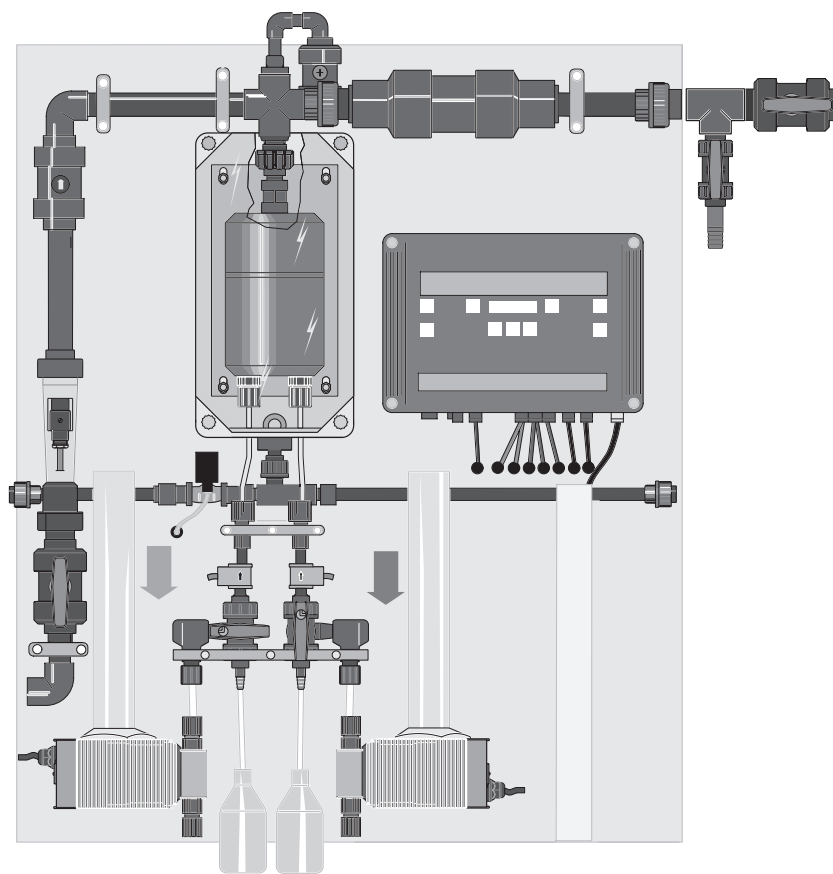


# Operating Instructions Manual

## ProMinent Chlorine Dioxide Systems

### Bello Zon® Type CDVb

### Part 2



CDVb 15-120

CDVb

Please enter the identcode of the device here

**For safe and correct operation of the Bello Zon® system you need Parts 1 and 2 of the Operating Instructions Manual.**  
**The two are valid only when read in conjunction with one another.**

**Please read through operating instructions manual carefully before use. Do not discard.**  
**The guarantee is void if the equipment is installed incorrectly.**


**Publishing details:**

Operating Instructions Manual  
Bello Zon® Type CDVb, Part 2  
©ProMinent Dosiertechnik GmbH, 2003

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Subject to revision  
Printed in Germany.

Please fold out this page! 

## Controller

## LEDs

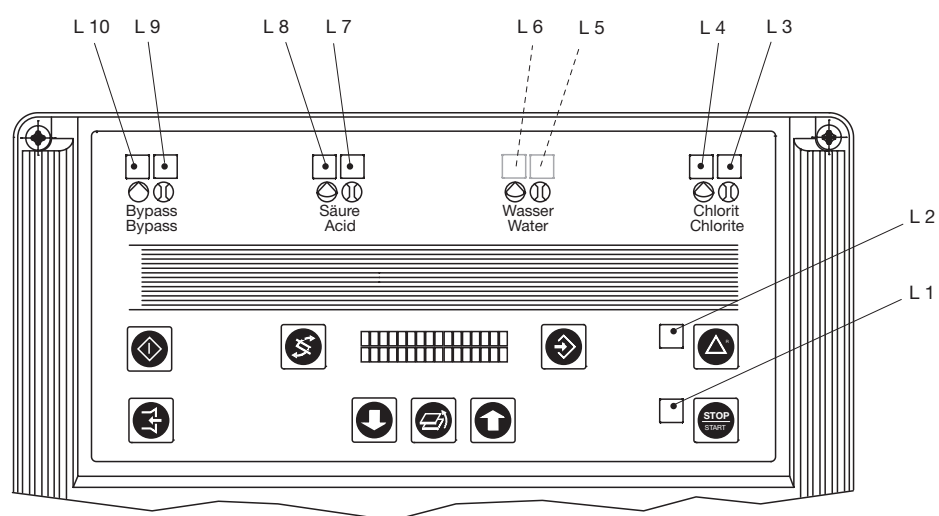


Fig. 1

|             |               |   |
|-------------|---------------|---|
| <b>L 1</b>  | <b>Green</b>  | operating indicator                                       |
| <b>L 2</b>  | <b>Red</b>    | warning light (steady light)<br>Fault indicator (flashes) |
| <b>L 3</b>  | <b>Yellow</b> | Yellow Actuation, chloride metering pump                  |
|             | <b>Red</b>    | feed monitor, chlorite pump : fault                       |
| <b>L 4</b>  | <b>Green</b>  | feed monitor, chloride pump : OK                          |
| <b>L 5</b>  |               | No function   |
| <b>L 6</b>  |               | No function   |
| <b>L 7</b>  | <b>Yellow</b> | Actuation, metering pump, acid                            |
|             | <b>Red</b>    | feed monitor, pump, acid: fault                           |
| <b>L 8</b>  | <b>Green</b>  | feed monitor, pump, acid: OK                              |
| <b>L 9</b>  | <b>Yellow</b> | Actuation, bypass pump                                    |
|             | <b>Red</b>    | bypass monitor: fault                                     |
| <b>L 10</b> | <b>Green</b>  | bypass monitor: OK  |

## Buttons and LC display

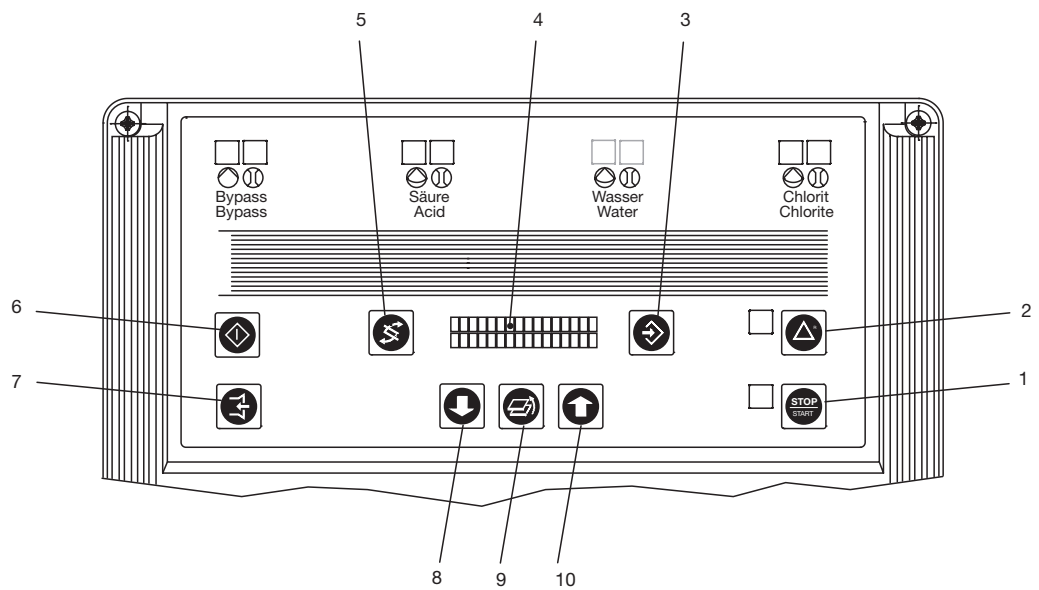


Fig. 2

- 1 START /STOP button**  
To start/stop metering function.
- 2 QUIT button**  
To acknowledge alarm or error warnings (if L 2 flashes).
- 3 ENTER button**  
For (horizontal) movement within the operating menu and to save a displayed value or status.
- 4 LC display**
- 5 CHANGE button**  
To change between the setting menus, change between the permanent display and the info displays and to change between the digits of the active code.
- 6 SUCTION button**  
To gauge capacity in litres (in the menu item "Gauge capacity in litres of pump"): the metering pumps run at the maximum stroke rate until the set capacity gauging volume has been reached.  
To start up (in the menu item "Start up"): the metering pumps run for the pre-set run-in period at the maximum stroke rate.  
Suction: the metering pumps carry out 20 strokes at the maximum stroke rate.  
If the "Acid " feed monitor produces 8 error pulses at this point the chlorite pump stops (for safety).
- 7 SUCTION button**  
To extract gases from the reactor cabinet.
- 8 DOWN button**  
To reduce a displayed numerical value and to change a variable (flashes).
- 9 BACK key**  
To exit the parameter menus or the configuration menus without saving the displayed numerical value or variable.
- 10 UP button**  
To increase a displayed numerical value and to change a variable (flashes).

|   | Page      |
|---|-----------|
| Identcode   | 6         |
| Operating code  | 7         |
| General user instructions                                   | 8         |
| <b>1 About this equipment</b>                               | <b>9</b>  |
| <b>2 Safety</b>   | <b>10</b> |
| <b>3 Equipment overview</b>                                 | <b>14</b> |
| <b>4 Function description</b>                               | <b>15</b> |
| <b>5 Settings</b>   | <b>17</b> |
| 5.1 Operating mode "internal actuation"                     | 18        |
| 5.2 Operating mode "Flow-dependant actuation"               | 19        |
| 5.3 Operating mode "Control variable-dependant actuation"   | 20        |
| <b>6 Commissioning</b>                                      | <b>21</b> |
| 6.1 Installation - final steps                              | 21        |
| 6.2 Configuring controller                                  | 21        |
| 6.2.1 Operating mode "Internal actuation"                   | 21        |
| 6.2.2 Operating mode "Flow-dependant actuation"             | 22        |
| 6.2.3 Operating mode "Control variable-dependant actuation" | 25        |
| 6.3 Starting up the system                                  | 26        |
| 6.4 Checking for tightness                                  | 27        |
| 6.5 Discharging metering pumps                              | 27        |
| 6.6 Setting feed monitors                                   | 28        |
| 6.7 Checking safety devices                                 | 29        |
| 6.8 Installing component containers                         | 29        |
| 6.9 Checking chlorine dioxide generation                    | 29        |
| 6.10 Setting pause metering                                 | 29        |
| <b>7 Operating</b>  | <b>30</b> |
| 7.1 Replacing component containers                          | 30        |
| 7.2 Bleeding metering pumps                                 | 31        |
| 7.3 Discharging metering pumps                              | 31        |
| 7.4 Checking chlorine dioxide generation                    | 32        |
| 7.5 Feed monitor settings                                   | 33        |
| <b>8 What happens in the event of incorrect use</b>         | <b>34</b> |
| <b>9 Maintenance</b>  | <b>35</b> |
| 9.1.1 Servicing by service technicians only                 | 35        |
| 9.1.2 Regular checks, possible without service              | 36        |
| <b>10 Repair</b>  | <b>41</b> |
| <b>11 Troubleshooting</b>                                   | <b>41</b> |
| <b>12 Decommissioning</b>                                   | <b>44</b> |
| 12.1 For a short period                                     | 44        |
| 12.2 For a longer period                                    | 44        |
| 12.3 Preparing for frost-proof storage                      | 45        |
| <b>13 Disposal</b>  | <b>46</b> |
| <b>14 Technical specifications</b>                          | <b>46</b> |
| <b>15 Spare parts</b>                                       | <b>48</b> |
| <b>16 Accessories</b>                                       | <b>49</b> |
| <b>17 Options</b>   | <b>50</b> |

## Appendix

Leaflet "Safety data sheet, Chlorine dioxide: characteristics of chlorine dioxide and notes for handling with aqueous solutions "

Leaflet "Bello Zon® acid-03, safety data sheet in accordance with guideline 91/155/EWG "

Leaflet "Bello Zon® chlorite-03, safety data sheet in accordance with guideline 91/155/EWG "

EU conformity declaration

Literature list

## Identcode

The Bello Zon® system is supplied with a factory-set Identcode. The Identcode is made up of the system composition as specified in the order, e.g. flow-dependent or measured value-dependent metering, as specified.

| CDVb chlorine dioxide system type CDVb |      |   |          |  |  |  |  |  |  |  |
|--|------|---|----------|--|--|--|--|--|--|--|
|  |      | System type: ClO <sub>2</sub> feed rate   |          |  |  |  |  |  |  |  |
| 0 A                                    | CDVb | 15 =  | 15 g/h   |  |  |  |  |  |  |  |
| 1 A                                    | CDVb | 35 =  | 46 g/h   |  |  |  |  |  |  |  |
| 2 A                                    | CDVb | 60 =  | 66 g/h   |  |  |  |  |  |  |  |
| 3 A                                    | CDVb | 120 =   | 130 g/h  |  |  |  |  |  |  |  |
| 4 A                                    | CDVb | 220 =   | 225 g/h  |  |  |  |  |  |  |  |
| 6 A                                    | CDVb | 600 =   | 600 g/h  |  |  |  |  |  |  |  |
| 8 A                                    | CDVb | 2000 =  | 2000 g/h |  |  |  |  |  |  |  |
|  |      | Operating voltage:  |          |  |  |  |  |  |  |  |
|  | 0    | 230 V, 50/60 Hz   |          |  |  |  |  |  |  |  |
|  | 1    | 115 V, 50*/60 Hz  |          |  |  |  |  |  |  |  |
|  | 4    | 24 V (only CDV 15-120)  |          |  |  |  |  |  |  |  |
|  |      | * CDVb 600-2000 not available in 115 V, 50 Hz version   |          |  |  |  |  |  |  |  |
|  |      | Chemical suction lance:   |          |  |  |  |  |  |  |  |
|  | 0    | none  |          |  |  |  |  |  |  |  |
|  | 1    | suction lance for 30 l tanks  |          |  |  |  |  |  |  |  |
|  | 2    | suction lance for 200 l tanks   |          |  |  |  |  |  |  |  |
|  | 3    | suction lance for 500 l tanks   |          |  |  |  |  |  |  |  |
|  | 4    | suction lance for 1000 l tanks (CDV 600 and CDV 2000 only)                                    |          |  |  |  |  |  |  |  |
|  | 5    | flexible suction assembly up to 5 m with two stage float switch (CDV 35-120)                  |          |  |  |  |  |  |  |  |
|  | 9    | suction lance for 30 l tanks with 2 x 40 l drip trays without leak sensor                     |          |  |  |  |  |  |  |  |
|  |      | Bypass version:   |          |  |  |  |  |  |  |  |
|  | 0    | bypass without preliminary mixer and without bypass monitor                                   |          |  |  |  |  |  |  |  |
|  | 1    | bypass with preliminary mixer and without bypass monitor                                      |          |  |  |  |  |  |  |  |
|  | 2    | bypass without preliminary mixer and with bypass monitor (float and orifice flow meter)       |          |  |  |  |  |  |  |  |
|  | 3    | bypass with preliminary mixer and with bypass monitor (float and orifice flow meter)          |          |  |  |  |  |  |  |  |
|  | 4    | PVC-C bypass without preliminary mixer and without bypass monitor                             |          |  |  |  |  |  |  |  |
|  | 5    | PVC-C bypass without preliminary mixer and with bypass monitor (float and orifice flow meter) |          |  |  |  |  |  |  |  |
|  | 9    | bypass with preliminary mixer and with bypass monitor and with stainless steel bypass pump    |          |  |  |  |  |  |  |  |
|  |      | Control variable input:   |          |  |  |  |  |  |  |  |
|  |      | (for the connection of a controller for measured value-dependent metering)                    |          |  |  |  |  |  |  |  |
|  | 0    | none  |          |  |  |  |  |  |  |  |
|  | 1    | contact, pulse range 0-4 Hz   |          |  |  |  |  |  |  |  |
|  | 2    | analogue (0/4-20 mA) or contact (commutator)  |          |  |  |  |  |  |  |  |
|  |      | Flow input:   |          |  |  |  |  |  |  |  |
|  |      | (for connection of a water meter)   |          |  |  |  |  |  |  |  |
|  | 0    | none  |          |  |  |  |  |  |  |  |
|  | 1    | contact, pulse range 0-4 Hz   |          |  |  |  |  |  |  |  |
|  | 2    | frequency, max. 10 kHz and contact (commutator)   |          |  |  |  |  |  |  |  |
|  | 3    | analogue (0/4-20 mA) or contact (commutator)  |          |  |  |  |  |  |  |  |
|  |      | Language presetting:  |          |  |  |  |  |  |  |  |
|  | D    | German  |          |  |  |  |  |  |  |  |
|  | E    | English   |          |  |  |  |  |  |  |  |
|  | F    | French  |          |  |  |  |  |  |  |  |
|  | I    | Italian   |          |  |  |  |  |  |  |  |
|  | S    | Spanish   |          |  |  |  |  |  |  |  |
|  | P    | Polish  |          |  |  |  |  |  |  |  |
|  | C    | Czech   |          |  |  |  |  |  |  |  |
|  | M    | Hungarian   |          |  |  |  |  |  |  |  |
|  | B    | Portuguese  |          |  |  |  |  |  |  |  |
|  | R    | Romanian  |          |  |  |  |  |  |  |  |
|  | N    | Dutch   |          |  |  |  |  |  |  |  |
|  |      | Analogue output:  |          |  |  |  |  |  |  |  |
|  | 0    | none (standard)   |          |  |  |  |  |  |  |  |
|  | 1    | analogue (0/4-20 mA) for computer or remote display   |          |  |  |  |  |  |  |  |
|  |      | Remote control input:   |          |  |  |  |  |  |  |  |
|  | 0    | none  |          |  |  |  |  |  |  |  |
|  | 1    | contact (pause function)  |          |  |  |  |  |  |  |  |
|  | 2    | analogue (0/4-20 mA)  |          |  |  |  |  |  |  |  |
|  | 3    | contact and analogue (0/4-20 mA)  |          |  |  |  |  |  |  |  |
|  |      | Temperature monitor:  |          |  |  |  |  |  |  |  |
|  | 0    | with extractor unit and without temperature monitor   |          |  |  |  |  |  |  |  |
|  | 1    | with extractor unit and with temperature monitor  |          |  |  |  |  |  |  |  |
|  | 2    | without extractor unit and without temperature monitor  |          |  |  |  |  |  |  |  |
| CDVb — — — — — — — — — —               |      |   |          |  |  |  |  |  |  |  |

## Operating code

If changing the intended use of the equipment it is possible - to a limited extent - to change the controller pre-settings (depending on the existing hardware). The operating code is used for this purpose.

Example: system version Identcode CDKb xAxxx11Dxxx has both contact signal actuation variants

- you select the one you want using the operating code

A "0" in the corresponding identity code position indicates that this version cannot be activated by the operating code.

| CDVb |   |   |   |   |   |   |   |   |   | Chlorine dioxide system type CDVb |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
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| ↓    | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓                                 | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |

### General user instructions

Please read through the following instructions carefully. They will help you get the most use out of the operating instructions manual.

On the open-out flap behind the title page you will find an overview of the “Controls and button functions” and the “Operation/settings diagram”. You can leave the “Controls and button functions” overview opened out while you are reading the manual.

The following are particularly highlighted in the text:

- numbered points
- practical instructions

working instructions:

#### **NOTE**

**Notices are intended to make your work easier.**

and safety instructions with symbols:



#### **WARNING**

describes a potentially hazardous situation. If not avoided, will place you in danger of your life or could result in serious injury.



#### **CAUTION**

describes a potentially hazardous situation. If not avoided, could result in slight or minor injury or damage to property.



#### **IMPORTANT**

describes a potentially damaging situation. If not avoided may result in damage to property.

#### **Note for the operator**

Contains remarks and extracts from the German guidelines as to the responsibilities of the plant operator. They in no way relieve the operator of responsibility, but simply draw attention to particular problems. They make no claim to completeness, nor to validity in every country or for type of application, and do not claim to be completely up to date.

The version numbers of the hard and software are displayed by the controller (hardware version before the hyphen and software version after, e. g. 03 / 4. 01). In the event of a complaint or expansion of a previously installed Bello Zon® system please specify the version number as well as the identity code.



## 1 About this equipment

The Bello Zon® chlorine dioxide generating and metering systems work in accordance with the chlorite/acid-process. In these systems a chlorine-free  $\text{ClO}_2$  solution is produced by the displacement of sodium chlorite solution with hydrochloric acid.

$\text{ClO}_2$  is an extremely reactive gas, which cannot be stored due to its instability. Instead it must be manufactured in special systems, as and when required, in the place where it is to be used.

$\text{ClO}_2$  has a number of advantages compared to chlorine which is generally used in potable and industrial water disinfecting. The disinfecting strength of chlorine does not diminish with a rising pH value. In fact it increases slightly.

$\text{ClO}_2$  remains stable for long periods in pipes and can provide microbiological protection for water for many hours, even days.

Ammonia and/or ammonium, which have a strong degrading effect on chlorine, are not affected by  $\text{ClO}_2$  so that once metered, the full  $\text{ClO}_2$  effect is available for sterilisation.

Chlorophenols, odour-intensive compounds produced during the chlorination of water and similar, do not form with  $\text{ClO}_2$ . Trihalogen methanes (THMs) are a class of substances which, like their major representative, chloroform, are suspected of being carcinogenic. They form when chlorine reacts with natural substances found in water (humic acids, fulvic acids, etc.). Whenever  $\text{ClO}_2$  is used as an alternative disinfectant, measured concentrations are drastically lower.

For most applications metering is quantity-proportional, i.e. flow-dependant on the basis of the signal of an inductive flow meter or a contact water meter or in parallel with a booster pump.

In cyclical systems such as bottle cleaning machines, cooling circuits etc., in which only  $\text{ClO}_2$  loss must be replaced, the feed can be controlled measured variable-dependently by means of chlorine dioxide or redox potential measurement.

Decades of experience with the Bello Zon® chlorine dioxide system have shown that an outstanding output of 90 - 95 % is achieved under the selected process parameters (relates to stoichiometric element ratio). With the correct settings, chlorite is not metered as a by-product. Bello Zon® CDVa systems work with dilute chemicals, i.e. with Bello Zon® acid (hydrochloric acid 9 %) and with Bello Zon® chlorite (sodium chlorite 7.5 %). For every litre of the two solutions the system can generate approx. 40 g  $\text{ClO}_2$ .

