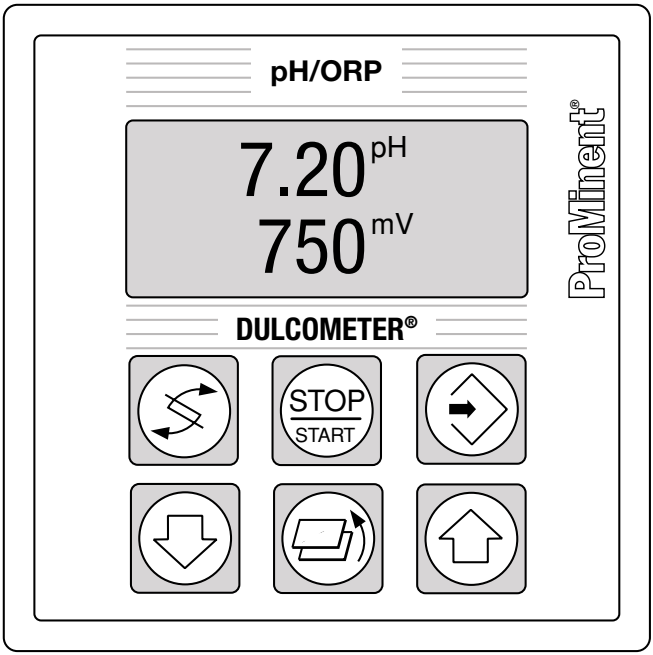
Operating Instructions

DULCOMETER® D2C

Part 2: Adjustment and Operation,
Measured Variables pH/ORP

D2C2-001-pH/ORP-GB



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

Part No. 987822 **ProMinent Dosiertechnik GmbH · D-69123 Heidelberg · Germany** BA DM 063 11/99 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
PR	pH (0-14 pH) / ORP (0-1000 mV)

	Connection of measured variable 1 (connection measured 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
0	None

	Disturbance variable connection
0	None
2	Temperature (Pt 100) for pH via terminal

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

	Power control
A	Alarm relay
G	Alarm and 2 limit relays
M	Alarm and 2 solenoid valve relays (pulse length control)
R	Alarm relay and actuator with feedback

	Control characteristic
1	Proportional control
2	PID control

	Protocol output
0	None

	Language
D	German (E, F, S)
E	English (D, F, S)
F	French (D, E, S)
S	Spanish (D, E, F)

D2C A	___	___	**PR**	___	___	___	___	___	___	___	___	

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 bold bullets (•).

IMPORTANT:

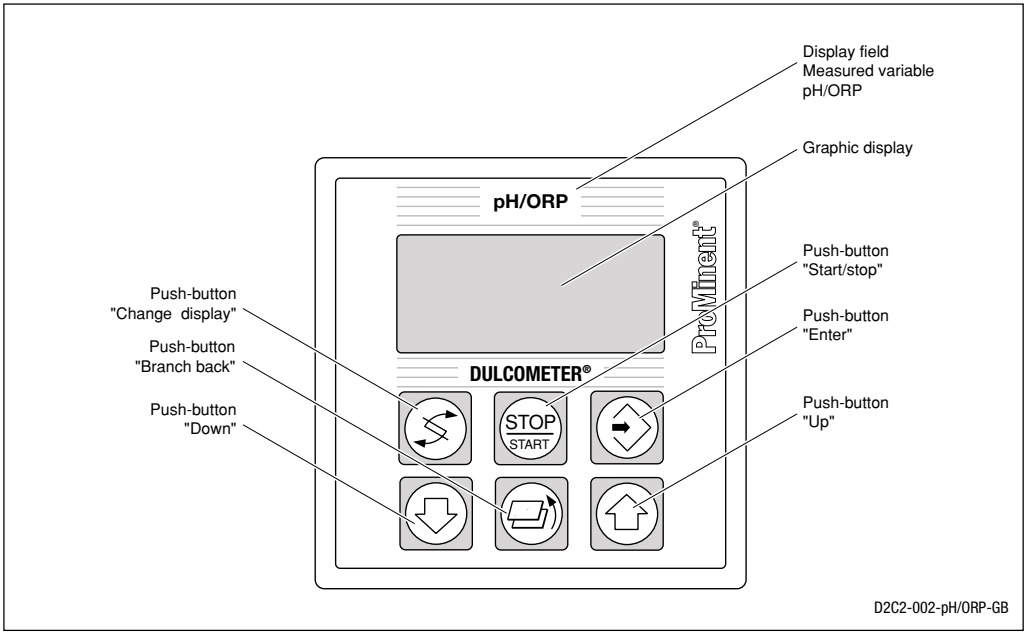
Please observe the parts of these operating instructions applicable to your particular version! This is indicated in the Section "Device Identification / Identity Code".

IMPORTANT:

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 therefore recommend urgently to activate "check out time limits" with automatic control shut-off!

3 Device Overview / Controls



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

	UP menu button To increase a displayed numerical value and to change variables (flashing display)
	BRANCH BACK menu button Back to permanent display or to start of relevant setting menu.
	DOWN menu 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 cycle times must be taken into consideration when activating solenoid valves (pulse length) in the same way as their running times when activating servomotors (3-point).

