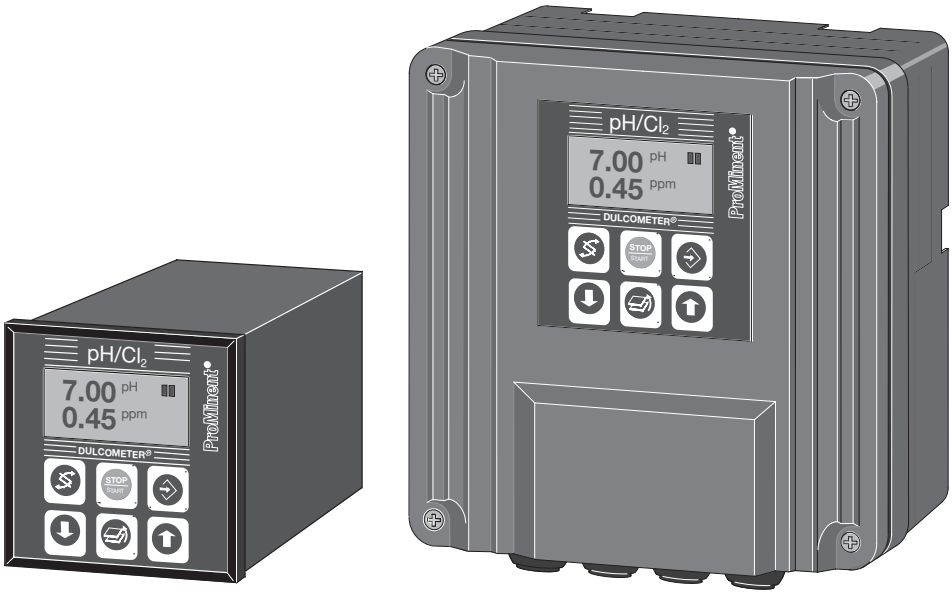
Operating Instructions
DULCOMETER® D2C
Part 2: Adjustment and Operation, Measured Variables pH/chlorine

D2C2-001-pH/chlorine-GB



type D **type W**

D2C A ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___

Please enter the identity code of your device here!

Please completely read through operating instructions! • Do not discard!
The warranty shall be invalidated by damage caused by operating errors!

Part No. 987855 **ProMinent Dosiertechnik GmbH · 69123 Heidelberg · Germany** BA DM 104 04/03 GB

1 Device Identification / Identity Code

D2C A	DULCOMETER® controller Series D2C
W	Wall mounting
D	Panel mounting (96 x 96 mm)

	Operating voltage
0	230 V 50/60 Hz
1	115 V 50/60 Hz
4	24 V AC/DC

	Measured variable 1/Measured variable 2
PC	pH (0-14 pH) / Chlorine (0...0,5/2/5/10/20/50 ppm)

	Connection of meas. variable 1 (connection meas. variable 2: 4-20 mA)
1	Terminal standard signal 4–20 mA (signal converters are necessary)
2	SN6 plug connector
5	Terminal mV

	Correction variable (Temperature for pH)
0	None
2	automatically (Pt 100 via terminal)
4	manual

	Disturbance variable connection
0	None

	Signal output
0	None
4	2 Standard signal outputs 0/4-20 mA, free programmable

	Power control
G	Alarm and 2 limit relay
M	Alarm and 2 solenoid valve relays (pulse length control)

	Control characteristic
1	Proportional control
2	PID control

	Protocol output
0	None

	Language
D	German
E	English
F	French
S	Spanish
A	Swedish
N	Dutch

D2C A	___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___

Please enter the identity code of your device here!

2 Contents / General User Information

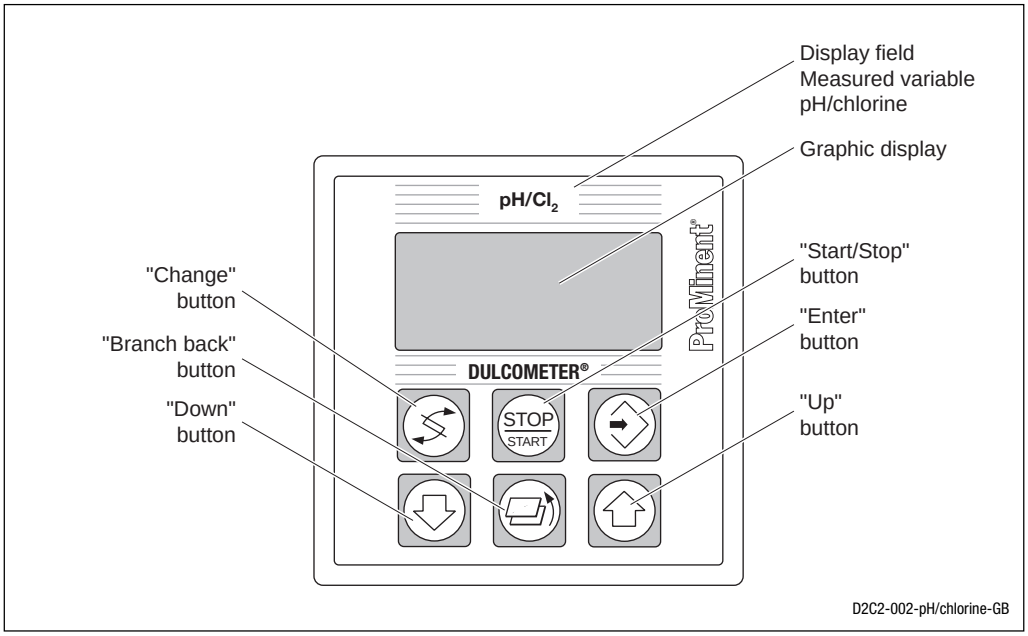
General User Information

These operating instructions describe the technical data and function of the series DULCOMETER® D2C controller, provide detailed safety information and are divided into clear steps. The activities to be carried out are identified by arrows (▶).

IMPORTANT

- ***Please observe the parts of these operating instructions applicable to your particular version! This is indicated in the Section "Device Identification/Identity Code".***
- ***Correct measuring and dosing is only possible in the case of impeccable operation of the probe. The probe has to be calibrated/checked regularly!***
- ***In the event of a probe failure, uncontrolled chemicals addition may result. We therfore recommend urgently to activate "check out time limits" with automatic control shut-off!***

3 Device Overview / Controls



	CHANGE button To change over within a menu level and to change from one variable to another within a menu point.
STOP START	START/STOP button Start/stop of control and metering function.
	ENTER button To accept, confirm or save a displayed value or status. For alarm acknowledgement.

	UP button To increase a displayed numerical value and to change variables (flashing display)
	BRANCH BACK button Back to permanent display or to start of relevant setting menu.
	DOWN button To decrease a displayed numerical value and to change variables (flashing display).

4 Functional Description

NOTE

Please refer to the description of the operating menu for a detailed description of the individual characteristics of the DULCOMETER® D2C controller!

