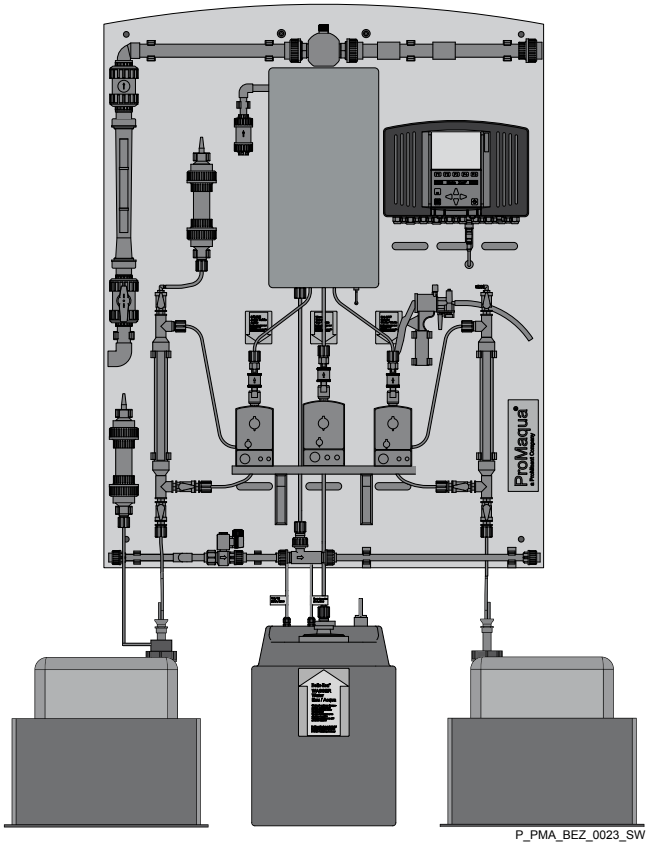
Operating instructions

Chlorine Dioxide Systems

Bello Zon® Type CDKc

Part 2



These operating instructions are only valid in conjunction with the "Operating instructions Chlorine dioxide systems Bello Zon® Type CDKc, Part 1“!

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.

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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 Identity code

CDK product range, version c								
CDKc	**Type**	**Capacity**						
02	CDKc 170	170 g/h						
04	CDKc 420	420 g/h						
06	CDKc 900	900 g/h						
08	CDKc 2100	2100 g/h						
10	CDKc 3000	3000 g/h						
12	CDKc 7500	7500 g/h						
	Version							
	P	ProMaqua						
	N	Neutral						
		Operating voltage:						
		A	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					
			00	Without bypass				
			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 with CDKc 170-900 g/h)				
			06	Bypass PVC-U for storage module, with water supply. 230 V (only with CDKc 170-900 g/h)				
			07	Bypass PVC-U for storage module, with water supply. 24 V (only with CDKc 170-900 g/h)				
				Ventilation unit				
				1	Without reactor housing with ventilation unit, with calibration device			
				3	With reactor housing with ventilation unit, with calibration device			
					Suction lance, suction assembly chemicals			
					0	None		
					2	Suction lances for 200 l-tank		
					3	Flexible suction assembly 5 m		
						Mechanical design		
						0	Standard	
							Preset language	
							DE	German
							EN	English
							FR	French
							IT	Italian
							ES	Spanish

CDK product range, version c																	
								Control									
								0	Base version								
								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						
											Certification						
											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.

ClO_2 is an exceptionally reactive gas, which is not stored due to its instability, rather must only be manufactured according to requirements at its location of use in special systems.

In contrast to chlorine, which is mainly used in drinking and industrial process water treatment systems, ClO_2 has a series of advantages. Thus for instance, the disinfection effect does not reduce with increasing pH-value as is the case with chlorine, rather remains constant across the entire pH-range normally encountered during water treatment.

ClO_2 remains stable in piping systems over long periods and provides from many hours up to days of microbiological water protection.

Ammonia or ammonium, which cause considerable chlorine loss, are not attacked by ClO_2 so that the dosed ClO_2 remains fully available for disinfection purposes. Chlorophenols, strongly smelling compounds, which result from the chlorination of water etc., are not formed with ClO_2. Trihalogenmethanes (THMs), a substance class, which, like their main representative, chloroform, are suspected of being carcinogens, result from the reaction of chlorine with dissolved matter naturally found in water (humic acids, fulvic acids, etc.). Where ClO_2 is used as an alternative, these substances do not arise.

In most applications, dosing is quantity-proportional, i.e. flow-dependent on the signal from an inductive flow meter or a contact water meter or parallel to a feed pump.

For circulation systems such as bottle rinsing machines, cooling circuits, etc., in which a ClO_2 loss need solely be made-up, the addition can also be controlled in a quantity-dependent manner using a chlorine dioxide or ORP potential measurement.

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.

As with every disinfection technology, the interfering dissolved matter in the water and the overall treatment must also be taken into account with ClO_2. ProMinent benefits from its experience from globally executed chlorine dioxide installations in may 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

Explanation of the safety information

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

Signal word	Meaning
WARNING!	This combination of symbol and signal word indicates a possible dangerous situation that can result in death or serious injury if it is not avoided.
CAUTION!	This combination of symbol and signal word indicates a possible dangerous situation that can result in minor injury if it is not avoided.
NOTICE!	This combination of symbol and signal word indicates a possible dangerous situation that can result in material and environmental damage if it is not avoided.

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 operate the chlorine dioxide Bello Zon® CDV without diluting water! Otherwise poisonous ClO_2 gas forms abruptly and then decomposes explosively within the reactor!**
3. - **The bypass water must never be exposed to a vacuum pressure! Otherwise the ClO_2 solution in the reactor is placed under a vacuum, the ClO_2 outgasses, forms a richer mixture and can decompose explosively!**

Correct and proper use

- The Bello Zon® CDK system is intended solely for producing a ClO_2 containing disinfectant solution from hydrochloric acid, sodium chlorite solution and diluting water and then for dosing it into a bypass line together with water.
- Any other uses or modifications to the system are prohibited!
- Die Bello Zon® system is not designed for treating liquids (other than water) or gaseous media as well as substances with ClO_2!
- The system must not be operated under conditions other than those described in the technical data!
- Do not allow untrained personnel to operate the Bello Zon® system! All other activities should only be carried out by trained and authorised personnel, see the following table!
- You are obliged 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 system's service life!

Qualification of personnel

WARNING!

According to accident statistics, holiday replacements are a safety risk.

– Holiday replacements must also hold the named qualifications and have been instructed accordingly.

Activity	Qualification level
Installation, installation of hydraulic system	Technical personnel
Electrical installation	Electrician
Initial commissioning	Customer service - authorised by ProMaqua
Start up	Technical experts
Operation, canister replacement	Instructed personnel
Maintenance, repair	Customer service - authorised by ProMaqua
Decommissioning, disposal	Technical experts
Troubleshooting	Customer service - authorised by ProMaqua, technical experts, instructed personnel (fault-dependent)

Explanation of the terms:

Technical experts

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

Qualified personnel

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

Instructed personnel

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.

Customer Service department

Customer service refers to service technicians who have received certificated training and have been authorised by ProMaqua® to work on the system.

Personal protective equipment

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

Safety Equipment

Which safety equipment is available and how it is tested, is contained in the "Start up" chapter.

Safety information

WARNING!

Danger from incorrect operation

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

– The operating personnel must be instructed by a ProMinent service technician. (Undertaken during initial commissioning.)
– The operating instructions must be available by the system.

WARNING!

Danger due to toxic and explosive ClO_2 gas

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

– To overcome this, for example, install a gas detector which switches off the system if ClO_2 gas escapes and triggers an alarm that is readily apparent from a distance. This ensure that save operation is possible with every ClO_2 system.

NOTICE!

Warning of illegal operation

Observe the regulations that apply where the device is installed.

Instructions for entering a room in which a chlorine dioxide system is 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.
- If there is a smell of chlorine dioxide, immediately switch off the system from a safe position, e.g. emergency stop switch, which is installed at a distance from the system.

Note for the system operator

Keywords when searching for the necessary regulations:

- Chlorine dioxide systems
- Chlorine dioxide (possibly chlorination as well)
- Drinking water

- Hydrochloric acid
- Sodium chlorite
- Storage
- Dangerous substances
- Personal protective equipment

Information in the event of an emergency

- You have already come into contact with acid: See the "EC acid safety data sheet" provided by the supplier!
- You have already come into contact with chlorite: See the "EC chlorite safety data sheet" provided by the supplier!
- You have come into contact with ClO_2 solution or ClO_2 gas: See data sheet "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! See also the data sheet "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 lots of water and wash away into the drain. See also the data sheet "Chlorine dioxide hazardous substance data sheet: Properties of chlorine dioxide and instructions for handling aqueous solutions" in the operating instructions, part 2, appendix!
- The Bello Zon® system was started without diluting water and the dosing 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 brigade, explaining about the risk of an explosion due to concentrated ClO_2 gas! ClO_2 gas can still explode after several hours! See also the data sheet "Chlorine dioxide hazardous substance data sheet: Properties of chlorine dioxide and instructions for handling aqueous solutions" in the operating instructions, part 2, appendix!
- The Bello Zon® system was supplied with concentrated chemicals and the dosing pumps have not yet started to pump: immediately switch the Bello Zon® system to *„dosing OFF“* (*[Start/Stop]*)! Only start the system as soon as trouble-free operation of the diluting pump is ensured.

Sound Pressure Level

The sound pressure level is < 70 dB (A)

at a maximum stroke length, maximum stroke rate, maximum counter pressure (water) according to:

DIN EN 12639 (Noise testing on liquid pumps).

4 System overview

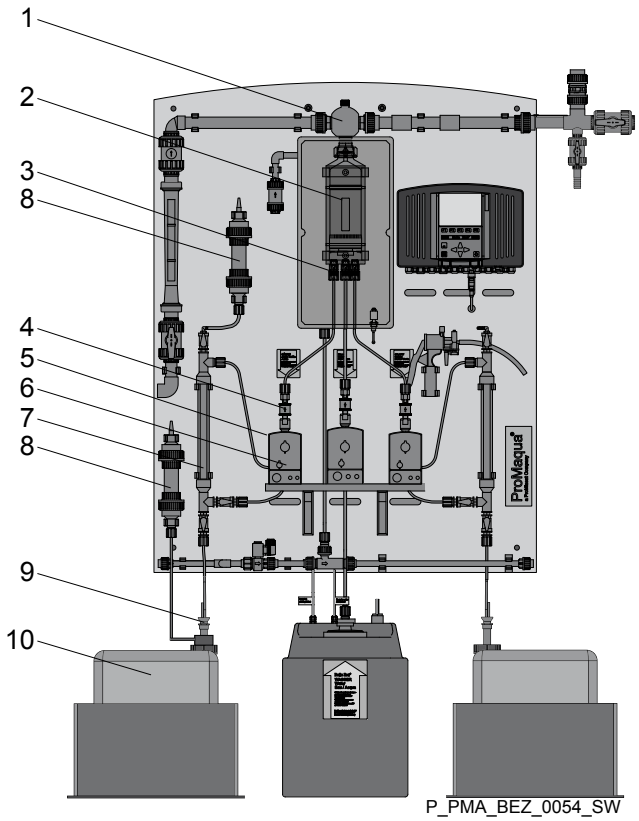


Fig. 2: Device parts for the acid metering line of the ClO_2 production system

1 Reactor outlet valve
2 Reactor
3 Reactor input valve acid
4 Dosing control acid
5 Bleed valve acid
6 /Acid dosing pump
7 Acid calibration device
8 Acid vapour separator
9 Acid suction lance with foot valve and level switch
10 Acid in chemical canister (accessories)

For the sake of clarity, only device parts of the acid metering line are identified.

The corresponding device parts for the chlorite metering line are always located in a mirror image fashion to the outer right of the corresponding acid device part.

The corresponding device parts for the water metering line are always located between the corresponding acid and chlorite device parts.

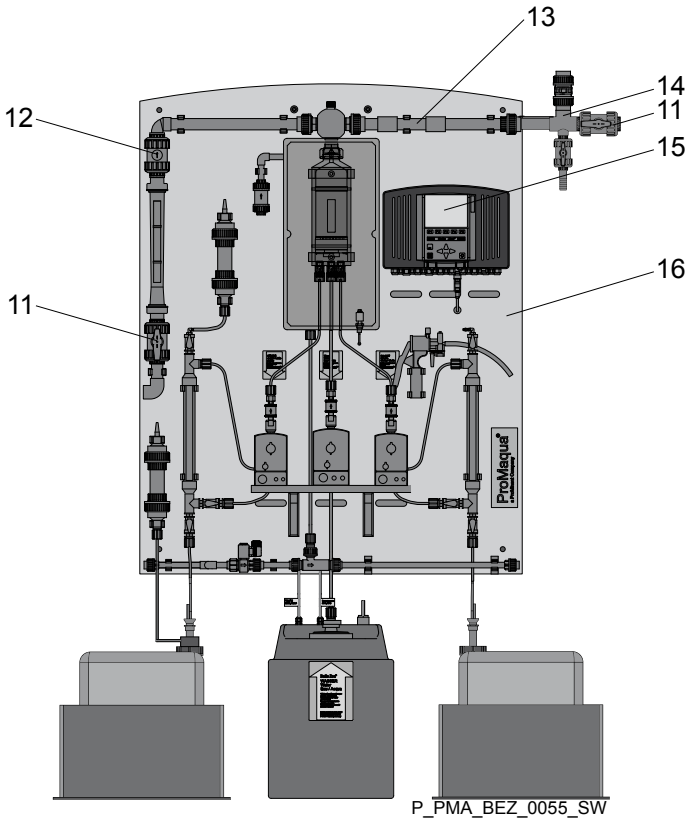


Fig. 3: Device parts of the CDKc without the device parts of the preceding figure

11	Bypass line stopcock
12	Non-return valve
13	Mixer
14	Flushing equipment with vacuum relief valve
15	Control
16	Panel
not shown	Danger signs
not shown	CDV fitting kit

5 Functional description

5.1 Chemical principle behind the systems

Operate the chlorine dioxide Bello Zon® system according to 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®CDV systems produce a 2 % chlorine dioxide solution (20 g/l ClO_2) at temperatures of at least 10 °C (15 °C for CDVc 3000 and 7500) through the combination of dilute hydrochloric acid and dilute sodium chlorite solution.

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

5.2 System operating principle

General description

Two metering pumps dose the acid, water and chlorite into the reactor. Here the components react to produce ClO2 solution.$_2$solution. The metering pumps are simultaneously used to transport solution from mixing via the reactor outlet valve into the bypass. A mixer is connected downstream of the reactor outlet valve which mixes the ClO_2solution homogeneously with the bypass water. At the point of injection, the diluted ClO_2eaches the main water flow and dilutes itself further to the final effective concentration which applies to the process.

In the "bypass version" - "bypass PVC-U for storage module", the "Water supply" module (comprising shut-off valve, filter, pressure reducer, solenoid valve, water meter and needle valve) supplies the bypass line with fresh water. Instead of entering the main water flow, the ClO_2solution enters a storage tank ("storage module"), from which several injection points can be supplied.

The control calculates the stroke rates for the metering pumps from the transported ClO_2output and, where necessary, from a current stroke rate. Moreover, it interprets the sensor signals from the safety equipment and if necessary switches the metering off.

Control types

The Bello Zon®system (the ClO_2output) can be controlled in for different ways:

- Manually (using the control alone)
- Proportionally to the flow (via a water meter)
- In proportion to the quantity (via ClO_2sensor)
- Control variable dependent (via external control variable, e.g. from the control room)

Definitions

– *"System" comprises the totality of the control for the Bello Zon®system and everything located on its panel.*
– *The "control" refers to the control in the housing on the panel of the Bello Zon®system.*

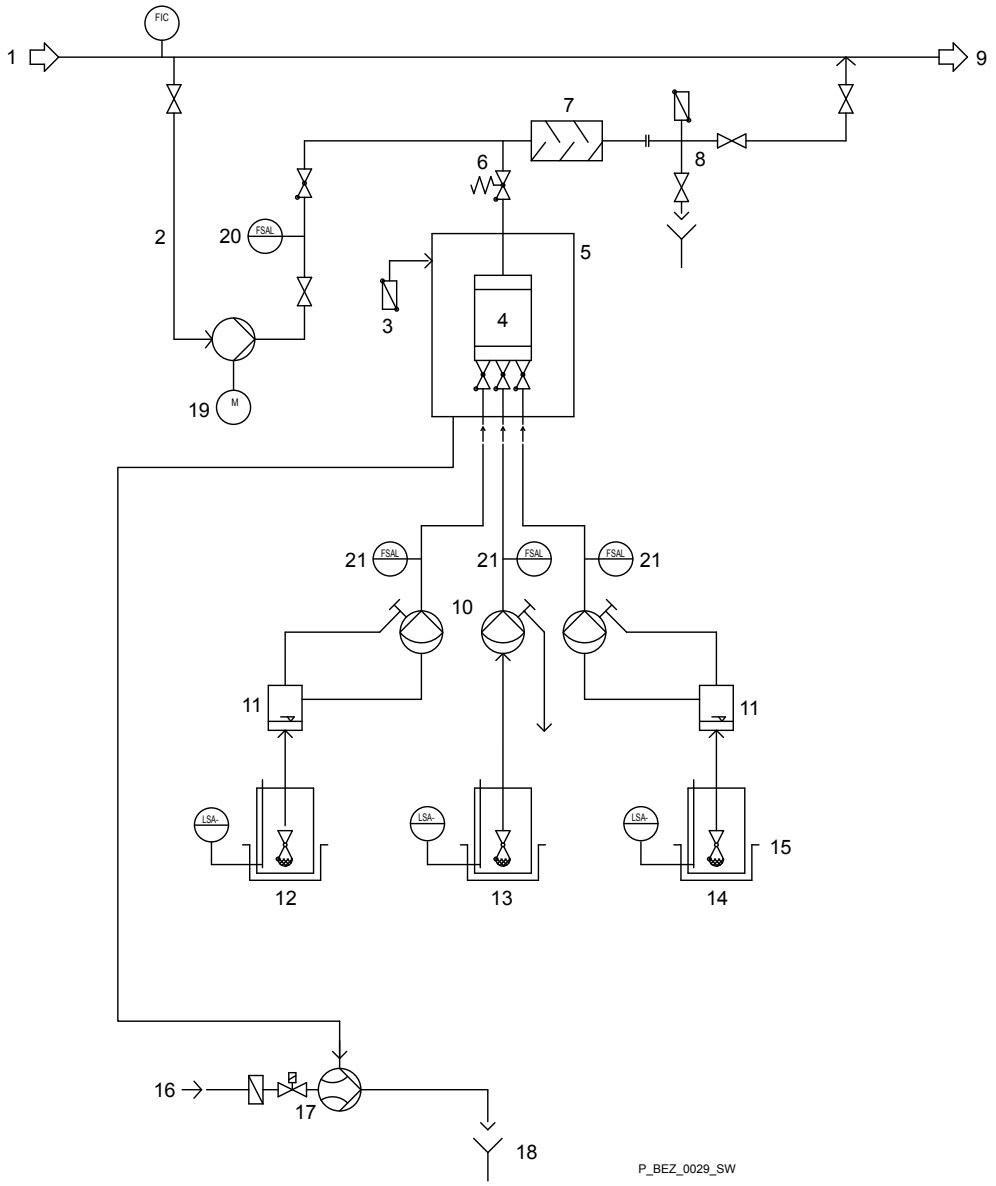


Fig. 4: Hydraulic drawing CDKc in bypass operation

1 Water to be prepared
2 Bypass
3 Ventilation (option)
4 Reactor outlet valve
5 Reactor housing (option)
6 Reactor
7 Mixer
8 Flushing equipment with vacuum relief valve
9 Water to be treated
10 Metering pumps
11 Calibration equipment
12 Acid
13 Water
14 Chlorite
15 Safety bund, recommended (option)
16 Drinking water, 1 ... 6 bar
17 Extraction reactor housing (option)
18 Waste water
19 Bypass pump (option)
20 Bypass monitoring
21 Stroke sensor dosing pumps

