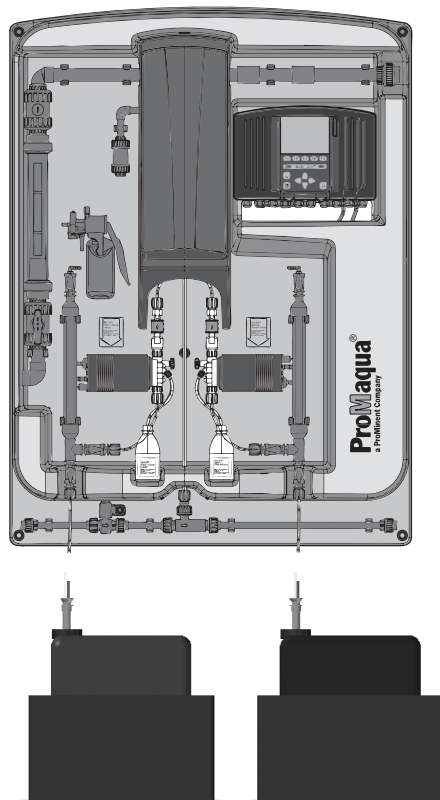


Operating Instructions

Chlorine Dioxide Systems

Bello Zon® Type CDVc

Part 2



CDVc

Please enter the Identcode of your system

These operating instructions apply only in conjunction with the
“Operating Instructions Chlorine Dioxide Systems Bello Zon® Type CDVc, Part 1”!

Please completely read through operating instructions. Do not discard!
The operator shall be liable for any damage caused by installation or operating errors!

Corporate information:

Operating Instructions Chlorine Dioxide Systems Bello Zon® Type CDVc Part 2
© ProMinent ProMaqua GmbH, 2008

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Technical changes reserved.

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General Notes for the User

Please read through the following user guidelines! Familiarity with these points ensures optimum use of the operating instructions.

Key points in the text are indicated as follows:

- Enumerations
- Instructions

Working guidelines:

NOTE

A note provides important notes for the correct functioning of the unit or is to facilitate your work.

Notes on safety identified by pictographs (see Chapter 2).

Notes to the system operator

Contain notes and quotations from German guidelines for the system operator's area of responsibility. They, however, do not release him from his responsibility as operator, they are only meant to remind the operator of certain problems and are meant to make the operator aware of these problems. They neither claim completeness nor validity for all countries nor any type of application nor unconditional up-to-dateness.

Version number of hardware and software

The version number of the hardware and software can be accessed as follows: In the display "Equipment off" press F2 SETTING, go to the menu "System information" and press the ENTER key. Please state the Identcode as well as the version numbers in case of complaints or when removing already installed Bello Zon® systems.

Identcode series CDVc

CDVc	Chlorine dioxide systems type CDVc												
	02	Metering output ClO₂:											
	04	CDVc	20=	20 g/h									
	06	CDVc	45=	45 g/h									
	08	CDVc	120=	120 g/h									
	10	CDVc	240=	240 g/h									
	14	CDVc	600=	600 g/h									
		14	CDVc	2000=	2,000 g/h								
		P	Design:										
		S	ProMaqua										
			S	Special design									
			U	Operating voltage:									
			A	100-230 V + 10 %, 50/60 Hz (for version without ventilation)									
			B	230 V + 10 %, 50/60 Hz (for version with „bypass“ - 04)									
				100-115 V + 10 %, 50/60 Hz (not available for version with „bypass“ – 04 or 06)									
				Bypass version, bypass monitoring:									
			00	Without bypass, only with four-way connector (PVDF)									
			02	Bypass PVC-U with float flow meter									
			04	Bypass PVC-U with float flow meter and pump (stainless steel)									
				only with “operating voltage” – “A” (only CDVc 20-600)									
			06	Bypass PVC-U for receiver module, with water meter, float flow meter									
				(w/o limit value transmitter), with module “water supply” (only CDVc45-600)									
				Suction unit:									
			0	Without suction unit without calibration cylinder, but with measuring cylinder									
			1	Without suction unit with calibration cylinder									
			2	With suction unit without calibration cylinder, with measuring cylinder									
				(not for “operating voltage” – “U”)									
			3	With suction unit with calibration cylinder (not for “operating voltage” – “U”)									
				Suction lance, suction fitting chemicals:									
			0	None									
			1	Suction lance for 5-60 l tank (only CDVc 20-600)									
			2	Suction lance for 200 l tank (only CDVc 20-600)									
			3	Flexible suction fitting up to 5 m with two-phase level switch (only CDVc 20-600)									
			4	Suction lance for 25 l tank with 2 bunds 40l without leakage sensor (only CDVc 20-600)									
				Mechanical design:									
			0	Standard									
			M	Modified									
				Preset language:									
			DE	German									
			EN	English									
			FR	French									
			IT	Italian									
			ES	Spanish									
			JA	Japanese									
			CS	Czech									
				Controller:									
			0	Basic version									
			1	With measuring and control properties									
				(only for “Extended in- and outputs” – 1 or 3)									
			2	With measuring and control properties, data logger and screen recorder (only for “Extended in- and outputs” – 1 or 3)									
				Extended in- and outputs:									
			0	None									
			1	2 analogue inputs, freely configurable for controller output, disturbance (only for control with measuring and control properties) and flow									
			2	1 analogue output, freely configurable									
			3	2 analogue inputs, freely configurable for controller output, disturbance (only for control with measuring and control properties) and flow, and 1 analogue output, freely configurable									
				Communication interfaces:									
			0	None									
			1	LAN interface									
			2	LAN interface + ISDN interface									
			3	LAN interface + GSM interface									
			4	LAN interface + PROFIBUS® DP interface									
				Approvals:									
			01	CE-mark									
CDVc	02	P	U	00	0	0	0	0	EN	0	0	0	0

1 About this System

The Bello Zon® chlorine dioxide generating and metering systems work according to the chlorite/acid process. In these systems, a chlorine-free ClO_2 solution is generated by the reaction of sodium chlorite with hydrochloric acid.

ClO_2 is an extremely reactive gas that – because of its instability - must be generated based on its need in special systems at the site of its use.

ClO_2 offers several advantages compared to the chlorine mainly used in drinking water and process water treatment. The disinfection capacity does not decrease with increasing pH values, as is the case with chlorine, but rather even slightly increases.

ClO_2 keeps a long-time stability in the network and ensures microbiological protection of the water for many hours or even days.

Ammonia or ammonium, which result in a significant chlorine consumption, are not attacked by ClO_2 such that the metered ClO_2 can be fully used for disinfection.

Chlorophenols, strong-smelling compounds, which may be generated during the chlorination of water, are not generated when ClO_2 is used. Trihalomethanes (THMs), a substance class, that like its principal representative chloroform, is suspected of being carcinogenic, are generated when chlorine reacts with natural water ingredients (humic acids, fulvic acids etc.). With ClO_2 as an alternative, dramatically lower concentrations are measured, if any at all.

Most cases of application require a volume-proportional metering, i.e. flow-dependent with regard to the signal of an inductive flow meter or a contact water meter or parallel to a metering pump.

In circulation systems, such as e.g. bottle washing machines, cooling circuits, where a ClO_2 loss has only to be supplemented, the addition can also be controlled via a chlorine dioxide or ORP measurement depending on the measured value.

Decades of experience with Bello Zon® chlorine dioxide systems have shown that an excellent yield of 90-95% (referred to the stoichiometric ratio) is obtained with the chosen process parameters. If correctly set up, no chlorite is metered as by-product.

For Bello Zon® CDV systems, diluted chemicals can be used, i.e. Bello Zon® acid (hydrochloric acid 9%) and Bello Zon® chlorite (sodium chlorite 7.5%). Approximately 40g of ClO_2 are generated from 1 litre each of the two solutions.

As is the case with all disinfection technology, ClO_2 also requires that interfering water ingredients and the entire treatment must be considered. ProMinent possesses the experience from chloride dioxide installations worldwide in many different areas of applications and would be happy to assist you in your special design.

Areas of application:

- Public drinking water supply
- Drinking and process water in the food and beverages industry
- Bottle washing
- CIP system as disinfectant
- Pasteurizing and rinsing
- Cold sterile bottling
- Treatment of condensed vapour (condensate) in the milk industry
- Washing water treatment for fruit, vegetables, seafood, fish, and poultry
- Disinfection of irrigation water in horticulture
- Cooling water treatment
- In the paper industry for combating slime and treatment of process water
- Treatment of waste water
- Combating Legionella

2 Safety Chapter

Identification of the notes on safety:

The following terms are used in the present operating instructions to indicate the various severity levels of the danger:

DANGER

Characterizes a hazardous situation. There is a danger of death or serious injuries if these notes are disregarded.

WARNING

Characterizes a possibly hazardous situation. Your life is in danger and there is a danger of serious injury if these notes are disregarded.

CAUTION

Characterizes a possibly hazardous situation. There is a danger of slight or minor injury or damage to property if these notes are disregarded.

The following warning signs are used in the present operating instructions to indicate different types of danger:



Warning of danger area



Warning of hazardous electrical voltage



Warning of toxic substances



Warning of explosion risk



Warning of caustic substances

Please always first observe the following three basic rules:

- 1. The two components Bello Zon[®] acid (diluted HCl) and Bello Zon[®] chlorite (diluted NaClO₂) must never get into contact beyond the reactor!
Otherwise, toxic ClO₂ gas may be generated very suddenly which might explosively decompose!**
- 2. The chlorine dioxide system Bello Zon[®] CDVc must never be operated with undiluted acid or undiluted sodium chlorite!
Otherwise, toxic ClO₂ gas may be generated very suddenly which might explosively decompose in the reactor!**
- 3. The bypass water may never be subjected to vacuum!
Otherwise, the ClO₂ solution in the reactor may be subjected to vacuum, ClO₂ gasses out, accumulates, and may explosively decompose!**

Proper use:

- The Bello Zon[®] system is exclusively designed to generate a ClO₂-containing disinfection solution from diluted hydrochloric acid (9%) and sodium chlorite solution (7.5%) and to feed it into a bypass line with water or in a suitable tank.
- All other uses or modifications are prohibited!
- The Bello Zon[®] system is not designed to treat liquids (with the exception of water) or gaseous media as well as solids with ClO₂!
- The system may not be operated beyond the conditions described in the Technical Data!

- The Bello Zon® system must only be operated by instructed persons! All other activities may only be performed by specially trained and authorised personnel (see table below)!
- You are obliged to observe the information in the operating instructions on the various life phases of the system!
- Please observe the relevant local regulations in all life phases of the system!

Activity	Training
Mounting / installation	trained qualified employees
Initial commissioning	customer service authorised by ProMinent ProMaqua
Commissioning	technical experts
Operation / replacement of can	instructed persons
Maintenance / repair	customer service authorised by ProMinent ProMaqua
Decommissioning / disposal	technical experts
Troubleshooting	instructed persons

Table 1: Qualification of the personnel for the operation of the system



WARNING

According to accident statistics, replacements during holiday represent a safety risk!

Replacements during holiday, too, must possess the above mentioned qualifications and must be trained!

Explanations for the table:

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

Note:

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

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

Note:

A technical training of equal qualification can also have been acquired by an activity of several years in the relevant field of work.

An **instructed person** is a person having been informed about the tasks assigned to him/her and the possible hazards in case of improper behaviour and having been trained, if required, as well as having been informed about the required protective equipment and protective measures.

The **customer service** means service technicians which have been provable trained and authorised by ProMinent ProMaqua for work in the CDVc systems.

Personal protective equipment:

- Face protection
- Rubber or plastic boots
- Protective gloves (ClO₂-tight!)
- Protective apron
- Respiratory equipment as full mask
- 1 replacement filter for each respiratory equipment



WARNING

- ***The operating personnel must be instructed by a ProMinent service technician! (is done during commissioning)***
- ***The operating instructions must be kept at the system!***
- ***Danger signs must be affixed at the installation location of the CDV and the storage rooms for the chemicals! (see Part 1 of the Operating Instructions)***
- ***Observe national regulations!***

Notes to the system operator

Keywords for the search for the required regulations:

- Chlorine dioxide systems
- Chlorine dioxide (possibly also chlorination)
- Drinking water
- Foodstuff
- Hydrochloric acid
- Sodium chlorite
- Storage
- Dangerous substances
- Personal protective equipment

Information for emergencies

- If you got into contact with acid: see EU safety data sheet acid, of the supplier!
- If you got into contact with chlorite: see EU safety data sheet chlorite, of the supplier!
- If you got into contact with ClO_2 solution or ClO_2 gas: see leaflet “Hazardous Materials Data Sheet Chlorine Dioxide: Properties of chlorine dioxide and notes on handling aqueous solutions” in the annex!
- An orange-yellow coloured ClO_2 gas was released: immediately vacate the room and interrupt the power supply (e.g. emergency switch)! Don the complete protective equipment and condense the gas with sprayed water! See also leaflet “Hazardous Materials Data Sheet Chlorine Dioxide: Properties of chlorine dioxide and notes on handling aqueous solutions” in the annex!
- An orange-yellow coloured ClO_2 gas was released: immediately vacate the room and interrupt the power supply (e.g. emergency switch)! Don the complete protective equipment, pour sodium thiosulphate solution over the ClO_2 solution, then dilute with a lot of water, and flush into the drain. See also leaflet “Hazardous Materials Data Sheet Chlorine Dioxide: Properties of chlorine dioxide and notes on handling aqueous solutions” in the annex!
- The Bello Zon® system was supplied with concentrated chemicals and the metering pumps have already pumped some of it to the reactor: immediately vacate the room and interrupt the power supply (e.g. emergency switch)! Contact the fire brigade and inform about the explosion hazard caused by concentrated ClO_2 gas! (ClO_2 gas may explode even after several hours!) See also leaflet “Hazardous Materials Data Sheet Chlorine Dioxide: Properties of chlorine dioxide and notes on handling aqueous solutions” in the annex!
- The Bello Zon® system was supplied with concentrated chemicals and the metering pumps have not yet started to pump: immediately set the Bello Zon® system to “Metering OFF” (Start / Stop key)! Place the suction lances in a bucket of water each and get a chemicals container with diluted chemicals. Have the concentrated chemicals disposed of by a specialist. See also leaflet “Hazardous Materials Data Sheet Chlorine Dioxide: Properties of chlorine dioxide and notes on handling aqueous solutions” in the annex!

Description and Test of the Safety Devices

The chlorine dioxide systems Bello Zon® are designed and operated corresponding to the German "DVGW working leaflet W224" and "W624" (DVGW = German Technical and Scientific Association for Gas and Water). They include the following safety devices (figure at the end of the chapter):

Bypass monitor A bypass monitor prevents that ClO_2 is generated and accumulates as soon as no water flows in the bypass downstream of the reactor to dilute the ClO_2 .

ProMinent ProMaqua supplies a bypass monitor on the customer's request:

A float flow meter with minimum contact switches as soon as the specified minimum flow is undershot. The control then deactivates the production ("Production fault"), the device LED flashes red, the horn sounds and the alarm relay switches.

If you do not want to use this bypass monitor, you have to ensure by other means that the system does not meter as soon as no water flows in the bypass!

Test: Slowly close the shut-off valve upstream of the float flow meter. The control must deactivate the production, the device LED flashes red, the horn sounds and the alarm relay switches. Press the key F5 HORN OFF, open the shut-off valve and then press the key F1 ACK.

Metering monitor devices The pumps must always meter the chemical components in the same ratio.

If too much acid is metered, insufficient ClO_2 may be generated and at the same time the treated water becomes excessively acid. If too much chlorite is metered, the treated water contains chlorite (limit values!).

This is prevented by two different devices:

Level switch The suction lances in the cans are equipped with two-stage level switches. The level switches are to prevent that only one component alone is metered. At the first level, the control emits a warning with e.g. the message "Supply acid low" on the LCD display and the alarm relay switches. At the second level, the control in addition deactivates the production ("Production fault"), the device LED flashes red, the horn sounds and the alarm relay switches.

Test: Slowly remove the suction lance from the filled tank and check the above mentioned responses. Press the key F5 HORN OFF and then press the key F1 ACK.

Metering monitors The metering monitors are to indicate if the metering ratio of the components changes uncontrollably. For this purpose, a stroke sensor is installed downstream of each pump. The magnetic float in the stroke sensor bounces to the rate of the pressure surges of the metering medium from the pump. This is registered by the control through the ring initiator of the stroke sensor - the green bars in the permanent display 1 extinguish at the rate of the metering strokes. If these signals fail 6 times in a row, the control then deactivates the production ("Production fault"), the device LED flashes red, the horn sounds and the alarm relay switches. The metering monitors can thus also indicate a high excessive pressure through the changed metering outputs.

Test: Move the upper shim and the ring initiator of a stroke sensor to the top - the green bar in the permanent display 1 must stop flashing and the control must deactivate the metering after 6 missed strokes. At the same time a message is displayed on the LCD screen, the device LED flashes red, the horn sounds and the alarm relay switches.

Press the key F5 HORN OFF, then return the ring initiator and the upper shim to their original positions, and press the key F1 ACK. If the position of the lower shim was altered, readjust the stroke sensor.

Now, check the other stroke sensor.

Safety bunds (accessories) The safety bunds are designed to prevent that the chemical of a defective component tank uncontrollably leaks or even mixes with the other component.

Test: Remove the intact tank from the dry safety bund. Fill the safety bund with water up to the top and check for leaks (if this is a safety bund with leakage monitor, the control must deactivate the metering. Press the key F1 ACK.).

Suctioning reactor housing (option)

The control regularly triggers a ventilation process for the reactor housing to prevent that dangerous amounts of ClO_2 accumulate in the reactor housing. For this purpose, the solenoid valve in the drinking water line opens. The water jet pump downstream then suctions off gases and liquids from the reactor housing. The vent valve or a deaeration line at the top of the reactor housing supplies air.

Test: Press the key F5 VENTILAT to manually start the ventilation. The water jet pump has to start to emit a roaring noise. If required, press the key several times to switch on and off the ventilation process several times.

Reactor housing (optional)

The reactor housing retains slight amounts of ClO_2 gas or ClO_2 solution.

Test: Block the vent valve, left, and press the key F5 VENTILAT. Pay attention to noises which might result from leakage (excluding the roaring noise of the water jet pump). If required, press the key several times to switch on and off the ventilation process several times. Release the vent valve or the deaeration line at the reactor housing.

Level switch in the reactor housing

A level switch at the bottom of the reactor housing signals major leakages to the control which immediately stops the ClO_2 production.

Test: Lift the annular float of the level switch – the control must immediately stop the ClO_2 production. Press the key F1 ACK).

Cover reactor

The cover of the reactor is a simple splash guard if leakages should occur in the environment of the reactor or the reactor outlet valve.

Test: Check whether the reactor cover is correctly mounted.

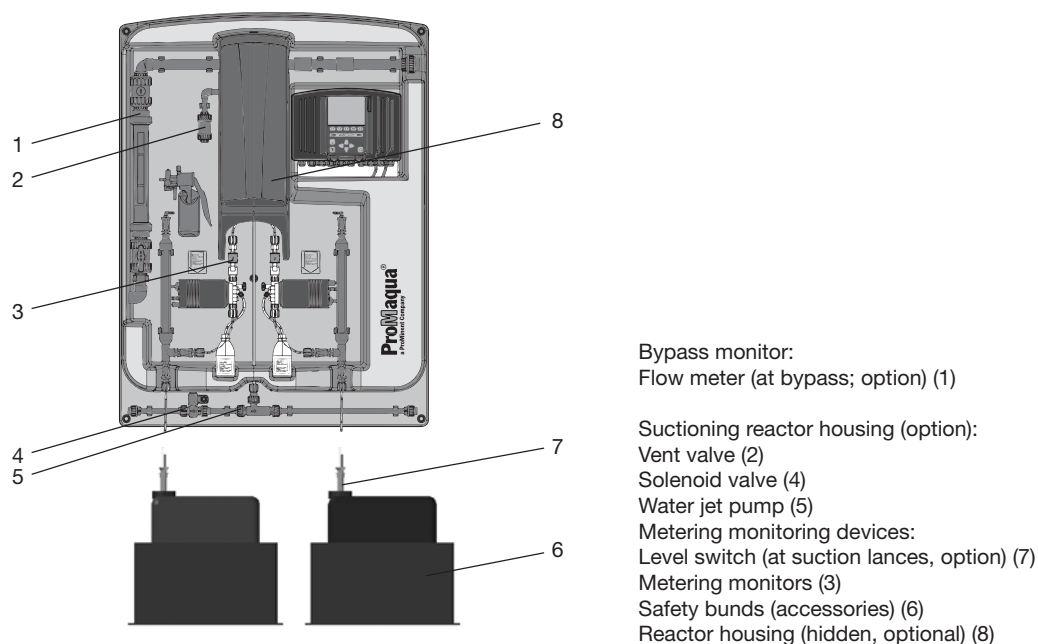


Fig. 1: Safety devices

3 System Overview

(excluding safety devices. For safety devices see figure above.)

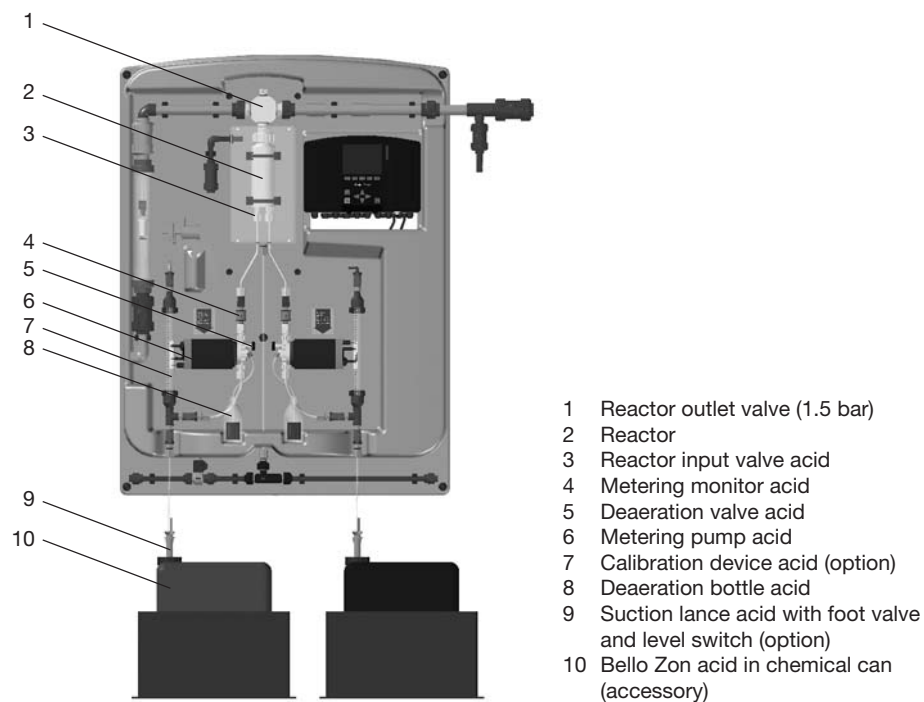


Fig. 2: Device components for the acid metering line of ClO_2 production

NOTE

For the benefit of clarity, only the device components for the acid metering line were identified.