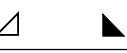
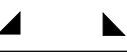
The control function (output of regulated variable) may be switched off via the control input "pause". The calculation of the regulated variable starts again with the cessation of the "pause" after expiry of the adjustable delay time "td". No fault treatment is performed with active "pause" function.

4.4 Fault messages

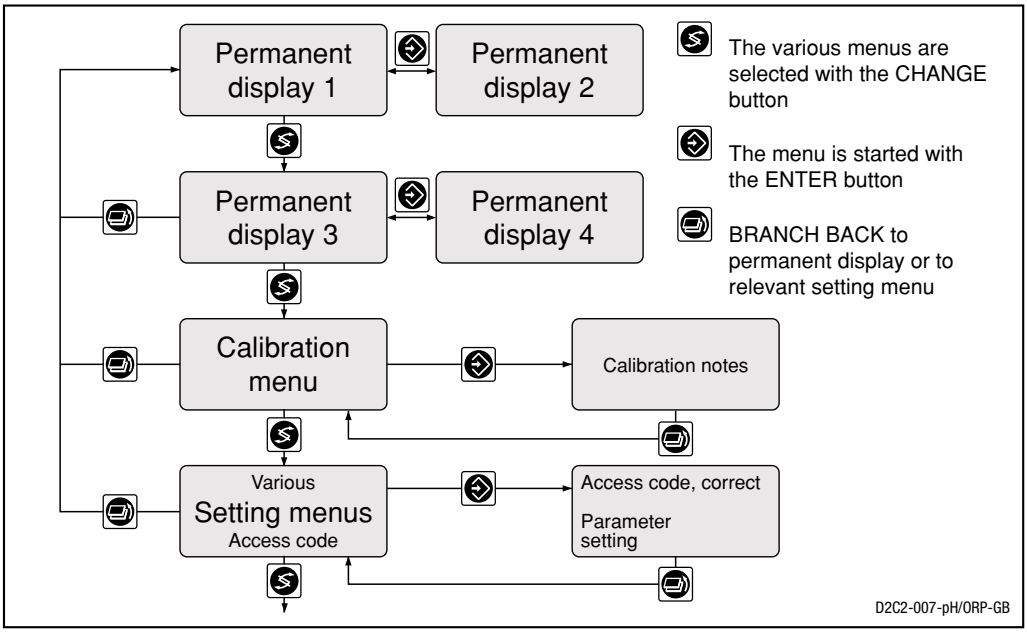
Faults to be acknowledged are shown in the permanent displays 1 and 3 by the symbol "Ɛ". The corresponding fault messages and notes are shown in the permanent display 2. Faults/notes continuing after acknowledgement are shown alternatively. Faults automatically remedied throught changing operating conditions are removed from the permanent display without necessitating acknowledgement. Chapter 10 includes an overview of fault messages and causes.

5 Display Symbols

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

Description	Comment	Symbol
Limit value transgression measured value 1 Relay 1 upper or zone	Symbol left	
Relay 1 lower	Symbol left	
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	
Servomotor measured value 2 Control open relay		
Control close relay		
Without control		
Position feedback	The bar increases from left to right during opening	
Stop button pressed		
Manual metering		
Delay time "td"	Control starts after expiry of "td"	pause 
Fault		

6 Operation



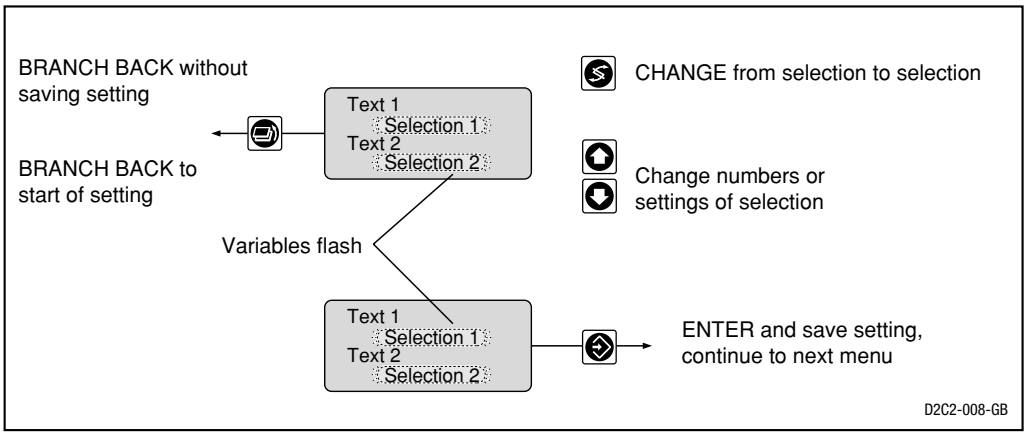
NOTE

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!