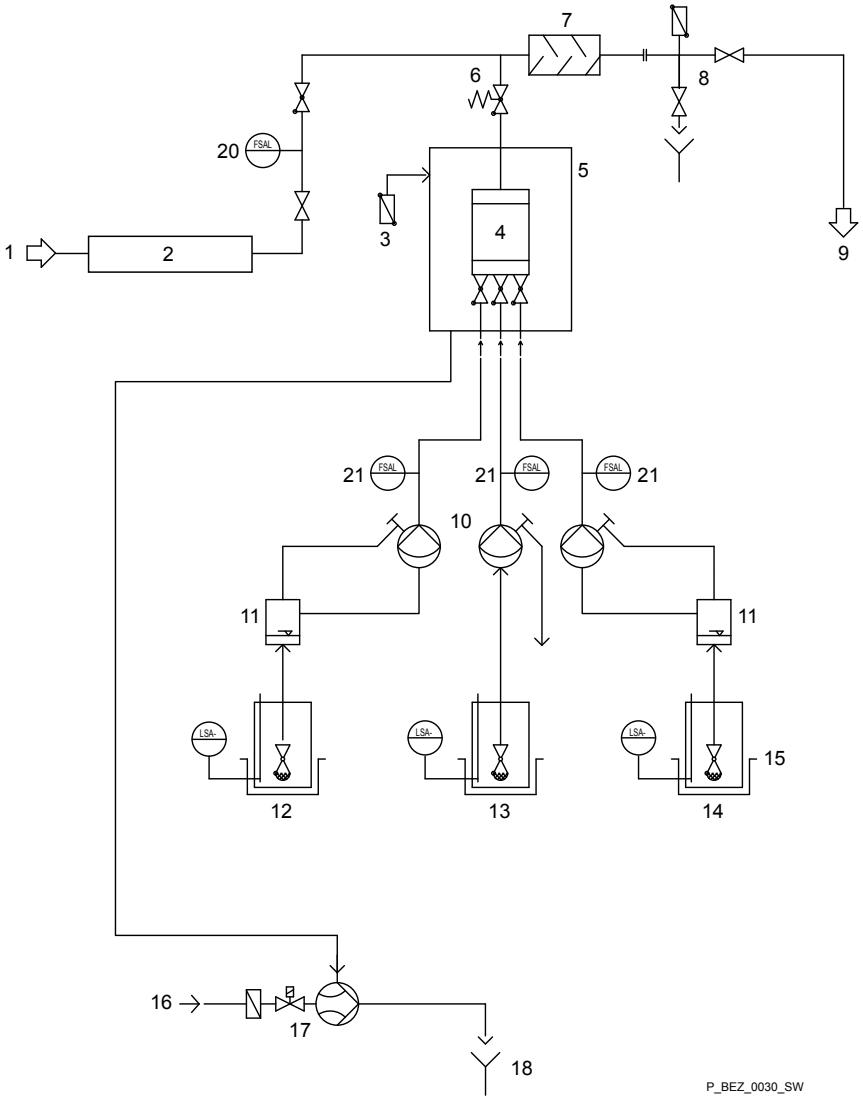


Fig. 5: Hydraulic diagram CDKc for the storage module version

1	Water to be prepared	11	Calibration equipment
2	"Water supply" module	12	Acid
3	Ventilation (option)	13	Water
4	Reactor outlet valve	14	Chlorite
5	Reactor housing (option)	15	Safety bund, recommended (option)
6	Reactor	16	Drinking water, 1 ... 6 bar
7	Mixer	17	Extraction reactor housing (option)
8	Flushing equipment with vacuum relief valve	18	Waste water
9	Storage tank	20	Bypass monitoring
10	Metering pumps	21	Stroke sensor dosing pumps

5.3 Safety Equipment

The description of the safety equipment is at the end of the chapter "Start up".

5.4 Control elements and buttons

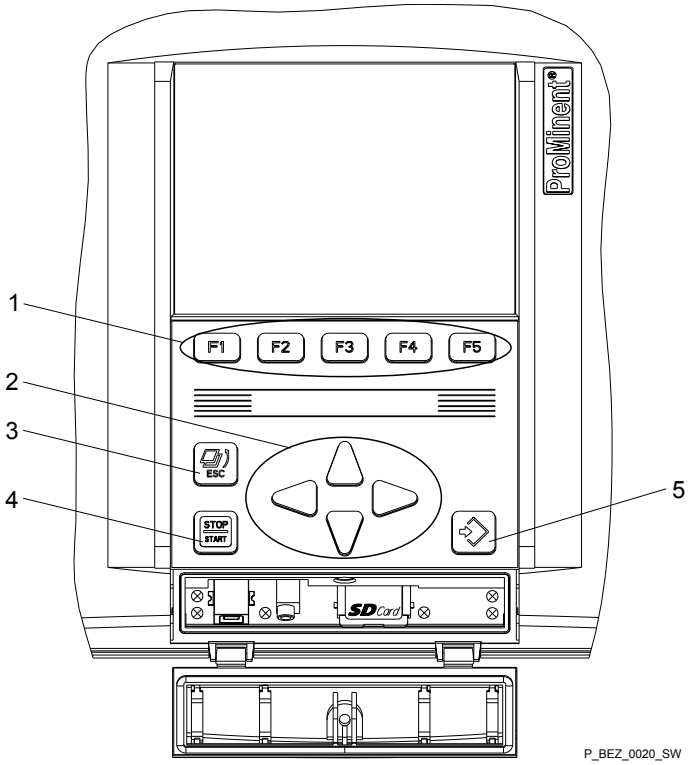


Fig. 6: The keys

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

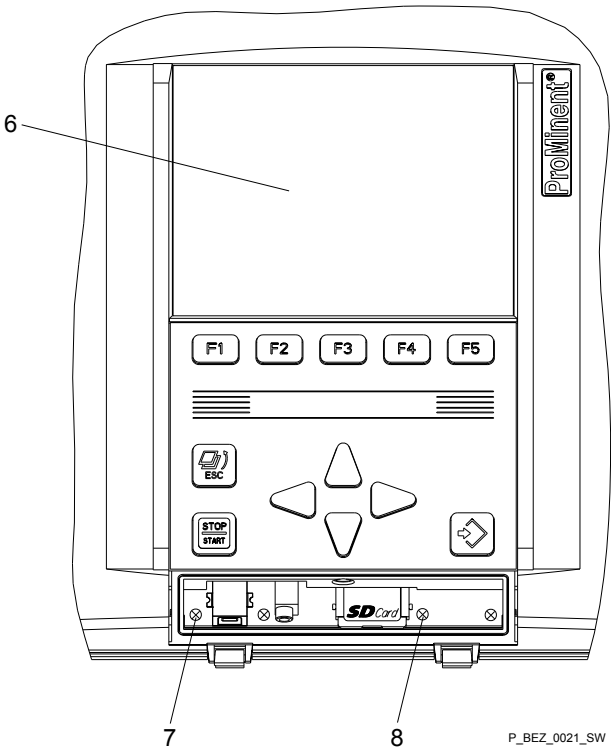


Fig. 7: The displays

6 LCD display
7 Devices LED
8 CAN 1-LED

5.5 Functions of the buttons

5.5.1 System control

START/STOP key

The [START/STOP] key is used to:

- Start the entire system. Key *[START/STOP]* Press for 3 s: *„Production off“* - *„System on“*
- Stop the entire system. Key *[START/STOP]* press: *„Production off“* - *„Equipment OFF“*

5.5.2 Navigation within the operating menu

[ENTER] key

The [ENTER] key is used to:

- Navigate from menu item to menu item in the operating menu - into deeper tiers of the operating menu.
- to make a selection of a menu item and confirm a change.

[ESC] key

The [ESC] key is used to:

- Navigate from menu item to menu item in the operating menu - upwards into higher tiers of the operating menu.

– *To return from any menu item of the operating menu back to the continuous display, either press [F1] HOME or repeatedly press the [ESC] key 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]

The arrow keys [UP], [DOWN], [LEFT], [RIGHT] are used to:

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

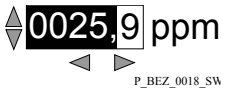


Fig. 8: Changing a numerical value

Function keys [F1] to [F5]

The function keys, *[F1]* to *[F5]* to which varying allocations can be made, are used to select menus or functions, which are displayed as keys in the display (e.g. menus *„SET“*(to set), *„CALIB“*(rate) or the function *„SAVE“*(accept)).

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

– Only the function *„SAVE“*can be used to save the menu settings.
– Individual numerical values such as in *„TIME“* or *„DATE“* are saved using the key *[ENTER]* .

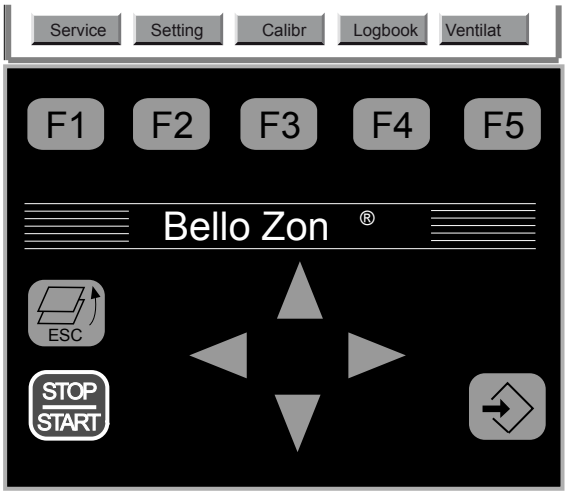


Fig. 9: Example assignment of the function keys

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

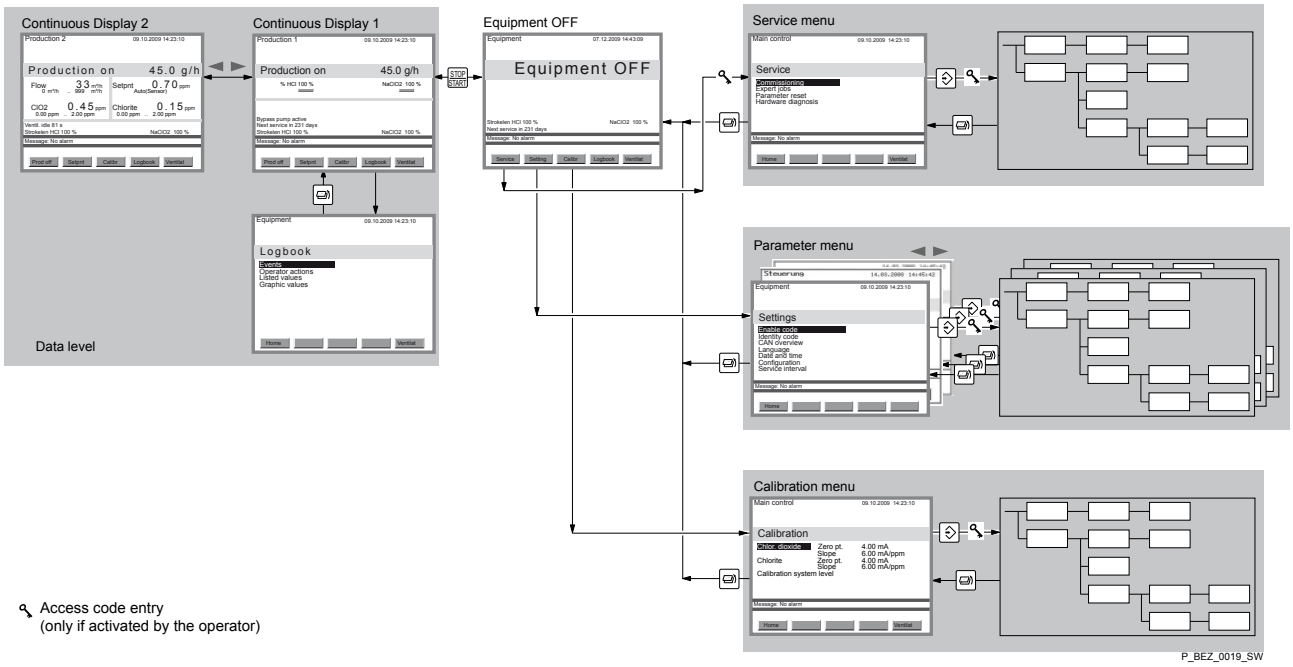


Fig. 10: Operating menu, schematic

The display „System 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:

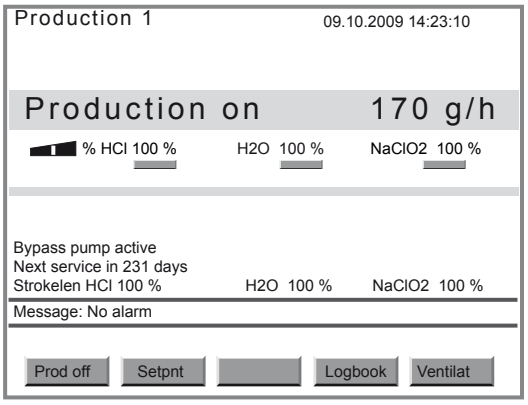
Name	Enables ...	Access code
User code	Enables functions which trained personnel must use in their day-to-day work.	Factory setting: 5005, can be changed in "Settings" - "System info".
Expert code	Enables additional functions which technical experts must use in their day-to-day work.	Is only provided 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)



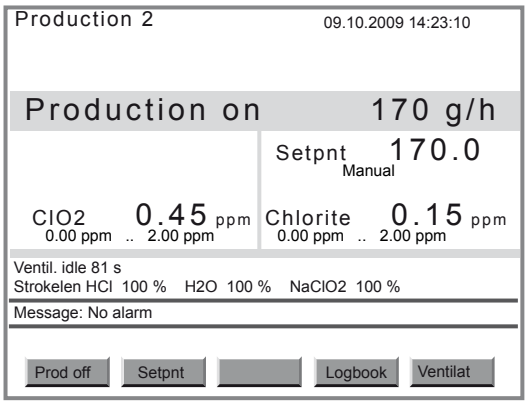
For example the "Continuous display 1" (Production 1") indicates:

- 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
- Remaining suction time
- Supply water filling time
- 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
- View the log book (option)
- Extract escaped gases out of the reactor housing (if the function exists)
- Acknowledge the beeper

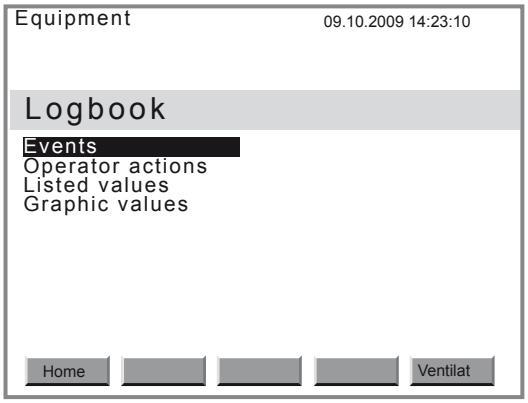
"Continuous display 2" (Production 2)



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
- Graphic values for the listed values

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 - Water 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
- Equipment on
- Production off

Listed values

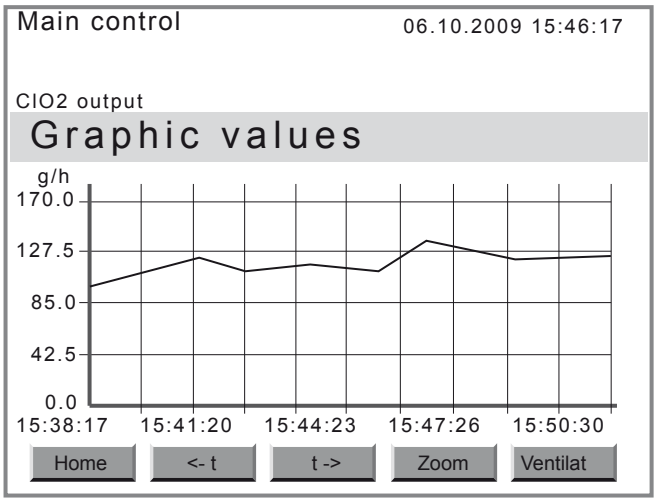
The menu *„Listed values“* lists the date, time and the measured values - independent of the system settings. For example this may be:

- ClO2 output
- ClO2 concentration
- Flow value

Graphic values

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

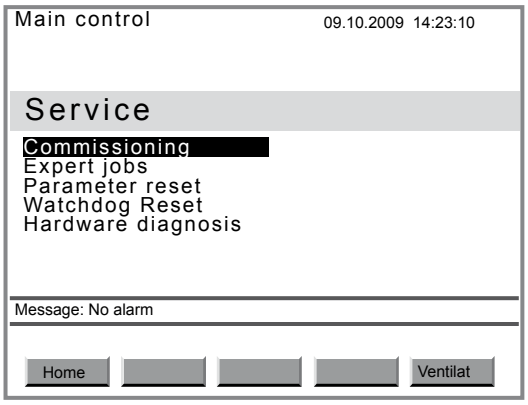
To adjust the control, the system must be "OFF" (key *[START/STOP]*) – the display *„Equipment OFF“* appears. Then the control does not actuate the pumps and ignores all input signals.

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

- *„SERVICE“*-Menu - see chapter ↳ *Chapter 7 „Setting, Service“ on page 26*
- *„SET“*-Menu - see chapter ↳ *Chapter 8 „Setting, settings“ on page 32*
- *„CALIB“*(rate)-menu - see chapter ↳ *Chapter 9 „Setting, Calibration“ on page 58*

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

7 Setting, Service



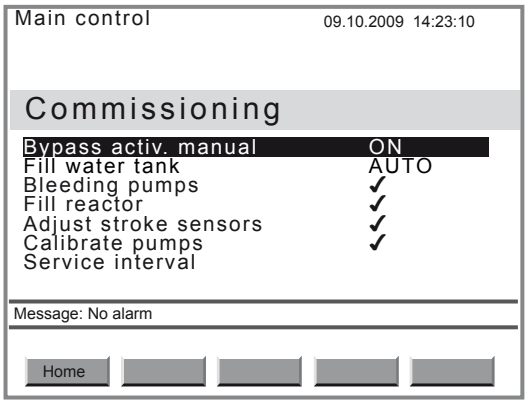
This menu contains the submenus:

1 - Commissioning: During start up, this menu must be run through - see *Chapter 7.1 „Commissioning“ on page 26*

2 - Expert jobs: Contains functions for working on the pumps - see *Chapter 7.2 „Expert jobs“ on page 29*

3 - Parameter reset: only for customer service - see *Chapter 7.3 „Parameter Reset“ on page 31*

7.1 Commissioning

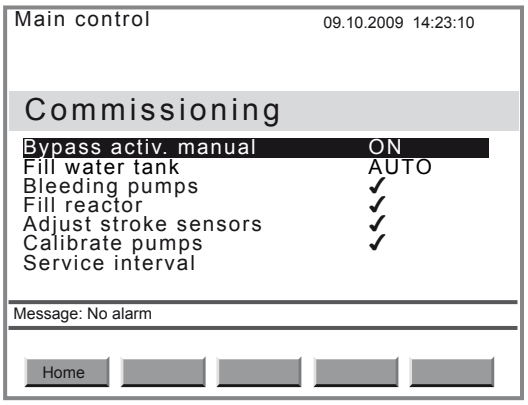


During start up, this menu must be run through.

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.

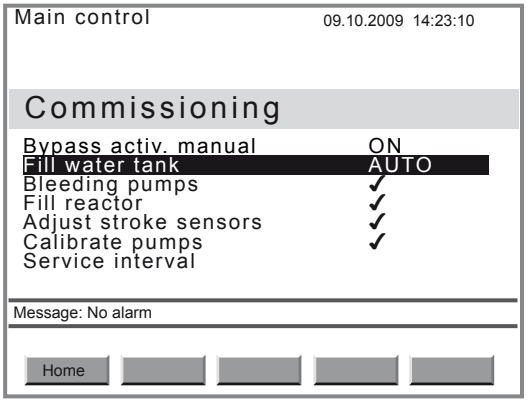
7.1.1 Bypass activ. manual



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

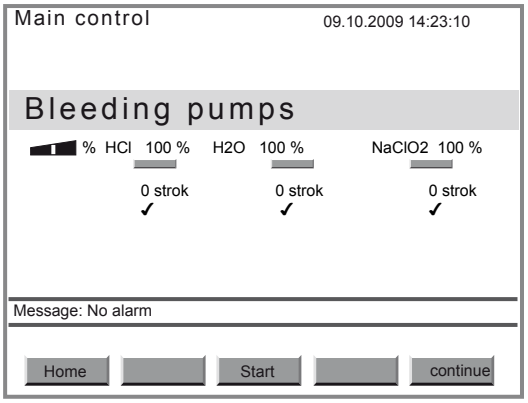
Outside this menu, the setting has no effect.