4.1 Operating Menu

The DULCOMETER® D2C controller permits settings to be made in two different menus. All values are preset and can be changed in the complete operating menu.

The controller is delivered with a restricted operating menu so that the D2C controller can be used effectively in many applications from the very onset. If adaptations prove to be necessary, all relevant parameters can then be accessed by switching over to the complete operating menu.

4.2 Access Code

Access to the setting menu can be prevented by setting up an access code. The D2C controller is supplied with the access code 5000 which permits free access to the setting menu. The calibration menu remains freely accessible even when access to the setting menu is blocked by the code.

4.3 Control

The D2C can operate as a proportional controller or as a PID controller - dependent on the device version (see identity code) and the setting.

The controlled variable is recalculated every second. Control procedures which require rapid correction of setpoint deviations (less than approx. 30 seconds) cannot be processed with this controller. The solenoid valve control (pulse on-time) must take account of the cycle times.

The control function (reference variable output) can be switched off through the pause function and the water control input. The calculation of the regulated variable starts again with the cessation of the "pause" after expiry of the adjustable delay time "td". No fault treatment is performed with active "pause" function.

4.4 Fault messages

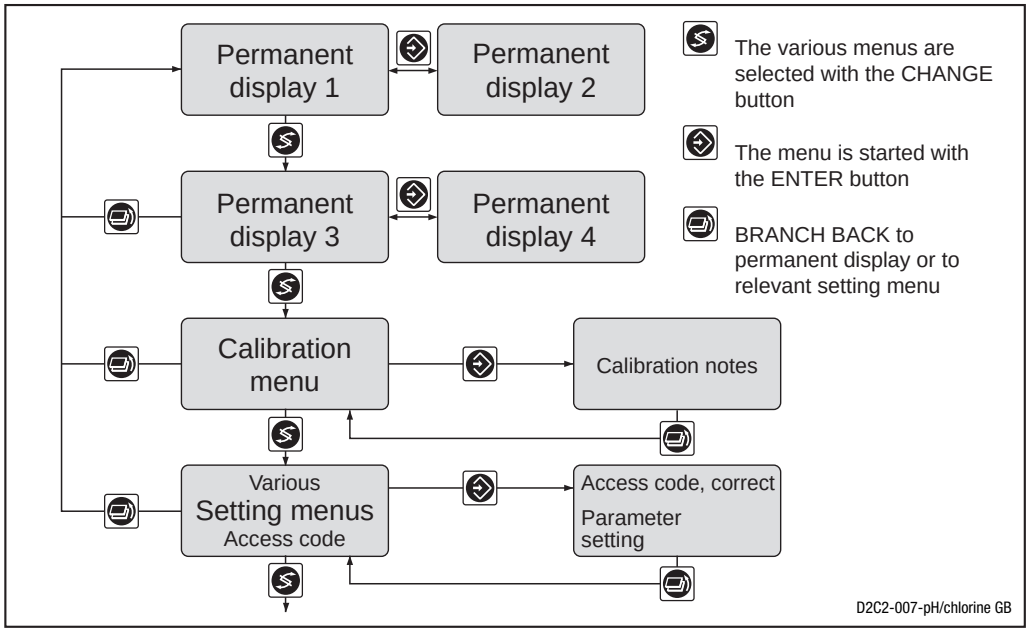
Faults to be acknowledged are shown in the permanent displays 1, 3 and 4 by the symbol "Ɛ". The corresponding fault messages and notes are shown in the permanent display 2. Faults/notes continuing after acknowledgement are shown alternatively. Faults automatically remedied throught changing operating conditions are removed from the permanent display without necessitating acknowledgement. Chapter 11 includes an overview of fault messages and causes.

5 Display Symbols

The display of the DULCOMETER® D2C controller uses the following symbols:

Symbol	Description	Comment
1	Limit value transgression measured value 1 Relay 1 upper or zone	Symbol left
↓	Relay 1 lower	Symbol left
1	Limit value transgression measured value 2 Relay 2 upper or zone	Symbol right
↓	Relay 2 lower	Symbol right
▮	Metering pump measured value 1 Control OFF	Symbol left
▯	Control ON	Symbol left
▮	Metering pump measured value 2 Control OFF	Symbol right
▯	Controll ON	Symbol right
◢	Solenoid valve measured value 1 Controll OFF	Symbol left
◿	Controll ON	Symbol left
◣	Solenoid valve measured value 2 Controll OFF	Symbol right
◺	Control ON	Symbol right
O	Stop button pressed	
M	Manual metering	
pause	Delay time "td"	Control starts after expiry of "td"
Ɛ	Fault	

6 Operation



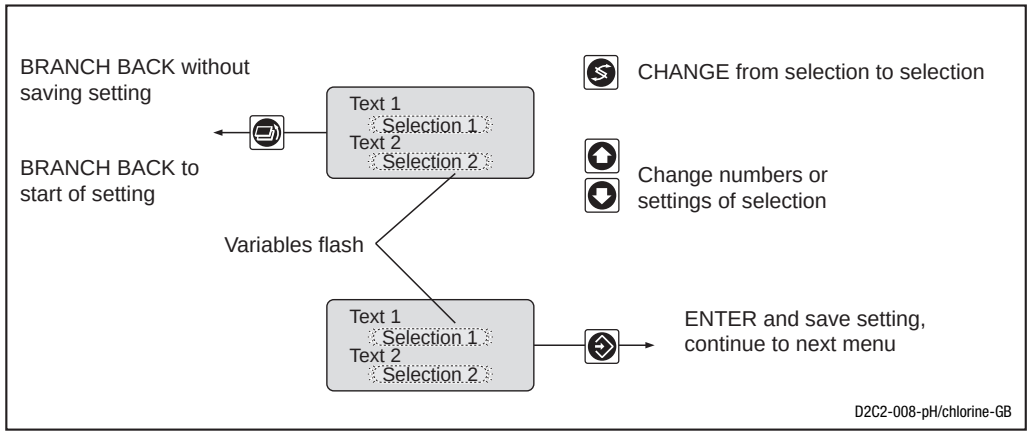
NOTE

Access to the setting menus can be barred with the access code!

The number and scope of setting menus is dependent on the device version!