When using the  $\text{ClO}_2$  method, as with all disinfecting technologies, you need to take into account the interfering substances found in water and the overall treatment. ProMinent has experience of installing chlorine dioxide systems throughout the world in numerous different application fields and will be happy to assist you in designing a system to suit your requirements.

Application areas:

- public potable water supply
- potable and industrial water in the food and drinks industry
- bottle washing
- as disinfectant in CIP systems
- pasteurising and rinsing machines
- cold sterile bottling
- condensate treatment in the milk industry
- treatment of water for washing fruit, vegetables, seafood, fish and poultry
- cooling water treatment
- paper industry in countering bacterial growth and for the treatment of industrial water
- wastewater treatment.

## 2 Safety

Always observe these three basic rules:

1. The two components Bello Zon® acid (dilute HCl) and Bello Zon® chlorite (dilute NaClO<sub>2</sub>) must never come into contact with one another outside the reactor.  
Otherwise there will be a sudden formation of toxic ClO<sub>2</sub> gas, which can disintegrate explosively.
2. Never operate the Bello Zon® CDVb chlorine dioxide system with undilute acid or undilute sodium chlorite.  
There will otherwise be a sudden formation of toxic ClO<sub>2</sub> gas, which may disintegrate explosively in the reactor.
3. Ensure that a vacuum never forms in the bypass water.  
A vacuum may otherwise form in the ClO<sub>2</sub> solution in the reactor, in which case the ClO<sub>2</sub> will effervesce and may explode.

Is the Bello Zon® system hazardous?

Please be aware that the use of modern, particularly high-performance technology often demands that you observe a few basic rules which may be new to you. If you observe these basic rules, however, the technology is simple to master.

For example, you almost certainly have a microwave oven.

You know that you should always place a fireproof glass rod into any liquid you are heating.

This prevents the liquid from evaporating explosively due to delayed evaporation and actually combusting.

Or you know you should always ensure that the doors of a microwave oven are clean before use (especially the door seals). Microwaves can otherwise be emitted and blind persons in the vicinity. Would you say, then, that a microwave oven was dangerous? No! You simply need to observe a few basic rules to operate a microwave oven safely.

### Correct use of equipment:

- The Bello Zon® system is designed solely for producing a disinfectant solution containing ClO<sub>2</sub> from dilute hydrochloric acid (9 %) and sodium chlorite solution (7.5 %) and metering it in water via a bypass system.
- All other uses or modifications are prohibited.
- The Bello Zon® system is not suitable for treating liquids (except water) or gaseous media, or suspended solids with ClO<sub>2</sub>.
- Do not use the equipment in conditions other than those described in the technical specifications.
- The Bello Zon® system must be operated by trained personnel. All other activities must be carried out by appropriately trained and authorised personnel.
- Observe the relevant national directives for all the service life phases of the equipment.
- You are obliged to note the information in the operating instructions manual on the various service life phases of the equipment.

Training personnel to operate the system:

| Activity                 | Training  |
|--------------------------|---|
| Assembly/installation    | Trained specialist technicians  |
| Initial commissioning    | ProMinent service technicians or qualified engineers authorised by ProMinent) |
| Commissioning            | Qualified engineers   |
| Operation/changing tank  | Suitably instructed personnel   |
| Service/repair           | ProMinent-service technicians   |
| Decommissioning/disposal | Qualified engineers   |
| Troubleshooting          | Suitably instructed personnel   |

Table 1

**WARNING**

According to accident statistics, filling in for members of staff on holiday represents a safety risk. Persons filling in for members of staff on holiday must also hold the above qualifications and have received the relevant instruction.

**Personal protective equipment:**

- Facial protection
- Rubber or plastic boots
- Protective gauntlets (ClO<sub>2</sub> proof design)
- Protective apron
- Respirator - full mask
- 1 spare filter per respirator

**WARNING**

- The operating personnel must be instructed by a ProMinent service technician (takes place at first commissioning).
- An operating instructions manual must be kept by the system.
- Attach warning signs in the CDVb installation area and in the chemical storage areas. (see Part 1 of the Operating Instructions Manual)
- Observe national regulations.

**Note for the operator**

Keywords for searching for relevant directives:

- chlorine dioxide systems
- chlorine dioxide (possibly also chlorination)
- potable water
- food and beverages
- hydrochloric acid
- sodium chlorite
- storage
- hazardous operating substances
- personal protective equipment

**Information for emergencies**

- If you have come into contact with the acid: see leaflet “Bello Zon® acid-03, EU safety data sheet in accordance with EU guideline 91/155/EWG” in the Appendix.
- If you have come into contact with the chlorite: see leaflet “Bello Zon® chlorite-03, EU safety data sheet in accordance with EU guideline 91/155/EWG” in the Appendix.
- If you have come into contact with the ClO<sub>2</sub> solution or with ClO<sub>2</sub> gas: see leaflet “Hazardous substances data sheet, chlorine dioxide: characteristics of chlorine dioxide and notes for handling with aqueous solutions” in the Appendix.
- If orange-yellow ClO<sub>2</sub> gas is leaking out: empty the room immediately and disconnect the power supply (e. g. emergency stop switch). Put on full protective gear and suppress the gas by spraying with water. See also leaflet “Hazardous substances data sheet, chlorine dioxide: characteristics of chlorine dioxide and notes for handling with aqueous solutions” in the Appendix.

- Orange-yellow  $\text{ClO}_2$  gas is leaking out: empty the room immediately and disconnect the power supply (e.g. emergency stop switch). Put on full protective gear and pour sodium thiosulphate solution onto  $\text{ClO}_2$  then dilute with plenty of water and rinse down the drain. See also leaflet "Hazardous substances data sheet, chlorine dioxide: characteristics of chlorine dioxide and notes for handling with aqueous solutions" in the Appendix.
- The Bello Zon® system has been charged with concentrated chemicals and metering pumps have already pumped them to the reactor: empty the room immediately and disconnect the power supply (e. g. emergency stop switch). Inform the Fire Service of the risk of explosion due to concentrated  $\text{ClO}_2$  gas ( $\text{ClO}_2$  gas can still explode after a few hours). See also leaflet "Hazardous substances data sheet, chlorine dioxide: characteristics of chlorine dioxide and notes for handling with aqueous solutions" in the Appendix.
- The Bello Zon® system has been charged with concentrated chemicals and metering pumps have not yet begun to pump: switch the Bello Zon® system immediately to "Metering OFF" (Start /Stop button). Place each suction lance in a bucket filled with water and fill the chemical drum with dilute chemicals. Dispose of concentrated chemicals appropriately. See also leaflet "Hazardous substances data sheet, chlorine dioxide: characteristics of chlorine dioxide and notes for handling with aqueous solutions" in the Appendix.

### Description and test of safety equipment

Bello Zon® chlorine dioxide systems are designed according to the German "DVGW-Worksheet W224". They have the following safety equipment (illustration at the end of this section):

#### *Bypass monitor*

A bypass monitor prevents the generation and build-up of  $\text{ClO}_2$  if there is no water in the bypass to dilute the  $\text{ClO}_2$ .

ProMinent can supply you with a bypass monitor on request:

A float and orifice flow meter with minimum contact is triggered as soon as the flow falls below the preset minimum volume. The controller then switches off the metering process. Once the flow is above the minimum volume, the controller reactivates metering.

If you do not want to use this bypass monitor you must use other means to ensure that metering ceases when there is no water flow in the bypass line.

Test: slowly close the stop cock upstream from the float and orifice flow meter. The controller must switch off metering, the red "ALARM" LED (L 2) flashes and the alarm relay is triggered. Press the "Quit" button.

#### *Feed monitoring equipment*

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

If too much acid is metered, too little  $\text{ClO}_2$  will be generated and the treated water will be too acidic. Too much chlorite means that the treated water will contain chlorite (limit values).

Two different devices prevent this from happening:

#### *Float switch*

The suction lances in the tanks are fitted with two stage float switches. The float switches should prevent just one component from being metered. At the first level the controller gives an LED warning and the red "ALARM" LED lights up. At the second level the controller additionally switches off metering, the red "Alarm" LED flashes and the alarm relay is triggered.

Test: draw the suction lance slowly out of the filled tank and check for the reactions outlined above. Press the "Quit" button.

#### *Feed monitors*

The feed monitors should let you know if the metering ratio of the components alters. A feed monitor is placed downstream from each pump for this purpose. The magnetic float in the feed monitor jumps each time there is a surge of metering chemical pumped through. This is recorded by the controller via the feed monitor's ring initiator (yellow LEDs "Feed monitor components" (L 4 and L 8) light up in time with the discharge strokes). If these signals are missed 8 times in a row, the controller switches off the metering and gives an alarm: the red "ALARM" LED (L 2) flashes and a message appears in the LCD display.

This means that the feed monitors can also indicate a high over-pressure by means of the changed feed rate.

Test: move the upper adjusting wheel and the ring initiator of one feed monitor up - the yellow LED "Feed monitor, components" (L 4 or L 8) must go out and the controller must switch off metering after 8 failed strokes. At the same time the red "ALARM" LED (L 2) on the controller starts to flash, the LED "Feed monitor, pump components, fault" (L 5 or L9) lights up red and a message appears in the LCD display. Push ring initiator and upper adjusting wheel back to their original positions and press the "Quit" button. If the lower adjusting wheel has been moved, reset the feed monitor.

Now check the other feed monitor.

*Safety bunds  
(accessories)*

The safety bunds should prevent the chemicals from flowing uncontrolled out of a faulty tank or even mixing with the other components.

Test: take intact tank out of the dry safety bund. Fill the safety bund to the brim with water and check for leaks (if dealing with a safety bund with a leak monitor, the controller must switch off metering).

*Reactor tank extractor  
(optional)*

To prevent hazardous quantities of  $\text{ClO}_2$  building up, the controller regularly activates a reactor cabinet extractor. For this purpose it opens the solenoid valve in the potable water mains. The injector thereby extracts gases and liquids out of the reactor cabinet. Air is supplied via a breather valve or a breather pipe on the top of the reactor cabinet.

Test: to actuate the extractor, press the "Suction" button. You should hear a hissing from the bottom of the reactor. If necessary press the button several times to switch the extractor on and off more than once.

*Reactor tank (optional)*

The reactor tank retains low quantities of  $\text{ClO}_2$  gas or  $\text{ClO}_2$  solution.

Test: hold the breather valve or a breather pipe on the top of the reactor tank closed and press the "Suction" button. Check for any sounds that would indicate a leak (without the injector hiss). If necessary press the button several times to switch the extractor on and off more than once. Release the breather valve or the breather pipe on the top of reactor tank again.

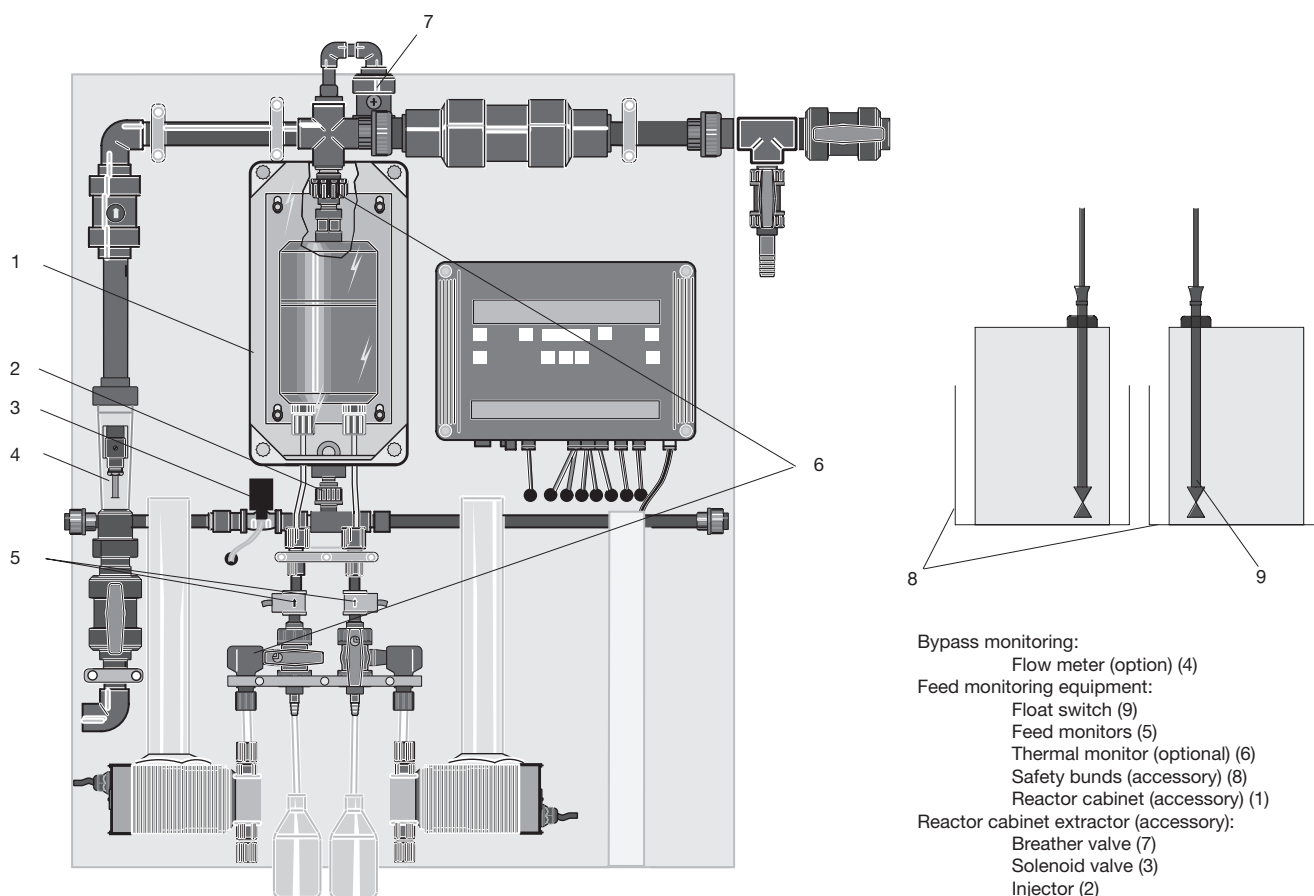


Fig. 3

### 3 Equipment overview

(without safety equipment. See figure above.)

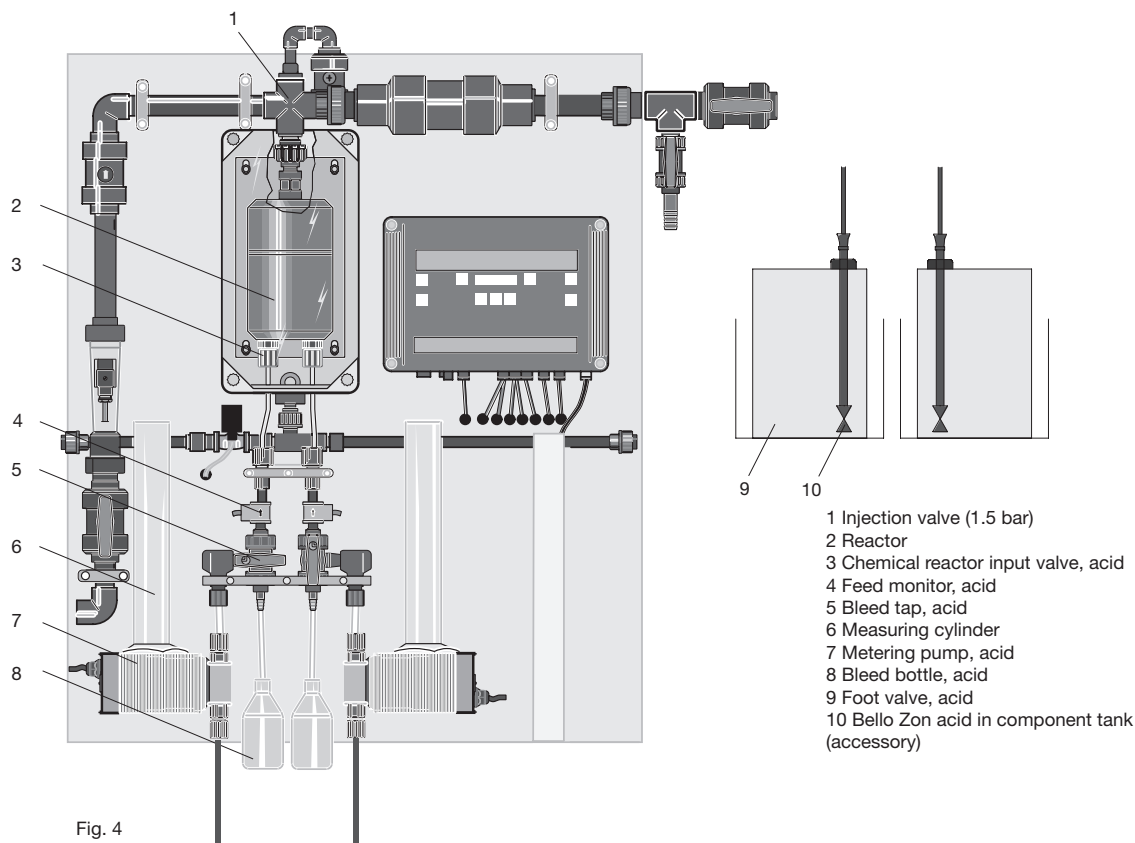


Fig. 4

#### NOTE

For ease of understanding, shows only those system parts for the acid-metering line. The corresponding system parts for the chlorite metering line are positioned to the right, and arranged symmetrically with regard to the corresponding system acid parts.

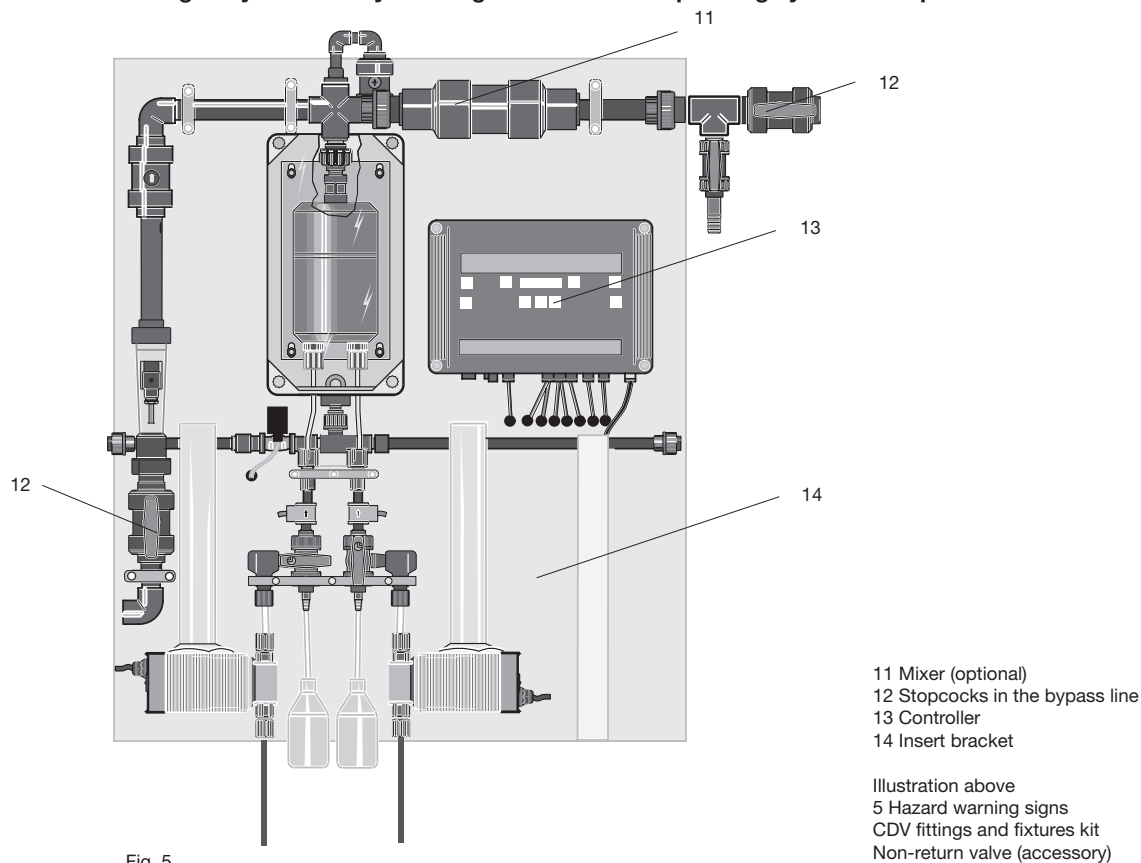


Fig. 5

Illustration above  
 5 Hazard warning signs  
 CDV fittings and fixtures kit  
 Non-return valve (accessory)

## 4 Function description

### Chemical principle of the system

The Bello Zon® CDVb chlorine dioxide system operates according to the hydrochloric acid-chlorite process:

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

The Bello Zon® system initially generates a 2 % chlorine dioxide solution (20 g/l  $\text{ClO}_2$ ) by combining dilute hydrochloric acid and dilute sodium chlorite solution.  
As soon as it forms this solution is fed to the water which is being treated.

### Function principle of the system

Two metering pumps meter the components Bello Zon® acid and Bello Zon® chlorite into the reactor. The components react to form  $\text{ClO}_2$  solution. The metering pumps simultaneously feed this solution to an injection point (injection valve) in the bypass. A mixer can be connected downstream from the injection valve to combine the  $\text{ClO}_2$  solution homogeneously with the water of the bypass. The dilute  $\text{ClO}_2$  solution reaches the discharge point where it meets the main water flow and dilutes it to the ultimately effective concentration for the process.

The controller calculates the stroke rates for the metering pumps from the quantity of  $\text{ClO}_2$  pumped and, where applicable, a set value. It also interprets the signals from the sensors of the safety equipment and switches off metering if necessary.

The Bello Zon® system's  $\text{ClO}_2$  output can be manually adjusted (internal actuation) e.g. contact water meter controlled (flow-dependent actuation) or e.g. controlled at a chlorine dioxide measurement point (control variable-dependent actuation) .