7.1.2 Fill water tank



This menu is used to permit automatic or manual filling of the water tank.

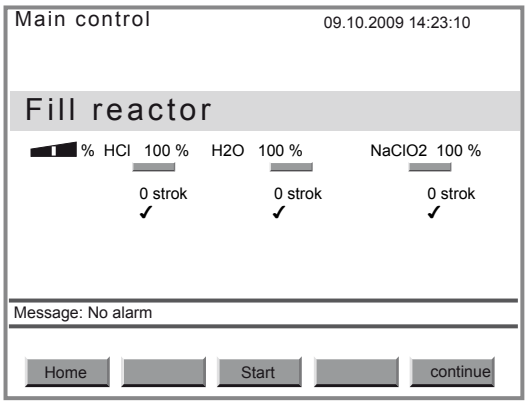
7.1.3 Bleeding pumps



This menu is used for bleeding the dosing pumps.

For more information see the "Start up" chapter.

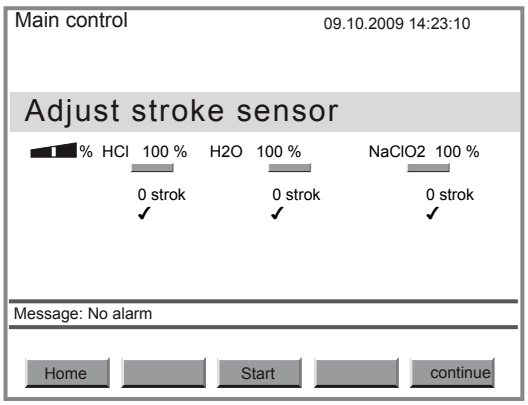
7.1.4 Fill reactor



This menu is used for filling the reactor tank.

For more information see the "Start up" chapter.

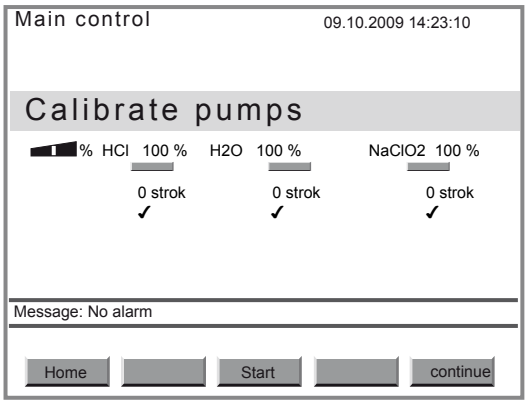
7.1.5 Stroke sensor adjust



This menu is used to adjust the stroke sensors.

For more information see the "Start up" chapter.

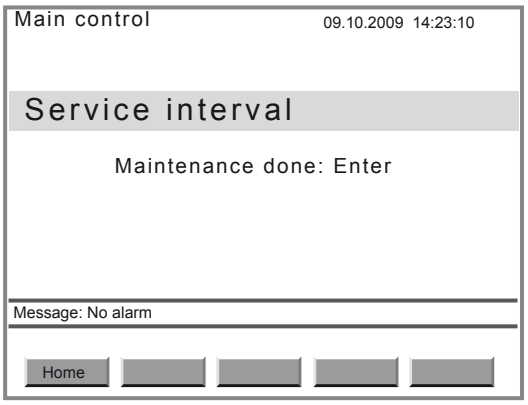
7.1.6 Calibrate pumps



The dosing pumps must be calibrated via this menu.

For more information see the "Start up" chapter.

7.1.7 Service interval



Confirmation of the annual service must be carried out via this menu using the *[ENTER]* key, so that the system is re-enabled and the day countdown of the annual service interval is restarted.

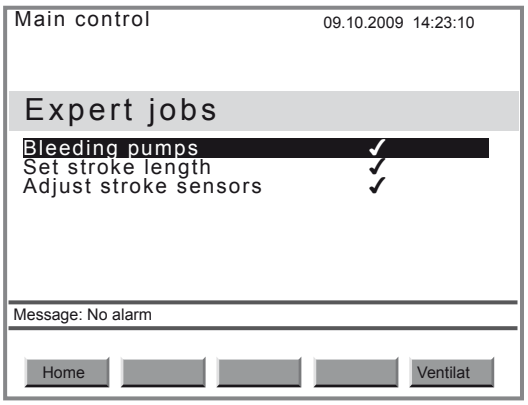
WARNING!

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

– The *[ENTER]* key must not be pressed as a consequence of work other than the annual service being carried out.

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:

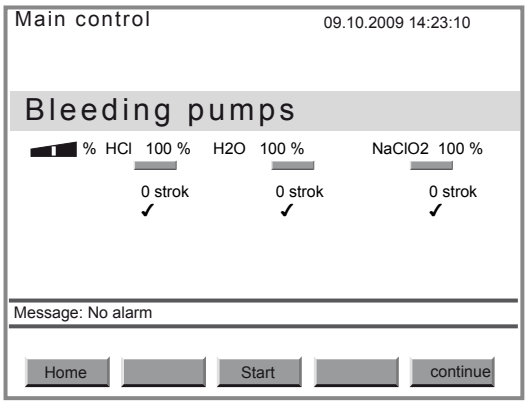
1 - Bleeding pumps - see *Chapter 7.2.1 „Bleeding pumps“ on page 30*

2 - Set stroke length - see *Chapter 7.2.2 „Set stroke length“ on page 30*

3 - Adjust stroke sensors - see *Chapter 7.2.3 „Adjust stroke sensors“ on page 31*

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

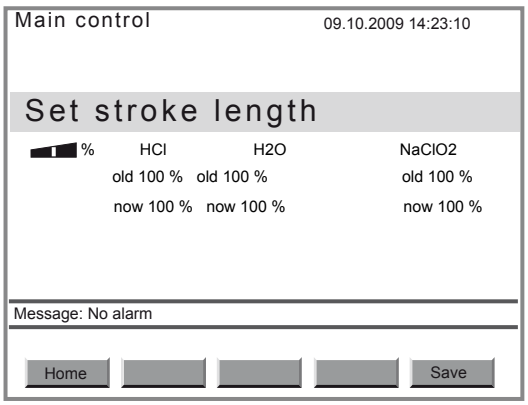
7.2.1 Bleeding pumps



This menu is used for bleeding the dosing pumps.

For more information see the "Start up" chapter.

7.2.2 Set stroke length

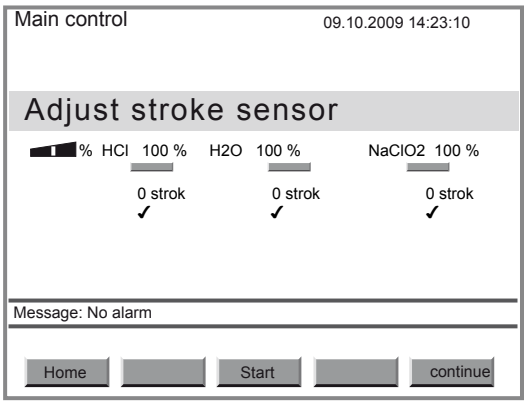


This menu must be used to adjust the stroke lengths, so that the set data are transferred to the control.

- *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.

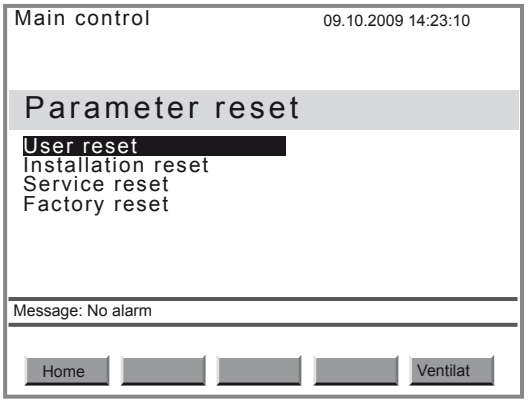
7.2.3 Adjust stroke sensors



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:

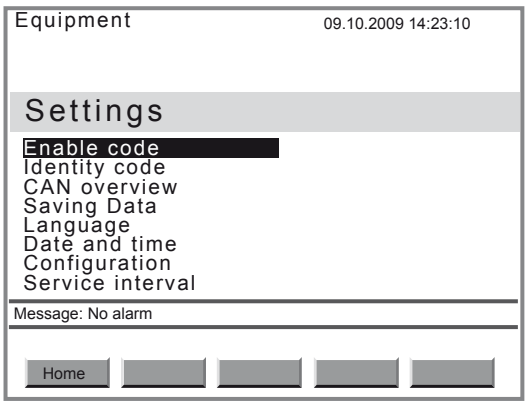
1 - *„Equipment“ Chapter 8.1 „Equipment“ on page 32*

2 - *„Control“ Chapter 8.2 „Control“ on page 37*

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 arrow keys *[LEFT]* and *[RIGHT]* .

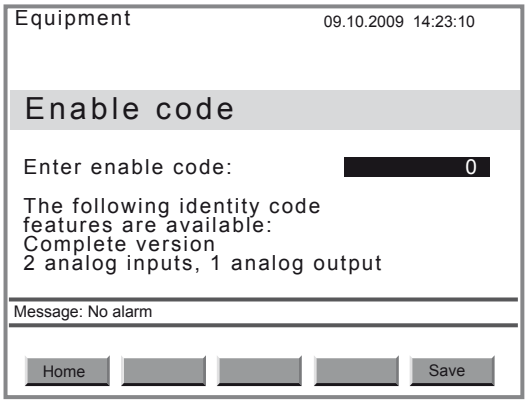
8.1 Equipment



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

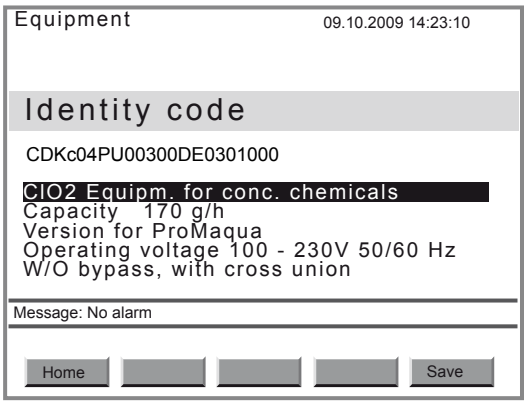
- *„Enable code“ Chapter 8.1.1 „Enable code“ on page 32*
- *„Identity code“ Chapter 8.1.2 „Identity code“ on page 33*
- *„CAN overview“ Chapter 8.1.3 „CAN overview“ on page 33*
- Saving Data *Chapter 8.1.4 „Saving Data“ on page 34*
- *„Language“ Chapter 8.1.5 „Language“ on page 34*
- *„Date and time“ Chapter 8.1.6 „Date and time“ on page 35*
- *„Configuration“ Chapter 8.1.7 „Configuration“ on page 35*
- *„Service interval“ Chapter 8.1.8 „Service interval“ on page 36*

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

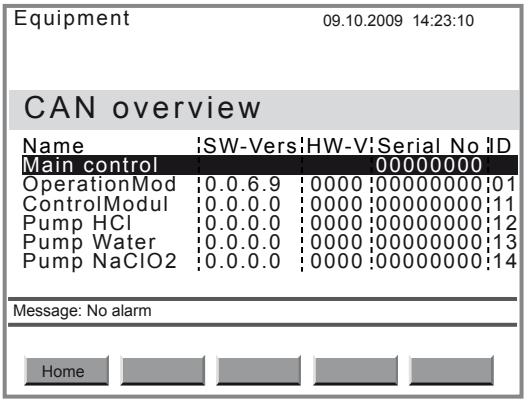
8.1.2 Identity code



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:

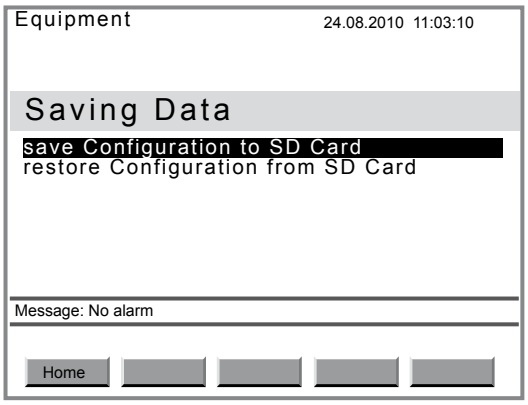
- Software version
- Hardware version
- Serial number
- Node ID

The serial number of the control is also the serial number of the system.

This menu is also used to change the User code.

1. In the menu *„CAN overview“* press key *[P]* .
   ⇨ The sub-menu *„Control“* appears.
2. Change to menu item *„User code“* and press key *[P]* .
3. If necessary, change the access code using the *[arrow keys]* and press key *[P]* .
4. Accept the new User code using *[F5 Save]* .
   ⇨ Confirm the request *„Save changes? Yes = ENTER“* by pressing the *[ENTER]* key.

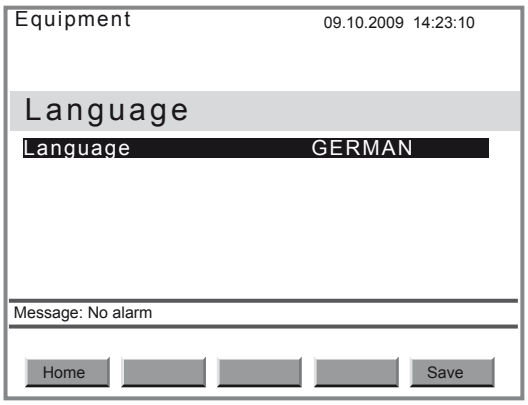
8.1.4 Saving Data



From here it is possible to save parts of the system configuration, such as the identity code, on an SD card.

This menu is also used to update the software.

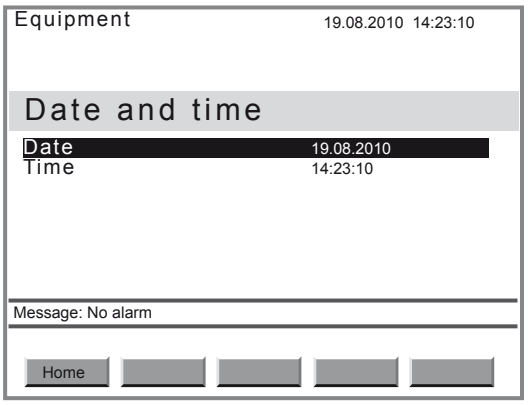
8.1.5 Language



The user interface language can be changed here.

Parameter	max.	min.	Factory setting	Code	Remarks
Language	German		Depending on identity code	none	
	English				
	French				
	Italian				
	Spanish				
	Czech				

8.1.6 Date and time



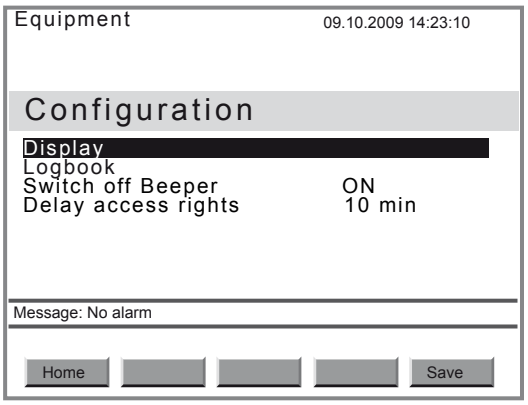
This menu is used to set the date and time for the control.

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



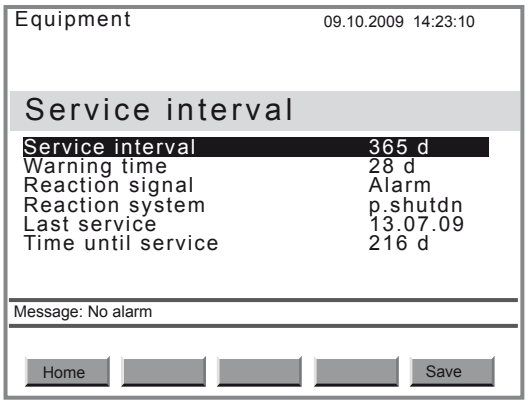
This function is used to configure:

- Display
- Logbook
- 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	

Parameter	max.	min.	Factory setting	Code	Remarks
Dim time	99 min	0 min	5 min	none	To extend the service life of the display
Logbook					
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 Service interval



The following points can be adjusted here:

- Service interval
- Warning time
- Reaction signal
- Reaction system

The following points are for information only:

- Last service
- Time until service

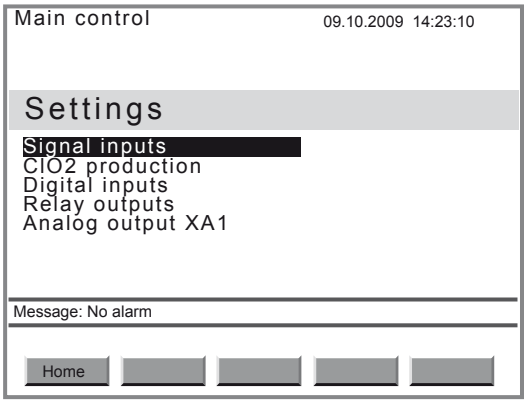
Parameter	max.	min.	Factory setting	Code	Remarks
Service interval					
Service interval	999 d	0 d	365 d	Service code	
Warning time	999 d	0 d	28 d	Service code	Warning signal before the next service interval
Reaction signal	Alarm Warning Info n.exist.		Alarm	Service code	Reaction signal
Reaction system*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

Parameter	max.	min.	Factory setting	Code	Remarks
	shutdown continue				

* 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 37

2 - *„ClO2 production“* Chapter 8.2.2 „ClO2 production“ on page 45

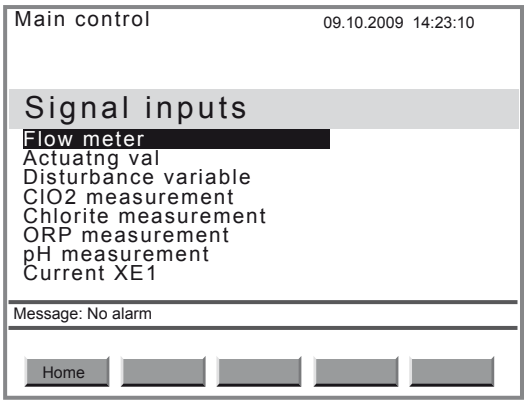
3 - *„Digital inputs“* Chapter 8.2.3 „Digital inputs“ on page 54

4 - *„Relay outputs“* Chapter 8.2.4 „Relay outputs“ on page 56

5 - *„Analog output XA1“* Chapter 8.2.5 „Analog output XA1“ on page 56

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

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 38

2 - *„Setpoint“* Chapter 8.2.1.2 „Setpoint“ on page 39

3 - *„Disturbance variable“* Chapter 8.2.1.3 „Disturbance variable“ on page 40

4 - *„ClO2 measurement“* Chapter 8.2.1.4 „ClO2 measurement“ on page 40

5 - *„Chlorite measurement“* Chapter 8.2.1.5 „Chlorite measurement“ on page 41

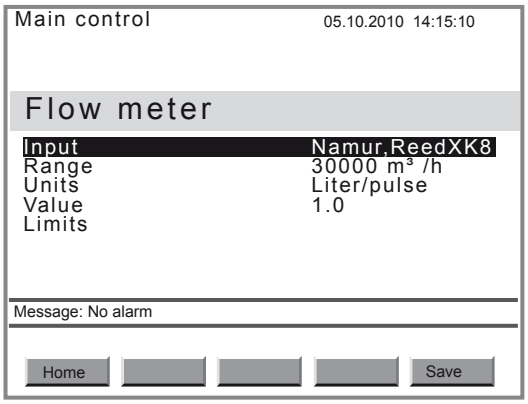
6 - *„ORP measurement“* Chapter 8.2.1.6 „ORP measurement“ on page 42

7 - *„pH measurement“* Chapter 8.2.1.7 „pH measurement“ on page 43

8 - *„Current XE1“* Chapter 8.2.1.8 „Current XE1 / XE2“ on page 44

9 - *„Current XE2“*

8.2.1.1 Flow meter



This menu contains the following flow meter menu items:

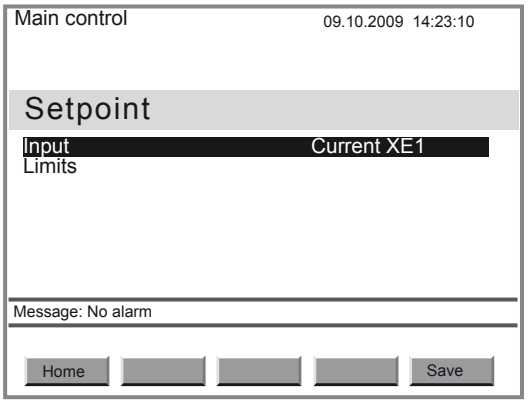
- *„Input“* (input used)
- *„Range“*
- *„Units“*
- *„Value“*
- *„Limits“*

Parameter	max.	min.	Factory setting	Code	Remarks
Input	not available Namur, Reed XK8 open Coll. 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
Range:	30 000 ... 1 m^3/h	1 m^3/h	1 m^3/h	Expert code	
Units	Liter/pulse Pulses/liter		Liter/pulse	Expert code	Valid for both contact inputs

Parameter	max.	min.	Factory setting	Code	Remarks
Value	9999.9	0	1.0	Expert code	Valid for both contact inputs; impulses per litre of the water meter
Limits					
Min value(a)	30 000 m^3/h	1 m^3/h / off	1 m^3/h / off	Expert code	
Max value(a)	30 000 m^3/h	0 m^3/h	999 m^3/h	Expert code	
Hysteresis(a)	30 000 m^3/h	0 m^3/h	10 m^3/h	Expert code	
Min value(w)	30 000 m^3/h	1 m^3/h / off	1 m^3/h / off	Expert code	
Max value(w)	30 000 m^3/h	0 m^3/h	999 m^3/h	Expert code	
Hysteresis(w)	30 000 m^3/h	0 m^3/h	30 m^3/h	Expert code	
tDelay(alarm)*			0 s	Service code	Delay time
Reaction system*	p.shutdn/shut-down/continue		shutdown	Service code	

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

8.2.1.2 Setpoint

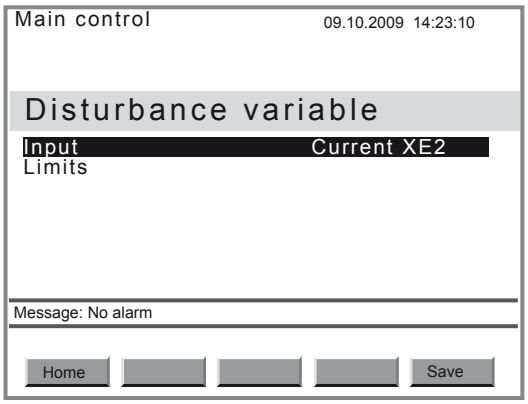


This term is explained in the "Terminology list" at the end of the operating instructions.