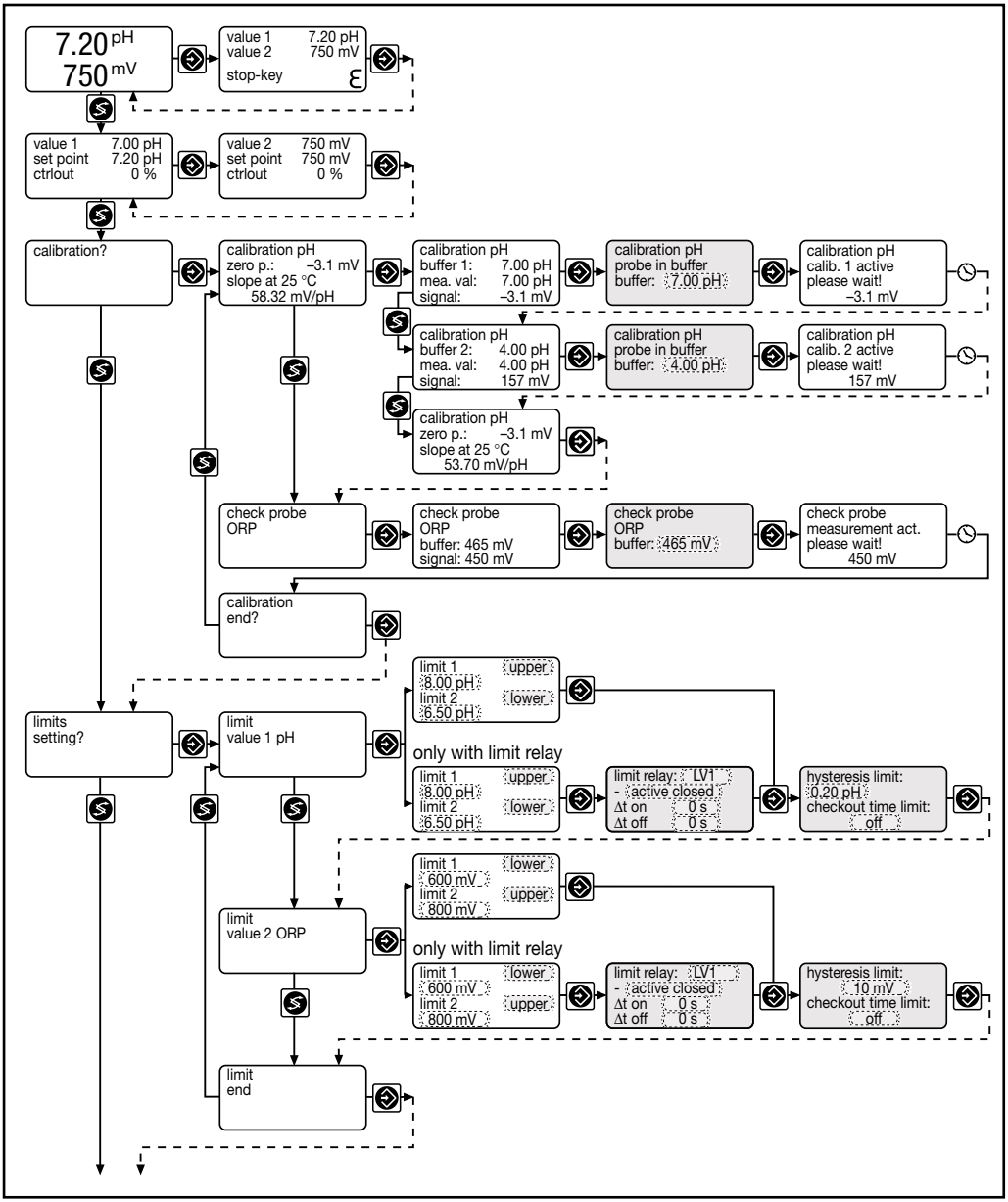
If the access code is selected correctly in a setting menu, then the following setting menus are also accessible!

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.