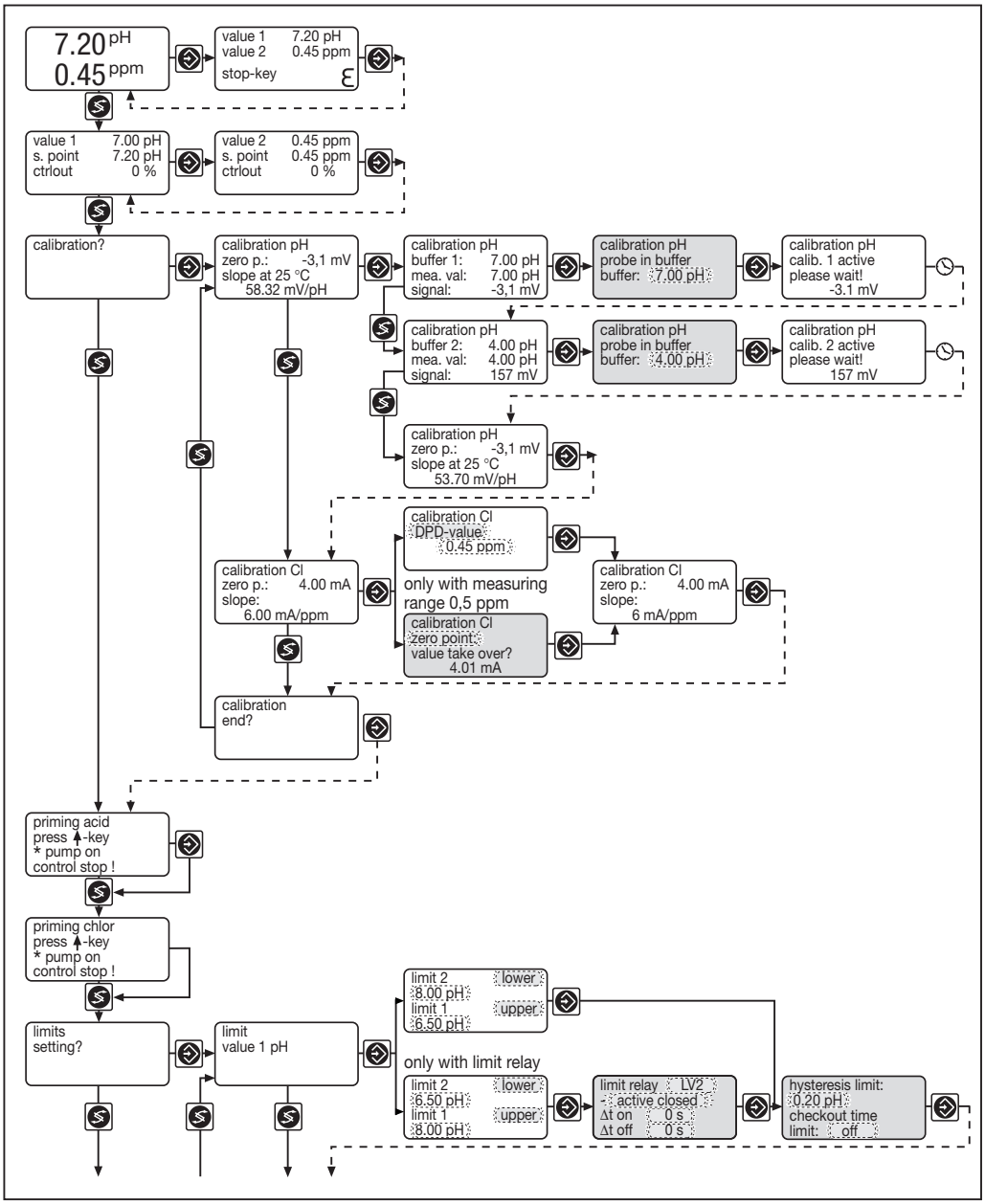
If the access code is selected correctly in a setting menu, then the following setting menus are also accessible!

If within a period of 10 minutes no button is pushed, the unit automatically branches back from the calibrating menu or a setting menu to the permanent display 1.