Parameter	max.	min.	Factory setting	Code	Remarks
Actuating 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)*			0 s	Service code	Delay time
Reaction system*	p.shutdn/shut-down/continue		shutdown	Service code	Reaction control

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

8.2.1.3 Disturbance variable

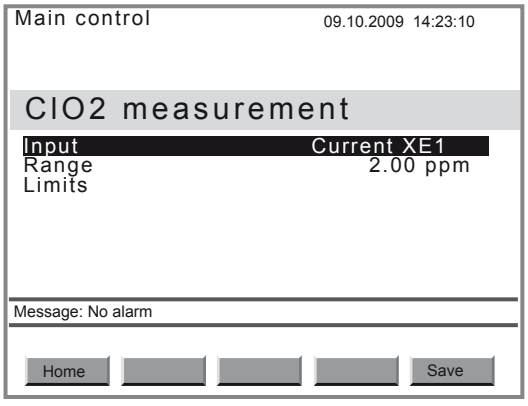


This term is explained in the "Terminology list" at the end of the operating instructions.

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)*			0 s	Service code	Delay time
Reaction system*	p.shutdn/shut-down/continue		shutdown	Service code	

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

8.2.1.4 ClO2 measurement



A suitably equipped Bello Zon® system can measure and also control ClO2

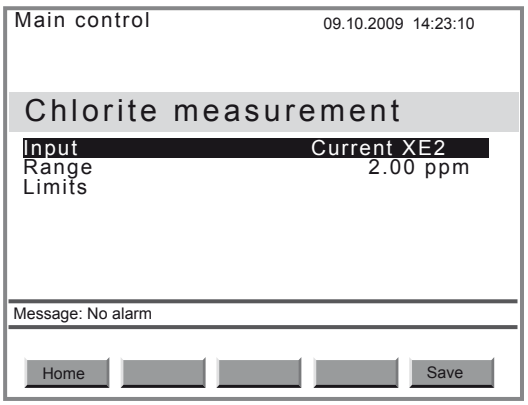
This menu contains these menu items for ClO2 measurement:

- *„Input“*
- *„Range“* (of the sensor)
- *„Limits“*

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

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

8.2.1.5 Chlorite measurement



A suitably equipped Bello Zon® system can measure chlorite.

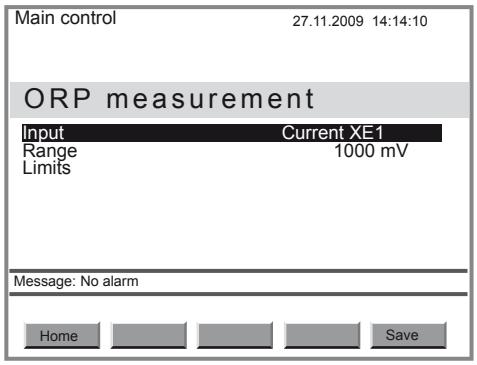
This menu contains these menu items for chlorite measurement:

- *„Input“*
- *„Range“* (of the sensor)
- *„Limits“*

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

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

8.2.1.6 ORP measurement



A suitably equipped Bello Zon® system can measure the ORP voltage.

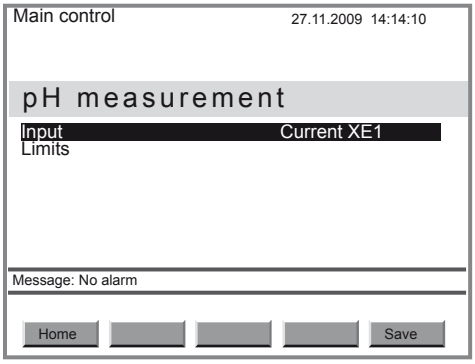
This menu contains these menu items for ORP measurement:

- *„ORP measurement“* (input used)
- *„Range“* (of the sensor)
- *„Limits“*

Parameter	max.	min.	Factory setting	Code	Remarks
ORP measure-ment					
Input	None Current XE1 Current XE2		None	Service code	Input used
Range	2000 mV	0 mV	1000 mV	Expert code	
Limits					
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 time
tDelay (warning)*	999 s	0 s	0 s	Service code	Delay time
Reaction system*	p.shutdn/shut-down/continue		shutdown	Service code	

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

8.2.1.7 pH measurement



A suitably equipped Bello Zon® system can measure pH.

This menu contains these menu items for pH measurement:

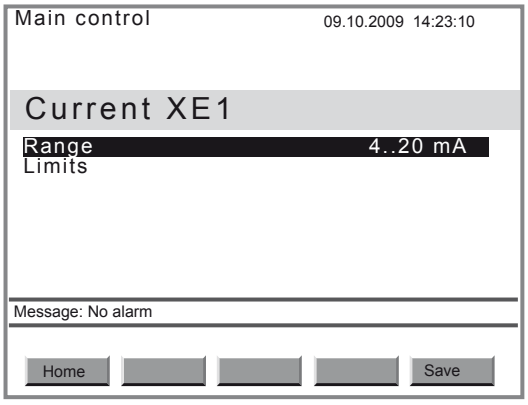
- *„Input“*
- *„Limits“*

Parameter	max.	min.	Factory setting	Code	Remarks
Input					
Input	None		None	Expert code	

Parameter	max.	min.	Factory setting	Code	Remarks
	Current XE1 Current XE2				
Limits					
Min value(a)	pH 16	pH -2	pH 2	Expert code	
Max value(a)	pH 16	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	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 time
tDelay (warning)*	999 s	0 s	0 s	Service code	Delay time
Reaction system*	p.shutdn/shut-down/continue		shutdown	Service code	

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

8.2.1.8 Current XE1 / XE2

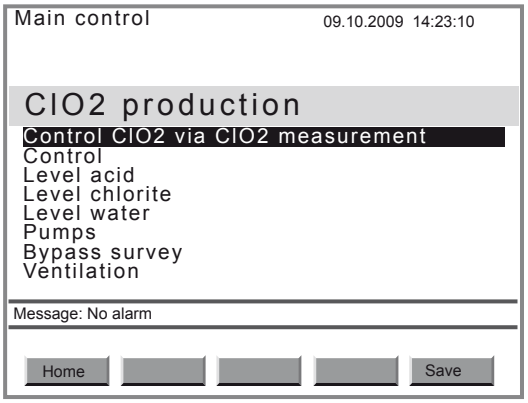


This menu is used to check the mA signal at the current input XE1 (XE2 analog).

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

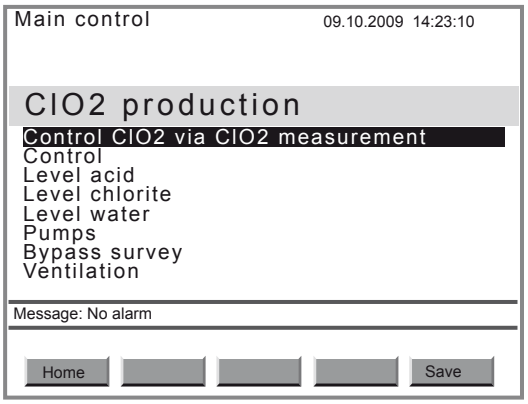
8.2.2 ClO_2 production



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 ClO2 via“ on page 45*
- *„Control“* (ClO_2 production) *Chapter 8.2.2.2 „Control“ on page 46*
- *„Level acid“* (suction lance switch) *Chapter 8.2.2.3 „Level acid“ on page 49*
- *„Level chlorite“* (suction lance switch) *Chapter 8.2.2.4 „Level chlorite“ on page 50*
- *„Level water“* (suction lance switch) *Chapter 8.2.2.5 „Level water“ on page 51*
- *„Pumps“* *Chapter 8.2.2.6 „Pumps“ on page 52*
- *„Bypass control“* *Chapter 8.2.2.7 „Bypass control“ on page 53*
- *„Ventilation“*

8.2.2.1 Control ClO_2 via



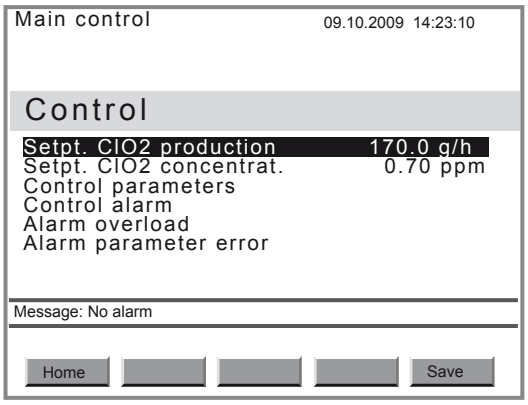
This menu is used to set which signal should be used to control the ClO_2 production quantity:

Manual	No input signal; constant quantity
Setpoint	Via external setpoint, e.g. from the control room; setpoint dependent
Flow value	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 Setpoint Flow value 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.

A. Setpt. ClO2 production (manual control)

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

- *„Manual“*

This value can be set during operation in the continuous display „Production“ under [F2] SETPOINT, as soon as the control has been started using the [START/STOP] key.

B. Setpt. ClO2 production (measurement-proportional control)

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

- *„Flow value“*
- *„ClO2 measurement“*

This value can be easily set during operation in the continuous display „Production“ menu under [F2] SETPOINT, as soon as the control has been started using the [START/STOP] key.

C. Setpoint ClO2 high concentration

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

C. Man. CLO2 production

Here Setpt. ClO2 production can be preselected for "Dosing input"-"man. dosing".

D. 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	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	
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	500v% 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 %	0 %	Expert code	
Control parameters for the PID control					

Parameter	max.	min.	Factory setting	Code	Remarks
P factor	500 % of the measuring range	1% of the measuring range	0.20 ppm	Expert code	For ClO2
P factor	500v% 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 %	0 %	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.

E. Control alarm

Parameter	max.	min.	Factory setting	Code	Remarks
tDelay(alarm)*	999 s	0 s	0 s	Service code	Delay time
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.“*

F. Alarm overload

Parameter	max.	min.	Factory setting	Code	Remarks
tDelay(alarm)*	999 s	0 s	0 s	Service code	Delay time
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.

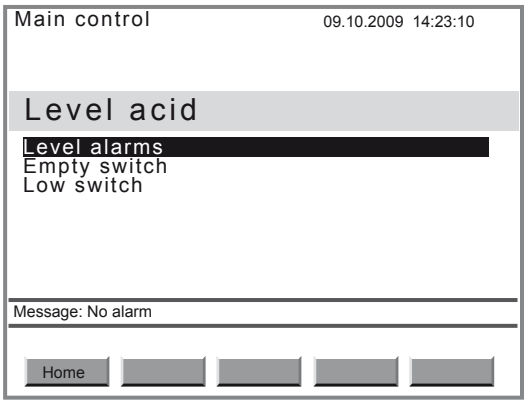
G. Alarm parameter error

Parameter	max.	min.	Factory setting	Code	Remarks
tDelay(alarm)*	999 s	0 s	0 s	Service code	Delay time
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:

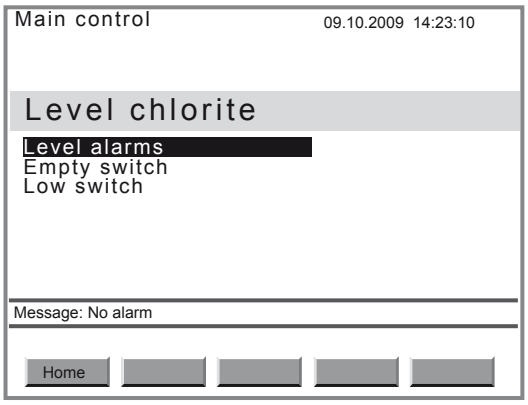
- Level alarms

These items can also be set:

- Empty switch
- Low switch

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

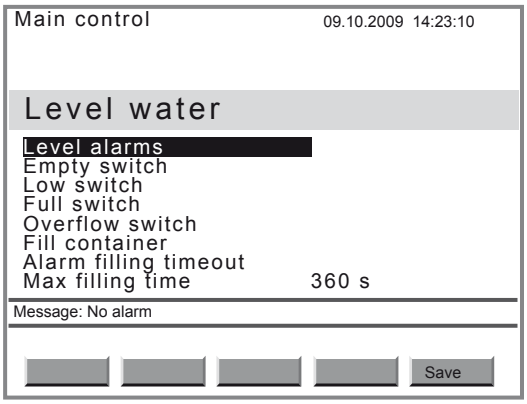
- Level alarms

These items can also be set:

- Empty switch
- Low switch

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

8.2.2.5 Level water



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

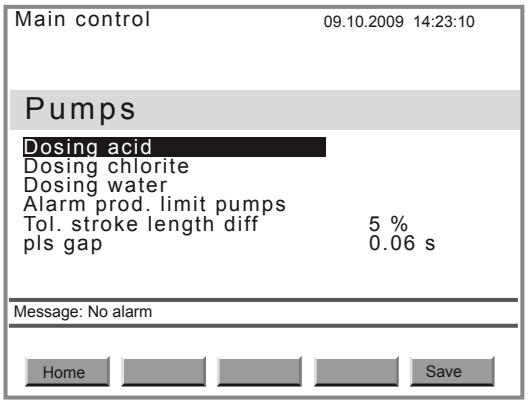
- Level alarms

These items can also be set:

- Empty switch
- Low switch
- Full switch
- Overflow switch
- Fill container
- Alarm filling timeout
- Max filling time

Parameter	max.	min.	Factory setting	Code	Remarks
Empty switch					
Type contact	N/O / NC (open)		N/O	Service code	
Low switch					
Type contact	N/O / NC (open)		N/O	Service code	
Full switch					
Type contact	N/O / NC (open)		Open	Service code	
Overflow switch					
Type contact	N/O / NC (open)		Open	Service code	
Fill container					
Type contact	N/O / NC (open)		N/O	Service code	
Alarm filling timeout					
tDelay	999 s	0 s	0 s	Service code	
Max filling time					
Filling time	360 s	0 s	8 s	Expert code	

8.2.2.6 Pumps

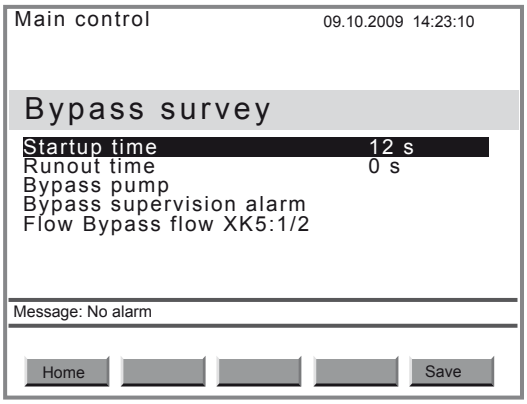


This menu is used to set or read-off the parameters for the following sub-menus:

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

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

8.2.2.7 Bypass control



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 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 time
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 contact	N/O / NC (open)		N/O	Service code	

* *„Startup time“* control

Via the *„Startup time“* it is possible to select after what timespan monitoring (control) of the bypass pump should be activated following bypass pump startup.

** *„Runout time“* Bypass pump

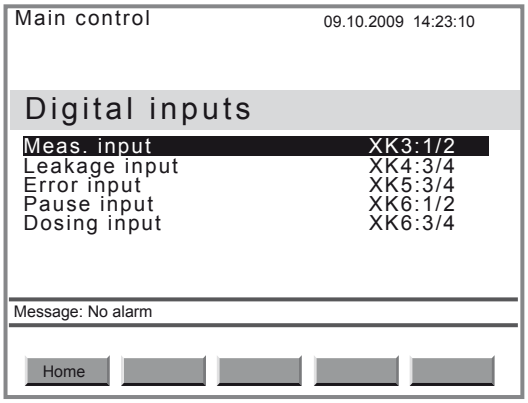
Via the *„Runout time“* it is possible to select how long the bypass pump should run on if the control switches during production to *„Off“*, *„Pause“* or *„Error“*. If the control enters the state *„Equipment off“*, the bypass pump stops immediately.

*** *„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 bund)
- *„Input error XK5:3/4“*
- *„Input pause XK6:1/2“*
- *„Input dosing XK6:3/4“*

Parameter	max.	min.	Factory setting	Code	Remarks
Input sample water XK3:1/2					
Type contact	N/O / NC (open)		Open	Service code	
tDelay*	999 s	0 s	5 s	Service code	Delay time
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 contact	N/O / NC (open)		Open	Factory code	
tDelay*	999 s	0 s	0 s	Factory code	Delay time
Reaction signal	Alarm Warning Message none		Alarm	Factory code	
Reaction system*	p.shutdn shutdown continue		p.shutdn	Factory code	

Parameter	max.	min.	Factory setting	Code	Remarks
Input error XK5:3/4					
Type contact	N/O / NC (open)		Open	Factory code	
tDelay*	999 s	0 s	0 s	Factory code	Delay time
Reaction signal	Alarm Warning Message none		Alarm	Factory code	
Reaction system*	p.shutdn shutdown continue		p.shutdn	Factory code	
Input pause XK6:1/2					
Type contact	N/O / NC (open)		Open	Service code	
Input dosing XK6:3/4**					
Type contact	N/O / NC (open)		N/O	Service code	
Oper. mode	non-existent High dosage Manual dosing		non-existent	Service code	

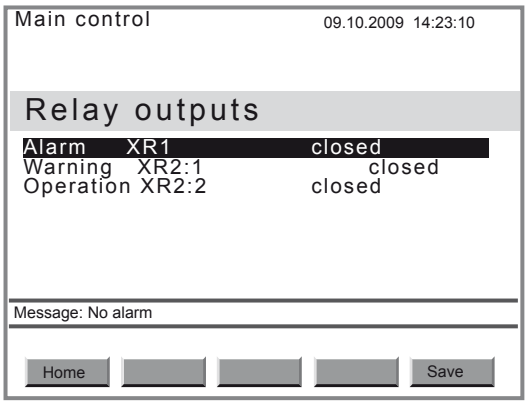
* Explanation see "Terminology list" at the end of the operating instructions.