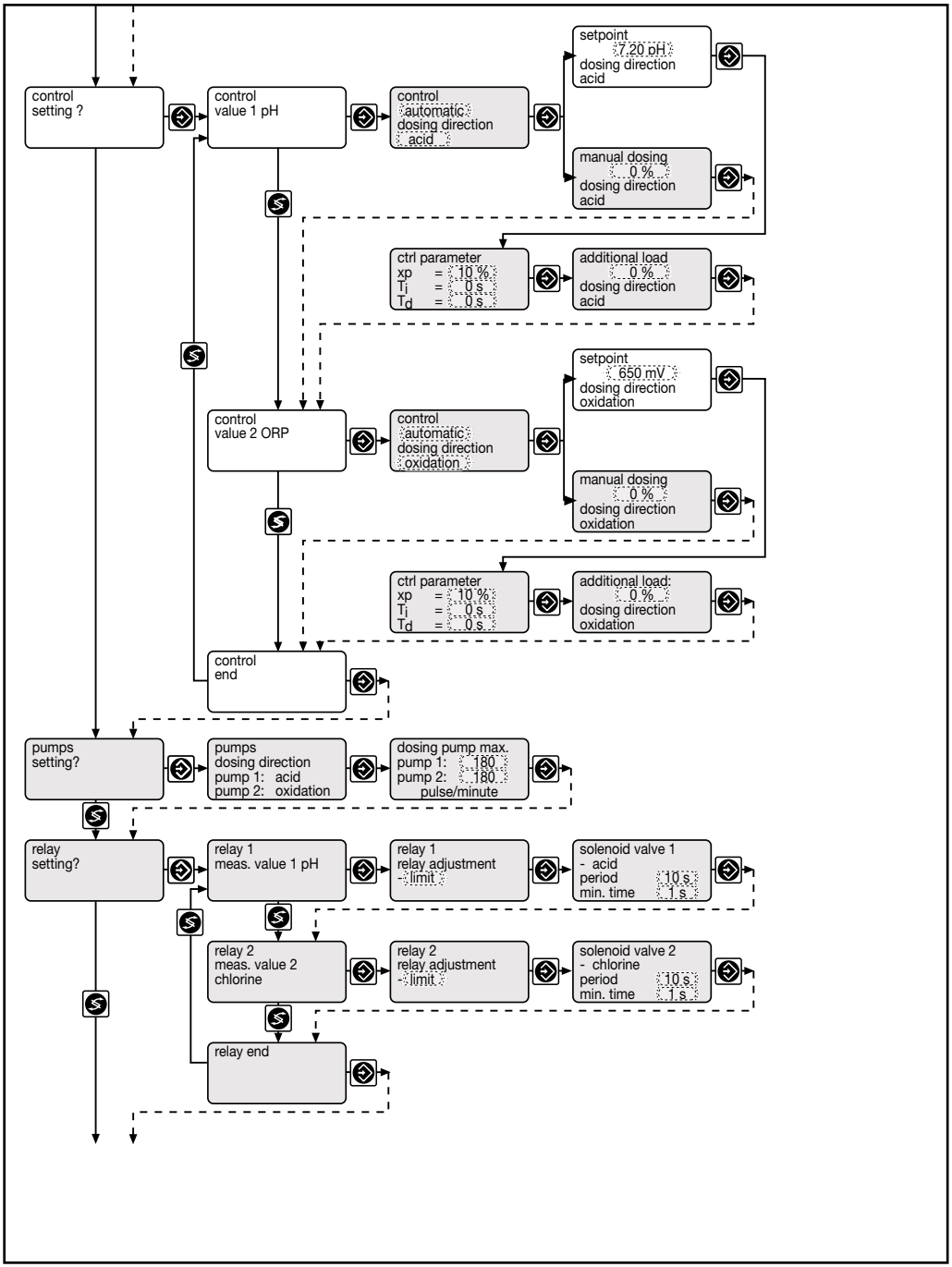


7 Operating Menu / Overview

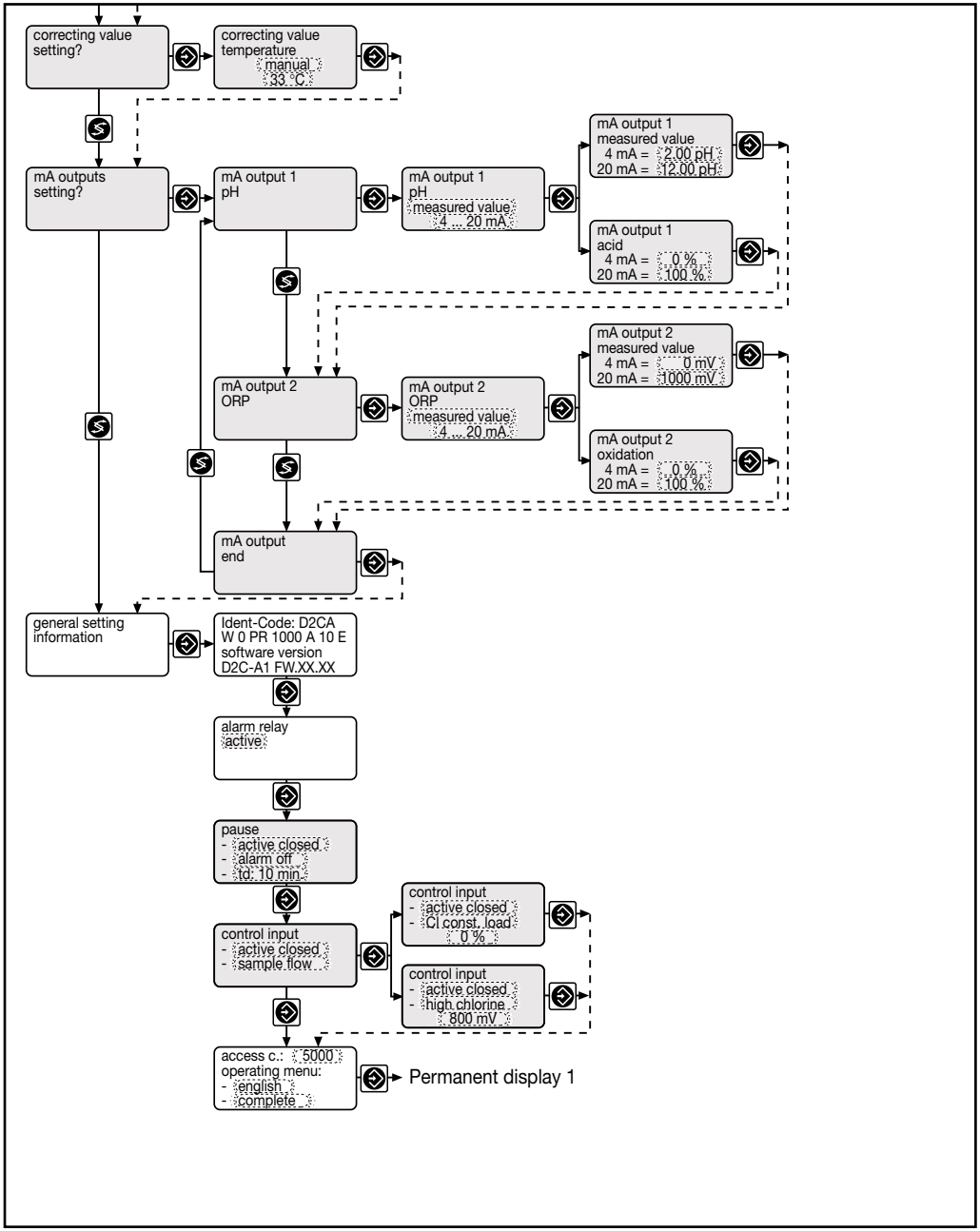
The setting menus highlighted in grey and the adjustable parameters are only visible in the complete operating menu.