The relevant device components for the chlorite metering line are always (mirrored) on the right of the relevant device component for acid.

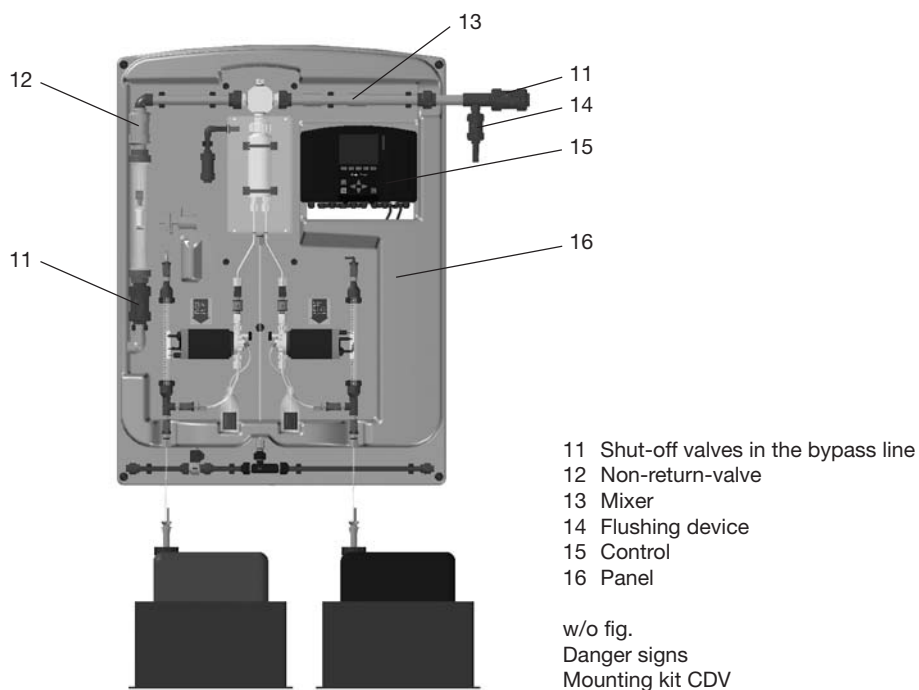


Fig. 3: Device components of CDV without the device components of Fig. 2

4 Function Description

4.1 Chemical Principle of the Systems

The chlorine dioxide system Bello Zon® CDV works according to the hydrochloric acid/chlorite process:

hydrochloric acid + sodium chlorite = chlorine dioxide + sodium chloride + water
 $4\text{HCl} + 5\text{NaClO}_2 = 4\text{ClO}_2 + 5\text{NaCl} + 2\text{H}_2\text{O}$

By combining diluted hydrochloric acid and diluted sodium chlorite solution, the Bello Zon® system first generates a 2% chlorine dioxide solution (20g/l ClO_2).

This solution is diluted in the bypass line immediately after having been generated and then supplied to the water to be treated.

4.2 Functioning of the System

Two metering pumps meter the components Bello Zon® acid and Bello Zon® chlorite into the reactor. There, the components react and generate the ClO_2 solution. The metering pumps also serve to transport this solution to the bypass via an injection point (reactor outlet valve). Downstream of the injection point, a mixer is installed which homogeneously mixes the ClO_2 solution with the water of the bypass. At the metering point, the diluted ClO_2 solution arrives at the main water flow and is diluted to the concentration finally effective in the process.

In the “bypass version” – “Bypass PVC-U for receiver module”, the module “Water supply” (consisting of shut-off valve, filter, pressure reducer, solenoid valve, water meter, and needle valve) supplies the bypass line with fresh water. Instead of flowing to a main water flow, the ClO_2 solution is transported to a feeder tank (“Storage module”) from which several metering points can be supplied.

Based on the required ClO_2 output and based on an actual value, if required, the control calculates the stroke frequencies for the metering pumps. In addition, it interprets the signals of the sensors of the safety devices and deactivates the metering, if required.

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

- manually (via the control alone)
- flow-proportional (via water meter)
- volume-proportional (via ClO_2 sensor)
- controller output-dependent (via external controller output, e.g. control room)

Definitions:

“Equipment” is the entirety of controls of the CDVc system, everything on its panel, and any existing CAN modules BatchControl and DosControl.

“Main control” is the control in the housing at the panel of the CDVc system.

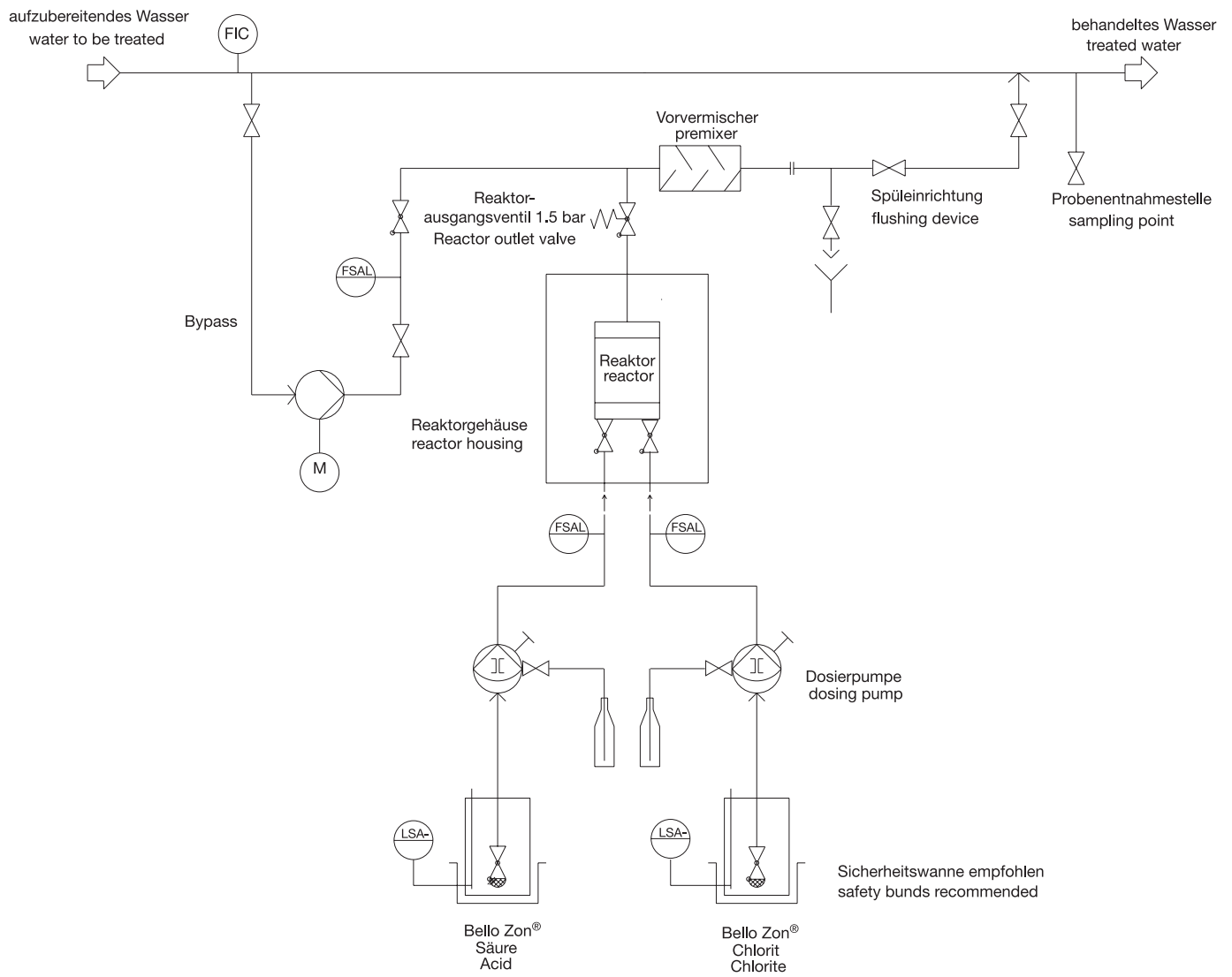


Fig. 4: Hydraulic diagram CDVc in bypass operation

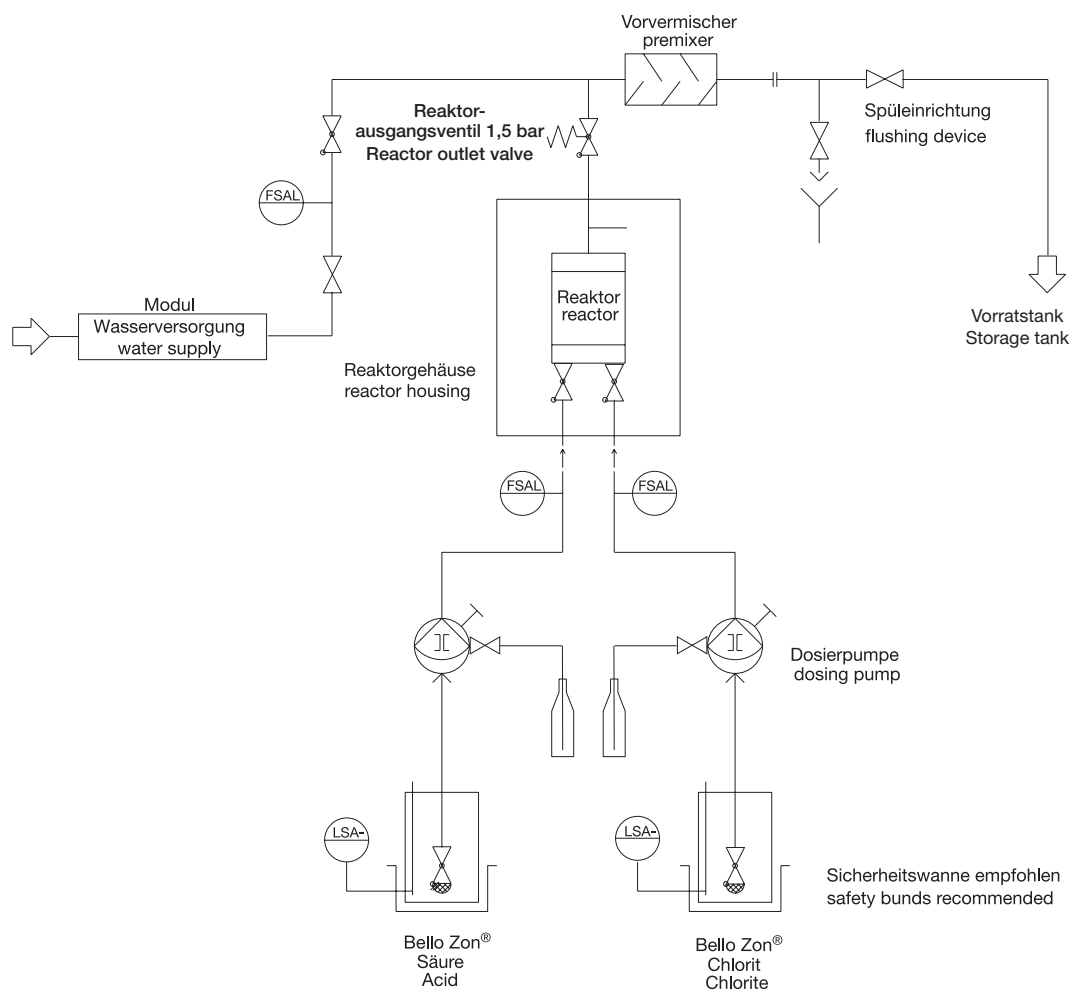


Fig. 5: Hydraulic diagram CDVc for the type with receiver module

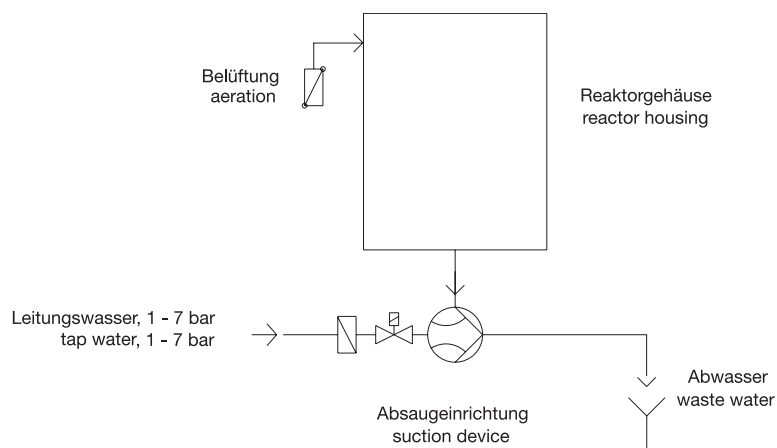


Fig. 6: Hydraulic diagram suction device

4.3 Safety Devices

For a description of the safety devices please see the end of the safety chapter (Chap. 2).

4.4 Controls and Keys

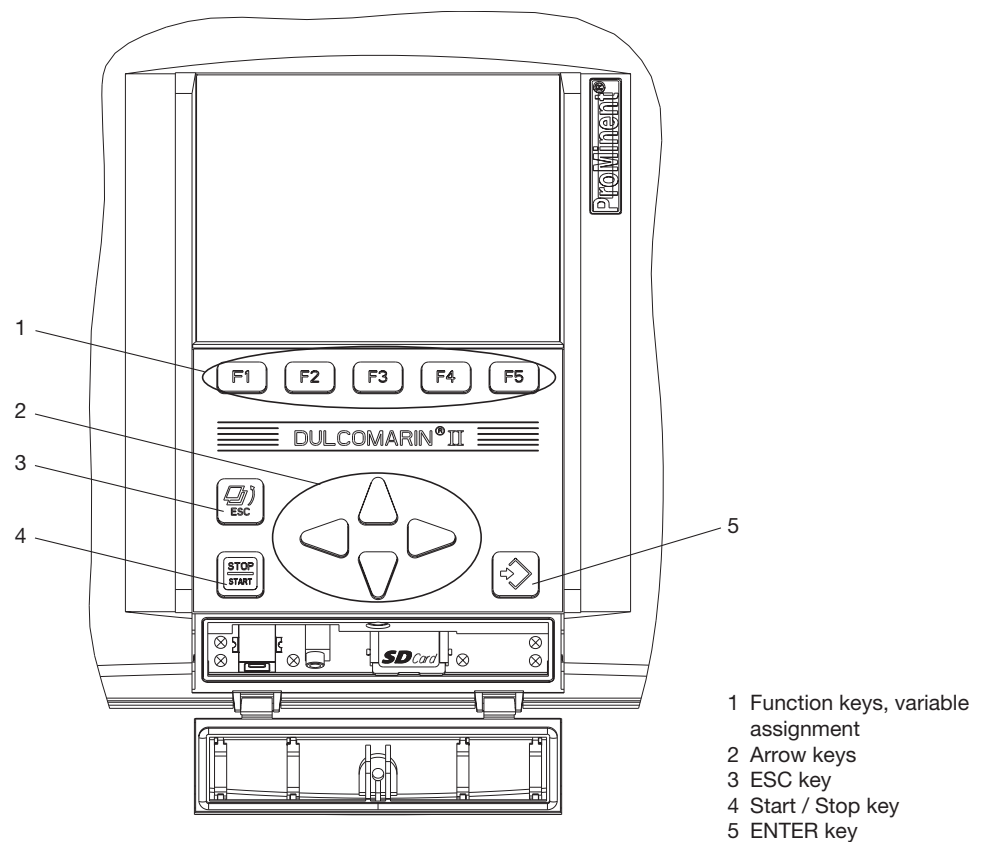


Fig. 7: The keys

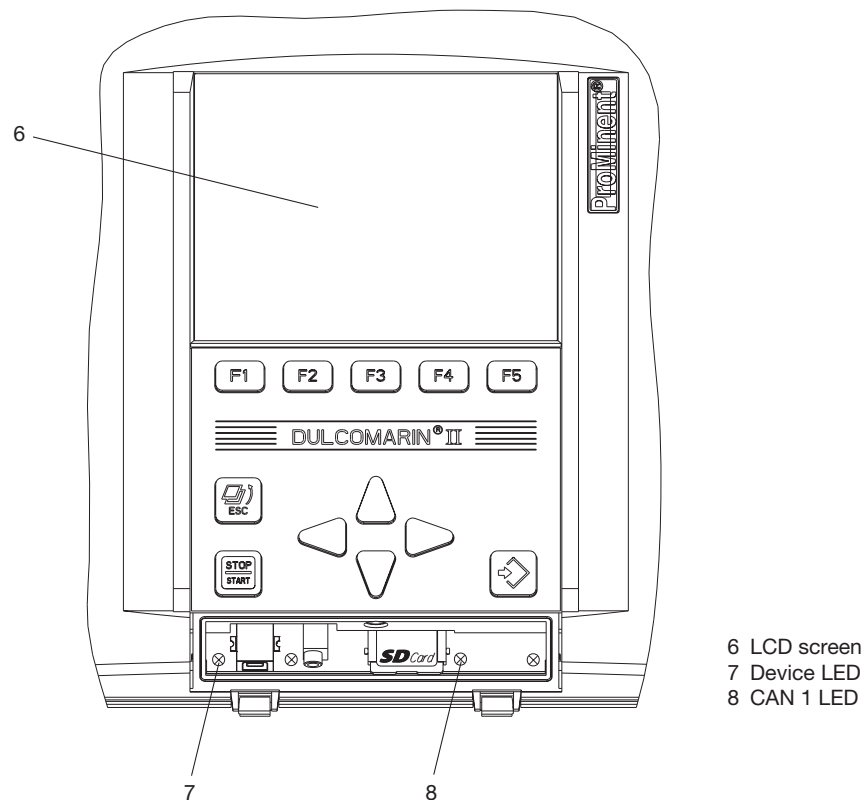


Fig. 8: The displays

4.5 Functions of the Keys

4.5.1 Controlling of the System

START / STOP key

To start the entire system, press for 3s: "Production off" – "System ON"
To stop the entire system, press: "Production off" – "Equipment off"

4.5.2 Navigation in the Operating Menu

ENTER key

The ENTER key is used to:

- go from menu option to menu option in the operating menu – into the menu option.
- access a selection in a menu option and confirm a change.

ESC key

The ESC key is used to:

- go from menu option to menu option in the operating menu – out of the menu option.

NOTE

To return from any menu option of the operating menu to the permanent display, press either F1 HOME or the ESC key repeatedly until the permanent display appears.

It is also possible to wait until the control automatically returns to the permanent display.



Fig. 9: Changing of numerical values

Arrow keys UP, DOWN, LEFT, RIGHT

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

- toggle between the selections of a menu option.
- In a selection, the numerical value or variable displayed can be changed with the arrow keys UP, DOWN. With the arrow keys LEFT, RIGHT, the decimal point to be changed can be selected for a numerical value.

Function keys F1 to F5

The variably assigned function keys F1 through F5 are used to select the menus or functions displayed above in the display as keys (e.g. menus SETTING, CALIB(ration) or the function SAVE(ept)).



CAUTION

The settings in the menus can only be saved using the function SAVE(ept).

Individual numerical values such as TIME or DATE are saved by pressing the ENTER key.



Fig. 10: Example for the assignment of function keys

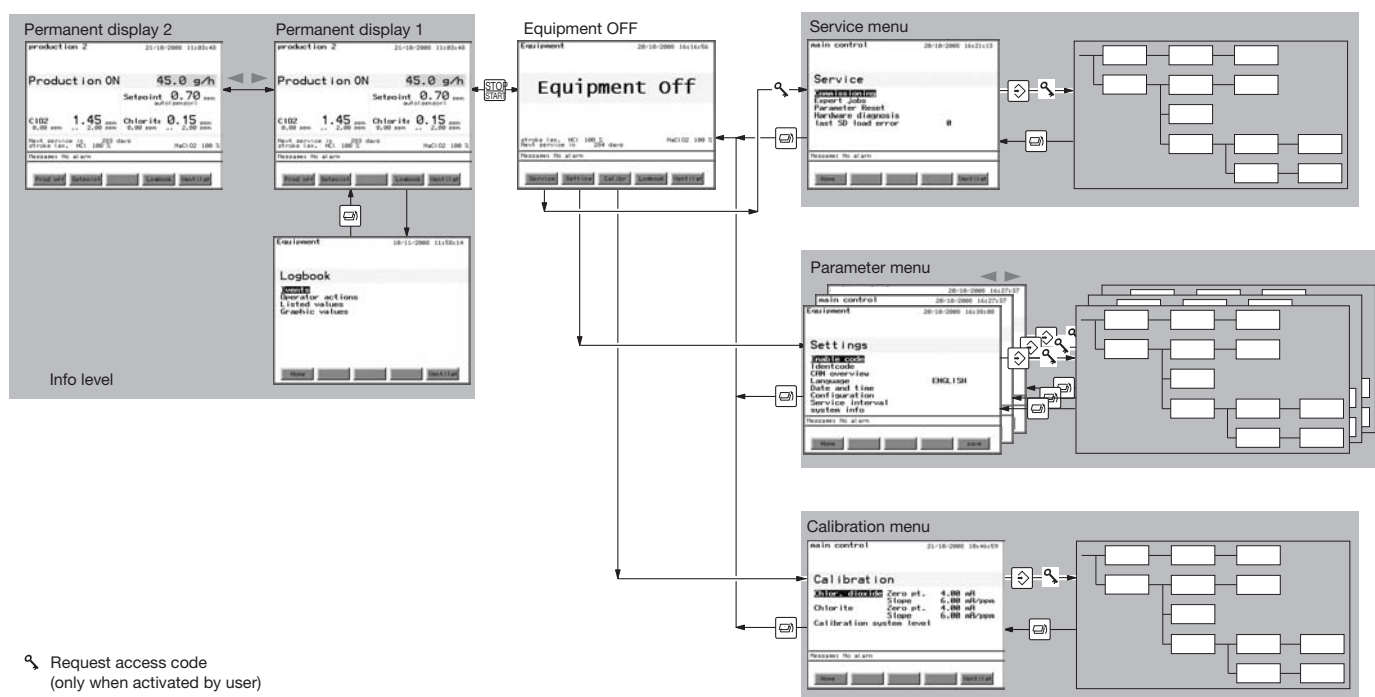
5 Settings

NOTE

This chapter 5 describes the operating menu, its functions and its setting options.