** If the installation requires a high level dosing of ClO_2 solution from time-to-time, then reconfigure *„Dosing input“* as *„high dosage input“* . As soon as a contact between the terminals of the *„high dosage input“* has been created - under the pre-setting *„N/O“* - the control increases the ClO_2 concentration to that value, which was set under *„Settings ➔ Control ➔ Adjustment ➔ Setp. ClO2-high conc.“*. Simultaneously, the message *„High dosage“*appears in the continuous display. Moreover, the system must also be able to supply this concentration.

** If the installation requires a different concentration of ClO_2 solution from time-to-time, then reconfigure *„Dosing input“* as *„Manual Dosing input“* . As soon as a contact between the terminals of the *„Manual Dosing input“* has been created - under the pre-setting *„N/O“* - the control changes the ClO_2 concentration to that value, which was set under *„Settings ➔ Control ➔ Adjustment“„Setp. 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.

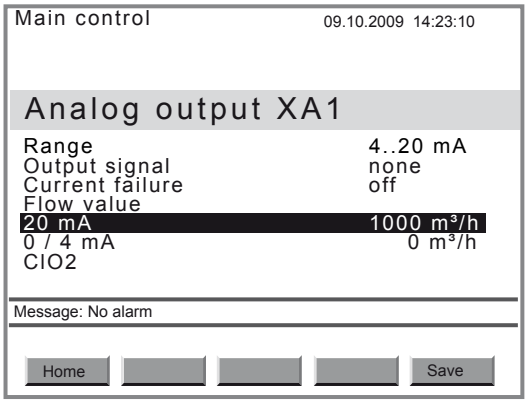
8.2.4 Relay outputs



Service technicians can read-off information about the relay from this menu for:

- *„Alarm XR1“*
- *„Warning XR2:1“*
- *„Operation XR2:2“*

8.2.5 Analog output XA1



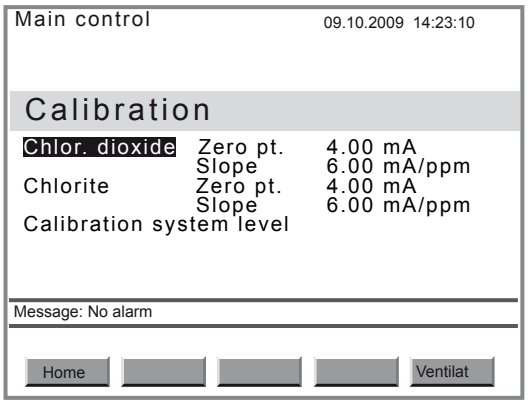
The control can output these signals via the analog output XA1, provided they are present or measured:

- *„Flow value“*
- *„Setpoint“*
- *„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 value Setpoint ClO_2 Chlorite Production volume		off	Service code	

Parameter	max.	min.	Factory setting	Code	Remarks
	ORP pH				
Current failure	off 0.0 mA 3.7 mA 22.0 mA 23.0 mA		off	Expert code	E.g. signals to a PLC a system fault (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
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
Actuating 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



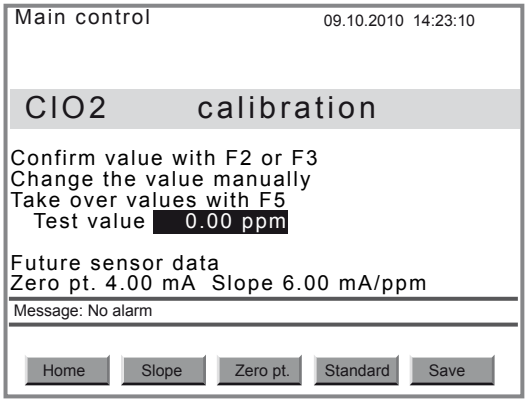
From here it is possible to calibrate:

- Chlorine dioxide (sensors) *Chapter 9.1 „ClO2“ on page 58*
- Chlorite (sensors) *Chapter 9.2 „Chlorite“ on page 61*
- ORP (sensors) *Chapter 9.3 „ORP“ on page 65*
- pH (sensors) *Chapter 9.4 „pH value“ on page 67*

Only for factory settings:

- Calibration system level *Chapter 9.5 „Calibr. System level“ on page 70*

9.1 ClO2



Safety information

CAUTION!

Danger from incorrect dosing

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.

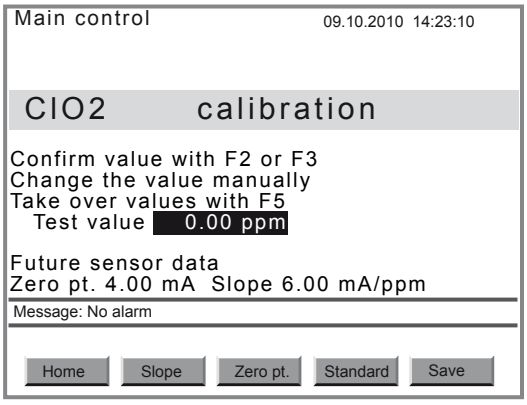
– Bear in mind when changing to the calibration menu, that the control interrupts monitoring of limit values and signals.

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".

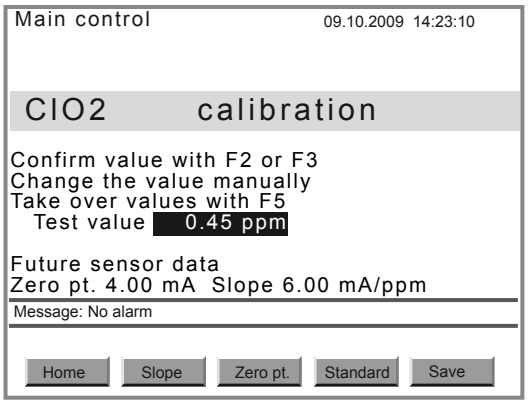
1. Remove the sensor. Sample water shut-off?
2. Dip the CDE sensor in a bucket of clean, chlorine dioxide free tap water (or in still mineral water or distilled water. Check the tap water for chlorine dioxide using a suitable sampling instrument). The chlorine dioxide free water must be at the same temperature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

5. Press *[F3]* CALIBR to change to the calibration menu.
6. Select the submenu *„Chlorine dioxide“* (*[arrow keys]*) and press the *[ENTER]* key.
7. Confirm the displayed measured value under *„Test value“* by pressing *[F3]* ZEROP.
8. Accept the zero point using *[F5]* .
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 *„Chlorine dioxide“* (*[arrow keys]*) and press the *[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 press
6. the *[ENTER]* key, to change the displayed measured value with the arrow keys and save by pressing the *[ENTER]* key, and then confirm with *[F2]* SLOPE.
7. To conclude the calibration and save the values, press *[F5]* SAVE.

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

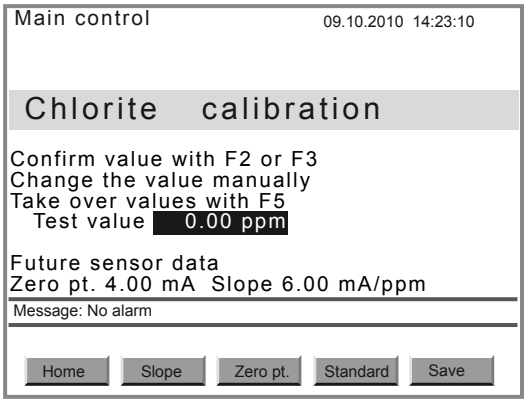
Fault description	Cause	Remedy
After the sensor run in period (for CDE approximately 2 ... 6 h), the measured value is clearly too low.	The sensor is not yet run-in.	Double the run in period or extend until the following morning.
After the run in period (for CDE approximately 2 ... 6 h) the sensor will 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 information

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.

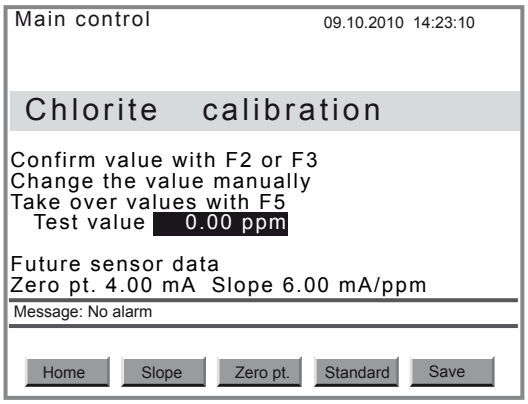
- Bear in mind when changing to the calibration menu, that the control interrupts monitoring of limit values and signals.

If you want to return to the factory settings for zero point and slope, 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 key *[LEFT]*) remains stable and close to zero for 5 minutes.
4. Stop the system with the *[START/STOP]* key.
5. Press *[F3]* CALIBR to change to the calibration menu.
6. Select the submenu *„Chlorite“* (*[arrow keys]*) and press the *[ENTER]* key.
7. Confirm the displayed measured value under *„Test value“* using *[F3]* ZEROP.
8. Accept the zero point using *[F5]* SAVE.
9. Replace the sensor in the in-line probe housing.

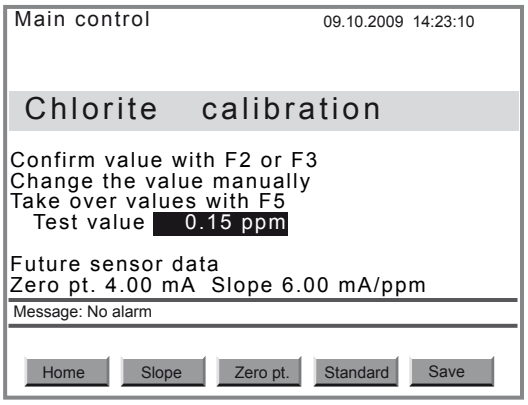
CAUTION!

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 submenu *„Chlorite“* (*[arrow keys]*) and press the *[ENTER]* key.
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“* using *[F2]* SLOPE or
6. press the *[ENTER]* key, to change the displayed measured value with the arrow keys and save by pressing the *[ENTER]* key, and then confirm with *[F2]* SLOPE.
7. To conclude the calibration and save the values, press *[F5]* SAVE.
8. If you do not want to carry out any further calibrations, press the *[ESC]* key to jump back to the menu item *„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

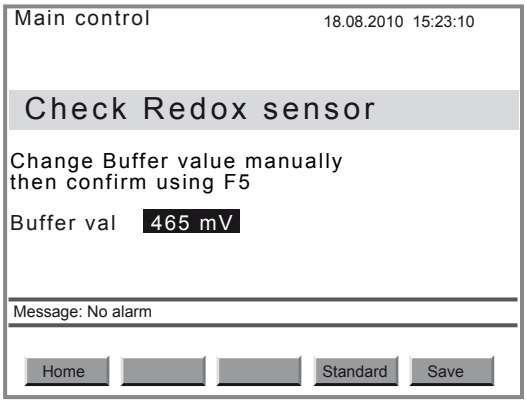
Fault description	Cause	Remedy
After the sensor run in period (for CLT approximately 2 ... 12 h), the measured value is clearly too low.	The sensor is not yet run-in.	Double the run in period or extend until the following morning.
After the run in period (for CLT approximately 2 ... 12 h) the sensor 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 ORP



Safety information

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).

Prerequisites:

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

1. Shut-off the sample water - if necessary acknowledge any alarms which occur by pressing the *[ENTER]* key.
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 menu *„Calibration“* .
7. If necessary use the key *[DOWN] „to select ORP“* .
8. Using the key *[ENTER]* switch to the menu *„ORP checking“* .
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 using the *[ENTER]* key.
11. Immerse the ORP sensor in the buffer solution.

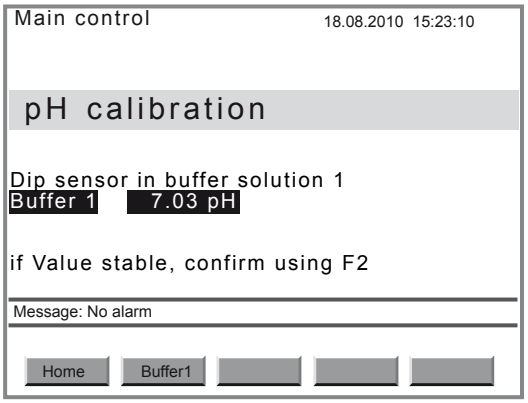
If an equipotential bonding pin was used for measuring, then also dip this in the buffer solution.

12. As soon as the displayed value is stable, press *[F2 check]* to start the test.
13. Accept the value using *[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. Using the key *[Start/Stop]* start the system.

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

9.4 pH value



Safety information

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] .

Requirements, general

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

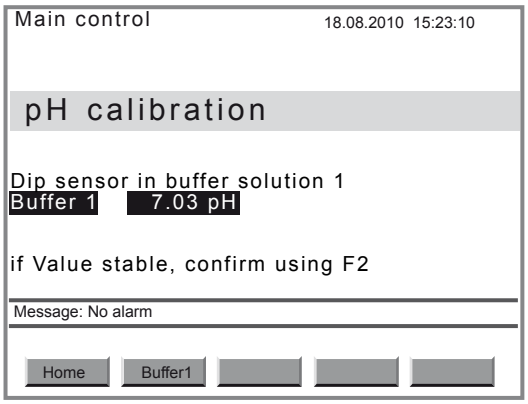
Instruction

The pH sensor calibration is a 2-point calibration.

Prerequisites:

- The sample water is shut-off - if necessary acknowledge any alarms which occur by pressing the *[ENTER]* key.
- 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 switch to the menu *„Calibration“* .
7. If necessary use the key *[DOWN] „to select pH“* .
8. Using the key *[ENTER]* switch to the menu *„pH calibration“* .

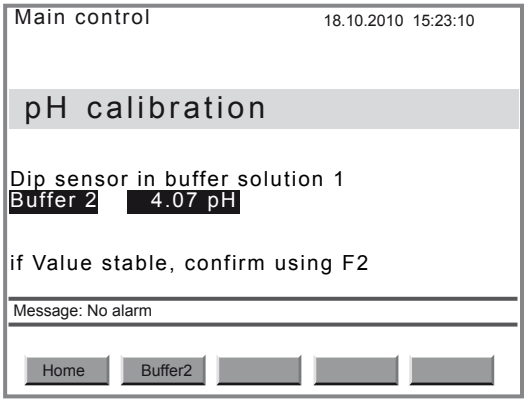


9. Immerse the pH sensor in the first quality buffer (e.g. pH 7) and stir slightly using the sensor.

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, press *[F2 Puffer 1]* to confirm.
11. To specify the value from the buffer bottle press the *[ENTER]* key and use the *[arrow keys]* .
12. Confirm the entry using the *[ENTER]* key.

13. Accept the value using *[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.

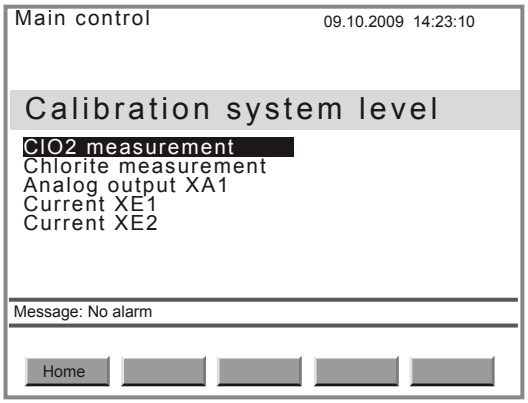
If an equipotential bonding pin was used for measuring, then also dip this in the quality buffer.

17. As soon as the measured value *„Buffer 2“* is stable, press *[F2 Puffer 2]* to confirm.
18. To specify the value from the buffer bottle press the *[ENTER]* key and use the *[arrow keys]* .
19. Confirm the entry using the *[ENTER]* key.
20. Accept the value using *[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, press *[F4 Standard]* to load the standard data and repeat the calibration.
22. If the displayed sensor data appear plausible, press *[F5 Save]* to accept.
    ⇨ The query "Save changes?" appears
23. Confirm the query using 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. Using the key *[Start/Stop]* start the system.

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

Fault message	Cause
„Slope too low“	Slope < -60 mV/pH
„Slope too high“	Slope > +60 mV/pH
„Difference too low“	Δbuffer < pH 2.00

9.5 Calibr. System level



This menu has no meaning to the user.

Only for factory settings:

- Calibration system level

9.6 Calibrate pumps

The dosing pumps can be calibrated by customer service via the *„SERVICE“*menu - see chapter ↳ *Chapter 10.3.5 „Calibrate pumps“ on page 82*.

10 Start up

Safety information

WARNING!

- Prior to Start up carefully read through this entire chapter.
- Initial commissioning (Start up) many only be carried out by ProMaqua authorised customer service.
- The ProMaqua authorised customer service must instruct the operating and maintenance personnel during the Start up.
- Such a commissioning may only be carried out by an expert.

WARNING!

The reactor can explode

If the empty reactor is started up directly with chemicals, an explosive ClO_2gas phase can form inside the reactor.

- The chemical canister must only be connected after the reactor has been completely filled with water.

WARNING!

Warning of the possible escape of corrosive liquid

If the system leaks, corrosive liquid can escape.

- Under no operating status must the system maximum permissible operating pressure be exceeded.
- The entire installation must remain leak-tight when operated at the maximum operating pressure.
- Prior to Start up carefully open all the shut-off devices in the bypass.
- Check the hydraulic connectors.

Note for the system operator

During Start up, also adhere to the instructions of the following regulations without fail:

a) - Accident prevention regulations (in Germany: GUV 8.15 or VGB 65): Chlorinating systems must only be started up, after they have been checked by a technical expert to ensure they are in a correct and proper state and have been subject to leak testing. Chlorinating systems must be checked for safety prior to each re-commissioning by a technical expert. Only personnel must be appointed to operate and maintain chlorinating systems and handle chemicals, who have been instructed in such matters and who can be expected to reliably fulfil their duties.

b) - The ordinance relating to dangerous substances (in Germany: ArbStoffV according to the edition of 11 February 1982 BGBl. / page 145)

c) - Requirements relating to output chemicals - see chapter *„Safety information“ on page 89*

d) - All other local regulations for such installations outside Germany

Overview

10.1 Installation - last steps

1. Check the implementation of the hydraulic connectors.
2. Check the implementation of the electrical connections.
3. Connect the Bello Zon®system to the mains (cable with 3 x 1 mm^2conductors).

10.2 Configuring the system and control

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

- Tab *„Equipment“*
- Tab *„Control“*

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

"Equipment" tab

1. Press *[F2] „SETTING“* to change to the *„SETTING“*menu, tab *„Equipment“* .
2. Under *„Identity code“* check whether the identity code is suitable for the desired operating mode (flow meter, analog inputs, control properties ...) and if necessary adjust.
3. Under *„CAN overview“* check, whether all CAN modules have been recognized by the control.
4. Under *„Language“* change the language of the operating menu as necessary.
5. Under *„Date and time“* change the date and time as necessary.
6. Under *„Configuration“* configure the inputs, display, log book and the dosing module which are found here.
7. Accept the settings using *[F5] „SAVE“* and the *[ENTER]* key.

"Control" tab

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

1 - "Manual" control

2 - Proportional control "Flow"

3 - Proportional control "Setpoint"

4 - Proportional control "ClO_2measurement"

10.2.1 "Manual" control

The Bello Zon® system should operate continuously with a preset, constant ClO_2ouput.

1. Press *[F2]* *„SETTING“* to change to the *„SETTING“* menu, tab *„Equipment“*.
2. Change to the tab *„Control“* using the *[RIGHT]* key.
3. If necessary configure a current input under *„Signal inputs“* . *„ClO2 production“* selection (keys *[UP]* or *[DOWN]*) and press the *[ENTER]* key.
4. Set *„Control ClO2 via“* to *„Manual“* (key *[ENTER]*, keys *[UP]* or *[DOWN]*, key *[ENTER]*).
5. *„Control“* selection (keys *[UP]* or *[DOWN]*) and press the *[ENTER]* key.
6. Set the required ClO_2output using *„Setpt. ClO2 production“* (key *[ENTER]*, *[arrow keys]*, key *[ENTER]*).

   ⇨ The continuous display 1 (*„Production 1“*) and the continuous display 2 (*„Production 2“*, (key *[LEFT]*)) henceforth show both the set ClO_2outputs.
7. Accept the settings using the key *[F5]* *„SAVE“* and the *[ENTER]* key.
8. If necessary, set limits and alarms in other menus.
9. If necessary change the suction interval and suction duration under *„Ventilation“* .
10. If necessary, match the digital inputs and the analog output to the requirements (Pause, leakage sensor...).
11. Accept the settings using the key *[F5]* *„SAVE“* and the *[ENTER]* key.
12. Accept all settings using the key *[F5]* *„SAVE“* and the *[ENTER]* key.