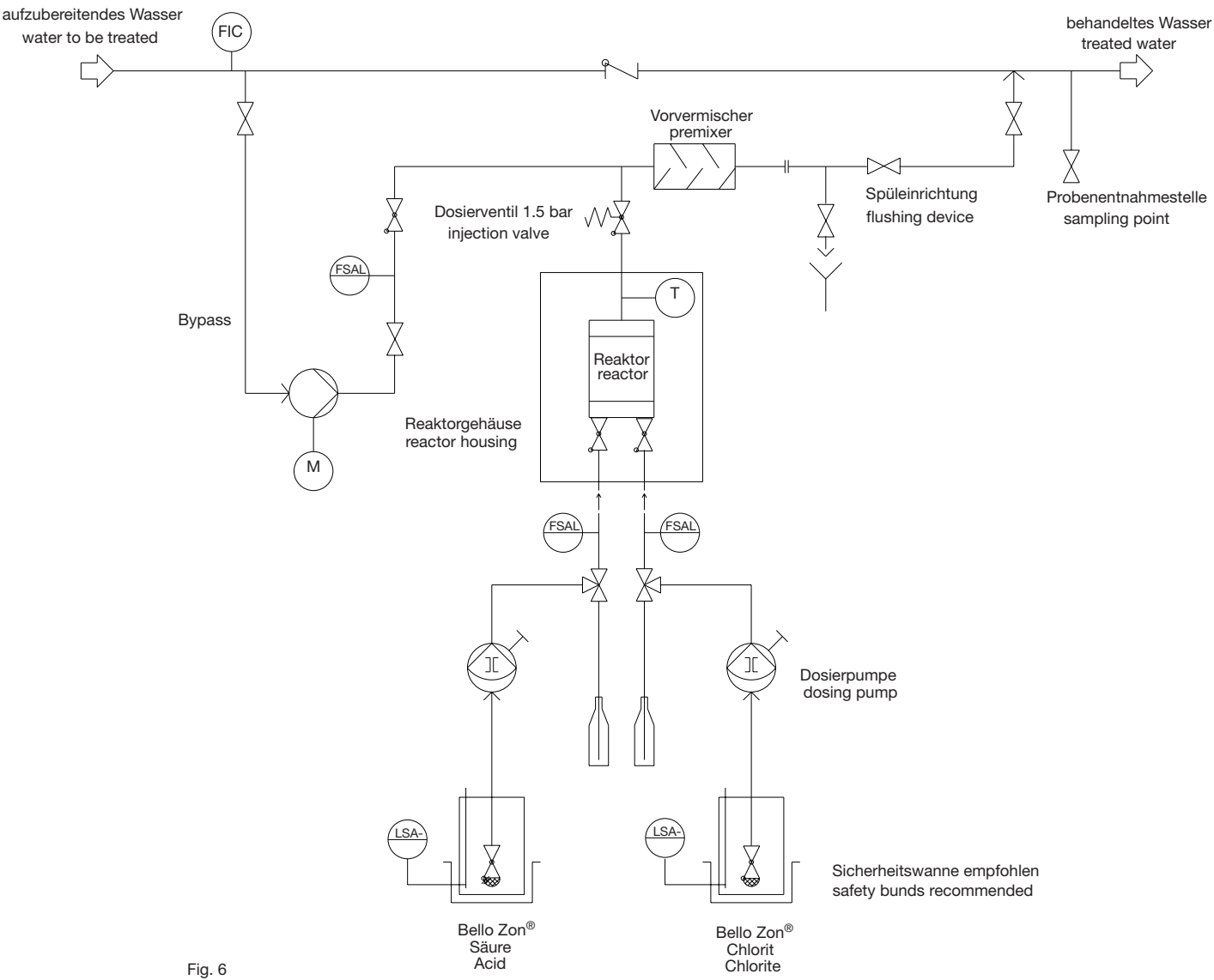


Fig. 6

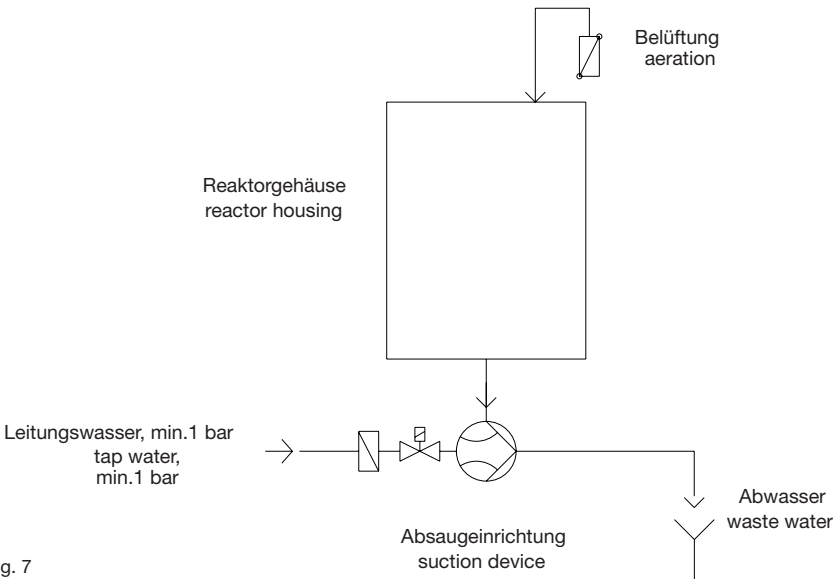


Fig. 7



### Operating modes

Operating mode- “Internal actuation”

The Bello Zon® system operates continuously at a fixed, constant ClO<sub>2</sub> output.

Operating mode- “Flow-dependent actuation”

The ClO<sub>2</sub> output of the Bello Zon®-system changes in proportion to the signal of the flow meter (contact water meter, inductive flow meter. . . ) .

Operating mode “Control variable-dependant actuation”

The ClO<sub>2</sub> output of the Bello Zon®-system changes in relation to the value measured via the mA signal of a controller (D1C and ClO<sub>2</sub> or redox sensor) .

### Safety equipment

The safety equipment is described at the end of the safety section (section 2).

### Controls and key functions

The controls and key functions are described overleaf from the title page.

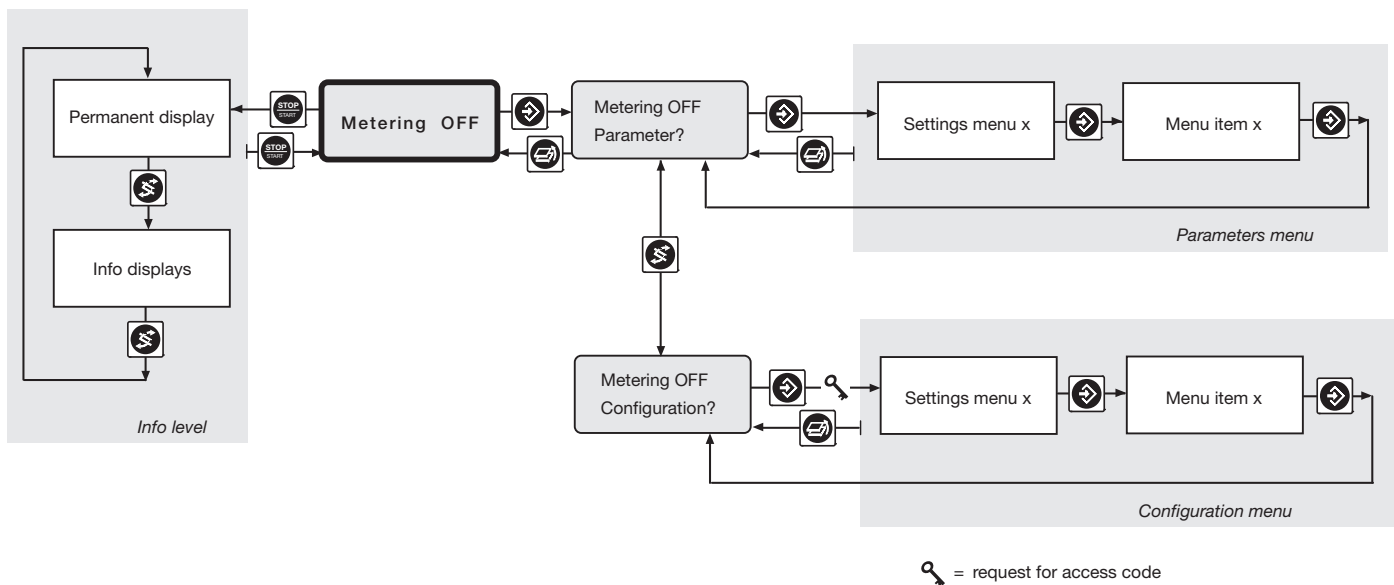
## 5 Setting

### NOTE

The controls and key functions are described overleaf from the title page.

Setting the operating code is described in the section entitled “Commissioning”.

Operating menu diagram



The permanent display appears when metering is on.

It shows the current ClO<sub>2</sub> output, and the actuation type or the set ClO<sub>2</sub> output or feed quantity. You can also switch to the info display using the “Change” button. You will then see:

- the equipment Identcode
- the hardware version
- the software version
- the active code

and depending on the actuation type:

- the set ClO<sub>2</sub> output
- the actuation type

To alter any controller settings, metering must be off ("Start/Stop" button), the LCD display shows "Metering OFF" (the controller does not actuate the pumps and ignores all input signals). After pressing the "Enter" button you have the choice between adjusting the parameters or configuring the system.

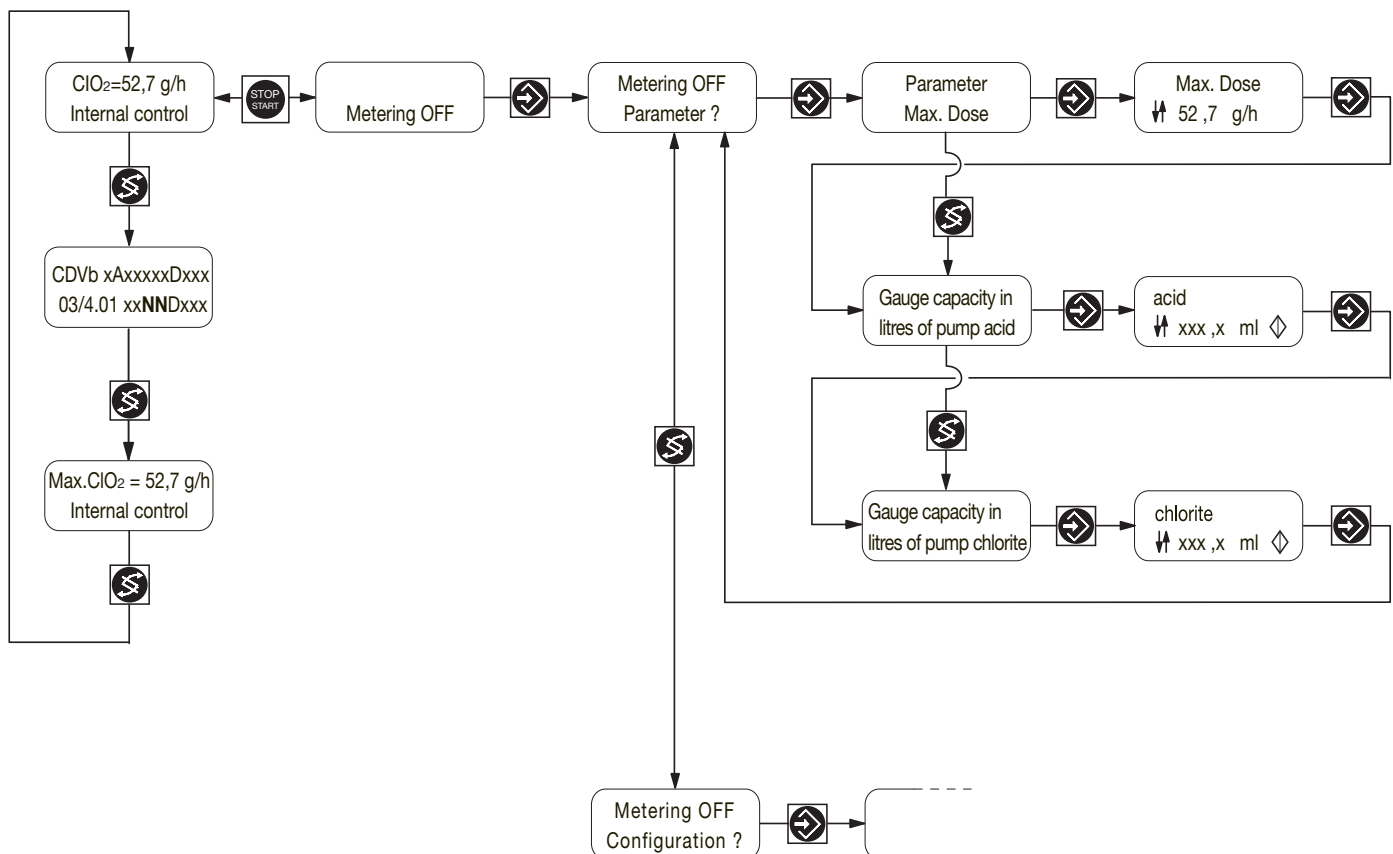
#### NOTE

- If an  $\updownarrow$  appears in a display you can change the displayed value with the arrow buttons.
- If a  $\diamond$  appears, you can use the "Suction" button to trigger an action.

### 5.1 Operating mode- "Internal actuation"

(The operating code is: AKTIVxx NNDxxx)

The Bello Zon® system operates continuously with an adjustable, constant  $\text{ClO}_2$  output.

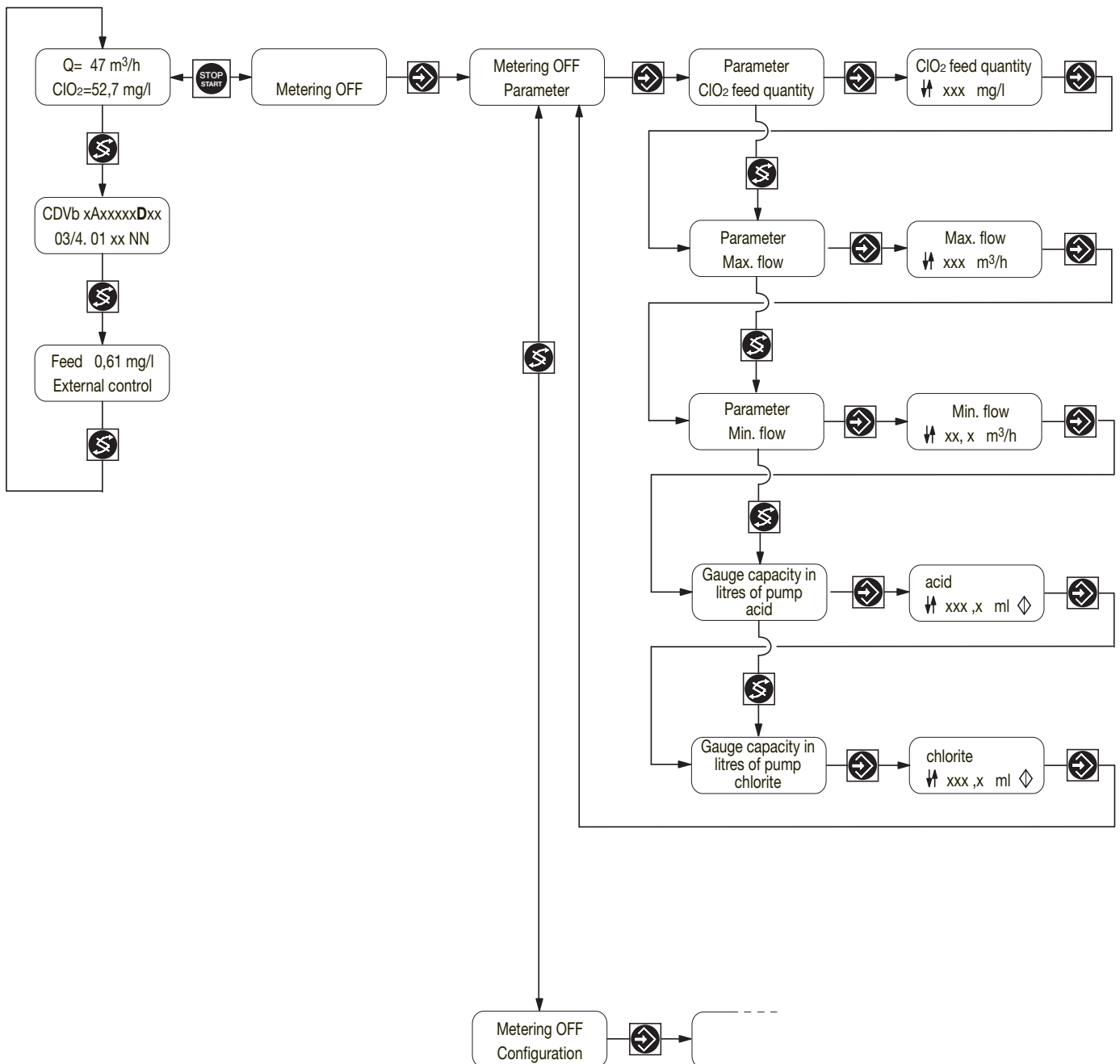


Settings in the parameters menu:

- Set the required  $\text{ClO}_2$  output to “Max. dose” with the arrow buttons
- Gauge capacity in litres of the pumps (see section 6. 5).  
The info displays show the  $\text{ClO}_2$  output (values under “ $\text{ClO}_2$ ” and “max  $\text{ClO}_2$ ” are the same).  
Systems with optional operating code “Remote control input contact”: the pause dose is displayed under “ $\text{ClO}_2$ ” during a pause.

## 5. 2 Operating mode “Flow-dependent actuation”

(The operating code is: AKTIVxxxYDxxx with Y =K, F, 0 or 4) The  $\text{ClO}_2$  output of the Bello Zon®-system changes in proportion to the quantity indicated via the signal from the flow meter (contact water meter, inductive flow meter...).



Settings in the parameters menu:

- Set the ClO<sub>2</sub> concentration -“ClO<sub>2</sub> feed quantity” - with the arrow buttons (required ClO<sub>2</sub> concentration = ClO<sub>2</sub> concentration + decay.)
- Press the “On” button in the menu item “Max. flow” until the numerical value no longer changes. If the actual maximum flow is clearly below this value it is sensible to enter this second value.
- Set the minimal flow value in the menu item “Min. flow”.



#### **WARNING**

**Analogue flow meters (0/4 - 20mA) be sure to set a “Min. flow” rate greater than “0”. The Bello Zon® system can otherwise meter ClO<sub>2</sub> without any water to dilute it, which can lead to the build-up of an explosive concentration.**

- Gauge capacity in litres of the pumps (see section 6.5)

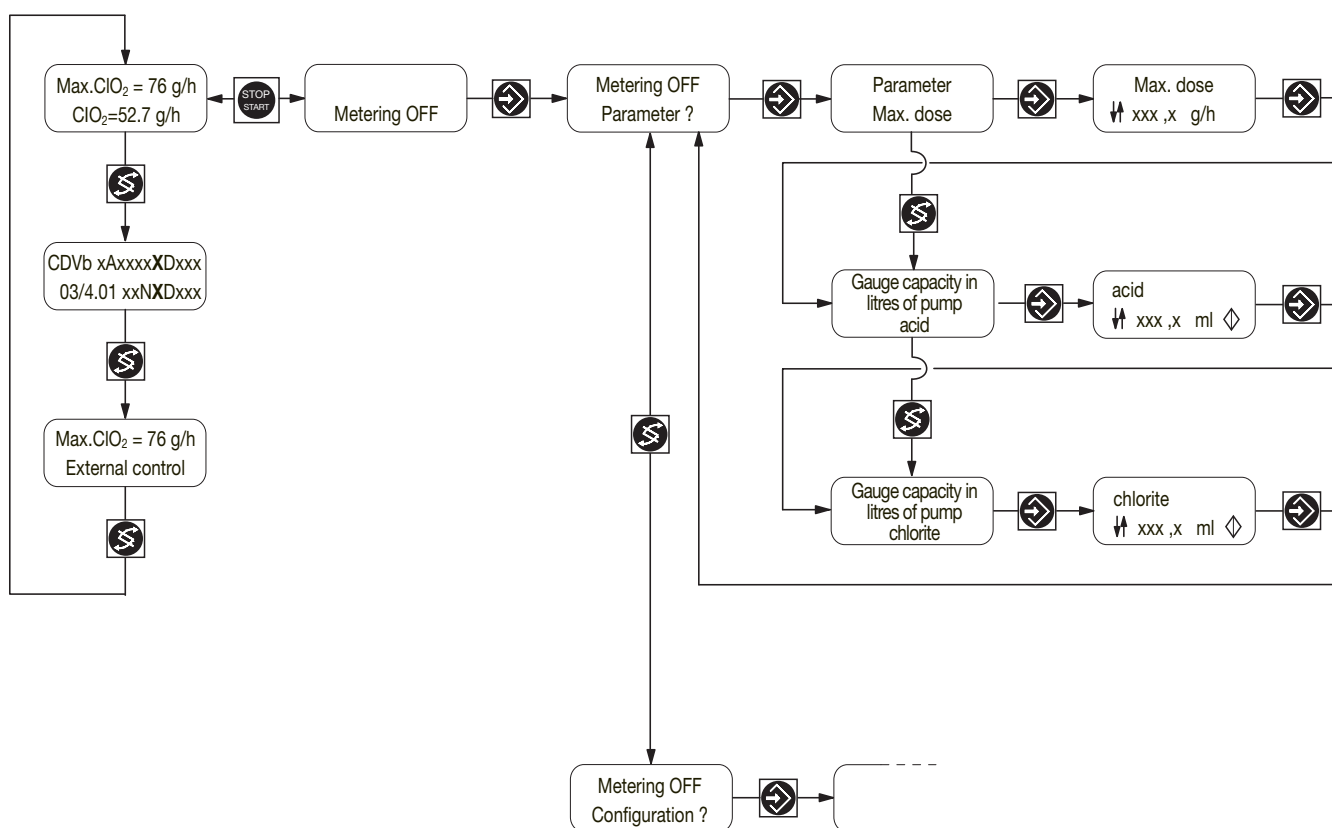
The info displays show the flow, the current ClO<sub>2</sub> concentration and the maximum set ClO<sub>2</sub> concentration (feed value).

Additional explanation: if the flow exceeds the max. set value the controller will keep the Bello Zon® system ClO<sub>2</sub> output constant and the concentration will consequently drop. If the flow drops below the minimum set value the controller will switch off the metering.