The applications in connection with a concrete purpose are described in the following chapters, such as e.g. Chapter 6 "Commissioning", Chapter 7 "Operation", ...

5.1 Operating Menu, Diagram



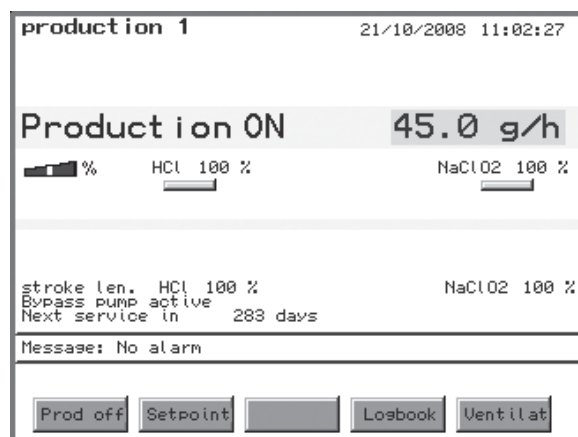
NOTE

The display "Equipment off" is the linchpin of the operating menu! At this point, the operating menu branches into different menus. It is thus worthwhile remembering its look.

The INFO level is reached from the screen "System OFF" by pressing the START/STOP key. It consists of:

- Permanent display 1 (Production 1)
- Permanent display 2 (Production 2)
- Display "Logbook"

"Permanent display 1" (Production 1)



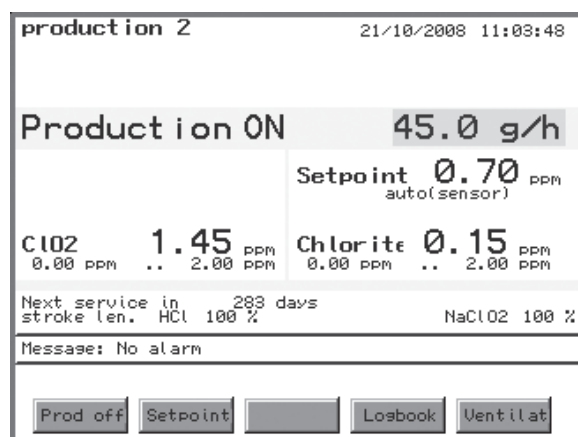
The "permanent display 1" (Production 1) shows e.g.:

- Present ClO_2 output
- Stroke length of the pumps
- Activity of the pumps
- Remaining time until maintenance
- Error messages

In addition, the function keys can be used to:

- Switch on or off the ClO_2 production
- Change the setpoint
- Switch over to the logbook (if the function exists)
- Suction off released gases from the reactor housing (if the function exists)

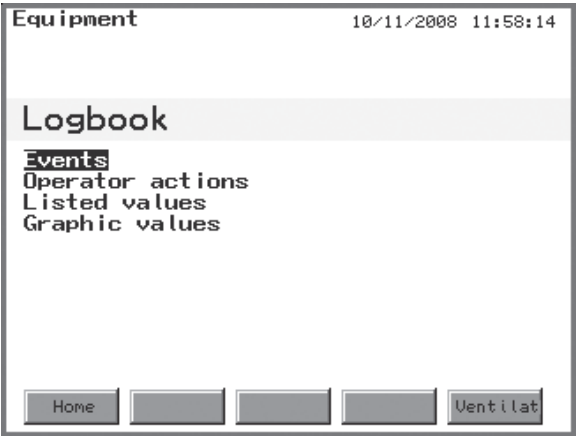
"Permanent display 2" (Production 2)



The "permanent display 2" (Production 2) shows in addition e.g.:

- Present flow in the bypass
- Setpoint of the ClO_2 production
- Measured value ClO_2 concentration (if the function exists)
- Measured value chlorite concentration (if the function exists) instead of the present ClO_2 output and the activity of the pumps.

„Logbook“



The display “Logbook” shows:

- The recorded events
- The operating actions at the control
- Measured value lists
- Measured value curves of the measured value lists

Settings

To be able to enter settings at the control, the systems must be “off” (START/STOP key) – the display “Equipment off” is shown (the control then does not drive the pumps and ignores all input signals).

Using the function keys, the relevant menus are then accessed such as e.g.:

SERVICE menu (see Chap. 5.2.1)

- SETTING menu (see Chap. 5.2.2)
- CALIB(ration) menu (see Chap. 5.2.3)

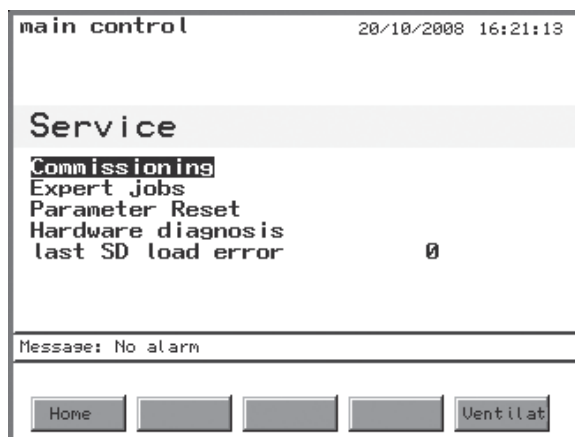
5.2 Setting the Control

This chapter describes the individual menus of the control.

The menus are protected by access codes of the following levels:

User code	Releases functions which have to be used by instructed persons during their daily work. Factory setting: 5005, can be changed in “Settings”-“System information”.
Expert code	Releases additional functions which have to be used by technical experts during their daily work. The access code is only made available during training courses on the technical matter.
Service code	For basic settings during commissioning and maintenance. The access code is only known to correspondingly trained persons such as customer service staff.

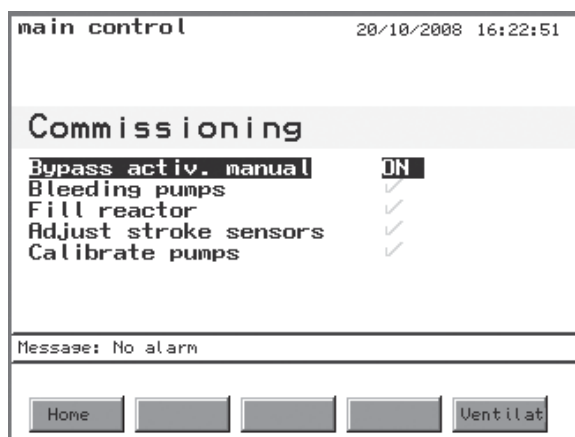
5.2.1 Service



This menu includes the submenus:

- A Commissioning: This menu must be executed when commissioning.
- B Expert work: Includes functions for work at the pumps
- C Parameter reset: only for customer service
- D Hardware diagnosis: only for customer service
- E Last SD load error: only for customer service

5.2.1. A Commissioning



This menu must be executed when commissioning.

For a detailed, binding description of commissioning, see Chap. 6.4 “Starting the System”.

NOTE

A green check mark is shown behind the executed menus of the menu "Commissioning" if successfully executed.

5.2.1. A.A Activation Bypass Pumps

main control 20/10/2008 16:22:51

Commissioning

Bypass activ. manual	ON
Bleeding pumps	✓
Fill reactor	✓
Adjust stroke sensors	✓
Calibrate pumps	✓

Message: No alarm

Home [] [] [] Ventilat

Here, any existing bypass pump can be switched off manually during commissioning. The setting has no effect beyond this menu.

5.2.1. A.B Bleeding pumps

main control 20/10/2008 16:24:24

Bleeding pumps

%	HCl 100 %	NaClO2 100 %
0 strokes	0 strokes	
✓	✓	

Message: No alarm

Home [] Start Continue

This menu supports the deaeration of the metering pumps. For a detailed explanation see Chap. 6.4 “Starting the System”.

5.2.1. A.C Fill reactor

main control 20/10/2008 16:25:56

Fill reactor

%	HCl 100 %	NaClO2 100 %
0 strokes	0 strokes	
✓	✓	

Message: No alarm

Home [] Start Continue

This menu supports the filling of the reactor tank. For a detailed explanation see Chap. 6.4 “Starting the System”.

5.2.1. A.D Adjust stroke sensors

The screenshot shows the 'main control' interface with the title 'Adjust stroke sensors'. At the top, it displays the date and time '20/10/2008 16:27:37'. Below the title, there are two columns of controls. The left column has a bar graph icon, 'HCl 100 %', and '0 strokes'. The right column has a bar graph icon, 'NaClO2 100 %', and '0 strokes'. Both columns have a checkmark icon below the stroke count. A message box at the bottom says 'Message: No alarm'. At the very bottom, there are five buttons: 'Home', an unlabeled button, 'Start', an unlabeled button, and 'Continue'.

This menu supports the adjustment of the metering monitors.
For a detailed explanation see Chap. 6.4 “Starting the System”.

5.2.1. A.E Calibration of the Pumps

The screenshot shows the 'main control' interface with the title 'Calibrate pumps'. At the top, it displays the date and time '20/10/2008 16:30:42'. Below the title, there are two columns of controls. The left column has a bar graph icon, 'HCl 100 %', and '0 strokes'. The right column has a bar graph icon, 'NaClO2 100 %', and '0 strokes'. Both columns have a checkmark icon below the stroke count. A message box at the bottom says 'Message: No alarm'. At the very bottom, there are five buttons: 'Home', an unlabeled button, 'Start', an unlabeled button, and 'Continue'.

In this menu, the metering pumps must be calibrated.
For a detailed explanation see Chap. 6.4 “Starting the System”.

5.2.1. B Expert jobs

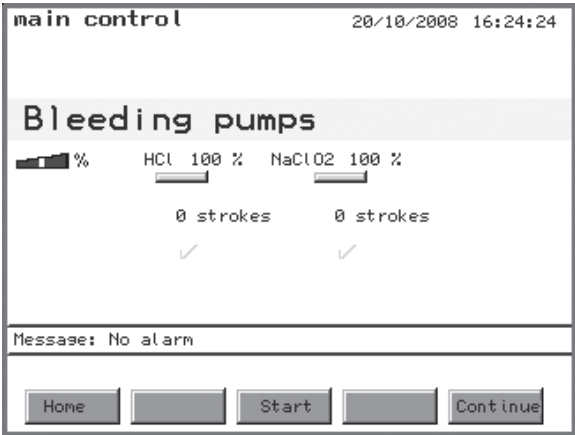
The screenshot shows the 'main control' interface with the title 'Expert jobs'. At the top, it displays the date and time '20/10/2008 16:32:10'. Below the title, there is a list of tasks: 'Bleeding pumps', 'Set stroke length', and 'Adjust stroke sensors'. Each task has a checkmark icon to its right. A message box at the bottom says 'Message: No alarm'. At the very bottom, there are five buttons: 'Home', an unlabeled button, an unlabeled button, an unlabeled button, and 'Ventilat'.

This menu supports the following activities in operation in the correct sequence:

- A Bleeding pumps
- B Setting of stroke lengths
- C Adjustment of stroke sensors

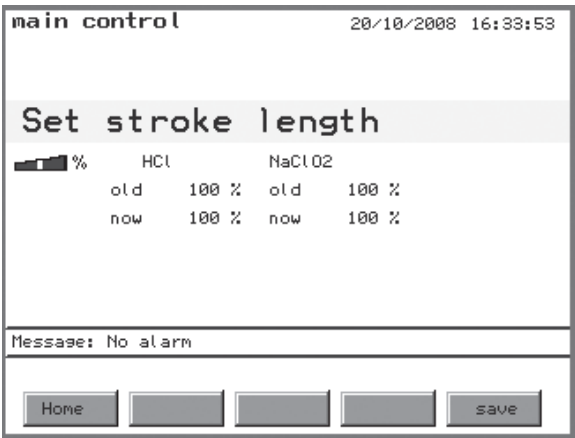
For a detailed, binding description of the expert work, see Chap. 7 “Operation”.

5.2.1. B.A Bleeding pumps



This menu supports the deaeration of the metering pumps.
For a detailed explanation see Chap. 7 “Operation”.

5.2.1. B.B Setting of Stroke Lengths



In this menu, the stroke lengths must be set for the control to receive the set stroke lengths.

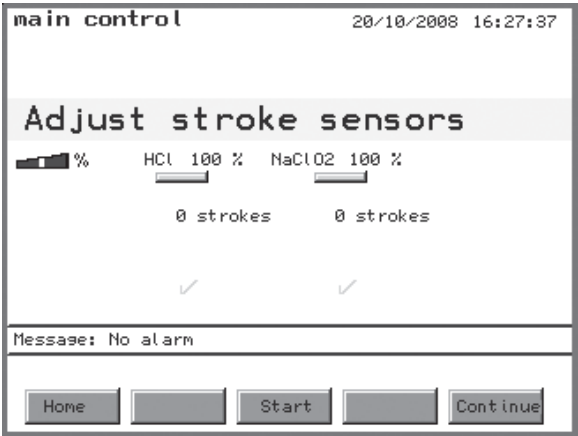
NOTE

If for calibrated pumps only the stroke length is to be changed - via the menu "Setting stroke lengths", the pump must not be recalibrated.

The CDVc control can adapt the calibration to a modified stroke length, provided the pumps can send the present stroke lengths to it via the menu "Setting stroke lengths".

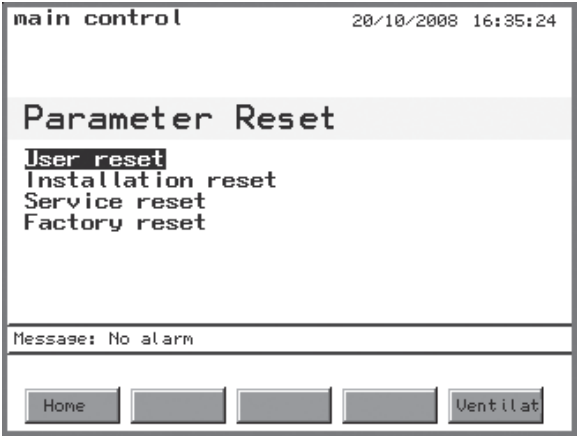
For a detailed explanation see Chap. 7 “Operation”.

5.2.1. B.C Adjust stroke sensors



This menu supports the adjustment of the metering monitors.
For a detailed explanation see Chap. 7 “Operation”.

5.2.1. C Parameter Reset



Type	Effect on
User reset	all values which can be changed with the user code
Installation reset	all values which can be changed with the expert code
Service reset	all values which can be changed with the service code
Factory reset	all values (i.e. all) which can be changed with the factory code

This menu serves different, far-reaching resets.

All values, which can be changed in the operating menu with the specified access code, are reset to the factory settings when reset.

5.2.1. D Hardware Diagnosis

This menu has no meaning for the user.

5.2.1. E Last SD Load Error

This menu has no meaning for the user.

5.2.2 Settings

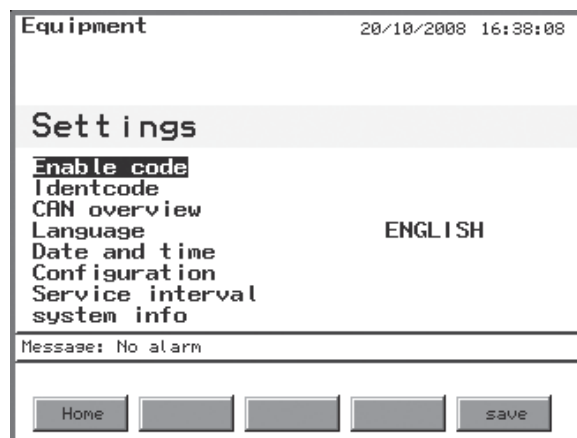
The SETTING menu branches into the following parameter sets:

- A Equipment
- B Main control

The display indicates in the left top corner (see e.g. the display below) in which parameter set the control presently is.

To branch to other parameter sets in the menu “Settings”, use the arrow keys LEFT and RIGHT.

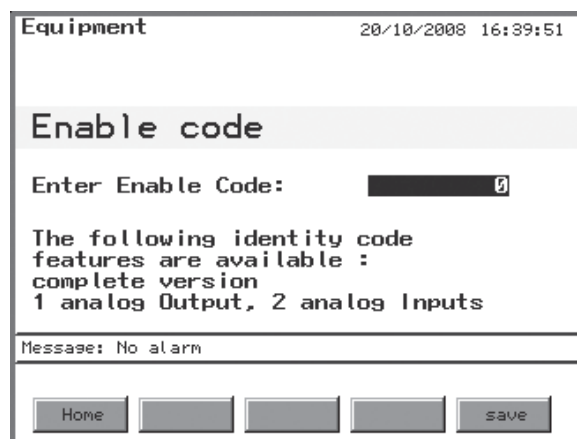
5.2.2. A Equipment



This submenu of the SETTING menu contains the parameter set “Equipment”, consisting of:

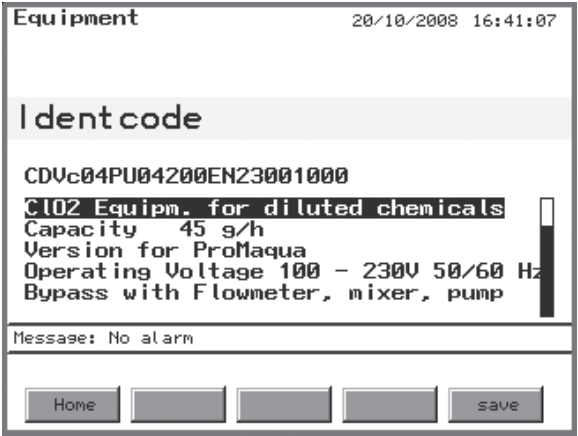
- Activation code
- Identcode
- CAN overview
- Language
- Date and time
- Configuration
- Maintenance interval
- System information

5.2.2. A.A Enable code



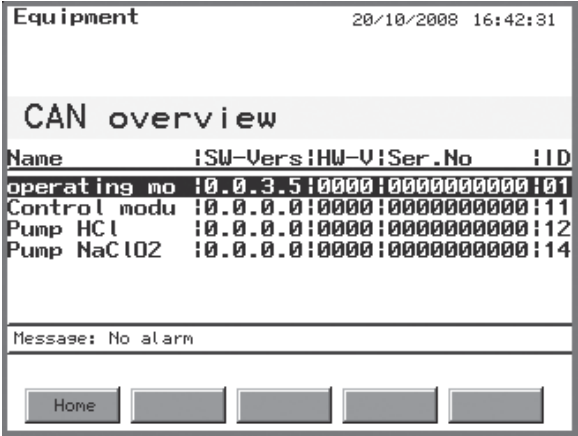
Additional, charged Identcode properties for the system can be activated in this menu with the activation code.

5.2.2. A.B Identcode



This menu indicates the Identcode of the system and the explanations of its Identcode options. Here, the Identcode can also be changed. Charged Identcode options can only be activated with an activation code (see chapter above). Please order the desired Identcode option from ProMinent; please state the serial number of the system when ordering.

5.2.2. A.C CAN Overview



This menu indicates the detected CAN modules of the system as well as their:

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

NOTE
The serial number of the operating module is also the serial number of the system.

5.2.2. A.D Language

Here, the language of the user interface can be changed.

Parameter	max	min	Factory setting	Code	Remarks
Language	German		depending on Identcode	none	
	English				
	French				
	Italian				
	Spanish				

5.2.2. A.E Date and Time

This menu serves the setting of 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

The clock must be manually set to summer time, if required!

5.2.2. A.F Configuration

This menu serves the configuration of:

- Input high dosing (yes / no)
- Input pause (yes / no)
- Display (dimming time)
- Logbook (interval, storage period)
- Additional modules (yes / no)

Up to 14 metering modules can be connected to the control.

Settings

Parameter	max	min	Factory setting	Code	Remarks
Input high dos. XK6:1/2 *	no yes		no	expert code	
Input pause XK6:1/2	no yes		yes	expert code	
Display					
Brightness				not adjustable	
Contrast				not adjustable	
Dimming time	99 min	0 min	5 min	none	To increase lifetime of the display
Logbook					
Rec. mode			ROLL	not adjustable	
Interval	9999 s	0 s	60 s	user code	
Archiving:					
Archiving			ON	not adjustable	
Storage period	7 d	1 d	1 d	user code	
BatchControl	no yes		no	expert code	
DosControl	no yes		no	expert code	Up to 14 metering modules can be configured.

* If the installation requires a high output metering of ClO₂ solution from time to time, reconfigure the „Input pause“ as „Input high dosing“. If a contact between the terminals of the "Input high output metering" is closed (for default "make contact"), the control increases the ClO₂ concentration to the value specified in "Settings" – "Main control" – "ClO₂ production" – "Controlling". At the same time, the permanent display shows the message "High output dosing". However, the system must be able to supply this concentration. If the contacts are opened, the concentration returns to the standard value.

5.2.2. A.G Service interval

Equipment 20/10/2008 16:46:38

Service interval

Service interval 365 d
warning time 28 d
Prio (warn) 0
Prio (Alarm) 0
react. signal alarm
react. syst p.shutdn
Last service 31/07/08
Time until service 284 d

Message: No alarm

Home [] [] [] save

Here, the following parameters can be set:

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

The following items only serve for information:

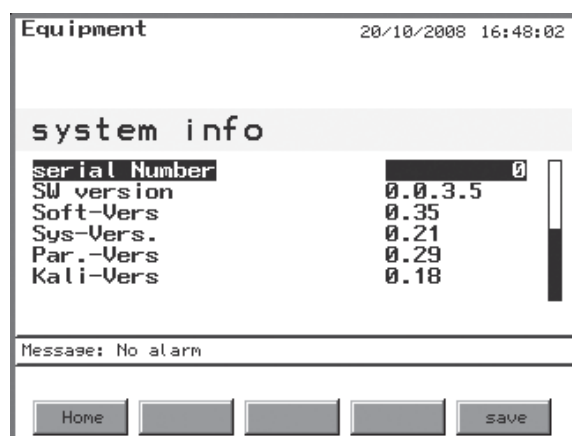
- Last maintenance
- Time to maintenance

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	alarm message before next maintenance interval
Reaction signal	alarm Warning Info no		alarm	service code	response message
Reaction Syst.*	p.off off not off		p.off	service code	response system
Prio (alarm)				not adjustable	
Last maintenance				not adjustable	
Time to maintenance				not adjustable	

* For explanations see "Glossary" at the end of these operating instructions.