10.2.2 Proportional control "Flow"

The ClO_2output of the chlorine dioxide system should change in proportion to the quantity using the flow meter signal (contact water meter, inductive flow meter, ...).

1. Press *[F2]* *„SETTING“* to change to the *„SETTING“* menu, tab *„Equipment“*.
2. Change to the tab *„Control“* using the *[RIGHT]* key.

Configuring the water meter

For the water meter under *„Signal inputs“* configure the input *„Flow meter“*:

1. *„Signal inputs“* selection (keys *[UP]* or *[DOWN]*) and press the *[ENTER]* key.
2. *„Flow meter“* selection (keys *[UP]* or *[DOWN]*) and press the *[ENTER]* key.
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 flow meter range (key *[ENTER]*, *[arrow keys]*, key *[ENTER]*).
6. Under *„Units“* set the units *„liter/pulse“* (key *[ENTER]*, keys *[UP]* or *[DOWN]*, key *[ENTER]*).
7. Under *„value“* set the number per litre per pulse of the flow meter (key *[ENTER]*, *[arrow keys]*, key *[ENTER]*).
8. Under *„Limits“* set the correct values. In this respect, observe the following instructions!
9. Accept the settings using *[F5]* *„SAVE“* and the *[ENTER]* key.

WARNING!

Danger of explosion

ClO_2 can form a rich enough mixture to become explosive, if the Bello Zon®system is dosed with insufficient diluting water.

– For analog flow meters (0/4 - 20mA) set a value greater than "0" under *„Lower lim.<A>“* without exception.

As small as possible a pulse interval for the water meter ensures uniform mixing of ClO_2solution in the water, which is to be treated.

Selection of a suitable flow meter

The 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_2concentration; only if this is successful, can the desired ClO_2concentration in the water flow really be maintained at a constant level.

In this respect two cases can be considered:

1. - If it is expected 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); this can easily "replicate" these slow oscillations for the control. For the Bello Zon®control, the contact water meter must deliver 0.25 ... 20 pulses per second.
2. - If it is expected 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 was larger in this case, the system and the system output could only react too slowly and with a very "square response" to changes in the actual flow. For the Bello Zon®control, the IDM must deliver 10 ... 10 000 pulses per second.

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. *„ClO2 production“* selection (keys *[UP]* or *[DOWN]*) and press the *[ENTER]* key.
2. Set *„Control ClO2 via“* to *„Flow value“* (key *[ENTER]*, keys *[UP]* or *[DOWN]*, key *[ENTER]*).
3. *„Control“* selection (keys *[UP]* or *[DOWN]*) and press the *[ENTER]* key.
4. Set the required ClO_2concentration using *„Setpt. ClO2 concentrat. “* (key *[ENTER]*, *[arrow keys]*, key *[ENTER]*).
   ⇨ The continuous display 1 (*„Production 1“*) and the Continuous Display 2 (*„(Production 2“*, (key *[LEFT]*)) show both the set ClO_2outputs.
5. Accept the settings using *[F5]* *„SAVE“* and the *[ENTER]* key.
6. If necessary, set limits and alarms in other menus.
7. If necessary change the suction interval and suction duration under *„Ventilation“* .
8. If necessary, match the digital inputs and the analog output to the requirements (Pause, leakage sensor...).
9. Accept the settings using *[F5]* *„SAVE“* and the *[ENTER]* key.
10. Accept all the settings using *[F5]* *„SAVE“* and the *[ENTER]* key.
    ⇨ Continuous display 1 and continuous display 2 now show the instantaneous ClO_2output as well as additionally the flow and the set setpoint.

    If the flow exceeds the maximum value, the ClO_2output remains constant at its maximum value and the ClO_2concentration falls (error message *„Warning: Prod. overload“*).

    If the flow falls below its minimum value, the control stops the dosing.

10.2.3 Operating mode "Setpoint-proportional control"

The ClO_2output 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. Press *[F2]* *„PARAMETER“* to change to the *„SETTING“*menu, tab *„Equipment“*.
2. Change to the tab *„Control“* using the *[RIGHT]* key.
3. *„Signal inputs“* selection (keys *[UP]* or *[DOWN]*) and press the *[ENTER]* key.
4. *„Setpoint“* selection (keys *[UP]* or *[DOWN]*) and press the *[ENTER]* key.
5. Under *„Setpoint“* e.g. set the *„Current XE2“* (key *[ENTER]*, *[arrow keys]*, key *[ENTER]*).
6. If necessary, match under e.g. *„Current XE2“* the current input to the requirements (key *[ENTER]*, *[arrow keys]*, key *[ENTER]*).
7. Using the key *[ESC]* jump back to the menu *„Settings“* .
8. *„ClO2 production“* selection (keys *[UP]* or *[DOWN]*) and press the *[ENTER]* key.
9. Set *„Control ClO2 via“* to *„Setpoint“* (key *[ENTER]*, keys *[UP]* or *[DOWN]*, key *[ENTER]*).
10. Accept the settings using *[F5]* *„SAVE“* and the *[ENTER]* key.
11. If necessary, set limits and alarms in other menus.
12. If necessary change the suction interval and suction duration under *„Ventilation“* .

13. If necessary, match the digital inputs and the analog output to the requirements (Pause, leakage sensor...).
14. Accept the settings using *[F5]* *„SAVE“* and the *[ENTER]* key.
15. Accept all the settings using *[F5]* *„SAVE“* and the *[ENTER]* key.

Output adjustment range ClO2 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.
CDK 170	70	7 ... 120	9 ... 170
CDK 420	60	12 ... 250	20 ... 420
CDK 900	50	23 ... 450	45 ... 900
CDK 2100	40	42 ... 840	105 ... 2100
CDK 3000	40	60 ... 1200	150 ... 3000
CDK 7500	30	113 ... 2250	375 ... 7500

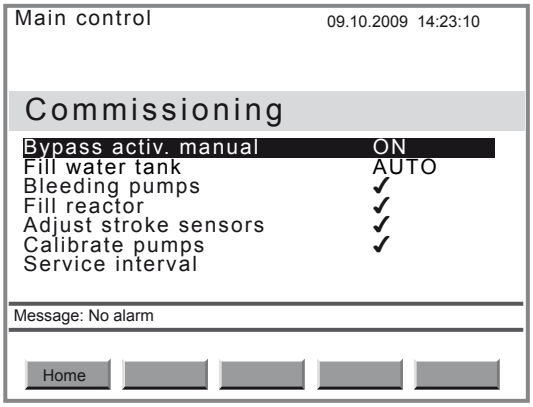
10.2.4 Proportional ClO2 measurement control

The ClO_2output of the Bello Zon®®changes according to the measurement-dependent mA signal of a ClO_2sensor connected directly to the control.

1. Press *[F2]* *„SETTING“* to change to the *„SETTING“*menu, tab *„Equipment“*.
2. Change to the tab *„Control“* using the *[RIGHT]* key.
3. *„Signal inputs“* selection (keys *[UP]* or *[DOWN]*) and press the *[ENTER]* key.
4. *„ClO2 measurement“* selection (keys *[UP]* or *[DOWN]*) and press the *[ENTER]* key.
5. Under *„ClO2 measurement“* e.g. set the *„Current XE1“* (key *[ENTER]*, *[arrow keys]*, key *[ENTER]*).
6. If necessary, match under e.g. *„Range“* the current input to the requirements (key *[ENTER]*, *[arrow keys]*, key *[ENTER]*).
7. *„ClO2 production“* selection (keys *[UP]* or *[DOWN]*) and press the *[ENTER]* key.
8. Set *„Control ClO2 via“* to *„ClO2 measurement“* (key *[ENTER]*, *[arrow keys]*, key *[ENTER]*).
9. *„Control“* selection (keys *[UP]* or *[DOWN]*) and press the *[ENTER]* key.
10. Set the required ClO_2concentration using *„Setpt. ClO2 concentrat. “* (key *[ENTER]*, *[arrow keys]*, key *[ENTER]*). The continuous display 1 (*„Production 1“*) now shows the instantaneous ClO_2output and the continuous display 2 (*„Production 2“*, (key *[LEFT]*)) additionally shows the set setpoint ClO_2concentration.
11. Select "Control" (keys *[UP]* or *[DOWN]*) and press the *[ENTER]* key.
12. Match the control parameters to the process and press the *[ENTER]* key.
13. Accept the settings using *[F5]* *„SAVE“* and the *[ENTER]* key.
14. If necessary, set limits and alarms in other menus.
15. If necessary change the suction interval and suction duration under *„Ventilation“* .

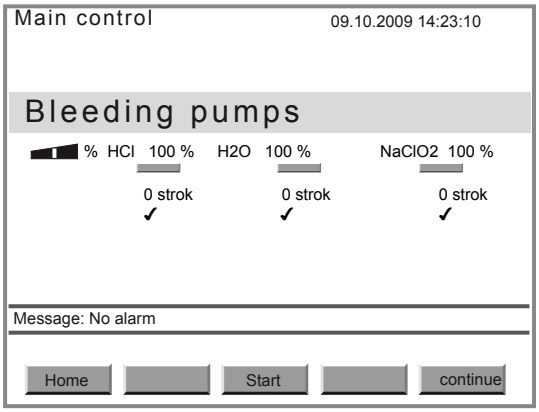
16. If necessary, match the digital inputs and the analog output to the requirements (Pause, leakage sensor...).
17. Accept the settings using *[F5] „SAVE“* and the *[ENTER]* key.
18. Accept all the settings using *[F5] „SAVE“* and the *[ENTER]* key.

10.3 Starting the system



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

10.3.1 Bleeding pumps



With a calibration device

Prerequisites:

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

1. Remove the vacuum pump from the system panel.

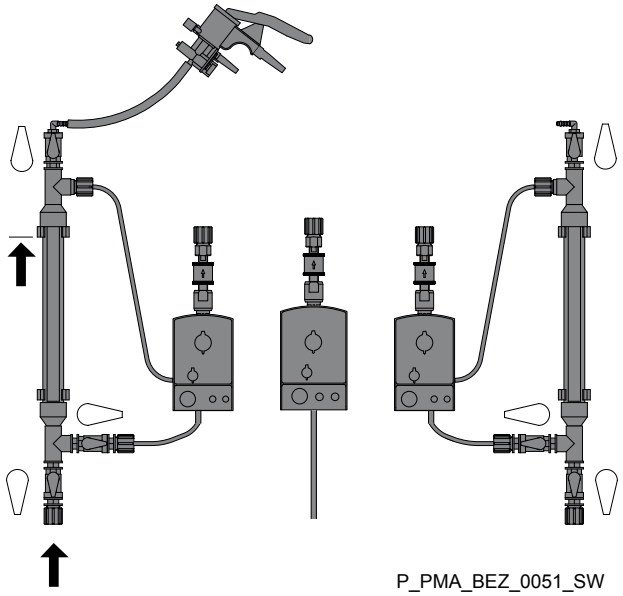


Fig. 11: Stopcock positions during filling of the calibration devices, shown here for CDK

2. Place the vacuum pump on the left (acid) calibration device and suck feed chemical manually up to the top to the "0" marking, 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 right (chlorite) calibration device and suck feed chemical manually up to the top to the "0" marking, but no further! Is the top stopcock on the calibration device open?

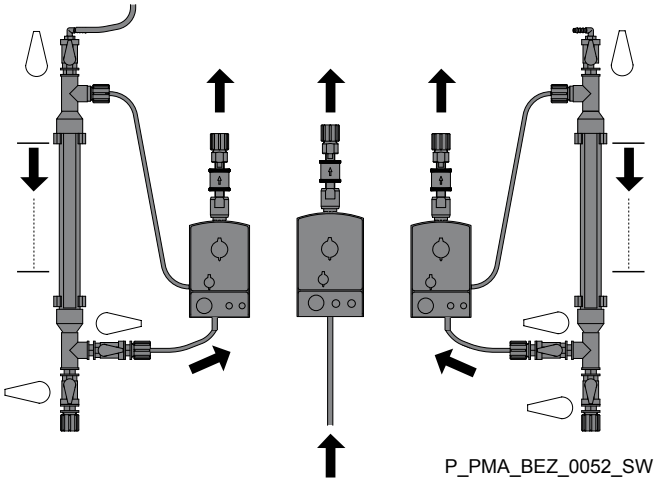


Fig. 12: Stopcock positions during calibration, shown here for CDK

5. Close the bottom stopcock to the suction lance.
6. Using the key *[DOWN]* to *„Bleeding pumps“* and press the *[ENTER]* key.
7. Start bleeding with *[F3] „START“* - wait until the suction lines and liquid ends are free from bubbles.

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

8. If the suction lines and liquid ends are not yet bubble-free after the dosing pumps have stopped, repeat bleeding with the *[F3] „START“* key.
9. Press *[F5] „NEXT“* to switch to the menu *„Fill reactor tank“* - see the following chapter.
10. Open the bottom stopcock to the acid suction lance.
11. Place the vacuum pump on the left calibration device and suck feed chemical manually up to the top to the "0" marking, 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 right calibration device and suck feed chemical manually up to the top to the "0" marking, but no further!

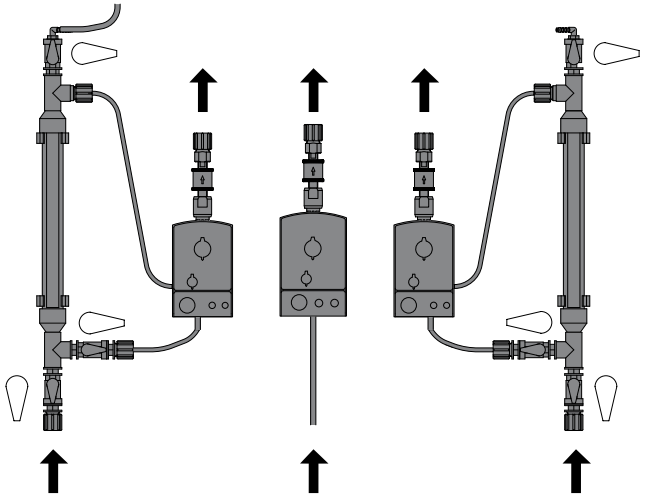


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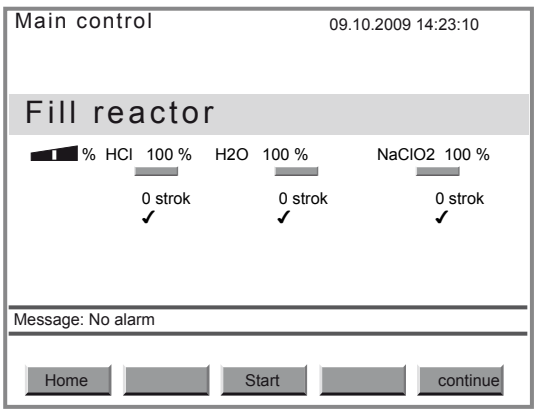
Fig. 13: Stopcock positions in operation, shown here for CDK

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 stroke sensor is not correctly adjusted.	■ Turn the knurled screw beneath the stroke sensor by one turn downwards. ■ Acknowledge the error message.

10.3.2 Fill reactor



WARNING!

System parts can burst

If the rinse valve is not open when filling the reactor, the pressure of the dosing pumps can cause the reactor to burst.

– Before filling the reactor, open the rinse valve.

– *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. Open the rinse valve.
2. Start filling with*[F3] „START“* -

CAUTION!

In an emergency, the pumps can be stopped with the *[F3] „STOP“* key.

⇨ The control counts down the preset number of strokes.

3. Wait until the preset number of strokes is processed.
4. If the reactor is not yet full, i.e. no liquid has yet escaped from the rinse valve, start filling again using the *[F3] „START“* key.
5. Do not change to the next menu using *[F5] „NEXT“* , rather check the system for leaks - see the next chapter.

10.3.3 Checking for leaks

WARNING!

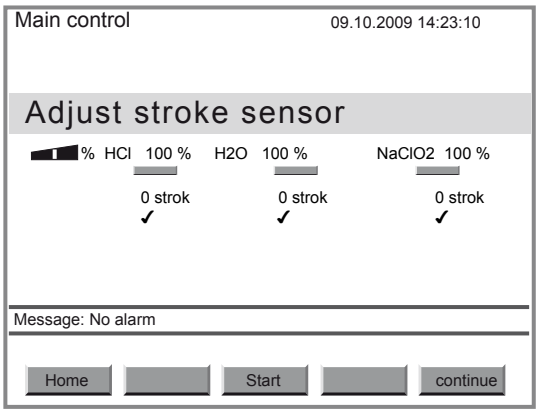
Warning of toxic ClO2 solution

Toxic ClO_2solution can escape through leaks.

– Immediately seal any leaks using appropriate measures.

1. If the dosing pumps are not yet running, start them via the menu *„Fill reactor“* using the *[F3] „START“* key.
2. Check the system parts for leak-tightness with the dosing pumps running at maximum operating pressure.
3. Immediately seal any leaks which may occur using appropriate measures.
4. If checking is still not complete, start the dosing pumps again using the *[F3] „START“* key.
5. If the dosing pumps are still running, stop them after the test using the *[F3] „STOP“* key.
6. Press *[F5] „NEXT“* to switch to the menu *„Adjust stroke sensors“* (= "Adjust stroke sensors") - 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.

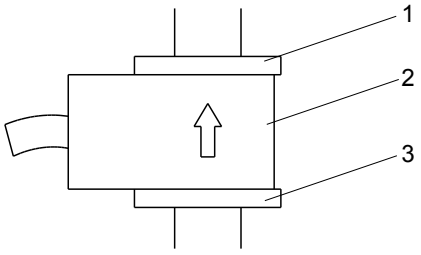


Fig. 14: Stroke sensor overview

1 Top adjusting washer
2 Ring initiator
3 Bottom adjusting washer

Prerequisites:

The dosing pumps are bled.

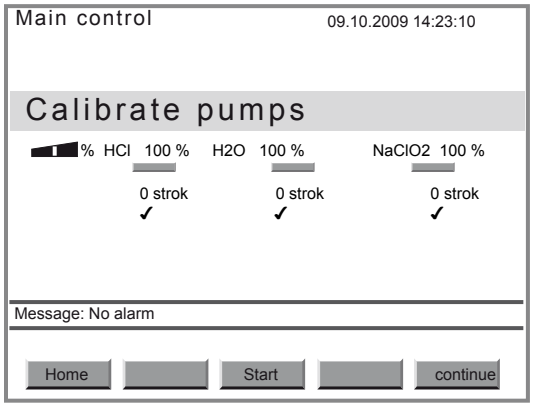
1. Turn the top adjustment washer (1) of the stroke sensors fully upwards.
2. Reposition the ring initiators (2) and the bottom adjustment washers (3) respectively.

3. Start the metering pumps with the *[F3] „START“* key.

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

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 bottom adjusting washer (3) by 1 turn.
6. Lower the respective top adjusting washers (1) to the ring initiators (2).
7. Press *[F5] „NEXT“* to change to the menu, "Calibrate pumps" see the next chapter.

10.3.5 Calibrate pumps



CAUTION!
Warning of toxic substances in the water
If the dosing pumps are not calibrated at the operating pressure, which will subsequently apply during operation, the chemicals will possibly not be mixed in the correct ratio within the reactor.

– Only calibrate the pumps at that operating pressure which 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 panel.

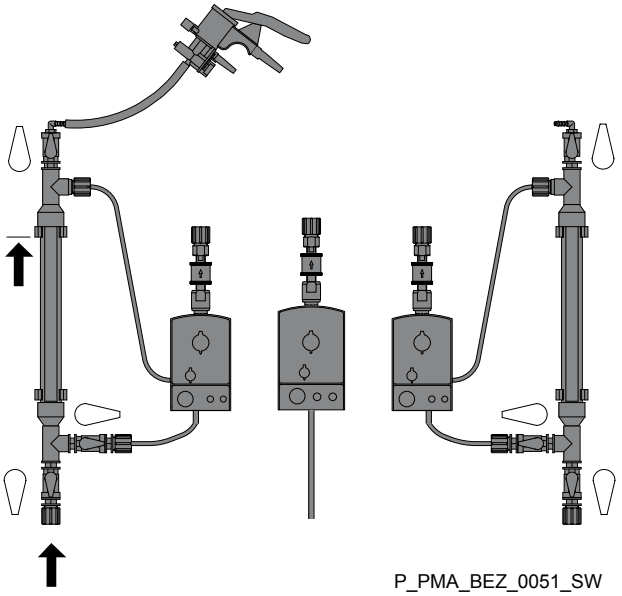


Fig. 15: Stopcock positions during filling of the calibration devices, shown here for CDK

2. Place the vacuum pump on the left (acid) calibration device and suck feed chemical manually up to the top to the "0" marking, 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 right (chlorite) calibration device and suck feed chemical manually up to the top to the "0" marking, but no further! Is the top stopcock on the calibration device open?