Operating Menu / Overview

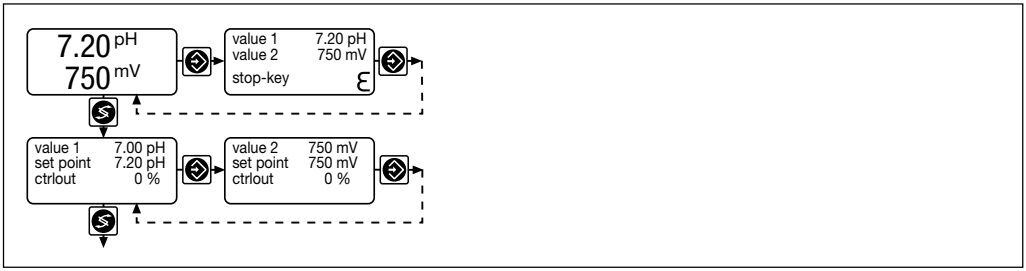


Operating Menu / Overview



8 Operating Menu / Description

Permanent displays

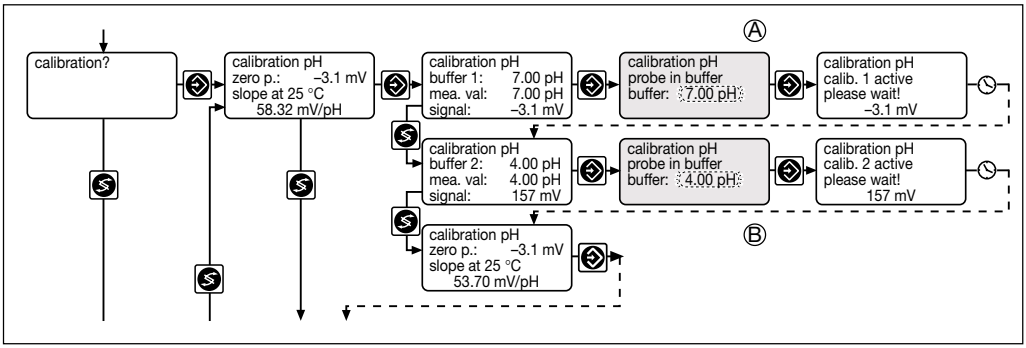


The permanent displays 1 to 4 serve information on fault messages/causes (see also table on page 20) as well as on operating values/settings.

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.

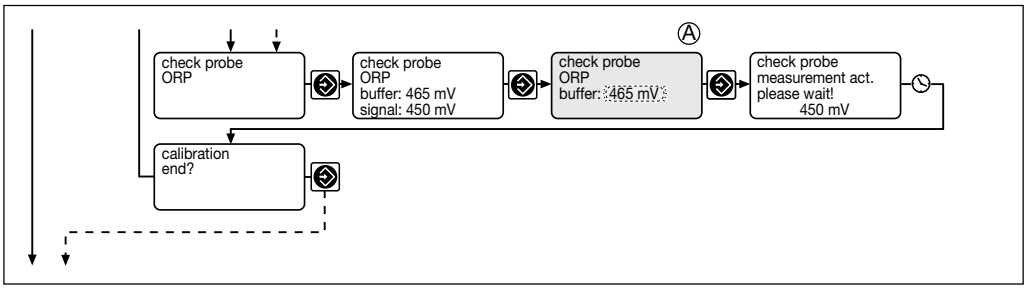


	Initial value	Possible values			Remarks
		Increment	Lower value	Upper value	
Buffer values	pH 7 pH 4	0.01 pH	–2 pH	16 pH	Error messages when both buffers too close (<2 pH-values)

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			"

Checking the redox sensor

The redox sensor is checked with the aid of a redox buffer solution. The standard buffer value is set at the factory to 465 mV. If a different buffer is to be used (e.g. 220 mV), the default in the complete operating menu (menu A) can be changed accordingly. Control is stopped and metering is reduced to the set basic load during the test. The 0/4...20 mA output (measured value) is frozen. If the test is concluded successfully, all error checks concerning the measured values are restarted.