As soon as the time "Service interval" has expired, the control responds with the response set in "Reac. Syst."

5.2.2. A.H System Information

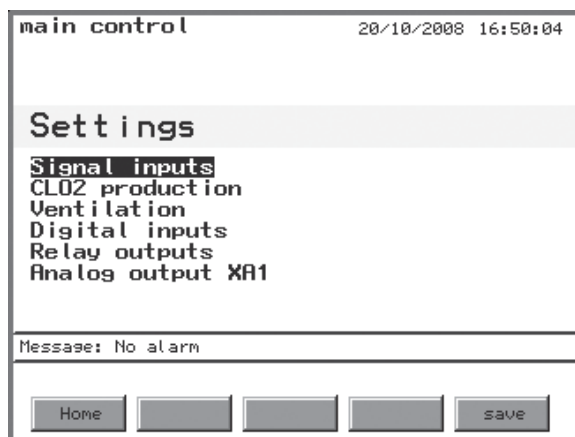


The following items only serve for information on:

- Serial number
- Software versions of the individual components

Here, the user code can be changed – with the corresponding code.

5.2.2. B Main control

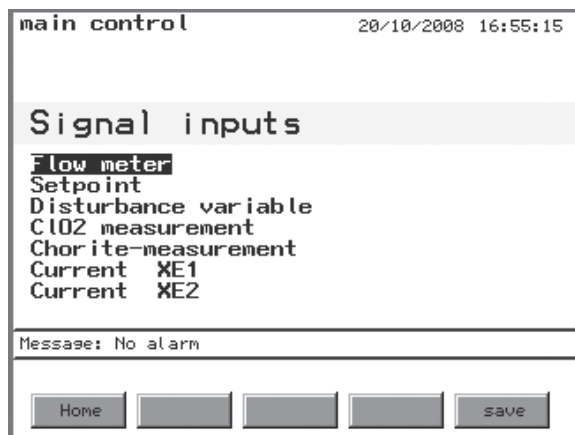


This submenu of the SETTING menu contains the parameter set "Main control", consisting of:

- Signal inputs
- ClO₂ production
- Ventilation
- Digital inputs
- Relay outputs
- Analogue output XA1

Here, the inputs and outputs of the control can be configured and the parameters for the ClO₂ production and the ventilation of the reactor housing can be set.

5.2.2. B.A Signal Inputs



This menu serves the configuration of the inputs and the setting of the pertinent limit values for:

- Flow meter
- Setpoint
- Disturbance variabel
- ClO₂ measurement
- Chlorite measurement
- Current XE1
- Current XE2

5.2.2. B.A a) Flow Meter

This menu includes these menu options for the flow meter:

- Input (used input)
- Measuring range (flow)
- Unit (flow)
- Value (for “Unit”)
- Limit values

Parameter	max	min	Factory setting	Code	Remarks
Flow					
Input signal	no Namur, Reed open-Collector Current input XE1 Current input XE2		no	service code	Namur, Reed = XK8:3 a. 4 open-Collector = XK8:2 a. 3 Current input XE1 = XE1:2 a. 3 Current input XE2 = XE2:2 a. 3
measuring	30,000 m³/h	0 m³/h	1 m³/h	expert code	applies to current input
Unit	litres/impulse impulse/litres		litres/impulse	expert code	applies to both contact inputs
Value	10000	0		expert code	applies to both contact inputs; impulses per litre water meter
Limit Values					
Lower limit (A)	30,000 m³/h	0 m³/h	0 m³/h	expert code	
Upper limit (A)	30,000 m³/h	0 m³/h	999 m³/h	expert code	
Hysteresis (A)	30,000 m³/h	0 m³/h	10 m³/h	expert code	
Prio (alarm)			0	not adjustable	
tdelay (alarm)*			0s	not adjustable	delay time
Resp. Syst.*			p.off	not adjustable	

* For explanations see “Glossary” at the end of these operating instructions.

5.2.2. B.A b) Setpoint

main control 21/10/2008 10:07:15

Setpoint

Setpoint Limits nonexistent

Message: No alarm

Home [] [] [] save

For explanations of this term, see the “Glossary” at the end of these operating instructions.

Parameter	max	min	Factory setting	Code	Remarks
Setpoint:					
Measuring input	no Current input XE1 Current input XE2		no	service code	used input
Limit values:					
Lower limit (A)	100%	0%	0%	expert code	lower limit alarm
Upper limit (A)	100%	0%	100%	expert code	upper limit alarm
Hysteresis (A)	100%	0%	2%	expert code	for alarm
Prio (alarm)			0	not adjustable	
tdelay (alarm)*			0s	not adjustable	delay time
Resp. Syst.*			not off	not adjustable	response control

* For explanations see “Glossary” at the end of these operating instructions.

5.2.2. B.A c) Disturbance Variable

main control 21/10/2008 10:08:41

Disturbance variable

Disturbance variable Limits nonexistent

Message: No alarm

Home [] [] [] save

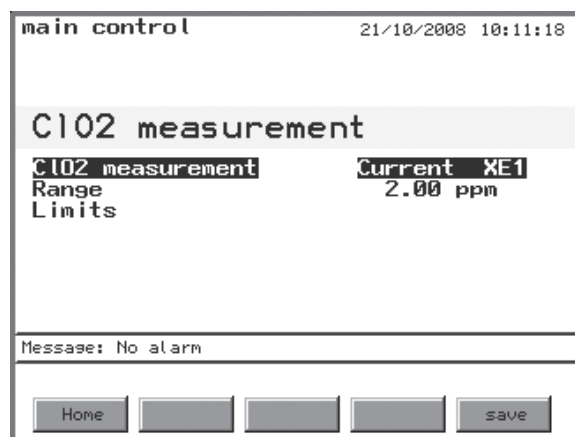
For explanations of this term, see the “Glossary” at the end of these operating instructions.

Parameter	max	min	Factory setting	Code	Remarks
Disturbance:					
Measuring input	none Current input XE1 Current input XE2		none	service code	used input

Parameter	max	min	Factory setting	Code	Remarks
Limit values:					
Lower limit (A)	100%	0%	0%	expert code	for signal check
Upper limit (A)	100%	0%	100%	expert code	for signal check
Hysteresis (A)	100%	0%	2%	expert code	
Prio (alarm)			0	not adjustable	
tdelay (alarm)*			0s	not adjustable	delay time
Resp. Syst.*			not off	not adjustable	

* For explanations see "Glossary" at the end of these operating instructions.

5.2.2. B.A d) ClO₂ Measurement



A CDVc system with the appropriate equipment can both measure and control ClO₂.

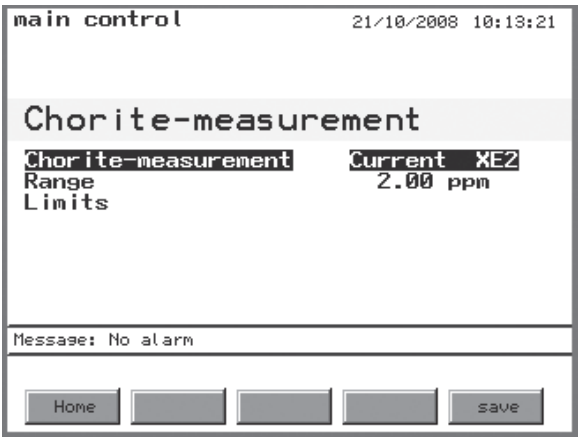
This menu includes these menu options for the ClO₂ measurement:

- ClO₂ measurement (used input)
- Measuring range (of the sensor)
- Limit values

Parameter	max	min	Factory setting	Code	Remarks
ClO₂ measurement	Current input XE1 Current input XE2 no		no	service code	used input
Measuring range	0.50 ppm 2.00 ppm 10.00 ppm 20.00 ppm		2.00 ppm	expert code	
Limit values:					
Lower limit (A)	measuring range	0.00 ppm	0.00 ppm	expert code	lower limit
Upper limit (A)	measuring range	0.00 ppm	2.00 ppm	expert code	upper limit
Hysteresis (A)	measuring range	0.00 ppm	0.04 ppm	expert code	
Prio (alarm)			0	not adjustable	
tdelay (alarm)*	999s	0s	0s	expert code	delay time
Resp. Syst.*	p.off/off/not off		p.off	expert code	

* For explanations see "Glossary" at the end of these operating instructions.

5.2.2. B.A e) Chlorite Measurement



A CDVc system with the appropriate equipment can measure chlorite.

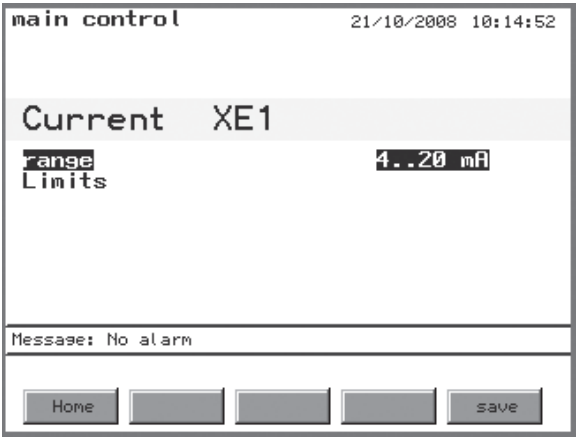
This menu includes these menu options for the chlorite measurement:

- Chlorite measurement (used input)
- Measuring range
- Limit values

Parameter	max	min	Factory setting	Code	Remarks
Chlorite measurement				service code	
Measuring input	none Current XE1 Current XE2		none	expert code	
Measuring range	0.50 ppm 2.00 ppm		2.00 ppm	expert code	
Limit values					
Lower limit (A)			0.00ppm	not adjustable	
Upper limit (A)	Measuring range	0.00 ppm	2.00 ppm	expert code	
Hysteresis (A)	Measuring range	0.00 ppm	0.04 ppm	expert code	
Prio (alarm)				not adjustable	
tdelay (alarm)*	999s	0s	0s	expert code	delay time
Resp. Syst.*			p.off	not adjustable	

* For explanations see “Glossary” at the end of these operating instructions.

5.2.2. B.A f) Current XE1

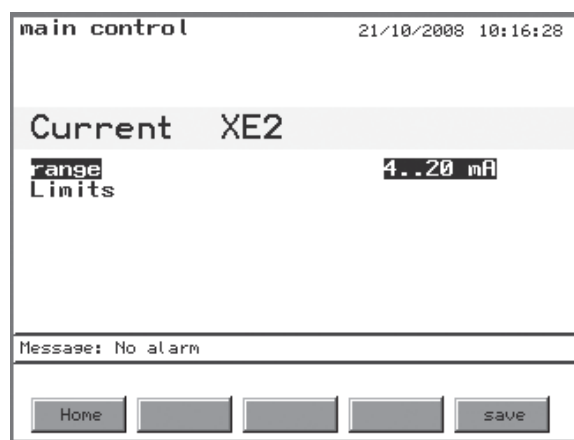


This menu serves the checking of the mA signal at the current input XE1.

Parameter	max	min	Factory setting	Code	Remarks
Current XE1					
Control range	0..20mA / 4..20mA		4..20mA	expert code	
Limit values:					
Lower limit (A)			3 mA	not adjustable	lower limit
Upper limit (A)			23 mA	not adjustable	upper limit
Hysteresis (A)			2 mA	not adjustable	
Prio (alarm)			0	not adjustable	
tdelay (alarm)*			0s	not adjustable	
Resp. Syst.*			not off	not adjustable	

* For explanations see "Glossary" at the end of these operating instructions.

5.2.2. B.A g) Current XE2

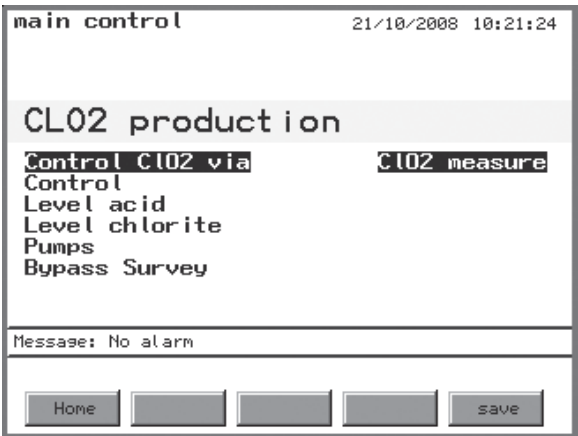


This menu serves the checking of the mA signal at the current input XE2.

Parameter	max	min	Factory setting	Code	Remarks
Current XE2					
Control range	0..20mA / 4..20mA		4..20 mA	expert code	
Limit values:					
Lower limit (A)			3 mA	not adjustable	lower limit at 4...20 mA
Upper limit (A)			23 mA	not adjustable	upper limit at 4...20 mA
Hysteresis (A)			2 mA	not adjustable	
Prio (alarm)			0	not adjustable	
tdelay (alarm)*			0s	not adjustable	
Resp. Syst.*			not off	not adjustable	

* For explanations see "Glossary" at the end of these operating instructions.

5.2.2. B.B ClO₂ Production



This menu serves the setting or checking of the parameters required for ClO₂ production:

- Control ClO₂ generation through flow meter, ClO₂ measurement...
- Controlling (ClO₂ production)
- Level acid (switch of the suction lance)
- Level chlorite (switch of the suction lance)
- Component pumps
- Bypass monitor

5.2.2. B.B a) ClO₂ production



This menu serves the setting of through which signal the ClO₂ generation is to be controlled:

- Manually without input signal; constant volume
- Controller output via an external controller output, e.g. control room; controller output-dependent
- Flow via the water meter, flow-proportional
- ClO₂ measurement via ClO₂ sensor; measured value-proportional

Parameter	max	min	Factory setting	Code	Remarks
Control of the ClO ₂ volume through	manually		manually	expert code	
	Controller output				
	Flow				
	ClO ₂ measurement				

5.2.2. B.B b) Controlling

The screenshot shows a terminal window titled 'main control' with a timestamp '21/10/2008 10:23:33'. The main display area is titled 'Control' and lists the following parameters and their values:

Setpt. ClO ₂ production	45.0 g/h
Setpt. ClO ₂ concentrat.	0.70 ppm
Setp. ClO ₂ high dosage	0.70 ppm
Control parameters	
Control alarm	
Alarm Over load	
Alarm Parameter Error	

Below the parameters, a message box states 'Message: No alarm'. At the bottom, there are five buttons: 'Home', three unlabeled buttons, and 'save'.

This menu serves the setting of all control parameters and the pertinent alarms.

i Setpoint ClO₂ production (manual operation)

Here, the constant setpoint ClO₂ production for the “Control ClO₂ volume through” can be preset:

- „Manually“.

NOTE

This value can be set in operation in the permanent display “Production” in F2 SETPOINT as soon as the control has been started by pressing the START/STOP key.

ii Setpoint ClO₂ concentration (measured value-proportional operation)

Here, the setpoint ClO₂ production for the “Control ClO₂ generation through” can be preset:

- „Flow“
- „ClO₂ measurement“.

NOTE

This value can be easily set in the permanent display “Production” in F2 SETPOINT as soon as the control has been started by pressing the START/STOP key.

iii Control parameter

Here, the control parameters for the “Control ClO₂ generation through” can be set:

- „ClO₂ measurement“.

NOTE

For an explanation of the parameters, see “Glossary” at the end of these operating instructions.

Parameter	max	min	Factory setting	Code	Remarks
Setpoint ClO ₂ production	max. production volume (config)	0 g/h	0 g/h	user code	
Setpoint ClO ₂ concentration	measuring range of ClO ₂ sensor	0.00 ppm	0.00 ppm	user code	
Setpoint ClO ₂ high concentration	measuring range of ClO ₂ sensor	0.00 ppm	0.00 ppm	user code	

Controller parameter

P contribution	500% of measuring range	1% of measuring range	0.20 ppm	expert code	value is indicated in ppm
I contribution/reset time	999s	0s	0s	expert code	

Settings

Parameter	max	min	Factory setting	Code	Remarks
D-contribution/rate time	999s	0s	0s	expert code	
Neutral zone			0 %	not adjustable	
Control time			0s	not adjustable	
Output man. operation			0 %	not adjustable	
Basic load	100.00 %	-100.00 %	0 %	expert code	
Controlling mode	PID controller P controller 2-point controller		PID controller	expert code	
Disturbance variable connection	no additive multiplicative		no	expert code	disturbance variable connection
Factor disturbance	100.00 %	0.00 %	0 %	expert code	
Band for 2-point controlling	100.00 %	0.00 %	0.00 %	expert code	
Lower limit controller output	100.00 %	0.00 %	0.00 %	expert code	lower limit
Upper limit controller output	100.00 %	0.00 %	100.00 %	expert code	upper limit
Tolerance threshold			0 ppm	not adjustable	
On min	999s	0s	0s	expert code	minimum operating time for 2-point controlling
Off min	999s	0s	0s	expert code	minimum interruption duration for 2-point controlling

Determination of control time

(For closed circuits such as bottle washing machines.)

Prerequisite:

The system has reached the setpoints for the ClO₂ concentration (0.45 ppm) as well as the other values.

- ▶ Stop the controlling by pressing the START/STOP key.
- ▶ Wait until the ClO₂ concentration dropped to 0.1ppm.
- ▶ Restart the controlling by pressing the START/STOP key.
- ▶ Stop the time until the setpoint is reached again.
- ▶ Enter this time, multiplied by 1.5, as control time for the ClO₂ concentration.

iv Controller alarm

Parameter	max	min	Factory setting	Code	Remarks
Priority			0		not adjustable
tdelay*	999s	0s	0s	expert code	delay time
Response mess.	Alarm Warning Info		Warning	expert code	message
Resp. Syst.*	p. off off not off		not off	expert code	

* For explanations see "Glossary" at the end of these operating instructions.

Here, the parameters for the response to a "Controller alarm" can be set.

v Alarm overload

Parameter	max	min	Factory setting	Code	Remarks
Priority			0		not adjustable
tdelay*	999s	0s	0s	expert code	delay time
Response mess.	Alarm Warning Info		warning	expert code	message
Resp. Syst.*	p.off off not off		not off	expert code	

* For explanations see “Glossary” at the end of these operating instructions.

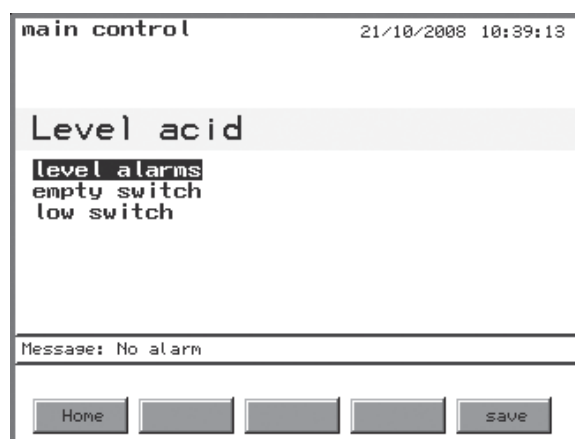
Here, the control parameters for “Alarm overload” can be set. This alarm occurs as soon as the current process requires more ClO₂ solution than can be supplied by the system.

vi Alarm parameter error

Parameter	max	min	Factory setting	Code	Remarks
Priority			0		not adjustable
tdel*	999s	0s	0s	expert code	delay time
Response mess.	Alarm Warning Info		warning	expert code	message
Resp. Syst.*	p.off off not off		not off	expert code	

* For explanations see “Glossary” at the end of these operating instructions.

Here, the control parameters for “Alarm parameter fault” can be set. This alarm occurs as soon as the parameters are entered at the control which result in inconsistencies in a parameter set.

5.2.2. B.B c) Level Acid

In this menu, service technicians may read information on the following functions:

- Fill level alarms

The following items may also be set:

- Switch empty (contact type: make contact, break contact)
- Switch low (contact type: make contact, break contact)

Settings

Parameter	max	min	Factory setting	Code	Remark
Fill level alarms:					
Prio (warn)				not adjustable	
Prio (alarm)				not adjustable	
tdelay (warn)				not adjustable	
tdelay (alarm)				not adjustable	
Resp. Syst.				not adjustable	
Switch empty:					
Contact type	make contact/ break contact		make contact	service code	
Switch low:					
Contact type	make contact/ break contact		make contact	service code	

5.2.2. B.B d) Level Chlorite



In this menu, service technicians may read information on the following functions::

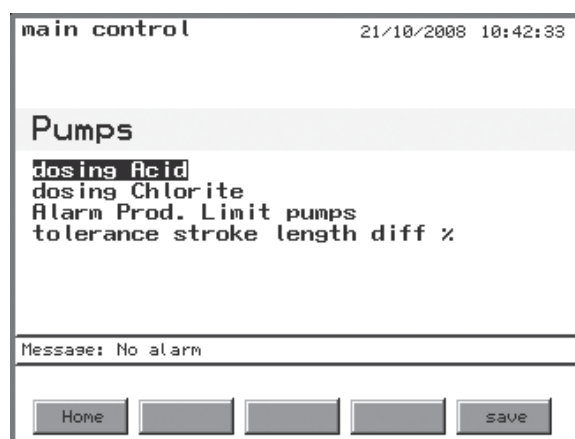
- Fill level alarms

The following items may also be set:

- Switch empty (contact type: make contact, break contact)
- Switch low (contact type: make contact, break contact)

Parameter	max	min	Factory setting	Code	Remarks
Fill level alarms:					
Prio (warn)				not adjustable	
Prio (alarm)				not adjustable	
tdelay (warn)				not adjustable	
tdelay (alarm)				not adjustable	
Resp. Syst.				not adjustable	
Switch empty:					
Contact type	make contact/ break contact		make contact	service code	
Switch low:					
Contact type	make contact/ break contact		make contact	service code	

5.2.2. B.B e) Pumps



This menu serves the setting or reading of the parameters for the following submenus:

- Dosing acid
- Dosing chlorite
- Alarm production limit pumps
- Tolerance stroke length diff.