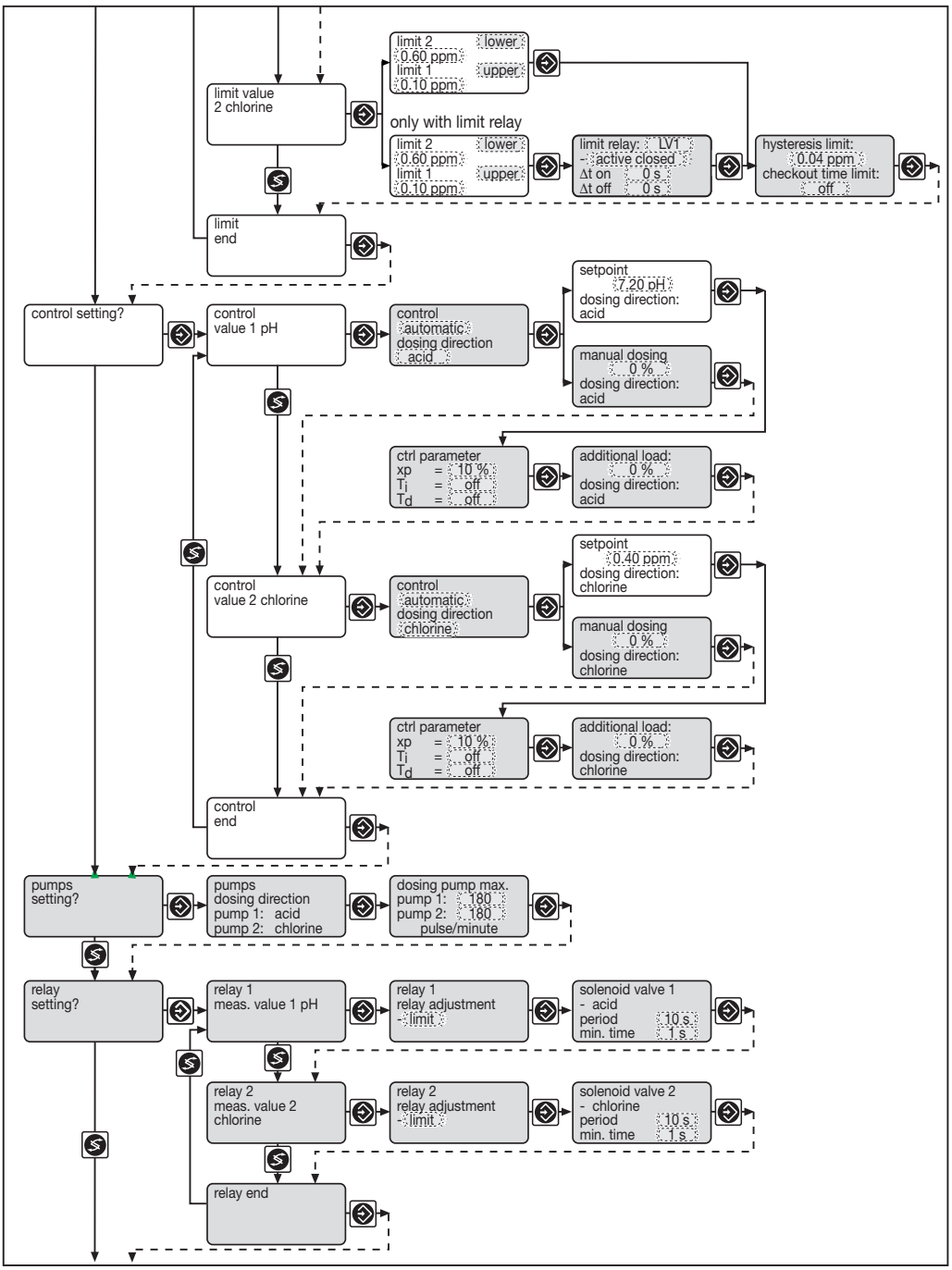


7 Operating Menu / Overview

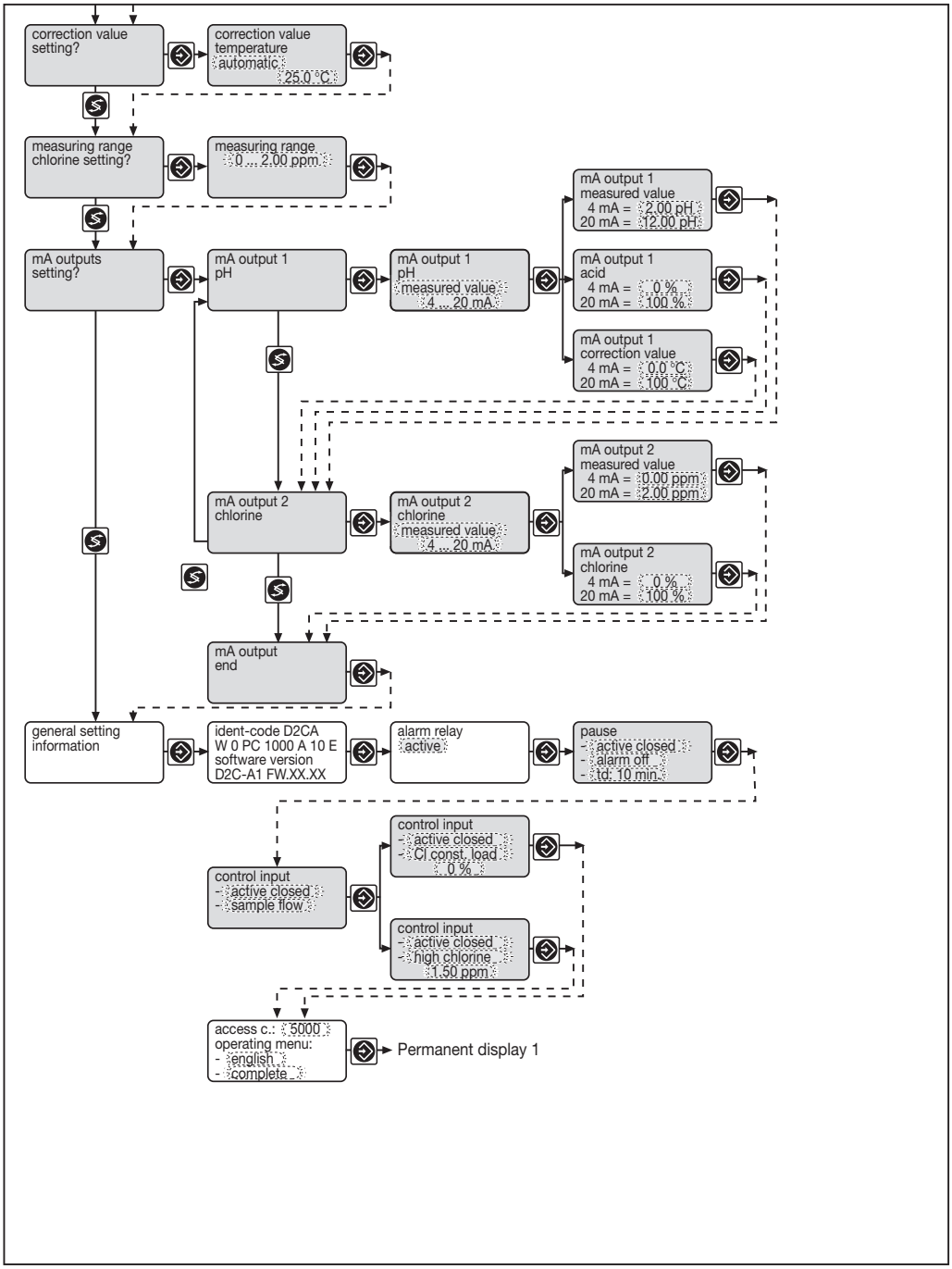
The setting menus highlighted in grey and the adjustable parameters are only visible in the complete operating menu.



Operating Menu / Overview

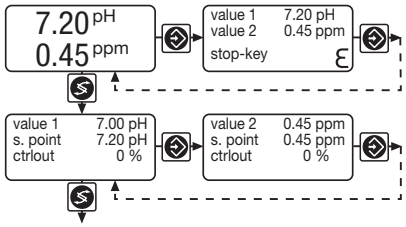


Operating Menu / Overview



8 Operating Menu / Description

Permanent displays

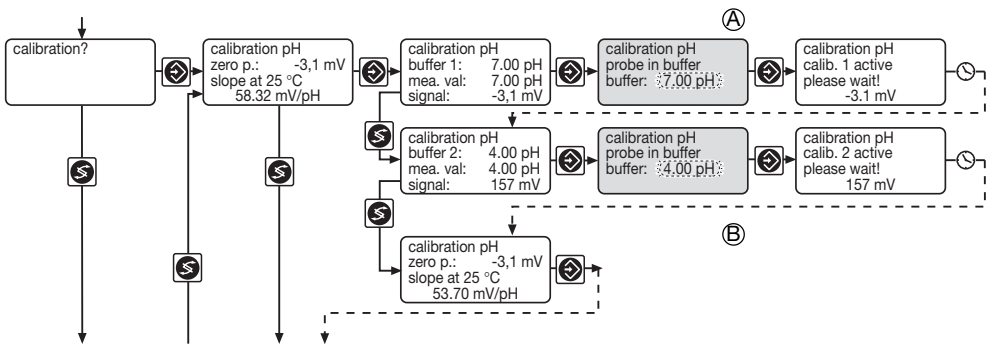


The permanent displays 1 to 4 serve information on fault messages/causes (see also table on page 22) as well as on operating values/settings.

Calibration

Calibration of pH probe:

The calibration of the pH probe uses a two-point calibration method (zero point, slope). As buffer pH 7 (zero point calibration) and pH 4 (slope calibration) are factory-set. If other buffers are to be used, the defaults in the complete operating menu (menu A, B) may be altered. During calibration control is stopped and metering is reduced to the set base load. The output 0/4...20 mA (measuring value) will be frozen. After successful calibration, all fault determinations relating to the measuring value are started again. The current probe data (zero point/slope) will be displayed.