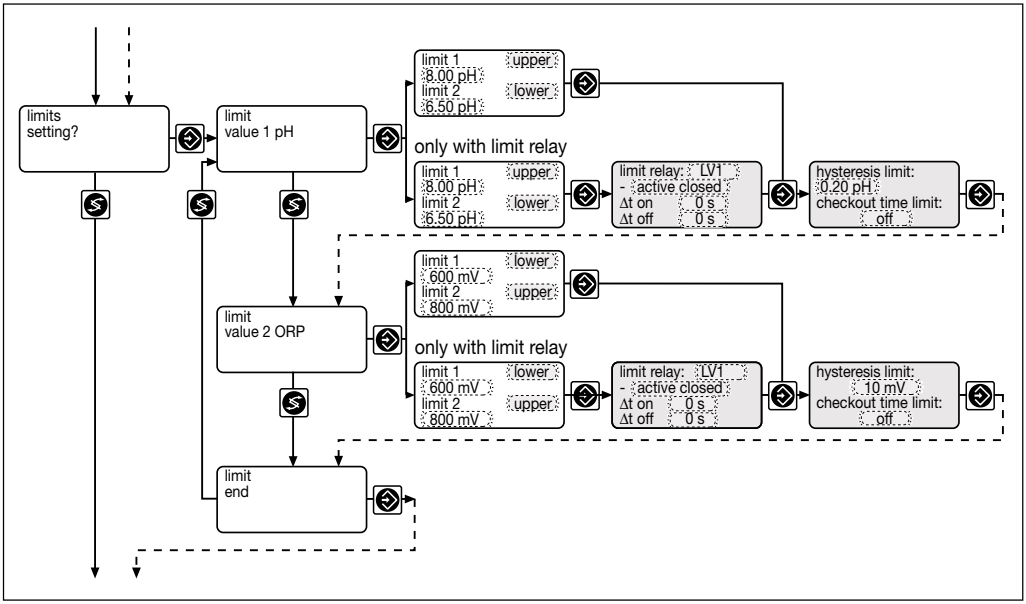
	Initial value	Possible values Increment	Lower value	Upper value	Remarks
Buffer value	465 mV	1 mV	0 mV	1000 mV	–

Error messages	Condition	Remarks
Probe ORP defective meas. value too low	10 % meas. value < buffer value	Clean probe repeat calibration
Probe ORP defective meas. value too high	15 % meas. value > buffer value	Buffer to old repeat calibration

Limits

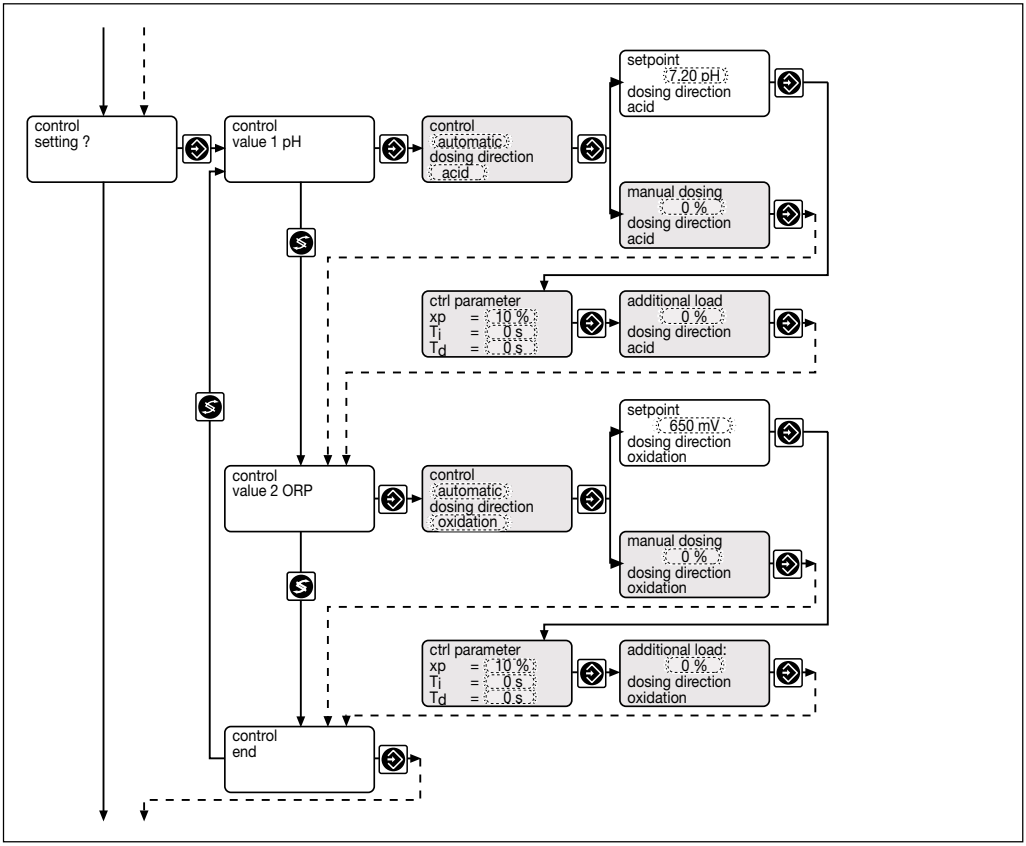
When setting the check out time, metering of the corresponding pump is stopped and an alarm is triggered through the alarm relay in the event of limit violations exceeding the set check out time.

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 Measured value 2 ORP	 upper lower	 upper lower			Limit transgression when exceeding or dropping below value
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 ORP	600 mV 800 mV	1 mV 1 mV	0 mV 0 mV	1000 mV 1000 mV	
Limit relay 1 pH	LV 1	LV 1 LV 2 zone* OFF			*With regard to the setting "zone", the difference between the limits and the set hysteresis should be ≥ 3x.
Limit relay 2 ORP	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 value 1 measured value 2	 pH 0.2 10 mV	 pH 0.01 1 mV	 pH 0.02 10 mV	 pH 16 1000 mV	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.