Parameter	max	min	Factory setting	Code	Remarks
Dosing acid/ chlorite					
Pump:					
Pump type			according to Identcode	not adjustable	
Stroke length during calibration				not adjustable	
Minimum stroke length			according to Identcode	not adjustable	
Stroke length tolerance			±5%	not adjustable	
Max. stroke frequency			according to type	not adjustable	
Calibration volume/setpoint			according	not adjustable to Identcode	
Calibration volume/actual				here not adjustable	entry during calibration
Stroke volume/setpoint			according to type	not adjustable	given mean backpressure
Stroke volume/actual	19,000 ml	0.001 ml		here not adjustable	entry during calibration
Deaeration of pumps			100 strokes	not adjustable	
Adjustment of the stroke sensor			200 strokes	not adjustable	
Stroke length error:					
Prio			0	not adjustable	
tdelay			0s	not adjustable	
Response mess.			alarm	not adjustable	
Resp. Syst.			p.off	not adjustable	
Metering monitor:					
Contact type			make contact	not adjustable	
Perm. difference			5	not adjustable	
Prio			0	not adjustable	
tdelay			0s	not adjustable	
Response mess.			alarm	not adjustable	
Resp. Syst.			p.off	not adjustable	

Settings

Parameter	max	min	Factory setting	Code	Remarks
Alarm production limit pumps					
Prio			0	not adjustable	
tdelay			0s	not adjustable	
Response mess.	Alarm/Warning/Info		warning	service code	
Resp. Syst.	p.off/off/not off		not off	service code	
Tolerance stroke length diff.					
			2 %	not adjustable	difference between the two pumps

5.2.2. B.B f) Bypass Survey

This menu serves the setting or reading of:

- Start-up time
- Runout time
- Bypass pump (contact type)
- Bypass supervision alarm
- Bypass flow XK5:1/2 (contact type)

Parameter	max	min	Factory setting	Code	Remarks
Start-up time *	999s	0s	12s	expert code	
Runout time **	999s	0s	0s	expert code	
Bypass pump					
Contact type			make contact	not adjustable	
Bypass supervision alarm					
Priority			0	not adjustable	
tdelay ***	10s	0s	1s	service code	delay time
Response mess.			alarm	not adjustable	message
Resp. Syst.****			p.off	not adjustable	

Parameter	max	min	Factory setting	Code	Remarks
Bypass Flow					
XK5:1/2					
Contact type			make contact	service code	

* Start-up time monitoring

Through the start-up time it can be preset after which period after the start-up of the bypass pump the bypass monitoring is to be activated.

** Trailing time pump

Through the trailing time it can be preset how long the bypass pumps still have to run if the control goes to "Off", "Pause" or "Fault" during production.

If the control goes into the mode "Equipment off", the bypass pump stops immediately.

*** tdelay delay time

If the flow undershoots the limit value during production, a warning is emitted without delay and the delay time starts to run. But if the flow undershoots the limit value exceeding the delay time, the control goes to the mode "Production fault"

**** For explanations see "Glossary" at the end of these operating instructions.

5.2.2. B.C Ventilation

main control 20/10/2008 17:03:30

Ventilation

type cont. closed

Ventilation time 110 s

interval 10 min

Message: No alarm

Home [] [] [] save

Parameter	max	min	Factory setting	Code	Remarks
Contact type			make contact		not adjustable
Suction duration	300s	1s	see "Remarks"	expert code	The factory setting value depends on the reactor size.
Interval	99 min	0 min	10 min	expert code	

This menu serves the settings for "Suctioning".

The ventilation and its menu can be activated or deactivated in the submenu "Equipment" via "Identcode".

5.2.2. B.D Digital Inputs

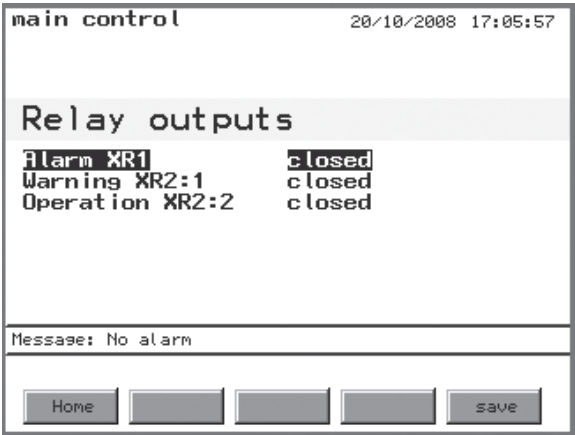
This menu serves the setting or reading of parameters on:

- Input pause XK6:1/2
- Input high dosing XK6:1/2
- Input sample water XK3:1/2
- Input error XK5:3/4
- Input leakage (safety bunds) XK4:3/4

Parameter	max	min	Factory setting	Code	Remarks
Input pause XK6:1/2					
Contact type			break contact	not adjustable	
Input high dos. XK6:1/2					
Contact type			make contact	not adjustable	
Input sample water XK:3:1/2					
Contact type			make contact	not adjustable	
Priority			0	not adjustable	
tdelay*	999s	0s	5s	expert code	delay time
Response mess.			alarm	not adjustable	message
Resp. Syst.			p.off	not adjustable	
Input error XK:5:3/4					
Contact type			break contact	not adjustable	
Priority			0	not adjustable	
tdelay*			0s	not adjustable	delay time
Response mess.			alarm	not adjustable	message
Resp. Syst.*			p.off	not adjustable	
Input leakage XK:4:3/4					
Contact type			break contact	not adjustable	
Priority			0	not adjustable	
tdelay*	999s	0s	0s	expert code	delay time
Response mess.			alarm	not adjustable	response message
Resp. Syst.*			p.off	not adjustable	response control

* For explanations see "Glossary" at the end of these operating instructions.

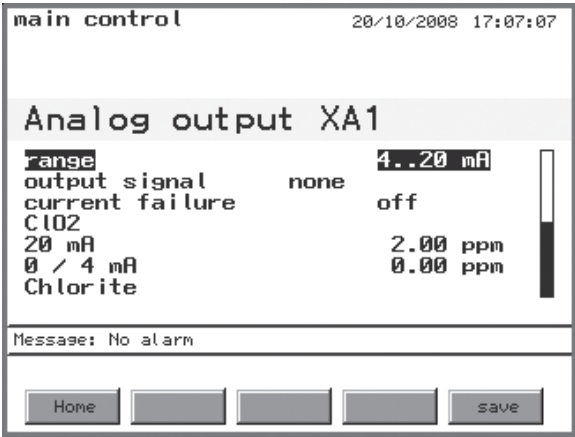
5.2.2. B.D Relay Outputs



In this menu, service technicians may read information on the relays for:

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

5.2.2. B.E Analogue Output XA1



Via the analogue output XA1, the control can emit these signals, if present or being measured:

- Flow
- Controller output
- ClO₂
- Chlorite
- Production volume

Parameter	max	min	Factory setting	Code	Remarks
Range	0..20 mA 4..20 mA		4...20 mA	expert code	
Output signal	Nothing Flow Controller output ClO ₂ Chlorite Production volume		off	expert code	

Settings

Parameter	max	min	Factory setting	Code	Remarks
Current failure	off 0.0 mA 3.7 mA 22.0 mA 23.0 mA		off	expert code	signalises e.g. to a PLC a fault in the system (in case of fault)

Flow:

20 mA	30,000 m³/h	0 m³/h	1 m³/h	expert code	
0/4 mA	30,000 m³/h	0 m³/h	0 m³/h	expert code	20 mA value ≥ 0/4 mA value + 1 m³/h

Controller output:

20 mA	100 %	0 %	100 %	expert code	
0/4 mA	100 %	0 %	0 %	expert code	20 mA value ≥ 0/4 mA value + 5%

ClO₂:

20 mA	dependent on the measuring range	0 ppm	2.00 ppm	expert code	factory setting = meas. range factory setting
0/4 mA	dependent on the measuring range	0 ppm	0 ppm	expert code	20 mA value ≥ 0/4 mA value + 0.1 ppm

Chlorite:

20 mA	dependent on the measuring range	0 ppm	2.00 ppm	expert code	factory setting = meas. range factory setting
0/4 mA	dependent on the measuring range	0 ppm	0 ppm	expert code	20 mA value ≥ 0/4 mA value + 0.1 ppm

Production volume:

20 mA	depending on system size	0 g/h	45 g/h	expert code	setting = system size
0/4 mA	depending on system size	0 g/h	0 g/h	expert code	20 mA value ≥ 0/4 mA value + 1 g/h

5.2.3 Calibration

main control

21/10/2008 10:46:59

Calibration

Chlor. dioxide

Zero pt. 4.00 mA

Slope 6.00 mA/ppm

Chlorite

Zero pt. 4.00 mA

Slope 6.00 mA/ppm

Calibration system level

Message: No alarm

Home

Ventilat

Here, the following can be calibrated:

- Chlorine dioxide (sensors)
- Chlorite (sensors)

The customer service can read these information for:

- Calibration system level:
 - ClO_2 measurement
 - Chlorite measurement
 - Analogue output
 - Current input XE1
 - Current input XE2

5.2.3. A Chlorine Dioxide



CAUTION

- *Please also read the operating instructions for chlorine dioxide sensor and in-line probe!*
- *A slope calibration must be carried out after having replaced a diaphragm cap or electrolyte!*
- *For a perfect functioning of the sensor, the slope calibration must be repeated in regular intervals!*
- *Air bubbles sticking to the sensor might cause a low measured value!
This may result in an excess metering!
Avoid airlocks in the sample water!*
- *Observe the valid national regulations for calibration intervals!*

Prerequisites:

- the sensor has been run in
- constant flow at the in-line probe – at least 40 l/h
- constant temperature of the sample water
- identical temperatures of sample water and sensor (wait for approx. 15 min.)



CAUTION

- *The sensor must have run in!*

NOTE

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

Press the key F4 STANDARD to return to the factory settings for zero point and slope.

Zero point

main control		21/10/2008 10:48:23	
C102 calibration			
confirm value with F2 or F3			
change the value manually			
take over values with F5			
test value		0.00 ppm	
future sensor data			
Zero pt.		4.00 mA	Slope 6.00 mA/ppm
Message: No alarm			
Home	slope	zero pt.	Standard save



CAUTION

- **Only perform a zero offset if you use the chlorine dioxide sensor at the lower measuring range limit!**

Prerequisite:

The control is set to "Production on".

- ▶ Remove the chlorine dioxide sensor (sample water closed?)
- ▶ Dip the chlorine dioxide sensor CDE into a bucket with clean, chlorine dioxide-free tap water (or in non-carbonated mineral water or distilled water. Check the tap water for chlorine dioxide with a suitable measuring tool). The chlorine dioxide-free water must have the same temperature as the bypass water.
- ▶ Stir with the sensor until the measured value in the permanent display 2 ("Production 2", arrow key LEFT) has been stable for 5 min. and remains close to zero.
- ▶ Stop the system by pressing the START/STOP key
- ▶ Switch to the calibration menu using F3 CALIB.
- ▶ Select the submenu "Chlorine dioxide" (arrow keys) and press the ENTER key.
- ▶ Confirm the indicated measured value in "Test value" with F3 zero pt.
- ▶ Accept the zero point by pressing F5 SAVE
- ▶ Re-install the sensor at the in-line probe.



CAUTION

Now, the slope has to be calibrated:

Slope

main control		21/10/2008 10:48:23	
C102 calibration			
confirm value with F2 or F3 change the value manually take over values with F5 test value 0.45 ppm			
future sensor data Zero pt. 4.00 mA Slope 6.00 mA/ppm			
Message: No alarm			
Home	slope	zero pt.	Standard save



CAUTION

**Chlorine dioxide must be present in the sample water all the time!
Otherwise, the measuring system cannot be calibrated.**

- ▶ Switch to the calibration menu using F3 CALIB.
- ▶ Select the submenu "Chlorine dioxide" (arrow keys) and press the ENTER key.
- ▶ Directly after, take a sample water sample at the in-line probe.
- ▶ Directly after this step, determine the chlorine dioxide content of the sample water using a photometer and a suitable measuring tool (e.g. DPD 1 for chlorine dioxide (sensor CDE)).
- ▶ Immediately confirm the indicated measured value in "Test value" by pressing F2 SLOPE or press the ENTER key, change the indicated measured value with the arrow keys and save by pressing the ENTER key, and then confirm by pressing F2 SLOPE.
- ▶ Press F5 (SAVE) to complete the calibration process and to save the values.

- ▶ If no further calibrations are desired, press the ESC key to return to the menu option “Equipment off”.
- ▶ Reopen the shut-off valves for the sample water - first outlet, then inlet.

Repeat the calibration the next day!

If the control indicates a clearly insufficient measured value or cannot be calibrated after the running-in period of the sensors (for CDE approx. 2-6h), double the running-in period or extend it to the next morning.

If the sensor can then still not be calibrated, contact the ProMinent customer service (telephone numbers are stated on the back cover page).

Please name the following data:

- DPD1 value (chlorine dioxide)
- Sensor type with measuring range

Error messages during calibration:

Designation	Cause
Zero point too low	< 3mA
Zero point too high	> 5mA
Slope too low	Slope < $\frac{1}{4}$ x standard slope
Slope too high	Slope > 3 x standard slope
Test value too small	< 2 % of measuring range

5.2.3. B Chlorite



CAUTION

- *Please also read the operating instructions for chlorite sensor and in-line probe!*
- *A slope calibration must be carried out after having replaced a diaphragm cap or electrolyte!*
- *For a perfect functioning of the sensor, the slope calibration must be repeated in regular intervals!*
- *Air bubbles sticking to the sensor might cause a low measured value!
This may result in an incorrect metering!
Avoid airlocks in the sample water!*
- *Observe the valid national regulations for calibration intervals!*

Prerequisites:

- the sensor has been run in
- constant flow at the in-line probe – see “Technical Data” in the operating instructions of the sensor CLT
- constant temperature of the sample water
- identical temperatures of sample water and sensor (wait for approx. 15 min.)
- constant pH value in the permitted range (pH 6.5 .. 9.5) is given.



CAUTION

- *The sensor must have run in!*

NOTE

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

Press the key F4 STANDARD to return to the factory settings for zero point and slope.

Zero point

main control		21/10/2008 10:53:11	
Chlorit calibration			
confirm value with F2 or F3 change the value manually take over values with F5 test value 0.00 ppm			
future sensor data Zero pt. 4.00 mA Slope 6.00 mA/ppm			
Message: No alarm			
Home	slope	zero pt.	Standard save

**CAUTION**

- *Only perform a zero offset if you use the chlorite sensor at the lower measuring range limit!*

Prerequisite:

The control is set to "Production on".

- ▶ Remove the chlorite sensor (sample water closed?)
- ▶ Dip the chlorine sensor CLT into a bucket with clean tap water which is free from chlorite and reducers (Fe²⁺, Mn²⁺, nitrite, ...). (or in non-carbonated mineral water or distilled water. Check the tap water for chlorite with a suitable measuring tool). The water must have the same temperature as the bypass water.
- ▶ Stir with the sensor until the measured value in the permanent display 2 ("Production 2", arrow key LEFT) has been stable for 5 min. and remains close to zero.
- ▶ Stop the system by pressing the START/STOP key
- ▶ Switch to the calibration menu using F3 CALIB.
- ▶ Select the submenu "Chlorite" (arrow keys) and press the ENTER key.
- ▶ Confirm the indicated measured value in "Test value" with F3 zero pt.
- ▶ Accept the zero point by pressing F5 SAVE
- ▶ Re-install the sensor at the in-line probe.

**CAUTION**

Now, the slope has to be calibrated:

Slope

main control		21/10/2008 10:53:11	
Chlorit calibration			
confirm value with F2 or F3 change the value manually take over values with F5 test value 0.45 ppm			
future sensor data Zero pt. 4.00 mA Slope 6.00 mA/ppm			
Message: No alarm			
Home	slope	zero pt.	Standard save

**CAUTION**

**Chlorite must be present in the sample water all the time!
Otherwise, the measuring system cannot be calibrated.**

- ▶ Switch to the calibration menu using F3 CALIB.
- ▶ Select the submenu "Chlorite" (arrow keys) and press the ENTER key.
- ▶ Directly after, take a sample water sample at the in-line probe.
- ▶ Directly after this step, determine the chlorite content of the sample water using a photometer and a suitable measuring tool (e.g. DPD for chlorite (sensor CLT)).
- ▶ Immediately confirm the indicated measured value in "Test value" by pressing F2 SLOPE or press the ENTER key, change the indicated measured value with the arrow keys and save by pressing the ENTER key, and confirm by pressing F2 SLOPE.
- ▶ Press F5 (SAVE) to complete the calibration process and to save the values.
- ▶ If no further calibrations are desired, press the ESC key to return to the menu option "Equipment off".
- ▶ Reopen the shut-off valves for the sample water - first outlet, then inlet.

Repeat the calibration the next day!

If the control indicates a clearly insufficient measured value or cannot be calibrated after the running-in period of the sensors (for CLT approx. 2-12h), double the running-in period or extend it to the next morning.

If the sensor can then still not be calibrated, contact the ProMinent customer service (telephone numbers are stated on the back cover page).

Please name the following data:

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

Error messages during calibration:

Designation	Cause
Zero point too low	< 3mA
Zero point too high	> 5mA
Slope too low	Slope < 1/4 x standard slope
Slope too high	Slope > 3 x standard slope
Test value too small	< 2 % of measuring range

5.2.3. C Calibr. System Level

main control
21/10/2008 10:55:09

Calibration system level

CL02 measurement

Chlorite-measurement

Analog output XA1

Current XE1

Current XE2

Message: No alarm

Home

In this menu, service technicians may read information on the following functions:

- ClO₂ measurement
- Chlorite measurement
- Analogue output XA1
- Current input XE1
- Current input XE2

5.2.3. D Calibration of the Pumps

The metering pumps can be calibrated by the customer service in the SERVICE menu, see Chap. 6.4.6 "Calibration of the pumps"!

6 Commissioning



WARNING

- *The commissioning must be carried out by a customer service authorised by ProMinent ProMaqua!*
- *The commissioning may only be performed by technical experts!*



WARNING

- *If the reactor is empty, no chemicals may be used for start-up (even not in the lines between the chemical cans and the reactor!) because in this case a ClO₂ gas phase may form in the reactor! This gas phase may explode in case of a ClO₂ concentration of 20 g/l! The chemical cans may only be connected after having completely filled the reactor with water.*



WARNING

- *The maximum permissible operating pressure for the system must not be exceeded in any operating condition!*
- *The entire installation must be leak-free for operation with maximum operating pressure!*
- *Open all shut-off valves in the bypass before starting to commission the system!*
- *Check the hydraulic connections for integrity!*



WARNING

- *Check the electrical connection for integrity!*
- *Read the entire chapter thoroughly before commissioning the system!*
- *The customer service authorised by ProMinent ProMaqua must instruct the operating and maintenance staff during commissioning!*

Notes to the system operator

During commissioning, the instructions of the following regulations must also be observed, in Germany!:

- a) the accident prevention regulations (in Germany: GUV 8.15 or VGB 65):
Chlorination systems may only be commissioned after having been inspected by a technical expert for their proper condition and subjected to a leakage test.
Chlorination systems are to be inspected for their safety by a technical expert before being re-commissioned.
Only persons, who have been instructed and of whom it can be expected that they perform their tasks reliably, may be entrusted with the operation and maintenance of chlorination systems as well as with the handling of chemicals.
- b) the regulations on dangerous substances (in Germany: Arb-StoffV as amended on 11 February 1982, Federal Gazette / p. 145)
- c) requirements on the precursors: see Chapter 7.1
- d) all further local regulations for installations outside of Germany

6.1 Installation – Last Steps

- ▶ Check the hydraulic connections for integrity.
- ▶ Check the electrical connections for integrity.
- ▶ Connect the Bello Zon® system to the power supply (cable of 3 x 1 mm²).

6.2 Setting of System and Control

- ▶ Check whether the system is “OFF” (if required, press the Start/Stop key).

Now, in principle work through the individual tabs in the SETTING menu (F2 SETTING):

- Tab “Equipment”
- Tab “Main control”
- Tabs “Metering module”, if existing

NOTE

Switching between tabs with the keys LEFT, RIGHT, the name of the tabs are indicated in the upper left corner.

- Tab “Equipment”*
- ▶ Press F2 SETTING to go to the SETTING menu, tab “Equipment”.
 - ▶ In “Identcode” check whether the Identcode matches the desired operating mode (flow meter, analogue inputs, controlling properties...) and edit, if required.
 - ▶ In “CAN overview” check whether all CAN modules are detected by the control.
 - ▶ In “Language” set the language for the operating menu, if required.
 - ▶ In “Date and time”, set the date and time, if required.
 - ▶ In “Configuration”, configure the inputs, the display, the logbook, and the metering modules.
 - ▶ Confirm the settings by pressing the key F5 SAVE and the ENTER key.

- Tab “Main control”*
- ▶ In the tab “Main control”, press the LEFT or RIGHT key to switch between options.
 - ▶ Set the parameters in the menus according to the desired operating mode:
 - 1) Operating mode “Manual control”
 - 2) Operating mode “Flow-proportional control”
 - 3) Operating mode “Controller output-proportional control”
 - 4) Operating mode “ClO₂ concentration-proportional control”

6.2.1 Operating Mode “Manual control”

The Bello Zon® system works continuously with a preset, constant ClO₂ output.

- ▶ Press F2 SETTING to go to the SETTING menu, tab “Equipment”.
- ▶ Press the RIGHT key to go to the tab “Main control”.
- ▶ If required, configure a current input in “Signal inputs”.
Select “ClO₂ production” (key UP/DOWN) and press the ENTER key.
- ▶ Set “Control ClO₂ via” to “Manual” (ENTER key, key UP/DOWN, ENTER key).
- ▶ Select “Controlling” (key UP/DOWN) and press the ENTER key.
- ▶ Set the desired ClO₂ output in “Set point ClO₂ production” (ENTER key, arrow keys, ENTER key).

The permanent display 1 (Production 1) and the permanent display 2 (Production 2, (LEFT key)) indicate from now on the set ClO₂ output.

- ▶ Confirm the settings by pressing the key F5 SAVE and the ENTER key.
- ▶ If required, set limit values and alarms in the other menus.
- ▶ If required, set the suction interval and the suction duration in “Suctioning”.
- ▶ If required, adapt the digital inputs and the analogue output to the required values. (pause, leakage sensor ...).
- ▶ Confirm the settings by pressing the key F5 SAVE and the ENTER key.
- ▶ Confirm all settings by pressing the key F5 SAVE and the ENTER key.