	Initial value	Possible values Increment	Lower value	Upper value	Remarks
Buffer values	pH 7 pH 4	0.01 pH	-2 pH	16 pH	Error messages when both buffers too close (<2 pH-values)

Error message	**Condition**	**Effect**	
Buffer distance too small	ΔBuffer <2 pH	During calibration procedure: Recalibrate buffer 2!	
		Return to permanent display:	
pH zero point low	< -60 mV	Basic metering load	Warning, old zero point and slope retained
pH zero point high	< +60 mV	"	"
pH slope low	<45 mV/pH	"	"
pH slope high	>65 mV/pH	"	"
Measured value pH unsteady			"

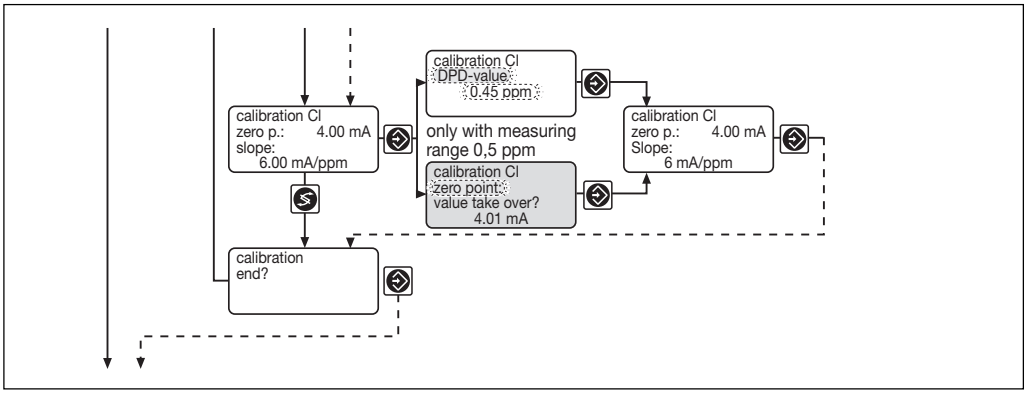
Calibration of the chlorine probe

The calibration (slope calibration) of the chlorine probe uses the DPD method. When starting calibration, the frozen measuring value is proposed; this value may be adjusted to the measured DPD value using the Up and Down buttons. A calibration will only be possible if the DPD value is ≥ 2% of the measuring range. During calibration, control function and metering are maintained. After successful calibration, all fault determinations relating to the measuring value are started again.

With a measuring range adjusted to 0 - 0.5 ppm, the zero point may be calibrated in the entire operating menu in addition to the slope. The zero point calibration should be performed under realistic condition with **chlorine-free** water. In this case, control will be stopped and metering will be reduced to the set base load. The output 0/4...20 mA (measuring value) will be frozen.

IMPORTANT

The measuring range of the chlorine probe must correspond to the adjusted measuring range of the DULCOMETER® D2C (factory setting 0 - 2.00 ppm). A possible alteration of the measuring range (see page 19) must be done prior to calibration. If the measuring range is altered, all settings are reset to the factory settings.



		Possible values		
	Initial value	Increment	Lower value	Upper value
DPD-value	measured value	0.01 ppm	0 ppm	20 ppm
zero point	measured value (mA)	–	–	–

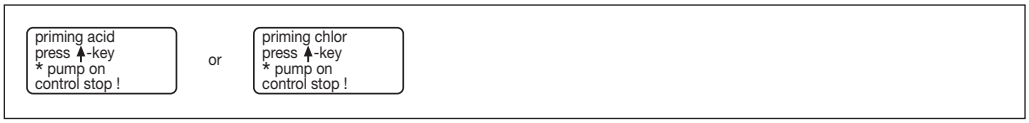
Error message	Condition	Effect
Calibration Cl not possible probe slope too low	Cl slope too low (<25% of standard slope)	Repeat calibration
Calibration Cl not possible probe slope too high	Cl slope too high (>300% of standard slope)	Repeat calibration
DPD value too low DPD > x.xx ppm	DPD <2 % of measuring range	Repeat calibration after addition of chlorine
Zero point too high	probe signal >5 mA	Repeat calibration in chlorine-free water
Zero point too low	probe signal <3 mA	Check probe connection replace probe, if necessary

Priming

Metering pumps without an integrated electronic controller need to be commissioned after changing a tank or when starting up the metering equipment for the first time.
It is essential to prime (filling the pump and suction line with chemical) and completely vent the discharge line up to the discharge valve for the metering equipment to function correctly (see operating instructions for metering equipment and pump!)

To carry out this function, see priming menu.

Priming:



To prime with pH corrective agent or oxidant, press the change key to access the Prime (acid/alkali) or Prime oxidant settings menu. Press the Up key, the control variable will jump to 100 % and the pump will run for approx. 30 sec. The same applies if the Start/stop key is pressed or if metering stops due to an error signal.

Stop priming:

▶ press any key

Every time you press the Up key the pump will prime for approx. 30 seconds.

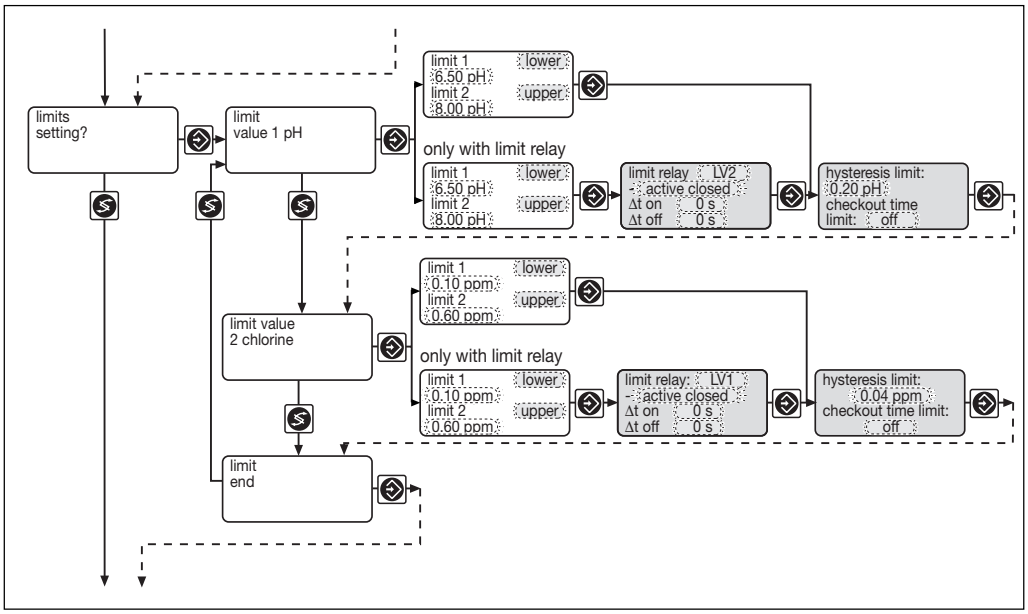
Recommence control:

▶ Access permanent display 1 and press the Start/stop key.