### **5.3 Operating mode “Control variable-dependant actuation”**

(The operating code is: AKTIVxxYxDxxx with Y =K, 0 or 4)

The ClO<sub>2</sub> output of the Bello Zon®-system changes in relation to the control variable in proportion to the mA signal of a controller. (The controller - e.g. a D1C controller -can use the measured value from a ClO<sub>2</sub> sensor or a redox probe. )



Settings in the parameters menu:

- Set the maximum required ClO<sub>2</sub> output in g/h under “Max. dose”
- Gauge capacity in litres of the pumps (see section 6.5).

The info displays show the current ClO<sub>2</sub> output and the maximum set ClO<sub>2</sub> output.

## 6 Commissioning



### WARNING

- Commissioning must be carried out by Customer Service.
- If the reactor is empty, do not use chemicals when starting up (including in the lines between component tanks and reactor) since ClO<sub>2</sub> gas can build up in the reactor. If the ClO<sub>2</sub> concentration is 20g/l this gas may explode.  
Only once the reactor is full of water should you connect the component tanks.
- The maximum admissible operating pressure for the system must never be exceeded in any operating state.
- The entire installation must be free from leaks when operating at maximum operating pressure.
- Open all stop taps and valves in the bypass before commissioning.
- Check all hydraulic connections.
- Check all electrical connections.
- Read this whole section through carefully before commissioning the equipment.
- The ProMinent service technician must instruct the operating and general maintenance staff during commissioning.

### Note for the operator

Note the following directives when commissioning this equipment:

a) Accident prevention regulations GUV 8.15 and/or VGB 65:

Chlorinating systems must not be commissioned until they have been checked by a qualified engineer to ensure their fitness for service and been thoroughly checked for leaks. Chlorinating systems must be safety-checked by a qualified engineer before every recommissioning.

Operation and maintenance of chlorinating systems and handling of the chemicals used in them must be entrusted only to personnel who have been suitably instructed and who can be expected to carry out their duties conscientiously.

b) The hazardous operating substances ordinance (Arb-StoffV) issued 11th February 1982 BGBl. / p. 145

c) Requirements of starting chemicals: see Section 7.1

### NOTE

- A “Commissioning log” form is included in the appendix.
- The access code for the Bello Zon® controller configuration menu is “1000”.

### 6.1 Installation - final steps

- ▶ Check the condition of the hydraulic connections
- ▶ Check the condition of the electrical connections
- ▶ Connect the Bello Zon® system to the mains power supply (with 3 x 1 mm<sup>2</sup> cable).

### 6.2 Configuring controller

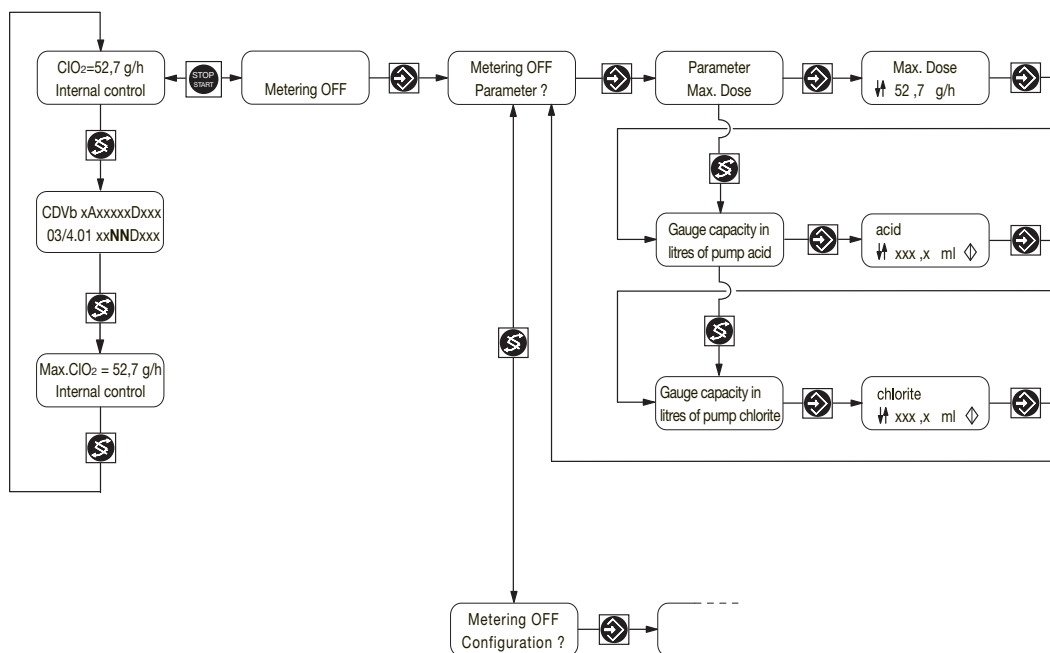
- ▶ Ensure “Metering OFF” status (if necessary, press the “Start /Stop” button)
- ▶ Set the configuration parameters and the active code depending on the required operating mode at the controller:

- 1) Operating mode “Internal actuation”
- 2) Operating mode “Flow-dependent actuation”
- 3) Operating mode “Control variable-dependant actuation”

#### 6.2.1 Operating mode- “Internal actuation”

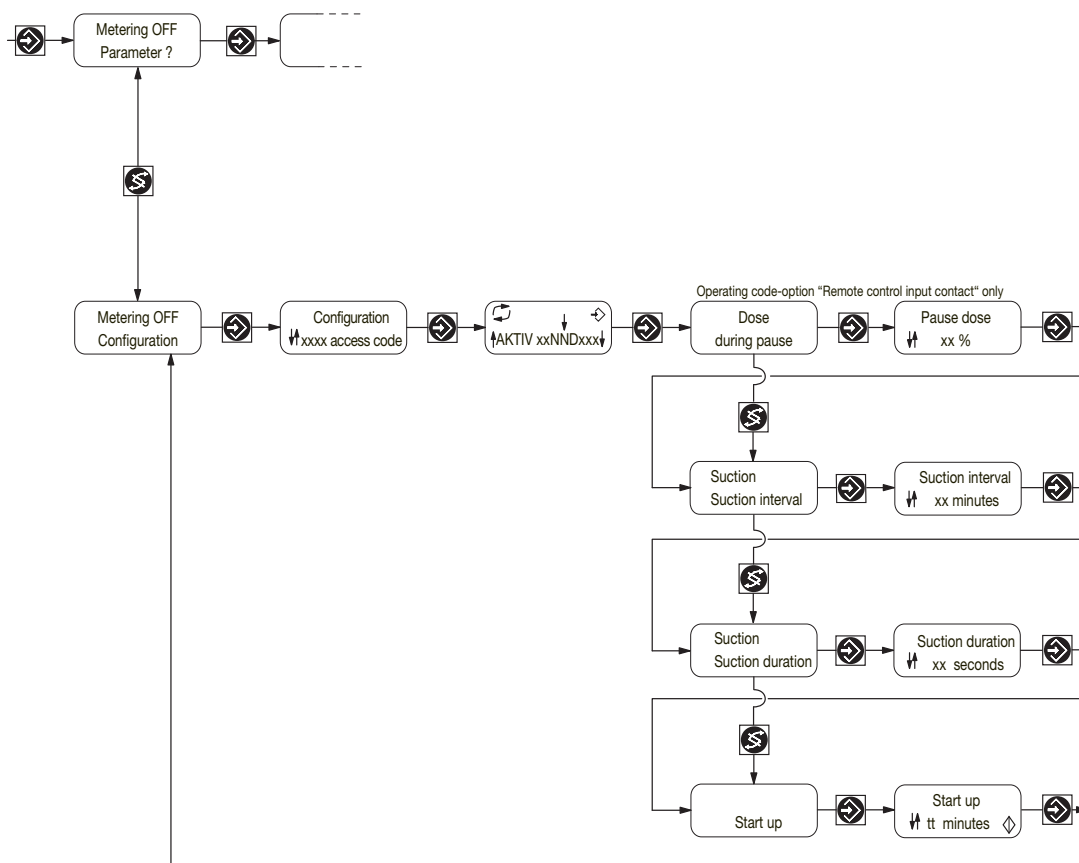
The Bello Zon® system operates continuously at a set constant ClO<sub>2</sub> output.

Settings in the parameter menu:



- Set the required  $\text{ClO}_2$  output to “Max. dose” with the arrow buttons.  
The info displays show the current  $\text{ClO}_2$  output and the maximum set  $\text{ClO}_2$  output (in the case of systems with analogue remote control, these values are not the same) .

Settings in the configuration menu:



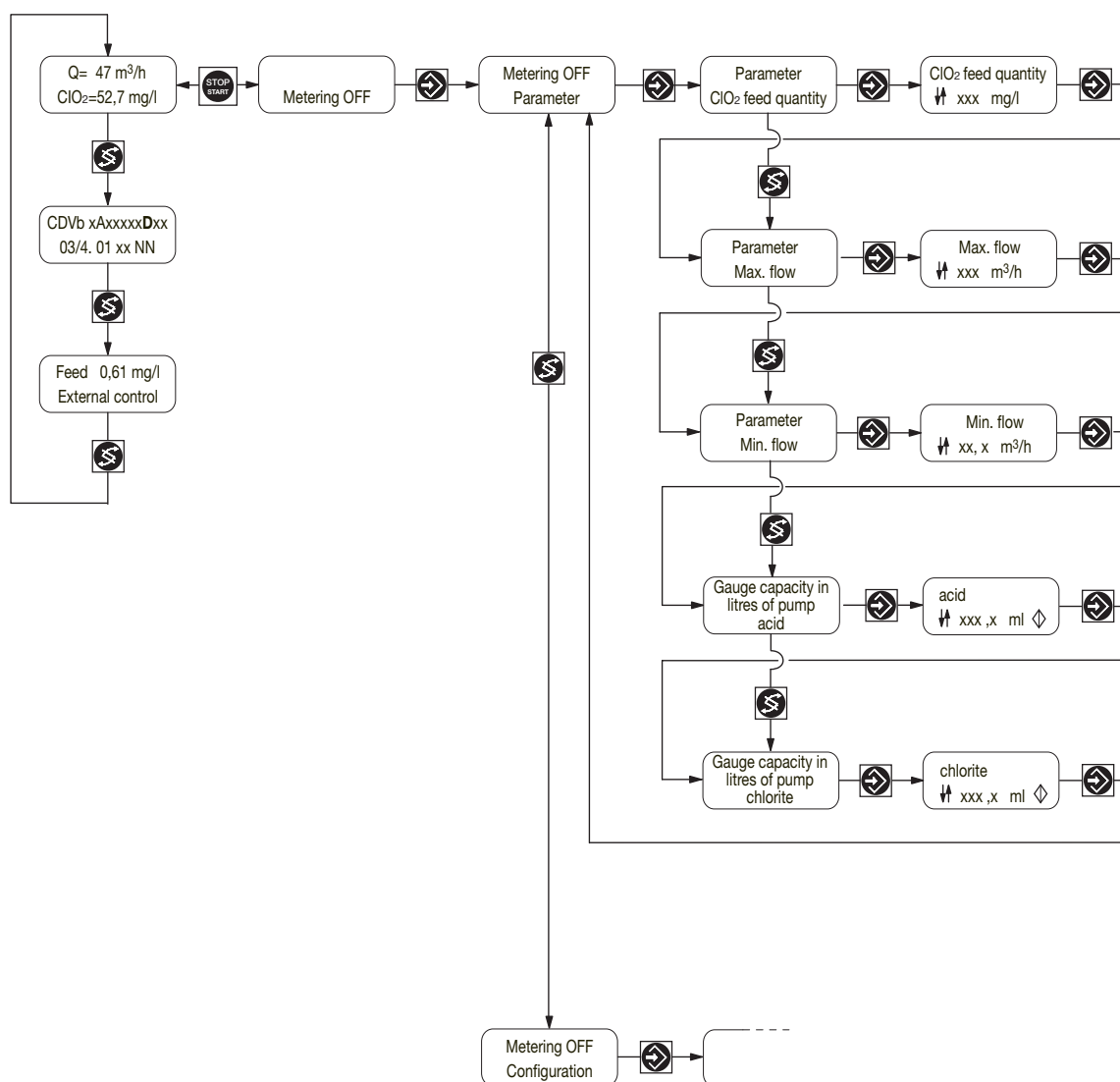
The active code is: xx NN Dxxx

- Set the other active code-characteristics depending on the accessories fitted
- Change the suction interval and suction duration if necessary.

### 6.2.2 Operating mode- “Flow-dependent actuation”

The  $\text{ClO}_2$  output of the chlorine dioxide system changes in proportion to the signal of the flow meter (contact water meter, inductive flow meter. . . ).

Settings in the parameters menu:



- Set the  $\text{ClO}_2$  concentration to “ $\text{ClO}_2$  feed quantity” with the arrow buttons.  
 $\text{ClO}_2 \text{ concentration} = \text{required } \text{ClO}_2 \text{ -concentration} + \text{decay}$
- In the menu item “Max. flow” press the “On” button until the numerical value no longer changes. If the actual maximum flow is clearly below this value it is sensible to enter this second value.
- Set the minimum flow value in the menu item “Min. flow”.



### WARNING

**Analogue flow meters (0/4-20mA) -be sure to set a “Min. flow” value greater than “0”.**  
**The Bello Zon® system can otherwise meter  $\text{ClO}_2$  without any water to dilute it, which can lead to the build-up of an explosive concentration.**

- Gauge capacity in litres of the pumps (see section 6.5)

To select the right water meter follow this rule

(DP = pulse interval of water meter) :

$$\text{DP}_{\min} < \text{DP} < \text{DP}_{\max}$$

where  $\cong$

$$\text{DP}_{\max} \cong \text{output (g/h) / concentration (mg/l),}$$

$$\text{DP}_{\min} \cong \text{DP}_{\max} / 10$$

Example:

e.g. the ClO<sub>2</sub> system is set to the maximum output = 129 g/h and the concentration in the water main (possibly downstream from a reaction tank) is 1.5 ppm ClO<sub>2</sub>.

At maximum ClO<sub>2</sub> output the following applies:

$$DP_{max} \cong 129 / 1.5 \cong 86 \text{ litres/pulse}$$

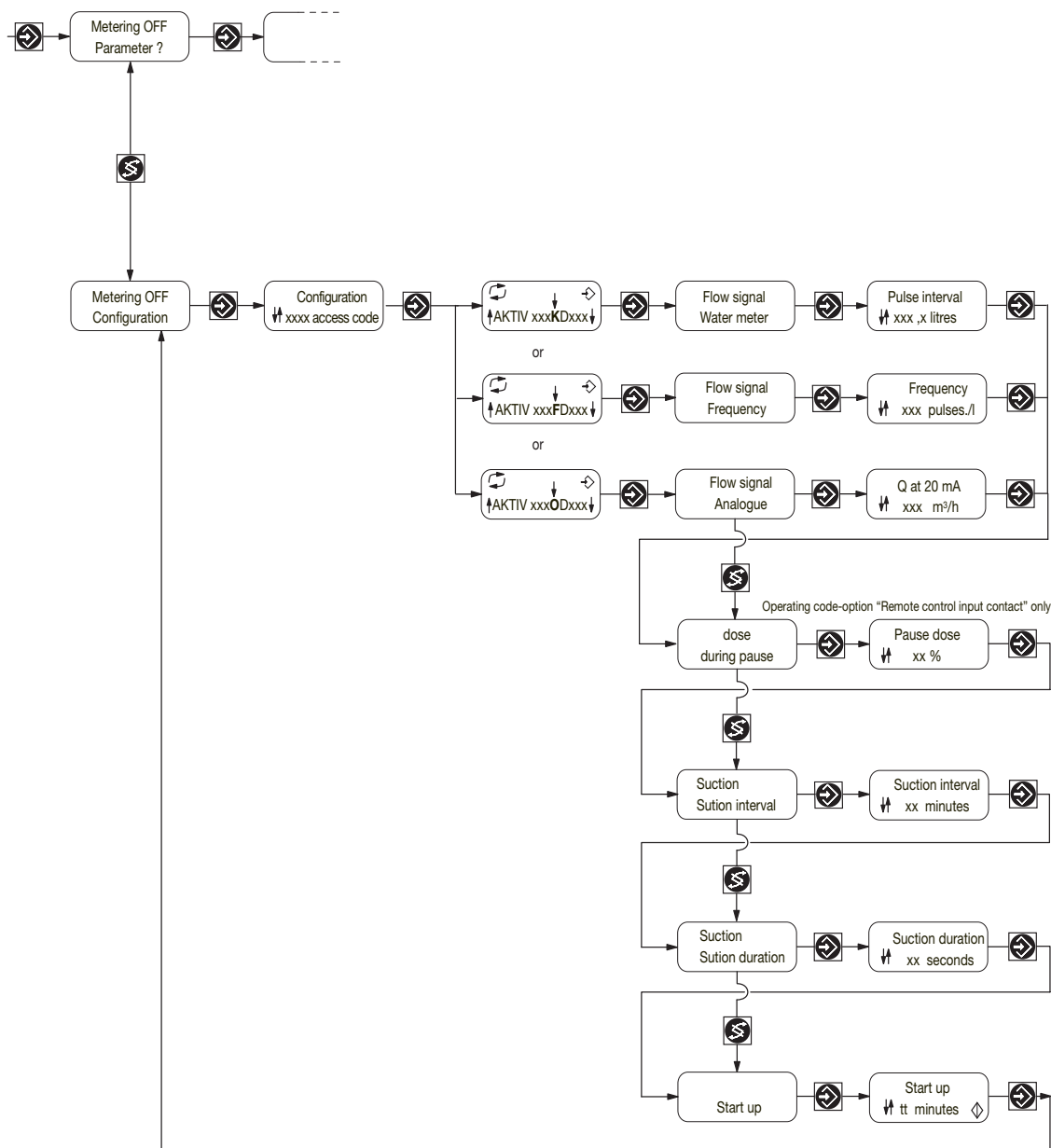
$$DP_{min} = 86 / 10 \cong 9 \text{ litres/pulse}$$

## NOTE

The pulse interval can be adjusted with most water meters.

The permanent display and the info displays show the flow, the current output and the set feed value. If the flow exceeds the maximum value the ClO<sub>2</sub> output remains constant and the feed value falls. If the flow drops below the minimum set value, the controller will switch off the metering.

Settings in the configuration menu:

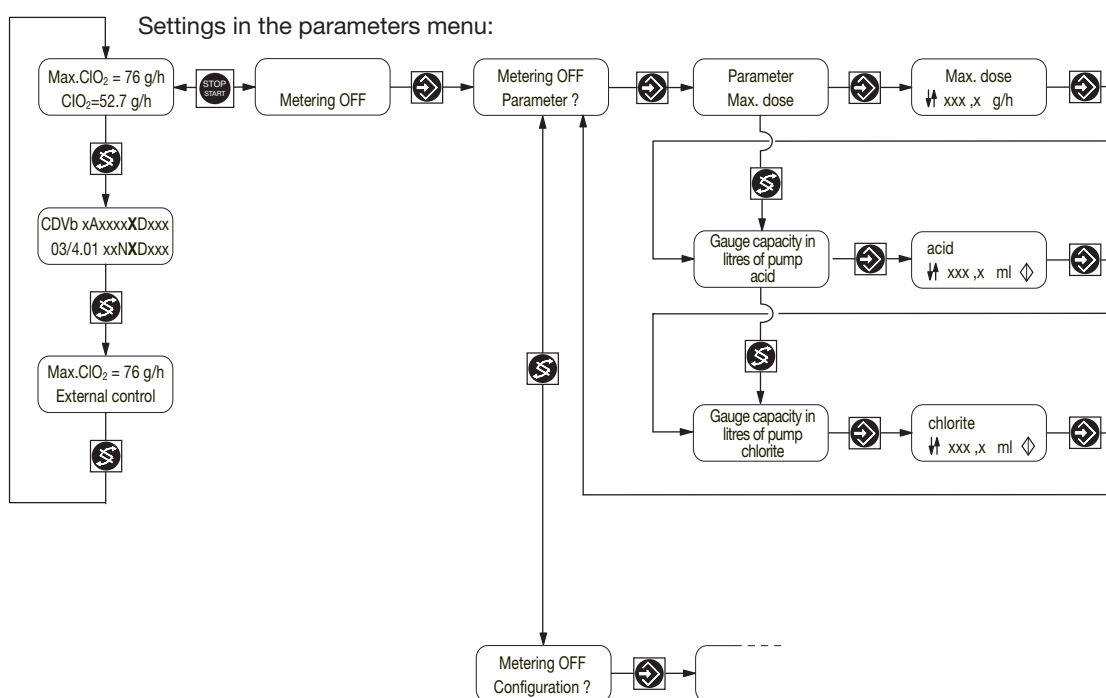


- ▶ Set the active code characteristic "Flow input" to K, F, 0 or 4
- ▶ Set the other active code-characteristics depending on the optional accessories fitted
- ▶ In the following menu item set:
  - with active code-characteristic "Flow input" = K: the pulse interval of water meter
  - with active code-characteristic "Flow input" = F: the pulse value (frequency) of the flow meter
  - with active code-characteristic "Flow input" = 0 or 4: the maximum measured flow at 20 mA (the controller sets the flow value for 0/4 mA to 0) .
- ▶ Change the suction interval and suction duration if necessary.