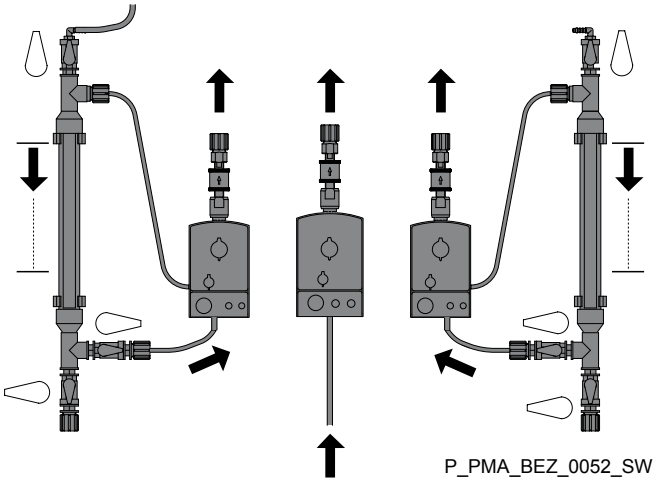


Fig. 16: Stopcock positions during calibration, shown here for CDK

5. Close the bottom stopcock to the suction lance.
6. Fill the measuring cylinder up to the top marking with water.
7. Slowly raise the water suction lance, hold perpendicular and carefully position in its measuring cylinder: There must be no air in the suction lances which would falsify the calibration.

8. Press *[F3] „START“* to start the dosing pumps.

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

If the calibration devices become empty too soon, stop the pumps using the [F3] „STOP“ key.

9. As soon as the displayed strokes are processed, the pumps stop, the menu option "Set calibration" appears.
10. *[F2] „ACID“* press, then press the key *[ENTER]* and enter and record the used quantity of feed chemical from the left calibration device using the arrow keys.
11. Confirm the value using the key *[ENTER]* and accept using the *[F5] „SAVE“* key.
12. Determine the difference value between the first value and the new value (in ml) for water.
13. *[F2] „Water“* press, then press the key *[ENTER]* and enter this difference value using the *[arrow keys]* .
14. Confirm the value using the *[ENTER]* key.
15. Accept the value using *[F5] „SAVE“* !
16. *[F3] „CHLORITE“* press, then press the key *[ENTER]* and enter and record the used quantity of feed chemical from the right calibration device using the arrow keys.
17. Confirm the value using the key *[ENTER]* and accept using the *[F5] „SAVE“* key.
18. Enter the values for acid and chlorite in the commissioning report or the system log book.
19. Enter the value for water in the commissioning report or the system log book.
20. Press *[F5] „NEXT“* to exit the menu.
21. Open the bottom stopcock to the acid suction lance.
22. Place the vacuum pump on the left calibration device and suck feed chemical manually up to the top to the "0" marking, but no further!
23. Close the top stopcock on the left calibration device.
24. Open the bottom stopcock to the chlorite suction lance.
25. Place the vacuum pump on the right calibration device and suck feed chemical manually up to the top to the "0" marking, but no further!

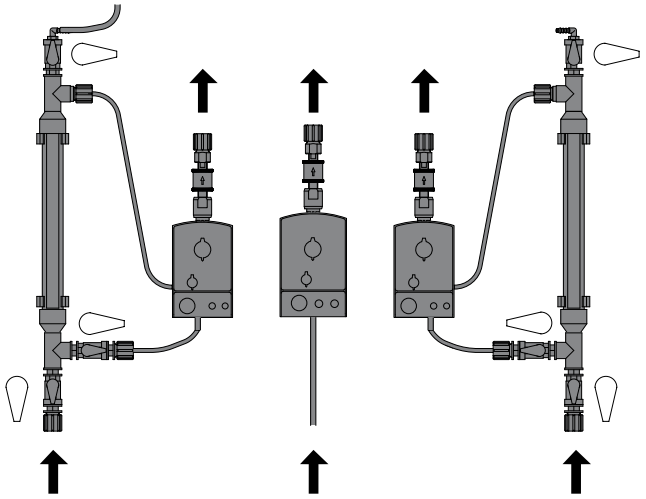


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Fig. 17: Stopcock positions in operation, shown here for CDK

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

27. Slowly raise the water suction lance, hold perpendicular and carefully position in its canister.

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 quantity (during initial commissioning still with water).

10.4 Testing the safety equipment

Safety bund (accessories)

Remove the intact tank out of the dry safety bund. Fill the safety bund with water up to the edge and inspect for leaks.

If the safety bund is one provided with leakage monitoring, the control must switch off the metering. Press key *[Press F1] „QUIT“* .

Acid and chlorite level switches

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

Press key *[F5] „BEEP OFF“* and then press the key *[Press F1] „QUIT“* .

Water level switch

The following table gives the level switch settings and the results for 3 different tests.

Test	Upper level monitoring	Lower level monitoring	Result
Lack of water:	lower	lower	The system switches off, error message
Water top-up:	lower	upper, in 5 s after lower	Solenoid valve "Top-up water" opens and closes after 360 s (default setting)
Overflow:	upper	upper	The system switches off, error message

Adjusting the water storage tank top-up

In the menu *„Setting“* - *„Control“* - *„Level water“* under *„Max filling time“* adjust the default 360 s, if necessary. The tank should be filled to just below the top level switch each time a filling process is carried out.

Stroke sensors

More the upper adjusting washer and the ring initiator of a stroke sensor upwards, the control must switch off dosing 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 key *[F5] „BEEP OFF“*, then move the ring initiator and the top adjusting washer back to the initial position and press the key *[Press F1] „QUIT“*. If the bottom adjusting washer was displaced, reset the stroke sensor.

Now check the other stroke sensors.

Reactor housing (option)

Keep the bleed valve, left, or the bleed line closed and press the key *[F5] „VENTILATE“*. Listen for noises which could originate from a leak (without the roar of the water jet pump). If necessary, press the key several times, to switch the suction on and off several times.

Release the bleed valve, left, or the bleed line on the reactor housing again.

Reactor cover

Check that the reactor cover is correctly fitted.

Level switch in the reactor housing (option)

Raise the circular float of the level switch - the control must immediately stop ClO_2production.

Press key *[F1] „QUIT“*.

Function explanation: The level switch on the bottom of the reactor housing reports significant leaks from there to the control, which immediately stops ClO_2production.

Ventilation reactor housing (option)

To start ventilation manually, press the key *[F5] „VENTILATE“*. The water jet pump must start to roar. If necessary, press the key several times, to switch the suction on and off several times.

Bypass survey

Slowly close the stopcock prior to the float flow meter. The control must switch off production, the device LED flashes red, the bleeper bleeps and the alarm relay switches.

Press key *[F5] „BEEP OFF“*, open the stopcocks and then press key *[F1] „QUIT“*.

Gas detector (option)

Test the gas detector and its sensor according to its operating instructions.

10.5 Chemical canister installation

1. Switch off production in the continuous display using *[F1] „PROD OFF“* - "Production off" appears.
2. Position the chemical canisters beneath the system - acid left (HCl, red), water middle (H_20, green), chlorite right ($NaClO_2$, blue), – viewed from the front!0, green) – viewed from the front!
3. Immerse the left suction lance in the acid chemical canister. Does the foot valve float just above the bottom 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 bottom of the chemical canister?
6. Tighten the screw lid.

10.6 Checking ClO2 production

1. Switch on production in the continuous display using *[F1] „PROD ON“* - *„Production on“* appears.
2. After a suitable time period, prepare a sample from the main water supply line (after a reaction tank, if fitted, or at an in-line probe housing) - the ClO_2solution must in the meantime have reached this point.
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 > 25 °C!
4. Immediately measure the ClO_2content of the sample using a colorimeter, e.g. using the photometer DT 1.
5. As necessary change the control parameters or supply quantity in the *„SETTING“*menu, allow the system to run and repeat the measurement after a sufficiently long interval.

CAUTION!

Warning against illegal operation

– Observe national and local regulations in respect of ClO_2concentrations.

If the stroke length must be changed, then:

– *carry this out via the menu "Set stroke length".*
– *Observe the minimum stroke lengths.*

- *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.*

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

11 Operation

WARNING!

Risk of explosion due to ClO_2gas

Together the two components, hydrochloric acid (HCl) and sodium chlorite ($NaClO_2$ almost instantaneously form large quantities of toxic ClO_2gas, which can also decompose in an explosive manner.

– Together the two components, hydrochloric acid (HCl) and sodium chlorite ($NaClO_2$ must never be brought into contact except in the reactor.

WARNING!

Warning of toxic ClO_2gas

When pouring chemicals back into chemical canisters mix-ups often occur. Then lots of toxic ClO_2gas can be generated.

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

WARNING!

Warning of toxic ClO_2solution.

If system leaks occur, toxic ClO_2solution can escape.

– Under no operating status must the system maximum permissible operating pressure be exceeded.
– The entire installation must remain leak-tight when operated at the maximum operating pressure.

11.1 Chemical canister replacement

Safety information

WARNING!

Warning of toxic ClO_2gas

Large quantities of toxic ClO_2gas can arise, if the chemical canisters are not handled correctly.

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

WARNING!

Warning of toxic ClO_2solution.

If leaks occur due to corrosion on the system, toxic ClO_2solution can escape.

– The hydrochloric acid must conform to DIN EN 939.
– The chlorite must conform to DIN EN 938.
– The diluting water must be of drinking water quality.

Purity requirements

For sodium chlorite 24 ... 25 %	Upper limits according to DIN EN 938
Sodium chlorate	12 g/l
Sodium nitrate	0.3 g/l

For hydrochloric acid 30 ... 33 %	Upper limits according to DIN EN 939
Iron	60 mg/l
Halogenated organic compounds	6 mg/l

For the diluting water
Drinking water quality

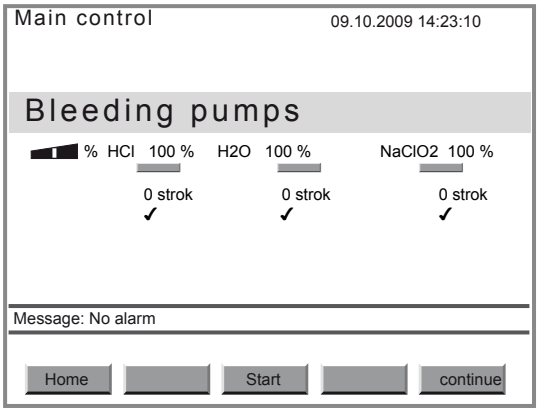
Minimum temperatures, liquids

For chemicals and water	Temperature, at least
CDKc 170 ... 2100	10 °C
CDKc 3000 ... 7500	15 °C

Instructions

1. Switch off ClO_2production in the continuous display using *[F1] „PROD OFF“*.
   ⇨ *„Production off“* appears.
2. Carefully remove each suction lance out of its chemical canister. Raise slowly, maintain perpendicular!
3. Place each of the suction lances in its own bucket full with 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 (HCl, left), blue chlorite (right)!
6. Slowly raise each suction lance, hold perpendicular and carefully insert in the corresponding chemical canister.
   Red stands for acid, blue for chlorite!
7. Check the suction lines for air bubbles, bleed as necessary (in accordance with the next chapter).
8. Switch on ClO_2production in the continuous display using *[F1] „PROD ON“*.
   ⇨ *„Production on“* appears.

11.2 Bleeding pumps



Prerequisites:

The stroke lengths of the pumps are set equal to each other and according to the minimum values from the table *on page 76*.

1. Press *[F1] „SERVICE“* to change to the *„SERVICE“* menu.
2. Press key *[DOWN]* change to the *„Expert jobs“* menu and press the *[ENTER]* key.
3. Using the *[arrow keys]* select *„Bleeding pumps“* menu.
4. Press key *[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 coarse/fine bleed valves on the pumps (clockwise direction).
7. Start bleeding with *[F3] „START“* - wait until the suction lines and liquid ends are free from bubbles.

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

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

WARNING!
Warning of toxic ClO_2gas
When pouring chemicals together lots of toxic ClO_2gas 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. The risk of a mix-up is too high.
- Pour the contents of the bleed bottles individually into the drainage and flush away each of chemical contents with lots of water.

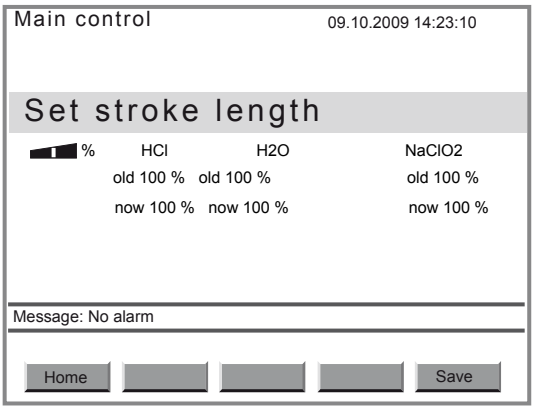
CAUTION!
Corrosive chemicals may escape
After several sequential bleed processes, the bleed bottles may overflow.

– If carrying out several sequential bleed processes, monitor 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 stroke sensor is not correctly adjusted.	■ Turn the knurled screw beneath the stroke sensor by one turn downwards. ■ Acknowledge the error message.

11.3 Set stroke length



If the stroke length must be changed, then:

– *carry this out via the menu "Set stroke length".*
– *Observe the minimum values from the table* ↳ *on page 76.*

– *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.*

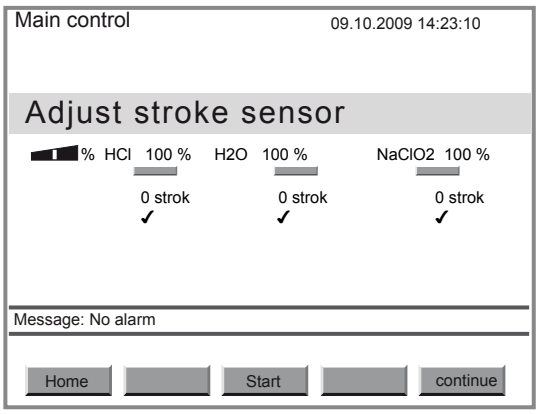
1. Press *[F1]* *„SERVICE“* to change to the *„SERVICE“* menu.
2. Press key *[ENTER]* switch to the menu *„Expert jobs“* .
3. Use the arrow keys to select the menu *„Set stroke length“* .
4. Using the key *[ENTER]* switch to the menu *„Set stroke length“* .
5. Set the new stroke lengths at the dosing pumps.
6. Accept the new values for the stroke lengths with the *[F5]* *„SAVE“* key.

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

Output adjustment range ClO2 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.
CDK 170	70	7 ... 120	9 ... 170
CDK 420	60	12 ... 250	20 ... 420
CDK 900	50	23 ... 450	45 ... 900
CDK 2100	40	42 ... 840	105 ... 2100
CDK 3000	40	60 ... 1200	150 ... 3000
CDK 7500	30	113 ... 2250	375 ... 7500

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.

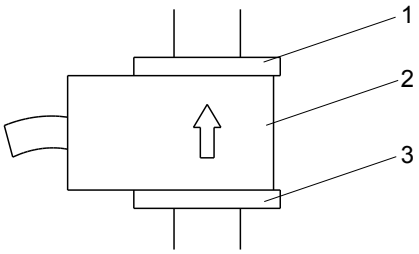


Fig. 18: Stroke sensor overview

1 Top adjusting washer
2 Ring initiator
3 Bottom adjusting washer

Prerequisites:

The dosing pumps are bled.

1. Turn each top adjustment washer (1) of the stroke sensors - see figure Fig. 18 - fully upwards.
2. Reposition the ring initiators (2) and the bottom adjustment washers (3) respectively.
3. Start the metering pumps with the *[F3] „START“* key.

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

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 bottom adjusting washer (3) by 1 turn.
6. Lower the respective top adjusting washers (1) to the ring initiators (2).
7. Press *[F5] „NEXT“* to exit the menu.
8. Press *[F1] „HOME“* to change to the display *„Equipment off“* .

11.5 Check sensors

In the event of measured valued dependent dosing, the sensors must be regularly checked. The interval is dependent upon national regulations or process conditions - see the sensor operating instructions.

ClO_2sensor

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.

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. 7. 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. Also the old values can 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 supplied SD card is 512 MB. In general, this is sufficient capacity for 1/2 to 1 year.

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

The SD card formatting must be FAT 16.

SD card insertion

1. To insert the SD card, open the bottom transparent interface cover on the control.
2. Push the SD card into the card slit until it engages. If it is not engaged, the error message *„SD card not initialized“*.
3. Close the interface cover and screw in place to ensure that it is moisture-proof.

WARNING!

Danger of electric shock

– The transparent interface cover must be screwed in place to ensure it is moisture-proof.

Evaluation of the SD card files

1. Remove the SD card - logically reversed as under *„SD card insertion“ on page 95*.
2. Copy the files contained in the SD card to a PC via a card reader - they are contained in the "Logbook" directory.
3. Plug the SD card back in, as under *„SD card insertion“ on page 95*.

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

If you have changed the clock of the Bello Zon®control 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_2gas is formed in the 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_2gas 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_2dosing 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_2solution diluted. ■ With too little acid: – The yield of ClO_2 falls and the displayed ClO_2quantity is no longer correct. – The result is possible health hazards due to exceeding of the permissible chlorite concentration! ■ With too little water: – The ClO_2concentration in the reactor becomes too high. The high temperature can result in material damage and leaks. – The ClO_2concentration in the reactor becomes so high that the reactor explodes.

c) Bypass

Incorrect operation:	The limit contact of the flow meter in the bypass is set too low.
Consequence:	The ClO_2concentration 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_2dosing 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_2solution diluted. ■ With too little acid: – The yield of ClO_2 falls and the displayed ClO_2quantity is no longer correct. – The result is possible health hazards due to exceeding of the permissible chlorite concentration! ■ With too little water: – The ClO_2concentration in the reactor becomes too high. The high temperature can result in material damage and leaks. – The ClO_2concentration in the reactor becomes so high that the reactor explodes.

13 Maintenance

Safety information

WARNING!

Toxic ClO_2 solution can escape

If maintenance is forgone or neglected, the worst case scenario would result in the escaping of ClO_2 solution through a pipe leak.

– Customer service must service the Bello Zon® system at least annually.

WARNING!

Toxic chemicals may escape

Toxic chemicals in the hydraulic components of the system.

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

WARNING!

Danger of an electric shock

Danger due to incorrectly replaced electrical cabling.

– Control cabling or mains leads must only be replaced by customer service.
– Only the appropriate special cabling must be used.

Relating only to the reactor housing:

WARNING!

Toxic chemicals in the reactor housing

The interior of the reactor housing may contain toxic ClO_2 gas or ClO_2 solution.

– Prior to any opening of the reactor housing, always extract its contents. Accordingly press *[F5]* VENTILATE. Water for the ventilation must flow.

Relating only to the reactor housing:

WARNING!

The reactor housing can explode

If ClO_2 can become enriched in the reactor housing, it may explode.

– Never operate the reactor housing ventilation with a de-energized solenoid valve.
– Never operate the reactor housing ventilation with a blocked water supply line.

NOTE for the system operator

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

Customer service can carry out this check as part of a service. We therefore recommend the taking out of 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
	Dosing pumps 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 he ClO_2 concentration in the treated water; observe national regulations.
2. Check the levels in the chemical canisters and compare, note possible warning *„Low level“* in the display, as 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. In older systems, check the pipe walls of the bypass line for limescale.
6. Check the system for leak-tightness.

Cleaning the housing

1. Check the housing using a cloth dampened with soapy water.

CAUTION!
Solvent can attack the surfaces.
– Do not use solvents under any circumstances.

2. Rub the housing dry.

Dosing pumps inspection

1. Check the dosing head screws for correct seating.
2. Check the dosing lines on both the discharge and suction sides for correct seating.
3. Check the dosing lines on both the discharge and suction valves for correct seating.
4. Check for moisture in the leakage hole of the end disc. If moisture is present, a membrane rupture has probably occurred.