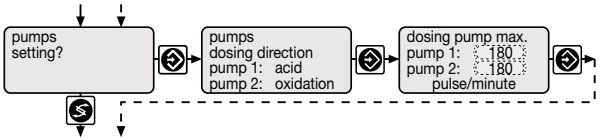
Control



	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 1000 mV (measured value 2)
Setpoint					
measured value 1 pH	pH 7.20	pH 0.01	pH 0	pH 14	
measured value 2 ORP	650 mV	1 mV	0 mV	1000 mV	
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 %	

Pumps

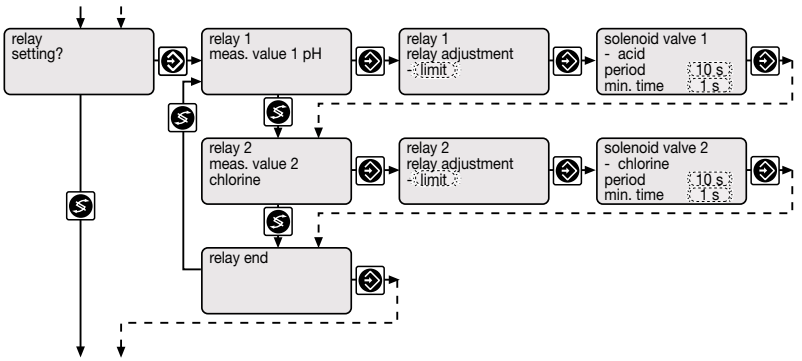
The maximum stroke value of the metering pumps should correspond to the stroke frequency of the metering pump used.



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

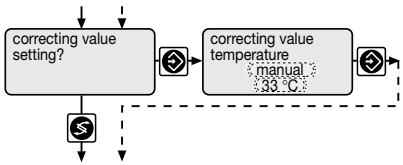
Relays

Allocation of the two relays with regard to the function (limit, actuator, solenoid valve, servomotor) 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			*e.g. electrolytic plant or 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			
Solenoid valve					
Period	10 s	1 s	10 s	9999 s	
Min. time	1 s	1 s	1 s	period/2	

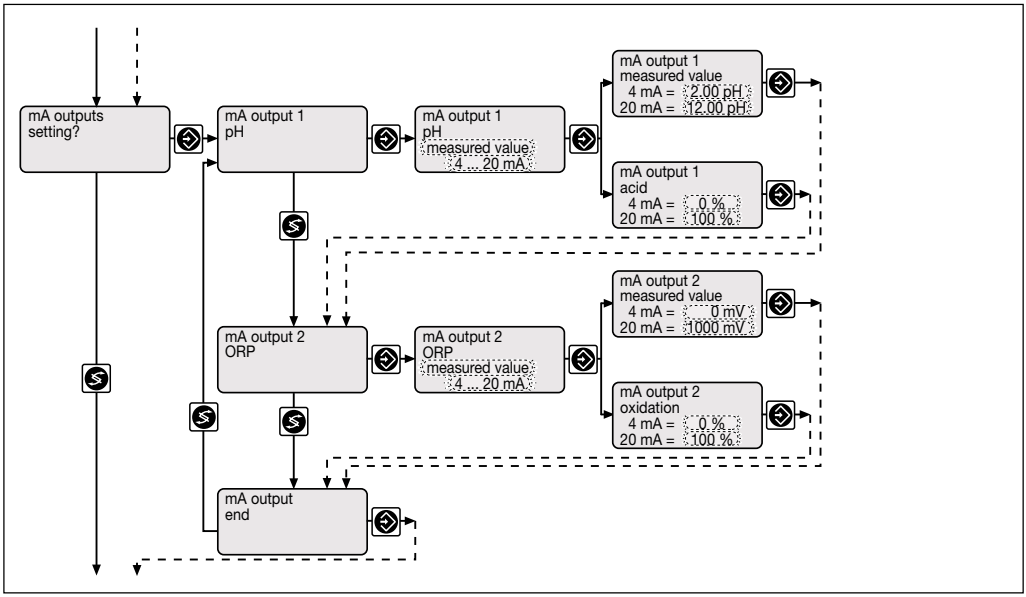
Correcting value measured value 1 pH



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

Outputs 0/4 - 20 mA

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			
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 2 ORP	0...1000 mV	1 mV	0 mV	1000 mV	Minimum range 10 mV
Range regulated variable	0 %…+100 %	1 %	0 %	+100 %	Minimum range 1 %