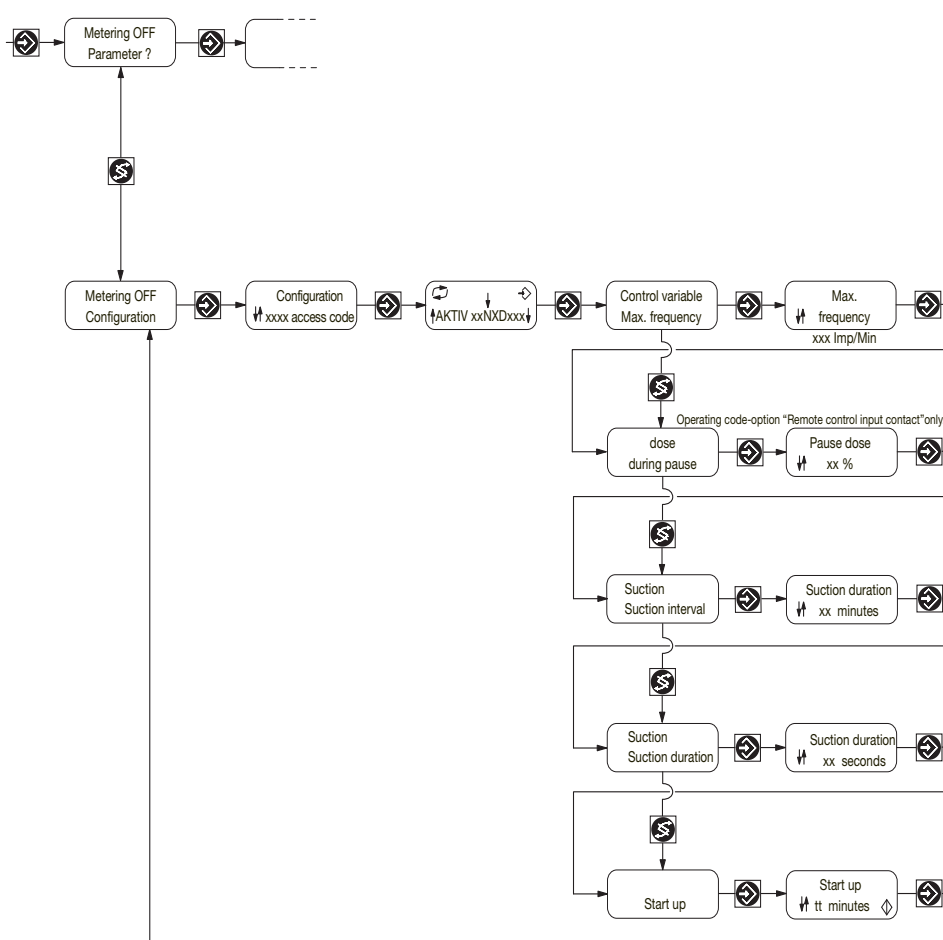
### 6.2.3 Operating mode “Control variable-dependant actuation”

The  $\text{ClO}_2$  output of the Bello Zon® system changes in relation to the value measured via the mA signal of a  $\text{ClO}_2$  or redox measuring point.



- Set the maximum required  $\text{ClO}_2$  output in g/h  
(the controller calculates internally the minimal feed rate of the pumps from the set maximum  $\text{ClO}_2$  output)
  - Gauge capacity in litres of the pumps (see section 6.5).
- The info displays show the current  $\text{ClO}_2$  concentration and the maximum set  $\text{ClO}_2$  output.

Settings in the configuration menu:



- ▶ Set the active code characteristic “Control variable input” to K, F, 0 or 4
- ▶ Set other active code-characteristics depending on the optional accessories present
- ▶ If the active code-characteristic “Control variable input” = K, enter the control variable pulse value.
- ▶ Change the suction interval and suction duration if necessary.

| System type | Output adjustment range $\text{ClO}_2$ (g/h)<br>(at min. / max. stroke rate) approx. |
|-------------|--|
| CDV 15      | 1 - 50   |
| CDV 35      | 5 - 70   |
| CDV 60      | 10 - 100   |
| CDV 120     | 15 - 130   |
| CDV 220     | 60 - 350   |
| CDV 600     | 250 - 600  |
| CDV 2000    | 300 - 3000   |

table 2

## 6.3 Starting up the system

- ▶ Place each suction lance in a separate bucket filled with clean water
- ▶ Turn the bleed cock handle to the “Bleed” position (see Fig. 8)
- ▶ If “Remote control input contact” in the operating code is O or C: in the case of “Metering during pause” always enter “0” under pause dose (configuration menu)
- ▶ Set in the menu item “Start up xx minutes” 30 minutes and press the “Suction” button
- ▶ Set the metering pump stroke length to 100 %
- ▶ Let the metering pumps feed until the intake lines and liquid end are full and contain no bubbles.
- ▶ Stop the metering pumps by pressing the “Suction” button
- ▶ Turn the air bleed cock handles to the “Bleed” position (see Fig. 8)
- ▶ Open the stopcocks in the bypass
- ▶ Set 60 minutes in the menu item “Start up xx minutes” and press “Suction” button  
Wait until the remaining lines and the reactor are full of water and the Bello Zon® system is working at the normal operating pressure.



### WARNING

Never combine the contents of the bleed bottles.

Never pour the contents of the bleed bottles back into the component tanks. The danger of confusion is too great.

Never swap over the bleed bottles.

This will cause the production of toxic  $\text{ClO}_2$  gas.

Pour the contents of the bleed bottles separately down the drain and rinse away each with plenty of water.



### IMPORTANT

If conducting several bleeding operations, one after the other, watch the level of the bleed bottles.

Commissioning

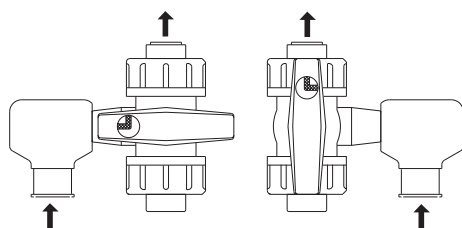
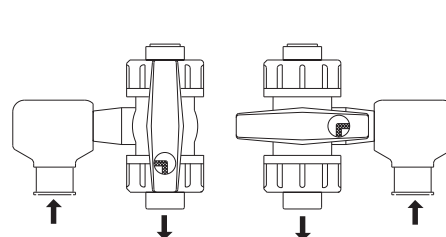


Fig. 8

Bleeding



## 6.4 Checking for tightness



### WARNING

**Remedy leaks immediately by suitable means.**

**A vacuum may otherwise form in the  $\text{ClO}_2$  solution in the reactor, in which case the  $\text{ClO}_2$  will effervesce and may explode.**

- ▶ Check all system parts for tightness at maximum operating pressure during start up
- ▶ Remedy any leaks immediately by suitable means.
- ▶ Press the “Suction” button to end the start-up process.

## 6.5 Discharging metering pumps

Before discharging, the metering pumps must have reached the operating temperature (after approx. 1h at maximum stroke rate).

- ▶ Set both metering pumps to the same stroke length (minimum values see table. 3)
- ▶ Access the settings menu “Gauge capacity in litres of pump, acid” and press the “Enter” button - the “acid **tt** min” menu option appears.
- ▶ Press the “Down” button until the numerical value no longer changes - this gives the minimum volume for capacity gauging of the “Acid” pump

### NOTE

**If this minimum volume is not reached in the subsequent capacity gauging process, increase either the stroke length of both metering pumps or the feed rate of the CDV system or reduce the maximum flow value in the bypass.**

- ▶ Not at initial commissioning: place each suction lance in a separate bucket filled with clean water (this will rinse away the chemical-residues and prevent the suction lances running empty)



### IMPORTANT

**Never put both suction lances in the same bucket. This can cause toxic  $\text{ClO}_2$  gas to be produced.**

- ▶ Place the calibrating cylinder on a level, even surface for easier reading (the fluid level should be easy to read off)
- ▶ Fill both calibrating cylinders with water to the top marking (500 ml and/or 1000 ml)
- ▶ Place each suction lance carefully into its calibrating cylinder - slowly raise the suction lance, hold vertical: do not allow air in the suction lances to interfere with the discharging.
- ▶ Set both bleed taps to “Bleed” (see Fig. 8)
- ▶ Start the capacity gauging process by pressing the “Suction” button - the controller allows the metering pumps to carry out a preset number of strokes (duration up to 1.5 -12 min)

### NOTE

**Only the “Acid” feed monitor is active during capacity gauging. Should a fault occur at this point, the flow monitor must be reset (see section 6.6) and repeat the capacity gauging process with a refilled measuring cylinder.**

- ▶ Withdraw the suction lances from the calibrating cylinders (slowly raise while holding vertical) and place each in its bucket
- ▶ Place the calibrating cylinder on a level, even surface for easier reading (the fluid level should be easy to read off)
- ▶ Read off the new values from the calibrating cylinder.

- ▶ Constitute the difference between the first value and the new value (in ml) for acid - the value must be greater than the minimum volume but not by more than 30 % (take minimum volume times 1.3)
- ▶ Enter the new value for acid into the controller with the arrow buttons
- ▶ Press the “Enter” button until the “Gauge capacity in litres of pump Chlorite” menu option appears
- ▶ Calculate the difference between the first value and the new value (in ml) for chlorite - the value must be greater than the minimum volume but not more than 30 % more (take minimum volume times 1.3)
- ▶ Enter the new value for acid into the controller with the arrow buttons
- ▶ Press the “Enter” button until the “Gauge capacity in litres of pump, chlorite” menu option appears
- ▶ Calculate the difference between the first value and the new value (in ml) for chlorite - the value must be greater than the minimum volume but not more than 30 % more (take minimum volume times 1.3)
- ▶ Enter the new value for chlorite into the controller with the arrow buttons
- ▶ Press “Enter” to save
- ▶ Enter the values for acid and chlorite in the Commissioning log/System logbook
- ▶ Exit the configuration menu by pressing the “Return” button - “Metering OFF Configuration?” appears in the LCD display?
- ▶ Set both bleed taps to “Normal operation” (see Fig. 8)
- ▶ Not at initial commissioning: place the suction lance for the acid carefully into the “Acid” drum and attach
- ▶ Place the suction lance for the chlorite carefully into the “Chlorite” drum and attach  
Rinse the calibrating cylinders and buckets thoroughly
- ▶ Pour the contents of the bleed bottles separately down the drain and rinse away each with plenty of water.



## WARNING

**Never swap over the bleed bottles.  
Never combine the contents.  
Never pour the contents of the bleed bottles back into the component tanks. The danger of confusion is too great.  
This will cause the production of toxic  $\text{ClO}_2$  gas.**

## 6.6 Setting feed monitor



## WARNING

- **Never leave the ring initiators in the lowest position.  
The feed monitors cannot otherwise carry out their safety function during metering.**
- **The stroke lengths of the metering pumps must be greater than the minimum value in Tab. @.  
The feed monitors cannot otherwise carry out their safety function during metering.**



## IMPORTANT

**Always adjust feed monitors at normal operating pressure.**

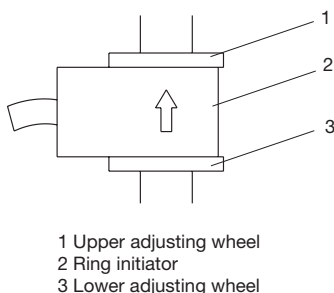


Fig. 9

| Stroke length table, | minimum values |
|----------------------|----------------|
| CDV 15               | 100 %          |
| CDV 35               | 60 %           |
| CDV 60               | 50 %           |
| CDV 120              | 50 %           |
| CDV 220              | 40 %           |
| CDV 600              | 40 %           |
| CDV 2000             | 30 %           |

Table 3

- ▶ Switch off metering with the “Start/Stop” button
- ▶ Screw the upper adjusting wheels (1) on the feed monitors (see Fig. @) right to the top
- ▶ Do the same with the ring initiators (2) and lower adjusting wheels (3)
- ▶ Start the metering pumps with the “Suction” button - they will run for 20 strokes
- ▶ Lower the ring initiators (2) slowly until the green LEDs “Feed monitor, acid” (L 6) and “Feed monitor, Chlorite” (L 10) (see Fig. @) light up at each stroke precisely with no error pulses
- ▶ Then lower the ring initiators (2) approx. 2 mm
- ▶ Screw the upper adjusting wheels (1) down to the ring initiators (2)
- ▶ Stop the metering pumps by pressing the “Suction” button
- ▶ Start metering with “Start/Stop” button.

The system now operates at the required feed rate (at initial commissioning, must still be with water).

### 6.7 Checking safety equipment

see section. 2 “Safety” “Description and checking of safety equipment”

### 6.8 Installing component containers

- ▶ Switch off metering with the “Start/Stop” button - “Metering OFF” appears
- ▶ Place the component tanks under the system (acid left (HCl, red), chlorite right (NaClO<sub>2</sub>, blue) - viewed from the front)  
Immerse the suction lance in the component tank for acid (the foot valve should be hovering just above the bottom of the tank)
- ▶ Screw on the lid
- ▶ Install the suction lance for chlorite in the same way.

### 6.9 Checking chlorine dioxide generation

- ▶ Switch on metering with the “Start/Stop” button
- ▶ After approx. 1 h prepare a sample from the water main (downstream from a reaction tank, if present or at a ClO<sub>2</sub> metering point) - the ClO<sub>2</sub> solution must have reached this point by now
- ▶ Take the sample in a clean container and displace immediately with the DPD 1 reagent (see operating instructions for your colorimetric measuring device; ClO<sub>2</sub> tends to effervesce, particularly at water temperatures >25 °C.)
- ▶ Quickly measure the ClO<sub>2</sub> content of the sample with a colorimetric meter (e. g. with a DT 1 photometer)
- ▶ Change the maximum ClO<sub>2</sub> output and/or feed quantity in the parameters menu if necessary, run the system and repeat the measurement after a sufficient time has elapsed.



### WARNING

- If you have to change the stroke length you must calibrate the metering pumps and readjust the feed monitors.
- Observe national and local directives with regard to the ClO<sub>2</sub> concentrations.

### 6.10 Setting pause metering

- ▶ If “Remote control input contact” in the operating code is at O or C: for “Metering during pause”, enter a value under Pause dose if necessary (Configuration menu).

**The Bello Zon® system is now ready to run.**

## 7 Operating



### WARNING

- The maximum admissible operating pressure for the system must never be exceeded in any operating state.
- The entire installation must be free from leaks when operating at maximum operating pressure.

### 7.1 Replacing component container



### WARNING

- The component container must be changed by trained staff only. Incorrect assembly can result in large quantities of toxic  $\text{ClO}_2$  gas being generated, or even reactor explosion.
- Note colour code.  
Red stands for acid ( $\text{HCl}$ , left), blue for chlorite ( $\text{NaClO}_2$ , right).
- Never pour chemicals back into component tanks or mix together.  
This can cause large amounts of toxic  $\text{ClO}_2$  gas to be produced.
- Never put both suction lances in the same bucket.  
This can cause toxic  $\text{ClO}_2$  gas to be generated.  
The two components, hydrochloric acid ( $\text{HCl}$ ) and sodium chlorite ( $\text{NaClO}_2$ ), must never be combined except in the reactor.  
There will otherwise be a sudden formation of toxic  $\text{ClO}_2$  gas, which can be explosive.
- Make sure that the “acid” suction lance is fitted into the “acid” component tank and the “chlorite” suction lance is fitted in the “chlorite” component tank (check labels).
- Never operate the Bello Zon® CDVb chlorine dioxide system with undilute sodium chlorite solution.  
Otherwise highly concentrated  $\text{ClO}_2$ -gas will form, which may explode in the reactor.
- Use only Bello Zon® chlorite or dilute sodium chlorite ( $\text{NaClO}_2$ , 7, 5 ± 0.3 % by weight).
- If using dilute sodium chlorite ( $\text{NaClO}_2$ , 7.5 ± 0.3 % by weight) ensure correct dilution at all costs.
- Never confuse sodium chlorite ( $\text{NaClO}_2$ ) with chlorine bleach ( $\text{NaOCl}$ ). Use only Bello Zon® chlorite or dilute sodium chlorite ( $\text{NaClO}_2$ , 7.5 ± 0.3 % by weight).
- Use only Bello Zon® acid or dilute hydrochloric acid ( $\text{HCl}$ , 9 +1.5 % by weight).
- If using dilute hydrochloric acid ( $\text{HCl}$ , 9 +1.5 by weight) ensure correct dilution at all costs.
- Do not use contaminated acid.  
It can contain organic chlorine compounds (EOX) which will attack the seals and make the PVC lines brittle.

### NOTE for the operator

Israel only: use only fluoride-free chemicals.

- ▶
- ▶ Press the “Start /Stop” button - the LCD display must indicate “Metering OFF”
- ▶ Lift each suction lance carefully out of its component tank (raise slowly, hold vertical)
- ▶ Place each suction lance in a separate bucket filled with clean water (this will prevent suction lances from running empty)
- ▶ Seal the empty component tanks and dispose of correctly.
- ▶ Place the new component tanks under the system (red stands for acid (left), blue for chlorite (right))
- ▶ Slowly raise each suction lance, hold vertical and immerse in the correct component tanks (red stands for acid, blue for chlorite.)
- ▶ Check the intake pipe for air bubbles, bleed if necessary, (see 6.3)
- ▶ Start metering with “Start/Stop” button.

## 7.2 Bleeding metering pumps

- ▶ Turn the air bleed cock handle to the “Bleed” position (see Fig. 8)
- ▶ Press the “Suction” button and hold
- ▶ Run the metering pumps until the intake lines and liquid end are full and without bubbles
- ▶ If this does not happen, set the metering pump stroke length to 100 % (note values) and press the “Suction” button and hold - then gauge capacity in litres of metering pumps and set feed monitors.
- ▶ Turn the air bleed cock handle to the “Bleed” position (see Fig. 8)
- ▶ Pour the contents of the bleed bottles separately down the drain and rinse away each with plenty of water.



### WARNING

**Never swap over the bleed bottles.**

**Never combine the contents.**

**Never pour the contents of the bleed bottles back into the component tanks. The danger of confusion is too great.**

**This will cause a large quantity of toxic  $\text{ClO}_2$  gas to be generated.**

## 7.3 Discharging metering pumps

Before discharging, the metering pumps must have reached the operating temperature (after approx. 1h at maximum stroke rate) .

- ▶ Set both metering pumps to the same stroke length (minimum values see table 3)
- ▶ Access settings menu “Gauge capacity in litres of pump, acid” and press “Enter” button -
- ▶ “acid **tt** min” menu option appears.
- ▶ Press the “Down” button until the numerical value no longer changes - this gives the minimum volume for Gauge capacity in litres of the “acid” pump.

### NOTE

**If this minimum volume is not reached in the subsequent capacity gauging process, increase either the stroke length of both metering pumps or the feed rate of the CDV system or reduce the maximum flow value in the bypass.**

- ▶ Not at initial commissioning: place each suction lance in a separate bucket filled with clean water (this will rinse away the chemical residues and prevent suction lances from running empty)



### IMPORTANT

**Never put both suction lances in the same bucket.**

**This can cause toxic  $\text{ClO}_2$  gas to be generated.**

- ▶ Place the calibrating cylinder on a level, even surface for easier reading (the fluid level should be easy to read off)
- ▶ Fill both calibrating cylinders with water to the top marking (500 ml and/or 1000 ml)
- ▶ Place each suction lance carefully into its calibrating cylinder - slowly raise the suction lance, hold vertical: do not allow air in the suction lances to interfere with the capacity gauging process.
- ▶ Set both bleed taps to “Bleed” (see Fig. 8)
- ▶ Start the capacity gauging process by pressing the “Suction” button - the controller allows the metering pumps to carry out a preset number of strokes (duration up to 1.5 -12 min)

#### NOTE

**Only the “acid” feed monitor is active during capacity gauging. Should a fault occur at this point, the flow monitor must be reset (see section 7.5) and repeat the capacity gauging process with a refilled measuring cylinder.**

- ▶ Withdraw the suction lances from the calibrating cylinders (slowly raise while holding vertical) and place each in its bucket
- ▶ Place the calibrating cylinder on a level, even surface for easier reading (the fluid level should be easy to read off)
- ▶ Read off the new values from the calibrating cylinder
- ▶ Record the difference between the first value and the new value (in ml) for acid - the value must be greater than the minimum volume but not by more than 30 % (take minimum volumes times 1.3)
- ▶ Enter the new value for acid into the controller with the arrow buttons
- ▶ Press the “Enter” button until the “Gauge capacity in litres of pump, chlorite” menu option appears
- ▶ Record the difference between the first value and the new value (in ml) for chlorite - the value must be greater than the minimum volume but not more than 30 % more (take minimum volumes times)
- ▶ Enter the new value for chlorite into the controller with the arrow buttons  
Press “Enter” to save
- ▶ Enter the values for acid and chlorite in the commissioning log/Appendix-Logbook
- ▶ Exit the configuration menu by pressing the “Return” button - “Metering OFF Configuration?” appears in the LCD display.
- ▶ Set both bleed taps to “Normal operation” (see Fig. 8)
- ▶ Not at initial commissioning: place the suction lance for the acid carefully into the “acid” drum and attach
- ▶ Place the suction lance for the chlorite carefully into the “Chlorite” drum and attach
- ▶ Rinse the calibrating cylinders and buckets thoroughly
- ▶ Pour the contents of the bleed bottles separately down the drain and rinse each with plenty of water.



#### WARNING

**Never swap over the bleed bottles.**

**Never combine the contents.**

**Never pour the contents of the bleed bottles back into the component tanks. The danger of confusion is too great.**

**This would cause a large quantity of toxic  $\text{ClO}_2$  gas to be generated.**

#### 7.4 Checking chlorine dioxide generation

- ▶ Switch on metering with the “Start/Stop” button
- ▶ After approx. 1 h prepare a sample from the water main (downstream from a reaction tank, if present or at a  $\text{ClO}_2$  metering point) - the  $\text{ClO}_2$  solution must have reached this point by now
- ▶ Take the sample in a clean container and displace immediately with the DPD 1 reagent (see operating instructions for your colorimetric measuring device;  $\text{ClO}_2$  tends to effervesce, particularly at water temperatures  $> 25^\circ\text{C}$ .)
- ▶ Quickly measure the  $\text{ClO}_2$  level of the sample with a colorimetric meter (e. g. with a DT 1 photometer)
- ▶ Change the maximum  $\text{ClO}_2$  output and/or feed quantity in the parameters menu if necessary, run the system and repeat the measurement after a sufficient time has elapsed (1 hour or more).



#### WARNING

**• If you have to change the stroke length you must calibrate the metering pumps and readjust the feed monitors.**

**• Observe national and local directives with regard to the  $\text{ClO}_2$  concentrations.**



## 7.5 Feed monitor settings



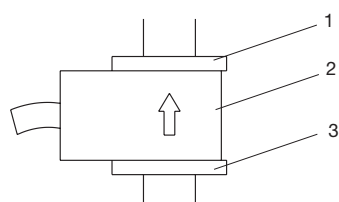
### WARNING

- Never leave the ring initiators in the lowest position.  
The feed monitors cannot otherwise carry out their safety function during metering.
- The stroke lengths of the metering pumps must be greater than the minimum value in Tab. 4.  
The feed monitors cannot otherwise carry out their safety function during metering.



### IMPORTANT

Always adjust feed monitors at normal operating pressure.