6.2.2 Operating Mode “Flow-proportional control”

The ClO_2 output of the chlorine dioxide system changes volume-proportionally with the signal of the flow meter (contact water meter, inductive flow meter, ...).

- ▶ Press F2 SETTING to go to the SETTING menu, tab “Equipment”.
- ▶ Press the RIGHT key to go to the tab “Main control”.

Configuration of the water meter

For the water meter, configure the input “Flow meter” in “Signal inputs”:

- ▶ „Select “Signal inputs” (key UP/DOWN) and press the ENTER key.
- ▶ Select “Flow meter” (key UP/DOWN) and press the ENTER key.
- ▶ Set the required measuring range of the flow meter in “Input” (ENTER key, arrow keys, ENTER key).
- ▶ Set the input for the flow meter in “Measuring range” (ENTER key, arrow keys, ENTER key).
- ▶ Set the unit “Litres/pulse” in “Unit” (ENTER key, UP/DOWN key, ENTER key).
- ▶ Set the number of litres per pulse of the flow meter in “Value” (ENTER key, arrow keys, ENTER key).
- ▶ Set the correct values in “Limit values”. Observe the following notes!
- ▶ Confirm the settings by pressing the key F5 SAVE and the ENTER key.



WARNING

ClO_2 can accumulate up to an explosive concentration if the Bello Zon® system meters without diluent water!

A value larger than “0” has to be set in “Subgr.<A>” for analogue flow meters (0/4 - 20mA)!

A pulse spacing of the water meter as small as possible ensures an equal mixing of the ClO_2 solution in the water to be treated.

Selection of a suitable flow meter

The Bello Zon control is to calculate the actual, present flow based on the set pulse spacing of a flow meter and its signals. To do so, the pulse spacing of the water meter has to be preset according to the fluctuations expected for the flow.

Background: The control needs good values for the flow because it must be able to calculate the matching, present system output based on these and the set ClO_2 concentration; it is if this is successful that the desired ClO_2 concentration in the water flow can actually be kept stable.

In this respect, two cases can be considered:

1. If it is expected that the flow changes slowly or is stable, use a water meter with a long pulse spacing (e.g. contact water meter with Reed contact or NAMUR output); the water meter can “map” these slow fluctuations easily for the control.
(For the Bello Zon control, the contact water meter may not deliver more than 10 pulses per second.)
2. If it is expected that the flow changes often and quickly, use a water meter with a short pulse spacing (e.g. IDM with frequency output (inductive flow meter)); the water meter will then be able to “map” these quick fluctuations for the control. If the pulse spacing were larger in this case, the system could only respond too late and very angularly to the changes of the actual flow with its system output.
(For the Bello Zon control, the IDM may not deliver more than 10,000 pulses per second.)

The maximum, sensible pulse spacing thus depends on the requirements of the relevant process because it determines the delay time with which the control responds to flow fluctuations.

NOTE

For most water meters, the pulse spacing can be adjusted.

Further settings

- ▶ Select “ClO₂ production” (key UP/DOWN) and press the ENTER key.
- ▶ Set “Control ClO₂ via” to “Flow”
(ENTER key, UP/DOWN key, ENTER key).
- ▶ Select “Control” (key UP/DOWN) and press the ENTER key.
- ▶ Set the desired ClO₂ concentration in “Set point ClO₂ concentration”
(ENTER key, arrow keys, ENTER key).
The permanent display 1 (Production 1) and the permanent display 2 (Production 2, (LEFT key)) indicate from now on the present ClO₂ output.
- ▶ Confirm the settings by pressing the key F5 SAVE and the ENTER key.
- ▶ If required, set limit values and alarms in the other menus.
- ▶ If required, set the suction interval and the suction duration in “Suctioning”.
- ▶ If required, adapt the digital inputs and the analogue output to the required values.
(pause, leakage sensor ...).
- ▶ Confirm the settings by pressing the key F5 SAVE and the ENTER key.
- ▶ Confirm all settings by pressing the key F5 SAVE and the ENTER key.

The permanent display 1 and the permanent display 2 indicate from now on the present ClO₂ output and in addition the flow and the specified setpoint.

If the flow exceeds the maximum value, the ClO₂ output remains stable at its maximum value and the ClO₂ concentration drops (error message “Warning: Prod. overload”).

If the flow undershoots its minimum value, the control deactivates the metering.

6.2.3 Operating Mode “Controller output-proportional control”

The ClO₂ output of the Bello Zon® system changes with the mA signal of an external device, e.g. a control desk.

- ▶ Press F2 SETTING to go to the SETTING menu, tab “Equipment”.
- ▶ Press the RIGHT key to go to the tab “Main control”.
- ▶ Select “Signal inputs” (key UP/DOWN) and press the ENTER key.
- ▶ Select “Controller output” (key UP/DOWN) and press the ENTER key.
- ▶ In “Controller output” e.g. set the “Current inp. XE2”.
(ENTER key, arrow keys, ENTER key).

- ▶ If required, adapt the current input to the requirements in e.g. “Current inp. XE2” (ENTER key, arrow keys, ENTER key).
- ▶ Press the ESC key to return to the menu “Settings”.
- ▶ Select “ClO₂ production” (key UP/DOWN) and press the ENTER key.
- ▶ Set “Control ClO₂ via” to “Controller output” (ENTER key, UP/DOWN key, ENTER key).
- ▶ Confirm the settings by pressing the key F5 SAVE and the ENTER key.
- ▶ If required, set limit values and alarms in the other menus.
- ▶ If required, set the suction interval and the suction duration in “Suctioning”.
- ▶ If required, adapt the digital inputs and the analogue output to the required values. (pause, leakage sensor ...).
- ▶ Confirm the settings by pressing the key F5 SAVE and the ENTER key.
- ▶ Confirm all settings by pressing the key F5 SAVE and the ENTER key.

System type	Capacity adjustment range ClO ₂ (g/h) (at min./max. stroke frequency and min. stroke length) approx.	Capacity adjustment range ClO ₂ (g/h) (at min./max. stroke frequency and max. stroke length) approx.
CDV 20	0 - 14	0 - 20
CDV 45	0 - 27	0 - 45
CDV 120	0 - 60	0 - 120
CDV 240	0 - 96	0 - 240
CDV 600	0 - 240	0 - 600
CDV 2000	0 - 600	0 - 2000

Tab. 1: Capacity adjustment range ClO₂ production for the individual system types

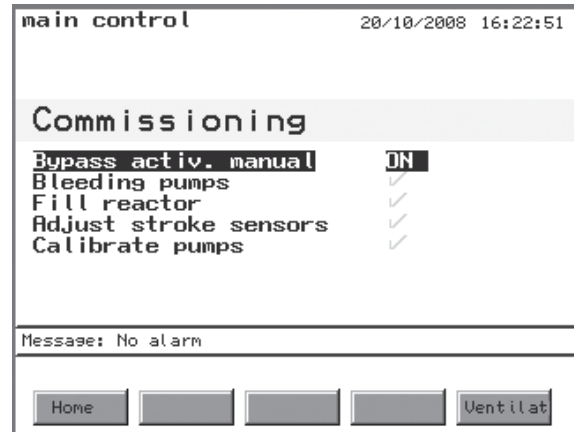
6.2.4 Operating Mode “ClO₂ concentration-proportional control”

The ClO₂ output of the Bello Zon® system changes measured value-dependent with the mA signal of a ClO₂ sensor directly connected to the control.

- ▶ Press F2 SETTING to go to the SETTING menu, tab “Equipment”.
- ▶ Press the RIGHT key to go to the tab “Main control”.
- ▶ Select “Signal inputs” (key UP/DOWN) and press the ENTER key.
- ▶ Select “ClO₂ measurement” (key UP/DOWN) and press the ENTER key.
- ▶ In “ClO₂ measurement” e.g. set the “Current inp. XE1” (ENTER key, arrow keys, ENTER key).
- ▶ If required, adapt the current input to the requirements in e.g. “Measuring range” (ENTER key, arrow keys, ENTER key).
- ▶ Select “ClO₂ production” (key UP/DOWN) and press the ENTER key.
- ▶ Set “Control ClO₂ via” to “ClO₂ measurement” (ENTER key, UP/DOWN key, ENTER key).
- ▶ Select “Controlling” (key UP/DOWN) and press the ENTER key.
- ▶ Set the desired ClO₂ concentration in “Set point ClO₂ concentration” (ENTER key, arrow keys, ENTER key).
The permanent display 1 (Production 1) indicates from now on the present ClO₂ output and the permanent display 2 (Production 2, (LEFT key)) indicates in addition the specified setpoint ClO₂ concentration.
- ▶ Select “Controlling” (key UP/DOWN) and press the ENTER key.
- ▶ Adapt the control parameters to the process and press the ENTER key.
- ▶ Confirm the settings by pressing the key F5 SAVE and the ENTER key.

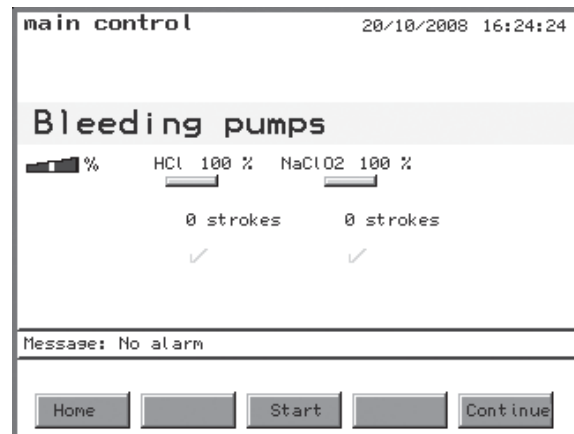
- ▶ If required, set limit values and alarms in the other menus.
- ▶ If required, set the suction interval and the suction duration in “Suctioning”.
- ▶ If required, adapt the digital inputs and the analogue output to the required values. (pause, leakage sensor ...).
- ▶ Confirm the settings by pressing the key F5 SAVE and the ENTER key.
- ▶ Confirm all settings by pressing the key F5 SAVE and the ENTER key.

6.3 Starting the System



- ▶ Switch to the SERVICE menu using F1 SERVICE.
- ▶ Press the ENTER key to go to the commissioning menu. For further steps see the next chapter.

6.3.1 Bleeding pumps



Prerequisites:

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

- ▶ Place each suction lance in its own bucket of clean water.
- ▶ Open the coarse/fine vent valves at the pumps slightly (counter-clockwise).
- ▶ Use the DOWN key to go to “Deaerate pumps” and press the ENTER key.
- ▶ Start deaeration with F3 START – wait until the suction lines and the delivery units are filled bubble-free.



CAUTION

In an emergency case, the pumps can be stopped by pressing F3 STOP!

- ▶ If the suction lines and deliveries have not been filled bubble-free after the stop of the metering pumps, start deaeration again by pressing F3 START.
- ▶ Press F5 CONTINUE to the menu "Fill reactor" (see next chapter).
- ▶ Close the coarse/fine vent valves at the pumps (clockwise).

NOTE

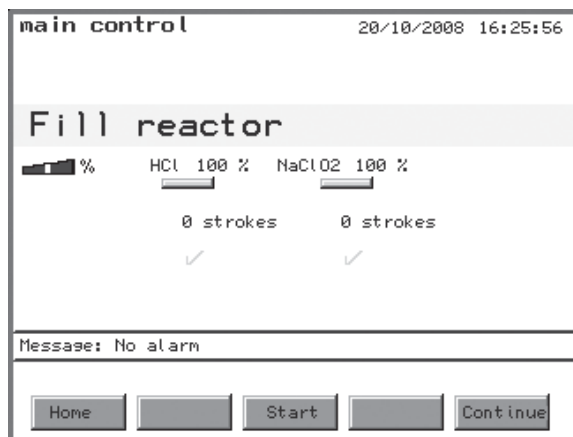
In case of several repeated deaeration processes, check the fill level in the deaeration bottles.

Remedy in case of malfunctions

If the strokes are not counted backwards and the bar above it becomes red, the relevant stroke sensor reports a malfunction.

Turn the adjusting screw below the stroke sensor one turn to the bottom.
Acknowledge the error message.

6.3.2 Filling of the Reactor Tank



Prerequisite:

The metering pumps are deaerated.



WARNING

System components may burst!

When filling the reactor tank, the flushing valve must be open!

NOTE

The CDVc control can adapt the number of the preset strokes to a modified stroke length, provided the component pumps can inform it about its present stroke lengths via the menu "Setting stroke lengths".

- ▶ Open the flushing valve.
- ▶ Start filling by pressing the key F3 START – wait until the preset number of strokes has been executed (the control counts the preset number of strokes backwards).



CAUTION

In an emergency case, the pumps can be stopped by pressing F3 STOP!

- ▶ If the reactor has not yet been filled, i.e. no liquid discharges from the flushing valve, start filling again by pressing F3 START.
- ▶ Do not go to the next menu with F5 CONTINUE but check the system for leaks (see next chapter).

6.3.3 Checking for Leakages

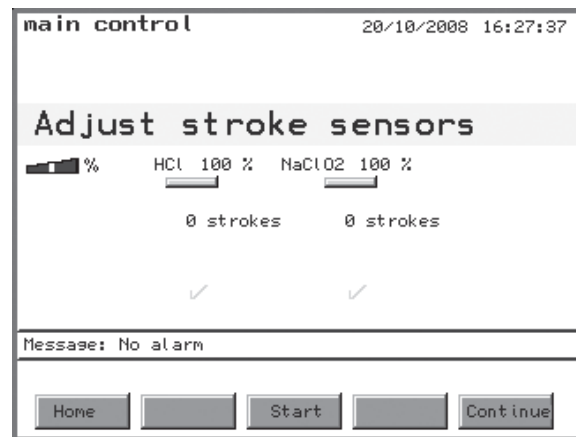


WARNING

**Remedy leakages immediately by taking suitable measures!
Otherwise, toxic ClO_2 solution may leak!**

- ▶ If the metering pumps are not yet running, start them in the menu “Filling reactor” by pressing F3 START.
- ▶ Check all system components for leakages under running metering pumps at maximum operating pressure.
- ▶ Remedy any possible leakages immediately by taking suitable measures!
- ▶ If the test has not yet been completed, start the metering pumps again by pressing F3 START.
- ▶ If the metering pumps are still running, stop them after the test by pressing F3 STOP.
- ▶ Press F5 CONTINUE to go to the menu “Adjust stroke sensors”
(= “adjust stroke sensor”; see next chapter).

6.3.4 Adjust stroke sensors



WARNING

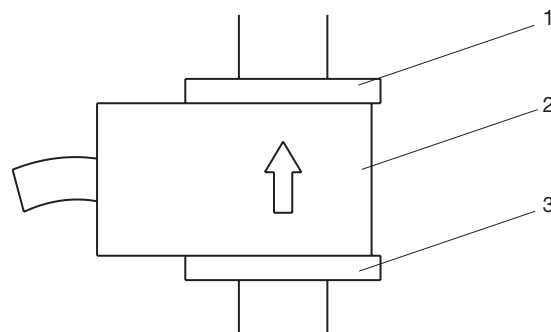
**The metering monitors may loose their safety function in metering operation!
Never leave the ring initiators in the lowest position!**

The stroke lengths of the metering pumps must be larger than the minimum value in Tab. 2!



CAUTION

The metering monitors may only be adjusted at the operating pressure which will also be given later in operation!



- 1 upper shim
- 2 ring initiator
- 3 lower shim

Fig. 11: Overview stroke sensor

Prerequisite:

The metering pumps are deaerated.

- ▶ Turn the upper shim (1) of the stroke sensor (see Fig. 11) to the upper top.
- ▶ Follow with the ring initiators (2) and the lower shims (3).
- ▶ Start the metering pumps by pressing F3 START.

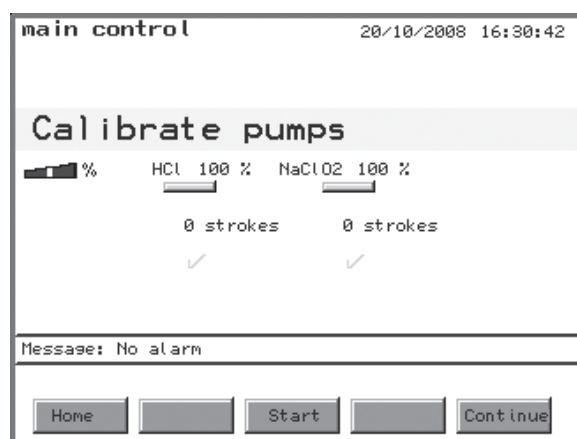


CAUTION

In an emergency case, the pumps can be stopped by pressing F3 STOP!

- ▶ Slowly lower each ring initiator (2) until the figure below the pertinent green bar remains stable at 0 to 1 strokes (e.g. for the left ring initiator (HCl): left bar).
- ▶ Then lower the lower shims (3) by 1 turn.
- ▶ Lower the upper shim (1) onto the ring initiators (2).
- ▶ Press F5 CONTINUE to the menu "Pump calibration" (see next chapter).

6.3.5 Calibrate pumps



CAUTION

The pumps may only be adjusted at the operating pressure which will also be given later in operation!

NOTE

If for calibrated pumps only the stroke length is to be changed - via the menu "Setting stroke lengths", the pump must not be recalibrated.

The CDVc control can adapt the calibration to a modified stroke length, provided the pumps report the present stroke lengths to it via the menu "Setting stroke lengths".

With calibration device:

- ▶ Disconnect the vacuum pump from the panel of the system.
- ▶ Position the vacuum pump on the left side of the calibration device and manually prime metering medium up to the top of the line "0". Do not exceed this mark! Is the shut-off valve on top of the calibration device open?
- ▶ Close the shut-off valve at the bottom in the direction of the suction lance.
- ▶ Position the vacuum pump on the right side of the calibration device and manually prime metering medium up to the top of the line "0". Do not exceed this mark! Is the shut-off valve on top of the calibration device open?
- ▶ Close the shut-off valve at the bottom in the direction of the suction lance.
- ▶ Start the metering pumps by pressing F3 START.

**CAUTION**

In an emergency case, the pumps can be stopped by pressing F3 STOP!

- ▶ As soon as the indicated strokes have been executed, the pumps stop – the menu option “Set calibration” is displayed.
- ▶ Press F2 ACID, then press the ENTER key and enter the used metering medium amount from the left calibration device with the arrow keys and record.
- ▶ Confirm the value by pressing the ENTER key and accept with F5 SAVE.
- ▶ Press F3 CHLORITE, then press the ENTER key and enter the used metering medium amount from the right calibration device with the arrow keys and record.
- ▶ Confirm the value by pressing the ENTER key and accept with F5 SAVE.
- ▶ Record the values for acid and chlorite in the commissioning report or the system logbook.
- ▶ Exit the menu by pressing F5 CONTINUE.
- ▶ Open the shut-off valve at the bottom in the direction of the suction lance.
- ▶ Position the vacuum pump on top of the calibration device and manually prime metering medium up to the top of the line “0”. Do not exceed this mark!
- ▶ Close the shut-off valve at the top of the calibration device.

Without calibration device:

- ▶ Not for initial commissioning: Place the suction lances individually in a bucket filled with clean water (this removes external chemical residues and prevents that the suction lances run empty)

**CAUTION**

Toxic ClO₂ gas may be generated!

Never place both suction lances in one and the same container!

- ▶ Position the measuring cylinders on a horizontal, flat support to facilitate its reading (the fluid level should be well-readable)
- ▶ Fill both measuring cylinders up to the upper mark with water (500 ml or 1.000 ml)
- ▶ Carefully place each suction lance in its measuring cylinder – slowly lift the suction lances, keep upright: No air in the suction lances may bias the calibration!
- ▶ Start the metering pumps by pressing F3 START.

**CAUTION**

In an emergency case, the pumps can be stopped by pressing F3 STOP!

- ▶ As soon as the indicated strokes have been executed, the pumps stop – the menu option “Set calibration” is displayed.
- ▶ Remove the suction lances from their measuring cylinders (lift slowly, hold vertically) and place them in their respective buckets.
- ▶ Place the measuring cylinders on a horizontal, flat support to facilitate its reading (the fluid level should be well-readable).
- ▶ Read the new values at the measuring cylinders and record.
- ▶ Calculate the difference between the first value and the new value (in ml) for acid.
- ▶ Press F2 ACID, then press the ENTER key and enter this difference with the arrow keys.
- ▶ Confirm the value by pressing the ENTER key and accept with F5 SAVE.
- ▶ Calculate the difference between the first value and the new value (in ml) for chlorite.
- ▶ Press F3 CHLORITE, then press the ENTER key and enter this difference with the arrow keys.

- ▶ Confirm the value by pressing the ENTER key and accept with F5 SAVE.
- ▶ Exit the menu by pressing F5 CONTINUE.
- ▶ Record the values for acid and chlorite in the commissioning report or the system logbook.
- ▶ Not for initial commissioning: Carefully place the suction lance for acid in the container “acid” and fix it.
- ▶ Not for initial commissioning: Carefully place the suction lance for chlorite in the container “chlorite” and fix it.
- ▶ Not for initial commissioning: Thoroughly rinse the measuring cylinders and the water buckets.

NOTE

A green check mark is shown behind the executed menus of the menu “Commissioning” if successfully executed.

The system now works with the required metering volume (in case of initial commissioning still with water).

