically dissolved chlorine dioxide gas

19.1.2 Properties of gaseous chlorine dioxide

Colour: Orange-yellow

Odour: Pungent

Melting point: - 59 ºC

Boiling point: 11 ºC

Stability:

Gaseous chlorine dioxide explosively decomposes at concentrations above 300 g/m^3(≅10 % by volume) into chlorine and oxygen.

Dilution reduces the explosive tendency; there is no longer a risk of explosion at concentrations below 10 % by volume in gases with which chlorine dioxide does not react (e.g. with air, nitrogen, carbon dioxide).

A concentration of more than 8 g/L of chlorine dioxide (at a temperature of 20 degrees C) has to be be reckoned with, for instance with a critical chlorine dioxide concentration in the gas chamber above an aqueous chlorine dioxide solution.

A severe to explosive-type reaction likewise occurs with oxidising substances.

19.1.3 Properties of an aqueous solution of chlorine dioxide

The gaseous phase is decisive.

Stability:

Without an upper gas compartment, aqueous chlorine dioxide solutions are explosive from a concentration of around 30 g/L, i.e. they can autonomously explosively decompose without any external influences, such as heat, sparks, dirt or rust.

Chlorine dioxide is stable over several days as an aqueous dilute solution, provided the solution is pure and stored in the dark or if the temperature of the solution remains below 25 degrees C and its pH value is less than 7.

19.2 Handling aqueous chlorine dioxide solutions

19.2.1 Labelling and characters

Label the workplace and surrounding area using characters conforming to the (German) Accident Prevention Regulation "Chlorination of Water" (GUV 8.15, appendix 3).

19.2.2 Storage

Chlorine dioxide cannot be stored or transported either as a gas or as concentrated aqueous solution due to its explosive nature. Therefore it is only produced as dilute (see point 1.1.3) aqueous solutions in special systems for immediate use.

19.2.3 Measures in the event of spillage, escape, gas leaks

Precipitate the gas with water spray.

Pour sodium thiosulphate solution over escaped solution, then dilute with lots of water and wash away into the drain system.

19.2.4 Measures in the event of fires

Chlorine dioxide itself is not combustible, however it acts in an oxidising manner. Explosive decomposition at temperatures greater than 100 degrees C. Cool storage tanks with water, precipitate any escaped chlorine dioxide gas with a water spray. **There are no restrictions with regard to fire extinguishing agents in the event of fires in the vicinity.**

19.2.5 Disposal

See point 1.2.3

19.3 Health protection

19.3.1 MAC value and odour threshold

MAC value: 0.1 ppm (mL/m^3) or 0.3 mg/m^3

Odour threshold: The odour of chlorine dioxide gas is perceptible above a concentration of around 15 mg/m^3 of air.

19.3.2 Personal protective equipment

Respiratory protection: Gas mask, filter B/grey

Eye protection: Safety goggles, face visor

Hand protection: Rubber gloves

Other: Protective clothing

19.3.3 Health hazards

A chlorine dioxide gas concentration of over 45 mg ClO_2/m^3 causes breathing difficulties and leads to irritation of the mucous membranes and headaches.

In general, chlorine dioxide causes considerable irritation in the areas of the mucous membranes of the eyes and breathing organs. Depending on the concentration and the duration of the effect, the results can include a danger of suffocation, coughing fits, including vomiting, conjunctivitis and severe headaches, in severe cases pulmonary oedemas with breathlessness, oxygen starvation symptoms and circulatory failures. In the event of very brief influence of very high concentrations, there is a risk of laryngospasm or reflective apnoea or cardiac arrest. Harmful to the nervous system (e.g. eye muscle paralysis).

19.3.4 First Aid

First aid

If clothing comes into contact with chlorine dioxide or its aqueous solution, immediately remove the clothing and thoroughly wash the skin with soap and lots of water.

Rinse any splashes into the eyes for several minutes under running water, keeping the eyes opened.

If chlorine dioxide is inhaled, keep the patient in fresh air, keep absolutely still, lie horizontally, keep warm.

Inform a doctor immediately, even if discomfort does not become immediately apparent. If necessary, transport quickly to a hospital using quick, but gentle transport.

19.4 More Information

DVGW Data Sheet W 624 " Chlorine dioxide metering systems", Edition 02/2012.

DVGW Worksheet W 224 "Chlorine dioxide in water treatment"

Accident prevention regulation "Chlorination of water" (GUV 8.15)

Ullmann Volume 5, Page 551

Kühn-Birett, Sheet C 20

Note:

The information is based on our state of knowledge at the time of these operating instructions going to print. It is intended to contribute to the safe handling of aqueous chlorine dioxide solution and, as such, does not have the purpose of ensuring certain properties. Automatic correction upon revision is not guaranteed, also legally non-binding.

This data should only be regarded as an initial starting point for operators. The operator should also himself obtain the latest information, especially safety information about chlorine dioxide solutions.

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