1 Upper adjusting wheel  
2 Ring initiator  
3 Lower adjusting wheel

Fig. 10

| stroke length table, | minimum values |
|----------------------|----------------|
| CDV 15               | 100 %          |
| CDV 35               | 60 %           |
| CDV 60               | 50 %           |
| CDV 120              | 50 %           |
| CDV 220              | 40 %           |
| CDV 600              | 40 %           |
| CDV 2000             | 30 %           |

table 4

- Switch off metering with the “Start/Stop” button
- Screw the upper adjusting wheel (1) on the feed monitors (see Fig. 10) right to the top
- Do the same with the ring initiator (2) and lower adjusting wheels (3)
- Start the metering pumps with the “Suction” button - they will run for 20 strokes
- Lower the ring initiators (2) slowly until the green LEDs “Feed monitor, acid” (L 6) and “Feed monitor, chlorite” (L 10) (see Fig. 1) light up exactly at each stroke.
- There must be no error pulses.
- Then lower the ring initiators (2) approx. 2 mm further
- Screw the upper adjusting wheels (1) down to the ring initiators (2)
- Stop the metering pumps by pressing the “Suction” button  
start metering with “Start/Stop” button.

Measured value-dependent metering: check the sensors regularly (interval dependent on process conditions; see operating instructions manual for sensors).

## 8 What happens in the event of incorrect use?

### a) Component tanks

Incorrect use: component tanks have been swapped

The result: toxic  $\text{ClO}_2$  gas will form in the component tanks

Incorrect use: undilute acid and undilute chlorite have been used and the Bello Zon® system/the pumps started

The result: the undilute chemicals will combine in the reactor, it will get very hot, toxic  $\text{ClO}_2$  gas will form which may cause the reactor to explode.

### b) Metering pumps

Incorrect use: different metering pump stroke lengths have been set and the feed monitors set accordingly, no capacity gauging or wrong values specified for the capacity gauging

The results:

- overdosing of acid or chlorite:  
Acid overdose: the existing acid overdose will be strengthened, the  $\text{ClO}_2$  solution diluted and consequences will be minimal.
- Chlorite overdose: the  $\text{ClO}_2$  output will drop and the displayed  $\text{ClO}_2$  quantity will no longer be correct.

### c) Feed monitors

Incorrect use: ring initiator set too low

The result: it is possible that the feed monitor will not recognise a reduction in the flow rate of > 30 % and metering will continue to run.

- Will cause overdosing of acid or chlorite:  
Acid overdose: the existing acid overdose will be strengthened, the  $\text{ClO}_2$  solution diluted and consequences will be minimal.
- Chlorite overdose: the  $\text{ClO}_2$  output will drop and the displayed  $\text{ClO}_2$  quantity will no longer be correct.

Incorrect use: ring initiator set too high

The result: the controller will switch off the metering after eight pump strokes.

### d) Bypass

Incorrect use: the limit contact in bypass is set too low

The result: the  $\text{ClO}_2$  concentration in bypass will be too high which can lead to environmental or health hazard.

Incorrect use: the limit contact in bypass is set too low

The result: the  $\text{ClO}_2$  concentration in the bypass will be too high which can lead to environmental or health hazard.

### e) Controller

Incorrect use: incorrect calibration values set

The result: will cause overdosing of acid or chlorite:

- Acid overdose: the existing acid overdose will be strengthened, the  $\text{ClO}_2$  solution diluted and consequences will be minimal.
- Chlorite overdose: the  $\text{ClO}_2$  output will drop and the displayed  $\text{ClO}_2$  quantity will no longer be correct.

## 9 Maintenance



### WARNING

- The Bello Zon® system must be serviced every six months by ProMinent. In the worst case a vacuum can form in the undilute  $\text{ClO}_2$  solution in the reactor e.g. due to a leak in one of the lines downstream. The reactor could then explode.
- Before all servicing work (exchange of parts etc.) flush the Bello Zon® system with water to remove all traces of chemical from it and, above all, the reactor.
- Reactor cabinet only: Extract contents of reactor cabinet before opening. Press the "Suction" button (water should flow).



### CAUTION

- Signal leads and mains connection cables must always be replaced by ProMinent service engineers.
- Only corresponding special leads may be used.

### NOTE for the operator:

According to the accident prevention regulation GUV 8.15 and/or VGB 65 § 19 (2) chlorine dioxide systems must be safety-checked regularly, but at least once a year and before every recommissioning, by a qualified engineer.

This inspection can be carried out by the service technician within the context of the six-monthly service. We therefore recommend that you arrange a service contract.

### 9.1 Service by service technicians only

Every six months

#### 9.1.1 Flush reactor, detoxify reactor contents



### WARNING

- Wear suitable protective equipment for  $\text{ClO}_2$  gas,  $\text{ClO}_2$  solution, hydrochloric acid, sodium chlorite and caustic soda (protective goggles, rubber gauntlets, gas mask, rubber apron...)!
- In the event of contact with one of these chemicals, rinse immediately with plenty of cold water, consult a doctor if necessary.
- Observe national and local directives.
- The disassembly of an un-rinsed reactor is risky because air can get into the solution as it drains out, which can quickly produce an explosive  $\text{ClO}_2$  gas. This measure is therefore acceptable only in an emergency and also only if the reactor volume does not exceed 3 litres.

Materials required:

- approx. 3 m water hose
- 1 open tank for neutralising
- 1 l caustic soda,  $\text{NaOH}$  50 % (C, irritant)
- 1 l hydrogen peroxide,  $\text{H}_2\text{O}_2$  30 % (Xi, irritant)
- 1 pH meter (ideally pH-paper, but is bleached by  $\text{ClO}_2$ )
- Potable water (see table)

Quantities for detoxification

| System type   | Neutralisation tank | Water volume | Caustic soda | Hydrogen peroxide* | Reactor contents with tower packing |
|---------------|---------------------|--------------|--------------|--------------------|-------------------------------------|
| CDV 15 - 120  | 20 l                | 5 l          | 27 ml        | 8 ml               | 0,4 l                               |
| CDV 220 - 600 | 80 l                | 20 l         | 130 ml       | 37 ml              | 1,8 l                               |

Table 5

\* Instead of  $\text{H}_2\text{O}_2$  you can use a desert spoonful of sodium perborate,  $\text{NaBO}_2 \cdot \text{H}_2\text{O}_2 \cdot 3 \text{H}_2\text{O}$

### Flushing reactor

Before dismantling components for servicing (reactor, metering lines, valves, seals, ...) force the contents of the discharge line and the reactor from bottom to the top with water. For this purpose, either pump water from the intake side through the system or run the system with water instead of chemicals:

- ▶ Switch off metering with the "Start /Stop" button
- ▶ Switch to "Configure?" menu
- ▶ Set the "Run-in period" parameter to at least 30 min in the "Start up" settings menu
- ▶ Depressurise the bypass if possible. Close the stopcock upstream from the Bello Zon® system and downstream from the flushing assembly
- ▶ Connect a hose to the purge valve of the flushing assembly
- ▶ Insert the hose into a tank containing neutralisation solution (see below) - the hose must be immersed below the liquid level
- ▶ Open the purge valve
- ▶ Place each suction lance in a separate bucket filled with clean water
- ▶ Press the "Suction" button and set the stroke lengths of both metering pumps to 100 %
- ▶ Run the Bello Zon® system until the pump's liquid ends, the reactor and the lines up to the flushing assembly are filled with water

### Detoxifying reactor contents

(See also Tab. 5)

- ▶ Once the reactor is completely empty, its contents must be diluted 10:1 in the neutralisation tank.
- ▶ tank. Fill the neutralisation tank a quarter full with water while stirring
- ▶ Add the quantity of caustic soda required for neutralising (protective equipment).
- ▶ Then add the calculated quantity of hydrogen peroxide while stirring (overdose is uncritical).
- ▶ If the  $\text{ClO}_2$  solution in the neutralisation tank does not colour immediately, carefully add another
- ▶ cup-full of NaOH or  $\text{H}_2\text{O}_2$  (the pH value must be over pH 8).



### CAUTION

Add the alkaline flushing water to the neutralisation tank for neutralisation.

### Carrying out emergency procedure:

- ▶ Fill the neutralisation tank with enough water to ensure that the reactor is completely covered.
- ▶ Dismantle the reactor (wearing protective equipment), lower into the neutralisation tank and place both rapidly outdoors or at an exit.
- ▶ The unscrew the valves under water and lift the reactor up and down to allow the contents to run out into in the neutralisation tank.
- ▶ Add first the caustic soda and then the hydrogen peroxide to the tank contents (see Tab. 5), until the solution is colourless.
- ▶ If the  $\text{ClO}_2$  solution in the neutralisation tank does not colour immediately, carefully add another cup-full of NaOH or  $\text{H}_2\text{O}_2$  (the pH value must be over pH 8) .
- ▶ Let the reactor empty out into the neutralisation tank and rinse again with water if necessary.

### 9.1.2 Replacing consumables



### WARNING

Disconnect the system from the power supply and prevent from being switched on again.



### IMPORTANT

If the system is continuously run at maximum stroke rate, maximum back pressure and 100 % stroke length, the consumable parts on the metering pumps will need replacement more frequently.

If the system is run at a moderate load the consumable parts on the metering pumps will possibly need replacement only once a year.

Solenoid metering pumps  
Beta® BT4a, BT5a

Replace the following consumables:

- Pump diaphragms (see Fig. 11 and 12 )
- All metering line seals (from the intake valve of the metering pumps to the system's injection valves- see Fig. 13 and 14)
- Compression springs of injection valves (see Fig. 14 )

#### Replacing pump diaphragms



#### **WARNING**

- **Protect yourself from the metering chemical.**
- **Depressurise the discharge line.**
- ▶ Empty the liquid end (flush liquid end thoroughly).
- ▶ Set the stroke length while Beta® is running at 0 % stroke (the driving axle is then fixed).
- ▶ Switch off the Beta®
- ▶ Unscrew the hydraulic connections from the discharge and intake sides.
- ▶ Remove screws (1).
- ▶ (Just) slacken the liquid end (2) and head washer (4) from pump housing (6).
- ▶ Take hold of the housing (6) with one hand and clamp the diaphragm (3) with the other between the liquid end (2) and the head washer (4). Slacken the diaphragm (3) on the driving axle by lightly screwing the liquid end (2) and head washer (4) anti-clockwise.
- ▶ Unscrew the diaphragm (3) completely from the driving axle.
- ▶ Remove the head washer (4) from the housing (6).
- ▶ Check the condition of the safety diaphragm (5) and replace if necessary.
- ▶ Push the safety diaphragm (5) onto the driving axle just until it is lying flat against the pump housing (6) -no further.
- ▶ Screw new diaphragm (3) up to the stop onto the driving axle (6) - essential for the pump to meter precisely.
- ▶ Unscrew the diaphragm (3) once more.
- ▶ Place the head washer (4) onto the housing (6).



#### **IMPORTANT**

- **The leakage bore must face downwards when the pump is subsequently installed (See Fig. 11, arrow)**
- **Place the head washer (4) in exactly in the right position on the pump housing (6). Do not twist the head washer (4) on the pump housing (6), this will cause the safety diaphragm (5) to distort.**
- ▶ Insert the diaphragm (3) into the head washer (4).
- ▶ Hold tightly onto the head washer (4) and screw the diaphragm (3) clockwise until it is sitting firmly (you will feel the return spring resistance).



#### **IMPORTANT**

- **Do not over-screw the diaphragm (3)(particularly in the case of type 1001) .**
- **The head washer (4) must be in the right position to prevent the safety diaphragm from distorting (5).**
- ▶ Fit liquid end (2) with the screws (1) onto the diaphragm (3) and the head washer (4) (the intake connector must face downwards when the pump is in place).  
Tighten the screws (1) lightly and then tighten alternately (tightening torques, see below) .

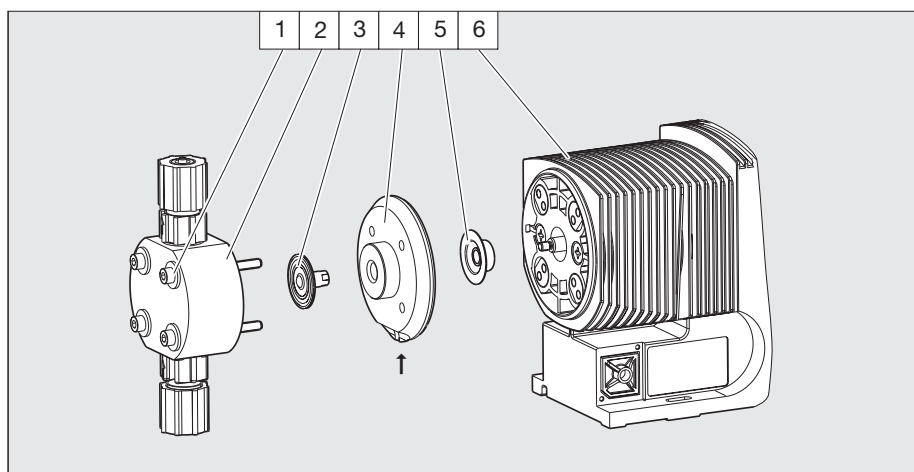


Fig. 11

- 1 Screws
- 2 Liquid end
- 3 Diaphragm
- 4 Head washer
- 5 Safety diaphragm
- 6 Pump housing

## NOTE

- Check the tightening torques of the screws after 24 hours operation.
- PP liquid ends: check the tightening torques again after three months.

Tightening torques for the screws:

Liquid end Ø 70 mm: 2.5 to 3 Nm

Liquid end Ø 90 mm and Ø 100 mm: 4, 5 to 5 Nm

Motor driven metering  
pumps ProMinent®  
Sigma S1Ca, S2Ca

Motor driven metering pumps ProMinent® Sigma S1Ca, S2Ca  
Change gear oil after approx. 5000 operating hours.  
Gear oil ISO Viscosity grades VG 460 e.g. Mobil Gear 634,  
ProMinent Order no. 555325 (oil quantity approx. 0.5 l) .

## Replace the diaphragms



## IMPORTANT

**Rinse liquid end first. Force water or suitable rinsing solution with a squeeze bottle through the intake connector of the liquid end.**

- ▶ Set stroke length to zero while the pump is running. Switch off the pump.
- ▶ Undo the six screws from the liquid end and lift off with the screws.
- ▶ Then slacken the diaphragms by twisting the push rod to the left and unscrew.
- ▶ Screw on new diaphragms until seated firmly on the push rod. Place liquid end with screws with the intake connector facing downwards (note direction of flow / arrows on the valves) . Switch on the pump. Set stroke length to 100 %, insert screws and tighten alternately to  $4.5 \pm 0.5$  Nm (S1Ca) and/or  $7.5 \pm 0.5$  Nm.  
Check pump for tightness at max. pressure.

**NOTE**  
Check the tightening torque of the liquid end screws after 24 hours in operation.

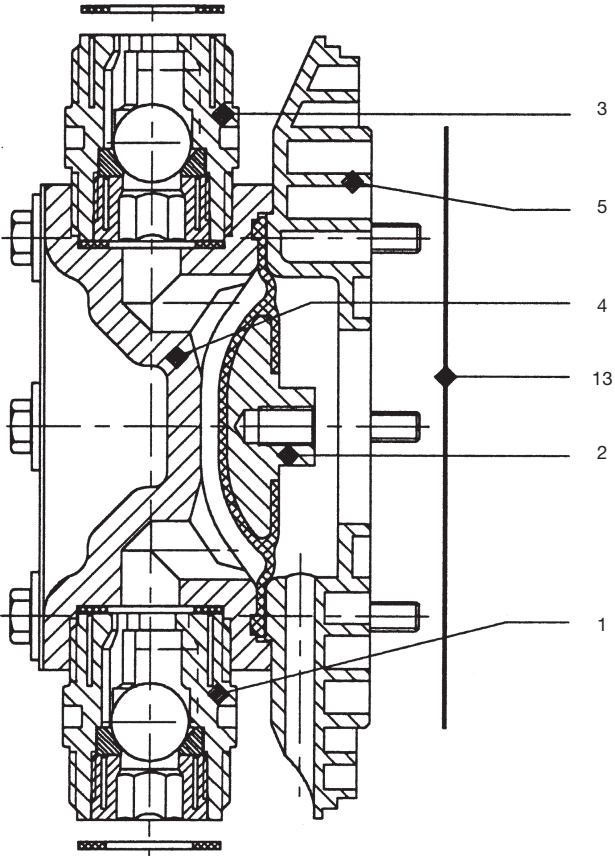


Fig. 12  
Replace all metering line seals

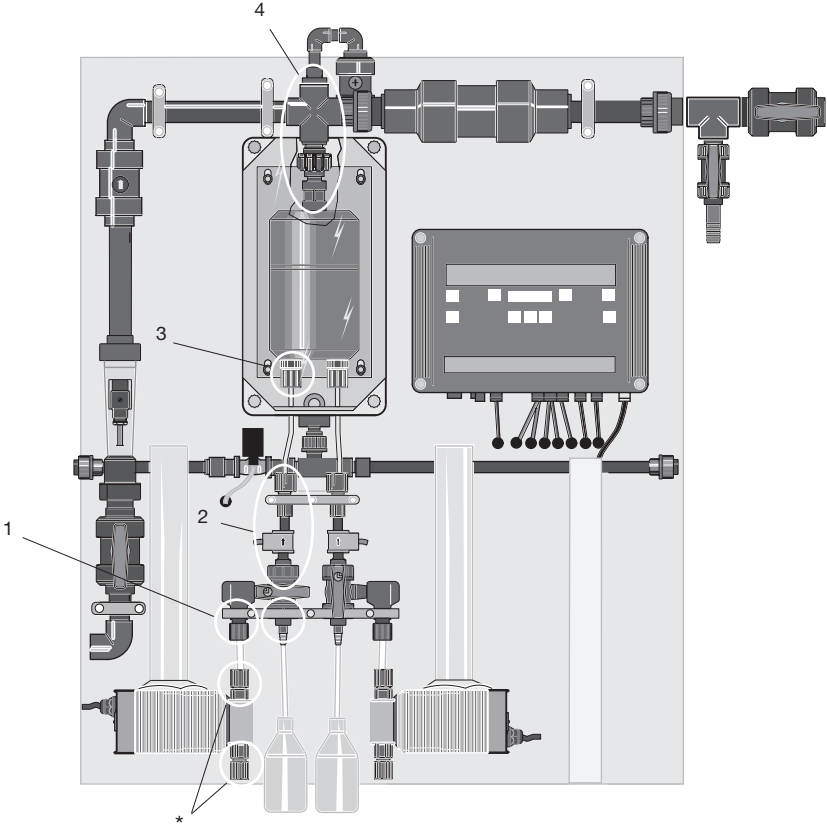


Fig. 13

Assemblies with consumable seals for the “acid side” (numbers indicate the sectional drawings in the illustration below)

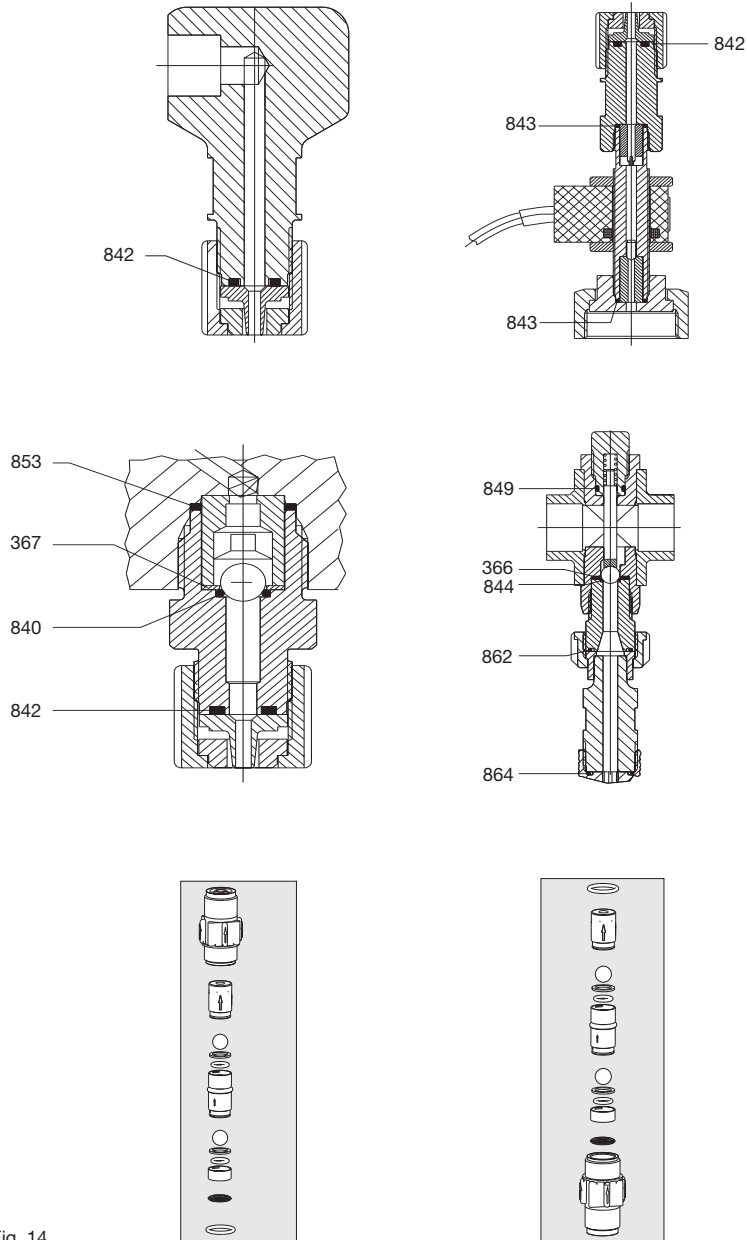


Fig. 14

Sectional drawings with position of seals.

Replace the seals on the “chlorite side” in the same way as for the “acid side”.

#### Replacing compression spring of injection valves.



#### IMPORTANT

**Even in an unpressurised bypass line, the area between the reactor intake valves and the injection valves is always under a priming pressure of approx. 1.5 bar. This area can be depressurised by slowly unscrewing the compression spring centre.**

The injection valve compression spring is easy to remove after unscrewing the centre (see Fig. @) once the Bello Zon® system and bypass line are not under pressure. It is practically impossible for liquid to leak out and run through the system.