6.4 Testing the Safety Devices

- | | |
|--|--|
| <i>Bypass monitor</i> | Slowly close the shut-off valve upstream of the float flow meter. The control must deactivate the production, the device LED flashes red, the horn sounds and the alarm relay switches. Press the key F5 HORN OFF, open the shut-off valve and then press the key F1 ACK. |
| <i>Level switch</i> | Slowly remove the suction lance from the filled tank and check the above mentioned responses. Press the key F5 HORN OFF and then press the key F1 ACK. |
| <i>Metering monitors</i> | <p>Move the upper shim and the ring initiator of a stroke sensor to the top - the control must deactivate the metering after 6 missed strokes. At the same time a message is displayed on the LCD screen, the device LED flashes red, the horn sounds and the alarm relay switches.</p> <p>Press the key F5 HORN OFF, then return the ring initiator and the upper shim to their original positions, and press the key F1 ACK. If the position of the lower shim was altered, readjust the stroke sensor.</p> <p>Now, check the other stroke sensor.</p> |
| <i>Safety bunds (accessories)</i> | Remove the intact tank from the dry safety bund. Fill the safety bund with water up to the top and check for leaks (if this is a safety bund with leakage monitor, the control must deactivate the metering. Press the key F1 ACK). |
| <i>Suctioning reactor housing (option)</i> | Press the key F5 VENTILAT to manually start the ventilation. The water jet pump has to start to emit a roaring noise. If required, press the key several times to switch on and off the ventilation process several times. |
| <i>Reactor housing (optional)</i> | Block the ventilation valve, left, and press the key F5 VENTILAT. Pay attention to noises which might result from leakage (excluding the roaring noise of the water jet pump). If required, press the key several times to switch on and off the ventilation process several times. Release the ventilation valve or the ventilation line at the reactor housing. |
| <i>Level switch in the reactor housing</i> | <p>A level switch at the bottom of the reactor housing signals major leakages to the control which immediately stops the ClO₂ production.</p> <p>Test: Lift the annular float of the level switch – the control must immediately stop the ClO₂ production. Press the key F1 ACK).</p> |
| <i>Cover reactor</i> | Check whether the reactor cover is correctly mounted. |

6.5 Installation of the Chemicals Cans

- ▶ Deactivate the production in the permanent display by pressing F1 PROD OFF – “Production off” is shown.
- ▶ Place the chemicals can below the system - acid left (HCL, red), chlorite right (NaClO₂, blue) – viewed from the front!
- ▶ Dip the left suction lance into the chemicals can for acid (does the foot valve float just above the bottom of the chemicals can?).
- ▶ Tighten the screw cap.
- ▶ Dip the right suction lance into the chemicals can for chlorite (does the foot valve float just above the bottom of the chemicals can?).
- ▶ Tighten the screw cap.

6.6 Checking of the Chlorine Dioxide Generation

- ▶ Activate the production in the permanent display by pressing F1 PROD ON – “Production on” is shown.
- ▶ After an adequate period of time, prepare a sampling from the main water line (downstream of a reaction tank, if any, or an in-line probe) - the ClO₂ solution should have arrived at this point in the meantime.
- ▶ Take the sample in a clean container and immediately add the DPD 1 reagent (see operating instructions of your colorimetric measuring instrument; ClO₂ tends to outgas, in particular at water temperatures > 25°C!).
- ▶ Immediately measure the ClO₂ content of the sample with a colorimetric measuring instrument (e.g. photometer DT 1).
- ▶ Change the control parameters or added amount in the SETTING menu, if required, start the system and repeat the measurement after a sufficiently large period of time.



WARNING

- ***If the stroke length has to be changed, then the metering monitors have to be readjusted!***
- ***If the stroke length has to be changed, then this has to be entered in the menu “Adjust stroke lengths”!***
- ***Observe the national and local regulations for the ClO₂ concentrations!***

NOTE

- ***Choose a stroke length as large as possible for a safe operation; this prevents the outgassing of the chemicals in suction lines!***
- ***Choose a stroke length as small as possible to ensure a good mixing because otherwise this would result in a high stroke frequency!***

The Bello Zon® system is now ready for operation!

7 Operation



WARNING

- *The maximum permissible operating pressure for the system must not be exceeded in any operating condition!*
- *The entire installation must be leak-free for operation with maximum operating pressure.*



WARNING

- *Otherwise, a large amount of toxic ClO_2 gas may be generated very suddenly which might explosively decompose!*
The two components hydrochloric acid (HCl) and sodium chlorite (NaClO_2) must never get into contact beyond the reactor!



WARNING

- *A large amount of toxic ClO_2 gas may be generated!*
Never refill chemicals into the chemicals cans and never mix chemicals!

7.1 Replacement of the Chemicals Cans



WARNING

- *A large amount of toxic ClO_2 gas can be generated, if the chemicals cans are handled improperly!*
 - *The chemicals cans may only be replaced by instructed personnel!*
 - *Observe the colour code!*
- *Red is used for acid (HCl, left), blue is used for chlorite (NaClO_2 , right)!*



WARNING

- *Otherwise, highly-concentrated ClO_2 gas may be generated very suddenly which might explosively decompose in the reactor!*
The chlorine dioxide system Bello Zon® CDV must only be operated with Bello Zon® chlorite or diluted sodium chlorite! NaClO_2 , 7.5 % w/w!
Only use Bello Zon® acid or diluted hydrochloric acid: HCl 9 % w/w!

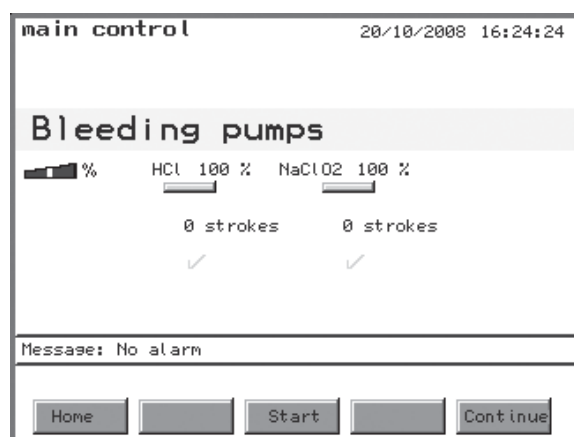


WARNING

- *Toxic ClO_2 gas may be generated!*
Never place both suction lances in one and the same container and never confuse them!
- *Leakages may be caused by corrosion!*
Only use Bello Zon® acid or diluted hydrochloric acid: HCl 9 % w/w!
Only use fluoride-free chemicals!

- ▶ Deactivate the ClO_2 production in the permanent display by pressing F1 PROD OFF – “Production off” is shown.
- ▶ Carefully remove each suction lance from its chemicals can. Lift slowly, keep vertical!
- ▶ Place each suction lance in an individual bucket filled with clean water. This prevents that the suction lances run empty and that ClO_2 is generated.
- ▶ Close the empty chemicals cans and have them disposed of by specialists.
- ▶ Place the new chemicals can below the systems: red is used for acid (left), blue is used for chlorite (right)!
- ▶ Slowly lift each suction lance, hold vertical and place in the pertinent chemicals can: red is used for acid, blue is used for chlorite!
- ▶ Check the suction lines for air bubbles; deaerate, if required (as described in Chap. 7.2).
- ▶ Activate the ClO_2 production in the permanent display by pressing F1 PROD ON – “Production on” is shown.

7.2 Bleeding pumps



- ▶ Switch to the SERVICE menu using F1 SERVICE.
Use the DOWN key to go to the menu “Expert work” and press the ENTER key.
- ▶ Select the menu “Pump deaeration” with the arrow keys.
- ▶ Press the ENTER key to go to the menu Pump deaeration.

Prerequisites:

The stroke lengths of the pumps are set corresponding to the minimum values from Tab. 2 and are set identically.

- ▶ Place each suction lance in its own bucket of clean water.
- ▶ Open the coarse/fine vent valves at the pumps slightly (clockwise).
- ▶ Start deaeration with F3 – wait until the suction lines and the delivery units are filled bubble-free.



CAUTION

In an emergency case, the pumps can be stopped by pressing F3 STOP!

- ▶ If the suction lines and deliveries have not been filled bubble-free after the stop of the metering pumps, start deaeration again by pressing F3 START.
- ▶ If the suction lines and the delivery units are filled bubble-free earlier, stop the deaeration with F3 STOP.
- ▶ Press F1 HOME to go to the display “Equipment off”.
- ▶ Close the coarse/fine vent valves at the pumps (counter-clockwise).



WARNING

Toxic ClO₂ gas may be generated!

- ***Never mix the contents of the deaeration bottles!***
- ***Never return the content of the deaeration bottles to the chemicals can!***
There is a significant risk of confusion!
- ***Pour the content of the deaeration bottles individually into the drain and flush down individually with a lot of water.***



WARNING

Caustic chemicals might leak!

In case of several repeated deaeration processes, check the fill level in the deaeration bottles.

7.3 Setting of the Stroke Lengths

main control 20/10/2008 16:33:53

Set stroke length

	HCl	NaClO2
old	100 %	old 100 %
now	100 %	now 100 %

Message: No alarm

Home [] [] [] save



WARNING

- **The metering monitors may loose their safety function in metering operation! The stroke lengths of the metering pumps must be larger than the minimum value in Tab. 2!**

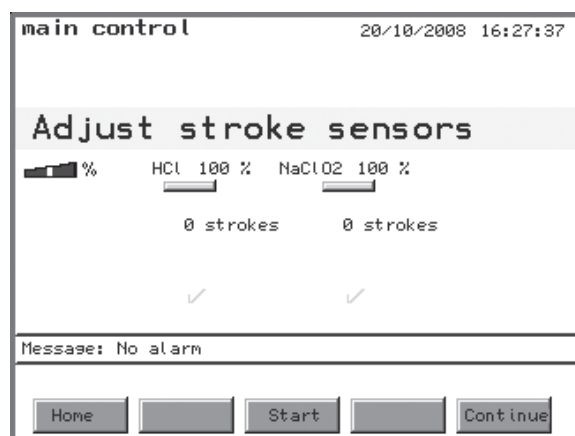
NOTE

- **Choose a stroke length as large as possible for a safe operation; this prevents the outgassing of the chemicals in the suction lines!**
 - **Choose a stroke length as small as possible to ensure a good mixing because otherwise this would result in a high stroke frequency!**
- ▶ Switch to the SERVICE menu using F1 SERVICE.
 - ▶ Press the ENTER key to go to the menu Expert work.
 - ▶ Select the stroke length adjustment menu with the arrow keys.
 - ▶ Press the ENTER key to go to the stroke length adjustment menu.
 - ▶ Set the new stroke length at the metering pumps.
 - ▶ Accept the new values for the stroke lengths by pressing F5 SAVE – the menu “Adjustment of the Metering Monitor” is shown.
 - ▶ Now the stroke sensor must be adjusted (see next chapter).

Table stroke lengths	Minimum values
CDV 20	70 %
CDV 45	60 %
CDV 120	50 %
CDV 240	40 %
CDV 600	40 %
CDV 2000	30 %

Tab. 2: Minimum values of stroke lengths

7.4 Adjust stroke sensors



WARNING

The metering monitors may loose their safety function in metering operation!

Never leave the ring initiators in the lowest position!

The stroke lengths of the metering pumps must be larger than the minimum value in Tab. 2!



CAUTION

The metering monitors may only be adjusted at the operating pressure which will also be given later in operation!

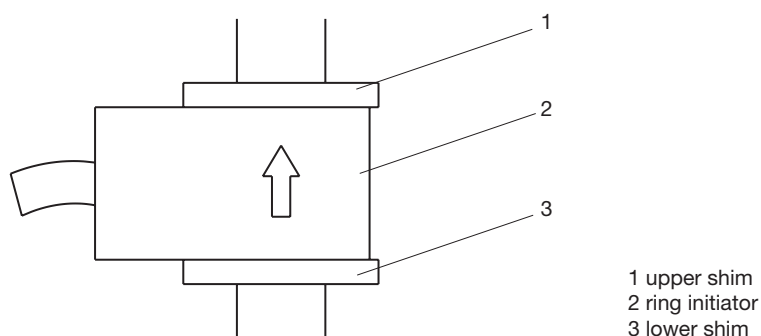


Fig. 12: Overview stroke sensor

Prerequisite:

The metering pumps are deaerated.

- ▶ Turn the upper shim (1) of the stroke sensor (see Fig. 12) to the upper top.
- ▶ Follow with the ring initiators (2) and the lower shims (3).
- ▶ Start the metering pumps by pressing F3 START.



CAUTION

In an emergency case, the pumps can be stopped by pressing F3 STOP!

- ▶ Slowly lower each ring initiator (2) until the figure below the pertinent green bar remains stable at "0" (e.g. for the left ring initiator (HCl): left bar).
- ▶ Then lower the lower shims (3) by 1 turn.
- ▶ Lower the upper shim (1) onto the ring initiators (2).
- ▶ Exit the menu pressing F5 CONTINUE.
- ▶ Press F1 HOME to go to the display "Equipment off".

7.5 Checking the Sensors

In case of a measured value-dependent metering, the sensors must be regularly inspected (interval depends on the process conditions; see operating instructions of the sensors).

8 What Happens in Case of Maloperation?

a) Chemicals can

Maloperation: Chemicals cans were confused.

Result: Toxic ClO_2 gas was generated in the chemicals cans.

Maloperation: Undiluted acid and undiluted chlorite were used and the Bello Zon® system / the pumps were started.

Result: The undiluted chemicals are mixed in the reactor, the reactor becomes very hot, toxic ClO_2 gas is generated which will result in an explosion of the reactor.

b) Metering monitors

Maloperation: Ring initiator is positioned too low.

Result: It might be that the stroke sensor does not detect a reduction of the flow volume of > 30 % and that the metering continues.

Too much acid or chlorite are delivered:

- In case of excessive acid, the already existing acid excess is increased and the ClO_2 solution is diluted. Leakages because of corrosion may occur.
- In case of excessive chlorite, the ClO_2 yield drops and the indicated ClO_2 amount is no longer correct. In addition, a health hazard may result if the permissible chlorite concentration is exceeded!

Maloperation: Ring initiator is positioned too high

Result: The control deactivates the metering after 6 pump strokes.

c) Bypass

Maloperation: The limit contact of the flow meter in the bypass is set too low.

Result: The ClO_2 concentration in the bypass becomes too high and environmental or health hazards may be the result.

If a gas phase can form, an explosion may occur!

d) Control

Maloperation: Wrong calibration values were set for the metering pumps.

Result: Too much acid or chlorite are delivered:

- In case of excessive acid, the already existing acid excess is increased and the ClO_2 solution is diluted. Leakages because of corrosion may occur.
- In case of excessive chlorite, the ClO_2 yield drops and the indicated ClO_2 amount is no longer correct. In addition, a health hazard may result if the permissible chlorite concentration is exceeded!
- The processed ClO_2 metering volume indicated by the control is no longer correct.

9 Maintenance



WARNING

Toxic ClO_2 may leak!

If the system was not serviced, ClO_2 solution may be discharged e.g. because of a leak in the line in the worst case!

The customer service must service the Bello Zon® system at least annually!

**WARNING**

- **Toxic chemicals in the hydraulic components of the system!**
Before carrying out maintenance work (replacement of parts etc.), flush the Bello Zon® system with water until the lines and above all the reactor no longer contain chemicals!
- **Only with reactor housing: Toxic ClO₂ gas or ClO₂ solution may be contained within the reactor housing!**
Always suction off the content of the reactor housing before opening it!
Press the key F5 VENTILAT (water for ventilation must flow)!

**CAUTION**

- **Danger because of incorrectly replaced electrical lines!**
 - *Control lines or power supply connection lines may only be replaced by the customer service!*
 - *Only the corresponding special lines may be used!*

NOTES to the system operator:

Chlorine dioxide systems must be regularly inspected by a technical expert for safety, however, at least once a year and before any re-commissioning – e.g. also in accordance with the German accident prevention regulations GUV 8.15 or VGB 65 Section 19(2).

These inspections can be performed by the customer service within the scope of the maintenance work.

We thus recommend concluding a maintenance contract.

Regular controls which are possible without involving a service technician

Daily to weekly, depending on the operating conditions:

Maintenance of system

- ▶ Checking of the ClO₂ concentration in the treated water; observe national regulations.
- ▶ Checking and comparing of the fill levels in the chemicals cans; observe any pre-warning “Level low” on the display; if required, keep Bello Zon® acid and Bello Zon® chlorite ready.
- ▶ Documenting the consumption of Bello Zon® acid and Bello Zon® (system logbook).
- ▶ Checking the flow in the bypass.
- ▶ Checking the system for leakages.

Maintenance of metering pumps

- ▶ Checking for:
 - tight seat of the liquid end screws
 - tight seat of the metering lines: pressure- and suction-side
 - tight seat of the pressure valve and the suction valve
 - moisture at the leakage hole of the end disc; if moisture is present, the diaphragm has probably fractured.

Cleaning of the housing

It is recommended to clean the housing with a cloth dampened with soap water. Subsequently, rub dry.

**CAUTION**

Do not use any solvents! Otherwise the surfaces may be damaged!

After 10 years:

Replace the battery of the control – see Chapter 13 “Disposal”.

10 Repair

**WARNING**

The Bello Zon® system may only be repaired by the customer service!

11 Troubleshooting



WARNING

Only instructed persons may remedy malfunctions!

11.1 Malfunctions without Error Messages

Liquid leaks from the end disc of a metering pump.

- Cause:* The delivery unit leaks at the metering diaphragm.
Remedy: Re-tighten the Allen head screws at the liquid end.
 If not successful, contact the customer service.

Metering pump has been running for some time, however, suddenly stops to deliver

- Cause:* Air is in the metering line or chemicals can empty.
Remedy: Deaerate the metering line, check the fill level in the chemicals can, if not successful:
Cause: Diaphragm at the pump is probably faulty.
Remedy: Contact customer service.

Metering pump does not meter, a green bar does not flash (see permanent display 1 in Chap. 5.1 "Operating Menu, Diagram")

- Cause:* Connection problem with CAN cables.
Remedy: Check the connection of the CAN cables.
Cause: Problem with the supply voltage for the pump.
Remedy: Check the applied supply voltage.
Cause: The fuse of the pump is faulty.
Remedy: Have the fuse checked by the customer service and replaced, if required.



CAUTION

Only use fuses of the specified size (see below).

11.2 Malfunctions with Error Messages

Error message	Remedy
Operating time expired	The system must be serviced – call customer service.
Operating time nearly expired	Order customer service for maintenance
Bypass survey	as error message – only expert: Press F1 ACK, check bypass, press F1 ON
Bypass survey	as alarm message: operating mode, no remedy required
CANBus failure	Interrupt briefly the supply voltage simultaneously for CDVc and all CAN modules.
Chlorite CANopen node not found	Check the cable connections to the chlorite pump
Chlorite concentration high	Only expert: check system
Chlorite concentration too high	Only expert: Press F1 ACK, check system, press F1 ON
Chlorite pump not ready	Only expert: Deaerate pumps (Chap. 7.2) adjust stroke sensor (Chap. 7.4), calibrate pumps (Chap. 6.3.5)
Chlorite sign. low (cable disruption)	Check cable connection to sensor CLT
Chlorite signal too high	Check sensor (operating instructions sensor CLT)
ClO ₂ concentration high	Only expert: Press F1 ACK, check ClO ₂ metering, press F1 ON
ClO ₂ concentration low	Only expert: Check ClO ₂ metering
ClO ₂ concentration too high	Only expert: Check ClO ₂ metering
ClO ₂ concentration too low	Only expert: Press F1 ACK, check ClO ₂ metering, press F1 ON
ClO ₂ signal too high	Check sensor (operating instructions sensor CDE or CDP)
ClO ₂ signal too low(cable disruption)	Check cable connection to sensor CDE or CDP
Dosing error chlorite	Press F1 ACK, go to "Metering error acid" or "Metering error chlorite" - detailed troubleshooting, below

Error message	Remedy
Dosing error acid	Press F1 ACK, go to "Metering error acid" or "Metering error chlorite" - detailed troubleshooting, below
Bypass flow	see "Flow bypass" - detailed troubleshooting, below
Flow sign. too low (cable break) (main water line)	Flow signal too low (cable disrupt.)
Flow high (main water line)	Only expert: check system
Flow low (main water line)	Only expert: check system
Flow too high (main water line)	Only expert: Press F1 ACK, check system, press F1 ON
Flow too low (main water line)	Only expert: Press F1 ACK, check system, press F1 ON
Flow signal too high (main water line)	Check signal transducer
Error input	Press F1 ACK, check system, press F1 ON
Incorrect control parameters	Controller parameters are not accepted by controller => enter correct controller parameters
Stroke length error Chlorite	Press F1 ACK, check stroke length or set identical values at all pumps, press F1 ON
Stroke length error Acid	Press F1 ACK, check stroke length or set identical values at all pumps, press F1 ON
IO CANopen node not found	Only customer service: check cable connections in the contro
No alarm	standard condition, no remedy required
Leakage	Check safety bunds or reactor in the reactor housing for leakage
Capacity limit pumps	Only expert: check system for match need for chlorine dioxide against set system capacity
Sample water max	Check relevant measuring/metering circuit
Sample water min	Check relevant measuring/metering circuit
Error sample water	Press F1 ACK, check system, press F1 ON
Production overload	Only expert: check system for match need for chlorine dioxide against set system capacity
Control error	Contact customer service – software error
Acid CANopen node not found	Check the cable connections to the acid pump
Acid pump not ready	Only expert: Deaerate pumps (Chap. 7.2) adjust stroke sensor (Chap. 7.4), calibrate pumps (Chap. 6.3.5)
Setpoint sign. low (cable disruption)	Check cable connections to signal transducer
Setpoint high	Check signal transducer
Setpoint low	Check signal transducer
Dist. variable too high	Press F1 ACK, check signal transducer, press F1 ON
Setpoint too low	Press F1 ACK, check signal transducer, press F1 ON
Setpoint signal too high	Check signal transducer
Dist. var. sign. low (cable disrupt.)	Check cable connections to signal transducer
Dist. variable high	Check signal transducer
Dist. variable low	Check signal transducer
Dist. variable too high	Press F1 ACK, check signal transducer, press F1 ON
Dist. variable too low	Press F1 ACK, check signal transducer, press F1 ON
Dist. variable signal too high	Check signal transducer
Supply Chlorite empty	Press F1 ACK, go to "Supply acid empty" or "Supply chlorite empty" - detailed troubleshooting", below
Supply Chlorite low	Replace both chemicals cans, WARNING: see Chap. 7.1
Supply Acid empty	Press F1 ACK, go to "Supply acid empty" or "Supply chlorite empty" - detailed troubleshooting", below
Supply Acid empty	Replace both chemicals cans, WARNING: see Chap. 7.1

Tab. 3: Error messages and remedies

“Dosing error acid” or “Dosing error chlorite”- detailed troubleshooting

- Cause:* A stroke sensor is misadjusted.
Remedy: Adjust the stroke sensor – see Chap. 7.4 “Adjustment of stroke sensor”. Press F1 ON.
- Cause:* The backpressure is increased.
Remedy: For high pressure increase, eliminate the cause; for low pressure increase, readjust the stroke sensor – see Chap. 7.4 “Adjustment of stroke sensor”. Press F1 ON.
- Cause:* Air is present in the line between the container and the stroke sensor – container empty.
Remedy: See chapter 7.1. Press F1 ON.
- Cause:* Leakage in the line between the container and the stroke sensor.
Remedy: Contact customer service.