Acid vapour separator inspection

Check both acid vapour separators for dark discolouring of the packing. If necessary, replace them.

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 customer service

Interval	Maintenance work	Personnel
After 10 years	If not previously replaced, the reactor and all bypass piping must be replaced now	Customer Service department
	Replace the batteries of the control on a preventative basis - refer to the "Disposal" chapter.	Customer Service department
After 6 months, at least annually	Replace all wear parts - ProMaqua service set!	Customer Service department
	Check the system for safety	Customer Service department

Concluding servicing

→ In the *„Service“* menu under *„Commissioning“* - *„Service interval“* conclude the service using the *[Enter]* key.

⇨ The daily countdown of the next annual service interval is restarted.

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 170	1036454
CDKc 420	1036455
CDKc 900	1036456
CDKc 2100	1036457
CDKc 3000	1036458
CDKc 7500	1036459

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

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

– 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 „Ventilate“, „External error“, „Leakage“ ...).*
– *If you wish to contact ProMinent because of a fault, then you must have the following information to hand:*
  – *The identity code (press[F2] SETTING, using key [DOWN] „Identity code“ select and press key [ENTER]),*
  – *The version number for hardware and software ([F2] SETTING, using key [DOWN] „select CAN overview“ and press key [ENTER] . „SW-Vers“ and „HW-Vers“ enter the desired information under „Control“ .),*
  – *the colour of the left LED of the Bello Zon ®control and its behaviour*
  – *the precise error text - in the event that the control is displaying an error message.*

15.1 Faults without error messages

Fault description	Cause	Remedy	Personnel
Liquid is escaping from the end disc of a dosing pump.	The liquid end leaks at the metering diaphragm.	Retighten the Allen screws at the dosing head. If this is unsuccessful, inform the Customer Service department.	Instructed personnel
The dosing pump has been working for a long time, but suddenly is no longer transporting.	Air in the metering line or the chemical canister is empty.	Bleed the metering line, check the level in the chemical canister, if no success:	Instructed personnel
	Pump diaphragm probably defective.	Replace diaphragm.	Customer Service department
Dosing pump does not dose, a green bar is not flashing - see "continuous display 1" Fig. 10.	CAN cables 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 dosing pumps are overstrained due to too low operating pressure.	Increase the operating pressure over 1.5 bar.	Technical experts
The processed ClO_2concentration in the water varies unusually.	The dosing 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

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

Fault description	Cause	Remedy	Personnel
Operating time expired	The system must be serviced.	Service system.	Customer Service department
Operating time nearly expired	The system must be serviced.	Book customer service.	Instructed personnel
Bypass survey - as an error message	No flow in the bypass.	*[Press F1] „QUIT“*, check bypass, *[press F1] „ON“*.	Technical experts
Bypass survey - as 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 available.	Check the cable connections to the chlorite pump.	Instructed personnel
Chlorite concentration high	Entire application problem.	Check system.	Technical experts
Chlorite concentration too high	Entire application problem.	*[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	Entire application problem.	Book customer service.	Technical experts
Chlorite conc. too low	Entire application problem.	Book customer service.	Technical experts
Chlorite signal (cable break)	Cable break	Check the cable connection to the CLT sensor	Instructed personnel
Faulty Chlorite calibration	Zero point or slope lies outside the tolerance range.	Improve the CLT sensor calibration once more.	
ClO2 concentration high	Problem with ClO_2dosing.	*[Press F1] „QUIT“*, check ClO_2dosing, *[press F1]* ON.	Technical experts
ClO2 concentration low	Problem with ClO_2dosing.	ClO_2dosing.	Technical experts
ClO2 concentration too high	Problem with ClO_2dosing.	ClO_2dosing.	Technical experts
ClO2 concentration too low	Problem with ClO_2dosing	*[Press F1] „QUIT“*, check ClO_2dosing, *[Press F1] „ON“*.	Technical experts
ClO2 signal (cable break)	Cable break	Check the cable connection to the CDE or CDP sensor	Instructed personnel
Faulty ClO2 calibration	Zero point or slope lie outside the tolerance range.	Improve the CDE or CDP sensor calibration once more.	
Dosing error chlorite	see "Detailed troubleshooting", below	*[F1]* press QUIT, next - see "Detailed troubleshooting", below	Instructed personnel
Dosing error acid	- see "Detailed troubleshooting", below	*[F1]* press QUIT, next - see "Detailed troubleshooting", below	Instructed personnel
Dosing error water	- see "Detailed troubleshooting", below	*[F1]* press QUIT, next - see "Detailed troubleshooting", below	Instructed personnel

Fault description	Cause	Remedy	Personnel
Flow Bypass	- see "Detailed troubleshooting", below	- see "Detailed troubleshooting", below	Instructed personnel
Flow signal (cable break)	Cable break of the mA wire for the flow meter of the main water supply line.	Check cable connection.	Instructed personnel
Flow high	The flow in the main water supply line is very high.	Check system.	Technical experts
Flow low	The flow in the main water supply line is very low.	Check system.	Technical experts
Flow too high	The flow in the main water supply line is too high.	*[F1] „QUIT“*, check system, *[press F1] „ON“*.	Technical experts
Flow too low	The flow in the main water supply line is too low.	*[F1] „QUIT“*, check system, *[press F1] „ON“*.	Technical experts
Flow signal too high	The flow signal in the main water supply line is too high.	Check the signal generator.	Instructed personnel
Leakage input	Leak at the safety bund or the reactor in the reactor housing.	Check for leaks at the safety bund or reactor in the reactor housing. *[Press F5] „Ventilate“* several times until the reactor housing is free from liquid or ClO_2gas. Book customer service.	Instructed personnel
Error input	An input is faulty.	*[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 at the chlorite dosing pump.	*[Press F1] „QUIT“*, check stroke length or set the same value for all pumps, *[press F1] „ON“*.	Instructed personnel
Stroke length error water	Incorrect stroke length at the water pump.	*[Press F1]* QUIT, check stroke length, *[press F1]* ON.	Instructed personnel
Stroke length error Acid	Incorrect stroke length at the acid dosing 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 connection in the control	Check the cable connection in the control.	Customer Service department
No alarm	Normal condition	No remedy necessary	
Error sample water	Error sample water	*[Press F1] „QUIT“*, check system, *[press F1] „ON“*.	Instructed personnel
pH high	Entire application problem.	Check system.	Technical experts
pH low	Entire application problem.	Check system.	Technical experts
pH too high	Entire application problem.	Check system.	Technical experts
pH too low	Entire application problem.	Check system.	Technical experts
pH signal (cable break)	Cable break	Check the cable connection to the pH sensor	Instructed personnel
Faulty pH calibration	Zero point or slope lie outside the tolerance range.	Repeat calibration, if necessary replace the pH sensor.	
ORP high	Entire application problem.	Check system.	Technical experts

Fault description	Cause	Remedy	Personnel
ORP low	Entire application problem.	Check system.	Technical experts
ORP too high	Entire application problem.	Check system.	Technical experts
ORP too low	Entire application problem.	Check system.	Technical experts
ORP signal (cable break)	Cable break	Check the cable connection to the ORP sensor	Instructed personnel
Faulty ORP check	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 available.	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 initialized	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 full.	Replace the SD card with an empty card.	
Setpoint signal (cable break)	mA cable connection to the signal generator interrupted.	Check the mA cable connection to the signal generator.	Instructed personnel
Setpoint high	Error at the setpoint signal generator.	Check the signal generator.	Instructed personnel
Setpoint low	Error at the setpoint signal generator.	Check the signal generator.	Instructed personnel
Setpoint too high	Error at the setpoint signal generator.	*[Press F1] „QUIT“*, check signal generator, *[press F1] „ON“*.	Instructed personnel
Setpoint too low	Error at the setpoint signal generator.	*[Press F1] „QUIT“*, check signal generator, *[press F1] „ON“*.	Instructed personnel
Setpoint signal too high	Error at the setpoint signal generator.	Check the signal generator.	Instructed personnel
Disturbance variable signal (cable break)	mA cable connection to the signal generator interrupted.	Check the mA cable connection to the signal generator.	Instructed personnel
Dist. variable high	Error at the disturbance variable signal generator.	Check the signal generator.	Instructed personnel
Dist. variable low	Error at the disturbance variable signal generator.	Check the signal generator.	Instructed personnel
Dist. variable too high	Error at the disturbance variable signal generator.	*[Press F1] „QUIT“*, check signal generator, *[press F1] „ON“*.	Instructed personnel
Dist. variable too low	Error at the disturbance variable signal generator.	*[Press F1] „QUIT“*, check signal generator, *[press F1] „ON“*.	Instructed personnel
Dist. variable too high	Error at the setpoint signal generator.	Check the signal generator.	Instructed personnel
Supply Chlorite empty	The chlorite storage tank is empty.	*[F1] „QUIT“* press, next - see "Detailed troubleshooting", below.	
Supply Chlorite low	The level in the chlorite storage tank is low.	Change both chemical canisters - see chapter *Chapter 11.1 „Chemical canister replacement“ on page 89*. WARNING!	
Supply Acid empty	The chlorite storage tank is empty.	*[F1] „QUIT“* press, next - see "Detailed troubleshooting", below.	

Fault description	Cause	Remedy	Personnel
Supply Acid low	The level in the acid storage tank is low.	Change both chemical canisters - see chapter ↳ *Chapter 11.1 „Chemical canister replacement“ on page 89*. WARNING!	
Supply water empty	The water storage tank is empty.	*[F1] „QUIT“* press, check the water supply and the level switch.	
Supply water overflow	The water storage tank is too full.	*[F1] „QUIT“* press, drain some water and check the operation of the solenoid valve.	Instructed personnel
Supply water filling time exceeded	The water tank filling time was exceeded.	*[F1] „QUIT“* press, if necessary drain some water and rectify the cause.	Instructed personnel
Water CANopen - node not found	No CAN bus connection to the acid pump available.	Check the cable connections to the acid pump.	Instructed personnel
Water pump not ready	- see "Detailed troubleshooting", below	- see "Detailed troubleshooting", below	

Detailed troubleshooting

Fault description	Cause	Remedy	Personnel
„Dosing error acid“ or *„Dosing error chlorite“*	A stroke sensor is misadjusted.	Adjust the stroke sensor - see chapter ↳ *Chapter 11.4 „Adjust stroke sensors“ on page 93*. *[Press F1] „ON“* .	
	The back pressure has risen.	If there is a high pressure increase, rectify the cause, if there is a low pressure increase readjust the stroke sensor - see Chapter ↳ *Chapter 11.4 „Adjust stroke sensors“ on page 93*. *[Press F1] „ON“* .	
	Air is contained in the line from the vessel to the stroke sensor, the vessel is empty.	See chapter ↳ *Chapter 11.1 „Chemical canister replacement“ on page 89*. *[Press F1] „ON“* .	
	Leak in the line from the vessel to the stroke sensor.	Rectify the leak.	Customer Service department
„Dosing error water“	A water stroke sensor is misadjusted.	Adjust the stroke sensor - see chapter ↳ *Chapter 11.4 „Adjust stroke sensors“ on page 93*. *[Press F1] „ON“* .	
	The back pressure has risen.	If there is a high pressure increase, rectify the cause, if there is a low pressure increase readjust the stroke sensor - see Chapter ↳ *Chapter 11.4 „Adjust stroke sensors“ on page 93*. *[Press F1] „ON“* .	
	Air is contained in the line from the vessel to the stroke sensor, the water tank is empty.	See chapter ↳ *Chapter 11.1 „Chemical canister replacement“ on page 89*. *[Press F1] „ON“* .	
	Leak in the line from the water vessel to the stroke sensor.	Rectify the leak.	Customer Service department
„Acid pump not ready“ or *„Chlorite pump not ready“*	The dosing pump has not yet been bled or calibrated within the scope of commissioning.	- see chapter ↳ *Chapter 11.2 „Bleeding pumps“ on page 91*.	Technical experts

Fault description	Cause	Remedy	Personnel
	The stroke length is set to too small a value.	Increase the stroke length with the adjustment knob - see chapter ↳ *Chapter 11.3 „Set stroke length“ on page 92*.	Technical experts
„Water pump not ready“	The dosing pump has not yet been bled or calibrated within the scope of commissioning.	- see chapter ↳ *Chapter 11.2 „Bleeding pumps“ on page 91*.	Technical experts
	The stroke length is set to too small a value.	Increase the stroke length with the adjustment knob - see chapter ↳ *Chapter 11.3 „Set stroke length“ on page 92*.	Technical experts
„Supply Acid empty“ or *„Supply Chlorite empty“*	Chemical canister empty.	Change both chemical canisters - see chapter ↳ *Chapter 11.1 „Chemical canister replacement“ on page 89*. Bleed dosing pumps - see chapter ↳ *Chapter 11.2 „Bleeding pumps“ on page 91*. *[Press F1] „ON“* .	Technical experts
„Flow Bypass“	The ball valve in the bypass is not open.	Open the ball valve in the bypass.	Instructed personnel
	The cable connection from the bypass survey to the control is defective.	Rectify this cable connection.	Instructed personnel
	If available: The bypass pump is not transporting.	Check he 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 mains fuse of the control

WARNING!

Danger of electric shock

Within the control, individual parts can carry a mains voltage.

– 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, a mains voltage still exists in the terminal blocks XR1 and XR2.

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

WARNING!

Warning of risk of fire and malfunctions

Fire risks and malfunctions can result from using incorrect fuses.

– Only use the approved original fuses from ProMinent, see . Only in rare cases will any other fuse, with the values given below, have the same properties.

Personnel: ■ Electrician

1. Undo the four countersunk screws.
2. Remove the front part. For further information - see Part 1 of the Operating Instructions, chapter "Installation, electrical".
3. Open the bayonet coupling of the corresponding fuse holder. For the fuse layout - see Part 1 of the Operating Instructions, appendix.
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)

Designation	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 below.

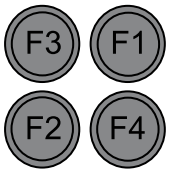


Fig. 19: Fuse layout in the control

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 coarse/fine bleed valves on the liquid ends of the dosing pumps.

16.1 For a short period

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

→ Press key *[START/STOP]* .

⇨ *„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.

16.2 For a longer period

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 several days, then the reactor should be rinsed through with water. To do this using the flushing equipment in the bypass line - see Part 1, chapter "Installation, hydraulic"

Safety information

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.

– Never leave the contents of the reactor without detoxifying them first.

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, "Liquid volume, total": 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. Stop the system with 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 liquid level.
8. Open the rinse valve.
9. Follow the path *„Service ➔ Commissioning“*.
10. *„Bypass activ. manual“* change to *„OFF“*.
    ⇨ The dosing pumps can also operate with out bypass control via the *„Commissioning“* menu.
11. Advance further in the menu *„Commissioning“* to *„Fill reactor“* - see chapter *„Setting, Service“* - *„Commissioning.“*
    ⇨ The dosing pumps begin to pump.
12. If the PVC hose continues to still contain yellow solution, press the key *[F3]* as soon as the dosing pumps have stopped, so that further rinsing can be carried out.
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 ...).

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	g	l	l	ml	ml	g	ml
CDKc 170	1.4	28	5	3	98	21	182	105
CDKc 420	3.5	70	2	7	245	53	455	263
CDKc 900	7.5	150	25	16	525	113	975	546
CDKc 2100	17.5	350	58	37	1225	263	2275	1315
CDKc 3000	17.5	350	58	37	1225	263	2275	1315
CDKc 7500	43.8	876	145	92	3066	659	5694	3291

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

17 Disposal

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 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.

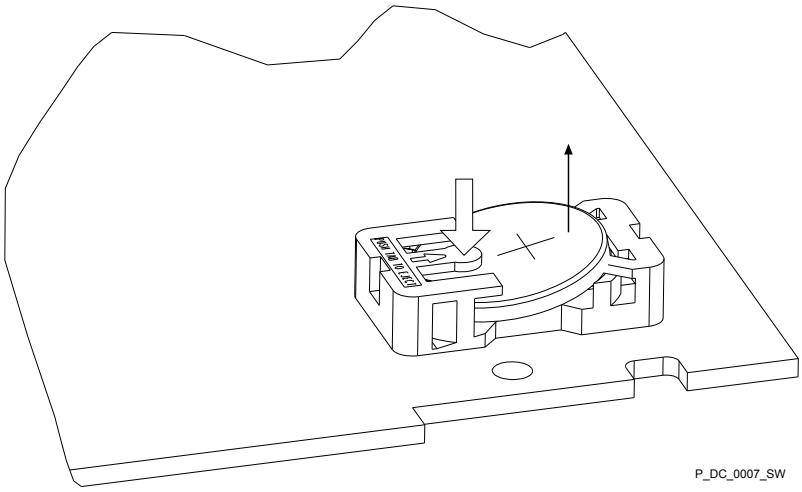


Fig. 20: Removing the battery

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 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

Designation	Units	1.	2.	3.	4.
Calculated Production volume	g/h	0	50	50	50
Actual disturbance variable	%	5	10	20	0
Disturb. variable factor	%	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

Designation	Units	1.	2.	3.	4.	5.	6.
Calculated Production volume	g/h	40	90	50	50	50	0
Actual disturbance variable	%	5	5	2	10	20	5
Disturb. variable factor	%	100	50	100	50	100	10
Final Production volume	g/h	120	120	120	120	120	120
Max. 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 control)

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 %.

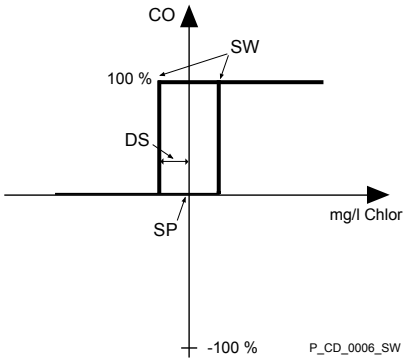


Fig. 21: 2 point control

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

Neutral zone

With neutral zone control (dead zone control) two set points must be specified. If the measured value is located within the neutral zone, then no control variable is issued. Set point 2 must be greater than set point 1!

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 %

Limits

"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.

High dosage

If the installation requires a high dosing of ClO_2 solution from time-to-time, then reconfigure "Input dosing" to "High. dosing" in "Settings"-"Configuration". 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 dosing

If the installation requires a certain constant dosing of ClO_2 solution from time-to-time, then reconfigure "Input dosing" to "Man. dosing" in "Settings"-"Configuration". 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 taken from the hazardous substances data sheet of the Bundesvereinigung der Firmen im Gas- und Wasserfach e.V. FIGWA, 50968 Cologne, of 16.4.1998.)

Properties of chlorine dioxide and instructions for handling aqueous solutions

The chlorine dioxide stock 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 compartment of less than 100 g/m^3. Consequently provided preparation is carried out correctly, explosive decomposition in both the gas compartment and the stock solution are excluded.

19.1 Physical and chemical properties

19.1.1 Chemical characterisation

Aqueous solution of chlorine dioxide (ClO_2) approx. 2 g ClO_2/L 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 Vol %) into chlorine and oxygen.

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

For example, with a critical chlorine dioxide concentration in the gas compartment above an aqueous chlorine dioxide solution, a concentration of more than 8 g/L chlorine dioxide (at a temperature of 20 degrees C) must be reckoned with.

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

The labelling of the workplace and area is carried out 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 ready for immediate use.

19.2.3 Measures for spillage, escaping, gas escapes

Precipitate the gas out 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 containers with water, precipitate any escaped chlorine dioxide gas out with a water spray. **There are no limitations for fire extinguishing agents in the event of encroaching fires.**

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 from 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 glasses, face visor

Hand protection: Rubber gloves

Others: 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 concentration and the duration of the influence, the results 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 the 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 out splashes into the eyes for several minutes using 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-Arbeitsblatt (worksheet) W 224 "Chlorine dioxide in water treatment" [in German]

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

Ullmann Volume 5, Page 551

Kühn-Birett, Sheet C 20

Note: A European standard for chlorine dioxide is currently under preparation as well as the DVGW-Data Sheet W 624 " Chlorine dioxide dosing systems", Edition 10/96.

Note: The information is based on the latest state of our knowledge. It should contribute to the safe handling of aqueous chlorine dioxide solution and as such does not have the purpose of safeguarding particular properties. Automatic correction upon revision is not guaranteed, also legally non-binding.

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