Operating Menu / Description

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

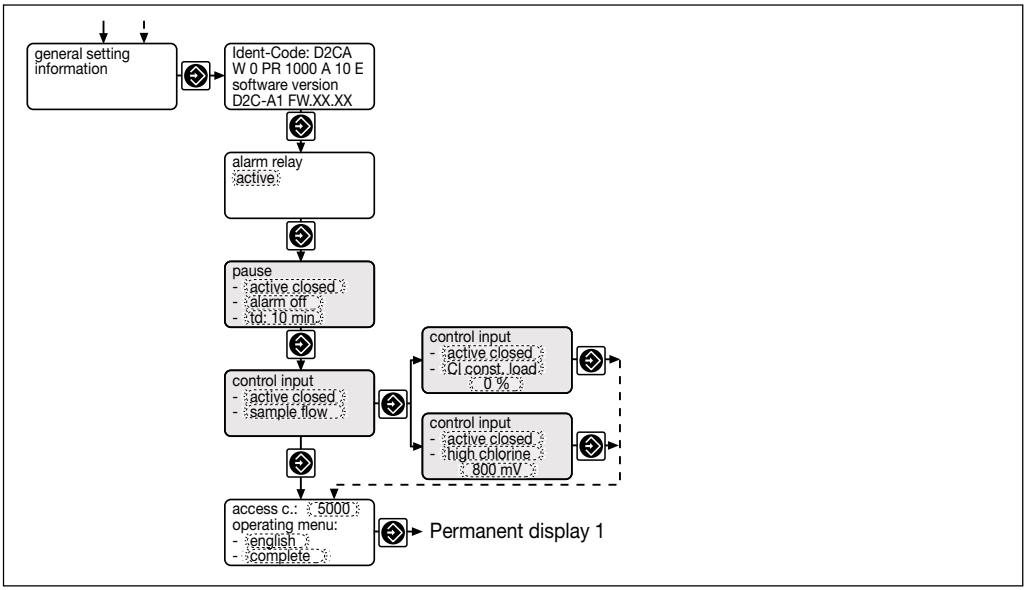
The control input may be used for fault messages for sample water, high chlorination or base load metering chlorine. In the event of fault message for sample water, control will be stopped, metering will be set to base load, and the alarm relay will be activated. If high chlorination is set, the control 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 restricted to complete. We recommend to set the restricted menu again after commissioning.

Access code

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



	Initial value	Possible value 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 water	sample water high chlorination base load chlorine OFF			
Control high chlorination	set point ORP	1 mV	set point ORP	upper limit 1000 mV	
Control base load ORP	0 %	1 %	0 %	100 %	
Access code	5000	1	1	9999	
Language	as per identity code	German English French Spanish			
Operating menu	restricted	restricted complete			

9 Technical Terms

Additive basic load: This results in the fact that the controller always generates a manipulated value corresponding to the additive basic 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.

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). If the DULCOMETER® D2C operates with automatic or manual temperature correction, a Pt 100 must be immersed in the buffer solution or the buffer temperatures entered manually.

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

Correction value: The signal of the pH probes (e.g. 59 mV/pH at 25 °C) is influenced by temperature. High temperatures increase the signal while low temperatures reduce the signal. The resulting measurement errors can be compensated for by way of temperature correction. As a rule, no correction is necessary for measurements conducted within the range around pH 7. However, if the measuring range is further away from pH 7, automatic temperature correction via Pt 100 should be implemented in the case of fluctuating temperatures. Manual temperature correction can be used if temperatures are constant.

Dead zone: 2 setpoints can be specified in the "control with dead zone" setting. If the measured value is outside the setpoint range defined in this way, the corresponding actuator is activated. If the measured values are within the setpoint range, the controller functions as if the setpoint were reached. In the case of a P-controller a controlled variable is then no longer produced. In the case of PI-controllers, the last controlled variable is retained.

Δ pH control: A difference between the two pH measurements is kept constant during Δ pH control.

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.

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.

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.

Relay: The relay (alarm, limit relay) switches 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.

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.

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

Technical Terms

Slope: The slope of pH probes should always be >50 (better >55) mV/pH.

Temperature correction: See correction value

Ti (integral-action time): This term defines the integral (I) control response. The greater the Tn, the weaker the I-component.

Td(derivative action time): This term defines the differential (D) control response. The smaller the Td, the weaker the D-component.

xp-value: This value influences the proportional control behaviour. In case of a deviation of 1.4 pH (=10% of 14 pH) resp. 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.

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 the chlorine probes is at 4 mA. Calibration is not necessary.

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 ↑↓	Ɛ	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	Ɛ	Basic load	Stop	no		Check probe, replace if necessary, recalibrate if necessary
Measured value 2 Signal exceeded/ drops below value	check mV-input ↑↓	Ɛ	Basic load	Stop	no	3 mA>Signal>23 mA	Check probe, transducer and cable connection
Calibration with error	probe ORP defective	Ɛ	Basic load	Stop	no		Check probe, clean or replace if necessary, recalibrate if necessary
Limit transgression after checkout time	pH-limit value 1 mV-limit value 2	Ɛ	none	Stop	yes	Function switchable	
Correcting value Signal exceeded/ drops below value	°C-input ↑↓	Ɛ	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	Ɛ O	none	Stop	no		Start device
Pause contact	Pause	Ɛ O	none	Stop	yes, may be deactivated	delay time td adjustable, ⏲ display elapsing „td“	deactivate interval deactivate delay time „td“
Fault sample water	Fault measuring water	Ɛ	none	Stop	yes	Function switchable	
High chlorination	High chlorination	Ɛ	max. frequency	Stop	no	Function switchable	
Base loead chlorine	Base load chlorine	Ɛ	frequency adjustable		no	Function switchable	
Electronic fault	EEPROM defective	Ɛ	none	Stop	yes		send in device

Operating Instructions DULCOMETER® D2C, Part 2, pH/ORP, Version 1.0, Issue 11/99
Subject to modifications · Printed in Germany
Addresses and delivery information may be obtained from the manufacturer:
ProMinent Dosiertechnik GmbH · Im Schuhmachergewann 5-11 · D-69123 Heidelberg
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