“Acid pump not ready” or “Chlorite pump not ready”- detailed troubleshooting

- Cause:* The vent valve at the delivery unit of the relevant metering pump is open.
Remedy: Close the vent valve.
- Cause:* The cable at the pump is not correctly connected.
Remedy: Check the connection of the orange-coloured cable from the pump to the control.
- Only expert:
- Cause:* Air is contained in the liquid end.
Remedy: See Chap. 7.2 “Deaeration of the pumps”
- Cause:* The metering volume reduced (by more than 30 %) caused by an increase in the operating pressure or an increase in the suction height.
Remedy: See Chap. 7.4 “Adjustment of stroke sensor” and see Chap. 6.3.5 “Calibration of pumps”
- Cause:* The specified value for the stroke length is too small.
Remedy: Increase the stroke length with the adjusting knob - see Chap. 7.3” Setting of the Stroke Lengths”

“Supply acid empty” or “Supply chlorite empty”- detailed troubleshooting

- Cause:* Chemicals can is empty.
Remedy: Replace both chemicals cans, WARNING - see Chap. 7.1 “Replacement of the chemicals can”, Deaeration of metering pumps, see Chap. 7.2 “Deaeration of the pumps”, press F1 ON.

“Flow bypass” - detailed troubleshooting

- Cause:* A ball valve in the bypass is not open.
Remedy: Open the ball valve in the bypass.
- Cause:* The cable connection between the bypass monitor and the control is faulty.
Remedy: Repair the cable connection between the bypass monitor and the control.
- Cause:* If existing: the bypass pump does not deliver.
Remedy: Check the bypass pump.
- Cause:* The float in the flow meter is blocked.
Remedy: Eliminate the block and clean the flow meter.
- Cause:* The limit value contact is faulty.
Remedy: Check the limit value contact and replace, if necessary.

NOTE

- ***If the metering is off, the control does not drive the pumps and ignores almost all input signals (with the exception of “Suction”, “External fault”, “Leakage” ...).***
- ***If you want to contact ProMinent ProMaqua because of faults, please keep the following information ready:***
 - ***the Identcode (press F2 SETTING, select “Identcode” with the DOWN key and press the ENTER key),***
 - ***the version number (for hardware and software: press F2 SETTING, select “System information” with the DOWN key and press the ENTER key)***
 - ***the colour of the left LED of the control and its behaviour***
 - ***the exact error text (if indicated by the control)!***

Replacement of the line fuse of the control



WARNING

- **Risk of electric shock!**
The line fuse of the control may only be replaced by a qualified electrician!
- **Risk of electric shock!**
De-energise the control and protect against restart!
- **Risk of electric shock!**
System voltage may be still present at the terminal blocks XR1 and XR2 even if the power supply has been switched off.
De-energise the pertinent power supply and protect against restart!
- **Fire hazard and malfunctions may result!**
Only use genuine ProMinent fuses (see Tab. 4)!

- Loosen the four countersunk screws.
- Remove the front part (see Part 1, Chap. 4.2).
- Open the bayonet lock of the relevant fuse holder (see Part 1, "Terminal Diagram").
- Remove the faulty fuse and replace by a new one.
- Lock the bayonet lock again.
- Attach the housing firmly.

Designation	Type	Supplies ...	Terminals	Order 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

Tab. 4: The approved fuses for the CDVc controller (230V AC, 115 V AC)

12 Decommissioning



WARNING

- **A large amount of toxic, explosive ClO₂ gas may be generated!**
 - **Never mix the contents of the chemicals cans!**
 - **Never return the content of the deaeration bottles to the chemicals can!**
 - **Never place both suction lances in one and the same bucket, neither together nor one after the other!**



WARNING

- **Caustic chemicals might leak!**
Do not open the coarse/fine vent valves at the delivery units of the pumps!

12.1 For a Short Time

In order to decommission the Bello Zon® system for only a short time, simply press the "Start / Stop" key ("Metering STOP" is displayed). The power supply to the system's control must not be interrupted.

The power supply to a possibly existing chlorine dioxide sensor must not be interrupted for more than 2 hours!

12.2 For a Longer Period of Time

Chlorine dioxide is an unstable compound which decomposes in the course of time. If the Bello Zon® system is decommissioned for a longer period of time, the reactor should be flushed with water. For flushing, the flushing unit in the bypass line is used (see Part 1, Fig. 7).

Flushing of reactor, detoxification of reactor content



WARNING

- ***ClO₂ gas, ClO₂ solution and sodium chlorite are toxic!***
 - *Wear suitable protective equipment to protect against (safety goggles, rubber gloves, gas mask, rubber apron, ... see safety data sheets)!*
 - *Flush immediately with a lot of cold water after contact with these chemicals and then proceed as instructed in the safety data sheets!*



WARNING

- ***Hydrochloric acid and sodium hydroxide are caustic!***
 - *Wear suitable protective equipment to protect against (safety goggles, rubber gloves, ... see safety data sheets)!*
 - *Flush immediately with a lot of cold water after contact with these chemicals and then proceed as instructed in the safety data sheets!*



WARNING

- ***ClO₂ solution forms an explosive ClO₂ gas phase after a short time!***
Never leave the reactor content detoxified!



WARNING

- ***Observe national and local regulations!***

Required materials

- hose with fabric approx. 3m, d 19/27mm, soft PVC #37041
- 1 container for neutralisation (see table)
- 1 l of sodium hydroxide 50 % (C, caustic)
- 1 l of hydrogen peroxide 30 % (Xi, irritant)
- 1 pH measuring instrument (alternatively pH paper, however, is bleached by ClO₂!)
- drinking water (see table)

13 Disposal



WARNING

Danger because of toxic and caustic chemicals!

The Bello Zon® system may still contain hydrochloric acid (HCl), sodium chlorite (NaClO₂) and chlorine dioxide (ClO₂)!

The entire Bello Zon® system must be thoroughly flushed with water (see Chap. 12, "Decommissioning")! If required, also flush the empty chemicals cans!



CAUTION

Please observe the relevant local regulations!
(... specifically with regard to electronic waste)



CAUTION

- ***Lithium batteries may emit substances detrimental to health, they may get hot or explode if treated improperly or with force (heating up, short-circuiting, crushing, ...)!***
- ***The lithium battery is hazardous waste!***
The battery must be disposed of separately from the controller!
Please observe the relevant local regulations!
- ***Electronic waste is hazardous waste!***
Please observe the relevant local regulations!
The battery of the control is located in a retainer on the back of the upper housing part.

- ▶ Loosen the four fixing screws at the front of the upper housing part, separate the upper housing part from the lower part to gain access to the battery.
- ▶ Press onto the lug at the retainer (see fig. 13) and remove the battery from the retainer.

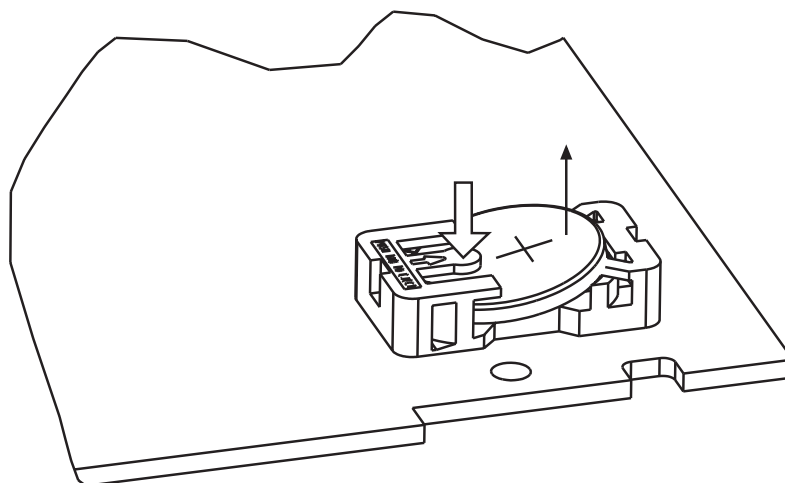


Fig. 13: Removal of battery

Glossary

pH value

The pH value is the measure for the concentration (activity) of hydrogen ions or more simply: a measure for the acid or alkali character of water.

The pH value influences the corrosiveness. The aggressiveness of water increases with decreasing pH value. Metallic materials may be attacked.

Calibration (sensor calibration)

All sensors deviate from the theoretical values. Thus, a calibration must be performed at the transducer.

The slope of the measuring sensor changes due to aging and contamination.

Zero point

The zero point describes e.g. the current or voltage a sensor gives off in very pure water. The zero point of the sensor changes due to aging and contamination.

Slope / sensitivity

This value is e.g. stated in mA/ppm at 25 °C.

Controlled variable (measured value, actual value)

The controlled variable is the variable to be measured or detected (e.g. concentration ClO_2).

Setpoint

The set point is the value which is to be continuously maintained stable throughout the process via controlling (e.g. concentration $\text{ClO}_2 = 0.30 \text{ ppm}$).

Disturbance

The control can e.g. process the signal of a flow measurement as disturbance.

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

Depending on the type of the influence on the production volume, the following is differentiated:

- multiplicative disturbance (flow-proportional influence)
- additive disturbance (controller output-dependent influence)

The controller output signal is present as 0/4 ... 20 mA signal.

During "Commissioning", the zero point signal of the flow meter must be checked without flow (must be ≥ 0).

Multiplicative disturbance

This type of disturbance processing is used e.g. for continuous neutralisation.

The "production volume" first "determined" by the controller is influenced by the ratio of the current disturbance to the factor disturbance. The final production volume can be up to 100 %.

$$\text{Final production volume [g/h]} = \frac{\text{determined production volume [g/h]} * \text{current disturbance [\%]}}{\text{factor disturbance [\%]}}$$

Examples:

Designation	Unit	1.	2.	3.	4.
Determined production volume	g/h	0	50	50	50
Current disturbance	%	5	10	20	0
Factor disturbance	%	100	50	100	50
Final production volume	g/h	0	10	10	0

Caption:

The determined production volume is the production volume which the controller would deliver without disturbance.

If the ratio current disturbance to factor disturbance is >1 , the final production volume may also be larger than the determined production volume!



CAUTION

The multiplicative disturbance is not to be used for the permanent deactivation of the production volume! Please use the pause function for deactivation.

Additive disturbance

The additive disturbance feedforward is suitable for metering tasks where the production volume primarily depends on the disturbance (e.g. flow) and only requires little correction. This type of disturbance processing is used e.g. for chlorination of water with almost constant ClO_2 consumption.

A base load metering depending on the disturbance is added to the "production volume" first "determined" by the controller. The final production volume can be up to 100%.

Production volume [g/h] =

$$\text{determined production volume [g/h]} + \left(\frac{\text{max. production volume [g/h]} * \text{current disturbance [\%]}}{\text{factor disturbance [\%]}} \right)$$

Examples:

Designation	Unit	1.	2.	3.	4.	5.	6.
Determined production volume	g/h	40	90	50	50	50	0
Current disturbance	%	5	5	2	10	20	5
Factor disturbance	%	100	50	100	50	100	10
Max. production volume	g/h	120	120	120	120	120	120
Final production volume	g/h	46	102	52,4	74	74	60

Caption:

The determined production volume is the production volume which the controller would deliver without disturbance.

If the ratio current disturbance to factor disturbance is >1 , the disturbance percentage in the production volume may be larger than the max. production volume!

CAUTION

If no current disturbance exists (flow = 0) but a determined production volume of the PID controller, then the final production volume equals to the determined production volume of the PID controller.

If a current disturbance exists (flow > 0) and the determined production volume of the PID controller is "0", then the final production volume equals to the 2nd term of the above equation:

$$\frac{\text{max. production volume} * \text{current disturbance}}{\text{Factor disturbance}}$$

Controller output

The controller output is the output (e.g. mA signal) received by an external system to adjust the system capacity.

Control time

The function "Control time controlling" offers a protection against excess metering. Upon expiry of the control time, it switches the relevant control circuit to metering 0% and triggers an error message, if:

for mere P controlling: the P contribution of the disturbance is larger than set.

for PID controlling: the PID disturbance Y is larger than set.

Delay time tdelay (alarm, general)

If a limit value has been violated, the control triggers an error message only after the delay time specified here. This prevents that an error message is triggered even in case of only a short-term violation of the limit value.

Delay time tdelay (bypass monitoring)

If the flow undershoots the limit value during production, a warning is emitted without delay and the delay time starts to run. But if the flow undershoots the limit value exceeding the delay time, the control goes to the mode "Production fault".

Controlling

The control can be specified as P, PI, PD, PID or two-point controller. This depends on the setting of the control parameters.

The control function (output of a controller output) can be deactivated via the control input Pause.

The calculation of the controller output starts with the lapse of the pause.

The following controller types exist:

P controller:

The controller output is directly proportional to the deviation of the actual value from the setpoint.

PI controller:

In systems with continuous consumption, a mere P controller will never be sufficient to reach the setpoint because shortly before reaching it, the controller output is just sufficient to compensate for the consumption but not to reach the setpoint. The I contribution of the PI controller ensures a magnification of the controller output beyond the value calculated by the P controller if the setpoint is not reached within the reset time T_n .

The I function is inactive for $T_n=0$.

PD controller:

The PD controller compensates for the inertia which occurs during the response to quickly changing conditions. For this purpose, the controller determines the current speed of change of the measured value and calculates the value which would result after expiry of the rate time T_v . The PD controller immediately sets the controller output the P controller would calculate from this future value.

The D function is inactive for $T_v=0$.

PID controller:

The PID controller combines all three functions.

2-point controller:

If the setpoint is exceeded by the “switching difference”, the controller emits a controller output of 100 % for a reset process. As soon as the setpoint is undershot by the “switching difference”, the controller resets the controller output to 0 %.

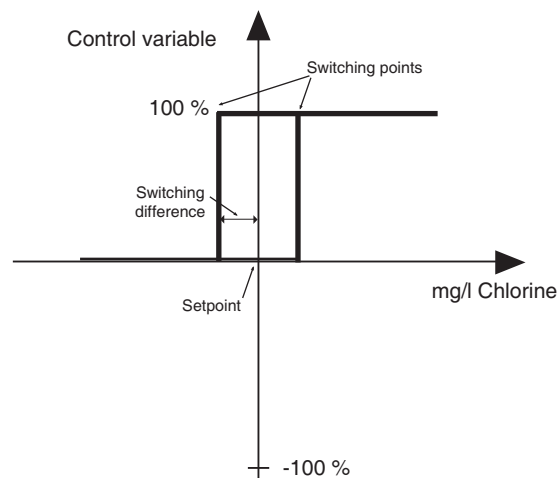


Fig. 5: 2-point controller

Neutral zone

In case of a neutral zone controlling (dead zone control), two setpoints must be specified. If the measured value is within the neutral zone, no controller output is issued. Setpoint 2 must be larger than setpoint 1!

Additive base load

A base load is added to the present controller output.

By applying an additive base load, e.g. a constant consumption can be compensated for.

$$Y_{Ges} = Y_p + 15\% \text{ (additive base load = 15\%)}$$

Example (one-sided control):

$$Y_{Ges} = 85\% + 15\%$$

$$Y_{Ges} = 100\%$$

Limit values

“Low. limit” means that the limit value criteria is violated in case of undershooting.

“Upp. limit” means that the limit value criteria is violated in case of excess.

Response system

In case of an alarm, the system may respond in various ways:

not off: The system does not switch off but continues to function as normal.

off: The system switches off (fault), if the condition no longer exists, the systems goes to “Off”.

p.off: The system switches off permanently, i.e. remains in the condition “fault” until the alarm is acknowledged. Theses alarms are indicated until they are acknowledged.

Pause

Upon closing of a pause contact, the control sets the controller outputs to “0” as long as the pause contact remains closed. While the pause contact is closed, the control calculates the P contribution in the background, the I and D contributions are inactive.

High output metering

If the installation requires a high output metering of ClO_2 solution from time to time, reconfigure the “Input pause” as “Input high output metering” in “Set up” – “Configuration”. If a contact between the terminals of the “Input high output metering” is closed (for default “make contact”), the control increases the ClO_2 concentration to the value specified in “Settings” – “Main control” – “ ClO_2 production” – “Controlling”.

At the same time, the permanent display shows the message “High output metering”. However, the system must be able to supply this concentration.

If the contacts are opened, the concentration returns to the standard value.

EC Declaration of Conformity

We,

ProMaqua GmbH
Maaßstraße 32/1
D - 69123 Heidelberg

hereby declare that, on the basis of its functional concept and design and in the version brought into circulation by us, the product specified in the following complies with the relevant, fundamental safety and health stipulations laid down by EC regulations.
Any modification to the product not approved by us will invalidate this declaration.

Product description : ***Chlorine dioxide generator***

Product type: ***CDVc...***

Serial number: ***see type identification plate on device***

Relevant EC regulations :
EC - machine directive (98/37/EC)
EC - low voltage directive (2006/95/EC)
EC - EMC - directive (2004/108/EC)
EC - directive for pressure equipment (97/23/EC)

Harmonised standards used,
in particular ***EN ISO 12100-1, EN ISO 12100-2, EN 809,***
EN 60204-1, EN 60529, EN 610000-6-1/2/3/4

other technical specifications
used, in particular : ***DVGW-Compilation of rules, job-sheet W224 and W624***

Date/manufacture's signature : ***08.01.2009***



The undersigned : ***Dr. Andreas Wolf, Executive Vice President***



TECHNICAL-SCIENTIFIC ASSOCIATION

St/eb 1269 h

16.04.1998

Hazardous Materials Data Sheet Chlorine Dioxide

Properties of chlorine dioxide and notes on handling aqueous solutions

The chlorine dioxide stock solutions used for water treatment have a ClO_2 concentration of 2 g/l. At a temperature of up to 25 °C, this results in a chlorine dioxide concentration in the gas-filled compartment of less than 100 g/m³. Thus, an explosive decomposition can be excluded given proper preparation both in the gas-filled compartment and in the stock solution.

1. Material and chemical properties:

1.1 Chemical characterisation

Aqueous solution of chlorine dioxide (ClO_2) approx. 2 g ClO_2 /L physically solved chlorine dioxide gas

1.2 Properties of gaseous chlorine dioxide

Colour: orange-yellow

Odour: pungent

Melting point: - 59 °C

Boiling point: 11 °C

Stability: Gaseous chlorine dioxide composes explosively to chlorine and oxygen from a concentration of 300 g/m³ (≈ 10 vol.-%)

A dilution reduces the tendency to explode; for concentrations below 10 vol.-% in gases in which chlorine dioxide does not react (e.g. air, nitrogen, carbon dioxide), there exists no explosion risk.

A critical chlorine dioxide concentration must e.g. reckoned with in a gas-filled compartment above an aqueous chlorine dioxide solution with a concentration of more than 8 g/L of chlorine dioxide (at a temperature of 20 °C).

A violent to explosive reaction also occurs with oxidable substances.

1.3 Properties of aqueous solution of chlorine dioxide

The gas phase is decisive

Stability: Without gas-filled compartment above, aqueous chlorine dioxide solutions are explosive from a concentration of approx. 30 g/L, i.e. they can decompose explosively without the influence of external factors such as heat, spark formation, dirt or rust.

Chlorine dioxide will be stable for several days in diluted aqueous solution, provided the solution is pure and is kept in the dark or provided the temperature of the solutions is below 25 °C and its pH value is below 7.

2. Identification and posting

2.1 Identification and posting

The identification of the work place and work space is made by posting the relevant accident prevention regulations "Chlorination of Water" (GUV 8.15, Annex 3).

2.2 Storage

Because of its explosion hazard, chlorine dioxide cannot be stored and transported neither as gas nor as concentrated, aqueous solution. It is thus only generated for immediate use as diluted (see Item I.3), aqueous solution in **special systems**.

2.3 Measures in case of spilling, leakage, gas discharge

Condense the gas with spray.

Pour sodium thiosulphate solution over spilled solution, then dilute with a lot of water, and flush into the drain.

2.4 Measures in case of fires

Chlorine dioxide itself is not inflammable, however, has an oxidising effect. Explosive decomposition at temperatures from 100°C. Cool container with water, condense discharged chlorine dioxide gas with spray. **There are no restrictions for extinguishants for surrounding fires.**

2.5 Disposal

See item 2.3

3. Health protection

3.1 MAC values and odour threshold

MAC value: 0.1 ppm (mL/m³) or 0.3 mg/m³

Odour threshold: Chlorine dioxide gas can be smelled from a concentration of approx. 15 mg/m³ air

3.2 Personal protective equipment:

Respirator: Gas mask, filter B/grey

Eye protection: Safety goggles, face protection

Protective gloves: Rubber gloves

Others: Protective clothing

3.3 Health risks

A chlorine dioxide gas concentration of more than 45mg ClO₂/m³ results in breathing difficulties and irritation of the mucous membranes and headaches.

In general chlorine dioxide causes severe irritation symptoms in the region of the mucous membranes of the eyes and respiratory organs. Depending on the concentration and duration of the exposure, risk of suffocation, coughing fits, in some cases vomiting, conjunctivitis and severe headaches may result, in severe cases pulmonary oedemas with dyspnoea, oxygen deficiency syndromes and circulatory failure. In case of short-term exposure of very high concentrations, laryngospasm or reflexory respiratory arrest or cardiac arrest may result. Nerve-damaging (e.g. ocular palsies).

3.4 First aid measures

Immediately remove clothing which came into contact with chlorine dioxide or its aqueous solution, thoroughly clean skin with soap and a lot of water.

In case of eye contact, rinse eyes with well-opened eyelid under running water for several minutes.

In case of inhalation of chlorine dioxide, provide fresh air, keep absolutely at rest, position horizontally, provide protection against loss of heat.

Seek medical advice immediately even if complaints do not occur immediately. If required, quick, gentle transport to the hospital.

4. Further information

DVGW leaflet W224: "Chlorine dioxide in water treatment" (German Technical and Scientific Association for Gas and Water)

Accident prevention regulations "Chlorination of Water" (GUV 8.15)

Ullman Volume 5, page 551

Kühn-Birett, Sheet C 20

Note:

The European standard for chlorine dioxide as well as the DVGW leaflet W 624 "Metering systems for chlorine dioxide", edition 10/96, are presently being prepared.

Note:

This information is based on our current level of knowledge. They are intended to contribute to the safe handling of aqueous chlorine dioxide solutions and thus are not intended to guarantee any particular properties. Automatic correction in case of innovations is not guaranteed, thus for information only and without legal responsibility.

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