Limits

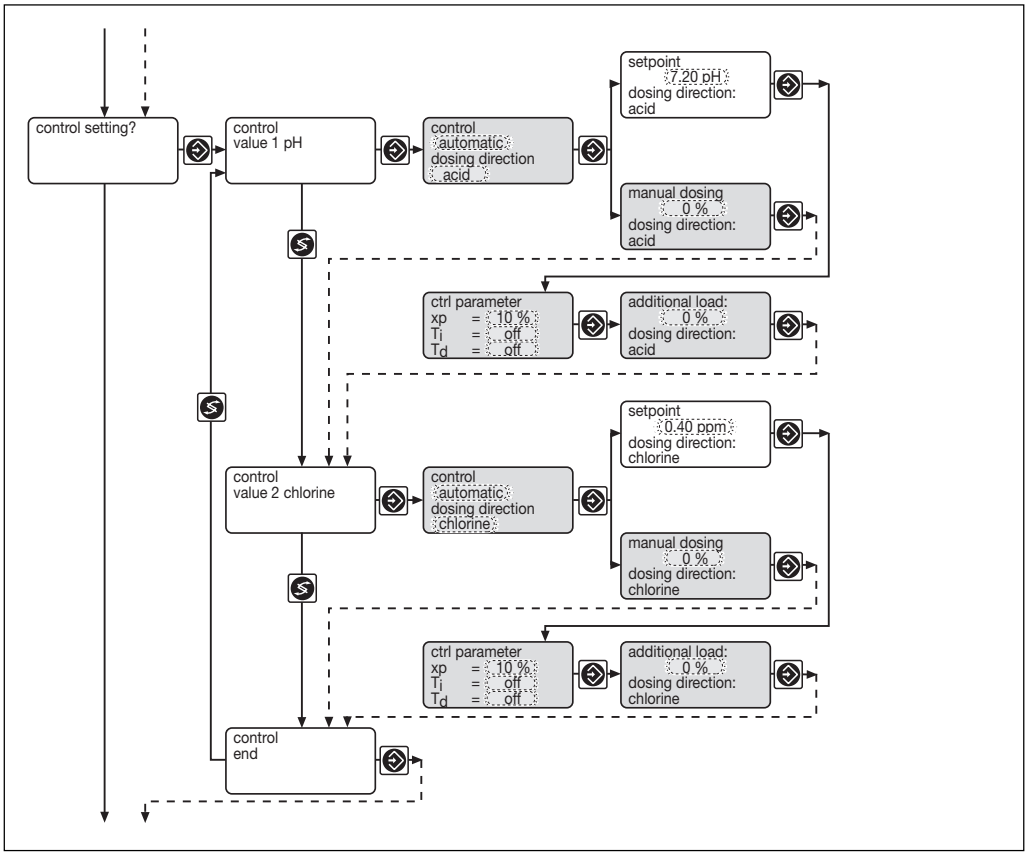
When setting the check out time, metering of the corresponding pump is stopped and an alarm is triggered through the alarm relay in the event of limit violations exceeding the set check out time.

For devices with limit relays, a limit value or a zone may be set for each measuring value, where the relay will switch.



	Initial value	Possible values Increment	Lower value	Upper value	Remarks
Type of limit transgression Measured value 1 pH	upper	upper lower			Limit transgression when exceeding or dropping below value
Measured value 2 chlorine	lower	upper lower			
Limit value Measured value 1 pH	pH 8 pH 6.5	pH 0.01 pH 0.01	pH -2 pH -2	pH 16 pH 16	
Measured value 2 chlorine	0.1 ppm 0.6 ppm	0.01 ppm 0.01 ppm	0.00 ppm 0.00 ppm	upper limit measuring range	*with regard to the setting "zone", the difference between the limits and the set hysteresis should be ≥ 3x.
Limit relay 1 pH	LV 1	LV 1 LV 2 zone* off			
Limit relay 2 chlorine	LV 1	LV 1 LV 2 zone* off			
Limit relays 1,2	active closed	active closed active open			
Switch-on delay* Δt on	0 s	1 s	0 s	9999 s	
Switch-off delay* Δt off	0 s	1 s	0 s	9999 s	
Hysteresis limits measured vlaue 1 measured vlaue 2	pH 0.2 0.04 ppm	pH 0.01 0.01 ppm	pH 0.02 0.02 ppm	pH 16 2.20 ppm	Is active in the direction of cancellation of limit violation.
Checkout time limits	off	1 s	1 s	9999 s	Results in message and alarm and shutting-off of the corresponding metering. Off: function off, no message, no alarm.

Control

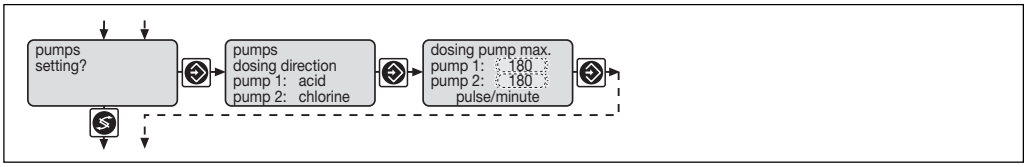


	Initial value	Possible values Increment	Lower value	Upper value	Remarks
Control	normal	normal manual			xp referred to pH 14 (measured value 1) xp referred to measuring range (measured value 2)
Setpoint					
measured value 1 pH	pH 7.20	pH 0.01	pH 0	pH 14	
measured value 2 chlorine	0.40 ppm	0.01 ppm	-0.20 ppm	2.20 ppm	
Control parameter xp	10 %	1 %	1 %	500 %	
Control parameter Ti	off	1 s	1 s	9999 s	
Control parameter Td	off	1 s	1 s	2500 s	
Additional load	0 %	1%	0 %	+100 %	
Manual metering	0 %	1%	0 %	+100 %	

Operating Menu / Description

Pumps

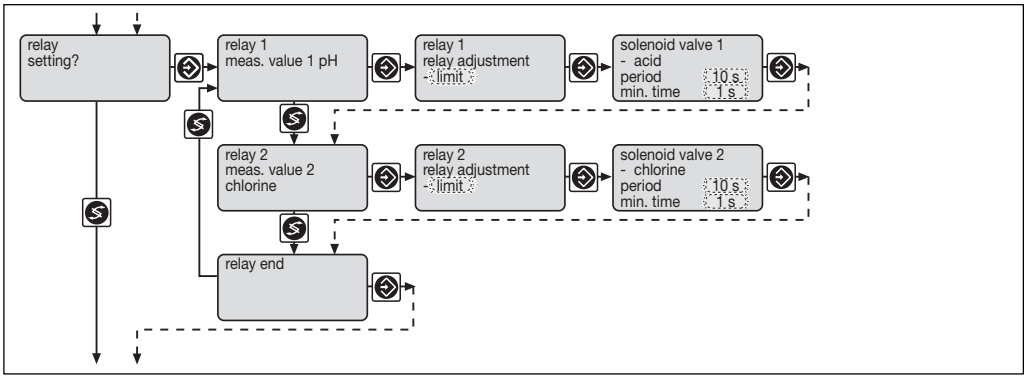
The maximum stroke value of the metering pumps should correspond to the stroke frequency of the metering pump used.