#### WARNING

**Commission the Bello Zon® system and bypass line with water first and as far as the tightly screwed-in compression spring centre of the liquid end. Only then should you operate with acid and chlorite.**



### Changing gear oil (only S2Ca)

Change gear oil after approx. 5000 operating hours.  
 Gear oil ISO 460 Viscosity grade VG 460 e. g. Mobil Gear 634,  
 ProMinent Order no. 555325 (oil quantity approx. 0.5 l)

Further steps:

- ▶ Recommission the system after completion of servicing (see section 6)
- ▶ Check the system for leaks.
- ▶ Check the safety equipment function (see "Safety" section) .

### 9.2 Regular checks, possible without service technicians

(each day to each week, depending on the operating conditions).

- ▶ Check  $\text{ClO}_2$  concentration in the treated water (observe national regulations)
- ▶ Check and compare liquid levels of the component tanks,  
 note "Liquid level low" warning in the display and have fresh components  
 ready if required.
- ▶ Document the consumption of Bello Zon® acid and Bello Zon® chlorite (System  
 log book).
- ▶ Check the flow rate in the bypass.
- ▶ Check the system for leaks.

### Maintenance of the metering pumps

Check for:

- firm seating of the liquid end screws
- firm seating of discharge line (discharge / intake side)
- firm seating of pressure valve and intake valve
- Moisture at the leakage bore in the head washer (moisture indicates probable diaphragm  
 rupture)
- Press the "Suction" button to check that the metering pumps are feeding correctly.

## 10 Repair



### WARNING

Repairs to the Bello Zon® system must be carried out by ProMinent service technicians.

## 11 Troubleshooting

### Liquid is leaking from the head washer of a pump

Cause: the liquid end is leaking at the pump diaphragm  
 Remedy: ▶ tighten the Allen screws on the liquid end  
 If this does not work, notify ProMinent service technician.

### Liquid is leaking from a air bleed cock

Cause: the internal seals are not pressed together hard enough  
 Remedy: ▶ depressurise the line and put on protective equipment  
 ▶ Detach the tubing from one of the opposite connections of the bleed  
 tap  
 ▶ Pull the toggle off the air bleed cock  
 ▶ Turn the toggle around and use as a tool to tighten the locking screw  
 in the air bleed tap (left-hand thread).  
 If this does not work, notify ProMinent-Service.

**Metering stops - green LED L 6 and/or L 10 "Metering pump" (see Fig. 1) does not light up at pump strokes - after 8 strokes -> "Fault pump x"**

- Cause: a feed monitor has been changed  
 Remedy: ▶ reset feed monitor-see section 7.5  
 Cause: the back pressure has risen  
 Remedy: ▶ eliminate the cause of the high pressure build-up  
 Reset the feed monitor in the case of a slight pressure build-up  
 see section 7.5  
 Cause: air in the line from the drum to the feed monitor - leak in the line from the drum to the feed monitor  
 Remedy: ▶ drum empty - See section 4. 6 @  
 Cause: leak in the line from the drum to the feed monitor  
 Remedy: ▶ contact customer service

**A pump is not metering, although LED L 6 and/or L 10 "Metering pump" (see Fig. 1) flashing yellow**

- Cause: air trapped in the liquid end.  
 Remedy: ▶ bleed as described in "Commissioning" section 6.3.  
 Cause: the stroke length is set too low.  
 Remedy: ▶ increase stroke length with adjusting knob.

**A pump is not metering, although LED L 5 and/or L 9 "Metering pump" (see Fig. 1) flashing red - Error message "Fault Pump X"**

- Cause: the metering volume has dropped (by more than 30 %) due to increased operating pressure or increased suction lift.  
 Remedy: ▶ reset feed monitor (see section 7.5).  
 Cause: the pump plug has come loose or the cable is not connected correctly.  
 Remedy: ▶ check the orange cable connection from the pump to the controller.  
 Cause: faulty setting of the air bleed cock in the corresponding discharge line.  
 Remedy: ▶ readjust air bleed cock (note symbol on handle).

**A pump is not metering, although LED L 5 and/or L 9 "Metering pump" (see Fig. 1) flashing red - Error message "Tank X EMPTY"**

- Cause: component tank empty.  
 Remedy: ▶ change both drums, (**WARNING** see section 7.1) Bleed suction lines.

**"Bypass" LED L3 (see Fig. 1) lit red - error message "Fault bypass"**

- Cause: a ball valve in the bypass (Fig. 5 -12) is not open.  
 Remedy: ▶ open the ball valve in the bypass.  
 Cause: the cable connection from the bypass monitor to the controller is defective.  
 Remedy: ▶ repair the cable connection from the bypass monitor to the controller  
 Cause: if present the bypass pump is not pumping.  
 Remedy: ▶ check the bypass pump.  
 Cause: the float in the flow meter is blocked.  
 Remedy: ▶ remove the blockage and clean the flow meter.  
 Cause: the limit value contact is defective.  
 Remedy: ▶ check the limit value contact and replace if necessary.

**A metering pump is not priming despite 100 % stroke length and bleeding**

- Cause: crystalline deposits on the ball seats due to valves drying out.  
 Remedy: ▶ raise the intake hose for a short period, flush pump well  
 (**WARNING** see section 9.1.2)  
 If this does not work, dismantle the valves and clean.

**Metering pump has been working for a long time but suddenly stops pumping.**

- Bleed discharge line, check level in the tank, if this does not work:  
 Cause: diaphragm on the pump probably defective.  
 Remedy: ▶ contact customer service.

**Pump is not metering, LED L 5 and/or L 9 (see Fig. 4) not lit (yellow)**

- Cause: problem with the mains voltage for the pump  
 Remedy: ► check for presence of mains voltage  
 Cause: the pump fuse is defective.  
 Remedy: ► have fuse checked by customer service and replace if necessary.

**NOTE**

**Use only the specified fuse sizes (see section 6).**

**If the fault is not rectified by changing the fuse, contact ProMinent Service.**

| Fault                      | Error message                  | Effect                 | Decel.          | LED red  | Acknowledge | Warn. relay | Alarm relay | Action   |
|----------------------------|--------------------------------|------------------------|-----------------|----------|-------------|-------------|-------------|--|
| Feed monitor Acid pump     | Error Pump S                   | Metering stops         | after 8 strokes | flashing | man.        | on          | on          | bleed or set monitor                                     |
| Feed monitor Chlorite pump | Error Pump C                   | Metering stops         | after 8 strokes | flashing | man.        | on          | on          | bleed or set monitor                                     |
| level acid prewarning      | Supply S low                   | Metering does not stop |                 | on       | man.        | on          |             | Prepare to change tank                                   |
| level chlorite prewarning  | Supply C low                   | Metering does not stop |                 | on       | man.        | on          |             | Prepare to change tank                                   |
| level acid                 | Tank S EMPTY                   | Metering stops         |                 | flashing | man.        | on          | on          | Change tank  |
| level chlorite             | Tank C EMPTY                   | Metering stops         |                 | flashing | man.        | on          | on          | Change tank  |
| Qby < Qbymin               | Fault bypass                   | Metering stops         | 0.7 Sec.        | on       | auto        | flashing    |             | Seek cause   |
| Circuit board failure or   | Flow input failed*             | Metering stops         | 5 Sec.          | flashing | man.        | on          | on          | Check circuit board 3.7mA>power signal>23mA Check signal |
| Circuit board failure or   | Control input failed.*         | Metering stops         | 5 Sec.          | flashing | man.        | on          | on          | Check circuit board 3.7mA>power signal>23mA Check signal |
| Circuit board failure or   | Remote control contact failed* | Metering stops         | 5 Sec.          | flashing | man.        | on          | on          | Check circuit board 3.7mA>power signal>23mA Check signal |
| Circuit board failure      | Remote control contact failed* | Metering stops         | 5 Sec.          | flashing | man.        | on          | on          | Check circuit board                                      |
| Circuit board failure      | Feed monitor failed*           | Metering stops         | 5 Sec.          | flashing | man.        | on          | on          | Check circuit board                                      |
| Circuit board failure      | Feed monitor failed*           | Metering stops         | 5 Sec.          | flashing | man.        | on          | on          | Check circuit board                                      |
| Supply voltage offs        |                                | Metering stops         |                 | off      | off         | on          |             | seek cause   |

\*First try to remedy the problem with a reset. To do this, disconnect the controller from the mains power for a few seconds. If this does not work, change the circuit board.

Table 6

**NOTE**

- If metering is off, the controller will not control the pump and will ignore all input signals.
- If consulting ProMinent about a fault, please have following information ready:
  - the Identcode (see info displays),
  - the version number (for hardware and software, see info displays) and
  - the precise error message text (if displayed).

**Changing the mains fuse in the controller**



**IMPORTANT**

- Disconnect the controller from the power supply and prevent from being switched on again.
- Use only original fuses from ProMinent.

- Undo the four flat head screws
- Remove the front section (see Part 1, section. 4.2)
- Open the fuse holder - bayonet catch (see Part 1, "Wiring diagram")
- Replace the defective fuse with a new one
- Re-attach the bayonet catch
- Close the housing.

Use only the following 5 x 20 mm fine fuses from ProMinent:

|                          | Order no.: |                    |
|--------------------------|------------|--------------------|
| Mains voltage 200-240 V: | 712057     | (0.2 A super slow) |
| Mains voltage 100-120 V: | 712021     | (0.4 A slow)       |
| Supply voltage 24 V:     | 712032     | (1.25 A slow)      |

## 12 Decommissioning



### WARNING

- Never combine the contents of the component tanks. This would cause a large quantity of toxic, explosive  $\text{ClO}_2$  gas to be generated.
- Never pour the contents of the vent bottles back into the component tanks. The danger of confusion is too great.  
This would cause a large quantity of toxic, explosive  $\text{ClO}_2$  gas to be generated.
- Never place both suction lances together or one after the other into the same bucket.  
This would cause a large quantity of toxic, explosive  $\text{ClO}_2$  gas to be generated.
- Never adjust air bleed cocks Corrosive chemicals may leak out.

### 12.1 For a short period

To decommission the Bello Zon® system for a short time only, simply press the “Start /Stop” button (“Metering STOP” appears). You do not need to disconnect the power supply for the system controller. The power supply to a chlorine dioxide metering point, if present, may not be cut off for longer than 2 h.

### 12.2 For a longer period

Chlorine dioxide is an unstable compound which breaks down over time. If decommissioning the Bello Zon® system for several days you should flush out the reactor with water. Use the flushing assembly in the bypass line (see Fig. 7, part 1).

#### Flush reactor, detoxify reactor contents



### WARNING

- Wear suitable protective equipment for  $\text{ClO}_2$  gas,  $\text{ClO}_2$  solution, hydrochloric acid, sodium chlorite and caustic soda (protective goggles, rubber gauntlets, gas mask, rubber apron. . . )! In the event of contact with one of these chemicals, rinse immediately with plenty of cold water.
- Observe national and local directives.
- Never leave the reactor contents in a toxic state. The  $\text{ClO}_2$  solution will form an explosive  $\text{ClO}_2$  gas in a short time.

#### Materials required

- Approx. 3 m hose
- 1 tank for neutralisation (see Table)
- 1 l caustic soda 50 % (C, corrosive)
- 1 l hydrogen peroxide 30 % (Xi, irritant)
- 1 pH meter (ideally pH-paper, but is bleached by  $\text{ClO}_2$ )
- Potable water (see table)

Quantity specifications for detoxification

| System type   | Neutralisation tank | Water volume | Caustic soda | Hydrogene peroxide* | Reactor contents with tower packing |
|---------------|---------------------|--------------|--------------|---------------------|-------------------------------------|
| CDV 15 - 120  | 20 l                | 5 l          | 27 ml        | 8 ml                | 0.4 l                               |
| CDV 220 - 600 | 80 l                | 20 l         | 130 ml       | 37 ml               | 1.8 l                               |

Table 7

\* Instead of  $\text{H}_2\text{O}_2$  you can use a desert spoonful of sodium perborate,  $\text{NaBO}_2 \cdot \text{H}_2\text{O}_2 \cdot 3 \text{H}_2\text{O}$

**Flushing reactor**

Before dismantling the Bello Zon® system, force the contents of the discharge line and the reactor from the bottom to the top with water. For this purpose, either pump water from the intake side through the system or run the system with water instead of the chemicals:

- ▶ Switch off metering with the “Start /Stop” button
- ▶ Switch to “Configure?” menu
- ▶ Set the “Run-in period” parameter to at least 30 min in the “Start up” settings menu
- ▶ Place each suction lance in a separate bucket filled with clean water
- ▶ Connect a hose to the purge valve of the flushing assembly
- ▶ Insert the hose into a tank containing in neutralisation solution (see below)
- ▶ Open the purge valve
- ▶ Press the “Suction” button and set the stroke lengths of both metering pumps to 100 %
- ▶ Run the Bello Zon® system until the pump liquid ends, the reactor and the lines as far as the flushing assembly are filled with water (during disassembly this will prevent ClO<sub>2</sub> solution from flowing out of the reactor)
- ▶ Disconnect the system completely from the mains power supply.

**Detoxifying reactor contents**

- ▶ After emptying the reactor, dilute its contents at least 10:1 in the neutralisation tank provided. Fill the neutralisation tank a quarter full with water before flushing process.
- ▶ Add the quantity of caustic soda required for neutralising while stirring (protective equipment).
- ▶ Then add the calculated quantity of hydrogen peroxide while stirring (overdose is uncritical). If the yellowish-green solution does not immediately discolour, check the pH value: it must be above pH 8 - if necessary correct with more caustic soda.

**CAUTION**

**Add the alkaline flushing water to the neutralisation tank for neutralisation.**

- ▶ In the final stage, allow ClO<sub>2</sub>-free water to run through the bypass for about 5 min.

**12.3 Preparing for frost-proof storage**

Should you need to winterise the Bello Zon® system you must empty the reactor and bypass line completely. For this you need to fully reconnect the Bello Zon® system.  
Emptying reactor:

**WARNING**

**Flush reactor for least 30 min (see “Decommissioning for a longer period”). Otherwise toxic ClO<sub>2</sub> solution or ClO<sub>2</sub> gas can leak out.**

- ▶ Flush the system with water (see “Decommissioning for a longer period”)
- ▶ Open the ball check valve at the reactor outlet/bypass

**CAUTION**

**If a reactor cabinet is present: Before dismantling the intake valves on the bottom of the reactor, press the “Suction” button, to extract the remaining ClO<sub>2</sub> gas from the reactor cabinet.**

- ▶ Dismantle the intake valves on the bottom of the reactor and empty the reactor.

## 13 Disposal



### WARNING

Flush the whole Bello Zon® system with water (see “Decommissioning”). If necessary, flush the empty component tanks as well.

The Bello Zon® system may otherwise still contain hydrochloric acid (HCl), sodium chlorite (NaClO<sub>2</sub>) and chlorine dioxide (ClO<sub>2</sub>).



### IMPORTANT

Observe all relevant disposal directives for your area (particularly with regard to electronic waste).

## 14 Technical data

Ambient conditions for storage and transport:

|              |  |
|--------------|--|
| Temperature: | -10 °C to +40 °C                         |
| Humidity:    | < 92 % relative humidity, non condensing |
| Sunlight:    | protect from direct sunlight             |

Operating temperatures:

|  |                  |
|--|------------------|
| Admissible ambient temperature range:          | +10 °C to +40 °C |
| Admissible temperature of water to be treated: | +2 °C to +40 °C  |
| Admissible component temperature (chemicals)*: | +10 °C to +40 °C |

\*You may require heating systems for the chemical lines if ambient temperatures are below 15 °C when working at maximum stroke rate and 100 % stroke length.

Maximum admissible temperatures for bypass water

| Bypass material PVC-U               |                             | Bypass material PVC-C               |                             |
|-------------------------------------|-----------------------------|-------------------------------------|-----------------------------|
| Max. adm. operating pressure in bar | Max. adm. temperature in °C | Max. adm. operating pressure in bar | Max. adm. temperature in °C |
| 10                                  | 40                          | 10                                  | 50                          |
| 8                                   | 45                          | 8                                   | 57                          |
| 2.5                                 | 60                          | 3.5                                 | 80*                         |

Table 8

\* At higher temperatures the dissolved chlorine dioxide is extracted in the open.

The set-up location must be well-ventilated.

### Contact and moisture protection

|                                    |   |
|------------------------------------|---|
| •Controller:                       | IP 65   |
| •Solenoid valve, extractor system: | IP 65   |
| •Bypass pump:                      | IP 54 (stainless steel)<br>(IP 44 (cast iron) ) |

### Sound pressure level

<70 dB(A) at maximum output (without bypass pump)

| Bello Zon®<br>CDVa | Chlorine<br>dioxide<br>metering* | Max.<br>operating<br>pressure<br>bar | operating-<br>temperature<br>°C | Max.<br>stroke<br>rate<br>strokes/h | Feed rate<br>rate per<br>component* | Metering<br>pump<br>type<br>Bello Zon® | Max. pump<br>priming<br>lift in**<br>mwh<br>version | Dimensions<br>(HxWxD)#<br>mm | Weight.##<br>(max.)###<br>kg | Power<br>draw<br>230 V 115 V 24 V |        |        |
|--------------------|----------------------------------|--------------------------------------|---------------------------------|-------------------------------------|-------------------------------------|--|---|------------------------------|------------------------------|-----------------------------------|--------|--------|
| CDVa 15            | 15                               | 8                                    | 10-40                           | 10800                               | 0,38                                | BT4 - 1000                             | 1,8   | 900x1160x210                 | 18,8                         | 2,7 A                             | 8,4 A  | 6,4 A  |
| CDVa 35            | 46                               | 8                                    | 10-40                           | 10800                               | 1,15                                | BT4 - 1001                             | 2,0   | 900x1160x210                 | 18,8                         | 2,7 A                             | 8,4 A  | 6,4 A  |
| CDVa 60            | 66                               | 8                                    | 10-40                           | 10800                               | 1,65                                | BT4 - 1002                             | 2,5   | 900x1160x210                 | 18,8                         | 2,7 A                             | 8,4 A  | 6,4 A  |
| CDVa 120           | 130                              | 8                                    | 15-40                           | 10800                               | 3,25                                | BT4 - 1005                             | 3,0   | 900x1160x210                 | 19,2                         | 2,7 A                             | 13,4 A | 10,0 A |

Tabelle 9

\*The feed rates are determined at an average operating pressure of 5 bar and an operating temperature of 20 °C with warmed-up pump (min. 3 hrs. at max. speed).

\*\*Priming lift with clean and wetted valves. Priming lift at 100 % stroke.

# without component tank, premixing or bypass pump

## without premixing, bypass monitor or bypass pump

### without bypass pump

## Fuse data

Use only the following fine fuses from ProMinent:

| Controller              | Order no.                             |
|-------------------------|---------------------------------------|
| Mains voltage 200-240 V | 712057, (5 x 20 mm, 0.2 A super slow) |
| Mains voltage 100-120 V | 712021, (5 x 20 mm, 0.4 A slow)       |
| Supply voltage 24 V     | 712032, (5 x 20 mm, 1.25 A slow)      |

The fuse is located in a fuse holder with a bayonet fitting in the terminal area of the controller (see Part 1, "Wiring diagram") .

Metering pumps:

Beta®:

| Fine fuse 5 X 20 mm | Order no.            |
|---------------------|----------------------|
| for 230 V           | 712021, (0.8 A slow) |
| for 115 V           | 712021, (0.8 A slow) |
| for 24 V            | 712021, (0.8 A slow) |

## Suction equipment

Priming pressure injector: 1...6 bar

Materials

|                                       |          |
|---------------------------------------|----------|
| •Hoses:                               | PTFE     |
| •Tubing, reactor, mixer, ball valves: | PVC      |
| •Controller housing:                  | PPE GF10 |
| •Panel:                               | PS       |

## 15 Spare parts

### Fuses

Use only the following fine fuses from ProMinent:

Controller:

|                         |                                       |
|-------------------------|---------------------------------------|
| Fine fuse 5 X 20 mm     | Order no.                             |
| Mains voltage 200-240 V | 712057, (5 X 20 mm, 0.2 A super slow) |
| Mains voltage 100-120 V | 712021, (5 X 20 mm, 0.4 A slow)       |
| Supply voltage 24 V     | 712032, (5 x 20 mm, 1.25 A slow)      |

The fuse is located in a fuse holder with a bayonet fitting in the terminal area of the controller (see Part 1, "Wiring diagram").

Metering pumps:

Beta®:

|                     |                      |
|---------------------|----------------------|
| fine fuse 5 X 20 mm | Order no.            |
| for 230 V           | 712021, (0.8 A slow) |

### Fixtures and fittings kits and spare parts

Fixtures and fittings kits are supplied as standard with the Bello Zon® system. They comprise all parts required by the customer for installation of the equipment.

- Cable glands Pg 7, Pg 9 and Pg 11 incl. seals, thrust rings and nuts.
- Washers, plugs and nuts for opened and subsequently unused snap-open apertures on the controller, in order to retain the stated enclosure rating.
- Wall plugs, screws and washers for wall-mounting the system.
- Spreading rivets in two sizes (spares):
  - grip length 7 mm, for attaching metering lines, head thickness 1 mm
  - grip length 8 mm, for attaching bypass line and cable duct, head thickness 3 mm

Fixtures and fittings kit  
see "Spare part kits" table

Order no. 791388

### Spare part kits

| System type  |              |            | CDV 15       | CDV 35       | CDV 60       | CDV 120      | CDV 220      | CDV 600      | CDV 2000     |   |
|--|--------------|------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|---|
| Spare parts list 81_01-404_00_14-14                |              |            | Set          | A            | B            | C            | D            | E            | G            | H |
| Spare part kit systems, set                        |              |            |              | 1022252      | 1022253      |              | 1022264      | 1022265      |              |   |
| Spare part kit, liquid end                         |              |            | S/C          | 1022266      | 1022267      | 1022268      | 1022269      |              |              |   |
| Spare part kit, metering lines                     |              |            | 1022272      |              |              |              |              |              |              |   |
| Fuses  | Pumps<br>S/C | 200V       | 712022       |              |              |              | -            | -            |              |   |
|  |              | 230V       |              |              |              |              |              |              |              |   |
|  |              | 100V       |              |              |              |              |              | -            | -            |   |
|  |              | 115V       |              |              |              |              |              |              |              |   |
|  |              | 24VDC      |              |              |              |              |              |              |              |   |
|  | Controller   | 200 / 230V | 712057       |              |              |              |              |              |              |   |
|  |              | 100 / 115V | 712021       |              |              |              |              |              |              |   |
|  |              | 24VDC      | 712032       |              |              |              | -            |              |              |   |
| Spare 3-way bleed cock S                           |              |            | 1002054      |              |              |              | 1002139      | 1002142      | -            |   |
| Spare 3-way bleed cock C                           |              |            | 1002158      |              |              |              | 1002140      | 1002141      | -            |   |
| Spare 3-way ball valve type 343<br>PVC/FPM DN10-20 |              |            | 1002038      |              |              |              |              |              |              |   |
| Spare chemical reactor input valve S/C             |              |            | 1002041      |              |              |              | 1002042      | 1002042      | 1002043      |   |
| ET Bund cover with seal. PM CDVb 15-120            |              |            | 1010878      |              |              |              |              |              |              |   |
| ET Bund cover with seal. neutral CDVb 15-120       |              |            | 1010721      |              |              |              |              |              |              |   |
| ET Bund cover seal CDVb 15-120                     |              |            | 1012909      |              |              |              |              |              |              |   |
| ET Feed monitor B                                  |              |            | B<br>1022412 | B<br>1022412 | B<br>1022412 | C<br>1022413 | D<br>1022424 | G<br>1022425 | J<br>1022426 |   |

Table 10

Spare part kits

More spare parts, see Bello Zon® Spare parts list      Order no: 987902.