	Initial value	Possible values			Remarks
		Increment	Lower value	Upper value	
Max. stroke/minute of pumps 1 and 2	180	1	1	500	off = 0 strokes/min

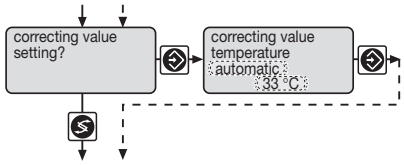
Relays

Allocation of the two relays with regard to the function (limit, actuator, solenoid valve) is freely selectable. If the function is set to actuator or solenoid valve, the relays will be set inactive in the case of fault in order to avoid faulty metering.



	Initial value	Possible values Increment	Lower value	Upper value	Remarks
Relay 1 Measured value 1 pH Relay adjustment	limit	Limit Actuator* Solenoid valve off			*e.g. motor pump Relay is deactivated in case of fault and during calibration
Relay 2 Measured value 2 chlorine Relay adjustment	limit	Limit Actuator* Solenoid valve off			
Solenoid valve Period Min. time	10 s 1 s	1 s 1 s	10 s 1 s	9999 s period/2	

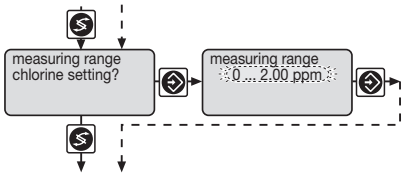
Correction value (measured value 1 pH)



	Initial value	Possible values Increment	Lower value	Upper value	Remarks
Type of temperature compensation	as per identity code	manual automatic off			Change-over only if pursuant to identity code = automatic
Manual temperature compensation	25 °C	0.1 °C	0 °C	100 °C	

Measuring chlorine

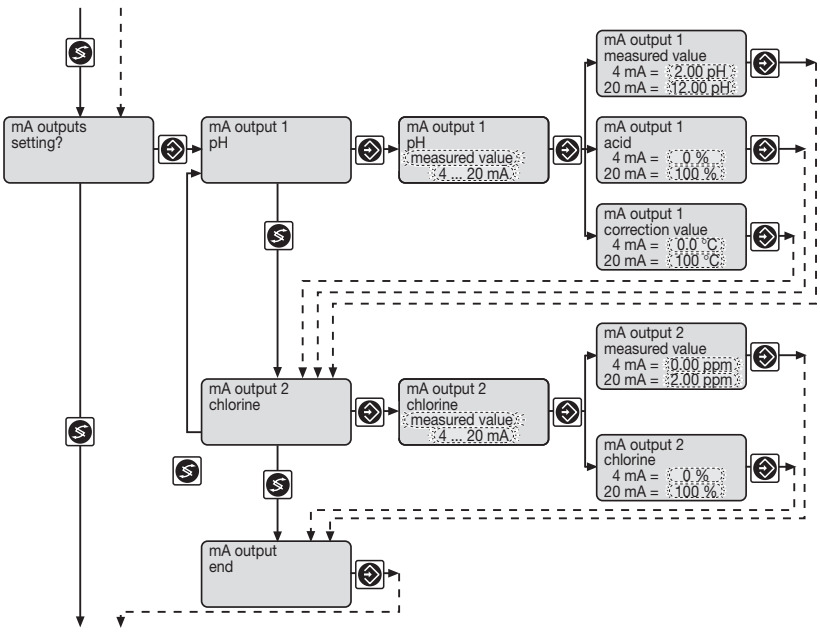
The measuring range (factory setting 0-2.00 ppm) must correspond to the chlorine measuring cell used. The factory setting (limits, setpoint...) is reset if the measuring range is altered.



	Initial value	Possible values			Remarks
		Increment	Lower value	Upper value	
Measuring range	0...2 ppm	0...2 ppm 0...0.5 ppm 0...5 ppm 0...10 ppm 0...20 ppm 0...50 ppm			

Outputs 0/4 - 20mA

The mA outputs may be used either for documentation of the measuring value or as regulated value. When the regulated value is set, the metering direction selected in "control" will be automatically used!



	Initial value	Possible values Increment	Lower value	Upper value	Remarks
Variable allocation	Measured value	Measured value Regulated value Correcting value			
Output range	4…20 mA	0…20 mA 4…20 mA			
Range measured value 1 pH	pH 2…pH 12	pH 0.01	pH -2	pH 16	Minimum range pH 0.1
Range regulated variable	0 %…+100 %	1 %	0 %	+100 %	Minimum range 1 %
Range measured value 1 chlorine	0...2 ppm	0.01 ppm	0.2 ppm	2.20 ppm	Minimum range 0.1 ppm
Range regulated variable	0 %…+100 %	1 %	0 %	+100 %	Minimum range 1 %

General settings

Alarm relay

The alarm relay may be activated / deactivated. When deactivated, no fault message is displayed.

Pause function

With regard to the pause, a delay time "td" may be set. The control will start again only after cessation of the pause contact and expiry of the preset delay time. When the delay time is elapsing, a clock symbol will be displayed. The pause function may be reset by pressing the start / stop button.

The mA output measuring value will be frozen when the pause function is activated.

Control input

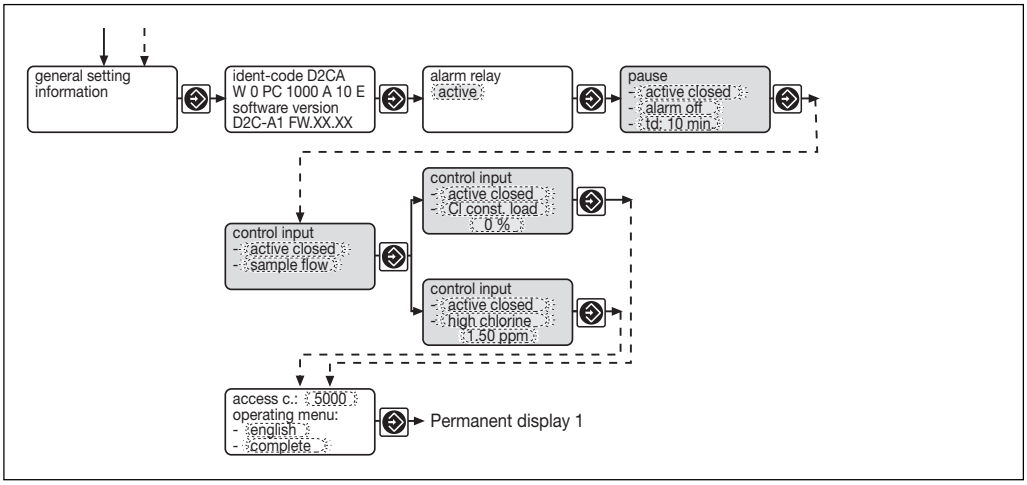
The control input may be used for fault messages for sample water, high chlorination or base load metering chlorine. In the event of fault message for sample water, control will be stopped, metering will be set to base load, and the alarm relay will be activated. If high chlorination is set, the control signal sets metering to maximum frequency until the preset specified value for high chlorination is reached. This function will only be available if metering direction is set to chlorine. If base load is set, a control signal will apply a base load to the chlorine pump. This base load will be maintained for the duration of the control signal.

Operating menu

All setting menus may be accessed by switching from reduced to complete. We recommend to set the reduced menu again after commissioning.

Access code

If the access code (factory-set to 5000) is altered, no settings (with the exception of cali-bration) may be carried out without entering the correct code.



	Initial value	Possible values Increment	Lower value	Upper value	Remarks
Alarm relay	active	active not active			
Pause	closed	closed open			
	Alarm off	Alarm off Alarm on			
	td: 10 min.	1 min.	0 min.	60 min.	
Control	sample flow	sample flow high chlorine Cl const. load off			
Control	regulated value	0.01 ppm	regulated value	upper limit	
High chlorination	chlorine		chlorine	measuring range	
Control base load chlorine	0 %	1 %	0 %	100 %	
Access code	5000	1	1	9999	
Language	as per identity code	German English French Spanish Swedish Dutch			
Operating menu	reduced	reduced complete			

9 Technical Terms

Calibration: By calibrating (adjusting), the measuring value readout will be adjusted to the actual probe signal. Without calibration, a correct measurement is not possible. A calibration should be performed regularly (depending on application).

Solenoid valve: Activation of solenoid valves (motor-driven pumps) is defined by the cycle time and the minimum on-state interval (minimum time) (pulse length control). The on-state interval always corresponds to at least the minimum time. However, it is increased up to the cycle time at a maximum depending on the control deviation and the control response. The cycle time itself defines the maximum possible on-state operations. For instance, an actuator is switched on a maximum of 60 times per hour when the cycle time is at 60 seconds. The minimum time defines the minimum on-state interval duration. It should be selected as small as possible while, however, ensuring that metering is still possible within this time.

Zero point: The zero point of pH probes is theoretically 0 mV. In practice, for a good probe function a zero point of ± 25 mV is acceptable.
The zero point of chlorine probes is 4 mA. A calibration is not necessary.

Slope: The slope of pH probes should always be ≥ 50 (better: ≥ 55) mV/pH. The slope of the chlorine measuring cell is given in mA/ppm. For a good probe function, the values accepted by the controller are sufficient.

Set point: The set point is the value which is to be continuously maintained stable throughout the process via controlling.

Regulated value: The regulated value is the value (e.g. frequency, mA signal) the controller sends to the final controlling element (e.g. metering pump) to reach again the set point.

Control parameter: The control parameters (xp, Ti, Td) determine the control characteristic (PID).

Manual control: In this setting, the controller produces a controlled variable corresponding to the entry. It is retained up to the next change. It is independent of the measured variable and the set control parameters. This setting can be used for determining the time response (e.g. dead time...) of the controlled system.

xp value: This value influences the proportional control behaviour. In case of a deviation of 1.4 pH (=10 % of 14 pH) or 0.2 ppm (=10 % of 2 ppm), a xp value of 10 %, for example, leads to a regulated value of 100 %. If the xp value has to be increased to 20 %, the deviation must be double the value in order to reach a regulated value of 100 %. In case of control overshooting, the set xp value must be doubled.

Ti (integral action time): This value defines the integral (I) control behaviour. The greater Ti, the lower the I proportion.

Td (differential action time): This value defines the differential (D) control behaviour. The lower Ti, the lower the D proportion.

Metering direction: This value determines in which direction the controller is active. In case of the metering direction "acid", the controller generates a manipulated value when the specified value for pH is exceeded.

Additive base load: This results in the fact that the controller always generates a manipulated value corresponding to the additive base load. This load may only be reset to 0 using the stop button. This function should not be activated when using PI or PID controllers.

Relay: The relay (alarm, limit relay) switch when the corresponding prerequisites (e.g. alarm condition, limit violation) are given. The relay function can be set either as make contact (active closed) or break contact (active open). The relay may be reset pressing the stop button. (Exception: limit value).

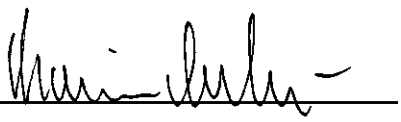
10 EC Declaration of Conformity

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 directives.
Any modification to the product not approved by us will invalidate this declaration.

Product description :	***Measurement and control system, DULCOMETER***
Product type :	***D1C / D2C***
Serial number :	***see type identification plate on device***
Relevant EC regulations :	***EC - low voltage directive (73/23/EEC)*** ***EC - EMC - directive 89/336/EEC subsequently 92/31/EEC***
Harmonized standards used, in particular :	***EN 60335-1, EN 61010-1/2, EN 60204-1*** ***EN 50081-1/2, 50082-1, EN 55014-1/2*** ***EN 61000-3-2/3, EN 61000-6-2***
National standards and other technical specifications used, in particular :	
Date/manufacturer´s signature :	***11th December 2000*** 
The undersigned :	*Dr. Rainer V. Dulger, Executive Vice President R&D and Production*

Fault	Fault text	Symbol	Effect on metering	Effect on control	Alarm with acknowledgement	Remarks	Remedy
Measured value 1 Signal exceeded/ drops below value	*pH-input* ↑↓	ε	Basic load	Stop	yes	3 mA>Signal>23 mA -499 mV>Signal>499 mV	Check probe, transducer and cable connection
Calibration with error	*pH calibration defect*	ε	Basic load	Stop	no		Check probe, replace if necessary, recalibrate if necessary
Measured value 2 Signal exceeded/ drops below value	*Cl-input* ↑↓	ε	Basic load	Stop	no	3 mA>Signal>23 mA	Check probe, transducer and cable connection
Calibration with error	*Cl calibration defect*	ε	Basic load	Stop	no		Check probe, clean or replace if necessary, recalibrate if necessary
Limit transgression after checkout time	*pH-limit value 1* *Cl-limit value 2*	ε	none	Stop	yes	Function may be deactivated	
Correcting variable Signal exceeded/ drops below value	*°C-input* ↑↓	ε	Basic load	Stop	yes	Signal ~ 100 Ω or ~138.5 Ω	

Operation	Note text	Symbol	Effect on metering	Effect on control	Alarm with acknowledgement	Remarks	Remedy
Stop button	*Stop button*	ε O	none	Stop	no		Start device
Pause contact	*Pause*	ε O	none	Stop	yes, may be deactivated	delay time td adjustable, ⏲ display elapsing "td"	deactivate interval deactivate delay time „td“
Fault measuring water	*Fault measuring water*	ε	none	Stop	yes	Function switchable	
High chlorination	*High chlorination*	ε	max. frequency	Stop	no	Function switchable	
Base load chlorine	*Base load chlorine*	ε	frequency adjustable		no	Function switchable	
Electronic fault	*EEPROM defective*	ε	none	Stop	yes		send in device

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