## 16 Accessories

### Chemicals

| Bello Zon® acid and Bello Zon® chlorite | Order no. |
|---|-----------|
| Bello Zon® acid 30 l                    | 950130    |
| 200 l                                   | 950131    |
| 500 l                                   | 950132    |
| Bello Zon® chlorite 30 l                | 950135    |
| 200 l                                   | 950136    |
| 500 l                                   | 950137    |



### WARNING

Never use components from the Bello Zon® CDK or concentrated chemicals. The reactor could explode.

Use only Bello Zon® acid or dilute hydrochloric acid (HCl, 9 + 1 % by weight) and Bello Zon® chlorite or dilute sodium chlorite (NaClO<sub>2</sub>, 7.5 ± 0.3 % weight).

### Safety bunds

The leak monitor in the safety bunds operates by means of a float switch.

#### Safety bunds with leak monitor Order number:

|       |        |
|-------|--------|
| 40 l  | 791728 |
| 250 l | 791729 |

Supplied with: 2 bunds plus circuit board

#### Safety bunds without leak monitor Order number:

|       |        |
|-------|--------|
| 40 l  | 791726 |
| 250 l | 791727 |

Supplied with: 1 bund

#### Slanted seat valve Order number:

|       |         |
|-------|---------|
| DN 25 | 1001877 |
|-------|---------|

(for adjusting the bypass flow where a bypass pump is fitted)

#### Safety filter Order number:

|                                  |        |
|----------------------------------|--------|
| DULCOFILT® 94 safety filter G1 “ | 911056 |
|----------------------------------|--------|

Set flow at delta P = 0.2 bar: 4 m³/h

|                    |        |
|--------------------|--------|
| Spare sieve insert | 143076 |
|--------------------|--------|

Mesh size 100 µM

### Bypass pump (stainless steel)

CDV 15...120 Grundfoss pump only

CDV 220 also KSB pump

### Motor data

|                        |                              |
|------------------------|------------------------------|
| Manufacturer           | Grundfoss                    |
| Voltage rating         | 220-240 V                    |
| Rated current          | 2.2 A                        |
| Motor                  | 540 W                        |
| Speed                  | 2880 min <sup>-1</sup>       |
| Electrical protection: | integral overload protection |

Table 11

**Metering points**

|   | <b>Order no.</b> |
|---|------------------|
| Injection pipe, DN 25, PVC<br>(can be used with tubing up to diameter DN 80)                    | 1001823          |
| Injection pipe, DN 25, PVC, with ball valve<br>(can be used with tubing up to diameter DN 80)   | 1018754          |
| Immersion lance, DN 25, PVC<br>(can be used with tubing up to diameter DN 100)                  | 1001822          |
| Immersion lance, DN 25, PVC, with ball valve<br>(can be used with tubing up to diameter DN 100) | 1018753          |

**ClO<sub>2</sub> detection kit**

|                             | <b>Order no.</b>      |
|-----------------------------|-----------------------|
| DT 1 photometer 1           | 1003473               |
| Consumables for photometer, | see product catalogue |

DULCOMETER® controller, series D1C, see product catalogue  
 DULCOMETER® sensors, chlorine dioxide, see product catalogue

|                               | <b>Order no.</b> |
|-------------------------------|------------------|
| Gas detector Life CGM         | 1002837          |
| Spare sensor for gas detector | 1003009          |

**17 Options****Suction lances**

The suction lances are supplied as essential accessories with a Bello Zon® system. They are designed for the various tank heights and intake hose diameters for the corresponding system size.

The operator should specify with the order the suction lance which fits the size of tank which is to be used.

| <b>System</b> | <b>Intake hose<br/>external ø /<br/>internal-ø (mm)</b> | <b>Component tank contents</b> |                  |                  |                   | <b>Float switch<br/>2-stage</b> |
|---------------|---|--------------------------------|------------------|------------------|-------------------|---------------------------------|
|               |   | <b>30 litre</b>                | <b>200 litre</b> | <b>500 litre</b> | <b>1000 litre</b> |                                 |
| CDV 15        | 6 / 4   | 790650                         | 791563           | 791612           |                   |                                 |
| CDV 35        | 6 / 4   | 790650                         | 791563           | 791612           |                   |                                 |
| CDV 60        | 6 / 4   | 790650                         | 791563           | 791612           |                   |                                 |
| CDV 120       | 6 / 4   | 790650                         | 791563           | 791612           |                   |                                 |
| CDV 220       | 8 / 5   | 914193                         | 791567           | 791613           |                   |                                 |
| CDV 600       | 20 / 15   |                                |                  |                  | 790387            | 790318                          |
| CDV 2000      | 27 / 19   |                                |                  |                  | 790387            | 790318                          |

Table 12: Suction lances for various tank sizes

**WARNING**

Use only ProMinent-suction lances with two stage float switches for problem-free operation.

## Appendix

BUNDESVEREINIGUNG DER FIRMEN IM GAS- UND WASSERFACH E.V.

FIGAWA

TECHNISCH-WISSENSCHAFTLICHE VEREINIGUNG

Stich 1269 h

16.04.1998

**Hazardous materials data sheet, chlorine dioxide****Characteristics of chlorine dioxide and notes for handling  
with aqueous solutions**

The chlorine dioxide base solutions used in the treatment of water have a concentration of 2 g/l  $\text{ClO}_2$ . A temperature of up to 25°C results in a chlorine dioxide concentration in the gamma space of less than 100 g/m<sup>3</sup>. Thus appropriate preparation in both gamma space and base solution eliminates an explosive disintegration.

**1. Physical and chemical characteristics***1.1 Chemical characterisation*

Aqueous solution of chlorine dioxide ( $\text{ClO}_2$ ) c. 2g  $\text{ClO}_2$ /l physically dissolved chlorine dioxide gas

*1.2 Characteristics of chlorine dioxide gas*

|                |   |
|----------------|---|
| Colour:        | orange/yellow   |
| Odour:         | pungent   |
| Melting point: | - 59°C  |
| Boiling point: | 11°C  |
| Stability:     | chlorine dioxide gas disintegrates explosively in concentrations from 300g/m <sup>3</sup> ( $\sim$ 10 Vol%) in chloride and oxygen. |

Diluting reduces explosibility; the risk of explosion is eliminated where concentrations are less than 10 Vol% in gases, with which chlorine dioxide does not react (e.g. air, nitrogen, carbon dioxide).

With a critical concentration of chlorine dioxide, for example in gamma space above an aqueous chlorine dioxide solution, a chlorine dioxide concentration greater than 8g/l (at a temperature of 20°C) must be used.

An extreme, or even explosive reaction similarly occurs with oxidisable substances.

*1.3 Characteristics of chlorine dioxide aqueous solutions*

The gas is critical.

**Stability:** With no gamma space, aqueous chlorine dioxide solutions are explosive from a concentration of around 30g/l, i.e. they can disintegrate explosively by themselves, without the impact of external factors such as heat, sparking, dirt or rust.

Chlorine dioxide is stable for several days in the form of an aqueous diluted solution, as long as the solution is pure and is stored in a dark place or as long as the temperature of the solution remains below 25°C and has a pH value less than 7.

## **2. Handling with aqueous chlorine dioxide solutions**

### *2.1 Identification and notices*

Workstation and work areas are identified via notices in compliance with the accident prevention regulations "Chlorination of water" (GUV 8.15, appendix 3)

### *2.2 Storage*

Due to the danger of explosion, chlorine dioxide cannot be stored or transported either as a gas or as a concentrated aqueous solution. Hence it is only produced as a diluted (see section 1.3) aqueous solution in special equipment for immediate use.

### *2.3 Measures for filling, leaking, gas emissions*

Condense gas by spraying with water.

Pour sodium thiosulphate solution onto any solution that has leaked, then dilute with plenty of water and rinse down the drain.

### *2.4 Actions in the event of fire*

Chlorine dioxide itself is not flammable but can be combustible. Explosive disintegration at temperatures from 100°C. Cool containers with water, condense leaked chlorine dioxide gas by spraying with water. *There is no restriction on fire extinguishing substances in areas where there is a fire hazard.*

### *2.5 Disposal*

See section 2.3

## **3. Health protection**

### *3.1 MAK value and odour threshold*

MAK value: 0.1ppm (ml/m<sup>3</sup>) or 0.3 mg/m<sup>3</sup>

Odour threshold the odour of chlorine dioxide gas can be detected in air in concentrations from around 15mg/m<sup>3</sup>.

### 3.2 *Personal protection equipment*

Respiratory protection: breathing mask with filter B, coloured grey  
 Eye protection: protective goggles, protective mask  
 Hand protection: rubber gauntlets  
 Other: protective clothing

### 3.3 *Health hazards*

A concentration of chlorine dioxide gas exceeding 45mg ClO<sub>2</sub>/m<sup>3</sup> causes breathing difficulties and leads to irritation of mucous membranes and headaches.

Generally chlorine dioxide causes severe reactions in mucous membranes pertaining to the eyes and respiratory organs. Depending on the concentration and duration of exposure it can lead to a danger of suffocation, coughing fits, vomiting, burning onto the skin and severe headaches, and in serious cases to pulmonary oedema with breathing difficulties, oxygen deficiency and circulatory collapse. With brief exposure to very high concentrations there is a risk that the person stops breathing or suffers glottal spasm or cardiac arrest. Damaging to the nerves (e.g. paralysis of the eye muscles).

### 3.4 *First aid*

You should immediately remove any clothing that has come into contact with chlorine dioxide or respective aqueous solution and wash the skin thoroughly with soap and plenty of water.

Rinse the eyes well for several minutes under running water, ensuring the eye is opened as widely as possible.

After inhaling chlorine dioxide, fresh air, lie down, keep still and keep warm.

Notify the doctor immediately, even if symptoms do not appear immediately. If necessary, smooth, fast transport to hospital.

## 4. *Further information*

DVGW worksheet W 224 "Chlorine dioxide in water treatment"  
 Accident prevention regulations "Chlorination of water" (GUV 8.15)  
 Ullmann volume 5, page 551  
 Kühn-Birett, sheet C20

#### **Note:**

For preparation purposes there is a current European standard for chlorine dioxide as well as the DVGW information sheet W624 "Metering systems for chlorine dioxide", version 10/96.

#### **Notice:**

Instructions are based on current knowledge. They are intended to contribute to the safe handling of aqueous chlorine dioxide solution and are in no way an assurance of particular characteristics.

**Bello Zon®-Acid-03**

Revision 28.2.2002

page 1/3

Material Safety Data Sheet according to 91/155/EEC

**1. Product and Company identification**

Product Identification: BelloZon Acid  
Company Identification: ProMinent Dosiertechnik GmbH, 69123 Heidelberg,  
Phone +49(0)6221/842-0

**2. Composition / information on ingredients**

Hydrochloric Acid (HCl) 9 % (approx. 95 g/L)  
CAS number : 7647-01-0  
EC number : 017-002-02-7  
UN number : 1789  
EINECS number : 2315957

**3. Hazards identification of the product**

R 36/38 : irritant to eyes and skin

**4. First aid measures**

after inhalation: See a physician in case of inhalation of aerosols  
after skin contact: rinse with plenty of water. Remove contaminated clothes and rinse thoroughly.  
after eye contact: rinse immediately with plenty of water (at least 10 minutes). See an oculist.  
After ingestion: drink plenty of water. See a physician.

**5. Fire-fighting measures**

Suitable extinguishing media: not applicable  
Unsuitable extinguishing media for safety reasons: not applicable  
Special risks caused by the product itself, its combustible products or gases: Not combustible  
Special exposure hazards: no special measures required

**6. Accidental release measures**

Personal precautions: avoid substance contact with skin and eyes.  
Environmental precautions: do not allow to enter sewerage system.  
Methods of cleaning up / of removing: dilute with plenty of water and wash away, neutralize with lime, Soda, etc.

Bello Zon®-Acid-03

Revision 28.2.2002

page 2/3

Material Safety Data Sheet according to 91/155/EEC**7. Handling and storage**

Handling: Store in a well-vented place.

Storage: keep original tank tightly closed until use of chemical. Avoid heat and frost.

**8. Exposure controls and personal protection**

Additional information on the system design: no further requirements, see chapter 7.

Components with specific control parameters: none

Personal protection:

Eye protection: protective eyeglasses

Hand protection: protective gloves

**9. Physical and chemical properties:**

physical state: liquid

colour: colourless

pH-value: approx. 0.5 (undiluted at 20 °C)

freezing point: below -10 °C

flash point: not applicable

vapour pressure: (aqueous solution)

relative density: approx. 1.05 kg/L (20 °C)

solubility: miscible in water

**10. Stability and reactivity**

Conditions to avoid: no decomposition if used as directed

Materials to avoid: reaction with Bellozon-Chlorite: formation of chlorine dioxide

Reaction with lyes: heat formation

Reaction with acid: formation of hydrogen

Hazardous decomposition products: none

**11. Toxicological Information**

Ingestion: LD 50 : > 2000 mg/kg (calculated)

Skin contact: Irritation

Eye contact: Irritation

Material Safety Data Sheet according to 91/155/EEC**12. Ecological information**Data regarding persistence and degradability

Degradability: not pertinent, inorganic product

aquatic toxicity: acute fish toxicity: LC50 > 2000 mg/L product

Product and Spill residues have to be neutralized to a pH in accordance to local sewerage regulations.

**13. Disposal considerations**

If recycling is not possible, disposal to be done according to local waste disposal regulations.

**14. Transport information**

GGVS/ADR/GGVE/RID: 8 II

IMDG-Code: 8/ II UN 1789

ICAO/IATA: 8 UN 1789 PAX 809 CAO 813

EmS: 8-06; MFAG 700

**15. Regulatory information**

Self-classification and labelling according to 4th novel GefStoffVO/EC:

Hazard symbols: X<sub>i</sub> irritant

R-phrases: R 36/38: irritant to eyes and skin

S-phrases: S 2: keep out reach of children

S 28: after contact with skin wash immediately with plenty of water.

National Prescriptions: water pollution class (WGK): 1 (self classification, Germany)

toxicity class: 3 (Switzerland)

**16. Other information**

This information is based on our current level of knowledge and relates to the product in the state in which it is delivered. It is intended to describe our products from the point of view of safety requirements and is not intended to guarantee any particular properties.



Bello Zon®-Chlorite-03

Revision 28.2.2002

page 1/3

Material Safety Data Sheet according to 91/155/EEC**1. Product and Company identification**

Product Identification: BelloZon Chlorite  
Company Identification: ProMinent Dosiertechnik GmbH, D-69123 Heidelberg,  
Phone +49(0)6221/842-0

**2. Composition / information on ingredients**

Aqueous solution of Sodium Chlorite (NaClO<sub>2</sub>) 7.5 % (approx. 80 g/L)

CAS number: 7758-19-2  
EC number: 231-836-6  
UN number: 1908

**3. Hazards identification of the product**

R 32: contact with acids liberates very toxic gas  
R 36/38: irritant to eyes and skin

**4. First aid measures**

After skin contact: rinse with plenty of water. Immediately remove contaminated clothes and rinse thoroughly.  
After eye contact: rinse immediately with plenty of water (at least 10 minutes). See an oculist.  
After ingestion: drink plenty of water. Avoid vomiting. See a physician.

**5. Fire-fighting measures**

Suitable extinguishing media: water, extinguishing foam

Unsuitable extinguishing media for safety reasons: Halone, CCl<sub>4</sub>, carbon dioxide

Special risks caused by the product itself, its combustible products or gases: dried solution increase the flammability of combustibles, in event of fire risk of formation of toxic gases: chlorine dioxide

Special exposure hazards: breathe protection at formation of chlorine dioxide

**6. Accidental release measures**

Personal Precautions: avoid substance contact with skin and eyes.

Environmental precautions: do not allow to enter sewerage system.

Methods of cleaning up / of removing: dilute with plenty of water and wash away, do not allow drying in of solution

**7. Handling and storage**

Handling: keep away from acids and reducing chemicals.

Storage: keep original tank tightly closed until use of chemical. Avoid sun, heat and frost as well as contamination of the product.

Material Safety Data Sheet according to 91/155/EEC**8. Exposure controls and personal protection**

Additional information on the system design: ensure supply of fresh air in enclosed rooms.

Components with specific control parameters: at formation of  $\text{ClO}_2$ : maximum admissible concentration: 0.1 ppm (0.3 mg/m<sup>3</sup>)

Personal protection:

Eye protection: protective eyeglasses

Hand protection: protective gloves (PVC, PE, no rubber)

Respiratory protection: protection mask, when  $\text{ClO}_2$  is liberated

**9. Physical and chemical properties:**

physical state: liquid

colour: colourless

pH-value: approx. 12 (undiluted at 20 °C)

freezing point: below -5 °C

flash point: not applicable

ignition temperature: not applicable

vapour pressure: (aqueous solution)

explosion limits: not applicable

relative density: approx. 1.06 kg/L (20 °C)

solubility: miscible in water

**10. Stability and reactivity**

Conditions to avoid: drying of solution (can ignite upon contact with combustibles)

Materials to avoid: reaction with acid: formation of chlorine dioxide ( $\text{ClO}_2$ )

Reaction with reducing agents and sulfur containing substances: vigorous reaction

Hazardous decomposition products: stable in original solution, with acids formation of Chlorine Dioxide

**11. Toxicological Information**

No data available for the 7.5% solution.

Ingestion: LD 50 :1019 mg/kg (rat, pure substance), formation of methemoglobinemia

Skin contact: not irritating (rabbit, OECD)

Eye contact: strongly irritating (rabbit, OECD).

Bello Zon®-Chlorite-03

Revision 28.2.2002

page 3/3

Material Safety Data Sheet according to 91/155/EEC**12. Ecological information**Data regarding persistence and degradabilityDegradability: not pertinent, inorganic productaquatic toxicity: acute fish toxicity: LC50 > 500 mg/L (Brachydanio rerio, 96 h, OECD)

Spill residues can be neutralized by mixing with reducing waste water or by addition of reducing chemicals (e.g. Sodium disulfite Na<sub>2</sub>S<sub>2</sub>O<sub>5</sub>)

**13. Disposal considerations**

If recycling is not possible, disposal to be done according to local waste disposal regulations.

**14. Transport information**GGVS/ADR/GGVE/RID: 8/61bIMDG-Code: 8/ UN 1908 PG.IIICAO/IATA: 8 UN 1908 PG. II / Drill 8LEmS: 8-06; MFAG 741**15. Regulatory information**Self-classification and labelling according to 4th novel GefStoffVO/EC:Hazard symbols: X<sub>i</sub> irritantR-phrases: R 32: contact with acid liberates very toxic gas

R 36/38: irritant to eyes and skin

S-phrases: S 14: keep away from acids

S 26: in case of contact with eyes, rinse immediately with plenty of water and seek medical advice.

S 36/37/39: wear suitable protective clothing, gloves and eye/face protection

National Prescriptions: water pollution class (WGK): 1 (Germany)toxicity class: 3 (Switzerland)**16. Other information**

This information is based on our current level of knowledge and relates to the product in the state in which it is delivered. It is intended to describe our products from the point of view of safety requirements and is not intended to guarantee any particular properties.

## EC Declaration of Conformity

We,

**ProMinent Dosiertechnik GmbH**  
**Im Schuhmachergewann 5 - 11**  
**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 : ***CDVb***

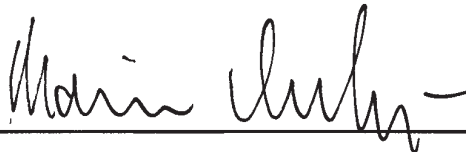
Serial number : ***see type identification plate on device***

Relevant EC regulations : ***EC - machine regulation (98/37/EC)***  
***EC - low voltage regulation (73/23/EEC)***  
***EC - EMC - regulation (89/336/EEC subsequently 92/31/EEC)***

Harmonised standards used, in particular Pump without motor: ***EN 292-1, EN 292-2, EN 809, EN 938, EN 934, EN 939, EN 1050, EN 12671***  
 Motor Ex "e": ***EN 60335-1 A6, EN 60335-2-41***  
 Motor Ex "d": ***EN 50081-1/2, EN 50082-1/2, EN 60801-2, EN 61000-6-2***  
 Stroke sensor:

National standards and other technical specifications used, in particular : ***DVGW-compilation of rules, job-sheet W224 and W226***

Date/manufacture's signature : 22.08.2003



The undersigned : ***Dr. Rainer V. Dulger, Executive Vice President R&D and Production***

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### **Literature list**

“Chlorination of Water“, VGB 65 (with instructions on execution), Carl Heymanns Verlag KG, Köln, 04/1980

“Metering systems for Chlorine dioxide“, DVGW-leaflet W 624, DVGW e.V., Eschborn, 10/1996  
“Chlordioxid in der Wasseraufbereitung“, DVGW-leaflet W 224, DVGW e.V., Eschborn, 04/1986, ISSN 0176-3504

“Chlorine dioxide in water treatment“, Dr. L. Lauer, ProMinent GmbH, Heidelberg, 1997

Water Conservation Act– WHG in der Fassung von 2002

Potable Water Ordinance– TrinkwV 2001

List of the treatment substances and disinfecting processes §11 TrinkwV, current edition